Oral History of Lucio Lanza, part 1 of 2

Interviewed by:
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Fairbairn: We're at the Computer History Museum in Mountain View, California. It's April 3rd, 2013 and we're here to interview and gather oral history from Lucio Lanza, who has a tremendous experience in electronics and a wide variety of areas. Our goal is to capture that history and add it to our archives. So Lucio, welcome, thank you for joining us.

Lanza: Thank you for inviting me.

Fairbairn: This is Doug Fairbairn, and I'll be doing the interviewing. Lucio, our first step in these oral histories is to go back to the beginning. Where were you born? What kind of family environment did you grow up in? If you can identify, did that lead you towards a career in technology?

Lanza: That's going back a few years. I was born in 1944 in Italy, in a little town in the province, the county of Milan in Lombardia. I was in this little town, because in 1944 it was the Second World War. We were, what is known, escape from the towns, because the towns were kind of under attack. You have to think, in 1944 was when Fascism was collapsing, but in the north, it was still Fascism. The Italians/Germans did not have radar, and did not even have very strong weapons against the planes. So routinely at night, the cities would be bombed on the civilians, according to the Patton philosophy, that the best way to discourage combatants is to kill their parents. Which is a good philosophy. So I was born there in '44, in a very small village. I went back there to see it and the village is probably 50 houses.

Fairbairn: Very small.

Lanza: And one villa. The villa is Villa Litta. The Villa is called Orio Litta. Interesting. I was the fifth of five kids, from the second marriage of my father, first marriage of my mom. His first wife died. So I had other half-brothers. There were six of us. The five of us, close brothers and one sister, were within seven and a half years.

Fairbairn: Oh my, your mother was very busy.

Lanza: So we were pretty close. That tells you that we were extremely close. Being the youngest was clearly somehow being considered very precious by all the other ones. Also, I could learn a lot from their experiences. After the end of the war, we went on the Como Lake. We stayed there for a little while. My father was what is called in Italian the guardia di finanza, or the financial police. The financial police is at the same time the police that guards the borders, but another side of the financial police is the IRS. It depends which one you are. And another side is the antidrug and tobacco, firearms of here. So he was involved in a lot of action, stopping people from doing the wrong things. He was considered military, so being a military, our life wasn't too easy during the Second World War. It was even less easy when he

was a military after the peace came, and he had been considered a military with the previous regime, so things were not exactly smooth. So we moved to the south.

Fairbairn: Did he live at home?

Lanza: He was living at home, but most of the time, the home was in the-- how do you call it in English? In the headquarters of police.

Fairbairn: I see.

Lanza: In the headquarters of the financial police, there were a few apartments given to the families of the heads of the army. We were living in the headquarters of the so-called police station. It was a safe place to be and a place where you would always be encouraged to stay in line. It wasn't easy. It was just being military, not anything to do in the wrong way. Then once you are in this kind of position, you get transferred wherever they want you to go. So my father was transferred in the south, south across to Bari. By the way, close to where he was originally from, he and my mom were originally from--

Fairbairn: Close to where?

Lanza: Bari, B-A-R-I. It's right facing Greece. The Lanza name, if you go back to 220 years, is a Sicilian name. From Sicily, it went to Naples, from Naples to area around the Naples, and from that area to Bari, and from Bari to north. I tracked it back across the Palermo. There's a lot of Lanzas there. Lanza, in fact, comes from lance. Lancia, the car, is the same. We moved down there for a few years and then when I was 12 years old in 1956, we moved from the south back to Milan. I had the elementary school and first time of middle school there, and I had all the high school up north in Milan. Now interestingly, it may be interesting, my mother was just the mother of five kids plus one. She died four years ago at the tender age of 95. She disappointed me, because I told her that I wanted her to beat my grandmother who died at 101. She didn't do it. But if I should have been--

Fairbairn: You have some long-lived genes in your family.

Lanza: My dad died in '94, so it's interesting. My high school was all in Milan. Now the interesting thing about my high school is that it was not a scientific or technical high school. It was what the Italians call classical high school. So my background from education, until I was 18, was fundamentally the classical high school. So I studied Latin for eight years, Greek for five years, French for five years, history for eight years, philosophy for three years, math for a long time.

Fairbairn: It sounds like Alberto, Alberto Sangiovanni.

Lanza: Very similar.

Fairbairn: A very strong classical background.

Lanza: The wisdom is that the classical school was considered a tougher school, and you were considered having a better general education. When I finished high school, I'll give you this, everybody, my family, thought I was going to get into medical school, because my father wanted me to go to medical school. My older brother was an engineer. The other two were lawyers, went to law school, and my sister went into teaching in languages.

Fairbairn: So they all went to university.

Lanza: All went to college.

Fairbairn: This is because your parents felt that was very important?

Lanza: It was absolutely important. It was fundamental. There was no choice.

Fairbairn: You were going.

Lanza: You go to college. Don't put in writing, but they could not afford it. So the way to go to college is that you bust your ass and there is no taxes to be paid, because you're on top of your classes. So when we moved from the south to the north, of the five kids that were very active in school, four had top ranking in Italy, which was used against us, because when we went to the schools in the north, since we were coming from the south, the closest thing you can think of racism, between the north and the south. Close as you can think of. They thought it couldn't be possible for the four of us, so they really treated us like crap for the first couple of years until we demonstrated we were okay. <laughter>

So, I went to school, and when I finished high school, it was interesting, because my father thought I was going to go to medical school. The teachers in the high school were absolutely positive I was going to do philosophy, positive, because I was very active in philosophy, very active. The teacher would give me, on any philosopher-- Italy was teaching in those times every discipline under the Gentile, as a philosophy-- was teaching every topic historically. You will not learn philosophy; you will learn history of philosophy. You will not learn art, but history of art. There was a concept that if it's the history, you are going to see

something, versus just picking things in an arbitrary way. So when I'd finished high school and I declared I was going to do engineering, I remember my philosophy teacher crying. I'm going to go the politecnico.

Fairbairn: So, where did you get that idea? Had you done any...?

Lanza: I never realized what. I think I happened to have a lot of admiration for my first brother, Aldo, that was doing engineering. He wasn't doing extremely well, was doing engineering. He always was the best in high school, always doing extremely well. Engineering, he had a tough time and the politecnico, that was a tough place. He had to work while studying. I thought that engineering was something like using philosophy to the immediate benefit of people. That is, you understand something, you see something, you see better than others and you get it out before anybody else does. And I was doing extremely well in math. The difference, I was studying like crazy philosophy, and I was doing math just intuitively, absolutely intuitively. I had a math teacher that was so annoyed at the fact that I would always find a mistake in what she was saying, that sometimes she was calling me, saying, "You talk!" I wasn't bashful about telling her this. She'd do n-1, 2n-1, yeah, it is odd, but you cannot do it, because everything is considered to n+1, which starts from zero. I remember that one.

She reminded me of that when I was graduating. So I went to Politecnico di Milan. Politecnico di Milan was a tough school. When people tell me about college here, I say, "Oh, their life in college, that's a great time." It was the toughest time of my life. Politecnico di Milan, the curriculum to get a doctor in engineering was five years. Five years was the minimum, which was a very interesting way of doing it. It was five years, and you had 31 classes and topics. In the first two years, we had 11. Unless you passed the top nine of those 11, you will be blocked. You could not take any classes until you finish those 11. It was called a deadbolt, a catenaccio. Unless you passed those, you are not going to proceed. We were 1200 people in the class, entering the Politecnico di Milan in 1962. Of the 1200, two women. <laughs> Of the 1200, normally what would happen is that 40 percent will not pass the two years. Then you had a maximum of I think was 35, but I might be wrong. It could be 50 or 35, that could go into electronics. The others could just spread around in civil engineering, mechanical, electrotechnic and so on. Definitely 35, but I don't remember the exact number. They had the 50th year reunion last year and I think 28 people participated, so the program was 35.

