An Interview with

FREDERIC J. WENDLING

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Conducted by Thomas J. Misa and Jeffrey R. Yost

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Abstract

With support from the National Science Foundation (Grant No. 0811988, "Designing and Using FastLane: Distilling Lessons for Cyberinfrastructures") CBI researchers Jeffrey Yost and Thomas Misa conducted oral history interviews with 70 NSF staff members as well as numerous additional interviews during 29 university site visits. An overview of the project is available at <www.cbi.umn.edu/oh/fastlane/> and a complete set of 643 publicly available interviews is at <dx.doi.org/10.13020/D6RG6B>. Here on the CBI oral history database is a selection of notable NSF staff including Joseph F. Burt, Jean Feldman, C. Suzanne Iacono, Constance McLindon, Carolyn L. Miller, Paul Morris, Andrea T. Norris, Erika Rissi, Craig Robinson, Mary F. Santonastasso, Rich Schneider, Frank P. Scioli, Beverly Sherman, George Strawn, and Frederic J. Wendling. Topics common to many of the interviews include the design and development of the NSF's FastLane computer system, interactions with users, e-government initiatives, grants management practices, peer review, and NSF policies and practices. These interviews span a wide range of NSF staff, from program officers to senior managers.

Fred Wendling was the principal project manager during the design and early development of FastLane, working closely with Connie McLindon and succeeded by Carolyn Miller.

Misa: We are at NSF with Fred Wendling. I am Tom Misa, and Jeff Yost will also be doing our interview today [19 February 2008]. We have a wide ranging set of questions on Fred's background and experiences before his involvement with FastLane. We hope by the end of today to be focused on the FastLane project itself. Fred, if we could start with just a bit of background. Can you tell us about your background and education prior to the Indiana University job in the IT field?

Wendling: Well, I went to Indiana University for most of my Bachelors. I was a chemistry major for my Bachelors. I think it was the second semester of my junior year I took a computer course – really loved it. So I took several more computer courses my senior year and decided I wanted to work on a Master's in computer science there at Indiana. That was relatively easy – I don't remember even applying to the school. They knew me and I got into the Master's program there. Really enjoyed it. After I graduated – about two weeks after graduation – I got married. My wife was still working on her Master's so I got a job there at the university for a year. I think it was one or two years before I graduated. I worked for the Workshop in Political Theory and Policy Analysis under Lin [Elinor] Ostrom and I got a full time job with that group for a year after graduation.

Misa: Did you have courses in databases, in programming?

Wendling: Programming, databases, artificial intelligence – which I really enjoyed. It was not the EE degree; it was the computer science side of it.

Misa: This workshop for political science, you were involved with managing IT resources for that?

Wendling: The first two years when I was doing it part time, I developed programs for data entry. They were doing surveys in the field and bringing them back, so they were doing double entry of all the data to make sure it all got in correctly. So I wrote programs to check the data. The year after I graduated I was put in charge of their IT group, managing their databases, making them available, assisting the people working on it getting access to it. I also wrote a program [for SPSS] that used a combination of – I think it was three different languages – to take two different surveys and put them together. So I wrote a program based on certain data elements within the two databases, [that] would match it up and create an SPSS input file for the researchers. That was a combination of FORTRAN, SNOBOL, and one other language I think PASCAL, in different steps to go through and take the SPSS source, read that in for both of them, and figure out how to take the data, merge the data, and then create an SPSS input that would read the data from both files correctly. They used that a lot. I heard even after I left they continued using that for the research there.

Misa: One of the interesting things about your career is that it seems to have spanned the mainframe minicomputer and network areas. This was I guess on a mainframe computer at IU?

Wendling: Yes.

Misa: How did you get from IU to NSF in 1979?

Wendling: After my wife graduated I wanted to come out here. My father was in the military and stationed in the D.C. area for many years. I liked the area and my wife and I wanted to move out here so Lin Ostrom, the head of the Workshop, got me an interview with Frank Scioli who [was] Deputy Director of the Division of Applied Research. So I flew out here and had an interview with him and his boss Vaughn Blankenship who was the Division Director of Applied Research. They said they were very interested in getting me in, and they would see what they could do about that as quickly as possible.

Misa: There are two major achievements in your career at NSF before FastLane that we'll want to talk about both in terms of mainframe procurement and also email, but before we shift to those can you give us a picture of what computing at NSF was like in 1979 or at least the early 1980s?

Wendling: So that is going to be pre-PC, and I'm trying to think which machine we were on at that time. When I first came to NSF we were on [a] Honeywell mainframe. Prior to that NSF had an IBM but I wasn't here when they had the IBM. So when I started in the agency we were on the Honeywell and one of the things I started doing, working in Applied Research, was people wanted to get information documents or reports [and] analysis out of the system. The system had a certain number of prescribed reports that

didn't really fit what people wanted. When I was in Applied Research Vaughn

Blankenship the division director was extremely good at program management and more

from the administrative side than the scientific side. He knew that Applied Research was

horribly underfunded [and] wanted to prove it. So part of the task I had was to go through

the NSF database and figure out funding rates across the organizations, and it was really

one of the first times somebody started talking about funding rates and comparative

funding rates. Or one organization being compared to another where his funding rate was

substantially lower than other divisions within NSF. Each division had presentations to

the director on their programs, and he did a presentation on how he compared with other

organizations. That included quality of proposals based on the ad hoc reviews and how

his proposals compared with proposals throughout the rest of the agency in terms of,

we'll say quality [laughs] but it's in different areas so you can't do a direct comparison.

But it could be used as a point of comparison across the organization and funding rates.

He was very successful and got more money for that.

Misa: The basic statement would be – just check if this is accurate – proposals in

Applied Research if [the ratings] were all excellent 90 percent of them got funded say but

only 20 percent if they were in the second tier; and with other divisions the funding of

successful proposals might go farther down the quality level?

Wendling: Yes, and he could show that he had proposals that were rated all excellent that

couldn't be funded because he didn't have enough money. Where other organizations

with proposals that had perfect all excellent were all getting funded, so part of it was that, yes.

Misa: Can you help us understand why that information had not been able to be collected before? Was it simply inaccessible to NSF?

Wendling: I think two things. One is [that] getting information out of [the] mainframe was difficult. They had a custom database – I think two agencies were using it — called Jason. But for ad hoc reporting they put a file out there of the data and had a report program that you could use to get reports. The only access was using that program. When I was up in Applied Research I asked can I get to that data directly? Then I wrote programs [using] that data, not using the NSF database [directly], but using this flat file that was extracted. They wouldn't let me get to the data via the database, Jason, but they would let me access the data that was on the flat file. So I started running reports against the flat file and set up programs for the program managers within the division.

Misa: Then this was all still with that Honeywell mainframe; no [mini computers] and you said, of course, this was before the PC era.

Wendling: Right, so that would have been in 1979 or 1980. So there was a new division director in information systems that joined NSF I believe it was about February of 1979 – sometime in 1979. She was looking at hiring people and she heard about me and some of the things I was doing in Applied Research. She asked me to come down and have a chat

with her. This is Connie McLindon. So I went down to talk to her – sort of an interview

as it turned out – and she made me an offer I couldn't refuse. [laughs] So she opened up

a job in DIS and I think I applied for that and I got the job in DIS and was in the IT

organization from 1980 until probably about 5 years ago.

Misa: So something around 2002. We can again check the paper record that's fine.

Wendling: Yes, I'd have to walk up…

Misa: I have talked with Connie on the phone, and we are looking forward to

interviewing her as well, but can you just say something about her background. Did she

bring some kind of different thinking? Was she interested in doing different things with

DIS?

Wendling: Absolutely. I think actually she is probably a lot more key to FastLane than I

am – in many ways. [laughs]

Misa: We'll talk with her. She had a different perspective on FastLane than you did.

Wendling: She was key in moving things and we can talk about how she did that. Connie

came from DARPA and was program manager, did funding in DARPA. Because of that

she was very aware of some of the latest research going on that other people were not

aware of. And she liked funding research and came to NSF and wanted to see what NSF

could do to improve how we're doing things. She was interested in the possibility of funding research that would benefit NSF internally, the business processes of NSF.

Misa: DIS is not a traditional research arm of NSF.

Wendling: No, absolutely not. She moved it into the research arena. That was because of her background; she had the credentials to do that. She had the Rolodex to do that. [laughs] Because of all the people she had met and funded at DARPA. So she came in and I don't know how long after she was here, but she was very interested in seeing what she could do to improve NSF by leveraging what's going on in the research community and then also by funding research.

Misa: That's a shift then from how DIS had seen itself.

Wendling: It was an administrative organization that just supported the day-to-day operations of the agency.

Yost: What kind of budget did it have early on for funding research?

Wendling: The DIS organization? It was almost nothing. [laughs] Because most of it was maintenance of the Honeywell [mainframe] when she came; and the operations staff was fairly large to keep the monster up and running.

Yost: Roughly what size? How many employees?

Wendling: Probably around 20 staff and that was 24 hours a day, so three shifts running the systems and then very little money to do anything [else]. We had very few contractors in those days; almost all of them were computer room operators. She had very little additional budget and wanted to move off the Honeywell. She was familiar with other computers and I don't know how we did the procurement. I wasn't involved in the procurement of the next generation's computing which was the HP minicomputer. But going back to your question, pre-PC there were [also] some DEC machines that were available.

Misa: There were specific models in the VAX family of minicomputers.

Wendling: No, these were workstations, pre-PC, to create documents. So we actually did some programming in the environment to create review letters. So you'd have the reviewer letters and also the information that would do a merge to create the reviewer letters. I forget what DEC machines those were.

Misa: I think I remember reading about a MicroVAX. I don't know whether that's part of this.

Wendling: I don't remember the names.

Misa: So it sounds like NSF was – we have to be careful a little about chronology.

Wendling: [laughs] Okay.

Misa: But [in the] early 1980s NSF was mainframe centered.

Wendling: Right.

Misa: And there were ancillary computers to do some word processing, and there were no PCs, and nothing like a networked environment.

Wendling: Right.

Misa: And so that's obviously part of the change that we would like to explore because FastLane couldn't have worked in that environment. Of course when FastLane was being conceived in the 90s and then implemented, many universities faced the same thing with mainframes or other kinds of centralized computing facilities – people did not have PCs on their desks. The whole idea of having a flow of information from PI through a sponsored project [office] into NSF required a massive infrastructure of networked computers not only within NSF but connecting NSF to PIs.

Wendling: Yes, OK.

Misa: The story about the computerization of the Federal Government is not well known.

Wendling: Yes. And some of this background in moving from the Honeywell [mainframe] to the HP minicomputers fits in the FastLane [story] to some degree. In the HP environment Connie barely had money to buy computers. I think she had like $500,000 to play with, unallocated. And I think the cost of the machines was approximately $300,000 per machine. So we got the first one in and started moving applications over there. I was in the group in DIS that was writing [a] new reviewers system for the HP systems. So we took a look at how can we automate what people were doing, and a few things came together there in automating internally the proposal process and in particular the creation of review letters. Prior to that, review letters were done in most parts of the agency, one letter to one PI; and it was triplicate at least and people would type on their IBM Selectric their review letters and you would have some program managers that would get the letter and go, "Oh I forgot to say give my best wishes to your wife," and have the secretary retype the entire letter. [laughs] And doing the three copies, some of it they could do with whiteout, some they had to retype the whole things. So it was very painful.

Misa: Very labor intensive too.

Wendling: Extremely.

Misa: Talking about labor intensive for generating documents, but I am thinking also about these twenty people tending the monster [Honeywell mainframe] as you put it. So a lot of resources simply to keep the IT infrastructure going.

Wendling: To keep the process going – there wasn't the IT infrastructure to support that. So they were doing – IBM Selectrics I don't consider IT infrastructure [laughs] – so they were typing. When we did the new reviewers system it was for keeping [track of] the reviewers out there, selecting them, and also the generation of the reviewer letters. The computer science division said, 'hey we've been using the same letter. We just have a copy of it, we sign it and we put it in.' And so we were looking at, if it's good enough for them maybe it's good enough for the rest of the agency: a standard reviewer letter. So in the HP system we developed reviewer letters that were standard but allowed people to customize it themselves. Because every [NSF] program was different, they wanted to be able to change the wording for their particular organization, but then we did automate it so that people throughout the agency could print out the letter and this was one of the first steps in automation. When we did presentations throughout the building people – the support staff – are going, 'I'm going to be out of a job.' Because it's going to do all this work for me and that's what I do most of the day is type those letters.

Misa: The support staff was concerned about the impact of automation?

Wendling: Yes, very much so. Later on we had FastLane was also a big concern. 'FastLane is going to put us all out of work internally.' So we learned a lot – or I learned

a lot in going to the HP and when people started saying I'm going to be out of a job. I did some calculation and yes we were saving a tremendous amount of time. The story then and later [was] FastLane is going to allow you to spend time on other areas that have been neglected. So nobody is going to get fired, everybody is going to have a job, but it was a major concern. In reality, over those years from then and through FastLane the number of support staff did go down.

Misa: Did go down?

Wendling: Yes. When I first started NSF every single program manager had their own secretary. You don't see that now.

Yost: Do you remember the timing of this reviewer letter system?

Wendling: That's when we had the HP here, and it's going to be in the first couple of years that we had the HPs. I don't know the year but I can tell you when in that history it's going to be, if we can find out when we got the HPs. So we went from one HP to two HPs to three HPs and moved everything from the Honeywell [mainframe] and to the HP [minicomputer] environment.

Misa: The HPs themselves were still not networked in the sense that we think of networking now. How did the program officers gain access to the automated review letters?

Wendling: That was through HP terminals and they were proprietary: HP 2622, 2626 various different models…I learned a lot from the HP experience. [laughs] HP bid very low on their minicomputers, $300,000 I think. They kept on going down in their price for the second and third one. They learned a lot. It's sort of like their laser printers. They would virtually give you the computer; they made their money off the terminals. With the printers they make their money off the cartridges. The terminals I believe were $1,500 a piece. So you got a $300,000 minicomputer and to buy a terminal for everybody was going to be a couple million dollars to do that. So we were buying terminals to support that; more and more terminals. First there were terminal rooms and organizations and then certain people would have their own, and we kept on buying more and more HP terminals so that people could access the HPs. It was proprietary terminals you couldn't go anywhere else; you were stuck using the HPs.

Misa: These were so-called dumb terminals at the time, or were they some version of what we would think of today as personal computers?

Wendling: No. Dumb terminals, but they had a chip built in to display the information on the screen [with] highlighted input fields and that was proprietary. One of the things that I did, and this was on my own time, was the HP terminal manuals had a description – I don't want to say calls – code strings for what is being sent to do certain things on the screen. I bought one of the IBM PCs within I think the first few months of it being out. At home, at night –

Misa: This would be 1981?

Wendling: 1982 I bought mine. I think the serial number is in the first two thousand. And I still have it at home and I enjoy looking on eBay to see what the current price is. [laughs] But actually the original [Microsoft] DOS discs are worth a lot more. I think they were a thousand dollars for the original DOS. So I bought one of those. Using those codes I wrote a program for the IBM PC to emulate an HP terminal. So that it would receive [data] from the HP [minicomputer] and be able to display properly what the HP terminals were doing. So I wrote that program and I think there was maybe three people in the building that knew I did that because it was on my own time and [there] was potentially some money to make selling it. I did put it on the market and sold some copies of it to various places.

Misa: What was the name of the program?

Wendling: HP 2622. I started marketing that. We started getting PCs at NSF, put that software on and because we didn't have to buy HP terminals at fifteen hundred dollars anymore that money was freed up and we could put more money into PCs. So I think I supported that [terminal emulator] for like four to six months. If there were bugs, I'd fix it at night so that it would work. [laughs] But it allowed NSF to move off the HP terminals. This is the early days of doing terminal emulation on PCs where everyone goes, 'yeah that's easy.' But in those days it hadn't been done.

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Misa: What did you write the program in so that it would run on an early IBM PC?

Wendling: I wrote it in BASIC.

Misa: In BASIC?

Wendling: So I started selling that, supporting it at the office. It worked fairly well. Then lo and behold one of the companies that bought it from me came out with their own product – Walker, Richer and Quinn. When the company bought it from me, I thought it was a law firm. [laughs] It sounds like a law firm, Walker, Richer and Quinn. They came out with a product that did the same thing with nice packaging, no bugs, and I had spent a lot of time – it was almost a full time job. Then I'm getting calls from companies, 'we're having bugs with this, can you fix this, we'd like enhancement can you do that.' And it was more than I could do. If I was smart I would have quit my job then and done that full time. But I didn't and NSF started buying their software. I was sort of happy to be out of it because I didn't have any free time. [laughs]

Misa: If you [were] selling to diverse customers then they will each have their own specific problems.

Wendling: And I'm one person. I didn't have anyone else and I've got a full time job! [laughs] That was important in allowing us to move to PC – maybe a little ahead of

everyone else. Connie knew I wrote the program and I gave the program to NSF and so

for I think it was about a half year, they were using my program and nobody knew it was

mine. [laughs]

Misa: That was part of a transition from the proprietary [HP] terminals to a PC based era.

Wendling: That assisted. Yes, tremendously in moving to the PCs. We started buying

PCs very early.

Misa: The classic story is that Erich Bloch [NSF Director 1984-90] had a lot to do with

that.

Wendling: Absolutely. He did. I think we were trying to get one PC for four people

approximately and really pushing to get enough money to purchase those PCs. Erich

Bloch came in and said, 'everyone should have a PC' and that was that. [laughs]

Misa: Then presumably you would have been happy to do that, so it was a question of

finding extra funding from Congress.

