



Interview of John Heafner

Interviewed by:
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James Pelkey: Thank you for making time for me in your schedule. I now understand that you have been through a lot of this history. So you can help me by first going back through your history. You were at RAND?

John Heafner: I was at RAND with the beginnings of networking, in terms of what you're looking at, around the Carterphone decision time, which was sort of an enabling condition that allowed the enterprise-wide networks of multi-vendor systems in a legal sense. It was a legal steppingstone which permitted that. You said you have talked to a lot of people. I guess I would like to identify a couple of them that probably ought to be mentioned in your book if you have a place for them, although I don't want to get into the people business because there literally are thousands that have made this happen. One is Paul Baron. You say you've talked with him. Paul started this through some work that he did for Project RAND under Air Force sponsorship at the RAND Corporation in the late '50s and early '60s, in terms of producing the ten or twelve documents in that report series that covered everything from tariffing considerations to security and everything about packet switch networking. By the way, if you don't have a copy of that series, you should get that. I have my own copy of that and will keep it forever. Larry Roberts, of course, is the other one. You've spoken with Larry already. He made this happen from the Arpanet, from the project office there at ARPA. He conceived of it using the work that had gone on by Paul Baron, the studies, he put it together and made it happen. The other guy that needs some recognition, in terms of looking at bringing it to market, is Maris Graube, who you may know as the chair of the IEEE 802 committee, and I'll cover some things in this scenario that Maris and I worked on together, and a lot of the things that have come to pass, such as the OSINET and the NBS workshop, were really the brainchild of Maris Graube. Very few people know that, but they should know that he has had a hand and had the foresight in seeing what ought to be done to bring it to market.

Pelkey: I look forward to hearing that story.

Heafner: Where to do you want to start?

Pelkey: When did you get involved? You were responsible for the hardware?

Heafner: I was responsible for the RAND node of the Arpanet --

Pelkey: Which was the fifth node?

Heafner: We were actually -- Santa Barbara and RAND were the first two nodes that were up on the Arpanet. There were five original nodes, that included Utah and MIT and I don't recall now what the fifth one was, but the first two that were up and communicating - - I guess the fifth one must have been at BBN. The first two that were up and communicating were RAND and Santa Barbara. I was at RAND in late '67 when I finished a graphics project, and the Arpanet came along, and I worked on that.

Pelkey: How did you get into that?

Heafner: As I say, I had just finished doing some work in graphics that I had been doing there for about four or five years, and Larry Roberts was promoting the Arpanet, this packet switching technology, wanted to create this network of the ARPA contractors. Quite a few of them were very hesitant to get involved in it, but they did. I hired one guy by the name of Eric Harslem, and the two of us did the RAND end of that.

Pelkey: Did you do the hardware?

Heafner: No. All of the hardware was done at BBN. They were responsible for it.

Pelkey: But you had to interface your 360 to the IMP, right?

Heafner: Right.

Pelkey: Who built that box?

Heafner: The guy that was responsible for that work, and I guess there were a half a dozen of them that did that, was Milo Davis at RAND.

Pelkey: And they all reported to you?

Heafner: No. Eric Harslem was the only guy that I hired, that worked for me. Eric and I did the software, and we worked with this big ARPA group that would meet twice a year to plan the protocols, design the NCP.

Pelkey: Steve Crocker's --

Heafner: Yeah, right.

Pelkey: Did you attend those meetings?

Heafner: Yes.

Pelkey: When did you start attending those meetings?

Heafner: From the beginning.

Pelkey: Which was in '67?

Heafner: I don't know if we started in '67 or '68, somewhere along there. The first one was to write the protocol for the NCP, which was the forerunner of TCP, and we also worked virtual terminal, which became Telnet, and the file transfer. We did a couple of RJE protocols and so forth.

Pelkey: So did you and Eric go around to these meetings? Were they scheduled around the country?

Heafner: They were usually held, I think, one on the east coast, one on the west coast. They were held twice a year; attendance of about 100 people or so, and a lot of yelling and screaming. Typical academic community environment, but good things came out of it.

Pelkey: Jim White was up at UCSB at this point?

Heafner: Yeah, Jim was one of the key players. I said, UCSB and RAND were the first two nodes up, and Jim was running that group there at Santa Barbara at the time. He's now with Telenet.

Pelkey: So you brought your nodes up in early 1970?

Heafner: No, I think it was probably in '68. I don't remember exactly. Probably in '68 or the latest in '69.

