Interview of John M. Davidson

Interviewed by:
James L. Pelkey

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UB (Ungermann-Bass) Networks
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John Davidson: I look forward to the conversation.

James L. Pelkey: You went to the University of Hawaii directly from undergraduate school.

Davidson: Yes, Middlebury College in Vermont, where it was cold, then to Hawaii where it was warm.

Pelkey: I went there RPI [Rensselaer Polytechnic Institute].

Davidson: I did a dissertation. Did you?

Pelkey: Oh, I have some stories about RPI. My father went to RPI. In what years was that?

Davidson: When I finished? '68.

Pelkey: '68. And I understand that Charlie [Bass] got there the same time you did.

Davidson: He was there the same time. They were beginning an activity which was—a research activity, the ALOHA system activity. *<inaudible>*. And two others formed our graduate department, which was just beginning at the time. There were actually some other folks that were there as well, but I remember those four as being instrumental in helping create this ALOHA system. *<inaudible>* and found, was being created.

Pelkey: What was your role in doing that?

Davidson: In the ALOHA system, there were lots of people who had some good thoughts about what could be done to share a single communications channel, so when you look back at the beginnings of all of the shared communications channel work, the ALOHA system gets some credit for that. And for some of the theory that came out of it afterward. It also built something. I got there and I was one of the guys who was a graduate student who was asked to build something, so I actually fell into a project that was ongoing. I didn't know anything about the theory that was being discussed, and I did not become a theorist, I became more the practical guy that helped build things. I had had some exposure to computing in the Middlebury undergraduate experience, so I thought that's what I wanted to study. That's what I entered school for, computer science, at Hawaii, and as a graduate assistant, I get assigned to this ALOHA system project, and I was asked to build some stuff. Well, what they had to do was try and make up a networked system which consisted of these outboard terminals that could use a radio link to connect them to a very strange front end receiver, which was built on some HP [Hewlett Packard] minicomputer technology, followed by an even stranger box that would get you into the IBM [International Business Machines Corporation] mainframe. This was an 1827 Analog-To-Digital Converter, but it could be used digital-in, digital-out. The digital came in on the IBM mainframe side by virtue of channel programming, some of which I did. It also, then, had to interface into the operating system, and the operating system at that time was VOS 360 environment. It was just, OS.

Pelkey: Right.

Davidson: And I had to write some of the underlying system code for the mainframe to allow data to flow back and forth on multiple logical channels through the one physical channel. So I did that component of it and these others did some of the front end programming, some of the back end timesharing programming, and then some of the file system. I would say those were the principal programmers of that activity. There were others who also built some of the hardware for the radio transmission and hooked it into *<inaudible>*.

Pelkey: And, as I understand, it eventually got working between Maui and Oahu.

Davidson: I suspect that's correct. I remember it working from one shed on campus to the main computing center, and I remember it as having three or four or five terminals that were very primitive, very old when you think of it now. They were TSR-33s, all capital letters *<inaudible>*, and they could work, and they worked in a very strange way, because if you typed a line of text and then hit return, that line had been buffered and would be sent, and it would be sent once, twice, three times, and if it didn't get through on the third time, you had to type it again. And there was a red blinking light on the radio transmitter. If you were watching, you'd see it blink once, then you'd see it blink twice and you'd start praying that it was not going to have to be retyped. But more often than not, you'd have to send it again. So the radio channel was very low speed, in terms of digital transmission on the standard radio analog thing *<inaudible>*. And it had the potential for being collided with by anybody else. It was a CSMA [carrier sense multiple access]-type of system, it was being called, and that was just a very primitive system. Now later, in later years, probably after I moved away from the main body that was interested in radio communications, they certainly did more communications.

Pelkey: Which is when?

Davidson: Probably in '71. In '71, there was a new computer system that was received on campus, that was placed on campus by the ARPA [Advanced Research Projects Agency] people. And so the sponsors of the ALOHA system changed from being Air Force to being Defense ARPA [DARPA], and the focus of the ALOHA system expanded, so that there was an ALOHA System I and an ALOHA System II, and part two took a very innovative computer system that had been created by a collection of people at came out of the University of California at Berkeley, and brought that computer system, which they tried to commercialize, onto campus after the commercial failure of the company that was created. And they asked this very special computer resource be placed on the ARPANET [Advanced Research Projects Agency Network], so ARPA was then funding some activity which encompassed the theory of the communications channel research and the actual construction of a connection for that computer and the refurbishing of that computer, to put it on the ARPANET, which was done. And I had a role in the programming of that computer system, to have it join the ARPANET, which is why I became the ARPANET technical liaison from Hawaii, and got to know all sorts of people and all sorts of things—what was going on in grander networking schemes.

Pelkey: Did you get involved in the scenarios? The demonstration of the first ARPANET?

Davidson: The first ARPANET demonstration? That occurred before we got involved. So, in fact, our original contract was to...

Pelkey: Because I have that in October of '72.

Davidson: October of '72? No. I don't believe we were involved in it in the memory that I have of that connection of things. So that would seem like we must have been up and on the network by that point. Certainly we were, but I don't think I or the university got particularly involved. We had some interesting problems to solve by virtue of being the first satellite-linked computer system, and worked on a number of things which resulted in RFCs, and contributions to telnet protocols, and contributions to the TCP/IP protocols during that period of time, but I don't think we were involved in the Great Demonstration. And October of '72 must be accurate, but I don't remember it that way.

Pelkey: When did Bob Metcalfe come over? Do you remember him?

Davidson: Well, that's a good question. Yes, I certainly do, and my recollection is that he came over for about a semester to work on various things. And those would have been mostly theoretical things. I think by that time he had done some of the Ethernet design work, is that correct? Or was he formulating that.

Pelkey: He had formulated Ethernet and...

Davidson: Was he still a student? *<interruption in tape>* So my recollection of Bob's visit is very sketchy, because I know he was there, I thought he was there for about a semester, maybe it was even a shorter period of time. I hooked up with him once or twice, mostly for just fun. I remember playing basketball with him one time outdoors. He was good athlete; he was a good tennis player, and he was a smart guy. And I think, somehow, in the pecking order, I felt like he was an established guy. He was already out working. He had some credentials, and, gee, I was just a student. So, I'm sure I figured he was supposed to hobnob with the professors and with others.

Pelkey: He was without PhD at that point in time.

Davidson: That's probably correct. Certainly, so was I, so I deferred to that, and of course I've always thought he was much older than me, by virtue of that, and I suspect he's even younger, but I do remember him going out there, and I think he stuck pretty much with the theory people.

Pelkey: You went up BBN [Bolt, Beranek and Newman] out of Hawaii?

Davidson: Yes.

Pelkey: And that was when?

Davidson: That was in 1977. So I had finished my PhD during 1976, and had an opportunity to come to California to work with a collection of people that were responsible for the government's ILIAC IV computer system, and I had known those people pretty well and I had working with them from a distance, actually, while in Hawaii. That work was being done at NASA Ames, and the NASA group was the project administrator for our funds that came through ARPA. So there was—there were a number of connections of people and things like that, but I thought I would like to continue working on networking things. I knew

the BBN guys. I had high regard for their skills and their accomplishments, and thought, also, that after nine years in Hawaii, I would like to live in New England. So I was able to receive an offer from them, went and moved there, and stayed for about a year and a half working on all sorts of interesting things for BBN.

Pelkey: What was your thesis on?

