Oral History of Victor (Vic) Poor

Interviewed by:
Gardner Hendrie
Len Shustek

Recorded: December 8, 2004
Melbourne, Florida

CHM Reference number: X3110.2005

Gardner Hendrie: Vic Poor has agreed to an oral history interview for the Computer History Museum and, right at the beginning, we thank you for being willing to do this. I think probably maybe the best place to start. Could you tell us a little bit about your family background, siblings, where you grew up, you know, when you were born, some of those things.

Victor Poor: Why? Does that have anything to do with computers? <laughs>

Hendrie: Huh?

Poor: I said, does that have anything to do with computers?

Hendrie: Well, what it actually does is, there's a clear association with people's early background and what they ended up doing.

Poor: Well, I'm a native of California, born in Los Angeles and I have-- I had one sister, who is also still alive, now lives in Seattle. But I was actually raised in San Diego, which was where I lived until I finished high school. My parents tell me that I was fascinated by radio and that, as soon as I was old enough to reach the knob on our Philco shortwave set, I was mesmerized by the radio. I certainly can't remember that but I do remember becoming a ham radio operator early on in life and I've always been a active ham radio operator.

Hendrie: What were your parents occupations? What did they do?

Poor: My mother was a public health nurse and my father was a construction...

<cell phone rings>

Hendrie: I think we need to pause while I get rid of this.

Poor: Okay. Take your time.

Hendrie: Yes, sorry. Okay. Sorry about that. I need a checklist these days <laughter> for everything I have to do. All right. Continuing on?

Poor: My father was a construction mechanic. He worked for Convair. Built the heavy tools that were used to build airplanes and that was the family background.

Hendrie: Okay.

Poor: He worked for Convair all during World War II and long afterwards, as far back as I can remember. He died fairly young. He died at 55, when I was in the navy but my mother lived to a ripe old age, retired from public health nursing and I went off and got involved in electronics businesses. From an early age, I was-- I spent four years in the navy as a electronics technician and went from there to becoming-- work for Strom-- after we got-- after I got out of the Service, worked for Stromberg Carlson in San Diego as a tech...

Hendrie: Okay. Yes. Sorry to interrupt you but, before we move onto that phase, could you-- what do you-- do you have any memories of what you thought, your earliest thoughts, as to what you might want to do when you grew up, when you were a youngster?

Poor: I think I was very single-minded about that. It was electronics and radio.

Hendrie: Okay. You really loved the radio.

Poor: Of course, that was too far back for computers to be-- play much of a part because we hadn't even heard of them yet but...

Hendrie: Yes, when were you born?

Poor: 1933.

Hendrie: Ah, okay. So shortwave radio, yes, before World War II, shortwave radio was...

Poor: Right.

Hendrie: All right. So, in high school, did you have any particular interests in high school? Did you, you know, were you interested in science and math or...?

Poor: Yes. Heavy into science and math and, again, ham radio.

Hendrie: And ham radio. <laughter>

Poor: Right.

Hendrie: Consume your...

Poor: That's right.

Hendrie: …your spare hours.

Poor: Almost anything technical, as a matter of fact.

Hendrie: Yes.

Poor: I was the natural born nerd.

Hendrie: Okay.

Poor: There's no getting around it. <laughs>

Hendrie: All right. It was in the genes.

Poor: That's right.

Hendrie: Yes. Okay. So when you graduated from high school, you then-- is that when you went in the navy?

Poor: That's right.

Hendrie: Or what did you do?

Poor: I went into the service. I went into the navy. I took a qualification test and then qualified for naval electronic school.

Hendrie: Okay.

Poor: And went into the service. Spent four years.

Hendrie: Okay. Now, you weren't-- were you married then or...?

Poor: I got married while I was in the navy.

Hendrie: Okay. All right.

Poor: That was something over 50 years ago.

Hendrie: Oh, my goodness.

Poor: And, believe it or not, we're still married. <laughter>

Hendrie: That's very good. So when you got out of the navy, you know, what did you...

Poor: Then I went to work.

Hendrie: ...what were you thinking of doing or did you-- how did you get a job at Stromberg Carlson?

Poor: Well, I looked around for a job for electronics tech.

Hendrie: Mm hm. Yes, because you now were a trained electronics tech.

Poor: And I don't remember how I made the connection but I know I went there for an interview and was hired on the spot so didn't take long. <laughs>

Hendrie: Okay.

Poor: Like, took a day looking for a job. And that was my first introduction to computers because the project I worked on at Stromberg Carlson was a CRT [cathode ray tube] display system for the Univac 11-- I think it was the 1101. Anyway, was an early, early Univac. It was either the 1101 or the 1103. I forget the numbers now.

Hendrie: Yes.

Poor: I remember the machine. I mean, it filled a whole room.

Hendrie: Right.

Poor: And it was a Charactron display.

Hendrie: I was going to say, did you work on the Charactron display?

Poor: Yes. This was the Charactron console. Amazing technology at that time. I mean, just the deflection yokes consumed so much power that we had to use high-powered transmitting tubes to drive the deflection yokes on the display. I remember using 4X150 tubes. I don't know if you're familiar with those but these are great big things with big fins on them and very high speed air blowing through them to keep them cool.

Hendrie: Okay.

Poor: It was an interesting experience and my first exposure to programming. I didn't get into it very detailed but I know we ran programs on the Univac machine to test the Charactron display and we would submit a program in the form of a card deck and try to run it. The MTBF [mean-time between failures] of the Univac machine was about 90 minutes so you had to get everything done quickly in order to find out. And everything had to be benchmarked in your program so that you could interrupt the program almost anywhere and recover quickly because the machine just didn't stay up very long.

Hendrie: Yes. And these were typically test programs?

Poor: Test programs, testing the display. Ultimately, the displays were going to be used for air traffic control. How they were going to do air traffic control with a machine that lasted 90 minutes, I never did understand, but that's-- everybody was confident that that, somehow, would be solved. But we had some interesting experiences with that system.

Hendrie: Okay. Now, what part of the electronics did you tend to work on? Were you working on the deflection-- on the analog electronic, not the digital part.

Poor: Yes, it was all analog. I mean, there was very little digital to it, comes right down to it.

Hendrie: Yes.

Poor: I also worked-- I can't remember now why we were doing it but they also needed an analog to digital converter and they were trying to get a resolution of one part in 1,000 and that turned out to be a real challenge, given vacuum tubes as your only tools to work with. I mean, we think nothing, now, of that kind of resolution but that was an incredible challenge to do. But it was all electronics to operate the console.

Hendrie: Okay.

Poor: I can't remember a lot of details about it. I remember the first time they wheeled in a Tektronix scope and they asked me did I know how to operate that and I said, "Well, I've never seen one before but I know what all the knobs do" so <laughter> we didn't have any trouble-- I didn't have any trouble adapting to it.

Hendrie: That's right. Those-- well, Tektronix were the best scopes there were back in the mid-'70s.

Poor: Well, in the navy, we had these old DuPont—Du Mont-- DuPont? Du Mont? I can't remember the name.

Hendrie: I think they were Du Mont.

Poor: Du Mont scopes.

Hendrie: Yes.

Poor: They were awful. By today's standards. But, somehow, we didn't know that at the time. <laughter>

<next recording>

Hendrie: Okay. We were talking about the, I think, your experiences at Stromberg Carlson and we got diverted into a discussion of how Charactrons worked, which probably isn't something we need to be discussing on your oral history.

Poor: No. <laughter>

Hendrie: But so how long did you work on that project?

Poor: You know, I don't remember. Probably a year, year and a half, something like that.

Hendrie: What did you do next?

Poor: Well, while I was at Stromberg Carlson, I also took time out, at Stromberg Carlson's expense, of course, and learned to program the Packard Bell 250. I don't know if you remember that machine.

Hendrie: Remember it very well.

Poor: And-- because they were also going to use that to drive the Charactron display.

Hendrie: Okay.

Poor: But I had hardly finished that course before I got a better job offer. <laughter> And I left to go to Raytheon as a field service engineer. And I worked with them, oh, up until-- I have trouble remembering dates any more. I think 'til 1959 on the Sparrow III Missile Project and I was based at Point Mugu and-- but, at one point, I was transferred from Point Mugu to Washington, D.C., still on that program, to act as an instructor for training navy personnel on the Sparrow III system. And that, of course, didn't involve anything to do with computers. There was a sort of a period of time there where I was purely analog, so to speak, because that whole missile system was all based on analog circuitry and vacuum tubes. It also didn't work very well but that's, again, not much to do with this history.

Hendrie: This was a radar controlled or a...

Poor: It was an air-to-air missile.

Hendrie: It was an air-to-air missile.

Poor: That was radar tracking, doppler radar system.

Hendrie: Ah, okay.

Poor: I left Raytheon in 1959 to form a company that-- it's name changed once but it became Frederick Electronics and it was a company in Frederick, Maryland, that manufactured-- designed and manufactured radio equipment, telegraph equipment for the common carriers, telegraph common carriers, record common carriers and for various government agencies.

Hendrie: Now, how in the world do you transition from field service <laughs> tech at Raytheon to, you know, tell me a little bit about the, you know, what ever gave you the idea of doing this, sort of how did this happen?

Poor: Well, you're back to ham radio again, you know? I was far more interested in radio and in communications than I was in firing missiles at somebody. And I became acquainted with some other people who were also-- had common interests and we just decided to go into that business.

Hendrie: Were these people you met through your ham?

Poor: Yes, we were all hams.

Hendrie: So you just...

Poor: Just did it. And that company lasted about 10 years. Well, it lasted-- in fact, it's still in existence. I lasted about 10 years, I should say, in that company. The company was sold in 1969 to Plantronics Corporation, a company out of Santa Cruz.

Hendrie: All right. Well, can you go back and tell me more about the formation of Frederick or, you know, what-- a few stories about, how many of you were there that sort of-- who were the principles? You were one of the principles.

Poor: How many-- I was one of the principles. There was, well, boy, you're taxing my memory now.

Hendrie: Oh, yes. <laughter>

Poor: Let me think a minute. There were at least three of us, plus one-- plus a fellow that helped bankroll us. He was primarily our VC. This was-- we didn't use VC. I mean, this was-- he was the sugar daddy, so to speak...

Hendrie: A local businessman, you said.

Poor: Right. Who helped us get started. Then, after we got started, we were designing equipment that was being manufactured by a company in Frederick and-- under contract. And then we made a deal with that company to combine our development group with their manufacturing facility and that's what formed Frederick Electronics. That was shortly after we started the company.

Hendrie: Do you remember where you got your first contract? What you-- you know?

Poor: My first one...

Hendrie: That sort of got you off the ground?

Poor: Yes, our first contract was with RCA Communications in New York, providing some equipment for-- they were an overseas telegraph carrier.

Hendrie: Yes, that was one of their divisions.

Poor: Yes. And we ended up selling similar equipment to Western Union International, to ITT World Com or Globe Com, I don't remember, but-- and to the Associated Press for their overseas...

Hendrie: Okay. And what was this equipment?

Victor Poor: Modulators and demodulators, primarily, for telegraph systems and for pictures, for video.

Hendrie: Okay.

Poor: For use on HF [high frequency] radio. But then we also, after we got started and were established in that business, we also started selling to the government agencies; after all, we were right there in Washington, even though that wasn't where our first business came from. And we sold to spook agencies and we sold to the State Department and we sold to foreign countries that used this equipment in their government service.

Hendrie: Was there any crypto part of this so that other people couldn't read the-- you know?

Poor: Well...

Hendrie: The modulators or was that...

Poor: There was...

Hendrie: That wasn't your part, you just got it?

Poor: There was, actually. We got into the crypto business near the end of my tenure with the company but, for the first few years, no. It was all-- we also ended up building RF [radio frequency] equipment. We built receivers and, in particular, the-- and this we did through impetus from our government customers who wanted to be able to operate receivers at embassies while transmitting at the same time and they wanted receivers with tremendous dynamic range so they could have a one kilowatt transmitter on one side of the building and a receiver on HF at the same time still receiving...

Hendrie: On the same channel, yes. Fundamentally in the same...

Poor: On the, on the...

Hendrie: ...frequencies.

Poor: Well, nearby. Not, obviously, on the same but-- and so that took some rather heroic designs to make receivers that could do that. We also built code conversion equipment. I built equipment that would both transmit and receive Morse code and convert it from and to teletype and we ended up selling a gaggle of that sort of thing to the navy. And we built transmitters. I don't know. It's-- over that 10 year period, we must have had 50 different products. I couldn't begin to remember them all.

Len Shustek: When the company was small, how difficult was it to get, in particular, government customers to agree to do business with a small startup?

Poor: Well, didn't seem to have much trouble. We had all the business we could handle. Didn't-- we weren't much into marketing, if you want to call it that. Usually, the volume of equipment we built is relatively small and, for that reason, it probably wasn't much interest to big companies but we could produce products quickly and we could do it in small quantities at fairly reasonable cost.

Shustek: When the four of you started this, did any of the four have any experience in either starting a company or in small companies?

Poor: No, we didn't have the foggiest idea what we were doing. If we'd known any better, we probably wouldn't have done it. But, you know, that's how you learn. <laughter>

Shustek: How quickly did it grow?

Poor: Well, we were profitable from early on. I don't think we ever got-- we never did get very big.

Hendrie: Had to be.

Poor: We did a few million a year at the time I left, were doing a few million a year at the time I left. I can't even remember the numbers any more. I mean, we were always a relatively small company.

Shustek: As the company got bigger, did you get professional managers in to run the company.

Poor: Oh, yes, we-- actually, that took place at the time we merged with our manufacturing partner. The head of the manufacturing company, a fellow named John Houston, was president of that company. He remained as president of the new company. I was the chief engineer for the company. And they had a manufacturing VP who came with the manufacturing side, plus a lot of other administrative stuff that either was with our startup or with the manufacturing organization.

Shustek: Was there any subsequent financing at any point or was it self-generating.

Poor: We had one supplementary finance, oh, two or three years, I guess, after we had started for a rather nominal amount of money. It was, you know, I don't remember, again. It was, like, $100,000, $200,000 or something from a venture capitalist. Venture capitalists were fairly rare at that time and we're talking about, you know...

Hendrie: Yes, when is this?

