WRANGLING SOFTWARE:
Computing Professionals and the Interpretation of Software Ownership in the University Computing Environment

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INTRODUCTION

Not so long ago, social practices surrounding software ownership were unsettled at best. The commodity status of software was decidedly less entrenched than it is today. Individuals and organizations have undergone a period of legal learning with respect to the software ownership environment. As personal computers spread across the university, academic organizations also confronted, more directly and extensively than ever before, the intellectual property regime that governs the ownership of computer programs. At the same time, the university also confronted questions and problems about how to manage and support new personal computing technology in general.

> *Initially, you bought a disc. In the early versions of any software, you could copy, and we made however many copies we needed. It wasn't a big deal. And then they made it more and more difficult, then there were numbers involved. You had to have a number to enter, as serial number that you entered when you bought a product…When you went on the network, they started tracking the numbers…the change in technology and the delivery of technology has influenced how information is distributed.*
>
> (Information Technology Administrator, Central Computing)

We think of the digital age, or the information age, as one in which we have more information at our fingertips than ever before. Indeed we do, but as sociologists, we know that there are structures in place, both technological and social, that facilitate and constrain our access to and use of this information. Sociologists need to pay more attention to how the legal and technological standards governing information are negotiated through social relations. This dissertation is a contribution to such a research agenda.

In the study of social practices surrounding software ownership, the role of the sociologist is particularly important because powerful legal and technological interpretive

frameworks are creating a commoditized approach to software ownership, indeed one might argue to other forms of intellectual property as well, that seem to extend beyond what "the letter of the law" in intellectual property intends.

> *When I first got here [mid 1990s], many people were still converting from typewriters to word processors, if you can believe that. …Someone would say 'hey, here's this box, go install it on this new professor's machine. I never thought of licensing as an issue. …I don't do things that way anymore…But that is definitely the way it was, and that was a correct approach [at the time]. Someone would know Word Perfect 5 and they would just say 'hey, you should be using this'…Whenever the box got handed around, we would go install it and someone would be there to help them figure out how to use it.*
>
> (Information Technology Administrator, Liberal Arts)

Such is not the right approach anymore. The rules have changed, not necessarily because the letter of the law of software ownership has changed in the last 10-15 years, but because our understanding of the law has changed. Our inclination to frame software as a commodity has also become more powerful and more taken-for-granted. The technological environment in which we use software has also changed, particularly as owners assert their rights by "tracking the numbers." Again, this occurs through a social process of interpreting the law. This project's goal is to unpack part of the interpretive transformation illustrated by these two statements by academic technology administrators.

The way software ownership is defined matters for how actors on the ground construct legal compliance activity. My dissertation explores the way information about law is brought into the organizational context and transformed into organizational policies and practices. Specifically, using a case study of university responses to software-related intellectual property protections, I focus on the interactions among

professional groups in the creation and implementation of university policies and practices. As noted by Edelman, Abraham and Erlanger (1992), "a striking feature of legal systems is that they have no systematic mechanism for the dissemination of information about law" (47). Organizations can only "know" about the law through their actors or agents. Information about the law must be interpreted and negotiated by organizational actors who assign responsibility for legal implementation and determine the form that implementation will take. In a broad sense, this project is a case study of the process by which law is translated into practice within an organization, and I ask basic questions in the classical sociological jurisprudence tradition about how the law operates "in action." How does information about intellectual property law regulating computer technology enter the university setting? If university professionals most proximate to computing and law carry, or filter, the bulk of computer-related legal information into the university, how do these professionals interpret and negotiate the meaning of legal compliance? Which groups, actors, and cognitive legal frames are advanced in devising legal compliance strategies? And why do actors and interpretations succeed or fail in influencing legal implementation?

I argue that computing professionals determine how to adapt through a process of "collective sensemaking" (Weick 1995) or institutional creation. Institutional scholars have argued that such a charge is led by the state and the professions (see DiMaggio and Powell 1983). Changes in the law to regulate activity are made by the state, which serves as enforcer in a coercive role. The law is filtered by professions, members of which are trained in common school and attend meetings where they share ideas about how to

interpret legal requirements and environments (Abbott 1998, Edelman et al. 1992). They work out solutions, which they transport back to their respective organizations. However, in the case of software, the state sets the rules of property ownership, but plays little role as enforcer.[1] Once they have been granted rights, owners of intellectual property are responsible for asserting (monitoring, policing, and litigating) their own rights through the courts. Furthermore, computing professionals are not highly organized in professional associations and structures. The literature that describes the role of the professions in organizational interpretation of legal compliance (Edelman 1990, 1992; Edelman Abraham and Erlanger 1992; Edelman, Fuller, and Mara-Drita 2001; Edelman, Uggen, and Erlanger 1999; Abbott 1988), therefore, provides limited explanatory power for this case. Key agents and agencies, namely regulatory agencies and professional organizations, that have traditionally constituted the starting point for understanding organizational legal interpretation are lacking for the case of computing related intellectual property law.

Much of the existing institutional research on law in organizations has examined organizational interpretation of and compliance with employment law. I extend this organizational legal compliance work to a case of organizational responses to computer related intellectual property law. Legal decision-making (legislative and judicial) applying intellectual property rights to biotechnology and computer technology has

[1] This may be changing. According to reports by intellectual property bloggers and some news agencies, the Obama Administration has been involved in both international and national closed door meetings about intellectual property "piracy". Such bloggers complain that only entertainment industry insiders have been invited to the table of the "Piracy Summit." As of February 2010, the administration has assembled an "intellectual Property Task Force". (See e.g., "Federal Intellectual Property Enforcement Gears Up" by Richard Esguerra, posted by the Electronic Frontier Foundation, March 5, 2010. http://www.eff.org/deeplinks/2010/03/fed-ip-enforcement-gears-up.)

generated huge economic markets. Intellectual property law is a useful place to study the way that social actors comprehend and implement the law because property rights have been under-theorized in sociological research (Carruthers and Ariovich 2004; Swedberg 2003; Campbell and Lindberg 1990), and even the classical connections between law and economy had been abandoned until recently (e.g., Edelman and Stryker 2005; Swedberg 2003). In addition, the relatively new nature of some categories of intellectual property and the constant challenge technology presents to existing categories of ownership in intellectual property make competing conceptions about how to interpret and apply these laws somewhat more accessible than they might be in more established categories of law drawing on standard sets of legal frameworks.

Sociology has been slow to recognize that the ownership rights underlying the commodities of the information age are foundational to power and inequality in access to information itself. There are collective action problems to solve in asserting the interests of technologically uninformed consumers (see Lessig 1999, 2001). Serious power differentials exist between intellectual property consumers and motivated corporate owners who control both information subject matter that is owned (Lessig 2004, Gillespie 2007), but also "insider" legal information about what the law does and does not allow with respect to consumption of the information (repeat players as emphasized by Galanter 1974). The law sets the framework for what can be owned, but since enforcement is carried out by these owners who pursue their ownership rights in court, much of the interpretive work that sets institutionalized practices about what can be owned and how is determined on the ground and in practice in extra-legal or non-legal arenas like the

market, in work organizations, through the physical configuration of the technology itself, and through publicity campaigns on movie and television screens. This is an area that calls for understanding social actors and how they put the law into practice. I analyze the interpretive work done by computing professionals with respect to software rules in the university. This professional group serves an intermediary role between access to computing and the computer-consuming public and plays a significant role in educating that public. This project is firmly situated in the body of law and society/law and organizations theory and research. However, I also use this research to inform a broader question about the control of intellectual property through technological protections.

The case examined in this dissertation is also intended to contribute to an understanding of the broader legal ownership issue of intellectual property in general. Computing professionals are the intermediaries between the computing code and the technology-using public. As such, they essentially teach the public at large about what computers and computer code make possible, thereby structuring the cognitive framework for understanding how to use computers, part of which pertains to which parts of computer code can and cannot be altered, shared, or changed. My research, then, is also motivated by an interest in a peculiar puzzle: why do computing professionals—who are supposed to be socialized into an environment of freedom and sharing—seem so willing to accept (or unwilling to defy) laws that tend to close up the use of computer code? Legal scholars and communication scholars lament the profound influence of the entertainment industry and owners of all forms of intellectual property on the legal environment of intellectual property (Burk 2003; Burk and Gillespie 2006; Gillespie

2006, 2007; Felten 2003; Lessig 1999, 2001, 2004; Reidenberg 1998). Most argue that the entertainment industry has successfully captured the legislature, and even to some extent the courts with the idea that the economic interests of the United States is best protected by powerful digital enforcement (i.e., technological locks) of intellectual property ownership laws. Such scholars argue that over application of technical protections on intellectual property may stifle some forms of innovation and certainly severely curtails the range of useful applications of computing technology. These industries have the monopoly attention of law makers and the governance system because their markets are comprised of average citizens who typically do not understand complicated intellectual property ownership laws. There is no collective will-power to remedy this ignorance because the public is increasingly cut off from the cognitive capacity to imagine an alternative information delivery system. If anyone could help inform the public, it is the computing professionals who support organizational computing environments, but they appear, from the outside, to be indifferent, at best.

In contrast to ordinary citizens who use technology for entertainment and other leisure-time tasks, I expect the IT profession in particular to be highly–attuned to the full range of computer technology capabilities and to be sensitive to the restrictions imposed by digital rights management systems and legal ownership protections. In short, they are not as cognitively restricted when it comes to thinking about how to organize computing as those people who accept the file permissions and network restrictions imposed upon them by the work computing environments. I chose to study this particular group of

professionals in the university environment to see what alternatives they imagine and, if they do resist common computing restrictions, what alternatives they erect.

The presentation of my research is organized as follows. Chapter 1, *Professional Construction of the Law*, lays out the theoretical groundwork for the dissertation by describing the state of theory and research about professional construction of the law and reviewing classical and recent sociological work on property rights. I draw on literature on organizations and institutions to set up what is known about organizations confronting changes in technology and the law, the role of professions in filtering legal knowledge in the organization, institutional frameworks that shape cognitive understandings of how to apply the law (and adapt to new social problems), and factors that influence power relations in organizations. This chapter sets up the research question about how organizations (and the actors within them) learn about the law. I draw on institutional literature which I review what is known about the role of professions in filtering legal knowledge on behalf of organizations and describe how institutional frameworks shape cognitive understandings of how to apply law (or adapt to new social problems). However, I study a new context (software ownership in the university) in which the state plays little regulatory role and professional associations are weak by traditional definitions. I, therefore, combine these theoretical insights with micro-level approaches to interpretive action on the ground, more typically associated with research on legal consciousness.

In Chapter 2, *Data and Methods*, I introduce the organizational setting, and explain the rationale for the selection of the university context and software ownership as

an appropriate focal point from which to analyze the way that law enters everyday organizational life. Starting with existing research about law and organizations, I employ an extended case method approach by selecting a case that challenges existing accounts of how law is interpreted by individuals in the organization. Applying the case to broad theoretical themes in law and society research, I explain how the case and setting were selected to alter or challenge elements of (in contrast to Edelman, Abraham and Erlanger 1992; Edelman, Erlanger and Lande 1993). I also use the idea or model of competing institutions (Heimer 1999) to analyze activities within the organization. I explain the types of variation that provide theoretically informed comparisons to draw out important themes, including variation in types of computing professionals (departmental teaching/research support, software developers, administrators); hierarchical differences across subjects; and change over time; as well as variation in technological expertise across collegiate units (CLA, IT and Central Administration).

Before moving to the core analysis of the dissertation, I review the legal context of software as intellectual property and of university computing more generally in Chapter 3, *The Formal Legal Context of Software in the University*. This chapter describes the unique set of formal legal processes through which software became subject matter of both copyright and patent law, highlighting the contested nature of the assignment of intellectual property status to software. Further, I review recent debates about the issues involved when intellectual property owners use code, or digital rights management (DRM) to protect their property. Although this study focuses on issues related to software ownership, a larger legal background influences university computing

more generally. The last section of Chapter 3 sets out some of the basic legal activity that shapes university computing.

I contrast the professional history of computing professionals and their associational patterns with those highlighted in the professions literature in Chapter 4, *Professionalization of Computing in the University*. Computing and other technology-related professions, like engineering, are organized around different principle s than those of law, medicine, and even accounting. The rapid growth of computing and the speed with which tasks change makes traditionally theorized efforts at professional boundary maintenance difficult at best. Instead, I argue that the computing machinery serves as a physical medium around which computing professionals can erect, assert and enforce professional boundaries. I also describe how the professional association of interview subjects is still less formally organized and show that socialization contributing to knowledge about legal issues is unlikely to come from organized professional associational ties. To some extent this chapter compares and contrasts this case of software regulation with the work on professional filtering of the law for human resource professionals in the work of Edelman and colleagues. Professional organizations do not have the same role here and to the extent that they do, it is the academic administrator organizations and the university security group rather than computing professional organizations that are positioned to interpret the law. Software developers and other individuals exert a constant pressure on the organization, however, to avoid falling into purely bureaucratic considerations.

Chapter 5, *Organizational Governance and the Bureaucratization of Computing in the University*, analyzes the process of legal interpretation and activity at the central organizational level. A central group of computing administrators has been able to carve out a large area within the university over the past 15 years to deal with the computerization of the workforce. Two areas of the organization have significantly influenced how computing is organized. Administrative accounting, budgeting and database management, and the internet security group exert the strongest control over practices that influence licensing organization in the university. Through the mobilization of the law and of computing expertise to handle the problems that accompany these activities, central computing organization administrators carve out organizational space for computing and lay claim to university resources. At the same time, they increasingly gain central authoritative control over the management and standardization of computing practices within the university.

Chapter 6, *Intersecting Institutional Frameworks of University Software Management*, focuses on the way that computing professionals within an organization may "know" the law through different institutional lenses. I analyze the implications that institutional frames for understanding software ownership have on how people make sense of the role of law in their organizational activities. Drawing heavily on Carol Heimer's (1999) work, I identify the competing institutions for the arena of software regulation in the university as market, technology, academia, and law. These institutional frameworks only become relevant when computing professionals are confronted with day to day decision points. The three main software ownership activities in which computing

professionals are engaged include software selection and acquisition, computer and network configuration, and troubleshooting. I rely primarily on interview data to illustrate how institutional logics are employed in different ways with respect to these "orienting activities." The logic of the market, and the formal law that supports the market, favor limits on user control of machinery, a position that is reinforced by bureaucratic administrative concerns. The logic of academic freedom promoted by faculty and the academic environment are reinforced by some of the open source preferences of technology professionals. The technological logic, however, favors different solutions to computing and software management depending upon the particular task at hand. Computing expertise is the primary criterion for decision making about control and access over machinery and therefore over responsibility and autonomy over licensing matters. Yet, because of the academic setting, “expertise” and jurisdiction are flexible constructs and are not tied to a job title or set of job titles, but rather to an assessment of user technical capabilities.

In the conclusion, I revisit the motivating questions of this research and suggest ways in which combining information about professions, bureaucratic environments, and the influence of competing institutions work together to portray the social processes that comprise social construction of the law. I suggest further avenues of law and society study suggested by my analysis of the case of software ownership in the university. I also explain how a sociological lens on the law in action contributes to existing legal and communications scholarship on formal political process of digital rights policy.

Chapter 1: Professional Construction of the Law

Laws are negotiable, not only in the courtroom or legislature, but also on the ground in everyday situations. Yet, the meaning of the law is constrained by the extent to which it is reinforced by, or resonant with, other social institutions. The interpretation of intellectual property rights provides a particularly interesting place to study the process of legal meaning making. This study seeks to fill a gap in the sociology of property rights by drawing primarily on scholarship in the law and society tradition. However, selection of this particular law--intellectual property as applied to software—also requires attention to the way that law intersects with the economy and with technology. In this chapter, I review classical work in law and the economy and recent calls for increased attention to the intersections between them. I then review the work on institutions and organizations that informs recent law and society scholarship, highlighting theoretical questions about ambiguity and legitimacy that are at stake in advancing interpretive frameworks in implementing the law. Finally, I explain three bodies of research within the law and society tradition that inform the three substantive chapters in this dissertation: sociology of professions with particular attention to the way that professional groups serve as organizational legal filters; law and organizations literature with emphasis on the organizational agenda and internal organizational jurisdictional cooperation and competition over legal interpretation; and, finally, law as one of a set of competing institutions.

Property Rights

Sociologists have been challenged to pay increased attention to property rights. As a fundamental component of modern capitalist economies, rights to private property are typically taken for granted and have received little attention from sociologists since the classical theorists first tried to understand the rise of capitalism and the industrial revolution. Intellectual property rights and the commodities they generate comprise a growing share of the capitalist market. Copyright and patent laws, two of the primary forms of intellectual property protections in the United States, stem from a common constitutional mandate to promote progress. However, the U.S. Constitution specifies no particular social or institutional arrangement or process for obtaining and enforcing these exclusive rights. These features of intellectual property law make it a rich area in which to study intersections between law and the economy as well as the construction of legal meaning. It is surprising, in fact, that sociology has not yet paid more attention to the myriad new forms of property that intellectual property has made possible over the past several decades.

Several sociologists have called for renewed attention to connections between law and the economy (Edelman and Stryker 2005; Swedberg 2003), and in particular to property rights (Carruthers and Ariovich 2004; Swedberg 2003; Campbell and Lindberg 1990). Initially conceived of as a static and predictable set of rights, property rights are increasingly theorized as manipulable tools of the state (Campbell and Lindberg 1990; Fligstein 1990, 2001; Hamilton and Biggart 1988; Lazerson 1988; North 1981; Scheiber 1981), and, as such, as targets of contest and struggle. Some authors have recently

suggested that intellectual property is an unexplored area of property rights, and, though they imply that there is something special and different about this type of property, they have as yet not identified a specific research agenda (Carruthers and Ariovich 2004; Swedberg 2003). Swedberg (2003) simply explains that intellectual property is "a topic that has not been much explored in the sociology of property" (17), but he is interested in the way intellectual property influences the reward system for scientists (18). Carruthers and Ariovich (2004) devote a section of their review essay on the sociology of property rights to intellectual property explaining that current intellectual property rights "reflect a set of changes: new objects and subjects of property, a shifting locus of enforcement, and new political coalitions favoring (or opposing) particular property rights" (38). They, too, explain that a tension exists between using intellectual property rights as an incentive for invention and the effect they have in blocking the free flow of information needed to foster invention or creation (39). It is an interest in the extent to which intellectual property rights do block the free flow of information, and the 'hows' and 'whys' of such activity, that motivate this project.

Intellectual property rights, in particular, govern exchange in an ever increasing portion of the market. Copyright and patent laws, two of the primary forms of intellectual property protections in the United States, stem from a common constitutional mandate to promote progress. However, the U.S. Constitution specifies no particular social or institutional arrangement or process for obtaining and enforcing these exclusive rights. They are foundational to economic transactions in newer markets like biotechnology and information technology. Yet, as exclusive rights in intangibles, they are more clearly

socially constructed than traditional forms of tangible property like land, goods or even shares of profits. In this study, I focus on one type of intellectual property, software, and examine the interpretive process that occurs as computer professionals and computer users make sense of how the law applies to their organizational setting.

Classical Law and Economy

Private ownership of property is one of the conditions established to facilitate wide scale capitalist market exchange. Sociological connections between law and the economy figured largely in the work of the classical sociologists, yet attention to property rights has been scant in sociology for many years (Carruthers and Ariovich 2004; Swedberg 2003; Campbell and Lindberg 1990). In the classical sociological literature and in traditional economic literature (whether classical economics or economic sociology), private property rights are treated as a fundamental condition of the modern capitalist economy. Classical sociological accounts of law and the economy try to account for and describe transformations in the social organization of society that occurred with enlightenment thought and the industrial revolution. These theorists view law and economy as integrally interrelated, positing law as a key component in ensuring capitalist interactions. They argue that the legal order corresponds to the capitalist economic structure: division of labor for Durkheim (1893 [1984]), class conflict for Marx (1967), and rules for stabilizing market activity for Weber (1978).

For Durkheim (1893 [1984]), stable private property rights are consensual and logically consistent with a move from mechanical to organic solidarity in modern society, in which society is organized around the division of labor and in which corresponding

social relations are based on exchange interactions. Even critics of some of Durkheim's ideas about the relationship between the nature of social solidarity and legal forms credit Durkheim for correctly recognizing that the legal order is profoundly influenced by societal structure. Sutton (2001) suggests that contemporary sociological theory draws on Durkehim's idea that the law plays an important symbolic role and emerges from struggles to shape the moral order (58). He explains that Durkheimian reasoning "suggests that law in general is an arena in which the latent moral dimensions of society are exposed and negotiated" (Sutton 2001: 59). From Durkheim, we continue to understand the law as stemming from interrelated experiences and continue to attend to the force of law's symbolic power. However, Durkheim pays little attention to the negotiation processes that accompany exchange relations or that help create the moral order. Marx and Weber have more to offer on that front.

For Marx (1967), stable private property is again essential to capitalism, but in his version of the relationship between law and social order, private property rights develop through a process of elite control and exploitation. Control over the means of production, in Marx' view, is the defining feature of power; those who control the means of production, or economic base, also control the law, which is one component of the ideology that justifies societal order (or superstructure). Like Durkheim, Marx describes how law, private property rights and capitalism developed simultaneously. People with resources in the pre-capitalist social arrangement were able to use their resources to secure continued control over new forms of those resources in the capitalist economy. In Stone's (1985) interpretation of Marxian economics, certain rules and laws are

foundational to the capitalist economic order, including private property and contracts. Both legal arrangements are essential to structuring social relations of the capitalist economy by enabling workers to sell their labor power in a free market and by making property more freely alienable and open to more uses. Stone's account of political mobilization follows a more Weberian conception of interest group formation and conflict, but the relative gains or losses of particular groups, even if they are at the expense of dominant classes rarely undermine the essential legal relations that undergird the economic system. Discrepancy in individual court or legislative decisions is not problematic as long as the essential legal relations remain intact. From Marx, we continue to pay attention to unequal distributions of resources and the power that affords individuals and groups to control further resource acquisition. We also should continue to pay attention to how that distribution of resources influences the rules and laws that are foundational to the capitalist economy.

To Weber (1978) the relationship between law and the economy is more nuanced, involving political interaction and rationalization of thought. His theory allows for elite influence as well as political mobilization over control of state actions. In a Weberian and traditional economic sense, the rules of property, including the enforceable contract, remain stable and predictable enough to ensure that the capitalist market can function predictably or expediently. In contrast to Durkheim, for whom normative rules or laws develop sui generis, and in contrast to Marx, for whom the state and its laws are an extension of elite control, Weber has much to say about the state as a rational and bureaucratic form of legal authority.

For Weber, law is an expression of political authority, which is power deemed legitimate by adherents and is part of the social structure that fuels the increasing rationalization of life in modern society. In contemporary society, political authority takes the form of an abstract set of rules carried out through a bureaucratic apparatus. Individuals within the bureaucracy carry out their actions through offices with attached sets of prescribed duties. Weber calls this type of authority legal-rational and it consists of legal written rules that are rational, internally consistent, and applied through formal procedures. To Weber, the modern bureaucracy is the "purest type of exercise of legal authority" (1978:220). Belief in the rules and belief in the fairness and correctness of the procedures used to enact and enforce the rules are the keys to the legitimacy, and thereby the efficient power, of legal-rational authority. Weber's rational legal authority has been used to analyze political states, but also to characterize other bureaucratic organizational forms and has, therefore, been highly influential in the study of organizations more generally.

The Move to Law in Action

Sociological theory, after Weber's discussion of social action, began to draw the focus of social research away from macro-structures and institutions down toward organization, small group and individual levels. Several important social theorists, such as Schutz, G.H. Mead and Cooley, flipped the question of how society constrains or guides human action on its head and began to ask questions about how humans construct the social world. In the area of law, American jurisprudential theorists, in particular O.W. Holmes (1963) and Roscoe Pound (1914), engaged in a sociological jurisprudence as a

critique of legal formalism. Legal formalism portrays legal decision making as a process of systematically applying logical and deductive reasoning to the evaluation of a set of facts to derive a correct legal outcome. Sociological jurisprudence, on the other hand, emphasizes the gap between formal law on the books and the law in action or the law in fact (Pound 1910).

This project falls in that tradition and the law and society tradition that followed. As many law and society scholars have described, the formal law requires a great deal of interpretation outside the courts in order to be put into action. Even to the extent that the formal law does specify software as intellectual property (a debatable proposition), it certainly does not prescribe the way that owners will assert their ownership rights, nor the way that consumers will (or will not) respect them. According to Sutton (2001), Holmes and Pound thought about law as something enacted by humans, in both the more formal context of legislative and judicial activity as well as the less formal enactment of legal rules by enforcement agents, regulatory agents and average citizens (135). Sutton (2001) attributes the emergence of sociological jurisprudence to a social context in which the legal protections facilitating laissez-faire capitalism, and entrenched through the doctrine of *stare decisis*, allowed rampant spread of monopoly power, deterioration of the economic status of workers, and deterioration of environmental conditions (136-37). The work of Holmes and Pound ultimately sought ways to incorporate information about how the law works in action into the formal legal system. Since then a body of research in law and society has analyzed the connections between the formal law and other societal institutions. This research has identified organizations as the site of much legal

interpretation outside of the formal legal system. In particular, this body of work has found that legal interpretation is highly influence by actors and groups from regulatory agencies and the organized professions.

Institutions

Many law and society scholars conceive of the process by which organizations adapt to legal change, and erect policies and practices to carry out the law, as a process of institutional creation or change. Drawing on Suchman (1995) and Weick (1995), institutional creation is an appropriate term for the process undertaken by social actors who face a new problem for which they have no existing institutionalized solution. Over time, these social actors may, in fact, borrow parts or combinations of existing institutions, which they modify to address their new problem through a process of "collective sense-making" (Weick 1995). The organizational research that initially addressed this process focused on the practice of institutional borrowing as a method of dealing with uncertainty (DiMaggio and Powell 1983; Edelman 1992; Edelman, Abraham and Erlanger 1992; Sutton and Dobbin 1996). We know, from the diffusion literature, that organizations borrow tactics and practices, sometimes wholly pre-packaged, for several reasons, but most prominently in order to establish organizational legitimacy. Less is known, however, about the process by which legal information or knowledge is created and negotiated within the organization. Likewise, social scientists know little about what determines which legal problem solving strategies are more or less likely to be advanced or borrowed.

Institutional theory provides the basis for understanding several avenues of research in law and society scholarship and is a useful place to start in building a theoretical background for understanding the interpretation of intellectual property law on the ground. A brief and general review of institutionalism provides a framework for understanding recent work of law and organizations scholars. Scott (2001) defines institutions as "multifaceted, durable social structures, made up of symbolic elements, social activities, and material resources" (49). They are enduring features of social life (Giddens 1984) and resistant to change (Jepperson 1991). Institutions are of interest to sociologists because they are the site of social action and interaction that bridges the gap between agency and structure. Institutions are commonly thought of as social structure, but institutionalism incorporates agency by calling attention to the role of patterned social behavior and meaning making systems of social actors. Scott organizes the work on institutions around "three pillars;" regulative systems, normative systems and cultural-cognitive systems are crucial to a thorough understanding of institutions. Scott (2001) and Hoffman (1997) see these pillars as a continuum moving "from the conscious to unconscious and from the legally enforced to the taken-for-granted" (Hoffman 1997: 36) collective meaning systems and social practices.

The regulatory component of organizations is the legally enforced and conscious aspect of institutions. It is probably the most clear and most commonly studied because it describes the objectivated (Berger and Luckmann 1966) world of explicit regulatory guidelines, procedures, rules or laws. Research in this area asks what is (or is not) allowed. In this aspect (or pillar) of institutions, rules are often enforced by state agents.

Rules might be carried out by force, but often they also, or alternatively, involve inducements or rewards for compliance. Social scientists focusing on the economy or on historical state formation often emphasize the regulative aspect of institutions (see North and Thomas 1973; Campbell and Lindberg 1991; Williamson 1975; 1994), viewing institutions as backdrops to organizational behavior, or examining the influence of one institution on another. Intellectual property rights are regulatory in effect because they dictate a set of conditions that users of intellectual property can and cannot do with the property, but they are different in that they regulate the rights of owners to exert those limitations. It is owners of intellectual property, not the state, who enforce the property rules by vigilantly searching out inappropriate uses of their property. This has implications for the regulatory power of the law, as explained later in this chapter.

The normative pillar emphasizes the role of values and norms in creating expectations and obligations. Understanding the normative aspect of institutions requires determining what actors feel they *should or ought* to do by asking what is right or good. Social obligations are at the heart of normative schema; roles, role expectations, and professionalization are among the central mechanisms by which normative expectations comprise institutions. Selznick (1949) has described the effect of goals and interpersonal interaction as a limitation on behavior within organizations. DiMaggio and Powell's (1983) category of normative isomorphism describes the process by which organizations become more similar to one another through professionalization (further described below). Edelman et al. (1991; 1992) finds that concerns of professionals and professional associations result in institutionalized conventions and patterns of behavior. Assigning

the term "property" to forms of information or innovation has both normative and cognitive (see below) implications. It engages the normative power of existing legal and economic institutions and their associated rules for behavior. Intellectual property owners further mobilize the normative aspects of legal and economic institutions when they wage publicity campaigns that label some uses of intellectual property "piracy." In many cases, they are using normative powers to assert the intended legal meaning, but they are often also trying to extend their rights beyond the formal law by overriding "fair uses" of the work as well.

The cultural-cognitive pillar draws on the idea that social actors act because they attach meanings to their actions. Meanings are socially created through communication and interaction. The cultural cognitive pillar emphasizes "templates for particular types of actors and scripts for action" over roles and obligations (Scott 2001: 58). They extend Weber's emphasis on human meaning making by elaborating on the types of scripts and belief systems that are employed on a cultural level in legitimating institutionalized social practices. This research also focuses on what actors view as legitimate, logical or possible. Shared experiences and shared understandings about the world or the relevant aspect of the world in which particular social action is taking place result in taken-for-granted ways of operating. "A cultural cognitive conception of institutions stresses the central role played by the socially mediated construction of a common framework of meaning" (Scott 2001: 58). Much of the neoinstitutional work in sociology (as opposed to economics or political science) is focused on the cultural-cognitive area of institutionalization. Cognitive theory emphasizes frameworks of meaning for

understanding the world, which may be macro worldviews or specific ways of classifying interpersonal aspects of life. Again, the term "property" alone has the cognitive power to change the way one thinks about intellectual products. Activities one might associate with information (sharing and free exchange) are less cognitively accessible if the material is considered property (market transactions for profit). Intellectual property owners are also increasingly using technological protections to limit the potential uses of these "products" (Gillespie 2007; Boyle 1996).

The pillars do not work in isolation, however. Coercive force (pure regulation) is inefficient, but authority is an effective coercive power because of its legitimacy, which is established by combining elements of regulatory, normative and cognitive-cultural aspects of institutions. Scott (2001) explains that federal programs often secure local cooperation through "the use of *authority*, in which coercive power is legitimated by a normative framework that both supports and constrains the exercise of power" (53). Even those scholars whose main focus is the regulatory pillar (Edelman 1992; North 1990; Paternoster and Simpson 1996; Skocpol 1985; Sutton et al 1994) argue that actions of agents responsible for enforcing the rules of the game are shaped by the rules, but also by their own interests and by the meanings they attribute to their environment. Law and society scholars concentrate on the way that law in the abstract is negotiated and interpreted by social actors in the process of its implementation (Edelman 1992; Suchman and Edelman 1996). The effect of the law, then, is not the result of a clear regulatory mandate efficiently carried out nor by normative understandings alone, but of a process

of interpretation, reinterpretation and potential conflict fueled by actors' use of cultural interpretations of action.

The pillars of institutions are interwoven, and they cut across all levels of sociological analysis, from interpersonal interactions to macro-societal cultural frames. Organizations seem an appropriate level on which to concentrate on the development of institutions, legal or otherwise, because they bridge the gap between individual and small group interaction. They are the units in which collective actors consciously combine efforts to meet objectives, and, yet, the same actors bring their cultural perspectives and internalized assumptions about the value of their objectives and the most appropriate ways to achieve them. In fact a prominent line of sociological work on organizations has been done in the institutional tradition.

Law and Society: The Construction of the Law

For the majority of social science researchers, the law is a backdrop for other behavior and provides a relatively stable set of rules and assumptions on which social actors can depend in going about their day-to-day routines. These accounts tend to portray law as structural condition for other activity (for examples in economics, see Fligstein 1990, 2001; Fligstein and Stone Sweet 2002). However, social scientists whose primary focus is the legal arena view the law as a dynamic process that intersects with many institutions and is continually interpreted and reinterpreted by both legal insiders *and* other social actors (who are not legal professionals). Much of it also originates in the theoretical work of Giddens (1979; 1984), Bourdieu (1990), and was further developed by Sewell (esp. 1992), merging structure and agency by focusing on social practice, or

the duality of structure as both rule and resource. These authors examine the mutual influence of law and organizations on one another. Social actors simultaneously create and respond to the law, or conversely, law is both a product of social interaction and a structural environment in which social action takes place. Institutional theorists (e.g. Powell and DiMaggio 1991, Meyer and Rowan 1991, for a review see Scott 2001), and their followers who study law and organizations, have done much work to document and theorize the dynamic working of the law in society. They emphasize the social construction of the law or the endogeneity of law (e.g. Dezalay and Garth 1995; Dobbin 1994; Edelman, Abraham and Erlanger 1992; Edelman, Uggen and Erlanger 1999; Edelman and Suchman 1997; Ewick and Silbey 1998, 1995; Kelly 2003; Uggen and Blackstone 2004). Negotiated understanding of law's meaning in organizational settings become habituated, legitimated, diffused and institutionalized in day-to-day practices among social actors. This line of research emphasizes cognitive frames for understanding the world, shared knowledge and shared belief systems. Cognitive structures that orient actors to common definitions of situational challenges, and appropriate response strategies, are more deeply-embedded determinants of social behavior than norms and values. Two aspects of this work fuel the social construction of the law. Work in the law and society tradition has typically attributed law's negotiability on the ground to its *ambiguity*. The solution for actors trying to implement the law on the ground, then, was to establish the *legitimacy* of their ability to interpret the law's meaning.

Ambiguity and Legitimacy: Law is a negotiated process

Ambiguity as an open condition for construction. Institutions, social construction, structuration, social interaction are all concepts that *describe* how structure and agency are part and parcel of the same ongoing social activity. Structures are reinforced at the very moment that agency is exerted all of which is influenced by the structure and agency (in social action) of an earlier moment.[2] DiMaggio and Powell (1983) have suggested that institutional isomorphism in organizational settings results from conditions of uncertainty. When organizations do not know the best way to adapt to new or changing environments, they look to each other for viable adaptations to their circumstances. Because the law is not specific, as organizations change, agents within them create new structures and routine practices. Technological change tends to require even more rapid adaptation processes. Their practices, in turn, alter the law itself. Conditions of uncertainty are underdeveloped in Powell and DiMaggio's work, though they explain two types of isomorphism: competitive and institutional. Competitive conditions are characterized by uncertainty and the need to innovate in order to secure economic advantage in the marketplace. Institutional conditions of organizational change are also fueled by competitive needs, but are arranged around competition for legitimacy and political power rather than for customers or resources (Powell and DiMaggio 1983:150).

According to some (e.g., Edelman 1992 and Scott 2001), ambiguity is what causes organizations to construct the law. According to Edelman (1992), legal ambiguity

[2] See Sewell for a discussion of structural transformation over time.

consists of laws that contain vague or controversial language; laws that regulate organizational procedures more than the substantive results, or outcomes, of those procedures; and laws that provide weak enforcement. Sutton (2001) elaborates a bit by explaining the conditions of regulation or legal change that are likely to make the law more effective. In addition to the conditions that Edelman (1992) describes, Sutton adds that enforcement through litigation (the courts) is much weaker than enforcement through regulatory agencies, especially if positive or negative sanctions are attached to compliance and non compliance. Also if individuals rather than state agents are responsible for bringing lawsuits, the law is likely to be less effective. Intellectual property tends to exhibit most features that make law ambiguous and can be highly interpretable on the ground. Furthermore, Black (1976) and Galanter (1974) have found that high status litigants (Black 1976) and "repeat players" (Galanter 1974) are more successful than others in their legal encounters. In addition, Sutton (2001) explains that laws with strict liability standards, rather than laws directed at intent, are the more effective laws.

Intellectual property law, particularly as applied to the subject matter of software, appears unsettled in the formal law. There are no prescriptions for its implementation in organizational settings and there is no state regulatory agency to enforce rules of practice around the enforcement of intellectual property rights. Self enforcement has led many intellectual property owners to devise additional methods of protecting and enforcing their property rights, including technological methods that assert rights beyond what the courts would be likely to enforce. It is up to owners of intellectual property to assert their

ownership rights through lawsuits. Powerful interests in intellectual property industries are not only repeat players, but often sole players in both courts and in influencing the legislature. Further description of intellectual property law and its application to software will be elaborated in Chapter 4, but it bears a number of characteristics that might make it ripe for interpretation on the ground. Legal ambiguity, Edelman (1992) argues, leaves EEO/AA law "especially open to organizational mediation" (1536) and gives organizations "wide latitude to construct the meaning of compliance" (1531). In the case of EEO/AA law, conditions of uncertainty fuel organizational responses that elaborate formal structures designed to signal symbolic compliance. In effect, DiMaggio and Powell (1983) and Edelman (1992) designate uncertainty or ambiguity as a scope condition for institutional isomorphism and diffusion (in the case of DiMaggio and Powell) or social construction of the law (for Edelman). Sutton (2001) is interested not only in the form that responses to law take, but also in whether those forms have the potential to achieve the goals they were designed to achieve.

Understanding legal implementation in organizations as a process of institutionalization diminishes the importance of ambiguity in the law, however. Berger and Luckmann's (1966) description of institutionalization might lead us to expect isomorphism and see the process of social construction in all cases of institutional development (or legal construction). Rather than designate uncertainty as a scope condition for negotiation of meaning in institutions, Berger and Luckmann include uncertainty as a core assumption about human nature and/or the social environment. Some of the more recent work incorporating elements of uncertainty or legal ambiguity

in law follows in this tradition. Suchman (1995a) attributes institutional change to efforts to respond to recurrent problems without existing satisfactory solutions. As they seek solutions, organizations engage in collective sensemaking activities (Weick 1995). Dobbin and Sutton (1998) explain the strength of U.S. regulatory law as resulting precisely from its ambiguous nature. Laws are open to negotiation between regulatory and regulated organizations, and open to interpretation in the courts or through informal deal making. Law, therefore, always undergoes a process of negotiation that solidifies internal logics of legitimacy and consistency among related institutions. In Berger and Luckmann's terms, these laws undergo sedimentation and become internalized. In her research on the emergence of employer-sponsored child care, Kelly (2003) finds that the meaning of law is transformed through the organizational implementation process despite the fact that its intent was concrete and specific. She draws on work that theorizes law as a resource for interested actors (see Stryker 1994, Swidler 1986) to explain that social actors can advance negotiated interpretations and meanings of the law to create ambiguities even when the law seems clear.

Legitimacy as a strategy. If the meaning of the law is negotiated, law in practice is an ongoing social construction, and collective sensemaking is a crucial component in understanding the law. In order to give meaning to their activity, organizations and professional factions within organizations try to stake out claims to legitimacy. Understanding legitimacy of the law and of the social actors involved in creating and implementing the law is also crucial to an overall understanding of the law force in our lives. Weber explicitly made legitimacy an important component of power

when he defined his types of legitimate authority. However, continuing work in sociology examines what legitimacy is, how it works and, more recently, how it is used as a resource. As Suchman (1995) explains, "legitimacy is more often invoked than described, and it is more often described than defined" (573). He also aptly points out that very often legitimacy eludes researchers because defining legitimacy is intimately related to explaining the purpose it serves. Laws and rules that are seen as legitimate, whether formal or informal, become deeply structurally ingrained in society. Those laws that are not viewed as legitimate fall out of use or get reinterpreted, even if they formally remain in effect. Work in the social construction of the law often addresses legitimacy, whether implicitly or explicitly, when it focuses on the way that social actors make claims to legitimacy or attach themselves to other actors, actions, or institutions that are seen as having legitimate status. Actors are typically described as undertaking these actions to advance interpretations of law that serve their own interests (Suchman 1995; Stryker 1994, 1989, Pedriana and Stryker 1997).

Suchman (1995) explains that most of the work on organizational legitimacy covers only limited aspects of the overall phenomenon and typically portrays legitimacy as either strategic or institutional. Strategically, organizations manipulate and project symbols to garner support to particular or general audiences (e.g. Pfeffer 1981). Institutionally, structural and cultural pressures facilitate certain types of legitimacy and particular strategies can prove more viable for garnering legitimacy than others (e.g. DiMaggio and Powell 1983; Meyer and Rowan 1991; Powell and DiMaggio 1991). These are the normative and cognitive-cultural processes by which legitimacy operates.