Fairbairn: Wow, out of the 35?

Lanza: Yeah. A couple died and I couldn't go. So, I think 35. In order to get there, you had to have nine out of ten as grades. So, it was tough. The reason why they would do that is there was not enough equipment, so you could not do anything hands on if you taught 500 people here. Today, they have 500, a few years ago, it was 500 people and that's ridiculous. You just don't get any understanding. So I was lucky enough to get into that. I went to school. Politecnico Milan at the time was--

Fairbairn: Were you studying transistor-based stuff?

Lanza: No.

Fairbairn: It was just vacuum tubes?

Lanza: It's very interesting. The first two years are math. Math, physics. It's absolutely theoretical stuff. There are only two applied themes, machine designs and only two classes were application. In the third year, you decide which direction to take. If you take electronics, electrotechnical, you are allowed to go into electronics if your degrees are high, if your score was high, if your card is high. Otherwise you just spread around. The philosophy was that you would get a degree and that degree would allow you to be an engineer in any discipline. In Italy today, I could sign up for a building or for a bridge or for a car, for anything, because what you are doing is studying general engineering. So I studied science of construction, which is buildings. I studied mechanical, I studied how to do bridges, all the stuff, very, very broad. Then the third year you do that and then the fourth year start specializing.

If you are lucky enough to get into electronics, and the electronics are more system than transistors, but also transistors later on and robotics. Machine control, it was called, robotics. So those were the two directions you would take. And then you would get more and more into electronics and the degree you ended up getting was not a computer's degree. It was a computers class from Grasselli. I got also some degree at Stanford, one year or so. He taught computer science. He was the only one that had the test that was a yes/no test, multiple choices, the only one. Everything else was a test one on one, one hour. The professor, the teacher is going to ask everything he wants, so that was the test. It wasn't very easy to go through. So fourth and fifth year were really electronics. One class in computer science, a lot of classes in communication. My degree is on satellites, electronic communication and satellites. So I've done more Maxwell equations than anything else. The computer science, I never thought it was a science. It's just stuff, not very complicated.

Fairbairn: Another language.

Lanza: But the politecnico, the classes were this way: you go at eight o'clock. 8:00 to 12:00, you have four hours of theoretical class, a teacher teaching and you take notes. And then four hours of what's called esercitazioni, or exercises, and that is practice. So, tests in the real-life building things, in any fashion. You build mechanical stuff, you build electrical stuff, you build all kinds, drawing stuff, all kinds of stuff, all hands on. So, four hours, 8:00 to 12:00, and 2:00 to 6:00, you would do the other ones, plus four hours on Saturday. <laughs> This would go from October 1st till end of May, and the last week of May would be tests. So, you had to study for the test and the exams before that, in this thing. Since I had no money, I would work. So, I would teach pupils math and so on in high school. So, when I finished at 6:00, I would go and teach from 6:00 to 10:00, 10:30, and then go home, eat and go to bed. If there was

classes, I had an examination to do, study and then go to bed, if there was time. So there was my five years of politecnico. The thing I'm proud of, I ended up exactly five years and I was one of the 11 people to finish in five years.

Fairbairn: Out of 1200 who started.

Lanza: Yeah. Eleven electronics. There were others. The electronics, of the 35 that we had, I think 11 had it in five years. And I was not the youngest. Another guy was younger. My father threw me to school at five years old, so I ended up, I was barely 18. I ended at 22, 23. I was just barely 23.

Fairbairn: So, then what?

Lanza: Then what happened is that I was lucky, because the work environment was very good, very good economy. Italy was moving up, very powerful, and people really driven. So, I applied to various companies to see whether they were interested. Being in that position, at Politecnico di Milan, I had more than 30 job offers. I had job offers from everybody.

Fairbairn: Now these are all within Italy.

Lanza: All within Italy, and in fact, all close to Milan. The philosophy is normally that you take a job and you stay home, in those days. You don't leave home until you get married, or you have to go to work out of town and my family liked better if we stayed there. I had no reason to leave. And besides, you need to help the family, so you stay in. So, your salary comes in, and you can do something better for everybody. And I remember, I accepted the job for my company. It was a subsidiary, probably, because it was 10,000 liras, which was higher than the job that was offered with Olivetti. Ten thousand liras salary was about $10, a difference.

Fairbairn: Ten dollars per?

Lanza: Month.

Fairbairn: Per month? Ten dollars per month?

Lanza: <laughs> So anyway, I accepted the other one and I went there, and I accepted it. My brothers were not very happy accepting that. I said, "Well, it's good. We need the money." I went there and they were happy, very happy, and they told me, "You need just to go make medical visit and you're in." So I went to get medical visit and the doctor said, "Okay, you have a very good CV from the school. Wow." I

said, "Yeah, I studied." He said, "What are you doing here?" the doctor. I said, "Well, I accepted a job." "Is that the only offer you had?" "No." "What are you doing here?" "I start the job in a week." "No. You have a choice. I'll make you fail the medical test, or you refuse the job on your own." <laughter> He said, "If you fail the medical test, of course, I have to put that on your resume."

Fairbairn: Record, yeah.

Lanza: "In your record. Your call." So, I went home. <laughs> I talked to my brother and he said, "So you call them, and you say that you decided differently." I said, "No, but I told them I would go. I cannot do that." "Well, you call them, and you tell them you decided differently." "I cannot do that." "Well, you call them and you--" "Okay." <laughter> So I called them. The other company that had the offer was Olivetti General Electric. It used to be Olivetti, but GE had just bought 80 percent of the interest in the Olivetti Computers. And the Olivetti Mechanical stayed, but the Olivetti Computers, which had very nice machines-- the 115 was the first one and Elea, some very nice machines, very nice. Of course, with transistors, mainly-- went to the General Electric.

So, I accepted the position at Olivetti General Electric, because it was Olivetti, and I wanted to do computers. Most of the other people went to work for telecommunication companies, GTEO [ph?] or Siemens or others. I really liked computers, so I probably was the only one of Politecnico di Milano of that year, I was the only one, that went to computers, worked at General Electric. Sure enough, I really liked it.

I give you this story because that gives you a little column about me. I accepted the job and then the starting time was in four weeks. I accepted a job from Mr. Kasabji [ph?] in Kuwait, Egyptian engineer. I really respect him, very smart. They got me the job. I went there and I said, "Well, great, I'm in." They said, "Okay, great. You're going to be working for Mr. Somebody Else." I said, "No, I came here to work for Dr. Kasabji." "No, no, Dr. Lanza, you work for Dr. Mizai [ph?]." "No." And they said, "Fine, no, you're going to work for Dr. Belperi [ph?]." Okay. They get me a desk in a room like this, 12 desks. I've got a desk there. And Dr. Belperi calls and says, "Okay, Dr. Lanza-- Engineer Lanza--" that's what we call them-- "Engineer Lanza, come here. Let's talk." We started talking and he said, "Well, I want you to look at these circuits because we seem to have some problems there. Look at this circuit here. Can you say something about this?" I looked at it and I said, "You probably have a problem on this inductor." "Yeah, I thought the same thing. I thought there may be some magnetism."

Fairbairn: Some what?

