

An Interview with  
ANITA B. MARSH  
OH 485

Conducted by Thomas J. Misa

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Abstract

Anita Marsh majored in mathematics at Texas Tech and gained a master's degree in mathematics at Northwestern University in Chicago in 1968, then took a position at Bell Laboratories (Naperville, IL) where she learned IBM assembly language on the job. One early assignment was creating a software emulator for the hardware of an ESS then in development. Marsh describes her experiences working part-time or flexible hours as a full Member of Technical Staff while raising children and lobbying for day care. Subsequent assignments were in internetworking, commercial UNIX, and 5ESS. In recognition of her technical achievements, she was made a Distinguished Member of Technical Staff in 1983 and retired from Bell in 1996. She describes her subsequent software work for Tellabs in wireless telephones and VOIP and for Arris in cable modems.

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Misa: My name is Tom Misa. It's the 9th of December 2015, [and] I'm here at the home of Anita Marsh talking with her about her experiences working for AT&T Bell Laboratories. This is part of a Sloan Foundation oral history project to try to understand the experiences of women who had technical careers in the computing industry. So Anita, I wonder if you could give us a bit about your background and your childhood. Particularly any hobbies, or interests, or subjects at school that attracted your attention, and that might've paved the way toward your doing a technical career later on.

Marsh: I grew up in Oklahoma and Texas. My dad was an engineer for an oil company, and my mother was a school teacher. We lived for a while in Houston, but mostly we lived in fairly small towns like Tulsa and Midland. And I went to high school in Midland. I never thought about *not* going to college. I graduated second in my class at Midland. It was about 500 students in my class, so it was fairly good size. Went to Texas Tech [and] majored in math.

Misa: May I ask about your high school, were there math classes there that attracted your attention and interest?

Marsh: I started getting interested in math when I was in about sixth or seventh grade. I nearly flunked third grade arithmetic because I thought it was so boring I couldn't stand it, and I could just see no point in my learning any of it. But with repetition and drill you do pick up most things. I started getting interested in math when I started getting to algebra. I thought, you know, this is kind of fun, and it's not very difficult, and there's no

arithmetic. So I thought well, this is kind of nice and I just stayed with the math and science because I thought it was interesting. So I took all the math and science that I could take in high school, and all the history and everything.

Misa: Did you have any particular math teachers in high school that were supportive and engaging?

Marsh: I had a math/algebra teacher that was very good. I mean, I had some bad teachers, too, but my algebra teacher was very good. And I just assumed that I would major in math because I liked it best and I didn't have any particular ambitions at that time. I met my husband in college. I can still remember my father-in-law [father-in-law to be — my husband and I didn't get married until the end of my senior year] saying to me be sure and not drop out of school in your freshman year and I remember thinking that is the dumbest thing I've ever heard.

Misa: Dropping out.

[Laughter]

Marsh: Why on earth would I ever do that? My husband at the time was a senior, and I was freshman and we went together all through undergrad. We got married when I graduated from college. I was at the top of my class and I had a degree in math and a minor in English. He completed his master's, which he might not have ever gotten if he hadn't met his girlfriend who wasn't going to drop out. We got married then, he got a job

in Chicago, so we moved here. When I looked around for a place to go to grad school  
[pause]

Misa: Can I just fill in the college years? What experiences did you have as a math major  
in college?

Marsh: There weren't many women in the math classes.

Misa: Not many.

Marsh: Not many at all, just maybe one or two. Very few. There weren't very many  
women in any of my classes, for that matter. But I liked the math, I just found it  
interesting, and I never really considered not doing it. I thought at first I might get a  
chemistry minor but I really did not like the chemistry classes. The professor was fine but  
the labs were taught by lab assistants who didn't necessarily speak English and it was  
really, really difficult — not difficult from a subject matter perspective, just difficult from  
lab procedures point of view since the lab instructor didn't really speak English and  
couldn't answer questions. And I didn't like the time pressures, and in math there wasn't  
any time pressure. So I just stayed with the math and I didn't have any idea what I would  
do with it. My parents always said be sure and get a teaching certificate, so I did. I got the  
qualification for a teaching certificate.

Misa: That was a common thing for people to do, women especially, be a math teacher.

Marsh: Right, be a math teacher. So when we moved up here, I looked for colleges to apply to for grad school and I applied to Northwestern, and to be honest, I really don't remember who else I applied to. Anyway, Northwestern gave me a fellowship that was very helpful at the time, and they paid my tuition, so that was very good.

Misa: That was to do a master's?

Marsh: Yes, to do a master's. So I got my master's degree and then I started to look around for a job. I asked my math professor where to go, what did he recommend? He said there were only two places to go: that was Argonne [Labs] or Bell Labs. Those were the only two places in the area.

Misa: In the Chicago area, because you were trying to —

Marsh: I had a husband who was working in Chicago, that's right. So I thought rather naively that Argonne was just too far to drive, so I applied to Bell Labs. I had also applied to some other places like Western Electric and Nicor and a local middle school. Western Electric, when they found out what my grades were, suggested I go see Bell Labs, so they wouldn't even really interview me. Nicor, for better or worse, I decided would be too boring. I just was turned off by the idea of maintaining FORTRAN code, it just didn't sound interesting. And I went to the school [pause]

Misa: Just a second, somewhere along the line you picked up some computer skills.

Marsh: I really had almost no computer skills; I had a math degree.

Misa: You had a math degree. Had you had any contact or experience with computing?

Marsh: I had one class in Northwestern. There was no computing stuff when I was going to Texas Tech; there was no mention of computers, nothing at all.

Misa: No mention of computing, that's interesting.

Marsh: So I have a math degree. I think very logically [pause]

Misa: And one computer class at Northwestern.

Marsh: And that was it. There was not really very much there in the way of computers at Northwestern, either. It was all just really basic math.

Misa: Can I ask when you graduated from Northwestern?

Marsh: 1968. So when I interviewed at the school I just thought you know, I'm never going to fit into this. I'm not very big on administrative things. I'm not very much into being part of a big huge hierarchy, this is just not going to work. So then I went to

interview at Bell Labs, and it seemed like they were doing things that were interesting. People were excited with what they doing, they were inventing new things, and I thought well this sounds pretty cool, I like this. So it turned out that it was a very good match for me. I'm not very good at following a lot of rules and regulations, and Bell Labs was not very much of a rules oriented place, and so there was a lot of freedom to do your own thing. When I first started out there I had a very good mentor who taught me programming. He sat down with me for about a month, month-and-a-half. He was doing a project, he was working on it and I just simply watched and learned what he was doing. And that was how I learned my first programming language, which was IBM assembler.

Misa: IBM assembler, okay.

Marsh: Yes, and that was the first language I ever learned, really. The math background was very good because I have a very logical mind and so I could understand exactly what the computer was doing. And I understood the concepts of memory, and how you write to memory, and registers, and it all made sense. So after his tutoring, I got a project and I just started off on my own.

Misa: So you didn't have necessarily, formal class but it was on-the-job training.

Marsh: On-the-job training.

Misa: Being helped by your supervisor.

Marsh: He wasn't my supervisor, he was just another man in my group.

Misa: Oh, just another person in the group.

Marsh: Another person in the group who I'm sure had an informal assignment to help get me started. I mean, I must have been his little protégé or something. And he was very good. I just learned a whole lot from him, and he was very, very helpful. So I didn't always follow everything he did, after I got further on my own way. He was more into writing the program down, you know, in programming sheets of paper. And I'm more of let's just type it into the computer and we'll get to the same place because I will have the same type of documentation and everything, and very organized. Because as I've told other people, the person who has to know what this program does a year from now might be me. [Laughs.]

Misa: Right, okay, good to help you out.

Marsh: So I need to know what this program is doing. I can't just leave it, just lines of code and nothing, because I won't remember that in a year's time. But he helped me a great, great deal and I just started learning on the job how things were. I didn't go into the switching world as some others did. I was in a tools area, so they were building tools to help the switching. In other words, they built a simulator so that they could simulate the code because the actual underlying computer wasn't available enough of the time.