Wendling: Yes. Erich took care of that. That is getting into the PC environment. The

[NSF's effort in] networking was also very early. Connie pops up all over the place in the

implementation. From her DARPA days, she was aware of networking and PC

networking was starting to come out. And this was early on. I believe PCs were only out

a year, year and a half, two years when networking started. There were I believe six companies that were doing networking at the time. I don't remember which of the particular jobs I had at the time, but Connie asked me to go check out networking and see what NSF should be doing. So I went and visited every single networking company that was out there except one that was based in Ohio. And I don't remember which one that was. So out in California, [I was] going from company to company to company looking at networking, what they were doing, and what NSF should do.

Misa: This would be mid 1980s?

Wendling: Early. I'm thinking 1983, 1984. It was early.

Misa: Early on. Okay.

Wendling: Looking at those companies, one I went to was 3Com [founded in 1979 by Robert Metcalfe]. [Networking boards at the time] were at different speeds; there were one megabit per second, two megabits per second, ten megabits per second out there. It was a zoo in the early days of networking. There were so many companies that were attempting to do that well. I went to 3Com, really liked what they were doing. They split [TCP/IP] and, because we were at NSF, I was aware that the computer people here were very interested in TCP/IP. Also it was ten megabit which helped. And I learned the lesson early; they said they were [IEEE] 802.3 compatible. They said there was a standard out there that was a new standard. I was looking at, 'Okay, there's a standard out there. It

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looks like they are compliant with the standard we should be okay there.' I learned my

lesson like a year later, six months later that "compatible" doesn't mean "compliant."

[laughs] So we got burned a tiny bit on that.

Misa: About standards, the successful story is the Ethernet standard. Was everybody

trying to follow the Ethernet standard at the time?

Wendling: No, absolutely not. They were using different technologies for how they were

doing it. I believe 3Com was the only one doing the Ethernet and that was [owing to] Bob

Metcalf and his [work] at Harvard. I believe it was his [proposed] doctoral thesis, and he

decided to implement that in a company. So they were going that direction, and it looked

like the best way for us to go for a lot of reasons. So I did that, came back [and]

recommended 3Com to Connie. Connie says, okay let's go out and she went to 3 or 4 of

the companies that I went to. This was like a month after I went out there and revisited

everybody. We met with 3Com; we met with Bob Metcalfe. He pulled out the first

production board for the PC – and this is how early it was in networking – it was the first

long board for the IBM PC. So I know we were very, very early in the process. She

agreed to go with 3Com and we bought our first three boards and I installed a small

network at NSF. I was working directly for her in the front office at the time and my job

was technology assessment. And that's all I did.

Misa: Technology assessment, a very interesting place to be at that point in time.

Wendling: Absolutely. But how many organizations have somebody set aside for technology assessment? And it went from one person to later on there was a technology assessment section.

Misa: Was that your formal title then?

Wendling: I don't know what my title was. The government has strange titles. [laughs] I was probably a "computer specialist" as the title but I was technology assessing. That was my job.

Misa: Connie said, 'Fred, do technology assessment . . . .'

Wendling: Yes. And she knew I had the background in computer science. I think there was one other person in DIS with a Master's in computer science. A few people with a Bachelor's [degree] and the rest were people that were taught programming [or] that had other jobs in the early days.

Misa: The early networking boards I think were very expensive.

Wendling: I believe it was like $2,000 for the first ones, and I remember when the price went under a thousand is when we started really buying them. We set up this three-node network and I had to do the wiring for it. There was no wiring available that you [could] go out and buy – this is the beginning. The companies assumed you'd take care of that.

So I went to Radio Shack and I found the right wire, but the connectors weren't there to hook up to that wire with the connector that went on the board. So I got a CB antenna connector that connected to another connector that connected to another connector where I could finally connect the wire into the board. So it was three connectors long, like [a foot] long, to plug it into the back of the machine. We had three PCs going. Bob Metcalfe came out to visit NSF and met with Connie. We got the network set up and so he wanted to see it and so I showed him. I showed him the connectors and he looked at it and laughed. He goes, 'That works?' [laughs] That shouldn't work! So I was sort of embarrassed but I said, 'Hey, I went to Radio Shack I tried to find parts; I couldn't get any and so this is what I ended up doing.' He went back the next month 3Com was selling cable, connectors, crimping tools because he realized that was going to impede him selling his boards.

Misa: Was it coax cable that you used? It was nothing like twisted pair cable – nothing like what we have now?

Wendling: No, it was coax. Those days it was – what do they call it – everything was in a line and then taps off of them, plugs at the end of the wire – I forget what those were called. [laughs] Terminators for –

Misa: I've heard the term "vampire clips" that people could access an early Ethernet by essentially puncturing the [wire].

Wendling: We did that later. In the beginning you kept the wire at the connectors and there was a tee off of the boards. Each board had a tee coming off of it, that connected it in a line. And then terminators at the end, and you had your server in the middle somewhere. We were at the very early days of the networking and actually, and I forget all the reasons, developed a very good relationship with 3Com. We'd [find] bugs in their operating system; we had access to their developers; when we had problems we'd call the developers directly, have them fixed. Bob Metcalfe and Connie sort of developed that relationship. I probably went out there once or twice a year to meet them, talk to them.

Misa: With this early three-node network, when you had it set up physically how did you test the network? Were you sending files back and forth? What types of experiments? It's not trying to make email work exactly . . . .

Wendling: No, not in those days. I don't even remember what we did. [laughs] Because that was just playing. I think that was sharing files back and forth but I don't remember.

Misa: People did some version of what we would call file transfers, FTP or resources sharing, remote login. Those were early network applications.

Wendling: We were just trying to get networking. And that ended up working, so NSF started networking PCs. [This] was our old building [in downtown Washington, DC on G Street], and it was an absolute pain in the butt to do the networking because it had to be in

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a line, and the conduit was in the concrete set up for telephone wiring from [one] central location to each of the phones.

Misa: The physical pipes that you needed to run your wires down were set up for the centralized telephone system.

Wendling: Yes. We had to go from one PC to the wiring closet back out to the next PC to the wiring closet to the next one. Sometimes we'd pop up [and] handle three computers, go back down and do the wiring. It was an absolute pain to do the wiring in those days. But we wired…and this was when Erich [Bloch] was there …virtually the entire building and it was very painful to do that. It was very nice when they came out with star wiring for Ethernet. [laughs] Wish they'd come out a lot sooner.

Misa: You were involved, in this period, with introducing an early email system. Some time, we're not sure, 1984 to 1988.

Wendling: Before PCs, Dialcom; sound familiar for email?

Yost: Yes, we came across about 300 users of [it].

Wendling: That started [when the] National Science Board wanted to communicate and Dialcom was out there, and we bought Dialcom for the National Science Board and then everybody wanted to start talking to the National Science Board. So the real senior

people got their Dialcom accounts, the assistant directors and above. Then people below that, the division directors, wanted to talk to the assistant directors so Dialcom accounts there; and we were starting to get more and more email accounts and paying for that. So we took a look [and decided] that's going to get outrageous. We can't afford to do that for everybody. How can we bring email in house? …I'm trying to think if we had something before that, I don't think so.[1] What we looked at was [Hubert Lipinski's] "cc:Mail".

Misa: Sorry, just to clarify: there wasn't an email system on the mainframe?

Wendling: The mainframe didn't support it. The Computer Science division had I believe it was a VAX server and they were doing email. It was called CSNET at the time and they were doing email on CSNET. NSF, we went to the proprietary off-the-shelf solution of Dialcom to provide email to the staff here. And then we looked at how to bring it inside NSF instead of using Dialcom and – I forget how we ended up doing that…selecting them. If I remember correctly there weren't too many email systems for PCs at that time. We, again Connie and I, went out to California and met with Hubert Lipinski [who] had created [this PC-based] networked email system.[2] He had written "cc:Mail" himself and it was selling. He may have had 15, 20 employees at the time. The second time we went out there he wanted somebody to run the company for him so he put an ad in the Palo Alto newspaper. He was going to hire a CEO to run the company. [laughs] Jacques [Vallée] – I forget the guy's name he hired to be the CEO of the

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[1] See pp.103-104
[2] http://en.wikipedia.org/wiki/Cc:Mail (July 2008)

company, who actually was very good for him. With the "cc:Mail" we brought it in, started using it, and we asked them, 'Is there a way to put mail into your PC email system so that we can insert mail and get mail out?' And they gave us the subroutine to do that. Mike Morris – who's still here [at NSF] – wrote an interface to "cc:Mail" to the TCP/IP based network – Mike can give you the details. So then we could use internet email and connect "cc:Mail" to the internet. So I know we were the first ones to connect that to the internet. "cc:Mail" came and said can we get your code, and they put that into the product and it sort of blossomed [laughs] after they put Mike's code into their software. Since it was government developed it was free.

Misa: There's two pieces of software that have gone out into the world, yours and Mike's then.

Wendling: "cc:Mail" was eventually bought by Lotus [Development in 1992 to enhance Lotus Notes] and Hubert retired happily. [laughs] That was very important because we jumped into PC email connected to the internet very, very, very early.

Misa: It was a PC-based email system — not a VAX cluster, not an HP cluster, not a terminal cluster but PC-based?

Wendling: Yes and it's because we wrote our own interface to the internet to get mail in and out of "cc:Mail". So we were very early in the networking, very early in the PCs, very early on email adoption, and a lot of this is Connie wanting to do that. She wanted to

take a look at the technology, see what's out there, see what we should be doing. And she was always talking to old friends so she'd hear new things coming up and, 'Fred go check it out.' The networking, whatever.

Misa: Her old friends from DARPA days were important to her.

Wendling: Yes, extremely. She funded Bob Kahn …

Misa: of the internet?

Wendling: Yes, very good friend of hers. As a matter of fact when she left NSF she worked for Bob Kahn at CNRI for many years. She had a lot of friends. She also funded Xerox PARC and some things they were doing there so she knew John Seely Brown and a lot of people there. She was very well connected. And that's why [I tell you] she's extremely important in this because she had all this background knowledge of things going on, and in the early days funded some of the networking. So she came here and goes, 'how can we use that?'

Misa: She was a forceful advocate then within NSF of a certain vision of networking computers.

Wendling: I want to go way beyond that – she wanted to bring technology into NSF and make NSF a technological leader both in the government and private industry, to be

preeminent: we're NSF, we're the best, we should have the best infrastructure. And it turned out a lot of that was leading edge [laughs] but we were way, way ahead of most people.

Yost: Were there mechanisms for DIS to get feedback from the divisions on how best to meet their needs with IT?

Wendling: At what point?

Yost: At the time say of the email implementation.

Wendling: It didn't impact me a whole lot but in preparing for this, I did run into something called the Information Technology Coordinating Committee. I was involved in it. I don't remember it that much but I think it was more meetings, talking about what we're doing [and] where we're going. There was some coordination but Connie wanted to move forward.

Misa: We'll talk with Connie too. We're interested also in your view of her vision.

Wendling: What I can tell you is, I was her technologist and she'd [point] me in the right direction and I'd go find out what was good. Hey, we should do this, do that. And then realizing certain things could be done. Like "cc:Mail" could give us some way of

plugging in to their email system. So just being aware that certain things could be done with various products, putting them together.

Misa: We'll want to have your perspective on EXPRES [in the late 1980s] in just a moment, but by the early nineties there were discussions within the Federal government, in doing something like what FastLane ended up achieving, about EDI, electronic document interchange. In the early nineties how much contact did you, here at NSF, have with that wider discussion about how to do paperless procurement or other ideas that were floating around?

Wendling: There was a government group that was looking at a common description for research grants to come up with a set of common data elements. [Brad Stanford at ONR] was I remember the leader of that group; it was looking at what we can do to standardize proposals so that they could be sent to agencies in a standard format. That was electronic submission, is what they were looking at in those days. Now we jumped several years there.

Misa: I wanted to come back to EXPRES because it has a particular role within the administrative structure of NSF, but I also wanted to get some idea about the [interagency] discussions.

Wendling: We participated in those I remember. I'm going to jump [forward] a tiny bit here – when we first started looking at doing FastLane. Before we started doing it Connie

said Fred talk to whatever the interagency group was and let them know what we are doing and ask if they want to participate. I remember doing a presentation to them. I think I spent one third on the presentation saying what the internet was, what Mosaic was, because I think less than half the people in the room had never heard of it. I said, 'we're going to be doing this and if anybody is interested in working with us – developing a system, sharing it, the software, sharing the development – we'd be happy to do it.' And it was so far over their heads that nobody expressed any interest whatsoever in joining NSF on this crazy thing they were going to do. [laughs]

Misa: So that might have been 1993, 1994, 1995?

Wendling: This is going to be very early 1994, probably, that we did the presentation to the other agencies. We were looking at automating our proposal submission.

Misa: So your distinct sense is that what you were doing was technologically more sophisticated in terms of implementing a workable system than the people elsewhere in the Federal Government . . . ..

Wendling: And we were working with the group on the EDI solution. Jerry [Stuck] who was here, was the primary person who was working with that group, that interagency group. Jerry was also part of the EXPRES program. I'm sure we'll get into that later.

Misa: Are there any other general influences that helped form NSF's thinking – people were talking about a paperless office or an electronic office – were those concepts floating around?

Wendling: Automating proposals, receiving them electronically – absolutely. We had Paul Chapin. He was a researcher on detail to DIS, did a nice job of a futuristic look at what NSF could be like in the future which included electronic proposal submission.

Misa: Paul Chapin? That's a new name to us so we'll have to track him down.[3]

Wendling: Yes. And this is one paper he did while he was on detail. And that went out to the agency, as a vision of things that could happen. But Connie always wanted proposals sent here electronically from her very early days. EXPRES was hers, PS-EXPRES was hers, FastLane. She just kept on trying over and over until we got it right. [laughs]

Misa: So again she was a forceful presence in trying to push NSF to embrace this particular vision of technology.

Wendling: Yes and when we get into EXPRES we can talk [more] about [this] – I mean she actually started EXPRES that was in a [research directorate].

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[3] Paul Chapin received his PhD in linguistics in 1967 and was a member of the faculty at the University of California-San Diego until 1975. From 1975 until October 1999, Paul served as Program Director for Linguistics at the National Science Foundation and is currently Senior Program Officer for Scientific Initiatives at NSF.

Misa: Let's turn to that. We've had conversations with Dan Atkins; we'll be assembling a full account of EXPRES. One of the questions is what do you think NSF as a whole learned from EXPRES which ran 1986 to 1989, I think, and what did you learn from it?

Wendling: 1986 to 1989, is that right?

Misa: Those are the dates that we've been able to determine.

Wendling: 1986.

Misa: I've got a notebook here.

Wendling: Ok, I thought it went later.

Misa: Those are the dates plus or minus a year, I'm pretty sure.

Wendling: Ok, I thought it went a little later than that and maybe it's because of other things that happened. Connie wanted to look at proposal submission and immediately got into the problems with collaboration. She was very good at working with [the] research community, the scientific community, and companies. Realized early on that there was a problem with collaboration, that within the university environment you'd have two people working on a proposal. One may have the UNIX system, one may have a Mac. How are you going to send the files back and forth? And [with] PCs there, you had at

least three different environments. How were people going to just get the file that the researcher [made on a] Mac or UNIX system to the DOS system that the sponsored research office may have; and also [there was] not only the problem of sharing documents within the university but collaboration among universities. She realized that the problem at that point was collaboration technology, and so she started talking to people in that area on how can this problem be solved. And so she is doing this, how can this problem be solved. And I think she had her goal – [electronic] proposal submission – but she was forced to look at this collaboration technology issue. How can people share documents and maintain the structure of the presentation, everything else in the documents. And [she] realized that there was a problem with collaboration technology that led to EXPRES. And [here] she was in this group that was responsible for providing systems, you know day-to-day computing to NSF, but realized that needed to be addressed. You are going to have to talk to her but somehow she worked it out that the project got funded, she started the project. The project was actually run out of the computer directorate by Al Thaler, and Jerry Stuck from DIS was moved over there to work on the project. She moved somebody from her organization over there but the project was run theoretically through the CISE directorate although she was running the project. And a lot of this was, you know, DIS doesn't fund research so it had to be done somewhere else.

Misa: She had also a limited budget for trying to do this.

Wendling: At NSF color of money is very important. There's administrative money and research money. Administrative money is very limited; research money is plentiful. [laughs] A big key that she did was to move DIS to an organization that could spend research money. This was further down the line. But the big step in that was she successfully managed EXPRES which was run through the CISE directorate from her location in the administrative group. And I don't want to say she ran it, I should be careful there. It was run out of the CISE directorate; she was very involved. Including the selection of the program manager at NSF.

Misa: That was Al Thaler.

Wendling: Yes.

Misa: So again her vision had some shaping influence.

Wendling: She knew a lot of the people. She went to go visit them. She went to visit Dan [Atkins] up in Michigan when he was there.

Misa: There's a document that Al Thaler wrote about EXPRES specifically, and it had two different visions in it. One was something quite specifically and narrowly focused on electronic submission of grant proposals, very workman like and somewhat narrow in its conception. In the same document there's also a vision that's talking about new

technologies to facilitate collaboration in entirely new ways across the sciences. EXPRES seemed to have an oscillation between the two of those.

