Interview of Jerry L. Holsinger

Interviewed by:
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James Pelkey: Maybe we can start in the period before you were bought by Codex, because the 9600 bit per second modem was revolutionary in the industry. They brought you in because of modem technology, and that was an important part of their company history and of the industry. Maybe we could start there and focus more on the why it didn't work out at Codex, then talk about Intertel and network management, since that was perceived as yet another level of innovation in the industry –

Jerry L. Holsinger: Pre-Codex starts with my thesis, my PhD thesis at MIT in which I was interested in telephone lines from work – from jobs I had had even before that, and how to transmit more data through telephone lines. So my thesis was concerned with a theoretical investigation of how much can you get through a certain amount of bandwidth – a band-limited channel.

Pelkey: So it was out of the Shannon –

Holsinger: Yeah, that kind of thing, doing error bounds and all that good stuff that everybody at MIT did, but applied to a band-limited channel, and then out of that, but not just rectangular band-limited, any kind of a channel. Then out of that I got some ideas and did some experimental work –

Pelkey: And what year was the dissertation?

Holsinger: I finished in the fall of '64. Long time ago, huh? So I did some experimental work as part of my thesis, and it turned out that later, after that, I found that other people had had similar ideas and had investigated some of this before, but I just plain didn't know it at the time. The net of that was to conclude that what I had done in the thesis wasn't very practical. Basically, it turned out to be an approach that said: "Use a whole bank of multiple tones, long parallel orthogonal tones, and modulate each of those independently, and that, in the limit of very long chunks of tones, will let you approach as close as you want to get to the best you can do."

It turned out, though, there were a lot of practical problems in that, and that led me to start thinking about time-delay-line-type equalizers, which Lucky [Robert W.] had been doing work with at Bell Labs in that time frame and published something. While I was at Lincoln, I was working with a fellow there, Paul Drouilhet, who was a good hardware guy, a good implementer, way out on the frontiers of what you build and how you can build it, and so we had some good interaction on ideas of how you would implement a tapped-delay-line equalizer and automate the tap setups and stuff like that.

Then following my thesis and working at Lincoln for another six months or so, I got frustrated with that place, because I wasn't really interested in being a researcher, I sort of had an entrepreneurial bug in me, and I was contacted by what was then called Defense Research Company out on the West Coast, who were interested in sponsoring development of this idea with the thought that we'd ultimately form a company to manufacture and sell a commercial product, this modem, and at the time I anticipated that I could get 9600 bits per second through an ordinary telephone line, and the view was that: "Gee, if you can do that, there ought to be a market."

Pelkey: Had you documented that in the public domain, or did someone have to chase you down in order to know that you thought you could do a 9600 its per second modem?

Holsinger: Actually, they were recruiting. That's how we got in touch. They were looking for PhDs, they used lots of PhDs in the business that they were running, and they were recruiting, and they got in touch with me through recruiting, and I basically said: "I don't want to go to work for anybody. I'm an entrepreneur." That led to discussions, and ultimately we got together.

Pelkey: The name of the organization was Defense Research?

Holsinger: It was then Defense Research; it's now called General Research. At the time they were doing government cost-plus studies. A lot of computer modeling and stuff like that, and they had been in

business a couple of years and were doing real well and they had a lot of money and were interested in trying to branch out.

So we got together in ‘65, and the first thing I had to do was to build a breadboard to demonstrate these ideas, which were now – it was a tapped-delay-line structure of an equalizer, but implemented digitally, and this is where I was really starting now to go beyond what Bell had done, because they had an analog tapped delay line, and they had – I forget what they had, stepper motors or something to drive the pots on each tap – really a very archaic design, and it was good enough to prove the principles, but it wasn’t good enough to be a product.

What I did was to develop an all-digital equalizer. The modem, using the very first serial shift registers, 32-bit cans if you can believe it at a buck a bit, and they’d pop real easy, and RTL logic, which was just then available in their little plastic packs, which made it more cost-effective.

So I developed a breadboard at DRC, took about a year, started running some tests with that on real lines. I was able to get various people to give me some lines, and started finding out that on some lines it would work great and on some lines it didn’t, and by all the measurements that people were making in those days, which was amplitude, delay, signal-to-noise ratio and a couple of other things, but not phase jitter, all the normal measurements that they made in those days – a line that worked well and a line that didn’t work well, you couldn’t tell them apart. In fact, sometimes it looked better when the modem worked worse. This of course was a big puzzle.

I remember running tests back at NASA Goddard, down by Washington. They had the best telephone-line measurement lab set-up of anybody in the country in those days. I remember working there a lot because they were loaning me lines and they were interested in this breakthrough and they wanted to see how it was working. I remember many hours of running tests there.

Somewhere in all that process, we began to get on to the fact that there was what’s called phase jitter on the line. The way you see that is, if you send a tone down the line, and look at what comes back, it sits there and it wiggles in its phase. That was something that nobody had known about prior to that, because for voice it doesn’t matter, and for low-speed modems it doesn’t matter, because it was a small enough number of degrees that for a 2400-bit-per-second modem or the 1200s, the stuff that’s asynchronous, it just didn’t matter at all.

It had no effect, but when you’re trying to run 9600, that’s effectively jiggling the carrier of the signal that’s coming in, and the original modem had been developed without knowing that that was there, and therefore effectively assumed that there wasn’t any jiggle. There were very slow carrier-recovery circuits, timing-recovery circuits and stuff like that, all predicated on an implicit assumption that it was fixed.

Pelkey: Did you confront AT&T or Bell Labs at this point about phase jitter?

Holsinger: When you’re a technical guy, what you do is go back and figure out how to work around it, as opposed to go tell them to fix it, at least that’s what I did. So the next phase of the work, which is basically the second year, was to redo the modem, and also to do a production prototype version of it.

Pelkey: So this is ‘66 now?

Holsinger: The first year was basically mid ‘65 to mid ‘66; the second year was mid ‘66 to ‘67 – does that sound right? Yeah, that’s about right. So what the thrust of the second version was, in terms of dealing with this phase jitter and then other instabilities, was to use a technique called partial response, which let you put nulls in the data spectrum, right at the edge, and then you could put pilot tones in there, and since the data spectrum was small right at these nulls, and the tones were pretty big, then you could grab onto a tone – one tone and get carrier, one tone and get timing, and then if things moved around and jumped, you could track them fast, where the prior technology had lots of data at the band edge and there was no way to track anything.

Now, this made a big improvement. Now you could work reasonably well on most lines. The negative of it was that it cost you about 6 dB in signal-to-noise performance, and at 9600, you were getting to the edge, where that 6 dB was important. But basically with that, it was a product that was much closer now to being something where you could put it in and it would run, but not great. Still not the way it is today where you just put them in and they run you don't have to worry about it.

At that point, which was about two years into the work out there, it was time to form a company, because I had done what I said it was going to do from a product standpoint, and it was clear that the people I was working with and I weren't going to make it, because I was an entrepreneur and they were government-cost-plus-mentality people, and my motivation was to make a better thing and charge all I can charge for it, and their motivation was to spend only what you can write off and charge the government, and take 3% after tax and say it was good enough.

So it was clear that, in the process of forming this company, we weren't going to do very well together, and in the course of a lot of time, talking to people about raising money and "what should I do" and stuff like that, I guess I talked to a lot of venture capital people and I kept getting pointed to Codex, because basically it was myself and a technician and I guess by then we had an engineer, or something, so it wasn't like I had a management team or anything like that put together, so I kept getting pointed to Codex as what I really ought to do with this modem and myself.

Pelkey: Why would they point you to Codex? Codex wasn't in the modem business?

Holsinger: Well, but they were in the data communications business. They were doing error-correcting-coding stuff at that time, and they were doing very exotic, sophisticated stuff, and I suppose that's why I would have been pointed there, I guess.

Pelkey: Codex was still private at this point too?

Holsinger: They were private, but they had money from more venture capitalists than you could imagine. They had gone through a lot of money in the course of being in business several years, so they had tapped a lot of venture groups, and in retrospect, looking back, what was I? I was a young PhD. What did I know about running a company?

So if somebody like me were coming to me now, I would probably tell them the same thing. Go belly up to somebody. It wasn't really what I wanted to do. I thought that I wanted to run a business, but it wasn't in the cards at that point, so I ultimately got together with Codex and they bought out the rights of the people on the West Coast, and effectively got me and a production-prototype modem design and that process.

Pelkey: Can you be more specific about how you got together with them? Did you call them up?

Holsinger: Oh, gee, I don't know. I had known them some from when I was getting out of school. I forget the details of how I had contact with them, but I remember, Art Kohlenberg I knew, because I had some kind of contact with him as I was leaving MIT. Dave Forney was basically a classmate of mine at MIT, and when I was coming back, he was there, and so quite possibly as a result of all these venture suggestions, I called them, or maybe the venture capitalists went to them and they called me. I really don't remember, but it was a case where I knew of them, and what I knew, I liked them.

Pelkey: Were you in Northern California?

Holsinger: I was in Santa Barbara.

Pelkey: So you moved from Santa Barbara –

Holsinger: Back to Boston again. Boston to there and back.

Pelkey: And that all happened in early ‘68? Or end of ‘67?

Holsinger: I’m trying to remember. It must have been mid ‘67. Let me just think. Yeah, mid ‘67, because I was basically in California two years, and it was roughly a year of breadboard and a year of prototype. That’s roughly the way I think of that.

Pelkey: So you became an employee with salary and some stock in Codex and moved back to Boston in the fall?

Holsinger: Mid-summer of ‘67. The thrust in bringing this back to Codex was to say two things. We were going to go start marketing, which, to support that, they had hired a guy to come out to California for a month or two while I was still out there to sort of start getting up to speed, and he was the guy who was going to start marketing this, and then they were going to start turning it into a production product.

