Interview of Ralph Ungermann

Interviewed by:
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James Pelkey: Thank you for taking the time to sit for this interview this afternoon. I would like to begin with your experiences with Collins Radio.

Ralph Ungermann: I was there in the very early '70s before going to Intel. Collins had already implemented an extremely advanced automation system. It was on the front page of Businessweek, and we brought many large companies through there. We had a very sophisticated LAN/WAN system installed in 1968 or so.

Pelkey: This is all pre-Carterphone then?

Ungermann: This is years before anybody else. In fact, I think I have a document in here, somewhere in my archive, of what was called the Collins C System. Art Collins had dreamed, when he was a kid, of hooking things up together on a ring so that they could communicate -- radios and stuff -- so we're talking very, very young age. As you know, they're very strong in avionics, but you probably didn't know that he was very strong in communications, and they built their own networking technology for tying together computers and peripherals and things, and they had, in fact, a 32 megabit LAN that tied together the processors in Cedar Rapids, another 32 megabit LAN in Newport Beach, and another 32 megabit LAN in Dallas, Texas, and then they had, coming off that 32 megabit LAN, I think it was one or two megabit sub-LANs, going through bridges, that connected up all the peripherals; teletypes and things like that. In 1967 you could not buy an oscilloscope at Collins Radio unless it had a LAN interface built into it -- proprietary. It cost a lot of money, so an oscilloscope -- we'd buy it from Tektronix and it would have a Collins C System interface to it. We built a semiconductor factory there in '67, '68, that at every workstation -- they built this incredible building --

Pelkey: This was in Dallas?

Ungermann: Newport Beach. They built this incredible building that was two stories high, and they ran, under both floors, a matrix of every possible element that you might want in a semiconductor factory. So there's this huge matrix. They had a computer program that, if you wanted to put a wafer processing step at a certain location, you could type that into the computer, and it would print out the drilling pattern for you to drill holes to get the de-ionized water, to get to certain gas --

Pelkey: My goodness.

Ungermann: -- and it worked. At every workstation in this semiconductor factory there was a Teletype, a dirty, oily Teletype that told you what to do with the work that was coming through. Everything moved under computer control in 1967 in that factory, all on this LAN. They had all three facilities tied together with 56 kilobit wide area links, and they had this incredible automation package that, as a program manager, in 1967, on Monday morning when I would come in, I would have a list of all of the materials that the factory did not yet have on order for any project, no matter how far in the future, that I was building, and it would have all the exceptions for any cost overrun, any project that was behind schedule, and then my boss would have a higher level exception, and his boss would have a higher level one. Every Monday morning, we knew the status of that entire company. Unbelievable -- all batch. The problem was that it was a very, very expensive system. As I remember, it cost about $45,000 to hook a teletype onto the one megabit LAN. I was involved in a project, in 1970, called the DVN, Digital Voice Network. We were putting -- I was building, I think, somewhere around 20 custom VLSI chips, to bring the cost of these LAN interfaces down, and to provide voice connectivity as well. In fact, we were working on voice switching as part of the LAN, and that piece is one of the only ones that survived. It's still available out of Cedar Rapids in some form for LAN switching. So Collins was about 20 years ahead of the industry, and it is where, I think, the LAN industry really matured. You might also be surprised to know -- and again I think I have a copy of this - - that Collins built the first microprocessor.

Pelkey: I was not aware of that.

Ungermann: I think I have it in my archive. I hope I do, but Collins actually -- I have a data sheet, and I think it's dated 1967, for a microprocessor, a single-chip microprocessor, maybe '68, I'm not sure. The

problem with it was, it was a four-bit serial processor. It had a serial interface, running at very low speed, and it operated at four bits inside. It didn't have any performance, but it was a true, genuine microprocessor. Anyway - -

Pelkey: Clarification: when you say LAN, was it more than just an electrical connection between devices? When we think about LAN today, we think about protocols on top of it and so on.

Ungermann: It was all custom stuff, obviously, but the LAN itself -- the lowest level obviously was a transport mechanism, and instead of using packet switching, we used time division multiplexing. As I remember, we had to lock all these time division multiplexers together into a single master clock, and there were some real tough technical issues, but 32 megabits -- I mean we still don't have 32 megabit rings running today.

Pelkey: Was it kind of like what we'd call a Slotted Ring arrangement?

Ungermann: To be honest, I've forgotten, almost, the technology, but I believe it was more just time division multiplexing. Again, I have an architectural --

Pelkey: Was Mel Doelz at the company at that time?

Ungermann: Yeah, sure.

Pelkey: Was he involved in this?

Ungermann: I suspect so, very heavily involved. Now, also, Collins was a tremendous leader in modem technology back then. There's a guy named Melvin -- Melvin, I think -- who was the leader in that. We were very big in building modems based on integrated circuit technology, mostly for the military. They could withstand tremendous drop-outs of satellite links and stuff like that, so Collins was a hotbed for communications technology. It was a world-class company.

Pelkey: As an aside there, Collins was one of the early companies in the modem industry, but in fact, never became a factor.

Ungermann: Right. They never -- well, I'll explain the story. What happened was, Art Collins decided, in the late '60s, that he was going to develop an entire computer system that included the LAN, the CPU, the disks, the printers, everything, and they started on this enormous investment of developing their entire, whole computing system -- and I mean disk drives and everything. Of course, Collins was a big leader in store and forward switching for airlines -- AIRINC and stuff like that. So Collins' strength was in avionics. They dominated the avionics world, and they got into this message switching AIRINC business, and then Art decided he was going to take the company into the general-purpose computer world and compete with IBM. We built our own computers, we built our own disk drives, we built our own printers, and that's what we used in our own factories, and we built our own software. I believe the software may have been 30 years ahead of its time. I still don't know of a package as powerful as the package they used when I was at Collins. It was all batch, but in terms of ability to run the business and know where the business was, I've never seen anything like it. If you went back and looked in the archives, I'm sure you'd see articles in Businessweek and stuff like that. As I remember, it was pretty well publicized. A lot of companies came through. The worlds' biggest companies would come through to see our system. Unfortunately, Collins took on a task that was infinitely bigger than their resources, and the company started to go out of business. I stayed there for a number, a couple of years, as they continually laid off people and laid off people as we poured all of our money back into it, because we were still very profitable in avionics. This MOS factory cost ten times the standard MOS factory, but again, it was this dream of this guy. In fact, I'll never forget, when they built the factory, he decided that he ground wasn't firm enough, because of the vibration that might occur, and so they took all the dirt out -- 20, 30 feet down -- and they mixed it with lime, or something like that, put it back in there, and for weeks they had these big graders and (unintelligible) mixed it in, comes out, he determined that it wasn't stable enough so they did it again. They did it three times, so --

Pelkey: He was a man of his own mind.

Ungermann: He was an unusual person. He's still alive, right? He may have died. He formed another company up in Cedar Rapids. I think he did die.

Pelkey: Sounds like a very unusual man.

Ungermann: Oh, extremely unusual. I was on his staff, working on this -- I had a special staff assignment, that wasn't my regular assignment -- but I was on the staff, in terms of this architecture of this whole thing, and I was responsible for the LAN portion of it. So, unfortunately, because I loved that company, I decided to leave, because it was going out of business, so I left.

Pelkey: When did you leave?

Ungermann: Well, I'm going to be rough on my dates. I don't remember real well, but I'd say '70.

Pelkey: And when did Collins get acquired by Rockwell, do you recall?