[Either the computer hadn't been built yet, or when built there was only one, and lots of programming/code to be developed/tested.] So they simulated the computer for the software that was being built.

Misa: So this is as a part of the ESS world, I assume.

Marsh: Right. I built the simulator that was part of that project and I was part of the group that built a simulator. And I was in a group that built a hardware simulator, so they actually simulated the hardware. The designer would describe the hardware in terms that the program would understand, and then it would simulate that hardware. So it was a hardware simulator so they didn't have to actually build hardware and then test it. Because it was, at that time especially, a very long process, and it wasn't very integrated. So you didn't go out and buy a processor. They actually were defining it, individual logic components and putting them together.

Misa: So you did essentially a software emulation of that.

Marsh: Yes.

Misa: And people could run software on your emulator without necessarily having to have the hardware in the lab?

Marsh: So they could simulate both their hardware — that was one group of people — and the software. So by building a hardware simulator and building a software simulator, I learned an awful lot about how computers actually work.

Misa: The work group that you joined was about how big?

Marsh: About a dozen people.

Misa: Were there other women at the time?

Marsh: No. [Laughs.] In fact, there was only one guy who was black [at that entire Bell Labs location]. There were two other [technical, non-clerical] women at the company that I knew about. I shared an office for a while with the other woman who was technical, in the area. She was on the ESS project. She was actually writing the software for the call switch, and I was doing tools. So I shared an office with Delta, I think mainly because we were the only two women in that area of the company. The other woman, Hildegard, worked in another area in New Jersey. So there was just the two of us, and that was it. And I guess there must've been what? Five hundred people at that location, something like that. [Editing Note: I remember there was one other woman engineer/programmer, but I can't remember her name – she was an STA.]

Misa: So not many women at that period in the sort of late-1960s.

Marsh: Not many women at all. No. Well this was 1968 when I got the job. I interviewed with them and I didn't really understand their two-track process because the men got hired with a master's degree as an MTS, and the women got hired as an STA, usually, but they hired me as an AMTS, which was supposed to be almost an MTS.

Misa: Is that an Associate Member of Technical Staff?

Marsh: Yes. And they told me in a years' time I could get promoted as an MTS, so I took them at their word for that, since I had no better knowledge of it. And so when a year had passed and I didn't have my promotion, I went and talked to my manager about this and it did come through rather quickly after that, but that was very, very unusual. It's just that I didn't realize that at the time, how unusual [pause]

Misa: It was unusual in what way?

Marsh: Most women didn't get promoted. They just stayed as AMTSes.

Misa: Oh really? Women were put in this associate MTS, but would be stuck there.

Marsh: Yes. Or they stayed as STA forever, you know. So I didn't realize how unusual it was. Well that's what they tell me.

Misa: And the STA again, is?

Marsh: Senior Technical Aide.

Misa: So that's more of a subsidiary.

Marsh: There's a Technical Aide. And then there's a Senior Technical Aide. And then there was an Associate MTS, and then an MTS.

Misa: And it was the MTS that really mattered; that was the full membership in the Bell Labs community from what I understand.

Marsh: Right. I just didn't realize exactly what I had started off. I didn't realize exactly, either, how much salary hit I took I am sure being female. When I went to Northwestern the class was 80 people in my graduate class and there were five women.

Misa: Five of 80.

Marsh: So we obviously bonded because we felt so outnumbered and in fact, I'm still friends with those women. [Laughs.]

Misa: Oh really.

Marsh: So anyway, when I was talking to Cindy, I found out that her husband joined Bell Labs — it was about two years later — but he got a 50 percent greater salary than I did and he came in as an MTS.

Misa: Fifty percent.

Marsh: Fifty percent. Now, I wouldn't have known any of this except that I knew his wife and that's how I found out. And so I thought oh, that's not right, that's not quite fair. But you know you just keep on going. And I have to admit that he did very well at Bell Labs and he certainly worked a lot harder than I did. As you could see, I'm married and he wasn't married at the time. He and Cindy got married a little later, not too much later but a little later. And I had children in the early 1970s, which was also very unusual. Of the women I knew, one was married, one was not. But I didn't know anybody who had children. At the time, if they had children, and they were an STA or a TA, they quit when they had children.

Misa: But you maintained your MTS status through having kids.

Marsh: I maintained through having kids but my compromise was I never worked 60-hour weeks because I had kids. And I figured between husband, family, and career I could do about two out of three. I couldn't do all of it so I maintained fairly normal working hours.

Misa: Did Bell Labs make any kind of accommodations? Today we would say maternity leave, or child care, or some time off from work then allowing you to come back or was that something you needed to juggle?

Marsh: [Laughs.] They were not used to that. Well not too long after this, there were a couple other women who worked and had kids, but I was the first. When my daughter was born, my supervisor just assumed I would quit so he put in for my termination right then. Our daughter was adopted so he didn't have a whole lot of warning. I told him we were looking into adopting, but when you adopt a child you don't get much warning, so I gave him a week. But he assumed I was going to quit and said, 'No, no, no, I don't want to quit. I want to work part-time.' And that just wasn't done. So I took vacation time and stuff like that for a while. But after about three months I had run out of vacation time and all so I took a leave of absence at that point in time. And then I started looking around for another job because I was figuring I would have to. I wanted to work part-time, and I didn't think that Bell Labs was going to let me do that. At the time, my manager was trying to get me back. I was a top rated person in their department, so they wanted me back. So when he realized that I was really serious about finding another job and I thought I could, they offered me part-time work.

Misa: Good incentive to maintain connections to a valuable employee. It's enlightened self-interest, or something.

Marsh: Yes, it was pretty enlightened although it took them a while to get to that point. I didn't come back until, oh, I think it was about three or four months later. I can't remember exactly what the date is, but I had a period of time off.

Misa: Your period of time off, though, just to be clear, that was on your dime.

Marsh: It was always definitely on my dime.

Misa: That was not company benefits, that was you taking vacation time, taking a leave of absence, so the burden financially and career-wise was squarely on your shoulders.

Marsh: Right, right. And they wanted to formalize some procedures about how many hours I should work when I came back, and what days it should be. And I had suggested to my boss, why don't we just try something and see if it works, and if it doesn't work then let's try another arrangement. So I think I came back I might've worked mornings or afternoons, or something like that. I said let's just keep it kind of informal and maybe another arrangement will work out better. As it turned out, I found that it worked out better for me to have three consecutive days that I worked rather than scattering them out.

Misa: So Monday, Tuesday, Wednesday or something rather than mornings.

Marsh: I said you know, let's just be flexible. Let's not put it down in company rules as to which days you have to work. Let's just get the three days in, and I wanted three days

because I figured that was enough to keep me involved with the company but it also gave me quite a bit of time off to do something else. And I think it worked out very well because as soon as I had done that, then another woman came onboard working part-time, too.

Misa: Can you say something about your job assignment both before and after? You wouldn't have hourly responsibilities, I understand that, but you'd be working on a project so some part of the project could be done — obviously you'd need to be in contact with your supervisor, with other coworkers — but a certain number of hours this was work that could be done on a more flexible basis.

Marsh: As it turned out, they were very concerned about what kind of work I could do, being flexible, not always there. But in the end, it turned out it didn't really matter. I did the same work that I'd always done and when I came back I had the same assignments. And I talked to some of my supervisors and they said that they made no allowance for my being part-time. They just gave me a job. It might take a little longer, and they might have to give me a slightly smaller job, but they didn't make any other allowances. It had worked out much better than they thought and that I produced as much as anybody else did.

Misa: Sounds like they were kind of trying to find their way, too.

Marsh: They were trying to find their way, too . . .

Misa: It was a new arrangement on the supervisor's point of view.

Marsh: . . . and when you think about it, it just worked out very well. Normally, you don't have daily contact with your supervisor anyhow, so if I was only there three days out of a week, he probably wouldn't have talked to me seriously, you know, about [pause]

Misa: Each of five days, or something.