This, unfortunately, was Codex’s introduction to the world of manufacturing. What they had been doing up to then was sort of one-off – error-correcting prototypes and studies for the government which they built with 3C modules, so this modem was the first thing they were going to try to produce as a production product. That was the thrust of the work on joining Codex, to take this thing and now make it a production product and get ready to turn the crank, go out and sell it, and start getting some business.

Pelkey: So when you got to Codex, did you have to redo the modem at that point?

Holsinger: Well, yeah, it was a matter of cleaning up. When you do the first – the production prototype that I had done out in California was a printed-circuit-board model, where the first breadboard was a real breadboard, wired up on vector board. So you do a production prototype on PC, you’ve got a lot of things to fix and revisions and corrections, so coming to Codex, it was a matter to crank in all those revisions and corrections and clean up the circuit boards and get it ready to turn the crank.

Pelkey: How long after you joined Codex was it before they started shipping the AE-96?

Holsinger: That’s a good question. I don’t know.

Pelkey: A year?

Holsinger: It certainly would have been six months and it might have been a year. The thing is that, it turned out that the early phase had a lot of – take two and go out and demonstrate it, and then take two more and go out and demonstrate it. It was a real missionary time.

What you found was that everybody was excited to hear about it. “Oh, yeah, that sounds fantastic,” and I got, when I was in California, free lines from Pan Am, because they were interested in this, so that was the attitude, but then, when you got done, “How about signing up for some?” That didn’t happen very fast. So my recollection is that in the first couple of years, we might have sold a half a million dollars of these, and they were going at $20K or something at that time. There was a lot of activity going out, and doing demonstrations, and showing it and talking to people and all that, but there wasn’t an enormous volume starting at that time.

Pelkey: Was it your perception, at that time, that it was really a manufacturing and sales issue for the company, in terms of getting it to be successful in the marketplace, or were there also issues about the reliability and robustness of the product?

Holsinger: Those questions evolved over time. There were questions that – two or three types of questions that evolved as you started to make this thing and then go out and test it.

One thing that came up was we started bumping into T-carrier. This was very early, when they were putting in T1 links. The first time I remember it was out at United in Chicago, and all their local voice links, the twisted pairs, they were running out of twisted pairs, so they were putting in T-carrier.

Do you know what that is? T-carrier is a digital transmission scheme in which you can take the twisted pair that goes from the central office out to a local subscriber where normally you get a voice circuit on twisted pair, you could put, I think it was 12 – 12 or 24 – down there by digitizing the voice and pumping bits down at 1.5 megabits and then converting it back to voice at the other end. Well that was just starting to be done in the '68 time frame, '67-'68 time frame, and that was one of the problems that we first encountered.

In those days, the T-carrier stuff had problems in the sense that there was a compander, which is a compressor and then an expander, and they didn't line up too well, and so it introduced distortions which they subsequently fixed with later generations of T-carrier, so that today T-carrier is widespread and it's not much of a problem. It's no problem at 9600, but then, because these things didn't work too well, it generated a good bit of distortion and, in the meantime, we had this partial response with tones which meant that we needed 6 dB extra signal-to-noise ratio on the line, so what you found is on T-carrier circuits, it was questionable. If the T-carrier stuff was all lined up just right it could work pretty well, but if it wasn't lined up just right you didn't work too well. So that was one problem we found.

We had manufacturing problems of all kinds. There were probably design-related problems because, in my naiveté, I didn't design things with worst-case tolerances. What did I know? I hadn't done this before, so I took typical and put a teeny bit extra in and away we went. So you had that kind of manufacturing problems. You had manufacturing problems that were learning problems – somebody trying to make stuff for the first time has a lot of those kinds of problems. Jesus, what else went through my mind when I said there was three. There was some other field problem, as I recall.

Another kind of problem that you found, as time went on, is in those days there were no applications for 9600 bits per second. People needed four 24s and stuff like that, and not 96, so that was another issue. While people were interested in the technology and wanted to see it work, it wasn't like they had all these masses of 9600-bit pipes waiting to pump data. Then, another problem that we encountered with the modem, which wasn't, in total, a big issue, but there was a while where it was a big issue, where we found that you set the thing out in tests, and it just drifted out of equalization, over days. That was strange, and there was a time when everybody at Codex was pretty glum, because if this couldn't get fixed, that was the end of the business.

Pelkey: What was the solution to that?

Holsinger: Well, it turns out there's a very subtle problem related to the fact that the data spectrum had nulls at the band edge, and if you didn't do some of the internal processing right, the equalizing algorithm was unstable. It would converge, but then small processing errors would cause it to drift, and it was a very subtle problem, but once I saw what was going on, there were three wires you changed and you fixed the problem and it all went away. So that was not a significant, longer-term problem, but it was a problem that I'm sure took us two or three months to solve.

But I'd say that the fundamental issues in that time frame were performance still not absolutely rock solid, manufacturing problems, and then the fact that the market – you're a missionary on the market, and the market wasn't yet ready, in terms of application demand, for that kind of product.

Pelkey: Do you remember Arthur Kohlenberg got involved in solving problems in the convergence issue?

Holsinger: Oh, everybody in Codex that had anything to offer was working with me on it. It went on, as I recall–

Pelkey: But Arthur was sick during this period of time, was he not?

Holsinger: I don't – maybe he was. It's hard to remember.

Pelkey: Do you specifically remember a meeting in which you made the comment at least to Arthur and maybe in front of other people, that he was the only person that could have found that? I'm led to believe that Arthur was the one who found the mathematics of the fact that you had this instability on the convergence.

Holsinger: Oh, God, no, because, what happened was, I had been working on it, as I recall, for about a month, and everybody was coming around: "How's it going? What can we do?" And one day I got fed up and I quit. I just quit working, not the job, but I said: "Fuck it, I don't know what the hell's the problem," and I sat back and I just put my feet up on my desk and I said: "The hell with it," and pop, the thought came into mind.

What it is, is that there's a matrix that describes this whole operation, and it turns out the matrix was singular, because of the way various things were being done, and it just popped in when I quit working on it, and I remember that absolutely clearly, because that was a profound lesson to me in how you do that kind of work. It's like, if you work on something – you have to do things intensely to sort of get this machine – get the data in and get it working, but sometimes then it stops, and you have to back off and quit trying to think about the problem, and then there's another part of your mind that takes over, and tosses out ideas. And I remember very clearly – but I have no doubt that I was talking to Arthur Kohlenberg, I was talking to Dave Forney and who knows all that I talked to, but I remember very clearly that when the light came on, I had just said: "The hell with it, I don't know anything more to do. I've tried everything I could think of, every idea, and nothing worked," and I just said: "The hell with it."

Pelkey: Do you remember around what time of year that was?

Holsinger: Well, that was probably – it would have had to have been a good year into the Codex program, so it would have been in the '68 era.

Pelkey: Second half of '68, sometime.

Holsinger: Probably. Somewhere in that time frame. It's hard to know exactly anymore.

Pelkey: When did you eventually leave Codex?

Holsinger: Our final time was November of '69.

Pelkey: What caused you to part company with Codex?

Holsinger: It was a fascinating story, I think. It relates to some earlier discussion.

Someplace in '68, I think, Codex went public. Do you know what the market was like in the '68 era? It was just cuckoo. I have never seen it as cuckoo since then, and it's been cuckoo at times since then, it was just that high technology was just crazy – I have never seen just – people starting high-technology companies, going public, and making money.

So Codex went public, and they were one of the hot stocks in the Boston area. At the time they went public, their revenues had been maybe $2 million, and they had been around for many years at that point, four, five, six years, virtually no earnings, and quite soon they were $50 million valuation, and somewhere in the process of all this going on, I started to get some contact with the investment banking people, and I met Jim Boyer, who was at Smithers at that point in time, and they were involved in Codex.

I started to find out that the reason that Codex was so hot was this modem. It was sexy, maybe another Xerox, that kind of thinking, and not that it generated any revenues or anything, but it had potential, and it was hot. Of course, in those days, people were going public on a lot less even than that modem. So you

begin to see that. It wasn't this error-correcting stuff – which happens to be where they were making their revenues, but they weren't making any money – that made the stock hot; it was this modem.

So you see that. Over time you get to meet a bunch of entrepreneurs around the Boston area different times and ways, and you put that together with internal problems and conflicts. The biggest one was, of course that, at Codex, it was long known and widely known that there was a red team and a blue team, and I don't know who was which, but when I was brought in, I was brought in by the president, Jim Cryer, and over great opposition by the key people that were in the company at that time. I don't know necessarily about Kohlenberg, but there was a couple of other guys there at the time totally opposed. So when I came in, I was one of those teams, and they were the other team, and –

Pelkey: You were Blue?

Holsinger: I never did know who was red and who was blue, but I knew there were two, and I was one – so there were a lot of difficulties in that time because the modem effort took funds, and money, and people, and effectively it was competing with this other group, and these other people had a lot more power, so there was a lot of internal antagonism over this effort.

So you put that together with seeing the company go public, seeing stock being pumped up, seeing all these other entrepreneurs making all this money, and not having a very big piece of the action myself, you said: "Why do that? Why not go start a company?" And that's basically what happened, as to the motivation.

As I look back, I realize now that I was never one to work for somebody. I'm just not that kind of person. I get very frustrated working for anybody, so it isn't – the problems they had may be no different from most other companies, but for me, it just wasn't my cup of tea, so you say good-bye.

Pelkey: Now, was the Threshold Decision Computer after you left?