Ungermann: I'd guess '71, '72, something like that, and that story is an interesting one. As I remember, Collins needed some money, I think to almost meet payroll, and they went to Rockwell and borrowed some money in exchange for warrants for 50.1% of the company, and so they loaned them the money, exercised the warrants, and sold the land that Collins owned in Newport Beach, and I think made an enormous profit. Collins owned all that land around the facility in Newport Beach, which is now just the most valuable land in southern California. So I left, and I went over to a little company called Western Digital, and I hadn't been there very long -- only a couple of days -- when I decided that -- I left in a rush, and I wanted to get into the semiconductor business, and there was only one choice in southern California, and so I really had my heart set on getting in the semiconductor business and driving communications technology in semiconductors, so I had only one choice. I went to Western Digital, and that turned out to be a poor choice, and I knew within a few days I wasn't going to stay there very long, but the first project that they were working on was the UART. They had a contract from DEC, and the first company that delivered this product was going to get the order. They gave the design to several companies -- or the requirements, not the design -- and I came in and immediately recognized that there were a lot of problems in it in terms of communications requirements, kind of restructured it. We drove it very hard, and we were the first to market with the UART, and we got the order from DEC, and then we became the UART company. I spend a lot of time selling, but I had pegged myself to stay there one year. It wasn't morally correct to do less than that, so I stayed there a year, drove the UART program, we got it out, and it became the standard in the industry; the first communications chip.

Pelkey: This was around '71 that the UART came out?

Ungermann: That would be '71, I guess. I have a real hard time with history. I don't remember history.

Pelkey: You're not the only one -- every one of you.

Ungermann: I can see the feature, but I can't see the history. So I left there. I really wanted to get into the semiconductor business, and I realized Western Digital was not going to be a player. It turned out I was wrong -- right, but wrong -- so I just sold my house and moved up to silicon valley.

Pelkey: Did you go to school in southern California?

Ungermann: I grew up in southern California, but I actually went to school at Berkeley, and --

Pelkey: So you went back after -- did you get a master's degree?

Ungermann: Actually, while I was Berkeley -- while I was working at Collins, I got a master's degree in computer science. I had a bachelor's degree in electrical engineering at Berkeley. So I came up here. I just moved up here; sold my house, bought a house, and I started looking around and looking at jobs. I talked to about 30, 40 companies, and I talked to everybody in the semiconductor business, and I decided Intel was the company I wanted to go to work for, so at a tiny, tiny fraction of the salary I would have gotten if I had gone to any other company, I went to work at Intel, because they really wanted to -- at the time -- they wanted to get into the voice communications business, which I also had a lot of experience in. They wanted to build codecs and things like that, and I wasn't very interested in that. I didn't see it as a big market, but I was very interested in the microprocessor activities. So I joined Intel, and at the time Intel had a very, very tiny commitment to microprocessors. They really had Faggin and two people working on microprocessors, and I was a strong advocate for Intel making a much bigger investment in the microprocessor. That's why I had come there, so they gave me the opportunity to run the microprocessor development organization.

Pelkey: Reporting to Faggin?

Ungermann: Reporting to Faggin. So I built it up to about 30-some people, but my key project was to build -- I think we called it the USART, which was the next generation UART, which was synchronous, or asynchronous, and we built that product. Then for, again, economic reasons that had nothing to do with Intel, except the '74 downturn came and, in fact, I was caught in what was unusual at the time, I executed -- I came to Intel, my stock, had appreciated a lot, I executed my options and -- I don't remember the exact numbers -- but I think the stock was up around 60 bucks. I went away for the July 4th weekend; when I came back, it was around 20, and the interest rate was 18%, and I had to borrow money to pay for the execute of the stock, and as I mentioned, my salary at Intel was quite low, and in fact, as I remember, the interest payments on my execution were higher than my salary, so I decided to leave, and I did. In fact, in another story, I had started a software company before that, that I didn't work at and wasn't involved with, that did logic simulations software, and I decided to go take that company and decide what to do with it. So I left Intel, and Faggin decided to leave Intel, and he came to me and we got together, and Exxon approached us and said: "Don't you want to be in the semiconductor business?" We said: "No, we didn't want to. We really, absolutely didn't want to," and Exxon fundamentally talked us into starting Zilog.

Pelkey: How did they know to come to you?

Ungermann: It was in Electronic News when we left. Intel was a fairly well known company. So they came to us, and they had this grand plan, I guess, and we didn't know it. We proposed going into the systems business, but they really wanted us to go into the microprocessor business, so fundamentally they talked us into doing it, and we did it. We took this software company and turned it into a semiconductor company; sold off all the software assets, and started Zilog.

Pelkey: When was this?

Ungermann: '74 we started Zilog. So Faggin was a processor expert, and I knew communications, so Faggin did the processor and I did the I/O chips, and the first chip I did was the SIO, which was a two-port serial asynchronous/synchronous interface chip, and I think that two things made Zilog. Certainly, the fact that the Z80 was compatible with Intel's 8080, and had a lot of bells and whistles -- in fact it's interesting, just last night I looked in Electronic News, and Zilog announced a new version of the Z80, a CMOS version of the Z80 running at a faster speed, and they used the exact same words to describe it in the first two paragraphs that I used in 1974. So here it is, 15 years later, and people are still bringing out Z80 products. So, Faggin really drove the processor side, and he had this guy, Masatoshi Shima working for him, who had done the 8080, and the 8008 -- or the -- the 8008 and the 8080 at Intel, and then he joined us at Zilog, and he did the Z80. I did the peripheral chips and defined the interface for the microprocessor to the communication chips and everything, but my real interest was in the communications part of it.

Pelkey: Did Intel have any problems with so many of you leaving and going off and starting a company?

Ungermann: Well, there weren't so many of us leaving. Faggin and I both left, and then Shima left independently, and that's all -- that was all of three of us. Intel was a very tough company, and they made it clear to us, but in fact, we went back to Intel and said: "Hey, we don't have any plans. We'll be glad to do a chip for you and work for you, and we'll do whatever you want to do," and we offered to do the design for them, and they said: "No, thanks, we really don't want to do that." So then we went ahead and did the Z80. The second reason for Zilog's success was the serial interface chip, because it won us many, many, many contracts, and the reason it won many contracts was the fact that all of a sudden, people were starting to build workstations -- or the equivalent -- communication processors, and they wanted to have them programmable for synchronous or asynchronous so that you could have a general purpose box that could interface to virtually anything. The two ports were important because very often they wanted one port to go to the telecom line and one port to go to a printer, or something, so we cleaned up the industry. As the thing matured, in fact, the price of the CPU dropped down to a few dollars. As you know, we introduced it at $200, and it dropped down to $2 within a few years, but the Z80 SI/O stayed up at $50, $60 for the time I was there, and was carrying the margin for the company, because it was a unique, very differentiated product. So I worked on the three generations of the serial interface chips. While I was at Zilog, a lot of activity was starting in this networking area from different directions, and certainly Xerox was driving it and a number of people, and there was a lot of interest in it. Charlie Bass came to me one day and said: "We need to hire this guy John Davidson from BBN, because there's an awful lot going on in this networking area, and we could be a player in it, and John's a real world class guy."

Pelkey: Charlie was with you at that point?

Ungermann: Yeah, Charlie was with me at Zilog from the start.

Pelkey: But he wasn't at Intel? You hired him --

Ungermann: No, I hired him from Berkeley.

Pelkey: That's right, he had been at Berkeley.

Ungermann: So he said: "There's this guy out there that worked on the Aloha Network and really understands networking, and we need to get him." Now, in the mean time, there are some activities that had been proposed, in terms of some networking, and we talked a lot about it, and we decided we'd build a network there called the ZNet. That's about when Exxon decided that they'd like to fold all their investments together and things started to unravel, and I ended up leaving, so I left in the middle of that. When I did, again, I went back and I looked around the industry for a number of months to decide what was going on and I saw --

Pelkey: Let me ask you -- in talking to Bill --

Ungermann: Carrico?

