Oral History of Paul Severino

Interviewed by:
Gardner Hendrie

Recorded: June 19, 2008
Concord, Massachusetts

CHM Reference number: X4966.2009

Gardner Hendrie: We have with us today Paul Severino who has graciously agreed to do an oral history for the Computer History Museum. Thank you for coming to do this, Paul.

Paul Severino: I'm very happy to be here.

Hendrie: What I'd like to start with is to maybe cover some of your early years and your family background. Could you tell us a little bit about your mother and father, what they did, where you were born, siblings that you had? Cover that area a little.

Severino: Okay. Well, I was born in 1946 in Patterson, New Jersey,(laughs) a long way from Massachusetts, pretty much a mill kind of a town, Italian family, an immigrant family. I was second generation. My father went to high school in Patterson, my mother went to high school in Patterson, and neither went to college. My father went to the army in World War II, served in Europe, came home, married my mother in 1944 I think, and I was born in 1946. My dad was a machinist by trade, a mechanical person, a very good machinist, had lots of skills and was very good at fixing problems in the area of machining metals, worked for a aerospace company and it wasn't really aerospace in those days. It was called Curtiss-Wright Corporation. My mother pretty much was a mother the whole time and we actually lived in Patterson in an Italian neighborhood in a double-decker house with grandparents on one floor and us on the other. And when I was about sixth grade we moved out of Patterson to a suburb town called Totowa, New Jersey.

Hendrie: Right—

Severino: Right next—

Hendrie: --the Curtiss plant in—

Severino: They were big in New Jersey. They had plants- a number of plants in New Jersey. (laughs) Yes. Curtiss-Wright made aircraft engines. A lot of the piston engines in World War II were made by Curtiss-Wright. Went to public school number #15 exactly. In Totowa we went to the public schools as well. I think I got my first inkling of deciding that I might want to be something technical in my life-- When I went to high school I made a choice to go to a technical high school versus the regional high school, and the technical high school was in Patterson actually, run by priests and brothers, Salesian priests and brothers—

Hendrie: You went to a Catholic school.

Severino: Went to a Catholic technical high school called Don Bosco Tech—

Hendrie: Were you an only child? Do you have any siblings?

<crew talk>

Severino: I have a younger sister who was born in 1950. She's doing well. She actually went to the regional high school a few years behind me, about three years behind me, but I went to this technical high school. It was in 1960 when I started. It was a school built in an old mill actually because there were a lot of mills in Patterson and so they built this school. They actually took over this old building and put this school in there and it was really started as a trade school in the late 1940's.

Hendrie: It was a relatively new school when you went to it

Hendrie: --15, 20 years——

Severino: Yes. The Salesians were very interested in teaching trades and the whole religious order started in Italy by a priest,, who became a saint later, who basically did that. He taught kids in Turin, Italy, actually.

Hendrie: Were there any experiences that you remember you had before you made this choice to go to a technical school that might have sort of pushed you a little bit in that direction or said this stuff is sort of interesting?

Severino: Well, I think what happened was that I always liked the kind of tinkering around with things and my father was always working in his shop down in the basement so I was always helping him so I was always around tools and things like that.

Hendrie: He enjoyed being a machinist because he would go down and work in his—

Severino: Well, he'd fix everything.

Hendrie: He'd go work on things even when he wasn't at work.

Severino: Yes. He'd fix the whole thing. He'd fix everything so that's how I kind of got the interest in that, but the interesting thing about the school was that they had a lot of trades but there was a priest there who was very much into the electronics side of things and he built an electronics program there that actually was very, very advanced. Just to give you an example, when I was a freshman we took DC circuits and the way it worked is we had half of our day at school was in our trade shop if you will and in our case it was in electronics and the other half was in academic. Okay. So you took all of the standard English and math and all that stuff and then you spent half your day every day and so it was really a place where people learned how to do trades. And we had a lot of mechanics. We had machine shop. We had drafting and mechanical design. We had electronics. We had printing. We had all that sort of thing and it was all boys. It was male , but the priest that did the electronics shop was very, very advanced and so I was literally in my freshman year doing things like an AC circuit analysis, doing things like imaginary numbers, and it was called the j operator. And then literally we had a textbook that we used in the shop

called Basic Mathematics for Engineers. I still have it. And we actually were learning calculus in our freshman year in the shop, so the shop was not just go there and work on radios.

Hendrie: Solder and—

Severino: Right. The shop was learning. We had a room called the theory room which was a classroom and that's where we learned Ohm's Law and Kirchhoff's Law and all that stuff as freshmen, and so there was a real connection there. It was interesting because most of the other students in the school that were taking some of the other shops had life kind of easy because they didn't get a lot of theory in their shops but we had a lot of work to do.

Hendrie: You had a lot of intellectual work besides—

Severino: Right. Exactly. So that was a great experience and over the four years we learned a lot about electronics. I actually as a freshman became a ham radio operator, got my general class license when I was a freshman and doing morse code and all that stuff, had my own ham radio stuff at home, things like that. So I've been doing this electronics thing for a long time.

Hendrie: Did you build anything, any particular projects that you remember that were sort of—

Severino: Well, the way it worked is this was a private Catholic school so we paid tuition to go there. Tuition wasn't very expensive but we paid it. We would have a program by which we would do experiments and as part of the experiments we'd actually have to build our own Heathkits, test equipment, so we would have to buy the test equipment ourselves from Heathkit, an order you would place, and it would come in to the school. And then part of what we did was learn how to build this stuff and then make it work and then use the test equipment in our experiments.

Hendrie: Did you get to keep the test equipment?

Severino: Yes. It was ours.

Hendrie: It was yours.

Severino: And In our senior year we actually built an oscilloscope.

Hendrie: That's really pretty advanced.

Severino: We had RF generators. We had EDVMs. What do they call them? It was an electrical digital volt meter or something that you plug in and I can't remember the whole name. We had all kinds of test equipment. I can't remember it all but I remember the oscilloscope in the senior year.

Hendrie: I bet that was a really big project—

Severino: That was a big project. Yes.

Hendrie: You really got a hands-on—

Severino: A lot of hands-on electronics.

Hendrie: --but the theory so you understood how it worked too. It wasn't just tinkering with stuff.

Severino: Right.

Hendrie: This particular priest I guess was pretty influential.

Severino: Yes. He was. Well, He actually taught us for four years although he did have some help and there were some years when we would get taught by some of the other Salesians. Sometimes they were priests. Sometimes they were what was called Salesian brothers, not ordained priests, not ordained but part of the religious order anyway. Yes. The school had a big sports program, especially basketball and running cross country, things like that. I wasn't involved in the sports program. I actually liked to play baseball but I just didn't get involved because I was way too busy with my electronics. We actually had a kilowatt ham radio set up there, all Collins equipment. We had a huge antenna on the roof of the school building that was one of these beam antennas with rotators and everything so we used to do a lot of ham radio out of there. We had a huge audio section. We had a studio actually and it was all acoustically treated and we used to do a lot of tape editing and things in there. There was a lot of activities going on.

Hendrie: You participated in lots of them.

Severino: Yes. I think the best one was in our senior year the priest that was teaching us taught us computers.

Hendrie: What was the first introduction to computers?

Severino: Yes, and that was it and he was very enamored with the PDP-8, so here I was a senior in high school in 1964 and he had all the information on the PDP-8, everything, and he even had some of the digital building block modules that you could buy, the flip-flops and everything else, and we used to build logic with those things. There was ways with little patch panels that you could build—

Hendrie: DEC had a product line—

Severino: That's right.

Hendrie: --that allowed you to do a lab line—

Severino: That's right, and that's what we had.

Hendrie: --put gates together and—

Severino: And we had that as seniors and so I became very aware of Digital Equipment and the PDP-8 in 1964 when I was in- a senior in high school and it was pretty—

Hendrie: That's pretty early.

Severino: --it was pretty amazing. Yes.

Hendrie: They did not have a computer though.

Severino: We didn't have a computer and I'll talk about that because it turns out that in the future there was a connection there between Digital Equipment and the school. So that's how- that's sort of how I got in to the technology space.

Hendrie: When you're getting to thinking about going to college, was this something that was sort of your parents wanted you to go to college? Was it sort of expected that you probably would go to college—

Severino: Yes.

Hendrie: What were the expectations—

Severino: Well--

Hendrie: --on the home front for your education?

Severino: Well, it was interesting I actually graduated number 2 in my class. There was only 75 or 80 kids but I was number 2 and it turns out that by the time I got to be a senior with all the work that I had done in the electronics area, and I still liked that, I actually decided that I didn't want to go to college right away. And so I didn't even take the college boards when I left high school.

Hendrie: Did your parents think you--

Severino: They thought I was making a big mistake.

Hendrie: They wanted you--

Severino: --but they didn't--

Hendrie: --to go to college.

Severino: Yes, they did. Yes, they wanted me to go. Right.

Hendrie: In their mind our son's going to go to college. We didn't but our son's going to go to college.

Severino: Right. So it was a disappointment.

Hendrie: What did you do?

Severino: So I went to work and I was 17 years old when I graduated. There were some bigger electronics things around New Jersey. I can't remember. It was some aerospace stuff and everything else but the problem was every one of those companies required you to be 18 to be able to work there. They had certain regulations. Yes. Maybe it was a state regulation. So I wound up getting a job out of high school in a small company in Patterson, New Jersey, that was in an old mill.(laughs) This is a theme.

Hendrie: Exactly. I can smell those coming, some more old mill stories.

Severino: And they made this big extruding equipment, extruders, and it turns out that extruders had control systems which were all these Honeywell set point controllers, things like that, and they had to build all the wiring and everything for that, and so with my sort of technical electrical background I wound up getting this job there. And it was a job that paid minimum wage and it wasn't very exciting but it was a job so I took the job.

Hendrie: Had you worked at all when you were going to school?

Severino: I worked in the summers. There weren't any real companies around there to go out and find jobs.

Hendrie: I was just curious.

Severino: Yes. I worked in the summers doing different jobs but it wasn't anything. I didn't get in to anything like that.

Hendrie: They weren't anything that were in your field. It was just typical—

Severino: Right, and plus it's awful hard for employers to figure out that someone who is maybe 14 years old or something really knows anything about electronics.

Hendrie: They normally don't trust you.

Severino: Right. So I guess that's what happened there It was a hard job and it was working in the shop. they did everything , they were totally vertically integrated. They did all of the machine work and all then all the machinists they put all the parts together and they built these extruders and then we'd go in and build the panels and put all the relays and the set point controllers together. And it turns out it was a very good education. It really was. So three months in to it I figured out that it's time for me to think about going to college.

Hendrie: Your brash thing,<laughter> I don't want to go to school anymore, I want to work-- Yes.

Severino: So I put my mind to doing that and it turns out that because I took electronics and all this other stuff, I never took chemistry in high school so I had to take a high school chemistry course before I could apply to colleges and I had to take the college boards, so I took the college boards I think in November or-- I'm trying to remember. I think it was November or December of 1964, which is the year I graduated from high school, and I took them once. I got my college boards and that's- in those days you thought you took them once, that was it. Yes, and today you can take them seven or eight times if—

Hendrie: Right. You keep trying to take--

Severino: And kids do that.. So I took them once but for me the decision about going to college was pretty much a simple one because it was going to be in New Jersey and it was going to be commuter just because of financial stuff, so I hadn't really thought doing anything else and so I had a choice of schools in New Jersey. There was a few, Stevens Institute of Technology, Newark College of Engineering, Fairleigh Dickinson. Those are probably the main ones.

Hendrie: Those were the three that—

Severino: Yes, and I never applied to Stevens because Stevens was in Hoboken and Hoboken was a dangerous place.(laughs)The Newark College of Engineering was in Newark and that was a dangerous place too but that was inexpensive because it was a state school.

Hendrie: It was a state school. And you—

Severino: So I thought—

Hendrie: You definitely were going to do engineering--

1. **Severino:** Yes. I was going to do engineering.. I wanted to be an engineer so I applied to Fairleigh Dickinson and Newark College of Engineering. It was called NCE at the time. Now it's called NJIT. It was difficult to get in to because it was so inexpensive and just about any student in New Jersey that wanted to go to engineering school pretty much applied there so I didn't get in to NCE but I did get in to Fairleigh Dickinson.

Hendrie: You did get in to Fairleigh Dickinson.

Severino: Yes, and so I went to Fairleigh Dickinson and so I finished my time out in this company and then went off to Fairleigh Dickinson.

Hendrie: You worked through the year until—

Severino: I worked through the year. Yes, of course.

Hendrie: --until the—

Severino: Until September. I worked up until the day before I went to Fairleigh Dickinson.

Hendrie: Collect the money.

Severino: And tuition was $650 a year at Fairleigh Dickinson. It was only 300 and some dollars a year at Newark College of Engineering if I remember correctly.

Hendrie: These numbers are just appalling these days, aren't they, for a year?