Davidson: Well, we actually got into the realm of computer security for the purposes of some of the work going on at NASA. So I spent some time trying to determine what kind of computer structure could be used to guarantee various forms of security, based on restriction of access to certain kinds of data structures. It was a little bit afield from the networking arena, but it was where the project had been directed by the...

Pelkey: What caused you to be interested in networking then?

Davidson: The ALOHA system activity, which got us into the networking world, and then the ALOHA system phase II, which got me to be the technical liaison, and the computer system that I mentioned, which was called the Berkeley Computer Corporation, the BCC-500, was a multiprocessor system, one of the processors dedicated to the function of communications. Communications at that point was terminal-oriented communications, and the management of the input and output independently, and then the delivery of characters to the computer and out the front end. And we took that micro-programmed processor, and programmed it to do additional tasks such as 'talk to an ARPANET IMP [interface message processor].' So I became familiar with what you had to do to do that, and I became the spokesman for the university in that, and a lucky guy.

Pelkey: Fantastic. Had you stayed in touch with Charlie during this period of time, your years at BBN?

Davidson: Yes.

Pelkey: Because he was out teaching at Stanford.

Davidson: He left at—he taught at Berkeley. He left from the University of Hawaii and went there. I visited him once at Berkeley just for a weekend. We went skiing and we talked about what he was doing and that type of thing. Then, when I moved up to the east coast, he actually came and visited me one time. That's when he was already at Zilog, and he was trying to tell the people at BBN about the Z8000, and the way it might be used in a particular interesting butterfly switching system that they were creating at that point. And he came out and spent some time at my house, and I think that's the genesis for the work that was actually ultimately done at Ungermann-Bass.

Pelkey: Right. So he was out proposing the Z8000, but for this butterfly-type computer. When you and he got together, you talked about what?

Davidson: Well, in my time at BBN, I was still thinking of myself as a networking guy. I worked on several types of things for them, including designing some TCP and various things having to do with UNIX systems, etc. So I was a jack of all trades, in part. I was called the Senior Computer Scientist, or

something like that. In the basement of BBN, there were five computer systems, most of which were on the ARPANET, but not all I believe, and if you were connected into one of those systems through your terminal, you connect out to anyplace else on the planet, it seemed. But if you were not connected into them, the way you got connected to anything was to call down to the basement and ask the guy in the basement to patch your terminal into something, and they would patch you into one of those computers. So it occurred to me while at BBN, prior to Charlie's visit, that 'Gosh, why don't they make an in-building system that would have a terminal switching capability just like they have with their TIP system. That was a Terminal Processor, and I actually proposed that to some people at BBN, and they said "Well, that would be nice, but we don't do commercial products," and I actually proposed it to one of the companies they were consulting with, Prime Computer, that was coming out with a token ring system that connected all of their own computers to one another, and asked them why didn't they make a little box that one could plug terminals into that would connect the terminals around their ring and into their hosts. And they were not particularly interested. That was Dave Nelson who is a dignitary in this industry for years afterwards at DEC and at—he had been at DEC before that; then he was at Prime, and he ended up at several other companies, and they just marketed their Apollo, I guess it was. And he didn't find it very interesting.

When Charlie came to visit me in September of 1978, he told me what was going on at Zilog and one of the things that was going on at Zilog was that they were trying to make the equivalent of an Ethernet system to join some of their development systems to one another. And I said "Gee, what you really ought to do is make a box that would hook into terminals and allow them to connect through your network and out the other side to their computer systems, so you could have switching just like they had in the ARPANET." And he said "Gee, that's a great idea. That's a great idea." So that was September, and at the end of October, I flew out to California for an ARPA-sponsored meeting, and I interviewed with Zilog, and in November I received an offer from them to come and work on precisely that type of thing. And in December I arrived, and began to work on various types of things for them, because I was the manager of the operating systems group. Also in December, Ungermann had his falling out with the Exxon owners of Zilog, and I think by January, he was gone. So, at that point the activity that I thought I had gone to Zilog to accomplish was kind of put on hold while Charlie and Ralph talked off-line about what this would mean, that he was leaving Zilog. We didn't really begin to bring it back as an activity again until we had figured out we could do it in this kind of company.

Pelkey: Now, there's a series of planning meetings that Bill Carrico was asked by Manny [Fernandez] to kind of come over and figure out, of all the millions of things that's going on, what should we really be doing? So there was—I understand that through May and June, that there was Bill and Judy [Estrin] and yourself and Joe Kennedy. Charlie sat in on some of that, and Phil Belanger, and the notion then was that there was this Ariel project that was kind of going on, there were the ideas that you had brought, the whole notion of doing a terminal server network, and the overall things of the minicomputer versus networked PCs. So out of that came the notion of doing ZNet, that series of planning meetings.

Davidson: Yes, that's correct.

Pelkey: And that technology, did that come from the ideas that you brought or...

Davidson: Well, it's very interesting. After Ungermann had been gone for a week or two, I approached Charlie and said "Gee what's going to happen to this idea that I that I had," and he said "I don't knew, you'd better sit on that for a while," and I said "Well, I was going to publish this memo." And he said "I wouldn't do that." And this sounds a little seditious as I reflect back on it, but those kinds of things went on, and the planning meetings that came quite a bit later, and I'll use your dates because I can't remember exactly when, but I don't remember that Charlie was there. I think he left the company about May.

Pelkey: End of June. His recollection was the end of June, because his getting vested in his stock prompted him to stick around.

Davidson: Then he may have been in on the meetings, but in those meetings, I felt very much alone as a possessor of an idea...

Pelkey: Yes, he certainly—let me put it this way, he certainly did not want to be seen or participate in the process because of conflict of interest, so he's perceived by other people as his behavior was confusing by other people.

Davidson: Well, the idea that I had had was something that could have been discussed in that meeting. In fact, people were all around the idea without having hit on it yet. During the meeting, they actually did hit on it, and I would attribute to Dave Folger the creation of that idea from all of the discussions that were going on. I was a participant in the discussions without announcing: "Here's exactly what you should do," and that's because I felt we were going to go do this kind of thing. The idea predated my involvement at Zilog, so I didn't think of it as a Zilog idea, and yet when Dave came up with it as an idea, I just watched the discussion. It caught everyone's fancy, it seemed to me, at that time. I'm not sure they knew how they would do it, but they had been building systems...

Pelkey: The ZNet as conceptualized strikes me as more the kind of 3Com, Etherseries sort of stuff. It was resource sharing; it was having—the Z80 microcomputer, such as the Apple, connecting them as opposed to just doing a terminal server.

Davidson: I think that's correct, and in fact, my idea was for terminal switching on the network. Lots of people had ideas, and it was already being done at several places. I could mention Prime and you've mentioned Xerox, which I would like to give lots of credit to the Xerox guys. They were terrific and predated lots of my ideas and gave me lots of ideas. But the work that was going on there was always resource sharing; computer to computer communications. That's a little bit different from just the communications aspect of the terminal to the computer. If you want to characterize, pretty soon, the differences between Ungermann-Bass at its inception and 3Com at its inception, you'll have a good time trying to trace the notion that they started off with a board that was 'dumb,' because they were putting a lot of software on the adjoining computer. We started off with a box that had to have both the hardware and the software in it, and later on, when the PC emerged, this theme continued, where they had software and a dumb card, and we had our card with the networking stuff on it that we had to put into the computer. And those took us in decidedly different directions.