Pelkey: Yes, and Judith about this point in time, they said that it was really, within Zilog at that point in time, it was an environment in which all kinds of things were happening. It was going to become a systems company; you were being a very successful semiconductor company, and you had two camps of thought process that were going on within the organization, and that networking, at first, was really a peripheral sharing thing, that the process of becoming more than a resource sharer, which seems like it comes out of the SIO process -- there was a planning meeting which Charlie participated in, early in the year there was a planning process -- and Bill Sweet, I guess, who had been brought aboard -- there was a planning process going on: "What are we going to do?" -- out of that planning process, this concept of making the ZNet came out of that couple day planning meeting that Charlie participated in, but you didn't.

Ungermann: I don't know about that. I would say that's probably true. I was driving the architecture from the semiconductor point of view -- no question about that. I remember many meetings with Roger

Badisher where we sat down and tried to define the chip sets of the future, and we definitely decided that we needed a high-speed bus to tie together chips, and that we were working on the concept from the chip point of view, and I would say they're probably absolutely true, that somewhere out of that, out of the systems group, which was software-wise driven by Charlie, hardware-wise was driven by Doug Broyles, who you may know. I don't know if you know him.

Pelkey: I don't know him, but --

Ungermann: Doug was really a key guy driving the system side of Zilog's business, and we were a company that was encouraged by our parent to go in as many directions as possible, because we were the most prolific producers of products, so they were constantly saying: "Can't you do this, can't you do that." So as a company, we went in ten different directions, but even to the last few board meetings, they were always saying: "We'd like you to do this, we'd like you to do that," because they had these other companies where they'd invest and nothing would come out the bottom, like Vadic and many of their other investments. We had stuff sprouting out all over the place, so we went off into memories, which was a mistake, and Doug Broyles, one day, took our development system -- which had been developed just for chip development, like Intel had -- he sawed it in half, built some boards, and put together a little system, and someone in our distribution channel said: "Hey, I can sell that." So we had the first microprocessor systems, but we were selling them through different channels than Apple did, and understood the problem differently than Apple did, and we missed the opportunity, even though we were driving the processor. We missed that; had no visibility on what was going on there.

Pelkey: Do you recall this Ariel technology?

Ungermann: Yeah, a little bit.

Pelkey: Is that something conscious? You were obviously off and dealing with lots of other issues, and there were a zillion things going on in the organization.

Ungermann: I can tell you that we had some very heated discussion where I was in where I believed, I think, that what we needed to do -- and again, I think I was driving this from the semiconductor side -- I had a different view than the systems people had, in that I wanted to go, I think -- and I don't remember. We had some yelling and screaming matches where I was convinced that we had to have a low-cost, semiconductor-based interconnect strategy, I probably can't articulate my position. I have lots and lots of notes on it, but I can't articulate it. At this point, I've forgotten.

Pelkey: There was a lot of contact between people at PARC and people at Zilog. I understand that there were parties where people would socialize with each other, and the two organizations really were hotbeds of creative activity going on; lots of enthusiasm for the future --

Ungermann: And I think the key to that was Charlie, on the software said. Charlie hired people like Judy, and he had a whole team of people like that, and it had a very high social content to it. I can remember we had a board meeting there and we walked Exxon around once to see the technology that we had going. I remember coming back to my office and thinking: "My god, unbelievable. It was unbelievable." We had everything in the world. We were doing our own compiler, PLZ. Charlie was doing that. We had our own software.

Pelkey: Clearly you had an incredible amount of talent there as well.

Ungermann: We had very, very good people, and we did lots of things, but we didn't make lots of money.

Pelkey: Was some of it because there was a lack of a mission? My sense of Xerox PARC -- there was this issue about the laser printer and the workstation, and there was some kind of an overall systems design that they were working towards. That may be oversimplifying it, but my sense of it was that you

had as much talent and as much energy going on, but it was more dispersed and it didn't have any mission or objective or unifying force to it.

Ungermann: I don't know if I would say that. I would say that we clearly had a lot of things going on, and we were encouraged by our parent to do that, therefore we had the money and the freedom to go do that. They loved to come out and see us working on new things, because they had this view that they were going to put together a computer company bigger than IBM, and there were missing pieces, and they were happy to see us try to fill in those pieces. Making money wasn't their goal. It was getting the pieces necessary to make this assault on IBM, so you have a company with all that money who was encouraging us to think big, think wide. "The sky is the limit. Do what you want. Can't you spend more? Can't you do this? Couldn't you do that?" We turned down project after project that they wanted to bring to us that they wanted us to get involved in because we were productive. When we said we'd do something, we could make it happen.

Pelkey: That must have been an incredibly fun, exciting period.

Ungermann: It was exciting. We had our trials. We all had some projects we could never get out. One of them was the PLZ compiler. As I remember, it was a couple of years late, and we sold it to a lot of people, and we had trouble on that one, but in general we turned things out on time. Zilog also made a very, very serious mistake. Not only -- the overexpansion was driven, and we didn't have a factory to build memories, and couldn't really compete effectively in that business because we didn't have the technology and the factory and that was a mistake, but also we made another tremendous mistake in the Z8000, in that even though we had made a corporate decision that it was going to be compatible with the Z80, somebody in the organization decided that wasn't appropriate and changed it, and we ended up with something that was incompatible. Now, all of a sudden everybody -- especially with Zilog, when everybody left -- they had to make a decision whether they were going to rewrite all their software, and if they were, they sure as hell were going to go with Intel, not Zilog, and it killed the company. So that was the fatal mistake, making the incompatible machine with the Z8000.

Pelkey: Yeah, because your strength at that point was in doing one up on Intel -- being compatible, but being faster, providing more functionality or something.

Ungermann: We had had AMD as a second source; I mean we were going -- if we had delivered the Z8000 on time, compatible, we would be completely different. We would have been in Intel's shoes today.

Pelkey: Yeah, it's amazing how --

Ungermann: Yes. Small mistakes. Small mistakes kill big companies. That was a serious mistake. That was the fatal error, because everything else was fine. Exxon is still funding it, right?

Pelkey: Was there any problem getting talent? Or were the interesting projects and the nucleus of really talented people enough that people wanted to come to work for you?

Ungermann: We were a pretty hot commodity, I guess. We had good people. Charlie definitely formed a kind of researchy environment where people -- I think they would absolutely compare themselves to PARC. In fact, when we started this company and we brought a few people over, that was their biggest disappointment. This wasn't going to be the same. We're a more product-oriented, profit-oriented company. So we definitely, in the software side of the company, had a real PARC atmosphere.

Pelkey: When you say 'software,' you mean non-semiconductor.

Ungermann: Yeah. There really were three pieces, because the semiconductor part was run by Badisher, and was driven towards one set of goals. Then Broyles had run the hardware side of the systems group, and Charlie did the software.

Pelkey: And the three of them reported to you?

Ungermann: Yeah.

Pelkey: So you said you left because of a dispute with Exxon?

Ungermann: Yeah. Exxon and Faggin and I all got tangled up in the whole thing as Exxon decided to really start pulling things together and move things around, and we got all sideways in this thing, and I decided -- they decided for me to leave. They asked me to leave, because I said: "No, I won't do that." So we started fighting, and I ended up leaving at their request.

Pelkey: This was when?

Ungermann: Late '78.

Pelkey: At that point in time, you went to found Ungermann-Bass?

Ungermann: Well, about a year later, nine months later, something.

Pelkey: When you left, what did you think was happening in that environment that was going to drive you to doing something else?

Ungermann: Well, I left because they told me to. I would never have left otherwise.

Pelkey: Right, but given that you left, then you were stuck with 'what do I want to do next?' You had this incredible visibility, having been at Zilog and knowing what was coming down and what was possible, and you had been at Collins where this vision of the future was pretty mature. There it was, and you were obviously very competent, in terms of understanding the potential of technology at this point in time.