Holsinger: Oh, no, that was a Dave Forney idea. Oh, no, that got implemented while we were there. Someplace in the process, Dave and I were working – I don't remember how that got started, but that was, as far as I remember, totally Dave's idea, and he recognized that the structure of a partial-response signal, it's somewhat like having redundancy that is present when you do coding, which is why it costs you 3 dB. He realized that you could use that structure to buy back some of the dBs you lost, by effectively putting a decoding scheme on it. He came up with that when we were having problems getting it to perform well enough. It was implemented, as I recall, while I was there, sort of at the end of the time we were there.

Pelkey: There was another enhancement of the product that related to this convergence issue resulting in a little light on panel that would go on and indicate the it was making a decision as to what state it should be in. Do you remember that?

Holsinger: No, the threshold decoder certainly does – I had forgotten about it – absolutely, I think it was important – from a conceptual standpoint, it was really neat, because nobody had realized that you could do that in those days. I don't know – oh, unless it was signal quality. Maybe there was a signal quality circuit we put in.

Pelkey: Someone told me about the airlines, for transatlantic – in fact, Air France left the modem open so they could see this little light –

Holsinger: Oh, probably what that was is what we called signal quality. You could tell how good a job the equalizer was doing equalizing the line, and you could make a measurement and effectively put a threshold in, and say: "If it's above this, turn the light on that says it's bad," or you could drive a meter, whatever.

Pelkey: When it was bad, the modem was actually retraining itself.

Holsinger: Yeah, right.

Pelkey: And that was part of the solution, the issue of convergence, or were there other issues?

Holsinger: If that's what you're talking about, that wasn't anything other just a convenience for a user, to show them a little bit of what the modem was doing. It wasn't part of the solution –

Pelkey: It wasn't part of the solution, but it did show that the modem was doing something, and you could see how often it was doing it.

Holsinger: I'm sure that's what it was, because what would happen is, if it drifted out, the signal quality would get worse and worse, and in fact, that's how they now cause modems to automatically retrain. If you have a point-to-point link, they just look at their signal quality, and if for some reason the thing is sick, the signal quality is bad, and it retrains itself and gets back in shape. So that's probably what that was, because when we started, we didn't have anything like a signal quality indicator, and I wouldn't be at all surprised if we ultimately put that in, because it turned out to be a very logical thing to do.

The early modems didn't retrain themselves. You had to push a button, and somebody here had to push one and somebody at the other end had to push one, and if you didn't have anything that told you when it was sick, you never knew to push the button. That was one of those things that, when you're doing prototypes you don't think about, but when you get in the real world, you say: "Aha, you need to know when it's sick," so I would imagine that we probably had that kind of an indicator.

In fact, now that I'm talking, we might well have had a three-colored one, you know: green is good, yellow is 'hey, we're getting bad,' and red is 'you're in trouble.' I'm not sure about that, but someplace in my past we have done that kind of thing. In fact, maybe it was the Intertel modems where we had a three-level signal quality indicator. It was sort of a way to know how the modem was doing and if the line was real bad and stuff like that.

Pelkey: So then in November of '69 you leave Codex?

Holsinger: First off, you have to understand that, now I have got – what have I got? Four and a half years of working on a high-speed modem. I've seen no significant sales volume because, in retrospect you look back and what do you expect? It was a pioneering product and was way ahead of its time and the market had to come along, but in those days, you didn't have that perspective. All you know is four and a half years on a high-speed modem and didn't sell anything, so I don't want to do that.

So our approach was to say basically: "We believe that there is a big commercial market to be had, or that's coming, in modems." The Carterfone thing had happened and – I don't know, it was just gut instinct. You thought there was a commercial business, or there was going to be something to be done commercially. Codex had been aimed mostly at the government because that was where there was the most potential market for that kind of a product. We said: "OK, we're going to go off and do something in the commercial business. If we can build 9600-bit-per-second modems, we can build anything. If you know how to do this, you can figure out those others pretty easy." Since we don't know much about that business, why don't we first go out and talk to people.

So there was – there were three of us that started the company. There was myself, Andy Toth, who had worked for me as an engineer –

Pelkey: At Codex?

Holsinger: At Codex, and there was a fellow, Bill Menges, who had also worked there on the modem project as – I think he was sort of a project coordinator. So we were the three guys. He was an engineering background guy also, but more a project manager as opposed to a hands-on engineer.

We were the three that started the company, and one thing that we did recognize is that you can't go far without a marketing guy, so as soon as we started, we started looking for a guy to join us, but in the meantime, we started talking to people. Basically, we went around the Boston area and we talked to time-sharing companies, we talked to DEC, we talked to anybody we could get in to see, and it was surprising how easily you could get in to see people when you aren't selling.

So we got in to see lots of people, and tried to find out what could we do that wasn't being done that would get us into this commercial business. Somewhere in that process, Steve Clark came on board, who became our marketing guy.

Pelkey: He came from?

Holsinger: He had been at a plotter company out on the West Coast – I forget its name – it got bought by Sanders – Calcomp. He had been selling Calcomp plotters and – he was a young fellow, but dynamite, sharp, a gung-ho guy, and had a lot of marketing moxie in him for a young fellow who had only been selling.

So he joined us and, I would say within about six months, he was on board and we had decided that what we were going to do was make low-speed modems and sell them on an OEM basis. PC card modems, a single card, 300 baud, a 103-type modem, a couple of 202 1200-baud type modems, and then eventually a 2400.

Pelkey: Was the 2400 an initial product?

Holsinger: No we started with the 300 and – I think it was 300. I forget, to be honest. We had to start with 300 or 12 –

Pelkey: But leased line?

Holsinger: Well, no, we did – to be honest, I forget whether it was leased or dial because we did both very early. The 1200 turned out to be the big product for us initially, and the 300 was never very big, and I don't honestly remember which came first any more, because 300 never really went anywhere, but the 1200 was big –

Pelkey: And was that both dial and leased?

Holsinger: Yes.

Pelkey: And that was the only one of that flavor?

Holsinger: Well, we, in those days –

Pelkey: Vadic had a dial-up 12.

Holsinger: Yeah, Vadic was generally more end-user in their marketing thrust. As I recall, our biggest competition in the early days was Penril. There was some little company that started out on the West Coast that was selling everything for half.

Pelkey: Halcyon maybe?

Holsinger: No. Jesus, I don't know. They went out of business after a while, because they were selling gold-plated quality at less than factory cost and they just didn't make it, but they were around.

In the early days – of course, when we started, it turns out there was probably, in that era, like 50 companies started in the modem business, so in the early days there were a lot of people mucking up the waters, and most of them went by the way pretty quickly –

Pelkey: Because?

Holsinger: Well I think that a large part of it was that they started – we were probably at the end of the starting era when – there was a lot of money. When we started was right when money started to dry up, so we had very hard time, but if you had started six months or 12 months before us, millions of dollars, easy to get, from the venture people.

I think there were a lot of people who started in that, like in the earlier '69 era, when money was plentiful, it was a pretty ebullient time, so many people weren't very frugal, and all of a sudden, you come into '70 and you're out of your money, and now you try to get more, and in '70 there wasn't any money to be had for people who had gone through the money before. We were coming in in '70 to raise money.

Pelkey: Early '70?

Holsinger: We started about the middle of '70, summer of '70, and I remember things like 'High tech is dead' coming back from venture capitalists. It was a pretty bleak time, and we were just lucky. We found a local guy in Boston –

Pelkey: Who?

Holsinger: Walt Winshall. Well, Walt was a legend in his time in those days. He was a guy who got known, at least in this area, because he had been going to MIT/Sloan School full time and Harvard Law School full time and he was getting straight As in both of them, but then he got caught and the schools got indignant, and they said you can only do one of those, so you have to choose, and in the meantime, on top of all of this, he was going off to Oppenheimer and doing investing stuff, and he got a following down at Oppenheimer.

By the time he got out of whichever of those schools he ultimately chose, I think he went to Harvard and finished up his law degree, sometime after that he left Oppenheimer and went into the venture capital business because he had a bunch of big people, people with a lot of money, that were now fans of his. And this was the gun-slinging days – long-haired hippies in '68, and they had a mystique, and Walt was one of them. So he went into the venture capital business and we got together with him, and things connected. In the meantime, I had gotten to know Jim Blair down at Smithers and between those two guys, we were able to raise our money in the latter part of 1970.

Pelkey: Do you remember what kind of valuation –

Holsinger: Oh, yeah, I remember well. It was a monster valuation of a million two, we raised 600K, and they got half the company.

Pelkey: And you had financed a large portion up until then?

Holsinger: We had financed the whole thing for a first year or more ourselves, basically on money we had made out of Codex. I financed the lion's share of the company, and that was on money that I had gotten from Codex when I joined them, and then all the boys sold the stock when Codex went public.

Pelkey: Was there some issue about your selling stock that Codex was concerned about afterward?

Holsinger: Yeah, well, it was a case that – I guess it was letter stock, unregistered stock. Believe me, in those days, I was naive about those things. They didn't tell you anything about it, so you've got stock out of options, which today, in that context, they would legend, and you couldn't sell.

Those days, they didn't legend, they didn't tell you, so you'd go off and sell it. And some place in that process, they found out that it was happening, and maybe by then I had left or was in the process of leaving, so it wasn't quite as friendly, so they put a stop on it and, yeah, it was a big mess and there was a lawsuit and it dragged on for years, and actually turned out to be very good for me, because I had sold it pretty near the peak.

By the time that it all settled out, I had to buy it back from the market to make up for what I had sold, but by then it was three or four dollars. But then it was tied up and they wouldn't let me sell it again for years, until way after Motorola acquired them. By then it was back up to 40 or 50.

Pelkey: So they really punished you.

Holsinger: So it turned out OK, but it was a long, drawn-out battle.