Pelkey: Very different.

Davidson: And the theme could be traced at many levels.

Pelkey: Thank you. What I'm interested in is that, so far, I have a difference in opinions about how much of the ZNet was the continuation of this Ariel project, although PARC [Xerox's Palo Alto Research Center] was gone, versus the notion of a communications product as you were beginning to conceive it?

Davidson: I think they were different, and I think you're characterization is fine. They went off to make the value of their computers enhanced, because they sold chips that went into computers, they sold the

development systems that went into computers, and they weren't just focused on doing communications. We sold communications systems, but we didn't sell the terminals, and we didn't sell the computers on either end, so we were kind of generic and unattached.

Pelkey: But that would mean to me that the Ariel ideas, in fact, were continued through into ZNet.

Davidson: I think so.

Pelkey: As opposed to, 'that was an interesting little experiment,' but really a whole new architecture came in that became ZNet. They happened the same people and the same laboratory, but it's a different technology trajectory.

Davidson: Yes, I'd like to be a spokesperson for what the differences are, but the ZNet projects came after the time I left, and I didn't pay that much attention to it.

Pelkey: So you leave and, one of the first things that happens, I gather, is the preparation of a bid for both BBN and Sytech, of what they're bidding on to Lincoln Labs.

Davidson: Well, there's several things that I remember as being interesting in the '70s, at the beginning time there. I think that the company actually got incorporated about July 11, and I was—I had left Zilog and was on vacation during that week and showed up something like July 16 to begin my work. It was that week that I spend in Hawaii where I first learned the Z80 assembly language for the first time, because I knew I was going to have to be building something right the next week. And when we got back, we were all meeting up at Ungermann's house, and my job was to try to communicate some of these thoughts that I'd had in a form that could be acted upon by somebody. Like, 'What is it we're building now and how does it work?' and stuff like that. So there were a series of memos that I had to create, and did so during that summer time, and others created memos as well, and then we all read these memos and we kind of did the architecting of the system.

Davidson: We didn't have anybody really building the system at that point. We didn't have any hardware guys to build the system at that point, and it was later in the summer that we got some of those skills into the company. So there was a planning period and then there was a building period, and we moved into the offices down in Santa Clara on October 19, I believe, when we all ran from Ralph's house down to here, about 12 miles or so, and that was kind of a day that we celebrated; we had a party, etc. From that point on we started building things, and as we were building, we were trying to communicate with people. We had to communicate with venture people, because we hadn't had our money yet; we had to communicate with potential customers; we had to communicate with potential allies; and the people at BBN and the people at Sytech were among those that we spoke with. I would say that we spoke with each of them during the springtime of that following year, and I think I noticed in your notes...

Pelkey: Spring of '80.

Davidson: Yes, I'd say it was spring of '80, because we came out with a product in '81—sorry, in 1980 in the summer time. It's about June 30 that we shipped it, and we shipped just exactly one year from the time we had started. And we ended up, in the spring of that year, talking with BBN, who needed to try and

put an LSI 11 computer onto this kind of a network, and with Sytech, who was involved in a bid, I think, at Lincoln Labs for switching systems. And the Sytech activity I date at that period of time because it was...

Pelkey: This is after you had a product?

Davidson: This was—no. We talked to them before we had our product.

Pelkey: That was still in '80.

Davidson: In '80, right, and I think your notes said '81, there, and so I would...

Pelkey: Actually, I had '79.

Davidson: Okay. Someone had said that the end of '79 we began our BBN discussions.

Pelkey: Okay.

Davidson: But we didn't have much working at the end of '79, and so I remember that, in the spring of '80 Sytech came over, they looked at our systems, they did quite a bit of question asking, and in the summer time, after we had announced ours, they announced theirs. So at the conference that I went to, the *<inaudible>* conference in Zurich Switzerland in 1980, and that would be another way to confirm that this was the actual time—I was there to talk about our product and they were there talking about their product, and I was also there installing one of the very first systems that had been sold, and that was sold to the École Politechnique *<inaudible>*, PFL, to a fellow who was enlightened, both in buying a product and later on in joining our company. And it wasn't much before then that we had realized that Sytech was not going to buy from us but instead was going to have their own broadband system.

Pelkey: And became the enemy.

Davidson: And became the enemy, absolutely.

Pelkey: So then you come out with your—during this period of time, after you went to Zilog, you had pretty much made the decision that this was going to be kind of an Ethernet-type network, and you, in fact, developed protocols that were XNS [Xerox Network Services]-like. How did that all come about?

Davidson: Before I left Hawaii, when I was attempting to find out what I might do next, I came to an ARPA planning meeting that was being held, probably, in the Stamford area, and got invited one evening by David Boggs, who's a Xerox technologist and who should get lots of credit and I think does get sometimes credit for Ethernet's creation, and I was invited by him to go to the PARC facilities and take a look at the operational network, and he exposed me to all sorts of ideas and gave me a little bit of a chalk talk on how it was that his protocols and his designs, which became the XNS designs, were different from the things that were being talked about by the TCP group. And I think his attempt was to A) show me some interesting things that he had been working on; B) convince me as another participant in the dialog

about what the ARPANET should be doing, that they had some very good ideas at Xerox and some of those ideas would be better than the ideas actually being talked about by the committee. And he accomplished both of those goals. I did get to see some new stuff and I was very interested in what they were doing, but then another thing that happened was I was very interested in Xerox and would like to have received an offer from him, and he said "No, we show everybody this stuff and they all love it and they all want to come to work here, and so we can't do that for everybody," but the other outcome was I remembered exactly what he told me about how the protocols worked, and what the various fields were in these protocols to help make them work. So when the time came for us to actually build the system, I chose to use those concepts as I remembered them from the chalk talk...

Pelkey: The chalk talk was in '76...

Davidson: No, that was probably early '77, because I left and went to BBN in the summer of '77. I think I reported there on August 1. The memories were vivid enough—the things I had learned were vivid enough that I was able to create something that very much looked like Xerox protocols, even though they had never published them.

Pelkey: Between '76 and '79, you must have been thinking about those kinds of things and developing them on your own.

Davidson: Oh sure. Yes, and I had written a number of things while I was in Massachusetts about how I would build this terminal switching system if I needed to, and that was what I was proposing to BBN, I was proposing to Prime Computer, proposed it to Charlie, and carried with my as my design notes when I went to Zilog.

Pelkey: And then on to *<inaudible>*.

Davidson: Yes, and actually built the same kinds of things I had designed in that time frame, so our protocols looked a lot like Xerox's, but when you look at 1979, TCP had also been created by then, and I looked very hard at whether to implement TCP in the original Z80 product or XNS, but we were stuck with a very limited capability in our 64K-based Zilog Z80 systems.

Pelkey: The days when memory mattered.

Davidson: Absolutely, so we made 8-bit fields for everything, and I decided against the complexity of TCP, and we actually ended up implementing the things that I had thought years before would be right to implement, and that served us very well for several years, especially in view of the fact that when Xerox came out with their office systems, only then did they realize that they had forgotten to connect in any foreign equipment, and then they looked around for how they would do that quickly, and they found our terminal servers to fit the bill if we would A) adopt the ten megabit standard, because we had built four megabits on our own, and B) change the protocols to be compatible with what Xerox was actually using, which we were delighted...

Pelkey: That took about 1.5 microseconds to say yes to.

