Interview of Robert Rosenthal

Interviewed by:
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Recorded May 4, 1988
Washington, DC

CHM Reference number: X5671.2010

James Pelkey: When did you get involved in this industry?

Robert Rosenthal: I got involved in 1969, fresh out of school and looking for a job.

Pelkey: Where did you go to school?

Rosenthal: University of Maryland. Came to work at NBS on a project that was just starting up with the Arpanet. NBS was the fourth node on the Arpanet, and I helped procure the TIP that we installed here. I started working indirectly with people like Len Kleinrock to figure out how to measure the performance of the network.

Pelkey: And this point in time, did they provide you the connection device of the TIP to the Arpanet, or did you have to build one?

Rosenthal: No, we worked closely with BBN and Larry Roberts to try to scope it, and BBN, of course, developed all of the design work and the integration of the ARPA network, and our focus was on the performance measurement of interactive terminal traffic on networks like the Arpanet. The UCLA mindset was how to look at the subnet and measure the performance of the infrastructure that supports the packets that are being switched. Our focus was to try to look at, model, and measure what the end user viewed and perceived.

Pelkey: Which is very different.

Rosenthal: A very different mindset; the focus being the service that's provided to the end user. In our case, the end user is the government, so we went about building instrumentation to do that. There's lots of NBS publications, NBS technical notes, many of them I authored, and many of the documents were published in IEEE conferences throughout the '70s. So I sort of cut my eye teeth at the beginning of packet switching technology. People like Willis Ware from RAND spent innumerable hours with us, helping us understand what it was that we were really trying to do, so it was a lot of fun.

Pelkey: That was a very exciting period.

Rosenthal: In 1975, '76, a couple of us got together and thought about how we might build a local network technology that would be suitable for use in the federal government, and we were very familiar with some of our friends at Xerox PARC. We had numbers of conversations with Bob Metcalfe, John Shoch and David Boggs - -

Pelkey: This was in '74, '75?

Rosenthal: '75, '76 as I recall, but I'm not really sure of the dates. We went ahead and implemented some techniques that were loosely based on CSMA/CD, as we know it today, but certainly quite different. We had followed the ALOHA activity in the early '70s. We knew what we didn't want to do based on some of the performance models that came out of that. So we went ahead and implemented a technology based on new microprocessor chips at the time, 6502s. I don't know if you remember that chip.

Pelkey: That Apple II.

Rosenthal: And we built a local area network that's still in use today on this campus, and had the unique attributes of having a single power supply, fanning out to up to eight RS-232 connectors, which at the time was completely different from the Xerox approach of building an Alto like workstation concept, supported by a local network technology.

Pelkey: So yours was a --

Rosenthal: Our concept was take really dumb terminals, give them to employees all over the bureau of standards, and let them get access to the few very large hosts that we had available. We had a very large 1108 at the time at NBS. We also had a number of machines in our Boulder facility, and we were able to build gateways, and so forth, between NBS Gaithersburg and NBS Boulder, and explore how users at dumb terminals, character at a time kinds of terminals, could gain access to the resources that could be shared from these large hosts. So we implemented this network and for a long time it had a growth curve of --

Pelkey: Does Jerry Bowen get any of the credit when it got implemented?

Rosenthal: Well, we actually let an RFP after we got three boards designed in one of my labs, and we got them designed, implemented, working and debugged, and then we let an RFP.

Pelkey: What year was this, do you recall?

Rosenthal: I think it was '77, '78 when we finally let a contract. A small company in Florida bid on it -- a couple companies bid on it, but a small company in Florida won the RFP --

Pelkey: Do you recall the company?

Rosenthal: No, I don't remember its name. They just started mass producing the component parts and stuffed the board, and we just started putting these devices in all over this campus. There's about a thousand devices connected together on this campus right now. People are still using NBSNET, and I got so excited about all of this that I thought it would be a good idea to put a workshop together, so I called everybody I knew in local area networking. A lot of people at MITRE had done a lot of broadband activity; CSMA/CD broadband concepts were being formulated. We were not interested in that at all because of the overhead of supporting a broadband backbone, so our focus was baseband technology. It's worth saying -- we got together with MITRE because of the context -- because the Air Force was real interested in this stuff as well, and so NBS and the MITRE Corp. sponsored the first local area networking symposium. I think it was the first -- it was a workshop just for local area networks. It was the first time. I was the chairman of that workshop, put it together.

Pelkey: May of '79?

Rosenthal: Actually, it was the one before that. There was an invited workshop here at NBS. Fifty people were invited.

Pelkey: Now was this one of the three that there were around the country before they had the one at the Copley?

Rosenthal: I wasn't aware there were three. I knew there was one. We had about 50 people invited to NBS, and I have the document in my office. I thought it was 1977, the end of 1977. It was in the winter of '77.

Pelkey: Would it be possible to get a copy of --

Rosenthal: Well, I only have one copy. You can look at it, but you can't have it. I'll dig that out. The result of that workshop was NBS's feeling that there was some serious work to do in local network technology, so myself and a guy named Norman Meisner -- M E I S N E R -- I can double check that name and look it up for you, but we put together, the both of us put together the Copley Plaza two day workshop, and I had what I thought was a good idea, and actually it was, that if MITRE could publish the proceedings, it would be a very nice document. If the government had to publish it, it would be pretty ratty looking. I don't know it you've seen that document.

Pelkey: Oh, it's a nice looking document.

Rosenthal: Oh, great, so you know it. So Norman and I --

Pelkey: I've got a copy of the index, actually.

Rosenthal: So Norman and I were co-chairman, and we got on the horn and invited all our friends. I think Bob Metcalfe came to that one - -

Pelkey: Jerry Saltzer.

Rosenthal: Yeah, we had a wonderful time. The bottom line, from my perspective, was recognition in the federal community that there was something -- a big wave was coming, and we better get out act together and get prepared for it. So I put together a number of proposals to find a mechanism and an approach for doing what we do well here at NBS, and what we're chartered to do here at NBS, namely: develop federal information processing standards, assist other agencies deploy technologies that support those standards, and conduct appropriate research so that we're at the leading edge. So I put together a huge laboratory to study the performance of local area networking technologies. I was the chairman of the IEEE Technical Committee on Computer Communications at the time, and a good friend of mine, Maris Graube had a great idea, that we need a voluntary standards effort. I talked to our management people here, and we all thought that, if we had a voluntary standards organization in place, the government could leverage off of that, and simply adopt standards that industry was willing to implement. Now that's key. That's real important.