Pelkey: You didn't even get your node until early 1970, because UCLA got the first node on September 1st of 1969. The contract was let to BBN in January of 1969.

Heafner: Ok, '69, whatever. I didn't realize that UCLA had gotten a node that early. Memory tells me differently, because they certainly weren't up on the network very early.

Pelkey: Jim's memory is that -- in fact, he said that he remembers sitting there in Santa Barbara with one hand on the terminal and one hand on his phone, trying to send packets back and forth, because you two had 360s, and at one point, all of a sudden: "Did you get it." "Well, no." Finally, he said, one time there was an explanation at the other end after he had said: "Did you get it?" Then there was: "Yes, we got a packet!"

Heafner: We used to do the same sort of debugging there at RAND with Dave Walden and debugging the IMPs themselves, prior to debugging our software in the host. Dave would sit on one end in Boston, and me out there on the other end in California reading the console lights.

Pelkey: Do you remember, at the end of 1971, when there was this exercise of seeing if everybody could talk to everybody else?

Heafner: Right.

Pelkey: I have been told, Systems Development Corporation was kind of a no-show in that process --

Heafner: I don't recall. By then there were a number of players.

Pelkey: But everybody was trying to talk to everybody else to see if the network had worked. Did you get involved in the scenarios at all?

Heafner: Yeah, we were involved in all of that, up until the time that the ARPA sponsored group at RAND left and formed Information Sciences Institute, which is one of the seven institutes affiliated with USC, so basically I worked for the same guy, for Keith Uncapher, for about 20 years out there.

Pelkey: Keith was at Rand?

Heafner: Keith was at Rand, and his group was the ARPA sponsored group, as opposed to the Air Force, which sponsored everything else there.

Pelkey: Ok, so the ARPA sponsored group went over and became ISI. What year did that happen?

Heafner: '72.

Pelkey: Beginning of the year, end of the year?

Heafner: I think it was around May. I'm not very good with dates, as you can see. You've already corrected me on when we came up with our node, but I believe it was May of '72.

Pelkey: Actually, I'm sitting here worried about what happens when we get to recent past.

Heafner: The reason that I can remember that one well is because my reason for going there was to finish my schooling, to get my PhD, and I got there in time to go for summer school --

Pelkey: At USC?

Heafner: Yeah, so I believe that was May.

Pelkey: Did you go to the scenarios in Washington?

Heafner: I don't recall which meetings I went to and didn't go to. I went to most of them up until that time.

Pelkey: The ICCC meeting? Did you go to that one?

Heafner: I don't recall. After '72, after going to ISI, most of the work I did -- Eric Harslem and I had designed something called the Data Reconfiguration Service, which was a data transformation device you could put somewhere on the network to do protocol translations. It was intended to be an interim tool, and it was just something we were exploring. So I did some work on that to bring it up and document it and run some experiments. After that, I worked on messaging; the tri-services personnel in Oahu were interested in the next thing after AUTODIN I.

Pelkey: So you were at ISI for how long?

Heafner: Until '77.

Pelkey: What did you do then?

Heafner: Well, I finished my schooling, and I was tired of driving an hour and a half each way from Santa Barbara down to LA, so I moved back to Virginia Tech, and I had a joint appointment there in the computing center and the computer science department. I taught automata theory in the computer science department, which is one of my favorites, and I was really brought there sort of as a gun slinger. Universities are very political, as you probably know, and there was a shoot-out to provide an interactive online system for undergraduates, and that was done over a period of a couple of years, and then, as usual, the citizens want to get rid of the gun slinger and hire somebody else as sheriff, so I came up to NBS at that time, in '79.

Pelkey: So when in 1979 did you join NBS?

Heafner: January or February, I believe. I think it was January.

Pelkey: When you joined NBS, what were your responsibilities?

Heafner: I just came up here as a networking person, and shortly thereafter assumed the responsibility for managing the Systems and Network Architecture Division, where most of the networking resided. There was some that, from a historical point of view, X.25 work was in another division, but all of the local area network activities, all of the OSI protocol activities, everything with the exception of X.25 was in this division.

Pelkey: What was your relationship with Robert Rosenthal?

Heafner: Robbie was working in the group that was doing local area networks, also part of this division.

Pelkey: Were you aware --

Heafner: Most of the time I was at NBS I managed this division, and Robbie was one of the group leaders.

Pelkey: At that point in time, Robbie didn't report to you?