Ungermann: What I did was I went around and talked to a lot of people about what was going on and where they were going, and what struck me was that every computer company was working on networking technology, and every single one told me the same thing: "Boy, just think, if we can control the wire, we're going to control the business," and it was clear to me that that's not what the customer wanted, and that there was an opportunity there. Then, my experience with networks at Collins led me to believe that the technology was here to really implement these things cost-effectively. In the meantime, Zilog was going along with some of the same thoughts, obviously, and some of the people there were coming to the same conclusions.

Pelkey: And you were aware of what was happening at PARC with --

Ungermann: Metcalfe and --

Pelkey: -- Metcalfe and his work at this point in time.

Ungermann: I met Metcalfe during that interim period and talked to him. I talked to 50 companies; went out and talked to them, so Charlie decided that, as everybody did, that his career wasn't going to be at Zilog, so we decided to get together, and we started kicking things around about what we'd do, and we started developing a strategy and a business plan, and started to go about getting funded.

Pelkey: You started Ungermann in June of '79?

Ungermann: I think it was July of '79 that we incorporated.

Pelkey: During this period of time, Bob Metcalfe's recollection is that you and he and --

Ungermann: Charlie --

Pelkey: -- Charlie and Pliner had had some discussions about creating a company.

Ungermann: I don't think so. I had a discussion with Charlie and Metcalfe and myself at the university, and he was committed -- at that time he had left PARC -- and he was committed to forming a company and making money, and Charlie tried to get him into the company, I think made him an offer and really wanted him to join. I wasn't involved in any of those discussions, but Charlie did make him an offer, I'm 90% sure, to join our company, but we never got close on that issue, I don't think. So there were discussions between the two of them about joining our company, or joining forces -- joining our company, I would say, but I can't speak to that, not having been there.

Pelkey: Pliner? Was there any discussion?

Ungermann: Pliner was later. One day I remember Charlie came in and said: "I just talked to this guy who's got a company, and they're building networks. They're actually doing this stuff." No, "they're consulting in networks." That's what he said. They weren't building product at the time. Then I had lunch one day with Charlie and Pliner and a couple of other people from Sytek, someplace here, so I met him way -- six, nine months after I met Metcalfe. Now, we did go --

Pelkey: And six, nine months after you started your company?

Ungermann: Three or four months after we started the company. So we started raising money. In the meantime, Metcalfe went off to do this custom deal with GE to do some kind of something, which I didn't understand, and Pliner continued to consult on networking, and in fact knew this company somewhere -- a little, tiny, four-person company that was building broadband technology down south of here -- and we went down and visited them, and they were building modems or something for broadband technology, but I think voice on broadband, I don't know what they were doing, but they had some broadband technology, and we decided to go Ethernet. I think he led us to this guy Tat Lam, who was building the first Ethernet transceiver.

Pelkey: Over in Milpitas?

Ungermann: No, I think right up here; Santa Clara, but I'm not sure. But Tat we found through Metcalfe or Pliner, I'm not sure. It was a small community. So we went out to raise money. Now, the fact is that in -- the day I left Zilog, I called Neill Brownstein. You know him?

Pelkey: Yes.

Ungermann: He knew a guy named Bob Field who was working for me at Zilog. He was running the marketing part. When I left, Bob said: "Call Neill," because I wanted to sell my stock in Zilog, so I had breakfast with Neill, and I asked him what was the prognosis of selling my stock, and he said: "Slim to none," but he'd be interested in what I was going to do. So I kept in touch with Neill from then on, and basically, as Charlie and I started to get the ideas and Charlie left Zilog, Neill sat back and said: "I understand what you want to do," because he had been involved in Telenet, so he had experience in wide-area networking, and we were doing a private version of that, or a small version of that, so Neill said: "Hey, I'd like to be involved." Neill stood by us during this whole time. At the same time, we got what we thought was a commitment from Kleiner Perkins, which turned out not to be one, and it turned out that, for various complex reasons, it took us a year to raise our first round of funding. During that time, we talked to everybody in the financial community, and virtually -- there were few venturers in the venture capital community.

Pelkey: Right. Still are.

Ungermann: And so, after the thing with Perkins had fallen through, we had a terrible time raising money, and Charlie and I funded the company, during that time, ourselves, for the first year. Then, one day -- ah, geez, what happened -- well anyway, the net of it is that we used Sytek as a reference, so all

these venture people were calling Sytek, calling Pliner, and what I've heard him say is: "Well, if they can do it, we can do it." So they followed us into the business, based on our business plan. In fact, since things happened which I probably shouldn't go into that caused us to be very unhappy with their behavior, we turned out to be pretty strong enemies.

Pelkey: Yeah.

Ungermann: So they became our number one competitor, and Sytek was our number one competitor, and that was the broadband/baseband war days. We decided to go into the broadband business, and as you know, Sytek had some real troubles and is no longer a major competitor.

Pelkey: So you recruited Jordan in the beginning of '80?

Ungermann: Probably. Jordan came early. In fact -- no, no, no -- yeah, he came before the first round of funding, which was in the middle of '80. He came right at the time of the funding, so he must have come in March of '80 or something -- March, April, May of '80. I recognized that what we were doing was going to create an end-user sales company, right? Charlie and I didn't know anything about that, so we needed a third partner. That's one of the reasons we had trouble raising money, because we didn't have that third partner on board. So Jordan joined us from Four Phase in March, whatever.

Pelkey: Was that during that period of time? You were out, from what I gather, seeking a person who knew how to put a sales organization together and go out to direct sales. The fact that he came from Four Phase, and didn't know anything about local area networks and so on, was that an issue?

Ungermann: Well, nobody knew anything about local area networks, right, so that wasn't a choice. It was just really a function of finding somebody who could put a sales organization together, and a high technology one, and Four Phase was certainly that. It turned out to be a good choice. He did do that. We met our business plan for the first six years quarter in, quarter out while he was running the sales force, so it turned out to be a real good choice.

Pelkey: Now, in the early days, as you say, your first product was the terminal multiplexer, and Ethernet --

Ungermann: Terminal switch.

Pelkey: Terminal switch, and Sytek's first product became a terminal switch using broadband technology, but a terminal switch, and 3Com was off doing something.

Ungermann: They started with GE, and that didn't pan out, and then they started doing transceivers.

Pelkey: Right, transceivers. During this period of time, they were on the verge of going out of business, almost all the time.

Ungermann: 3Com? Yeah, they were not growing or not a factor.

Pelkey: And Interlan was on the east coast, and they were --

Ungermann: When did Paul start his company – Severino? I'd say he probably started two years after us, or a year and a half after us. We were watching them, and he started out building transceivers, and then boards.

Pelkey: Interlan -- 5/81 incorporated.

Ungermann: So Interlan was started out.

Pelkey: What was it like trying to sell this in the early days?

Ungermann: Selling the product? Well, the customers, early on, were fundamentally companies that understood the advantage of networking, but really were just doing terminal switching, with a view towards the future. They tended to be technical organizations. The first shipment went to a university in Switzerland, and the second one went to West Point. In fact, at that time -- in fact, this was one of the largest reasons that we really got going in the company was -- GE's research center had decided that they needed a product like this, and they were out looking for a vendor, and I ran up to them at a seminar on LANs, on networking in New York, before we incorporated, or before we raised our money, I can't remember when. GE was going to fund the development of this product, so we tried very hard to get GE to be our first customer, and we came fairly close, but they decided we were too young and too risky, and so they actually gave the contract to Network Systems, and Network Systems, that became their HYPERbus product, which was never very popular, and we took over GE. We owned -- we've delivered all the networks in GE, ultimately, so we did win the business, but two or three years later. But those kinds of companies: the GE research lab, the research labs. Bell Labs was one of our first big customers.

Pelkey: Xerox was a really big customer --

Ungermann: OEM -- big customer on an OEM basis. They sold it as the communications server through wide area nets for their office automation system.