Davidson: We were delighted to do it, absolutely. We had to go forward with the ten megabit standard, because that was the standard that was going to eclipse our four megabits...

Pelkey: Were these conversations after the Blue Book is out September 30 of '80?

Davidson: They were, I would say, coincident with the creation of all of that, because we were the first company—and it didn't happen until '81 that was actually able to produce something that was associated with the—compliant with the Ethernet spec.

Pelkey: Which was in July of '81 is when you started shipping.

Davidson: And at that time we also had the software upgraded to be able to talk with Xerox equipment.

Pelkey: But you were not—did that early product have your Ethernet chip in it?

Davidson: No. The '79 product was two boards of logic to do the transmit function and the receive function independently, and quite a bit of logic to have a very sophisticated bus structure so that we could have multiple processors and memories use the single transmit and receive path out to the Ethernet. So our two boards were the equivalent of what 3Com's one board was, but they had a bigger system in which to place their one board. And then you didn't have the integrated circuits for some period of time after that.

Pelkey: Gotcha. Now, Judy Estrin joins on February 1, '81, and my understanding is that she was the one who was assigned the responsibility of negotiating the OEM deal, the joint development deal with Xerox. She was there for five months before leaving to—does that sound right to you?

Davidson: Gosh, I'd like to defer to her in this regard. I can't remember that she was doing that. She was more marketing-oriented than technical-oriented, and I'm sure we had her trying to do lots of things at that time. I think we did take advantage of her personal relationships with the Xerox people to help us in that regard, but I don't remember it being...

Pelkey: Were you involved in the negotiations?

Davidson: Always on the technical side. I was the spokesperson for what we had done and I was a recommender for what we could do and what they might do, because they actually enhanced their system to talk to ours as well as we enhanced ours to talk to theirs. For example, we had implemented what we called a rendezvous protocol, which was just 'how do you find a resource in order to connect to it?' Their technologists, Yogen Dalal in particular, had said "Yes, I wish we had implemented a rendezvous protocol. What did you do?" and "Maybe we could end up making ours talk to yours." That kind of discussion went on frequently, and I was involved, therefore, in the designs of what would change in our system and what they might to with in system, the documenting of all those kinds of thing, the implementation on our side, and then the actual deployment and debugging of things in the labs. So I spent a lot of time up at Xerox, a lot of time working with the Xerox people. But not on the business side. All that could have been done by Judy and others

Pelkey: During this period of time, the data PBX is your competition.

Davidson: Yes, yes the Gandolf switch, in particular, was popular.

Pelkey: Micom was coming out with...

Davidson: Micom was coming out with something very dynamic by comparison with Gandolf.

Pelkey: Do you remember having conversations with Micom people?

Davidson: Yes. Jim Jordan and I and our representative from the—it must have been the Toronto office—who was a sales representative went to visit with the Micom people, but it was a fairly unproductive activity. I remember it as being one in which they were surprised we were there. And so there had been some miscommunications, and yet we got to have a dialog with them, and it may be that Jim and others continued that dialog after that point, but nothing really came of it.

Pelkey: Okay. Then Sytech introduces their product in February of '81, their little two-port broadband.

Davidson: Yes, and I continue to think that was earlier than February of '81, but you'll be able to check, I think, with someone to determine that. It may be that they didn't have a real product shipping, and all they talked about in the summer of '80…

Pelkey: Oh, yes. Summer of '80, they announced it.

Davidson: They kind of announced it and they hadn't shipped. Yes, right. So, for quite some time...

Pelkey: Which came to be symptomatic of that company.

Davidson: Yes, but, gee whiz, they caught the fancy of so many people, even though it was a slow speed system. The concept of the virtually unlimited bandwidth was—it did capture people's imagination, and we fought against that tooth and nail. And I don't know why we had such trouble with competitors in those days. I think we were—it served, probably, the administration's purpose for all of us engineers to be absolutely almost killing somebody.

Pelkey: Seven days a week.

Davidson: And I'd like to think we're over that now, although I'm not sure I'm completely over it, even in our new company.

Pelkey: Adrenaline helps. Now, the conversation starts with Greg Hopkins in '81. Were you involved in those?

Davidson: I met with Greg and with Norm Meisner and other guys who were at Mitre to talk to them about their broadband capabilities, and their networking systems that they had built, and I think some of that came out of, maybe, a conference that went on sponsored by Lincoln Labs, I guess, in Massachusetts. I think that's where I met some of these folks, Meisner in particular. And I was not seeking them out to come to join our company and to start another group or anything like that, but I did talk to them about technology. And I liked them, and was happy to think that somebody with big, bold, business ideas was willing to strike a deal with these guys.

Pelkey: Was there a sense that that was happening when you were meeting with them?

Davidson: Yes. You could see that somebody was interested in having me talk with them, besides just for my own technical purposes, and, of course, they were brought into the company as salespeople.

Pelkey: Do you remember when that happened?

Davidson: I like your idea that it was '81 sometime. I think that must be accurate.

Pelkey: Then it must have seemed strange that they're reporting to Jordan.

Davidson: It probably seemed strange.

Pelkey: Because this is a period of time when Jim and Charlie start finding that they don't necessarily enjoy dealing with each other.

Davidson: I guess so. Maybe some of that was coming from some of us, though *<inaudible>*. But it seems strange in one sense, because these were technologists; it seems unstrange in another sense because, on the east coast, what we were doing was setting up a sales office. These guys were skilled in the technology, and it was a technical sell, and so they began to help us in that regard, and they brought the broadband capability and we were covetous of that capability, but having it be an east coast sales office-oriented thing, I guess it seemed...

Pelkey: Did they have responsibility for product, the first five megabit, which I gather wasn't delivered on time because had to OEM one for 3M for a while.

Davidson: I think we had to figure out how to get ourselves in the broadband business as quickly as we could, and the technologists that we acquired out of the Mitre organization were able to help us understand what to do, and then they were able to help us do it more by that acquisition than by being able to build it themselves in that time frame.

Pelkey: And the acquisition is Amdax.

Davidson: Yes.

Pelkey: Now, were you going to the 802 meetings?

Davidson: Yes, I went to those meetings. I went there...

Pelkey: Were you at the first one at the Jack Tar?

Davidson: I would like to say yes, but I think I wasn't. I think I had—was busy doing something, and maybe Charlie went, and met with the guy who had started that up.

Pelkey: Maris Graube.

Davidson: Yes, thank you. And it may have been only the next meeting that I went to, and I am failing to remember whether that meeting was in Seattle at the Red Lion or was in Phoenix at some other place, but after it became apparent what they were attempting to do, I became a representative from the company to that, although others went as well.

Pelkey: Were you at the December '80 meeting when the vote went token versus Ethernet?

Davidson: I was absolutely; all of the prior meetings and at that meeting. I can't remember the date of it.

Pelkey: December of '80.

Davidson: That seems too early.

Pelkey: Because that's when you gave up on having one standard.

Davidson: Yes, December of '80? Oh, no, that doesn't seem too early. That sounds exactly right. I went to all the meetings in which the technologies were discussed, and the initial disputes were centered around baseband versus broadband, and subsequent disputes were centered around those two versus token ring, and then all of those were resolved into three types of standards that would emerge from the 802 committee, and my goodness, they were meetings to behold. They were very clever people, doing whatever it took to justify their position in the world. And the DEC/Intel/Xerox group was a group that I felt an affinity toward and I naturally fell in with them, and worked with Phil Arst and Metcalfe and Ron Crane and Tony Lock, who was a representative from DEC, and all sorts of other people who would attend those meetings were very instrumental.