Severino: Yes. So I went to Fairleigh Dickinson and took electrical engineering and I did very well. I did really well. I don't remember all of my exact numbers.. The first summer I went back to that machine shop again and worked there again because I knew the job so well. They really wanted me back and I filled in for a lot of the people who were on vacation during the summer so I was a good match for that and I went back there. And it turns out that I went back there every year during my time and by the time I was going in to my junior year they put me in the engineering department.

Hendrie: Oh, really.

Severino: Yes, so I became part of the engineering department.

Hendrie: Tell me a little bit about what sort of things you did, sort of specialized, at Fairleigh Dickinson--

Severino: Well, I took electrical engineering, right, and it turns out that all of the engineering curriculums in those days pretty much your freshman year was the standard stuff, physics, calculus, chemistry I think. I think we had one semester of physics, one semester of chemistry, calculus two semesters and then there was some of the elective stuff that you did. So I did all that

Hendrie: Did you have to do the power engineering?

Severino: No, I didn't do that—

Hendrie: By then they had split out.

Severino: Yes. And then the second year again, there was some electrical engineering in there. There were some of those network- resistor network kind of engineering, learning about all the laws and the Kirchhoff's Law and Ohm's Law and all that stuff, which I learned in high school.

Hendrie: You already knew that. That was easy.

Severino: Yes, but I think the real interesting part is that I went there and I remember my last term there I had a 3.8 cumulative so my total cumulative was 3.4 or 3.5 or something like that, and I went back to this company in the summertime between my sophomore and junior year and—

Hendrie: Do you remember the name of the company?

Severino: Yes. John Royle and Sons, R-o-y-l-e. They're still around actually. They still make these extruders. Actually, there was a lot of interesting things about that business and some of the technology they used to do these because they made extruders that actually coated high-power cable, high-tension wire cable They did the whole thing where the extruder would coat the cable. They would take it down a pipe. They would cure the cable as it went down the pipe and they would take it off the pipe and put in on. They made all the equipment that did that. Yes. So I got involved in a lot of that as well once I moved over to the engineering side, but the interesting thing was that I met a young guy who was actually also working in this company and he went to Newark College of Engineering. And he told me that he had transferred to Rensselaer.

Hendrie: Partway through—

Severino: Well, he had just transferred. He hadn't started at Rensselaer. He finished two years at Newark College of Engineering and he was transferring to Rensselaer. He was actually married and had some children and they had married student housing. He was a very smart guy and asked me what my grades were like and I told him about my grades and he said, "Why don't you transfer to Rensselaer?" And I said to him, "Well, maybe I should take a look at it." And so I did. I took a look at it and got all the stuff.

Hendrie: Got the material, looked at it.

Severino: --made the application, and in June of 1967.

Hendrie: You've just completed your—

Severino: Sophomore year—

Hendrie: You were sort of doing the same track he was because he transferred—

Severino: Well, Yes. I—

Hendrie: He was transferring at the end of sophomore year after two years.

Severino: I hadn't thought about transferring until I talked to him.

Hendrie: You hadn't until you talked to him. He put the idea in your head.

Severino: My thinking at the time was I have good grades and Rensselaer is a place that if I went to Rensselaer and graduated from Rensselaer I think it would give me a great opportunity in my career and it's worth at least taking a shot at it. Well, the bottom line is I made the application. I didn't hear anything for about a month right through July. In the early August I got a letter from Fairleigh Dickinson telling me, "Here's all your stuff. You got to sign up. Send your check."

Hendrie: Send your money.

Severino: So I said, "Well, I haven't heard anything from Rensselaer," so I actually got on the telephone one day at lunchtime at the company and made a call to the admissions office at Rensselaer, and I got the admissions director on the line and he started to talk to me and got my file out and went through and asked me a few questions and then proceeded to accept me on the telephone.

Hendrie: You're kidding. Wow. <laughter>

Severino: And he said to me, "Well You're accepted," and he says, "Do you have a place to live?" And I said, "No. I haven't even been to the school yet." And so he said, "Well, why don't you come up next week and we'll get you all squared away and find you a place to live and get you signed up." And so that's what I did. In August I went—

Hendrie: That's called a late acceptance.

Severino: --I took my first trip up to Rensselaer.

Hendrie: Were there any economic problems? Did Rensselaer have an even higher tuition?

Severino: Yes. Rensselaer's tuition was $2,000 a year. The good news was I got scholarships and I got loans, so the bottom line was that I could afford to go there. It was about the same out-of-pocket costs. Of course, I paid the loans off later but- as was done at Fairleigh Dickinson, and I had to live there as well so it was the first time I actually—

Hendrie: Now you weren't living at home anymore.

Severino: Yes. Right. And I will say that I went there in September of 1967. I did the same thing I was doing at Fairleigh Dickinson. I would study, I would do all those things, and the first three tests I took I failed them cold and I never failed a test in my life <laughs>at Fairleigh Dickinson and so I realized that this was a really different place and—

Hendrie: Different standard here.

Severino: Different standards, right, and so I actually thought about leaving and going back to Fairleigh Dickinson and I actually called Fairleigh Dickinson and they told me that they were not interested in taking me back because the term had started but they'd certainly take me back in the next term if I wanted to, and being very focused on my financials, as I was, I decided that since I was there and I'd paid for this then I'm staying. And so I stayed and I basically stayed and did very well and then did the next year and the next term—

Hendrie: You figured out what you had to do and—

Severino: Right. Yes. So I got my electrical engineering degree at Rensselaer in 1969 and it was a great experience. I learned a lot. I got to really love the place I guess is a better way to put it, but I was only there two years and I didn't have the same experience that so many of the students had that were there from the beginning, the fraternity experience and all. I just wasn't part of that because then when I got there I was almost 21 years old so I wasn't joining a fraternity for a year, but anyway it was a great experience. I really liked it a lot and made some very good friends.

Hendrie: Did you specialize? Tell me a little bit—

Severino: Well, no. Again in those days it was electrical engineering and the curriculum was pretty much you took circuit design courses; you took electromagnetic theory and all that stuff; you took logic design. You did your Fortran programming on punch cards on an IBM mainframe and then you'd have to go put in late at night and get to the punch cards and all that stuff. That was the experience.

Hendrie: So there weren't a lot of electives that allowed you to sort of specialize a little bit.

Severino: That's right. I liked the logic design course. I thought that was good and my real focus was it was time for me now to go out and get a job and get moving on this career thing, and this is where the PDP-8 comes in from high school. So I'm looking for jobs and I'm on the boards looking for jobs and I'm a senior. Rensselaer had a great placement office and companies flocked there to hire engineers as you know. Your son went there.

Hendrie: Absolutely. It was a prestigious school and everybody wanted Rensselaer engineers.

Severino: Yes. It was good. So I had my choice of interviews but I looked on the board and there I saw Digital Equipment Corporation coming to interview and I said, "Wow. I remember Digital Equipment, PDP-8's." Now most of my college associates and friends knew nothing about Digital Equipment Corporation because in 1969 it was about 12 years old. It was about a $70 million a year company and unless you really knew about mini computers, which were a brand-new area-- But we had no mini computers at Rensselaer at the time.

Hendrie: Really.

Severino: Yes. None, zero.

Hendrie: Zero, just the IBM mainframes to—

Severino: IBM mainframe. That was it.

Hendrie: --to run the—

Severino: To run Fortran.

Hendrie: To do Fortran—

Severino: They probably ran all the programs on it. I didn't know about the other programs. All I knew about was—

Hendrie: They may have run administrative stuff too on it.

Severino: Right. Yes. All I knew about was McCracken and Fortran. So I did a bunch of interviews and actually interviewed with Digital Equipment Corporation and I figured that it was kind of meant to be that I was going to be there because the fellow who came to interview me—

Hendrie: Who interviewed you?

Severino: was named Dave Mitchkie who I knew for a long time but Dave was a salesperson in Rochester, New York, a young guy, who was selling digital in industrial process control areas, these PDP-14 controllers that they had.

Hendrie: Yes.

Severino: So he sits down with me and I tell him my background. I worked in this machine shop, I built these control systems for extruders, getting my electrical engineering degree at Rensselaer, and guess what. He thought I was a great fit.

Hendrie: He said, "He has some real practical experience and things—

Severino: Right. And so I interviewed at Digital and the nice thing about it was when I got to Digital and I saw the old mill I knew I was going to be working there <laughs>because it was just another old mill<laughter> where I went to work in high school and then everything else. So the old mill at Maynard was where I wound up going and I worked in the group that did industrial process control and analog to digital converters. So I wasn't working on computers' designs. I was working on the peripheral stuff.

Hendrie: Did you look at any other companies besides DEC seriously or—

Severino: But most of the companies that I looked at were companies that were like the Boeings of the world, the 3M's, the Monsanto, things like that, big companies.

Hendrie: Big companies.

Severino: I did not have a concept in those days about business and about size of companies I can honestly say that when I went to work for Digital I had no idea about Digital financials. I didn't know how much revenue they were generating. All I knew it was this company that was booming, there were people

working hard, and I liked what I saw and I liked the fact that I was working in this area of industrial control stuff and things like that that I--

Hendrie: That felt very comfortable.

Severino: Yes. So when I received that offer I definitely decided that's where I was going and so that was a very key thing for me because when I walked in the door at Digital it was still a very entrepreneurial company, very entrepreneurial, and it was a place where you- as a young engineer you got to work with engineers who had lots of experience and there were lots of engineers around.

Hendrie: It was an engineering-oriented company for sure.

Severino: Right, and I remember working with engineers that had badge Number 50 and badge Number 70 and badge Number 100 or 200 and just sitting around the lunch table you would hear the stories about how they came in to the company and wound up having to paint their own offices and did this with Ken Olsen and did that with Stan Olsen and did that with all the founders. And so it was a very exciting place and I kind of took to it.

Hendrie: You really liked it.

Severino: Yes, very strongly, but I must admit that when I walked in the door I didn't know anything about computers really. I thought I was a hot shot with my electrical engineering degree from Rensselaer but I realized that I didn't know a whole lot about this technology, and so I spent the first couple of years very intensely taking on things and trying to learn them. And Digital was the kind of place where they flew a young engineer in to the mix and there wasn't much training. There wasn't any long programs of doing little diddly stuff. They wanted you to become productive very quickly.

Hendrie: They hired people they figured could swim in this environment and--

Severino: Right.

Hendrie: Do you remember what any of your first projects were—

Severino: Yes. We worked on a major new product area for Digital which was to build add-on products for the mini computers, the PDP-8's in those days That both had A to D converters associated with them and then also had all of the industrial process control requirements like digital I/O that was isolated from the computer using relays and analog to digital conversion, which was isolated from the computer using a technique called flying capacitors. I don't know if you ever heard of that but it's an interesting technique and having a whole subsystem where a customer could build lots of contacts and be able to put in these boards that allowed you to connect to these industrial floor products that turn on relays and turn on equipment and things like that for the computers. So it was very interesting—

Hendrie: Probably read thermocouples, do—

Severino: Yes, just do a process control essentially.

Hendrie: The classic kinds of things.

Severino: Very much like the Foxboro business was but this is done by Digital because that's what Foxboro did. Foxboro was trying to take their controller-- Foxboro used to make these set point controllers like I used for example in the extruders and then they were going in to the computers and they were buying Digital Equipment, computers, to do that. So-- But it was an interesting time because I was only at Digital from 1969 to 1972. I was there 3-1/2 years but I worked on a lot of different things including the first A to D converter for the PDP-11. It was one of those projects where the PDP-11 was ready to be introduced. It was clearly targeted to Data General—

Hendrie: Yes.

Severino: They needed an A to D converter right away so I was asked to build a subsystem to do that

Hendrie: An A to D converter subsystem so it connected to

Severino: Yes. It connected on a Unibus.

Hendrie: Not a free-standing A to D converter but connected to the Unibus—

Severino: Right, connected to the Unibus.

Hendrie: --had sample and hold circuits and—

Severino: That's right.

Hendrie: --and all of that sort of—

Severino: Well, yes, so there was two parts of this thing. Right. At Digital our group actually built modules that plugged in to the standard Digital backplanes which were all wire wrapped by the way, and so we had an analog section of this wire-wrapped backplane and we had an interface section of the wire-wrapped backplane, and what I was doing was the interface section. I started out basically feeling that I liked connecting to the computers and working on the computers more than doing the analog design so I wasn't an analog designer. I did some of it but I didn't really enjoy it.

Hendrie: It wasn't something you decided you wanted to become a specialist in.

Severino: Right.

Hendrie: All right.

Severino: So where did we leave off?

Hendrie: Well, we left off that you were working on the PDP-11 but that you weren't doing the analog necessarily, the analog part of it.

Severino: Right, we were doing the interfaces, right. And then we did this very big industrial subsystem thing and it turns out that in my group I always like to figure out well, where is, you know, who's doing all this stuff, and where's the work being done and everything. So I'd walk around the company a lot and get to know people that were doing sheet metal because of my background. And so I actually became pretty good at getting my projects through the system at Digital because I got to know a lot of the people.

Hendrie: Yeah, the support people, the people that had to do stuff that you needed to do stuff to make your thing...