Poor: ...very early 1960s. I know, when we sold the company in 1969, that the VC that had invested in the company said he was very pleased with it because he said he basically lost money on practically everything he'd ever invested in but the money he had made on our company made up for everything and still gave him a very good return <laughter> on his total investments.

Hendrie: That's funny. Do you remember who he was?

Poor: No, I can't remember. He was somebody out of California. I know that. I can't remember names any more.

Hendrie: All right.

Poor: But it was pretty small scale stuff.

Hendrie: So you basically made your business doing things that weren't commercially available for...

Poor: That's right.

Hendrie: Yes. Solving problems that wasn't a commercial product to solve…

Poor: In those days, we called these telegraph systems. Nowadays, we'd have, you know, they'd be data transmission systems or something else. I mean, it was the best technology we had at the time.

Shustek: Did the ideas for products come primarily from the customers you were selling to or did you self-generate things?

Poor: It depended. I can give you an interesting example.

Hendrie: Oh, good.

Poor: Again, because I was a ham and active with ham radio, I decided I wanted something that would-- that I could type on a teletype machine and send Morse code. So I built a box to do that in my spare time. I had it sitting on the bench in the lab at the company and it had a little paper tape reader on it. I could stick the tape-- teletype tape on it and run the tape through and out would come Morse code. I had a fellow from the navy, we were doing some other work for the navy, and he was in there. He looked at that and he said, "What's this?" And oh, I said, "This is just a toy" and I showed him what it did. And he said, "Could I take it with me?" I said, "It's just a breadboard." He said, "Just let me take it with me." And the next thing I know, we're getting an order for these things. <laughter> You know? And he said, "I got to have a model number and a price." <laughter> We didn't have a product, mind you, and I invented a model number and a price and a spec sheet and so on. They gave us an order. Then we went and designed one suitable for manufacturing and started producing it. We sold that for years and then, after that, they came back and said, "Well, we need to reverse. We want one that will listen to Morse code and generate teletype tape." So then we built a machine that would do that.

Shustek: That's a much harder problem. Can you describe how you solved that problem?

Poor: Well, we did it. I remember building a **ROM** memory that would match patterns by having lots and lots of little cores and running wires through them in a pattern to shape-- the shape of Morse code characters. And, depending upon-- on how the incoming data stream would fit, it would cause cores to flip or not and, in turn, convert it to a teletype character. And then there were some elaborate timing to track the speed of it coming in and so on. But I-- the details, I can't remember. This was all done, you know, before even medium scale integrations. It was all done with discrete components and transistors.

Shustek: But it was all done without software? There was no processor that was executing algorithms.

Poor: No, there was no processor involved.

Shustek: Okay. What sort of accuracy did you get?

Poor: Well, if the incoming signal was machine-generated, which typically it was, it was accurate as a teletype machine would have been, you know?

Hendrie: Okay.

Poor: If you sent it by hand, it would track your hand and try to adjust the speed but it all depended on how good you were. I could sit and send to it all day and it would copy perfectly but another operator could sit and send and get nowhere. Just depended on his fist, so to speak.

Hendrie: Okay. It was obviously an inherent problem in synchronization in where are the beginning and ends of each character?

Poor: Right. It was an interesting problem.

Hendrie: Yes.

Poor: But it was all done with discrete components. There was no software at that point.

Hendrie: No software...

Poor: In that...

Hendrie: ...and no integrated circuits at all, I presume, at that time?

Poor: No.

Hendrie: Wow.

Poor: Well, the box was, you know, it was in a five and a half inch high rack-mounted thing. I mean, it was quite a bit of bulk to it.

Shustek: There were small scale integrated circuits, I assume, 7400 series gates or didn't you use those?

Hendrie: Well, this is, what, the mid-- when would you say? This is the mid-1960s or...

Poor: Yes, it was mid-1960s. Well, we were using op amps, I know that. You could get an op amp in a chip at that point. But there wasn't much else. Yes, you could get individual gates and stuff. Sometimes, though, it was just easier to build it with discrete components because you could do all kinds of trickery you couldn't do with <laughs> with the...

Hendrie: The standard gate, yes.

Poor: ...with gates.

Hendrie: Okay. Well, that's a good story. Any other stories of products that you sort of came up with then?

Poor: Oh, we came up with a lot of stuff. It would be hard to dredge it all up from memory at this point.

Hendrie: Okay.

Poor: But-- like the receiver we built. We needed this receiver that would take very strong signals and we found a tube that was called a beam deflection tube that had an ordinary vacuum tube that had two plates and coming out of the cathode, there were a pair of deflection plates that would allow you to direct the electron beam to one of the two plates in the tube. And we could use that as a mixer and it had tremendous dynamic range. And we could use that to solve this problem about running a transmitter near a receiver. And we ended up with this rather strange receiver front end which I never heard of it being used again for that purpose. The beam deflection tubes weren't designed for that purpose but they served that purpose in that one case. I don't know. God, that was a long time ago.

Hendrie: <laughs> All right. Good. The-- so maybe you could tell us a little bit about the, you know, toward the end of your time at this company, what's the story there?

Poor: Well, in the latter half of the ten years, we started getting into switching systems. We both-- the company built both telex switches and message switches and they were computer based. We started off using the Interdata Model 3, if you're familiar with that old machine.

Hendrie: Yes.

Poor: And, in fact, we took delivery of one of the first ones Interdata ever built. And we-- the contract with Interdata was such that not only would we get a computer but we would get an assembler to go with it. We got the computer but there was no software. There wasn't even an assembler. It was nothing but front panel switches.

Hendrie: Yes.

Poor: And they said, well, we have a problem and it's not ready yet but we went ahead and shipped you the machine. Please pay the bill. <laughter> But I had a young fellow out working for me in the summer and this happened during a summer vacation, while he was away from high school, and he was already into computers. His high school had had a computer of some kind that he had got some experience with but he was mesmerized by this machine. And, see, he went to work and built an assembler for the machine.

Hendrie: Now, who was this?

Poor: His name was Harry Pyle.

Hendrie: Oh, all right.

Poor: And I remember being on a trip to New York to visit our customers up there and I came back one night, I got off the plane and I stopped in the office before I went home. As I walked in, I heard this music, this computer sounding music being played from the lab. It was playing Anchors Away, as I remember. And I walked in. There was Harry with the teletype machine sitting at the computer running this tape through that would play this tune off the Interdata 3.

Hendrie: Oh, my goodness.

Poor: And I said, "Well, what-- how on earth did you do that?" And he said, "Well, I've discovered this machine radiates a tremendous RF signal so I've put a receiver over here and I can listen to it and I can generate all these tones by changing the nature of the little loops I put the thing into." So he'd send it from one tight loop to the next, you know? And then he calibrated that into the musical scale and, from that, he wrote a program that would play notes until he could get it to play whatever music he would feed through on the tape. <laughter> This was how it got started. Anyway, we built a full forward-referencing assembler for the machine and...

Hendrie: Okay, it wasn't there so you did it yourself.

Poor: Did it ourselves. We built our first telex machine, telex switch with that machine that would control an elaborate matrix of telex lines to-- and would handle the typical routing data that would be provided, typical being CCITT standardized telex switching routing. And then made these telex switches for, I think it was RCA. I don't remember the-- which carrier. But, anyway, it was one of the carriers that was providing telex service and one of our customers, at this time, was a company called Tropical Radio, Tropical Radio Telegraph. They no longer exist but TRT operated telex and message switching services or message handling services, I should say, for Central America. They were actually, I believe, a subsidiary of United Fruit Company. They had stations in Miami and New Orleans and all through Central America. And they were interested in the telex switches but they were far more interested in message switching. They would like to be able to get away from manual handling of telegrams.

Hendrie: Ah, so get rid of the torn tape center.

Poor: Get rid of the torn tape. So we went to work and this was, like, the last year I was there and we built a fully electronic, computer-controlled telegraph message switching system so they could route their traffic from station to station over HF radio and then out over telex lines and deliver it to their customers without handling it manually. Replaced all the torn tape stuff. In fact, that system was not quite finished when I left for Datapoint but the engineers at Frederick finished it after I left.

Hendrie: Now, was this system-- you mentioned it went over HF radio. I wasn't familiar-- I'm not familiar with teletype-- a lot of teletype systems were, obviously, went over wires but they-- the switching was still done with...

Poor: Wire were...

Hendrie: Message switching was still done with torn tape.

Poor: Right. The radio is just a link. It could have been a piece of wire.

Hendrie: It could have been any kind of...

Poor: Right.

Hendrie: That wasn't an important part of the...

Poor: No.

Hendrie: ...design? Okay. All right.

Shustek: The system was based on the Interdata 3?

Poor: We started off with the Interdata 3. The Interdata 3 we used as the heart of our telex line switching but the message switch, we ended up using a Hewlett Packard 2114 to control that.

Shustek: What were these machines like in terms of configuration? How much memory did they have? Did they have hard disks or not?

Poor: No. They were small machines, paper tape loaded and operated with fixed programs. The-- like in the message switching system, the storage was all done in external-- the storage elements that we built, we used recirculating memory for-- delay line memories to store the messages, not in the computer. The computers were too anemic for doing that kind of thing.

Hendrie: So which-- the magnetostrictive wire?

Poor: Mm hm.

Hendrie: Yes. Okay. Acoustic...

Poor: Yes, well...

Hendrie: ...wire delay.

Poor: Obviously, my early experience with the Packard Bell 250 had-- played a part in this. <laughter>

Hendrie: Of course, of course. And you could-- I think you could buy those part-- I think Ferranti made some of those. I can't remember who made some of those.

Poor: I don't remember where we bought them. I know they were readily available.

Hendrie: Yes.

Poor: And the-- but the computers were, for all practical purposes, they might as well have been ROM-based. I mean, they just-- you loaded the program off of paper tape and it ran and that provided the service and that was it. And it was-- there was no real operating system. I mean, there was a small monitor built in but that was about it.

Shustek: There was no persistent storage. So if the power would fail, the messages would get lost?

Poor: Well, they were core memory. Core memory was persistent.

Hendrie: Okay.

Poor: If the glitch wasn't too bad when the power failed. <laughter> But they more or less would keep their memory. We didn't have to reboot very often, even if-- we could shut them off and turn them back on and continue running if it was an orderly shutdown and turn on.

Hendrie: Okay. Now, was this a custom sort of job? I mean, you bid it and built it for...

Poor: Well, the telex switch was not custom. That was meant to be a standard...

Hendrie: Product.

Poor: ...console. Yes, it's a thing that went in a rack and you could put telex lines up to it and you'd program in the various headers to route things and that was a standard product. The message switch was a custom product for TRT.

Hendrie: Ah, okay, because I know the-- I think it was probably about the same time that-- I can't remember now. Another company was doing the same thing with a mini computer for Western Union, I remember. That was the era where people just were getting the glimmer of the idea that you could get rid of a torn tape system.

Poor: And that, by the way, is where the 8000 series chip started.

Hendrie: Okay.

Poor: Because, while we were still at Frederick, Harry and I got it in our heads that we ought to be able to design a simple processor so we didn't have to buy-- these machines were terribly expensive. Just design a simple processor of our own making that we could use for these products and so we started screwing with computer design, came up with a number of ideas. Never did implement anything for Frederick.

Hendrie: Okay.

Poor: But then, in 1969, is when I joined Datapoint. And, by the way, I already had an association with Datapoint before I went to work for them. That's another story. I don't know how much you want to get into that.

Hendrie: Oh, sure, we want to get all the way into it.

Poor: You do. <laughter> Datapoint started in 1968.

Hendrie: Excuse me, you know, just before, why don't we change a tape and then we won't have to interrupt in the middle of the story.

Poor: Okay.

Hendrie: You were starting to tell the story of the beginnings of your relationship with the people in Texas.

Poor: Oh, with Datapoint, yes. Well, two guys started Datapoint, Phil Ray and Gus Roche. They worked for a company in Orlando, Florida. I forget the name of the company but they had it in their heads they wanted to start their own company. They asked me to-- if I could give them a hand in getting started because, obviously, by now, I was thought of as an entrepreneur <laughter> and I said, sure, and I said I had some friends who could probably bankroll something and I'd be happy to go with them and let them make their presentation and so on.

Hendrie: Now, how did you meet these people?

Poor: Well, Gus Roche and I were both working for Raytheon at the same time and...

Hendrie: So that was quite a long time ago?

Poor: Right. I'm not sure, now that I think about it, whether he worked for Raytheon but I met him while I was working for Raytheon and was working in the offices of Bureau of Aeronautics in Washington and he worked for some other company, I don't think it was Raytheon. I don't remember who now. Anyway, we got to be great friends, our family were good friends and so on so we kept contact long after they left. Anyway, I said, sure, I'd be happy to make arrangements so I took the two of them to visit a friend in California.

Hendrie: Do you remember his name?

Poor: It was the president of Plantronics and-- I'm sorry, name…

Hendrie: Now, by this time, Plantronics had acquired...

Poor: No, Plantronics was talking to us. They were interested in the company and I don't even remember how we connected with Plantronics. It was some mutual friend or something. Anyway, Gus and Phil went out there and I went with them and I hadn't rehearsed them or anything. I just thought I'd introduce them and they sat down and they explained what they wanted to do. And it was awful. <laughter> It was just positively awful. And it...

Hendrie: Do you remember what it was?

Poor: Well, yes, they was this company in receivership in Orlando that they were going to-- they wanted to acquire and then get started by having acquired the facility and the assets, then do government contracting with the Cape. But there was no specific product in mind, you know, it's not the kind of story that, say, a venture capitalist would have the slightest interest in. They didn't know that and I didn't know that was what they were going to say. <laughs> I just said oh, wow. So we got back to the hotel room afterwards. Phil had to go somewhere and I sat down with Gus and I said, "Gus, you're not going to get anywhere with this pitch. You're going to have to do something completely different." I said, "You've got to come up with a product, do a little research, make sure you know where it's going to sell, what it's possibilities are and write a business plan around it." "Well," he said, "a product. Well, what kind of product did you have in mind?" <laughter> I said, "Well, I'll give you an example. The Associated Press wants us to make an electronic teletype machine, a machine that would have all the characteristics of a Model 33 Teletype except a CRT instead of paper because they're tired of sitting there banging on these machines all the time. They want a tube in front of them." Well, at that time, nobody made a thing like-- quite like that. I mean, IBM had the 2260, you know, terminal that went onto a mainframe but, I mean, these were really big buck items. Just a simple...