Pelkey: Could you characterize after September 30, after DIX [DEC/Intel/Xerox] comes out with the Blue Book, and how that got presented to the 802 crowd?

Davidson: Maybe not accurately. It seems to me that the existence of the specification, which was driven, I believe, by Metcalfe's view that he had to have a standard here for this thing to catch on and be ubiquitous, was possibly the catalyst for the creation of the IEEE committee. They were going to endorse

something, but they didn't want to just endorse a commercial product. They wanted to have a chance to rethink all the issues, and that's what caused it go in the tailspin that it went into for a while. And it came out with several recommended changes to the Ethernet spec which didn't every really get done; several clarifications where the original spec had been fairly well written, but maybe was not totally precise. So, certainly early on, it was a topic of conversation. I don't remember anybody saying: "By the way, IEEE, we have solved your problem." I think it was more that the IEEE committee got together after the existence of the spec.

Pelkey: And then this arguing first about broadband/baseband, which kind of got settled in the December '80 meeting, but then, in '82, took IBM and token ring starts to become the big thing. And sometime in early '82, as I have it, ECMA said "We're going Ethernet." And it's characterized to me as then that, in October, the Ethernet and token bus standards were submitted into the approval process, and I gather not token ring, although...

Davidson: I think token ring always came later. 802.5 always seemed to be dragging behind, I think because there was too much work to be done to adapt the IBM proposals to the needs of the standards group...

Pelkey: They didn't have anything at this point in time that worked.

Davidson: They had some trouble getting off the ground with that. I thought their design was just excellent, and you will have heard, probably from Charlie, about the interactions that we had with IBM on token bus technology for broadband and on token ring technology, because we got to be partners with them concerning that too. I just thought they had an excellent, excellent set of concepts and design, and that they were really on their way to do something quite good, and they didn't ever quite achieve it the way they would like to have, maybe just because they were a little bit late in coming to market. It could have been a very popular, and was a very popular system.

Pelkey: Coming back then, this is, again, '81. You then start shipping your ten megabit Ethernet and I gather, somewhere along the line, you start shipping to Xerox, after the second half of the year, and then IBM had introduced the PC in April of that year, which was—maybe not as earth shattering for you as it was for someone like 3Com, but...

Davidson: Yes. We didn't know what to do with it. There was another terminal for us to connect into our network.

Pelkey: Yes, exactly. Then, in February of '82 you started shipping the five megabit broadband—excuse me, you announce it in February, don't start shipping until September, so I gather that was the modem problem.

Davidson: It surely could have been, trying to make that five megabit system work. The software did not have to do much to accommodate that new system, so we were ready with the software side.

Pelkey: Then you get your Ethernet chip back in '82, which I gather...

Davidson: Okay, I'm glad you have these dates, because I could be wrong.

Pelkey: So, in this process, two things. One is that there are some conversations going on with Interlan.

Davidson: Yes, I remember talking with Interlan along the way, and I remember a number of things. They had a couple of clever guys who were there...

Pelkey: Dave Potter.

Davidson: Dave Potter was one of them.

Pelkey: And Paul Severino.

Davidson: And Paul and Dave and Ralph and I, I think, all met one time in Massachusetts in a hotel room to see what possibility there was for companies doing things together. I think right about that same time, they had taken some business away from us at Sanders up in New Hampshire with the existence of the terminal server that was based on the Intel processor set, and we were still, I think, dealing with our Z80 product. And they had some neat features…

TAPE SIDE ENDS

Pelkey: So they were using the Intel microprocessor, probably the 86 at that point.

Davidson: That was probably the 80186, right, and they probably had more memory and they were able to do some things that we weren't able to do, and while we could promise those things, I think we were, in part, surprised that somebody else had built them, so we thought "Well, that's and interesting company. They're doing some interesting things," and I believe there was in intent in the meeting, on the part of the Interlan guys at least, that we think about how to maybe merge the companies. I was there to try and assess what their technology was and compare it to our technology and see if we could make sense of that, but I don't believe I got involved in too many discussions after *<inaudible>* because it must have been viewed as a...

Pelkey: Now, during that same period of time, Charlie has gone to Wally and made a presentation to these IBM guys who had this ambitious product planned, but they can't do everything. For instance, the bridge...

Davidson: Yes, from the token ring to a broadband system, and they said "Well, let's go talk to somebody who knows something about these broadband systems and see if they can help us."

Pelkey: And you're talking with Hopkins at this point

Davidson: Oh, yes.

Pelkey: Because you know you want to be in the broadband business, and so...

Davidson: Yes, I think we probably were in the broadband business.

Pelkey: Amdax merged in on January 1 of '83.

Davidson: Okay.

Pelkey: So the deal was probably structured, but financially didn't happen until the first of the year.

Davidson: Good, but we were probably delivering some broadband systems before that.

Pelkey: Oh, yes, the five megabit. Yes, in September.

Davidson: So we were a broadband company by then, and that's why IBM would have sought us out, and I think they sought out some others, too. Charlie must have sniffed this deal out, or they sniffed us out or something like that, but yes, by the time I got involved, he had a good relationship with them, and we were able to construct a bid for this bridge work, and we were asked to put together this bid very quickly, and it was asked to have a technical component. So I wrote quite a bit of text to try and describe how we would go about building this bridging functionality, and it was written in some intimate detail. Then we produced the document, submitted our bid, flew up to Raleigh to talk with Murray Bolt and Dan Warmenhoven and others, and present to them our design. And I believe that they felt this was a good design and, indeed, the right way to work this stuff. Probably what they felt was "Well, here's a good, small, fast-moving company that knows something about broadband. We like Charlie. These technical guys seem to know what they're talking about. We'll pick them," and my perception is that we were competing against others for this opportunity, including Sytech, and one of the reasons I think we won is that our five megabit technology was much closer to what was going to come out of the IEEE and what was coming out of the IEEE, or what thought of by IBM to be a good thing, or something.

Pelkey: Good, because Sytech was totally *<inaudible>*.

Davidson: Yes, so probably a whole bunch of factors lead to the selection of us, but we got into the business of dealing with IBM through that.

Pelkey: Which was roughly an 18-month relationship that ended after two management changes and two spec changes.

Davidson: Boy, they changed a lot.

Pelkey: Spec changes and so forth.

Davidson: Yes. We never did produce for them the component that would have helped them connect those two worlds. We learned a lot from that project at the time, and we got into this other relationship with them in the token ring chip set. That became a very important relationship for us.

Pelkey: And when did that one start?

Davidson: When did that start? I would say that didn't start until probably about 1984 sometime. When did they actually...

Pelkey: Their cabling system was May of '84, the cabling announcement.

Davidson: The IBM cabling system? Okay, we probably were dealing with them—I would have said prior to, but I'm not certain. It seemed to me I was learning lots of things about their cabling system when we were down there prior to that, that probably were proprietary, and in particular the couplings that they showed us—these are not for bid couplers for plug in systems into the wall. You couldn't get the plug *<inaudible>*. Now, what I've tried to get to here is a memory of the interaction that we had with them that preceded, for us, the token ring relationship, and I believe that was after we had a group that was already doing token bus Broadband systems, and it was that group that got kind of chartered to do the token ring stuff.