Severino: Right including people who did layouts of the printed circuit boards, people who wrote diagnostics for our products and things. Then I took a real interest in understanding, well, how does a customer see this thing? And so I got very focused on writing manuals myself even though we had manual writers. And manual writers would write the description stuff, but I would write how to calibrate these A to D converters or how to configure these things to make sure that it was very clear to people, this is exactly how you have to do this. And it's interesting that the A to D converters at Digital in those days in that whole-- any kind of equipment that wasn't just plug and play on the computer was always tough for the field service people to deal with. And the reason was that, as I looked at it, the documentation was just not very good. So I spent time figuring out what we had to document and how we had to do it. So I got a lot of kudos <laughs>from field service saying, "Hey, these are the first A to D converters, by gosh, you can go in and install because there's actually some good documentation around them.

Hendrie: Yes, I can figure this out. When something doesn't go right, I can-- or what I have to do.

Severino: So I started to train field service people. I started to do things like that. And then I became more of a project manager in very quick order, right?

Hendrie: Well, this is project oriented work. You're worrying about the overall project not just designing your little narrow-- putting your logic gates down.

Severino: Right, exactly, and it only took a couple years for me to get to that point. And then in 1972, well, something interesting happened. In 1970 Data General, Data General went public in. It started in what, 1967?

Hendrie: Yes, 1968.

Severino: Sixty-eight, but it went public in 1970 or 1971 if I remember correctly.

Hendrie: Right.

Severino: And I thought that what I really wanted to do was be in a startup company and I missed that at (Data) General because I was only a right out of college a 1969 graduate. And I was going to kind of figure out how I was going to do that. And again, something happened that kind of fell into my lap.

Hendrie: Now, did the economics influence you or what? What is it that influenced you to do this?

Severino: What influenced me was-- what influenced me was that by the time...

Hendrie: I mean, there are a lot of possibilities.

Severino: Yeah, well, it was really pretty straight forward. The group that I was in, in 1971 got kind of reorganized and they changed managers around, and the job changed, and it was not the same kind of environment.

Hendrie: Who had been your manager before ?

Severino: Well, I mean, there was a couple of levels, right?

Hendrie: Yes.

Severino: My direct manager was a fellow by the name Clark Crocker who was a very good analog designer and actually that was his real expertise, but he wasn't a great engineering manager. He was a good, very good analog designer. There was another guy who was kind of the product line manager. At Digital they called them the product line managers, and he was kind of an executive type guy. His name was Ron Noonan]. I don't even remember what happened to him.

Hendrie: I know Ron Noonan.

Severino: I'm sure you know him..

Hendrie: Yes, okay, I used to work with him.

Severino: In?

Hendrie He was at RCA before Foxboro

Severino: Oh, yeah. Used to smoke cigars?

Hendrie: Yes.

Severino: Yes, same guy.

Hendrie: Okay.

Severino: Like to sail.

Hendrie: Yes

Severino: He was a big sailor.

Hendrie: Yes.

Severino: Anyway, so, anyway it all changed around so I was kind of getting to the point where I felt like Digital was turning into a bigger company, and it was. It was growing like crazy.

Hendrie: Well, it was growing like a weed.

Severino: So my boss, Clark Crocker, decided to leave Digital for that reason as well, and he went to Prime Computer in 1972, in February of 1972, employee number 15, 16, 17 whatever at Prime Computer.

Hendrie: Now, who recruited him?

Severino: Prime.

Hendrie: Somebody at Prime.

Severino: Yes, because Prime was going to build a Honeywell replacement mini computer and it needed analog to digital converters, right?

Hendrie: All right.

Severino: They were going to sell them to the same markets that Honeywell were selling them to and part of it was process control A to D converters. And Clark went there in February and in October of 1972 he called me and said, " I've got to build all this stuff, I need to have what you can bring to the table." And I went down and interviewed with Prime Computer in 1972. They hadn't shipped-- they were about to ship their first computer in October of that year. And that's pretty good considering they started in February.

Hendrie: Uh-huh, that is pretty good.

Severino: Or January. They probably started earlier on the design, but the money actually came in, I think, February of 1972. These were wire wrap boards now, not backplanes, but wire wrapped boards.

Hendrie: Big wire wrapped boards.

Severino: So that's how they managed to do it. Bit-slice architectures, 16-bit, Honeywell instruction set, Honeywell interface, I/O interfaces, so very compatible with Honeywell, everything Honeywell, because Honeywell was getting out of the mini computer business.

Hendrie: Okay. Now, who was running the group that you...

Severino: Joe Cashen.

Hendrie: Joe Cashen, okay.

Severino: And Bill Poduska was the VP of engineering. I went down and I interviewed and I got that job. And I went back to Digital and told them I was leaving, and a number of people tried to convince me otherwise telling me how crazy I was because these former Honeywell people didn't know how to make successful companies and businesses anyway. They actually were former 3C people, right?

Hendrie: Yes, they really were former 3C people.

Severino: Right. So I decided to take the leap, again, and so I did. I took the leap and went to Prime computer. Prime was a very tremendous experience, but it was very tough. It was a company that had a great product, but it was a product that was a me to product, the first one. We did convert Honeywell customers to Primes. We did build A to D converters and analog I/O and digital I/O for that machine. But

my primary role when I first got there was to focus on building the I/O interface part of the computer that was kind of developed but it wasn't totally finished. And so I had something that was important to Prime and that I never worked for 3C, so as the engineer designing that I wouldn't have any issues about patents and whatever. I think that's the reason that it was done.

Hendrie: Yeah, so it would be you just figure it out.

Severino: Yeah, so what I did was all these other A to D converters and things, I actually did the standard logic to interface to the Prime I/O bus, the standard logic on the peripherals.

Hendrie: Yes, on the peripheral side, so the sort of the standardized interface and then from that and everybody would put that on their board if they were building a peripheral and then take it from there to interface the

Severino: And then I also built a wire wrapped board that actually allowed us to to put other peripherals together, but this was going to be pre-wire wrapped with the whole interface done and tested. So the engineers that were doing disk controllers, or doing the communications controllers and doing the A to D converter boards could just use this interface. So they didn't have to reinvent the wheel.

Hendrie: Okay, so it's like having a board which has the standard interface all designed, wire wrapped all going to the correct pins and then they could design something special and put it--...

Severino: And connect to it.

Hendrie: Connect to it. Okay.

Severino: And that was interesting because as you know the 3C and the Honeywell computers had interesting DMA, Direct Memory Access modes. They had all kinds of priority interrupt modes. So there was a lot of stuff going on there and it was kind of interesting. And it allowed me learn that architecture which was very different than the Unibus architecture and all those other things.

Hendrie: Yes, exactly. So it was a whole other way of connecting up to a computer. Their I/O bus was, well, it was older but it worked.

Severino: Yes, so I did that first and then once that was done then I started to work on these I/O products that were for the process control and the analog to digital conversion areas.

Hendrie: Now, how many people were there working in this area of the I/O?

Severino: Oh, just like three of us, maybe, in the early days.

Hendrie: Yes ,a classic startup, very small group of people.

Severino: Yes, and you had to make it happen, right? ...

Hendrie: There was nobody to help you.

Severino: Nobody else there. But I became sort of the I/O expert, I guess, so that was something I did and I also did these other things. And, at Digital I was a design engineer. I typically had one technician at Digital working with me. Even though I was project managing some stuff I was pretty much doing it on my own. At Prime it was the same thing. I was working as an engineer developing products. And there were a couple things that came out of the Prime experience that I thought were very influential to me. One was working with Bill Poduska. In the early days of Prime, Bill was basically a software guy who came from the academia side, worked on MULTIX which was this incredibly great timeshare operating system that utilized scarce computer resources to get multi users to use the same computer. Basically that's MULTIX. Bill was doing a startup company for the first time and he wanted to know everything there was to know about the hardware side as well, and the processor side and everything. So he would spend hours with various engineers talking about these things, and he did the same thing with me. And we talked about the I/O stuff and how does it work. And one of the things that he instilled was this concept of, "Well, how fast is this thing going to go? How fast are we going to do transfers?" And he really was performance oriented. He wanted this machine to perform. And that's one of the things that I didn't see a lot at Digital. I'm sure the people who designed processors at Digital focused on that, but on the I/O side we didn't focus on it much. And in fact, the Unibus at Digital was not a performance product because it was asynchronous. You know, the idea was you can stretch the Unibus no matter where and it'll work. In those days performance wasn't as critical in the mini computer side. But Poduska talked about performance and he forced us, all of us engineers, to think about performance as one of the defining factors of our products, What are the performance requirements for this product, and how do we get there, and what's the best you can do and where can you go with this, that kind of thing. And so he forced us to do that. And sure enough, when you work on performance, guess what, you can make things happen. And so we had very fast I/O capabilities because we looked at all the cycles. We tried to figure out how fast we can transfer stuff out of memory, how fast we can get stuff into memory from the I/O peripherals and things like that. It makes a big difference. So performance was a big issue and I learned that from Bill. I also learned about the concept of, and I think I got this both at Digital and Prime, you have to build really great products to compete. They somehow have to be better than what's out there. If they have a better performance level, they have to have a better functionality level and they have to cost less, so all those three things are important when you start to think about competing.

Hendrie: Right. And doing all of them at once can be quite a challenge.

Severino: Right, ,So you also start to learn in Prime the concept of gross margin and the concept of profitability and how the company succeeds.

Hendrie: Okay, so engineers started to understand cost...

Severino: Because it was such a small company.

Hendrie: And how it fitted into pricing and profitability.

Severino: Right. And where do you make money? Why is this company going to make money? Where is it going to happen? It was a five year process where Prime started out doing the strategy of the Honeywell replacement stuff. The first CEO left the company. During the time that there was an interim CEO, who was our Chief Financial Officer...

Hendrie: Oh, who was that?..

Severino: Ben Roblin].

Hendrie: Oh, Ben Roblin was the interim.

Severino: Was the interim CEO.

Hendrie: I know Bob Baron was the first CEO, yes.

Severino: Yeah. Prime wasn't growing. I mean, it was doing okay. Every year it would grow a little bit, but we were still like under $10 million dollars a year revenue.

Hendrie: But you were profitable.

Severino: We were breakeven.

Hendrie: Breakeven, just barely profitable in other words.

Severino: I don't remember the exact numbers, but it wasn't great. And there was one time in there where we almost didn't make it through, the venture capitalists finally came up with some more money, I guess. But then Prime went public once they started generating some revenues, small public offering. But Bill Poduska got the idea that said we're doing this data acquisition and process control stuff, I mean, it's just not working. We're not really differentiated in our computing architecture. but he had an idea. And the idea was to build MULTIX into the Prime computer in a next generation product called the Prime 400, and he did that. And I was able to actually work in that small group of engineers that did that working, again, on the I/O part of the system. We were working on the I/O part of the machine.

Hendrie: You know, how big a leap? He put in paging into the machine.

Severino: Well, it was a huge leap, all right? The real essence of what he did, and he can talk about this a lot more in detail than I can, but the real essence of what he did is he put in virtual memory, page

segmented virtual memory. And what that allowed, all those things, paging, segmentation and virtual memory, what that allowed you to do was swap things in and out very quickly. And so the Prime 400 when it first came out just took-- for the application of running multiple users, for example, in an engineering application running apps, running different apps, maybe they were Fortran apps, maybe they were design apps, whatever they were in those days. That was in 1975 and 1976 when this thing came out. I mean there was no comparison. The PDP-1170 wasn't even close. Data General had nothing in this space —,even the Data General soul of a new machine, machine didn't have that operating system. And all the other mini computers just weren't competitors, and so that came out in 1976. But the interesting thing was at that time Ken Fisher was coming on board as President, who was a great sales person. It was clear to me that under Ken's leadership he was going to take this great product, which the engineering department built under Bill's leadership and he was going to go out and sell it like crazy. And what was more important to the company then. was sales than it was development. And I just felt that there was not much of a future for an engineer there in terms of being able to take part in the growth of the company because we had some stock options. I was there five years and I counted my shares in the hundreds not in the thousands. That's how low the stock options were. But the sales people were continually getting commissions and options. So I decided that, you know, this...

Hendrie: This wasn't going to be an engineering oriented company any more.

Severino: Well, it didn't have to be an engineering oriented company. It had to appreciate some of what the engineers did, and I felt that it was just not the right place for doing that. So I got the bug again to want to do something entrepreneurial.

Hendrie: Well, before we get into that just tell me a little bit more about the different things that, in your-- in your later years at Prime you worked on, specifically, the projects you were involved in.

Severino: I think one of the small projects that was important, that turned out to be more important, was we had sold a Prime machine to a company in San Francisco, actually we sold multiple Prime machines, and part of the deal was to connect those computers together with a high speed connection.

Hendrie: Oh, okay.

Severino: Okay? And they needed to do it fast because the machines were shipped and they needed to get the revenue from them and we weren't going to get the revenue from them until the customer got his connection.

Hendrie: Because they'd been promised this. Now, this was an engineering special that the salesman had sold?

Severino: Well, it was a...

Hendrie: Was it in-- but it wasn't in the product line yet.