Pelkey: It is, and I want to come back to that. If I might, thought, before we get into that, come back to this conference, because I'm led to believe that this conference was a watershed.

Rosenthal: It was a turning point, absolutely.

Pelkey: You say that you had this conference in '77.

Rosenthal: It was a very small workshop, and 'invited only' kind of thing.

Pelkey: Like, for instance, do you remember some of the people who attended it?

Rosenthal: No, but we can find out.

Pelkey: So then afterwards, you went through a period of time in which you realized that this was really important --

Rosenthal: And we went and implemented our own network so that we could get smart.

Pelkey: You implemented your own network after that conference?

Rosenthal: Part of the output of that conference led us to believe we were doing just the right stuff.

Pelkey: Had you already let your contract?

Rosenthal: The two things, in my mind -- I'm sure if you talk to some other people in mind you may get a different view -- but in my mind they were really unrelated things going on. At a higher level than myself at that time -- I was a fairly junior person back then. There may have been -- I'm sure there was a lot of coordination at the higher management levels of NBS, I'm sure of that.

Pelkey: So these two events: you putting this terminal multiplexer LAN in --

Rosenthal: Oh, no, it is a one megabit per second CSMA/CD local area network.

Pelkey: So you're installing this local area network here, and this effort to reach out to the community and find out what was happening --

Rosenthal: No, from my perspective, it was: "Hey, I've got a group here I've got to get real smart about this technology." We had a number of contracts with some other agencies to actually install some of the early three-megabit Ethernet devices, and I had put a lab together here with just Altos and Dover printers and the like. We also did some work for some people downtown. So we were very much aware of what Xerox was up to. Xerox's mindset, as I recall, at the time, was not to unbundle the LAN technology, but to sell an office system. Our motivation was to unbundle that technology and provide the equivalent of a carrier, but local area networks, at the time -- we were forcing definitions like 'locally owned and administered.' All

the bad things that we knew about carriers, from a user's perspective -- they're not bad; the regulatory kinds of things -- we wanted to do without, because we were trying to connect terminal devices within buildings that we owned. There was no need for carrier services, so we administered them ourselves, we did everything ourselves. That's what we meant by local networks at the time. So we wanted the Ethernet technology unbundled from the office product environment, and Xerox PARC didn't really want to do that. They wanted to have the workstation -- they were selling the workstation -- "Oh, and by the way, it's connected this way." -- That was irrelevant, even though all of the patents that Boggs and Metcalfe had on CSMA/CD were focused on that technology, it was bundled as part of the Xerox solution, and we were, in my mind, a driving function to unbundle that. Now, around this time frame, '77, Charlie Bass came out. Mike Pliner had just left NSA. He was going out on the west coast trying to -- at Ford Aerospace. Well, you know the Silicon Valley story. You know the Silicon Valley environment, I'm sure. So, Charlie came out here a number of times. In fact, whenever he's in town he stops by to say hello. One of my favorite stories is that I happened to be on the west coast with my wife and I stopped by to visit Charlie to start rumors -- to put plants in his ear about this new thing called LSI. I had this little slide show that I went around with.

Pelkey: What year is this now?

Rosenthal: This is 1980 or '81, same general time frame. It's all a little fuzzy in my head.

Pelkey: You're too young to have it be fuzzy.

Rosenthal: No, I'm not as young as you think. I went to visit Charlie, and my wife was with me. I don't know if you know John Davidson or not, but John was the nuts and bolts guy at Ungermann-Bass at the time -- he was the guy writing the code -- and had the oscilloscope probes connected to boards and stuff, so Charlie was showing us around the shop, and John let out this shriek. I'll never forget this: the first packet was successfully transmitted when we were all standing there, and they were just so excited, they were beside themselves. I'll never forget that afternoon.

Pelkey: That's fantastic. So, coming back again to the conference. You had the '77 conference -- how long in the planning was the conference that was held in Copley Plaza?

Rosenthal: In Boston? The planning for that -- I started working towards that as a goal -- I sort of set, in my own mind, a goal to have something like that -- as soon as our 1977, or whenever that 'invited' workshop, was finished, because there was a clear message that something important was happening.

Pelkey: And how did that message manifest itself?

Rosenthal: Well, we had who we thought were the experts in the world in this area.

Pelkey: And what were the concerns at that point, do you recall?

Rosenthal: Just the ones that I mentioned, that there was a technology, there were some companies who wanted it all bundled, and it wasn't really clear how products would ever reach government markets. We had done our own experimentation with dumb terminals. You have to remember that timesharing was an important word back then. We have 3,000 scientists and engineers around here who were carrying decks of cards, from 26 buildings scattered over 500 acres, to an 1108, and we knew there was a better way, but we didn't want to invest in big workstations for 3,000 people. The government couldn't afford that, so we wanted that carrier technology unbundled, and we wanted to control it locally, and we know that there are many, many federal agencies that could take advantage of that. That, again, in my mind, was really the driving function. Let's get the folks who knew that technology together. "Ok, Xerox wants to keep it bundled, fine. That's ok, but let's expose as much as we can," and so we knew there was a real need to start the talk about local networks, and we decided to call them local area networks, by the way. I remember Bob Metcalfe always wanted to call them 'local computer networks,' LACNs, and I wasn't particularly fond of that because of this mindset I had of unbundling this technology, and I always wanted to call them local area networks.

Pelkey: Do you recall --

Rosenthal: I recall a conversation I had with Bob and John Shoch about that, because I was real interested in what John was doing. John had just gotten his PhD from Stanford on performance measurement of the Ethernet, and we had exactly the same system in one of my labs upstairs, and all I wanted to do was do a controlled, repeatable experiment of what John had done -- real science. If you can repeat the stuff, then you can start to measure things, develop methodologies for -- the kind of stuff we did very well at NBS. So, we all got together, talked this thing out, and I wanted to expose it.