Wendling: Yes. This fits into exactly what I said Connie was trying to do. She realized there was this problem with collaboration technology so if she was going to get to proposal submission, this collaboration technology problem had to be resolved, fixed somehow. So EXPRES was funded to look at this bigger collaboration – how can scientists collaborate – hoping that she could at least get the result we can submit proposals electronically as the first application of that new collaboration technology. And that's why you probably do see a little of both [visions] in there.

Misa: You see more-or-less both visions – there's one thing and then there's the other – and the hope [was] to have them fit together in some fashion.

Wendling: I think it wasn't hidden that she wanted one of the applications to be proposal submission. And that wasn't hidden. Find out how scientists can collaborate not only within their university but across universities, multiple different platforms – I mean now you look and it's easy, but in those days it was not easy. [laughs]

Misa: At Carnegie Mellon they were trying to use Andrew, which was their cluster of workstations, trying to figure out ways of moving documents back and forth. It seems [if] you could have replicated Andrew across the universe that would have been a way of

doing that. Were there promising things that could have been done in the late eighties? It seems like a very challenging problem.

Wendling: And you're going to have to talk to somebody else about that because I was not involved with EXPRES. I got involved with EXPRES at the postmortem meeting that she called with some PIs, people from the research environment, private industry. That was like 15 people she pulled in to say where do we go from here. She pulled me in, starting there. So I was there for the postmortem and I don't want to say the postmortem.

Misa: Lessons learned, I suppose.

Wendling: Status review: Where are we and were should we be going. That may be a better way of putting it. For the Andrew [system at CMU] and what happened during EXPRES, and what should have happened, and what could have happened, you're going to have to talk to Al Thaler, Dan Atkins, Jerry Stuck for the details of what happened during EXPRES.

Misa: Jerry Stuck was involved as well?

Wendling: Yes. And he was on detail from DIS.

Yost: In 1988, the electronic proposal submission project started, we came across that; were you involved?

Wendling: 1988? Which one was that?

Yost: It would have been the last year before EXPRES ended, so midway in the EXPRES project.

Wendling: ….no, I wasn't that I remember.

Misa: At this so-called post mortem/status review, what were some of the lessons that you drew or that Connie was hoping that people here would draw from EXPRES as an experiment?

Wendling: Well, I know at that point one of my jobs was going to be, 'Fred, take a look at where we should go from here.' So I was there looking at the next steps. And I remember very vividly, and other people in the room may remember other things, that their solution was that private industry will be solving this within the next two to three years, and just wait for them to solve it. It's a problem that's got to get solved, so just wait for them to solve it.

Misa: So it would be some vision of applying EDI technology, or one of the other concepts that were out there, and then somehow NSF could simply piggyback?

Wendling: Yes, some vendor is going to come out with a solution: just buy it when it's available. And that's what I heard from that. That it is a problem, there's lots of money to be made so somebody's going to develop a solution to it. And again, other people in that room probably heard lots of other things. And what I heard was they don't have a solution, and I've got to come up with something else. [laughs]

Misa: There's a curious shadowy period; FastLane is organized and funded between December 1993 and the spring of 1994. Can you speak about what was going on and what you were doing between the end of EXPRES – say 1989 or 90 – and 1993? We're trying to get at the origins really of FastLane. This is completely undocumented as far as I can see.

Wendling: Yes. And after EXPRES – I'm grabbing a book. [pause] After EXPRES there was a Postscript [version of] EXPRES [PS-EXPRES] when they were looking at matching pairs of data with the EDI and submitting proposals and matching pairs, you know, PI last name, and then the last name and coming up with a standard description that was with other agencies. So that was moving forward on how the agencies could work together to come up with this standard format, and they would submit the cover sheets and not the proposal. So that problem is still out there. And the agencies were working together to come up with a standard that could be used to do that.

Misa: This was specifically on an interagency basis -- not only within NSF but between agencies?

Wendling: Yes, to come up with a standard so you'd get documents electronically that would have the proposal information without the proposal text. But you'd get everything else electronically. And agencies working together on a solution. Then it was PS-EXPRES. [looking through book] …proposal task force…and then…I'm going through [laughs]…I'd do a presentation on this.

Misa: You have a set of overhead transparencies slides.

Wendling: I titled the presentation Electronic Research Communication: Commitment to IT. We were talking about [this] with Erich Bloch. Business Practices Working Group was that interagency group.

Misa: Did you call it earlier the Information Technology Coordinating Committee?

Wendling: No, that was internal NSF. I believe the interagency group, Business Practices Working Group, was a Brad Stanford group. [Then there was the] Electronic Commerce Committee, they spent a lot of time on the data dictionary, it came out monthly and it was very difficult to do that. Email, we did start doing review receipt of the email. The computer science group started in the early days receiving reviews via email. [continues flipping through book/folder] I'm remembering all sorts of things with this. [laughs] EXPRES to PS-EXPRES to Proposal Task Force. And this would have been internal that we need to do something external submissions, internal processing [consider] other

applications. O.K. And that's when I got involved in it. I was Deputy Division Director of DIS at the time and I'd say for the most part working for Connie about 90 percent of the time and working for the Division about 10 percent of the time. She assigned me the task of coming up with a solution after EXPRES and PS-EXPRES; and this EDI's going nowhere. After looking at what had been done before and trying to find a solution, I looked at an EXPRES paradigm [where] documents would go from the researcher to the [university's] department of sponsored research to NSF – and all of these would have to be compatible and interoperable. With this "project X" what I was looking at is [having documents go] from each of these groups [researchers, universities sponsored project offices] to NSF, and NSF would serve as the translator [in one machine]. So I was looking at developing the software for UNIX, Mac, and PC environment. And [the idea was that] NSF would send this [software package] off, free of charge, to all the universities. So whatever machine they had, [they would] load our software and then we would act as the intermediary and translate the files. We could write the software that would take care of them getting the right information logging onto our system. So the researcher could enter it, the sponsored research office could bring it up, take a look at it, approve it, change it. This is what the internet does today but this [was] pre-internet, pre-Mosaic; and we were about "this close" to start doing it. Connie goes, 'Okay, that sounds reasonable let's go with it.'

Misa: Then with "project X" NSF [was] much more at the center? [A university's] Sponsored Projects Office would still have a chance to approve; the text of the proposal

would be uploaded to NSF, the department or the college could review it, approve it [and then submit it]?

Wendling: Right. Everything that FastLane does now, but that infrastructure wasn't there so we were going to create an infrastructure [with project X] that would allow people to submit [a research proposal] to NSF, and then other people at the university, or other universities, to access that information. And we'd write the software for three environments.

Misa: Was it at all clear what technology would have been used for project X?

Wendling: No, that was the solution we knew it could be done. This was one of those [moments] throughout my career [where] I'm going, 'yes, I can envision it so I know we can do it.' [laughs] And if you can think it, you can do it. I wasn't worried about getting it done – that's the easy part of it in a way [laughs] doing a program to do that.

Misa: Just to take the next step in terms of detail, what would have been the problems? People would have sent you text files or proprietary word processing files, and somehow that would have been translated into a system that NSF could store and that other people could access?

Wendling: We would do whatever translation was necessary so that the next one could read the document. I don't remember the exact details of how that was going to be done,

but that was determined that would be the way we could do it where EXPRES was going this way we'd do it this way. We could solve the problem, write the software and have everybody communicate with us. So we were extremely close to beginning to implement this and spend some money to develop it. When serendipity happened. [laughs]

Misa: We're coming close to the origins of FastLane, so you can tell us what serendipity was. Should we take a five minute break?

Wendling: Yes, that would be good. How about ten minutes? [laughs] I didn't realize we'd been going that long.

……

Misa: Fred, when we were talking before, we were going through some of the precursors within NSF, most recently about "project X." And you said it was very close to being put forward and implemented except for serendipity. Serendipity, we'd like to understand that.

Wendling: Yes. Another thing I was working on for Connie was – she began hearing about this new software called Mosaic that was coming out of the University of Illinois. One of the biggest advocates [of it] within the building was Chuck Brownstein. I think he was acting assistant director of CISE at the time. He started playing with it a lot. Just seeing what was out there, what other people were doing, and [he became] outrageously

impressed with it. Connie had a lot of contacts and she spent a lot of time on the phone talking to her friends all over. There were many times I'd come into her office and, 'oh, I'm talking to so-and-so,' or she'd be on with so-and-so at MIT or so-and-so here. She started to hear that this thing [Mosaic] could be something interesting. So she sent me up there [to the University of Illinois] to see what's going on and how we may be able to use it at NSF.

Misa: The thing being Mosaic.

Wendling: Yes. Primarily [we were interested in a means] to get information out. To be able to get program announcements up, information about NSF, guidance rules, etc. Just to have a place where people can get information about NSF. [Hardin and his group] was receiving NSF funding. So I went up there to talk to them about using it for NSF. My contact there was Joseph Hardin, who was probably never in the history books regarding the development of the internet.[4]

Misa: And that's Hardin?

Wendling: Yes, Joseph Hardin. Yes, nobody has heard his name. [laughs] Marc Andreessen [widely known as the inventor of Mosaic, the pioneering internet browser][5] worked for somebody, that's the person he worked for. [laughs]

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[4] In 2008 Hardin is at Michigan <http://www-personal.si.umich.edu/~hardin/> (July 2008)
[5] See http://en.wikipedia.org/wiki/Marc_Andreessen (July 2008)

Misa: Marc is famous.

Wendling: But Hardin is not! He was doing collaboration technology in an NSF grant and I think other funding, to take a look at how people can work together. He had one of his students work on this software that could be used for people to share things over the internet. So he was the contact and there were various staff members also working on it. So NSF was looking at the possibility of doing a website. Chuck Brownstein was very interested in it, and it was one of these things that looks like NSF needs to jump into this because [Connie] liked being on the new technologies, and having NSF be on the forefront having new technologies. I was sent up there to meet with them and see what we could do. We started talking about it, and I really loved Macs, DOS PCs, and UNIX systems all getting the information. So I said this is great and I said, 'what about an input field?' And they go, 'we just added that last week.' [laughs] Initially it was just display only and if you could [call up] it would present the information. So I go, 'What about an input field where you'd send information to the other side?' 'We put it in last week.' And I go, 'Really?' [laughs] Then I start talking about [what] we're looking at.

Misa: Because this changes it from being a one way communication getting something from the center – NSF – out, to the possibility of interchange, so that somebody a PI or a sponsored research office could send information in. Big, big point.

Wendling: Yes. So we talked a little about capabilities and what you'd be able to do with the information. Then I go, 'what about file transfer?' They go, 'we're talking about it.

Allowing the transfer of the file using that and the interface. We're talking about it.' So I came back from that trip and said, 'Connie, it looks like this might be able to handle the proposals and it's [already] in three environments. This is really promising.'

Misa: Because the [input] field could add structured information, the file transfers could transfer the proposal text and other things. The two of those together would give you a platform for the two-way transfer including the submission of [proposals].

Wendling: Yes. So I wouldn't have to write the software for all three environments. They [would] use a modem or whatever, they dial in to our server, transfer the files back and forth. It looked like this may be a good solution to it. It's like when Walker, Richer and Quinn [which took up Wendling's terminal emulator] came out with their own version, I go, 'Phew I don't have to do that.' [laughs] There's something we can get off the shelf. So I came back and said, it looks like this might work. [Connie] sent me back up to talk to them about really doing proposal submission. Saying, I want you to talk to them about doing this project and doing submission of proposals. So I went up there and talked to them in detail about capabilities. When they'd have the file transfer – 'we're working on it.' And talked to them about doing proposals and the application was proposal submission. And Joseph Hardin said, 'it's too ambitious. I wouldn't do it.' Those were his exact words 'too ambitious.' [laughs]

Misa: Why do you think that he was reluctant to be enthusiastic?

Wendling: People weren't doing stuff like that with [Mosaic]. I don't think he envisioned real work being done and potentially complicated new environments, [b]leading edge – I don't know, you can ask him. [laughs]

Misa: Yes, we will.

Wendling: Too ambitious. So I came back to Connie and I go, again, 'I can envision it. I can see how we'd do it. Writing the program is the easy part.' And I said, 'I think we can do it.' So she was excited about it. Said, 'Yes, that sounds good.' I think she probably made some phone calls. So she became comfortable. [laughs] I don't know, you'll have to talk to her.

Misa: The point of serendipity then really is your contacts with the Mosaic [group].

Wendling: Going up to Illinois, yes, and hearing that 'last week we added the input field'. And if I hadn't have gone up, we probably would have started the other one [project X]. So after that it was, 'yes we think we can do it.' Then she started her discussions internally and who she talked to I don't know. She ended up talking to the director, talking to him about the possibility of doing this. Then there was a presentation to the director. Connie was there, her deputy Terri Glazer was there, me, Neal Lane and others in that meeting. This was a semi-formal presentation on what we were looking at doing, focusing on the problems, the risks. I did the presentation and talked about the problems. It's a new [piece of] software. We don't know if they are going to stop developing [it]

two months from now. We don't know if it's going to go anywhere. I mean it was real new at that time, and the estimate was something like 23 percent of researchers had access to the internet, even fewer had Mosaic. We don't think anybody in the sponsored research [or] financial office has access to the internet. We don't know if they'll ever [successfully] do the file transfer. And [so I] went through all these potential problems. Connie said this is very much on the edge, nobody has ever done this. What we are attempting to do is new, and we'd like this considered a research project. Neal Lane agreed to do it and I vividly remember him – you know because I had gone through all these problems – towards the end [he] said you know we'll do the best we can.

Misa: You were both excited but you could also see the challenges.

Wendling: Huge potential for failure. HUGE potential for failure. You're going somewhere nobody's gone; we even told them Joseph Hardin said it's too ambitious. You know we laid it out. He [Lane] goes, 'no, this is a good research project. If you fail it's okay.' That was very nice of him. You know walking into it that he realized [there was a] huge potential for failure. There were too many variables that we didn't have control over that could fall apart. It was very nice of him to say if it's a failure it's okay. And having the head of a government agency say, 'yes, go work on this project and if it fails it's okay,' it's really nice. On the other hand, because of that we wanted to make sure it didn't fail. [laughs] He was investing a lot of himself into the project. Man, this is spending research money in DIS which was unheard of.

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Misa: This was before December 1993, before FastLane is formally constituted?

Wendling: This was before it was called FastLane. I was looking to see when it was called "FastLane" and so this is before anybody know we were going to do it. This was real quiet. Connie may have talked to a couple of people in the building. But as far as I know it was a very small group. Me talking to Connie, Connie going okay I trust you, and let's talk to Neal about it, and that was it. She had talked to him separately, you know 'we'd like to come up and give you a presentation'. And so this was the formal presentation of the project. He agreed to fund it initially $800,000 for the first year and out of research money. But I should be very careful…this gets a tiny bit touchy using research money for operations in effect….

Misa: But you could see that you weren't necessarily sure that you were going to be able to implement this. This was cutting edge. It was an application of experimental software.

Wendling: Yes, and NSF has a pot of money called Program and Evaluation which is research money that can be used for program development and evaluation activities so this sort of fit in that pot for program development. I think officially the money came out of that pot which was normally spent for other things – hiring a contractor to do a review and peer review process, for program development evaluations. [Neal Lane] stuck his neck out to do this.

Misa: Within NSF, what went on between this initial presentation and the document that we believe that you wrote, "functional requirements" from October [1994]?

Wendling: I didn't write that. This was real quiet at this point and one of the things he said, to Connie, in this meeting was 'make sure you get buy-in internally and with the community.'

Misa: Internally to NSF and the community of PIs and sponsored project people?

Wendling: Yes, with the research community. The boss says do it, and so she looked at doing that. At that point four or five people in the building knew we were going to do it. [laughs] And so it was, 'OK, the director said we can do it. Let's start.' So Connie needed internal buy-in. I believe she then had Tom Weber as division director DIS – he also had a PhD at the end of this name – she had him write a paper for internal [use] – and he wasn't at this meeting with the director – for use in getting buy-in. And I think she did it because I didn't have the PhD at the end of the name; he did. [laughs] That she had him do that and that was used…and I don't even remember where it was used that paper but it was one meeting that she wanted that paper for. I got a little mad at her because she didn't let me know. [laughs] Because I got it after the fact, I go Connie, 'It's not even accurate.'

Misa: But when you're changing a complex bureaucracy like NSF – let alone its connection to this large research community that feels very invested in NSF – there's lots

of different levels that you need to have people buy-in, so it's a very interesting political set of maneuvers.

Wendling: Yes, and she's an expert at it. Extremely good at it, like I said. So you've got these resources, 'Tom, please write the paper.' So it served its purpose on helping to get buy-in for the project. For the external – she drove me crazy. 'Fred, get an external advisory group together.' And I go, 'oh god I just want to get it done. And we're going to have all these people coming in and telling us what to do.' But of course she's right. [laughs] And we needed that. And that's external.

Misa: External advisory group would be external to NSF. Did that involve more people in the government, or rather from the PIs and sponsored projects?

Wendling: PI and sponsored research. She also had me do the presentation to that interagency group. To let them know we were doing it, you know, to cover bases. Other government agencies, research community, internally.

Misa: Is that the same presentation that you mentioned, earlier on, where you outlined Mosaic, the internet, on and on, this is what we're doing?

Wendling: Yes. And it was so far over their heads they just didn't understand what we were talking about because they'd never heard of it. You know [in] another year or two years – 'Oh! we want to do that, too, but we're going to come up with our own way of

doing it.' So we got the buy-in and money and then it was doing it. To me it was a project; all the tools were there, almost all the tools were there; we just had to build it. And so I took it as let's start building. And that one document –

Misa: The "functional requirements" document.