Pelkey: It's kind of paradoxical that it created a lot of this technology --

Ungermann: Well, they just bought a piece from us to fill in their product, so we had a piece and they wanted to do as little as possible, so they bought it from us, but we've never been good at it as -- at that point, we were not good as an OEM supplier, so we didn't really customize and adapt the product to their needs, and we just kept pursuing the end-user business, so over time, that didn't turn out to be a major part of our business.

Pelkey: Did you participate in the 802 process? You picked Ethernet technology, which I guess was -- it was widely known that you had come from an environment in which you knew Metcalfe and you knew about Ethernet and so on. There were papers written at this point in time on Ethernet.

Ungermann: Well, we sat back and picked what we should do, and I suspect Charlie was the driving force here. The first year, I spent most of my time raising money. I spent very little time on the engineering side, and John Davidson was the key technical doer. Charlie was running it, but John was doing it. We picked Ethernet, and we adopted a style that we've carried out since then, which is: try to anticipate. Don't worry about -- we'd go to the committee meetings occasionally and we'd just kind of watch it and anticipate, so our first systems that we delivered were what we thought the four megabit experimental Ethernet was, and we told our customers: "Don't worry, we'll upgrade you when the spec becomes a standard," and the day the Blue Book came out, we had everybody going on that thing, and we build the first semiconductor chips to implement Ethernet, and delivered the first system that really ran Ethernet. We did that, and then we upgraded all our customers and made it compatible, so we went over to Fujitsu and did a joint venture development with them where we developed the chips to make Ethernet a reality.

Pelkey: On software, you --

Ungermann: John developed a whole series of software to provide the networking layers.

Pelkey: It was kind of an XNS sort of --

Ungermann: It was XNS-like, and I remember those discussions. We couldn't decide whether to do TCP or XNS, and we decided TCP was too big to fit in the Z80, which is really yet a third story, which is that we started the company because of our experience with Z80 in our background, and the fact that the Z80 had the best communications capability. We chose it as our architecture, and that turned out to be our Achilles Heel, because Zilog didn't make it, and therefore we ended up having to change

architectures to Intel, and that's how Bridge got started. They recognized that we had a big transition, and they jumped on a 16-bit processor and went around and said: "See, they're the pioneers, but we've got the real advanced technology and higher performance and everything," and they got a start by getting a jump on us on that second generation.

Pelkey: They started on the 16-bit?

Ungermann: They went to the 68000 as their starting product.

Pelkey: 68000 they went to?

Ungermann: I think so -- 68000 or something. They're Motorola based. They went to Motorola. They're Motorola based, and we had the transition to Intel. That was a very painful transition, because if we announced it or anything --

Pelkey: You would have chopped off all your customers -- the Osborne effect.

Ungermann: Precisely, so they took advantage of us on that issue.

Pelkey: So the TCP/XNS decision was largely dictated by your processor choice?

Ungermann: The processor we picked, memory size, and efficiency. We thought XNS was a lot more efficient to run in a machine, and at the time, it looked like XNS was going to be a winner. Nobody thought TCP was going to spring up from the dead, so we thought we'd picked the winner, and we thought a lot of companies would - - so did Bridge. Everybody was picking it in those days.

Pelkey: Xerox really shot themselves in the foot when they opened it up and then --

Ungermann: They tried to keep it proprietary --

Pelkey: -- and then came back and said: "We gave you that much, but we're not going to give you the rest of it."

Ungermann: They wouldn't give you the interface to the printers and stuff. They wanted to lock you in to buying their peripherals, and so they withheld some of the pieces to provide that locking in, and that was the death of XNS.

Pelkey: What do you think -- given that they had already opened the door up, why did they turn around and close the door?

Ungermann: I suspect they looked over there at Apple and saw . . .

[Tape Side Ends]

Ungermann: . . . from Apple, and decided they needed a strategy to protect themselves.

Pelkey: The proprietary strategy.

Ungermann: Same one DEC and IBM use, so it's not unusual. If you think you're powerful enough to do it, you might as well try, I guess.

Pelkey: Do you know if Charlie, at this time, was aware of what was happening with Berkeley trying to develop at TCP/IP for Unix?

Ungermann: Oh, yeah, we knew a lot about TCP.

Pelkey: Bill Joy's work and, as much as anything, TCP being in the Berkeley Unix release in '83, and just shipping with it -- everybody getting that source code -- that was as much a reason for TCP/IP becoming a market force as anything, as I understand the story.

Ungermann: Yeah. Well, the reason that TCP is a force is that, for various reasons, connectivity through it became available on lots of machines, so overnight, even though no vendor was proposing it as THE standard to use, all of a sudden people looked around and said: "Hey, look at this. We can to this, we can do that." In fact, it kind of just grew up from that. So we had people who wanted to put together word processing systems, and they found they wanted to use VAX and they wanted to use this and they wanted to do that, and how did they do it? "Well, I can go to Wollongong and buy that -- " They were piecing these pieces together, and Unix was -- Berkeley was a major factor there -- so it just got out in a lot of places, and primarily driven by Unix in engineering, but it was people outside of that that started to use it again. They used it, and then everybody recognized that: "Hey, there is real strong connectivity here, and this is a good standard to jump on."

Pelkey: Then when Xerox says: "No, we're not going to give you the whole everything," and TCP is available --

Ungermann: Well, Xerox had killed XNS already, and now the question was where to go next. The sense was OSI. We made a huge bet on OSI.

Pelkey: When did you become aware of OSI?

Ungermann: Well, from the start. I have never been active on the standards side, so I'm not a good spokesperson for these issues, but we were involved in the OSI model from the day we started the company, and involved in committees at various levels from the day we started the company. We've never tried to drive a standard -- well, we have. We seldom try to drive standards. We try to sit back and see which ones are going to survive, and then support them, so we tend to be more reactive than proactive on standards. We drove towards OSI, so we came to feel that the driving force for OSI was going to be MAP and GM, so we made a huge investment there and a huge bet, and that really cost the company, because that's the first time we picked the wrong technology.

Pelkey: You were responsible for that decision and putting the GE deal together, if I understand correctly?

Ungermann: Yeah, that's absolutely right. We felt --

Pelkey: you did that after you got the broadband, so you got into broadband first. You got into broadband by acquiring some company?

Ungermann: It helped us get in, but --

Pelkey: What was the name of that company?

Ungermann: Amdax, but the real reason for that was to get into the Token Ring business. They just happened to have some broadband manufacturing also. They had a broadband network and we killed it. We shot it. What we really did was we hired a guy named Greg Hopkins in Boston, out of MITRE, and told him to get us into the broadband business, and he got us into the broadband business.

Pelkey: And [Norman] Meisner.

Ungermann: And Meisner. He brought Meisner on later, but Hopkins was the ringleader. Meisner was a salesperson. Hopkins developed the product, and I gave him the charter: "Get us in the broadband business and make us the leader in broadband," and he did -- we did. We killed Sytek, and to this day we're the only real major broadband vendor.

Pelkey: Absolutely. Do you remember when you brought Greg aboard?

Ungermann: No, I don't know, but I'd say '81. I'm guessing. So Hopkins came in and put us in the broadband business. I also made the decision that Token Ring was going to be very critical, and therefore we acquired Amdax and acquired a Token Ring capability, that I think, long-term, will turn out to be our most critical technology.