Severino: It wasn't in the product line, but Honeywell had a product like this, okay? And so my boss at the time, Joe Cashen, came to me and said, "We need to have this thing in three months." And he handed me this spec from Honeywell.

Hendrie: Ah, so this is, okay.

Severino: And I looked at it and I said, "You know, I don't think I should build it like this." I went back to Joe and I said, "Joe, I can do this, right, but I think I should change this. I think I should make this so that we can connect eight computers together not just two."

Hendrie: Oh, it was designed for connecting two computers.

Severino: Just two. And it was...

Hendrie: What was it? Yes, tell me what...

Severino: It was just a parallel interface. It was just taking a board, plugging it into the Prime computer and then doing DMA transfers across to another computer buffering on both sides.

Hendrie: And a 16-bit parallel.

Severino: Sixteen-bit parallel transfers, right. That's what it was.

Hendrie: Okay, yeah and with twisted pair wires or something like that, or did it go to coax?

Severino: Some cabling. No, no, there was no coax. There was not a concept of coax. This is before...

Hendrie: Okay, so the computers had to be reasonably close together.

Severino: Yes. So I did something a little different. I basically went to Joe and Joe said, "Well, we need it in three months He said, "Why don't you talk to Bill?" So I went to Bill Poduska and I said to him, "Bill, I'd like to do this project in three months, but I want to do it so that we can connect eight computers together." And he said to me, "How do you want to do that?" And I said, " we're not concerned about how fast necessarily this goes all the time, and if we we've got eight computers we're going to have longer lengths of wire, so I need to have something that's asynchronous, not synchronous so I can just let it, you know, get the length of wire that we need and then just, you know, do the ACK and NAK if you will, back," you know how you do that. And basically it was an idea that the Unibus had, right? And I thought that for this application to be able to connect and to go pretty darn fast even though it wasn't directly synchronized.

Hendrie: Yes, it didn't necessarily need to be synchronized if you had enough band width on the connection. You could still go pretty fast.

Severino: Right. So Bill was intrigued by it. So he said to me, "Okay, let's get the group together," so we got a little design review group together and I basically presented what I wanted to do. And everyone agreed that I should do it. And they said, "Well, how are you going to do it in three months?" I said, "Very simple." I said "I'm only going to build it to work between two computers first and get it all tested and running and get it installed in that customer's site. And then I can do the eight computer thing. So I'll do it just to work for two computers and then I'll do it for the eight computers." And so what I did was I actually used a cabling system that was like twisted pairs that was a standard cable plugged in. So I got my 12, I got my eight, my what, 32 wires that went across.

Hendrie: Okay. You still made it 16-bit parallel.

Severino: Sixteen-bit parallel. I still made it 16-bit parallel, because I wasn't going to change that at that point, okay? And we called it the IPC, the Inter Computer-- IPC; I forget the name of it now. It doesn't matter.

Hendrie: Okay. Anyway, marketing came up with a name.

Severino: It doesn't matter. I actually named it myself.

Hendrie: You named it yourself.

Severino: But anyway, so I designed this thing and I worked very hard. I had some help from the software people so they could get some algorithms written so I can get this thing tested. We shipped it, got paid and everything else and this was a two computer interface that worked. Shortly after that I actually left Prime, or maybe a year later, but I had worked on the Prime 400, but I had left Prime and I decided...

Hendrie: Oh, so this was before the Prime 400, working on the Prime...

Severino: This is-- I can't remember the exact time. It was around that. It was before-- it was just before the Prime 400 project was going. So the prime 400 project was the one we worked on like eight or nine months. So this was just before that. It was one of these things that, I mean, I used to do this kind of stuff where they say, "I need this or I need that," you know, and I'd go do it. So I was like my own special systems group for a while there.

Hendrie: Yeah, right. Oh, and then they put it in the catalog, of course, yes, in the price list.

Severino: Yes, right. So I did this, it got shipped, and I never had a chance to go back and finish it, right, to make it work on eight computers. So I still had this urge...

Hendrie: But you knew the architecture would work. It was just a matter of implementation.

Severino: Yes, you had to test it. You had to test it.

Hendrie: Yes, testing.

Severino: And I didn't have the resources to put an eight computer network together and all that stuff, it just wasn't going to happen. Anyway, I decided that I was going to do something else and I had an opportunity to join two people I knew from the analog to digital world who had started a little company that did A to D converters in a new configuration of a module that plugged onto a print circuit board. And they needed somebody to really focus on connecting those A to D converters into this new area of microcomputers.

Hendrie: Ah!

Severino: Okay?

Hendrie: Okay.

Severino: And these were 8080 based microcomputers. And in those days that was the beginnings of the Altair, the MITS Altair and all that stuff. And so I decided that if I could get paid a little bit from these guys that I would probably join them. And it turns out they couldn't pay me much. I did one consulting job for them just to help them out with something, but...

Hendrie: This is before you left Prime.

Severino: Yeah, just a little thing that they needed.

Hendrie: A little thing on the side.

Severino: That they needed done and I helped them out with it. But they all of a sudden got a contract. They sold a $40,000 contract of modules to a particular company. Then they called me.

Hendrie: Remember what the company was?

Severino: No, I don't remember.

Hendrie: Yes okay. And they called.

Severino: And they called me and said, "We got some money because we got this contract and if you can come we'd like to have you come." And I said, "Well, if I come I'm going to want to be part of the company. I don't want to just be employed. I want get some stock. And so sure enough I did a deal. I got 10 percent of the stock.

Hendrie: Wow, that's pretty good.

Severino: Yes.

Hendrie: Okay, now, we're going to continue this story, but I have a couple of questions that I have to ask going backwards. Now, had Prime given stock? Did you have any Prime stock?

Severino: I had some stock options at Prime, but they were very small.

Hendrie: They were very small. They were not very generous either. They did not give big hunks of stock. Well, you got there...

Severino: Actually I got a stock options at Digital when I was there, believe it or not, and because of the things I had done there they singled out what I had done and said, "You should get--" and it was actually restricted stock. And then when I got to Prime they gave us an option. It was 200 shares, but see I didn't understand what that meant, right? When I went to Data Translation and joined up with Fred Molinari and Aaron Fishman who were the founders, I said, "You know, this company's worth nothing right now, I don't want a hundred shares. I want to know what my percentage is."

Hendrie: Ah, so you had figured this out by now.

Severino: Right.

Hendrie: Tell me how you met. How did-- how did these people find you or you find them?

Severino: Well Aaron Fishman, I worked with him at Digital Equipment. He was in laboratory data products. I was in industrial data products, but we worked on A to D converters

Hendrie: Yeah, there were A to Ds in lab and...

Severino: Right. So I knew Aaron Fishman, and Aaron had left Digital and gone to Analogic Corporation. Fred and Aaron...

Hendrie: Oh, yeah. Bernie...

Severino: Bernie Gordon. Fred and Aaron had started Data Translation to compete with Analogic Corporation and got sued by them, by the way, you know, for doing that. But they also tried to sell Prime these little A to D boards, A to D modules. So I made a connection with them through that.

Hendrie: So they came in as that...

Severino: Because they were selling-- actually Clark Crocker was designing that. I wasn't making that decision. Clark made the decision.

Hendrie: Yeah, but they came in and you saw them.

Severino: They came and talked. And then I met them, and I talked to them, and they basically said, "You know, we should try to get together and do something together because you're the computer guy and we're the analog and we need that capability. So I kept talking to them, but they just never had the money to do anything. And finally when they got this order they came to me and said, we've got the money but, it's not going to last forever, but at least we could pay you for the next couple of months. And I said...

Hendrie: Now, were you married yet?

Severino: No. I was single

Hendrie: You were single. Okay. So there is at least a possibility of surviving.

Severino: Oh Yes. I was able to sell some of my Prime stock for a couple thousand dollars and put it away, so I had a little cushion. I lived in a very small apartment in Framingham and it was no problem.

Hendrie: Okay, no problem..

Severino: So anyway, just to close the loop on this little product I made to connect computers together, my first year or so at Data Translation. We were down in New York City doing some customer stuff and there was the National Computer Conference, NCC, remember the NCC?

Hendrie: Yes, I remember NCC.

Severino: Used to be at the Coliseum in New York City.

Hendrie: Yes, exactly.

Severino: And we went there and Prime had taken off like a rocket ship with that product, with the new computer. And I wanted to go in and see how Prime was doing and everything else. And I got there and Poduska said to me, "We've got eight computers running here together." <laughs> And so they had resurrected my design to do this thing.

Hendrie: Given it to somebody else to finish and.

Severino: And given it to somebody else to finish and they actually made Prime Net, the first Prime Net.

Hendrie: Oh, my goodness, out of this.

Severino: Out of that little project we did.

Hendrie: Oh, wow.

Severino: So it was very satisfying to see that happen.

Hendrie: Yes that's good..

Severino: And at the same time Bill Farr was working on the next generation which was a token ring implementation with coax and all that stuff.

Hendrie: Yes, which Dave Nelson, one of the founders, had sort of, was...

Severino: Yes, right. And that was actually three years after I did my original product. But I had three months to do something, right?

Hendrie: And you did it.

Severino: But it turns out that it got done, it worked and it was...

Hendrie: Oh, that's cool.

Severino: It was the origins of PRIMENET.

Hendrie: Very good. That's cool, which sort of got them into the networking world.

Severino: Right.

Hendrie: Yes, okay.

Severino: And it made me think about networking again, okay?

Hendrie: Yes. All right, well, but now that's a story still to come. Let's go back to Data Translation. You had your head down.

Severino: Well, Data Translation was...

Hendrie: So you went to do this work on-- help them with this contract.

Severino: Yeah. There was no financing.

Hendrie: It was a bootstrap operation.

Severino: This was a bootstrap thing. We were being sued by Analogic so no one wanted to touch us. They also started in 1974. There was no venture capital in 1974.

Hendrie: Yeah. Oh, that was a terrible time in venture capital.

Severino: But, again you learn the basics of building a business which are you've got to have a good product. You've got to have it priced properly. It's got to work well. It's got to be well documented, you know, all these things. And so that's what I did. I went to Data Translation and we had almost no cash to spend, right? So we decided to do the A to D converter modules. They had them.

Hendrie: They had figured out how to do that. They had built...

Severino: They did that great. That was working fine.

Hendrie: Now, that was Fishman mostly?

Severino: Fishman, yes and Fred...

Hendrie: Now, was Fred an engineer or...

Severino: He was an engineer but he doesn't design. He didn't design anything. He was an MBA now and he was the CEO, I mean, the president. He was he president.

Hendrie: He was the CEO and the salesman. He was the president and sales, and chief salesman.

Severino: Right, and chief marketing, really chief marketing person.

Hendrie: Chief marketing guy, okay.

Severino: But basically we decided to do something. And the LSI-11 was just being done then, and we didn't have enough resources to go build LSI-11 products. So we decided to do something on the Intel platform. And we picked an Intel development system to work on. And it turns out that we started to work on this Intel development system, because I got all the information from Intel, and I looked at everything they had, and I decided that that was the one we should pick. I'm into the design already, the new design of this thing, this board that's going to plug this A to D converter and D to A converter into this Intel development system. Not nearly knowing who's going to buy it necessarily, you know, and all that stuff. We find out that Intel is about to develop a single board computer called the SBC 80 which has as part of it-- the concept of the single board computer is you put it in it becomes a controller in an industrial process area, so perfect fit for us. We found this through an Intel rep who told us he wanted us to talk to a product manager at Intel. And so when we told the product manager what we were doing he said, "I'm going to be in Boston in a couple weeks. I'd like to talk to you about it." And it turns out that they loved what we were doing because they had exactly that, developed this single board computer to fit into a little, you know, rack and they wanted A to Ds and add on boards all this stuff for it. And so they actually gave us a single board computer, racks, software and we were off and running developing something for the Intel SBC 80/10 platform. And we did that and I did the first product, I finished the first product from scratch by myself in three months. And at the end of three months I can remember it was Memorial Day weekend 1976. Fred and I packed up six boards to customers that we sold at, I think, it was $1,800 dollars a board.

Hendrie: Okay, oh my goodness. All right.

Severino: Or something like that, some number over a thousand dollars.

Hendrie: Over a thousand dollars, all right.

Severino: And we sold six of those boards. And that was, we doubled our revenues in that month just by doing that product. And then what happened was the next thing we did was LSI-11, and in one year I did like three new products, and we were up to, you know, a million dollars in revenues in that year.

Hendrie: Wow, okay. And so what you would do is you'd do the interfacing and the digital and using these modules that were...

Severino: Right. And what happened was, people wanted to buy solutions. They didn't want to just buy the A to D modules. They wanted to plug them in, write some software and do some algorithms.

Hendrie: Yes, exactly.

Severino: And probably the biggest mistake we was not doing an application for the computers right away because, a company called National Instruments got started in that era and what they did was make applications, and now they're a very successful company, and I'm actually very good friends with the founder of National Instruments.

Hendrie: Really?

Severino: Yeah, he's a Rensselaer Alum, Jeff Kodosky.