Pelkey: How about that. So now you've raised your money –

Holsinger: Now we've raised our money in late '70.

Pelkey: Have you introduced a product yet?

Holsinger: Yeah, at the time we had – I think we had developed – what we did is we developed a 202 card modem, what we called a standard product, and we also had a 103, and you needed those so that when you went to somebody, a computer company and said: "Here's my OEM modem . . ."

Tape Side Ends

Pelkey: . . . They had fallback 300 capability on that. They came out with that.

Holsinger: That was way later.

Pelkey: '76 was it?

Holsinger: Much later. We weren't in that market, so I don't remember dates, but it was way down the road after we started.

Pelkey: Then you came out with a 2400 baud?

Holsinger: Soon, in that process, we developed a 2400, and that was the first product in which we really were starting to do some pioneering, in that time frame, around active filters – op-amp-based active filters.

I remember well, our first big order that we got from Bunker-Ramo, and we had gone down to Bunker with, literally – we called it our cardboard breadboard. We had a 2400 that had been wired up on vector board and put cardboard underneath to keep it from shorting out, and we went down, and they ran tests, and all this, and at the time they were buying a modem from Milgo that they put inside their terminals, a 2400 modem. In those days, Milgo had these exotic LC filters, and a big card. It was 8" x 12" or bigger, a couple of inches thick, and many pounds heavy because of all these inductors. We came down with this little, teeny little active-filter modem, which performed better than theirs, and it was much smaller and, of course, much less expensive. So that was our first major order, from Bunker-Ramo, taking the business away from Milgo with a 2400 that had active filters.

Pelkey: Do you remember how large that order was?

Holsinger: Well, over time, it was big, millions of dollars.

Pelkey: But that was a big event in your company history?

Holsinger: Oh, Jesus, yeah. Looking back, that was a very key event, because that got us moving.

Pelkey: Had you sold any OEM 1200s up to that point in time?

Holsinger: It's hard to remember correctly, because our early customers – Wiltech, there was a company down in Connecticut that is no longer around. They were a big company early. Bunker was big early. TRW Data Systems out in LA was a big early customer. Mohawk Data were big early ones. My recollection is, I think, Bunker was the first really big one, but they all came along within – I think by the end of the second year, it was all starting to turn, as I recall.

Pelkey: Which would be the end of –

Holsinger: '71.

Pelkey: So Bunker-Ramo happened after the financing?

Holsinger: Oh, yeah. I'm pretty sure we didn't have any firm orders at the time of the financing, because I remember very well afterwards, like the following spring, Steve and I would sit and go over the prospects and said: "Can there be something wrong, because we're not getting business? We're doing all these things. Seems like we're doing everything right, but there's no orders getting signed," and I can remember many months of that process, and then it all started to fall.

And of course, you look back now, and we were coming out of a recession, and the orders started to flow as the economy was starting to turn, and in fact, if you look back now, every time there was a difficult time with the company it was coincident, or thereabouts, with a recession. And our start-up was right on the tail end of a recession in '70, so at the time we were sitting there wondering what's wrong and why haven't the orders happened, part of it was that the economy was starting to come alive. OEM modems follow along with the health of the computer industry, which follows along with the economy's health.

Pelkey: So the 2400 took you into '72, and things were starting to look much better. Then what came next, the 48?

Holsinger: I think in early '73, late '72, was when we started to say: "OK, now what are we going to do?" Maybe we were up to a couple of million in those days, a million to two which was, you know, not that bad for those companies in those days. Codex probably wasn't much bigger and Milgo might have been five or ten, but that's about all there was, so one or two million was a pretty good size for this industry then. And it was like: "What are we going to do now, looking ahead several years, to keep growing and get bigger?"

We decided that we weren't sure that the OEM business had the play in it that we had thought when we started, in terms of continuing growth, and we said: "Let's go see if we can find end-user business that has some of the attributes of OEM, namely one big customer, rather than lots of little customers, and so that you can sell and support it in a way that you're more used to doing on OEM, rather than mass marketing;" a box here, a box there, a box someplace else, which we didn't know how to do, so that led us to start talking, again thanks to Steve, we started talking with big end-users, and we tried to ask: "What can we do that solves a problem, that keeps us from being just another modem box vendor?" The last thing we needed to do was go out and compete with Milgo head on. "I got a 24, you got a 24, why don't you buy mine?" Well, what are you going to sell on? Price.

So we said: "Let's try to go at it in a different way and see if we can solve some problems that they've got that nobody's solving." Well, in that process, we talked with, among others, a fellow down at Manny Hanny [Manufacturers Hanover Corporation], Gunther Kempin, and a fellow down at Eastern down in Florida, whose name I don't remember, and started working on some ideas for operating in multipoint polled networks in order to diagnose problems, because if you went down and saw what those people were doing in multipoint networks and what kind of problems they had, this was a new ball game, because, in the old days of point-to-point, there were skilled people at both ends. If you have a problem, you call the guy up at the other end and he gets out his patch panels and his test equipment and you work on it. In a multipoint network, you have operators on the remote end at those terminals, and they don't know nothing from nothing.

So you were now operating in an environment where the only technically skilled people were at the computer site, and in the meantime, these were on-line networks where, if it was down, it wasn't like: "Oh well, what the hell, if we don't run our batch today, we'll run it tomorrow." It was like, hey, they're not working. The bank wasn't doing its transactions or the airline wasn't making reservations, and that's really how it was.

The multipoint environment was a timeshare guy, so he calls up the computer and he can't get through. Well, he'll call it up tomorrow. He isn't out of business. Or even if they're running payroll checks batch, well if they're late, then they're delayed, but it doesn't put them out of business. Or they're running their accounting records or whatever, but when you've got an on-line network, a polled network, the very character of that application means it can't be down. So here we have, now, this is now back in late '72 or '73 with all this stuff just starting to happen, and the people that are doing it are starting to understand they've got problems.

Pelkey: Now who is supplying them?

Holsinger: Oh, they just got their modems from Ma Bell or Milgo or whatever. They just put in modem boxes in those days.

Pelkey: How did they make it a multi-drop environment?

Holsinger: The 2400s and 12s and stuff would do polling. That wasn't any problem in terms of the polling aspect, because it was easy to make them respond quickly and start up and run. So probably in those days, most of the networks were Bell modems, I would think, I would guess, because that was an era where, on private lines, at the lower speeds, Bell had most of the business. In the early '70s, if you look high speed, then Codex and Milgo were basically getting the business, but if you look 2400 down, an awful lot of the business was Ma Bell. In any case, they were just modem boxes. That's all they were.

Pelkey: Coming back to our earlier conversation, did AT&T have a 1200?

Holsinger: They did 103s first, 300 baud, then they did the 1200s, then they did the 2400s.

Pelkey: And they had those in the early '70s, but they were leased line?

Holsinger: Both.

Pelkey: Both lease and dial?

Holsinger: Yeah. The 2400 were lease only because it wouldn't run on dial, but they had a 2000 version of the 2400, which was a dial modem, synchronous, and then they had the 1200 async and a 300 async. And the 1200 – there was a dial. There was a 202C, which was dial, and there was a 202D that was multi-point private line, and then if you got your private line conditioned, it would run 1800 baud, maybe, most of the time, sometimes, and if you didn't get it conditioned, it ran 1200 baud reliably.

Pelkey: So the customers are starting to realize that they are putting these multi-point, multi-drop modems in, but if something goes wrong, they had problems, and they don't know anything's going wrong until it goes wrong.

Holsinger: The way they knew there was something wrong was they would get a call from a user saying there's no response at the terminal, because in those days there apparently was no central site of anything that would tell them that this terminal wasn't responding. So, by definition –

Pelkey: So when you talked to Eastern and you talked to Manny Hanny, was that a revelation at that point to you? Do you remember saying: "God, this is a real opportunity?"

Holsinger: The way I remember it, and it's hard to know because these things just sort of evolved – it's hard to know how it started. What I remember doing is going with some ideas, like: "Hey, we could do this," because in that time frame, Milgo I think it was, somebody was starting to do some remote control loopback.

Do you know about loopback testing? In the old point-to-point days, they used to have switches, and you could do analog loopback, which would loop the line back, and you could test this modem down and back, and you could do digital loopback, which went through the modem. That was part of the way you did your troubleshooting, but you had to have a guy at each end to flip the switches and to see what was going on.

I think Milgo was starting to do some remote-controlled loopback, which means you would send out a tone and activate it and loop it back. As I recall, we sort of started with that, but then we started thinking about this on-line problem, and started to say: "Gee, that won't work, because what happens if I try to do a loopback and the loopback doesn't work? I don't know." When you had a guy at each end, then it meant something, but when you're trying to do a remotely controlled loopback and it doesn't work, you've got a problem.

So then we started saying: "Well, what can we do about this? What are all the different things that can fail and how can we design tests that will figure out these various things?" And you do a bunch of these things, and I remember going down to the guy at Eastern, I remember going down to him and drawing it on the board, and saying: "Well, we can do this and that." He'd like some things and wouldn't like some others, he'd give you some new ideas, and we did some of this with Gunther, and so we sort of iterated for a while, and eventually it came in to be our first product for the end-user market, which was our MPT, our MPT 500, a multi-point tester, and basically what it was was a diagnostic card that went in the modem and a central-site controller in which you could go out of band on the telephone line without interfering with the data, and interrogate the remote modem and have it do various tests and stuff like that. It was very well human-engineered, so it was very easy to use, with the little switches and the little LED display. It was very easy to run a test. Test this, test that, get back results and know what your problem was.