Lanza: Magnetism. "Say again?" "I thought that there might be some magnetism." So I left and I called the head of personnel, of HR, and I left a message with the assistant to Dr. Kasabji and I said, "I am not going to work for this guy, not even dead." They said, "Well, you are in his office. That's it." "Well, I can

fix that." So I picked up my desk <laughs> and I moved the desk in the office of another executive, the lab of another executive. Then I went to see him. I said, "Dr. Vinsani [ph?], I'm going to work for you." He said, "No, you're working for--" "No, I'm going to work for you. I'm not going to work for that guy. I cannot do that." <laughs> "Well, let me talk to Mr. Kasabji." So, he called, and he said, "Okay, you're going to work here." So now I've got my first job. <laughs> Then they asked me, the first job, they said well, "Dr. Kasabji has an idea that he would like you to work on. We at GE have decided-- at OGE-- we have decided that we really would like to connect computers serially, because these cables are crazy. We would like to do a serial interface. Can you see if you can conceive a serial interface for these things?" "Sure." So I started looking at that, I started designing. A product had just come out from Fairchild. It was the 9300 4-bit shift register. I thought it was a great little product. It was a TTL. So I designed TTL for the interface with the MSI. It was the equivalent of 50 transistors, I think, or 80 transistors, 4-bit shift register.

Fairbairn: This is late '60s?

Lanza: This is now '68, exactly. I started February 21st, '68, so the year's '68. I really liked it. I designed the thing and what happened is that there was a lot of stuff that was pretty original. So we applied for a patent. That's another story, long. We applied for a patent and said, "Well, great." Now at GE, I was very happy and I really liked the fact there was something extremely advanced.

I was talking to very selected people because this was one of the most secret projects, because IBM didn't have one. IBM was going on modems. It was a secret project really, so I was the only one doing it. I was very excited about it. I had some circuit engineers with me. So we're applying for patents all over. So I was writing patents. I didn't speak any English. I was writing in Italian, _____ and then would check in English, just to learn some English if I could. I studied French. Ninety percent of people studied French in those days. Then I asked to look at some other papers that I really thought were important inside GE, or Olivetti General Electric. They said, "No, you're not allowed to look at those, because those are secrecy level four. You are only allowed to secrecy level three." I said, "Really?" "Yeah, you cannot read those."

Fairbairn: These are internal papers?

Lanza: Internal papers. They said, "That's secrecy level four." "Hmm, well, okay." So they said, "Just if you can finish the stuff on the patents." "So how I'm going to do it?" "Well, you cannot do it. They are secrecy level four." I cannot read it. <laughs> I cannot check what I'm writing. So they moved me to secrecy level four. <laughs> I was not the easiest guy. That thing was very nice. We were able to do this, Kasabji and I. It was 20 megabits a second, it was 15 a second. It was really, really fast for those times. It was as fast as hell. It was working very, very well. To me, it was a very interesting, challenging project.

Fairbairn: So this became incorporated into a standard product?

Lanza: They ended up not incorporating it, but I'll tell you the reasons why. What happened is that after I finished this, many of the people of Olivetti General Electric, Olivetti bought by GE, and GE was changing a lot of things. GE wanted me to move to Schenectady. They offered me a job there. They said, "We are wasted here. We want you there." I was about to get married, but not get married yet. But I was pretty heavily involved and engaged. So I went to my future wife and I said, "I would like to go." She said, "Well, of course you can go, but we cannot keep a relationship at a distance." So I said, "I'm not going to go. Sorry." So I stayed. I stayed but I was a misfit in terms of the things I could do.

At this point, it was becoming GE only and I wanted really to work for Olivetti. I thought that getting Italy into computers was what I really wanted to do and participate into that, and being part of a 350,000 people company was not as exciting. And they were right, if I wanted to do something, I had to go to the States and this brief little place was not a great thing. They convinced me that my future would be either there, Schenectady one possibility, or Phoenix another possibility, about the big GE625 then. They couldn't fit me. The Olivetti guys realized that, so they quickly offered me to move to Olivetti, so I moved to Olivetti. Now we are '69.

So there I am in Olivetti and it was the same people. Most of the people worked one place at Olivetti General Electric had moved to Olivetti. The Olivetti was interesting, because they had sold all the computer stuff to GE, except the computer stuff that was tied to the evolution of calculators and typing machines. So the computer stuff tied to the evolution of typing machines was word processing, which was not there yet, but was moving in that direction. And the computer stuff with little calculators was this programmable Acento that you had there, and some different way of doing the computation. This engineer Perroto who was the guy in charge of this, and a couple of people, Desander Mercuri [ph?]. Mercuri came to the States and then unfortunately got into incredible health issue, unbelievable.

Fairbairn: He had incredible what?

Lanza: Health issues.

Fairbairn: Oh, health issues.

Lanza: Malpractice. He is a vegetable, still there. He only recognizes his daughter and Mario Mazzola. That's it. Doesn't recognize anybody else. He was my best friend and boss, good friend and boss. So, I went to work for Olivetti, but Olivetti was thinking of doing something bigger than just the calculator machines, under the same boss, an umbrella of the calculator machines. So, we were trying to do this new development. It was called the E900, or E Novecento, was really a minicomputer. It was targeted to

compete with the 360-20 or the 360-25. It was a great product, TTL design, and it was a very, very nice machine. It had the magnetic media, printers.

Olivetti were very strong in printers those days. So, they put me on this project. The beauty of this project, I did not go there asking for that, but happened to be downtown Milan, one mile from my house where I was living, and I was married. One mile from my house, so it was fantastic, absolutely fantastic. It was 17 people in this apartment, downtown Milan, third floor of the apartment in Via Camperio. It was an unbelievable powerhouse, brain wise, unbelievable. We were designing C900 and they put me in charge of designing the communication.

I was in charge of doing the communication protocol, again serious stuff, communication protocol for asynchronous and communication protocol for bisync. Bisync at the time was 8-bit, 7-bit, 6-bit. It was eight for IBM and six for CDC, and I think seven for Burroughs, if I remember. But there was this protocol and I designed the board to control that protocol. I designed the board in a way that was flexible enough to control the entire thing. So asynchronous, synchronous, all the different variations, bisync, etc., etc. It was a great experience. And I remember, I designed it and a lot of the code I was writing on a PDP11 with a 4K memory. Or PDP8. PDP8 and PDP11 also. Tell me if it's too much detail.

Fairbairn: Raise it up a little bit, yeah.

Lanza: Yeah. So, I did that design. I finished that design and then that project was canceled, and they asked us to do a more advanced project. This time it was going to be based on a new CPU and the CPU was going to be fundamentally LSI. So, they decided that I would stop doing any protocol and any bi-synch and move into designing CPUs. So next thing, I designed this CPU. I did two designs, 1008, 1016, and one 8-bit, one 16-bit. They asked me to do something that was kind of a mix of the two, which I called 1009, in the middle, and that was the CPU that was designed, which ended up as the CPU in all the Olivetti developments from then on. It was very interesting, because that CPU ended up in all the banking terminals Olivetti did. Olivetti ended up with probably 90 percent of the banking terminal business in Europe, and a large percentage of banking terminal businesses here. Also ended up in all the Olivetti more advanced calculating machines. I'm talking now about the P66 and those guys, big machines.

Fairbairn: Were some of these computers that you were working on, or that your group was working on, outside of what Olivetti had--?

Lanza: Had never done it before.

Fairbairn: Had agreed to. They had agreed to spin off all of the non-calculator computing.

Lanza: They were not forbidden from moving in that direction. So they tried to move bottom up instead of going against IBM. When we positioned them in the business that we were strong in, IBM just wasn't there. They could not compete. So the entire thing moved in that direction. At this point, they decided to move us to Ivrea. We are 70 people. They took the 70 people from Milan, they moved them to Ivrea. I ended up in charge of a big team doing CPU designs, memory designs, memory controls, all this stuff. Next, the people doing these controllers, and some of them communication controllers, there was Mario Mazzola, next one. And Kafi von Trenko [ph?] was working either for him or for me, I don't remember. We were very close, because we started commuting from Milan to Ivrea every day, so we were in the same car, the three of us. The interesting thing is that really took off, because I designed the CPU when I was in Milan.

