Interview of Audrey Maclean

Interviewed by:
James Pelkey

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Audrey MacLean: The first correction that doesn't require subsequent editing is that there are, in fact, six founders of NET, and to really look at the genesis of this whole thing, you have to start back immediately in the wake of the break-up of the Bell System, which, as you probably recall, took place January 1, 1982 -- the original divestiture of the Bell Operating Companies. At that time frame, I was the western regional manager at Tymnet, and a guy named Roger Chrisman joined Tymnet to head up an engineering project that was going to conduct some experiments in wideband communication services offerings to corporate users, and specifically, that experiment that was arranged was a Tymnet/SBS experiment, which used Satellite Business Systems long-haul satellite connection between New York and San Francisco, employed distribution to the user's location across Manhattan Cable in New York, and across Digital Termination Services microwave radio service out to end users in the San Francisco Bay Area. During that time frame, my involvement with the experiment was somewhat peripheral. As the western regional manager for all the sales and service operations of Tymnet, I had responsibility for helping to come up with some willing guinea pigs, customers, for that experiment; among them folks like Crocker Bank, etc., so my involvement was initially one of sideline interest as I came up with a couple of potential customer participants. However, my interest in the area was keen, because at the time, the western region at Tymnet was really leading Tymnet into a business area for them which was private packet-switched sales. To that point, Tymnet, like Telenet, had really almost exclusively focused on value-added services. They were VANs in the true sense of the word. People paid as they went for connections to Tymnet. They would connect up their hosts and then their geographically dispersed terminals, independent of location, could access those hosts across the Tymnet network for a fixed rate, based on utilization. It was probably in '81 that Tymnet had first started building private packet-switched networks, beginning with TRW down in southern California, and then, in the 1982 time frame, the second major private network on the west coast was Bank of America's network, which was about a $6 million private X.25 network sale. Having been extremely instrumental in putting that sale together, I looked at what the Bank of America's overall communications need was, and saw that the X.25 network that I had sold them really covered only a small cross-section of their application need, and that if I looked at their whole global data network plan, and if I also concurrently looked at their voice network that they were rolling out at the time -- I think they bought $15 million of PBXs at about the same time they bought the $6 million worth of packet switches -- it began to occur to me that it would make logical sense for them to, in some fashion, at least in terms of the transmission, integrate these two networks.

So, as my thinking was developing along that line, my curiosity began to grow relative to the experiments that were being conducted, because obviously more bandwidth would be required to offer a combined or integrated network solution. It was also very clear to me at the time, keeping in mind that when you sell a private X.25 packet-switched network, what you sell against is an SNA network alternative, and one thing that was clear to me as I went into companies like Bank of America and saw what they were doing with their networks and the planning of them, I was 100% confident that the PBX would not emerge as the office controller, inclusive of for data requirements as was then envisioned by the management of the large PBX vendors. I was pretty certain that there was a predisposition on the part of major companies to only use the PBXs for intermittent data traffic, E-mail type applications, that there was no intention of putting your mainstay SNA traffic, or certainly your 3725 host front ends, through some PBX for switching. Similarly, I saw no feasible way that you could envision putting the

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voice switching requirements of a location in through any of the then current data solutions. It seemed to me that the two things would, in fact, remain separate, and that it would be very attractive as a migration strategy for major corporations if they could, in fact, somehow share the physical layer transmission facilities between separate voice and data requirements, inclusive of SNA, packet switching, host-to-host requirements, and voice.

Now, during this time, as I said, my interest was growing relative to the experiment, because the experiment was looking at exactly that, provisioning T1 rate service out to the end-user's location, T1 being a 1.544 megabit transmission connection to that location, which by far exceeded any of the then current demands for data connectivity. 56 kilobit was considered really fast, but was entirely appropriate if you were going to look at including voice switching needs, or voice traffic needs, on those links. Roger Chrisman, at this time frame, was struggling through configuring, from an engineering standpoint, the experiment, and the reason I say he was struggling through it was that, at each one of the endpoints of the SBS links in New York and in San Francisco, you had to obviously terminate the T1s or the DS1s coming off the satellite, and connect them across DS1 links to the end user's location, and there was no switch available on the market that could handle multiple DS1s. There were multiplexers, such as the type made by General Datacom, that could take N inputs and one T1 output. There were channel banks that could take 24 or 48 voice inputs and one T1 output, but they were all the traditional multiplexer triangles, if you will, in terms of their architecture. They were not switches so in order to put together a switching core in these main hub locations in the network he was trying to build, you literally had to back-to-back cross wire multiplexers to begin to have switching. In fact, Roger used to walk around disgruntled, bitching about the fact that this was one step up from carrier pigeon. So, it was as his thinking began to grow about the kind of switch that he needed to solve the problem -- he was trying to optimally engineer this network -- that he came up with the thinking of building a switch that handled multiple DS1s and was able to move traffic from one DS1 onto another within the same switching mechanism. He worked, at the time, for a guy named Art Caisse, who subsequently, just in terms of the genesis of the industry, was out and founded a company called Cohesive Networks. For a brief period of time, Roger and myself and Art Caisse had considered putting a company together ourselves, but had general disagreement in terms of the management structure for the company, and also, at that time, Art was contemplating building DTS microwave systems, which, as you know, require gallium arsenide technology and are very capital intensive. Roger and I were dead set against that, and Art subsequently abandoned that himself, in terms of the way the Cohesive plan developed, but at the time he was pretty certain that he wanted to build DTS systems and we were pretty certain that we didn't want to.