Heafner: Not when I came here, no. No one did.

Pelkey: Were you aware of these about-to-be MITRE/NBS workshops that were being sponsored and would happen in the spring of 1979 in local area networking?

Heafner: Not really. I don't really remember very much about that. I don't think it was something that was terribly important at the time.

Pelkey: Certainly not in your mind.

Heafner: In my mind, the things that were important in local area networking were the things that took place in the IEEE, and mainly a lot of the things that Maris had spawned, or ideas that he had come up with.

Pelkey: Help me understand where that process with Maris began.

Heafner: Well, not with Maris, but with the process with NBS. Let's cover that. When I took over the division, we had probably 15 or 20 people that were people that were here before. Although it was called Systems and Network Architecture, most of them didn't really have any experience in that particular area.

Pelkey: When did you take it over.

Heafner: I don't know, it must have been '80 or '81, somewhere along there. The idea was to get some immediate recognition by doing some good things. We did that through early contracts with Bolt, Beranek & Newman, because they have a lot of expertise, as you well know, in networking, and we had a substantial contracting program with them. In parallel with that was to bring in some good networking people and train some good networking people so that we had credibility ourselves and could do some of the investigation research here in-house. We did that, and when I left a little over a year ago, we had about 50 people in the division, and we've published a few hundred documents that have received some acclaim, and done some things.

Pelkey: I'm led to believe that there was a fundamental shift that was beginning to happen at NBS at this time, one of which being a perception that there was going to be less money available for outside contracting, that NBS had a small staff and had used organizations such as BBN as a contracting agent; and a movement towards more internal staff.

Heafner: I couldn't say about NBS as a whole, or even ICSD as a whole, but that was a local decision. The funds were discretionary. They were Congressional funds to do the networking program, and I saw fit to build a competent staff in-house as opposed to continuing with contracting. So we did that.

Pelkey: Was there a conscious decision about this philosophical change, trying to get industry to build products that the government could buy, as opposed to the DOD view of the world which was to fund the development of products that were specific for their needs.

Heafner: Sort of the way I put it when I came here is that we will have won when DOD buys OSI from IBM, we'll have covered all the bases, getting the largest supplier to supply to the largest consumer, and do it in a standardized way. Our thrust from the beginning was to work in ISO, and to some extent in CCITT, to make sure that government needs were covered when those protocols were being developed.

Pelkey: When you joined NBS in '79, were you aware of OSI at this point.

Heafner: Sure. OSI was started in '78. I went to OSI meetings the first month I was here, ANSI meetings.

Pelkey: How did it get over to Europe and become part of ISO?

Heafner: Within CCITT and ISO, they decided to build a reference model, and then later on from that, the services and protocol definitions -- there are at least four people that I know of from four different countries who claim to have invented that, so I won't name them. I don't know really who came up with the initial idea, but that was in '78, and things were moving along pretty well, in terms of trying to define and flesh out the reference model by the time that I started in January of '79 participating in these activities.

Pelkey: So the reference model was under way, but nothing else.

Heafner: Nothing other than the reference model. We found that -- ANSI at that time was populated by a number of vendors who seemed to have the mindset that proprietary was better. So I wouldn't say that they were a stumbling block, but we found it, here at NBS, more expeditious to work through ECMA and other organizations in making our requirements known and our contributions that were ultimately fed into ISO. We were the only organization that wasn't a member of ECMA that was invited to participate in all their meetings.

Pelkey: ECMA is --

Heafner: The European Computer Manufacturer's Association. And Europe, of course, their contribution to this whole thing was in pushing and driving for OSI. Their motivation, I guess, was to try to relieve the dependency on the US and Japan in those terms, and promote their own computer communications vendors, so they have pushed very hard. They fail in implementation somewhat because they have lots of countries and lots of authorities and bosses, where we have one country.

Pelkey: At that point in time, when you got involved in this, you say that ANSI had its own private agenda.

Heafner: I don't know what its agenda was. All I know is that, in terms of making positive contributions, most of those that I saw coming out of the US came out of NBS and they went through ECMA to arrive at ISO.

Pelkey: How did NBS get into this role?

Heafner: NBS has a mandate from Congress to provide standards for ADP, communications and so forth. It's part of their role. The program was reviewed here at NBS in the mid to late '70s, as to why they hadn't done anything significant, and the answer coming out of that was: "Yes, they haven't done anything significant, and the reason is they don't have enough funding. There's not enough resource there." So, in '78, the budget was trebled for this particular activity, for ICSD, which is networking and compilers and all the other things dealing with ADP. It was sort of a fortuitous time to come here when they --

Pelkey: When it was in the growth stage.