Marsh: Yes. Anyway, I was a very independent worker so I didn't go to my boss every day, or every hour, for guidance. I pretty much did my own job, and if I worked with others which, of course, you always do, that was still the case. We negotiated among ourselves what needed to be done, and who was going to do what, and then did it, and we didn't always discuss or rehash that every day. We generally didn't do that. So my working part-time as it turned out, just didn't matter. And after they kind of got over that hitch, getting used to that notion of coming back after a while, it worked out well. My only regret was that I only worked part-time for five years. I wish I had worked part-time for a little longer because when my daughter was two, we adopted a second child. So my son was three when I went back to work full time and that was a little bit harder than I would've liked. But again, Bell Labs being Bell Labs, it was a pretty good place. This was in the late 1970s. I approached my management, my supervisor, and said you know, I'd like to shift my hours. I'd like to come in early and leave the same way. And so they

weren't so sure about it but I'd been working part-time and again, I was highly rated, so they kind of let me do what I wanted to do.

Misa: I suppose that some people come in early and just stayed late, too. It's that workaholic sort of pattern.

Marsh: It is a workaholic type pattern, but a lot of people came in at say, nine or 10, and stayed until whenever. Some of them left at six. Some of the left at 10. Some of them just worked a lot. I never worked 20 hours a day but what I did for quite a few years was I came in at 6:00 or maybe 7:00 in the morning, and I left about 2:00.

Misa: Six or seven, so that's quite early.

Marsh: Quite early, yes. I was coming in for many years at 6:00 in the morning and leaving about 2:00. So I was getting my time in, but I was doing it very early and that let me get home by the time my children were coming home.

Misa: That's right, so 2:00, then you'd have a chance to be there when your kids were coming home from school.

Marsh: Because at that time in the greater scheme of things there was no day care. You just couldn't hardly find day care. So my children were at the time in first grade, second grade, that sort of thing. So it was a help to be here when the school bus let them off so I

could manage that. So we did that for quite a while. My husband would get the kids ready for school and I would handle the afterschool. I have a very supportive husband, fortunately, I mean that would be a very hard thing to manage otherwise. But we did very much share the responsibilities.

Misa: Good for working that out, challenge to that.

Marsh: Yes, it can be very challenging. I worked that way for a while until my children got quite a bit older and then I started working more normal hours. But I usually still came in fairly early, like 7:00, 7:30, and would leave a little on the early side, like 4:30 or 5:00.

Misa: Can you talk a little bit about the content of the projects or the work that you were doing during these years?

Marsh: Again, I worked on the logic simulators, and this was kind of a tools area. And then after that, I've forgotten exactly why, but I transferred and worked on the underlying processor itself. It was a UNIX processor. It was called a 3020D. I worked on the operating system for a while. I liked the environment, and it was a very general purpose operating system. It was a real time system used for the call processing, and had to be very reliable. But still, it was a basic operating system and I learned a lot about operating systems, and languages, all kinds of good things. And then I worked on a project that was building a network, a cross-network project. This was in the mid-1980s when the internet

was just barely first starting and it wasn't sure what the internet would become — there was no World Wide Web or Internet.

Misa: The internet is sort of standardized in the 1980s, something like that.

Marsh: Well, it's not even at that point, because this was in 1985 so it wasn't clear whether the internet would go the TCP/IP route, just the IP route, or would go the OSI route. [This was an early example of Bell/telephone standards versus network/computer industry standards and what would become IETF.]

Misa: That's right.

Marsh: Which were then competing as protocol suite. So we did a project working with GM to build a model automated factory. You could use a remote computer to order a part/product from the factory, and it would build a part for you. But it was a full, multi-layer network protocol, going up and down, and so as a part of the project that demonstrated future factory automation possibilities.

Misa: Did that fit into any of the networking working options? You said there was TCP/IP and then OSI.

Marsh: Okay, there was IP, just as that whole internet protocol, as the very basic lower level. How do you address the packets? And then TCP is the reliable one, and it could be

UDP, which is unreliable. And then they had a transport layer on top of the TCP which kind of guaranteed end-to-end transport so that if a packet got dropped then it could be resent. And then there was some more session and application. It kind of got a little more complicated. So we did the whole seven layers of the protocol at the time.

Misa: Well, the seven layers, that's the OSI model.

Marsh: Yes, and IP was kind of competing with them at that time. We used IP but they still hadn't really simplified all the stuff. Now I think after TCP it really goes into — you might have what they call “session” which is a connection. You might establish connection, maybe you don't, maybe you do. And after that it's all an application. So they kind of simplified some of the upper layers but OSI just never really quite took off. [Too complicated, I think – and too many standards bodies needed for approval.]

Misa: That's for General Motors?

Marsh: General Motors is the one that organized it. I think I still have some of their toys from the final conference/demonstration there. And that project was an awful lot of fun to do that, it really didn't have anything more than that. And this was about the time that Bell Labs was also affected by the split-up with AT&T. This is when RBOCs were formed and Bellcore was formed. And so Bell Labs was wanting to become more entrepreneurial — with software, services, and apps, and all.

Misa: In the 1960s, I don't think Bell Labs was working for another company like GM.

Marsh: Well they weren't really working *for* GM. GM had a consortium of most of the bigger computer companies. I think Hewlett Packard, and DEC was there, and AT&T, and then I don't remember which other smaller computer [companies]. And they all did their own thing; each one of them did an implementation of the protocol stack. So they all had their own little projects where you could order the parts and they would all talk together through the factory. [Note: Bell Labs did do a lot of work for the US government at that time, but this was a smaller project working with GM and a dozen or so other computer companies — IBM, HP, DEC, CDC, ... on factory automation and networking. Historically, GM as well as Bell Labs had been interested in time-sharing computers and automation, and this was a part of that effort.]

Misa: How interesting.

Marsh: So they were trying to show how it was interchangeable, and they could all have different — what would you say — applications or nodes, or whatever you want to call them, talk to each other over a common protocol. Sort of like the internet does today; sort of like you have your Android versus Apple. Well this was a very, very early version, precursor to that. But it was the same kind of thing. It was just a lot of fun. I enjoyed myself a lot doing that.

Misa: Was there a networking group within Bell Labs?

Marsh: There was a networking group in the 3B2 and 3B5 [small Bell-system computers originally for call processing, later more general purpose], which is some more processors that Bell Labs was building at the time. It started out the 3B20 was built for call processing and then they built a, I think it was a 3B5 for a smaller switch processor. And they decided they might want to make them general purpose and sell them as commercial products.

Misa: As commercial products, that would've been a sharp departure from . . .

Marsh: Oh, it would've been a very sharp departure.

Misa: . . . well, since the 1956 consent decree, which forbid Bell System from selling computers in a commercial.

Marsh: Right. This was just about 1985, so they were thinking there was a split-up and they would sell them commercially. They also had a networking product they called Starlan. It was sort of like Ethernet but in a star arrangement instead of the Ethernet bus. I don't remember too many more of the details. They were going to sell that commercially. They might have sold it a little bit, I don't know. There was a lot of commercial, private protocol networking products at that time. They were all kinds of computing products/networks and I think eventually Ethernet won out, really.

Misa: IBM had this token ring.

Marsh: IBM had a token ring, yes. That was another one of them.

Misa: So it sounds like Bell Labs was really positioning itself much more, not only in the networking world but also in the commercial world.

Marsh: Networking, yes, and they were going to sell processors and an operating system because remember at this time, UNIX was just beginning to become available. I think it started becoming available in universities in the 1970s. I think I first started using it in the 1970s, and so they had given it away at that point in time. UNIX had been distributed free to universities, that's where you get the various flavors of LINUX and BSD UNIX, and Red Hat UNIX, and SCO, and a whole bunch of other little flavors, but they all came out of that world. So they decided they were going to try to commercialize it, and I've forgotten what the spinoff was, but there was a UNIX spinoff from Bell Labs to go commercial. I don't think it lasted too long but they were moving into that world, and I was working in parts of that.

Misa: In parts of that.

Marsh: Yes.

Misa: What kind of work did you do for that commercial application?