"Within this tradition, *legitimacy* and *institutionalization* are virtually synonymous. Both phenomena empower organizations primarily by making them seem *natural* and *meaningful*; access to resources is largely a by-product" (Suchman 1995: 576). Suchman, here, is describing legitimacy of organizations. This is a static and post hoc assessment of legitimacy and is often used to explain why practices are already viewed as legitimate thereby reinforce existing practices.

Stryker (1994) also synthesizes instrumental and normative/cognitive (institutional) approaches to legitimacy, but takes a broader approach to what confers legitimacy on claims to truth. She examines how science and the law interact in social policy and simultaneously serve as both rules and resources (drawing on Sewell 1992) for social actors, which Stryker calls technocratization of law. In Stryker's work, science serves as an additional explanatory device that garners legitimacy. By introducing science into the law, social actors can create new interpretations of legal/policy activities. Although Stryker's empirical research examples focus on formal policy making activity, her theoretical work conceives of politics as playing out in any context where conflicts are acted out (2000, 2003). Extending this idea, beginning with Sewell (1992) and applied to the law by Stryker (1994), Kelly suggests that understanding law as rule and resource helps us understand how social actors can construct and advance alternative interpretations of the law to suit their needs. As most of these theories explain, alternative interpretations can exist at the instrumental level as well as through cognitive frames of reference.

Stryker (1994, 1989) and Pedriana and Stryker (1997) examine the way that legitimacy is central to uses of culture and law as a resource. As Silbey and Sarat (1987) explained, the construction of legitimacy is not a mere label; it is an active process. Pedriana and Stryker's (1997) work shows how real forces are mobilized to garner legitimacy, which can transform the effectiveness of the law and the capacity of the state. Stryker also explains that the disparate treatments of legitimacy in the literature on laws or rules contain three major themes. Normative accounts categorize legitimacy as "attitudinal approval," instrumental accounts see legitimacy as "behavioral consent," and constitutive accounts portray legitimacy as "cognitive orientation to binding rules" (Stryker 1994: 856). Studying legal construction requires an examination of the way that law has been used as a resource. It also requires examination of legitimating processes in other institutionalization practices that confer power to interpret the law.

Much of this work has studied the construction of legal meaning by and within organizations. Organizations are key collective actors in many macro-societal institutions, but the activities of individuals and groups within organizations shapes what the law ultimately looks like. Social actors not only react to and interpret the law, their patterned actions and interactions constitute what the law will become. While law and society scholars have long researched the influence of legal professionals on the law (Abbott 1988; Abel 1988; Dezalay and Garth 1996, Van Zyl Smit 1985), everyday actors are also important. Organizational personnel responsible for developing and implementing policy in accordance with the law, especially human resource personnel, have more recently been the focus of sociological research on law and organizations

(Edelman 1990, 1992; Edelman, Abraham and Erlanger 1992; Edelman, Erlanger and Lande 1993; Edelman, Uggen and Erlanger 1999). Actors implementing the law, resisting the law, and negotiating the practical meaning and application of the law create the law itself, especially under particular state configurations (see also Dobbin et al. 1993; Kelly 2003; Kelly and Dobbin 1999; Sutton et al. 1994).

Three bodies of research within law and society work inform the substantive chapters of this dissertation, and provide a collection of vantage points for linking legal construction to legitimacy, all three of which overlap and inform one another. First, organized professions have figured prominently in research about organizational legal environments. Second, related work suggests that in constructing the meaning of the law (typically the meaning of organizational compliance to the law), professionals use the law as a resource to gain power and status within the organization and vis-à-vis other sub-professions in the wider society. Finally, a third body of work puts law back into the larger institutional context to examine how legal meaning and interpretation is one among a body of competing institutional frameworks for understanding the law. Below, I highlight key features of each area.

The Professions

If legal systems make no provisions for dissemination of information about the law (Edelman et al. 1992), how do organizations learn what the law requires? And, how do organizations learn about legal implementation and compliance? Information about what the law requires is especially sparse in the case of intellectual property law, for which, under most circumstance, no regulatory agency recommends action or oversees

implementation, and for which enforcement occurs through courts and markets. Existing literature highlights "the professions" as frontline filters of legal information in organizations (Abbott 1988; DiMaggio and Powell 1983; Dobbin 1994; Dobbin et al. 1993; Edelman 1992; Edelman, Abraham and Erlanger 1992; Edelman Erlanger and Lande 1993; Edelman and Suchman 1997; Edelman, Uggen and Erlanger 1996; Edelman et al. 1991; Galanter 1983; Heimer 1999; Kelly 2003; Kelly and Dobbin 1999; Selznick 1949; 1969; Sutton et al 1994). By professions, these writers mean not only the formal legal profession, but other organized professional groups for whose work a law or set of laws is relevant. Professions are involved in the process of organizational "collective sense-making," by helping to develop concrete policies, implement practices an engage in constructing the meaning of the law itself.

Professional groups and professional associations are among "the great rationalizers" (Meyer and Rowan 1991, Scott 2001, DiMaggio and Powell 1983). Professionals meet in universities, at association meetings and share information through specialty publications, all avenues through which professionals share experiences and engage in collective problem solving. Thus, the professions have been regarded as a key way in which professional knowledge is negotiated and disseminated through and to organizations. Many organizational problems and solutions are channeled through these social structural organizational arrangements, but the information relevant to this research is information about the law: its meaning, interpretation and its application to the work setting.

Building on institutionalism which said that professions are responsible for isomorphism in policy, legal regulation, and other organizational forms, Edelman and colleagues have developed a body of literature about the professional construction of EEO law. Although this conception relies on theories and descriptions of the early professionalization scholars for intuitive mechanisms of shared knowledge, those mechanisms are not absolutely necessary for isomorphism to work. Social construction literature would tell us that common sets of activities and problems make people likely to share common approaches to the world. However, a loosely organized set of professionals does not give us a clear theoretical portrait of how professionals (or almost professionals) learn about the law. Edelman and colleagues posited that through professionals associations, common training programs and conference interactions give professional groups a forum to develop strategic responses to the law (as well as to other organizational problems).

The work of Edelman and colleagues in this area focuses primarily on the legal filtering of Equal Employment law by human resource professionals. Including themselves in the group, Edelman and Suchman (1997) describe how "many culturalist accounts of law and organizations call attention to the important role of professional discourses in constructing the meaning of initially ambiguous laws, in determining the situations to which legal reasoning applies, and more generally, in advocating for the legality and legitimacy of particular worldviews. Significantly, these 'lawmaking' activities are undertaken not only by attorneys, but also by nonlegal professionals, such as personnel officers, doctors, teachers, and accountants" (499). These scholars found

that, indeed, professionals were inclined to use law as a resource (Sewell 1992; Stryker1994) to advance their organizational positions and their positions within the broader societal system of professions. They tend to portray legal issues as significant organizational threats, and propose solutions that rely on their own jurisdictional professional expertise and utilizing their own professional tools.

Early work on the professions. The early work on professionalization examined the professionalization process and they attempted to catalogue common patterns in the development process of the most highly organized and well-established professions. Most of the work done in the 1960s and 1970s outlined the characteristics indicative of professionalism: training programs, university degree programs, professional associations, the development of accreditation or licensing requirements, codes of ethics (Bledstein 1976; Caplow 1954; Johnson 1972; Wilensky 1964; Millerson 1964; Friedson ; Larson 1977). Early work concentrated on identifying the timing and pattern of the establishment of these markers of professionalism, while later work added nuance to the motivations, contextual arrangements, and power dynamics that influenced the development of the formal professions.

System of Professions. Abbott (1988), however, revises the tradition by looking at the universe of professions in concert, a system of professions. Abbott is less concerned with the timing or presence of a set of professional events in an evolutionary process, except as the establishment of these features, as well as other activities of professionals, contribute to boundary maintenance among a *system* of professions. Abbott defines professions as "exclusive occupational groups applying somewhat abstract

knowledge to particular cases" (p. 8). Because the professions exist in a societal system of professions and because professionals occupy specific social locations within their workplaces, Abbott's definition helps explain why professions are associated with the organizational features identified by earlier scholars.

A significant concern of the professionalization project is the establishment and maintenance of authoritative boundaries around a set of work activities which are the jurisdiction of that profession. Activities that constitute these efforts include the definition and legitimization of abstract knowledge that bears on professional activities, but is not identical to the mechanics of the activities themselves. Thus the establishment of training programs and ultimately of disciplinary university training is one component of establishing a claim to a unique set of abstract knowledge. Training programs implement gatekeepers who can make determinations about who is allowed into the jurisdictional boundaries. These educational organizations also do another important task of selling the legitimacy of the knowledge set to the public. Finally, educational programs provide the institutional setting for another task of the profession's jurisdictional agenda, that is, they are capable of executing accreditation programs.

The most successful professions have undertaken political lobbying to get state entities to require accreditation of people undertaking certain tasks in society. This entrenches the boundary maintenance system. The establishment of codes of ethics both helps sell the legitimacy of the body of knowledge and the professional claim to jurisdiction over it to the public, but it also helps the profession assert the right to police these boundaries from within. Thus, Abbott does not focus on the exact features that any

profession or profession-like group exhibits, but rather on a looser set of characteristics that orient occupational group members around a common set of work activities and, importantly, to a set of activities by which they attempt to lay claim to jurisdiction over those activities.

Existing research about professional construction of the law focuses primarily on the legal filtering of Equal Employment law by human resource professionals. Authors were able to identify a standard body of professional literature and associational activity to which they attributed the legal socialization of this professional group. In literature about professions more generally, information technology professions and within IT, computing professions, have always been bracketed as "different," in the way their profession has historically developed and in their relatively diffuse organizational structure (esp. Abbott 1988). Professionals come from a variety of training backgrounds and specialize in a variety of tasks. Given the less-centralized nature of the computing profession, do theories about the professional construction of the law that apply to human resource professionals also apply to computing professionals? In chapter 4, I describe the basic features of the computing profession and evaluate the extent to which their interest in and ability to interpret the law governing software ownership is consistent with existing research on professional construction of the law. Computing activities are vast and diverse, as are the professionals responsible for the variety of associated computing development, management and support tasks. The group, as a whole, and even the subset responsible for university related computing practices, are less professionally cohesive

than many other professions, including the human resource professions that are the subjects of other legal implementation research.

Professional construction of the law in organizational legal environments

Edelman and Suchman (1997) identify an emerging trend among organization scholars and law scholars to forge connections between these two previously disparate areas. They review key perspectives within this work and highlight the reciprocal relationship (endogeneity) between law and organizations. They propose that there are three interrelated legal environments of organizations: the facilitative, the regulative and the constitutive[3]. The *facilitative environment* provides "tools and forums," essentially a set of legal procedures and instruments (e.g. "the lawsuit, the public hearing, the Freedom of Information request, etc."), used to accomplish organizational goals (Edelman and Suchman 1997:482-83). Organizations are actors and the legal system is the arena in which they act. Stryker (1994) and others who emphasize the potential for law to be used as a resource by instrumental actors describe this aspect of the law as a dynamic element of the interconnection between law, action and meaning construction and less as an "environment" which still implies backdrop and stasis. In the *regulatory environment*, law actively controls organizational behavior. This environment, described here as the legal environment, is similar to Scott's (2001) regulatory pillar of institutions. Substantive edicts, often with some form of enforcement mechanism, control or enable various organizational activities. Finally, in the *constitutive environment*, the legal system "constructs and empowers" groups of organizational actors (p. 483). The law provides

[3] The authors explain that, following Suchman (1993) and Scott (1993), the facilitative, regulatory and constitutive environments roughly correspond to procedural, substantive and definitional law.

conceptual and discursive frameworks for understanding the roles and relationships within and among organizations. As the cultural-constitutive pillar of the legal institution, this environment is subtle and barely, if at all, apparent to the organizational actors themselves.

Even if professional organizations and their respective publications are sources of much legal interpretation, organizational responses to the law are not likely to be imported fully formulated and functioning. Rather, organizational response to the law is a process that unfolds as organizational actors exert their own interpretations and solutions within their particular organizational locations. Existing work has helped explain that professionals who implement the law are able to construe the meaning of the law. Professionals within organizations engage in jurisdictional competition for organizational status and control. They "construct" the law for several reasons, but researchers have paid particular attention to professional efforts to enhance their own organizational status and work autonomy (Abbott 1988; Edelman 1992; Edelman, Abraham and Erlanger 1992; Kelly 2003; Sutton et al 1994). In this sense, they are utilizing law and their expertise over its interpretation or implementation as an instrumental resource (Pedriana and Stryker 1997) to further other professional aims.

Highly organized professionals (i.e., professions with national professional associations, associated journals and other publications, professional conferences, established courses of study, advanced degree programs, and self-regulatory governing bodies, according to Abbott 1988) and high status professionals (Heimer 1999; Abbott 1988) wield power and have influence over less organized ones in a variety of ways and

settings, most notably in their ability to define the conditions of their work and claim jurisdiction over related institutional processes. Chapter 5 analyzes the creation and development of an organizational unit to oversee information technology within the organizational setting of the university. I pay particular attention to the construction of claims to decision making about how computing technology is organized and the way that actors construct claims to legitimate authority in governing this process. In so doing, I find ways that law is constructed so that it can be mobilized as a resource, but I also find ways in which laws about software ownership are minimized because of their limited use in claims to legitimacy within the academic setting.

Competing Institutions

Professional expertise might be employed instrumentally to influence organizational legal implementation, but the associated professional socialization also provides the foundation for particular cognitive understandings of organizational problems. Heimer (1999), like the other institutional law and society scholars, sees organizations as an important site of legal implementation and law as a variable outcome, dependent upon social interaction and competition. Heimer describes the negotiated nature of meanings and implementations of legal practices (and other institutional practices) as institutional competition, and her case involves the three competing institutions of law, medicine and family, in neo-natal intensive care. In her research on law in organizations, she concentrates on the way that different social groups working on a collective task bring their unique collective and personal perspectives to social interactions. She explains how social groups (not only professional ones, but also family

groups) can represent distinct institutionalized normative and cultural approaches to a collective task, illustrating how jurisdictional competition and cooperation over tasks is culturally informed. In her account, law is one of a set of institutions that may bear on a particular problem of interest, and related institutions provide cultural frames of reference that potentially influence how law will be interpreted for a given setting and issue. Expecting patterns in outcomes of competing institutions, Heimer observes that professionals from high status occupations, legal repeat players, and actors with frequent physical proximity (locals) to a problem have greater power to advance their institutional preferences and legal interpretations.

Heimer's work clearly draws on institutionalism but infuses it with a structurational approach to understanding legal construction. Her work draws in some ways on legal consciousness scholarship of Ewick and Silbey (1998). I also take an interpretive approach to analyzing the professional construction of legal meaning. All of these activities that describe the reciprocal nature of law and individual socialization rely on an interpretation of the law as *legality* (Ewick and Silbey 1998). The way that people comprehend the law and its relationship to their own life situations depends upon their experience and socialization. Ewick and Silbey (1998) emphasize the way that people perceive, mobilize and resist the law in their everyday lives. People may hold simultaneously conflicting views about the law, and often do so only sub- or semi-consciously (Sarat 1990; Ewick and Silbey). Ewick and Silbey (1998) see legal consciousness and the understanding of law as legality as way to bridge the relationship between agency and social structure (39). Their research details the process of

structuration (Giddens 1979, 1984).Work on legal consciousness examines the way that formal laws define peoples experiences and shape social activities, but also how peoples social understandings are brought to bear on the way that the law is invoked or avoided, consciously or unconsciously (Engel 1993; Ewick and Silbey 1998).

This body of work provides a context for examining the work of professionals in constructing the meaning of software ownership in their work settings. The formal legal context guides the interpretation of the law, but the real act of giving the law practical meaning occurs as social actors make sense of their daily activities. The three bodies of research within the law and society tradition are applied to how professionals construct the law in this project. The sociology of professions lays the groundwork for how professional groups serve as organizational legal filters. Law and organizations literature provides a starting point for an inquiry into how the organizational agenda and internal cooperation and competition over legal interpretation and professional jurisdiction have consequences for legal interpretation. Finally, understanding law as one of a set of competing institutions provides a framework for analyzing the interpretive process of organizational professionals, especially in a case of law for which there is no formal regulatory agency or prescribed policy.

Chapter 2: Data and Methods

Extended Case Method and Case Selection

The research questions motivating this project call for analyzing a process of knowledge creation and organizational learning, in this case the way that university computing professionals interpret intellectual property laws relating to software ownership. This is an interpretive project that engages with research subjects and organizational documents to uncover the process by which individuals create meaning systems. I use an extended case method approach to analyze a case of the "professional construction of law" in organizations, selected to maximize its potential to challenge existing theory. Extended case method begins with existing theory but introduces new or different elements in order to challenge or extend the theory beyond its existing explanatory frame (Burawoy et al. 1991; Burawoy 1998b). The goal of the extended case method is not to falsify theory or produce grand generalizations, but to challenge existing theory by valuing anomalous or new information. Furthermore, Burawoy (1998b) argues that the case study can be treated as a microcosm of influences at work in the broader society.

I begin with existing theories about the construction of legal meaning, which posit that organized groups, primarily state regulatory agents and organized professional group members, have great capacity to interpret the meaning of legal compliance on behalf of organizations. I chose the case of software regulation in the university with the intent of challenging existing research on three fronts: a type of law that lacks a regulatory agency; a professional group, that of computer and information technology professionals, that

defies existing characterizations of "typical" professional organization; and a setting, the university environment, which maximizes the potential for competing institutional understandings of what it means to own information thereby maximizing the range of interpretations of compliance with software ownership laws.

The law: intellectual property. I chose a case of intellectual property law because it imposes regulatory like requirements on organizations without a regulatory body for enforcement or for interpretation of statute. Copyright, patent, and other intellectual property laws are self-enforced by intellectual property owners themselves through courts, publicity campaigns, and increasingly, in the case of software, through technological protections. Much of the existing institutional research on law in organizations described in the literature review has examined organizational interpretation of, and compliance with, employment law (save Kelly 2003 on employer targeted tax law changes and Heimer 1999 on laws regulating neo-natal medical practices). I extend this organizational legal compliance work to a case of organizational responses to computer related intellectual property law. Legal decision-making (legislative and judicial) applying intellectual property rights to biotechnology and computer technology has generated huge economic markets. Intellectual property law is a useful place to study the way that social actors comprehend and implement the law because property rights have been under-theorized in sociological research (Carruthers and Ariovich 2004; Swedberg 2003; Campbell and Lindberg 1990), and even the classical connections between law and economy had been abandoned until recently (e.g., Edelman and Stryker 2005; Swedberg 2003). In addition, the relatively new nature of

some categories of intellectual property and the constant challenge technology presents to existing categories of ownership in intellectual property should make competing conceptions about how to interpret and apply these laws somewhat more accessible than they might be in more established categories of law drawing on standard sets of legal frameworks.

The professional group: computing professionals. Existing research focuses primarily on the legal filtering of Equal Employment law by human resource professionals. With a primary emphasis on analyzing the interpretation of the law or legal compliance, this research taken the existence of an established professional groups, especially the human resource profession, most likely to create legal compliance procedures as their starting point. Authors identified a standard body of professional literature and associational activity to which they attributed the legal socialization of this professional group. Furthermore, these are administrative professionals who are often already responsible for other regulatory compliance within the organization. Less is known about the organizational features of my focal professional group.

In literature about professions more generally, information technology professions and within IT, computing professions, have always been bracketed as "different," in the way their profession has historically developed and in their relatively diffuse organizational structure (esp. Abbott 1988). Professionals come from a variety of training backgrounds and specialize in a variety of tasks. Given the less-centralized nature of the computing profession and their lack of pre-existing responsibility for legal compliance, this case analysis can examine the extent to which the features of organizational legal

interpretation are attributable to professional group characteristics. Computing activities are vast and diverse, as are the professionals responsible for the variety of associated computing development, management and support tasks. The group, as a whole, and even the subset responsible for university related computing practices, are less professionally cohesive than many other professions, including the administrative and legal professionals that comprise the other professions in this research as well as the human resource professions that are the subjects of other legal implementation research.

The organization: the university. Academic organizations have had to adapt to the increasingly important role of computers, which extend the capacity and rate at which information can be exchanged. Most academic organizations provide computing technology for their faculty and students, requiring an infrastructure of computing personnel to manage and support this technology. Only 15 to 20 years ago, the early versions of computer support were very differently organized and regulated in the university. Today, the bureaucratic organizational apparatus for computing support is expanding dramatically. Although not all academic organizations, and not even all universities, will settle on the exact same organizational arrangements that I find in this study, they all share basic organizational features, national legal contexts, and professional associational contexts. The processes of how information about the law filters into academic organizations should be reasonably similar across these organizations.

Over time, software's status as a commodity has solidified and has come to be associated with market forces even though important exceptions exist for open source

products. Within the legal context of intellectual property compliance, universities (and academic organizations more generally) are in a unique position to imagine alternatives to information as intellectual property (accompanied by the associated exclusive rights to its use) because of the university's mission to educate and inform. Universities and colleges are responsible for collecting and disseminating information as part of their obligation to promote learning, impart knowledge, and even engage in social commentary and criticism. Such a setting requires and emphasizes the need for free exchange of ideas and information, forms of which are regulated by intellectual property law. Academic organizations must contend with a tension, if not outright conflict, between information as public good and information as private property. While this is an idealized portrayal of the practical matters of legal compliance, and while it is just as likely that, as large bureaucratic organizations, universities are as likely as any other organization to adopt formalized and isomorphic strategies of intellectual property compliance, universities may be more likely to entertain a broader array of imagined responses to intellectual property compliance. Public universities are also likely to have a more accessible set of available records and other data through which to examine these debates than private companies. This project makes use of that setting to explore the range of narratives that surround the use and implementation of practices around software use and licensing procedures. The complicating feature of this research is that these three "extensions" to existing theory intersect and are likely to work in concert. However, together they can also take theory about professional construction of the law and about property rights in new directions.

The Organizational Setting and Time Frame

The University Setting. My research necessitates a close examination of internal organizational dynamics, including detailed accounts of organizational change over time, policy change over time, and the interpretive accounts of these changes by the social actors that create them. In order to conduct such a case study, I chose a focal academic organization and faced organizational idiosyncrasies regardless of which academic organization I selected. The selection of a large Midwestern University, though convenient, is reasonable. The university selected for this research is a large land grant university, and though larger than most, is reasonably representative of large public universities. In terms of size of undergraduate student body and ranking, the University ranks among the top 25 public universities in the United States. While the U.S. News and World Report (2010) ranks the university in the top 100 among all U.S. universities and in the top 25 among public universities. The Center for Measuring University Performance, now at Arizona State University, rates the selected university among the top 25 overall in the United States (Capaldi et al. 2009). [4] With respect to computing, the University is like or surpasses many of its peers in its involvement in computer innovation and ranks high against standard markers of computing organizational leadership in Educause reports (Arroway et al. 2009). The large size of the university is

[4] Methodology for college ranking is hotly debated. Popular measures by U.S. News and World Report or Money Magazine have been roundly criticized by academically rigorous attempts to critique and reformulate college ranking formulae. The merits of overall rankings are also debated in the higher education literature. Popular news magazine rankings can be heavily influenced by missing data in ranking categories, which is partly why the university is not higher in the U.S. News rating. Research at The Center is more academically rigorous and focuses on academic features that would be of interest to funding agencies and other scholars. However, the news sources are more likely to influence college applicants and popular sentiment.

likely to mean that it has established a more highly bureaucratized organizational structure than smaller academic organizations (Hannan and Freeman 1984; Williamson 1984). Its public status, because of its proximity to the public sphere, is likely to make it more attentive to issues of legal compliance than private academic organizations (Sutton et al. 1994; Edelman and Suchman 1997).

Time Frame. Innovation in computing technology, and the intellectual property activity surrounding it, has developed rapidly. Therefore, I survey the activities of the university from 1990 to present to construct an institutional history of intellectual property computing regulation in this setting. Even into the 1980s, computer use and innovation commingled, so that many computer and software users were also software programmers, whether for private and recreational purposes, professional corporate purposes, or something in between. The development of smaller storage and processing technology and innovation in user interface systems allowed wider consumption of computers for personal use into the 1980s and 1990s. Prior to 1990, much of university computing was specialized academic research in science and technology disciplines, or facilitated administrative activity pertaining to student and personnel recordkeeping (enrollment, tuition, payroll accounting, etc.).

Throughout the 1990s, use of personal computers in the university expanded. Faculty computers became common and computer labs for students were established. Yet, even if computing in the university had been as widespread in the 1980s as it is today, we might not have seen institutionalization of the yet unsettled law related to software ownership until the 1990s. In the broader societal context, the biggest legal and

political struggles over software's copyright status were waged in the 1970s and 1980s, with patentability questions continuing into the 1990s. As the university began providing and supporting consumer-type use of computers, a system of monitoring and implementing related legal provisions became necessary.

The central Office of Information Technology (OIT) at this university was formally established in 1995, and the two key current university policies governing intellectual property were adopted shortly thereafter. The University Policy on Acceptable Uses of Information Technology became effective December 1996 and has been amended in some capacity at least yearly since then. The Board of Regents Policy on Intellectual Property, adopted October 8 1999, became effective May 15, 2001 and superseded the Patent and Technology Transfer Policy of 1986, which was oriented more completely toward university innovations. Although I situate my research within a broader history of intellectual property rights generally and the history of software intellectual property protection specifically, initiating a case study of the university in the early 1990s is sufficiently early to capture changes in organizational structures associated with university computing-related regulatory institutions.

Data

I employ a mix of methodological tools and data sources to investigate the process of organizational interpretation of computer-related intellectual property law in the university. Researching an interpretive process requires information from several sources. I draw on a range of data sources and use a variety of sociological research tools, including in-depth semi-structured interviews, archival research, and comparisons with

secondary data about the law and relevant professionals groups. My primary data comes from interviews with university personnel whose daily work involves management or support of academic computing and archival documents related to computing activity or policy at the university. I situate information from these sources within the broader context of the computing profession, the system of professions, the legal environment around software regulation, and university computing.

Interviews with computing professionals. The bulk of my data consists of in-depth, semi-structured interviews with 42 university computing professionals from three areas within the university: liberal arts, institute of technology, and the central office of information technology. I asked questions about the training and experience of these professionals, the software-related activities and issues that are most likely to occupy their time, the extent to which they are involved in policy making related to software use and monitoring, the way they communicate and interact in policy making decisions about computer related intellectual property compliance in the university, and their assessment of the university's liability risks with respect to software intellectual property infringement. Interviews were open-ended in order to make them conversational (Kvale 1996). The interview schedule is provided in Appendix C. Close to half of these professionals were from the college of liberal arts, roughly one-third were from the institute of technology and about one-quarter worked in the central administration.

Although some questions were less relevant to particular organizational positions, I tried to ask the lead questions in all categories in order to let the interview subjects determine the degree to which families of questions seemed relevant to them. In many

cases, the way that responses are phrased has a great deal of meaning. If I thought they did not understand the question, I tried to use what subjects told me about their basic work tasks to connect the question to what they had already told me about their work activity. I also asked follow-up questions to make sure I understood the person's role with respect to that activity. For example, administrators were typically not involved in direct support of computing machinery, loading software on machinery or day-to-day trouble shooting, but I followed-up with questions about the extent to which they managed that activity, oversaw budgets for that activity or assigned tasks to groups who were responsible for such support.

These questions relate to two broad topics: sources of work-related knowledge and work activities involving software use or management. Questions about work-related knowledge included those about work history; formal and informal sources of training; participation in professional activities; and sources or resources used to solve work-related problems. "Google" was a common answer to questions about how to solve work related problems, so I adjusted questions over time to ask about methods for finding relevant information on Google and criteria used to filter search results for credible information. These questions often got subjects talking in more detail about the kinds of problems they encountered as well. As indicators of the process of the interpretation and implementation of law in the university, I asked a range of questions about change in computing practices over time, especially changes in control over access to computers, changes in types of software technology used and supported, and means of protecting themselves or the organization against legal liability with respect to software use. I also

asked about interactions with other university professionals in implementing policies or legal compliance strategies and the venues within which those activities take place.

Interviews typically ran a bit longer than an hour, with a few lasting only 45 minutes and the longest lasting close to two hours. According to Burawoy (1998a) and Kvale (1996), the interviewer controls the process, thereby exerting a certain amount of power over the interviewee. I found that a few of the computing support professionals with whom I had no prior relationship and no network-based introduction were somewhat suspicious of my interest in their work. In these cases, it was clear that as an interviewer I had taken these people out of their comfort zone (Burawoy 1998a). This seemed far less true for people who had been in their positions for several years or people through whom I had a network connection, even if quite distant. Most administrators from the central organization were more controlling of the interview process, sticking to talking point when possible. In these cases, I had to ask more targeted follow-up questions in order to maintain some level of control over the interview process.

Although interviews were structured around a specific set of questions, I tried to begin with questions that were easy to answer and for which interview subjects were clear authorities, such as confirming job titles, explaining current job duties and giving work histories, before moving to questions about software use and management. Interviewees had a variety of reactions to my interest in their work. Most were willing to talk and provided much detail about their work activities and shared their thoughts about when and how university systems did and did not work for them. I frequently arranged questions in a different order if subjects raised topics before they appeared in the

interview guide. I also asked frequent follow-up questions to elicit more information or to ask for clarification. I encouraged interview subjects to share thoughts that they felt were relevant, whether or not they bore directly on my planned questions in order to get them comfortable talking and to find out whether there were factors influencing software-related practices that I had not considered. If interview subjects had worked at comparable jobs in private industry or other universities, I also asked questions about how activities in the other organizations compared to the current one.

Archival sources. I draw on several archival sources to construct the history of the information technology office of the university and to situate the organizational position of interview subjects. I collected Information Technology Newsletter issues from 1994 through 2006 and meeting minutes from the Senate Committee on Information Technology from 1997 through 2009. Additional archival sources include organizational charts, university news publications, university budget records, budget office newsletters, and other internal Office of Information Technology documents. I supplement this information with university news sources and secondary data about the broader field of university computing, computing-related professional organizations, and related formal legal activity.

Two of these archival sources, the Information Technology Newsletter and the Senate Committee on Information Technology meeting minutes, comprise the bulk of my archival data. They also feature prominently in the chapter about the development of the university computing administrative unit because they provide a consistent stream of chronological information about the activities of that organization, even though they are

filtered through a particular organizational interpretive lens on that activity. The Information Technology Newsletter (IT Newsletter) began as the Computer and Information Science Newsletter, in the fall of 1991, as a monthly publication to inform the university community about computing related activities and services. The newsletter was renamed when the newly created central Office of Information Technology unit (OIT) was formed in 1995 and was used in part as a mouthpiece for the central organization's strategic initiatives. The IT Newsletter represents the public face of OIT to the university community. The publication tends to highlight services and inform the community about the work of the units of the Office of Information Technology. It is also an informational resource about where to seek technology related help, secure technology related products and services, and is a communication tool to inform the community about special rules or anticipated service disruptions.

The Senate Committee on Information Technology (SCIT) is a committee of the University Senate, comprised of volunteer faculty, staff and student representatives who provide input and guidance about activity and decisions concerning technology resources at the university. The Senate Committee on Information Technology is part of the governance system of the university. Interactions recorded in the meeting minutes represent an interaction between the Office of Information Technology and a group designed to provide guidance about university decision making. As such, the central Office of Information Technology (OIT) is both selling their position on technology related policy and practice as well as seeking guidance for challenging decision making. In many cases, requests for input are clear, but what is not always clear from these

records is how much weight the committee input has on OIT decision making or policy implementation. These two primary sources tell the history of the Office of Information Technology's development from the central administrative unit's point of view. I rely on interviews to provide a perspective from other units, and from the people "on the ground."

Analysis

During data collection, I combined document and interview information in an iterative process to analyze the professional construction of the law and the implementation of software rules in the university. My research questions focus on legal interpretation and implementation as a process. Heimer's concludes her article on competing institutions by suggesting we can only understand how "one institution gains ascendance over another" by "looking at the microprocesses by which institutionally based problems and solutions are brought together in a particular setting" (62). Barley and Tolbert (1997) and Orlikowski (1992; 1995; 2000) also advocate for process oriented approaches to studying technology (for an example, see Barley 1986). Furthermore, they recommend charting action and scripts, much like the institutional law and society scholars.

Content analysis. I transcribed interviews so that all data was in the form of written texts, which I content analyzed according to the thematic focus of each chapter. This involves categorizing data according to theoretically informed themes, but also leaving open the possibility of finding new themes in the data. According to Barley and Tolbert (1997), who recommend such an approach for the study of technology in

organizations, "prior knowledge of the setting and the institution under investigation may permit researchers to anticipate some scripts. However, unexpected scripts inevitably emerge during the course of study." They write that this is "particularly true when researchers are studying interaction orders with which they have little personal experience or that are in the process of changing" (Barley and Tolbert 1997). I engage in both comparative and (recent) historical analysis in the chapters that follow. I employ a comparative perspective along three dimensions that are designed to build on existing theory about professional construction of the law. These comparative dimensions roughly accord with my three analytic chapters and they move from meso- to micro-level processes. Interpretive approaches attend to the culturally embedded intentions of individuals or groups and select cases to highlight differences. (Griffin and Stryker 2000; Skocpol 1985). In all three chapters, I emphasize the way that law is interpreted within the organization, yet the comparative elements help call attention to key factors that influence those interpretations. I situate the computing profession within the broader system of professions in Chapter 4 and compare its characteristics and role in the legal interpretive process with other professions already described in the literature. In chapter 5, I examine change over time in the development of the organizational unit responsible for computing activity in the university. Finally, I compare level of computing expertise across university collegiate units to understand the role of technical expertise in interpreting software-related regulation in chapter 6.

Comparative approach. I compare an understudied profession, computing, to those studied in the existing literature in Chapter 4, in order to determine whether and

how different features of this profession alter the likelihood and style within which this group utilizes law as a resource in their professional development. I analyze the features of the computing profession based on interview data and secondary data about computing-related professional organizations. I compare the broad status of the computing profession with others in the system of professions, but also use information about the individual professionals from my particular case to tie professional characteristics to legal implementation. Indicators of professional training, socialization and communication are important for this analysis. I designed interview questions to gather such information and coded responses accordingly. While many of these characteristics are straightforward, I knew that some of these characteristics would deviate from those emphasized in the sociological professions literature. I was also surprised to find just how few of my research subjects had any affiliation with professional organizations in any capacity.

In addition, and in order to give my case a professional context, I gathered secondary information about computing-related professional groups that figure prominently in the history of software development, the Association for Computing Machinery (ACM) and the Institute of Electrical and Electronics Engineers (IEEE). As I analyzed the membership and professional associational characteristics of my research subjects in the university, I found that additional professionals groups were more relevant to the university computing environment, especially Educause and a security group called SANS. I gathered additional information about these groups to make sense of how they contributed to the legal interpretive activity of computing professionals in the university.

I retain implicit attention to changes over time in computing and software, within and outside the university, throughout the chapters, but in Chapter 5, I use a temporal and narrative approach to analyze change over time in the structure of the computing operation within the university. I analyze the way professionals mobilize legal interpretive frameworks in relation to other issues in the creation of that organizational structure. This chapter focuses on the organizational level of the legal interpretive process and emphasizes factors used by groups (especially the central computing unit) to establish their legitimacy as an organizational unit and with respect to their authority to control the rules associated with computing technology in the university.

In telling the story of temporal change, I anticipated coding a variety of activities related to "software" and/or "licensing" as the predominant method of analyzing data. As I coded newsletter and meeting minute content for these terms and related topics, I found that I had to expand my view to the university's approach to managing and organizing computing in general. The way that processes were put in place to manage computers had a great deal of impact on what research interview subjects considered appropriate or possible in dealing with software. Through an iterative process of reading, re-reading, condensing and reconsidering the documents available to me, I began to piece together the story of how security, networking, and budgetary strategic positioning of the central organization factored into a hierarchy of computing management for the whole university organization. Analyzing the extent to which professionals mobilize law as a resource required looking at a broader array of laws that only those concerning intellectual property.

Finally, I compare the way that different levels of computing expertise among individuals and small groups in different collegiate units within the university influence legal interpretation in Chapter 6. In this chapter, I analyze how individuals organizational positions, both hierarchical and horizontal influence the institutional frameworks they draw upon to understand how to handle software (use and licensing) in their daily work. Although this chapter is a micro-level analysis, I analyze the way that individual understandings of the law are tied to organizational and broader cultural frameworks. Institutions of law, technology, markets and academia compete with and reinforce one another in different ways across different units within the university.

As with the characteristics of professions in chapter 4, I had some ideas about issues that might influence professionals' conceptions of software ownership, use and licensing implementation practices. I developed ideas about frames for understanding software as intellectual property based on legal and communication scholarship as well as from my own experience as a computer user in the academic setting. I chose the focal law, intellectual property to explore connections between legal and economic frames. I chose the academic setting in order to maximize the potential for countervailing frames of information freedom. I was open to additional frames for understanding policies and activities surrounding the use of software in the university and knew that the invocation of any of these frames may also appear in a number of forms. For example, even though I expected market-oriented logic feature prominently in descriptions of how computing professionals acquire software, I did not know what channels they would use for purchasing. I also did not know whether the market frame would influence other

computing related activities, such as justifications for limiting user control over loading programs on their machines. I had to be especially open to listening for themes during interviews and pay attention to the content of interviews in coding transcripts to find themes in the approaches to software use and licensing in the university. Ultimately, I looked for repeated patterns in the data along 4 cross-cutting sets of categories: class of work activity, orienting tasks, cognitive frames, organizational location (and the related level of computing technical expertise). I describe all four categories in Chapter 6, but address each briefly here.

Classifying interview subjects across a different dimension, they fall into 4 broad families of work activity: software developers, computer support personnel, server managers, and computing administrators. The *software developers* are those who develop software to help accomplish academic research or who develop tools that help an academic department accomplish internal tasks. I have limited my case to the set of professionals who facilitate the use of computing for academic purposes of research and teaching. As such, I do not examine a range of interesting activities surrounding software development that is done by computer science or engineering faculty and research support staff that is created with the intent of serving purposes beyond the walls of the university. Thus, the software developers I interviewed tended to be those who support the use of computing for getting research done. Although some of this software could be used beyond the scope of a given research projects, in this study, it typically is not. *Server managers* run servers and networks for colleges, departments, research projects or research centers. They set up user accounts and maintain connections to the internet,

which requires routine monitoring for the safety and integrity of the system to ensure that no unauthorized access to the system takes place. They often provide and maintain software programs on the server and establish access for qualified members of the university. Computer *support staff* members provide computing support to faculty, staff, and students either as departmental support staff members or computing lab support staff. All of the above duties can intersect within a single information technology professional. *Computer administrators* are more like information technology managers and function more like other administrative personnel but with jurisdiction over computing and information technology activities within the university. They are not only the central administration staff that I interviewed, however, administrators also reside in the institute of technology and more so, in the college of liberal arts.

My research subjects are distributed across these four types of work activity, with between 8 and 15 people from each category. It is virtually impossible to classify job categories in terms of only one of these activities, but by apportioning job duties by wholes, halves and thirds, the approximate distribution of interview subjects by university unit and job task is shown in Table 2.1. Some staff members supporting servers for research projects in or across departments also spend part of their time providing departmental computer support. Some software developers also maintain servers for their respective research projects or departments. Some information technology professionals, particularly support staff in the institute of technology, do multiple duties by running servers, providing support, and doing a bit of project specific programming.

Table 2.1. Distribution of Interview Subjects by Collegiate Unit and Computing-Related Work Tasks (allowing for fractional apportionment of work tasks)

Computing Task	**Collegiate Unit**			
	Liberal Arts	**Technology**	**Central Administration**	**Total**
Computer Support	8	5	2	15
Server Management	3	5	0	8
Software Development	4	3	1	8
Administration	3	1	7	11
Total	18	14	10	42

I selected people from more than one collegiate unit for two reasons. First, in examining the implementation of rules, I expected variation in the institutional approaches taken to software regulation across the organizational hierarchy between computing professionals who do computing-related work and administrators within the computing unit of the university. Second, I selected the liberal arts and technology academic units in order to examine variation in the level of expertise of both computing workers and among the constituents served by them. I found expertise relevant not only between the two academic units but also even among individuals within single departments.