Heafner: Yeah, right. Jack Brooks, of course, is the one who has championed that in the Congress all these years, if you want to mention another name that's behind this whole movement, certainly his name should be mentioned. I think he's from Texas. I should know that.

Pelkey: How did NBS come to pick OSI, as opposed to --

Heafner: In the beginning, when I came here, they didn't. Basically, they had that mindset they had in the past, which was to go off in the corner and do it as fast as you can and get something out the door and check the box. I think maybe it was some of my influence as to: "Look, the only way it's going to be widespread and acceptable by vendors, therefor supplied so that we can buy it, is to get something that the vendors will agree to, and we have to get something that's agreed to internationally." So we began to work in ISO. The other insight we had here was --

Pelkey: Was there resistance to this concept when you presented it?

Heafner: There was resistance here in the beginning, yes. Their idea was: "Let's write the standards and get them published, because ANSI isn't doing anything. Let's do it now."

Pelkey: Let's do it on our own, since ANSI is not helping us. And you said: "Wait a minute, we've got to get the vendors out there -- "

Heafner: The vendors have to support it if you going to --

Pelkey: And it has to be international because of --

Heafner: Right, and so we went with ISO because it's an open organization, whereas with CCITT it's a NATO treaty organization that's made up of the PTTs around the world, and so it's less open. Looking at them historically, the telephone mind set wasn't in keeping with what we felt the government wanted; something more like the Arpanet suite of protocols. So through ECMA and other sources, we pushed the definitions written in ISO-ese of the DOD protocols, in particular Class IV Transport, which is the match with TCP, and the Internet Work Protocol.

Pelkey: You were working through ECMA into ISO. How did OSI get moved over from ISO into CCITT?

Heafner: I think it started pretty much the same time. I think they were working -- they both had reference models going, and over the years they sort of came together. At the end, before they were both standardized, they came together.

Pelkey: Ok, because the X.400 process came up through CCITT.

Heafner: Right.

Pelkey: Whereas OSI is more like (unintelligible) as ISO, although they work off the same --

Heafner: Well, they both developed protocols. X.400, RMHS(xxxxx), that whole series of recommendations came out of CCITT. ISO has a comparable effort called Modus that they are working on, with some extensions of X.400. Those two organizations are beginning to work more closely than they have in the past, but it's very difficult to get them together. They come from -- one primarily backed by the PTTs and the other a mixture of PTTs and primarily computer vendors and some user representation, and so forth. So it's very difficult.

Pelkey: So when you first started to get involved and you started to win the day as far as working with standards and have them be international and you started to work through ECMA -
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Heafner: Well, that's one of the places we worked.

Pelkey: Where else did you work?

Heafner: We worked with various other people around the world; whoever would work with us where we had a compatible agenda. I'd rather not name them. A lot of this was back door stuff, but that's the way you can make a lot of things happen.

Pelkey: The initial focus of your work was --

Heafner: The initial focus of our work here --

Pelkey: -- was transport?

Heafner: -- Well, yes, you have to start at the bottom and work up. That's the way -- people seem to understand the lower layer protocols much better, and our agenda here at NBS was to take the DOD protocols, and sanitize them through ISO. DOD wasn't a part of that in the beginning. That was later on, in '82 or '83 when DOD really got involved with NBS, but we knew that, in order to be acceptable to the government, it had to be acceptable to DOD, therefore it had to be the functional equivalent of what they were doing now, at least.

Pelkey: What precipitated DOD and NBS working together?

Heafner: It was driven by NBS, courting DOD continually to try to get them involved. NBS participated in the protocol standards steering committee at their group, which is a lot of the agencies under DOD, and worked with them; wrote some memoranda of understanding between the two. We finally ended up in contracts from DCA to NBS to build prototypes for the transition. That came about after -- you must have been exposed to this National Research Council study that was done --

Pelkey: National Science Foundation?

Heafner: National Science Foundation and the National Research Council did a study of -- they began looking at Class IV Transport versus TCP, to see if there is any functional difference, any reason why DOD needed to go with TCP and couldn't use the ISO protocols, and really got into the whole architecture and all the protocols. They published their report, which said basically there is no functional difference, and security was an issue at that time too, and they had both secure briefings and unclassified briefings, and the result of that, when it was published, the unclassified report was that it doesn't make any difference, as far as security is concerned, which side you go with.