The other founders of NET that came into the picture at that time were Sarah Schlinger, who is Roger Chrisman's wife. Sarah, at the time, was responsible for the business planning effort at Tymnet, looking into the provisioning of wideband services, and in fact it was Sarah's analysis that had shown the market opportunity for wideband services to Tymnet, and a proposal was taken forward to the board of Tymshare, the parent company, to build the kind of switching product that Roger was lamenting didn't exist for his experiment, and the board of Tymshare turned it down, primarily because they didn't envision themselves as a hardware company. They saw themselves more as a user of other people's hardware, and provider of X.25 software technology. So, for whatever set of reasons, given whatever financial trade-offs they had to

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examine at the time, they elected not to go forward, which is part of what caused Roger and Sarah and myself and Art all to consider externally pursuing the opportunity. Walt Gill, who is one of the other founders of NET and the senior technical officer of NET, had, at the time, been the chief engineer of Avantek, and specifically had been the person who had really put them into the telecommunications business through the introduction of the first digital microwave radio a number of years prior. Walt had come to know Roger Chrisman and Art Caisse through a series of presentations that Avantek was making at that same time frame to Tymshare regarding a Bay Area radio network that they would have built in support of Tymnet's intention to offer wideband communication services throughout the San Francisco Bay Area. It was Roger, initially, who contacted Walt and began talking about the possibility of his getting involved in this effort. For my own part, my interest was a little bit different than the original thinking that Roger and Sarah had. Roger and Sarah were charted with a specific charter within Tymshare, which was to look at wideband communication service offerings for Tymshare -- or Tymnet's, specifically -- then current customers. I had a different agenda, which is that I was increasingly convinced that there would be a strong private network market for customers who, not on a wideband service offering usage basis, but rather who would be motivated because of the economic incentives presented to them by the wide-scale availability of wholesale bandwidth, in the form of T1 which was one of the phenomenons that took place as a result of the break-up of AT&T in a newly competitive environment on the carrier front. One of the things that carriers, inclusive of AT&T, decided to do was to offer T1 services directly to end users. Whereas T1 had been an important part of the backbone of the network for 20 years, it had never been offered on a leased basis to corporate end users. So, prior to that, if a major corporation wanted to build their own private network on a wideband basis, they would have had to have gone out and procured microwave or extensive satellite bandwidth, which they were disinclined to do, both because of the capital intensity of putting your own microwave network in, the need for transmission expertise in your own organization, and, in the case of satellite, the inherent limitations of satellite, in terms of its appropriateness for all of your communications needs in the company. Suddenly, in the wake of the break-up of the Bell Systems and the confusion that that caused, major corporations decided: number one, communications is no longer simply an operating expense for our company, it is in many cases the delivery mechanism for our goods and services, certainly if your a bank or a brokerage or an airline that's true, but even if your a highly automated manufacturer, it's so integral to the communication flow and the information flow in your company that if behooves you, strategically, to take control of that resource in a way that allows you to integrate your backbone network with your business plan so that you can be responsive competitively, move into new markets, enter new lines of business or add new service offerings in the ones your already in more cost effectively and more quickly than your competitors might be able to. So, for the first time, companies decided: "Hey, this network is critical to our business operation," and they hadn't thought about it like that before. This happens to correspond with the move towards the introduction of a senior information officer in many of the larger corporations, again recognizing the importance of the technology to their future competitiveness. The other factor that motivated them was the sheer disruption caused by the break-up of the Bell System. They realized they could no longer leave the driving to Ma, and they really had to assume responsibility for this themselves. There was a lot of debate over whether or not you should “Be Your Own Bell,” and a lot of the more astute end users began saying: "You can talk about whether you're going to be your own Bell or not, but in reality, all of us are. It's just some of us are going to do it better than others, so you might as well start now." Then, the third motivation

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was sheer economics. The bottom line was that, through a relatively small increase in capital expenditures, usually to the tune of maybe one to two percent of one year's communications budget, you could reduce your on-going facilities charges in the network by as much as six or more percent, which typically came right off your bottom line. In anybody's communications budget, you usually find about 70% of the costs are facilities charges, so when you could have that kind of bottom line impact, the economic incentives alone were compelling, but you add to that the strategic motivations, and there was a very strong movement towards the adoption of private networks.

So that was my perception on why it was important to go out and build a switch that would allow users to efficiently integrate voice and data traffic on the same physical backbone network, and to effectively manage it, particularly in the presence of transmission failures, which is where, from a technology standpoint, the X.25 element comes into play. If you look at X.25 packet-switching networks, the thing that they really offered their customers was not simply efficiency, but improved reliability for their data applications; the ability to detect failures and automatically route around transmission failures, keeping the application available to the end users, and making transparent to the end user the transmission, the inherent transmission failures in a network. That was one of the main objectives in my view, and one of the main motivations, for users adopting X.25 technology. So my reasoning was that if you took those same networking concepts that we had employed in the X.25 packet switch arena, and brought them over to a physical layer only T1 network, and offered that same level of management control and reliability to the end user, that that, combined with the economic and strategic motivations, would be a sure fire way to successfully win over a large number of the potential private network customers in the country. At that time, I began to very strongly present that case to -- at this point, Roger and Sarah and I were together building the plan. Roger and I had started with Caisse. We left Caisse. Caisse went and formed Cohesive.

James Pelkey: When was this?

MacLean: Roger and I had both quit our jobs in July of 1982. We spent about 30 days with Art Caisse thinking about what kind of a business we might put together; didn't come to agreement, as I mentioned earlier. on either product or management. We left in August. Art, in September, formed a company called Cohesive. We, in September, formed a company called PCM, which Sarah joined in October. Roger and Sarah and I together built an initial business plan. I was strongly convinced, as I said earlier, that the network management and routing capabilities of this product from a software standpoint, would present the real value-added, and Sarah and I both knew Robbie Forkish from earlier Tymnet days, and went after Robbie, who at that point was over at Bell Northern Research, and he can tell you his own story in a minute, but he was very happy over at BNR, and had just built a real nice organization that he was running over there at the point that we called him up one day and said: "How would you like to have lunch," which he initially thought was a social call, and came to find out that it was a proposal quite different than that. Anyhow, Robbie had, needless to say, been one of the early people at Tymnet who had built a lot of the software architecture and in fact coded a great deal of what became the Tymnet X.25 networking offering, and had even had some blasphemous notions while he was at Tymnet as to what the importance of distributed intelligence was going to be in the future, which was exactly our thinking as to the way this product should be built, so, although his somewhat avant-