In analyzing the interpretive activity of these professionals, I found it necessary to classify the cognitive frameworks used by computing professionals to interpret software laws by the type of activity requiring interpretation. In other words, I have labeled the primary activities of computing professionals, "orienting activities," because it is only

through social interaction that institutions are referenced, created and recreated. *Software selection and acquisition* comprise a collection of activities, most of which ultimately require decision making about which software to load on any given machine, how to pool common requests for different types of software and, how to obtain the software of choice. *Configuration and access to machinery* involves setting up hardware, installing and selecting settings for software, and especially networking computers with one another in the university environment and beyond. All of these activities are part of how computing professionals make the computing tools work for their clients. The third set of activities that impact on software ownership rules are activities related to *troubleshooting and basic support*. Troubleshooting is the noticeable activity, and the one that clients may think of as the computing professional's primary job, though, as I describe in chapter 6, it is often the least predictable and, consequently the one that requires the most pre-emptive management. The need to categorize activities became apparent as I began coding interview material for cognitive themes that research subjects used to talk about and make sense of software-related problems, rules and practices. They invoke different cognitive themes to describe software acquisition, which tends to be very market oriented, than they do to talk about how they set up machinery or install software. I relied on repeated patterns of intersecting themes to analyze how and why policies and routine practices were accepted or rejected by various groups in the research setting.

Chapter 3: The Formal Legal Context of Software in the University

Copyright and Patent in the United States

Copyright and patent are two of the three primary areas of intellectual property.[5] Despite their common constitutional beginnings in the United States, copyright and patents have each taken on a life of their own. The two types of law share several key characteristics, due partly to their common legal origins in the U.S. Constitution, and partly to the goal they serve of fostering innovation by assigning ownership rights for the commodity forms of ideas. Patent and copyright laws grant exclusive rights, meaning that an "owner" has the right to exclude others from copying or using her creation or invention for a period of time specified by the law. In short, both types of law turn non-exhaustive common goods into privately owned property. However, copyright and patent laws typically pertain to different subject matter, though software is an important exception to this dichotomy. The two forms of property are subject to different evaluation procedures and standards, and the rights are assigned for different term lengths. In most cases, an owner of intellectual property may exert their exclusive right in several ways, including preventing others from use or copying altogether, licensing use of the property for a fee, or donating the work to the public domain prior to the end of the term. Important exceptions to the exclusive right exist, including fair use for educational and critical purposes in copyright and a limited range of experimental use exceptions in patents. Once the time limit expires on the exclusive right, the work enters the public domain and anyone may use the work.

[5] Trademark is the third, but its grant and authority originates in the commerce clause rather than the intellectual property clause.

Patents and copyrights have long histories, particularly in Europe, before their federal legal formalization in the United States. In the United States, a provision for the privatization and protection of intellectual creation and discovery was important enough to earn its own clause in the Constitution, yet little is known about the decision to include the clause, much less the reason for the particular form it takes. Although the clause clearly originated out of similar protection that had existed in the English common law, debate over the clause was brief and virtually undocumented, leaving little evidence about where language for the clause originated. According to Walterscheid (1994), little or no mention of it appears in draft versions prepared by colonial representatives (25-27). Yet, the United States Constitution establishes that Congress shall have the power "…to promote the progress of science and useful arts, by securing for limited times to authors and inventors the exclusive right to their respective writings and discoveries" (Article 1, Section 8, Clause 8). The constitution does not label these protections copyrights or patents, but the first session of congress enacted two parallel pieces of legislation: the Copyright Act of 1790[6] and the Patent Act of 1790.[7] Parallels in the conditions governing intellectual creation within these two Acts are evident, but they have developed along independent trajectories over time. Some changes seem consistent with the different subject matter covered by copyright and patent, but all of them call attention to the complexity of the social processes that influence the resulting configuration of rights.

[6] 1 Stat. 124.
[7] 1 Stat. 109.

Commodification as a social process

It is a challenge to turn information or the manifestation of an idea into a commodity, which is perhaps why Swedberg (2003) and Carruthers and Ariovich (2004) find intellectual property rights to be so interesting. Law and society scholarship has long recognized the socially constructed nature of the law, from the sociological jurisprudence of Pound (1910) and Holmes (1963) to the more recent work of Edelman, her colleagues and others (e.g. Dezalay and Garth 1995; Dobbin 1994; Edelman, Abraham and Erlanger 1992; Edelman, Uggen and Erlanger 1999; Ewick and Silbey 1998; Kelly 2003; Uggen and Blackstone 2004). Yet, The social nature of granting ownership rights over intangible ideas or information is especially evident.

Both copyright and patent grant exclusive rights, meaning that an "owner" has the right to exclude others from copying or using her creation or invention for a period of time specified by the law. Both types of law turn non-exhaustive common goods into privately owned property. According to formal intellectual property law, ideas cannot be owned. Like land, information is a common pool resource; absent legal protections and boundaries, information can be used by anyone who comes into contact with it. Unlike land, information is not geographically, physically or spatially confined. Furthermore, information is non-exhaustive; use of information does not result in decreased quantity or quality for others. Due to the non-exhaustive common good nature of intellectual property, the law only protects rights to the exclusive use of tangible forms of intellectual production. The ideas underlying the tangible expression or invention are meant to remain accessible to all. But this is an artificial distinction. As Cohen explains, "the

market and the law must confront the insuperable difficulty of determining exactly what is owned" (1998, p. 511). The courts, and to some extent the legislature, have tried to guide this determination process by separating the concept of the idea from its physical manifestation.

Subject Matter

A quick glance at the subject matter statutes of copyright and patent reveals what most people already perceive about the distinction between the substantive content of copyright and patent. Copyright protects creative expression, whether in words, music, art, dance, design or some other expressive form. Patent protects technological and scientific invention (and, though the statute does not provide for it, discovery).

Copyright. The current statute applies copyright protection to "original works of authorship" including the categories of

> (1) literary works;
> (2) musical works, including any accompanying words;
> (3) dramatic works, including any accompanying music;
> (4) pantomimes and choreographic works;
> (5) pictorial, graphic, and sculptural works;
> (6) motion pictures and other audiovisual works;
> (7) sound recordings; and
> (8) architectural works.[8]

Although the phrase "original works of authorship" has been a feast for the courts, the list of copyrightable subject matter has largely been a legislative effort. Copyright has a history of legislative tinkering, seemingly to adjust the law to changes in expressive media and technology. Copyrightable material initially included any original "book,

[8] 17 U.S.C. §102(a).

map, or chart."[9] Copyright law was revised to add prints in 1802,[10] musical compositions (but not the right of public performance, added in 1897) in 1831,[11] dramatic compositions, with the right of public performance thereof in 1856,[12] photographs in 1865,[13] paintings, drawings, sculpture, and models or designs for works of the fine arts in 1870.[14] In 1909, copyright language specified "all the writings of an author," and included protection for mechanical sound reproduction, though such a category did not become part of the written law until 1971.[15] Motion pictures were added in 1912[16] and the largest revision of copyright in 1976 settled on the first of the seven current categories listed above. In 1980, an amendment to §117 explicitly added computer programs,[17] though they already received some protection through the courts. Architectural works made it onto the list in 1990.[18]

Patent. The codified subject matter of patent law, on the other hand, has changed little since the first U.S. patent statute in 1790.[19] Patentable subject matter is rather broad and is specified in 35 U.S.C. § 101, "Whoever invents or discovers any new and useful process, machine, manufacture, or composition of matter, or any new and useful improvement thereof, may obtain patent therefore, subject to the conditions and

[9] Copyright Act of 1790, 1 Stat. 124. (May 31, 1790).
[10] 2 Stat. 171.
[11] 4 Stat. 436.
[12] 11 Stat. 138
[13] 13 Stat. 540.
[14] 16 Stat 212, Rev. Stat. §4948-71.
[15] 35 Stat. 1076.
[16] 37 Stat. 488.
[17] Computer Software Copyright Act of 1980. 94 Stat. 3015.
[18] Architectural Works Copyright Protection Act of 1990. 104 Stat. 5089.
[19] Patent Act of 1790, Ch 7, 1 Stat. 109-12 (Apr. 10, 1790).

requirements of this title."[20] Although "new and useful" might be debated, "machine, manufacture, composition of matter and improvement thereof" is broad, but relatively straightforward. Merges, however, explains that "the language of the Patent Act must be read in light of the many cases over the past two hundred or so years that have interpreted it and its predecessors in now defunct versions of the statute" (Merges 1997: 51). Thus, the common law nature of patent law is evident in this need for an understanding of the courts historical treatment of the statute. Rather than legislative additions to subject matter, the court has held the task of interpreting the subject matter of patents and has effectively added to the list of patentable subject matter over the years. Indeed, the court has construed the subject matter of patents broadly, as they have relied on the Committee Reports accompanying the 1952 Patent Act specifying that the subject matter of patents is meant to "include anything under the sun that is made by man."[21]

Common Ground: Exclusion of ideas from both copyright and patent.

According to formal intellectual property law, ideas cannot be owned. Jefferson, one of the primary figures in drafting what has come to be called the intellectual property clause, explains the unique character of intellectual production, "If nature has made any one thing less susceptible than all others of exclusive property, it is the action of the thinking power called an idea, which an individual may exclusively possess as long as he keeps it to himself… Its peculiar character, too, is that no one possesses the less, because every other possesses the whole of it" (Jefferson 1813:1291). The law, therefore, must be called upon in order to make intellectual production into something that can be privately

[20] 35 U.S.C. §101.
[21] S. Rep.No. 1979, 82d Cong., 2d Sess., 5 (1952); H.R. Rep. No. 1923, 82d Cong., 2d Sess., 6 (1952).

owned. Jefferson continues, "society may give an exclusive right to the profits arising from them [ideas], as an encouragement to me to pursue ideas which may produce utility, but this may or may not be done, according to the will and convenience of the society" (Jefferson 1813:1291). In Jefferson's account, the state might use its power to grant exclusive rights in order to spur creation or invention. Some legal and communications scholars argue that capitalist markets demand a transformation of all activity into commodity form (referred to as commodification or commoditization) and implicitly characterize law formation as a mechanism of the capitalist economy (Cohen 1998; Bettig 1992). The law insists that *ideas* themselves are ineligible for copyright or patent protection. *Tangible forms of ideas* are the ideas as they are manifested in practices, forms of expression, or inventions. I first compare copyright and patent on the basis of what is excluded from protection in the name of the freedom of the *idea*.

Copyright and ideas. Ideas, concepts, procedures and functional aspects of work are not protected by the copyright statute. The statute explicitly states, "in no case does copyright protection for an original work of authorship extend to any idea, procedure, process, system, method of operation, concept, principle, or discovery, regardless of the form in which it is described, explained, illustrated, or embodied in such work."[22] In literary works, for example, the idea of forbidden love between members of rival families is an "idea." The copyrightable expression of that idea in a novel, play, screenplay, film, etc. is the plot idea reduced to tangible form. Any number of core plot and characterization elements in the rendition of this classic story might constitute

[22] 17 U.S.C. §102(b).

unprotectable ideas, which, in combination and through the creator's specific language or style, constitute a tangible, protectable end product.[23]

Factual and functional aspects of work are also not formally copyrightable. Copyright, in general, applies to aspects of a work that express the author's original contribution. If the work is a compilation of facts or a description of a functional process, copyright covers only the original expressive contribution (often the selection and arrangement of information) of the author, not the underlying facts or functional processes. Thus, copyright in factual compilations is said to be "thin." For example, a work of nonfiction may contain an author's unique telling of the subject's life. The factual occurrences in a non-fiction biography are not owned by the author or copyright holder, but the selection of events, fictitious or speculative filling of gaps, and overall narrative or expressive style of the work is protected by the copyright.

Likewise, functional aspects of a work are not copyrightable. One of the first ledger forms for accounting was not suitable copyright material because of its functional nature, since the design of the ledger was nearly entirely attributable to its functionality (*Baker v. Selden* 1880). Copyright runs extremely thin for logical or functional arrangements of collections of facts like phone books or other databases. While a phonebook may have copyrightable aspects, such as an introduction or stylistic presentation, and does receive a copyright, the factual content and logical or functional arrangement of the phonebook (or other database) makes its copyright extremely thin

[23] A recent development in the patent law may undermine the exclusion of plot lines from the realm of intellectual property. Andrew Knight received the first "Storyline Patent" on November 17, 2005, but ownership thereof has yet to be tested in court.

(*Feist Publications, Inc. v. Rural Telephone Service* 1991). Sweat of the brow labor is not a legitimate criterion for granting U.S. copyright, because the congressional power to grant the right is limited, and balanced by, antitrust considerations.[24]

Patent and ideas. In patent law, *ideas* are things like "laws of nature, physical phenomena, and abstract ideas," all of which have been held not patentable (Merges 1997: 54). For example, Einstein's formula, $E=mc^2$ or Newton's law of gravity would not have been patentable. Likewise, manifestations of the laws of nature, like "the heat of the sun, electricity, or the qualities of metals, are part of the storehouse of knowledge of all men [sic.], … free to all men [sic.] and reserved exclusively to none" (*Funk Bros. Seed Co. v. Kalo Inoculant Co*. 1948:130)." The decision in *Funk Bros.* denied a patent for newly discovered (but naturally occurring) bacteria included in an inoculant. Interestingly, this decision established a condition under which products of nature are not patentable, but human modifications to products of nature are patentable.

In *Diamond v. Chakrabarty* (1980), the groundbreaking patent case that solidified the patentability of life forms, the Court interpreted Congressional committee reports as recognizing "that the relevant distinction was not between living and inanimate things but between products of nature, whether living or not, and human-made inventions"(*Chakrabarty* 1980:313). This ruling on human modifications to nature sets up an interesting incentive structure for inventions such as genetically modified plants, organisms, etc.

[24] Contrast this with the European Union's allowance of database ownership.

While ideas are not formally protectable, their exclusion from the realm of exclusive rights is somewhat less feasible in practice, because the line between the freedom of an idea and the protection of its tangible form is blurry at best. In addition, *Chakrabarty* provides an obvious example of how the arrangement of ownership rights fuels the development of some ideas at the exclusion of others. The use of injunction as a remedy to infringement can mean that certain ideas underlying modifications to existing protected works will be delayed in making it to the public, if not suppressed altogether. Creators, distributors and consumers of computer technology have more recently debated fact versus function in patent protection and idea versus creative design in copyright with mixed results. Written work is typically eligible for some level of copyright protection, even if the work consists primarily of fact or idea. If something is functional and new, a patent is typically the preferred form of legal protection. Software, however, is currently protected by both copyright and patent and is discussed separately below.

Newness and Originality

One requirement of intellectual property statutes is that work be new or original; the creation or invention of new property should be some alteration of, or improvement on (though improvement has proven difficult to require or evaluate), existing knowledge. In copyright, "originality" is the only requirement connoting any meaning of newness, and, in fact, requires little in the way of temporal newness. Patents require "novelty" and "nonobviousness," in addition to strict statutory tests for timeliness of invention through the "statutory bars."

Newness in Copyright: Originality. Federal copyright protection requires *originality*. However, there is no explicit definition of such contained in the 1976 Act.[25] The House Report on the Act suggests that the phrase "original works of authorship" in the statute is left intentionally undefined in order to incorporate the standard of originality that had evolved through case law.[26] The frequently-cited decision in *Feist Publications, Inc. v. Rural Telephone Service* (1991) explains the meaning of originality for copyright. Justice O'Connor, writing for a unanimous Court said, "'[o]riginal,' as the term is used in copyright, means only that the work was independently created by the author (as opposed to copied from other works), and that it possesses at least some minimal degree of creativity" (*Feist Publications, Inc. v. Rural Telephone Service* 1991:345). If two people independently create the same work, they may theoretically each hold a copyright in the work. In reality, however, whether or not a work was copied is sorted out through negotiation between the parties or through litigation within the courts, which can favor the person or party with greater resources.

Newness in Patent: Novelty, Non-obviousness, and Statutory Bars. Patent requirements of *novelty*[27] and *nonobviousness*[28] pertain to an invention's substantive newness and are principles designed to help evaluate whether anything substantially similar to the claimed invention already exists. Only *novel* inventions are patentable, meaning inventions that were not known before the patent application and referring to both substantive and temporal newness. The entire process of invention is subject to

[25] 17 U.S.C. §101 discusses the requirement.
[26] H.R. Rep. No. 94-1476 at 51-52, 56-57 (1976).
[27] 35 U.S.C. § 102(a).
[28] 35 U.S.C. § 103

scrutiny according to the statute. In some cases, even an invention that was only known or used by few people may not be novel if there is evidence of its prior existence and a patent application was not filed within a specified time frame. Novelty is required to ensure that the granting of exclusive patent rights is made in exchange for disclosing information about the useful invention to the public. A new invention can combine elements of existing inventions, but in combination or not, it cannot be obvious in light of the prior art (*Structural Rubber Products Co. v. Park Rubber Co.* 1984). *Nonobviousness* is an additional and separate component of evaluating patentability, described by Merges as a "nontriviality" requirement (1997: 479). Nonobviousness requires that an invention contain "that degree of skill and ingenuity which constitute essential elements of every invention" (*Hotchkiss v. Greenwood* 1851: 266). The nonobviousness standard is a judge-created one and a legislative attempt to clarify the requirement was first undertaken in the 1952 revision of the Patent Act. A patent is not permitted if the invention "would have been obvious at the time the invention was made to a person having ordinary skill in the art to which said subject matter pertains."[29] This requirement is more abstract than usefulness or novelty and refers to the technical accomplishment of an invention.

The seven subsections of §102 combine elements of newness or "novelty" and "statutory bars," which add stipulations on how quickly an inventor must file for a patent on a new invention. While novelty and nonobviousness both refer, at least in part, to substantive newness in an invention, the statutory bars require temporal newness (i.e. quick filing of a patent). The statute contains several specifications about whether and

[29] 35 U.S.C. § 103.

how long an inventor can wait to file a patent application after selling or publishing information about the invention. In addition, the statutory bars offer rules about adjudicating among claims that one or another inventor was first to invent. Timing between having an idea for an invention, "conception," and the successful "reduction to practice" has an impact on first to invent claims. The law recognizes that the idea for an invention is different from the successful completion of the invention. Since inventors are not eligible for patents on their "ideas," inventors who are not diligent (continually working to reduce the idea to practice) can also lose a first to invent claim if another inventor conceives of the idea later but reduces to practice sooner. The state offers the patent as a reward for the inventor's diligence and for release of information about the invention to the public. The invention in the patent application must also be described in sufficient detail for others who are skilled in the art to reproduce the invention. The question of how "public" the information in the patent really is could be the subject of yet another essay.

Newness requirements are much more stringent in the evaluation of patentable materials than they are in copyright. Patents undergo a lengthy review process before they are granted whereas copyright exists in a work "upon fixation" (i.e. as soon as it is written down, captured in film, in sculpture, in digital form, etc.) without review. A formal review process enforces newness and originality prior to the grant of a patent, but temporal newness in copyright is more likely to be enforced through litigation practices. Power differentials in litigation over copyright protection may create temporal restrictions in copyright material. Importantly, neither patent nor copyright infringement

claims require that the plaintiff prove intent to copy. In the case of patent, no independent creation of patented work, intentional or not, conscious or not, entitles the second creator to rights. In copyright, independent creation is theoretically allowed. Although copyright says that similar or identical works are conceivably copyrightable as long as they were not copied from one another or a similar third source, it is difficult to imagine that such a debate would allow both works to exist as originals in practice. In reality, it is likely that a simple power differential, rather than the merits or strength of the facts in the case, would lead an aggressive copyright holder to require similar works to "cease and desist." Under such circumstances, weaker parties are more likely to simply do so.

Merit

If the exclusive rights of copyright and patent are intended to promote progress in science and the useful arts, one might expect that the creation or invention should also show some artistic or functional merit. These issues have been debated in the courts and the conclusion has usually been that standards of creativity or usefulness are quite low. For the most part, the design and rationale of copyright and patent protection serves to turn creations into commodities, at which point the law seems to imply that the market should reward merit. Courts have explicitly refused to consider artistic merit in the case of copyright. Patents require a minimal standard of usefulness evaluated as part of the patent application system.

Merit in Copyright: "at least minimal creativity" and the market. As explained above, in copyright, "originality" does not include requirements of novelty, ingenuity or esthetic merit. Rather, originality requires primarily that "the work was

independently created by the author (as opposed to copied from other works)" (*Feist Publications, Inc. v. Rural Telephone Service* 1991:345). As far as creativity or artistic merit goes, the work should possess "at least some minimal degree of creativity." The *Feist* decision goes on to note that "indeed the requisite level of creativity is extremely low; even a slight amount will suffice" (1991:345). This low threshold of originality requires "more than a trivial variation of a previous work," (*Magic Marketing v Mailing Services of Pittsburgh* 1986*)* but there is no evaluation of creativity prior to the issuance of copyright. The copyright Act itself lists several of these trivial variations as explicitly outside the subject matter of copyright including "words and short phrases such as names, title, and slogans; familiar symbols or designs; mere variations of typographic ornamentation, lettering or coloring; mere listing of ingredients of contents."[30] Copyright attaches itself to a work at the moment of fixation and any claim to lack of requisite creativity would be evaluated only in the context of an infringement claim. In general, the court has decided to leave evaluation of merit to the market.

Merit in Patent: usefulness. Patents undergo formal examination by an administrative office, the United States Patent and Trademark Office. Unlike copyright, the patent office is responsible for reviewing patent applications to screen for the aforementioned subject matter, novelty, non-obviousness. As discussed above, non-obviousness requires that improvements on existing technology only receive patents if they are nontrivial. Additionally, the patent office must also determine whether the subject matter in the patent application is useful according to the *utility* requirement.

[30] 37 C.F.R. § 202.1(a) (1985).

Even inventions, such as machines that are only meant to amuse or entertain, have use value. Since nearly any tangible thing can be used for something, the usefulness requirement seems very minimal. However, utility places particular demands upon inventors in cutting edge scientific development and discovery, such as those in fields of chemical engineering and biotechnology. The meaning of utility has become particularly relevant to patents in chemical compounds and biotechnology, where exploration of new compounds might be a scientific endeavor in and of itself, with only vague notions of potential future uses (medical or otherwise) (Merges 1997: 192-3).

Inventors might discover processes or materials that are useful in further scientific applications, even if their practical use beyond scientific exploration is not yet known. The court explained, in *Brenner v. Manson* (1966), that the grant of a patent in a process that results in a chemical without specific utility "creates a monopoly of knowledge which should be granted only if clearly commanded by the statute. Until the process claim has been reduced to production of a product shown to be useful, the metes and bounds of that monopoly ...may confer power to block off whole areas of scientific development, without compensating benefit to the public" (*Brenner v. Manson* 1966:534). Additionally, the court explained that patents are not given to reward speculation, but to reward results. Famously, the *Brenner* decision explains that a patent "is not a hunting license. It is not a reward for the search, but compensation for its successful conclusion" (*Brenner* 1966:536).

Assuming an acceptable result or product is claimed, utility also requires that an invention be capable of actually doing the task that it is intended (and claimed) to do.

This requirement seems intuitively obvious, but the race to invent also becomes a race to patent. Inventors in the development process may begin a patent application before they have successfully completed the operational details of their invention (enablement).[31] If the invention does not do what it is designed to do, it does not fulfill the specific utility requirement. This requirement overlaps the enablement requirement in that an inventor must have more than "vague intimations of general ideas that may or may not be workable" (*Genentech v. Novo Nordisk* 1997:1366).

Although usefulness seems a relatively minimal standard of merit for most inventions, the combination of novelty, nonobviousness, usefulness, enablement and other technical considerations within a detailed examination process make the evaluation of patents quite rigorous, especially in contrast to copyright. The patent examination process has become considerably more complicated over the years that patent law has existed. However, as complex as patent evaluation is and as numerous as patent applications have become the sheer number of copyrightable works produced each year clearly precludes any practically comparable system in copyright. Even the minimal registration requirement in copyright was eliminated in the 1976 revision copyright and was replaced by automatic copyright in any tangible form of copyrightable subject matter. Registration is still available, however, and is advisable as it confers certain presumptive advantages in legal copyright challenges.

[31] Enablement requirement is part of 35 U.S.C. §112 Specification ¶1.

Term

The term length of intellectual property protection is perhaps the most obvious signal of its socially constructed nature. Whereas the subject matter distinction may appear somewhat intuitive, the vast divergence during the Twentieth Century in the length of coverage between copyright and patent is something that developed out of a system in which both types of property were treated similarly at the start. During the first session of congress in 1790, the length of the copyright term for both patents and copyright was set at 14 years. As explained in the introduction, Congress was granted the power to confer copyright and patent protections on authors and inventors *for limited times*. This provision seems to signal a decisive and purposive limitation on the monopoly that is extended to authors and inventors in intellectual property rights, though historical evidence of explicit thought or deliberation on the issue is lacking (Walterscheid 1994). The constitution signals a belief on the part of the framers that exclusive rights would provide an incentive to authors and inventors to create, invent, and, thereby fuel "progress" (U.S. Constitution, Article 1, Section 8, Clause 8). Walterscheid argues that the granting of limited monopoly in exclusive rights was probably more tacit than explicit and stemmed from the Framers experience and knowledge of the comparable English letters patent (1994, see also Bugbee 1967). Table 1 illustrates changes in term length for copyright and patent.

Term Length in Copyright. The early copyright provision specified a term of 14 years but allowed a renewal of a second 14 year term for authors, still living, who made

the necessary extension request at the end of their first term of protection.[32] Although initial terms were similar for patent and copyright, copyright has gradually yet continually extended over time. The term was first extended in 1831 to 28 years with a renewal period of 14 years. The Copyright Act of 1909[33] extended the term of copyright to 28 years with the possibility of renewal for a second term of 28 years to total 56. Several European nations recognized longer copyright terms for their authors and pressured the U.S. to conform to European standards in length of term protection. The U.S. Congress consciously resisted the European term lengths for another 90 years, partly to avoid the "natural law" logic that infused some European copyright law. During the 1950s, fueled by technological changes, international and internal pressures over term length, and the piecemeal nature of subject matter revisions over time, Congress authorized a copyright revision project.

More than 20 years of reports and hearings culminated in the Copyright Act of 1976.[34] One of its revisions was an extension of the term of protection to "life of the author plus fifty years" for individual works of authorship and 75 years from date of publication or 100 years from date of creation for works for hire (usually corporate works), anonymous or pseudonymous works (35 U.S.C. § 102(a) 1976). Many critics of copyright term length argue that "protection of the mouse," that is, Mickey Mouse, ™ largely fueled an additional extension of copyright term in 1998. The Sonny Bono

[32] Copyright Act of 1790. 1 Stat. 124.
[33] 35 Stat. 1080.
[34] 90 Stat. 2572.

Copyright Term Extension Act[35] added another 20 years to copyright in both individual and corporate work just before many Disney works, including Mickey Mouse, would have entered the public domain. The Court specifically decided that the most recent extension of copyright duration was within the bounds of legitimate congressional power in the case of *Eldred v. Ashcroft* (2003).

Term Length in Patent. Since its inception, patent term length has been minimally and infrequently extended. The 1952 Patent Act added 3 years to patent terms for a total of 17. Applications for patents on new inventions undergo a (often lengthy) review process with examiners from the U.S. Patent and Trademark Office. Both the 14 year and the extended 17 year terms granted patent protections for terms beginning when the patent issues. In 1995, Congress changed the patent term to 20 years from the date a patent application was filed. Due to delays in the application process, this revision (again to accord with international standards) added less than half a year to the average patent, but tended to reduce effective terms of patents on complicated subject matter such as chemical, software, pharmaceutical and biotechnological inventions. Under limited extraneous circumstances, causing undue delays between dates of filing and issuance of the patent, the term may be extended up to five years.

The reason for the vast divergence in term length of copyright and patent is a puzzle that calls attention to the socially constructed nature of intellectual property protection. It begs the question of how and why progress is promoted in only 20 years of patent protection but requires more than 100 years of copyright protection. Clearly, the

[35] 112 Stat. 2827 (1998).

divergence has something to do with legislative influence among copyright interests, but even that analysis would neglect the question of why no corresponding jump has occurred for patent protection. Both substantive and cognitive differences in artistic or expressive versus scientific creation must account for some of the difference in legal protection of these "ideas reduced to tangible form," but whatever difference in the law tacit and unconscious rather than explicit.

Table 3.1 Term Lengths for Copyright and Patent

Year	Copyright	Patent
1790	14, renewable for 14 = **28 years**	**14 years** from the date the patent issues
1831	28, renewable for 14 = **42 years**	No Change
1909	28, renewable for 28 = **56 years**	No Change
1952	No Change	**17 years** from patent issue
1976	**Life of the author plus 50 years**, 75 (100) years for corporate works	No Change
1995	No Change	**20 years** from patent application
1998	**Life of the author plus 70 years**, 95 (120) years for corporate works	No Change

Challenging Subject Matter - Software

Most works protected by patent or copyright are easily assigned to one of the two categories. Until relatively recently, the domain of patents was largely mechanical invention and that of copyright was literary or artistic expression. Of course, not all invention or creation fits neatly into these categories. Changes in technology and court interpretation or legislative mandate have resulted in merging and overlapping subject

matter in patents and copyright.[36] Computer technology and digital media have resulted in intersections between expression and invention unimagined by the existing copyright patent dichotomy.

Given the distinctions between idea and expression and the reluctance to grant copyright in functional or useful material, we might expect that software would be outside the scope of copyright. Due to the relative ease of obtaining copyright and to initial court decisions denying patents for software, copyright protection for computer programs was possible before patent protection. The literary appearance of computing code has, to some extent, obscured its functional nature in the courts. Since expression in a fixed medium is all that is required to assert copyright, and determination of originality and or of the idea/fact/expression distinction is litigated later, copyright adhered to computer code early in its existence. Whereas patent protection is evaluated and adjudicated through the administrative examining body of the patent office, its applicability to software was explicitly considered more carefully.

Copyright Protection for Software.

Like that of other subject matter in copyright, the formal addition of computer programs to the subject matter of copyright was largely a legislative effort, though the legislative action followed the court's lead. The 1976 overhaul of copyright did not address the issue of copyright in computer programs directly. However, toward the end of the revision process leading to the 1976 Act, Congress formed the National Commission on New Technical Uses of Copyrighted Works (CONTU) to study copyright issues

[36] Also in copyright-trademark and patent-trademark overlaps. See Moffat (2004) for a discussion of these additional overlapping intellectual protections.

related to computing.[37] CONTU concluded that computer programs were, and should remain, within the subject matter of copyright. It was another 10 years before patenting of computer programs became common. Computer programs fall under the purview of copyright, it seems, because they "are a form of writing virtually unknown twenty-five [now 50+] years ago. They consist of sets of instructions which, when properly drafted, are used in almost limitless number of ways to release human beings from such diverse mundane tasks as preparing payrolls, monitoring aircraft instruments, taking data readings, making calculations for research…"[38] The court makes a confusing argument when it tries to disentangle process, system or method of operation from expression by saying that copyright does not protect "the method which instructs the computer to perform its operating functions but only the instructions themselves. The method would be protected, if at all, by the patent law" (*Apple Computer, Inc. v. Franklin Computer Corp*. 1983:1251).

Patent Protection for Software.

According to Allison and Lemley (2002), the shift away from a pattern of mostly mechanical patents began only 25 to 50 years ago. Since the 1970s, the distribution of patents in computing and biotechnology has grown while the distribution among mechanical, electronic and energy related industries (except high tech mechanical devices in the medical and automotive industries) has declined. Inclusion of computer related

[37] Pub.L. No. 93-573, 93d Cong., 2d Sess. (1974).
[38] Majority Report. "Final Report of the National Commission on New Technological Uses of Copyrighted Works." (1978) at 10.

inventions in the allowable subject matter of patents was not a foregone conclusion, however.

Early patent applications for software were filed in the 1950s and early 1960s. According to Merges (1997), "the Patent Office met these with a uniform response: whatever software is, it is definitely *not* patentable subject matter" (66). The issue at stake was the "algorithm." The Supreme Court said, in *Gottschalk v. Benson* (1972), that computer software designed to interface with general use computer hardware is the equivalent of an algorithm. An algorithm is a generalized formulation for programs to solve mathematical problems of converting one form of numerical representation to another. The applicant filed for a patent on an invention being related "to the processing of data by program and more particularly to the programmed conversion of numerical information" (*Gottschalk v. Benson* 1972). The method was claimed as a process from the language of Title 35 U.S.C. § 101. At the end of the decision, the court refers to a Report of the President's Commission on the Patent System in which the commission claims that computer programs are non-statutory subject matter, and further, that efforts to circumvent the denials by claiming a process or machine or components thereof confuse the issue and should not be permitted. Finally, the court claims that software development has continued in the absence of patent protection and that copyright protection is already available. They imply that patent protection, is therefore unnecessary as incentive to invention in computing.[39] The court also seems to conclude that issues of software patentability are so complex that only committees of Congress can

[39] Citing "To Promote the Progress of … Useful Arts," Report of the President's Commission on the Patent System (1966:13).

manage them. Algorithms are considered by the court to be ideas or series of mental steps. If patent protection were granted for "discovery" of a mental process, mathematical formula, etc., it would be akin to preventing people from thinking certain thoughts. To take an example from Newell (1986), no one would ever advocate for the patenting of addition since it would, in effect, prevent people from adding up their own grocery bill (1027).

The disallowance of software patents on the grounds that they constitute algorithms, therefore ideas, prompted courts and lawyers to make two modifications to their patent claims, both of which link software inventions to tangible material. First, they focused "on the fact that the numerical values manipulated by software represent real things in the real world" (Merges 1997:77). Second, they emphasized that software operates on computer hardware, and thus (though in a very limited sense) each computer program creates a "different computer" each time it runs. They have succeeded in some cases (see *In re Alappat* 1994; *Diamond v. Diehr* 1981), and failed in others (see *In re Trovato*1994 (*vacated & remanded*), 1995 (en banc); also *In re Waldbaum* 1977). In part these cases seem to indicate that even if claims are limited to particular applications, the test of patentability is whether or not the algorithm itself receives the patent. If so, the invention or discovery is not statutory. However, if the court is convinced that some aspect of the computer application, other than the algorithm, is essentially receiving the patent, the patent is more likely to issue.

The new challenge to the distinct categories of copyright and patent posed by software illustrates how both property and progress are constructed concepts within the

law. Even if an internal logic of progress and property exists within patent and within copyright, an assumption that is questionable at best, the fact that software is now eligible for both protections means that it receives an entirely new set of protections. Moffat (2004) argues that the protections extend well beyond the set of rights envisioned by the constitution or by the independent development of patent and copyright laws. For example, Moffat describes how receiving protection under both the patent and copyrights regimes grants rights that go beyond the contractual exchange anticipated by protection in only one or the other type of protection. An author receiving copyright protection normally has their rights limited by the fair use provision, which allows use of the copyrighted work for educational and social commentary purposes. In addition, independent creation of the same material is theoretically allowed. These uses are precluded in the case of software by the patent protection. Likewise, patent rights normally require that the inventor disclose information that would allow others to reproduce the invention. Under patent, other inventors may benefit from improvements on the patented work, a benefit that could be eliminated with the addition of copyright protection. Under dual protection, copyright can prevent improvement by precluding "substantially similar" works, and it may do so for the life of the creator plus 70 years (instead of patent's 20 years) (Moffat 2004:1531). The benefits to the public intended by the separate laws, especially disclosure to the public in patent and fair use in copyright, are precluded by an overlapping protection system. Moffat explains that the court has been inconsistent in its concern for maintaining separate categories of intellectual

property, and, clearly, in software, they have thus far allowed both protections to exist simultaneously.

The larger topical issue of interest in this research has to do with the construction of the rules turning information into property within the growing information economy. A sociological perspective on the interpretation of the law within real organizations has been lacking. National debates about intellectual property protections tend to be prevalent in legal and communications research. The legal analysis highlights the intended constitutional balance between providing incentives for creativity and invention and preventing monopoly rights over information and the use of knowledge (Lessig 2004, 2001, 1999; Burk and Gillespie 2006; Gillespie 2006; Cohen 1998, 2003, 2006; Boyle 2003, 2008; Samuelson 1999, 2002, 2007). This research emphasizes the formal legal system's role in facilitating such a balance and evaluates policy based on these criteria. Communications and policy research often emphasizes the fact that copyright has been extended beyond its original intent under the political pressure of the culture industries (primarily movie and music industry associations). This work warns of the potential threat to creativity if corporate interests are allowed too much influence over self-enforcement of their intellectual property rights (McLeod 2005, 2001; Bettig 1992; see Gillespie 2007 for a refreshingly sociologically informed analysis of these developments).

Chapter 4: Professionalization of Computing in the University

In the law and society literature, the professions have been highlighted as foundational groups responsible for spreading information about the law to organizations (Abbott 1988; DiMaggio and Powell 1983; Dobbin et al. 1993; Edelman 1990; Edelman et al. 1992; Edelman and Suchman 1997; Selznick 1949; Sutton et al 1994), and as a force that influences further interpretation of the law itself (Edelman, Abraham and Erlanger 1992; Edelman Erlanger and Lande 1993; Edelman, Uggen and Erlanger 1996; Kelly 2003; Kelly and Dobbin 1999). The professions include not only formal legal professionals, but any organized professional groups for whose work a law or set of laws is relevant. Early work on professionalization (Bledstein 1976; Caplow 1954; Johnson 1972; Wilensky 1964; Millerson 1964; Friedson 1962; Larson 1977) catalogued common patterns in the development process of the most highly organized and well-established professions. In most cases, this work used medical and legal professions as exemplary models of professionalism in constructing their theoretical arguments and in modeling the ideal typical evolution of professional characteristics. Cases of semi-professions, emerging professions, declining professions, and other non-traditionally organized occupational groups were easily dismissed from consideration until and unless they managed to establish the requisite training and degree programs, professional associations and publications, accreditation requirements and codes of ethics. Occupations with a more technical body of knowledge were afforded little attention by the professions literature for a number of reasons, primary among them the fact that the body of knowledge for technical work is less abstract than that of the traditional

professions. For most occupations, such dismissal was appropriate because the purpose of defining professions was, in part, to explain the mechanisms that contributed to the special status and autonomy afforded them. However, the literature lacked explanatory power for emerging and declining professions.

Abbott (1988) revised the tradition in order to examine and theorize how the universe of professions functions in concert as a "system of professions." In part, his reconceptualization of the professions was meant to make the concept of profession more inclusive of emerging and declining professions and of occupational groups that displayed efforts to organize around a common set of abstract knowledge, regardless of whether or not they carried all the traditional markers of professions. In so doing, Abbot's work helps explain why professions are commonly associated with the organizational features identified by earlier scholars, but also allows room for variation. In particular, training programs, associations, professional publications, licensing requirements and codes of ethics help groups maintain authoritative and autonomous boundaries around a set of work activities claimed by the occupational group. Abbott's work, therefore allows consideration of a looser set of characteristics that orient occupational group members around a common set of work activities and, importantly, to a set of extra-occupational activities through which they attempt to claim jurisdiction over that work. Consequently, highly skilled but technical occupations, such as those in engineering and information sciences, are eligible for consideration in a system of professions. However, though Abbot includes engineers, information professionals, and computing professionals in his discussion, the characteristics and unique qualities of these professions still remain under-

theorized. These scientific and technical professions either require a professional categorization of their own, or the existing theories of professionalization must be revised to accommodate them.

Professions and Organizational Knowledge

The body of knowledge of technically oriented professions like engineers and computing professionals, is of a different character—the substance or subject on which computing professionals work is constantly and rapidly changing. Although the legal profession is oriented around a changing body of subject matter, which is the law, change in this body accumulates slowly over time. Abbott refers to this as a distinction between natural and cultural facts. Law is a cultural fact and changes slowly. In medicine, the focal subject matter is the human body, which is a static subject matter. The body of knowledge of medicine is changing, to be sure, as a result of scientific discovery aided by changing technological tools, but basic principles about how the body works change slowly as new discoveries are added to the existing base of knowledge. The subject matter of computing is the technology itself and it moves quickly, a characteristic of natural facts. This chapter describes the organization (or lack thereof) among the collection of computing occupations in an effort to build our understanding about how these non-traditional professionals acquire knowledge about legal regulation in their organizational environment.

The professions matter for this research because law and society theories tell us that organizational legal knowledge is interpreted for organizations by state regulators and by organizational professionals. Professionals meet in universities, at association

meetings, and in work groups where they share information and experience and engage in collective problem solving. Thus, the professions have been regarded as a key medium through which professional knowledge is negotiated and disseminated to organizations. Many types of organizational problems and solutions are channeled through these social structural organizational arrangements, but the information relevant to this research is information about the law: its meaning, interpretation and its application to the organizational work setting. The work in this area by Edelman and colleagues describes the filtering and social construction of Equal Employment law by human resource professionals. Their use of the idea of a profession assumes a pre-existing, well organized, roughly singular, professional group. The computing profession, if it can be called a profession or set of professions at all, defies the assumptions made by any of these existing theories. To the extent that this group of occupations has been addressed in the professions literature at all, they have been singled out as a loosely organized group.

