

An Interview with
LANCE HOFFMAN

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Conducted by Rebecca Slayton

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Abstract

This interview with security pioneer Lance Hoffman discusses his entrance into the field of computer security and privacy—including earning a B.S. in math at the Carnegie Institute of Technology, interning at SDC, and earning a PhD at Stanford University—before turning to his research on computer security risk management at as a Professor at the University of California–Berkeley and George Washington University. He also discusses the relationship between his PhD research on access control models and the political climate of the late 1960s, and entrepreneurial activities ranging from the creation of a computerized dating service to the starting of a company based upon the development of a decision support tool, RiskCalc. Hoffman also discusses his work with the Association for Computing Machinery and IEEE Computer Society, including his role in helping to institutionalize the ACM Conference on Computers, Freedom, and Privacy. The interview concludes with some reflections on the current state of the field of cybersecurity and the work of his graduate students.

This interview is part of a project conducted by Rebecca Slayton and funded by an ACM History Committee fellowship on “Measuring Security: ACM and the History of Computer Security Metrics.”

Slayton: So to start, please tell us a little bit about where you were born, where you grew up.

Hoffman: So, I was born in Pittsburgh, Pennsylvania in 1942 and I grew up there. Did not really leave Pittsburgh until I was 17, to go traveling anywhere. Basically went through public schools, no special education. I'm the second in my family to go to college. Three of my four grandparents were immigrants, with no higher education in their background. But they did believe that you're supposed to go to college, whatever that is, to succeed. There was none of this business I see all the time about "You're doing the trip, and your junior year is checking out the possibilities."

Hoffman: So anyway, so I went to Pittsburgh schools and in my crowd, I guess, by the time you were 17, you were graduating high school, getting ready to go to college. Where are you going to go to college? Well, for most people I grew up with, if you're going to go to college, and most of them did, where do you go? Well, in Pittsburgh at that time, if you did liberal arts, you might go to Pitt. If you were Catholic, you might go to Duquesne. If you were a woman, you might have gone to PCW, Pennsylvania College for Women, now Chatham University. And if you were good in math or anything like that, you might go to what was at the time called Carnegie Institute of Technology. It's now, of course, Carnegie Mellon University. I was good in math; so that was "college". So I applied and I got in; probably wouldn't get in today, but I got in then. So I went to Carnegie – and stop me if you want to expand on any of this –

Slayton: No this is great, thanks.

Hoffman: So I went to Carnegie; was there my first year as a freshman, and we had to take this engineering drawing course with old T-squares, and inclined desks, way before CAD. And unfortunately, I could not visualize anything in 3D-space. But you had to take this as a requirement if you were in the engineering school. So I was flunking this course; I hated it. So somebody – it wasn't the instructor, wasn't the professor – I remember him: he would subject us to religious tirades as well, it wasn't him. Somebody, a TA or somebody, came to me and said you know, you have to pass this course and you're not doing so well. I said I know. He said "Would you like to take something else instead?" I said I'll take anything to get out of this course. He said, "We're trying to populate this course called Computers." And that's how I got into computers.

Slayton: That's funny. And who was teaching this class?

Hoffman: Alan Perlis. That was in the days when Alan Perlis, and Art Evans, and Chuck Thornton, and a bunch of other people were starting up the computer science program at Carnegie.

Slayton: Herb Simon?

Hoffman: I actually ran programs of Herb Simon at my part-time job at the Carnegie Tech computing center. Herb was in GSIA, the Graduate School of Industrial Administration. He and Ed Feigenbaum, who I think was his student, were both there. Let's see; Newell, Shaw, Simon; Al Newell; wasn't Al Newell there, too?

Slayton: I think so. I mean, wasn't he at Rand as well for some bit of time?

Hoffman: I thought Cliff Shaw was at Rand.

Slayton: Maybe I'm getting confused then.

Hoffman: Because I heard Cliff Shaw give a talk out there, if memory serves me correctly.

Hoffman: Anyway, so I go and I take the computer course, and here I am a freshman learning computer science. This is great because (as I realize much later) all these great folks were sitting around and starting a department. I didn't realize any of it at the time.

Slayton: That's was what, like 1960?

Hoffman: Late 1960, you're probably right. Perlis and the students, we'd sit around and talk. Perlis had an amazing memory for train schedules and ball scores and other things

also. I also remember when he would lead the computer science students and faculty to a Chinese restaurant where we had foo yee. You know what foo yee is?

Slayton: No.

Hoffman: We should look it up now. It was basically some sort of delicacy with the eye of something. [Note added later: foo ye is a soybean-based dish that may have the texture of eye, but does not typically contain eye.]

Slayton: Oh!

Hoffman: I do remember that. It was a good group. In essence, I was an undergraduate assistant for three years, working in the computer center, taking courses and learning what we knew about compilers and other basics that would help us study computers. I didn't realize until later what a good foundation that would set for my graduate work.

Slayton: But there wasn't a computer science major at that time?

Hoffman: There was not; I was a math major. I graduated with a B.S. in math from Carnegie Institute of Technology in 1964. Those were the days when by the way, when we did input using 026 keypunches. So these were keypunches which didn't have capital letters, didn't have punctuation marks, and in fact, the programming languages, I still

remember, you would have to use a reserved letter for the equal sign or the left arrow of an assignment statement. It was very interesting.

Slayton: I bet it was. What kind of computer was at the computer center?

Hoffman: Does Bendix ring a bell?

Slayton: Yes.

Hoffman: Okay, Bendix G15, then the Bendix G20. So the Bendix G15, of course, you had to read your answers in bits, in binary lights, you know. The G20 might have had Nixie tubes, I can't remember; but it was better and bigger.

Slayton: That's funny. I like your clock by the way.

Hoffman: Thinkgeek.com, it's a great place for this. You know, that clock, they didn't get it right. We had to, when we bought it [pause]

Slayton: You had to fix the numbers?

Hoffman: No, we had to fix the dials because it comes with dark blue dials on a black background, so you couldn't see what time it was if it was up on the wall and I was sitting here at my desk. So we had to take some white-out and paint the dials.

Slayton: Oh, that's funny. Nicely done.

Hoffman: My colleague, Dr. Costis Toregas, next door, he did that; he figured that out.

Slayton: I wouldn't have guessed.

Hoffman: I wouldn't have either. So anyway, so those days there were still card readers, like 088 card readers. I know this stuff because between high school and college, when I graduated Peabody High School, in February 1960, I got a job, not a summer job, a job for the time before I went to Carnegie. And I got to work at Mellon Bank in downtown Pittsburgh, running, almost a one-man DP department, because I ran a whole bunch of their processing machines, everything from the 088 – let's see, I forget – some were collators, some were sorters, some were card conditioners. Yes, the Cummins card conditioner -- the steelworkers would cash their paper checks, which were IBM cards with holes in them, and basically these Hollerith cards would have to get conditioned before they could be read by anything since the workers had been carrying them around in their pockets, etc. After these were run through the card conditioner first, then they'd be processed by old 403 and 407 accounting machines, DP gear, that would chunk along and compute things. So I ran all those machines at Mellon Bank.

Slayton: That's interesting. So did you have an interest in security at that point?

Hoffman: No.

Slayton: Not even at the bank; it wasn't something that came up?

Hoffman: No.

Slayton: That's interesting. And was that your first time working with digital computers, in college?

Hoffman: Well, yes, because I would call the Mellon Bank stuff really accounting machines and things like that.

Slayton: They didn't have memories?

Hoffman: Well, sort of; they were plugboard machines so you could...looking back, one could program them. And we did do some programming of conditionals once in a while, but not much, and with wires. I mean, that's how you set up a go-to, with a physical wire from one hole to another. But how far back do you want to go? They were data processing machines, I would not call them computers, at least in today's terms.

Slayton: Not very advanced.

Hoffman: Right.