Pelkey: Did you get together here?

Rosenthal: Yeah, a lot of times. We got together a lot of times. In fact, Bob even had -- I even let a small contract to Bob, before he got involved in 3Com, to do some studies for us.

Pelkey: This is after he left Xerox?

Rosenthal: Gosh, I could look up the reports and we could see what byline he used on them. There was also, as I recall, there was a presidential commission involved in some of this, but I was at the wrong level of management to worry about those kinds of things, so I don't know the details of that. I know Bob Metcalfe was involved. I'm sure if you talk to him, he'd fill you in on some of those details.

Pelkey: He didn't mention --

Rosenthal: I don't even know that he wants to talk to you or not.

Pelkey: Oh, no, he gave me seven hours, but he didn't mention that presidential thing.

Rosenthal: Well, maybe I'm really speaking out of turn. That's why I'm saying to go back to him if there is something there. I don't really know that there is or not. Like I say, it was above my level at the time.

Pelkey: How did you decide what sessions to have at this conference at the Copley?

Rosenthal: Well, I've always been involved in organizing those things. I mean look around you today, I'm still doing the same bullshit today. It's that simple. I have a mindset of the kinds of things that are important. People carry around this baggage of their reputation. You'll never get away from that, that's group dynamics at its best. There's lots of new faces, lots of things you want to try, lots of things you want to do, and you just do them. A lot of times things fail, a lot of times things are very successful, and if you look at the proceedings from that workshop, you'll see. One of the things I was really excited about was having 'birds of a feather' kinds of sessions -- not only having very formally planned paper kinds of presentations, with guys like Zerakat from MITRE -- they just want to pound their chests and say: "Here we are, doing this wonderful stuff," so, fine, you have to do that, but what you can really do is get people that have common interests together, get them in a room like this one, get a recording secretary to take good minutes, people you trust to do that, and just throw out a couple of issues and listen, and try to record things and try to put things in perspective. And if you look at the proceedings from that workshop, that's what came through. That's the important stuff. It's the 20 pages at the end that talk about the discussions and the mindsets and the issues at the time that I think you'll find very interesting.

Pelkey: I have not seen those. I made a copy of the table of contents, but I wasn't aware of this part.

Rosenthal: So you missed the whole reason --

Pelkey: I missed the whole thing, but I'll get those, so I will not have missed them. Were you surprised by the number of attendees that came?

Rosenthal: I was flabbergasted that 400 people would register for a 'local area what?' There they were. May in Boston.

Pelkey: What was the mood at the conference?

Rosenthal: It was so excited. There was electricity in the air. People didn't know what to make of what NBS and MITRE were really up to. You had some of the leaders; you had Bob Metcalfe there, saying: "The world's going to be a better place. There's a need for this stuff." It was just really exciting.

Pelkey: Do you recall discussion between Ethernet and token ring at this point in time.

Rosenthal: None at all, absolutely not at all --

Pelkey: But Bob recollects that that was important.

Rosenthal: But I know -- I'll fill you in on that if you want.

Pelkey: He thinks that if he had been more successful at that conference, IBM would not have picked token ring.

Rosenthal: Well, Bob I'm sure had -- well, you know, you'll talk to different people and get different perspectives on that --

Pelkey: He thought he didn't argue strongly or loudly enough that Jerry Saltzer -- Saltzer won the day at that conference.

Rosenthal: I'm sure that's probably true. There were a lot of Bell Labs people there too. Some of them were doing silly things, some of them weren't. I made some real good friends as a result of that that have lasted through the years.

Pelkey: Were Farmer, Newhall or Pearce or any of those people there?

Rosenthal: No, but the paperwork was there. I don't recall that they were there. I think I even still have the attendance list from that thing. We could look at that.

Pelkey: You said you were going to remember an incident or two.

Rosenthal: Well, my first exposure to the bus/ring battle must have been 1982, so my exposure to that was well beyond this first conference, or the second conference. In fact, I remember, I called the proceedings "Update: Local Area Networks," because it was a follow-on to this first thing we had, so if you look at the title of the proceedings. it's called 'Update Of.'

Pelkey: Ok, I haven't seen that one.

Rosenthal: Well, that's the one I'm talking about. The real nice one from MITRE is called: "Update: Local Area Networks," because it was the second one we had.

Pelkey: Following this 'invited' one you had held.

Rosenthal: That's right. So anyway, that brings us up to February of 1980.

Pelkey: So you were coming around to Graube and the IEEE and --

Rosenthal: That's where we are. That's where I am.

Pelkey: So now the conference is ended, and you were making some comments --

Rosenthal: The result of the conference was the kind of exposure that I was real excited about. I was able to put together a group called a "local area networking group" at NBS, so there was recognition -- Actually, there's a guy named Ira Cotton; Ira was my boss for a while. I really

have to give Ira lots of credit for pushing this. He did a good job with this. He's now a consultant at Booz, Allen in Bethesda. Ira was truly instrumental in helping get that Boston conference to happen. Ira was a good manager for me. He and I got along very well. He sort of said: "Here's some rope, go hang yourself," that kind of stuff, and it worked out real well. Ira left about this time -- he left the Bureau. The concept of OSI was being formulated internationally. The reference model work had started in 1978. ISO had begun putting together an infrastructure that made it possible for international standards to evolve. The American National Standards Institute copied that infrastructure, and committees were formed under ANSI X-3

Pelkey: In, what, 1980?

Rosenthal: Earlier, '78. What I'm trying to do is say: "Look, there was an infrastructure to support the development of standards." At NBS, our mission is to develop standards for use in the federal government; federal information processing standards, mandatory procurement regulations for automatic data processing equipment. We were trying to position ourselves to develop standards in the voluntary community that we could adopt for use in the government. It's an important concept. We said: "This is our approach. We want to work with industry in a voluntary arena to get industry backing for products so that we can buy those products."

Pelkey: On a commercial basis.