Wendling: Yes, and that was probably months down the road, because the first thing was selecting what to do initially with the project. And because of the problems with the infrastructure one thing I knew we had to do – and I think in the discussions lots of people had input to what we should do. Proposal submission, of course, was in there because that was the thing Connie had been working on for years and years and years, as one of the initial projects. And the others were selected very carefully to hit different groups in the research community so that there were benefits or something to get them to want to use the system. So this was not only we got the researchers with the proposal submission; one of them was review submission so we'd hit the reviewer community and that's as you know PIs…   I think we were at about 30,000 proposals a year and with the co-PIs, you know most of them were with their own institution, let's say 40,000 researchers may be involved. When you go to the reviewer community all of the sudden it's hundreds of thousands of people potentially involved in sending in reviews. So we'd hit that group, and we realized that would not only be national but international, so we'd have to work through some of the issues that were going to be involved in transmission of reviews internationally. It was painful but from the very beginning – security, security,

security. You do a presentation, talk to anybody and it's, 'what's the security going to be?' [laughs]

Misa: Could we focus there just for the moment, how did you understand security at the time?

Wendling: At that time the transmission's going to have to be encrypted. [pause] And so you start looking at that early on, and NSF started working with University of Illinois and we actually funded some developments and add-ons. Chuck Brownstein was a lead on that with Larry Brandt – B-r-a-n-d-t. And funding enhancements to the system. So we realized early on we've got to do something. It's on the security everybody's going to bring it up. Everybody's going to mention it. We have to have an answer for that. I went through two of what the first six were. It was in that stuff I sent you. [papers shuffling] Proposal status, if you're going to force PIs to get in there and submit the proposal, we've got to give them a carrot at the end which was the status of the processing. I mean through all of this there was a lot of reengineering of how the agency does its work when we were implementing the FastLane.

Misa: We've got several paths to go down. One is helping understand this document, the "functional requirements" document. And on the other hand, you said something quite fascinating about a discussion of reengineering of NSF and the proposal process. One of my questions in reading the document, was this an opportunity to rethink the very nature

of a proposal and to what extent was that involved with how FastLane was implemented? Or to what extent was FastLane a mirror of the existing standard proposal process.

Wendling: Do you want to hold that? Let me go through the six and why we selected them. [laughs] We'll get back to some of the re-engineering.

Misa: Yes, OK.

Wendling: Part of the re-engineering [involved] giving the PI information. Final project reports was getting text in, and we wanted to experiment with getting text in, and we figured final projects don't have to be fancy documents, they can just be straight text. Because the original proposal submission was forms only, not the content. With the final project reports we could get some content coming in. Cash transaction [would] get their financial offices and sponsored research office involved. We were looking at they probably don't have the infrastructure, what can we do to give them a carrot to get in? The review information I talked about. Award actions, that was information about the awards, and that was public so we'd have something out there for the general public to look at. So they're looking and building the infrastructure looking at all the people who work with NSF, our constituents to make sure we were trying to cover everybody. Because we knew an important part of this was building the infrastructure of the research community.

Misa: How were these six targets decided on?

Wendling: I think I did a lot of them. Proposal submission was there. I think it was probably Connie and me, I don't remember anybody else. Even when we went to both the [FastLane] Internal Review Committee (FIRCOM) and the external review committee, we said we wanted to do these six first, and where we go from there we don't care. Wherever you'd like to go, especially with the external community, 'what would you like to see?' And boy did they respond. 'We want this. We want this. We want this.' [laughs] Which was great because that – you know, 'they're going yes, this is useful but to make it real useful for us we'd like all this.' And we're going, 'OK whatever you want.' And we didn't care. And that got a whole lot of buy-in, having them say 'we want this, we want that.'

One of my goals internally was I wanted anything that had ten thousand transactions per year or more automated. So if we had some interaction with the research community that would involved ten thousand transactions a year, those were the top ones I wanted to get. The low volume ones [would be] a lot of work for [only] a little pay off. When I saw proposal status even that and you'd think was easy but we were looking at how we can re-engineer this. I was looking at it, this is a carrot to researchers, they can find out what's going on with their proposal. I was looking at we get it in; you tell them we got it in. It's assigned to a program manager; you tell them which program manager it was assigned to. When it went out for review, you tell them it went out for review and how many reviews you sent out. When the reviews come in, give them a running sum of number of reviews returned – one of four, two of four, three of four – so they know

exactly. And I'm going, this will be great, it'll take all the pressure off of you [program managers] because they know that the problem is getting the review back from the reviewers. And you know getting the information as it goes on, full disclosure. The internal review committee, in particular Al Thaler goes, 'we can't tell them what's going on. When they know that three reviewers have returned it they're going to be on us to make a decision. [laughs] I think in some of it we wanted to do more. It was negotiations and the internal review committee was very important in that because it's the program manager going, 'you can't tell them that,' even though I would have liked to do it. I think we would have gotten a lot more use if they knew the [proposal's] status as it was going along.

Misa: Some of the early publicity had statements from PIs saying, 'well if I get one "Fair" coming back I know that I have to resubmit the proposal so we wouldn't wait for the proposal round'.[6]

Wendling: There was a lot of discussion about what information – yes, we could do that today, tell things like status as it's going on. It got refined later. I think we did tell them if [a proposal] was scheduled go to a panel, so they'd leave the program manager alone. And the effect [for] the program manager [was] they wouldn't get calls from a PI, 'what's up with my proposal?' because they could go see if it was going to go to a particular

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[6] Michael Grutzeck (Penn State): "You need practically all 'excellents' to have a chance for funding. Ideally, FastLane would post each rating as soon as it was sent in, and if I saw any 'fairs' I'd know it was time to start working on a revision"; quoted in "NSF Moves Into FastLane to Manage Flow of Grants" *Science* 267 (13 Jan 1995): 166.

panel. And that was to take the heat off the program manager, so that was a benefit to the internal people.

Misa: So that had impacts both externally and internally?

Wendling: Yes. But they'd get that information. They'd know.

Misa: So we have those six points – we hit a bit on the reengineering but I'm still curious about the "functional requirements" document. This document itself has no author and you hinted that you had not written it.

Wendling: No, that's Compuware. That should be Compuware, right? Does it say that anywhere?

Misa: It doesn't say Compuware anywhere.

Wendling: This should be [from] Compuware. I sat down with them. We went over the projects, and these are the six projects I want to do. Give us a proposal to do it. This was early on, but it was at the point where we knew these were the first six that we wanted to do, and we got buy-in, so this was a little down the road.

Misa: This is a very odd document. It's very revealing for what it says. It's a very clear description at a high level of abstraction about just those six things we were talking about.

Wendling: Yes.

Misa: But it's quite unclear who wrote this.

Wendling: I believe this is Compuware after discussions with me on what I wanted to do. They had been working internally in NSF on our systems and they could translate 'we want proposal submission' to here's all the forms we're going to have to cover on doing that.

Yost: Were most of the internal contractors then in DIS or Compuware people?

Wendling: No. We had [a] competitive proposal to work on this. A senior person at Compuware realized this could have a lot of impact on the company and he wanted this project very, very badly. He personally made the proposal in response to our request. So they got the initial work, but it was a competitive proposal and I believe even those days we had a few contractors that were working for us. To keep costs down, what we'd do is compete with a certain group of contractors [that had] previously competed. We'd have a big competition that says send us your proposals on how you would support general

activities here. I think we had four contractors, and then for those four we'd give all four of them all the documents. So Compuware won FastLane and did a great job.

Misa: They had an interest in doing this. Did they also have prior experience working as an NSF contractor?

Wendling: Yes. They knew the system.

Misa: They also had a track record with you, and had done acceptable or solid work prior to that point in time?

Wendling: Yes.

Misa: Were there any other external contractors that we might want to track down? Or did Compuware really do the bulk of the work?

Wendling: In the beginning [Compuware did] the bulk. Yes. [pause] I've got to think about this. There was probably some modifications needed to other systems; if those systems were developed and maintained by other contractors, the other contractors would have to make the adjustments. [[see also later discussion on Compuware and other FastLane contractors]]

Misa: If you do a Google search "FastLane and Compuware" some part of their publicity is citing FastLane as one of their achievements.

Wendling: Yes. They did a good job. Their Project Manager went on [to other things] and I'm sure he made a fortune. [laughs] The onsite manager left to go to one of the book companies. Working on this project meant the people were very valuable, and so we did have people leaving. There is one or two left here. Rich Schneider who is now an independent contractor, he was with the original Compuware group.

Misa: Rich Schneider?

Wendling: Yes. And he's right now actually a contractor for the budget office now.

Misa: I'm writing this down.

Wendling: Oh, he reminds me of stuff I forget about the project. He goes, 'Fred, you were crazy you told us to do this.' And they didn't have the file transmissions. He said, 'Don't worry it will be there.' So they were developing it, going OK we're waiting for this file transfer. [laughs]

Misa: Can you give us a sense what kinds of tasks did Compuware end up doing then for you?

Wendling: Everything: purchase of the hardware, setting up the system, developing the software, functional requirements, meetings to discuss progress and they'd go, 'On A1 we did this, on A2 we did this, on A3 we did this.' In the very, very beginning we hit some technical issues that we had to resolve, and then later on the problems were spread out, problems we had to solve. Some of the initial stuff was smart forms – that's what we called them. And in the early days I think everybody faced the same thing, and I think everybody invented the solution on how to do this. You could capture the data coming in fairly easily. So a PI would fill out a form and maybe five of those data elements are on the next form. Some of the benefits to the PIs [were that] we wanted to never ask for them to enter something twice. So if they enter it here, make sure you show it over there. Don't ask for it again.

Misa: Names of PIs, for instance, or addresses that appear in more than one part of the proposal.

Wendling: Yes, we'd populate that part of the form automatically. And immediately was, 'Oh we have to do smart forms which means we have to do the programming to send them back – write a program that will send the html back to them with the data filled in. The original Mosaic – I mean html anybody can do, the basic html – but the forms and capturing the data and then displaying that data had to be done programmatically. That was the first thing. We got to do smart forms. How are we going to do it? OK we'll do it programmatically. We're going to have to create it and send it out there. So it became obvious very soon that they were all going to have to be smart forms.

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Misa: Because originally Mosaic didn't have smart forms, it was a more or less empty shell?

Wendling: Well, to get that data and fill out the next form. It sounds easy now, but back then it was a big problem! [laughs] They filled out those three fields and sent it to you, 'OK we can capture that and store it in the database.' But on this next form they said, 'Oh go to that form' We don't want to give them a blank form to fill out. If we have the data, go to the database, find out what it is, and when you present that next form, fill out those fields for them. And like I said, I'm sure everybody who is using this invented it at the same time on how to create these forms and so you have programs creating html is what it is. So we had static pages and these smart forms, and I think we ended up with one static page and that was the first page. After that it all had to be programmed, so you had a program generating what went back to the user. This is pre-cookies [so] keeping track of who's doing what, and where they are, was a big problem. 'Back' button was a problem because people would hit the back button and lose everything they just typed. You know silly things where you could not intercede when they hit the back button to store everything before you went back. This is the early days. So you know, 'Warning! Warning! Do not hit the back button.' If you spent an hour filling out your budget page and hit the back button, you lost it. [laughs] Everybody had to learn. I'm sure every PI lost at least one form. [laughs] We had warnings all over place, don't hit the back button; or we got rid of the back button, that was an enhancement request to Mosaic. We were pushing the edge on Mosaic through all of this, and I even found a letter we sent, a

current list of problems we need you to fix, so that [Mosaic] would work on FastLane. And because NSF was giving them funding, they were very receptive to request for changes to the software.

Misa: So there is a relationship between your effort here at NSF, Compuware working closely with them, but also the Mosaic group. It's a three cornered hat.

Wendling: It's the same as with 3Com on the networking. We had a close working relationship with our vendors, so if there were problems we could go to them. I could call Bob Metcalfe and go, 'Bob, we got a bug. We need this fixed. It's not working.' It would get fixed. So it's the same with Mosaic: we're developing this, we've got a problem. One of them that perturbed me was we were doing the budget form and lots of input fields. I don't remember if it was just for one year or if up to five years was on one page, but Mosaic came out with a new version of the software and [where] we needed like 250 input fields per form, they cut it down to like 140. And I go, 'Wait we already designed the form, we're ready to go, and you cut down the number of input fields that are allowed.' And they go, 'Well we didn't promise you could always have that many.' [laughs] And then we go, 'We need it fixed.' They fixed it. [laughs]

Misa: But that's a crucial piece of software that you don't have absolute control. Negotiate your needs and the Mosaic people could respond to those as they saw fit.

Wendling: Yes and get it prioritized. After a while everybody was interested in Mosaic. Larry Brandt started interagency funding of that to do enhancements to the project, and he got money from all sorts of agencies. [The] cross agency effort to pay for development and it just got overwhelmed very, very quickly. I remember talking to Joseph Hardin later and it was, 'What are you going to do now? Mosaic is out of there,' and it's sold to Microsoft or whatever and he goes, 'Thank god I can go back to my research.' [laughs]

Misa: It became a dent in the universe, and you don't necessarily want that in the middle of your research lab.

Wendling: Yes, a big dent in the universe. [laughs]

Misa: You said that Compuware was involved in purchasing hardware as well as software systems and documents. I'm not sure what the hardware and the software were?

Wendling: The UNIX system – the server that was going to be post-FastLane. I should be careful, I don't know if they bought it or recommended, told us what we need to buy and we bought the hardware, but I think they bought it. They were responsible for A to Z on implementing it, so whatever was needed they'd let us know and we bought it.

Misa: So it was a consulting contract rather than a procurement contract? You were asking them for advice – rather than [say] your giving them ten million dollars, five million dollars and then actually purchasing the hardware itself.

Wendling: No. This was: we're hiring you to implement the system, and I looked at it as everything solvable, we're hiring them just to do it. So whatever, tell us where you're going to go on developing it. So some of the potential problems or you know the contractor [did I give them an email] upfront looking at what they think may be problems where the description that we gave them of what we wanted wasn't that clear or problems that they know they may run into or problems that they need to solve. But within us telling them what needed to be automated, it was, 'Do it.' And if there are issues, decision points, questions, let us know and we will take that and get you an answer. And during the implementation 'We can do it this way or this way,' on some of the re-engineering questions. We'll take it to the internal review committee [FIRCOM]. We'll go to the external review committee to get answers for which way to go on some of these questions, where it was unclear in any of the guidance which way to go.

Misa: I'm trying to get a sense of the time frame. Did you have weekly meetings with the contract people?

Wendling: I was trying to think about that too.

Misa: At some point in time, I suppose you're on the phone hourly.

Wendling: No; a lot of other stuff happened during this time too. I believe I was meeting with them weekly in the beginning. Tom Weber was the Division Director of DIS. I was

the Deputy Division Director of DIS but sort of working almost entirely for Connie on her projects. And so I was overseeing all the FastLane activities, and then Tom Weber heard of somebody from [University of Illinois] NCSA who was available and decided to hire him to come to NSF. That was Dave Garver. Many months into the project, he was hired. Officially he was the first one to have the title of FastLane Program Manager. And he worked for me. He came in and I think it was sold to him as 'this is a research project and we may need to resolve a lot of the research questions that are still involved'. So when he came I think he thought his involvement would be different than it ended up being. Where at that point in FastLane, I didn't see any technical issues or research issues that needed to be addressed. And to me it was building it because the majority of questions had been answered, and the problems that we'd run into would be with the vendors and we could work with them to resolve them. That it was building it. Dave was involved, but I still met weekly with the contractors with Dave, just to make sure things were going the right way. I think Dave was with us a year, maybe less, before he left.

Misa: Was there somebody that then replaced him when he left?

Wendling: Let's see. There's a few things that happened really close together there. The other thing that happened during this is Tom Weber left DIS to go…I think that is when he went to DMR, Division [of] Materials Research as the division director, and I was put in as division director of DIS. So all of the sudden I had 100 percent free time [but] I'm in charge of a whole bunch of stuff that needed to be watched. And for the day-to-day management oversight of FastLane, Carolyn at that time…Carolyn LaLumiere [Miller]

and so you'll see her referenced in some books. She became the FastLane program manager. She was very good – detailed, technical and I trusted her an awful lot to manage the program on the day-to-day. Again to me this was implementation, the hard parts been done and so it was implementing it. And because we had that external review committee it was, 'tell us what you want we're happy to do it.' 'What you think is important let us know.' Because we wanted to keep the community happy. This was a great working relationship. Tell us what you want. We'll add it to the list. We'll ask for funding to do it. We'll fund whatever we can down the list. And it worked very well.

Yost: Can you discuss the make-up of the external committee? How large was it?

Wendling: It looks like you know more about it than I do! [laughs]

Misa: That's this group here. It's referred to in several different ways and in fact even the number is not entirely clear, sometime we see it fifteen, sixteen, up to twenty.

Wendling: I think as we went along some people joined, some people quit . . . .

Misa: We can put this chart as an appendix to the oral history. You said earlier that Julie Norris and Pamela Webb had very important roles.

Wendling: Yes, from my perspective.

Misa: Were there other people that you had either particularly detailed discussions with or rewarding relationships?

Wendling: They would come in for these meetings and give us the input. Bob [Clorin] of Penn State I remember…others are big names in their research, the sponsored research community. Other than that I don't remember; and I was not real familiar with research community. Jerry Stuck was the DIS representative to FDP, the Federal Demonstration Partnership, so he knew the community, the members of the community fairly well. So I'm doing the external committee, we had some intentional design for it and Jerry was responsible for suggesting people for it as well as finding people – wanted to have names. The design was we wanted big institutions, small institutions, public institutions, private institutions. We wanted HBCU, universities, we wanted private companies or non-academic institutions who submit proposals -- [all to be] represented.