Hendrie: Oh, he was a professor wasn't he?

Severino: Yes, he was a professor.

Hendrie: That's where he started.

Severino: He started at the University of Texas in Austin.

Hendrie: He was a professor at the University of Texas.

Severino: Right.

Hendrie: Yes, I was involved in a company that unsuccessfully competed with him.

Severino: And I remember it.

Hendrie: Yes, okay.

Severino: It was...

Hendrie: Kendall...

Severino: No, Cayman Systems?

Hendrie: No, no, no.

Severino: It was down in Boston.

Hendrie: Yes, down in Kendall Square.

Severino: Yes, right. But anyway, so we built the company and Data Translation was great. I learned the concept of building a business from scratch and understanding what was important, understanding how important market was, marketing, understanding sales, understanding channel issues, understanding profitability, you know, the whole nine yards. It was a great learning experience.

Hendrie: Well, yes. It was a really small company and so you got involved. You could be part of all of that.

Severino: It was a tremendous learning experience.

Hendrie: Yes, because it was so small.

Severino: Yes. And that was 1976. The thing about Data Translation it was growing every year a significant amount, and it was profitable all the time, always profitable, very profitable. And I was vice president of engineering.

Hendrie: You were vice president?

Severino: What happened was the analog founder left about six months into my tenure there.

Hendrie: Oh, really?

Severino: Yeah.

Hendrie: Well, why did he do that?

Severino—I It was a lot personal issues that he had to deal with and he was divorcing and getting remarried and all that stuff. And the company, wasn't making a lot of money even back then so he decided to leave.

Hendrie: Then he needed to.

Severino: And he actually sold back his stock to the company and to Fred, so Fred became a 50 percent shareholder. I didn't buy any back because I didn't have any money, obviously. But, anyway, he left and then we hired another analog engineer who was a very good guy who actually still works with Data Translation today.

Hendrie: Oh, who was that?

Severino: His name is Steve Connors. He's still there.

Hendrie: Wow.

Severino: and that's from 1977 until now.

Hendrie: That's a really long time.

Severino: That's 30 years. So, anyway, he's a very good analog engineer.

Hendrie: Yes. All right let's-- can we take a pause now?

Severino: Sure.

Hendrie: And we'll change the tape again.

Hendrie: I want to get a little bit more about what other things you did later on at Data Translation, because you were there for five years and obviously you did all those interfaces in the very early years, doing them yourself, just tell me a little bit more about Data Translation and what kinds of things you did.

Severino: Well after the first full year we actually started to get to the point where we needed to build a little more of an organization. So I formally took over the engineering organization once the other founder left. And we started to hire some engineers . We were doing the same products but a lot more sophisticated products. For example, the LSI-11 had really taken off as a platform, especially in labs. And some of the experimentation that was being done required very high performance DMA interfaces. The LSI-11 started out as a quad board. It became a dual board and so, as a result of that, we had to

continue to make our products smaller and more efficient, The concept of miniaturization was starting to happen back then because semi-conductors were beginning to provide a lot more integration. So, we kept building these new generations of products right along and our business really became one of providing a whole family of products around a couple of platforms. One of the major platforms was the LSI-11 platform. But another platform was the Intel platform, as well. And then there was the Z80-- Zilog had a platform, for example.

Hendrie: So, you continued to support the--

Severino: We continued to do that.

Hendrie: -- the Intel platform as you went on to the--

Severino: Right, And so what we would do is we stayed in the area of data acquisition. We'd do A to D and D to A conversion. We would do DMA. We would do much more high performance conversion, more throughputs. We'd do more resolution conversions.

Hendrie: I was going to say, yes, you went to--

Severino: So, we had this whole product line of stuff that we did. And so as VP of Engineering, what I wound up doing was building out that product line and making sure that all of the pieces of the puzzle were happening. We were hiring the right people. We were doing more software. We actually did a lot more software. Not so much applications, but, software that allowed customers to basically easily access these boards and easily write--

Hendrie: Yes, drivers.

Severino: Drivers.

Hendrie: It might be viewed as drivers as opposed to applications.

Severino: Yes, exactly.

Hendrie: The original product line were 12 bit A to D's?

Severino: The original product line were 12 bit A to D's, right. And we went up to, like, 16 bit I think. And we have our analog design group. We have our interface group. We have our software group that developed all of the drivers and everything else for all the different operating systems, for example. So an LSI-11 didn't run VAX but it ran RSX-11A, B, C, D and all that stuff. So, we were sort of the one-stop shop for those kinds of products. And Fred Molinari was a brilliant marketing person. And he developed

an approach to marketing. We didn't have direct sales. We basically either had reps or distributors. But he would do a catalog and the catalog kept growing as we added more products and we kept moving it forward. And it got to the point where he would print thousands of catalogs and he'd get them on mailing lists and get them out. And then he got this bright idea that maybe he needed more wider distribution of the catalog. And so what he did was he cut a deal with Electronic Design Gold Book. Remember Electronic Design's Gold Book?

Hendrie: Mm-hmm.

Severino: And Electronic Design Gold Book-- so what we did is we took a Data Translation catalog and it became part of the book set for Electronic Design Gold Book that went around the world. And so I basically ran the engineering side of the puzzle. Fred ran the marketing/sales/administrative side of the puzzle. And we had a very good partnership and a very successful. Products worked very well. We competed very well. And we were-- in 1980, we had probably finished about a $10 million year.

Hendrie: Okay, so you build it from zero.

Severino: In four years, yes

Hendrie: In four years, up to about $10 million. That's very good.

Severino: And then in 1980, I made a decision that said I really think I should try to start my own company, because it was clear to me that this was never going to be my company. Even though I was a significant owner and even though I was the VP of Engineering . But I understood one thing and that is the LSI-11, there was a whole industry around the LSI-11.

Hendrie: They call it an ecosystem these days.

Severino: Right, and companies like Zilogic, for example, used to make LSI-11, enclosures, and they'd make peripherals. They did, like, this peripherals for the LSI-11. And there were companies that did-- Emulex did peripherals and people did communications boards for them. And so, there were all these companies that did that, add-ons to the LSI-11. What I thought about in the concept of building my own company was finding a space that I wasn't going to go compete with that whole ecosystem, but a new space where I could do something different. And I certainly wasn't going to go compete with the company I was just leaving, or going to leave. I hadn't left yet, but I was going to leave and--

Hendrie: Now, you talked to Fred about over a period of time that you were going to go do this?

Severino: I didn't talk to him about it at that time. I talked to him about it when I got more serious about it..

Hendrie: Yes, when you were almost ready.

Severino: when I really found something that made sense for me, then I started to talk to him about it. But there was an interesting thing that happened, and this goes back to this network stuff, right. In 1980-- I think it was in 1980, or maybe 1979, I actually started to read articles in *Electronic News*, I guess it was.

Hendrie: Yes, that was the rag in those days.

Severino: It's one of those papers-- about a new standard in networks that were going to be developed by Dec, Intel and Xerox called the Ethernet. And I was intrigued by that because I had thought, again, about my eight-computer network at Prime, and the fact that I thought that it was really important that computers get connected together and at high speeds in a standard way. And so, as a result of that, I actually got copies of the blue book spec, which were actually published in October of 1980, I believe. It was called the DIX Blue Book Spec-- Digital Intel Xerox Blue Book Spec, Version 1.0. And your museum should have a copy of that because I gave it to the Computer Museum in Boston.

Hendrie: Okay, well then we have it.

Severino: And I'm sure you must have it somewhere. You probably-- even probably got it from someone else, maybe Bob Metcalfe . I'm sure Bob Metcalfe has those copies as well. I had kept in touch with a lot of people at Prime. Bill Peduska had left Prime to start Apollo. I had always been enamored by the startup thing and venture capital and the whole thing. So, I actually got in touch with some of my friends from Prime who had been successful. At that time-- by 1980, Prime was flying high. There'd been a lot of success there. One of my friends in particular was a marketing VP there called Russ Planitzer. And I called Russ and said I had some things to talk to him about and he said, "Let's meet for Chinese food," or whatever. So, we had dinner and the upside of the conversation was, " Russ, I think it's time for me to go do my next thing. I'd like to start a company and I think I found an area that might make some sense for me to think about starting a company in." And he asked me what that was. But - I'm sorry.)[Aside] First, before that conversation there was another conversation that says, "I think I'd like to do this, but, I don't yet know what I want to do." And he said to me, " you've got some good experience. You probably are financeable, but here's what you need to do. You probably need to grow the company for another year and get more growth. Find out if you're going to leave. You should make sure you have a replacement on board and let's figure out what you might go do next." He said, "But get yourself ready to leave." And so that's what I did. I spent the next year this was in 1979. This was before the Intel/Xerox thing. I got those things out of order. Got them out of order, but-- and it was good advice because what it did was it sort of said to me, and so I went out and hired more senior people to work for me in engineering, especially one particular senior person who I felt could be a VP of Engineering replacement. And I also worked hard to make sure that the company got good growth in that year and just did everything we needed to do getting our products out and everything, so continued to work very hard on that. And then I found the Digital Intel Xerox Spec. When I found that spec, I went back to Russ and I said to him, "Okay Russ, I've done this. you told me to grow the business... You told me to find my replacement and I found this area, Ethernet, which I think I have a way of entering that market that would be a great opportunity for a startup company." And he basically looked at me and said, "I can't believe you actually did what I told you to do." <laughter> And so he and I basically agreed that that was a good plan. And he helped me to build a business plan and then at that time I started to talk to

Fred about the fact that I was going to try and do something different. But I told him that I thought there was someone on board that could help make a transition. And sure enough, in the spring of 1981, we financed Interlan as an Ethernet product company. And the strategy there was basically to bring Ethernet out so that computers could actually be connected on this standard and do it very fast, do it before the chips were available and get people connected and get early adopters connected and get into the business and understand the business by actually becoming a pioneering company in the business. And at that time there was only two other companies that I knew about that were doing things in Ethernet that weren't Digital , Xerox and Intel. There was Ungermann Bass and there was 3Com. And 3Com was more like what we were doing. We heard that 3Com was building a VAX interface board and they were building transceivers. Ungermann Bass was building a terminal server product, which basically allowed you to connect terminals on the Ethernet network to--

Hendrie: And then they could go to the computers on the network.

Severino: They could go to the computer but they were doing boxes. So, you put a box-- you put a bunch of boxes around the network. You build it yellow cable with the transceivers.

Hendrie: And then you connect a whole bunch of terminals to each box.

Severino: And then you connect a whole bunch of terminals to each box and then that one box-- the smaller box would connect into an interface on the computer. Not even-- probably an Ethernet interface, if that existed, but they didn't really exist in those days yet. So, while Ralph Ungermann was doing terminal servers, Interlan and 3Com were doing board level products to actually connect the computers.

Hendrie: Yes, they plug into the computer and then with appropriate software do something.

Severino: I think it was another example of being young, foolish and not totally figuring out what was going on out there because, 3Com was founded by the inventor of Ethernet and I was doing A to D converters for the last five, six years. I've never seen an Ethernet. So, it turns out what was important and what we brought to the table in Interlan was the fact that we knew how to build these interface boards because I had done it for a long time. So, whether it was an Ethernet interface or an A to D converter didn't matter. And as a result our first products, which were VAX connections to VAX' section of the Ethernet, were very competitive products, much more so actually than 3Com because we did DMA interfaces to Digital VAX's, which are, by the way, were big computers that required DMA interfaces. The 3Com board was literally a memory kind of memory move interface.

Hendrie: Yes, it was programmed out.

Severino: Right, and so we went out, and by the way, we started Interlan in 1981 in April and we actually shipped our first Ethernet boards in January of 1982. They had lots of wires on them but we shipped them. And basically by April of 1982, we had a solid Ethernet board product that plugged into VAX's and multibus computers.

Hendrie: Now, tell me about where did the Ethernet come from, the actual Ethernet. There weren't any chips yet.

Severino: We designed our own Ethernet hardware. We designed the module.

Hendrie: You designed a transceiver and it--

Severino: Well, we didn't design a transceiver. We designed a module that was the Ethernet connection. And the first module actually we did with a Z80 controller. It was a big module, all right, because Intel--

Hendrie: This isn't potted or anything. This is a print circuit board.

Severino: No, this is a print circuit board that we actually can put on top of another print circuit board. So, we made it modular so that we could move-- that we could go different--

Hendrie: So, you could do this interface, this interface and this interface, plug the same Ethernet thing in each one.

Severino: Well, also we were thinking that, Ethernet was not the given standard. And we thought that maybe another standard might arise, like for example, Token Ring.

Hendrie: So, you were prepared.

Severino: And we could quickly move over.

Hendrie: Okay, but you started with Ethernet.

Severino: We started with Ethernet.

Hendrie: Okay, now I need to roll back a little bit and hear a little bit more about the founding of Interlan. you wrote a business plan with Russ' help. Where'd you get the money?