Slayton: You went then to Stanford's computer science in the fall of 1964?

Hoffman: No, I didn't. I worked at Mellon Bank, then went to Carnegie-Mellon and spent four years at Carnegie-Mellon, but what do you do during the summers? There certainly weren't, at least I wasn't aware of, any opportunity, you know, summer camps for computers and that sort of thing at the time. It turned out that during my junior year at Carnegie, I had been working at the computer center and SDC sent a recruiter; System Development Corporation, you know about them?

Slayton: Yes.

Hoffman: They sent a recruiter to see Carnegie-Mellon, so it's not that different than what they do now; companies pick the best schools and they go there.

Slayton: And this would've been 1963, 1964?

Hoffman: 1963, summer of 1963. They interviewed me and several other people there, and hired three of us to go out as students, to go out from Carnegie-Mellon, and we drove across the country to Santa Monica, moved from Pittsburgh to Santa Monica for the summer.

Slayton: Oh wow.

Hoffman: I'm trying to think if we were all SDC. No. It was me, and Alex Nesgoda, and John White as I recall. Three of us had summer jobs in the Los Angeles area. I was one of 25 or so, picked people to be in the SDC summer intern program.

Slayton: What a great opportunity.

Hoffman: It was a great opportunity. I mean, boy, they pay your way, you drive out there; it was terrific, you know? And, of course, lured by California, since Pittsburgh wasn't really cleaned up that much at the time, and the Beach Boys were beckoning, all that; so this was great, you know? So we rented a place, my two college buddies and me; rented a place in Pacific Palisades. We could basically come home from work, throw off our clothes, put on our swim suits, and go running over the bridge that went over Pacific Coast Highway into the ocean. So that was a great gig.

Slayton: Nice.

Hoffman: I remember doing some work with IBSYS that translated job control language (JCL) into something more reasonable.

Hoffman: But anyway, I was there for Santa Monica for the summer, and then I was hooked on California. It was great.

Slayton: It does that to you.

Hoffman: Yes. Where did you grow up?

Slayton: Southern California. The LA area, not Santa Monica. The Bay area is pretty hard to beat.

Hoffman: I agree. One thing I have decided there's no one best place though. And in a perfect world, I'd have enough money to live in 10 great places.

Slayton: Yes. You went back to Carnegie-Mellon after the summer.

Hoffman: Went back to Carnegie to finish up, yes.

Slayton: That was your senior year then.

Hoffman: That was my senior year, so now I've got to get a job. So what do I do? I didn't really have any inclination to teach or anything like that so I didn't really think much about it. But there weren't that many computer companies around and so I looked at a few, and I interviewed with several, including some non-computer companies; I interviewed with GM, for example. I ended up going with Control Data, so then I moved to Arden Hills, a suburb of St. Paul.

Hoffman: Control Data interviewed me first at Carnegie-Mellon, and I guess, they were impressed with my knowledge of compilers and other things. So I went there and worked on developing a time-sharing system. This is before, of course, Multics, but not by much. That work was going on at the same time, I think.

Slayton: Yes, just starting up.

Hoffman: CDC had a number of machines, including a 3000 series and a 6000 series. The 6000 series were the supercomputers. The 3200, and 3400, and 3600 were more business machines. As I recall, I was developing a time sharing system for somewhere in the 3000 series, which was very interesting because you didn't have the hardware to support that built into the machine architecture. You couldn't really fence off various regions of the computer, so it would go down periodically because, you know, stray code would mess up memory somewhere, and the system would just die. So what do you do then? Well, we had switches all over the building. You flip the switch and red lights went on all over the building indicating the system is now down and will be up soon.

Slayton: How long were you with Control Data?

Hoffman: Just a year in the upper Midwest. I didn't really like the area that much and I also had the sense I needed to get more education. And so, at that time, I said okay, well I've already done Carnegie. At the time, at least in my mind anyway, it was Carnegie,

M.I.T. and Stanford. And so I said okay; so I applied to M.I.T. and Stanford. I didn't get into M.I.T. but I did get into Stanford.

Slayton: Oh nice. Weather's better, anyway.

Hoffman: Absolutely. But I didn't go out even full time right away because I talked to the people at Control Data and I said, "I really want to move, wouldn't you like to send me to your research lab in Palo Alto?" They said "If we're going to lose you otherwise, yes." So they sent me to Porter Drive in Palo Alto and I spent maybe a year or two working there and going to Stanford part time.

Slayton: Oh, interesting. But as a Ph.D. student in computer science...

Hoffman: Not at all; just completely clueless. Completely clueless.

Slayton: Okay, just taking classes.

Hoffman: Well, I knew that I wanted a master's but a Ph.D.? What's a Ph.D.?

Remember, I was the second in my family who went to college. I don't think I ever met anyone with a Ph. D. until college. So my family didn't have any of those traditions or that knowledge.

Slayton: I understand.

Hoffman: So I was taking classes and working at Control Data on some R&D stuff. That was fun, by the way. A lot of this is not about computer cybersecurity so you'll lose a lot of this, I guess, but [pause]

Slayton: It's all relevant.

Hoffman: Well, is it?

Slayton: To some extent, yes.

Hoffman: It was fun; it was sort of like; Google but in the old days, the real old days. I remember the CDC building on Porter Drive in Palo Alto, the research lab; basically, there was a two-story building with two long halls, but the two long halls required six people to participate in chair races. So you needed a pusher, you needed somebody sitting in the chair, you needed somebody at the other end of the hall to make sure they didn't go hurtling over the precipice onto the first floor and lose the company's high powered talent.

Slayton: Nice.

Hoffman: The other thing we'd do periodically is we'd sit in the chairs, the swivel chairs in our office, and howl, ooo-o-oo, because of some crazy thing that was going on. The

bosses would just close their doors, if they were interviewing or talking to somebody about business.

Slayton: They were fairly tolerant.

Hoffman: They had to be fairly tolerant, yes. Maybe things haven't changed that much, I don't know.

Slayton: So was Control Data paying for you to go to school, as well?

Hoffman: Yes. Well, they paid. But then I decided that I wanted to go to school full time and so I had to quit then but I got an assistantship funded by IBM that paid for Stanford. You know, I...actually I could be wrong on that because I'm sure some of my graduate work was at least later funded by the Energy Department or whatever . . .

Slayton: AEC?

Hoffman: Atomic Energy Commission out of SLAC, yes. So I got the master's and said to myself, this is pretty cool, and gee it's sort of fun here, and I can go and get a Ph.D. and it seems like maybe not a bad idea. But I wasn't really thinking much about it.

Slayton: What made you think about doing it at all? It seemed like a nice thing to do or . . . ?

Hoffman: Or what?

Slayton: Why did you decide to do that at all, was it just more interesting than the work that you were doing at Control Data; did you think it would get you someplace in your career?

Hoffman: The latter. I thought it would get me someplace; I thought the idea of getting more education was a good idea. And I liked being there, I liked the people. So I said well, why not hang around some more? I'm getting paid; I'm not making a lot of money but I wasn't ever driven by making a lot of money. As long as I could eat, that was fine. And so I stayed there and was at Stanford for several years as a full time graduate student, with a great group of people. I look back and I say this is really cool because if I look at the roster of Turing Award winners, I've either met, or taken courses from, or something, from a third to a half of them, or something like that.

Slayton: Wow, that's fantastic.

Hoffman: Yes. That number goes down as you get older, but anyway.

Slayton: And were there particular people at Stanford; I asked the question, actually, about your Ph.D. advisor, but others that were really influential for you?

Hoffman: Bill Miller, my Ph.D. advisor, was by far the most influential. But certainly, things rubbed off from other people. I mean, just the way of approaching a problem, or looking at things, I can't articulate it but, I mean, smart people were there. I remember Raj Reddy was there; Ed Feigenbaum, Don Knuth; I mean, you name them; Gene Golub.