I'll tell you this very quickly. That was the time-- we're talking now about '69-- it was a very, very tough time politically in Italy. The Red Brigades were it. There was a lot of strikes. The only way I could get to work in the morning was to go to work before the picketing people would come there. They would come at 7:00, I would go to work at 6:00 and leave after the picketing guys would leave. It was about ten o'clock. So that was my time. I had told them that we could do that product in 1,008 chips, MSI/LSI, position chips. There was one board and two lines. I told them I would deliver it, if I remember, was in 1970, February. And I did, exactly then. And they said, "Okay, done. You guys move."

Fairbairn: How many chips did you say?

Lanza: It was 108 chips.

Fairbairn: One hundred and eight.

Lanza: Yeah. It was 90 one board and two lines on the other board--

Fairbairn: Oh, I see, okay.

Lanza: Because I had some memory that I had to put in. It was a completely microcoded machine. It was a very interesting machine. We'll talk about it in a second. So people really were excited about what we'd been able to accomplish with that team. We developed that. We tried to develop that and then move it-- get the CAD department to do the PCB. It was too dense, too complicated, they couldn't do it. They were using four boards. I said, "Absolutely no way." "But it's going to take us six months doing two boards." I said, "I cannot do that. I need to deliver." They said, "It cannot be done." I said, "Okay, well." So, I decided instead to put it on two boards-- I said, "Well, we're going to be debugging this thing anyway for a long time, so why do we need it on two boards? We put on one board that is extra large." So we put everything on one extra large board. I did 50 of those and put them in, and that's how we walked in parallel with the guys putting in two boards at PCB.

The diagnostic guy said, "We cannot do diagnostic for this thing. We don't have the right people. If we do, it'll take six months." "Forget it." We needed to do that, so I did diagnostic myself. The entire thing ended up, the team would take every single thing and we ended up doing the entire job. That really struck people, because we delivered everything we promised, and we were there and the machine came out. The product was unbelievably successful.

Then I was modifying this project for the scientific calculators, which was called the 6064. And a guy that was working there at that time, I happened to meet him a few months ago in Milan. Wow, that was an experience. I never saw a 60 year old guy, cry. When I met him. Well.. It's unreal. Interestingly enough, we did that. Now they decided that we'd get in charge of all processors at Olivetti and all peripherals. It was a big job, because I had to take also responsibility for a project that was a microprocessor that I had not designed. It was designed by somebody else, but would end up in my organization, and future strategy would be depending on me. On strategy, they always asked me to do the strategy, always. I said, "I don't know. There are processors coming from the States." So I said, "Why don't you do this: we need better position with the States, so why don't you find a way to go there and talk to these other companies?" Lots of people had worked with the States, the people doing the Micro-8, this product, we were working at the time with Motorola, who was the designer of this product. We were working very closely with Fairchild, for some of the ROMs. I was using PROMs. I was using products from Monolithic Memories and various other companies. PROMs was the characteristic _____. You remember that.

So they said, "Why don't you do this? Your English is not that good, but you can probably make it work. Why don't you do a design based on which you can gauge the technical ability of the various US companies? Go there with this design. We'll set contacts for you with the various companies. You go there and say, 'Would you be interested in doing this?'" Now keep in mind, Olivetti at this point was one of the top three users of integrated circuits. NCR and Olivetti were absolutely the top two. We were the largest volume, huge volumes for those days. Huge! So I said, "Oh yeah, I'll write it." I wrote it. A technical guy gave me the spec. That is in my office; I'll find it one day. I took that and we went around. It was a very interesting thing because the CPU I had designed-- Mario Mazzola came and was hired from his previous job there. I remember that my job was to teach these people what a CPU is, how it works. When I did the class, taking the schematics of my CPU and go through it. Why do I need to do anything? I go through it. You realize what it is, how it's done. I remember Mario Mazzola saying, "Wow, that is a messy thing. Why did you do that?" I said, "Thank you for saying that. That's for compatibility with the previous product." That was the only messy thing. It was the first time Mario Mazzola heard about computers, so I always remind him that. So, I came to the States, and my CPU was designed in a way that was incredibly modular. It had a control ROM, a timing ROM and a little verification ROM. So, it was completely micro coded, completely. You had the control word here, you had the enabling word on timing ROM, and you had the clocking word on the _____. Even the clock--

Fairbairn: Was programmable.

Lanza: Was programmable. So, the duration of this clock was a function of how many bits were in the clock, in the shift register. That's why I destroyed the delay line, because the delay line would give you a fixed thing and I didn't want a fixed thing, because then every instruction has one time-- some instructions are very fast and I only did one clock. So why should I waste time? So, I optimized that way. I applied for patents on that. I thought I was going to get a million patents. Unfortunately, IBM had most of the patents, but I did get a few patents. That were specific on that design.

Fairbairn: So you were going to the US to get them to do a microprocessor.

Lanza: No, I went to the US, I had to gauge their technical ability to become a partner with Olivetti. Whether it would be to do a microprocessor, to modify a microprocessor, do other things, we had not decided yet. But who were the companies with the best technical abilities? It was a good way to look at these companies, we thought. It probably was not, but at the same time, Motorola had destroyed all the activity on bipolar for custom, so they would not do this. This product ended up being transferred to Mostek and Micro-8 became the Mostek thing. So even the microprocessor was going to probably be discontinued because we did not want really to continue with that one. We're going to go with different things, probably compatible with what we had, or different products than the Micro-8 was different than what we wanted to do.

But we noticed that Intel had designed the 8080. We didn't like the 8008? because it was a very unique design. There were many things you could not really design a processor. _____That doesn't work. But by the time of the 8080 [8008?], they were talking about the 8080 to us, because we were good customers of them too. And we liked the 8080. We said, "Yes, it looks pretty good." Now we're talking about '72, '73, to May in '74. We went there and the product that they had was my CPU but divided in four. It was a 4-bit slice of the CPU. So. with this thing, we went with the control ROM. We went to Intel and we said, "Do you think this is feasible?" And they looked and said, "Ah, yeah, do that, two bits is what you want to do. That 4-bit is too much." Whoa, excuse me. We went to Fairchild, they said, "No, we don't want to do those things." So. we went to TI and they said, "Well, we're doing the same thing ourselves." Went around and in the end, we went to Monolithic Memories and John McDowell was the technical guy there. Ze'ev Drori was the CEO. John looked at and said, "You know what, I like it. I will do a couple of changes. You have scratch pads, 3101 Intel scratch pads. We cannot do those. We'll do a dual port memory. But other than that, we like it. We'll send you back a proposal."

They sent back the proposal and that was the first bit slice of the 6700-bit slice. We became customers of bit slice. But at this point, I was involved here. I had good connection with MMI. I had a good connection with Fairchild, because some activity was also with Fairchild. And I talked to Intel and I liked the 8080 very much, and I liked the fact they were moving probably to the 85, but I think the 85 was already in the works. But I thought the 85 was a real good product, and we should discontinue the Micro-8. So, I told my friends, and they're investing incredibly that. We cannot complete that. So, let's not do the microprocessors. On the other side, for other products, having a processor is not the center of everything.

It's the center, but it's not really reducing the cost. We need to have all the kits around. So, we really need to have a set of products that will allow us to be the best at reducing the costs of the machines that we have. So, I said okay let's do that. So, by now I'd been back and forth with Intel. Intel had offered me a job-- not yet. Back and forth, and they said okay go to Intel and see if you can convince Intel to do some peripherals.

