



Interview of Manuel (Manny) Fernandez

Interviewed by:
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James Pelkey: Zilog. Were you a founder of Zilog or did you come in afterwards?

Manny Fernandez: I came in January 1st, 1979. The company was a year and a half old at the time.

Pelkey: Who founded the company?

Fernandez: Federico Faggin and Ralph Ungermann. The two founders were from Intel. The company was formed with 50% equity from them, 50% equity from Exxon Corp. from day one.

Pelkey: When did it come out with a microprocessor?

Fernandez: The company was formed, actually, back in 1976, somewhere around that time frame, and a year and a half later, they came out with the Z80 CPU, just the central processing unit. The two guys had worked at Intel before. Faggin had been the designer of the 8080, so they had a pretty good understanding of what the heck was going on in the 8-bit microprocessor world. They did the CPU part right away.

Pelkey: What are the dates again?

Fernandez: I don't have this thing quite clear, but I would think it was '76.

Pelkey: That they founded the company?

Fernandez: Yes.

Pelkey: And you joined the company in?

Fernandez: '78. December of '78.

Pelkey: So they came out with the Z80 in roughly '77.

Fernandez: Yeah, I would think that's about right. We may want to check on that exactly.

Pelkey: I'm going to talk to Ralph as well.

Fernandez: Who, Ungermann?

Pelkey: Yes.

Fernandez: Then he'll be able to give you the exact dates. Bottom line, what happened in the deal was that Ralph and Federico -- this had nothing to do with the technology -- Ralph and Federico had partings of ways. They got to basically hate each other in '78, and they asked the board of directors to chose one of the two to stay, and the other guy would leave. Basically, I came in to replace whoever was going to leave. It was kind of an interesting process.

Pelkey: And Ralph left.

Fernandez: Yeah, I never even met Ralph. He had left and I came in the next day.

Pelkey: How about that? Where were you before that?

Fernandez: Fairchild.

Pelkey: Were you running the division?

Fernandez: I was running the Discrete Products Group at Fairchild.

Pelkey: Was Zilog doing things in communications when you came on the scene?

Fernandez: Well, if you take a look at communications, from a communications point of view, the application of the microprocessor, of course, has had -- the implications of telecom, the whole telecommunications side of the business -- the implications of how microprocessors were utilized in a lot of the different telecommunications gear that was built and their ability to be able to bring computer power into small things, which has created a lot of other things in telecommunications, both in data com and telephony. A lot of the other work that took place was in peripheral chips that also added value to the communication issue. Thinking of serial and parallel communication chips, where all of a sudden you could communicate digitally between chips in a serial way with a single channel or a dual channel, whether there is a one-way or a two-way channel of communications. So there was a lot of that work that went on at Zilog. There was an individual that I referred you to before, already, that is now at Xilinx, Ross Freeman, who came in from Teletype as the design engineering guy in charge of making the first communications chip, which was the first serial communications chip that really came about, that was a dual-channel, two-way chip. So that started to open a lot of doors in data communications. So, if you take a look at the thing, I see it as the microprocessor, per se, the implications of the microprocessor in my mind is that it was applied in many different places; that some of the places were personal computers, some of those things were calculators, and some of those things were telecommunications things, whether they were phones, desktop phones, or whether they were part of a PBX, or whether they were other telecom or datacom oriented things. Of course, there was also the application to computers of all types, and terminals of all types, which are also the core of data communications. So the microprocessor opened the avenue to inexpensive, more readily accessible, higher incredible growth that took place in how people communicate. So communications as a whole have been greatly affected by the microprocessor chip itself. Now, as you know, a microprocessor by itself is not a lot. It is the peripheral chip sets that run the microprocessor that make the system happen. Whether it is a DMA, which is the Direct Memory Access of microprocessor to memory, which is a way to communicate, which at one point in time was a big board and cost millions of dollars to make, became a single chip for five bucks, to a parallel chip to be able to do parallel interfaces with the outside world, or, as I have been mentioning, serial interface chips, where communications would be serial, so therefore RS-232 and all the serial ports for data communications could take place. That, in essence, is the impact of the --

Pelkey: At that point in time, in terms of the serial chips, serial communications, in terms of standards, hadn't been established. Every terminal and computer manufacturer had their own error correcting protocols and flow control and so on. Did that have an impact?