I lay out the traditional markers of professionalism and describe the primary groups that might be expected to be important in the socialization of computing professionals. In particular, the Association of Computing Machinery (ACM) and the Institute of Electricians and Electrical Engineers (IEEE) have long histories in the United States and were among the first professional groups of the mathematicians and engineers who created and developed software. I then explain the particular challenges the computing professions faced in exerting any control over professional boundaries as the demand for computer programmers outpaced the training of people to fill the positions. The people in my study look even less like traditional professional group--I explain the

associations to which university computing professionals belong, if they belong to any association at all. Finally, in the discussion, I explain how the problem of professional boundary maintenance is resolved to some extent by the physical machinery itself.

Traditional Markers of Professions

Training and abstract knowledge

Computing exhibits a number of features of a traditional profession. If we were to take only a cursory look at the computing profession, it might seem a relatively simple task to construct a picture of a computing profession that exhibits many of the formal markers of professional status identified by the early theorists of professions, including training programs, disciplinary university training programs, professional associations, professional publications, and codes of ethics. The number of people in computing related occupations has grown dramatically since the end of World War II, and along with it, the size and number of professional organizations and academic training programs. This is especially true if we limit the group to computer software developers or engineers. One of today's key professional computing associations grew out of parent organizations of electrical engineers, and by the late 1940s, some of the members of the electrical engineering groups were meeting and forming subgroups around computing activity. A separate professional group, the Association of Computing Machinery (ACM), was also established by the late 1940s and was growing at the time of the founding of the first academic computing discipline at major universities. They quickly provided professional publications and embraced the idea of professionalization. The first academic programs in computer science appeared only as recently as the late 1950s at

Stanford and Purdue Universities (Ceruzzi 2000: 101). The advancement of these markers of professionalism has been a self conscious and reflexive process on the part of key members of these computing associations, who were familiar with the sociological literature about professions at the time and understood the professionalization process as a way to gain legitimacy, power and status. However, the diversity of the group that would be professionalized has been the major stumbling block to the founding of a single well organized and disciplined professional group.

Associations

The primary professional organizations to which computing professionals belong, and which have been in existence since computing began its meteoric rise are the Association for Computing Machinery (ACM) and the Institute of Electrical and Electronics Engineers (IEEE). As the names imply, the ACM is devoted entirely to computing, while the IEEE is a society of engineers from which a computing branch has developed. Together, the existence of these two organizations helps make a case for an organized group of computing professionals. Both organizations are geared towards computer programmers, scientists and engineers and their member base has significant overlap.

The Association of Computing Machinery (ACM) was founded in 1947, as part of a series of meetings and symposia at Columbia, Harvard, MIT, and by the New York Chapter of the American Institute of Electrical Engineers. The purpose of the association at its outset was in part "to advance the science, development, construction, and application of the new machinery for computing, reasoning and other handling of

information." (ACM Website http://www.acm.org/about/history accessed April 20, 2010). ACM claims to be the "premier membership organization for computing professionals, delivering resources that advance computing as a science and a profession; enable professional development; and promote policies and research that benefit society." The organization sponsors more than 150 conferences per year, runs educational programs, develops educational curriculum guidelines, and publishes more than 40 professional publications, *Communications of the ACM* being their flagship publication. The ACM currently claims more than 96,000 members from "industry, academia and government institutions throughout the world."

The Institute of Electrical and Electronics Engineers (IEEE) is "the world's largest professional association for the advancement of technology" according to their website slogan (http://www.ieee.org/index.html accessed on April 21, 2010). IEEE is an umbrella organization for all types of engineering and Computer Society (IEEE-CS) is the subgroup for computing professionals. The umbrella organization dates its origins to the late 1800s and boasts early members that include Thomas Edison and Alexander Graham Bell. The early organization was largely focused on electrical power, but included a secondary focus on wired communication (telegraph and telephone). A separate organization, the Institute of Radio Engineers (IRE), founded in 1912, was originally devoted to radio, but increasingly to electronics. Electricity use and application grew and the areas of the two organizations increasingly overlapped, but they did not formally merge until 1963 to form the organization of today. Each original group had formed computing subsections by the early 1950s, which also combined when their

parent organizations merged to form the group that is now the IEEE-Computer Society (IEEE-CS). The first of their regular publications was issued in 1966 and several more were established throughout the 1970s. The organization developed an education committee in the 1970s to create model curricula for the field of computer science. The group has added specialty subgroups over time, many of which participate in computing standards setting activities. Membership peaked in 1990 at more than 100,000 and hovers around that number today.

Abbot (1998) argues that a "single, identifiable national association is clearly a prerequisite of public or legal claims" (83). Although the two professional organizations for programmers and software engineers identified above have a great deal of overlap and coordinate many professionalization efforts, they continue to exist as separate entities. Furthermore, a recent study of the development of the "new profession" of software engineering describes the breakdown in political certification efforts that occurred regarding the extent to which software programmer credentials should be "engineering" credentials (Adams 2007). Adams reports that the two organizations had worked together in the 1990s to form software engineering codes of ethics, establish curricula, and define a core software engineering body of knowledge, but that conflict arose over the licensing and regulation of software engineers ultimately resulting in ACM pulling out of the cooperative committee. Engineering, programming, or software development may form the core of the "computing profession." Abbott (1988) describes the internal stratification that occurs within professionals groups, from which pure engineering and software development jobs would be among those expected to be highest status because they most

purely apply only the knowledge set that constitutes the profession. However, there is significantly more to the technology and to the set of occupations that constitute computing than software development or programming alone. As a result, several additional professional associations have been created to organize computing workers around various types of computing knowledge.

Additional professional associations have vied for control over parts of the computing field, both on the technical and applied end of the occupational spectrum as well as in the more business management oriented side of information technology. In the early 1950s, a group called the National Machine Accountants Association (NMAA) was formed in Minneapolis and quickly grew across the nation. The group changed its name in 1962 to the Data Processing Management Association (DPMA) and began a certification program in data processing (CDP). In contrast to the ACM and IEEE organizations, the DPMA emphasized applied knowledge. The organization changed its name again recently to become the Association of Information Technology Professionals (AITP) in 1996 and continues to focus on information technology education, primarily in applied settings. Because computing technology now crosses nearly every occupational boundary and because large scale information management is all handled by computers today, many industry specific professional organizations also have developed sub-sections for information technology professionals that are focused around targeting computing applications to the specific tasks of that industry. Examples include the American Health Information Management Association for medical records management, the American Library Association for librarians, and, relevant to this research, an

organization called EDUCAUSE for higher education technology management, to name only a few. Organizations like these contribute to a more diffusely organized set of professions than indicated by a strictly computer science view of the computing professional field.

Academic programs

Training programs are important because they signify efforts to position claims of professional expertise around a set of abstract knowledge. Aware of the need for a core of abstract, and especially scientific, knowledge, in the 1960s the ACM embarked on an effort to establish an academic discipline of computer science. There were debates about the body of knowledge upon which this field should be based and the need for an *abstract* body of knowledge and academic degree programs was the agenda, specifically because of the research coming out of sociology (Ensmenger 2001). By the end of the 1960s, the core of the field was rooted in information management and the study of algorithms, but critics, particularly from the business side of data processing, argued that the curriculum was too theoretical to be useful (Ceruzzi 2000, Ensmenger 2001). The DMPA experienced considerable success with their certification programs during the 1960s, but proponents of the more academic approach, coming from the ACM and parts of the IEEE continued to fight against the idea of computing as a mechanical trade or computing professionals as technologists. Computer science struggled into existence, beginning in a few mathematics departments. An active faculty advocate for computer science at Stanford helped develop a separate division of computer science within mathematics at Stanford in 1961 and turned it into a standalone department in 1965 (Ceruzzi 2000).

Within 4 years, from 1964 to 1968, the number of undergraduate programs offering degrees in computer science rose from 12 to more than 100 (Ceruzzi 2000). Within the ACM, there were debates about whether computer science was the study of computers or the study of mathematics and the algorithm. By the end of the 1960s, academic computer science programs were oriented around the more theoretical study of "algorithmic procedures, programming structures, and data structures" and people wanting to work on hardware studied electrical engineering (Ceruzzi 2000, 103).

Over the past 50 years, computing professionals have continued to wage a campaign against the idea that they are merely technologists. A recent series of articles about professionalization appeared in a 2008 issue of IEEE's publication, *ITPro,* arguing that professionalization efforts should concentrate on remaking computer developers into "information technology professionals*."* In it Miller and Voas (2008) write that "a cornerstone of a well-defined profession is its body of knowledge, which—along with the skills associated with that knowledge—is in large part how a profession stakes its claim for special status" (15). As Miller and Voas conclude their introduction to that series of articles, they ask the reader to "keep an open mind about what it means to be an IT professional. Our role is evolving, and as we negotiate our collective relationship with the public, we need to step back and consider who we are and who we want to become" (17). The professionalization process is an unfinished business for computing, but provides an interesting opportunity for research. This recent debate has shifted from an emphasis on making software development a profession to making a computing profession that is inclusive of a range of computing-related occupations. Given the prevalence of

computers, the internet, and the role of technology in our lives, we would be remiss to brush off the socializing power of these computer experts, in all their forms, only because we cannot easily classify them in the terms of traditional professions. It is time for sociology to take seriously the role they play in shaping our interactions with, and access, to information of all kinds.

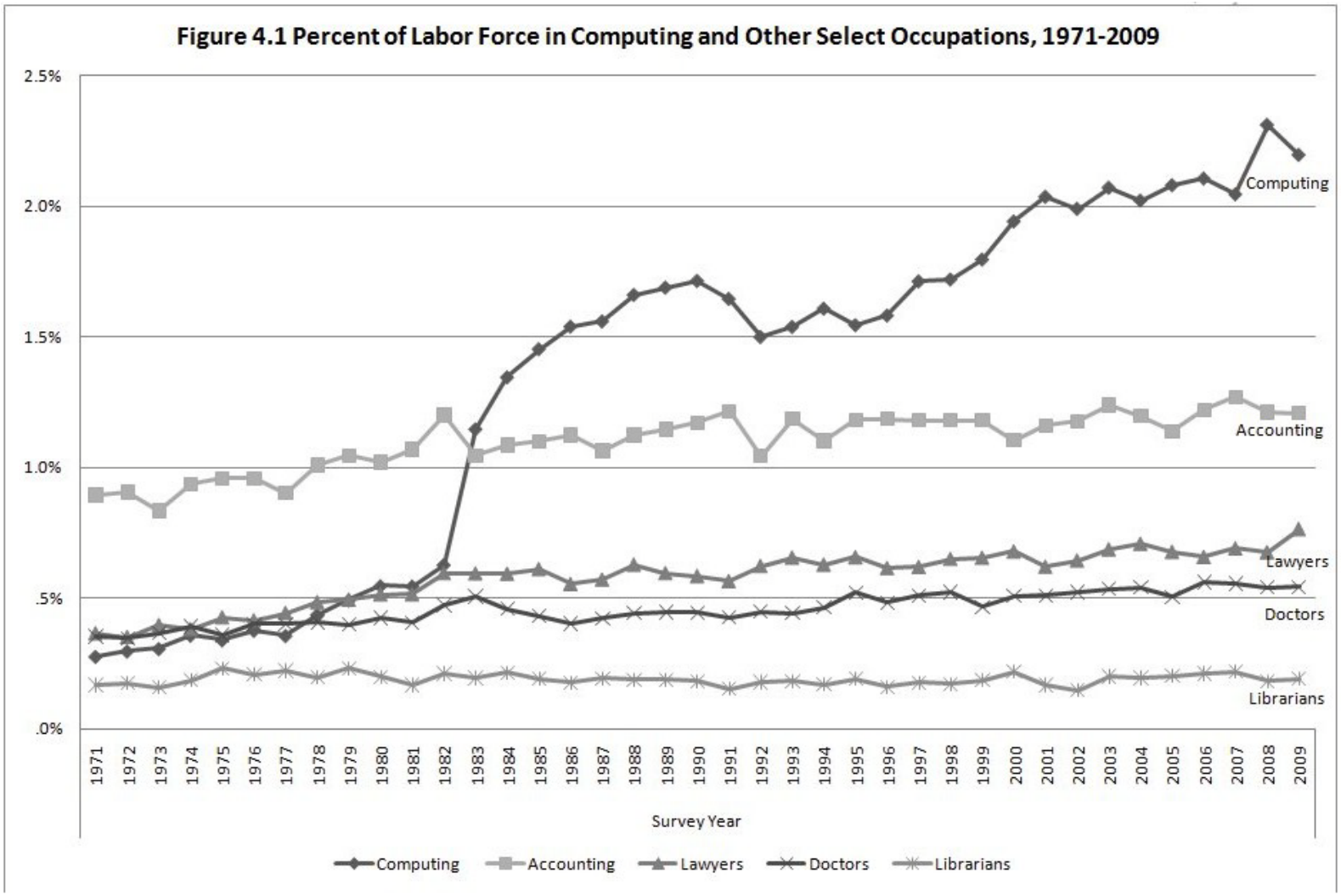
Lack of Boundary Maintenance in Computing

Although academic computer science departments have proliferated and the two professional organizations have grown, publish journals, develop training curricula, and get involved in many standardization efforts, computing has not become a well organized, singular, professional group. Key features of professionalization are lacking and the tasks associated with computing have grown so rapidly and are so diverse that they defy organization into a single professional associational entity. Furthermore, the sheer shortage of people available to work in all the needed computing activities has contributed to relatively open recruitment strategies. Open recruitment is at odds with efforts at boundary maintenance, an attribute that Abbott (1988) characterizes as a central activity of a profession. Many certification programs exist for specialties in particular software programs, server technologies, etc., yet there have been few efforts to lobby politically for the ability to police hard and fast boundaries around who is allowed to do computing work.

The explosion of computing during the 1950s and especially 1960s and its application to myriad business settings and activities meant a dearth of qualified people to do the work of managing and creating programs. Ensmenger (2001) surveyed industry

literature from the time period and reports that the largest employer (and trainer) of programmers in the mid and late 1950s, the Rand spinoff company, System Development Corporation (SDC), "could hardly train enough programmers to meet its own internal demand" (57). In the late 1950s, SDC is reported to have trained more than 2,000 programmers, "effectively doubling the number of trained programmers in the United States" (Ensmenger 2001, 71). Technology changed rapidly and programmers had to regularly adapt to new programming languages and more powerful machines. By the 1967, there were reportedly 100,000 computer programmers, but a need for 50,000 more (Ensmenger 2001 [citing a 1967 report by Fortune magazine]: 58). Industry demand was high and salaries were high, so private technical schools and vocational schools stepped in to provide training, as did the DPMA. The Association of Computing Machinery warned that the rapid and cursory training of "hordes of programmers" were not creating the right kind of programming nor were such programs likely to adhere to the right types of standards (Ensmenger 2001: 58). Already, the ACM had professional concerns.

As Ensmenger (2001) explains, the constant demand for computing professionals rendered boundary maintenance efforts impractical. The increase in computing related occupations has continued through the present and is expected to remain one of the most rapidly growing occupational groups in the coming years (Bureau of Labor Statistics 2010). Occupational classifications used to analyze the composition of the labor force help illustrate both the growing and shifting nature of the computing field. The occupational classification systems of the Census Bureau and Bureau of Labor Statistics (BLS) did not even include categories for computing occupations until 1960, but the



Microdata for the tables accessed through *Integrated Public Use Microdata Series, Current Population Survey: Version 2.0.* [Machine-readable database]. Minneapolis, MN: Minnesota Population Center [producer and distributor]. King, et al. 2009. Collected by the Bureau of Labor Statistics, USA.

group then grew from 0.2% of the labor force in 1960 to 1.9 % in 2000 (Population Reference Bureau 2008), nearly a ten-fold increase. Figure 4.1 illustrates the rapid growth in computing occupations from 1971 to 2009 in comparison with the more traditional and well-organized professions emphasized in the sociological literature. The dramatic increase in 1983 is an artifact of the change in the occupational classification system that added computer operators to the existing computer categories from 1971-1982. Clearly, the rise in the computerization of the workforce and the occupations associated with these activities predated the creation of the new classification.

The fact that these activities were reorganized under a computing classification indicates the changing nature of the work task, but may also indicate that the professionalization mission of computing was having an influence in the public arena. Table 4.1 is compiled from occupational outlook projections from the BLS and indicates that the rise in computing occupations, though diversifying, shows no signs of slowing. According to the 2008 occupational projection put out by the BLS, Computer Software Engineers and Computer Programmers "are among the occupational groups projected to grow the fastest and add the most new jobs over the 2008-18 decade" (Bureau of Labor Statistics 2010). The BLS estimates that jobs in computer programming will fall slightly, but that computer software engineers in applications and systems software development will grow by more than 30%. Computer and Information Systems Management as well as Computer Network Administration are expected to grow considerably faster than average

Table 4.1 Labor Force Projections for Computing Occupations 2008-2018

Occupational Title	Employment, 2008	% of Labor Force, 2008	Projected Employment, 2018	% of Labor Force, 2018	Change 2008-18	
					Number	Percent
Computer software engineers and computer programmers	**1,336,300**	**0.87**	**1,619,300**	**0.97**	**283,000**	**21**
Computer programmers	426,700	0.28	414,400	0.25	-12,300	-3
Computer software engineers	909,600	0.59	1,204,800	0.72	295,200	32
-Computer software engineers, applications	514,800	0.33	689,900	0.41	175,100	34
-Computer software engineers, systems software	394,800	0.26	515,000	0.31	120,200	30
Computer network, systems, and database administrators	**961,200**	**0.62**	**1,247,800**	**0.75**	**286,600**	**30**
Database administrators	120,400	0.08	144,700	0.09	24,400	20
Network and computer systems administrators	339,500	0.22	418,400	0.25	78,900	23
Network systems and data communications analysts	292,000	0.19	447,800	0.27	155,800	53
All other computer specialists	209,300	0.14	236,800	0.14	27,500	13
Computer support specialists	**565,700**	**0.37**	**643,700**	**0.39**	**78,000**	**14**
Computer systems analysts	**532,200**	**0.35**	**640,300**	**0.38**	**108,100**	**20**
Computer and information systems managers	**293,000**	**0.19**	**342,500**	**0.21**	**49,500**	**17**
Computer and information scientists, research (Computer scientists)	**28,900**	**0.02**	**35,900**	**0.02**	**7,000**	**24**
	3,717,300	**2.41**	**4,529,500**	**2.71**	**812,200**	**22**

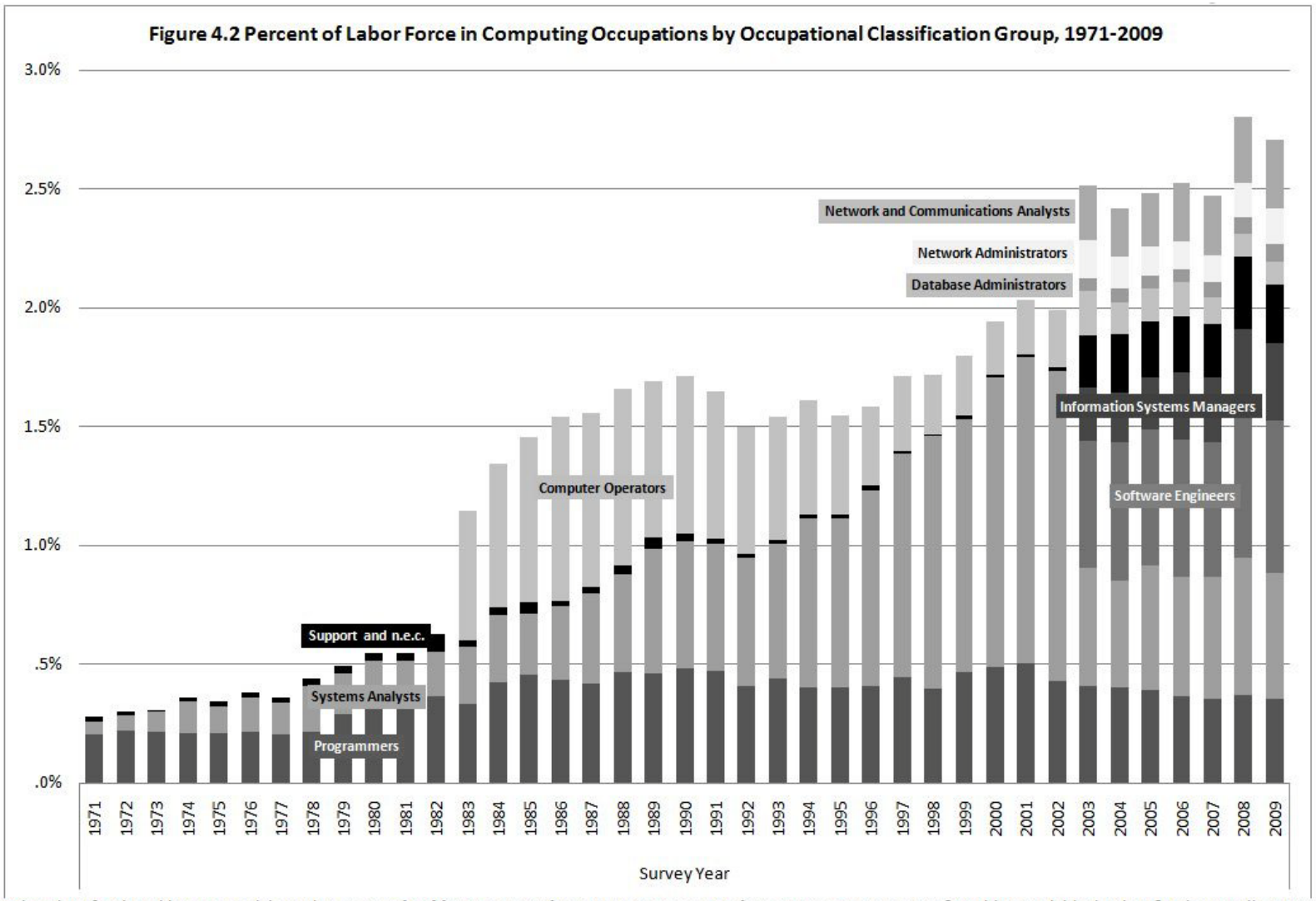
Compiled from occupational outlook projections for computing related occupations in the "Occupational Outlook Handbook (OOH), 2010-11 Edition. Bureau of Labor Statistics. (http://www.bls.gov/oco/ accessed May 10, 2010).

for occupations overall. The growth in computing jobs that challenges boundary maintenance efforts will continue into the near future.

Not only has the need for and number of computing workers increased, but within the field, work activities themselves constantly shift to accommodate new technological developments. In some ways, one might think of the entire collection of computing professions as analogous to the entire medical occupational field, in which doctors, nurses, technicians and all the other specialized fields of medicine are treated as one professional group. On the other hand, computing occupations have had a little more trouble formally distinguishing one group from another and they lack the types of clear formal jurisdictional certification boundaries found in medical professions.

Figure 4.2 illustrates the collection of occupational classifications within the computing field. From 1971 to 1982, the Bureau of Labor Statistics, which collects the data for the Current Population Survey, used 3 categories to classify computing occupations: computer programmers, computer systems analysts, and other computing occupations not elsewhere classified (n.e.c.). The size of each category rose slightly over this period. An additional small portion of people involved in computing at the time would have classified themselves as electrical engineers, but electrical engineers are not comprised solely of computing professionals and that group is not shown in this figure. In 1983, a fourth category of computing professional was added to computing occupations, computer operators. These workers clearly needed a category of their own by 1983 because they already comprised about 1% of the labor force before they were even added

Figure 4.2 Percent of Labor Force in Computing Occupations by Occupational Classification Group, 1971-2009



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to the classification system. In fact, computer operators made up the largest portion of the computing workforce throughout the late 1980s, many of them working on large mainframe computers. By the early 1990s, the number of workers reporting computer operator as an occupation began its decline, probably as personal computers began to appear on the desks of all types of workers, taking some of the business away from mainframes. The group of people self classifying as systems analysts began its rapid rise during this period. Programmer occupations remained fairly steady from the early 1980s through to the present, but systems analyst became a catch-all classification that included people doing other jobs.

The next major overhaul of occupational classifications is clearly evident in the figure, occurring in 2003, when software engineering, information systems management, computer support, and a collection of networking positions were added to the occupational classification system. Computer operators, a group that represented nearly half of all computing professionals in the latter half of the 1980s, comprise only a small portion of the overall total by the late 1990s. The addition of the software engineers in 2003 was in part a victory of the professionalization efforts of the group. They may have been self reporting as part of the systems analyst group prior to the reclassification, but more likely many of them had also previously reported themselves as electrical engineers.

The addition of the network-related positions represents another twist in the ever changing field of computing. This recent time period from 2003 to 2009 includes computer workers who have taken on the work activities related to networking and the

internet. This group was not included in Figure 4.1, but adds significantly to the overall rise in computing occupations and is expected to be the biggest growth area over the coming years. The only occupation that appears stable over time, programming, is an occupation that underwent rapid change in tasks as complier programs became computer languages, the languages became increasingly complex and branched into several languages used to instruct the computer to do different types of tasks. It is possible that this group is emerging as a core "profession" in computing, given that they have the most well established professional associations. Yet, the stable look of programming probably belies the increase in similar and related tasks that are done by the software engineers. Not only has the number of computing jobs risen dramatically, but the types of jobs to be done in the field fluctuate rapidly as well. Although many attempts have been made to identify and formalize a body of abstract expert knowledge, it is difficult when tasks change. Some successes have occurred in the areas of software programming or engineering, but several people from slightly different backgrounds are involved in these activities and they have different ideas about how to formalize the body of knowledge.

According to Abbott (1988), changes in natural facts and cultural facts are both the chief providers of new professional tasks as well as the destroyers of professional work. While cultural facts tend to change slowly, change in natural facts, chief among them being technology, can occur quite rapidly (92). Engineering professions are among those who must adapt to technological change. "Today new technologies create potential jurisdiction both rapidly and often. The succession of computer 'professions' is indeed so rapid that few such groups have any stable existence" (p. 92). Both the legal and

professional settings, in which computing was situated, were radically disrupted by the move to personal computing and again by the development of the internet. The move to small widely-available personal computers disrupted the professional world of computing and the professional jurisdictional boundaries in two ways. Putting computers everywhere and in the hands of nearly anyone expanded the jurisdiction of the computing professional but also diffused and diluted it. Hobbyist enthusiasts in the early days of computing and possibly today as well are capable of having as much "expertise," and potentially more innovative ideas, about the capabilities of computing than the heretofore professionals. The more recent move to networked systems has given computing professionals a new way to regain control over their physical subject matter, the computer, but it has also created entirely new types of occupational knowledge.

Abbott has mixed treatments of the changing nature of technology, the rapid growth of computing, and the relatively open boundaries of the industry. On one hand, in most cases, "the more strongly organized a profession is, the more effective its claim to jurisdiction," particularly in the public and legal realms, but also in the workplace (82). Strong organization makes the profession better at mobilizing its members, better at directing media and better at controlling academic content. Clearly the computing profession is lacking in this area. On the other hand, Abbott makes repeated references to the flexibility and uniqueness of the information and computing professions. He acknowledges that "in a peculiar way, relatively less organized professions have certain distinct advantages in workplace competition. Because they lack a clear focus and perhaps a clearly established cognitive structure, they are free to move to available tasks.

This kind of freedom has been a striking feature of the evolution of the computer professions" (83). The idea and description of a "relatively less organized profession" defies the very definition of profession in the literature. However, rigid entry standards can also hurt a profession's ability to move to available work, which is clearly something that computing was trying to avoid throughout the rapid advances in technology and the proliferation of desktop computers. It is possible that what appears to be flexible movement to available tasks is not movement to tasks that are really "up for grabs" at all. Tasks that look new, but do so because of technological advances are, perhaps, already under the presumptive jurisdiction of the occupations that create and advance the technology. Although tasks appear new, technology professionals are trained to be attentive to advances that go beyond their current "body of knowledge" and to assume jurisdiction over technology that bears resemblance to those they already know.

The stories told in the history of computing embrace the history of programmer recruitment (and in a sense the open boundaries to entry) as a key element that assisted in the rapid, exciting, and unique development of computing. Although openness threatens computing's reputation when under-qualified people create subpar programs, without the openness of the computing field, some of the greatest computer developers may never have tried nor gained entry to the profession. The necessity of allowing and encouraging brilliant mathematicians, physicists, bridge players, chess wizards, maverick scientists, "computer girls," and others with a variety of backgrounds to enter the world of programming has contributed to an almost mythological account of the magical entry into the technological age (see e.g., Lohr 1999). College dropout computing geniuses are

heroes in histories of computing. The story, told in this way, also helps historians of the rise of computing (academic and journalistic) explain the special flexibility attributed to people involved in computer programming and to computer innovation in general. This flexibility characterizes descriptions of the field of computing to this day.

Projects examining professional construction of the law have turned to professional association publications as the definitive source of information about how a given profession interprets a given law. Given the state of the organization of computing professions, one might default to the professional publications of the ACM and IEEE-CS as starting places for information about how the law is viewed by the profession. However, that literature certainly would not be a definitive source for all or even more than a small fraction of people who do computing work. Such a strategy would be an appropriate starting place to examine how software developers make decisions about licensing their own work, but not appropriate to understand how workers who support computing in the organizational setting learn about licensing issues. So, the question remains as to how computer professionals "know" about the legal context of software ownership. In fact, it is possible that were one to study the issue using the publications of the ACM and IEEE-CS, they would find more debates and open questions about the best use of ownership rights to protect software than solutions about how to organize compliance to rules and regulations about ownership. In the local setting, the connection between the professional associations and professional knowledge is still more varied and tenuous.

Empirical Characteristics of Academic Computer Support

In the organizational setting of the university, "information technology professional" is a job title that covers many organizational positions and many computing related tasks. Of those people classified as information technology professionals, only a fraction are engaged in full time computer programming or software development/engineering. I have described the categories of professionals in the methods section, but they bear repeating here in relation to how they fit within the group we might call the computing profession. Those who are involved strictly in development activities, *developers*, are not situated in the intermediary space between software owners and software consumers that is the focus of my research. Rather they tend to support large scale or large budget research projects. Other workers under the information technology professional classification, *computer support staff*, provide computing support to faculty, staff, and students either as departmental support staff members or computing lab support staff. Yet a third group among information technology professionals, *server managers*, are the people responsible for running servers and networks for colleges, departments, research projects and centers. Finally, there are *computer administrators*, who are information technology managers and function more like other management or administrative personnel except that their jurisdiction is over computing and information technology in the university. My research subjects are distributed nearly evenly across these four broad categories, with between 8 and 15 people from each category. Some information technology professionals, particularly support staff in the Science and Engineering school, do multiple duties by running servers, providing support, and doing a

bit of project specific programming. The loosely organized computing "profession" described in the previous section has little reach into the university setting, except perhaps among the research software developers. Few of my interviewees were trained in any computing field and few are familiar with, much less belong to, the formal computing professional associations, ACM or IEEE.

Training

Software *developers* do indicate some ties to the formal profession in their training. Research subjects primarily or significantly responsible for computer programming or software development almost all have computer science or engineering degrees. However, only a handful of all other positions, support, *server managers* or *administrators*, had computer science or related degrees, two had undergraduate degrees in the related field of mathematics, and only a few had taken any undergraduate courses in computer science. Nearly everyone had finished at least a bachelor's degree, but in such diverse fields as Music, History, Sociology, Education, Veterinary Science, Psychology, English, Physics and Rhetoric, and among them, many have advanced degrees in equally diverse fields. Although a few of these degrees reflected the types of disciplines they supported in their computing positions, this was true in fewer than half of the support positions. Among *support* professionals, in both hard and social science fields, many had exposure to disciplinary uses of computing in their fields and followed the computing path subsequent to their disciplinary training, whether remaining in their own discipline or moving to a related one. For example, a person trained in one field of engineering, but with a position programming lab instruments ended up supporting

computing in a different engineering field. In other cases, social science support staff who had been interested in early computing applications in their disciplinary undergraduate or graduate training, and who had written data analysis programs before analysis software packages were available, also followed the programming and computer support activity rather than the academic disciplinary track. Given the variety of non-computing backgrounds among computer workers in the university, it is fair to conclude that formal computer science training programs are not a socializing force in the university computing environment.

Interestingly, many computing professionals believe they are unique in not having a computer science or computing-related degree. When asked about their formal and informal training background, they say things like "well, I'm not really like most people who do this kind of work…my background is in…" Older workers who have been at the university for a number of years will describe themselves as among "the last of the breed," who came up in the "self-taught" atmosphere of computing. A few people wax reflectively about the unique character of computing as a self-taught skill, implicitly including themselves in the group of computing experts. Shared tolerance for change and diverse sets of expertise may characterize the professional socialization of computer professionals more than a particular shared training or associational background. The story that historians of computing like to tell of maverick, unconventional computer programmers is a characteristic that was evident in the identity portrayed by many of the computing professionals I interviewed. As much as the open borders in computing qualifications present a serious challenge to self-policing the quality work and stifles

efforts at boundary maintenance, the independence and self-initiative story is the alternative these workers provide in their claims to legitimacy.

Associations

Membership in either ACM or IEEE is extremely rare in the university setting. Even among the software *developers* I interviewed, only about half mentioned either the Association of Computing Machinery or the IEEE as organizations they consulted for information about their job, and only one-quarter reported ever having formally belonged to either organization. Typically, their association with the organization was in the form of reading the journals, especially *Communications of the ACM*. The only people who mentioned the IEEE were those who had backgrounds in other types of engineering. While lack of membership in these organizations doesn't mean that the organizations, ACM in particular, had no effect on the socialization of computer developers, as socialization of their teachers, supervisors, and colleagues could indirectly influence their experiences, but the role of the recognized computing professional organizations is unlikely to be the primary source of information about laws of software ownership.

Two other associations, one geared toward university administrators and the other geared toward network managers, however, have distinct influence on sets of computing professionals within the university. *Administrators* almost universally report membership in an organization devoted to information technology management in academia called Educause. *Server managers* almost universally reported having received training and having other affiliations with a network security group called SANS. Many *support* staff also have training from SANS or cite it as an important organization in helping them deal

with security. These two groups, Educause and SANS, perhaps more than the ACM or IEEE, have direct influence on legal understandings of software ownership within the academic setting.

Administrators tend to belong to Educause, which claims to be "a nonprofit association whose mission is to advance higher education by promoting the intelligent use of information technology" (www.educause.edu, accessed April 22, 2010). Its activities are targeted at "those who lead, manage and use information resources to shape strategic decisions at every level." Organizations have membership status and pay the membership dues. Once the organization is a member, any paid staff within the organization may join the organization, but the people who do join often do so because they have been invited to do so by higher computing administrators within the organization. There are some activities or research projects for which access is only granted to CIOs or high administrative officials designated by the CIO. More than 2000 colleges, universities, and educational organizations belong to Educause, resulting in more than 17,000 individual members. Their activities, research and publications are targeted towards information technology governance, leadership, and management in higher education. Once the organization belongs, anyone with computing related duties from within the organization is eligible to join, though within the university this often tends to be the information technology administrators. A research and server support staff member, who reported having attended Educause conferences, found the content of limited use for understanding how to use technology to support academic teaching and learning. He thought that the organization had really been taken over by the "business

school types" and was more about saving money or looking technologically up-to-date than it was about determining the best ways to help support academic learning and research. Whether or not the goals are counter to one another, it is true that the Educause organization has increasingly set its standards around those of information technology management in the private sector. In my interviews with administrators, they referenced both Educause as well as business information technology groups, such as the Gartner group, as they sought to determine how to organize information technology in the university by looking at "best practices" in private sector corporations. To Gartner and similar organizations, the information technology "professional" is a business manager that oversees information technology operations rather than, say, industrial operations, or financial operations. It has little to do with principals of programming or technological development itself, but with creating the type of business structure to organize and pay for such activities. Educause is an organization to do the same, but within the context of the academic environment and mission.

Server support and many of the departmental support workers within the university report having had some interaction with an organization called SANS. The SANS (System Administration, Audit, Network, Security) Institute was established in 1989 and purports to be "the best and most trusted source for computer security training." (www.sans.org, accessed April 23, 2010) The quick growth of this group is a result of the developments of the internet and expanding network capabilities. SANS is not a membership organization, nor is it a professional organization, at least not yet. Rather, it is primarily an educational organization. Over time, SANS has developed a certification

program in network security training which is widely recognized throughout the industry. SANS also provides additional services to the computing community. The organization runs a web resource called the Internet Storm Center, which tracks threatening development related to internet traffic and vulnerabilities, such as spam emails and internet viruses, etc. They also publish a weekly digest of computer security news articles, a weekly summary of internet related vulnerabilities, and original research papers about internet security matters. SANS looks the least like a traditional professional organization, but it is the organization that may have the most influence over computing support professionals in the university, even among those who are not directly responsible for server management. Many information technology professionals in all areas of university computing report that they consult the SANS Institute's Internet Storm Center, whether or not they are directly involved in server support, because they all consider basic system security an essential part of their responsibility.

Computing professionals reported few commonalities across other sources of job related information. Those who have been in computing positions for several years have read trade magazines in the past, and continue to read a few in their online versions. Longer term employees and developers to this day will consult books if they are learning an entirely new software program, computing language or computing tool of some sort. Many interviewees have attended short training programs about particular types of software programs and server technology, with or without certification programs. Other than SANS training and Educause conferences, subjects report very little overlap in professional conference attendance. The internet, and Google specifically, are the

primary sources of job related information. Based on their existing knowledge about the problems they need to solve, information technology professionals are able to sort through Google search results and identify the most valid looking sources. Some of the filtering criteria have to do with whether or not the answers come from a vendor sponsored site, but most of the time they can only articulate that they can tell whether a blog or other website is reliable from experience.

The influence of SANS, and security more generally, on the information technology professionals in the university does not stop with their SANS training. Nearly all of my interviewees are familiar with a university run group that provides a forum for inquiry and exchange among computing professionals at the university. This group runs a list serve to which people can post questions or information. The group holds monthly face-to-face meetings in a conference room of the university's supercomputing center. This group was reported to have existed as long as anyone can remember and was initially started as an informal venue for computer related workers or other computer interested persons at the university to exchange information. More recently, the group serves as a forum for the central administration's computer security experts to inform the computing community within the university about network vulnerabilities, central Office of Information Technology large scale initiatives, and secondarily to serve in its earlier capacity as a forum of free exchange among computing professionals. Computing professionals of all types at the university rely on the listserv of this group to stay apprised of the most important security issues related to their jobs. The security experts advising the group at the face-to face meetings are highly connected to SANS via the

Internet Storm Center and their other security reporting venues. Thus, if any single organized group informs computing professionals about issues related to their work at the university, it is SANS and the computer security professionals that run the listserv meetings.

Changes in the technology and work activities of computing have influenced workers in the local setting as well. As one interviewee described the social organization of computer support in the mainframe era,

> *The way I try to visualize those mainframes, or very large, what seemed like very large, computers at the time. They were so to speak kept in temples. They had their priests and priestesses who ministered to them. And if you had a computer run that you wanted done, you would take your offerings to them and they would go to the holy of holies and submit your offerings to them and they would see what came to your output bin.*
>
> (Support, Liberal Arts).

Among the subgroup of computer support professionals, the tasks changed from "priest" who stands as intermediary between the computer and the computer user, to "pastor" who guides the user in their personal relationship with the machine. This interview subject had a hard time coming to terms with the more consumerist version of the human-computer relationship. He continues, "I had this anxious feeling that 'that's not computing.' Computers were no longer mainly doing data processing, they were word document processors. Finally a grad student…said, 'there go your clients and you had better follow them, in fact you should lead them'" (Support, Liberal Arts). Leading them, however, required a shift to a different set of work tasks. While this person accepted the change somewhat reluctantly, other research subjects made a point of telling me that they used

some of the freedom afforded them by the university setting to explore new technologies and to keep up to date; they felt this was essential lest the technology pass them by.

Discussion: Security and Machinery as Jurisdictional Boundaries

By its very nature and attachment to the technology of computing, computing related work continually undergoes transformations. Computer workers of all types are aware of the rapidly changing technological environment and, I would argue, the taken-for-grantedness and general acceptance of (or resignation to) perpetual change in the objective aspects of computing are partly what define the professional context. Flexibility, adaptability, and work contexts which facilitate these qualities are, in part, what define the environment of computing, as well as the "experts" themselves, within the computing field. Yet, clearly, rapid change makes this profession different from most others.