Rosenthal: Right. Fundamental difference between that way of doing business and the way the Department of Defense wants to do business. The Department of Defense, at the time, would throw money at a problem until it got solved. Vint Cerf and company went off to invent TCP at the time because they got lots of DOD money to make networks work. We said: "Fine, you do whatever you need to do, but our approach is to work with industry. This OSI thing looks like it might be a nice hook to hang our hat," so we jumped in with both feet. I personally said: "Ok, a whole group of people go off and do OSI, but I think this local network stuff needs to get done. I understand the technology. I know some of the players. Let me have at it." So, as I mentioned before, I was the chairman of the Technical Committee on Computer Communications in the IEEE.

Pelkey: When did you become chairman?

Rosenthal: 1980-ish. Some other names, I think, would be important.

Pelkey: Please.

Rosenthal: Ken Thurber and Harvey Freeman. They're in the Minneapolis area. They were IEEE people as well.

Pelkey: Now was this technical committee already in existence?

Rosenthal: Ken, I think, actually made the technical committee. He was the critical mass to get it together to make it, but everyone has their own agenda. My agenda was to use the IEEE as an

appropriate vehicle to get industry together to create an appropriate voluntary standards forum that I could leverage into a federal information processing standards program, because that's what I was getting paid to do. So I worked with a guy named Maris Graube, from Tektronix, who had a long background and history in working in these kinds of standards arenas. He had come from a group called PROWAY, trying to develop some similar kinds of things for the process control community, and Maris really made everything gel.

Pelkey: And is he still at Tektronix?

Rosenthal: He's still the chairman of Project 802.

Pelkey: And 802 --

Rosenthal: A Project Authorization Request was put together --

Pelkey: Was 802 in existence in 1980?

Rosenthal: No, that's what I'm saying. A Project Authorization, an IEEE PAR was put together and submitted, and it came back through the Technical Committee on Computer Communications as a project, and it's number was Project 802. So there it was. Everything was in place.

Pelkey: And when was --

Rosenthal: We had our first meeting in February of 1980 -- God, maybe it was '81. It was coincident with the IEEE meeting that's held every February called ComCon Spring at the Jack Tar Hotel, only I don't think it was called the Jack Tar -- what's it called now?

Pelkey: It was the Jack Tar then. I forget what it is now.

Rosenthal: It's the Cathedral Hill now.

Pelkey: It must have been '81.

Rosenthal: It was either '80 or '81. Again, that's just the records. We can look that up.

Pelkey: Ok, so the first meeting of 802 was held --

Rosenthal: It was held coincident with ComCon Spring, IEEE biannual meeting. Maris was the chairman. If I'm famous for anything, it's for making the first motion. The first motion was something like: "We all agree to build standards that reflect OSI." Those were my marching orders to come to that meeting.

Pelkey: And what happened to this motion?

Rosenthal: It passed unanimously.

Pelkey: And who else was on the committee at this point?

Rosenthal: All we had was Maris to stand up and put it all -- to organize it. To stand up with all these people, wondering what the hell was going to happen, knowing that NBS was there. I sat next to John Shoch at the meeting. I don't think Metcalfe was there, but I know John was there, and some DEC people were there; some of the guys who had done the Yellow Cable spec from DEC. Some of our good friends from Intel were there. Bill Arst was there, as I recall, people who had worked on architectures for chips. There were no products at the time but there was a lot of architecture work that had already been done on masks and so forth. You could feel the fire in the air.

Pelkey: Was the committee formed at this session?

Rosenthal: Yeah, that was the first meeting of 802.

Pelkey: Let me make sure I'm clear. When you say this was the first meeting, there was only Maris who was on the committee, and there was a bunch of people in the room.

Rosenthal: There was -- I don't know if you know the hotel, maybe you've been there. There's a little pagoda thing in the middle of the hotel, by the swimming pool. The place was packed, jam-packed. All the -- what the hell were they? They weren't RBOCs back then. Bell Labs was there in droves. All the people were there, wondering whether we were going to talk about PBXs, whether Ethernet was really going to come. I don't even know that Ethernet itself was available as a public specification. The triumvirate hadn't published their spec yet, or maybe they had. Again, that's a detail. You can look at the dates and figure that kind of stuff out. So there we were, just trying to figure out how to get organized, how to make something happen, and the rest is just history, and I've got file cabinet after file cabinet of the stuff.

Pelkey: I'd like to hear about this. Was there a group of people formed at this point who made up the committee?

Rosenthal: We had put in place meeting schedules, and again, I used to keep very accurate lists of the meetings. I could reconstruct it, but I'm really not interested in doing that. I did give a lot of material to Maris the last time he was here, about a year ago, just memorabilia that he waned, because he's still running the show here.

Pelkey: Good. I'll get hold of Maris, obviously.

Rosenthal: What I think was important was that -- and I'm not sure of the particular meetings that this happened -- but an organization began to form, and we started choosing up teams, like you would do, and we had a couple of false starts. We weren't sure whether we should look at interfaces between things, whether we should have a group looking at lower layer issues. It was just the ramblings that go on when you try to get things to happen; a lot of personality things came out. The true nature of people and who their sugar daddies were came out. IEEE, at the time, was not accredited as a standards making organization under the rules of the American

National Standards Institute. I was very concerned about that. I worked closely with a fellow, one of the division chiefs here, one of the higher management kinds of people here, to get IEEE accredited under the rules of ANSI, just as X3 was accredited. As I recall -- well, there's some interesting things that had happened. IEEE is a professional society, and when you go there, you represent yourself. Everybody knows there's a sugar daddy paying your bills, but you're there and you go because you're you, not because you work at IBM or DEC or wherever. ANSI X3 has a secretariat, CBEMA, the Computer Business Equipment Manufacturer's Association, and you go to X3 as a company, and you vote as a company. There's a whole different mindset involved here, and because of the 'I'm an individual' mindset, none of us felt bad, the way little kids would sit around in a sandbox and throw sand at each other. It was real exciting times. There were some personalities that are still around. It's like a big sandbox, really, where people built little sand castles and other people came up and kicked them down, that kind of stuff. However, we got to the point we got to, I know I tried to push OSI down these people's throats as often as I could, and very seldom would people hear of it. Then, I remember one meeting in particular in Phoenix, where it was -- I remember Bob Metcalfe was there -- and it was the pull the hair out and scratching; what do we do about bus versus ring? How do we solve that issue? It got down to a vote in a room about this size, a closed ballot --

Pelkey: So there's about 50 or 60 people there?