So, I went to Intel, and Bob Noyce was the guy in charge of the interface with Olivetti. So, it was really close in interacting with him. And Tom Logan was the sales guy. And I talked to several people Glenn Newey was one guy. Stein was there but he was a kid. He was just out of school, couple-- few people-- and we started talking about whether it would make sense for Intel to do peripheral products. And we thought it would make sense for Intel to do three products. A disc controller, an SDSC controller, of course evolution of bisync, and CRT controller, _____ CRT controller. And Intel said, "yeah we can do it. We are willing to do it because the volume with Olivetti was huge."

But there was one condition that you discontinue the Micro-8 and you give us all the 8080 is the standard-- 8080 and the 8085 would be the standards within Olivetti. We said okay. We switch all of the products will be with the 8080, 8085. And I said great.

Second condition, we're going to do it, but you will give us the expertise. And everybody said okay, what do you mean? They said that guy. So, at that time, I went back to convince my wife by now that it would be a great opportunity. She would be moving here too, blah, blah, blah, etc. And she was not very happy about that, but I did not read it well. And unfortunately, I did not read it well. So, I decided I would move to the States for a few months and would work on writing the specs of these things. So, I came to the States and the three products, I started writing the specs. The three products became the 8271, 73 and 75. And the guy that worked on this thing was Steve Bisset. Steve Bisset became the founder of Megatest. The guy was sharp as a tack, great guy.

He looked at the first two products, he looked at this controller and the SDSC controller, and the way I was designing them. And he said "This product is one product. It's the same." Because the way I was designing was I put the byte processor to process the bytes, and the bit processor to process the bits. So, after I put the bits in a shift register… I said I'm going to do-- so, that was the way I put it to him, I said. But at that point it became one product where the only difference was the shift register ought to be opposite, because one is first-- the highest bit first, the other is lowest bit first. Otherwise it would be absolutely identical set. That was first two products. And then we did the 75. That came out.

When things were moving that way, I kept going back and forth from Italy. To be-- and assume that is the best demonstration of my financial stupidity because I was working now at Intel, paid by Olivetti. My salary was one third the salary of a new guy at Intel and no stock. So, at a certain point Intel said, "Why don't you join us?" I said, "Well, that's a good question. Okay, I will resign and join you." But in Italy you have an obligation if you resign to give a notice of six months given my position, six-month notice. And so

I'll join you in six months. So, I left and went back to Italy for six months. At this point, it became clear that my wife would not-- not there yet. Anyway, and then I stayed there for six months. Everybody knew that I was going to be leaving, and I gave notice. And the six months later I sent the notice to Intel. So, okay I'm going to be there this week.

You serious? Yeah, I told you I was going to be there that week.

<laughter>

Fairbairn: They'd forgotten about you, huh?

Lanza: Wah, merci beaucoup! Okay. Okay. So, I sent out-- I remember because I sent them a Telex, and they sent back a Telex. So, okay, yeah we can make that. Okay, come on. So, I joined them. So, I--

Fairbairn: What year was this?

Lanza: By now we're talking about the joining was in '77. October 11, 1977 is what was on my one-way ticket.

Fairbairn: It was your what?

Lanza: One-way ticket.

Fairbairn: Oh.

Lanza: Because any every other time we come there and had a return ticket. That was one-way.

Fairbairn: A one-way ticket.

Lanza: And so, I go there, and it turned out they could not hire me because my visa wasn't there. So, I stayed illegal for a few months. And they could not pay me either, which made it for a very interesting life, very interesting life. And then I became legal I think in March, six months later. But in order to become legal, I applied not as an engineer, but as an artist in computer architecture.

<laughter>

Lanza: So, all the ads were out of books and out of magazines. Artist in computer-- so, by now anyway at Intel, I got there. And the 71, 73, and 75 were being finished. And unfortunately, what happened is that they had in the six months that I was gone, they had decided to build another product called the 8086. And I really didn't like it. I didn't like the architecture, and I'm not going to make statements. But Intel had too much vicinity between the 86 and what became the 432. So, they could not put the product too close to the 432, so they decided to position them both in the middle. And therefore, they could not do a full sixteen-bit processor.

So, it's ironic, because the guy that became in charge of the product was Bill Pohlman. And Bill Pohlman came to Intel from designing the Western Digital/DEC PDP-11 product. The-- what it was called, the "dah, dah, dah 11," MS-- anyway it's the Western Digital product that was the product done for WDC at Western Digital computer lab I think. It was the one that was the PDP-11. So, perfectly flat architecture, the architecture we wanted, everybody liked, and they called up Intel just to finish this thing.

He didn't like it either, but he made it really clear to me that that's it, ain't going to change. We are committed to this. That's where we're going to go, four segments, puking stuff. He remembers that. Anyway, so, the 86 was done. So, they said, "Okay, why don't you continue on the peripheral stuff. There's more stuff we want to do on the peripherals. There's more stuff we want to do in the DMA controllers. There's more stuff we want to do in various areas." And I said, "Well, how about the evolution of the 8086? You're going to move it." They said oh yeah, yeah. The evolution of the 80-- they say what. You know I think you should move in two directions. One direction you push performance, the other direction you're push integration. So, best to move the direction of integration, we'll call it the 186 and bring in other pieces. The direction of performance called the 286.

So what happened is that was the time when I started getting heavy into the microprocessor strategy definition and decisions. And those were also the days-- I may be off by weeks, but also were the days when Intel was having very difficult times financially. And very close to those days is when-- it's '79 I think probably is when IBM decided to invest in Intel with an option to buy more. And one of the things IBM did those days was ask Intel about their strategy. IBM of course when asking Intel about their strategy did not ask Intel to tell me what your strategy is. It's IBM. So, they asked them what is your strategic process? And Intel said process? Process? Chips. <laughs> What is your strategy process? How do you define strategy? So, you know what I mean?

Fairbairn: We pick a product.

Lanza: You tell me. Oh god. Oh, it was interesting, Gordon Moore was teaching a class on strategy. Intel was a-- you have to remember this-- was a fantastic place in terms of creating culture, absolutely fantastic. They would have somebody from the outside come in and teach the top management. I'm talking about Grove, Noyce, Moore, that level. They would teach them how to hold meetings, how to decide how to hold meetings, what kind of meetings do you want and why. So, they would talk about how

to do these things. Then they would teach their people reporting to them how to hold a meeting. And the person who had defined that would participate in the class. And then their people would teach underneath. And the person that taught them is now participating. So Grove has been in my classes. And so on. So, you would be sure that the message would be potentially the same.

There was no Internet, so they were not able to just go and see it. And that's how we propagated the culture. And I remember when Gordon Moore was talking about these things-- was teaching one of the classes that the test was given at the end. Okay, define what was the Intel culture when they started? What was Intel's strategy? And they would have said "Well, our strategy was to do this. Then we're going to move to processors. Then we're going to do this. We'll do that." Everybody wrote these things, and everybody presented at the conclusion of the class to Gordon Moore. He said "Well I'll tell you what it is that we had. Our transistor was smaller, we thought we'd build better memories."

<laughter>

Lanza: That's it from Gordon Moore. That's it. Now, the interesting thing is that by IBM asking that, they also advised us to use a strategy teacher from the University of Chicago I think, which was Ram Charan.

Fairbairn: Who?

Lanza: Ram Charan.

Fairbairn: Okay, Ram Charan.

Lanza: Ram Charan came in and defined the-- what was called the strategic business process for Intel, would include SLRP, our strategic long range planning.

Fairbairn: Okay.

Lanza: Every April. And we'd be divided in sections. And there would be memories…I think EPROMs was one. And one was LSIs. The VLSIs at the time was including peripherals and processors, and then later on became processors. And I was put in charge of the SBS processors, which is chairman of the SBS processor segment.