Misa: I don't remember seeing any private companies here.

Wendling: Yes, I know.

Misa: There's a great diversity of research places and then some places that we wouldn't normally think about being research places.

Wendling: And I was in touch with Fred Hutchinson.

Misa: It's a research center here.

Wendling: Is that associated with the university or is that separate? I don't know. The design was to get a diverse group of universities in and then Jerry suggested the names. We'd say HBCU and he'd go, 'OK here's three of them.' I'd take all three and somebody would know one of them and go OK let's do this person. So I wasn't too involved in the selection of the committee, but I did manage all the meetings where they came out. Doing the presentations, doing the discussions, doing the voting and ranking on what we do. Asking them before the meetings 'what are your ideas for what we should be doing' so we'd have a list to present to everybody else at the meeting.

Misa: So the main feedback, I think you're suggesting, is this group of fifteen or eighteen universities and research centers would come here to NSF.

Wendling: Yes.

Misa: And then basically have a two day meeting or one day meeting with informal discussion?

Wendling: I think it was one day. And it was usually in relation to an FDP [Federal Demonstration Partnership] meeting that was going to be here so that most of them were in town anyway. I think it was the FDP meeting, it may have been some other – oh sponsored research office what meeting do they have? – Anyway most of them were in

town anyway, and we'd just do it the day before or the day after this meeting that they all showed up for. So most of them could do it with that.

Misa: In the main then, the point of contact here are the sponsored project offices of these institutions; it's not PIs per se.

Wendling: Some of these are PIs also. Sorry I should have said that, yes. So we have both PIs and sponsored research office, financial offices, so if you go through here and find out who they all are and where they all worked you'll hopefully find a combination of all that.

Misa: So there's a diversity of institutions but then there's also a diversity of –

Wendling: roles, yes.

Misa: Besides these day-long meetings were there other ways you got feedback from this group?

Wendling: For these when we had something new, we would let them know it was out there. Please go out and check it, run through it. We very early on created FLDev[7], a development system, and anytime we have something out there 'please go out there try it and see how you like it'. So everything that we did we made available to this group first.

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[7] Hosted at <www.fldev.nsf.gov>.

Misa: Were they doing this for real, or was it more-or-less an experiment and demonstration? Were they submitting real proposals?

Wendling: They were intimately involved with the development and gave us the initial feedback, so when we came out with the system they knew how it was going to operate. Did we force them to use the system? No. Did we ask them to use the system? Yes. So I think they were the leaders in the organization of the system somewhat but I don't know, I can't document that easily.

Misa: Neal Lane in a speech he gave in 1997 called them 'guinea pigs'. He was saying 'thank you for being guinea pigs'. I wanted to see what that meant exactly. It sounds like it was more than a trial or an experiment.

Wendling: There were a lot of hard times. We ran into a lot of problems, lots of bugs, lots of issues that needed to be resolved …like the back button [on the browser]. Every PI screamed at least one time in the early days. [laughs] So yes, everybody was a guinea pig until that could be fixed.

Misa: So one of the question that we wanted to pick up on was the internal process not only initially to sell FastLane within NSF but also to do this more thorough implementation, and you were just remembering the FastLane implementation group.

Wendling: I think it was FIIG, if I remember correctly: FastLane Internal

Implementation Group.

Misa: Can you say something about the group itself?

Wendling: I barely remember this and I think it was down the road to assist in

coordination with the directorates on new things happening in FastLane. During that time

there were lots and lots of changes happening at NSF. We sort of missed that whole part

of the infrastructure at NSF. After the HP systems were here, Erich Bloch joined NSF. He

was former IBM, career IBM. He was credited with the design of the [System] 360

architecture for IBM; while he was at NSF got the National Medal of Technology for

that. When he came there were lots of discussion about what we had and the HP

minicomputer – our three minicomputers, and discussion of whether a mainframe would

do better to serve NSF. Anyway after Erich was here, we ended up getting an IBM

mainframe and moved to that environment. FastLane was initially implemented using

the IBM mainframe as the host – or the database server, for FastLane where the

information was stored on the mainframe during this.

Misa: So that early Honeywell mainframe that we talked about before that was

completely gone, out of the picture?

Wendling: Yes, we went from Honeywell to HP [minicomputer] to IBM – back to

mainframe – and then to client server.

Misa: So there was four different generations then?

Wendling: Yes. And we had an IBM before the Honeywell, but that was before my time.

Yost: The IBM you're referring to is the 3090?

Wendling: 3090 200E [laughs] You know more about what's going on here than I do. [laughs] And that was here for a long time, the IBM. Looking back I personally would have liked us trying to make the client server after the HPs but we went to the IBM. So I think we were, [at least] compared to other places government and private industry, a little late to the client-server game because we were on the mainframe. One of the things that was going on -- at the same time as FastLane -- was moving everything off the mainframe to client-server and I had five years to do that. So that was extremely high priority. A very, very expensive environment to maintain. Contractors saying it costs twice as much to do development in that environment. It was a real pain doing it. Terminal emulators going, PC terminal emulators to the IBM. So a lot going on and a lot of changes impacting people throughout the building.

Misa: That was when you were head of DIS then?

Wendling: Yes.

Misa: So you were really in charge of trying to oversee this –

Wendling: Internal revolution while we're doing an external revolution. [laughs]

Misa: - while you're doing FastLane at the same moment?

Wendling: We were redoing every single system in the building in five years. [laughs] Well, developing the new one and redoing every system in the building in five years.

Misa: Was there any functional fit between the two, or were they really two separate projects that had their own trajectory?

Wendling: Not a lot of overlap because Fast Lane was feeding our systems. I mean that was data input to the proposal system, reviewer system, all that was captured and put into the internal system. Which was nice. We're small and we had the ability to do that which a lot of agencies would, you know if they were going to do it, would pull it in and then using another process get it into their database. Ours was completely integrated from day one, so that when something came in it would actually go to our real production server. If somebody submitted something, our people internally could immediately get to it.

Misa: So when people were submitting in the early stages of FastLane, I was thinking somewhere between 1996 and 2000, just say in that early time frame before FastLane

became mandatory for everyone – if somebody sent in a proposal that got dumped onto what? Onto the mainframe itself?

Wendling: Yes.

Misa: Wow.

Wendling: Yes, but that's our database; that's where you want it. So if there's things like when a university requested funds you want to make sure you go through the financial database, as of that second, how much do we own them? And if we owe them that much, you can pay them.

Misa: Was there a server separate from the mainframe?

Wendling: Yes, there was a FastLane server, but the production data did go to the mainframe. I'm trying to think what all was on the FastLane server. The proposal text I believe was on that. I don't know that's going way back.

Misa: Some kind of Unix machine was actually running the NSF side of the FastLane?

Wendling: FastLane server. [The web interface] yes. [pause] Sun Solaris but I don't [recall] which…

Misa: This move to the client server environment – individual people around NSF would have PCs on their desks. The model would be getting rid of the central mainframe but then having the NSF system networked onto what exactly? Now what was the two halves of the client server?

Wendling: SunSystems. So the FIIG is where we started this. There was a lot of turmoil at NSF because so much was changing so quick throughout the agency that people were overwhelmed with the amount of change. There was like a new system every month or a new feature every month or a new requirement every month – it was overwhelming. NSF survived it. I'll put it that way. [laughs] The management of change was very difficult, and funding was extremely sparse so it was very difficult to do everything and do it extremely well.

Misa: What were some of the management techniques that you needed to evolve then?

Wendling: Keeping contract cost down as much as possible, and a lot of time was spent doing that. It was amazing how much we got done with how little money. Somewhere here I've got the cost that we spent on the initial projects and it was amazingly cheap, unbelievably cheap that we got it done. I think the annual budget was like three million a year for whole development – that was FastLane and internal.

Misa: So that was while you were rolling out FastLane, scaling up FastLane, and also making the move from the mainframe system to the client-server system, you're doing the whole thing for three million?

Wendling: A year. Yes. It was difficult.

Misa: For a whole agency that was a very modest amount of money.

Wendling: That's not much. Compared to today, that's not much.

Misa: In the Weber report [there] was a early estimate, a [forecast] budget figure we saw there of thirteen million for FastLane as a whole. This was FY1994 through FY2000, something like that. It was obviously a prospective estimate. Do you have any sense about the budget figures the way they actually worked out?

Wendling: No but I've got documents. [laughs]

Misa: So we might be able to track that down. It's interesting because the thirteen million again, over that many fiscal years and for a complex project, it sounds like a very modest amount. And at least the way that the Weber budget was estimating it, something about half was being sent on external contracting, and there was amount specifically set aside for hardware, another part a little bit smaller for software.

Wendling: The first year…initially it was $800,000. I think we ended up getting $1.1 million the first year. And then the budget increases were modest and I don't remember the exact amounts.

Misa: Those are figures I'm sure that we can find.

Wendling: But there's also in this the development cost and maintenance cost. Because you are developing – this was [project modules] A1 through A6 and it was like up to 32 modules that we were adding to it. And you're both developing and maintaining the old systems and modifying the old systems to work with the new ones that you're putting out there. The cost of maintenance continued to grow at the same time we've got to spend money on development. Another problem we ran into was helpdesk which was one of the problems with FastLane. The helpdesk was initially pretty small; nowadays it's monstrous, the FastLane help desk. I believe we have forty people downstairs that do both support of internal and external. And that's an approximate.

Yost: Was the first IT help desk for FastLane internal?

Wendling: What do you mean?

Yost: When you started the help desk for FastLane.

Wendling: FastLane was its own help desk. We had an internal help desk at that time. Again a very small one. I think we had eight people for the entire agency. I think the FastLane started at four, went up to six, then eight but very small. We had very, very little money. We were doing an awful lot of work with very little money. And that came to bite us eventually.

Misa: In what way?

Wendling: We didn't get funding that we needed and it impacted the quality of the system, the support we provided, time to fix bugs, time to resolve issues – major issues.

Misa: Was there a set of years where those problems were particularly serious?

Wendling: Yes. And the community noticed. The worst was after Important Notice 123 came out, and that was the notice from the director of NSF that FastLane submission would be mandatory.[8] And then the research community knew it was real, knew they were going to have to do it, and when anything went wrong we got screams.

Misa: I recall it was October 2000 that it became mandatory.

Wendling: That sounds about right.

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[8] "Important Notice: Working Toward a Paperless Proposal and Award System" Posted September 3, 1998) <http://www.nsf.gov/publications/pub_summ.jsp?ods_key=iin123> (July 2008)

Misa: Was that a deadline that was fixed or did it [get] moved at all?

Wendling: That was Important Notice 123, a date was given.

Misa: And that was it.

Wendling: That was it. I think there was some exceptions but I don't remember. Some universities may have had some problems but that was the date. So there was a lot of pressure on us, on the research community, and it was painful and not enough funds to handle everything.

Misa: Ideally, what would you have needed?

Wendling: A lot more. [laughs]

Misa: More money and more staff?

Wendling: Yes. More money, more staff, more contractors, more help desk. And it was a very bad situation.

Yost: You also ran workshops for the external community. Can you speak a bit about those? When [did] those start?

Wendling: We did and, it was how to use the system. We did those all over the place. A lot of it was at the NSF regional conferences. We'd have people at all the regional conferences. We also had people out to visit organizations. I think a private company started doing FastLane training, focused on how to use the system. Even at the regional conferences there were updates, you know, what's coming. What's being introduced. What are we changing over the next year, etc. I didn't do those. People or staff in DIS would do the presentations. Evelyn F. Baisey-Thomas did a lot of those.

Misa: How do you spell her name?

Wendling: B-a-i-s-e-y.

Misa: So can you give us a bit of a behind-the-scenes perspective on the zero hour, this October 2000 implementation, and then also maybe the aftershocks from that. Prior to that point in time FastLane had been encouraged and it had been voluntary.

Wendling: In some programs it was actually mandatory for a few things. If I remember correctly for specific solicitations I think we made it mandatory. Project number 7 was nominations for the Medal of Science which was an actual proposal where they could submit the entire content. So we were receiving full submissions for the Medal of Science. But before that there was a lot to do on infrastructure, helpdesk. There were still problems with PDF. There were problems with printing; there were problems with

access. As more people started using it there were problems with response time. We had lots of problems. [laughs]

Misa: Can you say a little bit about the decision to adopt PDF?

Wendling: Yes. That was a very nice elegant solution and NSF took a lot of heat for that. It's similar to Mosaic that covered various environments so you had Mac, Unix, DOS taken care of with faithful – in the beginning not perfect – but faithful reproduction of the proposal in multiple environments, and being able to print it with it printing almost identically from all the systems. So it sort of solved that problem. Again we developed a good working relationship with Adobe and went out there and had some good discussions with them about using this and [they were] very supportive. We ran into problems. Other agencies were killing us on this because we wanted …NSF would have liked other agencies to join us and use the same environment, same systems, same interfaces, whatever, as we were using. As FastLane –

Misa: Sorry, just to be clear, other agencies, Department of Energy, Department of Justice? Outside of NSF, within the federal government.

Wendling: Yes.

Misa: This interagency network was also looking at streamlining or making electronic proposals?

Wendling: Yes. Well NSF started doing it and everybody started to notice. And we would have liked them to join what we're doing. There was a very serious pushback where everybody wanted to do it themselves, and [so they] found every problem they could with FastLane. The Department of Education wanted the project stopped and was very vocal about it. Because we were going in the wrong direction. In particular because we were requiring use of a third party software [i.e. Adobe's PDF]. I don't know if that sounds familiar with the current environment [laughs].

Misa: The [objection was the] proprietary nature of Adobe, then, that people had to buy this particular version of Adobe to submit proposals?

Wendling: Yes. And the Department of Education representative thought that was absolutely horrible, and NSF should be told to quit their project because they were requiring universities to use that third party software. It was bad. So we got complaints from them. NIH was a little different. They're called the whatever pound gorilla [laughs] in research funding and they very much wanted to develop their own system and have us use their system. And the more successful FastLane was, I think the worse it got. The more FastLane was out there, the more complaints we got from other agencies. I mean we were so far ahead of what they were doing or could do that it would have taken them years to catch up, so there was a lot of desire to stop the NSF [from the] Federal government.

Misa: Was the proprietary nature of PDF the chief complaint that the other agencies had?

Wendling: That's what Education did. [With] NIH – it was 'our proposals are different, we get them in in a different way, we don't require budgets, we get the final budget later'. Everybody had their reason for not doing what FastLane did and I think most of it was the NIH syndrome: Not Invented Here. I think everybody wanted to develop their own system. And they did start doing that. Education developed theirs. ONR developed theirs. NIH developed theirs. To the point where the community is screaming and still is. Too many systems, they have to learn too much, and why can't you guys work together?

Misa: Adobe has become a standard. We all accept it now. But at the time –

Wendling: NSF picked a lot of winners. [laughs]

Misa: At the time was there any practical alternative that somebody from the Education Department could have said, 'Well, no, instead of using proprietary software A, you should have used – open source was not around – some alternative? Did they have some alternative in mind?

Wendling: No. They didn't. No. And like I said a lot of this is they wanted to develop their own [agency-specific system] and were coming up with every excuse possible to come up with their own. So that was one of them.

Misa: It puts the cart before the horse but would PDF, hypothetically, have been a solution to the compound documents that the EXPRES project was trying to grapple with?

Wendling: I have to go back to those days. You could create PDF non-editable which means if somebody was on a Mac they could create a PDF; somebody from a DOS machine could pick up the PDF and display it. Could they edit the PDF? I don't know.

Misa: You know even today, it's not [easy] to edit PDFs. That's true.

Wendling: It was a way you could view things but not collaborate across a system. So getting a faithful reproduction to the reviewer, yes. Being able to use three different systems to develop a PDF document, I don't think so. But that was a long time ago. Actually, PDF was a big problem. One of the big strains before full implementation was the cost to the universities to purchase that. And that was one of my screw ups [laughs] that Craig Robinson resolved. In that we did require PDF, and to do that people were buying PDF creator from Adobe and so lots of copies got sold. Craig Robinson got involved and started to look for free PDF creation software, and actually found a company that had written a product to create PDFs substantially cheaper than Adobe. What we ended up doing was creating PDFs for people. Send us your document, we'll create the PDF for you, send it back to you, you can check it to make sure that it's OK. So we did it free. Now I never thought Adobe would ever allow one place to create PDFs from anything and send it out free of charge. The estimate on lost revenues, probably...if

you include various offices…hundred thousand copies minimum to create it at whatever

the cost for the creator was in those days; you're talking tens of millions of dollars. And

for them to allow NSF to do it free of charge; losing that type of income is not even a

question I thought about asking. [laughs] But Craig did. [laughs]

Misa: But Craig did?

Wendling: So I will credit him. And he was looking at the software to do it free of charge

and worked with that company to have an agreement people could send it to us, we'd

create it send it back to them. So the cost issue disappeared when we were doing it for

people.

Misa: So as a member of the research community somebody said 'I can't afford Adobe.'

Wendling: Send it to us we'll create a PDF.

Misa: So was there an office somewhere here where people literally were doing this or

was it automated?

Wendling: No, it was automated. They'd get it right back, the PDF version. So that went

a long way because all of the sudden there was not a cost issue. So that was a big one.