Marsh: Well, I did operating system work for that. I did I guess [what] you would call the operator interface. Not operator in the Bell System, like operator TSPS, not that call center where you dialed “0” for operator. Not that. But if you were a computer operator and you’re trying to manage your computer network, I was a part of the group that wrote the interfaces for managing the actual machine. I spent a lot of time with that. They called it 3BNet but it wasn’t an application for Ethernet that they were going to sell, and it was a competing interface. It didn’t make it, really. I did that for a while. And then it was just a very confusing world in that networking and UNIX world, and I didn’t think it was going to make Bell Labs — I didn’t think it was going to become a commercial, stable place to be. So I decided I would go and work on 5ESS.

Misa: So back to electronic switching systems.

Marsh: Back to electronic switching systems, so I took a job, and what was I doing? I think I was doing signaling systems. Signaling systems are really an awful lot like networking except that it’s to set up calls rather than to set up internet sessions.

Misa: Yes.

Marsh: I didn’t know anything about signaling, really, but I knew a lot about networking, and I understood packets.

Misa: 5ESS wasn't at all a packet switching system?

Marsh: No, they added a part to it they called packet handler, protocol handler, depending on I'm not sure which flavor it was. But anyway, that little other module that they added to the switch handled all of the packets, so it handled signaling packets as well. And it was just an 8086, which is an Intel product, a precursor to our PCs that we have now, but it was a commercial product that they used for that.

Misa: Standard microprocessor, then.

Marsh: Standard microprocessor. C was used as a standard language to implement it in; it didn't happen to [be] a standard C, it was Bell Labs C, but they're close enough.

Misa: Bell Labs had some important role in creating C in the first place.

Marsh: Bell Labs created C in the first place, right, and then it went on to become a little bit more standardized. I used C, and sometimes I used the underlying assembly language, which I had already learned from elsewhere. And I knew UNIX, and a flavor of UNIX was put on the machine. It was the same but different, more protocol, more packets. So I learned signaling system 6, and then I learned signaling system 7, and just stayed very technical.

Misa: The fact that you were able to stay in a technical role, that was something new, I believe.

Marsh: I don't know that it was so new. There were always people around that I knew who had stayed technical, who had had like 40-year careers and had stayed very, very technical, and were very well respected. So that wasn't so strange. I was offered positions in management a couple of times but after you turn them down two or three times, they realize that you're serious about not wanting to do that.

Misa: Going into the managerial track.

Marsh: Right. The reason that I didn't go into the managerial track is that I didn't think I would be able to stay technical. I'm a philosophical person and I thought about what I was doing, and I decided that I didn't like managing people very much. I didn't like going to meetings and having to negotiate or strategize how I could get ideas across. I prefer just to do things on a technical basis, and that's not always the case when you go into management. A lot of it is not technical; it's very strategic.

Misa: You're lobbying for resources.

Marsh: And I didn't enjoy that part of the world at all, so I could not see any point in taking a job that would maximize what I liked so little.

Misa: Smart insight.

Marsh: So I knew that there would be a penalty on my salary by not going into management, but I thought well, I'm just going to accept that I prefer to do the technical job. And when I interacted with my fellow workers, I preferred to be on a technical basis and let's talk about how to best do the job technically and we'll let our managers worry about the other things.

Misa: Was there a time at Bell Labs when there was a recognition that people needed to have good strong career paths, even if they did not want to make the switch into management?

Marsh: Yes and no. By the time they started realizing that, I'd already been there for 25 years and there was no further career path than where I was. I was the first woman to become a Distinguished Member of Technical Staff, at least at our location, and as far as I know, period.

Misa: At Indian Hill?

Marsh: At Indian Hill certainly I was the first.

Misa: You think across all of Bell Labs?

Marsh: If I wasn't the first, I was certainly not far off it. There weren't very many women in the group. And DMTS was quite a perk for quite a while because you were supposed to have the same office and the same amenities as the technical supervisor. It didn't quite work out that way, but still it was a recognition that there was a second track, and it was pretty good.

Misa: Do you recall when the Distinguished MTS was awarded?

Marsh: Somewhere around here I have a — hang on just a minute.

Yes, look at that. There.

Misa: Okay, it says 1983 Bell Laboratories Distinguished Technical Staff Award for Sustained Achievement, Anita B. Marsh. And it looks like it's a desk holder then so you can have that on your desk. The lettering is very small and distinguished.

Marsh: Right.

Misa: It's not like huge lettering, it's rather understated I might say, but a bit elegant.

Marsh: Pretty nice.

Misa: Yes. So 1983.

Marsh: It's kind of interesting because it is something where you would put, letters or something like that, and by 1983 I was getting to where I no longer used paper very much, not to write on. And I still don't. I use a computer.

Misa: So you could put envelopes in there but okay.

Marsh: But I don't use envelopes anymore, I just use my computer.

Misa: Yes. You said pretty early on you were more comfortable you said one of your initial male mentors was writing things out on paper, but pretty early on you were doing your programming work on the keyboard.

Marsh: On the keyboard. As part of my high school education, you know, you had to take certain classes. My parents thought that I really should learn how to type, that you never know what you're going to need in life and that typing would be a good skill. So they didn't see any point in wasting a whole high school course taking typing when I could learn that at home. So they took their typewriter — this is a manual typewriter — and they covered up all the keys with little plastic tags, and then they said here you go. Here's the book, learn how to do touch typing. So I did. I learned how to do it. Well when I got to Bell Labs, they started giving people — they weren't really computers — they were more just terminals. There was still a large centralized computer but there was a little good-size terminal on your desk where you could type and so you could directly interface with a time sharing computer. So Bell Labs invented TSS along with IBM and, I

think, Wayne State, and I don't remember who else. This is all part of the time that UNIX was also getting developed, but there was TSS first, and they did a lot of work on TSS.

Misa: Time Sharing System?

Marsh: Time Sharing System, yes. And then UNIX. You had a terminal, which is a — what would you call it? — it was like a keyboard but it had a monitor there, and you could type into the keyboard and you could store it in a file when you were on UNIX. So I think by the late 1970s I had a UNIX terminal on my desk and I was using my UNIX terminal. So I no longer wrote anything down by hand. I don't recall doing very much in the way of reports by hand, maybe I did but I don't think so.

Misa: For a time, flow charting was quite the programming tool, so sometimes flow charting preceded writing a program, sometimes it was after the fact, to get a sense of the structure.

Marsh: I never did it after the fact. I didn't see any point to it. The mentor that I had when I first joined, he used flow charting a great deal, so I liked flow charting. It was very logical and I liked it. He did it all by hand in paper and pencil on flow charting graph but after not too long — this must've been about this timeframe — there was a tool on one of the terminals that let you do flow charting diagrams. My terminal connected, I think, to time-sharing system, I could draw the flow charts, using the keyboard on my terminal.

Misa: So put in a square, or a diamond, something like that, and make links.

Marsh: Yes, and it used a keyboard.

Misa: Graphics oriented, not mouse but [keyboard].

Marsh: It was graphics oriented and it was so much better for me, because I could always type three times faster than I could write and I would always get frustrated by writing. I don't want to write all this out, I don't feel like it. So I would type and I could type so much faster, and when you were done, you had something that was fairly permanent, you could print it out.

Misa: And it was done.

Marsh: And it was done. And if there was a mistake, instead of having to go back and correct everything with paper and pencil and redraw it, you just went back in and fixed the little bitty mistake and reprinted it, so I preferred flow charting by far done on a keyboard. And UNIX has all kinds of stuff for doing that; and there's other commercial systems that let you do flow charting. I know SDL – used that product we talked about with GM and that network inter-op event; there's flow charting tools and I used it for that — just to get the program that I was writing to be understood by others. They wouldn't understand what the interfaces were otherwise. I used it for finite state machines so that I

could say, 'Well, if I get this input and my program is in this state, it will do these things and go to that state.'

Misa: So you actually used that almost as a diagnostic then?

Marsh: Yes.

Misa: Not just simply as a passive representation of a program but something that would have an ability to do some diagnostics.

Marsh: Right. And actually it was a good way to define what it was you were trying to do. I'm thinking about the late 1980s, early 1990s, a lot of the protocols that are formally defined in. There's SS7, and other signaling/network protocols, are defined using these diagrams. So if you can do it electronically, that's what I did. So when I designed programs I would do it this way because I thought it was a lot more clear as to what exactly it was doing. So I've done it that way for a long time.