Slayton: John McCarthy.

Hoffman: John McCarthy, certainly. Oh yeah, John. He was at the AI lab; it was his lab. In fact, you know at Stanford there was Sand Hill Road and I guess it was Page Mill Road, went up into the hills. And SLAC was up Sand Hill Road, and Page Mill Road I think was where; no, maybe it was Arastradero or Alpine where the AI lab was. They're separate hills.

Slayton: Okay, I didn't know the AI lab was over there.

Hoffman: Yes, at one time it was, yes. So anyway, we in the Graphic Studies Group would almost never go there but, you know, you'd end up at times at Rozatti's for beer or something like that. But it was more the ambience of the place rather than a particular memory. But Miller had the most professional influence on me, by far.

Slayton: He had a really interesting career, right? I mean, he worked in physics and computer science, business; and one of the things that struck me about your Ph.D. was

you were interested in the *cost* of computer security from the very beginning and I don't know if his background in business had a particular influence in a way.

Hoffman: No, he wasn't in the "B" School at the time. He was trained as a physicist and he was still in the CS department when I was there. He later went to business school, later became provost and all that. But I guess I've always been interested in civil liberties. In high school I won an award for best history or civics student, or something like that. So I was interested. And I realized right away with security there was a privacy component, as well. This was obviously way before Snowden – but same deal. Probably in the late 1960s, Bill Miller was on the Computer Science and Engineering Board of the National Academy of Sciences, as was Alan Westin. You know of Westin?

Slayton: Yeah, well, he wrote this book on [pause]

Hoffman: Privacy and freedom?

Slayton: Exactly, in 1972, with somebody else?

Hoffman: With Michael Baker, he wrote *Data Banks in a Free Society*. There were two books; one is *Privacy and Freedom*, one is *Data Banks in a Free Society*. I think *Privacy and Freedom* was first because I think I helped him on the second book, *Data Banks in a Free Society*. He talked to Bill in 1968 or 1969 and said, I need a techie to come back to Columbia and work with me for the summer.

Slayton: This is Alan Westin now?

Hoffman: It was Alan Westin. They're buddies from the National Academy of Sciences Computer Science and Engineering Board. So there I go back to Columbia, and I'm put up in Butler Hall and I'm working there for the summer with Alan Westin and a bunch of other students like Michael Baker, a sociologist; Dave Flaherty, who went on to be privacy commissioner of British Columbia, and a bunch of good people.

Hoffman: Okay. There was Ken Loudon also and a bunch of people in criminal justice; So we went ahead and interviewed people, as part of this work. I was more interested later in privacy with Alan Westin. In fact, Alan died last year and he was a very good family friend by that time. So he was also influential, even though he wasn't in computer science.

Slayton: Were you influenced at all by the Berkeley Free Speech Movement or any of that?

Hoffman: Absolutely. Oh absolutely. It was part of the time and, oh sure, all the civil disobedience that was going on. In fact, I remember sitting with several of my fellow computer science students and being actually walked over by the other side. We were the anti-war side, and I wouldn't call them pro-war, but the more establishment side...I

remember that we decided if the computer center was going to be shut down, we were going to do it, somebody else wasn't going to do it.

Slayton: Safer that way.

Hoffman: Oh yes. So it was a very; I was, for a while, very — well very is too strong relative to some people, but — pretty anti-government. And growing up at the time, everybody in my circle was against the Vietnam war. And, of course, at the time, at least the males had student deferments so they were not about to send us to Vietnam. And later, in graduate school, we had basically all “technical and scientific manpower” deferments. So I certainly was influenced by that, absolutely. So being concerned about an overriding, or a too-strong government, was part of it.

Slayton: So that influenced you; did that influence you to work on access control models?

Slayton: You wrote the formulary model for access control.

Hoffman: Yes, and in fact, it's interesting you mention that because I'm actually giving a talk — this is the point I want to make — I'm giving a talk next week out in California, on security and the Internet of Things.

Slayton: Where's your talk?

Hoffman: It's at the TRUSTe event in Palo Alto or not far away from there. But basically, I looked at the formulary model; and, you know, it would still work today. A few tweaks, but mainly, I think I had the right idea. Now, networks changed the game because in the old days, you would just have one computer you were trying to secure. You might have a bunch of terminals, but they were all coming into this one machine. Now you've got machines talking to machines with intelligence. It's much harder and much different. But the basic idea in the formulary model in my thesis, is basically just saying put stuff in one place, and then figure out what you want to do and have a bunch of different users to do different things, they can have profiles and all that, whatever — but they're able to decide what they're going to do and have it done there in one place. It's going to be interesting with the networks and sensors and such, what works and what doesn't work. But yes, that got me into doing that. I knew by 1968 or so, I wanted to do a thesis on security and privacy. Oh, I know what happened.

In 1967, I went back here for a meeting at the Brookings Institution. I know what it was; there had been a call that had gone out in the mid-1960s: let's establish a national data bank. And there was a big debate about this. So I went back to Brookings; there were maybe 20-30 people around the room talking about what should we do? Some people said let's give it to the academics because we really trust them. And a lot of people said no, no, academics [can't] run anything, that wouldn't work. [Laughs.] But anyway, the issue was discussed in a lot of literature way back then. Early visionaries were Willis

Ware, certainly in engineering this stuff; and Paul Baran and people like that were writing about it. I think Licklider may have written about it early, but certainly Ware and Baran did later; and Rein Turn, people like that.

Slayton: Did you get to know Ware and Baran, or any of the people at Rand when you worked there that summer? If you were really at Rand; you were at SDC.

Hoffman: I was at SDC. I think I may have met Paul Baran once, and I knew Willis. Actually before I ever met him, he had been sent my survey paper. I graduated in 1970 with a Ph.D.; but in 1969, the literature survey was more or less done. And I decided to submit it to *ACM Computing Surveys*, which had just started up. I think that Bill Miller may have encouraged me to do that. The publication was issuing a call for papers, there was even a bounty, so as a graduate student I was saying “What? They’ll pay you \$1,000 for a survey paper?! This is great!” So it was a survey paper (my first, in some sense, real publication) appeared there.

Hoffman: That survey, not the formulary paper, but the survey, Bill Miller sent to Willis and said “What do you think? Please give it a critical review.” And Willis wrote back and said “Don’t change a word.”

Slayton: That’s nice. That’s perfect! That’s fantastic!

Hoffman: That was amazing! [Laughs.] I thought then that it always happens this way.

Slayton: That's great.

Hoffman: So we didn't change a word and went through the review process, and got published in 1969, as you say, in *ACM Computing Surveys*. So I was interested in privacy and the whole business at that time but the thesis had to be computer science-y to pass muster. The sponsor, the Atomic Energy Commission (AEC), they weren't censors or anything, but I know Bill got at least one question from them. He wrote me a note — we had e-mail even then, with the Wilbur system — he said that people were asking, why is the AEC supporting this? So I or he wrote something saying here's why it's important for AEC.

Slayton: And that was particularly the security and privacy survey paper or was that the whole thesis?

Hoffman: It must have been the survey. If you're working too much in squishy areas like in privacy rather than security, some say "This isn't hard science, why are we doing this?"

Slayton: I would think the AEC would be obviously interested in security.

Hoffman: Oh, obviously.

Slayton: But not the privacy.

Hoffman: But clearly, I've been driven by privacy even more than security. As you look at my career, I've always been doing both of them, which could be an argument against that because it could lead to being a jack-of-all-trades and master of none. And I look back on that and I say did I make the right decision? And I say, for me, it was the right decision. Everybody is different in what they want to do.

Slayton: Was there a lot of this kind of work going on at SLAC?

Hoffman: No, not at all, there was none of it going on anywhere. Multidisciplinary was a concept even then, as now, that gets a lot of lip service but maybe not as much support in universities.