Misa: Can you help us identify Craig Robinson?

Wendling: He is now the acting head of the National Science Board Office. Dr.

Robinson. He came to us from – what's the NASA research place in Alabama?

Misa: Huntsville?

Wendling: Yes. He worked there as a research scientist and got into computers.

Yost: Marshall Space Flight Center [Huntsville, Alabama].

Wendling: Very intelligent person. He did that. Another problem we had, well, help desk

response times were horrible. Printing was a major issue. Getting faithful reproduction

back especially in color. People [were] sending us pictures or charts that were critical to

their proposal with color. In those days we were printing the proposals here and sending

them out. And PIs were complaining that the reviewers weren't seeing these important

pictures or whatever in color. So please send us whatever it was, eight copies, in color of

any of your color pages and we'll put it together. So that was a major problem.

Misa: You were taking in proposals, printing them here, and sending out paper copies

rather than sending out electronic ones?

Wendling: Yes, we got some concerns from universities: please do not transfer the cost

of printing proposals to us and in particular color proposals. And some of this [with] early

day network [spends] getting a whole proposal over the network wasn't trivial. So having them read it online was back then not that easy. And most wanted to get the paper copy of the proposal and that's what the external review committee [requested] you've got to send us paper copies.

Misa: It's a funny set up because under the old paper based system, universities were taking on the cost of printing, and if somebody was submitting a color proposal than he or she I'm sure had to get the university's permission to do color printing. Those were sent to NSF and then parceled out. And here there's a shift where NSF is building an infrastructure but in fact taking on some of the additional printing costs.

Wendling: Yes. And I sort of had an internal war. I wanted our administrative services group who actually did the mailings. You know they'd get the list of people to send it to, they'd do the printing, package it and send it out. I wanted them to get color printers. They go, we can't afford it. I go, you've got to get color printers. We can't afford it. Yes, you can! [laughs] So we had an arbitrator work on that issue, and it ended up we asked the universities to send us the color pages.

Misa: And just interleafed the color pages.

Wendling: Yes, what a pain in the ass.

Misa: Yes. The flow of paper itself I'm sure was staggering.

Wendling: Yes, when I first came to NSF in the old building major deadlines you'd have mail carts, you know the canvas mail carts, and sometimes they would be like 80 deep down the hall, lines all around. It's amazing the paper that used to come in and out of here. And our mail costs which is one of the ways we can actually [get] savings, and it's probably documented somewhere in that report.

Yost: What was the response to having to buy the PDF among the universities?

Wendling: One of the problems was this was one of those 'the rich getting richer and the poor getting poorer.' Anything that costs money we had to be very careful about. You know the Harvards and MITs can afford it. Can the four-year colleges afford to buy that for their important educational program that they want to do for their students? So anything that costs money was always an issue. It was more the smaller universities [that] had a problem. During the implementation there were a lot of concerns – is this equitable? Are we making the rich richer? The big universities, is this giving a preference to them? And that was a concern all the time when we were developing it. Because the big ones could adjust, very agile. The little ones – I mean just to send somebody to a conference to learn how to use FastLane and then come back and teach it, that's money. So that was a concern through all of this and one of the reasons that we did do the regional conferences. We'll come to you and teach it. There were some special presentations at four year colleges, community colleges, HBCUs on FastLane. We made an effort to hit conferences that targeted those groups to do FastLane presentations. So

cost was an issue and we wanted to do this free of charge at no cost to the university, but in the beginning the Adobe was difficult.

Misa: Were there other ways that you tried to respond to the concerns about equity between the MITs and Stanfords of the world and the lesser well funded places?

Wendling: Well, some of it was funding from the CISE directorate in hooking up – you know the original work of hooking up universities. They funded the initial [network] connection to a lot of universities that would be put in the grant to get that connection. Connected as part of some other project and those would get funded. Some of that was research money. One thing that happened is Jerry Stuck went to do a presentation at an HBCU financial officers – or CFO meeting – about FastLane what's happening there, where's it going and mentioned that NSF is very concerned about making sure it's equitable, this isn't putting anybody at a disadvantage – talking about the issue. And the response he got from the CFO's at the HBCUs was 'this is our problem not yours. We have to get in line with the modern world; and it's not only for you, it's for everything else. Don't worry about it, we'll be there.' Which was very nice. That was quoted many, many, many, many times and really helped. [laughs]

Misa: If you're part of the funding stream then you're part of the research community. Universities across this country depend on that absolutely, and if you're cut off from that then you're cut off from a whole set of really important resources.

Wendling: But at some point the universities realized this isn't just for federal dollars; this is for education and resources over the internet and communication over the internet and collaboration. NSF became a tiny reason for getting on the internet and networked within their universities that they had to do it. So yes, it was impacted, but they were moving to get connected quickly. There were some infrastructure grants that also were given by NSF for the networking, and we ended up doing free PDF conversion so that sort of answered that one and then it was just internet access. And, for a few years there, it was painful. This was an issue in the government, it wasn't only NSF but other agencies providing equal access to government services to all the citizens. It wasn't just an NSF issue; it was a federal government issue.

Misa: You mentioned Jerry Stuck; is there anybody else who might have a distinct impression or [who] was a little more in the front lines in terms of going out and doing these presentations?

Wendling: Jerry did an awful lot of them. He was FDP. I didn't. I did a couple special ones. But the regular ones I didn't do. Jerry's retired and you can probably catch him on a golf course somewhere – even if it's cold! [laughs]

Misa: NSF from the start seemed to have this idea of wanting to build in many different values [into the FastLane system] and making sure that the process was secure and stable. And equity seems to be one of those things that NSF spends a lot of time at.

Wendling: But I think that's just part of NSF in all of its programs is making sure there is equal access to their research dollars. I think that's just a part of NSF that you don't go out with a solicitation that, in general, limits competition to the big guys. Or gives them a specific benefit over the [other smaller] institutions.

Misa: I'm wondering whether we should close our session for today and continue tomorrow. You mentioned and I just wanted to make sure that we got this recorded that you had found other contractors besides Compuware. Is that something we should pick up tomorrow?

Wendling: Sure. I have to look at that and go, 'What? I don't remember that!' [laughs]

[End of recording 3]

…

Yost: My name is Jeff Yost. I'm here with Tom Misa and we're interviewing Fred Wendling today [20 February 2008] at the NSF in Arlington. Fred, I was reviewing *Customers.com*: [How to Create a Profitable Business Strategy for the Internet and Beyond (1998)] by Patricia Seybold and Ronni Marshak yesterday, and I wanted to run by a couple of statements in there and get your feedback on them. And the first is, I'll quote from that work, "The current FastLane project director Carolyn Miller, reports that every time she went to an academic conference people would approach her and beg her to join the FastLane advisory group. She quickly realized that FastLane was considered a

hot and eagerly awaited project within academic circles." Was that your impression as well?

Wendling: FastLane?

Yost: Yes.

Wendling: It was new, it was different, and I think there was excitement and trepidation about FastLane. People were excited that we were doing things to communicate directly with them. Proposal submission was always the big project that was included but FastLane had an awful lot of other modules, capabilities that were beneficial to the research community and various parts of the research community. So I think there was excitement in better communications, better ability to get information from NSF. Excitement, trepidation – what's the government doing to us and what are we going to be forced to do? How are we going to do? How are we going to learn how to do it? How do we need to modify our system to accommodate FastLane? So I think a little of both.

Yost: The other area that I found interesting was the part of the chapter that discussed security. Seybold and Marshak indicated that, "it was vitally important to the success of FastLane that no one be able to impersonate researchers or university officials." Was that the most critical issue with security?

Wendling: It was a extremely critical issue – there were many issues but that's one we couldn't bring up the system if we couldn't say that there was a secure environment for the proposals and that people couldn't just log on and get to people's information. It's sort of a show stopper. If people thought that their proposals were going to be obtained surreptitiously, they wouldn't be submitting them on line. A lot of the proposals may have patentable items in them, other information that the PI doesn't want to have disclosed, maybe later after the end of the research. It was very well known from the beginning that this had to be a secure environment.

Yost: To follow up a bit on the security issue, you mentioned that data had to be encrypted. Was the implementation of security something that Compuware worked on or oversaw or was it other contractors?

Wendling: I don't know the details. I don't remember the details of exactly how that was implemented. Compuware would be better to talk to on that.

Yost: In the early work on security were there any particular challenges?

Wendling: Well, PINs were part of the security from early on – PIN was the access code to get into the system – and initially we were assigning PINs [to researchers] or we wanted to assign PINs. I believe we were doing the initial assignment. That was a security access to the application where we had to make sure that person got their PIN. We were surprised that the universities in the external review committee said, 'We'd

appreciate it if you'd give us control over the PINs so that we could assign that access to

the people.' And we thought that they were taking on work which we tried to avoid

through all of this because everybody is busy enough. But the universities wanted control

over who at the university had access and [control over] providing that access to them. So

that was very nice. The universities wanted to be involved in who got access, and not

having necessarily NSF deciding who at the university could get access to the system. So

that was sort of a surprise to us.

Misa: There's an interesting thing though because if the universities are assigning PINs

then they have some sort of 'write' capability into NSF. Is that right?

Wendling: Yes.

Misa: So that means somebody from the outside has the ability to write information into

the NSF database -- that's one of those portals into what otherwise you must have

thought of as a secure system.

Wendling: I forget what we called them. They were like the super administrators for

their organization and they could create that. But that's similar to submitting the

proposals. I mean both of those are very important information that's being stored by

NSF and allowing access to store it in our database. I think in the early days we had to get

a signed letter from the institution, on letterhead, saying who is this person that has the

authority to create the accounts for their people. We knew the person had the authority at

the university, and from our end if we had a secure environment it was fine with us that they created those accounts.

Misa: Was there a discussion about the use of the social security number in this context?

Wendling: Back in those days, social security numbers weren't [required]; social security numbers were requested not required. As far back as I can remember, PIs could refuse to provide the SSN and NSF would assign an alternate SSN to the PI. So it was requested, not required. I'd say probably 98 percent [of PIs] used the social security number as the identifier.

Misa: You mentioned last time just briefly that reviewers could be from overseas. Were there any modifications or adjustments that you needed to make for access to overseas or international reviewers?

Wendling: The one concern we had that I remember is bringing down the systems at night to do maintenance backup; in those days backups were three to four hours, or more. So there was concern about people [overseas] being able to access it during their normal work hours. So we began publishing, 'we will be down these hours during the day' and kept that short so that, no matter where you were, [there were] some times during the work day – your work day – that you'd be able to access the system.

Misa: If you're dealing with the world then there is no time that you can't be down in some way. Did you get feedback from international reviewers or was this largely a question of your anticipating the problem?

Wendling: We anticipated that problem and started publishing the times because it was fairly obvious when we were going to do it. I'm sure somebody brought it up in some meeting, 'What about people in the middle of the night.' So that was just publishing when were up or when we'd be coming down so people would know.

Misa: Another follow-up, we were talking yesterday about the relation between NSF and contractors, specifically Compuware, and you discovered that there were some contractors in addition to Compuware. Could you [say] a bit about their roles and how significant they were?

Wendling: OK. Yes, I was going through some paperwork yesterday and noticed the names of a couple of other companies that I didn't remember their involvement [laughs] so I was sort of embarrassed. In looking at it, what it looks like is two companies that I saw referenced were AMS, American Management Systems I believe, and Capgemini. From going over that it looks like their involvement was [with] the internal interface to FastLane. The development of systems to upload and download data back and forth from the FastLane server to the mainframe and to take the information that was provided from the FastLane system and put it into the databases. So AMS I believe had responsibility for the NSF financial system, so if there were transactions from FastLane that needed to

go to the financial system they developed the interface on the mainframe to do that. And Capgemini I believe was responsible for other internal systems, so they would do the interface for the systems that they developed and were maintaining on the mainframe.

Misa: So it was largely a question of internal mainframe to FastLane server communication.

Wendling: Yes, communications and adding the data to the database.

Misa: FastLane was used [to make] financial transactions between NSF and universities requesting funds.

Wendling: Yes.

Misa: These must have gone through established financial networks?

Wendling: That was a cute one because we loved saying we spent two billion dollars over FastLane. You go to a conference, 'yes, we spent two billion dollars.'

Misa: Dispersed two billion in research money – it's a lot.

Wendling: It sounds [laughs] intimidating but it's really not that intimidating. Our systems keep track of all the rewards that we've made to institutions; and institutions –

the big ones – get paid for a short period of time, a week or two weeks at a time. The

university will submit a request for funds for the projects that they're funding. NSF can

go to the computer [and] find out all their awards: How much we owe them for the next

period that they're allowed to bill for. And as long as they request less than they're due,

we'd say, 'Okay, it's approved.' Which is what we used to do via email or paper prior to

that where they'd email requests for it. So the system could figure out what we owed

them, then NSF actually sends transactions – Treasury Department sends the money to

the institution. Since that payment location was predetermined, predefined, we knew if

we were making a payment exactly where it was [going]. And if a payment was

erroneously made we knew exactly where to go and find it. I'd say that should never have

happened, but I'm sure there were a few occasions where it might.

Yost: So they were preauthorized accounts of the university?

Wendling: Yes, and those were established so if we were sending money we knew

exactly where it was going. And it's actually the Treasury [Department] sending the

money not NSF.

Misa: So your interface through FastLane was not to a university directly but to the

Treasury Department and its financial systems.

Wendling: Well, the cash request capability in FastLane was the university financial

office logging on and saying, 'We need this much money for these projects.' So we'd

have to say, 'We approve your request' and then tell Treasury to pay. So it was very secure in that it was Treasury direct to the university.

Misa: You said to us yesterday that you were in favor of automating all transactions that had a volume greater than 10,000 per year. Was this one of them that had a high volume?

Wendling: I don't know if it was selected for that reason or because it involved the financial parts of the university. [pause] I'm trying to do a calculation real quick, how many requests we get…

Misa: Big institutions every week, multiplying it by the number of big institutions. It would be thousands I guess.

Wendling: Yes, it would be over ten thousand but I don't remember if it was selected for that reason or not.

Misa: The alternate reason would be to have buy-in or a positive benefit for the financial side of the universities so therefore the financial people at the university would see FastLane in a favorable light.

Wendling: And begin using it. It's not only favorable light but to get the buy in because financial people when you're doing proposals would usually be somewhere along the step. So if they didn't have the infrastructure to get the proposals internally or to access

them internally, they'd be a bottleneck in proposal submission. So if we could get them something, some reason to connect to the internet, get the infrastructure in the financial office, they'd be better prepared to handle proposals within the university.

Misa: We were talking yesterday specifically about the concern about equity and especially the concern about smaller versus larger institutions. I suppose that may have been an issue here as well for small institutions not having the IT infrastructure on their own financial side.

Wendling: The major institutions were the ones that did the [Treasury] cash request. The smaller institutions were paid differently. They would be paid upfront, or in large sums on longer basis; the smaller ones did not do the online cash request. Their awards were handled differently.

Misa: Were there other examples of a hybrid system?

Wendling: On the cash request and cash payments that was not FastLane. That was done before FastLane where smaller institutions got paid differently than large institutions. Large institutions that got tens of millions of dollars we did not pay that upfront to them because they didn't need it and the Treasury doesn't like the government spending money that's needed a year from now. [laughs] So that's why it was paid out in increments. That change was not for FastLane, we were just emulating the system that was used before that. And your question is were there accommodations in the systems?

Misa: This goes back to our interest in trying to understand the mechanisms that NSF used, and the FastLane project used, to deal with the very well-funded institutions and the more modestly funded institutions. In any of the other six components [A1 . . . . A6 above], were there possibilities where an institution had special arrangements or special permissions or some other way that the system was made somewhat more flexible to them?

Wendling: I can't think of any offhand. Given that once you're connected to the system you have equal access, it was more getting the access, providing the equality once they had access. They had access to all the things that the big institution had. So in a way you could say that could be beneficial to them, that they were treated the same as the big ones and could use the same system as the big ones. I actually remember going way back, small institutions saying it was nice to have their proposals submitted via FastLane because then they look the same to the reviewer. And reviewers could tell a FastLane proposal when it was printed. In a way FastLane provided that capability of a level playing field because you just needed access to the internet.

Misa: Once you got in [it], then, your proposal looked just like Carnegie-Mellon's, even if it was [prepared] on an older dot matrix printer . . . .

Wendling: Yes. Sent in by paper and copied and bad copies. [laughs]

Yost: In the early directorates that were used as a test for FastLane, I believe KDI [Knowledge and Distributed Intelligence] was one in 1998, were there any exceptions granted to smaller universities, or HBCU that didn't have sufficient internet access to submit it?

Wendling: Not that I remember but I think there was always an out, 'If you have difficulty submitting over the internet, please let us know.' That was going back to the early days that there was sort of a general out, if you're having problems or difficulties let us know and we'll handle it on a case-by-case basis.

Yost: Did that continue for a period of time?

Wendling: I think it continues today. When there's a hurricane those universities get an extended deadline for their proposals. Power outages, other problems, certain areas will get an extension for a submission of proposals. Virginia Tech last year [after the 16 April 2007 shooting] got an extension on all their deadlines. There's flexibilities in the system.

Misa: If NSF decides to change the proposal deadline say for Virginia Tech so that's not unique to FastLane but it's also consistent with NSF's overall orientation towards the research community.

Wendling: Yes.

Misa: Can we go back, you said that there were some parts of the email story that you told us that you wanted to complete or more fully explain.