Fairbairn: SBS, strategic business segment.

Lanza: Segment. Yeah. Before joining Intel, one interesting thing for you is how did AMD [Advanced Micro Devices] end up leading the bit slice?

Fairbairn: Yeah, I was wondering. I was expecting that to be the answer, and I didn't--

Lanza: They called me one day when I was here and I was working for Intel. And they asked me, "Can you come to see us?" I went to see them, and Clive Guest was the guy. The guy that went to Altera, I think. And they were there, and they asked me-- they said, "You know we really like the bit slice. And we understand you know something." Yeah. The said, "Well, we don't want to second source it. We want to do our own original one because the military likes a second source. And will have a second source who has a different model." So, they said, "If we change these things, and we move your multiplexor on top of the dual port memory. And you have-- you put it down here. And then we take this thing and move it there, take the register just move it there. Do you think it still works?" Yeah. It's going to work. You're going to have a slower rate of transfer. You're going to have faster IO. You're going to have these other three things. It's going to work. Great. That became the 2900.

Fairbairn: Twenty-nine hundred.

Lanza: Yeah, that's exactly what happened.

Fairbairn: But you were working for Intel by this time. And they were asking you--

Lanza: I think it was when I was working with Intel by Olivetti.

Fairbairn: I see.

Lanza: So, I was here, but not employee of Intel. So, at that time, I did not have an office at Intel. I had an office in the Olivetti center. Olivetti did not want me to have an office at Intel. They wanted to have total control of me.

Fairbairn: Right.

Lanza: So, that's-- and I was working on other things including this. I was working on some stuff with Monolithic Memories, some stuff with [?]. So, Olivetti saw me as the person who can do more than just-- So, anyway, I went back to that. So, here is the situation.

The SBS chairmanship was great. Sometimes, I say I was in charge of defining the strategy. That's wrong. I was in charge of being sure that the strategy is defined. I had my job. And this was just a matrix. So, I was in charge of finding out which people have a strategic mind such that you can take them out of the line job for a part time activity and define where we should go. But every single one has a job there. Nobody has a full-time strategy job. And at this point, what had happened is that Pohlman had left. The 286 guy had left.

Fairbairn: Paul?

Lanza: Bill Pohlman, the guy that designed part of the 286. And so, they attached-- by now we're talking about late '70s. They attached to the strategic business segment activity, and my activity in general on the architectural products, 186 and so on, they decide to put me in charge of the architecture of processors. At this point, my line-job was architectural, the architectural team. And strategy job was the one I loved, was just to be sure the strategy is defined. And the strategy was interesting because in order to get a strategy defined, they wanted to be sure you had a planning committee, a product planning committee. A planning committee was the one who defined where the company should go. It was a five-year plan. And was a great, great philosophy. You would start with the environmental analysis. And you say "Okay, what do I do here? I need to gauge my clock." So, it's a five-year plan. So, the first thing you do, you look at the world five years ago to just gauge what five years do in this industry. So, you want to just gauge the clock. You want to give--

Fairbairn: Figure out what the pace is.

Lanza: And then you can talk about the next five. I might accelerate it, but then I'm not going to be crazy. I'm going to be stupid thinking that it would happen in a year. So, that was the starting point. And then you had various things on analyzing what you did in the past, how your peers' program went, doing some analysis of different segments and environmental analysis, market analysis….

Fairbairn: Was this all part of the structure of strategic development that this--

Lanza: IBM that Ram Charan set up. It was absolutely great. And I'm sure I have it on a floppy disk.

<laughter>

Fairbairn: But there's nothing that will read the floppy disk.

Lanza: That's exactly the problem. <laughs> So, that I thought was a fantastic-- at the end of this, you would have a presentation that you'd give to the executive of Intel in mid-April. It was the April SLRP. It would be very interesting. So, that was the stuff. I ended up doing this, but interestingly enough, the strategy was defined in a very interesting way. The strategy was defined as let's not define strategy in a vacuum. And in order to do that, the person in charge of developing the strategy is also in person in charge of the product operation committee. What is the product operation committee, though? It is looking at the fab and problems that we have as an operation, as a business unit. So, you're always grounded. So, we had a POC, product operation committee, PPC, that is product planning committee. It is two committees where both are reporting to the chairman. So, the product operation committee is very important because you learn how things really happen in the fab, so you're not going to be stupid when you do planning, and think that the fab is going to do something that it's not going to do. You need to understand what the constraints are. Remember, PPC and the POC, the planning committee and the operating committee-- and the operation committee, the guy in charge of the operation committee was Paul Otellini.

Fairbairn: Oh.

Lanza: <laughs> You remember him? He was the CFO of the SBS. So, we were working together with Paul continuously on this thing. So, as part of this now, I was in charge of the architecture. And what happened is that one of the things that would happen in those days was that we wanted to evolve some of the peripherals also. And I said "Yeah." We want to evolve some of the peripherals. And what happened is that the-- '72, '73, Intel is doing okay. Seventy-one and seventy-three it was okay. Seventy, seventy-three were being hit by the fact that the standard was changing. Floppy disks or single density became double density. And the other one was under IBM. So, we got hit. And we had to do a second generation of those, that would be 8274 and some other stuff. At the same time we were very much ahead in processors, even in microcontrollers. We had done the [80]48 and the [80]49. Stan did that. And we also had some 8061 was this 48, 49 for automotive, competing with Motorola for Ford. And the [80]61 had an A to D converter in it that Ed Cheng designed. And we had the 8021, which had a smaller one that also had the A to D controller. NEC really liked the success of the 8080. And they had an 8080 double sourced themselves with a forty-two bit-- forty-two pin chip with three different power supplies with a puzzle scrap. And they wanted to-- remember, they wanted to work with us on that.

Fairbairn: They wanted to work with you on that?

Lanza: Work with us at Intel and second source the Intel 8080. We ended up agreeing that they would do it on the 85. But we were really hesitant. First thing of the cooperation we really want you to understand how we are designing. So, they say, "What we really like as a starting point, we want the 8021." Okay. So, we went there to NEC. And at this point, I was in charge of the technical interaction with NEC. And so, I went there. English by now was okay. And I went there with Ken Fine. Ken Fine was the guy in

charge of the operational stuff. I was in charge of strategy still and the architectural stuff. We went there. And we wanted to be bold. So, we told NEC, “We’ll give you the 21, but--“

Fairbairn: This is the 8021?

Lanza: Eighty twenty-one.

Fairbairn: What was that product?

Lanza: It was an 8048 downgraded for embedded processing with an A to D converter and a few other things. I don’t remember, very small things. But we said, “We-- that’s done. It’s ready. But we want you to design three chips for us.” And they said, “Whoa.” So, we went there. And we offered something. We started the negotiation with great people. We went there and they-- and we offer something as a preliminary contract. We send it to them. So, we went there. And they went in the hotel. So, we called them. We’re meeting tomorrow morning. They called us at the hotel at night. They said, “We saw your proposal. We’re not interested. Go home.” <laughs> They were not impressed.

So, just start understanding what happened. We offended them because we give you the 21. You give us three products. We asked for three against one. That’s the problem. No, we put milestones on the three products under which we could just close the contract. And we did not put any milestone on the 8021. It was a finished product. We were just giving the-- <laughs>. So, we had to go back and redraw the contract with parallel milestones. They made absolutely no sense on an existing product. They were already satisfied. But they want one parallel part on anything. And then we started understanding. I said in this I had to be Italian. I had to think form before I think substance. And I thought that is exactly what I did not have in Italy. That’s why I wouldn’t fit in Italy as well.