Hendrie: Keyboard and display was a big buck item.

Poor: Keyboard and display. You could plug it into, say, a time sharing machine or whatever and have an interactive thing. There was no such animal. <laughs> So I said, "Associated Press has asked Frederick to do this but we're in no position to take it on at all. Why don't you take up on that and see if you can't come up with an idea?" Didn't hear anything from him for a month or so. And, one day, I get a call from a potential investor in San Antonio, Texas, and he said I was given to him as a reference. And these fellows want to start a company building electronic teletype machines. <laughter> And he goes through this business plan over the phone with me and says, "You know, what do you think?" <laughter> Well, what I should have said was, "I couldn't comment on it because modesty forbids" but, instead, <laughter> I, you know, I said, "Sounds like a great plan."

Hendrie: Sounds like a great idea.<laughter>

Poor: So I said it sounds like a great idea and, anyway, they got bankrolled. But the investors were in San Antonio and they were in Florida. The investors said were local businessmen that wanted to build up business in San Antonio. They said, the condition for putting money into this company is you got to do it in San Antonio. So they up and moved to San Antonio and started a company called Computer Terminal Corporation.

Hendrie: Okay.

Poor: Which was the first-- the original name for Datapoint. And they spent most of 1968 and 1969 designing the first computer terminal product for Datapoint.

Shustek: Did they ask you to be involved or were you slighted that they didn't ask you to be involved?

Poor: Well, I wasn't slighted but, actually, I was involved. I mean, they had me consult with them on design ideas and so on. I didn't do much.

Hendrie: Yes, they hired some engineers...

Poor: They hired some engineers...

Hendrie: ...that they know or...

Poor: ...and so on. Mainly what they were interested in was, was this was I really had in mind? As if, somehow, this whole product was my fault. <laughter!>

Hendrie: They were going to blame you if it didn't work, too, or it didn't sell.

Poor: Anyway, it all came together late in 1969 and, as the product was reaching completion, they made me an offer to come work for them as their-- as technical director for the company at a very attractive salary by those standard in those days. It wouldn't have been much now. And I took them up on it and moved to San Antonio in November/December of that year. I don't remember. The very end of 1969, just as this product was reaching the manufacturing stage. By this time, they had 100 people working for them. They had a small assembly line set up and they were already starting to produce this product. They called it the 3300 and I said-- and they said the reason it was called the 3300 was it was 100 times better than a model 33 teletype machine. <laughs> And they actually started selling them like crazy and they had some interesting stories to tell. They had gotten $1 million bankrolled in San Antonio to get started but they needed more money for the magnitude of this project. They tried to interest some venture capitalists and one VC hired SRI [Stanford Research Institute] to come in and look at the product and look at what they were doing and tell them whether, you know, this was a good idea. And the president of the company kept this-- SRI's report in their desk, his desk, because he liked to show it to people because it basically was negative. It said the product didn't have enough market, didn't have enough features, didn't have enough future and they didn't recommend investing in it. And their estimates for the total number of units that...

Hendrie: Could be sold, yes.

Poor: ...could be sold was less than was sold in 60 days, in the first of 1970. <laughter>

Hendrie: Exactly. What do researchers know about markets?

Poor: Just told-- well, that's the problem. When you're-- there's no history for it. There was nothing like that. You can't drive a car looking in the rear view mirror. You've got to somehow go out there and guess. And, you know, this brings me back to a lot of what we did at Frederick. Our method of market research at Frederick was very simple. We would build one, we'd get an idea or a customer would suggest something. Rather than spending a lot of time researching it, we could knock it out in the lab in a week, compared to any other kind of marketing research, this was cheap. And then we'd go out and try it on people. Sometimes it would work, sometimes it would die. So, if it died, we went off and did something else.

Hendrie: Yes. You'd only invested a few weeks.

Poor: Right. <laughs> And this, in the case of Computer Terminal Corporation, they only had the one product and it was fairly sophisticated so they couldn't go building the thing on spec. But it took off. No question about it. It took off. And it was a perfect match for the blossoming time shared services that were out there. I mean, you know, you had-- GE had pioneered this early time sharing machine that ran on 33 teletype machines. You plug this thing in, now you've got a computer console or what looks like a computer console that's running off the thing and it was just beautiful. And you could run it at tremendous speeds compared to the teletype. You know, they could run it at 2400 baud. I mean, wonderful stuff. They just couldn't make them fast enough. But, there was always a but, they started getting requests from customers, "Well, we want a machine like this..." and this was even before they had sold their first one, "We want a machine like this but we want it to emulate the Burroughs terminal..." something or other or, you know, or the Univac terminal something...

Hendrie: Everybody wanted to replace all these very expensive things...

Poor: And they wanted all these different terminals. And Gus said-- I was still at Frederick, he said, "Come up with a way we could build a single product that would do all of these different terminals." And that's when Harry and I decided, by god, we're going to do this computer after all. And we would...

Hendrie: That you had been toying around with...

Poor: Right. But not for Frederick, we'll do it for Datapoint. And so we came up with a little computer that we could program to emulate any number of terminal devices incorporated in this 3300-like product.

Now, in those days, there was no semiconductor RAM memory at all but there was semiconductor delay line memory. I don't know if you remember it.

Shustek: MOS shift registers.

Poor: MOS shift registers.

Hendrie: M-O-S shift registers, yes.

Poor: Datapoint was using them by the ton in this terminal. We said, "Well, we'll just incorporate that into the product and make that the main memory of a processor. And we built-- I shouldn't say we built. We designed a computer based around that kind of memory and, again, this harks back to my experience with the Packard Bell 250 with its recirculating memory.

Hendrie: Serial machine.

Poor: Serial machine. And we concocted this thing that was one bit wide that would deal-- first, we played around with the idea of 9-bit words but the world seemed to be going to eight bits so we redid it again and worked out an 8-bit machine. But there was an advantage in the MOS shift registers that you didn't have with the acoustic shift registers or the drums, like on the 1403 or something like that.

Hendrie: Yes.

Poor: In that you could stop them. You could read them, stop them, move them, stop them, move them, stop them. You see, they had no inertia to them.

Hendrie: They weren't dynamic.

Poor: Right.

Hendrie: You didn't have to just keep moving them.

Poor: Yes. You had-- they would die eventually if you stopped them but, of course, you wouldn't stop them anywhere near that long. So this gave us a little freedom in the design and the architecture so we came up with this architecture that would work reasonably efficiently with recirculating pausible memory. And that architecture is the 8000 series chip today. Of course, I remember, later on, when RAMs came out and people said, "How on earth did you come up with such a cockeyed architecture?" I said, "Well, we didn't design it for RAMs."

Hendrie: It is very unusual. <laughter> Let's put it this way.

Shustek: So, for example, storing numbers least significant byte first, came from the fact that this was serial and you needed to process the low bits first.

Poor: You had to do it that way. You had no choice.

Hendrie: Yes, because if you're going to do arithmetic on it...

Poor: That's right.

Hendrie: ...you know what the data-- what has to hit the adder first.

Poor: So you have the-- that's right. I mean, all these things were dictated to you and it made perfect sense and it all worked.

Hendrie: So you used them for main memory and also for accumulator-- I mean, for...

Poor: For every...

Hendrie: ...registers?

Poor: Well, actual registers we-- by then we had MSI [medium scale integration].

Hendrie: Ah.

Poor: And you could buy adders and stuff. So we built the thing with MSI but all of the main memory was recirculating.

Hendrie: Was the recirculating…

Shustek: What about the program memory? What used…

Poor: Well, it was a Von Neumann machine. I mean, everything was in the...

Hendrie: Was in main memory…

Shustek: So the program was…

Poor: There was one address space.

Hendrie: Yes. It wasn't a separate program memory.

Poor: And-- but we had to have lots of registries because you had to keep a lot of intermediate stuff. You'd circulate through and you'd pick up arguments and you'd put them registers and then you'd pass them around themselves and then you'd put it back in the loop as it came around.

Hendrie: Okay.

Poor: It was-- and there were tricks for optimizing the machine, just like there was with any recirculating memory. But we didn't have to use multiple address. See, a recirculating memory off a drum or a wire(???) machine had to be multiple address because you had to decide where you were going to be when you got the next operand or the next argument, the next-- but, with this scheme, we didn't have to do that so it was a single address machine. But it did have other characteristics like the wrong end first, by conventional standards. I'm going to have to interrupt for a second.

Hendrie: Yes, of course. Very good.

<next recording>

Hendrie: Okay. You were going to take a slight detour back to Frederick.

Poor: Oh, you were asking about some of the interesting products we may have done then. One of them came back to my memory was-- had to do with this Morse code to teletype converter. Remember some people from the army, special forces, came in one day and said, "Could you make this machine that you're making for the navy, copy Morse code at 300 words a minute?" And I said, "I'm sure we could work that out." So we played around with it a little bit and they whipped out this little box, hardly bigger than a cigarette case, and it had a little dial on it with letters and numbers on it. And they dialed in a message. And they plugged it into a transmitter and transmitted it. We picked it up on a receiver and ran it into this box. And out comes a message, the message they had typed in. And this was something special forces used when they were off somewhere to send messages in short bursts at very high speeds on HF radio.

Hendrie: Oh, my goodness.

Poor: And this-- and they said, what they do is they listen on these specified frequencies, they get these bursts at 300 words a minute, tape record them and then play them back 10 times slower and have guys copy them on the typewriter. And-- but they said that takes a lot of-- there's a lot of delay in there. Now, if they could just take that burst of Morse code directly into a machine and print it out as fast as it comes in, it would be a big help. Worked the first time. It was amazing. So then they started running tests. They had some operational drill down in Panama with these little boxes and we set up a receiver and a beam antenna, aimed it at Panama, and they wouldn't tell us when they were going to make the transmissions. We had to monitor these things and, every now and then, we'd get this burst of stuff and they had a representative there at Frederick, who was watching it, and they would get the stuff out. And it wasn't absolutely letter perfect but it was apparently close enough that, for the first cut, it gave them everything they needed and then they would take the tapes and make manual copies for their final records or check accuracy and so on. And we had a ball with that. And, again, of course, for a ham, this was a great sport. So I started operating ham radio at 300 words a minute Morse.

Hendrie: Oh, my goodness!

Poor: Well, I fixed the tape machine so it would read the tape and create Morse at 300 words a minute and so a friend of mine out in California and I would QSO with each other at-- a fellow named Frank Wyatt, would talk to each other by sending these tapes at 300 words a minute back and forth on ham radio. It was perfectly legal. Nobody, of course, could copy it except us.

Hendrie: Yes, exactly. <laughter>

Poor: Sounds like a buzz when it comes through. One of the things I found was that, by playing Morse code at high speed, I got better copy over HF, more accurate copy, than at slow speed because it seemed to be more impervious to fading.

Hendrie: Okay.

Shustek: Of course, at that point, you were using machines at both ends so...

Poor: That's right.

Shustek: ...you wouldn't needed to be restricted to Morse. You could have used any other code. Baudot or something like that.

Poor: Absolutely. I mean, it was-- there was no real justification for it <laughter> other than...

Hendrie: It was fun.

Poor: ...fun. And, of course, in the case of the army, they had a reason for doing it that way because they wanted to be able to fall back to manual copy because the signals weren't terribly strong from these little pocket transmitters and stuff they used.

Hendrie: That's pretty amazing.

Poor: But we ended up selling them, a lot of these machines. Anyway, just to...

Hendrie: Yes. Very good. That's a great-- another great little product there.

Shustek: Going forward again to Datapoint, what was the structure of the company? I assume the million dollar investors owned a fair part of it?

Poor: Yes.

Shustek: Who else had equity in the company?

Poor: Well, there were some VCs that came in.

Hendrie: Do you remember who they were?

Poor: Well, I remember New Court Securities out of New York. God, you see, I'm back to this question of names.

Hendrie: That's okay.

Poor: There were at least three significant investors, apart from the businessmen in San Antonio that were in it. And then, after they started producing the 3300 and were well into that business, they wanted another round of financing to finance building this new machine that would be programmable. And this was about the same time as a company in Boston, I think it was called Viatron...

Hendrie: Ah, yes.

Poor: ...blossomed and failed overnight. And every investor looked at Datapoint as another Viatron all of a sudden and they couldn't raise money for anything.

Hendrie: Really?

Poor: It was...

Hendrie: It just poisoned the market.

Poor: Just-- yes. Yet the companies were completely different. But in the mind of an investor, you know, here was a thing with a keyboard and a tube and this company in Boston couldn't make it, why would some outfit in San Antonio make it? <laughs>

Shustek: So describe the differences between what Datapoint was doing and what Viatron tried to do.

Poor: Well, Viatron was making a data entry terminal and it was an ugly looking thing, I remember that. But it was designed to replace keypunch machines and record to tape or something.

Hendrie: And it was priced at some unbelievably low price.

Poor: Yes, it was priced below anything-- I mean, we looked at it and said, well, you know, we couldn't build whatever this is for what they're offering.

Hendrie: Selling it for.

Poor: But, of course, the company failed almost as soon as it got started and-- but they went through several rounds of financing in the process and...

Hendrie: They raised a huge amount of money.

Poor: Raised a huge amount of money and had even bought a corporate jet before they had sold their first product, you know? And this just poisoned everybody. But, eventually, the company survived it, you know? Datapoint survived it, obviously.

Hendrie: Yes.

Poor: But what it meant was that they had to raise equity on rather unfavorable terms as a result.

Shustek: Was there any equity participation by the employees in terms of stock ownership or stock options?

Poor: Oh, there was stock options, yes. We all had stock options. I mean, that's why I'm here today. <laughter>

Hendrie: Okay.

Poor: If it weren't for Datapoint stock options, you know, I'd still be working for a living somewhere. <laughter>

Hendrie: But they eventually did raise some equity again from...

Poor: Yes, they raised some more equity, it just was not very favorable.

Hendrie: Do you remember who that was from?

Poor: No, I-- the numbers-- well, I think the money came primarily from the existing investors.

Hendrie: Ah, okay.

Poor: I think they had trouble getting anybody new into the game at that point. But the company was obviously doing well, compared.

Hendrie: Was the company profitable at that time?

Poor: The company-- yes, in 1970, I think the company must have been profitable. It didn't stay profitable. We went through a rough patch after that but...