Wendling: Yes, again I'm embarrassed I forgot a whole generation of email systems here. [laughs] It was with us for a long time. And that's the system that was used after Dialcom, I had forgotten about it. We had a system called Note, a UNIX based system that was the predecessor to cc:Mail. That system we gave access to everybody in the building.

Misa: And how would people gain access to that?

Wendling: That's also a time when we were installing a switch. Going from the internal modems, 9600 baud modems, to a smart switch in the computer facility, everybody wired to that from their terminal and later their PC. And from that switch they could select which system to go to, to the HP system, mainframe system, Note system. They had higher speed and direct access to all the systems that we provided internally. I believe that it did have a dial-in capability via modem so that people could access it from home to create email via modem.

Misa: So that facilitates NSF staff members working from home or telecommuting.

Wendling: Also on travel or whatever. And I believe we have some 800 numbers for dial-in for staff.

Misa: And so was that a separate UNIX system?

Wendling: Yes.

Misa: One of the Sun Solaris units dedicated to that?

Wendling: I don't know. Mike Morris supported the Note system. I don't remember what the system hardware was.

Misa: The program was called, "Note"?

Wendling: That was our name for it but it was a basic UNIX email system. Yes. Mike could give us the details on exactly how that operated.

Misa: We have some questions about the organization and practices and the management of FastLane. FastLane existed over a number of years roughly fiscal 1994 to about 1999 and then was implemented in 2000. Were there a set of progress reports? How did the FastLane effort report its achievements, its progress, its different phases to NSF management?

Wendling: I think a lot of different ways. The director of OIS, Office of Information Systems – DIS whatever it was called at the time – was a member of the senior

management group at NSF, [who] participated in all the senior management meetings, usually weekly, where progress issues could be discussed. I was looking through my papers there, especially in the beginning, there were update presentations to the director and deputy director. I'm going to give you a paper that actually was the presentation with my notes on each of the slides. There were annual accountability reports that the government required; FastLane was always included in those. And that's not only internal but external accountability report to OMB. Various groups the FIIG, the FIRCOM were involved and [there was] accountability to them on what's going on… In the budget requests there's always here's what we did last year and here's what we plan to do next year. So that's another place where everybody in the agency, [including] senior management sees what we're doing and what we plan to do. There was an ITCC, IT Coordinating Committee, that was formed and all projects went to the ITCC for review and approval. That happens today, CIO [Chief Information Officer] advisory group where all projects for the next year or the year after are taken to the CIO advisory group for review and approval by those groups. And besides that everybody's using it [FastLane] daily [laugh] so if they've got a problem they'll let us know it's going on. So that's accountability on a daily basis when people both internally and externally are using it.

Misa: You know there's a paper trail that we could find with some of the presentations, simply again getting a big picture of those stages and that would be helpful in terms of pinning down dates and overall progress and seeing the dynamics of the project.

Wendling: Yes, I've found bits and pieces and I was going to look and see what else I have at home. But I have some here today that I can give you that are samples of that.

Misa: Great, having a sense of the whole as well as the parts is very helpful. The paper trail here would be quite helpful for that.

Wendling: Yes.

Misa: I had an email from George Strawn [NSF Chief Information Officer] when I was doing preliminary research in November of 2006. It was George [who] actually told me your name first. George wrote this to me, he said, "Fred Wendling wrote the follow-up technical approach document" – the follow-up to the Weber Report that we talked about – and also was involved with "selling the project to Neal Lane". That technical approach document, do you recall that?

Wendling: No. [laughs] And I don't know exactly which document he may be referring to. The technical approach was – and I don't remember writing it up but we discussed using a web interface to implement it and I think that may refer to a document the contractors may have done for us on here's how we intend to implement the various pieces together, the Unix server, the interface to the mainframe. I don't remember doing one. And also the other part of your statement is the selling with Neal Lane occurred before the Weber document – not as a result of the Weber document – and we talked

about that yesterday that Neal approved the project but wanted buy in both internally and externally and that's why Connie had Tom [Weber] do that document.

Misa: When did the name FastLane emerge?

Wendling: That's a fun one. After the project was approved, Connie said we get to name it. And she and I went back and forth with about fifty email messages and there must have been about eighty different names acronyms that we came up with and I kept on feeding her 'I don't like this because it uses this word, I don't like that because it uses that word.' I think I include in the email there, where Chuck Brownstein wanted it ending in a V for some reason and it got a little funny.

Misa: Do you remember any of the specific names?

Wendling: Yes, I've got some here. [laughs]

Misa: FastLane has become an icon, but it's nice to know that there could have been a different name.

Wendling: There were so many different names that we came up with. I used to have all the emails that had all the various names that were suggested and I still have a few. So I don't remember offhand but I did print it out. Connie was going to have a meeting with Neal Lane, [and] she goes, 'Fred we got to come up with a name – (it had to be right

now) – and so I gave her two of them. And one of them I said was FastLane and she

chuckled – nope. So she had her meeting with them and after the meeting she goes, 'Fred,

he went for it.' And I go, 'what?' 'FastLane.' And she said what he said to her was,

'Connie if it's successful it was named after me; if it's a failure I had nothing to do with

it.' So when you see FastLane the 'L' is always capitalized because it was named after

him.

Misa: FastLane, two words but conjoined.

Wendling: Right with the capital L.

Misa: You said that you gave Connie at the last moment two different options, do you

remember what the other option was?

Wendling: I don't remember what the other was. It didn't have his name in it. [laughs]

But there were two I gave her that day. She didn't think he'd go for it but he did. [laughs]

Misa: We've looked up 'FastLane' on the internet, and General Motors among other

people use that very same term. I don't whether they're aware of NSF's FastLane but

they use that also in their electronic commerce.

Wendling: We looked around. I made it a point to check on the internet for FastLane as a

word because I was concerned that somebody would have it copyrighted or a trademark. I

couldn't find anything so there was some initial concern. I don't know when they [General Motors] came up with that.

Misa: I think it's recently. The last couple of years, not the 1990s at all.

Wendling: Because I was afraid if it was a trademark and we start using FastLane somebody may go 'no you can't use that; that's our product.' So at the time I couldn't find anybody using FastLane as a product title or a trademark or anything so I thought we were clear.

Misa: Another question that's related to the internal promotion of FastLane but also to external representation, is the question of economy or efficiency and what FastLane was intended to do, or what the goals were. There must have been concerns about the economy or efficiency of the new system.

Wendling: Yes, and there were tradeoffs. Some things improved the process, we hoped speeded it up. Some of it's obvious: there were increases in speed – just the communications getting back and forth instead of mailing things being able to get reviews back electronically instead of via paper. You know there's some obvious areas where the speed in the transaction improved but did it improve the overall time to decision. You may speed up an awful lot of little processes but if the whole process isn't connected, [the question remains] did you show you speeded up the process? And part of the benchmarks we used was just the utilization of the systems. How much was it being

used. In the early days when it was optional, to have universities move to it was a good sign and universities were talking about the benefits to them. In some of the submission we did for awards, we did quantify some of the improvements. I think the nomination for Smithsonian [Computerworld/Smithsonian Institution Award], included some metrics for improving speed or cost savings. Did we spend a whole lot of time doing that? No. There was a study that was very helpful that was done by a program manager here. Here. David Schindel did that one – the cost comparison of panel review with and without FastLane. And this is a regular program manager just on his own decided 'I want to do this' [laughs] to see what impact it has and are there cost savings. So he did this analysis. This was well distributed throughout NSF where he documented the impact on his program and cost savings.

Misa: It looks like a very detailed document. There's specific percentages and then just at the end there's tables, there's a dollar cost and an Excel sheet with four columns and thirty or forty different lines.

Wendling: Yes, and he distributed this widely to show the impact on his program and to show the benefits of using FastLane.

Misa: Is that a document that we could add to our files?

Wendling: Yes, this stack is for you.

Misa: Marvelous. We've seen bits and pieces and we have anecdotal evidence for somebody who's trying to look before and after and look fairly at the data.

Wendling: There were things like this that helped tremendously in selling it internally as beneficial. The university, since they didn't have to use it [before October 2000], their use of the system also demonstrated that they saw benefits in using it. Not that quantifiable other than utilization of it and benefits to them. Now that I think about it there were discussion with the external review committee about cost savings to the universities and there were discussions about that. And also there were places where it may increase their costs. We would have concerns; they would have concerns. One I mentioned yesterday was printing proposals at universities. There was some concern about that.

Yost: There was a precursor to FastLane to distribute information that we found reference to called STIS [Science and Technology Information System] in which information on new funding opportunities, grant proposal guide, things such as that were available electronically. I think it was at the beginning of the 1990s and I saw reference that it was saving the NSF a million dollars a year in postage.

Wendling: Publication costs. Yes.

Yost: Can we talk about STIS?

Wendling: Dr. Ruta Godwin I believe was the person who did that on our staff if I remember correctly, making that system available, and I really don't remember the details of it. I don't remember having detailed involvement in that.

Yost: Was there anything from that that was learned in the development?

Wendling: Not that I remember. [laughs] I mean everything that happens around you shapes where you go from there so I was aware of it so it…everything does impact where you go because you do learn what works, what doesn't work, how to communicate with people. Directly, not that I remember. Indirectly, probably.

Misa: The name that you said?

Wendling: I think it's Dr. Ruta Godwin. And I believe that was her project.

Misa: If I remember right that was Gopher-based so it was hierarchical pre-web but very successful with certain types of activities. There's people even today who still love their Gopher.[9]

Wendling: I had forgotten about that. [laughs]

Misa: Was Gopher ever discussed at NSF as a major infrastructure for doing something besides this?

[9] http://en.wikipedia.org/wiki/Gopher_(protocol) (July 2008)

Wendling: I don't remember; I wasn't involved in that at the time.

Misa: It was not part of the technology assessment that you were doing?

Wendling: No and I'm trying to think what year that was and what I was doing at that time. I may have been in another job as branch chief or computer center branch. I did move around, so it may have been on one of the times I was not involved in that type of work.

Misa: Gopher seemed to be discussed in the early 1990s but by 1994 things looked very, very different.

Wendling: Right and I don't remember.

Misa: Could I ask you about FastLane's awards? You've mentioned the Smithsonian award and I've got a list of at least four major ones. The Smithsonian award I think was in 1997. There were two other awards in 2002, the president's quality award and then also in 2002, the Government Performance Leader award. But the one I think that you were most involved with in 1996, when the FastLane project was the winner of a National Information Infrastructure government award and that received wide publicity and made you into something of a public figure.

Wendling: Oh, FastLane. [laughs] It made FastLane a little more public. That was a new award. I think it was created the year before that. That became very prestigious. One of the winners that year was Bob Ballard [renowned oceanographer for his Jason Project's Undersea Internet site], who I really didn't know that much, was one of the other winners that year. It was an honor to meet him at the awards ceremony, hosted by [sportscaster] Bob Costas and I didn't realize how short he was [laughs] standing next to him. So that was very nice. We heard of the award and it was one of these 'why not apply for it'. Connie in general she didn't like spending the time to get self – to get congratulations for the work she did. She didn't go after awards but this was one of them that we saw, and we have been even asked or sent the information specifically by somebody that we should apply for it, because normally we wouldn't have just applied for an award on our own.

Misa: You put together some sort of documentation, submitted it, and then obviously were chosen to receive the award.

Wendling: Yes. They had panels of some extremely senior people in government and outside of government as the committee reviewing and selecting the awardees so it was done very nicely. For that one actually it was a two-day thing. There was press conference the first day and I handled that for NSF; for the actual awards and speech Neal Lane attended and accepted the award for NSF. And I think somebody's probably got a video of that around.

Misa: That would be fun to see.

Wendling: I think there's a video of that.

Misa: There's a speech, I think I mentioned it yesterday, where Neal Lane gave an "all-hands" meeting in January 1997 quite close to the award.[10] He was very proud of it and made many nice statements on behalf of the agency and thanking everyone so it must have been a moment of some high visibility. Did you have a sense of making a big achievement, being brought to not only agency-wide notice but national notice?

Wendling: No. That's one of those – it was sort of strange and even today it's we're doing our jobs. We're just getting done what needed to get done. We were using some interesting tools but we were just doing the work of the government and creating systems that universities can use. So no. [laughs] Not at all.

Misa: Then these two other later awards, again in 2002 the President's Quality Award and E-Government Performance Leader Award, those I think were distinguished but not quite with the same profile? Is that right?

Wendling: Those were – I was not involved in FastLane at that time. I was in the front office of [IRM] and the office of CIO at that time so I was not involved in those. I don't know – you'd have to ask Carolyn.

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[10] http://www.nsf.gov/news/speeches/lane/nl97-ahm.htm (July 2008)

Misa: Carolyn Miller?

Wendling: Yes, she was funded by us.

Misa: OK.

Wendling: There was also government technology leadership award – I'm trying to think of the other ones. They are hanging up around here. I can show them to you on the way out.

Misa: OK.

Wendling: I think I showed them to you last time you were here. And I don't remember when those were but they were earlier on in the process when we were just starting. Early into FastLane.

Misa: I'm wondering if it's a good time to take a break. We have some questions about the broader impact of information technology on NSF. That's a different set of conversations so maybe we should take a break now.

Wendling: Sure.

…

Misa: Judy Estrin is a name that popped up. She's connected to Bridge Communication and became a vice president of technology for Cisco. My notes from when we talked back in November 2006 don't explain enough about her.

Wendling: Judy was part of the networking infrastructure discussions back in the old days. We had 3Com for networking but the networks were limited to 1,000 feet or 2,000 feet. The Ethernet had some physical limitations so you had to start connecting those together. One of the division directors here was Thelma Estrin and her daughter was Judy Estrin. And Judy was at Bridge Communications; her company was making boxes to connect Ethernet segments, the first bridges to bridge separate networks. I had mentioned how we had to wire the old building: we had to connect an awful lot of networks together to make one big network. So we were forced in the early days to start bridging the various networks. So we got involved with her company both because they had the best product out there and because she was the daughter of an NSF division director, [as] it happened to be. So that was a good relationship. We were working with 3Com Bob Metcalfe; Bridge Judy Estrin. I think Connie was out in California. I didn't go to this. One afternoon she invited them both out together to go to dinner or drinks after work or something. And they met each other. And Bob Metcalfe said that was great that you could do that because we're not allowed to do that.

Misa: That being?

Wendling: Meet with the head of a competitor.

Misa: OK.

Wendling: Even though he was president of the company he probably needed permission, but when a client asks us we're allowed to do it. Anyway, Bridge and 3Com ended up merging. [laughs] And Judy and her husband became president, vice president of 3Com. And then she left there to go to Cisco.

Misa: Were there any other people that you remember from the early networking days that we might contact?

Wendling: Connie I think talked to lots of people on various areas, as a sounding board: 'we're thinking about doing this or that'. So she'd be very good to talk to on who else she may have consulted. Steve Jobs, we had a good relationship with [him] and he came out, met with Connie, and I was invited to the meeting. Nondisclosure talking about his next new product and what he was thinking about doing and wanted to get some feedback from us. And that was the Next system, this black box.

Misa: N-e-x-t?

Wendling: Yes. [laughs] So 'I'm thinking of doing this and that' and one of the discussions [with Steve Jobs] was, 'there's this new database company that I'm really

impressed with and I'm thinking of putting their database on the system'. That was

Sybase. So that's the first time I had heard about Sybase, and so because of his

recommendation we looked into that a lot more. And FastLane was actually the first

Sybase database that NSF had. And we ended up selecting that and I'll credit him [Jobs]

with pointing us in the right direction for that one.

Misa: How did you investigate Sybase?

Wendling: Looking at the capabilities, what else was out there, what's in Unix. Wow,

this is going back. The normal would be find out everything that's available and do a

comparison of them and determine which would fit our needs best. I don't remember

though.

Misa: I suppose in an emerging field though it's not like going car shopping for some

standardized good. These are emerging capabilities and emerging technologies so doing

some kind of a-b-c comparison really is not very easy to do.

Wendling: Yes, but we used to do it all the time, or I used to do it all the time and that

was part of the technology assessment. Comparing PCs when they first came out. We

were one of the first [federal government] agencies if not the first agency to buy Dells.

Everybody else was IBM or Compaq and there was this company Dell – there are ways

of comparing them – even with networking. You go in, ask for a technical description,

'what's good about your product', 'why are you the best'? And then if you know their

competitors, 'why are you better than this company,' 'why are you better than that company' and start to get a feel for the differences between them and they'll usually bring out the key differences. Then there's verification and what do we really need at NSF. In networking, one of the key things we were looking at was TCP/IP and if you didn't support that it didn't matter and you get people like Novell, 'well we do TCP/IP.' [So I'd ask:] 'How do you do TCPIP?' 'Well, we do tunneling so we put the TCP/IP in [our] packet.' I go, 'well we've got TCP/IP coming in off the internet. How are you going to handle it?' 'Well, we'll have something that will take that and we'll stuff it in.' Not a good explanation of how they'd connect to the internet with a native TCP/IP – back in the good old days.

Misa: So Novell was trying essentially to do a translation between TCP/IP and their own proprietary [protocols]?

Wendling: Yes. So they packaged the TCP/IP to send it around their network. Ray Morta wanted in NSF so bad that he goes, 'Connie I'll give it to you for free if you'll put it in. We want to be there.' [laughs] But it just wouldn't handle what we needed. So we talked to them about native TCP/IP and they didn't want to go that direction. Maybe one of the reasons they didn't do well long term.

Misa: That's harmed Novell in many different circumstances.