Pelkey: Now, at some level, the rap on U-B had been, is, was, that this issue of being in all these different technologies resulted in a lack of focus. At some level, because you had been doing direct sales -- and I presume, not having been there, that account control was a big issue -- and that when you started the company, you had gone around and talked to these companies, plus your Collins experience before that, would it be fair to say that your mental set was: "I don't want to have to lock a customer in. A customer has to be able to make a choice of what technology he wants. We want to give him the option, because the customer is going to control what the wire is, not us as LAN and/or the computer manufacturer, so therefore the best way for us is to just give him -- "

Ungermann: It's actually a very simple strategy, and you're right, it was highly criticized, but every single company that's not a computer company has adopted it behind us. So, it was highly criticized, but widely accepted. The idea was that if you want to buy a system from IBM, it's going to be Token Ring. If you want to buy a system from DEC, it's going to be Ethernet. If you want to buy a system from both of them, it's going to be Ethernet and Token Ring, ergo, a business opportunity, a niche. A broad product offering is required to support that niche, so you're not in business unless you've got a product line. So everybody said: "Ungermann-Bass is unfocused. They're doing too many things," but today, Bridge does Token Ring and broadband and Ethernet, and in fact, mastering those technologies is not very tough. Well, that's not true. Token Ring investment was an enormous investment, and broadband technology was a big investment, but they're do-able. They're engineering feats that, if you've got good engineering organizations, you can really do. The thing that got Ungermann-Bass in trouble was we poured all of our money into that factory networking business unit, and all of our resources into that, and all of a sudden somebody decided that the technology that we were delivering -- and we had 70% market share -- was going to be obsoleted by a new standard, and that maybe is our fault for not driving that standard more, but we didn't, and it happened, and all of a sudden we had an obsolete business unit with a huge portion of our resources going into it, and we had to shift from that. We had to shut that down, meld it back into the organization, and change a lot of people's careers and futures and direction, and everything else, so it was an enormous dislocation for this company, but we take risks and we miss one. So what? You keep going. We also made -- we took a gamble on broadband -- made a go. We made a gamble on being able to provide an IBM compatible Token Ring, and we're doing that, and we picked MAP, and we missed. So we picked three out of four, and that hurts, but so what? We're going to keep going. We're the only company that can come in today and provide you with a very broad connectivity of IBM and DEC, all based on open standards, and today I think everybody recognizes that's the only winning strategy for an independent LAN company. So everybody has adopted that strategy.

Pelkey: Now, in terms of Token Ring, when you went to do a semiconductor, you went to TI, right?

Ungermann: No, we did our own. We're the only other company besides TI and IBM that has a Token Ring chip set.

Pelkey: Ok, yes, I apologize. You did your own. Now, on the PC, the PC portion of the business, Metcalfe almost survived on it, and then the IBM PC comes out and Businessland opens up and he focuses on that marketplace with a low-cost, low-function product. He might not like that expression, but 'entry level' functional product, and obviously has been very successful. You got into that business later than he did.

Ungermann: Yes. I would say two things about that. First of all, the day I read that Krause had joined 3Com, I knew they were going to become a competitor --

Pelkey: Because?

Ungermann: Because I knew he would get their business sense right.

Pelkey: Had you known Bill before that?

Ungermann: I bought a house from him. He had the house that I formed the company in, and I just knew him very lightly, but I knew his reputation, and I knew -- the day I read that, I knew that all of a sudden we were going to have another competitor. Bill came at it from a computer company background, and aimed at being in the computer business. He and I had a very different strategy. Mine was to build large, complex communication systems and his was to build departmental PC systems and sell through retail. We were going to sell direct, so those are two completely different strategies. So we didn't compete very much. Bridge was our competitor -- not really. Major competitors are IBM and DEC. Bridge was getting -- so we were up here fighting this broad-based battle with this broad product line against IBM and DEC, and then we had this Bridge thing picking at our -- and there was the way Bridge got started, really, it caused some real animosity, and there was some tremendous hatred towards Bridge, too -- anyway, we, being in the terminal switching business, and finding a lot of success doing that, focused on supplying our customers' needs. So they were pushing us for this terminal, that terminal, 3270, etc.. In the meantime, the PC business was growing up, primarily around this retail distribution small cluster, and we were late getting into it -- probably a year and a half getting into it. What happens to most pioneers? You get it, you get a customer base, they're demanding things, you've got commitments, you've got contracts, you're doing well, you're meeting your business plan. All of a sudden, a new opportunity comes up; it's hard to get the company focused on that. We recognized that it was important, and we finally got our focus on it. Today, it's more than half of our -- PC connectivity is more than half of our business, and we've got a very broad, powerful product line, but we were behind them. That is not the reason for the difference in the growth rates, or whatever, how well 3Com has done. 3Com has focused on a business that has been a faster growing, simpler to implement business plan. We've always said the long-term survivors are going to be the system suppliers, because independent departmental decisions are going to go away.

Pelkey: Right.

Ungermann: And therefore, this is where the business really is, and if you get sucked into that, you're going to get sucked into a trap. Keep focusing on supplying an enterprise system, because departmental independent solutions are a four or five year business plan. We've always gone for the long term, as Tandem has, and said: "We're going to be a system supplier, a strategic system supplier." That's difficult. It grows slower, but it's like a flywheel: you get it going; it slows down slower too. You tend to stay in business longer. That's IBM's strategy, so we have an IBM strategy, and they have an Apple strategy.

Pelkey: It's ironic, their having bought Bridge and your combining with Tandem.

Ungermann: Yeah it is.

Pelkey: It's kind of starting to look -- not meaning to be disparaging, because I don't mean to compare them in that sense -- but at some level of abstraction, they go off and acquire a company so they can provide more general purpose networking communications, and you get involved in a company that has more computing resources, where they had internally developed their --

Ungermann: But very different, because Bridge was mimicking us exactly. In fact, I've talked to their people, and that's basically how they did their product planning. If we did it, they did it, and that was a good strategy because we were the leader, and they just said: "Yeah, we've got that coming too," or "we've got it and we're going to get it," so it was a good strategy.

Pelkey: And you could effectively compete with them, at some level, because of distribution scale and a broader product line, but they kept coming at you at specific points and being a nuisance factor to you.

Ungermann: And they won a couple of big accounts from us where we blew it and they got a foothold, and it was from -- this whole thing of broadness. We were focusing on our front, and we let them get into a couple of big opportunities that got them established, and then they were in business.

Pelkey: Excelan was never a factor for you?

Ungermann: Excelan has always been much more of an OEM LAN supplier, not an end-user supplier, so we've only really -- originally we had Sytek, and then DEC, and then IBM, I'm sorry, Sytek, DEC, Bridge, IBM -- Sytek has fallen off. So we've had one upstart and two big guys in front of us, but we always knew DEC and IBM were the competition, and now we know for sure, because I am absolutely 100% convinced that 3Com will -- that there will be no Bridge division as an effective competitor against us in another two years, because they're making a decision where they're going and I knew what that decision is going to be, and it's going to be over here where they're successful and where there's a good market. You see it in the defections of the people, and already we see an enormous difference in their competitiveness out in the field. They're losing focus and direction in our market, and that's great. At the same time, we've got IBM with more and more capability every day, and so therefore we say: "Oh, geez, we better get to be part of a bigger company, because all these guys are sitting up here saying: 'Geez, this is a strategic decision, and we only have three strategic vendors, and who's Unga - Ung - what?'" So we said: "We need to be part of a several billion dollar operation," but we picked a partner who would -- who saw things the same way we did, who really saw the businesses as being quite different, and if we, all of a sudden, said: "We're a Tandem networking company," our business would go to a tiny fraction of what it is and going to be, versus an open networking company, so Tandem was a really good partner. I believe you can't survive without being a strategic vendor, and Tandem has become one of those. It's only $1.2 billion, $1.3 billion this year, but on the other hand, they are a strategic supplier to a huge number of big companies, and already it's impacted our business very substantially and significantly, in terms of our opportunity to go in and deal with companies we'd never even think of getting into as a strategic communications supplier. So we're finding ourselves in more and more situations where IBM and Tandem are the computer company and we're the networking company. AT&T is the long-haul networking company. So I think it is a necessary part of this evolution, because my view is this information stuff is so critical, you're out of business without controlling it, and therefore every company is going to focus on it. What we want to do is pick off the leaders in those companies and make sure they implement it right, and then the others will follow. I guarantee you there ain't going to -- nobody's going to select a little company to be their strategic communications supplier. So are we big enough? Two billion. Well, we've got to grow fast, but Tandem has the reputation and the ability to deliver complex, strategic on-line systems, and therefore, we've been able to bid on and win some deals that we just would have not been able to do.