Rosenthal: It was less than that. It was the hardcore.

Pelkey: Because at this point in time, there were three subcommittees, but they were kind of --

Rosenthal: No, there weren't.

Pelkey: I thought there were three committees that were physical and link and everything else.

Rosenthal: That's right, that's exactly right.

Pelkey: Then you had this meeting.

Rosenthal: That's why I'm saying there was a lot of structure that started and fizzled, and we really were groping.

Pelkey: But then you had this meeting in which you really tried to deal with --

Rosenthal: Right, we've got to deal with it. You know, IBM was there. What are we really going to do? The Ethernet folks had made their pitch. It was clear that Ethernet was not going to go away. IBM couldn't envision that Xerox could do this to the world -- again, my perspective. I don't know what was really going on. They pulled out all the stops. The meeting was packed full of IBMers, it was packed full of everybody who had a stake. Then the PROWAY people were there, the old-time process control community that didn't want anything to do with token ring. They loved bus technology, but they couldn't deal with the probabilistic nature of CSMA/CD. They had to be deterministic, so they had a ring mindset, but it wasn't

token ring, it was token bus. So you had two important camps, the token camp versus the CSMA/CD camp. The vote came down: we've got to have two.

Pelkey: My understanding was you required a two-thirds vote to pass something.

Rosenthal: I don't remember the rules. I made up a lot of those rules, but I don't remember them.

Pelkey: Someone's recollection was you required two-thirds vote, and actually, token got more than half, but it didn't get the two- thirds required, and then everybody realized --

Rosenthal: That's right, I do remember that.

Pelkey: -- that Ethernet wasn't going to be prevented, but Ethernet wasn't going to get accepted.

Rosenthal: I recall that now. The bottom line is that, when it was all said and done, it was clear -- everyone breathed a sigh of relief that at last we could have two technologies supported in one standards committee. It pissed a lot of us off.

Pelkey: So actually, you made three.

Rosenthal: No, not at that time.

Pelkey: Ok, so then you go and change the concept of going from data and physical and everything else to the concept of CSMA --

Rosenthal: Again, my view was that this was a real disaster. Here I am trying to make standards for use in the government, and now I've got to chose between two technologies. Pissed me off to no end, but I had to live with that. So, I turned my attention to the CSMA/CD arena because of all of the stuff I knew about CSMA/CD. I had modeled it. I was sick of it. I knew it very, very well, and I had a network here, I had a lab here. Nobody else really had a laboratory where they could bring results from the laboratory to a standards meeting, except Intel, DEC and Xerox. So, where do we go from there?

Pelkey: So here you are in the committee, and you're at this reconciliation point of view, and it's a disaster for you.

Rosenthal: I turned my attention to CSMA/CD because I knew, in my heart, that's what the government needed, and the token people went off to kick and scream for a while, because they had their own two party system. They had a bunch of people from the process control community and a bunch of people from the technical, office community – completely different mindsets about this token system. A real interesting fellow who worked for Honeywell at the time, his name is Tom Phinney, and you've heard that name before.

Pelkey: Concord.

Rosenthal: Yeah, he left Honeywell, went to Concord, now he's back at Honeywell. Tom was a brilliant engineer. I always told Tom that, if I had my way, I'd take him out and shoot him. He had no business at all being at a standards meeting, because he designed most of the token passing system in committee, which is something an old standards person knows you never, ever do.

Pelkey: Right.

Rosenthal: As a result of that, a lot of decisions were made that had to be recalled because when you got to the point of trying to build some of those things, it just wasn't going to work, so you had to revisit many issues that everyone thought had been put to bed. So the token community went around in circles for a long time

Interruption in Interview

Pelkey: . . . NBS Workshop on Local Area Computer Networking -- there's that expression -- in Gaithersburg on August 22nd to the 23rd of 1977.

Rosenthal: This is an agenda I put together.

Pelkey: Work in progress and some reports.

Rosenthal: Let's see if there's any meat.

Pelkey: This is from the letter that was put out to Ira inviting people to this '77 conference:

"As you know, local data networks are distinguished from the large, geographically disbursed networks that have been in the forefront of research these past few years by the need to serve the intramural communications needs of a local community on a campus or office site, where the geographic separation of users is quite limited. As network and interactive use of computer systems grows in popularity, the number of communities that would be candidates for such local networks is growing, both in the public and private sectors.

"The technology to serve such users is still in its infancy. A variety of approaches to meet these local needs have been advanced, ranging from single multi-drop lines under centralized control to sophisticated ring and broadcast networks with distributed control. A few sites are now experimenting with one or more of these approaches. The time now seems right to bring together the various research in local data networking in a setting conducive to real technical interchange and sharing of experiences."

This is a note on the Update to Local Area Networks proceedings of May, '79: "Please make sure to review the comments at the beginning of Robert Rosenthal as well as get a copy of the workshop summaries, beginning at page 329 going through 361."

Tape Interrupted

Pelkey: We were just finishing up downstairs, and you were mentioning that it was kind of disappointing to you, now that there were multiple standards. OSI was still and important issue to you. Now, somewhere along the line, the government started to get behind TCP/IP.

Rosenthal: Oh, I'm glad you brought that up.

Pelkey: Then we can move over to the GOSIP.

Rosenthal: Yeah, we can. We can do that. So the history of 802 as it went through the years worth of effort and all of the meetings everywhere evolved what it now all the numbered groups. Maris and I had long conversations about how to get rid of the personality problems and focus more on an organization and structure that would support outputs that we would be proud of, rather than the in-fighting. So we had to get rid of that old structure. We had to put in place an infrastructure that would be conducive to making real things happen, and that's when we invented 802.1, .2, .3, .4 and so forth. As a matter of fact, I remember, it was a cold, windy night in Minneapolis when we did that. We were just walking around the lake, and we figured out how to do that.

Pelkey: How about that. It was just the two of you.

Rosenthal: The two of us, yeah. We knew there was a problem; we had to work it out. A division chief here named John Riganati was instrumental in the IEEE, who is very close to the people in New York who were the movers and the shakers in IEEE for all kinds of standards, but he worked at NBS, so we took advantage of that. We asked him to help us orchestrate this new change that we wanted to put in place in 802 -- taught us how to do that, really helped us do that, and we did it very successfully. So that was a pleasure, to be able organize.