Slayton: Was it mainly Bill Miller that got you connected with SLAC because of his connection to physics?

Hoffman: Yes. He basically ran the GSG, the Graphics Studies group up at SLAC. And we had a bunch of people at SLAC. Miller's guys were about eight graduate students, plus some technical staff like John Ehrman and Jim Cook. Some of them concentrated on graphical stuff like Jim George. Most went on to make their mark in various ways; Duane Adams was big in ARPA for a long time; Bob Russell was a professor at U-Mass; I mean, we all had decent careers at the very least. John Levy is a consultant out in Marin

County. We occupied trailers at SLAC because of a space shortage. So John Levy and I shared a trailer, which was always very interesting because — I know you're too young for this, probably, but — there was a show called the Groucho Marx Show that had a duck that came down from the ceiling on TV and quacked, asking the contestants to say the magic word. Anyway, we had a thing hanging down from our ceiling, right in the middle of our office, a punch card that said you are now entering the conservative sector on one side and you are now entering the liberal sector on the other side, because John was a conservative and I was a liberal. It was sort of like the Berlin wall. We had political discussions all the time but we got along fine. In fact, this is more for me than for you but we once did, in 1967 or 1968, I still have the stuff here, we decided that we were going to get into the computer dating business.

Slayton: You were precocious.

Hoffman: We were! We could've made a lot of money. In fact, I think that Bill Miller was worried that we or Stanford were going to get sued. At the time, we had a Burroughs B5500 at Stanford. We said that we're going to write a program to match people up. There had been a few of these programs before, but not many. And we said okay, we can do this. In summer, Stanford sort of clears out and a whole bunch of new people come in for teacher training and other summer endeavors; there's 20,000 people, many looking to meet some of the rest of the 20,000 people. So what do we do? First thing we do is we enlisted a couple of our colleagues from the computer science department like Peggy Sprague, who later had a long career at IBM, and some other people; and basically

erected a booth on the quad of Stanford campus with a sign that said “Computer Dates.” Just like “The Doctor is In” from Peanuts.

Slayton: Oh that is beautiful.

Hoffman: I wish we had a picture; we don’t have a picture. But \$4 computer dates for men, \$3 for women.

Slayton: [Laughing] Did you get a lot of takers?

Hoffman: What do you think?

Slayton: I have no idea. I would guess the undergraduates might...probably not. College students usually can find each other pretty easily; it’s the professionals that need the help dating. No?

Hoffman: Well, what’s interesting, and it was fascinating, was that first of all, we decided right away it was going to be matching men and women. We knew we were in the Bay Area and there was a large gay population, but we knew that the coding was going to be too complicated for that. Every time you made a mistake, you chewed up \$70 of computer time for a debugging run. So you couldn’t make a lot of mistakes. And we were losing our shirt. We must have spent \$500-600 of our precious graduate student money, because you had to pay for computer time for an endeavor like this and we were

running this on a big mainframe. We had to recoup it on enrollments. But we sat there in the hot blazing sun all week, as people went in for summer class registration, and 20,000 people marched by; at the end of the week, we had a grand total of 50 people signed up, 40 of whom were men.

Slayton: Oh that is funny. Wow, that would be tough. Women had to have to have a lot of dates, then.

Hoffman: Here's the thing: First of all, it doesn't seem to fit any known algorithm. You can learn about B-trees, and databases and all that; it doesn't really work when you're... And the other thing that we found when we ran the program finally, we matched on the basis of likes. So if you liked mountain climbing and somebody else liked mountain climbing, we'd add to your positive weight to be matched. But it doesn't make up for disparity in numbers. My first wife, who I met a few years later, looked at me when I told her about this, and she said you guys must have been crazy! I said why is that? Because, she said, no self-respecting woman would be found within a half mile of that booth signing up.

Slayton: Interesting.

Hoffman: Well, she was probably right.

Slayton: It'd be too embarrassing kind of thing?

Hoffman: In those days, yes. In those days, it was a different era. And, looking at imminent financial ruin upon us, we said “What do we do now?” This next got me interested in privacy, also. We took out a double centerfold ad in the *Stanford Daily*. Now, we had a questionnaire people had to fill out, so 50 of them filled it out at the booth but nobody else did. So we said okay, let’s take a big ad in the *Stanford Daily*. Our headline was “Deus ex Machina,” because we thought it meant “two from the machine.”
[Laughs.]

Slayton: Okay, nice. [Laughs.]

Hoffman: We’re geeks, what do we know? So we said here’s our questionnaire, fill it out. Now, do you want to guess how many questions there were?

Slayton: 50? Ten? I have no idea.

Hoffman: No, think of the technology of the time.

Slayton: Oh yeah, must have been pretty small.

Hoffman: No, where do you capture information on a Hollerith card?

Slayton: I don’t know; I don’t know Hollerith cards that well.

Hoffman: A Hollerith card has 80 columns in 12 rows, so we had 80 questions, it's that simple.

Slayton: That's a lot of questions to ask people.

Hoffman: We didn't do pretest, we didn't do anything with it. Some of the questions were more penetrating, if you will, than others. For example, we did let people do a little bit of discrimination, we did say, "I am . . ." what's your race, or age? I only date these kind of people. Which turns out later was important because one of the sadder stories is that — and I've got to get on to security . . .

Slayton: We'll get back to it, yes.

Hoffman: Okay, let's finish this. So basically, make a long story short; we put an ad in the *Stanford Daily*, opened a postal box, next day, postal mail, 400 letters spilled out.

Slayton: Wow, that's impressive.

Hoffman: Yes, so it just shows about privacy's importance.

Slayton: That's really, really interesting. That's fascinating.

Hoffman: Alright, moving on.

Slayton: Right, getting back to business; that's actually relevant so that's great.

Hoffman: Actually, it is. Alright, getting back to business; So I got the thesis done, and as you know, it came out in 1971, FJCC, or SJCC, or something like that. And then I had to get a job so I looked around in various places; decided I liked California; applied for and got the job at Berkeley.

Slayton: You started there in the fall of 1969, is that right?

Hoffman: 1970.

Slayton: 1970, and you started teaching a class there right away.

Hoffman: Right, in what now is called cybersecurity. In fact, I think it was the first course in the country, if not the world, in cybersecurity.

Slayton: Right. And so what motivated that class? Was there a lot of interest in computer security?

Hoffman: No, I was interested in it, and so Berkeley said to the new faculty member, teach your specialty. Actually, I taught a similar course, but not as rigorous or technical

or extensive, a year or two before, at Stanford in a SWOPSI (Stanford Workshops on Political and Social Issues) course on Privacy and Security, informed by excesses of the police in the Vietnam war era. But it wasn't ideological, you know, it was just here's all the stuff laid out. So it was the precursor to the Berkeley course.

Slayton: Did you have a lot of takers at Stanford?

Hoffman: A few, not many. I can't remember how many; maybe 10 or something like that. It wasn't a real Stanford course, it was a SWOPSI workshop.

Slayton: Right.

Hoffman: But the Berkeley course was a real course and had a decent number, 20 or 30 students. I would always mix security and privacy together. I would teach security, because you had to teach the basics of encryption, authentication, and so forth. If you look in the Table of Contents of my 1977 book, you'll see chapters about authentication, authorization, logging, traditional cryptography; newer, computer-oriented cryptography; and hardware.

Slayton: Lucifer...you had intrusion detection there already.

Hoffman: No, Lucifer was an algorithm for cryptography, it was not intrusion detection.

Slayton: That's right; I got confused.

Hoffman: Anyway, system programs, machine architecture, statistical databases — even then — that's what the Brookings thing was about, statistical inference. So the 1977 book covered the waterfront, as you can see.

Slayton: Was this designed as a textbook? Or who was your audience?

Hoffman: This was a textbook. Ultimately, after years of teaching at Berkeley I finally produced this, six or so years later. Previously, in 1973, I had an anthology that came out, which just had papers. I used that, but I ultimately developed this; this is the course I taught.