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garde theories had put him in disfavor with the original, early architects of Tymnet, who were more purists, it had in fact been exactly what made me drawn toward Robbie, to get him to be part of this team, because of some of the thinking he had presented at Tymnet that hadn't been very favorable. Anyhow, the team moved forward. Robbie and Walt both did leave their positions at BNR and Avantek to join the team, and we were, at this stage, in very advanced and protracted discussions with a number of the venture capitalists, including Jim Anderson and Merrill, Pickard, Anderson & Eyre, and a variety of others in the Bay Area, and Bruce Smith, at the time, was the president of COMSAT's technology products group, and, as an officer of COMSAT, had been one of the original partners on the partners board for SBS, so he had certainly had the same sort of thoughts in his head as he looked at what SBS had done wrong, how that had missed, and he saw what was happening from a regulatory standpoint, and was, in his own mind, thinking about the economic dislocations that would occur as a result of the break-up of the Bell System, he decided that he was not a big corporate guy and really wanted to go grow something on his own, and sent letters out to the venture community, including to Steve Merrill at Merrill, Pickard, Anderson & Eyre, to the guys over at J. H. Whitney, the folks at Oak, saying: "Here's who I am. I'm back here. I want to get out of here, and here's some of my thinking," and it quickly got us in contact with Bruce, because the thinking sounded, to the average venture capitalist, very similar to what we were all thinking about and had presented to them in the form of a business plan.

Pelkey: Which was when?

MacLean: Well, the first meeting with Bruce Smith took place on April Fool's Day, 1983, appropriately enough. The company was incorporated in May of 1983 with a small financed loan by the venture capitalists. Our actual first round closed in August of 1983, and that was a $4.3 million first round, so the six people at this point included, I guess in order of appearance on the scene, Roger Chrisman, Audrey MacLean, Sarah Schlinger, Robbie Forkish, Walt Gill and Bruce Smith. Actually, in terms of order of having resigned their prior jobs and joined the team is the correct way to present that. So, the six of us then started this thing, and Bruce, I think very astutely -- perhaps I'm commenting on that because it was my view as well, but he agreed with my view of the private net opportunity -- and said that this is not a product to build to go sell to the Tymnets and the MCIs of the world; this is a product to go build and sell directly to the end users of the world. And Bruce built, I think, the kind of financial structure for the company, in terms of the three rounds of venture funding that he took down, that enabled him to build the sort of direct sales and service capability that I think was as critical to the success of NET as was the technology base, which fortunately, Roger and Walt and Robbie and their team did materialize with software that really did accomplish the task, and reliably, but it was the combined notion that, in order for us to really take a walk between the giants' toes, the giants being IBM and AT&T, that we would need to run faster, and furthermore we would need to have our own ability to deliver solutions to the end users who were all Blue Chip companies and expected us to have first tier funding, deep pockets, and the kind of documentation, training and service support that they knew needed to accompany a product that was going to sit strategically in the backbone of their network. So, if that's a good opening for it --

Pelkey: Before I ask Robbie for his perspective, what did you do before you were western regional manager of Tymnet?

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MacLean: Well, in terms of my background, I originally majored in mathematics, so that was my technical origin, although I subsequently switched to business. I lived in Paris for a while, which has nothing to do with my professional career, other than that I had wanted to live in Paris, and we decide to start selling something to the French, I think my language fluency might prove useful, but other than that, it was just an interlude.

Pelkey: You were with Tymnet at this point?

MacLean: No, this was prior to coming to work for Tymnet. I actually began my career for Tymshare back on the east coast when I came back from Europe and decided it was time to get serious, I thought: "Well, what does a woman with math and business background do?" I certainly knew that I had a technical aptitude and the computer industry was more receptive to women than others back in the 1973 time frame, so I knew that I ought to go there, but I also knew that I didn't want to be a 'pass me a pizza under the door' technical type. I enjoyed programming and had no problem with that, but I wanted to be sure that I was building my business acumen through interaction with the various functional areas within companies, and did some research, quite frankly, on the computer industry, and one of the things I stumbled across at the New York public library were some articles on a company called Tymshare, which was at the time, even then, the largest independent timesharing company, but more importantly, was being acknowledged in some of the articles I read as being one of the first timesharing companies to take the lead from just offering engineering packages and raw CPU cycles to really beginning to offer some business decision support type application support to companies, and I thought: "Now there's a good opportunity for me to come in, and I don't want to just do accounting systems. I want to do more of the decision support system sort of activity," and I joined Tymshare initially as what they call an 'applications consultant,' which is a technical position where you go out and work with the folks in the marketing department and finance department of customers, help them build models to solve problems that they're not looking to their regular MIS folks to get around to ever doing. I did the technical role for two years, and interestingly, among the customers I supported at the time, was Nynex, or New York Tel at the time, so that was one of my earliest introductions to communications, but I really spent, I think, four or five years in Tymshare's business before I finally decided, again interestingly because I was doing a paper at the time associated with business school looking at the timesharing industry, and my analysis of the timesharing industry was that the minicomputer was going to significantly disrupt that business -- this was before the microcomputer was even on the horizon -- and that the availability of better decision support tools sold directly to customers to live on minicomputers, would begin to displace a lot of the traditional timesharing business, but at the same time, my analysis showed an increasing need for, because of that phenomena, for remote terminal access to databases and to a greater proliferation of computers that would need access, and so I became increasingly interested in the communications side of Tymshare's business at the time Tymnet was --

Pelkey: This was '78, '79?

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MacLean: Gosh, I could look to give you the precise date, and I'll get that for you, it was probably '77, but I'll look for you. When I first made the move from Tymshare to Tymnet, and I basically said: "Hey, I want to go over to the -- "

Pelkey: So, you then were at Tymshare, and you got interested in Tymnet, so you switched over to Tymnet?

MacLean: That's right, and it was interesting because there was a lot of resistance, obviously, to doing that. For one thing, they didn't want me to make my study too public, that I had done. They also didn't want it to signal too much of a 'jump ship' point of view to the other employees on the Tymshare side of the company. They wanted to be very careful about how much of the talent they had on the cash cow side of the business was able to migrate over, so it was difficult to get --

Pelkey: Tymnet at this point in time was just captive --

MacLean: Fledgling. Captive, it just served Tymshare's needs, correct.

Pelkey: And it was very small.

MacLean: Right. Very, very small.

Pelkey: Had it, in fact, conformed at this point to the X.25 standards? X.25 just came about in '76?