The computing profession also differs from many of the traditionally studied professions in that it is oriented around a technology. So, like a few of the professions that are treated peripherally in the literature (other engineering professions, and the now diminished railroad professions), the computing profession has a material, or objective (Abbott 1988), feature that some of the "pure" professions do not. Law and medicine lay claim to highly abstracted knowledge, while those professions oriented around technologies often get classified out of "profession" status and characterized as trades or mechanical skills. The technology (or machinery) that stands between the computer professional and their human clients makes these professionals constantly vulnerable to the "technologist" label, a label that relegates them to less than professional status and

characterizes them as computer mechanics. However, *the machinery also creates an objective basis around which these professionals can organize their jurisdictional boundary*. Unlike legal professionals, whose subject matter is entirely abstract and cultural, computing professionals have a material component to their subject matter, the computer itself. Medical professionals, too, have a material subject matter, the human body. Although medical professionals can claim expertise over knowledge about how the human body functions and over how to treat its maladies, medicine cannot claim jurisdiction over any given human body without consent from that person. Medical professionals could lobby for that jurisdiction, and in extremely limited contexts, they sometimes do, but it is a difficult battle. They have mediated their limited control over the physical body by exerting control over the physical treatment environment, and over the timing and terms of treatment (see Heimer 1999). Computing professionals, on the other hand, can use the physical machinery itself to help draw jurisdictional boundaries. They lost control as "priests" of the mainframes with the move to personal computing, but networked systems, giant file servers, and increasingly sophisticated hardware and software programs have again given them a material technology over which to orient their control.

Abstract knowledge is the key in most theories to true professional claims. While computing occupations of all kinds certainly require complex and abstract forms of knowledge, the various groups organized around computing have not fully made the case for one coherent body of knowledge. Adaption to rapid technological change in the field is a characteristic of the field that does require abstract knowledge about what

programming is and how it works. Even if they are successful, however, computer workers continue to have an objective machine component as an essential part of their jurisdiction. The capacity for the machinery itself to assist in demarcating the computing professional's jurisdictional boundary has left the computing professional organizations less interested than one might expect in pursuing the legal credential route to boundary maintenance. Their source of expertise lies in their knowledge, and control over, hardware and software. Given this source of expertise, they have little interest in adopting the legal issue of software ownership that would have to be pursued through normative education and legal knowledge. Unlike human resource professionals, computing professionals in my environment are not eager to claim jurisdiction over the law of software ownership as a resource for advancing their position in the organization. To the extent that they claim jurisdiction over any laws related to computing, it is over their ability to defend the institution against network security threats. The control they gain over licensing issues becomes a secondary consideration that they must attend to by virtue of the actions they take to secure networks.

Chapter 5: Organizational Governance and the Bureaucratization of Computing in the University

An Administrative Unit for Computing Technology

This chapter describes the creation and development of the central Office of Information Technology as a process of bureaucratization. According to Weber (1978), bureaucracy is key feature of modern society, having arisen to coordinate tasks in large organizations. It involves the creation of administrative staff, who hold impersonal positions, carry out specific delimited organizational tasks, and are bound by rules. Bureaucracy is characterized by hierarchy, consolidation, and standardization. For Weber, bureaucracy is the exemplar form of rational authority, the legitimacy of which is secured through the establishment of formally correct rules, established through accepted procedure. The process of bureaucratization pressures organizations toward a formal rationality, which over time, emphasizes the efficiency of task completion over the substantive rationality of fulfilling normative goals. The growth of the central Office of Information Technology unit and the activities that shaped information technology governance in the university have influenced the way in which computers are controlled and regulated within this environment.

As characterized by Weber, the establishment of bureaucratic governance is virtually automatic, particularly in large organizations. Since the Office of Information Technology was created within an already highly-bureaucratized organization, its development, too, could be viewed as automatic. However, new social groups and structures do not form without social interaction. The new administrative unit had to

establish the rules that would reinforce the legitimacy of its existence and had to follow acceptable procedure in creating administrative offices or setting those rules. Furthermore, this process is all the more necessary in the academic setting, a place in which processes which are formally rational in economic or efficiency terms are sometimes called into question if they are not substantively rational in terms of fulfilling teaching, learning or research objectives. Although the large size and prior bureaucratization of the organization create conditions favorable to the bureaucratization of computing related tasks within the organization, the social interactions which take place within the organization to carve out this administrative space are part of a political process. Resources, both material and authoritative must be mobilized in order to gain further right to legitimate authority over computing tasks. I explain how the creation of this administrative system to deliver technology also catered to the administrative tasks of the larger organization and by so doing shaped the procedural rules about deploying technology across the university.

Software use and licensing issues are a background activity to supporting the information technology needs of faculty, staff and students and to the process of bureaucratizing computing technology. When software licensing is examined as part of the overall computing organization, it becomes clear that licensing issues are only secondary to other technology concerns. Yet, responses to those other technological concerns shape the way that licensing is organized and controlled in the university. Maintaining the machinery and facilitating the exchange of information are the

foreground activities. As such, the software licensing issue takes a back seat to, *but is impacted by*, decisions about how to set up machinery and networks.

Based on the work of Edelman and colleagues (Edelman 1990; Edelman Abraham and Erlanger 1992; Edelman, Erlanger and Lande 1993), we would expect law to serve as one of the resources that could be mobilized in claims for power within the organization. It is the case, in fact, that some technology-related laws were used in this way in the setting I studied, but software ownership laws are not among them. Broader copyright issues were only acknowledged as a legal issue in the extreme case of file-sharing lawsuits. Claims to power and control over university resources by OIT were largely based on two principles: technology's power to make bureaucratic processes more efficient, and the necessity of technological security to protect the university from hackers, viruses, data privacy breaches, and file sharing problems. For these claims, the new OIT relied in part on the threat of legal liability, and their power to help avert that threat, in order to advance their position within the organization. However, laws about data privacy and entertainment file sharing contributed to the way that security and computing machinery were managed more than the threat of software piracy or other software licensing issues.

At the organizational level, the rapid rise of personal computing led to the creation of a large new organizational administrative unit, the Office of Information Technology (OIT) in the mid 1990s to help manage the University's myriad computing activities. Prior to this, in the 1980s and into the early 1990s, the personal computer, even within the University workplace, was precisely that: a *personal* computer. Individuals

made independent decisions to acquire and use personal computers, they secured funds from grants, university discretionary funds, or personal resources, and they were largely responsible for figuring out how to use and maintain them. As computers became a mainstay tool for accomplishing work tasks, more personnel were hired by individual units to provide reliable support. As the organizational leadership began to capitalize on the technology to promote and facilitate new uses of the tool to advance organizational goals and interests, they began to see systematic technology support as a necessity and began to bring the disparate technology pockets under an organizational bureaucratic structure.

The Office of Information Technology (OIT) was formally established in 1995 as a central administrative unit for the purpose of creating and supporting the university's participation in an increasingly technical society. In the sections that follow, I outline how the bureaucratic organizational environment shaped the way technology is used and organized at the university by orienting problem construction and problem solution around two main themes; administrative efficiency and security. Both activities were effectively promoted by the central OIT group to support their growth and legitimacy. These activities have consequences for how computers are configured, which has, in turn, implications for software use and licensing.

I have separated the growth of the central technology unit in the university into 3 phases: the first period of *organization building* covering approximately 5 years from 1995 to 2000; a second phase of *power building* that capitalized on the opportunities and threats of computer networks from 2000 to 2005; and the current phase of *central*

standardization and control from 2005 to present. I then describe the software licensing-related activities that accompanied each stage of organizational development. Once in place, professionals in the new administrative OIT unit were able to promote problems with technological solutions. They used law as one of several "resources" for gaining power within the organization (Edelman and Stryker 2005; Edelman Abraham and Erlanger 1992), but it was "technology" and the unique expertise in technology that served as the primary resource in establishing a prominent administrative unit and in maintaining their newly found power within the organization. Capitalizing on security issues and advancing security expertise have been the key ways in which information technology professionals have gained organizational administrative space, control and jurisdiction within the university. Security and administrative professionals within the information technology section of the university have been particularly good at advancing their positions, but the frames and issues they have mobilized have been used as resources by nearly all computing professionals within the organization.

Licensing Developments

Centralized systems to handle software licensing developed over concurrently with the growth of the central OIT unit. The story told to me by interview subjects about the development of centralized licensing was very much a demand-driven narrative. In the early years of personal computing, many people wrote their own little programs to carry out set tasks. Some of the programs used for standard tasks were bundled into products and sold. There was a legacy of purchasing certain software programs for mainframe computers, but the model did not transfer well to personal computers. On the

mainframe, one hardware system served many users and required only one copy of (or license for) the software program. In contrast, once personal computers became powerful enough to run some of those software programs, individuals could load their own copy of software onto their personal machine.

The expanding market for software brought on by the transition to personal computing required increased tracking mechanisms on the part of the university and involved increased pursuit of ownership rights on the part of software vendors. Over time, central license delivery and inventory mechanisms were increasingly reliant upon features of the centralized university recordkeeping system for purchasing and budgeting. In addition, the site-wide license purchases were ways of implementing central OIT's bureaucratic interests in "leveraging economies of scale" and in facilitating software "compliance." Licensing activities, though impacted by them, were not directly tied to the organizational development of the central OIT unit. At the end of each phase of OIT development, I describe changes in licensing practices during that phase and how they were related to the organizational activities of central OIT during each of those periods.

I draw on several sources to construct this narrative of the development of central OIT, but draw most heavily on two archival sources: the Information Technology Newsletter issues from 1994 through 2006 and meeting minutes from the Senate Committee on Information Technology from 1997 through 2009. Additional sources include organizational charts, university news publications, university budget records, budget office newsletters, other internal Office of Information Technology documents, and personal interviews. The IT Newsletter represents the public face of OIT to the

university community. The publication tends to highlight services and inform the community about the work of the units of the Office of Information Technology. It is also an informational resource about where to seek technology related help, secure technology related products and services, and is a communication tool to inform the community about special rules or anticipated service disruptions. Meeting minutes of the Senate Committee on Information Technology (SCIT) are also largely shaped by the central Office of Information Technology. Interactions recorded in the meeting minutes represent an interaction between the Office of Information Technology and a group designed to provide guidance about university decision making. As such, the central Office of Information Technology (OIT) is both selling their position on technology related decision making as well as seeking guidance. In many cases, requests for input are clear, but what is not always clear is how much weight the committee input has on OIT decision making.

Phase I: Organization Building, 1990s

Taking the helm and consolidating units

At the start of the 1990s, as the University undertook long range planning for the year 2000, a committee was charged to review technology needs for the future. The 1992 Advisory Users Committee for Computer and Information Services concluded that

> *information technology must be central to the university …because it supports University units in carrying out their research, teaching, and administrative functions; and it is central to the University's outreach efforts…As members of a major research and teaching university, students, faculty and staff need access to information resources at the level of technology appropriate for their disciplines…including access to workstations and local, national, and international electronic communication networks.*

(1992 Advisory Users Committee report reprinted in IT Newsletter, April 1996)

One of the initiatives undertaken as a result of this long-range planning was the "restructuring of the central information technology providers into the new Office of Information Technology." Prior to that restructuring, technology resources were provisioned, and technology needs were addressed, in localized settings or as offshoots of the old mainframe organizational structure, which was increasingly out of sync with the rise of personal computing.

The Office of Information Technology was created on November 1, 1995 and was seen as the key first step in fulfilling the vision of a centralized technology unit within the University. Around the same time, departments and colleges were gradually finding ways to put personal computers on the desks of all faculty and staff members. The transition to personal computers did not happen uniformly across units nor across departments within colleges, but the overall trend was in the direction of making sure that computers were ubiquitous throughout the university. A brief article in the Information Technology Newsletter, by the Assistant Vice President for Information Technology Operations, announced that the new office

> *represents an important union of the University's key information technology providers: Engineering Services, Distributed Computing Services, Telecommunications Services, Networking Services, Central Computing Services, Administrative Information Services and St. Paul Computing Services.*
>
> (IT Newsletter, April 1996)

Seven independent units were combined into three overarching groups: the Business and Student Information Services (BASIS); Networking and Telecommunications Services

(NTS); and Academic and Distributed Computing Services (ADCS). Though many of the units retained their work activities and much of their existing structure, the creation of a central coordinating body added a new hierarchical layer above the existing units, a key marker of bureaucratic organization. However, information technology presence in the central administration also gave all levels of technology development and support a more secure and integrated place in the University governance and administrative structure. The creation of a central OIT unit did not mean an automatic centralized governance of information technology, however. It was only the beginning of a long social process of reorganization and continued efforts to gain legitimacy in the eyes of both the administration and in the eyes of the units OIT expected to govern.

The three units created to oversee centrally run technology activities represented academic computing support and development (through ADCS), material networking and telecommunications infrastructure (in NTS), and administrative computing support and development (through BASIS). Each area came to represent the basis for a core claim to organizational legitimacy and jurisdictional control, and hence provided justifications for access to organizational power. The academic unit provided several services to the university through the development of classroom technology tools and delivery systems, some of which were considered quite innovative by the national academic community. OIT emphasized their role in serving the academic mission of the university highlighting this unit's ability to promote and assist with the development of technology enhanced teaching and learning resources. The administrative branch of OIT (ADCS) was promoted as a unit that could help the University realize cost savings and improved

administrative efficiencies through the strategic deployment of technological tools to streamline administrative duties. Finally, over time, networking connections and capabilities (provided through NTS) became essential to the university, but created a variety of data privacy and file sharing threats to the university. OIT leveraged the technological skills of their units in providing both the essential network technology as well as the security expertise to protect it.

Even though this project concentrates on academic computing support (as opposed to administrative, financial system, or student records related computing support), it is the networking infrastructure and those very administrative projects of the central organization that shaped the way everyone at the university accesses their machinery and the internet. The administrative unit activities are important because they consumed the largest share of resources and created a computing infrastructure that helped set standards for hardware and software choices in many areas. Networking activities were important because they are most closely tied to the increasing concern with data security. Consequently, systems that were initially formed to handle bureaucratic record keeping activities of the financial and student records units have structured the way that all computing at the university is arranged and protected.

Selling the new OIT

Shortly after forming, the newly created Office of Information Technology officially took over the Computing and Information Services Newsletter, which then became the Information Technology Newsletter (IT Newsletter). The newsletter had formerly been an informational venue for the disparate technology-related units. The

newsletter changed in tone as it switched from informational outlet for the various and disparate technology-related units to the publicity mouthpiece of the newly centralized OIT. In the first issue of the renamed Newsletter, the Acting Director of Information Technology wrote:

> *It is clear that a world class university cannot exist in the year 2000 without the effective application of information technology and an appropriate information infrastructure…In future issues of the Information Technology Newsletter, we will communicate more about OIT strategic planning in support of the University's core missions and the administrative functions.*
>
> (IT Newsletter, April 1996)

The same editor continued to collect, assemble and publish the Newsletter, and the units which had contributed to the earlier newsletter continued to provide material for the new one, but under the umbrella of the newly created OIT. The new IT Newsletter initially reflected the structure of the consolidated units for at least a brief period of time as it was organized into three sections to represent the three newly consolidated areas of OIT. Within a year, however, the three distinct sections were no longer part of the Newsletter format. The newsletter also began to feature highlights of broad OIT accomplishments written by the Vice President, Chief Information Officer, or other top level OIT administrator, which appeared as feature articles every couple months for the first few years and less frequently thereafter.

Once formed, OIT engaged in what I call organization building. Their activities included limited policy making and conducting an organizational inventory of the activities of units under their control, both those that obviously fell under their jurisdiction as well as potential and scattered units, such as the technology units within

colleges, not clearly situated under the central organization. They began a process of formulating their mission by coordinating demands for increased resources and jurisdictional control. Six months into the operation, the Acting Director of Information Technology provided an update in the IT Newsletter, selling the idea that the Office of Information Technology is a partnership between the central administration and other units of the University.

> *The leadership role of the Office of Information Technology is undertaken in partnership with campuses, provostal clusters, colleges, departments, and units. OIT's leadership is not by fiat but through respectful consideration of the needs and expectations of its customers. OIT is accountable to customers, other service beneficiaries, and stakeholders and retains its leadership because it produces the desired outcomes and can demonstrate its contributions to meeting the University's Critical Measures.*
>
> (IT Newsletter, May 1996)

The article was likely necessary *precisely because* it appeared as though central OIT was created entirely by fiat. Now that OIT controlled the newsletter, they also controlled representations of OIT to the University Community. Here they used the newsletter outlet to try to reassure the university community that OIT had a purpose and had an interest in working with units to achieve common goals. For the first few years, OIT would try to consolidate their operations and build their legitimacy within the organization.

One year into its existence, OIT had moved the physical machinery supporting their business and student record group to a single location and renamed it Central Computing Operations (CCO) because it "better communicates the services this organization provides with the merger of the units" (OIT representative in the IT Newsletter, October 1996). The computing operations organization handled tasks which

included the production of in house programming in support of administrative computing; technical computing assistance for administrative computing; and security and disaster recovery operations. Some, but not all, of the staffing groups were also physically moved to shared office buildings

Harnessing the power of the web in advancing OIT's status

The units within the central organization of OIT had already been providing the basic technological infrastructure for both academic and administrative computing at the university, but continual improvements in network technology provided new opportunities for people to communicate and to disseminate information digitally. A signal that the central OIT had increased power and a share of governance within the University was the announcement "the future network plan has been developed and is now an integral part of the University's biennial budget request" (IT Newsletter, October 1996). Rather than make special requests for funds on a periodic or regular basis, networking had become more essential than ever before. It is not clear from the evidence available the extent to which spending on network technology actually increased, but the change from repeated requests for one year funds to a regular line item in the budget is a clear signal of entrenchment in the bureaucratic apparatus.

Two top down initiatives to take advantage of the new internet capabilities were implemented under the consolidated OIT. A course website development project and a large scale web-based administrative recordkeeping system for higher education were both considered innovative uses of the web at the time. The administrative project sought to develop a system for web-based student registration which would in turn be used to

streamline web-based processing of administrative forms. The Office of Information Technology was able to capitalize on this growing asset within the organization while simultaneously positioning themselves as protector against the ills of the internet. The other project, a web-based registration system, was developed by the university. The University, along with one of their peer Universities, had organized a higher education web development conference in the summer of 1996. In reporting on the conference in the IT Newsletter, the web development representative explained that both universities

> *have been leaders in exploiting this new dimension of the web [a move from informational sites to interactive sites], with [the other university] developing one of the web's first financial database access systems in higher education and [this] university developing its web registration system. With both projects receiving numerous requests for more information about these systems, it became clear that the time was right for hosting a conference on the subject.*
>
> (IT Newsletter, November 1996)

Both projects aimed to take advantage of the world wide web, which had been growing over the mid-1990s. In April 1997, the IT Newsletter announced that the network had doubled in size for the fifth year in a row, and their development project had made web registration a reality for spring semester of 1997.

Strategic initiatives for OIT in 1997 included improvements to network infrastructure, enhancements to the Digital Media Center (primary provider of technology enhanced learning initiatives), and an administrative process redesign. The IT Newsletter announced that

> *The university has committed to replacing, or significantly improving, all central administrative systems over the next four years. The purpose for replacing systems is to improve our administrative processes; simplify policy and procedures; apply best practices; streamline underlying work-*

> *flows; reduce process cycle times; reduce staff workload; and ultimately reduce cost.*
>
> (IT Newsletter, May 1997)

This project was called the enterprise project. In explaining the project to the Senate Committee on Information Technology, the project was presented as

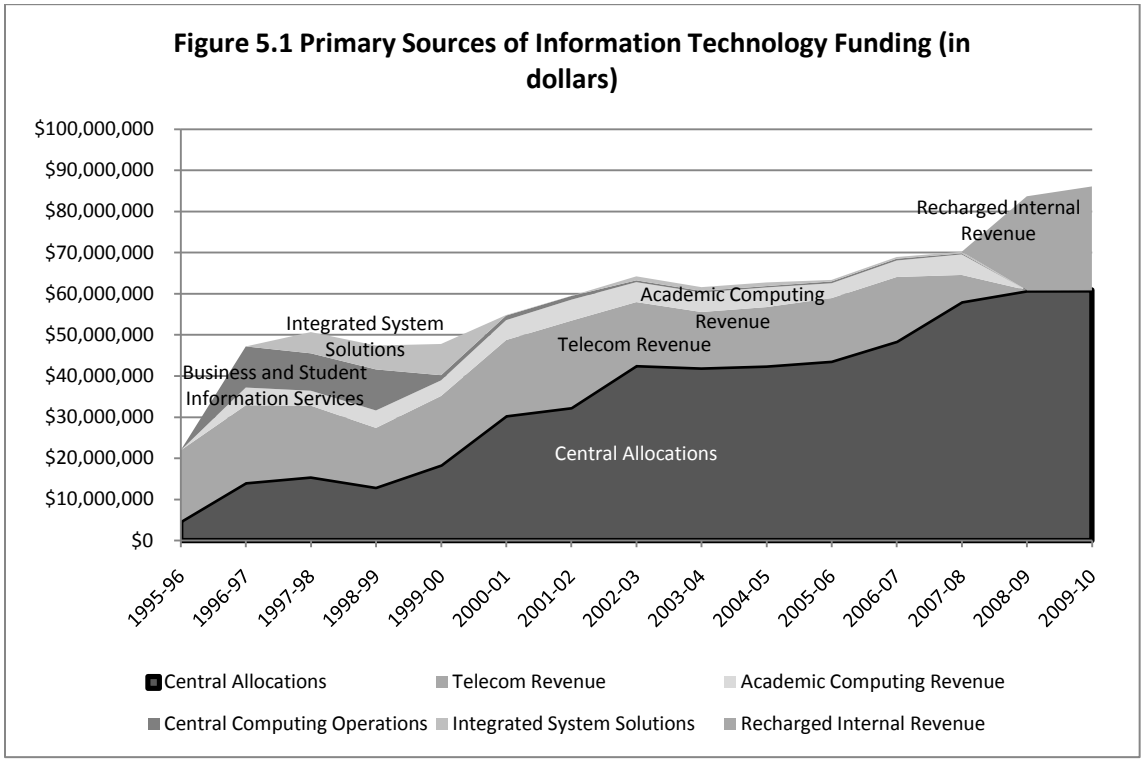
> *an effort to replace the administrative systems (i.e., human resources, financial, payroll, student administrative, registration, admission, financial aid). Enterprise is the current term for large system projects that combine a suite of solutions to provide an integrated approach.*
>
> (SCIT Minutes, January 15, 1998).

The project had been allotted 42 million dollars over the course of the 3 years, though, the university president had "challenged [OIT] to spend only 38 million." During a project update the next month, the project manager provided a schematic of the current and redesigned administrative process. The schematic was not available in the minutes, but the manager explained that

> *Currently 75-90% of University operations are conducted manually. With [the new system], that will switch to 75-90% being conducted automatically. Instead of specialists being needed throughout departments, individual users will be able to complete services for themselves.*
>
> (SCIT meeting, January 15, 1998)

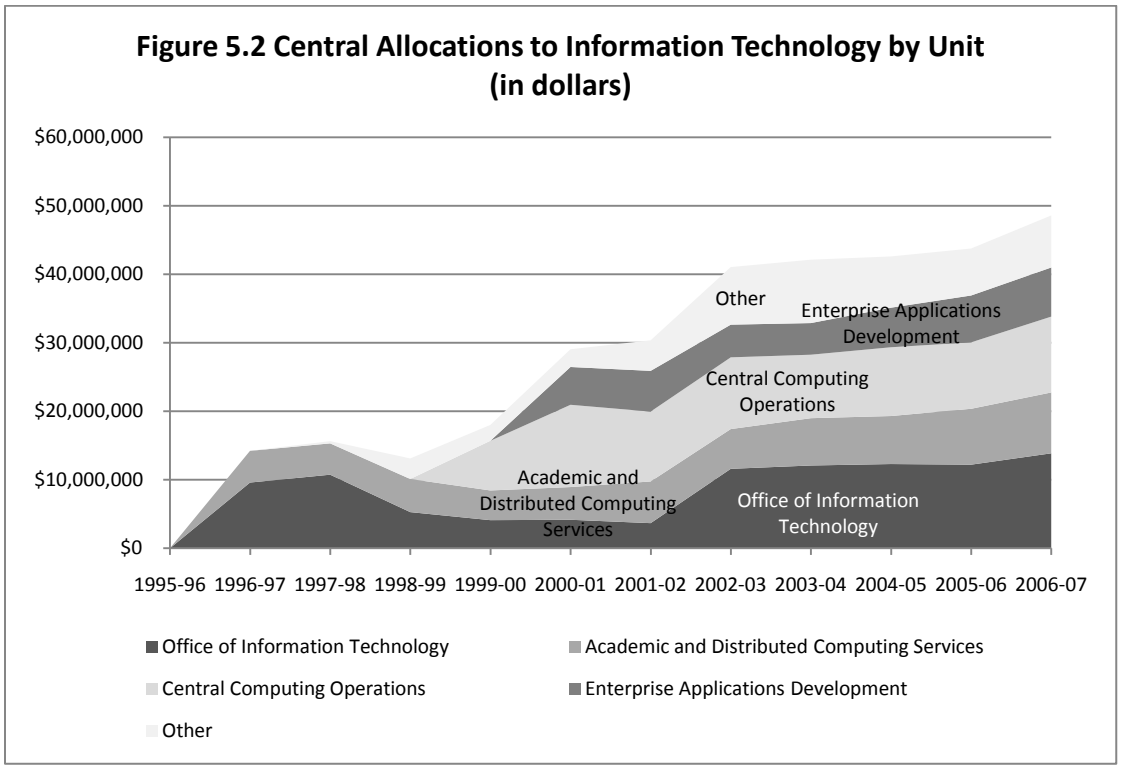
This research does not evaluate the validity of these efficiency claims, only the process by which claims were leveraged by OIT to gain legitimacy, authority and jurisdiction within the university. Training of those users in the new complicated system was not addressed at the meeting. Furthermore, according to some interview subjects, the portrayal of savings did not necessarily clearly represent the increased staffing resources that may have been necessary in individual units or departments as individuals completed "services for themselves."

Figure 5.1 illustrates the primary funding sources reported in the Information Technology budget in dollars raised or allocated. Clearly, central allocations increased



throughout the late 1990s to replace other less dependable sources of revenue for the unit. Even though line items in the budget do not guarantee particular budget amounts, they provide a more reliable mechanism for securing funds. The sources of revenue included in the figure include money raised through internal sale of goods or services. Networking and telecom raise revenue through charges for phone and, over time, for network connections. Academic and Computing Services charged departments for a variety of services including departmental computing support and things like assistance developing technology materials to aid in course instruction. Central Computing Operations was initially called BASIS after the establishment of central OIT, but was changed to Central Computing Operations soon thereafter when administrative recordkeeping and computing

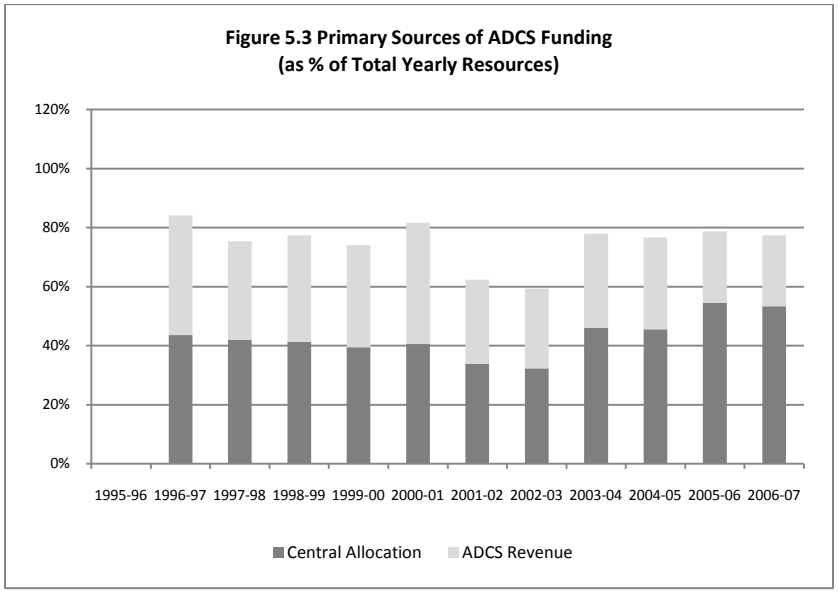
support was consolidated even further. Figure 5.2 shows the allocation of central funds to units within central OIT from 1995 to 2007. Central funding to Central Computing Operations begins in 1999 and funding for Enterprise Application development begins

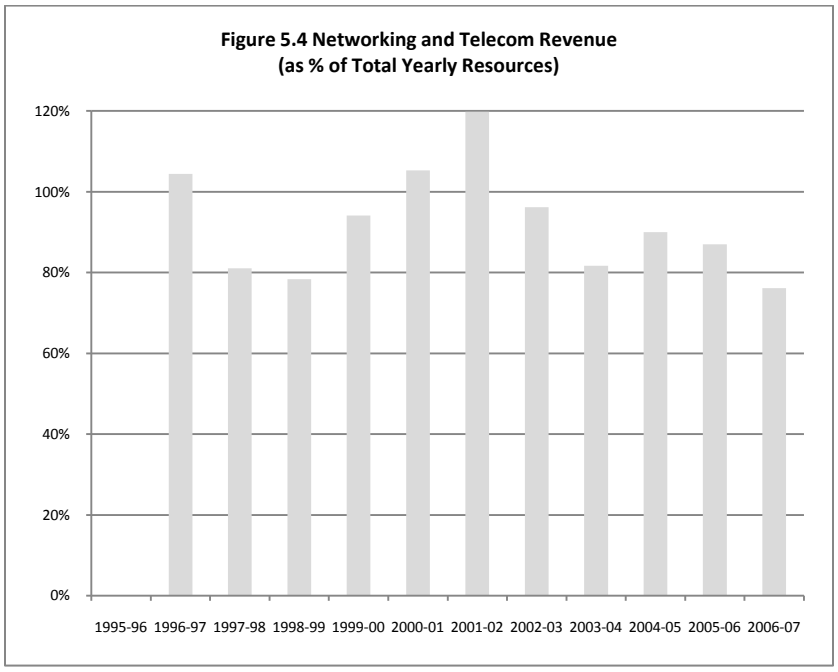


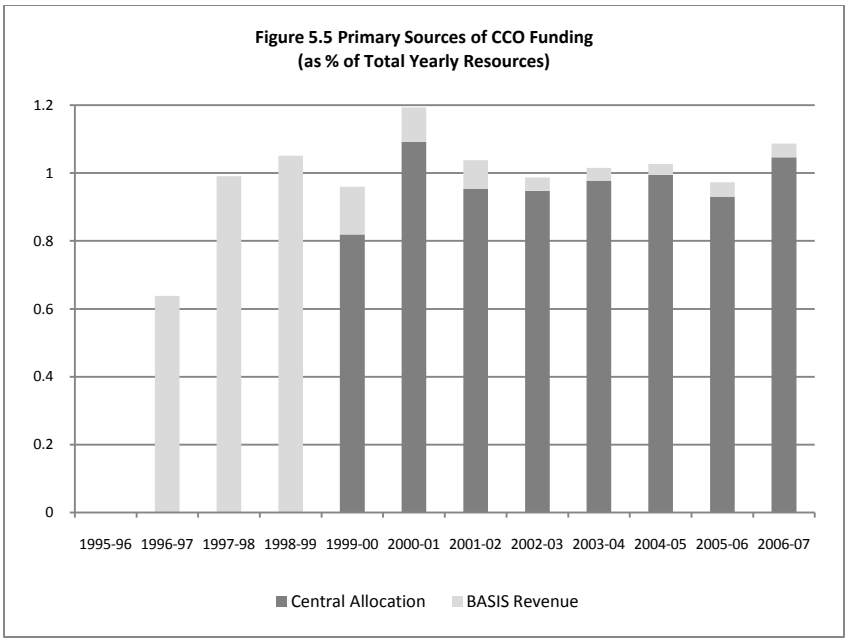
in 2000, both of which replaced the revenue streams from departmental charges shown in figure 5.2. The bulk of Enterprise funding was distributed through a separate budget, the Enterprise Service Project, which was accounted for through an entirely separate budget line.

Figures 5.3 through 5.5 further illustrate the replacement of service revenue by central funds, showing the sources of funding as a percent of total resources for key units within central OIT. During the first period of organization building, the sources of funds for administrative computing and enterprise level integration of recordkeeping tasks

became infrastructural. That is, the university determined that they were essential to the entire university community and should be funded at a central level. Academic and







Distributed Computing Services have been funded by central allocations and sale of services, as well as a variety of other funds throughout the time period studied (figure 5.3). Networking and Telecommunications have remained largely funded through charging for services, as indicated in figure 5.4. The administrative activities of Central Computing Operations as well as the Enterprise computing were changed in the early years from charge-for-service models to centrally provided infrastructure, as demonstrated in the replacement of revenue by centrally allocated funds in figure 5.5.

Although funding to OIT overall has increased in total dollars over time, central OIT expenditures as a percent of total University expenditures has not. Measuring by percent of total salaries paid or percent of total expenditures in the Institutional Support category also have changed little over the past 15 years. However, the institutionalization of budget lines to cover infrastructural computing and devoted to administrative computing suggests an increased level of control over resources and consolidated

decision making in the organization. Other central OIT administrative units, namely OIT Finance and OIT Planning, though small in comparison to units illustrated in Figure 5.2, received their own central budget revenue streams during the organization building phase of OIT development.

Bureaucratic essentials: policies, consolidation, and budget requests

Once the single OIT was established, it did not take long for the organization to engage in the bureaucratic formalizing activity of policy making. Early in 1997, a group within the newly formed OIT began working to craft a policy "relating to acceptable use of computers, networks, and electronic facilities." The policy was general and was announced with little detail or fanfare in the IT Newsletter.

> *The short of it is: you have a responsibility to abide by all university policies and procedures and all current state, federal and international laws when you use computing resources supplied by the University The new policy outlines your rights and responsibilities relating to computer use.*
>
> (IT Newsletter, January 1997)

For "the long of it," the article simply provided a link to the policy on the university website. The link, it turns out, did not function. A small correction at the back of the following months' issue of the newsletter announced that the policy was now online. While we might expect formal policy to grow out of a legal regulatory requirement, this policy seemed to have little direct connection to any identifiable regulatory law. Rather, the policy signaled the presence of a formal high level unit within the university and potentially served as a place holder for future control over computing resources. The first version of the policy was vaguely worded and seemed to serve as much to remind users

that their personal work computers were "university property" as to say anything specific about how the machines could or could not be used.

However, the Acceptable Use Policy was redrafted the following year

> *because of a suggestion from the Office of the General Counsel to clarify certain aspects of the existing policy dealing with the University's ownership of the physical resources and official University data. It also needed a disclaimer on personal communications and a statement on the consequences of violations of this policy.*
>
> (SCIT meeting minutes, May 22, 1998).

The problem of mixed personal and university property residing on a single machine was common in the early days of personal computers, but was frequently resolved in other settings by disallowing personal material on workplace machinery. In the university, such a divide was unthinkable. Several members of the Senate Committee on Information Technology expressed concern that the university not control personal communications, not claim to own data stored on machines, and make every effort to "protect the principal of academic freedom" (SCIT May 22, 1998). In most committee member's minds, the less control the university claimed over the content stored on machines, the better off the organization would be in terms of avoiding liability for individual actions. There was a sense that the university had a different orientation to individual freedoms than was practiced by non-academic work settings. The tensions between freedom and autonomy in the academy and control over computing machinery appeared repeatedly throughout the development of the central OIT organization and in individual units.

The same meeting that reviewed the "tightening" of the Acceptable Use policy also signified centralization within the Office of Information Technology and other efforts to carve out administrative space in the University. The new Assistant Vice

President and Chief Information Officer informed the committee of a full agenda for the coming year which included planning for the biennial budget request and undertaking initiatives within the colleges. The Vice Provost, who was primarily involved in Technology Enhanced Learning (TEL) initiatives, signaled some efforts at consolidation that would infiltrate the entire central OIT organization. The TEL group had contacted people in each unit to ask them to start long range planning. The process was one by which units would submit long range plans to the central organization (rather than working independently as they had been).

> *We thought that the situation within each unit was unique. As we began to work with them, we realized that many initiatives can be linked across units as well as with OIT. Communication will be a key factor to finding solutions…[The whole process] revealed a need for infrastructure which is linked to many of the academic initiatives within the units.*
>
> (SCIT Minutes, May 22, 1998)

The efforts to find and weed out overlapping efforts would become a recurring theme as the central organization became more organized and as budget considerations mounted. However, budget processes and security efforts were as much a resource to be leveraged for increased central organizational power as they were constraints imposed from outside upon the organization. In many cases, even though units within OIT that were increasingly under the jurisdiction of new administrators also found their overall status enhanced as IT administrators better secured their own positions.

The CIO termed these efforts a "co-provider model" in which units make technology decisions but implement those plans with help from OIT and the Provost's office. According to the CIO, "one step in this process is determining a set of minimum requirements for each unit" (SCIT meeting minutes, May 22, 1998). Much of the

impetus for forming a consolidated Office of Information Technology stemmed from the new possibility of integrating administrative systems across the entire organization. A revealing question and answer session based on the CIO's presentation helps confirm the link between the Enterprise administrative project and OITs ability to legitimize claims to organizational control. The question and answer session at a SCIT meeting helped confirm that some of the reorganization and consolidation was motivated by the move to an administrative software system that integrated much of the University's recordkeeping. When asked about how OIT was handling the differing levels of resources and sophistication in technology across the university, the plan was explained in the answer:

> *First, we need to establish standards for support staff ratios and network connectivity. Then we can see where each unit ranks in these areas, and work with the units that are under to bring them to the baseline. IMG by itself might not help, so a 'Robin Hood' model might need to be used where central funds would be given to some units.*
>
> (SCIT Minutes, May 22, 1998)

Upon further questioning about the need for equipment replacement, OIT staff estimated that the cost would amount to

> *$4 million for desktop replacement. This amount was originally included in the Enterprise Project cost, but at the request of the deans it was removed. The issue will need to be addressed, along with the need for training and development with emerging technology.*
>
> (SCIT Minutes, May 22, 1998)

Potential efficiency gains as well as the sheer size of the Enterprise undertaking helped legitimate OIT's claims for more financial resources.

Up to this point, OIT had emphasized services to the academic mission and to administrative efficiency. In the late 1990s, OIT began to leverage the expertise of their

staff in another area: network and data security. Enterprise level computing meant to improve administrative efficiency came with advanced technology that required attention to the possibility of private data being distributed to the wrong people. At the same time, OIT also had to address Y2K computing issues. After initial formation activities, OIT formed a security council in 1998.

> *In order to better address information technology security issues throughout the Office of Information Technology and the University, OIT has convened a security council to share information and determine OIT's overall direction and policies related to security.*
>
> (IT Newsletter, October 1998)

The Networking and Telecommunications Services staff members were also developing a Network Security policy to provide "guidelines for departmental Local Area Networks (LANs) that are connected to the University's network" (IT Newsletter, October 1998).

As OIT was forming, auditing and creating new policies and inventorying services across the University, two issues focused attention on technology security: the integrity of data and client privacy as consolidated databases were accessed through networks and preparation for the Year 2000 (Y2K) computer problem. As described above, the large scale enterprise endeavor was made possible, in part, by new computer networking capabilities and by the increased capacity of computers. Enterprise systems could use consolidated databases to store information and then employ programming and network capabilities to retrieve only what was needed for specific tasks. Errors in assigning permissions to access that data or weaknesses in the technological protections, however, could result in people seeing information that was intended only for limited use. Federal and state laws about data privacy would come later, but even at the start of the

University project there was acute awareness that systems would have to be in place to keep personal information secure and private. In the early days, separate log-ins were required to access different types of information, but between technology development and security systems, by the end of the 90s, the University was "moving towards a single authentication server…to verify usernames and passwords" (SCIT minutes, June 10, 1999). The effort was also in place to assist with student registration, and all servers at the time already had the ability to authenticate against the single login ID server. At that time, the University was beginning to consider establishing a University-wide security officer to serve as the "single point person to coordinate security efforts across and within campuses" (SCIT Minutes, June 10, 1999). In bureaucratic fashion, this would establish an "office" of responsibility for accountability.

Networking and Security get organized around Y2K

The other event that heightened and focused the information technology security and network groups on campus was the large effort preparing for the Y2K computing problem. Many computing programs and data recording systems had been programmed to use only two-digits in recording years. This posed a problem as people approached the year 2000 because computers would interpret 00 dates as the year 1900. Throughout 1998 and 1999, the limited communication venues available to technology staff at the University routinely included reminders about preparing for Year 2000 computing glitches.