Slayton: And how did the anthology come together? Was it people you knew?

Hoffman: It was a lot of people I had cited from the thesis. I'd take Baran's classic paper on packet switching, or something Willis Ware wrote. Peterson and Turn did some stuff at that time. A lot of papers like that; and Clark Weissman's material.

Slayton: 1967 Fall Joint Computer or Spring Joint Computer Conference, you put papers from that.

Hoffman: Yes, so a lot of those were in there, along with — I'm sorry I don't have the book along with me — but papers I found useful to cite because here were examples of what's going on. For example, well before Dorothy Denning, there was a guy in Germany doing research on statistical inference and writing about trackers. Anyway, this was basically stuff I would cite anyway. So here it all is in one place. I broke that up into maybe eight sections; and so that was what I first used to teach the Berkeley course.

Slayton: Interesting. Speaking of that Spring Joint Computer Conference, did you happen to go to that, where Willis Ware presented his paper on security and privacy, and the big discussions, in 1967?

Hoffman: No, I wouldn't have been there. I didn't get to meet Willis until afterwards; after he had written that note to Miller saying publish the guy (me). I met him at some conferences after that, but not then.

Slayton: Okay. Were there other classes on computer security and privacy then?

Hoffman: No.

Slayton: No, not at all. Okay.

Hoffman: Well, not at Berkeley. Slowly, there were a few pioneers after me, but not that many. I'm trying to think, in those days, Dorothy Denning started one; I'm trying to think of the academics who were teaching. It was pretty lonely. There weren't that many.

Slayton: So at the 1974 National Computer Conference, you were part of a panel on research and data security. Other members of the panel included Steve Crocker, and Rein Turn, and I'm just wondering, was that the first time you had met those people, in 1974?

Hoffman: I don't know when; I can't remember when I met whom. Rein Turn...I met him at several conferences through that period of the 1970s; and Crocker, I don't even remember meeting Crocker way back then, but I may well have. I didn't get to work more with him until actually many, many, many years later. It's interesting, historically, because maybe 10 years ago or so, Steve Crocker was one of the founders of Cyber Cash, and so I ended up working and taking a student of mine to work there for the summer on security and privacy. She has since gone on; her name is Rachna Dhamija. She's much younger; she's out in the Bay Area; she just did a startup and as I recall she just sold it to somebody recently. That's all I know. I had dinner with her about two years ago. But anyway, it's a small world. Crocker lives six blocks from me.

Slayton: Oh really; that's funny. And at that conference, that panel, you reported on a UC-Berkeley project, it was about the cost of computer security. Can you say a little more about that?

Hoffman: Right. Was this the thing with Ted Friedman or somebody where how fast was encryption?

Slayton: It was about what does encryption cost, I think.

Hoffman: Yeah, per cycle.

Slayton: Yes.

Hoffman: I always knew that there were going to be some cost benefits tradeoff because if it costs too much in cycles, or money, or whatever, people are not going to do it.

Slayton: Right, even in your thesis you mentioned that.

Hoffman: Yes, so I always knew that. And in fact, even today, as we speak — matter of fact, I'm going to lunch with a guy in a hour, talking about a project we have by a student down the hall, right now, working on something to do with the Snowden revelations — so it's real interesting how things come around. In fact, I'll show you this because in some sense, it speaks to cost, in this case of surveillance. This is really half baked right now, but basically it's, in essence, risk analysis, that can be refined and developed. There are methods people use, there are consequences, and then there are stakeholders. And the stakeholders could not only be organizations, they could be countries as well. And then each of them has a different take on things. But if, for example, everybody from the

ACLU to NSA says don't screw around with Tor, then you know it's probably not a good idea. So it's not so much the numbers but the relative merit. So we're working at this today.

Slayton: That's great.

Hoffman: So I've always been interested in cost. WEIS and other conferences like it are OK on the economics of cybersecurity, but we don't have any world class economists yet working on economics of cybersecurity, which bothers me.

Slayton: That is true, right. So, even in grad school, was your interest in cost influenced by any of your work with Rand or why do you think that drew your attention, because it wasn't something that everybody else was talking about. I think Willis Ware mentioned it in 1967, but [pause]

Hoffman: You know what? I think that people who have a more broad overview of things see that there are costs, whether monetary, economic, political, or whatever; there are inequities that have to be handled. And I think if you don't have the big picture outlook, you don't get it. And some people are really, really good technically, but they need to be brought to see the big picture. The other thing is it's much harder to do, it's not rewarded as much. Because, can you get anything out of squishy numbers? It's hard to convince people using them. A student of mine, Kurt Schmucker, did a book on fuzzy cybersecurity, inspired in part by my teaching some of the work of Lotfi Zadeh, out at

Berkeley. He wrote how you can use fuzzy metrics for cybersecurity because the data is unavailable or squishy and you can't just say here are the numbers, here's the science. So that gets into does a researcher do incremental work chipping away at a problem or non-incremental work and swing for the bases.

Slayton: Okay, good. When you were at UC-Berkeley, it seemed like your interest shifted a little bit; initially, you were focusing on cost but then you really got into risk management, in particular. What drove that shift?

Hoffman: It wasn't anything so rational or planned; probably, just because I think somebody needed to say something about risk management and that wasn't being done; it was easy enough to focus on developing the next great crypto scheme. A lot of people fall into that trap; look for the next great crypto scheme; which is fine and it's necessary but it only addresses a piece of the problem. I've always thought and still do think unless you address the whole problem holistically, you're not going to get things done properly. In fact, even today, I preach that. I run the CyberCorps program here at the university. Are you familiar with that; have you heard of that?

Slayton: I think I saw it from your website but I don't know a lot about it.

Hoffman: Basically, it's a scholarship program. It's not quite "ROTC for geeks", but almost. So basically, if you want to do cybersecurity, there are maybe 30 universities around the country that get grants from NSF to find cohorts of students to study

cybersecurity. Okay? And then they graduate; the *quid pro quo* is they must go to work for some government, typically the federal government, for at least a couple years. That's an approximation of the program but close enough. Basically, I want to make sure that all the people I graduate out of here -- I'm the principal investigator in this with my co-PI, Shelley Heller -- we have a great former student in the program, Patrick Kelly, who is with the federal government, who teaches as an adjunct. Anyone who graduates from here is going to know something about cybersecurity, they're going to know something about privacy, they're going to know something about the equities involved. We bring in people all the time from outside to speak; we're lucky being here; we call up our buddies and say, please hop on the Metro, come over here and talk. So they do, and sometimes we get people like General [Michael] Hayden and Vint Cerf and other luminaries.

Slayton: Oh wow.

Hoffman: And Phyllis Schneck, DHS deputy undersecretary came over just a couple of months ago. This is an elite group of students here. When we can, we take our guests out to dinner and they go off the record; it's just the professor and the students, the guest, and that's it. So our students learn a lot. But that's not history, so back to history.

Slayton: Right, getting back to history. So you must have come here, was it the fall of 1977?

Hoffman: Right.

Slayton: What prompted the shift?

Hoffman: Berkeley didn't want me. I didn't get tenure at Berkeley.

Slayton: Oh, I'm sorry. That's too bad.

Hoffman: That's okay.

Slayton: But it worked out quite well for you here, though.

Hoffman: Yeah, Berkeley didn't appreciate... I maybe did a couple of things wrong. I did publish a book and even though I wasn't attuned to getting research money, I got a reasonable amount of it. But I think I made a couple of choice comments in the faculty meetings, about [pause]...

Slayton: Some of these are just real hit and miss.

Hoffman: So anyway, okay, big deal. So I came back here.

Slayton: You did fine. So coming here, did you see a major shift in your work in terms of your involvement with government donors?