MacLean: That's right, and in fact Tymnet never was completely pure X.25, and still is not. There is an X.25 interface for taking standard X.25 into Tymnet's network, but it never was, at that juncture, nor now, a pure implementation of X.25. In fact, one of the things that, obviously, we had to do a lot of selling at that point in time was the differences between Tymnet and Telenet, and the differences between variable packets and the kind of fixed packets that Telenet used, and the differences in the efficiency of the network, the differences in the way the network management control took place in Tymnet versus Telenet. I think a lot of the concepts in Tymnet were both more efficient and made for more reliable management of the network, because of the way the supervisors ran the network at Tymnet in contrast to the way they did at Telenet, where you could lose a whole section of the network at a time. So, it was reasonably easy to compete, at least on the west coast, I found it very, very easy to compete against Telenet. I'm sure it was a little bit harder for the guys on the east coast.

Pelkey: But at some level, were they not selling to different -- they sold to a lot of people that you wouldn't sell to, because at that point, Tymnet only would sell to someone that was only a Tymshare customer, right?

MacLean: No, not really. In fact, there was a fair amount of aggravation between the two sales organizations because Tymnet's sales force was able to sell into Tymshare's customer base and suggest to those customers that you could put that application on your own host and run it across Tymnet's network and have all the benefits that you had with Tymshare, except better cost

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structure. We could also sell to non-Tymshare customers. In fact, if anything, it was probably encouraged, that if you could - -

Pelkey: Convince them to do that.

MacLean: Exactly. So, we did do a lot of selling --

Pelkey: And Telenet at this point in time is significantly larger.

MacLean: Telenet was significantly larger, but to the best of my knowledge, never profitable.

Pelkey: Let me come back to another point that, to me, was critical. That is the issue of T1. Let me -- you made the comment that January 1, '82, was divestiture. Divestiture was announced, but it became effective January 1, '83. It was the divestiture itself that led the RBOCs to sell T1 lines to customers directly, as opposed to having been just a CO to CO type of transmission. Now that transmission path is going to be leased out to customers, as opposed to staying within the AT&T system. My question is of two kinds. One is, can you be more precise in terms of the tariffing change, because my understanding is that a tariffing change that took place, as well as a competitive change…

Tape Side Ends

Pelkey: From my recollection of your comment, you hadn't -- clearly, at the beginning of '82, when you started thinking about these things, you had some idea that, in fact, this T1 opportunity was going to be opened up, but in fact, it only happened after January of '83, so could you help me with those two issues?

MacLean: Sure. I think that the main impetus was the change in the competitive climate, in terms of the carrier environments themselves. There may be other opinions on this; I don't know that the operating companies or AT&T on their own would have moved to offer T1 to end users if it were not for the fact that there was such increased competition in the carrier environment, where you started to have local carriers, other than the operating companies, who were building fiber networks --

Pelkey: IE, MCI and Sprint?

MacLean: Well, MCI and Sprint on a long-haul basis, but some of the more metropolitan oriented fiber networks, or for that matter, even some of the cable networks at the time were considering doing this. It was rumored that there would be -- in fact there were at the time -- 52 applicants for DTS service networks, which are these microwave T1 networks. So there was a general increase in activity, in terms of new carriers coming on the scene; people who were forming companies specifically to use newer technologies, like fiber, to put in microwave networks, to use new switching gear, to provide T1 bandwidth at cost effective rates to users, and it was certainly true on the long haul scene, in terms of MCI and US Sprint. So I believe that the operating companies, and AT&T, perceived that they had to, as well, respond to what was going to be a resultant demand of corporate users for cost effective bandwidth; that, from a tariffing

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standpoint, once they did tariff it, and I suppose it is interesting that they tariffed it at rates that were economically attractive to users again because of the competition created by new carriers that were coming in, but basically, even back then, if you took even a half dozen data lines and a dozen voice lines between two locations, you could easily justify a T1, and so if you looked at customers who had single purpose leased-line networks for 9.6 lines and 56 kilobit lines and 64 kilobit voice connections -- tie lines -- between their locations, it could very quickly see that T1 was justified in a lot of locations in their network.

Pelkey: When did the T1 tariff change, do you recall? It must have been after January 1, '83.

MacLean: It was probably -- the tariffs were probably filed prior to that, but the effect of it was in early '83, because NET started shipping gear not until the following year. If you had been out with our product earlier, it would have been much slower adoption, and in fact, there already were T1 alternatives on the market -- GDC and then subsequently Timeplex -- and there was a fair amount of T1 out there, but it wasn't really until '84 when NET came out on the market, that T1 was really on the lips of every communications director in corporate America, and it wasn't until NET introduced real networking capability to the T1 environment that the MIS directors started becoming involved, because suddenly the ability to tie your data centers together and have an automatic recovery plan for disasters, those sorts of applications that the MIS director focuses on, were really made possible through the introduction of true mesh networking capability, which NET brought to the market.

Pelkey: If I understand, then, even prior to January 1 of '82, there were companies starting to put in place transmission that they were trying to sell off to the corporate world, because the opportunity had been opened up prior. So microwave and fiber optic, and this stuff was starting to go into the ground and the air and starting to be put in place, so you were aware of that fact, that there were going to be alternatives, in terms of transmission, and then when the break-up happened, it was clear that this whole environment was changing, and you were aware of these changes because of being where you were at Tymshare, and then as western regional manager, and then realizing talking to customers, and then this experiment going on, it all started falling in place, that there were profound changes, customers want this, there's no solution to this problem of T1 to T1 other than on a statmux or one-to-one basis.