Pelkey: I think you've got a winning strategy, and I think you're going to be successful, and I don't say that because you're here. I'd say that anywhere, because of what's happening. When Micom bought Interlan, what was your reaction?

Ungermann: Well, I had looked at Interlan very, very closely, and we had considered it. We looked at it, and we always said --

Pelkey: Was it Alex who brought it to you?

Ungermann: Yeah, Alex must have started us into that, but we had many meetings in Boston. I already knew the company. We had already hired a couple of guys out of there, and I had already visited it a couple, three times, and we had talked about doing some things together. They were an OEM company. We're an end-user company. They took one account from us in their backyard that we ultimately won back, but I looked hard at it. We decided that we needed to focus, and so we chose not to get involved with an OEM company, but it would have filled out our product line some. So I was very well aware of what was going on, who the bidders were, and what --

Pelkey: Because in the early days, the data PBX must have been a --

Ungermann: Oh, that was the competitor.

Pelkey: -- when you competed, that was the competitor.

Ungermann: Yeah, that was a tough problem, because here we're selling this expensive LAN switch against low cost data PBXs. We were two or three times the price, and the only reason to buy us was that you had a view toward the future. You didn't get anything for it here. As soon as the PC came out, people aren't interested in it. That's where we knew we were going. That's where we knew the industry was going. We were just slow getting there.

Pelkey: So the PC caused people to realize the data PBX wasn't a solution, which was your primary competitor in the early days. The primary competitor was market understanding and so on, but given that they're going to buy that kind of functionality, for most of them, a data PBX was the preferred solution. That was a hot product category at

Ungermann: Oh, yeah, so they were using us --

Pelkey: The PC really told the customer: "Wait a minute. Data PBX doesn't have the bandwidth. I need something else, therefore I want to go LAN."

Ungermann: Pure and simple. Speed on the LAN.

Pelkey: But you didn't have a PC product at that point in time though?

Ungermann: No, we just kept telling everybody: "We will, and that's where you want to go, because the industry is going to be there," so even though we didn't get there first, we knew first where it was going, and that's the whole reason to develop the plan and slug our way through all of that. It's just that your customers consume you. When you get going in one direction, it's real hard to get other directions going in the company.

Pelkey: Why do you think that, as an example, the traditional datacom guys didn't do the LAN?

Ungermann: Well, they did, they just lost. Micom -- we worked with Micom in those days, and I knew the company pretty well. Our real competitors in those days were the PBX guys, right? Rolm -- I was on 50 conferences with Rolm -- Ungermann-Bass versus Rolm. Rolm was going to be the hub of the office, right? The reason they lost, and what's unbelievably ironic about this if you think about it is, they owned the wire. Today, you know what we go around telling everybody? "Telephone wire, absolutely the way to go." They owned the wire. They should have been able to master the technology, but they didn't understand standards because they came from this proprietary background, where you can do your own proprietary stuff and still win, and so they didn't understand standards and they didn't understand computer networking.

Pelkey: This is the Rolms of the world?

Ungermann: Rolm and everybody -- all the PBX companies. They just didn't understand.

Pelkey: Well, they had to understand a standard to be able to interface off to the AT&T at some point in time?

Ungermann: AT&T, yeah.

Pelkey: To some extent they knew standards.

Ungermann: But they tried to build you a custom handset to lock you in and buy it. Still -- they're still trying to keep that standard, even in the face of ISDN. So they lost on that, but they just lost it not understanding computer networks. They made the same dumb mistake. They said: "Well, 64 kilobits will

be great. That'll be fine." AT&T is still saying that, right -- 64 kilobits, and it ain't fine. We'll need 100 megabits to workstations pretty soon.

Pelkey: Channelized ISDN is such a joke.

Ungermann: For networking, yeah. It might be good for hooking up a flower store to something, but it's not going to be the hub of any office. So they just didn't understand, and they argued and argued and argued -- 64 was fine, 64 kilobits was fine, it would meet anybody's requirements, and they just kept arguing that, and they believed it. So they lost.

Pelkey: One of the issues I'm addressing is how companies get into their own mindset, their own paradigm, their own vision of the world, and many of these companies, when the environment changes -- like you were saying, when the PC came along, you knew that you wanted to do it, but getting the company to do it was just –

Ungermann: It was terribly tough. It's a huge problem. You see it right now in spades. Last night, I read in the paper that DEC is cancelling its RISC architecture to go with MIPS, or something like that. Just think of IBM or DEC trying to get into that direction, and how hard it is for their company to go in that direction -- Unix or whatever. Once you're in a direction, it's unbelievably hard to change. It's why IBM is not -- it's why IBM has left a hole for us to operate in, and that is that they are a hierarchical, host-based computer company; that as much as they're involved in talking about it, they can't really deliver it, and they believe in their own product lines, and they just won't recognize the fact that anybody would want to buy DEC, or Ethernet, and that mindset is going to stay there for 40 more years until all those people leave the company. I think so. It's impossible to change. We face it. Everybody faces it. It's real hard to get something going, so sometimes you'll see people take these little groups off and put them off to the side and start successful start-ups -- they often do it by going aside -- but you see so many companies fail, and with the technology exploding today as it is, the probability of getting in trouble and left behind is very, very high -- enormous implications for the industry.

Pelkey: Enormous, in terms of -- we have been proven to know how to build medium size companies, certainly small size companies, but when you think about the future of having to compete with these nation-state companies out of the Orient and what will happen in Europe by the end of the century, within the United States, building competitive organizations on that scale is going to be a real issue. For the most part, big companies haven't proven to be as innovative. It's a fascinating issue, in terms of how we innovate at the business level. People like yourself -- your experience is as germane as anyone's who exists, having been through Collins and Zilog and the incredibly successful Ungermann-Bass, and this process of how you innovate from within, and how you invigorate.

Ungermann: Well, I have a lot of theories about this. I know Japan really well. We have a major activity there. We are the number one networking company in Japan by a long ways, and that's really unusual. We have a Japanese company over there that owns the networking business, and I've been dealing with Japan for 15, 20 years, and I see the differences, but one of my fundamental theorems is that our financial systems and financial industry is an enormous anchor on this country, and so is the government. You put those two together, and we've got an unbelievable anchor tied around our neck. To take a quick look at a couple of those things: as we got in trouble, we made a bet. We made a big bet. We bet on MAP, and we missed, and the financial community, therefore, decided to destroy us, and they went about it as hard as they could to drive us out of business. They're bent on it, and in Japan, or even in Korea especially, they love their companies because they're so important to their success and future, and we try to tear them down. Just look what we were going to do to IBM a few years ago. We don't like companies here.

Pelkey: Look at Micron right now. We've got a DRAM problem that won't go away, and yet now the stock's been beaten down 20% in the last couple of days because a couple of management people leave. That's going to be a $15 stock your selling. Here you're trying to get capital to someone who, in fact, can get us competitive in a marketplace that's now deemed to be critical --

Ungermann: It's not only getting the capital, which is hard, but it's the unbearable pressure they put on the company. As soon as we got in trouble, everybody that wanted to write a story, everybody on the press would pick up the phone and call an analyst from the financial community, and: "Oh, yeah, those guys are dirt bags," and it just feeds on itself, and you just see that to every company as it gets into trouble. Every company gets into trouble. IBM is a terrible company. DEC -- I remember when what's-his-name was on the front cover as the worst manager in the history --

Pelkey: Olsen, when's he going to get out of there? Two years later he's the hero.