Fernandez: Sure, eventually SDLC -- the whole interface became much more standard, and what happens is that you become -- a chip set, if you will, or the chips themselves become so inexpensive, but part of being inexpensive is that they have to be properly used, and properly accepted, so as standards took place, and they were able -- you could take that and make it into a single piece of silicon instead of customized things for everybody, or custom boards, as it used to be, for every computer or every thing that you wanted to communicate, all of a sudden you have a \$15 or \$20 chip that was your serial channel. Not only a serial channel in a single way, but two ways, and not only a single channel, but a dual channel, and more and more sophistication eventually took place. At one point in time, it used to eight bits; eventually it became a 16 bit wide channel, with the 16 bit generation, so chips were -- did they set the standards or after the standards were set they were brought into silicon -- doesn't really matter. The important thing is that silicon was there to be able to create the ability for the world to have a cheap way to communicate.

Pelkey: At the point where you joined Zilog, was communications a strategic thrust area for you?

Fernandez: The way that we looked at it was two different ways. One, strategically, what did it mean, and strategically what it said was in two fronts. One is competitive advantage with the competition in the microprocessor world, and the second one is profit contribution. On both of those fronts, the communication chips were the most profitable, and the one that we have added the most value, and therefore had the most barriers to entry. Anybody could make a parallel interface chip. Anybody could

make a keyboard interface or those kinds of things. In the areas where you had to add the real value, which is where semiconductor companies eventually make their money, especially high end semiconductor companies, the direct memory access chips, which allow you to communicate to memory, and the serial ports chips, the communication to the outside world in serial ways, are the two areas that were A, the most complicated, the ones that we could add more value, the ones that we could charge more money and therefore the ones that were the most strategic because of the barriers of entry as well as the profitability contribution to the company.

Pelkey: At that point in time, when you came out with the Z80, the Z80 was THE chip.

Fernandez: Well, actually, the 8080 was THE chip. The 8080 was there first. The Z80 eventually overcame and became the number one 8-bit microprocessor.

Pelkey: What accounted for that success?

Fernandez: Well, I think two things. First: the microprocessor itself. I think that the founders of the company did an excellent job in the technical talent that they hired in, to be able to do a chip that was a superset of the 8080. Therefore, anybody that had an 8080 did not have to go spend a whole bunch of money to put in a Z80, and the Z80 had better things; better multiply and divide. It had things that made it a better microprocessor than the 8080; faster and a little bit better, with more instruction sets, those kinds of things, but you did not have to do a lot, because it was basically a superset, so all the instruction sets were the same. So people that had already learned -- you know, there is this tremendous learning process and software investment that you put into any microprocessor, so they did that well. The second thing that they did well was that they started a software development and systems business to be able to have a development system, so people could develop software for the new chip, the Z-80, at the same time, and they executed that very well. That was Ralph's deal, the system side, and Federico's deal was basically the component side. That's how they had divide up the things early on in the company, and they executed those two things very well. The third part of the execution which came from the beginning, but along the way it got much more enhanced, was that it was understood from the beginning that the chip, the Z80 CPU by itself, would be nice, but that would not be enough. You needed a chip set to be able to make computers all together. Whether it was the clock chip or the DMA chip, the direct memory access chip, or the serial port chip or the parallel chip or whatever, all of those chips were necessary to be able to make a chip offering, and to be able to handle everything from -- in other words, the communications pieces from the central CPU to all of the pieces, whether it was to run the things from the clock or from the keyboard or from a serial thing to memory or whatever, so the whole thing became -- and that was the strategy, from that point of view, was very good and very strong, and in some of those areas there was clear leadership. The CPU was better, the serial chip was better, the DMA chip was better, so that's how it continued to build.

Pelkey: You also had a process that I think differentiated you from Intel relative to second-sourcing.