Pelkey: John Riganati is a TKE.

Rosenthal: Well, I don't think so. John isn't involved in this kind of stuff at all anymore.

Pelkey: No, but at RPI.

Rosenthal: Oh yeah? John is your fraternity brother? Outstanding. John's a wonderful guy.

Pelkey: Small world. Is he still here?

Rosenthal: No, he runs a big super-computer laboratory way over in Prince Georges County right now for -- what the heck's the name of it. I can get it for you.

Pelkey: I'd love to be able to give him a . . .

Tape Side Ends

Rosenthal: . . . because I knew John here and got him and Maris together to sort of work out the specific details of how to implement the changes we had planned, and it was orchestrated very well.

Pelkey: So after you walk around the lake and you decided what you wanted to do, you got Maris together with John --

Rosenthal: After that, yeah. In fact, I tried to get John to come out to one of the meetings, but he couldn't do it, so we set up a conference call with all of the old people in Project 802 who were pissing and shaking each other all the time. John was there as an arbitrator, with a remote telecom, sort of led us through the discussion of how we ought to do this, and everyone agreed to do it. It was real interesting, real interesting group dynamics. It was a lot of fun to do that.

Pelkey: This must have been late '81?

Rosenthal: Well, I seem to recall '82-ish. I know it was in Minneapolis, so it had to be one of the earlier meeting, because we hadn't gone back there. Like I say, I gave all this stuff to Maris. Alright. So 802 was on course again. We had .1, .2, .3, and everybody started associating those numbers with the technologies, which I felt real comfortable with. I had 802.3, I thought, on course, and that's the technology I was real concerned about, because I understood it very, very well, and I was able to say: "Ok, feds, I'll show you..." I'm sure you've seen these books.

Pelkey: Oh, yes.

Rosenthal: What I was able to do was -- this is what I make. This is the products that I make. This is a Federal Information Processing Standard, and I'm real proud of this one, because it's the predecessor to all this GOSIP stuff, if you will. This is a federal standard. It's the only one that we have in networking in the government, out of NBS right now. GOSIP's on its way, so it should be here soon, but FIPS 107 is -- well, you can read the title.

Pelkey: It's dated: 1984, October 31st, and it's titled: Local Area Networks: Baseband Carrier Sense Multiple Access with Collision Detection Access Method and Physical Layer Specifications and Link Layer Protocol.

Rosenthal: Mandatory procurement, and standard -- and I told IEEE to let the world know, and put the fact on their cover, for 802.3 and portions of 802.2. That's what this does. So I won at the game. I made the rules, played the game, and I won.

Pelkey: After all that effort, that's fantastic.

Rosenthal: And all this does is point to the stuff industry said they'd do. That's what's really great.

Pelkey: That was your key objective.

Rosenthal: Exactly, so now -- and I know, I get calls all the time from GSA, the Government Services Administration, saying: "What is this FIPS 107?" And I say: "It's this technology," and people say: "Great." Anyone in the government can buy product without all the paperwork and shenanigans. They say: "Buy something that's FIPS 107," and it makes life very easy for ADP managers all over the government.

Pelkey: It sure does.

Rosenthal: So, GOSIP will include this, as well as token bus and token ring, because those standards are, in some sense, mature now. That's still debatable.

Pelkey: Well, the ring is more mature than the bus.

Rosenthal: Well, value judgments, I suppose. So I won at that game, and we started looking at what to do with this OSI stuff, from the beginning of '84, I guess, and got real serious about TCP/IP, all of the proprietary architectures. We looked -- we got seven mainframers in to sit down with us, and we said: "What are the features and functions of your architectures?" This goes way beyond local networks, now. We were looking at a much bigger picture now. IBM came in and said: "This is what SNA is." Everyone came in. Xerox came in and said: "This is what XNS is." DEC came in and said: "This is what DECnet is." We were able to abstract the features of all of those proprietary architectures, including DOD's TCP/IP, and try to evolve a consensus on protocols that would support all of those features. Transport was the key. If we could get agreements on transport, we would win that whole ball game. Everything else would follow. So, we got together with -- well, it's a long, long story, and I don't have time to go into it right now. The bottom line was, we were able to generate a formal description language for specifying protocols as research here at NBS, so formal description languages was a very appropriate thing for us to do. We specified a transport that incorporated all the features and functions of everyone's proprietary architecture in that formal description language. We built a compiler for that language, to build a reference implementation of the protocol we specified, in this case transport. We ran that reference implementation in one of our labs. We built test tools so that vendors who would implement to the standard could bring their equipment close to our reference implementation and test their implementation, and then we got together with Boeing and General Motors and said: "Let's go put on a show." And, at the 1984 National Computer Conference, we had a huge booth to demonstrate, for the first time ever, local area network technology on -- local area networks and OSI transport, that had been accepted internationally. There we had -- I've got some brochures on that, actually. I can get you some of those brochures if you're interested in that.

Pelkey: Absolutely. Was General Motors and Boeing --

Rosenthal: Now, here's what happened. In order to pull this off, we had to get some agreements. That's the key word, 'agreements.' We had to get the people highest up in these organizations to commit resources. We had to get a commitment of the CEOs, somebody with signature authority, had to be able to say: "Here's the check, you make it happen. Pull out all the stops. OSI is important. Make it happen." We had to get the technical people to ask the question: "Make what happen?" We had to say: "Make this happen," and we had to lay it out