Hendrie: So the-- at the peak of the 3300, it was profitable.

Poor: Yes, we were doing well. I mean, we were getting five grand apiece for these boxes and they're-- you know, our cost was $1,000 or something, you know? I mean, it was wonderful. <laughter> Just wonderful.

Shustek: Going public wasn't an option for getting additional financing?

Poor: The company had already gone public. I think the company went public in-- probably-- let me think about that. When did we go public? I'm sorry, I'm afraid I draw a blank now. I don't remember any more.

Hendrie: That's okay.

Poor: We got financing-- we got supplemental financing in 1969, after the additional businessmen. I can't remember whether that was public or private. And then we got some more private financing, I know, in 1970 and, at some point, we went public and I can't tell you where...

Hendrie: Yes, okay.

Poor: ...where that happened. Interestingly enough, going public, to those of us that were on the inside of the company, was not significant in those days. I mean, it is now. Everybody lives to go public. We were really interested in the business. It's a different men-- was a different mentality than we...

Hendrie: Yes. You were there not to make a fortune but to...

Poor: In fact, I was...

Hendrie: ...it was fun because you really enjoyed what you were doing.

Poor: I can remember when my stock suddenly was worth a lot of money and what a surprise that was. I mean, like, I just sort of woke up one day and said, you know, I'm a millionaire and I didn't even realize it. <laughter> Didn't even think about it.

Hendrie: You weren't focused on that.

Poor: That's right. That was not...

Hendrie: You were not tracking that.

Poor: That was not the focus.

Hendrie: Okay. All right. Well, getting back to your transition to going to, you know, leaving Frederick and going to Datapoint, do you remember roughly? That was late 1969, you said?

Poor: Right. I actually showed up for work at Datapoint, Computer Terminal Corporation, like Thanksgiving weekend or thereabouts. I remember, in November of that year, I was ready to move and I came down with appendicitis, ended up in a hospital and that delayed me for two or three weeks until I got over that. So it may have been, like, the first of December or thereabouts but it was right in there. It was before 1970, just before 1970 and as soon as I got out there, by this time, Harry and I had already worked out a plan for the new product.

Hendrie: Okay. Now, was Harry a full-time employee or was he...

Poor: Harry was a student at Case Western.

Hendrie: He was still going to school.

Poor: Still going to school and, in fact, I was still in Frederick during that Thanksgiving weekend and he came down from Case and the two of us spent, like, the four days in my house working on the design. I'd actually left Frederick, although it was hard to put a date on when you left. Things all kind of ran together but I had actually left Frederick technically and-- but was still going back cleaning up loose ends every day. Harry came down. We worked on the design for the new product for Datapoint and had it pretty well mapped out and pretty well documented. Interesting enough, all those documents that we created that Thanksgiving weekend included things like the design of the architecture, you know, the flow charts, the instruction sets.

Hendrie: The instruction set?

Poor: Instruction sets, everything was in there.

Hendrie: How the instruction set would work with the data flows and all that.

Poor: Right, all that. And I had that in my files for a long time at Datapoint and, later, much later, there started-- and, ultimately, I gave it to-- Harry said he was interested in it so I gave it to him. I'm not a string saver, you know? You were asking if I have any artifacts. I don't have a thing. <laughter>

Hendrie: Yes, you were just not a saver. That isn't who you are. Okay.

Poor: So Harry got all this stuff. Then, later on, there were some lawsuits over who invented the chip processor, an idiot sort of thing, and some lawyer borrowed the paperwork from Harry, with all this documentation, said he would make copies and give it back. He never gave it back. Harry could never retrieve it and it disappeared into some lawyer's file or god knows where so...

Hendrie: Oh, my goodness.

Poor: It's gone.

Shustek: Well, it may not be gone. It's just...

Poor: Well, we don't know where it is.

Hendrie: It may take some serious looking to find it.

Poor: Right.

Hendrie: Had you worked on the design of a processor like that earlier at Fredericks, before Harry got involved?

Poor: Well, I had-- I worked on some ideas for processors but I hadn't built anything.

Shustek: But you hadn't worked out an instruction set or more details?

Poor: No, probably not. Not in the detail we worked out for the Computer Terminal product.

Hendrie: Yes. It was essentially...

Poor: I mean-- right.

Hendrie: ...a spec.

Poor: Yes. We had to work it out to the point that it could be implemented.

Hendrie: And you were going to implement it using MSI TTL [transistor-transistor logic]?

Poor: MSI TTL and recirculating shift register memory.

Hendrie: Yes, okay.

Poor: That was the idea.

Hendrie: Okay.

Poor: It wasn't a chip processor. I mean, that wasn't what was in our mind at that moment.

Hendrie: Yes. That isn't what you were doing.

Shustek: So it was designed with, like, 74181 ALUs [arithmetic logic units] in mind and that sort of thing?

Poor: Yes. I don't remember the chip numbers but, yes, it was stuff that was out of the catalog, mostly out of TI's [Texas Instruments'] catalog, as I recall.

Hendrie: Okay.

Poor: Except the recirculating memory was Intel. They were the big producers of the shift register memory.

Hendrie: Okay.

Poor: But as soon as I got to Datapoint, the two founders of the company wanted me to go talk to Intel about producing as much of this as possible on a chip. They-- by the time I got there, they had come up with their own spec for what they wanted this product to be.

Hendrie: Oh, okay. And what was that?

Poor: And we kind of merged what Harry and I had done with what they wanted. They wanted-- they had an idea. They want-- they had done some "market research". <laughs> They said they wanted a machine that had the same footprint exactly as a Selectric typewriter, the same keyboard layout as a Selectric typewriter, the same feel. They wanted a screen that had the same dimensions for character size and spacing as the type on a Selectric typewriter. In other words, they wanted this to drop in place wherever-- on somebody's desk wherever a Selectric typewriter-- they didn't want it any taller than a Selectric typewriter. So we ended up with this-- I don't know if you've ever seen a 2200. That was the-- well, if you set that side by side with a Selectric typewriter, they were the same dimensions.

Hendrie: Ah, okay.

Poor: And that's how they came up with it. They also had the idea they wanted what they called n-key rollover because the Selectric had that apparently. I don't remember it but, anyway, they-- where you could push a key and then hold that key down, and push another key and hold that key down, push another key and hold that key down and you would get those three characters, not...

Hendrie: Any interference.

Poor: Not an interference where you had to lift one key to push the next and so on. And apparently on the Selectric-- and this-- or if you held the key down, then it would pause for awhile and then it would repeat. All these characteristics, anyway, they took from the Selectric typewriter.

Hendrie: They wanted a glass Selectric typewriter, fundamentally.

Poor: Right. And I guess this followed, since the first product was a glass teletype, this line was going to be a glass Selectric. Later on, there was a lawsuit over this because some keyboard manufacturer patented the n-key rollover several years after we had already been producing it. That lawsuit fell apart, of course, when-- of course, we didn't patent it but that lawsuit fell apart when we demonstrated the product to their lawyers that had the same characteristics that was built many years before they claimed they had invented it. <laughs>

Hendrie: Prior art, yes.

Poor: But-- anyway, that was the model they wanted us to fit and they figured the design hearing I came up with probably wouldn't fit in that box if we didn't do some crunching. And Intel was our single largest supplier of semiconductors because we bought so much recirculating memory. In fact, I think we were Intel's biggest customer at that time. Intel wasn't very big then. Well, I went out to Intel with my little design in hand and I met with Gordon Moore and, oh, who was his partner?

Hendrie: Noyce.

Poor: Bob Noyce. The Hungarian.

Shustek: Oh, Grove?

Poor: Andy Grove. They-- and Stan Mazor and Ted Hoff, five people. We all met and talked about and they were unanimous in one respect. They didn't want to build this because it was only going to be one part in each product we built and there'd be 100 recirculating memory parts. They said: “We're in here for quantity, not anything exotic. We really aren't that interested.”

Hendrie: Right.

Poor: Nevertheless, we talked about it.

Shustek: When you say talked about it, do you mean doing it all on one chip or some part of it?

Poor: Well, at the time, it was-- part of it was going to be on a chip but they didn't want to build chips unless they were going to be lots of them. And they couldn't see where there was going to be lots of whatever this was. And Ted Hoff had this 4-bit calculator chip he was building, designing for a Japanese firm.

Hendrie: At the same time, yes. At this time.

Poor: And he said, "Well, why don't you use that?" And I said, "Well, unfortunately, it doesn't work into the design or I would, you know?" <laughter> So it went, you know. I think it was Stan Mazor said, "Well, you know, we could probably put all of this on one chip." And I think that was Stan. I don't know who it was. Somebody out there said that. And so we kicked around that idea and I went back and Harry and I worked out a spec and I consulted with Harry on the phone. He was back at college and Harry and I worked out a spec for "a chip version" of this processor. And Intel quoted on it and said they'd build it.

Hendrie: Well, that's interesting. So they had a turnaround in their...

Poor: Well, they had a turnaround because Phil Ray said, "If you don't build this chip, we're going to buy our memory somewhere else."

Shustek: You had a lever.

Poor: They were not-- they were kind of reluctant but they did it. They went for it.

Shustek: So the spec you worked on, how detailed was it in terms of the chip design and did it specify, you know, the number of bits of input and output and the...

Poor: Yes, it was...

Shustek: ...width of the data buses and all of that?

Poor: Right. It was an external design. I mean, we were in no position to dictate how it would be implemented internally.

Hendrie: Or even probably figure it out, yes.

Poor: Yes. But they took that-- they came-- and then there was some give and take. They came back with some changes and some ideas. I can't tell you who was finally responsible for the design. I mean, there were so many people in the act. But we finally came up with a design that we thought would be...

Hendrie: That you guys thought.

Poor: We could use. And...

Hendrie: Do you remember any of the push backs from them about the design or any of those details...

Poor: One of them was the one bit versus 8-bit. They wanted an 8-bit wide part and, ultimately, that's how they built it.

Hendrie: Okay.

Poor: But it was still recirculating. But, you see, there are interesting points whether there's going to be a big end or a little end part could have been changed at that point but we didn't. We just left it...

Hendrie: Even after you went to eight bits?

Poor: Right. Which is why the Intel product line is that way today.

Hendrie: Right. Okay. But it was still-- from you-- when you made those changes, you still viewed main memory was going to be the shift?

Poor: Yes.

Hendrie: The dynamic shift registers.

Poor: Well, we were-- by then, we were already hard at work building the product with MSI.

Hendrie: Okay.

Shustek: So you had implemented that same instruction set in MSI?

Poor: In MSI. And this chip was going to be a drop-in replacement for it.

Hendrie: So you had to change, when it went to parallel 8-bit...

Poor: Actually, we didn't. We didn't have to because you couldn't tell, internally, whether it was one bit or eight bits wide.

Hendrie: Ah, okay.

Poor: And so our very first implementation was one bit wide with MSI but, later on, we switched even the MSI design to eight bits wide and we made a drop-in-- made it so, in theory, we could drop-in. But Intel didn't produce the part. Intel kind of did it when they felt like it, worked on it when they felt like it and they were a year late from their original schedule for producing the part. By this time, we had built the thing, had it in production, had squeezed all this stuff into the Selectric typewriter space. It was hotter than hell. <laughter> They had a fan running in there to cool it all down. We had a switching power supply built in there that...

Hendrie: Oh, well, that's pretty-- yes.

Poor: You know, to-- because you couldn't put a conventional transformer-type power supply in there.

Hendrie: Yes. Wouldn't fit.

Poor: I don't know how the hell we got it through UL [Underwriters Laboratories] but we did. It was not easy because, you know, we were doing everything different than had been done up to then to get it into this size. But, in April of 1970, we took a prototype of the machine, complete with industrial designer case and everything, to a banker's convention to show this product off.

Hendrie: Wow.

Poor: We didn't actually ship them, I don't think for another year. That's how quickly we put the prototype together.

Hendrie: Can we take a pause?

Poor: Sure.

Hendrie: Let's continue. You were saying about that from Thanksgiving to April you had working prototypes?

Poor: That's right. Datapoint brought in an industrial designer from Raymond Loewy in New York to design this case and did a beautiful job. Later on we actually hired the designer out of Raymond Loewy, he became a full time designer for Datapoint. But we showed the product off and generated some interest, I think that fall we went to the Fall Joint Computer Conference again I'm taxing my memory, I think it was in Houston. But I remember we had this booth and we had a number of them, they were still prototypes, we still hadn't really manufactured them yet or hadn't gotten into manufacture yet. And we had a number of them and we're showing theem off and we've of course spec sheets and generating orders and stuff. But I remember that conference so well because our booth was always crowded and I swear half the people in the booth had IBM tags on them. IBM was in there in spades, they were all over us.

Hendrie: Well this was a terrible threat to them in some sense because programmable…

Poor: I suppose but yet they never did anything with it at least not until 1984 or something.

Shustek: What about the software, it was a brand new processor; you had no tools, no assemblers…

Poor: Well we were doing all that at the same time. We had a small staff, we built-- obviously we started off building a monitor and an assembler to do it. And at the time we didn't think we were going to go any further than that because we were going to write the software to emulate different terminal types.

Hendrie: Yes this was not a computer product. It was a mechanism to an end.

Poor: That's right.

Hendrie: So mainly, a whole bunch of glass terminals.

Shustek: So by the demo in April at the bankers convention, did you have enough software to demonstrate it as a running terminal?

Poor: Yes, but I think all we were demonstrating was the teletype. <laughs> I mean we weren't demonstrating much. But yes that was the idea and depending upon what kind of channel you were connected to there would be a dongle, another black box that plugged in that included whatever kind of modem or signaling method you used to interconnect, because we could connect to-- see telex was still around, one of the things we emulated was the telex machine. You could emulate a telex machine, teletype machine or a number of the common proprietary terminals made by different manufacturers.

Shustek: Like 2260 which maybe why IBM was so interested in...

Poor: Except IBM-- we didn't-- we never succeeded in emulating a 2260 but we emulated a different IBM terminal that was more-- see the 2260 had a coax connection into a huge controller so the terminal itself was a really stupid box. But they had a 2265 or something that had, I don't remember the numbers, that did have some kind of serial port on it and we did emulate that.

Hendrie: Ah, Okay.