Fernandez: No, I don't think so. I think that everybody in the semiconductor business second sources things. The smaller the company, the more second sources you have to make because you have less credibility and the people do not want to design a chip if they do not see at least a bigger company in the wings that's going to do the same chip. So, they were, early on, forced into second sourcing the chip to a US firm, Mostek to begin with, and then to a Japanese firm, Sharp, and a European firm, SGS. The reality was that Intel has also had some second sources. As a matter of fact, today, you find Intel AMD things all over the papers. So second sourcing is a way of life, and a way of death, I guess, in the semiconductor business.

Pelkey: Now, when it came to making the transition from the Z80 to the Z8000, Zilog, having gone into a leading position in the marketplace at the eight-bit level, didn't execute well at the 16-bit level. It didn't maintain market share leadership.

Fernandez: Well, different things happened. The Z8000 architecture started to be developed a year and a half after the Z80, so by '77, '78, the architecture was in place, and actually, the Z8000 was announced in early '79.

Pelkey: When was the 8086 announced, do you recall?

Fernandez: Right before, and I'm getting to that. It was neck-to-neck announcements. As a matter of fact, it's a key element of this whole process. Personally, I think that there were two mistakes made in the Z8000, and there were a lot of good things. The Z8000 was, and still is, a very good microprocessor, and in reality, much better than the 8086, and for many applications, much better than a 68000, so the Z8000, per se, as a machine, is a good product. Some mistakes. Number one, the success of the Z80, it was clear that they were beating Intel to the punch. There was a feeling that they wanted to announce a 16-bit machine before Intel and create the de facto standard in the 16-bit machines. Good strategy from one point of view, but a small company. Hard to pull off, for a small company to do that.

Pelkey: Was Intel that much bigger than you at that point?

Fernandez: Oh, Intel was a huge company already. Hundreds of millions of dollars. Tremendous position. So in '78, and I wasn't around at the time, but the idea was drive this thing to announce the 16-bit machine before Intel. Remembering that the success of the Z80 was based on piggybacking on Intel's already existing success of the 8080, so here you had to create everything from scratch. All of a sudden, there was the pioneering of everything: a whole brand new software scheme; a whole new development system scheme; a whole new set of design skills. The beauty of the Z80 over the 8080 is that people -- they went into the side into all of these accounts, and you came right behind them, and you said: "You have an 8080 design. Let me tell you, this is better, so take that one out and design this one in." Totally different story on the Z8000, and I think that they totally underestimated what that would take -- to do the pioneering job and being that. The machine was better, but that goes to show you that machine to machine is not enough at times. The second thing that I think was underestimated on the Z8000 strategy-wise -- you had two strategies that you could have taken at any point in time. You could have taken the strategy to say: "Take the Z80, and with the same instruction set of the Z80, extend the Z80 to be a 16-bit kind of machine," basically what the 8088 did to the -- they did it down, from the 8086 down to 8088 -- make it a superset of the Z80, with more instructions, so on and so forth, do whatever you can, but stay with the same software scheme. Looking back, that should have been the right and proper strategy. At the time, I can also see how, to those guys who were there, thinking about it at the time, it made a lot of sense to say: "No, forget it. There is a dead-end to the 8-bit machines, and you have to jump into 16 bits, so the sooner you jump into 16 bits, the better off you're going to be." For a large company, that may be feasible. For a small company to be able to use their own customer base and expand it and extend it, it would have been a heck of a lot better strategy. So two things: one, if they had extended the Z80 to begin with, that would have been a better strategy, and they could have waited for the 8086 to come out, see how that would have played, and then do a superset of the 8086. That would have been, looking back, the obvious thing, but that was not in the cards. The Z8000 was designed. It was in there. The costs of doing microprocessors are millions of dollars. For a small company, you bet the farm.

Pelkey: How large was Zilog at that point?

Fernandez: When I came to Zilog, Zilog was doing maybe \$500,000 a year, maybe 800,000, something like that -- Fifteen or 16K a month.

Pelkey: This was '77?

Fernandez: No, this is January 1, '79, so that was not a big business, and you are out there investing a lot of money to create the next generation.

Pelkey: At that point, the Z80 was in the preeminent position?