Pelkey: '84 would have been appropriate, because '84 INI here.

Davidson: Yes, so it was Jim Green of the INI group who had a role in interacting with IBM on its token ring technology.

Pelkey: Coming back to '83, you had the issue that the Amdax merger happened. That's a year where you introduced your products, the 186 and the 68000. You start shipping it third quarter.

Davidson: Our products for the 186 world didn't come out until 1983, and that was a big transition, a big change for the company. In 1983 we had gone public, and in 1983 we began activities to try and connect PCs to the network with smart cards and stuff like that, so we began the development, I suspect, of the hardware associated with the 186, and we began a big software project which ran for quite some time. It was first under Charlie and then, after he left the company, it came under Jordan. And that big project never did succeed in creating the software for the 186-based systems. In fact, a smaller project was done by a group of four people that I lead, and that became the company's second generation of software for the 186 processor.

Pelkey: So the more formal large group didn't make it.

Davidson: Did not succeed for various kinds of reasons.

Pelkey: And you, in early '83, the PC—Jordan, I gather, is starting to say "We've got have a product for this thing."

Davidson: Yes.

Pelkey: And Charlie, as I understand it, wants to build a 186 product that happened to be a hot product, Jordan wants the thing to be sellable for $129. That's an exaggeration, obviously—and Ralph wants nothing to do with PC. He thinks it's a waste of time. Does that ring true?

Davidson: If those characterizations have been given be others, I'll leave them along, because I wouldn't ever say anything's quite that simple. I might have some other characterizations later on on other projects in which you could see those kinds of sides shaping up, but I believe we were asked to do something with the PC by one of our big customers, Texas Instruments.

Pelkey: Right.

Davidson: And they asked us to build something that would be relatively inexpensive for them, and yet our plans were to build smart products.

Pelkey: You did that deal in May.

Davidson: And there were actually two activities that went on during that year. We did build the dumb card and we did build the smart card, and I believe that the dumb card was based on our Fujitsu Ethernet chip, and it required software to run on the PC. So we had that ongoing, and it's kind of interesting; the major software project that I told you about was aimed at putting—going onto a 186 that would go into the PC as a smart card or go into a terminal server as our next generation, to compete with Interlan, for example. The hardware guys—this was Greg Hopkins' group on the east coast—were able to produce the small card which we code named the "Chickenhawk Card."

Pelkey: This is the dumb one?

Davidson: This is the dumb card, and there were many interactions between marketing and engineering that would probably help paint the picture of the relationship between Jim and Charlie. Jim Jordan and his marketing people would come to a meeting and say "Well, look, we need this set of features," and Charlie and his engineering team would say "Okay, we'll get back to you and tell you what we can do." And the next meeting they'd come back and the schedule was enormous and couldn't meet the needs of the marketing guys for timing, so they'd say "Well, then, could you do this?" And they'd go away again and come back with another long schedule. This, I think, began to be a problem for the company, certainly a problem for the individuals.

Davidson: One of the questions had been "Could you put your software inside the PC so that it would run with the Chickenhawk dumb card?" And the answer came back "Yes, but it will take us a year." So it was at that point that Ungermann came to me and said "Can you help with this?" And I said "Well, possibly." He said "What we need to do is take their code and put it on the PC running this card," and I said "Well, I can do that with my friend Jack Freeman, but I don't know anything about their code, I don't know anything about the PC, I don't know anything about the C language that they've written their code in, I don't know anything about the assembly language for the Intel products, I don't know anything about the new hardware, I don't know anything about the DOS operating system. I figure we can do it in two months," and we did it in one. So it was really quite an exercise. We were trying to read things and trying

to figure out things. We took their code as it was, we learned all about it, figured out how to assemble it and compile it and change it, we found several bugs in their stuff while we were doing it, and we got it to run on the PC and use this new piece of hardware which we had to suffer through its debugging at the same time, in a very short period of time. During that period of time, Ralph said to me "Well, if you need another guy, you can hire this guy you've been interviewing."

Davidson: So I actually built a group with one person in it that was our research group. That was outside the main line engineering, not reporting to Charlie anymore. I was given permission to hire another guy and he came and worked with us, and then I was also able to attract into my group one woman who had been a good programmer and wanted to work on our projects with us, and I was able to do that only when it became apparent to Ralph that 'Maybe this big software project was also—could also be handled a different way.' So he asked me: "Well, what if you put together a little team? What would you need in order to do what these guys are saying they're doing?" And I sat down, because I had been a proponent all along that we weren't going to make it on that big project, and I said "Well, give me Sandy, the woman, and give me this rack, and we all, the four of us will go build you this thing, but we're going to build it our way, the way that we know how, and we can't just take their code and make it work because I don't think anyone can take their code and make it work." So he said "Okay, you can go." So we started in June of '84, and in August of '84 we had a demonstration, but the terminal server did not exactly exist yet. So we demonstrated it on the—we took the smart card—well, we demonstrated our code running on the dumb card with our code running inside the PC. So we started in June, we had a demonstration in August, we were done with our coding in September, and we shipped he product in November, and it had all the features in it that were supposed to be in the next generation product that the big group had not been able to accomplish.

Pelkey: And that 186 product was meant to be released early in the year, not in November.

Davidson: Yes, it was late, and there were many of them manufactured, and by the time the software came out, they were able to ship thousands of them. And the additional thing that we did in that same period of time with those same four people was make a whole new network management platform with our code underlying the management applications on the PC. So the PC with the management platform was all enhanced, and we looked at the Macintosh that had just come out in that year. We went to the store and looked at it's fancy user interface, and said "How close can we come to that?" And we found a package that someone had produced—it was Blaze Technology, I believe—licensed the package—I just went and bought it from them, licensed it for our purposes—we adapted it. We got the sources to it. We adapted it extensively, but made the second generation of network management components as well. So we had just a tremendous amount of software done in a very short period of time by a small team, and that, if you were to ask Ralph, he had said many times and said publicly, that saved the company, because we were without a competitive product. Bridge had a 968K-based product, Interlan had their product, and we were late. So that was a good effort.

Pelkey: Yes, I agree. Early in '84, around this time, the whole INI process, I gather somewhere along the line, GE visits. There's a meeting at which GE makes it known that they want to do something with token bus and MAP, and in June, at a board meeting, it's proposed that a joint venture type thing be put together. The board was skeptical that any big company was going to put much money into the deal, and then in October, the deal is announced that GE is going to put in $6 million for 40 percent.

Davidson: Your information on that is going to be more accurate than mine, because I was not involved in those meetings, and the stance that I took during that period of time was that there was no reason why this would have to be done in a separate company, because we can do that. If you give me a board with token bus technology, I'll give you the software to run on it. And, in fact, we built software that did run on

the other guy's board, and one of our most compelling demonstrations that we had ever done was for General Motors, and it was probably done in 1985. We showed them a system in which a .3 Ethernet was connected to a .4 token bus which was connected to a .5 token ring system. We used the INI token bus card because UB [Ungermann-Bass] didn't make one, but we used our software. We used ISO-based software that we created.

Pelkey: INI card means CDS?

Davidson: No, INI's adaptor card that they built.

Pelkey: Okay, so they had one by this time.