Poor: But interestingly enough that didn't take off, I mean we did what we thought our customers were asking for and it was what our customers were asking for but when we did it they didn't buy it. But we got a whole crop of different kind of interest that we were never expecting, the people who bought these early machines by now it's 1971, wanted a desktop computer and that's what they bought them for and they bought that with the assembler and a monitor and we had a printer attached, we had tape cassettes attached. So you could read and write tape as if you were doing paper tape only this was, you know, magnetic cartridges. And that's when the light finally dawned in our heads that we weren't in the business we thought we were, we were building desktop computers. And I'll give you an example of an experience I had. I taught the first class on how to program this machine for customers to program it, this had to have been late 1970 early 1971, I don't remember. And I remember one of the customers that was in the class was a programmer and actually there was a couple of them, a girl and a guy from Pillsbury up in Minneapolis and they took it all in, they were good programmers, they were assembly level programmers and the assembly language programmers were a little more common then, then they are now. And then we delivered some of the first machines went to Pillsbury and they seemed awfully anxious to get these machines and so we put them way up on the queue and I called the gal that was in that class and I said, you know: “How you doing with the machine?” “Oh we're doing fine, they're installed and working.” I said: “Well where are they,” you know.

Hendrie: What are you using them for?

Poor: “Well they're at a chicken farm in El Dorado, Arkansas, they're working fine, no problem” and I said: “Well, what protocol are you using, because you didn't get any terminal emulators from us.” “Oh we're not connecting it to anything, we're running payroll in El Dorado” and I said you got to explain. She said: “Well, the telephone lines were so bad we couldn't run our Burroughs terminals down there so we just wrote a payroll package and ran it in the machine and then we just mail the tapes back and we had to do that because if you didn't pay them every Friday, they wouldn't feed the chickens.” “And we had to have—“ and the printer was a tractor feed printer and they could print out the checks and they'd make up the payroll and they had this tape, they'd send it back to a 2200 in Pillsbury at their headquarters, which was connected to a machine and there they took the data and fed that into their payroll program, their payroll accounting, but the actual payroll stuff was all done in El Dorado and that, they were just using it as a stand alone machine. And then the next customer I came up against was General Electric and they were using it to run traffic control lights, this was a central console, a computer to control traffic, control lights out of their traffic control division and so on it went and we just, every time I turned around there was some application I'd never dreamed of.

Hendrie: Yes, exactly.

Poor: Some drug store chain was using it for accounting for prescriptions, they had some legal requirement for prescription accounting and they did that on the machine in the drug stores.

Shustek: Were there any alternatives in the markets…

Hendrie: So you were just discovering, I mean, it's almost a revelation.

Poor: And these things were being done by these customers' programmers and in assembly language with nothing more for storage then these magnetic cassette tapes and tractor printer.

Hendrie: And they put the program on the magnetic tape.

Poor: Right and loaded it in and ran it. And the first machines by the way only had 8K of memory, you couldn't have done anything except in assembly language anyway. 8K of recirculating memory and they weren't very fast. When I look back on it I am just dumbfounded that anybody could do anything with this, what can you do with 8K?

Hendrie: Or would even try?

Poor: What could you do with 8K of memory today, you know, we increased it to 16K, we went from recirculating to RAM, by this time like by 1971 Intel was producing 1K RAMs.

Hendrie: Okay, the 1103 was out and it's sort of worked.

Poor: And we converted it, we converted the products to an upgrade.The original 2200 was just simply faded out, we replaced it with the same model number and basically didn't change much but we call it model 2 or something, you know, version 2, 16K of RAM, no longer recirculating memory. Suddenly, it's on order of magnitude faster and we went to work and got a hard disk, put a hard disk on it.

Shustek: Still using the MSI implementation?

Poor: Still using MSI, we never did use the chips.

Shustek: Nothing from Intel?

Hendrie: The same MSI, the original MSI or did you redesign…

Poor: Well when we went to 8-bits we ended up.

Hendrie: When you went to 16K.

Poor: I mean when we went to 16K went to an 8-bit wide machine from a 1-bit wide machine.

Hendrie: Okay, that's when you made the transition.

Poor: Right, we didn't build very many of the small one's because the 1K came out like in 1970 and didn't take us long to rework it and convert over to it. Lost my train of thought here.

Hendrie: Well, I want to roll back anyway, do you remember who were the principle engineers that worked on that original-- building those original-- the original design that ended up as those prototypes in April of 1970?

Poor: Names, Gary Asbell was one, Stan Kline was one, Jonathan Schmidt I think you've talked to him haven't you?

Hendrie: Yes we have actually interviewed him.

Poor: An engineer I've long lost track of named Joel Register. This is about as much as I can remember, there weren't very many of us. I mean if there had been very many we couldn't have accomplished anything, you know.

Hendrie: Exactly, didn't need very many.

Poor: Didn't need very many to do this kind of thing.

Hendrie: And was Harry Pyle involved or was he still in school?

Poor: He was in school-- I'm not sure when he finished school, I think he finished school in 1970, he came full time early on, yes he must have finished by the spring of 1970, he must have been out of school. Because I think by the summer of 1970 he was full time oh you'll have to ask him to be sure.

Hendrie: Yes, we have his-- he's on our list.

Poor: Anyway this shock wave that came through the company that said, you know, we're not in the business we think we are led to an overhaul on our marketing. I didn't have a lot to do with that but it certainly led to an overhaul on how we looked at product design in the engineering side of the company. And one of the first things we decided is, we needed a compiler and we needed a high level language. And we're doing this-- we wanted to do this in a 16K machine.

Hendrie: Well here's a tour de force coming up.

Poor: And we wanted to do it without necessarily requiring there'd be a hard disk on it, so we came up with a language called DATABUS and the language was inspired I guess is the best way of doing by the Autocoder language used in the IBM 1403. We used that as a rough model but made an instruction set that fit in our machine and Harry wrote the compiler. And DATABUS became very popular and there was a DATABUS users group even still in existence a few years ago and it ultimately migrated to PCs and other machines, which I thought pretty absurd but nevertheless hung around for a long time, I don't know if it still exists or not.

Hendrie: And you decide to do this instead of taking something like BASIC or…

Poor: Oh, we couldn't have implemented BASIC.

Hendrie: Yes, you just couldn't have squeezed it in?

Poor: Not then. We did later, later we put all kinds of languages on the machine.

Hendrie: But at that point the restrictions--it was just so.

Poor: Yes, it had to be, it just had to be real, real simple. But as it worked out that became popular, we sold, I don't know, huge numbers of these machines and people-- and they weren't terribly reliable, we had lots of learning to do, you know, we were always pushing the technology right to the wall. Like you say the 1103's work sometimes, most of the time. <laughs> I remember we had memory testing programs that we would as they came off the production line we'd run these programs to thoroughly flip every bit and memory and we had a hell of a time getting them to pass. And I remember the manufacturing manager coming to me one day-- manufacturing vice president, he ought to have known better he was an engineer saying, you're going to have to do something about this test program, it's obviously working the machine too hard. <laughter> I had trouble explaining to him that there's no such thing as too hard.

Hendrie: Right, exactly.

Shustek: Getting back to the microprocessor story, so Intel never delivered on the chip that they said they would produce for the time?

Poor: Well they delivered, they were a year late. By this time we were way beyond needing that part, but they were not the first company to deliver the chip.

Hendrie: Oh, okay.

Poor: Early in 1970 we were buying semiconductors from two companies basically, Intel and TI. The TI salesman was in there everyday, he was on our case always.

Hendrie: But you weren't buying the MOS shift registers?

Poor: No, we weren't buying…

Hendrie: You were buying those from Intel and then the other logic…

Poor: But this salesman was one of these guys that wants everything and he learned somehow or another about this project with Intel to build this processor and so he gathered up his best MOS people from TI and brought them in an said: “Well we're processor experts and we can do this too and here's our plan for how you could use TI processors.” And they came up-- they presented us with a three processor MOS.

Hendrie: Three chip.

Poor: Three chip set with bizarre instruction set and nothing we could have integrated into the thing and I said: “Guys, I gotta tell ya this ain't gonna fly, we're not gonna use it.” and.

Hendrie: They didn't come in and say we'll take your instruction set and your…

Poor: Right and I said anyway at this point we're all settled with Intel, they're going to produce this part, I didn't realize how late they were going to be. And they said: “Well, if we can have the spec, we'll quote on making a plug replacement for that part.” Well we talked about it and the president of the company said: “All right give them the spec and let them quote.” And I don't know-- the difference-- in Intel's case we agreed to pay like $100,000 NRE [Non-Recurring Engineering] but in TI's case we said if you do it, you do it on your own, we're not going to go through this a second time.

Hendrie: You didn't feel you needed a second source or anything like that?

Poor: Right, so they went off and they built a look-alike chip, they delivered it before Intel did, so TI actually built the first production 8000 series part. Well I won't call it a production part, they built the part, we brought it in and we tested it, the noise margins on it were so- so narrow, because you couldn't put it on a board with anything else without it making errors.

Hendrie: Now when you say noise margins, which kind of noise, which lines are we talking about?

Poor: The input and output lines on the-- actually the output lines on the MOS chip weren't buffered, they were very fragile and the voltage swings we very narrow and you had to have threshold sensitive on the external parts that were looking at a chip.

Hendrie: So you had to have special parts looking at the chip to, almost like sense amps as opposed to just ordinary TTL?

Poor: That's right and the voltage swings were so narrow that if you had other stuff running on the current op which obviously you did, there was enough noise floating around we could not tame it, we could not make the part work. And we sent it back and said thanks anyway, we're going to stick with MSI, well this didn't bother TI very much 'cause they were selling us the MSI. So they didn't-- I mean they had inter-divisional issues I suppose over it but there was no.

Hendrie: Oh I think they did.

Poor: But was of no concern of ours. Then later Intel came in with the part and said that here's your part, now that one was acceptable in the sense that it met the original specs.

Hendrie: Technically that they did make it work.

Poor: Technically it met the requirement. Unfortunately by this time we had moved to a richer instruction set, 4K memory had come out from…

Hendrie: Mostek?

Poor: Mostek, we had…

Hendrie: Intel also had 4K memory but.

Poor: Well we were using Mostek.

Hendrie: You were using Mostek.

Poor: We started using Mostek and we built a new machine called a 5500 with a richer instruction set. The instruction set looked like an 8080 and so we were building with MSI an 8080 class set, 4K parts and we were now running a 64K machine and this little chip only had address space for 16K. We said guys this is history and the instruction set was pretty anemic as well.

Hendrie: Well it was the original what, yes.

Poor: And so the president of Datapoint who were good-- he and Bob Noyce were good friends.

Hendrie: Who was this?

Poor: Phil Ray.

Hendrie: Okay.

Poor: The two of them made a deal, Intel could keep the part, but they could have all the rights to it and we wouldn't pay them any NRE. I don't think Noyce was very happy about it, but he accepted that and they put it in their catalogue as an 8008 and the part took off. And it-- from then on Intel was the chip, the computer on a chip manufacturer.

Hendrie: Yes, and TI could have-- well if they'd fixed the problems, the interface problems.

Poor: I don't think they knew how.

Hendrie: Really?

Poor: I don't think their technology was far enough along yet to do it.

Hendrie: At least in their technology?

Poor: Yes, yes, Intel was ahead of them in MOS from what I could tell.

Hendrie: Yes, I think the-- as I remember the TI part's a metal gate part and Intel already had silicon gate and, you know, knew how to do TTL levels and all of those things.

Shustek: There was apparently another MOS processor done by Lee Boysel at Four Phase Systems, did you or TI or Intel know about that part and make any use of their design?

Poor: I didn't know anything about the part, I know Four Phase was a competitor of ours of sorts, I mean they were a little different, they were reaching a little different market than we were. But I certainly remember Four Phase but no, I couldn't tell you much about them.

Hendrie: Do you…

Poor: Motorola's 68 something or other, 680.

Shustek: 6800.

Poor: 6800 whatever it was, was the first real alternative that I have any recollection of to Intel's chips. And of course that was designed later and architecturally made more sense in the context of conventional RAM memory.

Hendrie: Yes, wasn’t designed for a serial memory.

Poor: Yes, they didn't have the history behind it. But there was no changing what we did because we had this compatibility issue, anything we made had to run all the code from the previous machine.

Hendrie: Well, yes, you wanted your customers to be able to upgrade to the newer machine.

Shustek: Which is a problem that Intel eventually inherited with the 8008 and having to be to this day compatible with that instruction set .

Poor: That's right, that's right yes, I could still today if I had the code run my original test programs from my 2200 on a PC today.

Hendrie: That's pretty uh….

Poor: I mean it's that compatible, all the way up.

Hendrie: That's pretty amazing.

Shustek: So how do you feel about having designed the instruction set that most of the world uses at this point?

Poor: It's interesting. <laughter> I mean-- I don't attach much significance to designing an instruction set I mean this kind of thing, given the context is pretty obvious what it has to be. There's all this-- I'm just amazed at this constant debate about who invented this and who invented that and, you know, TI claims they have a patent on the original chip processor and I got sucked into depositions over this and the papers they presented at the deposition were literal Xerox copies of Datapoint documents that we have given their designers when they wanted to build something to compete with… And they went out and patented it, they applied for a patent, it took them 17 years to get the patent through the patent office but they finally got the patent and then they were suing everybody in sight.

Hendrie: There was a time when TI was-- decided that their lawyers were profit center, I remember them suing everybody on anything they could think of .

Poor: To me that's a perversion of the patent system completely.

Hendrie: Of course it is.

Poor: I do remember we had a patent attorney in Houston that did patent work for us, we did do some patenting, not a lot and when he was over on a visit I'd presented him the design for the 2200 and the chip processor and so on and said, you know, what do you see here we could work with and he said, he didn't see anything there that was really patentable, he said just the fact that the processor's on a chip is no great significance. I mean there's no new art there, it's just a computer like other computers already existed and he kissed it off. Another attorney from that same firm was in the depositions 20 years later, wanted to know why I didn't patent it at the time and I said well your firm advised me that there was nothing patentable.<laughter>

Hendrie: That shut him up.

Shustek: Not only didn't you patent these things but you didn't feel that it was intellectual property that you had to protect, you didn't feel awkward about giving TI the specs for the instruction set?