Fernandez: Oh, no. That was just starting to take off, and by the time, '79 and 1980, that's when we really took Intel's market share down. So those were the two critical elements in the whole process. Now, even with all that said and done, could the Z8000 have won? The answer to that is, if life would be perfect, the Z8000 still would have had, on a technical basis, still would have had a chance of being the microprocessor of choice. Unquestionably, you look back, and the Intel/IBM impact, of Intel selling a piece of Intel to IBM; IBM choosing the 8086 to be the microprocessor of choice and owning part of the company --

Pelkey: That happened when?

Fernandez: Late 1980 or '81 -- was a critical element of this whole process.

Pelkey: So the customer base at that point in time said --

Fernandez: No, in reality, still nothing had happened. So IBM chose the 8086, they were just another customer. There are some people that say that the reason that IBM did not choose the Z8000, which was a better machine, was because Exxon Enterprises owned most of Zilog, they were competitors with IBM head on in the word processing business, and getting into systems and all of that, and they didn't want to get any part of that. I don't know whether that's true or not. It doesn't really matter. What matters is that Intel did an excellent job in getting that account, but even at that time, it was just one account.

Pelkey: Were you fighting for that account?

Fernandez: Oh sure, but even at that time, it was only one account.

Pelkey: When did they introduce the PC?

Fernandez: Then. In '81, they introduced the IBM PC -- 8088 based, as you know. The product was announced, and even at that point in time, people did not know what an IBM PC was going to do, but obviously, it took off like a rocket in '82, and the rest of it is history. After the base is there, you have the software base, everybody else has to go, so therefore you then have two other places -- then, the only other place left was much more higher systems, and that's where Zilog fought head on with Motorola on the 68000. The 68000 was a product that was designed later than both the 8086 and the Z8000, and they did, basically, what the Z80 did to the 8080. They had a product that, while in some applications a Z8000 was still a better performer, for the general application, and mostly one of memory access, you could access larger blocks of memory on the 68000, was a better product, and if you aim it at the high end, where that was an important thing, the Z8000 got squeezed. A great processor, good software, good everything, but it squeezed in the high end because of memory access by the 68000; squeezed in the commodity side, which is really where the company had done very well with the Z80 because of the IBM pact and the take-off of the IBM PC, so that's how the Z8000 happened. However, the good news was, so much for the CPU. There's the whole -- the rest of the strategy was still intact. Do it again. Do the development systems, do the peripheral sets that make sense, bring all of that together all at once to be able to make that a very feasible kind of thing. The peripheral sets have done very well, and in reality, when you think about it -- take a look at a Mac, for example, and it's been years now since I've left, and I don't know exactly what the SE has inside, that was designed with the 68000, as everybody knows, and the 68000 was a big deal and so on, Motorola had a contract with the 68000. Actually, there are probably more dollars of Zilog parts inside a Mac than there is of Motorola's, because the peripheral sets, especially the communications chips, are all Zilog parts. There's a part called the SCC, which is Serial Communications Chip, so therefore, interestingly enough, the peripheral strategy survived the microprocessor, even if -- and the Z8000 did very well, CPU wise, in the military and in other places, but that's the story.

Pelkey: In 1980, do you recall what the market share was of the 8080 and the Z80?

Fernandez: We have it all here. DataQuest can give you that information. As a matter of fact, there's a guy here you may want to talk to. His name is Mel Thompson. He runs the semiconductor business for

DataQuest, and he was a product marketing guy at Zilog, so the information is all here. Basically, we overtook Intel with the Z80, the eight-bit business, I believe in 1981. By 1981, we had absolutely overtaken Intel with the highest market share, but you should verify that with Mel.

Pelkey: When did you leave?

Fernandez: I left in '82.

Pelkey: In '82, when you went to Gavilan. The issue of the role of -- the Z80, it was originally introduced in '76 and '77?

Fernandez: Yeah someplace around there. Mel can also give you the specific date on that. Ralph will and Federico will, I'm sure.

Pelkey: So you played a role, in terms of focusing on these peripheral chips?