Misa: Anita, I wonder if we might step back for a moment. I've got a couple of recruiting advertisements. These were nearly the moment that you were looking at the workforce. This is from *Datamation* in 1967, and there's a variety of different companies and I think different images about men and women being hired into computing. I wonder if you might take a look at these and tell me your thoughts? I think there's that one and four more. This is from Bell Com.

Marsh: I don't even know what Bell Com is.

Misa: It sure looks like Bell down below.

Marsh: It does look like Bell Communications.

Misa: Bell Communications, yes. I don't know what unit this is.

Marsh: I don't either.

Misa: But thinking back to say, 1967, if you had seen that ad — I'm not saying that you did — but if you had seen it, what would you have made of it? Read it across the top, maybe.

Marsh: It says, "Scientific Math Programmers and Math Modelers." I didn't have any of that because it wasn't offered; I didn't know about that. I have a math background and I'm very logical, and I didn't have any trouble picking up all of the stuff they were doing at Bell Labs. I learned it as well as anyone. What I should mention, Bell Labs at that time offered college level courses in various things, like databases, and networking, all kinds of cool stuff. You could take an hour or two off a week and go take this college level course and it was great. I took a lot of stuff that way. Databases. I remember one of them was psychology and perception, and how people perceive things.

Misa: That'd be fascinating.

Marsh: It was fascinating and I really enjoyed it. But I didn't have any specific computer background when I joined. It simply wasn't offered at the schools I went to.

Misa: I wonder what you make of the symbols across the top.

Marsh: I would've thought they were symbols from, what do you call it? Astrology. I wouldn't have known they were for anything else. They look astrological. I don't know what the crescent is here, the moon shape, I have no idea.

Misa: Some people would've said that's a crescent moon and I don't know what that means. But then there's a symbol for the male and symbol for the female.

Marsh: Female, yes, astrology. I have no idea.

Misa: There's another one to look at, and these are all from 1967, from Lockheed. It says across the top, "Where can man go in programming?"

Marsh: I'm not sure. They had scientists working in commercial business programming and I was always in the, quote, scientific programming, although it's kind of an artificial

division, in a way. I did sort of learn COBOL but not much, just because there was a little COBOL floating around and I never did find learning a language very difficult.

Misa: Do you think a woman would've seen herself in "Where can man go?"

Marsh: Probably not.

Misa: I don't know whether this was intentional.

Marsh: I sort of ignored the part about "Where can man go?" I mean, yes, I figured that if man can do it, I can too.

Misa: But it's interesting here, there's a male and female symbol here, and that is with Bell Com, and it says a Bell System Company. And then Lockheed seems to not include women specifically.

Marsh: I would imagine that, I mean I feel like the Bell Com symbols are not male and female, nor are they trying to appeal to above, I think they're just doing astrology because of the moon program.

Misa: Oh that's right, Apollo was a big deal, so okay.

Marsh: I don't feel it had anything to do with men and women, or equality, or anything like that.

Misa: Okay. This is RCA.

Marsh: I might do that, you know, this one looks a little more interesting for me. Sure, why not.

Misa: This is TRW Mission to Mars.

Marsh: Yes, that was really big and computer-aided design, displays, those techniques, yes I could have done all that. Although I didn't know anything about it at the time, but I learned. There was some early display stuff going on where I worked, a display interface. [A] guy did that; we inherited it.

Misa: What's notable to me is this is an advertisement that has both a man and women prominently pictured, and with their names, too, so it's very personal.

Marsh: Cool. I didn't know any women like that but hey, it's really good. I wish I had some of that.

Misa: Presumably TRW had some group like this and they were giving Tom Vickers and Linda Howard visibility. Some of the ads are very abstract, but this is real people. This last one is from Cornell Aeronautical.

Marsh: It almost looks like some of the computers that I used to know. Yes, here it is, PDP-9. I actually did program one of those.

Misa: PDP-9, okay.

Marsh: And a PDP-8, too, and a DEC. They were there, and yes, I used them and did programming on them.

Misa: So they're talking about an IBM 360 Model 65, a PDP-9, and [pause]

Marsh: I did programming for all those things. Again, learning one more language is not very difficult, it's pretty easy so you can do that. My big problem was getting taken seriously, you know, that I could do the work that Bell Labs wanted to have done, and finding the support and the time to do it. I don't know if you ever talked to Jo Anne Miller, if she's on your list? She may not be.

Misa: I have not talked with her.

Marsh: She and I, while we were at Bell Labs, she went on into management and I did not, but we were friends, technical friends working together. We decided that we would make a proposal for a day care center to be opened at Bell Labs. Economically, you could justify it. So we sat down and figure out this is what you're spending on recruiting new people; you're spending this much per person to recruit new people. You could gain just the same advantages from having a day care center because that would retain people and you wouldn't need to recruit so much. So we went, and we presented it to our executive vice president, and he looked at it. He was a little surprised at the two of us. There was a fairly active club — at that time Bell Labs supported a lot of different clubs so we formed a working parent club. We decided not to make it working women, we decided to make it working *parents* because some of the guys had wives who worked. Not too many, but I would say at least a third of our members were guys who had small children and wives.

Misa: Who would've benefited from . . .

Marsh: Would've benefited from it too, and they were very supportive. Some of them had wives working that had the same issues we had. So we had some auditorium programs on the problems of working parents, and made the proposal to have a day care center. It never happened but it was a good effort we had. One of the local day care managers came in and made a presentation to one of our vice presidents.

Misa: Another thing, of course, in the 1970s that had a pretty large impact on many women, was the women's movement.

Marsh: Right.

Misa: Did you have any experience and engagement with the women's movement in the 1970s?

Marsh: A little. We formed some women's group and met in each other's homes for a while, and talked about some of the problems we had. We didn't limit it necessarily just to Bell Labs, so some were Bell Labs and some were not, and that was kind of interesting. Did that for a while.

Misa: So the people from outside Bell Labs, where would they've been working?

Marsh: Some of them weren't working. Some of them were stay-at-home mothers. It was kind of an interesting group. Some of them were wives of people working at Bell Labs and had found out through the grapevine that we were doing that.

Misa: Was this a Bell Labs activity then, or something that you would do outside?

Marsh: No, strictly outside. Helen was a part of that, too, so if you talk to Helen Bauer?

Misa: I did yesterday.

Marsh: She didn't mention it?

Misa: Not the parenting part.

Marsh: No, she didn't mention that.

Misa: But she did discuss some of the networking that she did with women's groups within Bell Labs.

Marsh: Right, and I was a part of that. And our attempt to get day care at Bell Labs, sort of grew out of some of that. Jo Anne and I were trying to figure a practical way, because we didn't figure that Bell Labs management, who were mostly men in their 50s, was going to respond to an emotional appeal. [Laughs.] The guy couldn't shoot it down. I mean, he agreed it was logical but they said no, they couldn't do it. They were a monopoly and they just couldn't dedicate money to this because they couldn't justify it to the regulators. But after they were no longer a monopoly they couldn't do it because they couldn't justify it to their stockholders. [Laughs.] Hmm.

Misa: Okay, those might be excuses rather than straightforward responses. In the 1970s, that was a time where a lot of things were in motion but one of the things that's notable in computing was that women were increasingly choosing computing as a profession to go into. Did you see any evidence of that? You said the numbers were low to start with.

Marsh: Oh, yes. But they increased tremendously. By the 1980s there was a great many more women. I wouldn't say it was even numbers, but still 20 percent or so, something like that. I'm guessing, but there was a lot more women and women were moving into management. I think we even had some of the first department heads. By about the 1980s, mid-1980s, I had a woman who was a department head. That was amazing. And then Helen became a department head sometime about that time.

Misa: We talked about that a little bit, yes.

Marsh: I think there was a huge amount of pressure on them to succeed.

Misa: What did you think about that development, having women going into the managerial tracks?

Marsh: I thought it was great; more power to them! It wasn't what I wanted to do . . .

Misa: You personally didn't choose that.

Marsh: . . . but yes, more power to them and I felt like yes, this is right and I'm going to support however I can.