Secondly, and I think this came out of the work with Gunther, we developed the dial back-up capability, which meant that, if the line went down, and I think it was 50 or 60% of the problems were line problems. When a remote site is down, over half the time, the line was out. So we developed the dial back-up capability, in which a central site operator could call up and get the remote site back up over a dial network, without the operator having to do a thing, and so with that batch of diagnostics and line restoral, and that capability applied to 1200 and 2400 bit-per-second modems, that's how we started our end-user marketing thrust.

Pelkey: And when was that?

Holsinger: That, I think, was in '73, and as I recall, we sold that off of Xeroxed spec sheets to good old Gunther Kempin, because he was a real pioneer. You know, all this leading-edge stuff you sell to pioneers, the guys that want to do the leading-edge kind of thing, and they get excited because they are

influencing your product, so if you get the right guy, then it is a dynamic interaction and then he's really hooked. So we – I'm pretty sure it was in '73 that we sold our first stuff to him.

Pelkey: Early, middle, late?

Holsinger: My guess is it was in the middle part of '73. They were putting on – it's so amazing to look back on this now – they were doing their first branch-banking network. They had a teller network – a savings teller network – that they wanted to put on-line, so that you could go into any branch and do deposits and withdrawals from your savings account regardless of where your home branch was. Prior to this, if you didn't go to your home branch where they had all the records, they'd have to call the other branch and you'd sit there while they called: "Does he have the money? How much?" And all this stuff was a mess, so this was the first thing that Manny Hanny was doing to go on-line.

Pelkey: So they were bringing all the records back to the home office?

Holsinger: They were going to put all the records in the central computer and let you access it from a terminal in any branch around the city, and there were 50-some branches at that time, I think, and they were very concerned about up-time and stuff like that, so they were interested in diagnostics and in dial back-up restoral. And that was the first major account that we got.

Pelkey: That sounds like it was a hot product.

Holsinger: Well, what it was, it was an interesting product to sell. It was like the 9600 bits in '68, it was a missionary sell to start with, because –

Pelkey: The applications weren't there.

Holsinger: Well, there were people on-line, but you go in to sell, and the problem that we've got originally, in the early days was, you get a techie, and boy he got excited because he could see what it would do for him, but then he had to get it approved by some financial guy, and what's the cost/benefit?

Pelkey: So it was mid to late '73, and it was another missionary sale, even though you had gotten some of these pioneers to define the spec and the need, which you had followed, there weren't a lot of pioneers, and you had to go off and start to educate the market. How long did it take before it started to catch on?

Holsinger: It was a couple of years, I guess. In '74, we had a very bad year, because in late '73, a couple of our big OEMs went away, and again, if you look back, there was a recession going on there. So we had a bad year in '74.

Pelkey: So '73 was around another couple of million dollars year?

Holsinger: '73 was about three, and what I remember as the numbers, roughly, is that it was 75% OEM and 25% end-user.

Pelkey: Were you profitable?

Holsinger: Oh, yeah, very profitable in those days. '74 was a very tough year because the OEM business went away, so we had to gird up to try to do end-user, and my recollection is we were up nominally – it seems like '73 was maybe 3.2 million and '74 was maybe 3.4 million.

Pelkey: But your spending rates were higher.

Holsinger: Spending rates were higher because now you're trying to do end-user business.

Pelkey: Did you still make money?

Holsinger: I forget, either we just did or we just didn't, one or the other. It was basically not much as I recall, but the ratio had flipped, and we were 75% end-user and 25% OEM at that time.

Then, in the next couple of years, in that process, Steve Clark left, and we went through a couple of marketing guys, and eventually got a guy in, Dick Hosseboon (?), in probably '74 or '75, someplace in there, and it was probably about '76 when it really began to start to pick up speed. He got a sales organization together and some of the missionary work was about to pay off, plus you begin to have enough accounts to let you reference-sell, which was very valuable as time went on. You began to get more people who knew what network control was about and that they needed it, so it was not as hard an internal sell as it had been in the early days, so the whole thing started to pick up speed, then, I would say in the '76 time frame.

Pelkey: So in '76, your revenues were above 10?

Holsinger: I would imagine it was getting in that range. Jesus, it's been so long.

Pelkey: When did you become Infinet?

Holsinger: Oh, that was much later. Way in the '80s, '81, '82. That was in the Horton and Hedrick era.

Pelkey: But by '75, '76, other people were starting to recognize that this network control, diagnostic functionality that you had introduced was in fact valuable.

Holsinger: Paradyne was the first one that really woke up and did something about it. Others maybe recognized it but they didn't have any impact on us. Paradyne was the first one to recognize it and really go gangbusters and then start really giving us a lot of trouble. I believe it was more like '78 when we were really starting to feel Paradyne.

We had a few years where the numbers were nice and the margins were fat and there really wasn't – the problem, in the early days, was just convincing people that they needed us, but if we could convince them, we got the business. There wasn't much dealing on price, because there wasn't a lot of competition, so we had a couple or three years where there wasn't any competitive selling, it was selling the concept, and if they bought the concept, they went with you.

I remember then, later on, as Paradyne came on, that the whole sales force had to learn what it meant to do competitive selling, because it's a lot more fun when it's not competitive. You sell an idea, when the guy buys the idea you've got the business. That's a lot more fun than head-to-head. I believe it was more like '78, because we had a few years of enjoying it.

Pelkey: Did you hire anybody out of General DataComm? General DataComm believes that some of those ideas came from them, about network management.

Holsinger: Oh, that's ridiculous. General DataComm was famous in the industry for stealing other people's stuff. I can tell you – every modem they ever had above 1200 they got from somebody else. I don't think I'm alone in feeling that or believing it.

Pelkey: Let me ask you your recollection about one other very specific thing, an ad that you ran, that came out around a trade show, in which it was: "Ask Codex. Ask Milgo."

Holsinger: Oh, I remember it, oh yeah.

Pelkey: Do you remember when that was?

Holsinger: Well, it would have been very near a TCA show, because I remember very well running into Matt Kenny out at TCA and he was pissed off as hell because we had done that. I never understood why, because it wasn't negative. It was just –

Pelkey: Can you remember what year?

Holsinger: It would had to have been in the '78 era, I would think, because – it was probably Paradyne, Codex, Milgo – I don't remember if it was two or three.

Pelkey: Was AT&T one of them?

Holsinger: No, they weren't there then. They didn't come until much later.

Pelkey: Where did you run the ad?

Holsinger: Probably Data Communications Magazine.

Pelkey: Some people believe that your fortunes dwindled after that ad because you legitimized these other vendors – creating the perception in the marketplace that these other vendors were really credible, and that you must have fired your ad agency subsequent to that. Outsiders see that ad as having been critical in your company's history.

Holsinger: Negative?

Pelkey: In a negative sense.

Holsinger: No, there was no sense of that. The problem we had was who were we?

In fact, Intertel always had that problem, because we never did a good job of getting recognized, and the intent of that ad was to associate us with them. Hey, we're like those big guys, and in the meantime to point out that, when it comes to network control, which was really true, if you looked very deep, you'd find out that what they were selling wasn't much, and that was really correct in those days.

Our difficulties in why we didn't stay dominant and Paradyne took over was just because we were very inexperienced, whatever, from a marketing standpoint. Our weakness was marketing, always, because I was never able to get that kind of a capability in the company.

Pelkey: Did you recognize that?

Holsinger: Oh yeah, for years. It was always a problem. We were – we did as well as we did because we had great products with adequate marketing, and Paradyne came along, and brought in a bunch of guys out of the data processing world who understood a level of marketing moxie – this is now '77, '78, somewhere. Jay Hill and a whole crew came in. They understood – the data processing marketing business in those days was sophisticated by comparison to what all us little modem guys were used to doing.

I don't care whether you talk about Codex or anybody – they brought in guys, and they understood how to market stuff, and so with a product that was OK, but with superb marketing, they outstripped us, and – it was that, as well as, what did I know about running a company as it got bigger and all the things you need to do with that, so we outgrew our management horsepower, starting with me, and we never could put together a really topnotch marketing operation, and as a result, in a couple of years, Paradyne had a big piece of the business.

Pelkey: Did you peak in the late '70s in terms of revenue?

Holsinger: Yeah, very late '70s and early '80s the growth slowed down.

Pelkey: What were you at, around a $20 million company?

Holsinger: Yeah, 20, 22, 24.

Pelkey: Were you still President at this point?

Holsinger: Well, what we did, I had heard all the stories about the entrepreneur who stays too long, and in '77 or '78 I said: "OK," after a lot of soul searching, "I want to go out and get a President, a guy that's a good marketer, experienced manager and all that good stuff, and let me go back and dream up new things."

And we went through a search; spent about 18 months looking for a guy, brought in a fellow by the name of Sy [Seymour A.] Rosen, IBM background in marketing, Harvard MBA. On paper, he had run a division of General Instruments; he even had a physics undergraduate degree, which I found to be valuable to make people feel comfortable in the technical world. An English major doesn't feel real comfortable with technical people. So this guy on paper was perfect, smooth, polished, the whole thing.

It turned out that it didn't work. He had a lot of problems, alienated the sales force, alienated the whole management of the company.

Pelkey: He came in in '78?

Holsinger: It was May of '78, I believe. The company was on a roll at that point.

Pelkey: Paradyne was beginning to –

Holsinger: They were beginning to hit us, and the sales guys complained about it, but the numbers were good and profit margins were phenomenal.

In fact, right when he came in, I went to the AEA conference in Monterey, where all the small companies go that are looking for money and may go public, I went out there and made a presentation and showed our numbers, and I was beating off people afterwards. I didn't quite know what I was doing when I did, because the numbers looked so good.

Pelkey: Had you raised any more money?

Holsinger: We never raised money. We raised the initial $600K. When we went into end-user business we had to get a lease financing line in place, which we did through banks, and there was never another round of venture money put into the company until the Horton and Hedrick era, which was a whole different thing.