Ungermann: Yeah, right. We just tear the hell out of -- it was just unbelievable, the pressure on this company as we were going along. We had hit every plan for six years, we made a major investment, we missed on it. Instead of saying: "Hey, there's a company -- " they tried to tear us down. At the same time, the government -- they haven't impacted us, fortunately. Well, they have, right now, DRAMs, right? The government is going to help us, right? What do they do? They raise our costs by a huge percent, and they put every penny of profit over in Japan. The Japanese semiconductor companies are rolling in money, because our government is helping us. It's a terrible situation. It's really terrible, and I don't see any way out of it, other than we get so -- that we just keep destroying so much, that ultimately everything changes, and we'll swing back, maybe, the other way, I don't know. It's a terrible problem.

Pelkey: Should you have gotten into the T-1 business?

Ungermann: T-1 business? I don't think so. We are in the T-1 business. You don't realize this, but we --

Pelkey: You have Bridge as a gateway to it.

Ungermann: We tie our networks together -- almost all of our networks are now wide area/local area, and the T-1 business -- the difference is -- the T-1 business, NET, is basically selling to a different person in the organization, because the voice networks and the data networks are still pretty much independent, and tending to stay that way. Even though they've moved them under the same boss, voice networks are stable, mature, integrated, and the data networks are being built, usually by a different person, and so I could ask every one of our customers: "Would you buy a T-1 multiplexer?" and they say: "No." So I got a zero response that that was an important product. The reason is that we're focusing on a different person who is building the data networks. In fact, usually they say: "No, that's the voice networking guys." Now, the voice networking guys needed to put some terminal traffic across for certain applications, so it's an extension of the voice network that NET is selling to, and we're selling to these automation projects that have nothing to do with voice, generally. Now, someday, voice and data is going to come together when you can sit down and dictate to your word processor and stuff, and four or five years from now voice and data are going to start to come back together, and we're watching that real close, but today, I don't think there's any market with our customers. We'd have to go to another set of customers, and de-focus some more, so actually, we're a pretty focused company, we just have a broad product line, so we go to the MIS planner who is putting together an automation project and say: "We can solve your communication problems," and his communication realms don't ever include voice.

Pelkey: Now the issue of -- first it was on the hardware level, and then we went to TCP and we're now migrating over to OSI, but a large part of the competition is going to be at the level of that, increasingly.

Ungermann: Yeah, that's where the competition is today.

Pelkey: EDI is becoming a very important part of how businesses are starting to think about doing business, driven by the trucking industry and some other places, but this issue about applications that are going to run on top of these highways that you've been building and putting in place is really where the competition is going to start to increase, is it not?

Ungermann: Well, I don't know if it's going to start to increase, but that's where the action is. That's where the value is. We basically break our business up into three pieces, surrounded by a fourth. The

key is managing it, making it work. That's the key. It's in the heart of your business, it's production network -- I've been saying that for nine years, but today it's really true, and doing it is real hard. Nobody can really do it well enough, actually, including us. We are constantly stressed on that battlefront, but we do it better than IBM, we do it better than DEC, but not good enough. The bottom of our product line is what we call a big set of open pipes, communication pipes, and we like to think of it as big, fat, open, well managed communication pipes, so you can take DEC traffic and stuff it in the pipe and it'll come out over hear and talk to IBM. The protocol is real - - nobody should even talk about it. That doesn't matter. They don't matter to anybody, and we concentrate on them. What we've done is put a strategy together so you don't have to worry about them. We're trying to put exactly the same application interfaces on any protocol, so you can't care, or don't know what's running. That seems to be working with our customers. They don't really care. They're trying to solve a problem, so what they want is the application services on top. For example, our driving software product is a thing called the universal workstation, which is a software product that goes in a workstation and allows you to have simultaneous connectivity, either for file transfer or sharing peripherals or looking like a terminal, through windows, to IBM while you're doing to DEC, while you're going to HP, and at the same time can have a window running a DOS program or an OS/2 program. It allows you to be doing simultaneous things across the network. That's our largest selling product, and it drives our sales. We win business based on that software product in there, so we are the best at being able to take workstations and connect them to IBM hosts, Tandem hosts, HP hosts, or DEC hosts, across these big, well managed pipes. So we've got two pieces of our business. The pipes, which we go in and sell, and then the services on top of that. Now, they're also going to run IBM services, and DEC services.

Pelkey: And you just have the transport for that?

Ungermann: Transport and enhancement for it.

Pelkey: Right, transport and enhancement for it.

Ungermann: So IBM has some software. We've got to run that across our network, and then we're going to offer enhancements to that software.

Pelkey: Right, that makes a lot of sense.

Ungermann: So their software will only run into IBM, but we'll run into DEC also. It makes tremendous sense to customers today.

Pelkey: I had asked you the question at the very beginning about the issue of the semiconductors, and I made the note that without the microprocessor and memory, it doesn't exist, but the UART and the USART -- that technology was important. The LAN controller chip was important chip technology. The operational amplifier over on the side of the modems was very important in terms of the way things are done. From your view, are there other significant semiconductor developments on the datacom side?

Ungermann: Well, I've always liked to think there was. When we've poked at it and played at it and I've always dreamed about it since I was at Collins, and that was to really build a communications processor that was really good at doing this stuff, and you see some of that in the Intel products, but basically we still use 186s to drive these things, or 286s or 386s, and we've never really come up with a way -- a good reason to implement a different technology. If you look at our products, there's the LAN controller, there's the standard microprocessors and memory, but then there's a big hunk in the middle that, basically, allows the sharing of information between those different resources, so we tend to have a single, very complex circuit on the board that can talk to buses and get into memories of attached computers and can move that into memory on your communication port that can be shared by the processor and by the communications chip, so it's a three-ported complex memory controller that still is a custom design, and we developed five or six generations of those. For example, one of them can run the PS/2 bus, and the PC bus, so there's all of that. In fact, now we have a next generation of that that's actually a four- ported memory controller that can also share between two processors on the communication, for building bridges and gateways and stuff like that. There is this sharing of information chip that we have developed

a lot of generations of, and used on all of our communication products. That's what allows us to have very smart communication processors that'll fit on a small board and go inside a PC. That's the difference between us and 3Com; we do build very smart cards with lots of intelligence to keep an environment that's separate from the operating system so that we have control over the real-time response.

Pelkey: Built for communication control.

Ungermann: Other people, especially people in the computer business, tend to build a real dumb card and put all the protocols in the computer, because they like to sell MIPs and they like to sell processors. So that's been their strategy, but our strategy is off-loaded. Put the communications out on the smart card.

Pelkey: It's always seemed to make sense to me.

Ungermann: It allows you to be free in the future. That doesn't get you trapped into operating system dependencies, so we can roll to OS/2 overnight, or roll to Unix, or roll to anything. The customer is going to have much less probability of being locked in, and especially as we go to OS/2 --

Pelkey: Because there's the view of the computer as a peripheral to this, as opposed to networks of peripheral to computer.

Ungermann: Yeah that's some --

Pelkey: -- version of it. Do you know of any place where this information about Collins in the early days is available in ready form?

Ungermann: No I don't, but let me just take a real quick look in the TTY's and stuff like this. [Leafing through papers] These were the major loops in the process.

Pelkey: Oh my goodness.

Ungermann: This was in production in those times. I haven't read this in 10 years, or 20 years, but that's basically it. There's the big main loop, 32 megabit loop, and all these secondary loops -- loop couplers here. There were teletypes, or whatever, hung off here.

Pelkey: Isn't that -- and it was '68.

Ungermann: Terminal unit -- here's how you build them.

Pelkey: Along the way, did you ever come in contact with what Pierce and Newhall and Farmer were doing at AT&T, or Farber or Irvine.

Ungermann: Farber I met with a couple of times in the early days of our company, and I went to Irvine and I don't remember if I knew him then. I don't think so, but I did talk to him afterwards. Nothing ever came out of it. I'll have her make a copy of this. Wide area links -- bi- directional, full-duplex, 56 kilobit, wide area links.

Pelkey: Ralph, thank you very much for your time.

END OF THE INTERVIEW