Hoffman: Yes. Well, of course, my work was involving the government even back in California. I was appointed in 1967 or 1968 to the California Assembly Committee on Statewide Information Policy, way back then.

Slayton: Wow, that's interesting.

Hoffman: Yes, and in fact, that was even when I was a graduate student, as I recall. They needed a technical person. And I was always interested in politics. A few years later I was at Berkeley, about 1972 or 1973, and somebody said look, Alameda County, which Berkeley is in, was putting in this criminal justice system with no safeguards, what's going on here? And I said, I don't know about this. So basically, I went to the press conference and listened, and then – “any questions?” So I said, stupidly, well, this seems to be lacking all sorts of controls and things like that — which I'm sure they didn't like — in terms of the press conference. I was an assistant professor at Berkeley at the time. [Laughs.] So I never cared with tenure.

Slayton: That's good, though, you have to speak your mind.

Hoffman: So I ended up being appointed by Tom Bates, who was a county supervisor at the time, to head the CORPUS Advisory Committee. The criminal justice information system was named CORPUS in Alameda County. So I headed that advisory committee, which was a bunch of people from around the county telling the County what they ought

to do. So that's how I got into that. I wish I had had more brains, I'd have planned this more, but it just sort of happened.

Slayton: No, this is great. Thank you. And then another government panel that you were involved in, in 1982, the ACM National Bureau of Science Workshop on Access Control; both as a member of the planning committee, and you were also a member of the identification group.

Hoffman: I don't remember much about it.

Slayton: Okay, you don't remember that. I was going to ask a little bit about how that workshop came about but that's not going to be a great question...

Hoffman: Yes, I don't know how that came about. I didn't instigate that. I did instigate things like the workshop that lead to this book, *Computers and Privacy in the Next Decade*, in 1980. You can look at this, okay?

Slayton: Great. Which workshop was this?

Hoffman: This was out at Asilomar in California, after the report of the Privacy Protection Study Commission. So this is a privacy agenda for the U.S. and there were a bunch of related papers; Willis was there, comments by Paul Armer, all these folks. And people like Hans Peter Gassmann from OECD came and we worked for two or three

days, asking what should we and the country (and the world) do next? And so I put together this book based on the workshop that I think was funded out of an NSF grant, if I'm not mistaken.

Slayton: Good. Again, you may not remember this but I want to know about a 1978 workshop hosted by the National Bureau of Standards on a Miami, Florida response to security on it and evaluation.

Hoffman: I don't remember much about it. Was I there?

Slayton: Yes, you were there. You were on the panel on Managerial and Organizational Vulnerabilities and Controls.

Hoffman: By that time, I started looking at less in terms of technical things and more what are the things you can do just as a manager. So, even with my technical background, I never got that deep into technology; even now, I'm not that deep into technology.

Slayton: Yes, but when you shifted focus from access control to risk management; it seems that you shifted in that direction.

Hoffman: This is very helpful to me because I never really have gone back and looked at this.

Slayton: It's really interesting. You also did some work with the OTA in the early 1980s?

Hoffman: It's really too bad they're not around anymore. The Congress' Office of Technology Assessment (OTA) was a very good and impartial observer and reporter on all the technology trends and things like that. As I recall Frederick Weingarten was at NSF and he may have gone to OTA after, but OTA was a good, good thing. By the way, Rick was key in funding my and other early work on cybersecurity.

Slayton: Do you remember when and how you got involved with OTA? That was after you were here.

Hoffman: Yes, probably here, somebody just called and said do you want to go and do this? It's all pretty much networking, but you know, people see you at panels, like what they see, ask you, and you say okay.

Slayton: Your work with the OTA and the people you met there, was that helpful?

Hoffman: Very much so. I still remember Marcia MacNaughton and other people who were there, big in the privacy world. I'm still very much connected, as much to the privacy world, maybe more than the security world because even now I'm invited to and present sometimes at the PLSC. Do you know about that?

Slayton: No.

Hoffman: Privacy Law Scholars Conference. It is a major event every year; it's grown; it's now in its sixth or seventh year. It's run out of Boalt Hall at Berkeley and out of the GW Law School. Typically, Dan Solove at GW and Chris Hoofnagle at Berkeley run it; they're both law professors and it attracts the best minds, I think, in the legal reasoning about privacy in the world, in the country at least. There are always about 50 technologists and other people around in addition to a couple of hundred lawyers. I have been honored to be invited many times, so I go there along with Sweeney, Anton, Bellovin, and other nonlawyers interested in the topic. By definition, all the nonlawyers who go there are interdisciplinary, so it's a good place for us odd ducks to gather and to cross-fertilize.

Slayton: That's great. So another government workshop, in 1985, the Air Force Computer Security Program Office sponsored a workshop on Federal Information System Risk Analysis . . .

Hoffman: Okay.

Slayton: . . . which I don't know if you have the proceedings, I haven't been able to find them. But were you at that meeting, were you part of it?

Hoffman: I may well have been, I don't recall it.

Slayton: It looks like it led to this 1988 workshop on Computer Security Risk Management Model Builders Workshop.

Hoffman: That rings a bell, sort of. One thing that happened, although that's important, right around that time, maybe it was 1986 or so, I was doing something called RiskCalc. RiskCalc was basically a decision support tool. I had a graduate student write this program; all it did was elicit information from you and then produce [pause]

Slayton: Was it Securate?

Hoffman: No, that was earlier; that was Eric Michelman; The same idea. But this was different; I could even run it for you now or some other time. RiskCalc still runs, it's DOS based, and basically, it elicits information [like] what kind of system do you have? Dot Dot Dot. And then it says okay, and what's the value of something? Basically it does FIPS 35, or whatever the number of what NIST did was?

Slayton: [FIPS] 65 is the 1979 guidelines on risk analysis by Robert Courtney.

Hoffman: I guess I was thinking of NIST Special Publication 800-35. Yes, FIPS 65, by Bob Courtney, yes. So basically it does that and it says okay, so tell me what things are worth, and this and that, a few other things, and cranks out an answer: "Based on all this that you told me, I (the system) think such and so." But the interesting thing is I saw to it

that it was written very generally, so it's really just a shell that looks like cybersecurity, but is more general purpose. I had a little company that sold a few of these programs, and sold some to Ernst and Young, and a few people liked it, I went to a convention or two, a trade show or two, where I was in a booth and people would come and I'd invite them to take a test drive and run it themselves. The idea was to run this in the privacy of their own office. You can put in whatever you want, you can see what comes out, and one thing you can apply it to, of course, is – itself! And then ask “Should I buy this program?” It had a report generator, it had its user interface, a system manager part and a user part, and it was an early risk analysis tool.

Slayton: That's interesting. Did it use fuzzy metrics?

Hoffman: No, it used real metrics. I got out of the business because after a while I decided that it wasn't selling enough the way it was written. People really wanted something that you could just use turnkey, turn the crank. I decided, at least at that time and probably still, that one size does not fit all. People just wanted to turn the crank and have something tell them what to do, but you can't really do that with any integrity. You had to have enough knowledge, or if you didn't, then you really needed to buy consulting with it and they didn't want to pay for the consulting.

Slayton: That's fascinating. So you started a company at that time?

Hoffman: I had a company way back in the 1980s or 1990s here for a while.

Slayton: Do you remember when you started it? Was it 1985 or so?

Hoffman: Something like that, I don't know.

Slayton: And then you got; at what point did you say this isn't going to be working right?

Hoffman: It wasn't that many years later; maybe five years later or something like that. I mean, I was happy enough with what the program did, but it didn't match the user's needs. It's a classic case of where you should go talk to the users first.

Slayton: Right, it's what the users thought they needed.

Hoffman: Yes, exactly. So maybe it was before its time; maybe it's still before its time. I don't know.

Slayton: You definitely had the perception then that the people using risk analysis tools just wanted some black box solution? Didn't want to think too much about it?