Fernandez: I think that there were two issues. If I look at my stint at Zilog, there were two issues that were important. One was making sure that the product family became a more cohesive product family and a total product family. Make sure that the transition between the -- to take the transition from the 8-bit to the 16-bit machines, and we originated, while I was there, the strategy to be able to co-make the extension to the Z80, to be able to make it a 16-bit machine and be able to give the people at the low end the ability to grow within the same software scheme, and start the development of a 32-bit machine. So that's strategy one, product strategy. Grow the family, both in the expansion --

Pelkey: Bringing your current customer base upward.

Fernandez: Exactly, and start looking into what are you going to do about 32-bit -- the next generation. And I think that we executed all of that part pretty darn well. We brought about an extension to the Z80, designed the architecture and put it in place for the 32-bit machine. Unfortunately, all of those products were done and were to be in the market in late '82. Architecturally done, most of the products in silicon, and the company never executed after that, and some of those products have never even come to the market. That's a different story, and I don't think it has anything to do with communications, but basically I left in February of '82. They did not even replace me as president until June or July.

Pelkey: Was Federico still there?

Fernandez: Oh, no, Federico had left in 1980. I came in in '79, and within eight or nine months or a year, something like that, he left.

Pelkey: So you inherited an organization that was really torn asunder from this Ungermann --

Fernandez: There were some problems there. There were some interesting days, from that point of view, but it was fun. A bunch of great people. Got a lot of technology. The second part of my strategy at Zilog was that technology, by itself, was not going to make it. Zilog had to be able to take the next two steps. One, the marketing step, and the manufacturing step, and I think that the contributions on those two sides were, in my opinion, were the two other things that I had to do while I was at Zilog. One of them was to create a manufacturing firm that could manufacture at a low cost and that could compete head on with Intel, because we were going to go head on with them. It is the achievement of that that allowed Zilog to be able to be highly competitive, and therefore capture the majority of the market share, because we were able to move manufacturing wise, properly, both in the chip manufacturing side as well as in the packaging side. The second thing was to be able to create a marketing force that could start creating -- the marketing force that is required to be able to design in the chips. Those were the three tasks, if you will, that had to take place, and we were very fortunate. I think that by February of '82, the company was already at the running rate of probably about 100 million, so there was a significant growth that took place in that time frame.

Pelkey: When you look back on those days, other than the serial communications and so on, was there a sense that the data communications industry -- the modem business was taking off, the multiplexer had come on the scene, things were in the air about Ethernet and local area networking and the IBM PC had not taken off, although Apple was around -- was there any sense at that point in time that this was --

Fernandez: Sure, if you take a look at Zilog, from the beginning communications always played an important role. We felt that it was absolutely critical for more other chip sets to come about, there would be more communications chips, and that that was an important part of the whole process. A lot of people don't realize that Zilog built, probably, the first local area network in the marketplace, for their development systems, a network called Ariel, with the internal development of that product, and it's a product that we absolutely failed to capitalize on and implement properly and so on. Not from a product point of view. The product was there . . .

Tape Side Ends

Fernandez: . . . and the company was being pulled apart in 1979 with all of this effort that was going on. This was a pet project of Ralph Ungermann, and he was right. The local area network business was there. The product was created, so on and so forth. There was a product, a Z80 based local area network server. Implementation was probably not the best, but being the first in the world, from that point of view, it was a beginning. When they left, when he left, took a few people with him --

Pelkey: People out of that group?

Fernandez: Yeah, they created Ungermann-Bass, which obviously, it's the same product that Ariel was, for all practical purposes, and they wanted to create the local area network business. Out of that same group, another group of folks spun out a year and a half or two years later, late '81, I would say, and that became Bridge Communications, the other local area networking company.

Pelkey: Did Judith Estrin come from Zilog?

Fernandez: Yeah, sure. Judy was a product manager for Ariel, and Bill Carrico, who is the president, was the marketing manager.

Pelkey: Had you hired them into the organization?