Misa: Do you think that helped change the culture at Bell Labs, specifically at Indian Hill, to have an appreciable number of women going into a managerial track?

Marsh: Probably yes. I mean there were women at the executive director level. Helen was that and our director. But then I think they changed the title, so it was the director level. And Moe Grzelakowski came in at that level, also. So yes, that was great.

Misa: One thing that's puzzling sometimes about corporate life: IBM was known as 'I've Been Moved.' I understand there were many people, men and women, who when they were offered a managerial job, needed to move to someplace else — New Jersey or another Bell Labs facility. Do you think there was a lot of movement at the technical level? The people that were more directly staying the technical track, did they also move to, say, New Jersey for a time and rotate different job assignments?

Marsh: Not officially, but certainly you could, and yes some certainly did. I don't think it was required, exactly, but the Bell System in the mid-1990s was quite different from what it had been in 1968.

Misa: Can you describe some of those differences as you experienced them?

Marsh: Well for one thing, they had a very difficult time producing new products. They did a wonderful job of producing the 5ESS switch [which] made them tons of money selling it to the various telephone companies around the world. But when it came to knowing what the next product would be, beyond that 5ESS, they just missed the market repeatedly and continuously. They just couldn't seem to take anything else out of either

research, or whatever, and develop it into a product. So they tried it with UNIX, but that was not a commercial success, it went other places. They tried with networking, that didn't develop into a commercial success. They were going to do transaction systems for a while — it would be like a database machine — that didn't turn into a commercial success. They had different follow-ons to UNIX and then to processors, and those didn't work. I mean they just couldn't really seem to decide what it was that they wanted to do. They entirely missed that World Wide Web thing. They entirely missed the voice over IP, the packet based — all that stuff, they just missed all of it.

Misa: That would've been hard to see for somebody who thought we know what our system does and VOIP is something else.

Marsh: And they missed the entire mobile cellular world. I mean I can remember friends who had cellular phones back in the 1970s.

Misa: 1970s.

Marsh: Yes, the late 1970s, and they missed the whole thing. They had consultants who said it's never going to take off. And maybe if there hadn't been a divestiture maybe it wouldn't have taken off because they might've priced it such that it would not have been commercially viable. But they missed continuously, so it was just becoming a world that was very much bound by procedure and hierarchy. They knew how to do SESS, they knew how to do a few things, like they made cross connects but there's no longer a

market for cross connects. They were dominant in that. They made signaling systems but if you're going voice over IP, you've got a very different signaling world and so those signaling system boxes either they get made by Tekelec, or somebody like that, or they're not even really getting made at all like that. [Tekelec was acquired by Oracle in 2013.]

Misa: You sensed that this networking activity wasn't working quite as well as the company had hoped, so you shifted.

Marsh: I left in 1985, yes.

Misa: Were there other ways that the uncertain commercial prospects influenced your own career?

Marsh: Yes, really, because I retired from Bell Labs in 1996. I felt there was nowhere else to go technically at the company. There were no other new projects. There was nothing really interesting that I wanted to do. And I didn't want to move but even if I had moved I wasn't at all sure that there was anything elsewhere. This was in mid-1990s so you could see that the Bell Labs and Lucent were having problems. The research area was not as well funded and had been given orders to either get a Nobel Prize or else produce a viable product. And so that's not really a [pause]

Misa: Neither one of those is easy to do, different reasons.

Marsh: Different reasons, and so really the research area was kind of killed, and then Bellcore couldn't make it either, and so it was kind of all gone. So I retired in 1996 because I could see nowhere else to go in Bell Labs, certainly not at this location, but nothing to do. There was a research area still over there but it wasn't producing anything that would lead to any product. So I went and joined Tellabs, because it seemed more interesting.

Misa: Tellabs. Can you say a bit about that?

Marsh: Tellabs is a small company started in, when was it? The 1970s by Mike Birck and some of his fellow engineering friends. They had worked for Bell Labs and AT&T in the past, and a group of them started a small company. They were making, if I understand it, they were competing with cross connect equipment that Bell Labs, of course, and Western Electric sell to — what was it, I can't even remember the name of it now — but a big cross connect. And so Tellabs was also made a competitor to the Bell System D channel bank, which was part of that old analog system switching system. They made some components that were a lot cheaper than Western Electric and evidently better, and they stayed in that business. And then they went into echo cancellation, which was another thing that Bell Labs had started and came out of Western Electric, but they did a better job of it for a while and did real well at sales. And then they developed their own cross connect and that did real well. So I didn't work on any of those things particularly, I worked in an area that was looking at mobile telephone systems and how they were hoping that they could sell mobile systems to boost sales of Tellabs cross-connect

product, or maybe sell an alternative to your land line phone that was on mobile phone technology. Mostly because in some of the developing countries you can steal the copper right out of the ground as soon as it's put in, but it's really hard to steal radio waves out of the air.

Misa: That's right, there's not a cash value like there is for copper.

Marsh: Right, you just can't do it. So there was, at that time, Tellabs was looking at selling wireless stuff to build up its market in cross connect because you still had cross connect back at the head office to connect all these costs. So I learned a whole lot about wireless telephones, and that was really fun.

Misa: Were you still working in software?

Marsh: I was still working in software, yes.

Misa: So what were the interesting software issues with mobile?

Marsh: At that time, I was what they called architecture, so I was still running high level software, and the interesting issue was how to make it work. I learned at that time how to do a little bit of planning for the radio frequencies, how to divide the area up. Getting the telephone calls to work is not very hard, and that had already been done. I mean, the ideas

of how to do it had been done at Bell Labs a long time ago. There were even standards on how to do it, so that was not so hard. It was mostly just putting a system together.

Misa: A system of cell towers, and the handoffs, that sort of thing.

Marsh: And also just how do you control a call, and how do you control the call path within the local — you know, the box that's out by the cell tower is a big box, big concrete building, it's got equipment in there — bay station. How do you handle the stuff that's going through there? How do handle the central office?

Misa: It's really at the architecture level.

Marsh: Very high level.

Misa: Very high level, okay.

Marsh: Yes. So it was fun. They didn't sell too much; Tellabs decided it wasn't going to go into that business, and decided to look at voice over IP. And one of their sales people had heard about voice over IP. [He] wasn't really sure what it was but it was starting to be mentioned in sales. So he asked me and another engineer if we could devise an application, to see if we could devise a system that would be a voice over IP system to support phone calls. So I said, 'Well, why don't you give us a month to kind of think about it.' So we, in that month time developed a very high level architecture for doing

voice over IP cost. They already had a machine that would handle the interface to the network — it was ATM at the time but that was okay — so they had an interface.

Misa: ATM was Asynchronous Transfer Mechanism.

Marsh: Right.

Misa: One of the flavors of networking that came through.

Marsh: That came through, right. They had the box that talked to that network, so we developed another box and spec'ed it out, and said this is what you have to do. [We] developed the high level diagrams as to what you had to do exactly, and what the different boxes were that you had to have to make all this whole thing work. And then we said well, and it doesn't really have to be over ATM, it could be over something else, like IP, or whatever else you want, we don't really care. And presented it back to the sales person. He had a technical background so he could sort of understood what we were doing but I think it took Tellabs by surprise. I don't think they really expected it. Dale and I worked on that for, I guess, three or four years and they looked around, we found a company that could do the call control at the head of the calls and some other stuff, you know, signaling, and interface to the network, and all that. We actually spec'ed the whole system out and said this is what you have to do. And we got it up to where it was, you know, was demonstrating that it could do it, and Tellabs — this was in the late 1990s — was going through its own turmoil with uncertainly.

Misa: Telecom boom, dotcom boom, very turbulent time in the industry.

Marsh: Very turbulent times. Well Mike Burke wanted to retire. He made his money, he wanted to get out, he wanted to enjoy his late 60s, you know? So he hired a manager from Ameritech, what's his name? Notebaert. He came from Ameritech, he'd been a finance guy, and I think he just had cold feet about whether this would ever really take place, and if they would ever really have a voice over IP architecture for phone calls at all.

Misa: Wow.

Marsh: I think he really got cold feet. They had another product that Tellabs was doing, an advanced cross connect so he chose the advanced cross connect over the voice over IP, and it just was a bad decision.