The IT Newsletter and e-mail list serves from the Y2K planning group reminded people to have back-up systems in place, and informed technology staff whom they could

call for assistance in auditing their systems for potential problems. This effort was important partly because the security group had to identify as many routes as possible to try to reach all corners of the University. The OIT Newsletter was a communication venue for the central organization to get messages out to the university community, but it had a broader audience than just other computing personnel around the organization. E-mail list serves and other computing groups at the university were tapped to spread information about recommended Y2K preparations. The issue gave the security unit a visible presence among university technology professionals. The two security issues were important not only in setting up administrative procedures, in linking units to one another via computing networks, and in utilizing new communication venues, but they also trained and groomed personnel to take on new roles within the central OIT unit. The Enterprise project manager later became the Chief Information Officer, and two of theY2K staff members would later become the computing security officer and the software license administrator.

Licensing during Phase I

During the 1990s, many aspects of personal computing were indeed personal. Individuals could load whatever they wanted onto their machines. According to one interviewee,

> *When I arrived here [mid-1990s], the college was in the process of rolling out computers, trying to get a computer on the desk of every faculty and staff person in the college…Yes, users were responsible in the sense that they could install more or less whatever they wanted to as long as it didn't break their machine.*
>
> (Computing Support, Liberal Arts)

At this time, people often purchased individual copies of software to load onto their machines, but they might just as easily borrow a copy of someone else's software to load onto their own machine. The university had several ways of distributing software. People could buy licensed software, packaged by vendors from the university-run computing store. Some software was licensed in bulk by the university or purchased through a site-license agreement, in which case purchasing by individuals or departments within the university was undertaken by providing university budget numbers to the computing services unit and picking up copies of the floppy discs from a university computing lab. Some university site-licensed software programs, as well as software program updates, were available for download from university servers.

The university managed a small number of site licenses for software at the time. The software manager estimated that the university had site licenses for about 10 software programs when she started managing them in the mid-nineties. The licenses were primarily for statistical packages, for which the university had a number of different types of license arrangements, covering mainframes, servers and personal computers. The university also made site-license agreements for anti-virus programs, which they promoted heavily. The site-license agreements typically meant that that university had purchased the rights to a volume number of seats or copies which they could then resell to university members, usually at a discount. In the case of antivirus software, the university often sold the copies at a drastic discount in order to encourage computer users to keep virus protection up to date. Other software purchases were handled on an

individual or departmental level, with the option of making purchases through the campus operated computing store.

In the 1990s, the IT Newsletter also frequently announced that certain updates to common operating systems or other free software programs or updates were available on university run servers. Updating software was a long process that could take several hours to download and several more to install. Obtaining these updates from software vendor servers often took much longer because of a higher volume of traffic trying to access the server. Users were advised to have several floppy disks ready on which to download the software. Some of the site licensed antivirus or update software required payment but was also available on the server. In somewhat of an honor system, a department, faculty or staff member could make a purchase through computing services with a university budget number and would then be directed to a server from which they could download the program. In other cases, when vendors charged for software updates that were not site licensed, a user would have to purchase the software from the computer store directly and pick up the floppy disks in person. The process of acquiring software through internal processes often obscured the distinction between which software was purchased and which was truly available without cost. Even technology support staff, became accustomed to thinking of any software not requiring a budget number as "free" regardless of whether the university had paid money for the site license or not.

Phase 2: Building Power by Capitalizing on Networking, 2000-2005

Networking opportunities and threats

Networking presented opportunities for increased efficiency and created expanded communication capabilities, but was accompanied by threats that included computer hacking, viruses, and technical vulnerabilities, all of which compromise privacy and data security. OIT was in a position to capitalize on both the opportunities and the threats. Their staff had proven their ability to implement enterprise level computing changes, which were viewed by the central university administration as improving overall organizational efficiency. They also had the expertise to help alleviate the threats that came with implementing and maintaining the networked systems.

Despite some inroads into the central administrative budgeting process and a beat on the largest of projects in their three umbrella units, OIT did not have a clear and coherent mission at the time. OIT had weathered the Y2K storm without noticeable incident, which left a collection of computing experts ready to step into security and other administrative roles within the OIT unit including enterprise-level software upgrades and growing software licensing management. Their networking unit continued to expand and improve the network in the early 2000s, and OIT continued to promote several technology-enhanced learning initiatives of the academic unit. These initiatives included WebCT (a course web software system) and other support for technology in the classroom provided by the Digital Technology Center. Security concerns dominated OIT's activity in the first half of the 2000 decade fueling the organizational power aspirations of the OIT unit. When security concerns were presented to the university

senate committees or to the university community at large, they were commonly accompanied by pleas for increased staff or financial resources or by justifications for improvements already being undertaken. Thus, security activity provided the venue by which to request and justify increasing access to power and resources.

File sharing becomes an "issue"

In February 2000, several representatives from OIT's administrative and security staff attended the Senate Committee on Information Technology (SCIT) meeting with news that Napster, the most popular internet music file sharing system, was becoming "an issue." At this first meeting addressing Napster (and at most subsequent meetings addressing the same) Napster and other file sharing programs were presented as a problem of bandwidth use rather than as a legal problem. The primary message at the first presentation to the committee was that Napster file sharing accounted for 50% of the network traffic. Emergency measures were taken to filter and restrict traffic, but because filtering was controversial, the OIT staff sought advice from the committee on how to proceed. Servers were operated by many departments, colleges, individuals, and research projects all over the university. According to one of OIT's security representatives,

> *There are other issues that arise from time to time in which consultation would be helpful. One is that departmental servicer are taken over by hackers which results in service being removed from that server to rectify the problem. If this action is not taken, the University is black listed by other organizations and emails are then refused.*
>
> (SCIT Minutes, February 29, 2000).

Until this time, no unit had even considered a coordinated inventory of university servers much less the possibility of taking over any centralized management of them. The

presentation to SCIT marked the first documented concern about servers run by individual units.

Solidifying the budget

Although there was discussion of creating an advisory group to help craft procedures to deal with bandwidth filtering and to provide guidance in dealing with university servers, no such group was formed at the time. However, the Technology Planning group had been had been working throughout the previous months to consolidate and revise the collection of technology budget requests. They identified linked requests in order to represent the "main ideas" in the biennial budget request. The presence of technology lines in the biennial budget request was another sign that OIT was becoming an established entity in the university's administrative body. The senate committee discussed several funding mechanism options for technology, including the merits of central technology fees versus budget items. Some suggested that technology

> *is integral to today's education and therefore cannot continue to be a tack-on fee. Instead it must be part of what the students and state are funding.*
>
> (SCIT meeting, April 4, 2000)

Others explained that

> *the University cannot keep spreading costs out to the units and then putting all their hope in the legislature. If the University matched funds, it might be more attractive to the state.*
>
> (SCIT meeting, April 4, 2000)

Finally, OIT representatives, clearly having thought about their best approach, justified their budget claims by explaining how the enterprise system was helping to integrate information management by connecting registration, admissions, financial aid and billing.

They also pointed out that they had taken on a change to a semester system, Y2K management, and a conversion to an enterprise system all at once, without a centralized system or centrally coordinated technology budget. In other words, OIT was more than capable of leading technology planning at the University.

Learning to use technical expertise as a power resource

Security representatives from OIT continued to seek cooperation from outside their unit for advice on allocating bandwidth resources. Both Napster and spamming were becoming irritating problems for the security wing of OIT. The security group had limited Napster briefly when its use had consumed nearly the entire network and the security team wanted input from SCIT about allocating resources.

> *A committee of students, staff and faculty needs to be convened when these instances arise to provide consultation instead of OIT just making a decision on their behalf*
>
> (SCIT Meeting, May 2, 2000).

Although computer security personnel had internal criteria about how such resources should be allocated, they also seemed to think that their organizational environment demanded input from a broader constituency. The security team was still not comfortable wielding sole power in determining how bandwidth resources should be allocated, even though they had the knowledge and expertise to take control. Spamming was the other irritant for security and also was best solved, according to central OIT, by meddling in the affairs of individual units. Spamming reportedly entered the system through

> *unmonitored servers in departments. The servers need to be identified and tied to administrators so that the administrators can be contacted about any problems… Then, if the server is not fixed, they can be taken off-line, which will no doubt get their attention. OIT does not want to take a*

> *policing role, but they also do not want to answer messages from people asking why their messages are being rejected by certain sites.*
> (SCIT Meeting, May 2, 2000).

The central organization was not yet interested in taking them over, but was clearly starting to assume responsibility for all server activity occurring on campus.

After repeated attempts to seek input from SCIT or departmental representatives, OIT security staff and administrators went ahead and crafted Network Management Guidelines over the summer of 2000 without other outside participation. Problems with file sharing bandwidth use continued into the fall of 2000, and OIT brought their preliminary Guidelines to SCIT in December. There was a discussion about how much university network usage was devoted to file sharing. When asked whether the university could legally block file sharing, the security team phrased their answer in a way that addressed the fundamental tension in the university setting between security and central resource control on the one hand and academic freedom or autonomy on the other.

> *The University can legally do whatever it wants: it is a private network. The question is what does the University want to do as an education institution. There are norms, of course, in an educational institution: freedom of speech, freedom of access, (particularly in a public land grant institutions), so I do not want to use the word 'legal.' It is a real fine line here where you really do not want to block anything; what you want to do is assign an appropriate level of bandwidth for each application, to serve its purpose to the institution, and that should be your general policy.*
> (SCIT Minutes, December 5, 2000).

The security unit was laying the groundwork for filtering different types of bandwidth use, but was either not entirely comfortable imposing their own criteria on the use of network resources, or, more likely, felt that SCIT involvement or approval was essential to establishing the legitimacy of the policy. They explained that there are different types

of file sharing protocols and that those using the greatest bandwidth were primarily designed for entertainment.

> *It probably should be policy to never block anything, except in a real dire situation, but the University is going to have to be discriminatory in saying that certain protocols have primary purposes outside the core mission of the institution.*
>
> (SCIT minutes, December 5, 2000).

They floated their version of the bandwidth resource issue. Without the input they had originally sought from SCIT, OIT security and administration had created their own guidelines and now presented them to SCIT for endorsement as part of a legitimation process.

An overload on the system due to Napster use caused OIT security to put a temporary block on Napster for a short time one weekend in August of 2000. The block received attention from the University newspaper and one of the city papers. Although they were aware of the possible scrutiny a decision to temporarily block any application would face and did not want to be in the position of censoring network activity, OIT also reported to the Senate committee that

> *the fact that we were labeled publicly as a blocking institution probably helped us avoid a lawsuit.*
>
> (SCIT minutes, December 5, 2000)

Gradually throughout the 2000-2001 school year, SCIT and OIT security reviewed network usage rates, filtering options and potential costs of increased bandwidth. By March 2001, the Network Management Guidelines were in place and served to split network usage into two categories:

> *those having merit and purpose to the core mission of the University (teaching, education and research) and those secondary applications which may prove to have significant bandwidth usage.*
>
> (SCIT Minutes, March 6, 2001).

If capacity of secondary applications exceeded 10% (or an updated percentage determined by the CIO), OIT security could potentially limit the usage. OIT still sought participation by the university community and suggested that in cases where intervention proved necessary, the governing bodies of the affected populations would be notified so that OIT could work with them on solutions.

Fall 2001, OIT was significantly limiting the use of file sharing programs and was engaging in education efforts with students about the file sharing issue. OIT had formed a subcommittee to help with file sharing education and with bandwidth shaping decisions, this time without appealing to SCIT. OIT was also considering putting the dorms on a separate network connection (SCIT Minutes, November 6, 2001). Each time the security group had sought advice from the Senate Committee in managing bandwidth resources, they seemed to have difficulty coordinating meaningful participation from either SCIT or the affected units. Units wanted internet access, but rarely wanted to consider the technical aspects of making networks work. The course of making independent decisions and policies about managing network resources taught the security group that they had the power to take control of technical resource allocation decisions.

Making technology a "common good"

Network resources were expensive and a variety of parties, from local departments to colleges, had been involved in installing network connections and switches and many units had helped foot the bill. Early in 2002, OIT reviewed network

usage rates for the above mentioned reasons. The university also reorganized the way units were charged for their use of the network. Up until that point, the way OIT charged for network use was to

> *divide the annual cost of operations and maintenance by the number of [network] connections. These costs are then distributed to collegiate and administrative units as monthly service. Alternatively, OIT is proposing that the institution move away from a per-connection charge for the network and mover towards a model that supports the 'common good' infrastructure.*
>
> (SCIT Minutes, February 5, 2002)

OIT floated two charge-back options by the SCIT committee but explained that in either case, the cost of installing connections would continue to be charged to respective colleges and administrative units.

> *OIT's goal is to increase access, increase mobility and encourage the use of wired and wireless networking technology, all while simplifying the business model needed to support this goal.*
>
> (SCIT Minutes, Feb 5, 2002).

The 'common good' model and term were used more and more frequently by OIT. An interviewee, who was an IT administrator from one of the collegiate units explained that the model was part of the change in overall university budgeting. Rather than allowing units to "buy in" to centrally provided technology infrastructure, OIT encouraged the use of centrally provided technology infrastructure by requiring payment for "common goods" regardless of whether or not a unit chose to use the service or technology. The funding structure encouraged use of standard and centrally selected technologies in order to eliminate redundancies and take advantage of economies of scale.

During the entire period of the early 2000s, the IT Newsletter featured technology enhanced learning initiatives and support services offered by the Digital Media Center. According to the Digital Media Center's director, the university had a prominent presence at the 2002 EDUCAUSE conference and

> *ranks high in terms of CMS [Course Management System] national trends. The University currently has several initiatives underway that focus on faculty development, assessment and evaluation, and Virtual Communities of Practice.*
>
> (SCIT Minutes, November 5, 2002)

OIT frequently advertised services and accomplishments in this area as part of their offerings to the University. The Technology Enhanced Learning (TEL) initiatives included training programs and software licenses for several web authoring tools, small financial awards programs for innovative classroom and course delivery web projects, and a comprehensive web authoring facility run by the Digital Media Center. The TEL program hosted fairs for the University community see the commended course web designs first hand. The technology enhanced learning initiatives were well publicized in the IT Newsletter and served to reinforce OIT's legitimacy in terms of the university's academic mission.

File sharing takes on the legal frame

File sharing issues continued to escalate throughout 2001 and 2002. Many issues pertaining to data privacy protections were taking on a more legalized tone, both in the wake of post 9/11 legislation and in response to increasing accessibility and transferability of digital data. The security group was working more closely with the Office of the General Counsel to determine what implications the USA Patriot Act had on

higher education. Patriot Act implications did not require additional technical work, but rather required that the University allow increased access to records by law enforcement in cases of possible computer hacking. The fact that additional laws spotlighted computer security conferred increased status on the OIT security unit.

Bandwidth use problems from file sharing had been managed to some degree through criteria established in the network guidelines, but the legal side of file sharing was forced to the fore as the entertainment industry, the Recording Industry Association of America (RIAA) in particular, began targeting University campuses. The University security officer explained to SCIT that for the administration the problem involved three issues: a legal issue, because students were illegally distributing copyrighted materials; a network resource issue, because bandwidth use for file sharing is high; and a network design issue because residence halls may require a separate treatment than the rest of campus in the future.

> *The university has a limited liability when it comes to illegal file sharing. When the University is notified of a violation, its policy is to take action within 48 hours. In order to curb illegal file sharing, OIT plans to do more to educate students on the policy and make the policy clearer.*
>
> (SCIT Minutes, November 5, 2002)

In typical fashion, a student representative and another member expressed concern that the University not stop legal file sharing in its attempt to stop illegal sharing. A committee member commented that

> *it is vital that the University not let itself get itself into the position of acting as 'copyright police.' Rather, it is and should continue to be incumbent upon the copyright holders to defend their copyrights.*
>
> (SCIT Minutes, November 5, 2002)

Through the winter of 2002-2003, OIT formulated their budget request, which included a network upgrade, an enterprise level financial system replacement, and an upgrade of the course management system. The budget proposal discussion at the SCIT meeting revealed that the Office of Information Technology had made significant inroads into the top levels of the University administration. Technology was seen by the administration as a tool to leverage in gaining large scale organizational efficiency. The OIT had been asked to participate on the Executive Oversight Group,

> *charged by the President to investigate ways to save money through better leveraging of Enterprise scale technology across the institution.*
> (SCIT Minutes, March 4, 2003)

The committee was established to better measure the University's return on investment. According to OIT, one way to help would be to think of ways to consolidate purchasing to secure savings.

> *The University's purchasing strategy is poor compared to corporate purchasing strategies. Corporate strategies leverage best price through volume purchasing. Plus, the University does not practice the discipline of buying the right machine for the right job. The administration is in no way suggesting that there can ever be a centralization of all purchases at the University. However, the University could recognize financial gains if it were able to develop a model that would allow its distributed decision makers to participate in a process that would security the University better pricing and purchasing the right equipment for the job.*
> (SCIT Minutes, March 4, 2003).

Despite the fact that the administration claimed that it was "in no way suggesting … centralization of all purchases," OIT was certainly suggesting that increased standardization would help optimize volume purchasing. OIT also developed the UPortal over the course of 2003. It was used to deliver teaching and create a more personal web

experience for students, but had also been used to deliver employee training about data privacy that provided significant cost savings over other forms of training delivery.

File sharing continued to be at the forefront of security concerns throughout 2003 and remained a legal issue. A lawsuit involving Verizon Communications concerned the university security and legal staff because the music industry had sought names of users who were using file sharing programs from the internet provider. Although Verizon had filed an appeal, at the time the District Court had ruled that the name of the user must be supplied. OIT reported to SCIT that

> *The University is receiving an ever-increasing number of DMCA notifications. If the University abides by the provisions of the DMCA, the institution has certain legal protections. When the University is notified, immediate action is taken. The person is contacted and is required to remove the offending material from the network. If there is a repeat offense, the person is denied network access and referred to Student Judicial Affairs. This requires a lot of work on the part of OIT. In April 2003, OIT received 130 DMCA notifications.*
>
> (SCIT meeting, May 2003).

OIT used the opportunity to explain how much staffing efforts for DMCA compliance cost the University. File sharing was rising to the level of a legal threat and the organization was responding by incorporating the "legal form," as described by Edelman and Suchman (1997) into its management of file sharing issues.

The October 2003 SCIT meeting was a busy one. One of the attorneys from the Office of the General Counsel visited the SCIT meeting to provide the update on file sharing. The university had not yet received subpoenas regarding downloading of copyrighted materials, but he reported that more than 1000 subpoenas had been issued by the Recording Industry Association of American (RIAA) to internet service providers,

including several universities, seeking the names and addresses of people who had allegedly downloaded copyrighted material. Furthermore, 260 lawsuits had resulted from those subpoenas. This was a public campaign to crack down on file sharing by the RIAA. RIAA had announced in a press release in April of 2003 that they would be targeting internal campus networks, having filed lawsuits against four college campuses (RIAA News Room, April 3, 2003).

Discussions following the presentation included recommendations to continue the conversation, to deal with file sharing in a more proactive way, to be cautious about cooperating with the RIAA and related organizations from the entertainment industry "as they court colleges and universities", and to establish more clear-cut guidelines for information technology directors and administrators "so they know what is an appropriate response to inappropriate use of University technology" (SCIT Minutes, October 7, 2003). The head of security and the Office of the General Counsel had already begun an effort to "streamline procedures on where to seek out advice for different situations." Their target was file sharing of music and movies, but software could be shared through similar avenues. Measures taken to deal with file sharing and especially those designed to provide technological protections for the university would have implications for some uses and transfer of software as well.

At the same meeting OIT reported a rash of computer worms and viruses that were infecting computers on campus. Attacks, according to OIT, were primarily due to the "failure by individuals to patch their computer systems" (SCIT Minutes, October 7, 2003). In order to deal with the attacks, OIT networking and security implemented

emergency shut-downs of ethernet ports. The actions were considered necessary in order to prevent infected machines from spreading the worms until they could be properly patched. Turning off access points was not an optimal solution because users were unaware of whether problems accessing the internet were due to a disabled jack or due to a problem with their own computer.

> *A member pointed out that dealing with these worms and viruses is very expensive in terms of staff time. Concern was voiced over instances where wireless access points were turned off…therefore, it was suggested that OIT strategize about other remedies that are not network jack-based…[the security staff] acknowledged this concern, but noted with the limited resources that were available in the midst of the infection, OIT had no other course of action available at the time to remedy the problem.*
>
> (SCIT Minutes, October 7, 2003).

Expert knowledge trumps other usability concerns and is connected to the legitimacy of claims to more material resources. It would be preferable to identify infected machines rather than simply compromised jacks. The administrative OIT representative at the meeting took the opportunity to point out that the new network would "afford OIT additional management capabilities that may be able to help in these instances" (SCIT Minutes, October 7, 2003). The other problem was the failure of individuals to install patches in a timely manner. The more machines could be managed with an automated configuration system, the better IT staff would be able to help control the installation of patches. Perhaps not surprisingly, OIT was in the process of collecting bids to upgrade the network to address many of the technical limitations that had hindered efforts to deal more effectively with the virus problems.

Moving toward standardization: turning law, services and resources into standards

In 2004, OIT did two things that represented a slight shift in their approach to managing technology and that represent their willingness to take more direct control over standardizing university wide technological resources. First, they used volume purchasing of Microsoft licenses and file sharing systems to alleviate legal threats in the area of copyright. Second, they became more aggressive about defining standards and in requiring adherence to the standards across units at the university. In part, standardization was becoming a viable option because of the enterprise system upgrades that OIT had already managed and continued to manage. In addition, OIT continued to roll out infrastructural systems, such as the calendaring system, the enterprise level financial system, and a record digitization service, that they intended as standard tools for the university community. An "ever increasing number of security issues," including peer-to-peer file sharing, network, server, and desktop management practices, meant that OIT would "need more funding" and would need "more standardization and restrictions on campus" (SCIT Minutes, February 4, 2004).

OIT had established a huge agreement with Microsoft in the summer of 2002 to provide reduced-price Microsoft operating system and Windows licenses. They had extended the licenses to reduced prices for student purchases in 2003 and heavily advertised the licenses throughout 2004. In February 2004, however, OIT reported to SCIT that they would like to "continue to leverage the Microsoft Campus Agreement" by

standardizing the Microsoft desktop environment on campus "to reduce support costs and increase functionality." The CIO explained that

> *OIT is receiving a lot of support on the departmental level related to security matters. The Microsoft Campus Agreement has also been helpful. Other issues that need to be addressed include reducing the number of operating systems on campus, and finding a push technology for patches that can be easily deployed*
>
> (SCIT Minutes, February 3, 2004).

Although OIT had limited power to enforce their will across units at that particular time, the stronger line on requiring common technologies and practices across the university would continue through the latter half of the 2000 decade. Their desire for a single standard operating system was in line with the bureaucratic goals of efficiency and predictability. The push-back from the user community, however, was varied in interviews. Users of Macintosh and Unix-based operating systems maintained constant pressure on central OIT to support interoperability with these systems. Meeting the demands of these users was generally of low priority to the central administration, but the constant demand usually eventually resulted in OIT development of some interoperability solutions.

In May 2004, OIT reported to SCIT that they had also finally received notice from the RIAA about lawsuits against two university network users regarding alleged illegal file sharing. The university was not named in the complaint but intended to do whatever the law required of it as a service provider. At that meeting, the security officer also presented an overview of security issues to SCIT.

> *The new reality… is that the University must comply to a higher legal expectation or standard related to security and that the environment we operate in, as it relates to worms, viruses and Trojans, is becoming*

> *increasingly dangerous. The sophistication of spammers and hackers continues to grow and represents an ever-increasing threat.*
>
> (SCIT Minutes, May 4, 2004).

In this case, the "threats" of the new reality were not accompanied by requests or justification for more funds. Rather, OIT representatives highlighted the tools they had developed to help combat the threat and made a strong case for a set of guidelines and for strong accountability on the part of departmental units. OIT reorganized the guidelines associated with several policies in early 2004, including *Protecting Private Data;* the *University Network Standard for Network Security and Operational Continuity;* and *Information Technology Support: Guidelines and Recommendations*. They also formalized a distinction between standards and guidelines. Prior to this distinction, most guidelines had served as recommendations without much force behind them. OIT clarified that standards required compliance, and guidelines should be treated as recommended best practices. Guidelines, one interviewee told me, should be treated as pending standards.

> *The university recognizes that not everyone can meet the guideline right now, but the guideline alerts people that they should be moving in that direction, because it is going to be a standard some day.*
>
> (IT Professional, Liberal Arts).

The CIO intended to establish accountability for the policies and standards in each college.

> *Units will need to set up appropriate operational environments. OIT will work with the OGC and Office of the registrar in establishing them. Once models are put in place and standardized across campus, labor costs will go down.*
>
> (SCIT Minutes, May 4, 2004).

The move toward standardization that had been a desirable goal a few months prior became a mandate by the end of the spring semester. OIT created tools on their web page to check computers for security weaknesses, and the newly renegotiated agreement with Microsoft allowed free upgrades which were available on a server.

That summer, OIT distributed information about the standards for anti-virus and operating system critical updates. They had made services available through their short term computer support service operation to set up automated scans and updates for departments that did not have their own IT support staff. Microsoft also understood the security concerns and had produced a number of programs and operating system features to improve security for customers. OIT Security and Assurance coordinated a two day training session run by Microsoft and designed for IT professionals at the university. Microsoft initiated the contact about scheduling such a training session, but the Security Unit reported that they "happily coordinated this class for the University community" (IT Newsletter, July 2004). The class was originally organized to accommodate 40 attendees, but filled up within hours. Extra seats were added to accommodate100 employees, with demand for even more. The IT Newsletter reported that attendees were pleased with the presentation and had indicated interest in attending such events in the future. The Newsletter also reported that the university community had learned that the university is not nearly as uniform a computing environment as business settings are.

Another lawsuit was filed against a university network user, and the CIO reported to SCIT in Fall 2004 that the University had received approximately 400 illegal files haring notices in the previous academic year under the Digital Millennium Copyright Act

(DMCA). One component of the response by the University was to negotiate a one-year online music service deal with Rhapsody as a "legal alternative" for downloading music. OIT also received subpoenas for the names associated with IP addresses of alleged file sharers. The CIO reported to SCIT that "the subpoenas are forwarded to the Office of the General Counsel to handle." However, per the General Counsel's previous report to SCIT, the legal way to comply with the requests in the wake of the Verizon case was to turn over the names to the copyright holder. More than one interviewee from the central organization also reported that the University turns over the names to copyright holders when those requests are made.

By the end of 2004, the focus of most antivirus efforts was on controlling e-mail SPAM and SPAM was consuming a great deal of technological resources. In 2004, the University received 300 million e-mails (not many by today's standard), more than half of which were blocked because of spam or viruses. Managing spam was an increasingly complex task and the university was collaborating with other universities to develop spam strategies. This was the first report that the university might consider looking into outsourcing their e-mail service, which had been developed in house.

An important shift had occurred over the 10 years since OIT's creation. OIT had leveraged several resources at their disposal to gain an integral place in the top ranks of the University system. While the integration of technology into the organization was functional and inevitable – talk about mobilization of resources, putting the bureaucratic elements in place and taking authoritative control over power within the IT wing. Law as a resource had shown itself a bit, and legalization of the workplace is certainly confirmed

in the way that the university handles that. Bureaucratization of the workplace is also evident. Having gained the bureaucratic structural tools to wield authoritative power, they begin further standardization. Risk management infused logic is taking over.

Licensing during Phase II: Network Threats and Opportunities

In the second phase, networks altered the way that software could be delivered, both complicating and simplifying aspects of the process of handling software licenses. In April of 2000, the new "TechMart" was made available to the university community. It was an online version of the computer store from which people at the university could purchase computer hardware and software. Features of the new online system, reported by the IT Newsletter, included the ability to shop any time of day or night, a minimum 4% discount from all vendors, additional educational discounts, and free shipping. University members were required to use their internet identification and password to enter the purchasing area of the website. In addition, the purchasing section was designed to integrate with the University's financial system for departmental purchasing.

As described earlier in this section, online exchange of digital information made all forms of file sharing possible. Prior to improvements in network capacity and integration, software stored on floppy discs or CDs could be, and was, easily passed around and copied, but the network made the exchange of digital information even easier. Vendors began working on technological protections during this period, but also employed a self-enforcement approach by auditing organizations to enforce the contract nature of the license agreement (in the case of Microsoft and other large vendors). Vendors also began to tie software to authorization codes, enforcing their ownership

rights technologically. Two changes were made by the university in 2002 to handle the issue of software "compliance." First, the university made a contract agreement with Microsoft in the summer of 2002 to provide Microsoft Office and Operating System software at a greatly reduced cost for all computers owned by the University. Second, that same summer, the university created a full time staff position to administer software licenses. Both changes were featured in the October 2002 issue of the IT Newsletter.

To the campus community, the Microsoft agreement was billed as a great service for departments and cost savings boon for the university at large. To the senate technology committee, OIT billed the agreement as a cost savings and efficiency tool, even to the point of eventually suggesting that

> *the goal of this agreement has been to standardize the Microsoft desktop environment on campus to reduce support costs and increase functionality.* (SCIT meeting minutes, February 3, 2004)

In interviews, and perhaps with the benefit of hindsight, administrators emphasized the appeal of the Microsoft campus agreement in more legal terms, referring to the agreement in terms of "software compliance."

> *We have the university wide contract, where all computers owned by the university can download Microsoft Office and Microsoft Windows, which really helps with compliance. We know we are in compliance.* (OIT Central Administrator)

In the same interview, one software licensing administrator, discussing the terms of the license, explained that

> *For the student program they [Microsoft] look at the FTE [Full Time Equivalent] count for Fall. For faculty and staff, they look at part time and full time and there is a calculation that they do. When we look at the renewal process, we look at our statistics and figure out whether it makes*

> *sense for us to do it. It also makes sure we are in compliance, so that is a big factor.* (OIT Central Administrator)

In other words, yes, the campus agreement saves money and a lot of tracking costs, but the software compliance component is also a factor in determining whether to continue the agreement.

A collegiate unit director also explained his interpretation about how network file sharing capabilities and Microsoft's auditing threats contributed to the move to a site-wide campus licensing arrangement.

> *The other thing that happened [in addition to the file sharing lawsuits] … when we got on the network, people started thinking about ways to share things illegally and companies started auditing. Microsoft could show up at the university saying, 'we want to see if you guys are in compliance.* (Liberal Arts IT Administrator)

When I asked whether Microsoft representatives did show up, the answer was

> *Yeah, they would show up at the university, they'd have auditors checking. That scared the university a lot. The university said, 'hey, we need to make sure we are not illegal.' Departments then said, 'hey, this is expensive, we need some help with this. My organization was charged with buying licenses for all of the faculty. Central took on the responsibility for getting contracts for the biggest products.* (Liberal Arts IT Administrator)

This conversation illustrates several of the challenges and changes occurring at the time. Networking was credited with creating a huge opportunity for file sharing. Even though the ability to make quick and perfect digital copies existed prior to widespread internet use, increased networking capabilities made it easier to distribute those copies. Site-wide licenses capitalized on economies of scale while also alleviating the problems with monitoring individual units and machines for unauthorized copies of software. While central computing "took on the responsibility" of getting the biggest products, collegiate

units were also encourage to get more involved in the business of securing authorized licenses for commonly used software applications.

It is interesting that central OIT did not sell the site-wide Microsoft license as a "compliance" strategy to the Senate Committee audience with its faculty representation. Some representatives from the faculty and certainly the student body representative regularly raised concerns about the university not allowing software owners to exert too much control over university autonomy. Although these concerns rarely amounted to much direct action against software vendors or copyright owners, it did seem to require that OIT represent their position in terms that did not overly privilege outside copyright owners nor over enforce restrictive licensing arrangements. The budget office, on the other hand, saw the compliance component from the very beginning. When the budget office announced the agreement in the newsletter, Dollars and Sense, in the fall of 2003, they described the Microsoft Agreement in both cost savings and compliance terms. Benefits of the agreement were listed in the following order

> *-The licensed software is available for use on all computers at the university.*
> *-Accountability for software licensing is simplified as a result.*
> *-Upgrades are automatically available and may be used as they become available.*
> *-Downgrades (e.g., older versions) are also fully licensed.*
> *-The university saves on licensing costs.*
>
> (Dollars and Sense, Fall 2003)

Simplification of accountability was a compliance benefit in terms of both legal liability and internal monitoring costs.

Other versions of site-wide licenses, though not as comprehensive as the Microsoft campus agreement, were becoming more common for widely used software programs. Combined with the online purchasing option through TechMart, the job of handling licensing requests was getting more demanding. The university created a new staff position to handle the licensing tasks.

> *Due to an increase in vendor software available in the Software License Program, as well as an increase in demand by the University community, Academic and Distributed Computing Services (ADCS) has appointed a full-time Software License Administrator.* (IT Newsletter, October 2002)

In an interview, the software licensing manager explained,

> *Software licensing was a part of my job. I was an office assistant and then I became an office manager [for the academic computing services group]. One day, I realized I was spending at least 80 percent of my day dealing with software licenses. So, we wrote up a new job description and I applied for it…It was tracking software and renewals for anything that OIT had.* (OIT Software Administrator).

Indeed, in other interviews with computing support professionals who had been at the university for any period prior to about 2006, everyone knew the software manager on a first name basis. For many of my interview subjects, questions about how they acquired software for their department were met with the following answer: "I call [first name] – the software person." The software manager kept track of who had which licenses. Some licenses were sold by department, some to specific machines associated with particular people. The software manager explained, "

> *we had a filemaker database when I first started. We just had a record for every single person…but [an internal university development group] developed the database I am using now.* (OIT Software License Manager)

The database enabled her to search by software program or by expiration date so that she could send reminders to people when their licenses were approaching renewal dates. Computing support professionals typically had a rough idea about which licenses they had ordered for their department members and when they might be in need of renewal, but most of them reported relying on the software manager to let them know about renewals.

Phase 3: Standardization and Control, 2006 to present

Technology as infrastructure

Within 10 years of its formation came evidence that the Office of Information Technology was fully integrated within the central administration. When the university began a new strategic initiative, described by the CIO as "arguably the most comprehensive strategic review this institution has ever undertaken," information technology comprised an important role in the plan. The CIO was to participate heavily in the administrative task force activities and explained that he expected significant reorganization to improve sharing of resources and to take best advantage of economies of scale. While OIT representatives seemed somewhat disappointed that no task force was devoted entirely to information technology, the CIO reported to SCIT that "most of the task force's recommendations would rely fairly heavily on technology to realign the University's strategic goals," which would have "implications for OIT" (SCIT Minutes, September 13, 2005). As part of the strategic positioning effort, many university units were required to conduct reviews of their activity and find ways to eliminate redundancies. During the period from 2005 to present, OIT engaged in more overt efforts

to standardize technology itself as well as technology management practices. They also sought to clarify and solidify their role as providers and overseers of technological "infrastructure" for the university.

A new financial system enabled OIT to designate many of their services as "common goods." Rather than having a choice of whether or not to "purchase" OIT's services, college units were simply charged for their estimated share of common good services whether they had their own alternatives or not. Preparations for a new budget model also led to other organizational changes over the period from 2005 to 2010. The effects of the new budget model show up in the budget structure shown in Figure 5.1. Infrastructural technology as defined by the central administration is charged to collegiate units through a formula, based on headcounts (sometimes student, sometimes staff) or square footage. The charges are taken out of a collegiate allotment before ever entering their accounts. This is different from the previous "opt in" method through which collegiate units could choose whether to participate in a collective system for some of their technology needs. Although central OIT had been imposing some of these charges and incentivizing participation in centrally provided technology goods and services prior to the new budget model, the new model was a stronger tool for requiring adherence to any technology deemed infrastructural to the entire university community. As OIT centralized services they deemed infrastructural and implemented mandatory cost recovery for colleges, IT directors demanded more transparent information about how the money central charged their collegiate departments was spent. The interactions had led to the establishment of an IT director's group that met with representatives from the central

OIT organization. OIT sold the establishment of this group to SCIT as a great opportunity to gain information about the technology needs of the institution. The IT directors explained it to me as an opportunity for them to hold central accountable to their responsibilities now that they were demanding more central buy-in from colleges.

In 2005, after having implemented two enterprise level administrative systems, OIT implemented a technical governance software tool to manage their own IT business processes (work requests, etc.) through an integrated system. It was primarily a system to make sure that the integrated computers on the financial systems were all being attended to and maintained in a uniform way.

> *With the implementation of the new Financials system from PeopleSoft, there is an acute need to develop or buy a change control application that will support the necessary migrations of patches, modifications and tools inherent to the support of PeopleSoft… IT Governance will allow OIT and its customers to extend the existing Quality Assurance processes and controls to all facets of IT delivery, providing real-time visibility and control over all initiatives and operations.* (IT Newsletter January 2005)

Once the university began to standardize one system of digital records management, they had to continue by standardizing other forms of digital work management.

Pairing the law with technological expertise

The pairing of formal legal problems with technological solutions was occurring at all levels of society with respect to digital technology. In response to leaks and theft of personal information contained in private records, state and national laws dealing with information privacy were amended for the digital age. The IT Newsletter was dominated by the Health Insurance Portability and Accountability Act (HIPAA) and the Family Educational Rights and Privacy Act (FERPA) compliance information. These laws

covered several aspects of how to handle health and student records. In light of developments in technology, 2005 was a date for compliance with new federal standards in handling data and in establishing organizational accountability. The University implemented a new standard to cover data privacy and in response to these laws throughout the first half of 2005. The official date for HIPAA compliance was April 21, 2005. The university standard to cover data privacy was "good news" according to the IT Newsletter because

> *it shows an institutional commitment to support the goal of security [protected data] against intentional or unintentional loss of confidentiality, integrity, or availability regardless of location.* (IT Newsletter, April 2005).

The university standard provided a checklist for assessing whether encryption techniques were appropriately implemented, proper staffing was in place, and whether backups were being handled properly. Laws about data privacy emphasized security concerns and provided additional justification for central tracking of university record databases and servers that stored any data defined as private by either of the laws.

The attention to data privacy, continued rapid growth of internet traffic, and the U's strategic planning initiatives led OIT to conduct a review of "several policies that have security implications."(SCIT minutes, November 1, 2005). In particular, wireless internet capabilities were expanding and the university needed to figure out the best way to secure connections to the wireless internet. IT security no longer seemed to hesitate about making decisions that impacted the way resources were allocated, rather they had been empowered to make decisions that they felt secured the university's computing resources and digital data. The SCIT found the proposed changes to the Acceptable Use

policy "too technical for the common user to understand," but it is not clear that any language changed as a result. As far as the security group was concerned, the policy now required computing personnel to be responsible for computing-related security and they needed only simplify the language enough for technical staff to understand it. Furthermore, the data privacy This merging of legal requirements with technological solutions is precisely what people like Lessig (1999, 2001, 2004) and Gillespie (2007) have described in the national and international technology arena. Here, we see how these macro-level trends are interpreted on the ground, within the organization, by the users and technology professionals at whom the legal and technological changes are directed. Organizational procedures and power arrangements shift as the law, technological expertise, and bureaucratic concerns are simultaneously leveraged for legitimacy and authoritative control over computing.

Consequences for violation of the policy (denied access to wireless privileges) were not even enforceable at the time that the policy was presented to SCIT, but would be "when the university moves to the next generation wireless design" (SCIT Minutes, November 1, 2005). At the very next meeting, OIT presented their case for a next generation wireless network rather than continue extending access points of the existing one (SCIT Minutes, December 6, 2005). One of the tricky things about rapidly changing technology is the ease with which functional arguments are leveled for explaining the implementation of the new technology. It is true that in order to keep current with wireless communication technologies, a necessity at a large research university, wireless connections would have to be provisioned. The need for new technology and the rapid

changes associated with it are part of a communication field that extends well beyond the scope of this study. What is important here is the way that the experts who deal with such technology were increasingly essential to university operations and how their expertise over technology enabled them to exert authority over many aspects of how technology is managed. University governing bodies must rely on the expert knowledge of the computing professionals, but particularly those whose positions are associated with security. The overlap between the law and the technical knowledge required for compliance meant that computing experts mobilized both the law and their technological expertise simultaneously.

More laws, state laws this time, in 2005 called for additional security policy amendments. The state Data Practices Act, effective August 2005, required organizations to notify individuals if their private data had been acquired in an unauthorized manner. The CIO sent a letter to deans, directors and department heads in December 2005 advising them of the new law, which required state agencies and the university to notify individuals of any breach of security of private or sensitive data.

> *The number one way to avoid having to deal with the new law is to store as little legally protected information as possible, centralize the private data that is needed as much as possible, and maintain a high level of security for the private data.*
>
> (Letter to the university from the CIO, December 2005).

These strategies pushed for reliance on central university servers, managed, housed, and run by the central computing operations of OIT.