Fernandez: No, Judy was there. Judy was there from the beginning with Ralph. It's a long story. Judy was going to go to Ungermann-Bass and she stayed. Real bad blood. Can you imagine this thing -- they broke up, Federico and Ralph, but Judy finally stayed, and she stayed for about a year and a half. Bill was at Fairchild with me. I brought Bill into Zilog. Eventually, he became the marketing manager and then eventually he became the general manager of that product line, the network product line, and eventually, by the end of '81, when they were in the midst of breaking up, it was pretty clear that the relationship with Exxon was not going to be one that was going to be great, and that we were not going to be able to support the network business, so they basically broke out and created Bridge, so those two companies have been very successful in something that really began out of Zilog. Actually, all three companies have been successful.

Pelkey: Why was it obvious that there wasn't going to be the support for the networking, was it because --

Fernandez: Well, it was just a matter of focus. You take a company, Exxon, far away, and sold on the idea of being a semiconductor supplier, not understanding greatly the interactions of systems and components, a company that, to be able to carry out both strategies, was going to require a significant amount of money, but the pay-offs could be there. Other facts: Exxon ran into trouble on some of their other subsidiaries, like Qyx and Qwip and Vydec and those things. So there was a misjudgment, but understandably so.

Pelkey: When you brought Bill over, at that point in time, was it -

Fernandez: Semiconductor marketing.

Pelkey: So there wasn't any concept of local area networking?

Fernandez: No, the local area network --

Pelkey: It was the contact with Ralph --

Fernandez: No, Ralph was already gone. Local area network had already began under Ungermann, work, this project called Ariel, it was a very early start, but that means that they had started the thing, and it was finally finished in 1980, or late '79, something like that. So that's when we put in the first Ariel network around. There were a lot of things going on. There was another network, another group of people called Summit that was working. There was a lot of network business going on inside Zilog.

Pelkey: Who is the best person to talk to about all of that?

Fernandez: Probably Bill and Judy. I think that Judy and Bill would add significant value to your book.

Pelkey: I plan to talk to both of them. I talked to Vinton Cerf, who was the creator of TCP/IP, and Judith was in his group at Stanford. Bob Metcalfe used to interact with them, and part of the book is this issue of how people came in contact with each other and how ideas merged. You, as an executive of the company, the issue of networking and commitment to networking, was that just --

Fernandez: I can honestly tell you that I wanted to move Zilog deeply into the systems business. I felt, from the beginning, that if Zilog's business would not be at least 50% in systems, that long term, there would not be enough cash generation to be able to support the semiconductor business, and there would be no way in the world that we could get Exxon to afford the bill, nor could we go into the public market. There was no other way to get cash, so from a very survival point of view, it was clear that you had to get into the systems business to execute that. So from the beginning, that was an area of trying to get there. The network business, per se, did not have the same kind of a fit that systems and components had. It was a third leg of a stool that was kind of dangling -- a good leg, if you would have strong business and you have the technology and you go ahead and explore it, but it did not have the same attachment. Systems were important because they could be used as development systems. You could use a lot of the chips to be able to leapfrog the things. That's how the components and systems things came together. So I think that basically what happened was, network business was exciting, it was on the horizon, it loomed as a great place to be, but there was not the attachment, and therefore the support internally, to be able to make it happen.

Pelkey: Along that line, a lot of the small companies I have talked with, it's clear that the innovative companies saw these new technologies, but by the constraint of how many R&D dollars they had, which was driven by the focus in the organization, they just couldn't make the investment. They had to draw the line someplace. Were you faced with the same issues?

Fernandez: Sure.

Pelkey: So that, in terms of allocating your R&D dollars, you said that systems are important, components are important, networking looks big in the future, but we've got to grow to the point where we can finance and support that.

Fernandez: Yeah, and I think that it became pretty clear that there were too many investments that had to be made, and Exxon was not going to make them, and you could not go outside to get investment from anyplace else.

Pelkey: Did Bill come to you and say: "Manny, I'm thinking about leaving here."

Fernandez: Yes.

Pelkey: So you knew what he was going to be doing?

Fernandez: Sure.

Pelkey: It was agreed that --

Fernandez: We blessed them.

Pelkey: Any thing else you can think of relative to the datacom side?

Fernandez: No, I think that talking to Judy and Bill would be great. I think that you'll get a totally different perspective than Ralph Ungermann's perspective. I think that would be it.

Pelkey: Thank you.

END OF THE INTERVIEW