Hoffman: Not everybody; some were more sophisticated. But a lot of people, you know, they come by the trade show, and ask about it. But you really have to develop strategic

plans in business or in any organization, and you have to develop relationships. The software by itself didn't do that and thus was not that appealing.

Slayton: Right, absolutely. One of the things that interested me about your project, how do you pronounce it?

Hoffman: Sec-u-rate.

Slayton: Securate. Was that you placed a really high value on usability from the very beginning.

Hoffman: Yes.

Slayton: And I'm just wondering, why do you think you had that orientation? Because not everybody in computer science does.

Hoffman: Right. Probably because, well, probably because I'm less tolerant of doggedly sticking with something to get it done than some other people, okay? And so after a while, if it didn't work, I'm going to throw up my hands and say this is nonsense; somebody else can do this. Maybe it's just that simple. I feel like there are enough things to do; even today, there are enough things to do in the world and not enough time to do them. So if something is too hard, either it's going to be really important to work on, and if you do that, you may be pigeonholed or typecast into just this one thing. And then, do

you want to do that? Part of it's [that] I've always been oriented to lots and lots of things, not just computer science. That's a curse as well as a blessing, I guess.

Slayton: What prompted you to think of using fuzzy set theory? Did you have fuzzy set theory in grad school?

Hoffman: No, not at all, but bumping up against Lotfi Zadeh at Berkeley. He was a colleague at Berkeley, the inventor of fuzzy set theory. He, of course, he and his students, have had a lot of influence, using it for running washing machines and all sorts of other things way back when. So basically, I said it seems to work and it seems to fit; it's sort of useful for something as squishy as cybersecurity, even now. I mean, this program I showed you with all those nice diagrams, yes, it has numbers right now but it could easily use fuzzy set theory, as well, and may well end up doing it, who knows?

Slayton: Right, exactly. And was Securate actually used by people in the real world? It was used for [pause]

Hoffman: No, it was just purely academic.

Slayton: When you developed RiskCalc, you didn't continue using fuzzy set theory. Was there a reason you didn't keep using it?

Hoffman: Yes. I wanted to give an economic evaluation; I wanted to show if you do this; if you, user or company, do this you will save this much money. Is the game worth the candle?

Slayton: That's very difficult to do.

Hoffman: Yes. So I couldn't do anything but numbers, so I took numbers and I said this is what you have, but it pretty soon became apparent that just using numbers was not going to do the trick.

Slayton: Right. So if you wanted; so RiskCalc would actually say that here's a return on investment...was one way of thinking about it; or here's how much money you will save if you invest in a particular [interrupted]

Hoffman: RiskCalc was smart. RiskCalc had a separate input generator. So the way it worked is people would input their data, and then, I had a little language which I used that in essence was like the early spreadsheets but it was a little better, not much. If we had more time I'd show you. Basically, in fact I probably ought to; that's something to remember to get to -- maybe put in a museum or the archives because it might an interesting thing as one of these early tools. But basically, you'd put in the inputs; and now I have all your data, and now do you want this report or that report? Do you want a report for this kind of manager? That kind of manager? This was basically a report template, in essence words, but at the right time, the program would lob in the calculated

number into the report. The program would say, you said all this stuff; [blah]; then it would say okay, based on this we estimate that your cost to do such and so will be [blah]; and to do this it will be [blah]. There were all sorts of scenarios you could run. So you could look at viruses, you could look at this, that, or the other thing in specialty areas. So people would develop specialty templates, if you will, for it because it was a general purpose tool.

Slayton: Was it difficult to develop a tool like that because there's kind of a lack of data out there, right?

Hoffman: There was, and the tool worked fine, but to get it to work with real data and do anything -- exactly, because the lack of data was another problem. So I'm sure that's one reason people saw this and said well I can't use this, because I don't have a lot of data.

Slayton: Because they couldn't put the data in.

Hoffman: Yes.

Slayton: Interesting. So there's this computer security risk management model builders workshop, there's one in 1988, another in 1989, and then after that there weren't any. And I know that the National Bureau of Standards and the NCSC, National Computer Security Center, had sort of partnered in developing computer security risk management lab; do you know what happened with all of that? I can't find much evidence of what

became of all that. There was a lot of excitement it seemed at that time about what was going to happen.

Hoffman: It's always been an interesting mix between NBS at the time, and NSA basically. Even today, I think the cultures are different and so...who knows? I wasn't in tune at the time into who got what money to do what. I don't know why it fell apart but I suspect funding decisions, and who knows why that happened.

Slayton: Yes, culture clash maybe. Okay, so the National Bureau of Standards obviously did a lot in the area of risk analysis. I'm wondering if there were private companies that also played an important role.

Hoffman: There were some. I had some competitors; small man-and-a-dog companies that did risk analysis; and certainly the Big Eight, at the time; the accounting firms did risk analysis.

Slayton: For computer security?

Hoffman: Yes. Whether they knew anything about it or not sometimes didn't seem to matter. Having no data is really a problem, that's why it's hard to write insurance and sorts of other things.

Slayton: Right, okay. I guess as sort of a follow-on question to that, did you think that the interest in risk analysis and then buying, obviously, the tools to help with risk analysis, was that driven strongly by government regulation or was that a private sector interest as well? Were there companies saying we really need to do risk analysis or was it more the agencies said we're required to it?

Hoffman: The agencies, I think in some sense more; well, I'll be careful here. I don't know because I think a well-managed company does it anyway. But do they do it in cybersecurity? The government has a mandate to produce these reports and for a long time they just produced reports. I don't know; I wish I could help you.

Slayton: That's okay; it's sort of an impressionistic question.

Hoffman: Yes.

Slayton: So another set of questions that I'm going to ask you about, and I think then we're almost done; was whether you were involved...what sort of role the ACM played in the field of computer security. I'm on an ACM History Fellowship to look at that in particular; and I didn't know if you were involved in any ACM special interest groups like SIGSAC?

Hoffman: I was, I was involved in SIGSAC. Well, I was a member of SIGSAC. For a while I was also the chair of the Information Security Subcommittee of the IEEE Committee on Communications and Information Policy.

Hoffman: Was that for the symposium on security?

Hoffman: No, this was an ongoing committee, like an ACM SIG. I've certainly been involved in the ACM for a long time; I've been an ACM member ever since I was in undergraduate school.

Slayton: Oh. Really!

Hoffman: Yes. And I'm an ACM Fellow now. The ACM has had a lot of impact, maybe unheralded, in cybersecurity through various mechanisms. For example, Peter Neumann for years has written the Risks journal, whatever it's called.

Slayton: *Risk Digest*.

Hoffman: *Risks Digest*, yes. And maybe he's been less active in that in recent years.

Have you talked to him?

Slayton: Yes, I knew him a little bit. He was very helpful for my book project, actually, on trustworthy computing.

Hoffman: Yeah, so his stuff is really good. And, he's been around a long time, obviously, and he was publishing the ACM Risks Forum. A lot of other people in the ACM have pushed cybersecurity along, and certainly, USACM is doing lots of stuff. Spaf [Eugene Spafford], I guess, is stepping down, as chair. He was chair for a number of years. So ACM has had a big influence.

Slayton: So SIGSAC, was that a very active group?

Hoffman: I don't think it was that active. For some reason, it didn't get the legs behind it like, for example, IEEE S&P.

Slayton: Exactly.

Hoffman: I don't know why.

Slayton: IEEE has had the main conference everybody's most familiar with, but then there's these others, and I'm wondering if you've been involved at all with like the New Security Paradigms Workshop?