Pelkey: So what happened to Rosen?

Holsinger: He came in, he was in there about nine months, and it got so bad –

Pelkey: -- beginning in early in '79?

Holsinger: I'm pretty sure that was it.

Pelkey: You were Chairman?

Holsinger: Yeah, I was Chairman and I think I was CEO. Yeah I was Chairman and CEO, and it was clear that either he went or the company was going under, so I did my thing and he left and I stepped back in.

Pelkey: That must have been a painful experience for you.

Holsinger: It was painful because I didn't really want to go back in at that time.

Pelkey: As well as firing people.

Holsinger: I fired a lot.

It was painful much more because of what he had done to the company, because the company was in very good shape when he came in; it was making money, the people were as happy as people are, and when he left – I mean, I spent the first month being a therapist to people, and just let them talk out all the terrible things that had gone on as a result of him.

Then you have to try to get the place going and moving again, and fortunately, business in general was good enough that, from the numbers, you really wouldn't have known what went on. The unbelievable profit margins –

Pelkey: If you looked at market share – but not in terms of your growth.

Holsinger: Yeah, if you just looked at our numbers, that's right. The margins are down a little bit and the revenues aren't up quite as much, but it didn't look like a disaster.

Pelkey: So now you're back in control and it's the beginning of '79, what's the next step? You've alluded to a period that's a foul-up. There must be a traumatic thing that happened along the way.

Holsinger: It's funny, that period of time – it's almost like a blank spot in my life. It's a little thing – it's funny, when I left the company and I had some time, I started digging out records and stuff –

Pelkey: Which was when?

Holsinger: Oh, I got out in '83 or '84. I got out in '84.

I started getting out phonograph records and stuff, and I realized I hadn't played them since 1978, roughly. It's like, when Sy Rosen left, there was a whole part of my life that just (explosion sound), and it was an awful, long grind, and I didn't want to go back and do it. I was doing it because I felt I had to and I didn't see any way out. In retrospect, I made a mistake, in the sense that I should have fixed it up and gone right back out and tried to find a guy again.

Pelkey: But you wouldn't because you had lost confidence that you could get somebody.

Holsinger: I said: "Never again am I going to do that to the company," and so it ended up an era where, once I got the company turned around and it was sort of back reasonably on course, it was like I was on a treadmill then, and I had lost my goal, my vision. It was too big for me, so now I was strung out all the time, frantic, going 90 miles an hour, but not effective. It just had really changed.

At the time I decided to go find Sy Rosen, I sort of shut off on driving the company. I was now going to look for a guy and he was going to drive the company, and when I had to take over, that drive was gone, and now it was: "Oh my God, what am I going to do? I've got to go keep this place going because I don't know what to do with it."

Pelkey: Did you ever think about trying to sell it?

Holsinger: Eventually I did, maybe on the order of a couple of years after Sy Rosen left, I finally had had it. We had a guy on the board, Harry Boles, a really senior guy who knew all the Wall Street brass, and I remember going to New York and talking to investment bankers, because we were going to sell the company. We started the process going –

Pelkey: Around 1980?

Holsinger: It must have been around 1980, I think.

Pelkey: Maybe 1981?

Holsinger: One time I got curious, so I sat down and figured all these things out – it would have been about '80, probably. It's funny, you start with one event, and if you sit, you can eventually put an awful lot of dates to events, but it was around '80.

Pelkey: Did you retain anybody?

Holsinger: Yeah, we got Goldman, Sachs. They were interested in getting into high tech then, and we took the view that we wanted an M&A specialist, and the high tech part, they could learn or we could teach them or something.

So we started trying to put together an offering memorandum, and right in the process of doing all of that, the damn company started to fall apart in terms of sales and earnings and stuff, so as we were getting closer to having a document and them being ready to go, it wasn't the time to go out and talk about selling the company.

As I recall, again, in retrospect, we were heading into a recession in the early '80s, so I think it was the same old thing again: we were going into recession, our business was falling off, and it didn't look good, so now it was REALLY bad. We weren't going to sell the company. I didn't know what I was going to do.

We were having marketing problems up the kazoo. We hired a consultant, Dave Hedrick, who one of the fellows there had known somehow and thought well of, and brought Hedrick in to try and help us on our marketing problems. Collectively we were very impressed with him. He seemed like a really sharp guy, very bright guy, very marketing-oriented guy as opposed to a sales guy, had come out of Prime and done some good things there. We tried to hire him, because we were really looking for a VP of Marketing at the time.

He wouldn't come, but after six or nine months of that and me being desperate and just wishing the hell that I could get out of this thing somehow, a guy that he knew from Prime was leaving as a result of Henson coming into Prime, a fellow by the name of Horton. Dave Hedrick had worked for Dave Horton at Honeywell, and then they knew each other at Prime and all this, so Hedrick came and said: "Gee, I think Horton would be a good guy to run the company." He knew I wanted to get somebody to run it. He said: "He could be a good guy to run the company, and if he comes, I'll come."

So we could solve two problems at once, and in the meantime, the guy we had in engineering wasn't doing too well, and maybe I could go back to engineering and clean that up. So after a couple of months of the courtship ritual and reference-checking and all of that, I think a fair consensus was that none of us was REAL excited about Horton, but he seemed like a nice guy and he had a good reputation as a people person and all that, and what we really wanted was Hedrick, and me out. So it netted all out like it looked like, probably, a pretty good thing.

So we went ahead with that, and that was in February 1st, I think, of '82. They came in. They both came out of a Prime background. Hedrick was there very early, so he saw Prime explode, what 70% a year, 100% a year, so they had the big-growth mentality. They were going to do in data communications what Prime had done in computers. So you come in and make big plans, big budgets. You do your revenue

things and all this, and the thing that always gets implemented in those plans usually is the bottom part, the expend part, and we didn't have any trouble meeting that part of the plan, but – initially the revenues didn't do badly, and it looked like what Hedrick was doing – it had a very good impact, and the revenue started to take off, so they got more aggressive, and, you know, bringing in people, and then inventory starts to climb, and all this stuff.

After about a year, they had gone through a $10 million bank line, where when they came, it was about nothing. Unbelievable inventory build-up, just unbelievable, but the revenues were coming along pretty well in that year's time, and – good story, and so basically the outside venture people and the banks were believers. Then at some point they got as far as they could go with the banks, I don't know, maybe $10, $15 million. They said: "You've got to raise some money," so they went out and raised $8 million at a not very good price.

Pelkey: Private placement?

Holsinger: Yes.

Pelkey: Did anybody manage that private placement?

Holsinger: It seems to me that Robertson & Colman was involved. Fundamentally, it was driven by Sam Shannon at the company. He's really the one who drove it and made it happen.

Pelkey: What venture capitalists came in?

Holsinger: I don't remember well any more for two reasons. One is that I wasn't much in the stream of that, and secondly, I've been out so long that all the names are going away. They went back to some of the old group and they got some from the old group, and then they brought – oh, I'll take it back. A couple of them I remember. Fidelity came in, and that was a new group. Greylock came in, they were an old group, but they also came in pretty big. There was another one, Orange Nassau that came in.

Pelkey: Greylock, old group meaning, they were part of the original –

Holsinger: They were an intermediate investor, in the sense that they bought from original investors. They never put money in the company prior to this one, but at the time they put money in they had a reasonable block that bought from other old shareholders. So they raised the eight million. This is probably the '83, early '83 time frame, and in that time frame, we're in the process of coming out with a fast-poll 9600 that would work in these multipoint networks. We're coming out with a 14.4, I mean we're planning to come out with these.

Pelkey: And you're in engineering?

Holsinger: I went back to engineering when Horton and Hedrick came in and after about a year, I got out, and they brought in another guy to run engineering, and I went into Chief Scientist role, whatever that was going to be. That was just about exactly a year after they came in, a year and a couple months.

Pelkey: And after the financing?

Holsinger: I suspect the financing was done after Pete Savage came into engineering, as I recall. I think he came into engineering when the financing was in process, because I think he was –

Pelkey: So spring of '83 was the financing.

Holsinger: Yeah, I think so. So then – I guess in late '83, he was beginning to not – oh, yeah. '83 was when the market was hot again, wasn't it. High tech was hot, IPOs were hot. OK, '83 is when we started talking about going public. You'd look at what we were supposedly going to do, you looked at how the

bookings and sales had been picking up, extrapolate it out, and it's time to start thinking about going public. The market was hot.

We got together with Robertson & Colman and Alex Brown. We picked those two to be the bankers on it, and started making plans. Rather than rush, we were going to do it right, so rather than go quick and get it done when the market was hot, we were going to wait, because we wanted to get our products out and get some stuff coming and make sure the numbers were good, and we were going to go like in January or February.

Well, by January and February, the market had gone south, and our number were going south, in part because those two new products hadn't happened, and in part because, in retrospect, other things were starting to fall apart too, but the net of it was that the numbers weren't looking good, and there was no way in hell we were going to go public when you put that together with the shape the market was in.

In the fall of '83, I got back involved in those two technical problems, and we got those sort of fixed by January of '84, and I guess what happened is we went through '84 – month by month, with rationalizations at the board meeting of why we weren't making our numbers but we soon would, there was a line backlog problem. With all the deregulation, the phone company was behind on their line installations and that was why we couldn't sell modems. We went through all this stuff. Every board meeting there were more rationalizations, and '84 was the year of waiting for it all to happen. And in the meantime, inventory growing, people coming in, unbelievably high-paid levels, all this craziness.

Pelkey: What sales level were you at then?