Pelkey: When was this report published?

Heafner: I have a copy of it, but I'm in the process of moving. I don't have any of my stuff available. Maybe '85.

Pelkey: When did the process start?

Heafner: '84, '85, somewhere along there. It started about a year or 18 months before. Like all committees, it dragged on and tried to prolong its lifetime as long as it could.

Pelkey: Did you participate in this committee process?

Heafner: I participated in it to give testimony on behalf of the OSI work.

Pelkey: Who authorized -- did the DOD --

Heafner: All of the Arpanet people, of course, Jon Postel and all those guys gave testimony on behalf of TCP. The vendors and NBS and others gave a lot of testimony on behalf of OSI.

Pelkey: And who authorized NSF to do this?

Heafner: It was sponsored jointly by DOD and NBS. DOD paid most of the money for it. It was done because the office of the Secretary of Defense wanted to decide which way to go. Were you going to be talking with Steve Walker?

Pelkey: I was hoping to interview him yesterday and he had to cancel.

Heafner: Well, Steve was there at the time and it was his decision to have this aired through this organization, as opposed to making a decision without the benefit of that analysis. ARPA, of course, was pushing toward the Arpanet protocols, and NBS was pushing toward the OSI protocols.

Pelkey: Steve Walker was at the --

Heafner: -- at OSD at that time, and it was his decision to have that study performed. The results of the study said: "You should go ahead and commit to OSI, and try to send OSI as soon as you can," basically. OSD, I guess, gave DCA the operational responsibility for implementing

that plan; coming up with a plan, for transition with a schedule, and the products for it. At that time DCA and NBS had already begun a little bit of contract work, and DCA then supplied more money to NBS to help them with the transition. Gerry probably told you about some of the OSI - Well, not OSINET, that wasn't part of it, but some of the transition products they're building, in terms of the gateways.

Pelkey: Yes. I want to touch on that a little bit.

Heafner: It's important because, if we look at the way that's been handled, how organizations are going to get from where they are to OSI, even if the products are all there tomorrow, what are they going to do with them? How are they going to get there? DOD has a fairly generic plan, I think. ARPA, NBS and DCA all contributed to that plan, and it could be applied elsewhere. If you look over in Europe, especially in the UK, they have something called the Intercept Strategy, which was to take a piece of OSI that's developed now, wherever it stands, in DP form or DIS form, and build that and start using it, and it'll be easier to make the change over to the IS's later on. That failed because vendors are not going to build a lot of throw away products. They aren't going to build those intermediate things. DOD, I think, has a very solid plan. It allows you to do it sort of instantly, but it's inefficient operationally, so it has a built-in sunset clause, and it's a good plan. I think others need to take a look at this, other large organizations.

Pelkey: Now, when did the implementor workshops begin?

Heafner: February of '83. I guess we'll eventually cover, not in one spot, but what NBS's contribution has been to all of this, one of course is the workshop. That was, again, Maris Graube's idea. There were six companies that met with NBS at a meeting up in Boston in December of '82. Vendors had asked NBS to host or sponsor or provide the umbrella, so they could get together and do some sort of demonstration of OSI in some form. We responded right away and set up the first meeting in February of '83, and as you can see, they've been going on since. They're going on here today in this very building. That led up to the NCC '84 demonstration in June of '84 in Las Vegas. What got that rolling, I guess, was at about the second meeting we had of the workshop, Pat Mulvey from IBM stepped forward and said IBM would be pleased to participate in this demonstration at the NCC, and of course the other companies came along and it flew. Again, it was Maris's idea.

Pelkey: Let me go back. This meeting that happened in December of '82 in Boston with the first six members?

Heafner: Just a meeting, a sort of a clandestine meeting, that happened.

Pelkey: Can you help me understand how it came together?

Heafner: No, I can't help you with that.

Pelkey: Was it one person who called up or six vendors contacted you? You said: "To do a demonstration."

Heafner: We just happened to be sitting down in a room with six other companies, that's all. I don't want to go into the details of it.

Pelkey: I'm not trying to -- this is the

Heafner: One of the principals there was Maris Graube, and it turns out that he happened to be working for Tektronix, but I think he was really representing -- wearing his hat of IEEE 802 chair.