Severino: Well, okay, let's go back to the founding. I wrote a business plan. It was clear to me that I had to find some Ethernet expertise and the good news was that in Massachusetts, Digital had Ethernet expertise. So we found the people in Digital who worked on Ethernet. One of them was an engineering guy by the name of Dave Potter, who actually was involved in writing the spec and working on concepts of how Digital was going to implement Ethernet. There was also a marketing guy and another

engineering guy in one of the other groups who were also doing it and we wound up recruiting those three individuals. It was Dave Potter, it was Bill Siefert and it was Bob Olsen.

Hendrie: Okay, now Bill Siefert, what was his--

Severino: At Digital, he was engineering.

Hendrie: He was an engineering guy.

Severino: He was an engineering guy who was actually working on the engineering side of the Ethernet stuff. And that was key to us because Russ Planitzer ,I'll go back to Russ Planitzer. When I told Russ Planitzer about this issue of doing this company. And the reason he helped me do the business plan is because he was on his way to J.H. Whitney as a venture capitalist.

Hendrie: So he had already decided to leave.

Severino: Prime.

Hendrie: But he hadn't left yet.

Severino: He hadn't left yet. He was leaving shortly, like, in just a matter of months. So, I was working on the business plan, he was helping me with that. And when I say helping me, he was basically critiquing and telling me what I was missing because I had never written a business plan before.

Hendrie: Yes, and you didn't know what you had to have in it to sell it.

Severino: Right. Then I did another thing in that timeframe, I actually went to Bill Peduska and said to Bill, "This is what I'm thinking about doing." He had already started Apollo. He was at Apollo. They were already I think even shipping. He was like-- I think he started Apollo in 1980.

Hendrie: Yes, he did.

Severino: So, he was just getting product shipped. He was very busy, but he took the time and he really wanted to help me with this. And he was also a very big help in telling me about, how you structure the deal and it was nice to have someone who wasn't my venture capitalist telling me how a deal should be structured. So, Bill and Mike Reed, who was also an Apollo founder, actually helped me a lot with this. . And it all came together and in the spring of 1981 we got the financing from J.H. Whitney. It was Russ'

first deal. He walked into the door with my business plan at J.H. Whitney and they agreed to do it. And we raised $650,000 first round to get this thing started.

Hendrie: How much was the pre-money value, do you remember?

Severino: I don't remember, but it was-- I could find out but I can't remember.

Hendrie: That's okay.

Severino: I think he bought about 40% of the company for that money. And so we had our money and we started to hire and we had a sales VP who we hired, Betsy Miller, who actually had been at Data Translation and had left, but we hired her. She came on board. And we hired Dave Potter as VP of Engineering. And then we hired a number of engineers to go do the job that we needed done. And the other person we hired was Kathy Noland who became my wife.

Hendrie: Yes, how about that? That's pretty good.

Severino: After about three years-- two years actually, I guess it was. We got married in 1983. Yes, so after two years, so we wound up getting married. So, Interlan brought a lot of success in many ways. And we got started, and the idea was to build Ethernet products. We didn't want to build a transceiver. We actually bought our first transceivers from Olivetti.

Hendrie: Oh, they got into the transceiver--

Severino: They were in the transceiver business. Mario Mazzola , who is a very famous guy today, from Cisco, sold Cisco the first Ethernet switching company Crescendo, back in 1990 whatever it was-- two or three or four. And the idea was, we we're going to go find these customers. It turns out our first three customers, basically, were Digital, Intel and Xerox. They bought our first three boards because they wanted to see what we did because Digital was actually making their own boards. And it took them a long time. It took them a very long time to get it done.

Hendrie: Okay, but it would be obviously natural that they would go do that.

Severino: Yes, but it was, like, years. We got started because we really wanted to get into this market very early and be first mover advantage and it did work. And basically what happened was we started to sell to early adopters. We'd sell to some universities. We sold to BBNN and then we started to figure out, one of a big plus for us was this Berkeley UNIX project. You had Bill Joy out at Berkeley doing UNIX-- BSD UNIX-- Berkeley Software Development whatever UNIX 4.0 or something like that-- 4.2. And it was TCP/IP. And they wanted to build networks. That's why they did that Berkeley UNIX project-- made UNIX a networkable operating system. And they discovered us, we discovered them. They liked our product because it was fast and became the standard for Berkeley UNIX. And so we used to get orders over the transom from big companies who were basically running Berkeley UNIX operating

systems on their VAXes. Companies like Tektronix, for example, and Boeing and those kinds of places, just had all these VAXes running UNIX and that was the development environment back in 1982, basically-- 19'83. And our price, but the way--

Hendrie: So, while you had to deal with the software side-- Yes?

Severino: Our price for a Unibus board when we started was like, $4,200. And, obviously that came down over time. But basically, I mean, there was a lot of chips on that board, okay. And the transceivers were $1,000 a transceiver. Understand we weren't connecting desk top devices. We were connecting computers that were expensive computers.

Hendrie: Yes, that was the original-- And you're still in the yellow cable.

Severino: Yellow cable?

Hendrie: And it's still in the yellow cable era

Severino: Yes, big transceivers starting to happen. And one of the things that happened in that timeframe is that the first year of revenue was, like, a million something dollars, and that started in 1982, or maybe it was two or three million dollars. I have to go back and look, but the bottom line is by 1984, we were doing $20 million in revenue and we were making about 10% profit-- operating profit.

Hendrie: Now, you hadn't gone public though or anything like that?

Severino: No, we had never gone public.

Hendrie: You never did.

Severino: Along the way two things happened. We basically chased 3Com out of the business that they were in and Metcalfe was not having much success selling his VAX boards because we were selling ours.

Hendrie: Because yours were better.

Severino: Ours were a lot better because we were DEC people.

Hendrie: Yes, and you knew how to do it.

Severino: We knew. I knew how to do DEC and the people I hired from DEC obviously knew how to do DEC. And even though they were connected to Gordon, which surprised me about what they did,. I guess Gordon didn't get into the detail of what's your interface going to look like? But at any rate, they needed to do something. What they did was they decided that the PC was where they wanted to spend their time because they saw the PC coming. And so to the credit of 3Com and to Bob Metcalfe and his organization, they decided they weren't going to be doing this--

Hendrie: Minicomputers.

Severino: Minicomputer stuff. They were going for the PC business.

Hendrie: They were going to drop down one level.

Severino: The most significant thing they did was they did a deal with SEEQ, which is a chip company out in Silicon Valley, S-E-E-Q.

Hendrie: Yes, I remember them.

Severino: And they did a little Ethernet controller chip for them so that they were able to do an Ethernet connection on a PC interface board. You remember those PC boards that you plugged in?

Hendrie: Yes.

Severino: And so they did the board and then they used a thin coax cable rather than the big yellow cable-- the big yellow cable. So, they made a local, a very local Ethernet called Thin-net. They called it Thin-net, and--

Hendrie: So, they did the interface work and they did the transceivers to drive and receive--

Severino: And they didn't do a transceiver actually, they did Thin-net, which is not like the other transceiver at all. It was very different than the other transceiver. And Thin-net had some limitations.

Hendrie: But they did the electrical engineering to build the drivers and the receivers for it.

Severino: Right, and so what they did was they made a new standard for Ethernet, which was the Thin-net standard. And they focused on PCs and obviously, that worked very well for them because they went public on the strength of that business. They grew that business very, very aggressively and they did very well. And so they were doing that, Ungermann Bass was doing pretty well.

Hendrie: Were they still doing the terminal servers?

Severino: They were doing terminal servers, but they were making them smaller and cheaper. And then they were actually looking at us-- Ungermann Bass looked at us as a possible acquisition. We went down the path. Obviously, what they wanted from us was our board level technology because we could basically give them a way to connect, not only just connect to the Ethernet but also put terminal servers on our boards-- terminal server interfaces on our boards so that you could instead of having two boxes you have a box that connects terminals. You have a box that connects the computer. You can get rid of that box that connects the computer and just plug it right into the VAX.

Hendrie: Yes, so you can just plug the terminals directly into VAX, okay.

Severino: So, because there was a lot of stuff that had to be done when you're, moving terminal traffic on the Ethernet, obviously. So, it was interesting, the way this all went. We actually thought about going public but we did it at a time-- since we had entered the market later than 3Com and Ungermann, we did it at a time when the markets were not doing very well, and this was in 1985. And so we decided not to go public. And shortly after that MiCom Systems showed up and decided they wanted to buy us. And we sold the company to MiCom Systems for $65 million in MiCom stock.

Hendrie: Now, did you want to sell this or where were you in this or did you want to continue to grow it or, I mean, it sounds like you were doing quite well and then--

Severino: Well, what happened was we were doing well, but we had to do a little management building. We needed a new VP of Engineering. Our first VP of Sales didn't work out. We hired a guy from Xerox actually, that didn't work out. So, we had organizational stuff that really was pulling us back.

Hendrie: It was impeding the companies--

Severino: It was holding us back, and so we just--

Hendrie: Why did you have to replace Potter?

Severino: And then we replaced Dave Potter too, because Dave was a great, sort of theoretical guy but he wasn't necessarily an engineering manager type.

Hendrie: Yes, going to build a really strong engineering group.

Severino: Well, I don't know if that's the case. I mean, it's just his skill set. His skill set was very important when we first started because he had all the expertise of Ethernet.

Hendrie: Right, it was what you needed to start.

Severino: Right, When we needed to build an engineering organization we went out and found, another individual to do that.

Hendrie: Who did you end up hiring?

Severino: His name was Ray Moore. And he was pretty good. He was someone that actually wound up at Codex after that. But in the end, one of the things I learned from the Interlan experience was about building organization. You really had to build-- it was so important to put the right people in the right slots. It's just so critically important to do that.

Hendrie: Yes, if you got the wrong people it took forever to go and get rid of them and then get the right people and catch up.

Severino: Yes, I mean, every startup that I've seen-- almost everyone, even at Prime, it just seems like, you have to always be working on organizational structures and people being in the right slots. And it's not whether people are good or bad, it's just sometimes they don't fit what the skill sets that's required to do a articular level or job.

Hendrie: It's a matter of being in the right place.

Severino: Right, and I think in venture capital that's one of the biggest jobs you had is building-- making sure you got the right people in the right slots doing the right jobs at the right time. So, I learned that lesson at Interlan. But Interlan was sold to MiCom for $65 million.

Hendrie: Now, did you get any other investors in Interlan?

Severino: Yes, we did. It turns out that we did a second round of financing.

Hendrie: $650,000 taking you to $20 million is--

Severino: Well actually, it wasn't much more than that. We did a second round of financing and we raised maybe another two. I don't know that there was a third round.

Hendrie: Did you get any other investors?

Severino: Yes, we did. We got Oak Partners. We got Continental Illinois Venture Equity, and that was it. And those are the two. And I think it was just another couple of million came in. And then we were

kind of in a mezzanine place. There was some money that was invested in by some of the investment banks, like Alex Brown, Montgomery, they're doing it in those days. And then, like I said, we didn't go public so it was really time for us to either be public or be sold. And we decided that MiCom was a good partner. And it turns out MiCom did okay with the business afterwards. They built it to probably about $70 million. And then they sold the company to Racal and it became Racal Interlan. And then, over time it dissipated, but the real growth-- the one thing that MiCom did and we were just starting to do, we had just built our first PC interface for the Ethernet, so that was a board that we did. And Novell was starting to explode back then. So, what happened was we talked about 3Com going into the PC business, well, they did. But they focused on the hardware issue. Novell focused on the software issue.

Hendrie: And then eventually got rid of their hardware partner.

Severino: Right, and Novell basically built NetWare-- Novell NetWare, which was as simple as sharing a disk when it first came out. And Novell also built a networking protocol called IPX, which became a standard for them. And Novell caused a lot of problems for 3Com in the PC networking business.

Hendrie: Well, 3Com tried to be in the networking. I remember, and they did not end up owning that market like they really wanted to.

Severino: Right We had done the PC board. We hadn't brought it to market yet. And one of the things that MiCom did when they took it over and had Mike Barker running it as president, was to do a deal at Novell. And one of the big pushes for the $70 million was the fact that a lot of Novell customers were just buying Interlan PC boards for their connections. And that was also the time when the concept of Ethernet hubs had taken off. So, you had a bunch of things going on that were driving growth in those days. It was Ethernet Hubs, SynOptix, Cabletron, Chipcom, your company. And then basically MiCom took it over. I stayed around MiCom for about six months. And I actually did some strategic work for MiCom. I was VP of like a strategy thing.

Hendrie: Now, who was running MiCom at the time?

Severino: It was run by a fellow by the name of Bill Norred and Roger Evans, they were the two founders. Roger was the VP of Marketing. And they were a very successful company they were doing about $250 million in revenues. And they had started out building a statistical multiplexer, okay. That's what they'd built first thing. And that was a big part of their business. And then they built what they called a Data PBX, which was basically a switch version of a distributed Ethernet, terminal server. It was terminal access and they called it a Data PBX. And the combination of those two products catapulted them. But then they felt that they needed to get into this network thing and they were right. And so we became the vehicle by which they got started in that. But shortly after that, maybe three or four years after that acquisition, they wound getting bought out by a private equity firm. And the private equity firm sold off pieces of it and it kind of went away. So, that leaves me free and clear.