Poor: No, it didn't seem significant to us, in fact in doesn't seem significant to me even now because there isn't anything there that somebody else couldn't replicate in a moment's notice. Instruction sets after all by their very nature are public, you have to disclose them for people to be able to use them. What are you going to protect? I guess you could copyright it but which is what IBM has done but I don't know, it just didn't seem to be material.

Hendrie: Not from your point of view it wasn't, it wasn't how you compete in the world?

Poor: In 1970…

Hendrie: You compete by doing a better implementation, a better idea.

Poor: In 1970 the patent craze wasn't so strong as it has become later.

Hendrie: Yes, that's certainly true. Data General had the same problem they never bothered to copyright or patent their architecture.

Poor: Now what we did copyright was the work of the industrial designer, the appearance, the box…

Hendrie: Okay. Oh that's interesting.

Poor: …was copyrighted.

Hendrie: What about the code, the source code and the software ?

Poor: We use, yes we copyrighted the source code, that was the primary method of protecting source code in those days. I don't know how it's protected now.

Hendrie: Can you talk a little bit more about the interaction with TI, did you essentially just give them the spec and it…

Poor: Yes we sent them on their way, there wasn't a lot of interaction.

Hendrie: There wasn't a lot of…

Poor: There wasn't much interaction with Intel either once we agreed on a spec both companies went off and worked on their-- did their own thing.

Hendrie: It would be wonderful to find your notes.

Poor: <laughs>

Hendrie: You know of the original design and do you know whether it exists the-- what you gave Intel?

Poor: Well there's no finding it since Datapoint no longer exists I don't even know where any of those old records would be. Intel might have something from those days althought I doubt it and certainly TI does because their lawyers had it all, 20 years later.

Hendrie: Well I know…

Poor: Presenting it by the way as their own material. In fact when I remember looking at one of the documents and I said well that's a Datapoint document and they said well how do you know that, I said look at the typeface on that printed document it's Helvetica, our industrial designer required all the typewriters in our organization to use this distinct Helvetica type as part of the company's image.

Hendrie: Okay very good, excellent.

Poor: But I also recognized it because I knew where it came from but…

Hendrie: You knew what it said already.

Shustek: It wasn't stamped “Datapoint Confidential” or even Datapoint name?

Poor: Well some of what they had actually did have Datapoint's name on it but most of it wasn't, you know, these documents are thick, you know, maybe a cover sheet or something would have the name on it.

Hendrie: As part of our oral history project here, looking into the where 8000 processors came from we have interviewed Hal Feeney who designed the 8008 at Intel, was the engineer who actually did the, you know, turned it, did the logic design and then turned it into MOS and he has a hand written docket from Stan Mazor which allegedly Stan made from your spec but because he had to give guidance to the MOS designer interpret your spec for building a MOS chip.

Poor: Well Stan was our contact.

Hendrie: There were things he had to go do.

Poor: Stan was our liaison with Intel.

Hendrie: Okay.

Poor: Stan and I worked closely together to hammer out the document.

Hendrie: And whenever there was—yes, because obviously he had to make sure it could be implemented in MOS.

Poor: And he had to know things relative to implementation that I wouldn't even know to ask or to tell so on and so on . So there was a lot of give and take in there.

Hendrie: Okay so there were a lot of, there were a lot of interactions at least with Intel in the early days to get…

Poor: This was all before implementation even started though, this was all very early on. Once we got past that point.

Shustek: Did they make changes to the instruction set or ask you for changes?

Poor: Probably I can't remember, there wasn't much change if there was. I mean it was pretty simple, it really is. The register names for example, you know, the A, B, C, D, H and L, all the stuff that you see inside the machines today those were all..

Hendrie: Those were on those early drawings.

Poor: That's right.

Shustek: What about the instruction encodings the bit configurations, those were all part of your spec or…

Poor: Yes, they were all part of the spec yes, now they may have-- there's a point, we may have had the same mnemonic instructions and the same functions and they may have rearranged a bit here and there but we always-- we agreed whatever we did we agreed to it mutually and then that was again early on and then.

Hendrie: Yes, when you could still change your MSI design?

Poor: That's right.

Hendrie: So it would be compatible .

Poor: Much of it was actually dictated by what you could do with MSI, so I mean when you add two bits together there's only so many things you can do. <laughter>

Hendrie: Well there's a right answer and a wrong answer too.

Shustek: I remember reading something about the need for an increment instruction that didn't destroy the carry bit so you could do multi precision arithmetic. Do you remember anything about that and whether that was something you did or Intel did?

Poor: No I draw a blank on that. We enriched the instructions that considerably when we went to the 4K memory went to 64-bit, I mean 64K memory and-- but the original instructions they still had to run as is.

Hendrie: Yes, so this was all incremental additions to the instructions ?

Poor: And in some respects there were some subtle differences between the 8080 and our implementation, I no longer can tell you what they were, we could take our software and with minor changes run it on an 8080 or you could take an 8080 machine and with minor changes you could run it on one of our machines.

Shustek: That's because Intel substantially adopted your enhancements when they went from the 8008 to the 8080 is that right?

Poor: Probably, I couldn't tell you for sure how it came about.

Hendrie: Okay. Well next Tuesday we're doing the second half of an interview with Federico Faggin who designed the 8080 part so..

Poor: And then the Z80.

Hendrie: ..and then the Z80.

Poor: The Z80 incidentally was the first chip processor we ever used at Datapoint, in a peculiar product we call the 1500. This was years later and this was the precursor to the IBM PC. But that was many years later.

Hendrie: Should we try to take a break right now?

Hendrie: Could you just quickly roll back to the Frederick, I don't like to be so out of sequence, but you had an interesting story about another project you had when you were—that you figured out when you were there ?

Poor: That was the radio photo demodulator. We were doing business with Associated Press and they told us about a problem they had when they were getting poor image quality on their radio photos and they were using a radio photo demodulator built by a British company, I can't remember for sure the name of it, but they asked us if we couldn't do better because they could see the signals were good, could hear that the signals were good but somehow the picture quality was very intermittent. So we said we'd give it a try and we built a prototype of a demod using our own techniques and we sent it up to them to try and they ran it and they said well it was making good pictures but it unfortunately had a problem in that it had a an artifact, a shadow of a picture that was off set in each of their prints that was interfering with the reproduction. And they wondered if we couldn't fix it, they didn't know what it was caused by, we didn't know what it was caused by. None of our testing in our lab in Frederick showed any problems at all. So they sent us a photo processing machine and we hooked it up and set it up in the lab and we started copying pictures over the air from their transmissions and sure enough there was this displaced image and one of us, I think it was Jonathan Schmidt, did a little calculating and tried to figure out how much time delay was involved with this offset image and he finally realized that it was exactly the amount of time it took for a radio signal to go around the world. Well what we were seeing was the original picture plus a delayed transmission for one trip around the world and this of course meant what we had done is build a demodulator that was just a little bit too good. It was so sensitive and had such good resolution dynamic range that it would pick up the shadow of the delayed image. We fixed the problem by adding a certain amount of dithering to the output to mask that kind of low level signal, and sure enough that fixed and Associated Press was happy, we made a lot of units for them. But it was an interesting twist on what happens if you overdo the design of your products. <laughter>

Hendrie: Yes had to degrade it slightly. Good. Let's get back to Datapoint and the products that you're building there, we've gotten to the-- I guess the 5500 where you're using the 4K rams and had built an MSI parallel machine to run with them. Maybe let's-- what happened, you know? What kinds of things happened next?

Poor: Well first I can't tell you the exact sequence, at some point along the line there we added a hard disk to the machine, we built an operating system, something that looked very similar to DOS, in fact there's a story behind DOS and maybe we should digress on that a bit.

Hendrie: Okay. Why don't we?

Poor: We designed an operating system, operating system is a loose term as you well know, but we did design an operating system for the machine that would work with the hard disks and we called it DOS. One of the young engineers that had worked on that, his name escapes me now went from Datapoint to work for Tandy and Tandy came out with an operating system they called DOS, Tandy DOS or TDOS or something like that, looked marvelously similar to the product that we had at Datapoint for which we were honored. But the same fellow ended up going to work for Microsoft and Microsoft came out with a version of DOS that looked strangely similar to the Tandy DOS. I have a feeling if we looked at the code real close, we would find there was a…

Hendrie: There were definite artifacts of the original code .

Poor: …generational relationship between these things.

Hendrie: Oh that's fascinating, about what time is that you put the disk on, do you remember vaguely what year?

Poor: Well it would have probably been 1971, yes, I can't tell you for sure.

Hendrie: But relatively soon after.

Poor: Right, well of course once the light dawned as to what kind of business we were in, what we needed to do was pretty obvious and we already had put the printer in, Diablo printer being one of them, we had more then one kind of printer. We had…

Hendrie: Was the two cassette tapes on the original product?

Poor: Yes, the two cassette tapes were from day one. We added printers, I think our first printer was a thermal printer and then we added the Diablo wheel printer and then we started looking at adding a disk and we found a company in the LA area that made-- was introducing for the first time an OEM hard disk. It had a capacity of a megabyte and although at the time we thought a megabyte was more than we needed, we were prepared to use it, it was a fixed disk, not removable. And we started working on a designer for it when the Diablo folks said well look we're coming out with a two and a half megabyte disk for the same price as you're going to be paying for this fixed disk but it also has the advantage of being removable and it uses the same cartridges that the IBM 11…, what was that machine, the IBM 1130, was it?

Hendrie: Yes, 1130 was the machine and the disk had its own number, yes.

Poor: Well they used the same cartridge that the 1130 used, so we quickly switched over and adopted the 2-1/2 megabyte Diablo and we started marketing that and we'd hardly got that out the door then Diablo came out with if my memory serves me a 10 megabyte version then a 20 megabyte version and we had to run to keep up with them as they advanced them. We at first didn't think the capacity was going to be an issue, after all 2-1/2 megabytes was more than anything we could imagine these machines being needing. But our customers had other ideas and we ended up even before the 10 megabyte unit came out, coming up with a version of the controller that would support four 2-1/2 megabyte drives and then multiple 10 and 20 megabyte drives and so it went, you know. We were learning the computer business as we went, needless to say. The 5500 ended up being, mind you this is a 64K byte machine, actually technically it was 64K, the reality it was only 56K because the remaining memory was either ROM or reserved for something else, I don't remember what the address space was used for. But again Harry Pyle entered into the picture and he came up with using DATABUS the language, a time shared version of that machine that would use the 3300 as a stand alone terminal connected with a RS232 line into the 5500 and he could support 16 workstations off of this single 5500 as long as we had a big enough hard disk to hold all of the data. And we sold thousands of those things, I could not believe, I mean, when you look at the meager power that that had.

Hendrie: Yes, the processor that's in there.

Poor: And yet the customers were happy with it. Of course the applications were simple and everything was simply alphanumeric, there was never any graphics or any, you know, modern Windows type stuff, which there was no way you could have supported it, with those machines. But functionally they used them for point of sale terminals and running payroll, you name it, all kinds of applications, business applications. That's about where the product line evolved to, big disks, printers, we ended up putting other, a whole gaggle of printers on this machine, every customer had a different idea, we had Centronics printers to go faster then the Diablo's and we interfaced other products and eventually the Datapoint even developed it's own printer, which was a bad idea but nevertheless we did it, it came and went. It had one feature, which everybody liked and that was very attractive and had the same visual style as the workstations. <laughs> Otherwise….

Hendrie: Otherwise it probably wasn’t a good idea.

Poor: …there was no point in it. And at that point in development, now we're talking about by now 1975, 1976, along in there.

Hendrie: Now is this still a small engineering group, obviously it's a very successful company?

Poor: It's the same engineering group, yes.

Hendrie: Same engineering group, okay.

Poor: Not very big, but the engineers had the idea that they wanted to network these machines at higher speeds than could be done with RS232, you know, simple serial ports and that's when they started working on what became ARC and ARCNET. That process didn't go so fast, first of all the company wasn't backing that project, in fact those of us in management didn't really see the point of it because we were happy with what we had already.

Shustek: So who was pushing for it?

Poor: Just the guys, the engineers themselves, Harry, Murph, Jonathan, they paid no attention to management, they just went ahead on their own and developed the hardware and the software to make this thing go.

Hendrie: So the idea came from, do you have any idea where the idea came from for that?

Poor: Well yes Harry's-- the drive was-- Harry had done this basically time-sharing application that ran on the 5500 using 3300 terminals.

Hendrie: Yes, but with a limited number, yes of users..

Poor: And they wanted something that was more powerful than that, they wanted to be able to run the applications on the local machine but to have a common disk server that would provide a database so that they could run languages other than DATABUS. They wouldn't be machine limited by the number of cycles you could get out of one 5500 being shared 16-ways and so on. All the reasons for doing local area networks and so they kept plugging at it, the thing evolved from, first they were looking at a like doing it at 5600 baud, because that was a popular data transmission speed at the time and but they found that that didn't provide anywhere near the performance they thought they could get from the machines if that was the speed limit into the disk and so they went to the coax-based scheme, which became ARCNET. Murph designed the hardware, Harry was primarily responsible for the software, Jonathan was more or less the architect of the overall scheme and I sat in my office throwing darts at it the whole time. <laughter> But the company did turn it into a product and we introduced it into the market in 1979 and it took off like gangbusters. We've probably sold a billion dollars worth of that stuff of product based on the network, the use of the network over the next few years. That was to my mind the development of the local area network and the client server concept was implemented at Datapoint way before anywhere else. And this was done without any model, there was nothing much to go by, the model for the network itself, how we controlled the data over a high speed coaxial network was based on a scheme that was widely used in teletype for multiple teletypes sharing a single circuit. And…

Hendrie: Oh, what is that called?

Poor: Well somehow it sticks in my mind that it was called the Bell system 83B protocol, why I remember that I don't know.

Hendrie: Okay, so polling?

Poor: It was a polling scheme, really a token passing thing; ARCNET was a token passing network. There was a book published probably in the late 1940s or early 1950s in the UK called Telegraphy and the author of the book I think was Freebody and in it, it had described all the different teletype and low speed networking protocols that were out there and basically that was our model that instead of doing it at 50 or 75 bits per second, we did it at 2-1/2 megabits.

Shustek: So you weren't influenced by other academic research on higher speed networks?