Pelkey: Was the 802 Chair in place at this point?

Heafner: Sure.

Pelkey: And they had not yet decided what to do about the 802.3, 4, or 5 yet?

Heafner: That's correct. The very beginnings. Well, they had a lot of the work completed for 802.3, because that came out of the Ethernet work, with very little change. That and the token bus stuff I guess is what we decided to go with for the local area networks, token bus. Token ring came along later.

Pelkey: So one of the outcomes of this Boston meeting was, in fact, the creation of this first Implementors Workshop. You opened it up to vendors at large.

Heafner: That's correct. It was billed as an open international forum.

Pelkey: About how many organizations or people came to it?

Heafner: First few meetings, we held them all in one room. It was maybe 30 or 40 people, and as you can see now, they have it all over the Bureau, and there are hundreds, if not thousands, participating.

Pelkey: And what were these meetings like? You chaired them, right?

Heafner: Well, actually I had Maris chair them for a while, and then later on I was a moderator of the workshop until I left NBS. We tried to get the people from the development organizations within the vendor shops. We didn't want standards people, we didn't want politicians. We wanted engineers and computer scientists, the people that were responsible for building products. We were trying to put together a demonstration, and for the most part, those were the kinds of people we got. The rest of that is history. We did have the demo at the NCC and it was highly successful.

Pelkey: The NCC was in 1984?

Heafner: June of '84 in Las Vegas.

Pelkey: When was it decided to do that?

Heafner: I think probably at perhaps the second meeting that we had, or maybe even the first. We picked a target location, I think, even at the February '83 meeting, and we couldn't do it in '83, there wasn't enough time. We figured by '84 we'll certainly be ready, if we work real hard.

Pelkey: Now this was going to be a demonstration of the lower layers?

Heafner: Well, we had a rudimentary version of file transfer, what was defined within ISO at that time. I guess about '84 is when it became a DP. It's nothing like the version we have today, the completed version.

Pelkey: Who was responsible for --

Heafner: There were really two booths there. There was one that was the GM and Boeing sponsored thing that had -- this factory floor automation demonstration, and the other was sort of --I guess it really didn't have a good theme. It was the one that NBS was a part of. The booth looked like a McDonald's arches thing.

Pelkey: Who was responsible chairing this NCC and pulling it off?

Heafner: Collectively the thirteen vendors and three other companies, Boeing, GM and NBS that were involved in it.

Pelkey: Was there one person that was perceived as being --

Heafner: NBS was sort of the coordinator for all of it. We did a lot of the planning with --

Pelkey: Does that mean you?

Heafner: No it was the administration above me, for the most part, that did the leg work and the dealings with NCC for space and all that kind of stuff. Again, it was done by committee and it was done with marketing representatives from those companies. Not the technical people. The technical people were off trying to figure out how to make it happen in a technical sense. The marketing people got involved in terms of how to promote it, making arrangements with NCC and so forth. But I'd say it was a collective thing, not an NBS thing.

Pelkey: In December of 1982, were MAP and TOP under way at that point?

Heafner: No, early on, NBS invited GM and Ford and some others here, not on the same day, to talk with us about OSI. General Motors was in the process of designing their own specifications for computer integrated manufacturing, basically, and we convinced them to work with us on OSI as the quickest avenue to get where they are trying to go, and also to broaden the support for OSI, and they did so and have been great champions of that since that time, as you well know.

Pelkey: That happened subsequent to the '82?

Heafner: I can't remember when we first spoke with GM. I think it probably was somewhere in '82, perhaps the fall of '82, I don't know. Maybe later.

Pelkey: How did TOP come about?

Heafner: TOP came about after the NCC '84. It actually got its name a couple of meetings after that. We started having basically TOP meetings. The champion of this was Boeing Computer Services.

Pelkey: Do you recall how they came to be the champion of this?

Heafner: Well, we were looking for a volunteer and they stepped forward, because they have that problem of engineering workstations and office systems and so forth. They are a large company that has that particular problem.

Pelkey: Did the MAP TOP groups meet under the aegis of NBS in the course of trying --

Heafner: No, never. MAP was sort of collected under the umbrella of SME, the Society of Manufacturing Engineers, and when TOP came along, TOP was shoved under that same umbrella, simply because it was handy and easy to do, although the Society of Manufacturing Engineers doesn't have a lot to do with office systems directly, so no SME is basically the sponsor for both MAP and TOP. NBS has worked closely with them, of course in liaison back and forth and that sort of stuff. It's all OSI.