MacLean: All of that is correct. We had a lot of contact with AT&T from Tymnet. They had built our 56 kilobit backbone network that the Tymnet value-added network was built around, and they were talking about T1 as an alternative to the 56 kilobit backbone, so that was one source. Separately, Tymnet, as a regulated carrier themselves, had full-time FCC representation back east by our regulatory counsel, that we developed all our tariffs with, and I worked a lot, although I didn't have product management responsibility for developing the tariffs, there was a manager of tariffs, but I worked a lot in the construction of tariffs and what -- understood what the market was prepared to bear, and had interaction with our counsel back in Washington, and was getting from them a sense of the changes that were going to be coming down the pike in terms of the types of tariffs that would be likely applied for by the carriers to offer T1, and then the third input was from users themselves; folks like Bank of America who were already out, through their own national account management organizations from AT&T Communications, starting to get advanced insight into AT&T's intentions to start offering them T1 to their major

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locations for their private network. So, it was really coming in from those three directions, and it was an easy synthesis to see that -- when I was watching 52 different companies apply for DTS microwave licenses, and saw what the cable companies were doing and what Lightnet and other people were starting to consider, and saw what Sprint was already touting in terms of their intention to put more fiber in the ground than anyone else, it became pretty easy to envision, at least in the major fiber corridors, that there would be a lot of price competition on T1, and that the user who envisioned him or herself as the port-divestiture renaissance person, was going to be able to cherry-pick among those carriers, get a very cost effective network in place, and then was going to want to have the management control and visibility over that network, because it's a phenomenon where you put not only all your eggs in one basket, but all your baskets on one cart, and your exposure is significant, and I realize that, when they got past the dollar signs that were going to be making them smile, the next problem they were going to focus on was the network availability from a reliability standpoint, and the manageability of the network that they were going to build, and that that was the place to really make an impact, in terms of providing equipment that helped them do that.
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Pelkey: Now, Roger Chrisman, is that C H R I S S M A N?

MacLean: C H R I S M A N.

Pelkey: Roger was your boss?

MacLean: No. Roger was really a partner, if you will, in the early stage; Roger on the engineering side, myself in the sales and marketing side --

Pelkey: No, excuse, I meant at Tymshare.

MacLean: Oh, no. Roger Chrisman worked for Art Caisse, and they were really a very small experiment group that were just responsible for that Tymnet/SBS experiment. I worked for the VP of Field Operations at Tymnet, who worked for the president of Tymnet. So I was in the line organization. I had a $70 million dollar business that I had P&L responsibility for.

Pelkey: How did you get to know Roger?

MacLean: Again, through the early connection, which is where I was coming up with customers for the experiment. I was -- particularly being the region that was where headquarters was, I was heavily relied on by headquarters from a product direction standpoint, etc., so I had a lot of interaction with headquarters as to where we needed to go, what things we ought to be doing, etc. It was proximity to both the experiment and headquarters that led to the interaction.

Pelkey: And Art was the leader of this project?

MacLean: Art was the leader of the project, and quite frankly my interaction, initially, was primarily with Art. I came to know Roger later on.

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Pelkey: When Art went off then and founded Cohesive in September of '82, did he take other people from Tymnet?

MacLean: I don't know the answer to that, to tell you the truth. I would assume that there was at least somebody else, from a development standpoint, that he would have gone back to get, but I don't know that for a fact.

Pelkey: Do you know where the founders of NSS came from?

MacLean: Yeah, sure. My counterpart on the east coast was a guy named Al Zucchino. Al Zucchino, shortly before I left Tymnet, left his position as the Eastern Regional Manger, and came out to headquarters to be VP of Operations for Tymnet, which is basically the job that's responsible for the operation of the VAN. It's a little bit away from the private net side, it's on the value-added network, public network side, and he had that position for some number of months before I left, and for at least another six or nine months after I had left. During that time frame while he was VP of Operation at Tymnet, he spoke, in fact, on a number of occasions, to Robbie Forkish, who had joined our team, about what we were doing, etc., never divulging the fact that he was considering going to do something like that, and Robbie being the good, open-hearted soul that he is, thinking he's talking to a potential customer, was very forthcoming. Anyhow, we were all a little surprised. I think it was probably that summer sometime -- you might know the date better as to when they were actually formed -- but at some point --

Pelkey: Summer of '83.

MacLean: Yeah, I think it would have been late summer '83 or something like that, that Al Zucchino and Tim Zerbiec --

Pelkey: And where was Tim from?

MacLean: Tim was from Tymnet, and Tim was working for Al Zucchino, and they left, and I think they had some other people with them, left Tymnet -- I do think they took a couple of the development people from Tymnet -- left to go start NSS, Network Switching Systems.

Pelkey: Al was president?

MacLean: Al was president. Tim Zerbiec, I believe, was VP of Marketing and -- I know, it is incestuous, isn't it? Al hung in there through the initial Infotron investment, and I think made it almost all the way through, if not completely through, to when they sold the company out to BBN. Zerbiec was a casualty probably a year, year and a half into it, and is now the president of a company called Vertical Systems, which is really a consulting company; a market research/consulting firm in the Boston area, and Tim is a frequently quoted person on the T1 marketplace, as you would expect, in the trade press.

Pelkey: Do you know anything about where Spectrum Digital came from?

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MacLean: That's interesting too, although I have only sketchy information there. One of the things that Bruce had suggested we do very early on in the development of NET was -- I'm a big believer in primary market research, as opposed to secondary. I like to know who's going to buy it and why and what the economics of their decision is going to look like, so I had done, in the original plan that Roger and Sarah and I had put together, a great deal of primary market research that Bruce, obviously, reviewed, and he said: "The one thing that concerns me about this is these are all people who have done business with you before out here on the west coast," and he said: "I have to at least consider the fact that they may be biased and may in fact simply be saying they'd do business with you again," and he said: "Having known you even a short while, I can understand that that could happen," he said: "but I think it's prudent that we go back to the east coast and start developing some relationships with other people in talking to them about their needs to make sure that the same profile exists when we go back there and look."

Pelkey: And this is after Bruce has joined?

MacLean: Right, this is after Bruce has joined, and Bruce and Walt and I made a trip up and down the east coast visiting information executives of major corporations back there, the majority of whom are, today, customers of NET. We took a calculated risk, which was to divulge to them our plans early on so that, A, they could impact them; but, B, so that we would really know that there was a market for what we were building. We recognized that the risk was prematurely disclosing our intentions at a time when we were not at all prepared to take product to market, and somebody else could respond. One of the places we went -- we did all these, we had the majority of these meetings, at least the detailed ones, under non-disclosure -- one of the places we went was to MCI, because we wanted to also understand their perspective, in terms of what their users were asking for. We had a series of conversations under non-disclosure with MCI, and then two or three people that had been included in those discussions left MCI, and they went out and formed Spectrum Digital. Now, there was a fair amount of breakage between MCI and the folks that formed Spectrum Digital, and we just basically left the whole thing -- our perception of their ability to be successful was at least marginal, so we decided: "Hey, ignore it. Focus on getting to market and don't dilute your efforts with anything else," but there were two or three people directly involved, and I could go back and surface the names out of my notes.