Wendling: So we went straight from a 3Com network to Microsoft, and at the time we got to Microsoft I think Novell was 85 percent of the installed base of networking and it was a *real* hard sell internally not to go with them.

Misa: Because of the apparent standard of the 85 percent?

Wendling: Yes. That they were the defacto standard and a lot of people had used it other places, other businesses, [many people were] familiar with it; and Microsoft was new in that arena. So it was a very, very difficult thing to sell.

Misa: Could we shift a little bit and ask a set of broader questions? One of the questions we're interested in is the impact of IT on organizations, on work processes, on how information flows within an agency. In your estimation, how [did] the coming of email influence how people interacted within NSF?

Wendling: It changed the world. Email [did] because how the agency did business. Everything was over email. Discussions, paper disappeared, memos disappeared. And everybody was doing everything over email. Huge impact on the agency. But I think that was the same as any organization: that email had a tremendous impact. And people started using it and we had all of the normal problems. We had a newsletter and I remember us doing an article on 'flaming' and people saying things that they'd never say to somebody face-to-face but doing it in the email. We went through all of the regular growing pains introducing email. But it very much changed how we did business.

Yost: What about channels of communication within the organization?

Wendling: Yes. Good and bad because all of the sudden people could talk to anybody; so, at NSF everybody knew everybody else's email address – first initial last name. So if you wanted to send the director an email you could do it. And some people took advantage of it. So it opened up communications up and down, sideways, everywhere; and some people did take advantage of that. But I think that again happened at every organization where people could [suddenly] bypass the boss and talk to the big boss directly without setting up a meeting. [laughs]

Misa: Help us understand how that could be considered a benefit, and how could that also be considered a liability.

Wendling: Well, I think that's obvious, your boss wants to know what's going on. And I'm not saying that happened a lot here, but I think NSF went through the same thing everybody else did implementing it. And negatives, people want to know what's going on and bosses always want to know what's going on, what you're doing. And so if you're bypassing [your boss] that's in general not good.

Misa: So that would be a downside or liability from a chain-of-command or supervisory [perspective].

Wendling: Personal opinion, yes.

Misa: Do you think there was an impact on NSF of these successive generations of computer systems – the early IBM mainframe, the Honeywell, the HP, the IBM again?

Wendling: What do you mean?

Misa: On how information flowed, I'm thinking about channels of communication: who's able to talk to one another but also then, with the mainframe, who had access to the information that's on it. Who's able to generate reports, who's able to get insight.

Wendling: NSF has historically had great computer systems. Everybody in general has access to the systems. We're one of the few agencies where all the systems are completely integrated and that's been a great benefit to NSF, and if we didn't have that FastLane probably wouldn't have been as easy to implement. Very, very early on NSF automated virtually everything that we did so everything was computerized, internal activities: training, payroll, personnel, financial system, proposal system, reviewer system, all the activities were automated very early. Totally integrated was extremely important. To spend a penny, it had to check the financial system and that was an online real time check of the financial system. Does that account have the money? If so, yes and mark it as being [a] committed or obligated amount, so it was immediately put into the database that that occurred. And we were completely integrated, all systems, which was very nice. A lot of places have the financial system here, the proposal system here, and

the interface between those is batch or batch updates at night or even in some cases even today data entry at some agencies to get that information moved from one environment to the other environment. Because of that, even with FastLane, people want money [to] go out and do a real time check of it. An award's made its automatically [and] put into the financial system. They can start drawing down against that information. So NSF has always had an extremely good automated environment. People are sort of used to that having those capabilities there. As the systems progressed hopefully we made everybody's jobs easier as we did it. Yesterday I mentioned as we automate there was concern from support staff that they would be put out of a job. They wouldn't have a job left. People would get fired because we're automating everything that they did. And that was a constant concern. There were meetings about it. The union would have discussions about it. We did presentations on it. And NSF has been a great agency, nobody has ever been laid off, forced to leave NSF in the history of NSF. People were very concerned they would be laid off as we automated systems.

Misa: Do you think the concern about the labor impact altered how NSF approached automation? Changed how it was implemented?

Wendling: It meant there had to be better communications with people involved to explain what's going on, how it's going to impact them, and how they'll still have a job after those functions are automated. There was plenty of work to do so even if you automate one thing, it allows them more time to do something else and that eventually became obvious. But also as I mentioned when I first came here it was one secretary per

program officer; [then] after centers were created the numbers of support staff did go down through attrition, by retirements, etc., because in reality fewer people eventually were needed to support the same functions that they did before.

Misa: How did NSF understand that? Because of course with computers one of the things is to try to do something quicker or better, but another impulse often times is to save money and staff costs are an important part of that. How did NSF represent that to Congress or to the external world?

Wendling: I'm not sure [about] the question of representing it to the outside world. I don't know if we represented the breakdown of the staffing to the outside. Our staffing in general stayed flat for 28 years -- we've been at about 1200 employees, give or take a little. But right now we're trying to staff up because it is getting very difficult for program managers, [they are] getting overwhelmed – the number of proposals is going up. When I first started the number of proposals at NSF was about 30,000 [each year] and now maybe 40,000 – 45,000. But in general the number of proposals was fairly steady for many, many, many years where the workload, just the basic proposal workload stayed the same. But the difference, now versus then, is there is a lot more interactions among organizations, cross-disciplinary proposals that require coordination across divisions, more complex proposals, more group research being done, center proposals are getting very huge and the oversight required for those has increased substantially. So workload has gone up per proposal for program officers, so the need for additional program officers

staff is definitely there, and we've been pushing Congress for years and years that we need more staff. And we have that allocated so we're working on hiring up in that area.

Misa: Now program officers are in a more complex environment, a need for interaction between different directorates or between program officers within the same directorate. In what way do you think FastLane is facilitating it?

Wendling: I think a lot of it occurs [as] people meet, talk, have meetings on topics across organizations. Program managers talk to each other when they have proposals that are across disciplines. I think the important part is the people and that's why we hired the program managers to do that. I think FastLane facilitates it in that everybody can get access to everything. In the old days, one person would get the proposal and get twelve copies of it and then, 'gee, who else at NSF would maybe be interested in it?' Read it, OK, put the proposal in the envelope and ship it over there. Or make additional copies because I sent them all out for review, so make some copies and send one to Joe and Mike and Bob to take a look at and see if they may be interested in co-funding it. So just having everything out there and available to everybody helps. In doing that almost everybody has access to all the information anytime they want.

Misa: There's another important question about the impact of FastLane [on] the larger process of peer review which is of course a central value to NSF.

Wendling: A merit review.

Misa: It was once called peer review, now merit review.

Wendling: The old days it was peer review, yes.

Misa: You can see that we're stuck in history.

Wendling: And I have to be politically correct. [laughs]

Misa: What impact do you think that FastLane has had on that immensely complex process, whether peer review or merit review?

Wendling: It would be interesting to do a study of the reviewers. Initially getting proposals to people via paper, getting the reviews in, I don't think it impacted the quality of the reviews [since] the reviews still came in. We'd get them quicker. You could do automated reminders where in the past program managers would keep track of how long they'd been out there. With FastLane there were automated reminders that you can [send out] after however many weeks you could have the system send a reminder to the proposer to try to improve response. Over the years response rates have gone down, and that continues to be a problem.

Misa: That's the response rate of reviewers to review a submitted proposal?

Wendling: Yes. In the old days you could probably send out five proposals to get three reviews; nowadays it may be eight proposals to get three reviews returned. The response rate has gone down over the years. That's people being busy, overwhelmed, more proposals to do. If you think of 40,000 proposals sent out on average to eight reviewers that's 320,000 review requests going to the research community, that's for the ad hoc review, and then [for] panel review you get another tens of thousands involved in that process.

Yost: Did you notice any change in the general trend with FastLane?

Wendling: That's never been attributed to FastLane, the declining response rate. It's more the researchers not having the time to do it, not wanting to do it even though there were things the NSF did to try to make it easier, the fifteen page limit [on project description length]. When I first came the proposals could be 100 – 200 pages long, there were no limits on proposals; and the 15 page limit was monumental and a very difficult thing to get done. That also helped FastLane. If we had to handle 100 page proposals [it] would have been very bad, so the 15 pages limit coming in the same time we were doing FastLane helped tremendously.

Misa: The limited length of proposals and the development of FastLane occurred at the same moment in time?

Wendling: Yes, and so that helped tremendously in just space, transition times, everything.

Yost: But was the reduced length driven by FastLane?

Wendling: No, but it was very nice. I remember that they were doing the discussions on the impact on the reviewers, we're asking too much and the reviewers complaining it's too much work, and that was one of the reasons they did the fifteen page limit. And when those were being discussed, I go, 'Great!' [laughs] No, FastLane was not an impetus for that.

Misa: It was a beneficiary, but not a driver for that change.

Wendling: Yes.

Misa: We talked earlier about the interest in reengineering the proposal process. Once you had an electronic document, was there ever a discussion [along the line] well if you have text you could have images. If you have images you could have audio, you could have video, you could have multimedia. You could have many other things that typically would fall way outside the bounds of a paper proposal. Were there discussions about [this]?

Wendling: Yes. Oh, sure. And that's the 'visual' on Chuck Brownstein's name. That was always envisioned from day one that once it's electronic we could start receiving all sorts of media as part of the proposal. So yes. Has that happened? That much [i.e., very little]. Some people will send in audio, video, pictures as part of their proposal; for specific reasons that's done. But initially it was, 'yes, proposals, we should handle multimedia.' And that's obvious by just trying to name the project in the beginning when 'visual' was suggested as one of the names.

Misa: Was that met with some enthusiasm from the part of either the PI community, or people within NSF?

Wendling: Research community I don't know. Internally, it was hey this has a lot of potential so yeah that would be great if [FastLane] supported that.

Misa: OK.

Wendling: I'm thinking about the limits on hyperlinks. When we started receiving proposals, people were so concerned about review – and this is one of those reengineering [aspects] – PIs send in their 15 page proposal with hyperlinks that link you to fifty page documents and movies and everything else, and how's that going to impact the review process. Are reviewers required to go to through the hyperlinks? Should they go through the hyperlinks? What should be done with those? So concerns also on if you do have the multimedia and these proposals coming in, how's that [i.e. review process]

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going to change. With the [traditional] proposal being sent in, people can base their decisions, their write ups, their review on the content of the proposal. If there are hyperlinks to other areas, how do you know that's not going to change? That one reviewer will see the same things at the end of that hyperlink as another reviewer. That a decision will be made and a reviewer will put in 'when I looked at this hyperlink [it] was a bunch of junk' and the PI gets that and magically it changes, 'No it's not a bunch of junk!' [laughs] Lots of concerns on the other media, so that's why the proposal that is sent to us is the official record of the submission and not all the other things that may be linked to it.

Misa: Were there changes that FastLane – I'm thinking of hardware and software – needed for the possibility of complex documents? And storage I suppose would be another [question]?

Wendling: Well they were coming in in PDF and I don't think it was a concern. We eventually allowed attachments to the documents. Bandwidth was a concern initially, but I don't remember any serious problems brought up with that. Storage space for videos if they were to be included – it was more storage space where disc space was at a premium and expensive in the early days.

Misa: You permitted attachments to the PDF document?

Wendling: Yes, I think there were – gosh this is going back. When you submit a proposal there was the ability to have additional files. I believe attachment files that could be whatever, pictures or other things, is my recollection.

Misa: There's a category of supplementary documents that tends to be very, very specific – and I printed the instructions – words to the effect you may not use [them] to exceed the fifteen page limit.

Wendling: What we're talking about now was way back when those limits were not as hard as they are today; there were ways people could get other types of media to us with their proposal, and I think that was as other files that are transferred.

Misa: Just one other question about the impact of FastLane on NSF. Were there unexpected consequences? Things that you as a designer would never have thought, but in fact came about?

Wendling: [pause] I'd have to think about that for a while, because there were but I don't remember what they were. At the time there were lots of things that hit us – 'oh gee never anticipated that would happen' – as it was being introduced and people using it but nothing in particular offhand.

Misa: Two questions by way of doing an overall evaluation and wrap up. If you're reflecting on your experience in FastLane, across the period, would there be specific

lessons you could suggest in terms of "value centered" computing or "human centered" computing, or the flexibility and openness to user requirements that FastLane seemed to embody?

Wendling: Ok and a lot of that I'll credit Connie, because I was a technologist. Give me a problem and I'll find a technical solution for the problem, but a lot of the people interaction she was very good at. So in forming the committees – the oversight committee, the internal review committee, the external review committee – she made sure we did all of those. That was critically important because from the beginning, the very beginning, the universities were involved. We had the group of universities coming in and giving us detailed assistance and guidance on what they would like to see, what the priorities were, what [to do] next. And we always had the development site available [i.e. www.fldev.nsf.gov]. As we were adding new things we made it available so that people could go out take a look at it, give us comments before it went live. So it was a collaborative effort with the research community. And prioritizing projects, after we had the first six [functions]. I said you know I had a preference for the big volume ones. When we met with the external community I'd say we'd like to take care of the high volume ones while were doing this, but we want also to take care of what they wanted and so they set the priorities on what they felt was the most important things – fixes to the current ones, additional capabilities, etc. So you have a national user community in effect setting priorities for where we went on that. It was very important to make sure they were involved and happy with what we were doing and where we were going. And that helped through the entire FastLane project. When other agencies are beating us up, the

universities were saying that FastLane is doing a good job. NSF is doing a good job. We know what they are doing, we are involved with what they are doing, where other agencies didn't do that. Even today I don't see that happening as much. Although I'm not involved, it does not seem that the current government efforts in Grants.gov have that sort of day-to-day working relationship with the research community, on getting their inputs on what's more important. I think it's more driven by the government, 'we think this is important [and] we want to go in this direction,' as opposed to the research community guiding the government. So it may be a little different paradigm there. And it turned out what they wanted was what we needed and vice versa. I don't think we had to veto anything that they wanted, and they didn't have to veto anything that we wanted. So that was a good working relationship with the universities.

Misa: So you mentioned two things: one was the good communications that Connie was able to achieve within NSF and also outside of NSF, and then second this extensive interaction with the nationwide community of researchers.

Wendling: Yes. The number of meetings she attended that we had was probably very, very, very few that she ever attended on the internal/external. The important thing was she forced us to have them. [laughs] 'Fred, you will have an external review committee.' Oh, god! [laughs] But that was outrageously important. Who wants more oversight committees over them as you're working – I want this oversight committee, and that oversight committee and report to that committee – oh god! [laughs] but it was extremely important.

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Misa: It was hard to see perhaps.

Wendling: Yes, who wants more oversight? [laughs] It's like having eight bosses telling you what to do. In the end it wouldn't have worked out, it wouldn't have worked without that.

Misa: Then just finally, as a wrap up, I talked with Dan Atkins and he told me 'I have a question for Connie, I hope you ask her this some time.' I'll give you the question and see what you make of it. Dan said, 'What were the conditions at NSF that allowed her to get FastLane done?'

Wendling: What were the conditions?

Misa: What were the conditions that permitted NSF, as opposed to Department of Justice or another agency, to successfully do that project?

Wendling: That one's sort of easy. One, she was here. She had the background, contacts in the research community, and was respected for doing that. We had the infrastructure, We had the PCs. We had the networking. I remember GSA at some big conference, 'We want to announce that last month we became the first federal government agency to be totally networked.' And I'm sitting there going, we finished that two years ago. [laughs] But we don't go around bragging that we did so. We had the PCs, the networking, the

external networking. We had been using it for business. People were receiving proposal reviews via email and so we had cracked that, doing business over the internet. Reviews are confidential, but the [NSF's] Computer Science divisions started receiving proposals over the internet so us doing it was not that difficult a jump from them doing it. We had great support from the director in getting the infrastructure with Erich Bloch, doing the infrastructure and Neal Lane on beginning the project. A lot of it is we had the base and we had the partnerships with the vendor community – hardware, software, networking – that if anything went wrong we could work with them to get those problems fixed. And how many companies have that sort of relationship with companies that you know: [for instance] Netscape if something's not working, you can go to them and say 'hey can you fix this for us. We need this so we can use it in FastLane.'

Misa: So by base you mean this connection to the technology community that was co-evolving technologies that you were reliant on?

Wendling: Yes, with 3Com and Bridge [Communication] and the other companies we went to. Sun good working relationship with them. So yes, that helped, because we did run into problems. And instead of saying, 'Oh god, it doesn't support it we can't do it,' we went to them and we go 'hey can you fix this so that we could do it'. And I don't know many agencies would have done that or had the infrastructure background in place to be able to do that. When we did FastLane one of the things that was discussed in the meeting with Dr. Lane is, this is perfect for NSF in that we are supporting the research on the internet, building the internet, and the continued growth of the internet, and this will

help that effort or utilize that effort in building on what NSF did in the networking. And we were also funding the [University of Illinois] NCSA project so we were familiar with all of that. As I mentioned, you go to a meeting with the other agencies and have to teach them what the internet is and then what Mosaic is and yes eventually maybe you'll have access. We were familiar with it; we knew it so we were very far ahead of other organizations; and it's because we were NSF and we were funding it and we had access to that research. Connie was very good about that, looking at new things and capabilities, what should we be doing, what's out there and it went beyond FastLane and technologies there also.

Misa: NSF had this very important role in carrying the heavy lifting of the internet, as we know it today, for a long period of time until [it was]

Wendling: privatized.

Misa: privatizing, yes.

Wendling: Which was good.

Misa: We have learned so much in the past couple of days with you. Fred, thank you so much it's been a marvelous experience.