Holsinger: I think we got up to, total, in the high 30s. When they came in we were in the low 20s and they got up maybe by 50%, but in the meantime, in '84, sales aren't growing, expenses are growing, profits are going down, bank line is going up, up, up because as soon as they brought the eight million equity in, it just 'whoom' was gone.

I think they paid the line down or something. It was gone and the bank line was climbing back up again, and by – in the '84 era, I began to be concerned about the quality of the bookings, because you begin to find out from talking to people that maybe bookings – there were people that were wondering if Horton had gone cuckoo, and in the meantime the banks finally said: "That's it."

Pelkey: Spring of '85?

Holsinger: Yeah. "That's it. No more money," and the board then had to do something.

Pelkey: This is when the sale to –

Holsinger: Now, that came a year and a half later. It must have been August of '86, but the board now was faced with a situation, they had to do something. By then, they knew that Horton and Hedrick were a problem. There had been enough input, and they were plugged in enough and all that, so they fired them, and, in retrospect, very wisely, put a guy in charge, Nick Papatonis, who had been at the buy-in, but it was so cheap that everybody said: "Go away."

Nick had, in the meantime, sort of got to know them and kept in touch with them, and in fact, I think was OEMing a product, a node processor, from them. So the relationship had sort of developed, and as the company got better, I forget how or why, but NimoTech had a lot more money available to him a year or so later, so finally they did get together, which was August of '86, and they bought out Infinet, even though at the time Infinet was in pretty good shape, other than this ridiculous debt that the guys had.

Pelkey: And when did the name go from Intertel to Infinet?

Holsinger: That was in the getting ready to go public phase, because there were some Intertels out there.

Pelkey: That was in '83?

Holsinger: And it was part of getting ready to go public. We had long known that, if you wanted to go public, something had to be done about "Intertel," because there was a company out in Phoenix.

OK, I think what you're looking for is the thought that, probably starting in the '78 era, something like that, for many years, there was not really any product or technical innovation in our business. I can remember quite well, in that time frame, thinking that all people were doing was applying new technology, whether it was LSI or microprocessors. Codex did the LSI 9600 and that was neat, but it wasn't something that was solving a new problem. It was just technology, building what you've been building a different way.

Pelkey: It's like with the PC modem. It wasn't technology innovation; it was packaging innovation.

Holsinger: PC modem was, number one, recognizing that that market was there, and putting some intelligence in it so that – auto-dial and it does some handshaking and stuff that made it easy to use which previous dial modems didn't do.

Pelkey: So the 14.4 Paradyne forced, and that led to the 19.2. You were saying that was kind of a new generation of engineer . . .

Tape Side Ends

Pelkey: You were in the process of talking about innovation –

Holsinger: We were talking about the 14.4, and I was commenting that there wasn't much innovation from '78 on, and then when the 14.4 came out, what's important to me in that one, is that it sort of illustrates that fresh people coming in just looked at the lines, realized that the lines were better, or good enough to support higher than 9600, where all the people who had been in the business a long time knew they weren't. They were bad, because we remember ten years ago how bad they were, and as a company gets bigger, you don't have the hands-on input the way you did when we all started.

I was out there measuring lines in 1968 and '70, and you learn what they're like, and then you keep that model, and 10, 12 years later, Paradyne had some fresh people. They obviously measured some lines, looked at them and said: "Gee, we can send more bits." So their breakthrough had nothing to do with technology. They like to talk about their little corner points and they moved them and they got a patent and all that. That's all hooey, it doesn't mean a thing. It's a negligible effect. The real thing is they recognized the lines were better, so they put more points on the 9600 and ran 14.4.

Pelkey: And you were saying that you and Forney –

Holsinger: Oh, we chuckled about it because we knew it couldn't possibly work reliably, because we knew how bad the lines were, except we didn't, because they had gotten better. And I remember sometime, maybe a couple of years later or something, as it began to get accepted and we began to have competitive problems because we didn't have a 14.4, that someplace in all that process, you go out and you start looking at lines, and you shake your head, and you can't believe how much better they are than you remember. Phase jitter was the dominant problem in getting higher speeds.

Pelkey: Late '60s?

Holsinger: Yeah, when we first did the work, and the original Codex 9600 was so successful from a performance standpoint, because it dealt a lot better with phase jitter than the old AE-96 did, and that's

what let the Codex 9600 work well, and that's why they were able to do well with it. So we remembered how bad the phase jitter was and how important it was.

Well, when I finally started looking in, probably, the early '80s, it was like it almost didn't exist anymore. What happened, apparently, is that the phone company had upgraded all their oscillators and stuff in the course of those ten years or so, and now the network was much higher quality, and so 14.4 then just became a matter of basically just turning up your 9600.

Pelkey: What about the 19.2?

Holsinger: Now, the 19.2, that's technological advance, profound advance, because what that does is – it uses a technique called Trellis Coding, and it marries coding with signal design in the modem to get results that nobody ever got before.

For example, when I was in school doing my thesis work, they used to make a coder that you just piped in bits, then you put the bits into the modem, and you pumped them down the pipe, and then the same thing in reverse, so the coder was totally separate from the modem and how the modem was designed. Well, we found that, with that structure, coding didn't buy anything on telephone lines. By the time you put in the additional redundancy that you need for error correction coding, you had to run the modem so much faster that its performance degraded so much, that the coding couldn't overcome it and buy you anything. So all us old-timers knew that coding on bandwidth-limited channels didn't buy anything, it won't work, so forget it.

So, there's a guy Ungerboeck, much later, must have been in the late '70s at IBM, somehow started working on a different way of thinking about the problem, and he does signal design and coding combined, and – I don't understand it. I've never gotten into it, so I couldn't begin to explain it, but it marries the two as opposed to having a separate digital coder followed by a modem.

Total breakthrough. All of a sudden, it buys something now, and you can buy 3 dB in performance readily and the fact that this has happened, that it works, has now prompted people to look at more powerful codes and stuff so that now it will buy even more than that. Well, 3 dB is all you need to go from 14.4 to 19.2. If you have a coder and it buys 3 dB, then your 19.2 will run as well as the 14.4, and the 14.4 was pretty reliable when it was properly implemented. I believe that Codex may even have a more powerful code than the 3 dB effect, so they may well have a 19.2 that's better than the original 14.4s, for all I know.

Pelkey: Was that patented by IBM?

Holsinger: It was published a lot and it's widely talked about. My sense is there must not be any patent protection, or if there is, they must not be doing anything about it.

Pelkey: In terms of innovation in the industry, your 9600 bps modem was the first really big leap in innovation. The first one.

Holsinger: Yeah, that was a breakthrough.

Pelkey: That was looking at the world completely differently.

Holsinger: Well, it was – that's not quite fair, in the sense that Bell – the Bell Labs people had done it, they just didn't do it right. This was doing it right, and as a result, you could get 9600 bits.

Pelkey: And the improvement on your work with the QAM constellation work of Forney's, the combination of those two together, making a commercially very robust 9600, which took both events, was a milestone in terms of intellectual innovation in the modem industry.

Holsinger: I think, in fairness, though, I believe the QAM and all that was really Gallager's work, Bob Gallager. When I was at Codex, we knew about the phase-jitter problem, and Gallager was consulting.

Pelkey: He was at MIT.

Holsinger: He was at MIT, but he had known the Codex people for a long time. He had always been consulting for them, and he was working on the QAM stuff right at the time that I was leaving, the theoretical parts of the QAM.

Pelkey: Was that intellectual heritage out of the Shannon coding –

Holsinger: It really is nothing as complex as that. It's a matter of knowing how to model phase jitter, and then somebody that knows how to think about signal design right, of which there were very few in those days, looking at it and saying: "Oh well, if I do QAM, it'll be less sensitive to phase jitter."

Pelkey: Now, MIT, when you were there –

Holsinger: So it wasn't coding theory that did it.

Pelkey: Where would you have come into contact with signal theory?

Holsinger: Well, it was the kind of thing that coding people might think about, because it was – it sort of took a rather mathematical approach to thinking about modems and signal spaces and stuff, which, in those days, engineers didn't do. They didn't know how to do that.

Pelkey: That was a mathematical view of the world. Now, when you were at MIT in the '60s, MIT was a real hotbed of information theory with Shannon and –

Holsinger: Bob Fano.

Pelkey: And with the people who were –

Holsinger: Gallager, Wozencraft –

Pelkey: And I'm trying to think of the other information theorist who was there. Not Minsky, but –

Holsinger: Yeah, he's off in – Jim Massey was there at one time.

Pelkey: It's interesting to me, in doing this book, that MIT was profoundly important in the '60s in terms of information theory and technologies, but Xerox PARC in the '70s was THE research center in America, and in the late '70s, in recognition of this, MIT made great efforts to try to recoup its dominant position in information technologies which, while they were still way ahead of most places, Xerox PARC was clearly the greatest fountain of information technology innovation and productization of the '70s.

Holsinger: Well, I was going to say, I think there's a profound difference. I don't know a lot about Xerox PARC, but I think that's a more applied area.

MIT, when I was there, in information theory, these people were doing exotic, far-out stuff. I was the only guy that was practical, and I was looked at as a little strange, because I wouldn't work on a problem unless it had a practical application, and there was a tremendous amount of the view there that what's important is that it be intellectually challenging.

So they dealt with models of channels that nobody in the world ever used, and MIT, when I was there, was way off in circuit theory, everything had gone way off, very esoteric, and my sense is, they came

back in the ‘70s. They started saying: “Maybe we should solve real problems.” But information theory was –

Pelkey: Your PhD was in mathematics?

Holsinger: No, it was in EE.

Pelkey: Because modem technology, intellectual property of modems, is a combination of two events. One is that it was applied mathematics.

Holsinger: Tremendously, yeah.