Pelkey: Quite honestly, they're a footnote.

MacLean: Yes, exactly.

Pelkey: Other than for the fact that they ended up getting bought by Micom, which is interesting. Now, from the nature of your comments and from your background, in terms of competitive environment, you probably would have some views. My understanding is GDC was the first one to come out with a T1 multiplexer, which was in the mid '70s, which was really a starting point, I guess driven by Texaco down in Texas.

MacLean: I'm not certain that it was Texaco that originally drove them. I didn't have that insight. Certainly GDC's MEGAMUX product line, the old 1258, etc., was the staple on the market, other than Channel Back's, which had been there for a long time on the voice side for T1. MEGAMUX was the first product that allowed people to put voice and data into one network. A

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lot of the customers I talked to in my primary market research, particularly on the east coast, folks at Chase, IBM, etc., had used 1258s and had exactly the limitation that Roger had when he tried to build a network with them, which is that if they had three different banks, at the interim bank location, they had to back-to-back cross-wire two MEGAMUXes in order to get over to the third location. The initial business plan, the operating plan, that we did looked heavily at the MEGAMUX component of the overall GDC revenue picture, in terms of the information coming out of their annual reports, etc. We used that, in part, to determine what would be realistic near-term revenue expectations for our company as we put the plan together. So yes, the MEGAMUX product line from GDC was THE contender in the T1 area. I suspect that, although I don't know this to be fact, it's a speculation, but it would be interesting for you to research, I suspect that the MEGAMUX's success may have been one of the stimulants for Timeplex to think about developing a product that at least would allow you to get to the third location, which is basically the extent to which Timeplex's networking capability was developed. Given the proximity -- I guess GDC is in Connecticut or New York State and Timeplex is right in New Jersey -- they were probably talking to a lot of the same accounts, and certainly the people who were using the MEGAMUX product were quick to tell me what the limitations were, so I'm sure that I'm not the only person who heard that. Timeplex did as well, and I suspect that Timeplex had thought about its product as a step up from where the MEGAMUX was.

Pelkey: When was your recollection that Timeplex came on the market?

MacLean: I got a call, as a matter of fact, from a customer at Wells Fargo, when we were still doing the business plan, so that was the fall of 1982, probably the November time frame. I got a call from a customer at Wells Fargo, said: "Hey, I'm sending something over to you you might find interesting," and it was a Link-1 initial product spec sheet. Roger and I looked at that and said: "Oh, we're not going to be the only ones out there. We've got to hurry." Certainly we saw some of the rudimentary ideas -- a lot of the ideas that we were putting in, minus what I think the contribution of this guy over here who just left the room was, Robbie Forkish -- in terms of real networking capability, distributed intelligence, basically Timeplex was able to support more than one T1, they were able to support voice and data, they were able, at least on a table driven basis, to support reroute scenarios, but it was Robbie's introduction, I think, of software intelligence, the true intelligent signaling capability for this network, that made the difference. The other things that made a huge difference in NET's product was the architecture that, on a hardware side, was developed by Roger and his people and Walt, which was a time space time switching architecture, modeled after central office switching architecture, which can handle much greater throughputs and has a much higher level of reliability, which is one of the reasons why NET was able to get to a much greater cross-section of T1s per node, which, when we first came out, was eight, then 16, then 32. Today, it's 96 T1s in a single node, which was much, much larger than what anybody else could do in the market. In the early stage, nobody envisioned needing that, but very quickly, people began to realize that they did need much greater cross-sections. When they started looking at CAD/CAM traffic and file transfers and began to see how many single-purpose disparate networks they had out there that could begin to share this same physical backbone, then it became very clear that many, many customers would have large cross-sections of T1 between locations, and today, that's proven even further true by the fact there are now -- many of them are now moving to T3, because the tariffs today - - there's another shift -- today,

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for example, in Nynex's territory, if you have six or seven T1s, you've cost justified a T3. It's a 45 megabit pipe.

Pelkey: Is that a fact?

MacLean: It's fact.

Pelkey: There are certain corporations that have enough traffic where a T3 is justified, and when it gets to six or seven, there's probably a lot more corporations that have six or seven T1s where a T3 is very attractive.

MacLean: That's right. Now, of course, that's in locations where there is a lot of fiber. You won't find that across country.

Pelkey: Washington, Boston, New York corridor --

MacLean: Exactly.

Pelkey: So, when you started competing, as you mentioned in your opening remark, one of the critical issues was getting to market promptly with a product that worked, which very few companies successfully do.

MacLean: Right.

Pelkey: You got to the marketplace with a timely product, on time, and it worked.

MacLean: Correct. In fact, we were ahead of schedule. A couple of things that made a big difference was that, for the first time, somebody went to a white-board and designed a product with a team of people -- if you look at the whole engineering team that was assembled -- there was not only data networking and voice telephony expertise, but because of Walt, there was real transmission expertise, and there was speech processing expertise in the group as well, so for the first time, with NET, somebody went to the white-board and designed a product that was intended to optimize the use of the transmission facilities in the network, and to manage them. Walt knew so much about the properties of the transmission itself that he was able to help design the system A to B, completely compatible with the Bell hierarchy network, and also able to really pinpoint problems that would be occurring, literally down to a particular repeater site having a particular type of problem, which I think contributed substantially to the reliability of our products and the ability of our customers to more effectively manage their carriers for problem resolution. I think the fact that we had all those disciplines combined, versus someone like a Timeplex that was a data multiplexing company trying to make the big leap to networking and to voice, or StrataCom that's a voice telephony crowd that's trying to make the leap to networking and data, NET was the only place where, really, you had X.25, data networking, voice telephony, speech processing and transmission backgrounds, all assembled from the early stage of the design effort.

Pelkey: And consciously.