for them. They came back to us immediately and said: "There's too many options here." A DEC guy says: "I'm going to implement it this way, and the IBM guy's going to implement it that way, and we're at different altitudes. Why don't we go to the National Bureau of Standards, where we can all be peaceful, sit around the table, our techie guys can sit around and talk to each other without all the fears that you might have," non-disclosure and all that stuff, we can deal with that here at NBS, "let's ask the Bureau of Standards, good solid government agency with a good, strong reputation, if they'll do that for us." So industry came to the Bureau of Standards and said: "Please help us. Put together a workshop that looks like a big umbrella where our techies can get together, roll up their sleeves, and agree on what it is we'll implement." And we said: "That's a good idea. Why don't we start an NBS workshop for implementers of OSI so that we can not only reach these technical agreements, but we can use that as a springboard to demonstrate to the world that OSI really works." So we did that. From the end of 1982 through 1983, our focus was transport, because that's the key in OSI, because that's where end to end reliable service is delivered, and LAN technology, all of this stuff we had just produced, this FIPS stuff we had just produced. Eight companies, I think, signed up to do it; small companies like -- what's that crazy company with the leapfrog, some small company, we can look it up -- all the way up through IBM; a very broad spectrum of companies committing to implement OSI for the first time in 1983, and we played it to the hilt. We got all the mileage we could out of it. We burned out a lot of people at NBS trying to do that, but we had in place this workshop, this mechanism to demonstrate OSI concepts to the end - - we began calling it an international workshop, so, not only was US industry involved, but US industry, in my opinion, was so far ahead of the rest of the world, that it would be to our marketing advantage to get the Europeans and the Japanese involved, to get them on this OSI bandwagon, because we honestly felt, being in the Department of Commerce, that's really part of our job, to foster the US economy, that we'd have a leg up on the rest of the world. So it's an international workshop for implementers of OSI, and after we had done that with General Motors' support and Boeing's support --

Pelkey: And they came to you?

Rosenthal: Big users, huge user communities --

Pelkey: Came to you and said --

Rosenthal: They said: "Hey, this is great. You've got industry here saying come help, you've got big users, Boeing and GM." Bob Dryden from Boeing came out. Everything was wonderful. Smith from General Motors. The top. These people are committed -- they're using words like OSI. It's unheard of. It's working. What are we doing right? My God. It works because NBS is NBS. Very unique for a government agency, unique position. Let me sort of bring you up to date with this. The point of fact is that we had done this local network stuff. We had tried to foster the community. We were involved right at the beginning, but we saw, very clearly, that industry could handle their own problems, create their own -- there was no need for the government to be involved. There were many other areas where our focus and attention was demanded, so, fine, industry can go fight your ring and bus battles until you're blue in the face. We don't care anymore. We got what we wanted out of it. Let's move on to a richer set of problems. What's happening at the upper layers of OSI? How can we accomplish similar things? MAP community had always been grumbling in the background, but all of a sudden

General Motors saw what we could do with this demonstration stuff, and said: "Let's fly. We've just been taxiing around. It's time to take off," so MAP 3.0 became a reality. The same forum was used to do that. TOP happened, because Boeing couldn't let GM get away with all of the glory. Lori Bride from Boeing got involved and made TOP, and the TOP community, the MAP community, the Corporation for Open Systems is another two days worth, but that all happened -- there's a lot of reasons, and not enough time to go into that. Fundamental concept was: NBS had all this test technology, and Reagan had a privatization mindset, and still does, so what better thing than to try to get COS out of it? COS happened. You can find out all about that story if you want, and there's an Enterprise Network Event scheduled for June. The implementer's workshop you saw. That's what's going on today, this week, this same workshop. Implementers are here to make implementation agreements. They look like this now. I just published this last week, or in December. These are stable implementation agreements for OSI. They include lower layers and upper layers, all this stuff, and now there's a document somewhere on my desk -- here it is. I got this April 12th. If Boeing could do TOP and General Motors could do MAP, the government had to do something, so we did a government OSI profile. GOSIP. Same stuff, just a little different twitch. This is GOSIP. It'll end up a thin document that points to this, and says: "This is the federal standard for OSI," so that's how I've grown through all this stuff.

Pelkey: This is fantastic.

Rosenthal: Now, the movers and shakers to get all of this started were really, a guy named Bob Blanc made this happen. He was a Center Director here. He's left now. He's gone off to Intel.

Pelkey: In Sunnyvale?

Rosenthal: In Oregon. I haven't talked to him in over a year.

Pelkey: But he's the one I'm kind of --

Rosenthal: He's the one who architected all of this.

Pelkey: Bob Blanc?

Rosenthal: B L A N C.

Pelkey: Now, TCP/IP is still being bought by the government, and presumably at some point in time, GOSIP, once it gets finalized, everything will go over to GOSIP from TCP/IP, right? How did TCP/IP get -- it came out of the DOD side.

Rosenthal: Exactly, it's a DOD proprietary set of protocols. It had nothing to do with the international standards community. If DOD keeps pouring money into something, somebody will bid on it and build it. That's clear. That's what TCP/IP proved. The Department of Defense had some out with a memorandum, primarily based on this report -- this was done by the National Research Council --

Pelkey: It is a relatively recent report.

Rosenthal: Two years. February '85. It's even older than that now.

Pelkey: I can get this from the National Academy Press in Washington. It's called Transport Protocols for Department of Defense Data Networks: Report to the Department of Defense and the National Bureau of Standards.

Rosenthal: Right, and what it says is that -- there are a couple of different options for DOD. To make the long story short, DOD has a policy in place now to migrate to OSI, based on these agreements, based on GOSIP. DOD participated in the writing of GOSIP. DOD plans all major new procurements to be to GOSIP, within a two-year time frame, and all major upgrades to be GOSIP. So there's a clear message to industry, to the TCP developers of the world, to begin tooling up for OSI. A very pleasant migration strategy, if you will; very supportive of US industry, just like a new horizon, another goal for industry to reach, very well specified. Somebody will have tests in place. If it's COS, fine. What we need to do at NBS is make sure that some kind of testing authority is established somewhere -- an accredited laboratory, perhaps, that can test these products for conformance to the standards, and we have a big program in place --

Pelkey: Presumably COS somehow will do that.

Rosenthal: Well, it doesn't matter to us whether it's COS or some other organization. So what? What we want to do is just have -- perhaps even stimulate the whole market for testers and test competitively. Why not? It makes a lot of sense to me. There's really no evidence yet that COS really has the tests. Maybe we'll see that at ENE, I don't know.

Pelkey: So now, what was at DOD has now become NBS. This is really a revelation for me, the role of NBS.