Pelkey: And then secondly, what came about was a low-cost op-amp, and that a lot of the circuit designs about modems came out of people that had circulated through Bell Labs, because Bell Labs is where the real circuit theory design of modems was taking place. Now there were people at GTE – Lenkurt, maybe yourself, a few people – but really it was at Bell Labs that people began to understand the design and creating BCs.

Holsinger: Well, what’s interesting is, Bell Labs did almost all of the early work in modems, 300, 1200, 2400. From there on, they faded fast, I think because they were used to a cycle of five to ten years of development. There was no big rush. They’re going to write it off over 50 years, and they got used to that pace.

Starting in the late ‘60s, when some of the others of us got into the high-speed business, all of a sudden the pace changed. I went down there for an interview and saw on a lab bench there, their breadboard of this adaptive equalizer, clunk, clunk, analog tapped-delay-line thing.

I went off, ended up going to Santa Barbara and started, and the next thing you know, I had a product, and I remember being down at NASA for a demonstration, and a Bell Labs guy was there and saw it, and we did 9600 bits per second, they said: “Congratulations. You beat us,” and I was one guy and a technician, and I started after they had a breadboard of the thing, PhDs, labs, the whole thing.

They know how to do digital things, presumably, but they didn’t have a mentality that let them move quickly, and so they were just always behind, and it took them until the late ‘70s to get a good 9600 bit per second modem that was reliable and worked and people used. They were way behind, and so, it’s like through 2400 what you were saying was right, but start with high speed, and all the good work – actually, the high-speed field really came out of Codex, because even if Milgo had one, it didn’t work, because they were doing VSB, and they hadn’t – Codex had the advantage that, what I had done taught us about phase jitter very early, and then the Gallager QAM work said: “Here’s the solution,” so Codex is sitting, in ‘71, with a QAM modem that works, and it took the rest of the industry years to figure out –

Pelkey: Because everybody else looked at the AE-96 and tried to duplicate the AE-96.

Holsinger: A lot of people didn’t even do – they did VSB. Everybody that started in high-speed modems started the same way I did. You didn’t know about phase jitter so you build a VSB modem.

Pelkey: What’s VSB?

Holsinger: Oh, vestigial sideband. It’s the kind where you can’t track carrier because you’ve got data there. There’s two ways to get stuff put into the telephone band. One is the QAM and the other is VSB, basically. But with VSB, you can’t track phase jitter.

Pelkey: What is single sideband?

Holsinger: Single sideband is VSB with all the extra stuff cut off, which is effectively what I was doing with partial response. You're able to just shape it, like this, and you cut off the other sideband, and it's effectively single sideband, but it doesn't track – both single sideband and VSB are very sensitive to phase jitter, and QAM is inherently, the structure of it, is inherently less sensitive, so Codex was sitting there in the early – with effectively the second generation of knowledge, and nobody else knew any of this stuff, because they were just getting into this.

Pelkey: They were just starting to deal with the first generation, and here already Codex had the second generation.

Holsinger: So, once the 9600 started to take off from a market standpoint – I remember the numbers like: one, two, four, eight, 16, in that many years, just like that, because they had the only game in town, and it was all because they understood phase jitter and QAM, and that was the answer. Bell Labs, years behind.

Pelkey: In your opinion, what was the next major innovation?

Holsinger: In modems? Nothing until 19.2.

If you start with the Codex 9600, which was probably '71, the only thing that happened, other than implementation, the technology of implementation, is when we came out, ours would run on unconditioned lines. Up until that time, everybody else took C2 lines. We came out probably in '74 or '75, and that was –

Pelkey: Was this the same multi-drop – did it have any network control in it?

Holsinger: At that time, they weren't multi-drop. They were just point-to-point modems that then had a multiplexer so you could multi-drop on top of that. It was a four-channel 2400 kind of thing, so you could make computers and terminals think it was running 2400 bit per second lines, but there was a piece in the middle that was 96 with four of them, but our modem was running point-to-point within a multi-drop network, but that was a small step forward, because everybody else had required C2 lines which are expensive, and a pain to maintain and all that. Once that happened, then the only thing that happened was LSI and microprocessors –

Pelkey: And Hayes and their PC –

Holsinger: Well, that's different. That's a different thrust. That wasn't technology, that was a market that they saw that all of us in the business missed, and of course they have done quite well. So that was seeing a market need and understanding what they market wanted. It was nothing in technology.

Pelkey: So 19.2 was – Trellis Coding was the next.

Holsinger: That was the only other technology where somebody understood something new and different and really made an advance. The 14.4, as I said, was just recognition that things were different by somebody new in the business. The 19.2 was, in effect, recognition that you could think about some of this theory in a new way, by somebody that was new to the business and took a fresh start on it.

Pelkey: A question of a different kind: Why did the modem/multiplexer guys not participate in the LAN business?

Holsinger: We looked at it when it was starting. It's so different and you didn't understand it, the technology is different. Our stuff is all 3,000 cycles of bandwidth and op amps and stuff, and that was all high frequency stuff, so it's a whole different technology. It's a market that you don't understand.

Pelkey: Did you perceive it as data communications or was it conceptualized differently?

Holsinger: My view of it would have been that's much closer to being in the computer business.

Part of what I would have expected to happen, which I don't think did, is I would have thought the DECs of the world would have done LANs, because it's so integral to a lot of what they do. We got concerned about it, with respect to network management, as time went on, because local networks would plug into the public, what are now called wide-area networks, and if we're going to manage a whole network for somebody, you have to be able to manage the local network as well as the LAN.

So we thought about that aspect of it, but to get into the LAN business itself was a whole different ball game. It was a different business and it wasn't like it was just an expansion of the business that we were in. The technology is different; the market's different.

Pelkey: What about T1? Why did everybody – General DataComm and Infotron were into T1 relatively early, but Timeplex is the only one who –

Holsinger: Yeah, that all has happened since I'm out of the business, so I don't know anything about it.

Pelkey: You don't have any opinions as to why that happened?

Holsinger: I don't know. Usually, when these things happen, there's something that's sort of different that somebody new recognizes, like stat muxes. Roger Evans realized that people with minicomputers wanted to put terminals over telephone lines. Well hell, the world we were in, nobody did that, because our guys had IBM computers and multi-point modems.

Pelkey: Codex, at some level is the one who innovated the stat mux, right?

Holsinger: They may have done the technology part of it, I don't know, but Micom is the one that recognized the market and how to go at it.

Amazing to me to see that happen, because here we are, chugging along, doing our thing, and all these guys doing their thing, and I remember going to the Interface show in Chicago, when Micom had happened. It was a year before, who ever heard of a stat mux; one year later, they're going gangbusters and everybody's talking about it. It's that they saw the application, they understood how to market it, and they just took off. Codex might have done the technology, I don't know.

Pelkey: '76, '77 Micom was a phenomenon.

Holsinger: Oh, it was just BOOM!

Pelkey: Were you aware of Arpanet and the things that were happening in the ARPA community in the '70s?

Holsinger: Oh, just a teeny bit. I knew about Arpanet and what they were doing, but it didn't – what do I want to say. Their pipes were very high speed, and outside of it, as far as I know, they were computers and terminals, but they weren't doing on-line polled systems, as far as I know.

Pelkey: What about the DAA? On the dial-up portion of your business you must have had to deal with the DAA.

Holsinger: All our dial backup stuff had DAAs on them. You just built an interface card that did it.

Pelkey: Now, in the early '70s, there was this group called the IDCMA. Did you ever join that?

Holsinger: Oh, yeah, we were members for years.

Pelkey: What, a B member?

Holsinger: Yeah, I think that's right. The A members were the big three: Paradyne, Codex and Milgo, then there were B and C members. I think we were B members most of the time.

Pelkey: What was your sense of other people in the industry's attitude towards the DAA and AT&T during this period of time?

Holsinger: Well, I suspect that people like Chuck Johnson probably –

Pelkey: How did you feel? How do you think people in your situation felt?

Holsinger: We were less concerned because – somebody – Johnson sold primarily dial modems, or a huge amount of dial modems, and so it was probably a bigger effect to him, because he was competing with his modem plus the DAA against Ma Bell's modem.

We were selling a whole network control system, and the dial backups had to have some DAAs, so maybe some people bought a little less dial backup, maybe, because they cost too much, or something. It wasn't a big deal to us, so it was: "If it went away, it would be nice," but it wasn't a gut part of our business.

Other issues that IDCMA fought were probably more important to us, like keeping tariffs fair. In other words, making sure for 4800 bits, Ma Bell doesn't charge half price to drive us out of business. That was far more important because, even though we didn't sell just modems –

Pelkey: And AT&T did try to play games?

Holsinger: Oh of course, all the time. IDCMA, primarily all it did was fight legal battles to keep them honest on various tariffs and stuff like that, as well as fighting battles to get rid of the DAA, but it was mostly just to keep them honest.

Pelkey: What was your attitude and emotions about AT&T during these times?

Holsinger: Oh, you hated them.

Pelkey: Were they perceived as being malicious?

Holsinger: Oh, I think so.

One of the great examples is Datran. Look what happened to Datran and Ma Bell with their goddamn -- what was it, Digital Dataphone or something? They had all this crazy incremental pricing theory, and they were using unused bandwidth on their links, and therefore it didn't cost them anything, so they could price it real cheap. Datran might not ever have made it anyhow, but they played every game in the book, because there was a time – I remember reading market studies when people thought that Datran and digital transmission in a couple of years was going to be half the market, boom.

This, I think, was in the early '70s, and there was all this magic about Datran and digital transmission, and I think the phone company got worried, and so they played all these games, they cut the prices, they raised hell with them. No question.

Pelkey: You have been incredibly kind. This has been very enjoyable and I thank you very much.

END OF INTERVIEW