Pelkey: So, if I understand then, these implementor workshops began in early 1983.

Heafner: Well it was recognized at that time -- let me go back to what was happening over in Europe, and again, I credit the Europeans for starting the whole process of OSI and for driving it and insisting on it. In terms of looking at the entire picture and putting the other pieces in place necessary to implement it to get it to market, I think the US has scored all of those wins. First establishing the workshop, because we recognized early on that you can't take those OSI standards, voluntary standards, and implement from them and expect the thing to work together. Look at X.25, with all the options. Everybody has one, none of them work together. So that was recognized early on, so the workshop was seen as a way to write what we called Implementation Agreements, which are now known by their European name as Functional Standards. Now you see EWASP springing up to provide a similar workshop in Europe, and we're threatened with yet a third one called the Asian Pacific Workshop, which will have a different name later on. Actually, putting the things together in some trials -- we now have these ISDN trials all over the world. This was sort of the first trial, this NCC '84, so we did that here. Shortly thereafter we started, in fact I presented a white paper to the vendors participating in the NCC '84 out there one evening in Las Vegas to propose the OSINET. At that time, it was called the NBS CatNet, or concatenated network. Later on, people pointed out that it shouldn't have such a local biased title, it should have something more open, so we called it OSINET. It is spelled with all capital letters. I know that it's grammatically incorrect, but I liked the looks of it, so that's what we called it. Again, that was something that Maris Graube and I worked on together.

Pelkey: Do you have a copy of that speech?

Heafner: Probably not. It wasn't a speech, it was just several pages of notes, proposing: "Do you want to continue this work?" Basically, what's required is that vendors don't want to key up for a demo every year or two or whatever. What we needed was some sandbox where we could really play and do inter-operation testing and sort of develop the test technology and methodology that was needed behind all of this. So what was envisioned was basically a sandbox to play in, and that's what the OSINET is today.

Pelkey: And that is open to other vendors?

Heafner: Right. And I credit Maris with that.

Pelkey: Maris's idea was OSINET?

Heafner: Well, Maris and I discussed the need for putting together some in-place network that stayed in place, as opposed to a demo that went away right afterward. So it came along slowly because General Motors and others were promoting the Autofact '85 at that time, and in fact, all of our technical people here were working on the IP Test System and refining the transport test system, to give to Boeing and to ITI for doing that testing, pre-Autofact '85. On the side, some of us were working on the OSINET as well. We started with a handful of vendors. It quickly built up to about 20, and it's oscillated between about 20 and 25 all of these years, and I was told yesterday at their steering committee meeting, that all of a sudden it has jumped to 33 members. That was due to some charter changes we made back in January that allowed the membership to broaden. People with interests other than the narrow scope we had before. So anyway, that was another first done here in the US. We recognized the need of having to have something in place. So now we have EUROSINET, OSIcom and these standing networks all over the world. In fact, they're all tied together.

Pelkey: Let me go back. I'm trying to understand the thinking process, how ideas evolved. When you took over the department, you started in '81?

Heafner: '80, '81, somewhere along there. I don't remember exactly when it was.

Pelkey: Your push was towards standards and international. You started working through ECMA into ISO.

Heafner: ECMA and other places.

Pelkey: Then all of a sudden there was this meeting that happened in December of '82 and the workshops --

Heafner: We also worked through ANSI, by the way. Technically and legal, we worked --

Pelkey: -- so you were trying to push your ideas through these different groups, one of the most receptive being the international --

Heafner: Really trying to push DOD's ideas.

Pelkey: DOD's ideas?

Heafner: We were trying to push the specifications of the Arpanet protocols --

Pelkey: Yes, so that it would be -- in essence, the OSI --

Heafner: Without DOD's help in the beginning, but that's what we were trying to do.

Pelkey: So that OSI would look a lot like the ARPA.

Heafner: So it would at least incorporate that functionality and whatever else. It's everybody's perceived notion, so it's a lot of things, but it does encompass that as well.

Pelkey: And at some position, because of your early involvement in Arpanet, you had some familiarity with how those things evolved and what they were. You had a network of people out there that you could talk to, to come to understand it, so that when you were in a good position to be an advocate, to have understood the history and be able to argue those points to these different bodies, particularly the international bodies. This was all happening in '81 --

Heafner: Well, it's still happening to some extent, and we can talk about that in terms of the Estelle Test System. There are other components we haven't talked about yet.