Poor: I wasn't aware of any. If there was we certainly weren't influenced by it. Now that's a question you would be better asked for Murphy then me but I'm not-- there may have been stuff going on, I'm sure stuff was going on but I don't-- it wasn't based on anything that I was aware of. There was a thing called ALOHAnet, that was a quite a different protocol.

Hendrie: That was a collision network that was that sort of was a progenitor of Ethernet.

Poor: But we didn't-- we looked at the idea of a collision network but we thought token passing was far more efficient.

Shustek: Was there any input from marketing or customer-based studies to determine how many stations should be supported, what speed it should go at, what, any of that?

Poor: <laughs> No, what we did was we pulled numbers out of the air, the system was designed to support 255 connections or 254 connections because we had 8 bit address space and we didn't use 0 and we didn't use all ones because those were broadcast addresses or something and that dictated how many you could connect. Whether anybody ever put 250 on there I have no idea but, I mean, that's an example of how the design evolved. Marketing, no marketing didn't have the foggiest, no one did, I mean based on what, you know, how would you know what to do?

Shustek: What about the decision to use hub-based wiring scheme instead of Ethernet-like shared copper system, was that a conscious decision?

Poor: No, first of all I don't think there was any-- I don't think it occurred to anybody to do it any differently, I mean everything-- on a coaxial system where the distances aren't very large everybody can see everything all at once so whether you wired them in a circle or wired them through a hub wouldn't have made any difference. In fact you could hub it, I mean excuse me, you could loop it, we had-- from a hub you can put two or three terminals on a loop or actually not a loop but on a string all feeding the same line. I think you can put up to four or something, I don't remember the number, but hubbing just seemed like the obvious way to go.

Hendrie: At each terminal, I'm not as familiar as Len is with ARCNET, at each terminal did you receive and then retransmit the signal?

Poor: No.

Hendrie: So, it was a tapped…

Poor: Each device on the network had the token, had the control of the network and transmitted whatever data it had to whatever other specific machine it wanted to talk to during the time it owned the network. When it had finished its transmission then it passed the token to next higher address.

Hendrie: Okay, as opposed to a physical token passing where it's the next one in the ring?

Poor: Right, and you had a little table so that if a particular address wasn't being used it was marked out so we didn't poll it. And then if somebody came onto the lit network that hadn't been there before, no one would recognize it was there. So it had a technique of going on to the network and just broadcasting a disrupting signal to break the net. It broke the net and that caused the net to self-reorganize again and it would try passing the ring to all the addresses in the network, that way it would find out who was there and then it would go back to work again, it was just all automatic.

Shustek: And that was a scheme that was invented by John Murphy?

Poor: Probably, yes. Murph did the hardware and, you know, all three of those guys worked on the concepts, it's hard to say who invented. I always bristle when somebody says well who invented something because you don't know who invented it.

Hendrie: It was a joint project.

Shustek: One of the things that Xerox and later joined with Intel and Digital did with Ethernet was to promote as a standard that other people would use for other products. Did that ever occur to Datapoint to do that or was it viewed as a proprietary network for you use only?

Poor: Well at first we considered proprietary, certainly long enough to get established in the market, but then after that we made a deal with SMC to build a chip and we gave them license to sell the chip elsewhere, but we never made any effort to my knowledge to make it part of any standard.

Shustek: So you didn't see that widespread adoption of ARCNET was a benefit that you particularly wanted?

Poor: We didn't see it either as a benefit or as a liability. I don't think we thought much about it one way or the other.

Shustek: You were just building your products to the best of your ability.

Poor: We were just building our products, right and we didn't do a lot to defend it, that is to prevent anybody from doing, we didn't do much to promote it either.

Shustek: So again this is a case where you didn’t take out any patent protection on these ideas?

Poor: No.

Hendrie: That's interesting, you just weren't a patenting kind of-- wasn't the culture of the company then to patent?

Poor: No but even if we had what difference would it made? Ethernet was the one that took the market…

Hendrie: Yes, that's true.

Poor: … so it wouldn't have made any difference. In fact, a patent in that case would have probably discouraged it. I mean Ethernet had a patent on it but then they had to basically make it public to...

Hendrie: Get anybody to…

Poor: …to get anybody to use it. So what's the difference?

Hendrie: Well you could have been Söderblom and…

Poor: I suppose.

Hendrie: …gone into the licensing business.

Poor: Well, we didn't have that mindset, I guess.

Hendrie: Yes, I think sounds like it just wasn't that culture.

Shustek: You did many other innovative things with ARCNET though in terms of it advancing the distances. There was a LightLink I know that was developed to span large distances.

Poor: First of all if I remember the numbers correctly the timing on ARCNET was such that given the propagation factor of coax of about .6 it was good for about four miles. The greatest distance between two points, the longest path through the thing could be up to about four miles. We did build an infrared link that you could use to basically extend, replace a leg of the co-ax between say two buildings with infrared light and that was particularly useful in metropolitan areas where it was very difficult to get from one building to another without going to tremendous expense, you could literally shine this through two windows, you know, in adjacent buildings. We used it at Datapoint between our factory and our administrative offices for example to connect the two networks together. The administrative offices were in a complex of buildings but we ran coax between those buildings, but we couldn't get any coax down to the factory, which was a mile a way, so we ran a LightLink. Then the company built an executive office, mahogany row type thing that was way off to one side and at first we used LightLink for that but then we wanted to add video teleconferencing over to the president's office and so we switched to microwave and where we could get more bandwidth and we ran both video and ARCNET over the microwave channel and what we did with the signal footprint of ARCNET just fit in a 6Mhz video channel. So you can take standard video equipment, feed the ARCNET signal in on one end and get it out the other and go right on as if it were a piece of wire so like you could connect it over cable television.

Hendrie: I was going to say that'd make it perfect for the 6Mhz spectrum…

Poor: Well, in fact we did.

Hendrie: …in cable television.

Poor: We did and the company developed a product called MINX which was a video teleconferencing system that combined video teleconferencing with computer conferencing on the same cable. And this was sold primarily to the Defense Department, which-- they bought a bunch of them, in fact during the Gulf War this MINX system was being used between the gulf and Washington DC believe it or not.

Hendrie: Oh, my goodness.

Poor: But…

Hendrie: Over TV transponders, satellite transponder links.

Poor: But that was long after I was gone from there.

Shustek: What was happening on the software front in the meantime, were you developing more languages, more customer applications or databases or…

Poor: As a general rule we didn't develop applications, but we did end up supporting a number of languages, I remember we did BASIC, we did RPG, I think we did COBOL. What else did we do? We did something called DASL or Datapoint-- D-A-S-L I forget what the letters stand for, sounds like assembly language it was not it was like, it looked like C. This was before object-oriented stuff so there was no C++ or DASL++ but it looked very much like C and we also developed an operating system that looked very much like UNIX, which was called RMS. But those required bigger machines to use, the minimum they had to be 5500s we later came out with the machine called an 8800, which was a console-type machine with lots of memory. This was late in the game as far as I was concerned and by this time Datapoint had an engineering department and an R&D department, well actually we always had two departments but they practically worked as a unit for many years and then.

Hendrie: They were physically the same place?

Poor: Yes, but eventually they became separate. The 8800 became a development of the engineering department against a spec as opposed to researching things like local area networks and that sort of thing. Most of the-- almost everything in the way of something new or anything evolutionary came out of the R&D group in the company. The engineering was making stuff ready for manufacture.

Hendrie: Okay, so R&D might develop a product, come up with a concept, have a design…

Poor: Have a prototype…

Hendrie: and then maybe a prototype and then engineering might take it from there?

Poor: …take it from there and get it ready for manufacture. Usually redesigning it with cost and available components and other things in mind that R&D may or may not have…

Hendrie: Bothered with.

Poor: …**yes** or even known about.

Hendrie: In their rush to get something that works.

Poor: Right.

Shustek: Do you think that's a good way to organize an engineering R&D company?

Poor: Beats me I-- no I've often thought about what's the good way to organize a company and I've come to the conclusion there is no good way. No matter what we did, you know, at Datapoint we tried all kinds of schemes, we did skunkworks projects and we had separate departments and we merged departments and we unmerged departments and no matter what we did there was always something wrong; I don't know.

Hendrie: Yes, okay.

Poor: Datapoint got-- by the time I retired from Datapoint in 1984, the company had become so big and so complex that from my point of view it wasn't really fun anymore and so I was happy to go do something else.

Hendrie: It was more about the…

Poor: Well by this time also the company was very strongly driven by quarterly performance and how the investment community looked at the company and image and almost nothing to do with engineering and these are driven by outside influences on a company as you well know. Very counterproductive as far as innovation is concerned.

Hendrie: Now was the original head of the company, your friend, was he the CEO all through the…

Poor: No, he was CEO for the first I don't know three or four years and then Harold O'Kelly came in as CEO.

Hendrie: Now was he hired by the…

Poor: He was hired by the board and by the existing-- the original CEO and his cofounder, Gus Roche, Phil Ray and Gus Roche. Neither one of them were motivated to run a big company and Gus was not motivated to be in management at all, he never had a staff at all, Phil was CEO but he with the board's encouragement recruited Harold O'Kelly, he came from Harris here in Melbourne, believe it or not. And he took over the company in probably 1973 or thereabouts and Phil and Gus both retired.

Hendrie: How did the character of the company changed at that point?

Poor: Well, it didn't change a lot very quickly. Harold put his stamp on the company in a way, but the company was growing like a weed. We were growing, you know, we were doubling every 12 or 18 months and that was the real character-- that dictated the character of the company and I defy any CEO to keep control of an organization that's doing that.

Hendrie: Yes, exactly you can't hire really good people fast enough to…

Poor: I remember-- he recruited heavily from Harris, but, you know, years later I'm sitting in the President of Harris's office here in Melbourne, when we started AirNet and Harris was one of the investors at AirNet. And one of the venture capitalist's brought me into his office and introduced me to the president and said, you know, I'm going to be acting president until we can get this thing fully staffed and so on. And he was giving the Harris CEO a little background on me and he said, and of course he was executive VP at Datapoint and he looks at me with these beady eyes and he said: "Datapoint?" I said "Yes" and he thought a bit, you know, and he said: "So you're the guy that was bleeding all these people out of our company." <laughter> You know, this is a good many years later but he remembered.

Hendrie: But he remembered, that's pretty funny.

Shustek: Besides becoming big in the mid 1980s, what happened to Datapoint with respect to the rest of the market, the IBM PC came out in 1982 and Datapoint could have produced a product like that, they were certainly in that space of producing small computers to small customers. Did they not see that coming?

Poor: Some of us did but for the most part, no they didn't. You know the company got itself in a trap, it was getting very good margins and very good prices for its products and was selling at a good rate even during this period when the PCs starting coming out. But the problem was if you brought out a competitive product it would torpedo the existing market. And the management didn't want to do it. I remember a memo that Jonathan Schmidt wrote to the president of the company basically explaining we'd better do it now because if we don't somebody's going to do it to us. And that circulated around the company and I remember having a staff meeting with the president of the company and the other vice presidents and he was saying Jonathan just doesn't understand the problem, we can't do this and anyway he's overstating it, not to worry about it. Which he didn't, you know.

Hendrie: So and he didn't.

Poor: By 1984 we were really feeling the effects of the PC impacting the business and late in 1984 there was a hostile takeover of Datapoint engineered by Asher Edelman, I don't know if you guys remember that.

Hendrie: Yes, I remember that very well.

Poor: I had already left the company and left the board just like two months before and so in a sense I missed out on all of this but he had a proxy fight and he won and at that point the entire management of the company was dumped. Well not entirely, not the entire management but certainly the top management was dumped. I regret that I retired when I did because if I had just hung on there until that event I would have had golden handcuffs, would have had an extra payout, as it did I missed that. But that's all right I did well enough with the stock options, I'm not complaining. But that was the end of Datapoint, we went from 9000, the company went from 9000 employees at the time of the takeover on a worldwide basis, there were 6000 in the US, two years later there were 200 employees.

Hendrie: 200?

Shustek: What do you understand of Edelman's motivations, what was he intending to do?

Poor: Well his theory was that the company's assets were worth more than the company as a whole, he was going to sell of all the pieces. I don't think it worked, as soon as he bought the company he announced he was going to cut costs and the first thing he did was fire everybody out of the R&D department, Jonathan and Murph and all those guys were let go because he didn't…

Hendrie: …assign any value to them.

Poor: He assigned no value to them, they all started another company right away, Performance Technology, which you probably have all that information already. And as soon as they did that their orders dried up, nobody wanted to buy anything from a company that had just got in the computer industry that had just eliminated it's R&D department.

Hendrie: The customers were smarter than that.

Poor: The company just dried up very, very rapidly.

Shustek: If Edelman had not done this hostile takeover, what do you think Datapoint might have gone on to do or was it already too late because they'd missed the PC wave?

Poor: It was pretty late, I think the company was pretty badly damaged but I-- how it would have recovered I don't know, I really don't know. But that's just a speculation I don't think I'd try to get into. But Edelman certainly put a period on it real quick.

Hendrie: Yes it was already in trouble and Edelman…

Poor: Because see during this whole period from the time I joined the company until 1984, maybe 1983 along in there, every quarter had been a higher revenue-- higher net revenue than the previous. So we had like 15 years of quarter to quarter growth and then we had a down quarter. We had a down quarter, the stock was at 60 something, 66, 67, we had a down quarter and within 30 days the stock was 20. And that's when Edelman moved in.

Hendrie: Ah, okay. Can we take a pause now?

Poor: Sure.

Poor: …blossom and fade in this industry. I mean, where's Burroughs today, where is UNIVAC, and for that matter where is IBM? It's not the company it once was and where's Four Phase, where's Mohawk Data Systems, where's Data General? Is DEC still around? <laughs> No? Well, I've lost track. Who is the leader in the computer industry today?

Shustek: Microsoft?

Poor: Probably. Yes.

Shustek: Do you see it as healthy for the industry that companies come and go and that no clear leader is established for a long time?

Poor: I don't know. It's all right with me. <laughter> Well, the half life of these products is so short so what happens? Let's say Datapoint was still in business today. Would anything we have done in the 1970s and 1980s matter now? There wouldn't be any product still out there being used so what difference does it make as far as the user community is concerned?

Hendrie: From a business point of view, brand names and their reputations probably have a lot longer life than the products themselves.