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MacLean: Yes, so we did a real balanced job, I think, on the voice and the data sides of the problem.

Pelkey: From your perspective, it was to bring this kind of balanced view to it.

MacLean: You know, I think that everybody recognized that the objective was an integrated solution, and it was more a question of trying to back-fill our own skills, more than anything else, that brought us to it. For example, when I said: "Roger, you can't do this without a Robbie," and Roger had found Walt, who he knew had a transmission perspective that he himself didn't have, and Robbie brought some voice telephony folks from BNR, recognizing that some of the telephony aspects of it were going to be different, and Roger Chrisman brought one of his friends from M/A-Com, who had done the speech processing there, and Bruce had been adamant from day one on the speech processing need for ADPCM and for digital speech interpolation, to more efficiently use the bandwidth so that the data could ride free, because you use the voice so efficiently on the backbone. So all of these -- everybody was just thinking quickly as to: "Ok, who else do we need to round this out?" So, it wasn't as if somebody wrote down as objective number one for the company: "Our mission is to go get all these skills assembled so the product is as robust as possible." It wasn't like that. It was more that everybody was just thinking quickly, in terms of: "What else? What are the other ingredients to this problem?"

Pelkey: What did PCM stand for?

MacLean: Well, Packard, Chrisman, MacLean. Roger Chrisman's middle name is Packard. That company is defunct. It only lived during those first few months while we were pursuing funding.

Pelkey: When did Network Equipment Technology come into being?

MacLean: Network Equipment Technology was incorporated in May of '83, a short month after we had first met Bruce, everything fell into place.

Pelkey: Was Bruce on board?

MacLean: Oh, yes. In fact, there would never have been any funding for NET were it not for Bruce. Bruce came in and basically made the case --

Pelkey: So you met him in April. How long did it take you to get him on board?

MacLean: I think he came in the beginning of May, and it was the end of May by the time -- I guess it was maybe the second week in May when he had actually quit his job at COMSAT. No officer of COMSAT had ever left before. They couldn't believe that he was leaving such a fabulous job, in their view, and so they all thought he was crazy, and we all thought it was wonderful. He came out here and took down $4.3 million in the first venture round. It was primarily Bruce, at that stage, who presented -- because the venture capitalists knew how we all though about it. They wanted to know what his own convictions were, relative to this

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marketplace, and Bruce, in the case of the four venture capital firms that participated in our first round, presented to them his thinking on that. He secured a loan in May and an intention to close the first round. Then, in June and July, developed, along with the rest of us, an operating plan for the company, and closed the full $4.3 million, I think it was August 13th that the checks hit the bank. So it was very quick. Now, when we first incorporated in May, we incorporated as a company called MetroLink, which simply had a name change from MetroLink to Network Equipment Technologies. I told Bruce MetroLink sounded like a sausage vendor on the DC Metro system, and he said: "Ok, you've convinced me. Rename the company."

Pelkey: So who came up with Network Equipment Technologies?

MacLean: Well, that was curious too. I was about seven and a half months pregnant at the time, maybe eight months pregnant. I had decided to get pregnant because the gestation period on the baby was shorter than on the product, and it was a good time to hurry up and have the baby. Oh, it's true. David Morgenthaler thought that was interesting. Anyhow, I walked into the office one morning, and Bruce said: "You can not sit down or go to the bathroom until you name the company," and I said: "Ok, that's interesting." He was at the white board and he said: "What should we name this thing," and I said: "Well, put down the word network, because more than anything else, that's the difference between us and every other mux manufacturer out there." Then, I immediately said: "You better put equipment, because, otherwise, they'll think we're a VAN." Having come from that background myself, I wanted the word equipment in there, and then he wrote 'Corporation' and he said: "That's it, Network Equipment Corporation." I said: "You can't," and he said: "Why." I said: "NEC." He said: "Oh, you're right." Then, I said: "Well, I guess we could put 'Technologies' --actually I said 'Technology'," and he said -- Walt looks up at me and smiles and goes: "I like that. N E T," you know, with sort of his scout master kind of grin on, he said: "I like that, N E T," and Bruce said: "Technologies," which is the Bruce Smith big picture, and I said: "And then would could still put 'Corporation." He said: "No, no, I like it better without. Just N E T."

Pelkey: When you interviewed Bruce on April 1st, who was there.

MacLean: Well, that was interesting. Got a call from Roger Chrisman, who had just received a call that morning from, I guess, David Morgenthaler, I'm not sure, that Bruce Smith was out, that he had chatted with David and Jim, and that they thought that this was a guy that was worth our meeting, and Roger called me up and said: "We're going to have lunch. Can you come up here?" I said: "Roger, you're not going to believe this, but I have the worst case of morning sickness you can believe." This was back in April -- I was actually not due until September -- and I said: "I can't make that lunch," and I said: "but I'll meet Bruce later. I definitely want to meet the guy." I said: "You and Walt go talk to him, see if you like him. If you guys like him, then I'll know it's worth seeing him." So Bruce had lunch with Roger and Walt that day, and I had to go to Washington the following week on personal business -- or actually, I was going to New York, I guess, and I said: "When I'm going to New York, I'll swing by Washington and see Bruce back there," which turned out to be good, because I had had a chance to get Bruce to and Walt's make; I had a chance to talk to Jim and David and get their sense of things; then I went back and Bruce had his limo pick me up at National Airport and I drove over to the hallowed halls of COMSAT, walked up to see Bruce. It was kind of interesting because it was like -- there

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was a secretary's office you had to go through to get into Bruce's office, and Bruce pops up from behind his desk and comes around and smiles and shakes my hand. I look around his office. The first thing I said was something like: "Christ, you could play polo in this room." Bruce laughed and said: "Audrey, I think we're going to get along just fine." We went to lunch at one of my still, to this day, favorite restaurants in Washington, Szechuan Garden, and one way to my heart, for sure, is good Chinese food. It turns out to be a passion of Bruce's as well, and we basically had a lunch that, more than anything else -- we did talk about the market and found that there was incredible resonance between the way the two of us were viewing what was going on in the market and what the important of the private net opportunity in particular was, which was important to me, to make sure that our CEO was not some WECO guy who knew about selling test equipment to the RBOCs . . .