Davidson: Yes. The system that we showed, showed complete connectivity and file sharing among all three of those systems with a single management station that could manage them all, and the guys that came here from General Motors looked at this demonstration and said "You're done. You've done it all," and Bert was very impressed with it. There was a guy named Ernie, something I think, who came who was a big shot at GM's truck division or something, I can't remember these names, and that was the only interaction I had with anybody from GM. It was the Ungermann-Bass software, not the INI software, that was able to span all those three environments and treat the cards just as though they were the same, with one module change in each one to accommodate the different *<inaudible>*.

Pelkey: In spring of that year, management changes and Jordan leaves.

Davidson: That would be '85, spring of '85. So, when we talked about the big engineering activity, that wasn't succeeding, and the give and take between marketing and engineering in those meetings were that engineering didn't seem to be able to do things very quickly. There was a rift growing between Jim and Charlie, and that culminated in Charlie being removed from the engineering group and Jim being placed in charge of it. And that was probably during that period of time when our little software group was building next generation stuff. The difficulties that Jim had after that...

Pelkey: So, GM decides for INI after Jordan leaves, do you recall that?

Davidson: No, I think INI was going on in...

Pelkey: Because INI had had—GM decides for INI in the spring of '85.

Davidson: To put money in?

Pelkey: No, no, General Motors picks INI.

Davidson: Oh, I'm sorry, for their products?

Pelkey: For their products.

Davidson: Yes, I was confusing GE and GM. I believe that's correct.

Pelkey: And Jordan leaves before GM makes the decision?

Davidson: I can't tell you. I can not remember.

Pelkey: Then, in the fall of '85 also, a couple of other things happened. Wang gets signed as an OEM to put your stuff over their broadband. IBM announces the token ring in October of that year. Then in December, you complete the acquisition of this linkware company, Pyramid, which—do you have a view on that? Was that a significant event in the company?

Davidson: Well, let's see if I can remember about goings on there.

Pelkey: Because you bought it for $4.5 million and it had revenue for *<inaudible>*.

Davidson: I'm going to struggle to remember the initial interactions. It seems to me that they had one individual at the company who was a good programmer, named John Reed *<inaudible>* and he had done a lot of SNA work, and there was a need for us to do some SNA functionality somewhere. I'm trying to remember whether we were going to build a gateway or what, and I ended up talking with him, and figured this guy is a pretty good, smart guy. Someone else ended up talking with John Michael, who was president of Pyramid at that time, and decided that this would be a good company to do things with. It must have been Ralph who was doing the deciding here. And their product, at that point, was something that enabled a number of different machines to talk with one another. So, for example, the SNA work that had been done was important for IBM machines to talk with other kinds of machines, and I think that the model must have been "Gee, we've done a lot to connect things at the lower levels, let's see what we can do to connect things at the higher levels." And there were many thrusts and done by the company during that period of time, some of which actually worked quite nicely but none of which really turned into a homogenous system that could span lots of different computers. And I think that must have been the vision, and I would attribute that to Ralph saying "Sure. Here's how we'll get into that business." I don't remember the purchase price, I don't remember the revenues that they had or any of those kinds of things, but I did talk to some of their technical guys and I figured, 'There's some interesting things there.'

Pelkey: And, going back to '84, were you involved with Codex at all?

Davidson: No, probably not. The Codex relationship came because Murray Bolt went from IBM to Codex, and they needed some things and we had some of those things. That was an OEM relationship. They took, pretty much, our standard product. Maybe we augmented it some in the software to help them out. I know we changed some of the greeting strings that say Codex, but I didn't have any additional real...

Pelkey: TCP/IP started to become an issue for you by '84, because Berkeley 4.1C, which I understand is the version that was released in '82, had TCP/IP ported.

Davidson: Okay. I would say TCP became an issue because I had been thinking about it since '79, as to whether to incorporating it in those little Z80s. It was an issue all along, and there were people who were building systems that could talk TCP/IP, in particular 3Com. And they could—they had plenty of code space *<inaudible>*. When the fourth member of our design team that I didn't mention for that heroic effort in '84, Stan Mantelblye[?], thought 'Gosh, I would like to build TCP protocols for our world,' and so I allowed him to just go and build us an implementation of TCP that would follow the same model that I had built for the XNS and Sandy Aaron (??), the woman who was taking over the XNS and was building in ISO. So, in about 1985, he had completed the implementation of TCP/IP that could serve as the basis of our terminal servers, or serve as the basis of code that was on the smart card, or, by that time we had made all of our code run on the PC for use with the dumb card. So we began to try and use that code someplace, and we actually got some business out of Berkeley and we got some business other places. So, by '85, we had an implementation of TCP/IP for both the PCs and terminal servers.

Pelkey: Okay, good.

Davidson: Now, there are several interesting and significant things, I think, in the life of UB that went on that—for example, the relationship with Microsoft that was fashioned.

Pelkey: Yes, we talked a little bit about that. Charlie and I talked about it the other day.

Davidson: Well, when we got into the PC business to the point where we tried to treat it not just as a terminal but something that could be more than that, we were so late that we didn't have the chance to build our own file system. Now, the big project, as I say, that failed, it was code named Omega, part of their work would have been to incorporate a system for file sharing, disk sharing, print sharing that came from Davong Systems. Davong had been a manufacturer of, you know, disk drives, and had capitalized on...

Pelkey: Their code, their architecture.

Davidson: They made a networking architecture and they said "Look how easy it would be for you to justify the cost of one of our outboard, magnificent, big, expensive disk drives among a number of different units. So they had a very nice disk sharing system, and the big project would have caused theirs to be used in it. By the time that we got involved, and that project was late, we found, in the fall of 1984, that Microsoft and IBM and Sytech had come up—and Intel—had come up with this specification called NetBIOS, and if one would implement the NetBIOS interface, the applications programming interface, then there were modules that would run over it that would provide file sharing, in particular Microsoft had a redirector and a server component that would allow them to do file sharing. So did IBM. Microsoft had MS Net and IBM had PC Net, and the lateness that we had in bringing our algorithms into the PC meant we didn't really have a programming interface for the PC. So we said "Oh, well, we'll just adopt the NetBIOS applications programming interface," and so we were one of the first companies to really build a commercial product that offered that.

Davidson: And when Microsoft was looking for a product, I came across a proposal from our sales people for them that said "Here's what you could do," and it was not going to be compliant with the request. It was not going to be conformant or responsive. So I said "Trudy, don't do that. Don't bid that. Look. Get them to come down here. I'll tell them what we're building," and we were able to show them what they needed to believe in, which was our NetBIOS implementation, PC to PC, and then we were also able to tell them that, for their Xenix systems, which were multibus-based, we could produce a card,

that we had produced a multibus card, we could put the same code on that card, and all of a sudden with Xenix systems, could begin to use NetBIOS functionality to talk with the PCs. And they thought that was exactly what they needed for their campus network. At the end of that week that we showed them that, they gave us a check for a quarter of a million bucks, signed up to buy that product from us, and we did special development work for them, and became their worldwide standard for XNS that operates their network to this very day. Now, you know, they're trying like crazy to get over to the TCP arena these days, because they're now going to be a vendor of TCP, but they're still running XNS and, in fact, we have a relationship with them and a contract with them to sustain XNS through the next generation of Windows systems. So, that was a very important thing for the company, and we sold millions and millions and millions of dollars of networking equipment, not just the software but adaptor cards and hubs and everything *<inaudible>*.