Poor: Well, look at Hewlett Packard. It's in no way the same Hewlett Packard I knew 20 years ago. In fact, the Hewlett Packard I knew 20 years ago doesn't even have that name anymore. What do they call the instrumentation—

Shustek: Agilent.

Poor: Agilent, right? What does it mean? <laughs>

Shustek: There is some technology that continues on. Like you said, the original code that you wrote for the 8008 will still run in today's PCs because of that legacy.

Poor: Not that anybody would ever do it but-- <laughs>

Hendrie: Right, it probably doesn't matter particularly—

Poor: <laughs> That is right.

Hendrie: You are right, it does. Those things do tend to happen. I guess, I'd obviously like to continue from when you left Datapoint but I want to make sure that we've filled in enough detail in that intermediate period. In terms of-- when ARCNET first became a product and you developed that, you mentioned a few of the things that you went on to do. Are there any other developments that once you had this networking capability that you were led to or improvements in ARCNET?

Poor: Well, Datapoint got into some interesting businesses, not terribly successful but they got into them. One of them was telephone switching. They built an ACD and it's called an automatic call distributor, network based, integrated with Datapoint's computer system, but the division didn't do well and was ultimately sold. The whole division was sold off to another company and I- today I can't remember who that was. They built a laser printer, a high-speed laser printer, before those were commonly known, again driven off the network and somebody with a big Datapoint computer system, computer network, could have a laser printer, it had 20, 40 bins that you could run stuff into and have a central printing facility that printed very high speed, very high quality.

Shustek: Was this before Xerox's laser printers or at the same time, after?

Poor: I think it was before. It was just as the whole idea began to evolve. The developers of that were- was a team of guys that came from Harris, an electro-optical division of Harris. They were all keyed to build a thing like this and they did. Technically, it was a successful product. I don't think financially it did all that well but it enhanced the company, the stature of the company, overall which I guess has some value in itself. And of course we did the teleconferencing, the personal teleconferencing system, where you could sit at a Datapoint work station and talk and see the person you were talking to while sharing a computer facility. Now we do that today over Internet with NetMeeting and things like this because the machines are fast enough and the networks are powerful enough you can do it. In those days you couldn't handle the digital pictures so it was a combination analog picture, digital data thing using cable network facilities. So it was a different type of implementation, something that today would seem archaic.

Hendrie: But it didn't work over just the basic ARCNET network. You had to run another cable.

Poor: ARCNET ran in the-- ARCNET was part of the system but it ran in one of the TV channels on the cable facility. In other words, we would use the tools, the products, used to implement cable television to build the network.

Hendrie: Ah, okay. In this case you would implement the network with a different cable and a different…

Poor: And at the head-end of the cable where in a cable network you have a head-end where we bring in TV pictures. Instead we had a switch, a video switch that would switch between players.

Shustek: Was there any way to get geographical spread beyond the cable system? Could you go coast–to-coast?

Poor: Oh, yes. You could if you had the channel available but you had to have a video channel. Coast-to-coast video channels were costly but in fact some of our customers did that. Citibank I think did that for example. They had a nationwide videoconferencing system and they could extend it into their offices rather than going into a conference room using this system and I- the Defense Department made big use of it.

Hendrie: What about extending ARCNET to wider…

Poor: Well, you couldn't use ARCNET as such but you could use the wide-band channel to transmit packets from one geographical area to another but it wasn't part of the- of ARC.

Shustek: Did you have higher-level protocols to do…

Poor: Yes.

Shustek: …file sharing or direct-data access over long distances?

Poor: I don't remember any more. Yes, there were some protocols developed for doing that but I couldn't tell you what they were.

Hendrie: But that would be analogous to wide-area network connections today…

Poor: That's right. Yes.

Hendrie: …that join various local area networks.

Poor: Right. This was all pre-Internet.

Hendrie: Yes, clearly.

Poor: Internet has changed the way we look at the world now.

Shustek: It was pre-Internet but it was during the time of the network wars where the various physical topologies were fighting it out with each other. There was Ethernet, there was Token Ring, there was ARCNET.

Poor: You know…

Shustek: There were network-level protocols that were being argued.

Poor: You know Datapoint never got into the war. We ignored the war. We built complete systems, turnkey systems that did things and that's what we sold and none of us could care less about the network…

Hendrie: Which one was going to win out there…

Poor: Yes. It just didn't matter and I'm not sure it ever would have mattered.

Shustek: Well, there were certainly a lot of company resources spent in those wars trying to promote standards.

Poor: Yes. Well, not in ours. We didn't waste any resources on that. We just didn't ever do that.

Hendrie: You just attacked the problem and solved it.

Poor: We didn't do patents and we didn't do standards, we just did our thing right or wrong. I'm not about to argue the merits of it but that's how we did it. By the way, IBM was a lot like that, too. I mean, IBM tended to do their thing and if the rest of the world wanted to come along, well, that was their business.

Shustek: In some areas. They certainly did that for the PC but for example in Token Ring they made it an IEEE standard and they tried to get the rest of the world to adopt it as the standard.

Poor: Who ignored it.

Shustek: They did that with Micro Channel Architecture for PCs and…

Poor: Who-- Everybody ignored that too.

Hendrie: Right.

Poor: So what did they accomplish by it?

Hendrie: They clearly did not have enough vision to realize whether they could succeed or not. They wouldn't have tried it if…

Poor: Yes, but who does? Who does?

Hendrie: You're right.

Poor: I-- I'm sure we tried things at Datapoint that didn't work but, you know I can't even remember what they were. You just-- just once you see that something isn't going to succeed, you forget it, you go do something else.

Hendrie: Get rid of it, move on. All right, we are sort of at the point where you left Datapoint. Can you talk about what-- you decided to leave Datapoint because it just wasn't…

Poor: It wasn't fun anymore.

Hendrie: Wasn't fun anymore, all right.

Poor: Right. I stayed on the board for a while but the- O'Kelly was not happy with my basically walking out on him and so he asked-- he politely asked me to resign from the board and take a severance package and just forget it but I was already gone by that time. Well, what I did when I left Datapoint was Paula and I got on our boat and we went off to Europe. That was in the spring. I was…

Hendrie: The spring of what, eighty..

Poor: …four, 1984. Now I stayed on the board for a few more months but towards the end of that year I think O'Kelly wasn't happy about flying me back and forth from Europe for board meetings anyway and we parted company completely at that point and the very next board meeting was the one in which they had to face the Asher Edelman ultimatum and I was happy as hell not to be there, I didn't-- this is not something I would have enjoyed going through. But I did come back at the request of a colleague to take over as president of Image Data Corporation. Actually, that was a company whose name was Photophone Corporation but-- a small startup in San Antonio that was struggling but we changed the name to Image Data and focused our specialty on teleradiology and we did that-- I did that for about three years. You don't want to get into all this because it's-- there's no computer history here but-- and the company was eventually sold to E-Systems and after that I didn't take-- I didn't think I was going to take on any more full-time stuff but we went back to cruising on our boat. But in 1994 I came to Melbourne on a consulting project that was only going to take a few months to help get AirNet started, the spinoff out of Harris. AirNet builds cellular-based stations. Interesting product development, hasn't done much to do with computers, has a lot to do with DSPs [digital signal processors], and what was supposed to be a few months turned out to be about 2-1/2 years before I extricated myself <laughs> from that project and then I retired. Since I've taken on any more full-time work other than briefly for Globe Wireless as I mentioned before.

Hendrie: What was the AirNet's-- what was their proprietary-- what was their different idea?

Poor: Well, the engineers at Harris developed some DSP technology that was operated at very, very high speeds and they could take an entire band of cellular signals and receive them on one receiver, process them through one DSP and digitally break them out into individual channels and do the reverse. So a cell site could get by with one transmitter, one receiver, this exotic DSP and then everything else was digital, the whole thing was digital, and that product is being marketed today by AirNet and it's a GSM [Global System for Mobile Communications] product and they can have any number of GSM signals passing through a single transmitter and single receiver and it's used all over the place. It was certainly an economical way to implement a base station because you didn't have to have a separate transmitter, receiver pair and antenna multiplexers and all this at each cell. Now if you had-- if you're familiar with cellular systems, they typically have three antennas and if you have a three-antenna system then you have three of their little cell products and then they built the underlying controller that interfaced with the telephone network from the cell site. They're fast things to install because again the simplicity of the product. One of their recent noteworthy installations was in Afghanistan. After the Afghanistan war there was no telephone infrastructure at all and they basically heli-hutted(???) in and dropped these cell phones around Afghanistan and, by the way, the cell sites also have a characteristic that within the band pass of the cellular network the cell sites talk to each other so you don't have to have any wireline backhaul. So you now have a whole network just by planting the cell sites.

Hendrie: That sounds like a very innovative product…

Poor: And the …

Hendrie: … relative to the original technology for cellular.

Poor: And this is what got me into DSPs and the amazing things you could do with them. Of course, this was not a chip DSP.

Hendrie: Of course not.

Poor: They had a whole bunch of chips that were special built that they had to-- we had to fund there at AirNet just to build this DSP but the DSP was a card like this. I haven't kept up with them so they-- I'm sure they've improved their technology since then.

Hendrie: Do you remember how fast that first one that was on the board? What clock rate it was running at?

Poor: Oh, it was gigahertz. I don't know. <laughs>

Hendrie: It was very fast.

Poor: A lot of parallelism.

Hendrie: Ah, okay. Very interesting.

Poor: Well, this stuff had been developed-- The fundamental technology had been developed at Harris I believe and I don't have this officially but I believe it was basically for eavesdropping, so they could go in and look at a wide spectrum, digitize it and then use the digital image to go in and analyze the signals that were present, decode them and read them, and the engineers figured out that this would make a nice cell base station but the prod-- the reason I suspect that this is how it was with Harris was that the Harris technology was only a receiver. AirNet had to develop the transmitter equivalent to it which they did so that they had the full base station.

Hendrie: Ah, and they used the same fundamental…

Poor: The same fundamental…

Hendrie: …the idea in reverse.

Poor: In reverse. Right.

Hendrie: So that you only had one transmitter. A broadband transmitter that would transmit at the right…

Poor: Uh huh.

Hendrie: …frequencies. Very interesting. Well that probably-- that sounds right. Was it small enough to fly in a…

Poor: <laughs> Well, I don't know what Harris did with it but the AirNet product was obviously designed for commercial use and went in racks and sat on helots(???) and so on.

Hendrie: Well, let's see, what other things should we try to cover?

Shustek: How about some philosophical questions about engineers and managers.

Poor: <laughs>

Shustek: You've done both and that's a transition that some engineers find very difficult, to move from doing engineering to managing other people who do engineering. Do you think the same person can often do both or does it take a different mindset or do you better understand the engineers having been an engineer when you try to manage them?

Poor: Well, what's that cartoon?

Shustek: Dilbert?

Poor: Dilbert. You know the guy with the pointy hair? Well, that's what I felt like as a manager. I don't know. I don't feel like I ever succeeded very well as a manager despite all the exalted titles I've held in the past. I've had my CEO card punched, I've been an executive VP, I've been a chief engineer, I've been technical director for a company, all this crap, and the management side of the coin I have always felt like was done half baked. I never had a knack for it.

Shustek: Have you seen people who do have a knack for it?

Poor: Not especially. I mean, I have seen people who probably do better than I did, <laughs> maybe a lot better, but I don't think anybody's so smart that they can be the best engineer in the world or the best manager in the world. I will say this. I haven't seen any examples of good managers of technical programs and technical projects that didn't understand the technology. The idea of the pure manager strikes me as being pretty farfetched…

Shustek: So the only hope for a good manager is to find an engineer who can then graduate into being a manager, shift I shouldn't say graduate.

Poor: Well, or at least somebody who understands technology even if they are not necessarily good as a developer or a designer but I don't know. This "In Search of Excellence" book, I've forgotten the guys that wrote it…

Shustek: Tom Peters.

Poor: Yes. They came and interviewed us at Datapoint. I had a long interview with him and I- and we were- the Datapoint thing was written up in there and I couldn't- I didn't even recognize myself in there. He made it look like we were geniuses and it just is not true. It's just not true. We stumbled around on everything we ever did.

Shustek: Maybe that's the trouble with writing history is you tend to want to make it neater than it really was.

Poor: <laughs> That's right. It is.

Hendrie: And more idealistive. It's a romantic instinct…

Poor: I'll tell you. Running a high-tech business is real messy. It just really is.

Shustek: There's one school of thought that says the best way to manage engineers is to give them the resources and stay out of their way.

Poor: If the engineers are any good. It doesn't-- It is important to get guys like Harry and Jonathan and Murph and others of that caliber. Not only are they good designers, but they also have good imaginations. They can-- they don't need much in the way of clues to get started on an idea and get a product...

Hendrie: And they have good judgment on the way.

Poor: But I've had engineers work for me who could design everything out to six places but if you didn't tell them exactly what you wanted they had no idea what to do and they tended to work on manufacturing engineering <laughs> and I think that's fine if you're building a bridge but what are you going to do when you're- when you don't even know for sure how your product's going to be used? It's-- I don't know.

Shustek: What's your advice to new engineers about what kind of companies to look for, big companies versus small companies? Do you learn things by being part of a big company that make it useful or is it just too frustrating to be in an environment like that?

Poor: Well, that depends on the company. I never had any experience with a big company to speak of. I mean, I did work for a short time for Stromberg Carlson in a design role but it was a small group, almost a skunkworks, that was functioning as if it was a small company, as it was Stromberg Carlson in San Diego and not Stromberg Carlson in Rochester, New York, where the home office was. I just-- You know, the only big company I ever worked for was of my own making in a way, it was Datapoint, and I'll tell you, when it got big it got frustrating and the innovation was harder and harder to come by. There was one reason I think in a big company that an innovation is harder to come by is that there are so many naysayers. For every idea, there are that many more people willing to tell you why it can't work, won't work, shouldn't be invested in and so on. In a small company there's just not that many people around <laughter> Maybe that's all there is to it, I don't know. And I'm as guilty of naysaying as anybody.

Hendrie: All right, very good. Well, we'd like to thank you very much for taking the time to do this, Vic, and…
Poor: It was my pleasure.

Hendrie: I think it was very interesting.

Poor: I hope it was useful. <laughs>

Hendrie: It definitely is very useful. Thank you.

END OF INTERVIEW