Misa: In retrospect it would've been a good time to plunge forward but okay. If you could perfectly predict the future then the world would be different.

Marsh: So he cancelled that whole project, and then I went to work in a cable network because I had all this voice over IP experience.

Misa: You worked out a whole system.

Marsh: [Well, not me individually – the cable world was beginning to look at voice of IP over cable — and Tellabs had already sold proprietary cable systems to AT&T.] Tellabs had done quite a bit of work with AT&T to develop a cable system that AT&T Broadband was selling. They had a lot of cable customers. I don't remember how that worked because I wasn't there long enough to really remember that. But anyway, so I worked in the cable world for a while doing architecture, and learned a lot about cable stuff. AT&T wanted to set up a trial network to demonstrate voice over a cable network. So Tellabs agreed to go with them, and coordinated with a whole bunch of other companies that were developing call centers, and base stations to talk to the cable world, and cable modems. And our group was supposed to have all those separate products all work together. Well, Tellabs had our part – the cable modem, but the whole thing was very shaky, very full of bugs at the time. And to be honest, I don't think the people were really interested the new Cable Labs effort that was starting to standardize cable networks/protocol. If you were going to be doing that sort of thing, you had to follow the standard protocols, not the proprietary ones that Tellabs had been using before. And Motorola was in the same boat, were using proprietary ones, that the standard ones were going to replace. So anyway, they just ran into a crunch with spinning off a lot of money on development and most of it going toward proprietary stuff, and not having immediate customers so that project got trimmed down in the aftermath of the dotcom meltdown in 2001. So I got laid off from the job and I wasn't really ready to retire, so I looked around and you know how you network with people? So one of the guys that I knew said, 'Oh there's a new startup company over in Downers Grove or Lisle.' And he knew who to

contact over there, so I sent him my resume and like with most of these things you do over the internet, it's just nothing, you don't get any feedback. But about three months later this guy called me on the phone. I didn't know him but he said can you come in for an interview. We're looking at hiring people. How about tomorrow morning? Fine with me. [Laughter.]

Misa: Okay.

Marsh: Okay, so I go in, and I realize when I get to the company that I know a lot of these people. These are ex-Bell Labs people and I actually worked with a lot of them before, so I know quite a few of them, like four or five out of an office of maybe 100 people. And just in the interviewing process, I knew four or five of them.

Misa: Wow, okay.

Marsh: Yes, and they wanted me to do testing for their cable product. Sure, I can write test plans; you want test plans? No problem

Misa: You had done high level work in the cable so that was an area that you probably knew cold. Doing tests of that would be fairly simple.

Marsh: Right. Because I had been trying to get this test demonstration network up that didn't work. And I had been involved in doing the debugging of this test network that

didn't work. They had the same companies that they were trying to work with and had some of the same equipment, and so when I came in and I tell them this doesn't work this way, and this works that way, and you want to be careful of this. So I turned out to be a perfect match for what they were working on.

Misa: And what was this company?

Marsh: It was called Arris, A-R-R-I-S, so if you happen to have Comcast or all the big cable companies use Arris modems and Arris equipment to do their cable stuff. So I went to work for them.

Misa: That sounds like a perfect match.

Marsh: Perfect match. They were happy and it worked out very well. It's a very small company, and I really enjoyed the whole atmosphere. I had a grand time, a *grand* time. And it was very nice, there were no procedures, just would you do this job? Sure, no problem.

Misa: So it sounds there was something with that Bell Labs ethos that got put willy nilly into Arris.

Marsh: Yes, and they were actually delivering a product. And yes, it was a little bit shaky there. They had just about gone under about a month before I joined the company.

They had their economic problems but they managed to get acquired [by Arris, the month before I was hired]. They had been a small startup — I don't remember the name now — but anyway, they were acquired and they were hiring. I think they hired three people the same day I started.

Misa: And this was 2001 or a little bit later?

Marsh: Might've been 2002 because I think I had the cable job for a year. 2001 Tellabs shut the whole voice over [IP] project down. I think 2002 they shut most of the cable project down, certainly the part that I had been working on with the voice over IP. The standard protocols, all that stuff got shut down. I went to work for Arris, had a ball, grand time. It was just an awful lot of fun. You got to do just about anything you wanted to, really.

Misa: So did you actually end up doing work on these testing procedures, or did your responsibilities evolve from there?

Marsh: Well, okay, I think I went to work for them when I was 60. I was 59 or 60 when I took that job. I actually wrote test scripts. [Note – I just looked up the CableLabs spec – I tested a connection protocol called DQOS to establish voice call over the cable network with a guaranteed quality of service.] I wrote a whole bunch of Perl, yet another language, I didn't know that language but you know they've got reference books, I can look it up. Arris used a testing application written in Tcl — didn't know that language

either but I can look it up — so I wrote a bunch of Tcl scripts. There was a Tcl testing interface that could cause packets to be sent to the CMTS or modem being tested and then captures from the CMTS/modem. The packets had to be in a particular format, and I had to check to see if they were in that format. It was a new protocol. I also wrote Perl scripts that looked at the captured voice packets, and then I wrote a Perl script to go look through all the voice packets to make sure they all had the right format and none were dropped or duplicated. Not terribly difficult, but it was fun. I then wrote Tcl code for test scripts that allowed another group to automatically run the Perl and Tcl scripts. Sure, no problem, because that's what I believe too, and besides my running the same old thing over, and over, and over again is too boring, I don't want to do it, so yes, I'll do it, I'll write the scripts.

Misa: So you set up essentially a Tcl script to run a Perl script. Okay.

Marsh: Yes, sure, no problem.

Misa: But then that's something that you could do that's not only as a test but as a part of an operating system, too.

Marsh: That's right, so it just keeps on going. As they got new features and new things to do, then I wrote more, defined what this test should be. Basically wrote the test plans, and then I wrote the test scripts. We were in the lab a lot, and I helped the guys — I knew UNIX much better than the most of the people there did, so I could help them do things

on the UNIX system that had to be done. I could capture packets and look at that better than the engineers they had, so we captured packets and some of the engineers knew other parts of the stuff so we just worked together to figure out what was wrong and what was happening, why the things weren't working. But it was a lot of fun. It was just back to hands-on computer programming, and it was hardware, and firmware, and actually moving wires and everything.

Misa: And how long did that job [continue]?

Marsh: That lasted seven years. I retired in 2010, so I guess that adds a little over that, but I worked there full-time and part-time. I was a contract person at first. And then Arris decided they weren't going to have contract workers anymore so they hired me full-time. I think I liked being a contract worker better than I liked being a full-time worker because I didn't need the benefits that Arris was offering. I had already retired from Lucent, so I had all my Lucent health care and things like that so I didn't need it. So for me, working full-time as an Arris employee was not as good as working as a contract person.

Misa: Besides the benefits, was there a cut in pay?

Marsh: There was a cut in pay.

Misa: Oh, to get benefits.

Marsh: Yes, because they're gonna pay your Social Security now, and things like that in the benefits. But I can pay my own Social Security if I have to; I know how to do that.

Misa: Line item on your taxes, I suppose.

Marsh: You just have to be disciplined to do it, but it's no problem so I liked it better. On the other hand after I'd been there I guess another year or two, I decided you know I'm really tired of getting up and being here at seven o'clock every morning. How about if I only work four days a week? And the manager said fine. After I worked four days a week for a year or so, I thought you know, this is really getting a bit too much, too. I think I'd rather work three days a week. [Laughter.]

Misa: Three days a week. You'd had that experience before, didn't you?

Marsh: You know, I've got lots of things to do here in this world. And so, Bill, my manager at the time, was very happy to let me work three days a week. And it just got to where I'd done that for a while and I really thought you know, I've got other things that I want to do now. I don't really want to work too much more. They were willing to consider two days a week because they really liked what I was doing, but I just thought *enh*, I think I'll just retire. I think I was like the second person that had ever retired from the company. [Laughs.]

Misa: Oh, because it was a start-up, they were hiring people all the time, didn't know how to retire people.

Marsh: But they were very nice. I really, really enjoyed working there.