Hendrie: Now what are you going to do?

Severino: Well, as I said, I did some strategic work for MiCom. And one of the things that MiCom was in was wide-area networks.

Hendrie: Well, they had STAT MUX.

Severino: Right, they had STAT MUX. They had some other wide-area products, too. But they actually kind of got interested in this T1 multiplexing business and all that stuff, right. And the T1 multiplexing business was interesting because when AT&T decided to be able to offer T1 lines-- to sell T1 lines to customers, that was 1.5 megabits, okay. And so I, doing some strategic work for MiCom, got to know about what was going on in that wide-area side. And when I left MiCom, which was only six months after the sale of Interlan to MiCom, it was clear to me that I couldn't be an entrepreneur there. So, it was time for me to leave. And I almost actually went into venture capital. I actually had an offer to join Ben Rock.

Hendrie: Now, how did you meet them?

Severino: Actually, they were doing a search and my name came up.

Hendrie: Okay, so they were searching for new partners?

Severino: Yes, they were searching, and they liked the concept-- they had done very well with-- I'm trying to remember his name now. He's the guy who did the Apple investment for them. I can't remember his name.

Hendrie: Yes, okay, I can't either.

Severino: Yes, anyway. They had done very well with partners who had come out of technology companies and understood, the entrepreneurs and the companies etc… but I was enamored by it because I always was very, very impressed with what venture capitalists did. I think it goes back to my days at Digital when General Doriot was chairman of the board at Digital and, it just was an incredible thing that was going on there.

Hendrie: Really guided this engineer, Ken Olsen

Severino: Right, exactly.

Hendrie: In how to--

Severino: How to build a business.

Hendrie: How to make a business rather than a product.

Severino: Right. So, I talked to them, it was interesting but in the end, they wanted me to move to New York and I came from New Jersey and I just didn't want to be down in the metropolitan area. I liked it better in Massachusetts. So, I decided to stay and I also decided that maybe I should take one more shot at a company. And we started to look at different things.

Hendrie: Okay, can we do a pause now?

Severino: Sure.

Hendrie: Yes, this is a good time to pause.

Hendrie: You were thinking about what you're going to do next.

Severino: Well, before I talk about that I just think I should say a few things about where the market was back then.

Hendrie: Okay, that's good, what you were looking at, what was the environment.

Severino: In 1985, there had been a lot of competition about the standards , local network standards. And there were a few competitors. One was clearly the Ethernet, the other was clearly the Token Ring-- the IBM Token Ring, specifically. And there was another standard in broadband. And basically what the IEEE was doing--

Hendrie: You're referring to T1 when you say another standard in broadband?

Severino: No not broadband, I'm referring to, like, the Sytec Network, which was a broadband-- like a cable network almost-- you know, broadband cable network. In fact, Chipcom initially did a broadband cable modem, if I remember correctly.

Hendrie: But, Ethernet cable modems.

Severino: Ethernet cable modems, right.

Hendrie: Yes, believe it or not.

Severino: Right, now that would have been a good thing. So, the IEEE basically was trying to figure it all out-- the IEEE networks standards group. And they basically decided-- we had thought that they might

decide to just pick one. They actually picked multiple. So, there was 802.1, 802.3, 802.5, and all these ones and I can't remember all of the specs but Ethernet was obviously one of them, Token Ring was another and there was a broadband spec as well. And then there was a spec that was being developed for industrial automation, which was-- I think it as 802.5, at the time, but I can't be positive about that, but I think it was 802.5. And so there were a number of specs out there and then the question is what is the market doing? Well, what really drove the adoption of local networks in a big way was the personal computer. The personal computer, when that started to hit the desktops, it became pretty clear that if you networked the personal computer it became a lot more useful than if you just sat alone and just ran a word processor on it. The network part of it became much more important. So, that drove a lot of adoption of networks. So, the early adoption of the local network was in the engineering side where there was a lot of DEC VAXes doing engineering work and having this network of computers with terminals being able to access all the different computers on the Ethernet network, the terminal server, that became a standard. And then the desktop computing started and then, of course, the work station started in the early 1980's, as well. Apollo with their own proprietary network and then Sun, of course, later on, like, 1983, 1984, with Ethernet based TCP/IP UNIX. Basically, Berkeley UNIX on a desktop is what Sun did. And so that started to drive these networks. And so as we exited Interlan's business and we started to think about the next generation of things we wanted to do, for a short time I had a view that said I wanted to get back in industrial automation and control and so I thought about building a company that was going to take the networking expertise that I had and the industrial automation and control expertise that I had and put it together.

Hendrie: Okay, and what would that be, cell controllers?

Severino: It was actually a real-time cell controller that was going to take advantage of the real-time nature of the 802-- the General Motors mapped network, if you will. You remember this.

Hendrie: Yes, I remember that. I remember those wars. Now, excuse me. I apologize for interrupting, but you said 'we' were thinking of. Could you talk about who were the 'we' that were sort of brainstorming what you were going to do next.

Severino: Sorry, well there were a few people who had left Interlan, who basically wanted to get started on another company One was Bill Siefert, who was the co-founder of Interlan, the other was Dave Rowe who was our chief financial officer. Of course, I was involved in that and trying to lead that charge. And then a fellow by the name of Al Wallach actually got involved with us, who was a great entrepreneur who has done a number of startup companies. Prior to that he did MassComp and since then he did a number of other ones very successfully.

Hendrie: Yeah, and of course, MassComp was in labs and industrial. Yes.

Severino: Was in labs and industrial automation, right. So, and then finally, Steve Willis, who was an early founder of Wellfleet and an early engineer at Interlan who was interested in drawing.

Hendrie: I didn't know that Steve was at Interlan, too.

Severino: Yes. So, we worked on this project for about six months of putting together a plan. And we had what we thought was a nice plan. But it's interesting, we were getting pushed back from our investors who we'd made a lot of money for at Interlan, mainly Russ Planitzer at J.H. Whitney, who said, "This is a business that you don't want to be in. It's a very difficult business. It's hard to sell into this business. They don't adopt very well. They're not early adopters and you should think seriously about not being in it, and we're not that interested, frankly, in doing another one because we're involved in a robotics project up in Washington state that's just driving us crazy. It's not getting adopted.

Hendrie: And so we have enough trouble in--

Severino: And as much as we like you guys and like what you did, we think this is the wrong place for you to be." So, we actually went out to a show called Autofact in Detroit and tried to get a sense of what was going on with this map network, which was getting a lot of very positive press back then. And in the end, we left the Detroit Autofact show and I left there thinking I think my venture capital friends are correct about this. This is not the place to go start a company.

Hendrie: What did you see there that sort of reinforced that?

Severino: What we kept trying to do was understanding what they were building and what GM was actually doing with this network. And what we found out was that they were basically using this network to download software into their programmable controllers. And they really had no need for real-time. They really had no need for the differentiation that we're going to bring. And we just said, "You know, it's the wrong thing to do." And literally, having said that the team was starting to think about breaking up-- our team, and I said to the team, "I've got one area that I think we should go look at." I said, "You know, the thing we know about is lans (local area networks) are being installed everywhere and you can't connect them on the wide area. They're just not being connected on the wide area."

Hendrie: You can't connect two lans together.

Severino: Right, you can't connect two lands together in a wide-area network.

Hendrie: That are geographically dispersed.

Severino: Yeah, and there was one company that was doing this for Digital called Vitalink. And it was primarily a company that was bridging over a 56 kilobit wide-area line and doing very well, by the way, because Digital was finding a real need for this in their customer base. And Vitalink was out there doing this on this Vitalink bridge, they called it. I said, "we need to be in the business of connecting-- of networking the networks-- of providing this next layer of network. We came from computer companies and we'd been in the industry a long time." So we didn't have that university stuff.

Hendrie: You didn't have the university connections.

Severino: Right. We knew about DARPA. We knew about that there was a DARPA network out there, but we didn't really see that as being something that was important to us. What we thought was important to us was the commercial customers that we knew about and their ability to interconnect their networks. And by the way, we knew what they were running on those networks. They were running TCP/IP on their work stations. They were running DECnet. They were running DEC LAT protocols for terminals, which is a separate protocol from DECnet. They were running Apple Talk, IPX for Novell. They might have even had some Xerox network protocols on there. And so, what we saw was the ability to build a product that would allow us to connect to a local area network environment that had multiple devices and multiple protocols on it and interconnect those networks to-- over the wide area to other networks. And by the way, using routing technologies, like TCP/IP, we could make another level of network. In other words, we can make an internetwork. And that's the way we saw the market. We didn't see the market as being the internet because the internet really wasn't there in 1986. It was DARPA and there was activity going on there. We weren't a part of that activity.

Hendrie: None of your founders had been involved in that.

Severino: Right. So we saw the market from the commercial side and the need for companies that had built these local networks

Hendrie: Could interconnect them.

Severino: -- to build their next generation network, which was their internetwork. And a key element to that strategy was the ability to use T1 lines-- higher speed lines, not 56 kilobit lines.

Hendrie: Not the 56 kilobit that-- okay.

Severino: That was being used--

Hendrie: That Vitalink was using.

Severino: And so we decided that we would focus on that market segment. And it turns out that we did this in May of 1986. In early May of 1986 or late April, we made the decision to get off the industrial process control and do this. We put together a quick summary of what we wanted to do, actually did some PowerPoint slides-- I believe it was PowerPoint.

Hendrie: Not really a business plan.

Severino: Not a business plan yet but a concept of what we wanted to do. And we called up our venture capital friends, which was Russ Planitzer at J.H. Whitney and a new venture capital friend, who never invested in Interlan personally, but had invested through Alex Brown in Interlan, Eddie Anderson and he was doing Alex Brown Ventures.

Hendrie: I didn't realize that Alex Brown had been in Interlan, too.

Severino: Yes, they were one of the investment bankers that did an investment.

Hendrie: Ah, during that mezzanine round.

Severino: Right, and then Ed Anderson came later because Alex Brown said, "We got this venture capital thing that we did and nobody's taking care of it so let's get him." So, they hired Ed and Brundy Grayson to do that. And Ed Anderson had got to know me through the MiCom connection and some things that I looked at, some companies that I looked at that they were invested in and wanted to be involved. So, we called them and well, prior to this we had to put up some money because we had some people that needed to get paid.

Hendrie: The need to eat.

Severino: That needed to get paid, so Ed Anderson and I actually did a $50,000-- $25,000 each, incorporated the company and started to pay people. So, we paid Bill Siefert, Dave Rowe and Steve Willis and our administrator, Jennifer Lamonicas . We paid them. And Russ Planitzer was out of town at the time. And we took that money and we started to work on this thing and we worked for three weeks. At the end of three weeks we went to New York to J.H. Whitney's offices and we made our presentation. And about three-quarters of the way through it, Russ Planitzer said, "I've seen enough. It's time to do this deal. Let's do it. How much money do you need?" And we basically decided we needed about $2 million. We knew we needed that $2 million.

Hendrie: Yeah, you'd figured that out ahead of time.

Severino: Dave Rowe figured it out ahead of time. And we did the investment. I actually made a personal investment, as well, at the time.

Hendrie: Well, the venture capitalists liked that at the time, didn't they? Yes, I think they still like that.

Severino: Yeah, he liked it. And by the way, I gave Russ Planitzer my $25,000 seed investment because he was out of town and he needed to be party per se with the other venture signs, so that was worth a little bit of money later on down the road. But we were partners, so he took my $25,000 seed investment. So, we started Wellfleet in 1986 and we actually got the financing done literally a week after that meeting. And we still had to finish our business plan but we needed to get started on this product capability.

Hendrie: So, you got a loan or something because the lawyers can't do it all in a week.

Severino: No, it was first fast because we had the same paperwork that we used for the other ones. It was fast. In those days it was fast. I don't know how long it was exactly. All I know is by June we were ensconced in a little building in Bedford, Massachusetts and we were going to build this product. And the product basically was this internetworking product that had Ethernet interfaces. It had T1 interfaces. It had 56 kilobit interfaces. It would have, in the future, Token Ring interfaces. It would have fiber optic interfaces. It would be a multiprocessing system so that we can run multiple protocols. The idea was we'd have high through put, high performance, high reliability and we'd basically take any packet off the wire and either route it or bridge it, depending on its protocol and make a transparent internetwork. And that was the concept and that's exactly what we built. It took longer to build it, but that's exactly what we built and that was a very successful-- obviously, very successful product. There's a lot of things that happened back in that timeframe. It's interesting that very few of the major data communications companies saw that market. We saw it-- we actually did a competitive analysis. Companies like 3Com had bridges. Ungermann Bass had bridges. Proteon had a router. Proteon had an IP router, actually-- TCP/IP router. But nobody really had solved the problem of getting all the protocols together and being able to interconnect these things. And frankly, in the environments that were going to be adopting this early there was going to be a lot of VAX traffic and VAX has these terminal servers all over the place and the terminal servers had to be bridged. So we basically put bridging in our box so we did bridging and routing together.