Pelkey: Great. I didn't appreciate that. Thank you. Anything else? I think, at this point, you start shipping ten megabit token bus out of INI in '86, and the way I characterize—the way I'm leaving the tail end of this, because of the book ending in '88, is that, in '85, with this influx of new management and, in 85' your net income is down from $6 million to $3.7 million, and then in '86 is when you basically break even. You look at your income statement and your expenses were just very very high, even though your sales went from 70 to 110, so at this point I'm just saying that Ungermann-Bass had become a different company. It's no longer an entrepreneurial driven company. It has become something else, and then, in '87, the stock market crashes and DCA puts the company in play and *<inaudible>*.

Davidson: I think you're going to be more accurate if you describe that from everybody else's point of view, because the financial features were not of interest to me. I'll tell you one thing that happened in '86 that's kind of telling, and maybe not helpfully telling, so you may want to treat it kindly. We had gotten, in 1985, this TCP functionality, and we began to place it in various spots; Berkeley and some other places where TCP was becoming important. And, in 1986, it became apparent that we could do something with our 68K-based bridging product in software to turn it into a router. And I had my group of people create an IP router in 1986, and not just for purposes of showing. I decided "We're going to go get some business with this router, and then we're going to bring it to one of these crazy planning meetings we have and I'm going to say: 'By the way, we've already done it.'"

Davidson: So we actually got some people at the John von Neumann Center to work with out sales office out of Philadelphia and our technical support people and deploy six boxes, which were standard manufacturing release boxes, at the ends of three different T1 links to connect their six networks together, using these boxes for IP routing. And the—was that six networks that we really joined together? I'd have to take a look at what the topology really was, but we had three T1 links, six boxes. We built some special management software for them on a PC platform, and did everything the customer asked us to do, and we won that business. We displaced Proteon, we displaced , and the customer said "We like this router. We'll work with you guys. We like working with you, we like the management stuff you've got, plus you've got all these other things. Dynamite." I brought that product and that result to a planning meeting in 1986, and maybe representative of our problems at that point, it was rejected flat out as not what the customers wanted. 'Customers want bridges, not routers,' and they asked us to stop working on it. That was not the right decision in view of what Cisco and others went on to do after that.

Pelkey: Yes, yes. At this point in time, the company is no longer the company it had been, in terms of, not necessarily lean and mean, but more entrepreneurial, more fear of 'Are we going to be around?'

Davidson: There was some of that; certainly a concern on the part of major customers for the financial stability of the company if we were going to make bids on multi-multi million dollar commitments, and they asked questions. There would be those who said we ran ahead too quickly. There will be those who could

possibly say 'Well, there were other problems that were going to come to the company if we didn't get some financial stability.' I don't feel like I'm a good spokesman for those things. I would have—in fact, when the proposal for a merger came, I voted against it, thinking we're independent, we're still making money and we can do some great new products if we would just do 'em. So it took some convincing before *<inaudible>*.

Pelkey: I think that, unless there's something else that you think is relevant… In the book, I build up this process of Berkeley TCP/IP becoming available in '82, the *<inaudible>* version, the DOD, the ARPANET conversion, Dave Clark's PC version, XLAN then comes out, so at this point in time, TCP/IP, even though it's been thought less of, XNS had the day. Then, in '83, Xerox decides that they're just not going to make these upper layers available. So, given that there wasn't much functionality and functionality was starting to become an issue, talking to heterogeneous systems out there was becoming an issue, and everybody's XNS was proprietary, so there was really that software became available free and Sun was starting to take off and the multibus, 68000, UNIX phenomenon was happening, and that took TCP up. That took the whole TCP along with it.

Davidson: So TCP became enormously important, probably for all those trends that you cite. When we built our TCP in 1985, the company did not embrace it, and again, maybe here's the lack of understanding, or lack of entrepreneurial spirit, or something like that, but we built that, and we were able to sell it to the people at Berkeley, and they installed thousands of copies of it, and it was compatible with their UNIX implementation, so they had PC to UNIX connectivity with our TCP stack, and yet the company didn't embrace it. In fact, to get the company to understand what this was, I actually wrote a book to try and describe it to people.

Pelkey: Right. I have that book.

Davidson: You have that book? Well, that book was an attempt to make the sales force at Ungermann-Bass understand what TCP was, but a problem I had in writing that book was 'Gee, you never understood what XNS was. Why do you have to understand what TCP is?' But, none the less, here it is. It's all spelled out. There had been close to 30,000 copies of that book sold. It's still selling. It's translated into Japanese, translated into French, and I keep getting requests of 'Couldn't you make this more current?' But I don't have time to write a book right now. The company couldn't understand TCP and embrace it properly, finally did, but the original implementation didn't get seized on and enhanced until it became the property of Sandy, again, who was now doing XNS and the ISO and that early OSI stack, and took over the TCP. You find me now in a new little company called Network TeleSystems. I went back to Ungermann-Bass and said "You're not doing anything with your protocols, are you?" And Ralph said "No." And I said "Would you like some help?" He said "Yes," and I said "Would you give them to me? I'll help you." And so I took the entire workstation business unit, all the functionings of that unit, I took a couple of the people who knew what they were doing, we came over and we started this new company under the wings of Ungermann-Bass, and we have now produced this shrink wrapped TCP product based on...

Pelkey: And when did this start up?

Davidson: We started one year ago in July, and we have, in one year's time, created from a DOS-based, smart card-based only implementation and we have created a complete shrink wrapped VXD, or virtual driver, Windows, Windows for Workgroups, all sorts of applications. This is going to be an excellent product for us. We're still a small company with about 13, 14 people in the company, and Ungermann-Bass has now signed a relationship with us to sell this worldwide, and it will be, I believe, a very popular, very competitive, and in some cases very advanced, implementation of this, by virtue of the Ungermann-

Bass experience in deploying protocols for big, big companies. And our contribution, besides bring it into the Windows domain, was to bring it out of the domain of the MIS guy and his crafty people who could deploy *<inaudible>*, into the hands of the individual user as a shrink wrapped package, point, click, install.

Pelkey: Great. How come Synoptics got to be a successful company?

Davidson: Well, in part because—it was the very good perception of guys who, I think, again came out of Xerox, to do the twisted pair work.

Pelkey: Shielded twisted pair.

Davidson: And make the ten megabits work, and the minute that they got funded to do that type of thing, they were on their way to doing all the derivative types of things that one could and should do.

Pelkey: But why didn't you do it? Why didn't you beat them?

Davidson: Well, we did do it, and we did it in a time frame that was reasonably close to what they were doing, and we did it with the Access I technology, which enabled us at the end of our twisted pair, to offer all sorts of devices; RS-232 devices and Ethernet devices and we had been doing token ring and other types of things; Macintosh devices; we had a very good hub that was filled with smarts, that could do TCP or it could do XNS for you, it could do terminal switching and serving for you, but it was a little bit expensive compared with some of the things that Synoptics folks were doing. They were coming from the ground up. And you might end up, you know, looking at the entire industry, in terms of these trends, like companies that sell a system from the top down versus companies that go populate departments with the components from the bottom up, and probably one could make that story hold true in the Synoptics case. They came out with technology first and little increments to the technology second, and people could embrace it and install it, and use it where they were, and the company didn't have to make a big decision in their favor. So, probably UB doesn't get enough credit for what they did in '88, and Greg Hopkins helped do that Access I.

Pelkey: Thank you very much for your time.

INTERVIEW ENDS