Many universities were straining to keep up with the pace of technology in both legal and financial resource terms. In the summer of 2005, the University took on the

computer hardware systems of the state college and university system, to be housed at their central computing operations location. In January 2006, increasing use of internet reportedly "outpace[d] the University's ability to fund limitless growth." The problem put increasing pressure on bandwidth use, a problem reportedly shared by many universities. The approach to the problem was to prioritize "core mission traffic" and set a lower priority on "high bandwidth recreational applications," which typically meant those that involved peer to peer applications. At the same meeting, the CIO continued the discussion about implementing a new wireless network that would be common across all campuses and controlled centrally. OIT was intent on convincing a variety of decision makers that money allotted for improving the existing wireless network connections would be better spent on a new upgraded university wide wireless network. The discussion was tied to the drafting the new wireless networking standard for the Acceptable Use policy.

Wireless networks and computer portability reinforce security entrenchment

In 2006, security concerns reported to SCIT and addressed in IT Newsletters revolved around the "portability of data." Once the wired and wireless network procedures were in place, security turned to the increasing use of laptops and portable data storage devices, which held the potential for the exposure of private data. The Securing Private Data standard required that all such devices be encrypted, a requirement that some interviewees explained were not entirely welcome by some of their users, or at least were not fully understood. The CIO explained to SCIT, that

> *in light of a series of security breaches, laptop thefts, and misunderstandings concerning the University's security policies, a*

> *decision has been made to make data security training mandatory for all faculty and staff.*
>
> (SCIT Minutes, April 4, 2006).

Some support staff explained in interviews that they were relieved by the implementation of the standard (which "required compliance") and the mandatory training for faculty and staff. They had encountered some resistance from faculty about implementing encryption measure on their laptops. Laptops, regardless of the source of funds used to purchase them, are regarded as personal things. Computing professionals perceived the presence of the policy and the formalized training about protecting private data as assisting them in asserting expert knowledge and authority in minimizing privacy breaches.

Wireless networks continued to be a security focus as well. In response to questions about security in general, the CIO and Security officer explained to the SCIT group that wireless devices installed outside the knowledge of OIT were still a concern. They also explained that they had two strategies for dealing with it. The first strategy was to provide even better wireless service centrally so that units would be more likely to use the central service. The second was to actually block rogue wireless hubs once the next generation wireless capabilities were in place (they were in the process of moving to next generation wireless at the time). OIT knew that they were in a bit of a holding pattern with respect to centralizing servers, however. OIT was, at the time, offering to manage servers and they were also offering training courses on the proper management of servers. Some deans of units were mandating centralization of server management within their colleges. However, upon questioning from SCIT members, the security officer reminded members that

> *the University is an educational institution, and with this said, running these servers is in line with the institutions educational mission.*
> (SCIT Minutes, May 2, 2006)

He continued by explaining that problems arise when private data is stored on the servers. Since that time, the university has again inventoried all servers on campus and is moving toward a requirement that all servers be registered with OIT (and a preference that servers be *run by* OIT), and imposing strict guidelines on the security measures required of any server run by the university. Again, the tension between academic freedom and tight security prevented complete administrative control over the technology.

Licensing during Phase III

Two important changes in approaches to licensing are worth noting in the most recent period of time. First, the changes in administrative computing that tied financial, staff, and student records together have made purchasing of all kinds at the university more integrated and more automated, not to mention easier to track. This has extended to more automated systems for software purchases that enable licenses to be attached to particular individuals and specific computers within the university. Second, OIT has undergone a shift in their approach to software development, from a presumption that new systems should be internally developed to a presumption that contract services and pre-packaged systems are best at meeting technology needs.

There are a number of ways that an integrated enterprise level recordkeeping system has altered the way centrally coordinated licensing is handled at the university. The software licensing coordinator explained the new capabilities that could now be leveraged as a result of more automated university-wide record-keeping systems.

> *We are moving to a more automated system for software purchasing. Most people go through an online order form and enter account information there. Right now, people submit their applications for software licenses and we fill them. There is administrative work before we submit that. We make sure we have their budget or however they are going to pay. We set them up with download rights and access and email them. We put it in our database, get it to our accountant, get it back and put the accounting information in the database. We do have undergrad student workers who help us with the data entry. Our new database is going to automate more of that. It will be linked with the accounting in a better way. It will also be searchable in more ways.*
>
> (Central, Software License Coordinator)

The system simplifies not only the financial aspects of distributing software, but also some of the legal tracking obligations. Because of the level of record integration, the university was able to craft a computerized software system to distribute the site-licensed Microsoft software.

> *Microsoft was thrilled with our online order form with students. We were the first university that was able to have students log in and have the system check their enrollment and whether they have licensed before. We have had other universities call us up to ask how we implemented that system.*
>
> (Central, Software Administrator)

However, not all universities have integrated their record systems sufficiently to implement the same license tracking technology.

There was a formal acknowledgement of the shift in approaches to building software applications for university use in university records as well as interviews I conducted with university computing administrators.

> *OIT has adopted principles to guide it…building software applications is no longer the first approach. The university needs to be aware of what the market has to offer in terms of technology advancements.*
>
> (SCIT Meeting, November 6, 2007)

The principles guiding new software application projects clearly and significantly favored using market options as opposed to developing software in house. The university recently agreed to contract with Google to provide their mail and calendaring systems. In the SCIT presentation, a member asked whether the new approach to software might stifle innovation in certain departments. OIT representatives explained that they try to be accommodating and that they discuss the balance between innovative work at the edges and their new approach. From OIT's perspective, however, they were referring to large scale university enterprise type applications like running mail programs or choosing products to do things like stream video. The director of strategic planning explained in an interview that OIT was seeking a balance wherein, OIT would leverage the power of market efficiencies for large scale software needs and let the development happen at the research edges. OIT was not suggesting that research projects or academic development rely on packaged software, but that the University needed to establish "a balance."

Discussion

Two aspects of organizational development have shaped the setting of standards for computer use in the university: the integration of digital administrative recordkeeping systems and the increasing importance of network and computer security systems to protect the data. The development of these two systems has resulted in more centralized authority over computing practices and to more restrictions on use and access to computing activity in policy and standard operating procedures. In turn, these restrictions limit, to some extent, the ability of users to make full use of hardware and software capabilities. While bureaucracy may not be an iron cage, the organizing power of

bureaucratic systems is imbued with principles that steer organizational preferences toward efficiency and standardization. Organizational criteria for decision making revolve around minimizing economic expenses by seeking lower prices and consolidating work activities. Increasing attention to management principles means they also avoid risk where possible. Tracking systems and standardization are therefore preferred.

Central OIT was very insistent that the university is not centralized, yet interview subjects saw the creation and development of OIT as centralizing, and especially experience activity of the mid and late 2000 decade a period of more aggressive centralization. In particular, changes in the budget model and control over servers were seen as violations of expert autonomy and of academic autonomy by any units who wished to continue operating their own systems. Furthermore, among people who expressed agreement with the principle of central control over networks, there was dissatisfaction with the way that directory permissions were configured. In particular, the directory structure of the network could configured group authorizations in different ways, which would have allowed different types of authority over file management. When central administrators frame the centralization issue, they provide evidence that less than ½ of staff resources and less than ½ of financial resources are controlled by the central organization. However, material resources are but one form of authority. As Giddens (1979) explains, the "use of power in organizations is mediated via the organizational resources that participants bring to, and mobilize within, interaction (pp. 92-93). Resources, for Giddens, are both material and authoritative; power involves the ability to control either or both. Even if financial and staff totals appear to be

decentralized, clearly the central organization has gradually been able to lay claim to an increasing share of authoritative control over technological decision making.

Due to the changing nature of technology, fewer aspects of technology organization are taken for granted, but as a consequence of adapting to technology, other institutions (such as laws regulating technology, markets that distribute technology, or the bureaucratic systems that help deliver technology) may be even more taken for granted because they help manage change that technology creates. Bureaucratic authority systems imbue social activity and decision making authority with a practical logic upon which people can rely when confronted with new situations. Cost benefit calculation is a constant organizational activity; it is rational. The job of the sociologist, then, is to understand the processes by which the pathways to making efficient decisions were forged and to reflect on the way those pathways influence other action. In the case of university computing, organizationally efficient decisions about managing technology are driven by the most pervasive use of the technology in the organization: administrative record-keeping. In fact, the management of administrative records drives the central decision making authority to set most computing standards and guidelines around concerns for the safety and efficiency of this process.

In the process of finding these pathways to decision-making, sociologists are sometime criticized for not attending to reason or rationality. Sociologists, however, do not judge the reasonableness of the decision on the sociologists' terms. Rather, they explain the rationale behind the decision-making and ask what other options may have been possible, what options were available in other settings, or what options were

pursued but failed. The creation and development of a new central group to manage university technology was clearly a bureaucratic endeavor as described by Weber so many years ago. This chapter details OIT's activities, but describes obstacles to their development only as they were experienced by OIT, not as alternatives were mobilized and viewed by other actors, either inside or outside the organization. However, persistent themes recurred to influence how technology came to be organized. Market forces drove OIT to make use of economies of scale, engaging in bulk purchasing and trying to standardize certain products. Laws, technology providers and the basis of expertise of computing professionals combined to emphasize technological solutions to legal problems (both data privacy problems and software ownership problems). Finally, themes of academic freedom and autonomy recur, which preclude complete centralized management of technology, but which reinforce bureaucratic systems of authority.

Chapter 6: Intersecting Institutional Frameworks of University Software Management

Several aspects of software ownership law make it a rich area in which to examine social change. Even within the limited scope of academic computing in the university, several social forces influence the way actors understand the way that the law applies to them and to their setting. This chapter focuses on the way people within organizations determine what the law means for them in their particular organizational roles. Organizations can only "know" about the law through their actors or agents. Information about the law must be interpreted and negotiated by organizational actors who assign responsibility for legal implementation and determine the form that implementation will take. In this chapter, I describe the way that computing professionals draw upon institutional logics as cognitive frames of reference to understand their role in protecting or managing software.

The rapidly changing world of computing requires constant interpretation and reinterpretation of the rules that govern related activities, but actors can only make sense of new environments by drawing upon familiar frames of reference. As described in chapter 3, software has an uneasy place in intellectual property law. It is a rare type of invention or writing that has come to fall under the jurisdiction of both patent and copyright categories of intellectual property. In its formal legal history, it was not (and some claim it still is not) clear that either set of rights should adhere to software. Despite the fact that the formal law is arguably open for some interpretation, the reality is that both types of intellectual property laws unquestionably apply to software now, meaning

software receives a more extensive set of owner rights than it would otherwise receive if it were protected solely by copyright or patent. The rapid movement in technology that delivers software and protects ownership interests requires continuous adaptation among computer users and the professionals who support them.

Computing professionals determine how to adapt through a process of "collective sensemaking" (Weick 1995) or institutional creation. Institutions provide frames of reference upon which people draw when faced with new situations. Institutions can be conceived of as providing "rules of the game" (North 1990) by both constraining behavior and enabling action and by providing a logical structure within which to construct possible solutions to problems. Typical institutional work, however, pays less attention to how institutions are created and changed than to how they influence activity and propagate. This chapter analyzes the way that entrenched institutional cognitive frameworks influence the creation of new institutionalized patterns of practice in the university computing environment.

Institutional Logics of Software Ownership in the University

Looking more directly at the much smaller attention paid to institutional creation and change, Carol Heimer (1999) emphasizes the idea that institutions may be in competition or conflict with one another. Both Scott (1991) and Powell (1991) note that many institutions operate simultaneously and may conflict with one another, though the theme of conflict was not emphasized in their early work on institutions. Powell (1991) adds that cross cutting institutions provide a space or an opportunity for change. Heimer (1999) notes that the idea of competing institutions further takes the wind out of the sails

of institutionalism because institutions in competition or conflict cannot be fully "taken for granted." Like Heimer, I find that competing institutional frameworks are at work in my setting in order to make sense of an unsettled environment. Unlike Heimer, I examine the way that members *within* a professional group employ a collection of institutional logics to understand their activity within the organization. In the way that I conceptualize these institutions, they fall largely under the cultural-cognitive pillar of the framework laid out by neo-institutionalists and comprise the cognitive underpinnings of how individuals and groups understand their environment, or the way the world operates (see Scott 2001).

In Heimer's (1999) work, the institutions of law, medicine, and family are each carried to the setting by a distinctly defined group that represents a particular institution. The legal institution is carried by agents of the state like social workers, the medical institution is advanced by medical practitioners like doctors and other hospital staff members, and the institution of the family is carried by the relatives of the infant in the care unit, primarily parents. Institutions are more or less clearly demarcated and members of carrier groups are nearly synonymous with the institution with which they are associated. Although I use the idea of competing institutions, I separate the cognitive features of these institutions from particular groups of actors, because I assume that the logic of dominant institutional frameworks pervades meaning systems used to interpret daily life. Although I could associate groups within the university as most closely aligned with a particular institution, all actors have an arsenal of institutional logics upon which they draw to make sense of their situations.

Based on interviews with 42 computing professionals in the setting of a large public university, I found that four institutional logics constitute the cognitive frameworks for understanding software ownership and licensing issues in the university; market, legal, academic, and technological logics are all evident in the way computing professionals understand their roles, duties and daily activities with respect to software use and support. These institutional frameworks both conflict with and reinforce one another in a variety of ways depending upon the particular type software-related task in which people engage. Table 6.1 summarizes themes that are indicative of a particular institutional framework, both generally in the arena of university software ownership. The first two rows describe the general characteristics of each institution. The remaining rows describe the institutional framework as applied to software and provide a conceptual map of institutional themes that guided coding of the interviews. Many of these themes were not only anticipated, but constituted the criteria on which this extended case was selected. Some of the themes, however, arose as I analyzed the data. The case was selected in order to examine the way that these institutional frameworks compete and reinforce one another to guide behavior around software ownership and licensing implementation on the ground. However, the particular scripts and mechanisms driving the tension (and its resolution) became much clearer as I analyzed the interview data.

Action Orienting Activities: The Software Ownership Environment in the University

Institutions provide cognitive frameworks for understanding situations, both those situations that are familiar as well as those that are new. Yet, cognitive institutional

Table 6.1 Institutional Logics of Software Ownership in the University

Institution	Market	Legal	Academic	Technological
Institutional Goal	• Exchange	• Normative order • Fairness • Rules of exchange	• Knowledge • Scholarship	• Facilitate or automate work
General Cultural Cognitive Themes	• Pricing • Purchasing processes • Cost/benefit analysis • Efficiency (cost) • Contracts	• Rules • Laws • Policy • Formal legal organizations • Contracts	• Innovation • Invention • Experimentation • Learning environment • Autonomy	• Reliability • Functionality • Expediency • Efficiency (time and resource)
Application to Software	**Market**	**Legal**	**Academic**	**Technological**
Dominant Characterization of Software	• Commodity	• Subject matter of copyright • Subject matter of patent	• Tool • Object of study • Product of research or development	• Computer Program • Tool
Themes Particular to the University Software Setting	• License terms • Vendors • Open source	• Licensing • Legal department • Fair-use exception • Other laws (FERPA, HIPAA)	• Fair-use exception • Open source	• Interoperability • Security • Open source
Primary Carriers in the University Setting	• Administrators	• Legal Counsel	• Faculty and students	• University computing professionals

frameworks draw their staying power from the fact that they are continuously invoked through familiar routine activities, whether frequent or infrequent. Individuals figure out how the world works and then take for granted those solidified understandings of

situations they encounter. Each time the situation or interaction is repeated, it reinforces the settled logic upon which these actors have come to rely (Berger and Luckmann 1966). When encountering new problems, individuals reference solutions used in other contexts to make sense of the new one. The *new* situations provide the opportunity to apply more than one institutional understanding and may call attention to the way that institutional solutions compete. Faced with particular situations that require action, individuals sift through their stock of alternatives and choose one or more rationales and accompanying actions to carry out the task at hand. Because they interact and exchange ideas about their actions, individual activities become collective. Not all individuals need agree on a single interpretation for it to become the dominant solution, but if enough people invoke similar logic in approaching and solving a problem, collective institutional forces start to influence the interpretation of that activity. The repeated pattern of action, with its accompanying justification (or script), becomes "taken for granted."

In order to understand the way that computing professionals draw upon stock institutional logic in their approach to software ownership issues, we must examine the types of activities that orient their attention. The process of institutional competition can be seen in several activities undertaken by computing professionals in the university setting. My conversations with computing professionals and my review of organizational documents reveal three primary activities that are particularly relevant to the way that software ownership is constructed in such an environment: software selection and acquisition, computer and network configuration, and basic support or troubleshooting activity. Knowledge about software ownership is task dependent and context specific; the

problems and decision points confronting computing professionals influence which institutional frames of reference will appear relevant.

Selection and acquisition

Software selection and acquisition comprise a collection of activities, most of which ultimately require decision making about which software to load on any given machine, how to pool common requests for different types of software and, how to obtain the software of choice. The process is described by computing professionals as user-driven and in terms of purchasing in one form or another. Selection and acquisition activities commonly begin either when a user gets a new machine or when a user requests specialized software. The latter may be a simple request for specific software or it may be a request for assistance and advice in choosing software that can help them accomplish a particular task. Selection takes place on many levels of the university, from an individual program for a faculty member to site wide licenses that extend to everyone affiliated with the university. These are separate but interrelated activities, because selection is constrained in some ways by the process of acquiring the software. Selection and acquisition of widely used "standard" software is handled by high level administrators and can involve university legal counsel, whereas selection and acquisition of individual specialty software programs are managed by the user or the user along with their unit's computing professional.

Software and hardware selection and acquisition frequently occur simultaneously, particularly when faculty and supported staff get new computers. Since the mid-1990s, many faculty and academic staff have been on rotation cycles for computer replacement.

In most departments, these are 3-year cycles, but it varies by a year or more in either direction depending upon the unit. In addition to rotation cycles, faculty members may have discretionary funds to use for customized features. In some cases, particularly in science and engineering departments, computing needs can be very expensive. Faculty may use grant funds to pay specialized high-end computers and costly software they require to carry out their research activity. Acquisition of software for the new computer is part of an ordering process during which the hardware and most of the software are ordered simultaneously. Computers purchased as part of the replacement cycle are structured from the beginning by a set of pre-selected components offered in a package by the central computing organization at the university. Computers purchased through grants often use the same pre-packaged sets, but depending upon the research and the grant, these computers may deviate widely from the pre-configured packages and require highly specialized software.

Configuration and access to machinery

Neither computing professionals nor their academic consumers see software ownership as distinct from other aspects of computer use and maintenance. All aspects of computing are part of the process by which work gets done. Consequently, configuring hardware, software, and especially networking are all part of how computing professionals make the computing tools work for their clients. Once the hardware and software have been selected and purchased, computing professionals are responsible for setting up the machinery to make it work, both in terms of getting the programs to run and in connecting the machine to networks that enable communication with the broader

world. As described in chapter 5, networking has been a very important part of computing. Significant advances in the technology of networking have drastically altered, and continue to alter, the way that machines are tied together at the university and with the rest of the world. These changes have also influenced the relationship between computing professionals and the machines they support and between computing professionals and the academic users they support. Software programs that had to be loaded one by one onto individual desktop machinery 10 years ago can be imaged and copied quickly and updated via networks today. Configuring computers for the user and for the network increasingly consists of setting permissions to access various levels of the computer hardware. As described in the previous chapter, machine configuration is increasingly impacted by network security considerations. This can lead to power and political struggles between computer users, who want freedom and autonomy, and computing professionals, who are responsible for securing networks and data privacy.

Troubleshooting and basic support

The third set of activities that influence on the software ownership environment are activities related to troubleshooting. This involves a variety of problems to attend to, but is typified by the urgent "please fix it" call. These activities can include anything from a serious hard drive failure with loss of files to questions about how to use an e-mail system or how to make a PowerPoint slide. Many of the activities are not as stereotypical, however. Networking and server trouble can involve trying to make disparate software or hardware systems work together. Troubleshooting is noticeable to the user community, and is the activity that clients may think of as the computing professional's primary job.

In fact, since it is the least predictable aspect of the job, it may be the one activity that computing professionals feel the greatest need to control. It is also, perhaps, the main reason that computing professional prefers forego open source options for their user and to limit user access to administrative control of their machinery. If you give users free reign over their computers, they break things, which takes significant time and attention away from routine tasks.

Intersecting Institutions

The cultural-cognitive frameworks that institutions provide for understanding a host of situations might best be described as intersecting. When they provide divergent scripts for handling a problem, they compete, but they can also powerfully reinforce one another. The institutional frameworks that computing professionals use to understand software ownership do both. The institutional frame and the orienting activity determine the prescription for how to set up computer user capabilities, a prescription which influences what users can do with their software. Table 6.2 summarizes the scripts repeatedly invoked by computing professionals, organized by institutional logic and by action orienting activity. This table displays the way institutional logics come to bear on the different orienting activities as evidenced by the scripts that computing professionals use to explain how they handle software related activities. The bottom row of the table summarizes the prescriptions for managing computer technology resulting from each institutional framework. The sections that follow analyze the influence of each logic system on the way computing technology is handled and its implication for software use in the academy.

Table 6.2 Institutional Scripts of Software Related Activity in the University

Software-related Task (Orienting Activity)	**Institutional Logic Script**			
	Market	***Academy***	***Technology***	***Law***
Selection/Acquisition	• Cost: commodity price, tight budgets, economies of scale • Contract: site licenses, negotiations with vendors	• User preferences: faculty, staff and student • Expediency in high pressure research (especially for IT) • Special terms/rates for academic institutions • Open source philosophy within organizational constraints	• Works best or accomplishes the task Suited to user skill set Will it have good support? And/or Can I fix it? • Ease of security support	• Legal license • Contract specifications • Fair Use (as exception to the law)
Computer Configuration/ Access to Machinery	• Cost: labor time and efficiency with some control made possible by tech protections • Contract: Technology to restrict user, access is bundled with the commodity	• Faculty pressure for autonomy • Freedom to tinker	• Limit security vulnerabilities • Administrative control facilitates automated updates	• Enables limiting user control with tech protections • Other laws become relevant: Data Privacy Anti-circumvention File sharing
Support/ Troubleshooting	• Need efficient organizational models • Support contracts as part of product features and cost	• Support because of experimental use (push toward local needs) • Support should accommodate cutting edge uses	• Favors tested, well supported software for wide use • In general, preference for access to the code • Good support contracts	• Ownership control to license holder • Contracts to include high level support for licensed software
Prescription for handling software	***Market***	***Academy***	***Technology***	***Law***
	• Favors limits on user control • Requires license tracking	• Favors user control • Some support for open source options	• Differentiates control by type of user or by distinction between users and experts	• Facilitate market transactions, favors owner control and limits on user control • "Fair Use" exception and open source licenses favor user control

Market and, to the extent that it reinforces the market, legal logic dominate interviewee descriptions of *software selection and acquisition*. For the most part, the market and legal logic reinforce one another and favor computing arrangements that limit user access to the internal workings of the machinery. The academic setting and open source software options, however, provide some powerful checks on software as purely a market commodity. Academic logic and legal frameworks that offer exceptions to the proprietary reach of intellectual property rights on software reinforce one another in favoring an open and autonomous model of access to machinery. In *setting up machinery* and *supporting computer users*, academic ethics of autonomy and freedom challenge technological concerns about security and functionality. Technological approaches to computing take a number of forms that intersect with the other institutional scripts in interesting ways. The legal script is rarely emphasized as an independent force, but nearly always appears as an intersecting rationale in market, academic, or technical scripts. The technological framework for understanding software is more complex and situation dependent, favoring limitation in some instances and openness in others. Below, I will explain the key features of each framework, how they operate in practice at the university and how computing professionals resolve the tensions between control and openness in practice by enacting a flexible "expert" designation.

Market Institutional Framework

The taken-for-granted logic of the market was so profound that classical sociology was built on trying to explain the phenomenon, that is, the transition from feudalism to capitalism and the industrial revolution. The institutional logic of the market

is built on ideas of efficiency and cost-benefit analysis. References to costs, prices, and budgets dominate the market logic. Purchasing is described in terms of prices and of procedures or processes. Contracts are legal documents backed by the force and mechanism of the legal system, but as Weber tells us, they are also a key component of the capitalist organization of the market. References to software licensing contracts therefore signal both market and legal logics. Suppliers or owners of software, if they sell the software as a commodity are referred to as "vendors" and represent the suppliers in the market chain. The market framework tends to dominate computer professionals' descriptions of software acquisition, which is portrayed as a purchasing process and emphasizes leveraging economies of scale. These practices spill over into computer configuration, support and troubleshooting activity in the form of pressures toward standardization of machinery, software, and support regimes. Technological protections and limited user control make support more predictable and large scale purchases bring down both direct costs of goods as well as indirect support costs.

Selection and acquisition scripts are dominated by market logic because acquiring software is most readily thought of as a purchasing process. In all cases of selection and acquisition, the computing professionals see this process as user driven, and they rely heavily on the university computer purchasing system. Selection, per se, is not even an issue for "standard software" as Microsoft office tools and certain antivirus software are completely taken for granted in nearly every area of the university. When asked about the process by which they go about obtaining software, computing professionals almost unanimously respond by explaining that the university has agreements with Microsoft to

provide the Microsoft operating system and the Office products to everyone associated with the university. In some cases, this is phrased in words that indicate a market and contractual arrangement. In other cases, the message is that everyone at the university gets standard software "for free" or nearly free.

> *In terms of standard software, the process is pretty simple. The university has made agreements with Microsoft and Symantec in terms of university standard software. There is very little purchasing involved, the software is on one of the university servers and we go and get it.*
>
> (Departmental Support, Liberal Arts)

The process of getting the software onto a user's machine is a simple matter of downloading. The licensing arrangements for Office and antivirus software are so extensive that they entitle nearly anyone with a relationship to the university to use the software. To anyone but the highest administrators, this software is available for "free" or at minimal cost. The university also used, until very recently, the university webmail system and an open source browser for internet activities. Few people mention these software applications until I explicitly ask whether they use any open source software, because they are also available for "free." For the most part, my initial questions about software are interpreted as inquiries about software that is purchased and the answers to the questions seem so self-evident to the computing professionals that they wonder whether they understand the question correctly.

When it is time for users to get new or replacement computers, computing support personnel direct users to packages offered by the college or by the central computing organization:

> *I hand them the list of computer options and say 'So, here is our menu of computers that we are offering right now.' We generally offer the same set of options to faculty, to staff, to graduate students. We have a variety of options to choose from.*
>
> (Departmental Support, Liberal Arts).

The user makes a selection, sometimes with additional input from the computing professional, who can advise them about how specialized software will work with existing hardware and software. Once the machinery arrives, the software is loaded onto a clean machine.

> *We [the college] have a person who specializes in imaging…We just stamp them out, to make sure that they are essentially alike…once it comes, then we can add or change the specialized products*
>
> (Departmental Support, Liberal Arts).

Those specialized products involve smaller scale purchases, handled at the college, departmental, or individual level. Similar processes are described by computing professionals in the Institute of Technology, but for lab or staff computers more than for faculty computers in many departments. As explained in the previous chapter, when asked about whether they purchase or install software for faculty, computing professionals are somewhat confused by the question. In one case, the support staff, who was largely responsible for computers in the departmental lab even though he was one of only two computing professionals in the department responded as though I was asking whether faculty are above loading their own software.

> *Most of them are willing to do their own software loading. If they need help, we will help them.*
>
> (Computing Support, IT)

It wasn't even a consideration that a faculty would have restricted access to the computer. In one of my first interviews within the Institute of Technology, my questions about configuring computers and loading software for faculty were met with confusion. I explained a bit about how the software purchasing system in Liberal Arts was arranged. The IT computing professional explained,

> *We are maybe a little different here. The faculty are responsible for getting their own computers from their own research funds or general funds or whatever. So we do not buy the computers for the faculty.*
>
> (Computer/Server Support, IT)

The computer support staff, of course, did not load the software for the faculty either, and they only helped with technical issues if called upon to do so. One thing that computer professionals in the Institute of Technology did a lot of, however, was work on ways to enable users of multiple computing platforms to access the same files and resources. They were also more likely to go out of their way to support and encourage open source software use.

When pressed for more detail about software beyond the standard packages, it quickly becomes clear that software ownership still takes a variety of forms and that processes for obtaining software vary accordingly. In the case of the large scale, widely used, and "standard" types of software, the university arrangement is definitely seen as the best possible arrangement in terms of cost.

> *There is now an effort to consolidate licensing for better pricing. Several packages are managed that way.*
>
> (Research/Server Support, Liberal Arts)

At the level of the central computing administration, which is the level at which large site license arrangements are made, selection of "standard software" is a non-issue because

they have been using the same word processing and antivirus software for a long time and because it is just "what everyone uses." For other widely used software products, for which site licenses are purchased but sold to units through a central distribution system, selection is reactionary to user requests and is part of a market process. Over time, the selection and acquisition of such software has been consolidated and increasingly managed by the central administration, largely to take advantage of economies of scale. Initially, departments and research units pooled resources to acquire site licenses at departmental levels and procured their own computing support staff as needed. The site licenses are organized by the Central OIT unit only when the software is standard enough to result in economic incentives for purchasing large quantities.

The entire system is described as reactionary to requests in this way.

> *The process in the past has been that someone writes to us and says, 'I really think we should have a license for this product.' Then we have a group of technical people that are on a list, a listserv. We usually contact all of our technical people on campus or the few hundred people on that listserv. Then we usually contact them and say 'there is an interest here, is anybody else interested?' Because in order to buy a license, you have to make sure there are enough people who need to use it to justify the money and to be able to actually recover some of the money.*
>
> (Administrator, Central OIT)

If requests come to them, central representatives consider whether to buy a package, but only in the past 1-2 years have routines been considered to regularly survey departments or units about what software is being used in order to consolidate the purchases and distribute the licenses. Doing so requires administrative personnel and oversight, and the current system has, until recently, been reacting to requests.

> *There are a lot of other licenses on campus. So a lot of college departments have specific software that only that college uses, like biological sciences has their own. I think architectural design has their own. Things that we have licenses for are like SAS and SPSS, products that are very expensive if people are buying them individually. We just buy the large license and distribute it.*
>
> (Administrator, Central)

For the time being, the university provides licenses for the big products and lets departments or individuals work out their own terms for smaller products. Standardization attempts, as described in the previous chapter, further the level of economic rationalization.

This system is seen as efficient and individual units gladly give up local control over software acquisition to save money, pool resources, and save themselves the effort of obtaining licenses. Even though the following interview subject is skeptical about the ability of the university bureaucracy to support innovative research-related software needs, he is an advocate for the central system running large-scale licensing arrangements and facilitating the pooling of resources, both in terms of financial resources and in terms of the human resources involved in tracking and negotiating with software providers.

> *It costs millions for Oracle to run the central calendar, which alleviates the need to run that kind of thing in departments or colleges. Liberal arts used to run their own calendaring system, so did the business school, and everyone else did, too. Central has consolidated that and one by one other groups sign on, because that has more payoff.*
>
> (Research/Server Support, Liberal Arts)

Even if they understand a variety of software license configurations, without fail, computer professionals at all levels of the organization think first of widely used software as products that are bought and sold. They take for granted the fact that the university would manage the appropriation of these products at an organizational level. They also

understand that such an arrangement enables the university to take best advantage of its size, using economies of scale, in negotiating prices with the software producers, or "vendors," as they are typically called. In earlier days, teaming with departments or seeking college-wide licenses for standard programs were examples of large scale consolidation to realize economies of scale and bargain for better pricing.

> *We [Central Office of Information Technology] usually do the negotiation for the license. Sometimes the licenses are done, not just within this university, but we have a collaborative committee between big ten schools. The schools can negotiate a better contract if 4 or 5 of them buy into the license at the same time. So our antivirus software that we distribute on campus is a collaborative license between several universities.*
>
> (Administrator, Central)

The University-wide agreement with Microsoft was nearly unprecedented in the university community when first negotiated. Today, in order to maintain leverage with software vendors and maximize economies of scale, the university teams up with other universities in key negotiations with a few of the largest vendors.

For the most part, at face value, software acquisition, ownership and licensing equal purchasing. Nothing could seem more taken for granted. This is typically also true of mid-level software as well. These types of software are those that are used by an entire college, several units or departments within a college, a research lab, or a single department. Two processes dominate the description of the acquisition process for software that is used at these levels. The first and most frequently cited process involves the university-run software purchasing system, and the second is a process by which individual units or small groups of units purchase directly from a software vendor. In the

first process, computing professionals either say they "go through Techmart," or they report "using the university software purchasing system."

> *Right now between bookstore and techmart. They publish a list of all the software for educational use, I look at the terms and agreement for…how many users do we have, do we violate any of the rules they put down,…if this is a user license, how many users are we allowed, if this is a device license, how many devices are allowed…to make sure that we keep track of those and make sure we are not going to violate any agreement.*
>
> (Research Support and Development, IT)

Although they have several names for it, in both cases, they are usually talking about calling or e-mailing one person, the software license administrator, and they nearly always mention the person by name. Organizationally, all types of computing offices in the university have changed in name or organizational structure so many times that people have trouble recalling the latest name (or acronym) for a unit and several units go by several names. So, although the unit that takes care of these licenses may have changed names more than once, everyone tells me "if you need software, you have to talk to Jen (pseudonym)." Only those people who were newest to the university referred to the software licensing office rather than to the software licensing manager by name. When these computing professionals call the software licensing representative, they can expect that all inquiries about academic pricing have already been made of vendors, and, if available, are included in the price.

The fact that computing professionals in the university can order software through the central office also means that they get help tracking licenses, something that was not always required but which was has always been cumbersome.

> *When we were still working with local reps for those [statistics package] licenses, it was a headache in terms of keeping track of licensing information and expiration dates. One of them would just expire and go away. It was a total mess. The U has now purchased site licenses for some of them.*
>
> (Research/Server Support, Liberal Arts)

Instead of tracking expiration dates themselves, computing professionals can be assured that purchases made through the central system leave a traceable record of purchase that alleviates their need to keep other proof of purchase. It also means that the central system will generate e-mail reminders of approaching expiration dates. In the past two years, the licensing person has acquired an assistant who now primarily deals with average requests. In addition that purchasing process is more automated than ever before. It is now possible to conduct the entire transaction via web-based forms and e-mail correspondence. The days of calling up 'Joe' are nearly over. That process is explained more by the effects of administrative and bureaucratic consolidation described in the previous chapter. However, it is also evident that those administrative forces reinforce and are reinforced by the market purchasing system and licensing tracking requirements.

The other process, negotiating and purchasing directly from the vendor is the third tier method for acquiring software, which normally applies to the acquisition of specialized software applications. Some research computing projects, whether run by individual faculty members or in research labs, are supported by multiple departments and run their own servers. At the time of my interviews, the Central OIT was beginning a process of centralization for servers across the university. However, many departments or research centers continue to run their own servers and expressed skepticism that the

central administration could adequately manage the specialized needs of innovative research computing. Arrangements for software under these conditions are often made by the computing professionals that support the research division, in whatever form, through special negotiations with the vendor. In some cases, the rules for these interactions are virtually wide open. Professionals from these research projects and labs explained that licenses for specialized software and for servers could be more complicated.

> *We were shopping for server licenses not desktop licenses. The server level prices are much, much larger. They're based on server size, how many users, how many computers connected. We've had vendors who have said, 'well, how much do you have to spend?' There is no underlying price for servers in some cases. You write to them, and they send back an offer, and you say yes or no.*
>
> (Research/Server Support, Liberal Arts)

High end research in the Institute of Technology is often handled by faculty directly or by a specific research computing support professional.

The aforementioned descriptions of software acquisition follow a market-oriented purchasing script. The only thing that varies among different types of software is the market source of the product. At the highest level, the central university has taken care of the purchase and provides the software on a host site accessible to computing professionals because licensing has been paid university-wide by the central administration. At the second level, central consolidates products and prices in one university hosted location akin to an internal marketplace, which alleviates the need to track down multiple vendors. In this case, individual units or pooled units still "purchase" the software, but they do so through university budget and accounting transactions internal to the university. As a bonus, when they purchase software through the central

university system, computer professionals can be reasonably assured that someone has made sure they get academic pricing and that someone else is helping track license holders and renewal dates. Finally, specialty software involves a purchase in the traditional sense, requiring more direct interaction with vendors, and sometimes involving uncertain and/or creatively customized purchase agreements. Since, these are customized uses, the prices and contract term options are virtually endless.

Legal considerations enter the discussion about software selection and acquisition to the extent that contracts and license negotiations are legal supports to the market arrangement. Many of the day-to-day interactions concerning software are conducted through markets and contracts rather than through other more formal legal system channels. Among university computing professionals, software licenses are seen as the legal apparatus for asserting ownership or legal rights over software, though not explicitly so. Computing professionals do not refer to formal lawsuits or legal statutes concerning patenting or copyrighting of software. They may, in rare cases, refer to copyright or particular lawsuits regarding software ownership. More often, the most highly legalized accounts of software have to do with the possibility of lawsuits or references to copyright infringement. Most often, legal references highlight licensing terms and the contracts that spell out the terms of those licenses. Although the market script tends to dominate initial descriptions of software acquisition, the logic of the law enters the discussion as well.

Certain aspects of contract negotiation are seen as explicitly legal and such action constitutes one of the only circumstances in which the formal law is invoked. The

university legal department is rarely mentioned, but their involvement is seen as inevitable in large software contract negotiations. Their involvement is essential because they have to make sure that the transaction does not require a bidding process; that the details of exactly which people and which machines may run the software are clearly understood by all parties to the agreement; and that terms of support are clearly understood.

> *Often when we buy a license, we have to send it to University legal to look at the contract to make sure we know what we are agreeing to. The size of the purchase can make a difference [as to whether or not legal has to review it]*.
>
> (Research/Server Support, Liberal Arts)

The legal department makes sure that everyone understands the license terms and they often negotiate levels of support that the university can expect from a vendor in addition to prices and software features. The legal department is often involved in a technological concern as well when it reviews contract terms pertaining to support agreements. As the software administrator explained to me, when the university negotiates with vendors, they often ask for a certain level of support or something like a university direct support line rather than dicker about the price of the software. The legal department reviews the support agreement specifications carefully to ensure that the contract protects the university interest in terms of supporting a software product.

Purchasing software is a process of consenting to license contracts which specify a number of terms of use. It also means that software increasingly comes as an encrypted and closed system for which users cannot access the code. Digital rights management systems can apply to software. It is what was described by the computing administrator in

the opening quotes of the introduction to this research project. It is also what has been lamented by legal and mass communication scholars (e.g., Boyle1996; Cohen 2003, 2006; Gillespie 2007; Lessig 1999, 2001, 2004). The view of software as a product tends to invoke scripts and cognitive approaches that limit user control over their machinery and over software technology.

Academic Institutional Framework and the "Fair Use" Provision of the Law

The academic logic provides a check on the market. There is a tension between the proprietary nature of intellectual property rights and the academic "fair use" exceptions to those rights, which give universities a rhetoric to use to justify occasional undocumented copies of software. In addition, a more fundamental academic logic is at play when we examine the computing activities not related to purchasing. The academic script says that the academic environment is one that encourages experimentation and autonomy. The race to invent or discover and the accompanying race to publish mean that researchers sometimes wait for no one. A model that puts bureaucratic recordkeeping or even the most helpful computing professional between the researcher and the accomplishment of her research task is unacceptable in some situations. Furthermore, many software programs are simply shared informally through research networks. Often, they are simply shared freely, but at other times they are accompanied by complicated implicit systems of exchange.

Academic logic does not help control costs in high pressure cutting-edge research situations, nor does it have time to wait for the cumbersome trappings of bureaucratic or legal negotiation. In fact, it puts pressure on the system for quick acquisition of software

at times and for free access at other times. At times, computing professionals confront the academic setting in a different way when they have faculty demanding cutting edge software for time sensitive research. Sometimes, when they need software, they want it immediately.

> *Research does not want to wait for anyone. They have a hard time waiting for us for five minutes sometimes. They'll go buy…stuff to fill in the cracks in what they want to do. Many of those software purchases are duplicative, but they allow a person to proceed fast rather than wait for a committee.*
>
> (Research Support, Liberal Arts)

The idea that research does not wait for anyone is especially true in the IT, where many faculty purchase and control their own computers completely. Some of the computing professionals do not even know a great deal about the university's purchasing arrangements or systems because their work is nearly all original programming and the faculty with whom they work procure their own licenses.

> *They [faculty doing research] can't wait around for us to work out agreements with other departments…or clear the contracts with legal. So, if they have the funds, they'll just find it themselves and use it.*
>
> (Research Computing Support, IT)

In addition, high stakes research often comes with funding streams that either require or enable researchers to skip the bulk license process. I was told by people in both CLA and IT that the central administration cannot really consolidate all the software purchasing for research needs because of the way grants fund such research. The "funding streams are too complicated" to allow central to buy consolidated licenses for several different projects.

Selecting software is driven more by academic and technological considerations and is a process that is reportedly driven by faculty computer users. Academic status influences the price of software for academic use.