Hendrie: Now, were there routing protocols? What were the first routing protocols that you implemented?

Severino: The first routing protocol we did was TCP/IP and XNS and bridge.

Hendrie: And bridging, yes.

Severino: That's what we did. Those are the three things we did.

Hendrie: And did you have to go over T1's or did you have--

Severino: Well, we were the first company in this space to actually have a T1 interface in our box. It turns out that the early adopters were not using T1.

Hendrie: Okay, they used 56 kb?

Severino: They were using 56 kb.

Hendrie: Okay, so that's really what you sold first?

Severino: That's what we sold but then T1 started to take hold as it got more down in price. The original T1 lines that were sold were used by companies to actually do voice data and that's where the T1 multiplexers came in. The large companies that had lots of voice traffic and data traffic going between

sites would use the T1 multiplexer and take-- and allocate certain dizeros on the T1 for voice and certain dizeros on the T1 for data. And we had-- we actually had that ability and frankly we were one of the early players that basically brought the message that T1 was good for local area network traffic. And I think that really was a very important thing that we brought to the marketplace. We started in 1986. We literally for the first seven or eight months we never saw anybody in the market except the ones that we talked about the 3Coms and stuff with bridges and Vitalink a lot with their bridge.

Hendrie: Now was Banyan a--

Severino: Banyan wasn't even started yet.

Hendrie: Oh, Banyan hadn't been start--

Severino: Oh, I'm sorry. No, Banyan was started. Banyan did get started but they were in a totally different business.

Hendrie: They were not doing the wide-area.

Severino: Banyan basically made a different network-- a local network.

Hendrie: They were doing heterogeneous local networks not the wide-area thing. Okay, now does Cisco exist yet?

Severino: Well, that's when we--

Hendrie: Oh, that's where you're going to.

Severino: That's where I'm going. So, a year later we're doing a financing and my friend Gardner--

Hendrie: And you brought in Sigma and Continental.

Severino: My friend Gardner Hendrie was there. And Cisco was just showing up. They were just showing up. We had heard about Cisco. We had heard that they had a product that came out of the Stanford University network and that they were going to commercialize this product. It turns out that they had a very good TCP/IP router but it's-- the software worked well. The router worked well, but it was in a small multibus platform. It didn't have any mechanical design to it. There were a lot of issues about that product , it wasn't very well designed from a maintenance point of view and things like that, but it worked well.

Hendrie: Well, what you would expect probably--

Severino: From a university.

Hendrie: -- from a university background where the software probably is pretty darn good and the hardware's not so robust.

Severino I remember in Interlan days actually selling my multibus Ethernet boards and going to the West Coast, going to Silicon Valley and having a meeting on a Tuesday at Berkeley with Bill Joy to talk about Berkeley UNIX and our VAX boards. This is on the Interlan side. And then the next day going in with my sales person in the West Coast to visit this new company called Sun Microsystems that was just getting started and walking in on the first week that they were in their building and showing them my Ethernet boards and looking at their multibus chassis that had a processor, 68000 processor, had an Ethernet connection and had one other board in there-- must have been a graphics board. That's what it was, a driver-- graphics driver, a three-slot multibus, okay. It turns out that the Cisco guys who built the Stanford network actually built routers in that same platform. It was a multibus platform that actually had a processor board in it and also had an Interlan Ethernet board in it. Small world. So, Cisco showed up on the scene and they had a product that worked that was out there and they were starting to install it in the universities in a big way. And they were basically just getting going. They started out in their garage, a husband and wife team, Len Bosack and Sandy Lerner. They were getting a lot of traction in the universities and they were actually giving Proteon a pretty good run for their money, and then what happened was there was this plan to build some regional networks that take the network out of the university and do a regional network and I think that was the NIH that was doing that-- not the NIH, the NSF that was doing that. And that happened probably in 1988 maybe. And we were not part of that. We just weren't involved in that. But Proteon and Cisco were very much competing for that and Cisco did very well. Proteon won a few but Cisco won more of them. There were seven regionals-- original regional networks. There was one out of Princeton. There was one in New York State. There was one in Massachusetts called NEARNet-- New England Area Research Network. There was one out in the Bay Area. There was one down in the Washington D.C. area, if I remember correctly. There was a number of those and we just didn't play in those.

Hendrie: That wasn't sort of even on your radar particularly because you were looking at the commercial world.

Severino: Exactly. So-- but at the same time Cisco also had discovered the commercial world as well, because they were there early and they had product that worked. We started in 1986. We thought we'd have product in 1987. In 1987 what we wound up with was basically a bridge that did some routing and didn't have the right performance, as you know. And we worked very hard through that year of 1987 to 1988 but in the end of that we did have performance. We did have routing. We became very good competitors, but Cisco had entrenched themselves in places like Hewlett-Packard and Boeing by that time o they understood that there was a commercial market out there

Hendrie: Now was Cisco's original work when they were just in Stanford, did they have the internetworking part or were they doing 56 kb connections doing what you were doing?

Severino: You know, their first product had 56 kb connections.

Hendrie: So, it was competing with exactly what you were doing.

Severino: Yes, but with a very different focus I guess is what I'd say. So, we basically came out of the box in 1988 in a big way and we had a product that had a couple of platforms associated with it. One is our product was multiprocessing, so as we added connections we added processing power and that helped us a lot to be able to scale out product.

Hendrie: Okay, so that's what you mean by multiprocessing.

Severino: Right, we added processing, the processors did talk to each other. We weren't trying to share our processing. Whatever traffic came in on that particular board got processed on that board. We didn't share processing. We actually shared memory I guess is more the way we connected things together.

Hendrie: Okay, but Cisco had--

Severino: And Cisco had a single processing architecture. We basically had an architecture also that was much more focused on maintainability. Our processor elements were separate on a midplane from our interface elements and so you could take interface elements out, put different interface elements in or change them or repair them without taking apart the whole box. We had a much more maintainable system. And we also had two levels of support. We had five slots and we had, I think it was, like, 12-slot box. And the 12-slot box actually became known in the industry as a collapsed backbone configuration. What happened was we'd bring all this lan traffic in and instead of having to just interconnect it with lans again, we had to interconnect it through a high speed back plane. And so that became very popular in corporate America where they taking lots of these lans on different floors and different places and they were interconnecting them all into the collapsed backbone at very high speed and then from the collapsed backbone they can take it to the wide-area. So, it almost became like that centralized switching capability and it was very popular. And that was a major competitive advantage that we had. Cisco took awhile for them to get to that point of having a bigger box, and even though they had a bigger box they didn't necessarily have the same performance levels that we had. So, we always were very strong in the spaces of performance, of maintainability, ease of maintenance, that sort of thing, ease of spares, the whole thing. One processor board you didn't have to buy tons of processor boards because they were all the same.

Hendrie: Because they were all absolutely identical.

Severino: So, we had a lot of advantages and then what we did was we built organization. At Wellfleet Communications we started out with the group of founders. It was Bill Siefert as VP of Engineering, it was David Rowe as Chief Operating Officer. It was Steve Willis as sort of our software CTO person. It was myself and we had an administrative person, Jennifer Lamonicas. That was the original founding team but we started to build our engineering organization and we were able to hire a lot of really

interesting engineering people primarily because we had a noncompete with MiCom from selling Interlan so we couldn't go back to the well and get all of our engineers that we were used to having.

Hendrie: Okay, yeah, how long was that?

Severino: It was for-- it was a good I don't know how many years. It was a few years.

Hendrie: It was a few years. It wasn't the classic six months or one year.

Severino: No it was a few years. And as a result of that we had to go out and find new people. I'd like to share this with everyone that's listening to this tape at some point that there's a lot of benefit to bringing on new ideas and people from different backgrounds you get a stronger organization. If you just keep doing the same things with the same people all the time it's just not the same. You just don't get that same strength. So we had to build this organization from scratch and we start working on that in the summer of 1986 and we continued to work on that for years afterwards.

Hendrie: You have any particular examples that come to mind that illustrate this sort of principle of new blood just sort of--

Severino: Yes, I think on the engineering side we wound up with people that had worked in places like BBNN, that had worked in places like Data General, that had worked in companies were maybe small startup telecommunication startups around the Boston area. And as a result of that as we started to build the product there was a tremendous amount of creativity going on because people had done things differently in different companies and so said, "Well we did this much differently at Data General." Or, "We did this much differently at Codex." You know, and so we got that very rich environment of people creating and working off of each other's strengths.

Hendrie: Any examples that come to mind of particular problems that you came up with unique solutions?

Severino: I can't, one of the things that we did here was we had decided we were going to build an architecture. And I felt strongly about this having been in the board business before I wanted to be in the systems business this time. And so I wanted to have an architecture just like you have in a computer system. And so I was very, very focused on the architecture and I developed the concept of this multiprocessing architecture and this maintainability architecture and that was kind of driving everyone. So everyone's thoughts were going into how do we make this architecture work? And I think that we got it to work well because I think we just had a lot of people with different levels of experience. They had done multiprocessing or they had done interfaces on T1 lines. So, it brought together a lot of that capability. And the software part of this was a much bigger task than any of us thought it would be. The software part of it was a very big task. So we were late. It looked kind of bleak there for a little while because our competitor, Cisco, was out there really kind of ramping things up and we were still trying to get our product done. And there was a lot of talk about whether or not we should change the architecture, build something simpler. But I was convinced that if we did that then we'd just look like them

and we certainly didn't want to just look like them. We had to have our differentiation capability. So it took patience and it took some bridge financing from our investors and it took making some changes. We changed the VP of Engineering, although Bill Siefert stayed with the company we brought in Lou Piazza, from BBNN. We changed a sales person who had come on from Codex who just wasn't the right person and he basically retired after that. We brought on Gary Bowen..

Hendrie: Where was he from?

Severino: He was at MassCom.

Hendrie: Okay, brought on him to--

Severino: And then David Rowe decided to leave because he was going through some personal crisis stuff and I became CEO. We didn't have a Chief Operating Officer and I think that I developed this concept of having very senior people running big parts of the business. It became clear to me that if we were going to win here I had to have that structure. So, I actually developed a concept that was Senior Vice President of Sales and Marketing, Senior Vice President of Finance and Administration and a Senior Vice President of Engineering and Development. And I think that once we got that organization in place, we got through our product development--

Hendrie: Issues, yeah.

Severino: -- issues, we just really took off. You know, just as an aside about how we took off, in 1988 we did $3 million in revenue. In 1989,I'm sorry, I'm wrong. In 1989 we did $3 million in revenue. In 1989 we did $35-- we did $10 million in revenue. And in 1991--

Hendrie: Wait a sec, let's see. You did three-

Severino: I'll try it again, '91 is when we went public.

Hendrie: Okay, and you did how much--

Severino: That's when we did $35 million.

Hendrie: 35, so the previous year--

Severino: It was 10.

Hendrie: --in '90 was 10 and the previous year--

Severino: And ’89 was three.

Hendrie: ’89, was three. Got it.

Severino: I was right. ’89 was three, ten--

Hendrie: And 30.

Severino: Thirty-five, 85, 185, two something-- like, two-- mid-200’s. The bottom line is by 1994 we were doing $500 million in revenues.

Hendrie: Spectacular growth.

Severino: And we always were profitable. We actually were at 22, 23% operating profits once we got above $100 million. So, the organization from that point on almost never changed. It was that same core group of people who had the capabilities to bring the company forward and really do the job. But it was a battle everyday in how we had to go out for customers because Cisco was out there trying to grow their company as fast as they could, as well. The nice thing about it is in 1991,and 1992 we were the fastest growing public company in the U.S. in *Fortune Magazine* . And now it’s 2008 and I think that there hasn’t been another company that’s ever repeated two in a row-- two years in a row because that’s hard to do.

Hendrie: It’s very hard to do.

Severino: So we really built a very, very major set of customers. We had a great sale organization. We had a great support organization and we actually took the product the next step in the early 1990’s by doing an upgrade version of the whole architecture, called the backbone node and there we fixed a lot of the issues of interprocessing and intercommunication of processing elements on the backbone and we had pure hot swap kind of capabilities where we could just pull out boards, everything else kept running.

Hendrie: Okay, so you made it even more of the characteristics of--

Severino: Even more-- and even higher performance. The backbone mode router was very, very high performance because we used the next generation processing elements, 68070’s or whatever they were in those days and we just built a whole system that was really very high end and very capable of being very reliable for our customers and very high performance. So, that’s where we got to. And you know something, it’s 1:30.

Hendrie: 1:22.

Severino: Yeah, and I'm wondering if we should change, stop and maybe we can come back and do that last bit.

Hendrie: Yeah, sure.

Severino: You know, which talks about the bay networks thing.

Hendrie: Yeah, yeah, I'd really like to do that.

Severino: All right.

Hendrie: Why don't we do that.

Severino: All right, because I don't want to get rushed.

Hendrie: We are now pausing.

Severino: All right.

Hendrie: For longer than five minutes.

Severino: All right.

Hendrie: Thank you very much for doing this, Paul.

END OF INTERVIEW