Hoffman: I know that I wasn't. See, a lot of that stuff is formal and I shy away from formal math, basically. Not that it isn't important, just that it's just not important for me. I'm more interested in the mix. But I've got to be careful to not become a dilettante and

know nothing about anything. But one thing I have found is that I am as much of a matchmaker, or dealmaker, as a researcher. Now, I hope I can still recognize good research and bad research. But a lot of my work now, and even over the years it seems, has been putting people together, and putting ideas together, and that sort of thing. And in fact, Nico Habermann, back when I was a graduate student, he was a professor, visiting Stanford, came to a party out there and said, boy, Lance, he's an okay computer scientist...but he throws great parties. So I don't know. [Laughs.]

Slayton: You played a very important role, I think, in the ACM Conference on Computers, Freedom, and Privacy.

Hoffman: Yes, that's important to talk about. Jim Warren started that, of course, in 1991. I was at the first one and I said this is really good and it's got to be institutionalized. So I called back right then and there while I was at the first conference; called back here to GW and said get a room at the Marvin Center for next year and we'll do it. And I initiated this...because Jim had no interest in doing [it] continuously, I don't think. I got it under the wing of the ACM.

Slayton: I see, so Jim just wanted the one-time workshop and that was it?

Hoffman: He wanted to do a workshop; come let us reason together, with the cops, and the techies, and the lawyers, but I don't think he was interested in running it long term. But it grew into something much bigger. For a while it was quite the thing; now, of

course, now it's reinventing itself because it's very different now, there are so many more things to choose from like the Privacy Law Scholars Conference, for example. So it doesn't own the playing field anymore at all.

Slayton: Right, that's interesting. So how did you bring it under the wing of the ACM? Did you simply know people in the ACM? Did you have some funds through it?

Hoffman: I knew it needed an institutional base and the ACM looked like a likely group. I can't remember how — probably there are documents somewhere that say how — there's obviously a formal process that you go through. It was sponsored by three ACM SIGs: SIGSAC, SIGCAS, and SIGCOMM.

Slayton: I would have to check. So what else did you sort of do to keep that conference going and who were you working with on that? Were there others that wanted to see it established?

Hoffman: Oh yeah, a lot of people in fact. Let me see; I don't know if I have it here.
[looking for conference proceedings].

Slayton: I think they're online.

Hoffman: I know they're online. We could look it up, but if it's helpful, I could look it up online and we could talk about who are the right people, or not.

Slayton: It's okay, I was just interested in recollections that you might have that sort of embellished the written record.

Hoffman: In recollection, it seems to me I was the key guy who said let's do this, but I obviously had help and support and that sort of thing.

Slayton: Okay, great. So other workshops and ACM conferences that I'm just interested in knowing whether you attended or were involved with: SACMAT, the symposium on access control models and technologies?

Hoffman: Doesn't ring a bell.

Slayton: Okay. The conference on computers and communication security, so ACMCCS?

Hoffman: I may have gone to one of those at some time.

Slayton: Yeah. And the Computer Security Applications Workshop?

Hoffman: You know, I never got involved in that even though it's important and big.

Slayton: What are sort of the main conferences and workshops for you that you went to?

Hoffman: For me, again, not ACM. Certainly, the main thing in the last several years is the Privacy Law Scholars Conference, which is actually invitational so instead of a conference, it's a workshop.

Slayton: Right.

Hoffman: I thought I'd retire 10 years ago — but . . . [pause]

Slayton: [Laughing] Too much going on.

Hoffman: Too much is going on. So I have been basically running this institute, which puts people together from around GW and around Washington doing cybersecurity. And I've been fortunate enough to get enough outside and inside funding to pay for it. But I haven't really paid much attention to specific conferences; usually, these days, I send people to conferences.

Slayton: Go take notes.

Hoffman: Really, it's very easy to send someone to take notes. Now sometimes there's a conference you might [want] to go to, you'll be in a hallway and talk to people, that's very important, that's the reason you go. I just did that two weeks ago; not for the

program but for something else. I can't name any other recent conferences I went to for the program.

Slayton: The last question I want to ask you is are there any other questions or things I should have asked or should have addressed?

Hoffman: I don't know, let me look at my cheat slip. One thing I learned from media training way back when was [interrupted]

Slayton: That's brilliant, yes. Come with the answers you want to give.

Hoffman: Yes...you know. Let's see what I haven't covered. I do think — the arrival of the internet and series networking changed things, I said that already.

Slayton: Yes.

Hoffman: Ah! We had tools early on for controlling memory access and even early encryption tools but people didn't use them. Intel had hardware way back in the 1970s for this but people didn't use them because they weren't incentivized to use them, and they would mess things up and/or slow things down. And there are still not enough incentives to do security; it's still, in some sense, the Wild West.

Slayton: Were you aware of this lack of incentives at the time?

Hoffman: I certainly was, yes. In fact, let me stick with this for a minute because the Wild West triggered something. I think we are still stuck a lot these days, we are victims of von Neumann architecture. As long as we have data and program in the same memory, basically. This is a real issue. And if there are other architectures people use that become more standard, it would help a lot, at least in terms of baseline security. Until you do that, well, downloading apps is great but what do you want more, security or utility? It's always been a tension between security and utility. That's very important and that may be why I got into the economics; because it boils down to what do you – the user, or society – want?

Slayton: Balance.

Hoffman: And I think it's important to see the big picture, obviously, and try to design for where the computer systems are going to go, where the science is going to go. That's why I'm looking now into the Internet of Things, now, to try to influence that architecture to some extent. Design it right up front, because otherwise you're going to end up unhappy. And some things are very hard to undo. Look at Google and the recent court decision in Europe, telling many Europeans that they have the right to be forgotten. Well, how is any system going to forget people since that information may have long since flowed out of that system elsewhere?

Slayton: Right.

Hoffman: From the education point of view, I'd say look at the upcoming new actors – MOOC providers, community colleges, for profit credentialing organizations – as well as traditional institutions of higher education. I think education's going to change. I think we're going to see more and more education for everybody. Cybersecurity education is going to be almost like driver's ed or something like that.

Slayton: Right, good hygiene, I guess is a problem.

Hoffman: Right, good hygiene.

Slayton: There are a few other questions I didn't ask, just in the interest of time. You've had some really great students over the years.

Hoffman: I have.

Slayton: I don't know whose work you'd want to comment on.

Hoffman: Well, it's interesting, you look at your legacy and who was really good in various ways. I've had some very interesting students, and good students. I'll name a couple; Chris Inglis has just retired. He was civilian head of NSA so he was just in the news. Did he jump or was he pushed after the Snowden revelations? Chris was a very bright guy.

Slayton: Was he a student here?

Hoffman: At GW, yes. I taught him in class.

Slayton: That's fascinating.

Hoffman: And I had Amit Yoran, for example, he ran NetWitness before EMC bought it. He's a serial entrepreneur; he started with Ripstech, a company that got sold to Symantec. It basically analyzed network traffic, what's going on, where the threats are, that sort of thing. He came to me, I remember it must have been in the 1980s or 1990s, and said I want to go get my Ph.D. but I have this opportunity to start this company, what do you think? I told him, I said, you're young, start the company, you can always go get your Ph.D. And he did, and then I badgered him, I said you need an advisory board because people are not going to believe you by yourself. He finally bit the bullet and did so, and I ended up putting together the advisory board, which had me, Dorothy Denning, Fred Cohen, and I think Steve Crocker. So he started Ripstech and ran it for two or three years; sold it; started another one; and so he's a serial entrepreneur. Here's another interesting student, Patrick Kelly, he works for the Office of the Comptroller of the Currency. He was a public policy major; he used to [be] a legislative aide in Florida; came back, got his master's in public policy here; and has been working as a CyberCorps graduate, where basically you get your tuition paid, you get a stipend, and in return you've got to work for the government. He went to work for the government and has had a meteoric rise, he's

been doing great stuff on a number of government committees right now, so he's a guy I would watch. So those are three just off the top of my head who are really great.

Slayton: I'm sure there are many questions that I probably missed that I think we can probably follow up with e-mail.

Hoffman: We can, sure.