In fact, there is an interesting joke. I was leaving Olivetti, in the six months I was leaving Olivetti, I remember this guy who was Hugo DiRio comes there and says-- and I wasn’t saying where I was going. I had offers from everybody, many companies. I had many offers at the same time. I didn’t say where I was going. I didn’t want to create any trouble. I didn’t want anybody to call Intel and say don’t accept him, or saying we’re going to close your contract or whatever. I didn’t say anything until I left. So, this executive at Olivetti who meets me-- he’s with other people, meets me and in the hallway. And says, “Oh, Mr. Lanza, Mr. Lanza, I understand you’re going to the States.” I said, “Yes, I am.” “Oh, what are we going to tell people that ask us where is he going? Where is he going?” “I would tell him the truth.” “And that is?” “That you don’t know.”

<laughter>

Lanza: That line stayed in Olivetti for twenty years. Twenty years. I was going back, everybody would repeat the line. So, anyway, by now we're in NEC. We're discussing these things. And we wanted NEC to do two products for us for sure.

Fairbairn: So, did NEC people go back and then return what--?

Lanza: No, we were there. We're in Tokyo.

Fairbairn: Oh, you were in Tokyo? You fixed it.

Lanza: They told us go back. So, we fixed that. We started negotiating. And we were about to make three products. So, the first product we wanted was the double-density floppy. The second we wanted was a product was really making us pay for was the-- an equivalent to the SIO, the design of SIO, it was a pain in <inaudible>. Absolute pain, they'd buy all the kits from us and the SIO from Zilog.

Fairbairn: From Zilog?

Lanza: Yeah. And being Faggin, they could not stand it. It was a personal thing between Andy and Faggin. And the third product we were going to define-- we were talking about doing various things, doing a controller for the SBC cards and an A to D controller, some other stuff. And so, we went back. We had two defined, and one we would define when we got back. I said no. I said I really would like to define as the third product a graphic controller.

And so, I went to see Ramtek. Was it Ramtek? Ramtek and a couple other companies to look at the controllers. I said that's possible, graphic controls are pretty good on this thing. So, okay, let's do that. Let's do a graphic controller. And so, I asked Andy if they would let me design a graphic controller. And I think Dave House was in charge at this point by now. Yeah, Dave was in charge. Anyway, Andy will make the decision on this one. And-- I think it was Dave House. I remember that people said graphics controller, it's ridiculous. A graphic controller, there is fifty thousand graphics units sold every year. It's ridiculous. Why do a graphics controller? Graphics controller is the future, blah, blah, blah. And I wasn't convincing anybody. Of course, I wasn't convincing anybody. Why do you want to do this? Well, I said, "Two for one is already very good. So, you can do the third one any way you want it, any way you want it." I said "Okay, good. One condition, five percent of your time." Five percent of my time. <laughs> Five percent of my time? Ten percent is four hours a week. That's two hours a week. God, how do I define a controller that is not _____ in two hours a week? I said "I do not want to do it." So, I'm looking around. Who has the nicest bit compact graphics on their machine? HP had, the HP 97. So, I said I'm going to go to the HP maintenance warehouse, the warehouse at HP, at the corner of Middlefield and whatever-- Daisy's on the other side. So, and I would get the manual. I got the manual. I put it in an envelope. I sent it to NEC. I said, "That's the spec."

<laughter>

Lanza: Do better than this. And that became the 72220 or 82720, first graphics controller, LSI graphics controller in the industry. So, that was fun. It was one where there were people saying how did you do that. It was a very interesting experience. And some things to keep in mind at this point, microprocessors at Intel for many years, in fact until the PC time, microprocessors at Intel were not the winner. The 8086 was not considered the winner. The 286 was considered extremely heavy and extremely not agile. Things that people don't realize, the 286 was designed, inspired by Multics. So, the 286 structures were inspired by Multics. When UNIX was winning, Intel was so behind that we were inspired by Multics. That was the one we were really looking… it was terrible, terrible architecture. That's where the protection came from. That's where the overhead, all that architecture came from. And we're still seeing it today, still in the….. Now, the-- we had lots of--

Lanza: You have to think about this, when I was doing the presentations of microprocessor-- in the microprocessor SBS, the yearly presentation, I wish Intel had still those foils because I remember, still we had the microfiches. That was the example that we would give to people on how to do the SBS stuff. And I didn't have that. And microprocessor, when I was talking about the microprocessor, and where the microprocessor should go… I remember-- I hope Andy doesn't get offended. I remember Andy Grove telling me, "Lucio, you don't understand. The microprocessor is the loss leader. Two SBS in a row, it's the loss leader. We make money on EPROMs, and we make money on SBC and on development systems. The microprocessor is the loss leader." Boom, that to your face at the time with the entire executive there and the second level, two levels of management. So, that was Lucio presenting microprocessor SBS. <laughs> So, when we talk about how great we saw it, the point is-- the truth is we knew one thing for sure, one place where I was absolutely positive that the microprocessor would replace the existing solutions. It was the minicomputers. It's the only application never went in.

<laughter>

Lanza: The only one. It went everywhere, but not that one.

Fairbairn: That's the only one you thought it would do, right?

Lanza: The only one. I was positive.

Fairbairn: So, much for strategy.

Lanza: But at the same time, we were looking at the future. We were looking to put the operating systems in the microprocessor, looking at the kernel operating system. Was it designed by-- what's her name? Last name is Doerr, I don't remember the first name. It was the wife of John Doerr. She was designing--

Fairbairn: Oh--

Lanza: Anne Doerr. Anne was designing the chip that would become the operating system for the 8086, the operating system kernel. It was in his organization-- At this point he had moved.

Fairbairn: So, Anne was at Intel as well?

Lanza: Yeah. We were both under him. So, the interesting thing here is that-- so the first microprocessor wasn't doing well We were got to this Wescon, whatever it was called. We would get so mad because everybody was putting sign saying 68000 inside. And nobody would put a sign "8086 inside" because they were embarrassed. So, all the applications with the 8086 would win. We had a thousand design wins. Nobody cared. Absolutely nobody cared. And the-- it was just not the thing that people are excited about. And we really were convinced as a company, not as Lucio Lanza, but as a company, we were convinced the future was the 432 of course, for processors. And everything else was just a painful thing, just before we get there.

Fairbairn: So, Intel was not excited about the design wins? That was just not a--?

Lanza: They were excited more because there were design wins for the SBC, the single board computers. We were saying it's great, it's great, it's great. But the one's with volume were very few, tens of thousands, yeah some. But not-- very few with high volume, very few that were really-- workstations? Not one. So, we really were very, very concerned about it, very concerned. To the point that when we had a spot of strategy, various things were happening that we're trying to see how to win. We still considered the Z80 a big competitor in many of the businesses. 68000 was talking about it, but they did not have the structure around. They did not have the peripheral chips. They did not have all the stuff that Intel had. They did not have the development systems. They just didn't have it. And they did not have the CPM 86. There was lots of stuff they did not have. So, yeah it was a pain. We could see strategically it was a pain, but the real pain in the neck was Zilog, who was also for political reasons.

So, what was happening, one day I remember that Gordon Moore had called a meeting in his office on the second one. He said, "You know what? Why is the 8088 not flying? I want the 8088 to win against Z80." I said, "Well, it's difficult. It's a big chip." And Jack Carsten was there and a couple other people. I mean Jack got them for reasons he didn't realize. And Jack Carsten says, "Gordon, you don't understand." And that's the wrong start.

Fairbairn: You don't say that to Gordon Moore, right?

Lanza: No, listen the chip is big. It's bigger than the 86 because we had to multiplex things. So, even though it looks small, it's big and slower because we had multiplex delay. So, it's a bigger chip. He said, "Well, I want it to win. What if we price it down? We price it below the Z80?" "Let me tell you again, it's bigger than the 86. It costs more than the 86." And Gordon Moore, the only time in my life I saw him doing this, got red in the face, lifted his fists, both fists, started pounding the table, "I said price. I didn't say cost. What if we sell it for ten dollars, five dollars, one dollar, price not cost? Price." Silence. Oh, price. Yeah. I can do that.