Misa: Would you make any comments about this network of women that came up through the ranks at Bell Labs? It's pretty notable to me.

Marsh: I stayed in contact with a lot of them, not all of them by any means, but quite a few of them. Some of them, like Becky Mulligan I did not know her at Bell Labs before this group formed. I knew other people that knew her, but I did not know her. But it's been a nice group of people to know and when I got laid off from Tellabs they were all very supportive in helping me find another job.

Misa: That's helpful.

Marsh: It turned out that the job I found, I found otherwise through networking, but the networking is very helpful, very supportive. So it does good to know the people you know. I would say though that I probably network as much with men as much as I have with women, and I did notice that when I joined Tellabs that there were many fewer women at Tellabs than there were at Bell Labs.

Misa: Fewer at Tellabs.

Marsh: Many fewer. Only a handful of women were technical women at Tellabs. Almost all the people I worked with were men, a few women. Not as bad as Bell Labs in the 1960s by any means, but still noticeably fewer women. And at Arris it was even fewer.

Misa: Your sample is a very specific one but it maps, unfortunately, onto national trends because the peak — I think I mentioned this — was in the 1980s.

Marsh: Right.

Misa: Across the U.S. it was almost 40 percent of computer science degrees, and almost 40 percent of the white collar workforce, and it's dropped since then. Do you have any sense of why that might have been the case? Why computing was so attractive in the 1960s, 1970s, and 1980s and then in the mid-1980s it didn't remain attractive for women? Women did other work or they didn't find the computing work to be as attractive in subsequent years. So there's a big problem, too, even women going into many different technical roles are leaving after 10 years. The numbers are really quite high. Your own experience — you had great working experiences — but do you have any ideas about the system change and the cultural change?

Marsh: I think that computing is not as stable for one thing, and not probably as well thought of in a lot of cases. If you're in a small company, I think like Arris, I enjoyed it

there but it was fairly male dominated there. I can think of one woman who was a manager, two women I guess, but mostly men. It was a spinoff from Nortel, originally.

Misa: Oh, from Nortel, okay.

Marsh: Which is kind of strange, but that's what it was. It had some Nortel culture and I guess that would be the best way to describe it. By the time I was there they had also acquired a lot of people from Motorola. So there was a lot of people from Bell Labs and Motorola, and I can't think of the other electronic company in this area that they could've come from, but it was noticeably many fewer women. Now after I left, when I retired, there were more women but when I went there, there was only one or two other technical women there. Kathy and Ruth were there. I don't think the third person was there. Sufen [I don't remember her last name], I think she came later. So there was Kathy, Ruth, and Sufen, and after, just before I left they hired some more women but it was very male dominated for a while, definitely so. But when you think about it, there's been a lot of off-shoring of work to other locations, and that was certainly a thought that Lucent had, was that we'll just do the high level stuff and we'll get somebody else to actually write the code. Obviously, it wasn't a successful strategy because Lucent's really in serious — well, they've been sold. They're not doing much, they're imploding so it's not a good strategy. But when you see jobs, your job, being taken to a new location because they pay cheaper wages, that's not a real good situation for you to believe that you have a lot of importance. You're becoming a cog in the machine and that's [not] a real good feeling if you really want to come into that world.

Misa: Do you think women might experience that — this is of course a speculation — in a different way than men? Because men continue to find computing, even in this more challenging environment, to be attractive, but do women have kind of a sensitivity or awareness about that?

Marsh: I really don't know.

Misa: It's just a puzzle, there's no certain answer to it.

Marsh: I think that it's not a real exciting career. I didn't get my daughter to go into it; and my granddaughter's not doing it. And they're both computer literate because I made sure my daughter was computer literate. You couldn't grow up in our house without being that. [Laughter.]

Misa: Yes, right. Good thing there.

Marsh: In fact, my husband might not have been computer literate, except for me. You know he was working as a structural engineer, but that was before computers came into heavy existence. And it's just like, I can't understand why you'd not want to use a computer to do your taxes, or your budget? And why not do e-mail, and Facebook, and all this good stuff? So I'm not sure that there's a way forward. I don't know how much

research is being done in small places in computers. It's not quite as exciting; you don't see any NASA influence anymore.

Misa: Your career was at an exciting time. This was Bell Labs in its heyday.

Marsh: Bell Labs in its heyday, and I was able to get out into [pause]

Misa: Important, exciting interesting projects . . .

Marsh: Interesting times.

Misa: . . . would've been an attraction for any sensible person, male or female.

Marsh: Male or female, right. And they were cutting edge, leading technology, nobody else was doing it, it was really fun, it really was. And that was true for Tellabs for a while, doing the voice over IP stuff, that was really cool. And the cable world, I mean, that is just now coming into being, you know, you look at all the stuff. It's been fun. Really a lot of fun. I think to some extent some of the colleges are evolving into more like a junior college. I don't know what communications is but it seems to very popular. And there are more courses for human resources, you know, and other things that I wouldn't have thought of as actually college-level things to do. So you see quite a bit of that. I never wanted to do any of that sort of thing because didn't want to have to go to meetings all the time, that's not my idea of fun. If I was to go today, what would I do?

Misa: That's a good question.

Marsh: What would I go into? I think it would be hard to keep me out of the computers if I could do it on my own, in a small way. I probably would be writing some kind of app for it. I mean I would be interested I think in Google. Or what Amazon has done is very fascinating to me — it's a computer company but it's really using computers to control distribution, now that's a fascinating thing — so I think I would [pause]

Misa: Jeff Bezos chose books, not because he loved books because — I've read the story — he looked at doing music and he said the music distribution business is dominated by big companies so it would be very hard to gain entry. Book distribution was dominated by a bunch of smaller companies. That's exactly where a distributor like Amazon, a meta distributor, could have a lot of impact. And then, of course, they've expanded into many, many fields.

Marsh: Right, right.

Misa: So the computing is just a tool to connect.

Marsh: Exactly. So I think now you have to find something that interests you, and you have to be computer literate, you just have to be. But you don't major in computer science, exactly. I think you find something else that interests you. Maybe there's an

awful lot of technology in medical devices and medical stuff, that might be interesting. Cars are kind of interesting. There's an awful lot of electronics in that, a lot of technology there, [and] very interesting. Planes, I would probably shy away from planes a little bit because I don't want to work for Boeing. But drones, now that sounds, again, more fascinating.

Misa: Yes. [Laughs.]

Marsh: So I would probably do something like that.

Misa: Sounds fascinating. Well, Anita, this has been so marvelous, thanks for your time this morning. Any other topics or questions I might've asked you?

Marsh: I don't know, but I'll probably think of it when you're gone, but right now, no. I have to admit I'm not up on the latest technology; I don't have a smart phone yet. I just have a dumb phone mostly because I'm too cheap to pay for the data price. Verizon or whatever charges an awful lot of money for their data.

Misa: Good reason why Apple is making a lot of money off of people with their smart phone contracts. Somebody is paying all those bills.

Marsh: Very lucrative. Somebody's paying it and I haven't decided when to do that, but I probably will get a smart phone. I don't really think I need a tablet because I don't

really do too much of that, although even though I worked for a cable equipment company I don't like the cable TV stuff. I do like Netflix. Now that might be an interesting company to work for.

Misa: Okay.

Marsh: I like Netflix because it's different. I'm more into other things, these days, than that. Although I do quilting, an awful lot of quilting, because I like the artistic part of it and that, so I do find people keep talking about there's so much math in quilting. Well there's none, so I have a hard time [pause].

Misa: Kind of spatial arrangements but it's not math the way you would understand it.

Marsh: Right, it's not math, no, there's no math. Well square root of two, but that's really arithmetic so there's obviously none.

Misa: Oh no, back to that arithmetic that you didn't much like. Okay.

[Laughter]

Marsh: Arithmetic. That's probably why my quilts are all very asymmetrical, and boxes, but asymmetrical and yes, wonky.

Misa: Okay.

Marsh: So I have more fun with that, you know. And technology, yes, but only when it interests me.

Misa: Well thank you so much for your time; it's been a real pleasure.

Marsh: Yes.