Pelkey: And I'm trying to understand how these all fit together, so bear with me. I'm trying to pull out how these relationships were. You had this process under way, and then you had this meeting in December.

Heafner: Look at the process in terms of -- just as an aside. You start with some vendor and user requirements, somebody's requirements, and you develop voluntary standards in ISO or CCITT. Again, it represents everyone's perceived notion. All of the national bodies are there pushing their own points of view, so you have this humongous thing. It isn't practical to implement all of that in the marketplace, and from a vendor's point of view and from the users, if they want to conserve dollars, they want a much smaller subset of that, realistically. So the next thing -- again, I use X.25 as an example. You have a lot of them and they don't inter-work. We recognized that we had to have something like the workshop to write the functional specs from these voluntary standards, to cull it down, select among the protocols, chose among all of the classes and subsets of parameters and that sort of thing, nail that down. Following that, you need some way to test the stuff. One way was to put together the OSINET for testing inter-operation. We also recognized the need for doing conformance testing. As early as 1979 in the first contract we did with BBN, we put in there the development of what has come to be Estelle; formal description techniques for that. That's another necessary element. You also have to test it. Ultimately what the standard is will be exactly what the test systems are, and the tests, not what the original -- whatever ISO's document says won't matter, it'll be the test system and test. So you have to go through that whole process, and again, we foresaw the entire process in the

beginning, and as we could, put the pieces in places for it, but I'm saying, even the testing, like we now have COS and other organizations in that business, we foresaw that need in 1979 and in fact began the process.

Pelkey: I gather then, by the beginning of 1983, at least at the lower layers of the OSI, that there was enough specification so that you could begin Implementors Workshops around them.

Heafner: That's correct.

Pelkey: Now you were heavily involved in that process at the transport --

Heafner: It was from transport on down. Basically, it was transport running over CSMA/CD in the one booth at the NCC, and running over token bus to the other, and on top was FTAM in one and some stuff that was made up for factory floor automation on the other.

Pelkey: By this point in time, Robert Rosenthal is reporting to you, and he had been working on --

Heafner: So were a lot of others. I had about six or seven groups in the division.

Pelkey: But somewhere along the line, NBS came out with a document that related to the CSMA/CD as being a standard that, in fact, it was a FIPS --

Heafner: Yeah, well NBS published a CSMA/CD FIPS, and it was exactly the IEEE with the Class I, Type I, which is the datagram mode, sort of send and pray.

Pelkey: When was that published?

Heafner: Oh, that was published after the IEEE finished it. We waited until they finished, so whenever the IEEE sent it to ISO, probably '84, '85, I don't know. Somewhere along there. You can check with Rosenthal or someone, but it wasn't important. In terms of NBS FIPS program, when I first got here, the notion was: "Let's write down all of these specifications and go publish them as soon as we can as FIPS." Really, I stayed here until I felt my job was done, which was to write the initial GOSIP. That was all that was needed. We don't need to write, and to republish and re-track and maintain the same standards that ANSI and ISO and CCITT are doing, and IEEE. We simply need to write a procurement specification that references that work, and that's what has been done with GOSIP. All of those that NBS has done in the past with respect to networking aren't important. They don't mean anything.

Pelkey: When did you conceive of the concept of GOSIP?

Heafner: I'm not sure whose idea that was, but we first got MAP, and again this is something that the US did before Europe, understanding that you have to have a procurement document as well, you have to say, after the workshop has put together the functional specifications, you then have to go build a profile to say: "These are the ones I want to buy for factory floor automation. These are the ones I want to buy for technical and office systems," and so forth. So, I'm not sure

where the idea came from, but we recognized that certainly the government needs to specify what it needs to buy. It doesn't do it by replicating ISO and maintaining ISO standards as federal standards. What it needs is a procurement profile, so NBS organized this group called the GOSIP Committee, I believe --

Pelkey: When did this get organized?

Heafner: September of '86 we held the first meeting, and the initial specification I believe carried the date of December 18, 1986, which was the original draft that was sent out. The standard itself, I understand from NBS folks, will happen this summer, June or July.

Pelkey: So that process of GOSIP being organized in '86, will have completed a version 1 cycle of it in summer of --

Heafner: Will provide a procurement specification.

Pelkey: And the GOSIP concept is really two fold: one is leverage off what MAP was, the procurement spec . . .

END OF THE INTERVIEW