<laughter>

Lanza: So a week or two later, we came out with an ad on the Electronic Design [Magazine]. I wish we had that. The ad said we are offering free kits for design of the 8088, and the price is ten dollars, if I remember, of the 8088. But the tongue in cheek was, given the volume of the 8088, we can afford this price, which was a true statement.

<laughter>

Fairbairn: It was so low that it didn't matter.

Lanza: I'm not going to tell you who came up with the sentence, but the sentence was there. I remember that. Given the volume, we can afford to sell at this price. <laughs> So, the interesting thing is that that 8088 is the one that was noticed in Boca Raton by the word processing people, the one I competed with from Olivetti, because another application of my CPU was the word processing system. And they saw it, and they say "Wow. Eight bit, faster than that, we don't need to have this model cost necessarily. We command pretty high price on these machines." Eight-bit bus, it's just like a Z80, just sixteen bit inside. Eight-bit does not work for word processing. And I knew that from Olivetti because if you have eight-bit, you cannot qualify different type sets. So, you need at least ten to twelve.

The fact that we had sixteen-bit inside, we're allowed to switch type sets, to character sets. So, that's how it won. And the fact it was eight bits, the price was so low is what told them we're going to design with this one, unbeknownst to us. But I'm convinced that that's the way they started the design. We would have never won any of the computer guys in IBM, impossible, or in Digital-- for the reasons I was saying earlier. That's how we ended up there.

So, it was completely, in my opinion, completely serendipitous. It was a good move to attack a product like the Z80 with the 8088 and lower the price. That's-- tactically, marketing wise, strategical, whatever,

competition wise, great move. But I did not expect, and I don't think anybody at Intel expected this thing to become very important for word processing. I did not. My 1008-- I told you 1008, 1016, my 1008 was exactly designed that way, sixteen bit inside, eight bit output. And the word processing guys really liked it, but I did not think about that. I did not.

Fairbairn: I thought the 1009 was the combination eight bit, sixteen bit.

Lanza: Yeah, but the eight was pure eight bits-- pure eight bits. And the sixteen had a lot more register than the eight. The eight was really cutting down as much as you can. But you still had the sixteen bit inside.

Fairbairn: I see.

Lanza: But you see outside an eight, and you would have a lot of lower characteristics because it had to be to realign. That was going through the replacement of the calculating machines. But they cannot do two. The nine became the one that had the best combination of the two. Also the nine became the one that complete compatibility with the past. The nine was also another reason-- 1009-- reads 1009 in this way, and there is 9001 in this way. The previous product was a nine hundred. So, it was called the innovation, the D900. So, everyone would see in Olivetti there was 900, first revision of 1008 and 1016. So, that's why I used that now. So, anyway in the end that's how that PC product came about.

Fairbairn: So, how long did it take you before you realized what a good strategy this was to re-price the eight thousand, the 8088 to--?

Lanza: In that meeting. In that meeting. Then it was done. The meeting we thought about it, and--

Fairbairn: No, but I mean once it was re-priced, how long did you take before you realized how good of an idea that was?

Lanza: I think we left the meeting, and we knew it was the right thing to do. We just could not force Intel to lose money. We wouldn't even think about it that way. And Gordon can. But we knew that doing that would have given us a lot of additional product and additional wins. We did not expect the big ones. But there was going to be-- we would lose to Z80 because it had more register than the 8080 and was cleaner than the 8085. It was a better design period. And the 8088 was reasonably superior. And the Z8000 was not taking off anyway, and it was the one they were pushing more than anything else.

Fairbairn: Right.

Lanza: So, anyway that gets you to there. The thing that we can go over next time-- well we can go through that quickly in seven, eight minutes, is why once we started having the 186 and 286, what was happening and where would we be going. Now, 186 and 286, the 286 is there-- is not yet the product for the PC yet. It was the first one will come on the 8088. But it was clear that they would not look at the 86 per se. They would look at the 286 as the next big product.

Even at this point, even at this point, in Intel the best pedigree architects would not endorse the 286. They thought it was a crappy architecture, terrible thing, was the wrong thing to do. And they started two different architectures. One was the 432, which we knew by now was called P5. And the other one-- the evolution of <inaudible>. And the other one was an architectural-- that Glen Miles from IBM, architect from IBM, was pushing was called the P7. P4 and P-- P4 and P7. P4.

And it was an interesting architecture. And there was a time-- it was an interesting architectural time, not particularly exciting. But I was not in favor of changing architecture to begin with. But one thing that I was just referring to when I was saying I was going out as marketing guy, I was going out as marketing guy to talk about the future of the architecture. And I was in charge most of the time of talking about the entire system. There is the CPU, but there are also the peripherals. And Dave House would be talking about the SBC or Judi Ross would do that. We have different teams who would go around. And as Dave House used to say-- he was laughing saying that it's unbelievable how effective you are, Lucio, at presenting. People are always listening to you a lot. You are very lucky because you have such an incredibly terrible accent nobody can understand you.

<laughter>

Lanza: So, the only way to understand--

Fairbairn: So, listen carefully.

Lanza: So, listen carefully. <laughs> I said you're a lucky man. So, by now, however the 286 was something that people didn't like, there were two competing architectures of that. And I remember, by now, I really thought that we had to do the 386. I was in the process of still, and the process of [?]. And I really thought we had to do the 386, we had to clean up our act, probably drop some of the protection stuff of the 286. Try to clean it up. And I also got advice from some people at Berkeley, which have nuanced, that are doing the flat architecture, doing the--

Fairbairn: RISC.

Lanza: RISC machines. Yeah. So, they came there as consultants, because one of the people that we hired in the architectural team by now was Scott _____ and one of his students. Scott _____ was there, just tried to make sense of the next family, kid in the 86 family. And it was him, Bob Childs, which was the architect of the 286. Jack Clebbenoff was working with Childs, and Steve Renfield, ex-Data General. These four guys were now on the 86 area. Everybody else was excited P7, or now working on P4. So the four of us, when I say I want to do the 386, they say okay. We'll give you these people. Two were the 286 guys, but were in disgrace because of political reasons. One was in corrective action. So, we're getting four people, two of them were corrective action. Forget it. Anyway, so that was my team for the 386.

And then Ken Fine was put in charge of processors. He basically told me the 386 was a piece of crap. And he did not think we should work on that, blah, blah, blah, blah. And I had happened to get a hold of a memo from one of the architects, memo to go to-- this one was to Andy Grove. Andy Grove asked, "Tell me about this architecture, too many architectures. What should we do?" So, the memo was two pages memo [by Glen Myers]. And the first one page and three-quarters was describing the difference between P7 and P4, what are two-- both of them were incredibly good architecture.

Fairbairn: P7 and P4 again, were which ones?

Lanza: 432, and the P7's architecture was derived from a lot of IBM thoughts. And P7 was in Santa Clara. P4 was up in Oregon And the last sentence before the end said, "And then there is the dark horse of Mr. Lanza."

Fairbairn: <laughs>

Lanza: "The 386. But I don't think we should waste time talking about that." And that's the time when I went to see Jeff Katz. And I said I want to move to your team.

<laughter>

Lanza: He says, "What are you going to do here?" I don't care. Now, he knows this is the first time I did it. So, that's-- so, now we are to the point where I now move into peripherals. And we talk about this next time. And the PC is there. And we can take it from there next time.

Fairbairn: Okay. Excellent.

END OF INTERVIEW