Rosenthal: Oh, boy, it's the heart and soul of international OSI, and the reason is this workshop, based on results. I love to go to a meeting, anywhere in the world, and say: "Look what I did, you guys." You can listen to people talk about how wonderful OSI is. If you can say: "This is what's happening. Read it," people listen. If you have a document that says: "Stable implementation agreements for -- " The press hype that you've been reading about for years.

Pelkey: And this publication was in December, 1987.

Rosenthal: Issued January, 1988. This is hot off the press.

Pelkey: This is NBS Special Publication 500-150, which I can get from the US Department of Commerce.

Rosenthal: I can't give you this. I can ask you to go over to the workshop and you can buy this for $10.

Pelkey: Good. I'll do that. I know that you're constrained for time.

Rosenthal: I need to get back over there by quarter to 12, so I have ten more minutes.

Pelkey: At the end here we've taken big paint brushes of things that I'm interested in.

Rosenthal: You told me you're going to talk to Jerry Mulvenna. Jerry is currently responsible for this GOSIP document, for this document and its contents, and it's just pointers to this stuff. I'm responsible for this stuff, and coordinating the activities of about, 217 vendors are here this week, have registered already. It's mind boggling. That's my workshop. It's scary.

Pelkey: Let me ask you a more philosophical question, if I might, the issue of the United States, in terms of being competitive in the future, is obviously motivating you, and is part of my motivation for writing this book, about how do we create technology industries and how do we grow them and how do we get them to be big so we can compete on an international scale. The issue about building infrastructure is an important issue that one could look at the Arpanet as having been an important infrastructure building process, in terms of developing a technology and getting people knowledgeable, developing people's skills. That led to a number of different things – one could argue how successfully, but… Now, with the break-up of Bell Labs, again focusing on the communications industry, Bell Labs is unlikely to play as important a role in research in the future, and ARPA, going from ARPA to DARPA, with the Mansfield Amendment, over time has become much more tactical than research oriented. Given this role that NBS has played, through your offices and this process, what's your reaction to how we in this country do research and build companies and encourage the development of new technologies that are inter-company? How do we do it?

Rosenthal: I haven't thought through clear answers to that. I've never really asked myself that question the way you've just posed it, but I'm in a position to see how multi-national corporations, from the biggest ones like IBM to smaller ones, act and react to these kinds of processes. There is a problem in some areas, there's very little problem in others. For instance, mature technologies, like devices that support interfaces to public data networks, like X.25 mechanisms, find markets internationally, so there's no problem there. Important areas, like security, in open systems, still have national barrier kinds of problems, and part of our work now, the forward-looking work, in particular in security, has to address those problems. We have to deal with the way that our own government protects information, and the rules and regulations and policies that our national security agency imposes, and how we get companies to build security relevant products for open systems. It's almost like a dichotomy. How do you deal with this? It's a dilemma, really. Those are the forward-looking problems. How they actually get solved, I don't know. I can give you pointers to things that are happening internationally. This workshop has been much too successful. The Europeans have just formed their own regional workshop, and the Japanese have done the same. I don't know whether they'll be as successful as this particular workshop, but even the International Standards Organization has recognized the need for the equivalent for these kinds of agreements. They call them International Standard Profiles, or ISPs. All the processes that -- the infrastructure to support that is not yet matured, so until that happens, we'll need workshops like this. We'll need the big companies getting together saying: "This is what we'll implement. Where are the markets?" The markets come from standards like this. They come from large user groups, like MAP and TOP, and new stuff in

information technologies always happen. ISDN is, we think, just around the corner, so we've started a whole new similar kind of process here at NBS to get ISDN started and happening, at least in North America, in a way, almost, playing catch-up to what's going on in Japan. Believe me, I just came back from Japan. The Japanese are scared to death about the Koreans right now. That whole basin is -- the whole Asia Oceana basin is electric. I was going to think more about a compost pile and it's just been fuming for a long time, and there's just a lot of heat coming off of it. I don't know what's going to happen over there.

Pelkey: I agree with you, though, the Japanese are scared to death of the Koreans. I manage money for those countries. It seems to me, and I don't mean to be melodramatic, but this process, these workshops, is an emerging kind of organizational structure in order to be able to create --

Rosenthal: No, it's not new --

Pelkey: Let me explain, because the Blue Book, the only reason Intel, Xerox and DEC could get together was because they were going to make a standard of it. So getting around antitrust – we have this problem about antitrust and these big companies --

Rosenthal: It's not clear at all that what they did is going to get around antitrust; at least in my mind it's not clear. I'm not a lawyer for the Antitrust Division of the Justice Department. I know Bob used to worry out loud about antitrust. I know companies who started coming to this workshop worried out loud about it, and I went to great pains to get our legal people here at NBS to make sure we were doing it right, to support US industry, and that's how it started. We had to go to the Federal Register. We did everything right up to snuff, and we still have to do that. When we announce schedules for this workshop, we're very, very careful about how we say what we're doing, so that the government is not going to shoot itself in the foot here. We don't want antitrust problems to hinder participation here.

Pelkey: But that merging form of what you call the workshops, which allows industry and users to come together to the benefit of all is a new process, on some level.

Rosenthal: I'm not sure how new it is. We've been doing this since 1983. We had our first workshop in '83.

Pelkey: Right, but I'm saying when you started this process in '83 -- I'm saying there's an emerging form that you've created here that you're now taking over to ISDN and what's happening is that, through you and through Ira Cotton and maybe Bob Blanc --

Rosenthal: Ira Cotton and Bob Blanc are completely out of this picture now. They don't work at NBS anymore.

Pelkey: Ok, but I'm saying the process got put in place back then, and one that you're following through with now, it strikes me that there's something here, in terms of the way we're going to be able to create infrastructure in the future, maybe underneath the auspices -- currently NBS is playing this role, but allowing companies to get together so that we can pool the resources

required and create standards so that we can create infrastructure going forward, which are going to be needed. We're going to need higher speed networks and we need databases that can work together. There's lots of things needed in order to bring the information economy home.

Rosenthal: That's true. I agree with that.

Pelkey: Respectful of your time, I'll call it quits, and I'd love, after I get a little further down, if you don't mind, I'll give you a call and maybe we can find a more convenient time to talk some more.

END OF THE INTERVIEW