> *So Solaris is something that we purchase, actually the software is free and we purchase support for it. The other tool is, I think, normally like 500 or 600 bucks a seat. They've got very generous academic pricing, where I think we pay closer to 75 or 100 bucks a seat.*
>
> (Research/Server Support, IT)

In another server setting, there is a similar story.

> *We pay $60.00 per machine for the license. The commercial licensing for the same use is more expensive. Commercial is $900.00 per machine, for higher levels, it is $3000.00 per machine. We get the same product with less support. It's really a great deal. Normal pricing--there is no way we could have been able to afford it.*
>
> (Research/Server Support, Liberal Arts)

The great pricing is available because the software is designated for academic use. Computing professionals describe the rationale for these great prices in two ways. Either the company knows that the university is training future software users, or they see academic budgets as limited and part of a non-profit entity. If they get their product in the hands of students who are moving into private business, they are essentially positioning advocates for their software in future for-profit ventures. The students will go on to become employees of businesses and will convince their employers to use or continue using the software they learned during their academic training. Software companies also know that the university consumers cannot pay private business prices for their software products. Due to fair use provisions in the law, some people in academic settings may be willing to copy the software rather than pay for a license, asserting fair use rights. Alternatively, they may be willing to research and choose open source of otherwise

cheaper alternatives. If they charge affordable prices, software providers reap some benefit and position themselves for future rewards.

The university also understands the risks of associating with a single vendor for their software needs. Open source software is used for many tasks at the university and it was touted by more than one interviewee as an option to help protect the university from monopoly pressures.

> *One big example of using open source is in our course management system on campus. For the last 10 years, we have been using WebCT. WebCT was purchased by Blackboard two years ago/three years ago. Basically, there were so many vendors that were offering course management systems, and then the small ones were bought by bigger ones. Now it is really Blackboard and Desire to Learn. Three years ago we looked into open source. Now we offer two options on campus. If you are faculty, you can either use Blackboard (WebCT), which is owned by a vendor, or you can use Moodle, which is an open source product.*
>
> (Administrator, Central)

This administrator also explained that the university started looking into open source alternatives, because when they saw the consolidation of the proprietary vendors, they became concerned that they would be held hostage by the vendor in a monopoly situation.

Academic pricing can also come with special restrictions on the terms of use specified in the licenses. Licenses for academic use are frequently accompanied by special rules about who can use the software *and* for what purposes the software can be used. The differentiation can be difficult to negotiate and difficult to teach to users.

> *Some of these programs cost a lot of money if they are sold for public use. [Department A] had a license for software that was 'for development purposes only.' If you design a database for use with a web application it falls under that license, but as soon as you put it up on the web, it no longer falls under that category.*

(Research/Server Support, IT).

In other words, people using the software could learn how to make the web application, or teach students how to make the web application, but the minute any of the applications were actually deployed, the terms of the license contract were, in effect, violated. Similar distinctions between use of software for teaching and use of software for research also exist in license contracts for specialized software. This is particularly true in the science and engineering fields.

In these cases, everyone using the software is instructed about the rules around its use, but the facial expression of the computing professionals describing these special rules is typically a bemused look that implies they are dealing with a loose cannon. No one can absolutely control whether a student might deploy something made with the software and no one can absolutely control whether a faculty member might use something for research, rather than teaching, activity. When prices and license deviate from the standard package for academic exceptions, legal considerations become much more common. Often, special terms must be reviewed by university counsel to make sure that all parties understand the terms of the agreement.

In many cases, the academic setting helps control software costs. The larger legal environment of copyright carves out an exception for uses of copyrighted materials for educational use. For years, no one has argued that the fair use provision meant that a person could copy proprietary software at will. However, it is possible that the fact that some uses of software might be considered “fair-use” even if the software had been copied outside the normal terms of the license agreement make vendors more willing to

make pricing compromises in academic settings. Discount pricing may help keep academic institutions from testing the limits of the fair use exception to the law, though that is a question for further research. Computing professionals do not make this particular argument, but they do imply something similar when they assert that they are not too worried about liability for a few rogue copies. They know they are doing what should be done in order to comply with the law, and they tell me that vendors are unlikely to make the university their primary target because it is an academic setting and there is little money to be made off the university anyway. The university is more concerned about music companies looking for music file sharing than about software companies looking for violators, but as described in the previous chapter, the university administration did make organizational adjustments when Microsoft auditors started frequenting the campus. The legal rhetoric of the fair use provision in the law reads as though it is meant to foster the open exchange ethic of the academic environment. However, its looming presence seems to operate more as a check on exorbitant pricing and overzealous enforcement rather than serve as a true exception to proprietary regimes in the academy.

Technological Logic

Finally, the technological script is more complex, encouraging functionality, expediency in accomplishing the task. Software is both a tool as well as an object of study. In the technological institution, one of the strengths of software is its malleability. Software can be tailored to the task at hand, but only if a person has access to the code. However, tailoring the code requires technological expertise and tiny mistakes can bring

down an entire software program. In a world where software is simply a tool to accomplish other tasks, and in which the software needs to be working (not worked on), it is best to limit the ability of any given user to access parts of the software that might cause functionality problems. This leads to two competing regulatory solutions to software management in the institutional logic of technology that come down to secure-but-inaccessible machines or open-but-vulnerable machines. Only "experts" can be trusted to keep open machines secure.

Technology of security: the secure-but-inaccessible approach. The first consideration is a logic of functionality and security. To the extent that computer professionals support a tool, they want to make sure it functions reliably at all times. They also have an organizational obligation to ensure that the machine is secured against malicious attempts to do damage or careless exposure to outside network threats. Security-related computing laws and organizational policies foster an environment of restricted user capabilities.

Changes in technology since the advent of personal computers have saved labor time and have simplified the process of getting machines up and running. Computers are now easily imaged, a process that has streamlined computer configuration. The fact that machines are linked through networks means that they are also easier to support

> *[With the internet] we could suddenly manage machines differently than we had before. Before, managing the machine meant that we had to go there physically to the computer…[The internet] really changed our ability to support machines and allowed us to get more support from a single person.*
>
> (Administrator, Liberal Arts)

There are still plenty of jobs to do, however, because the network means more work managing computer settings and directory permissions. Furthermore, the fact that every computer is always connected to the network means that every computer is always exposed to security threats.

> *Once upon a time, you could sit down at a machine and you could do anything to it you wanted. There was no security model under Windows 3.1 or Mac OS7, 8, or 9. If you had physical access to the machine, you could do anything to it you wanted, it was your oyster. With the development of Windows 2000 and XP and now Vista and their various relatives, with the development of Mac OS10, it has become an issue as to, o.k., you now have the ability to differentiate between users who can do certain things users who can do other things.*
>
> (Departmental Support, Liberal Arts)

This support professional is talking about the distinction between administrator and user privileges to modify settings and install programs. The development of such technology on the part of computer manufacturers was partly in response to security concerns but also as a technological environment in which user activities could be controlled and digital protections on copyrighted material could be enforced. Although they justify it in terms of the former rather than the latter, this development is a boon to computing support professionals in terms of their duties providing basic support to users, even though it is an admittedly political issue.

> *How do you that? How do you make that differentiation and that distinction [between users who can have access to higher administrative privileges and those who cannot]? That has been at times a very political matter within departments and with specific faculty.*
>
> (Departmental Support, Liberal Arts)

Why would computing professionals want to make use of these administrator privileges? Well, users are not always careful or knowledgeable about their computers, and computing professionals often describe their job as protecting users from themselves.

> *Right, every user wants administrative access over their machines. As spyware and viruses started proliferating, …they left big holes for hackers to exploit. Sure enough, it is a machine in a grad lab somewhere and they have set up a server to share their files. Grad students, but also faculty, could have a machine that was a worldwide server and they didn't know it. This is not isolated—it happens in our college and others as well. Central said, 'look, we have to start locking things down.'*
>
> (Administrator, Liberal Arts)

There is a policy, but it came along well after people started wanting to or started having the ability to control which users could load software or other things onto the machine. The security stakes have gotten higher over time, both because of the increasing skill of hackers mentioned above and because of changes in the law with respect to private data.

> *They have a security policy, it requires that machines are overseen by competent information technology staff…that policy is a few years old…The securing private data standard is about three years old, but trying to lock them down started probably three years before that.*
>
> (Administrator, Liberal Arts)

> *We have to operate under the assumption that every account has private data. The University has decided that student ID numbers are private data.*
>
> (Research Support, Liberal Arts)

These are among the reasons why computing professionals in colleges and departments tend to accept the central position on security.

Regardless of the policy, computing professionals try to assert their right to manage permissions on the machinery. There are power dynamics at play, and elements of the academic logic of autonomy and freedom can make this difficult for computing

professionals. They instruct users about the utility of leaving the task of loading software to the professional using a script about technological expertise.

> *Most of the time, for computers that are used exclusively on campus, which primarily means desktops, my stance for faculty and staff is, 'if you need software installed on your machine, you ask me and I will do it, I will schedule it. I will get it done. Because that's* ***my*** *area of expertise. That's what I am here for -- to maintain your computers. Because of that you don't need those privileges.' And that works… If you need something done, please call and I will do my best to get it done in a timely manner and get it done, because that's my area of expertise.*
>
> (Departmental Support, Liberal Arts)

Not all computing professionals are quite as explicit or direct as the person quoted above, but most professionals who provide direct support to faculty expressed a similar strategy.

Pressure for openness from the academic framework. However, restricting access to load materials on the machinery runs counter to the academic ideals of autonomy and innovation. In the eyes of computing professionals, access to administrative privileges only accords with academic ideals in the case of faculty who are technologically competent.

> *Of course, there were users to whom you could say 'Sure, you know what you're doing.' You just said, 'O.K., be careful, be smart so call me if you need me.' Those are the users you just kind of wrote off and never hear from them…and if you do hear from them, the situation is 'wow, here's a question out of the ether, I'm really going to have to strain to answer that,' because they've already done the stupid stuff. So they ask the hard questions.*
>
> (Departmental Support, Liberal Arts)

Faculty such as these are frequently given administrative privileges, though university pressures, new operating system capabilities and the central administration's insistence that all computers be linked through a centralized directory system are adding pressure to

restrict administrative privileges only to computing professionals. Though, as discussed, in the IT, far fewer departments restrict faculty in any way. While exceptions are still available for some faculty, student facilities and labs have been largely restricted for several years in both IT and Liberal Arts environments.

> *Faculty always feel that they have to have executive power over their machines. We have been able to give them superuser privileges when we do run into situations that make it absolutely necessary…We have had to be very strict with the Grad labs. When there used to be a single password login, we would have complaints about porn, illegal software or music. We would have to lock them down. The two populations [faculty and grad students] are treated very differently. Graduate students don't have their own machine provided by the college, and they don't have…as much stake in [the university's reputation]*.
>
> (Administrator, Liberal Arts)

In fact, a couple interview subjects explained that student labs in IT required even stricter controls than those in Liberal Arts because the users were more technologically skilled at circumventing simple security measures.

Several computing professionals explained that they had begun training their users to seek help with configuring and maintaining any university computers long before they had official policy backing or operating system capabilities for restricting user access.

> *For most people it was a matter of professional courtesy and honestly that system worked fairly well, because most faculty and staff are aware of their own limitations and computers are important to them, they don't want to make it blow up. That was a relatively, relatively, happy situation. The things that made it less happy were things like viruses. That's not a user doing something out of malice, but it's doing something out of perhaps carelessness and because there is no way for them to not have the power to destroy their machine. A virus is a program that takes advantage of them.*
>
> (Departmental Support, Liberal Arts)

Some, but not all computing professionals found the limits of their power frustrating, and have had increased success preventing users from doing what they feel are inappropriate practices since the university has adopted policies to correct the problem.

> *But, in general, a lot of the problem I have with the policy at the university is that it isn't strong enough. There is, generally no way to enforce it on a faculty person that 'yes, your laptop is going to have an encrypted hard drive, I'm sorry, it's university-owned equipment.' There's very little way to enforce anything like that.*
>
> (Research/Server Support, Liberal Arts)

It matters, because professionals feel responsibility for the security of the machinery and of the private data.

> *And then when the machine gets broken into, technically they are in violation of university policy, and say it is my responsibility…And that's always the risk. That's the problem in being in a position dealing with security. You're an easy scapegoat if something goes really horribly wrong.*
>
> (Research Support, IT)

By now, certain practices are fairly standard "in the industry."

> *It is a constantly evolving security model. We don't have the perfect answer. Some of those that are common in the industry are 'don't give your users administrative privileges,' 'don't use administrative privileges on the machine except when you have to,' 'patch, patch, patch.' Those are three huge steps towards minimizing the level of disruption that security threats will cause your users.*
>
> (Research Support, Central)

On the other hand, the academic setting is also a place in which personal and professional lives intermingle. Computing professionals find it difficult to interpret their responsibility for the technical vulnerabilities of computers that faculty have at home, whether personal computers or laptops. The policies are typically vague and do little to cover anything but the most obvious situations.

> *For laptop users, who are going to be taking their laptop home with them, to conferences with them, overseas with them for sabbaticals…I have provided, very routinely, what are called administrative or root class privileges. So they can do anything to their machine that I can.*
>
> (Departmental Support, Liberal Arts)

Computing professionals vary in the degree to which they want to be at the beck and call of faculty. The technology departmental and research support professionals are somewhat more likely to see their job as partly consisting of on-call duties. They support servers for high tech research and understand emergencies for these types of systems as their ultimate responsibility. On the other hand, for the most part, neither IT nor liberal arts computing professionals feel that they should have to attend to faculty laptops at odd hours.

> *There will be a time when they need to [access administrative capabilities] and I do not want them to, nor are they supposed to, call me in the middle of the night on my cell phone…to ask me 'help, help, help, what do I do?' I do not have hours on the weekend. I have a life.*
>
> (Departmental Support, Liberal Arts)

This is likely to be a new area in which computing professionals will push for policy. They have very little power to secure personal faculty machines, but feel ultimately responsible for closing the security gap that is left by private university data on unsecured private machines.

Technology reinforced by academic ideals: the open-but-vulnerable approach.

On the other hand, computer professionals more than anyone else understand the great potential and flexibility of computers and computer programs. The more a person can tailor programs to their own particular needs, the more powerful and helpful the technology becomes as a tool for accomplishing other tasks. For the most part, computer

professionals see themselves as the only people who need or have the capability to capitalize on these features. Security and autonomy do not have to be at odds. In fact, computing professionals feel capable of ensuring both security and flexibility for themselves, because they typically know how to experiment with the technology under controlled conditions that will not do damage to other programs. In the Institute of Technology, open source products and multiple computing platforms are actively supported and promoted. The central organization is encouraging of that arrangement according to some, tolerant of it according to others. They did explain that for cutting edge research, central did not expect research projects to adhere to standardization efforts. This administrator expressed the idea that there was still a need for openness "at the edges, where research happens."

> *On our research side, we mostly use open source platforms to deliver that stuff. In those areas we need a great deal of flexibility to deliver that stuff.*
> (Administrator, Central)

Open source technologies are touted by computing professionals in both collegiate units as more secure and easier to fix.

> *It really has everything to do with open code. I'm of the opinion that it means that we can keep better patching and more up to date. There is more flexibility if we can see the code and modify it ourselves.*
> (Research Support, Liberal Arts)

In the university environment, official computing professionals are not the only computing "experts." In fact, the loose boundaries around the profession enable computing professionals to draw flexible lines around who is, or is not, an "expert," and that designation becomes the mechanism for relaxing what would otherwise be stricter rules around user autonomy.

When asked whether they or their departments were developing any software that had commercial viability, most people described one or both of two reasons they were unlikely to develop any software for commercial purposes. First, most programs were developed as highly specialized tools and did not have direct application to other general uses. Second, the process of turning a useful program into a packaged software product was a long one, which meant that it was likely that a larger developer (often a firm) would make it to market first with better resources to promote the product. Third, many research projects are federally funded and researchers often felt compelled to make their code public where possible.

> *We are federally funded and one of our grants indicated that we would make the source code for our data conversion programs and…freely available.*
>
> (Computer Developer/Administrator, CLA)

The person explained that there were several reasons for this including the fact that the project was federally funded, that the research project wanted the consuming research public to help identify any errors so that they could be corrected, and that sharing information was an organizational ethic.

Interestingly, the person also explained

> *I have been trying to get someone from the office of the general counsel to return a phone call or e-mail…to discuss what the University's thinking is about open source licensing as an institution…what do we need to do to the code to ensure, for example, that every file has a little header at the top saying this code is copyright [to the university]?…There are at least a handful of open source licenses that might be appropriate, but I am sure that the legal folks have an opinion, and it would be nice to find out what it is so that I can get this stuff out to the community of academics who care about it.*
>
> (Computer Developer/Administrator, Liberal Arts)

Furthermore, administrators in both Central OIT and in CLA explained that sharing of the code is good for the university's reputation. According to the ethics in the developer community, sharing of code is part of an expert ethic.

> *Technologists and software developers would rather people see them as competent experts in their field than make a ton of money, so hence sharing the code.*
>
> (Administrator, Liberal Arts)

> *In that case, where we had developed our own portfolio, we then positioned it so that it could be open source, so that we could establish our leadership position within the Information Technology industry and offered this product that we had developed as an open source product.*
>
> (Administrator, Central)

Discussion

Particular institutional logics may suggest competing or opposing solutions to everyday problems. Age-old tensions between freedom and security, private life and professional life, or market incentives and creative incentives, reappear in a case that did not set out to study any of those tensions. The market and the law reinforce one another and provide very strong frameworks for thinking about software acquisition. If software is sold as packaged commodity, it is taken as a product no matter how interested a computing professional is in technology freedom or how savvy they are about software licensing law. The commodity status of software is completely taken-for-granted and is reinforced by the bureaucratic apparatus of the university budgeting and accounting structure. However, the existence of open source software provides a powerful alternative to the market model. It is categorized in completely different terms from proprietary software, so that when one refers to software, most computing professionals in the university assume they mean proprietary software. Open source is something different

and is unencumbered by all of the bureaucratic tracking that is necessary for proprietary products.

Computing professionals across the board, from administrators to part time support staff are uninterested in the legal argument about software ownership or copyright as a justification for any restrictions over what users can or cannot do with their computers. As it turns out, they do not need to because there is an alternate threat, data security, they can point to for justification. Within the academic setting, it is more legitimate to invoke the privacy and security legal logic than to the ownership of information logic of software copyright. Security threats match better with the primary professional expertise that computing professionals have to offer. Finally, technological expertise might make computing professionals into activists for freedom of information ethics or avid open source enthusiasts, but computing professionals typically reserve this enthusiasm for the machinery they operate themselves. Some of them actively seek open source alternatives for some users and actively support and encourage faculty who seek out open source options. In many cases, the burden of teaching unfamiliar users to use entirely new products is too large a mission. Open source requires extra attention. Not all of it is reliable for wide scale deployment among users who are not computer experts.

Experts, then, are capable of handling the responsibilities of maintaining security within an open system. Table 6.3 summarizes the distinction between computer users and computer experts. Users are subject to the secure but inaccessible machine configuration. They must rely on computer professionals to make changes in software tools, including those that are not subject to proprietary

rules. Although this arrangement can be highly functional in keeping their machines working relatively smoothly, they are, nevertheless, being further trained to be passive consumers of computing technology and to accept an environment that limits their set of rights well beyond what the legal ownership laws allow. Under circumstances in which the academic logic was not present to challenge a restrictive environment, we might see the community of experts limited only to those

Table 6.3 Expert User Classification Used by Computer Professionals in the University

Computer Users	**Computer Experts**
Software management practices	
• Let IT staff make purchases • Let IT staff install software • Do not have administrator privileges • Limit open source software use to well tested programs	• Make their own software purchases • Install software and troubleshoot their own computing problems • Retain administrator privileges • Promote open source software use where possible
Ideal type	
• Non-computing personnel Faculty, Staff (other than computer categories), Students	• Computer professionals (by job classification category)
As practiced	

Non-experts
• All Students
• Most Staff
• Some Faculty
  ○ Most Liberal Arts Faculty
  ○ Some IT Faculty
	Experts
	• Computing Professionals
	• Expert Research Staff
	• Expert Faculty
	Many more in IT than in Liberal Arts

people with formal "computing professional" job classifications. Even in the university, it is increasingly becoming the language of formal policy to specify oversight of computers as limited only to certain computing job classifications.

Many strictly security-related activities beyond the scope of this research are tightly restricted to computing professionals with special security clearance status. However, in terms of configuring and using machinery, the boundaries around who qualifies as "expert" are much looser. Many skilled faculty and research staff are given a great deal of autonomy over computing despite policy, or because policy remains ambiguous enough to facilitate a range of interpretations of what it means to "oversee" computing and what it means to be a "competent" computer professional.

Conclusion: The Law in Action

The micro and organizational activities analyzed in this project have filled a space left empty by law and other disciplines. My research contributes an on-the-ground look at how this laws relating to software are understood and interpreted in practice. The sociology of law, particularly research about the professional construction of the law, has found that organizational professionals can construe the meaning of the law in new ways if the law is not compatible with practical experiences or organizational priorities. In other words, if the law does not make sense for the people on the ground who put it into action, they will alter it. Furthermore, the changes will filter back up into the formal legal system. The law of intellectual property makes no provision for enforcement of ownership rights. Over the past decade or two, owners have developed elaborate technological protections (called digital rights management or DRM) and "trusted systems" (see Lessig 1999; Gillespie 2007) to protect their products. The using and consuming public, on the other hand, is still determining the extent to which they will tolerate the arguably overreaching ownership protections in this DRM protected delivery system.

According to Gillespie (2007) and consistent with many other scholars, "if users are being technically barred from doing things the law would otherwise allow, then there is a political problem, a shift in the balance between content owners and the public that copyright was supposed to manage" (p. 225). Most of the time users are being technically barred from doing things that the law would not allow or from things they would not consider doing anyway. However, the act of barring them also limits what they can learn

about the technology itself. Lack of technological knowledge about this system on the part of the consuming public suggests that the public can and will do little to push back. Computing professionals play an important intermediary role, in which they have the potential to both envision alternative arrangements as well as inform the public about their options.

By describing organizational and professional practices in terms of their acceptance of, or resistance to, owner-asserted mechanisms for controlling intellectual property access, I also answer my question of how ownership law is constructed, professionally and organizationally. This research explains how technological protections can make sense in the organizational environment, even when the socialization of computing professionals and the institutional logic of academic freedom may suggest otherwise. This dissertation raised a question about why computing professionals, a group unlikely to be overly accepting of procedures that limit the accessibility or malleability of computer code, would embrace technological protections or other rigid interpretations of intellectual property rules for software. Furthermore, the case examined a university environment, in which fair use exceptions to such rules might be applicable. I have found that professional and institutional goals align in several ways with limiting user access to open computing environments. However, I also explain how and why the availability of open source options provide an important mechanism for resistance to closed systems, especially within a rule-bound environment such as a university bureaucracy. Key findings pertaining to particular sociological issues about the professional construction of the law also contribute to knowledge about how and why

intellectual property ownership enforcement activity has developed. Below I explain how the substantive findings of this project relate to the broader issue of intellectual property ownership.

Management of the computing environment is an enormous task. Software ownership considerations comprise only a small part, and according to interview subjects, an unwelcome part. Yet the organization of the information economy is profoundly influenced by the ownership rules erected to protect various forms of intellectual property. Motivated by questions about how organizational professionals interpret new legal contexts, this research finds that professional boundary maintenance among computing professionals differs significantly from that of previously studied professions. In addition, bureaucratic efficiencies and risk management strategies are highly influential in organizational construction of the law. The interpretation of intellectual property law and computer code ownership rules in the university environment were found to take a back seat to other legal considerations, namely data privacy and internet security. Finally, the open source licensing options create a real alternative to proprietary software regimes, but can only be fully utilized in an organizational setting when the user group is comprised of a critical mass of "experts."

Focusing on the computing profession provided an excellent opportunity to examine an understudied but frequently mentioned professional group. Features of the computing profession challenge the explanatory categories of existing theories of professions, and I found that professional boundary maintenance was difficult, at best, in a labor force environment where demand for professionals outpaced the availability of

persons to do the work. Including information about labor force participation and labor market demands helped clarify that demand for workers confounds efforts to galvanize around an abstract body of knowledge. I also found that the shortage of workers precluded efforts to exclude individuals from using such knowledge by erecting barriers such as certification requirements. My research supports, but extends Abbott's (1988) arguments by providing evidence that boundaries remain undefined and fluid and credentialing efforts fail in markets for which labor supply cannot meet the demand. Abbott also suggested that the lack of professional boundaries has enabled flexibility for computing professionals in moving to new tasks. This seems true as occupational categories of computing and tasks within categories have certainly changed over time, but it is difficult to say, based on this research, how much that characteristic differs from change in work activities within other professions. This research project has provided insight into how and why computing professionals have failed to police the boundaries of their profession through traditional means, but I argue that asserting control over a physical technological medium, in this case the computer itself, can serve as an alternative mechanism for policing professional boundaries. Theory about the role of professions in constructing the law should be expanded to handle technological-related professions, in particular those professions that can claim high levels of technical expertise.

The idea that the physical machinery may provide an alternative means of asserting professional boundaries around work tasks also speaks to the larger issue of how and why technological protections on copyrighted software are welcomed, or at least

tolerated, by computing professionals in the university. It is significant that this project, which set out to examine the interpretation of software ownership rules within the university, also became a project that examined the management of computing machine resources within the organization. The material medium, the computer, has a related legal framework. There are some laws, such as accounting laws about tracking expenditures on the machinery, which are of little importance to this research. Other laws, however, pertaining to security and data privacy, are highly influential in the way the ownership of intellectual property law is enforced. These security and privacy challenges were not only in the form of law imposed from the outside, but constituted logistical problems to be solved. The legal structure that grew out of such challenges was erected as organizational professionals across all types of organizations (not just universities) grappled with how best to defend themselves against internet attacks and how to prevent private records from being accessed by unauthorized parties.

The normative and legal regime governing the physical computing environment is interpreted by the professionals I studied. Just as the law can be used as a resource for organizational power, control over the physical environment also contributes to organizational power. This has frequently been described in terms of spatial proximity to powerful elites or control over the space in which social activity takes place. Here, control over the machinery others use to conduct their work confers an additional source of power. In the world of computing, managing usage rights, and consequently software ownership permissions, through the digital protections already provided in the software and hardware systems by copyright owners significantly curtails the range of possible

computing uses for the average computer user. This is often justified to 'protect users from themselves,' but it has consequences for information exchange as well. Scholarly work has not yet been done to catalog and describe the (relatively recent) historical evolution of these technological protections. Such work would significantly enhance efforts to understand the use of such technologies in work such as this project, but it would also provide a compliment on a macro scale to existing work about how corporate copyright interests lobby the legislature to ratify and strengthen the force of the technological protections they put in place.

Returning to the description of the encryption history, by a long time university computing administrator, that introduced this dissertation,

> *Initially, you bought a disc. In the early versions of any software, you could copy, and we made however many copies we needed. It wasn't a big deal. And then they made it more and more difficult, then there were numbers involved. You had to have a number to enter, as serial number that you entered when you bought a product…When you went on the network, they started tracking the numbers…the change in technology and the delivery of technology has influenced how information is distributed.*
>
> (Information Technology Administrator, Central Computing)

This is really a description of the development of digital rights management technologies and the way that the university system had to confront them. My research has unpacked many features of how and why computing workers in the university environment not only acquiesced to such a change, but often embraced it. They did so, not because they agreed with the limitations such changes brought for information exchange, but despite their dislike for such limitations, and because of a number of other professional and organizational factors. It was clear from the outset that privacy and security issues would confound a clear story of ownership rights, but it is that type of confusion (i.e., the way

intellectual property ownership is a condition of other more salient activity) that seems to get in the way of serious sociological research on the empirical activity surrounding intellectual property law. Indeed, privacy and security issues loomed much larger than copyright in my examination of the creation of an administrative unit for computing resource management in the university.

I have shown how and why security and privacy laws tend to dominate prescriptions for how to manage computing machinery and override the full range of software ownership activity permitted by intellectual property law. In the legal world of intellectual property, the culture industries tend to dominate interpretation of law, interpretations which are also then applied to other forms of copyrighted material, software included. The story of the creation of a bureaucratic unit to manage technology in Chapter 5 presents a decidedly internal portrait of university technology management. The effects of outside pressures are also evident, however, even in the documents and discussions of university professionals. There are clear pressures from outside that shape university computing practices, even in this internal telling of the story. It is clear that pressure from the RIAA on universities to police their servers for unauthorized file trading of music was an important consideration in university filtering of internet usage. The development over time of legal rules governing data privacy precautions and network security frameworks were also important contributors to the ability of the Office of Information Technology within the university to claim authoritative control over computing resources. The technological solution of digital rights management (DRM) technologies offered by content owners to police their rights also provided a tool for

bureaucratic professionals, who were increasingly oriented toward managing the risk of privacy or security breaches. The role that DRM plays in professional boundary maintenance helps explain why otherwise potentially skeptical computer experts embrace or at least find utility in DRM for their professional environments. Teaching users to comprehend and to follow restrictions on software sharing in legal terms is much more difficult than using the technological locks to do so for them. This provides the reason for owners to turn to these technologies in the first place, but also a reason for computing professionals to use them within their professional environments. The more their computer user group grew, and the more it included lay computer users rather than experts, the more reason computer professionals had to exert control over the computing machinery.

The closed-machine system of dealing with privacy, security, and consequently ownership, seem to align with the professional boundary maintenance efforts of computing professionals and with bureaucratic organizational structure of the university, in *desired outcome* if not fully in terms of philosophy or justification. Such an approach to managing computers, and especially in managing software use, seems counter to what most characterizations of computer professionals convey, which is a preference for open code, shared information environments and even, sometimes, cavalier attitudes toward cracking closed systems. Analyzing the variety of competing cognitive frameworks computing professionals use to make sense of their legal environment makes a contribution to our understanding of how norms, rules and preferences get put into practice. Professionals do construct the meaning of the law, but they are not completely

free to do so. Cognitive frameworks provide a set of limits around which constructions of legal meaning are viable. Resonant logic frameworks vary by organizational setting and even by units within the organizational setting, as evidenced by the radically different treatment of faculty computers in the Institute of Technology and in Liberal Arts. Meaning systems arise out of repeated sets of activities within particular social locations. The more powerful institutions provide competing scripts for action, the greater the range interpretive options.

In particular, I found that the academic and technological scripts of openness and autonomy presented opportunities for computing professionals to broadly interpret the increasingly restrictive policies on who could have full access to their computing machinery. Absent the pressures of the academic framework, even technologically sophisticated computer users would be likely to have restricted rights to control over their machinery. Furthermore, the legal technological experts in the broader society, who are promoting open source and "copyleft" alternatives help create cognitive space that enables a broader range of what it means to use software and technology. Institutions might be better described as intersecting; they both compete and reinforce one another. Although more powerful if actively promoted by groups with access to a variety of resources, the unique power of an institution is the ability of the institution to persist even without a direct or present advocate. Many powerful institutions are accessible to everyone. Even in confining my research to interviews with computing professionals, the influence of faculty members, lawyers, students and other staff members on the computing environment was clearly evident. Where institutions prescribe similar action,

they become more powerful; where they conflict, they create a greater range of action options. Furthermore, it is helpful to understand the range of activities influenced by any given law. A single institution may prescribe conflicting approaches depending upon the task at hand.

With respect to intellectual property ownership, computing professionals are familiar with, and readily accept the existence of, a wide spectrum of licensing arrangements and open source options. However, they determine the extent to which any particular licensing arrangement or array of software "products" intersects with their other concerns, including data security, privacy, ability to handle their support workload, level of technological expertise of their constituents, etc. The types of justification they use and rationale they provide for different tasks, and within different university computing environments, help illustrate the special role of open source alternatives to commoditization of software as alternatives to DRM and copyright protections. Open source provides the avenue for experts to continue to tinker, as does the "fair use" logic available in the university environment to a lesser extent. There is a tolerance for some level of legal uncertainty in ownership law under conditions of exploration, experimentation and learning. It should be no surprise that the open source licensing options arose within the social space where computing technology, law and academia intersect. A small collection of people who were experts in all three areas promoted a variety of rationale and anti-property licenses by enacting the very legal framework that enables ownership. The variety of open source licenses and the different types of philosophical approaches that support them (see Smajda 2010 for a review of the varied

perspectives within the open source field) attest to the fact that a single technological or legal regime will continue to have a difficult time reconciling intellectual property neatly within the material property analog. Resistance occurs not through rule breaking or copying, "stealing," or "piracy," in the university community, though a certain amount of those activities may be present. Rather, resistance is exerted through active support of open source technologies and through extra efforts at ensuring interoperability among different computing platforms and programs. These solutions are not feasible for all situations within an organizational bureaucratic environment when the neatly packaged DRM technology provides a clear solution for "protecting users from themselves." Open source options and support of interoperable systems expands the open space within which experts and expert-level users can learn and play.

Combining these different lenses and approaches to understanding professional constructions of the law has also helped inform the pressing topical issue that motivated me. If computing professionals are likely to have been socialized into an ethic of free information and sharing of code, how do they reconcile their positions as enforcers of technological restrictions? Three primary themes helped to answer this question and they have implications on further prescriptions for action. All of the themes concern what it means to be a computing expert as it is loosely and imprecisely defined in this setting, and among computing professionals more broadly. First, computing professionals in the university often see their role as one of protecting users from themselves. Users don't understand how vulnerable their machines are. They cannot be relied upon to bother with the patching and security measures that keep private data private and that protect them

from viruses and other issues that can interfere with the reliable functioning of essential work tools. For the most part, this is a true condition, though the script can be mobilized to overextend restrictions on user computing capabilities. Second, restricting user access to machinery, whether it is only a particular type of network or server system or the full range of administrative restrictions on a local machine, helps computing experts assert jurisdiction over their professional boundaries. Third, openness involves complexity. In environments where users are also experts and in their own personal work environments, computing professionals are often willing to go to great lengths and spend extra time finding ways to promote open programs and platforms. The fact that activists in the larger legal computing environment have promoted open source alternative licenses bears out as an appropriate strategy to counter some of the overly restrictive pressures of the commercialized side of software.

The university is an environment in which some of the alternatives to a fully implemented restricting DRM environment can be maintained, but bureaucratic pressures are at work even in this environment. The challenge identified by Gillespie (2007), that is evident from my work as well, is one of maintaining a range of cognitive recognition of all that influences the social construction of ownership in software. Digital rights management systems have the potential to "change the relationship between technology and its users in fundamental ways. Increasingly what is at stake here is the user's ability not only to act with a tool, but to act on that tool" (p. 226). The user's "perception that they have the capacity and the right to operate and manipulate their own technology" (226) is significantly curtailed if they are only able to interact with their machinery

through the filter of a "computer expert" and the university (or some other organizational) bureaucracy. The process limits the cognitive imaginings of the computer using public. Support of open source and interoperable systems helps maintain wider cognitive space for what is possible with the technology. Better technological training among up and coming computer users may also help retain a broad spectrum of software ownership interpretations.

I set out to study the professional construction of software ownership law as practiced in the university setting. I found, however, than in order to understand on-the-ground activity related to software ownership in the university, one has to understand on-the-ground activity surrounding the organization of computing and computing resources. This insight turned a neatly organized extended case into a larger and more complicated case. Rules about property are a taken-for-granted aspect of everyday life in a capitalist economy, so much so that it may seem unreasonable to question how social processes create such rules and norms at all. However, it is precisely because the social construction of intellectual property ownership hides easily in a capitalist market environment that it should be brought to light, particularly in an age and market economy increasingly built on information.

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Appendix A: Legal Cases

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In re Trovato, 42 F.3d 1376 (Fed. Cir. 1994), *vacated & remanded,* 60 F.3d 809 (1995) (en banc).

In re Waldbaum 559 F.2d 611 (1977).

Appendix B: List of Acronyms

ACM	Association of Computing Machinery
ADCS	Academic and Distributed Computing Services
AHIMA	American Health Information Management Association
AITP	Association of Information Technology Professionals
ALA	American Library Association
BASIS	Business and Student Information Services
BLS	Bureau of Labor Statistics
CCO	Central Computing Operations
CIO	Chief Information Officer
CLA	College of Liberal Arts
CDM	Certification in Data Processing
DMC	Digital Media Center
DMCA	Digital Millennium Copyright Act
DPMA	Data Processing Management Association
DRM	Digital Rights Management
EDUCAUSE	Organization of Academic Computing Professionals
EEO/AA	Equal Employment Opportunity/Affirmative Action
FERPA	Family Educational Rights Privacy Act
HIPAA	Health Insurance Portability and Accountability Act
IEEE	Institute of Electrical and Electronics Engineers
IEEE-CS	Computer Society section of the IEEE

IRE	Institute of Radio Engineers
IT	Institute of Technology (Now called Science and Engineering)
ITNews	Information Technology Newsletter
NMAA	National Machine Accountants Association
NTS	Networking and Telecommunications Services
OIT	Office of Information Technology
RIAA	Recording Industry Association of America
SANS	Security, Administration, Audit, Network, Security (Computer Security Organization)
SCIT	Senate Committee on Information Technology
TEL	Technology Enhanced Learning
Y2K	Year 2000 (abbreviation is typically used in reference to the threat of a computer malfunction associated with interpreting two digit years in the digital recording of dates)

Appendix C: Interview Guide

Computing Support and Administrative Professionals

Uniform questions will be asked of all interview questions regardless of their job category as identified in the interview guidelines. However, follow-up questions will request more detail about specific job duties, information sources, and participation in organizational decision making or policy making, in response to the primary questions in each category.

Identification Number: _____

PARTA: JOB HISTORY

For each position at this University:

- What is or was your Job Title and Division/Department?
- Does the division still exist?
- Briefly describe what you do or did in that position.

Other outside positions:

- Please describe other past or present computing related jobs you have held.

PART B: SOFTWARE USE, SUPPORT AND SUPERVISION

Standard Questions: asked for all substantive sections of this section.

- How have these activities changed over time? What duration of time?
- What is the process for making decisions about these types of issues?
- Are there policies or job descriptions that guide you in these activities?
  What are they?
  If not, how do you know how to accomplish these jobs?

Substantive questions:

- What is your role, if any, in the direct or indirect support of computer technology?
- What is the nature of the support?
  Prompts for:
  (1) resource allocation or budgeting,
  (2) software installation, trouble shooting, or other direct support,
  (3) facility development or management, or
  (4) other activities they would consider falling under the category of computer support.

For each affirmative response, request secondary information (below) and ask the standard questions (above):

- Resource allocation and budgetary management
  Secondary questions about
  - Licensing and contract negotiations for software
- Software installation, trouble shooting and other direct support services
  Secondary questions about
  - Types of hardware and software supported
  - Access to computer hardware/software
  - Modification of computer software content (who, how, policies)
  - Control over user capabilities
  - Purchase and licensing documentation
- Facility development or management (i.e. computer labs, kiosks, etc.)
  Secondary questions about
  - Types of hardware and software supported
  - Role in developing or supporting facilities
  - Role in determining what facilities are needed
  - Role in determining security provisions (esp. access to hard drive, installation)

PART C: SOFTWARE SELECTION

Standard Questions: asked for all substantive categories in this section.

- How have these activities changed over time?
- What is the process for making decisions about these types of issues?
- Are there policies formal or job descriptions that guide you in these activities? What are they?
- If not, how do you know how these activities are to be accomplished?

Substantive Questions:

- What is your role in determining which software to provide or purchase?
- What is the process for deciding which software is provided or purchased?
  Prompts for
  - Cost considerations
  - Quality considerations
  - User input
  - Open-source or in-house development versus purchase
- Decision making may be different for different types of software and different facilities or departments. Please describe examples of different types of decision making processes for selecting software.
- If not already answered, what was or is your role in the processes for making these selections?
  Prompts for

- Centralized University purchasing/selection
- Local decision making
- Consumer (i.e. student or faculty requests) decision making
- Other types

PART D: ORGANIZATIONAL CHANGE

What are the biggest changes you have experienced in your job since you have been here?

What kinds of changes in computing support have been most challenging to you, and why?

PART E: SOURCES OF SOFTWARE REGULATORY KNOWLEDGE

- Please describe job training that has prepared you for your job. What types of information did you get from each form of training.
  Prompts for
  - Formal schooling
  - Specialized training programs
  - On the job training
- Can you also describe informal sources of job related information?
  Prompts for
  - Computer user groups
  - Websites or logs that you visit
  - Trade or Professional publications (web or paper based)
  - Professional memberships, meetings, or conferences
  - For each information source, how often do you use it and for what kind of information
- How are you informed about new or changed University policies or procedures that relate to your job?
- How are you informed about laws that pertain to activities you do on the job?
- What kinds of operating systems and software are you most likely to use outside the context of your job?
- What, if anything, has changed most about how you select software since you have been at the university?
- What, if anything, has changed most about how you manage software use since you have been at the University?