Tape Side Ends

MacLean: . . . could steer the company from the helm strategically, and who would have the credibility to do a good job with Wall Street, which was one of my main bone of contentions with Art Caisse. I didn't see him as a CEO. I knew that this was going to be a phenomenal effort ahead, and I, quite frankly, only wanted to do it if it was going to be successful, so I thought it was extremely important to have a CEO who had substantial general management experience. The fact that he had been the officer of a New York Stock Exchange company was very important to me. So, other than the basic credentials, which I knew him to have, we mostly focused during the course of the lunch on motivations; what his motivations were, what my motivations were, and I was pleased with what I heard from him. I got the sense, very early on, that it was important to Bruce to -- that he was a craftsman, that he had a sense of craftsmanship about what he was doing, that it was important to him to build something, to see it grow, and to nurture it, and those things were important to my decision to join what became, obviously, Bruce's team, because we dissolved the other company and effectively we joined NET. Although we are founders of NET, we effectively joined as employees, because none of the four of us were officers then, or subsequently, of the company. So, it was important to me to make sure that, when you have a baby like that, and you're kind of giving it up for adoption at birth, you want to be sure of who you're doing that with, and I was real comfortable with Bruce.

Pelkey: For the four of you, that was a very mature decision on your parts of having -- most people who have ideas and start a company go out -- I assume the venture capitalists had a lot to say about they wanted somebody else to be running this company. Maybe yourselves as well, but to have been willing to play that role and to become part of the team, and it was your baby --

MacLean: Well, I'll tell you, the reason I giggled is, my first thought was starvation will do wonderful things for you. There's no question but that -- we had been at this since July, and we knew we had a good idea, and at this point, we were simply perturbed that nobody had given us money to -- we had gone as far as we could on the design without having a computer. We needed to continue to make progress, because that's really what you focus on, I think, as an entrepreneur is, how you continue --

Pelkey: You'd been at it for a year now.

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MacLean: We'd been at it very close to a year. You're now in April, and we had started in July. I had sold rental property to sustain the cash flow for our family, because I had no income. Roger and Sarah had no income. Robbie had quit his job with a young baby and another one on the way and a house payment. There was certainly the economic motivation to move forward and quickly, but I think that your point, however, in terms of the maturity, is well taken, in that very early on, we had all sat around a coffee table and said: "We're not ever going to go to second-tier venture firms." We could have had the deal funded, quite frankly. When you've got people like Jim Anderson and David Morgenthaler and those guys interested in the deal, you know that you could take it to the second-tier guys and get money. We had decided definitely not to go do that, because we knew -- I knew, because I was going to be responsible for the selling execution of this -- that I was going to be selling to Blue Chip companies, and I couldn't do it without first tier venture funding and the right kind of management structure for the company. None of us had ever seen ourselves as the president of the company. None of us wanted to be the president. We didn't see that we had the experience set necessary to pull that off, so there was no resistance in that matter at all. We all saw that we needed someone like a Bruce. We wanted someone with industry experience who had a technical grounding, which Bruce does in his MSEE, but also had the business training, which he did not only from his Harvard MBA Baker Scholar days, but more importantly, from his role as an officer of a New York Stock Exchange company. I think those things were well understood by us from the beginning. We had interviewed other potential CEO candidates, more of whom fit the other profile I gave, which was: guy who had sold test equipment through WECO to RBOCs and had some sense of what to do but didn't have the vision. Bruce had a vision that was consistent with what I saw had to happen with NET. Roger, I think, had a different vision for the company. He had more the engineer's view of what it would be and may have subsequently been a little more disenchanted with the big picture view that Bruce had. I had, very clearly, the same kind of expectation for NET that Bruce did. I saw it as a company that could literally pop out of the middle, between IBM and AT&T, and everybody would turn around and look and go: "Where the hell did they come from?" So I knew that it wasn't like the start-ups of the decade before in the '70s, where you could boot-strap your way to success over the course of a decade, and have a management team that started it when they were 29 and took it through to a $500 million level ten or 13 years later. I knew this wasn't like that. I knew that it was a three or four year, make it or break it, strategy. I used to call it the 'paper bag strategy;' that if we failed, we'd all go down to Safeway and put brown paper bags over our head and leave town. So it was important to me to have a Bruce Smith.

Pelkey: Why do you think some of the others -- I mean, General Datacom and then Timeplex got into the market -- obviously General Datacom is not particularly important to the market anymore, though they have some market share, but they're not a force in the market -- why do you think that the other players, like for example Codex, who should have been a leader in this market -- there were the Paradynes, there's the Racal-Milgos, there's a whole host of them, and I suppose the ones who probably missed it most were the PBX manufacturers who should have had this part of their offerings?

xxxxx

MacLean: Well, I'll tell you, there's a dozen reasons. One is the big macro-observation that, well, it wasn't IBM who invented the minicomputer, it was DEC, and it wasn't DEC who invented the microcomputer, it was Apple, and on and on. This sort of innovation, in many

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senses, comes from people who are looking for a way to fit into a picture that's already effectively painted. They're looking where they can break in in some way and add value, and I think that that's a lot of the reason, quite frankly, right there. I talked to a couple of presidents of large PBX companies at the time, and I saw that they were really perceptually frozen in this view of the PBX being the office controller, and I don't think they could see the fact that there was an opportunity for someone to focus on the transmission management problem and offer value to all the PBXs in a way that left the user an autonomy of selection of PBXs. In fact, if you look at IntaCom, they failed because they tried to do something similar to what we did, but included in it the PBX functionality, whereas we consciously stayed at the physical layer, did not usurp the addressing and routing functions of either the PBX or the front-end processor, because we knew that we could coexist with them if we strictly focused on adding intelligence to the transmission layer of the problem. So, I think that there's the perceptual frozen-ness that keeps the mainframe from inventing the mini, from inventing the micro, and the same thing happened here, where the PBX guys thought they were going to control the world and the data guys thought that they were better than the PBX guys, and nobody was really thinking about the integrated problem, I think, in a way that was able to come in and not displace the installed bases that everybody had, but add value to it. Most of them were too intent on protecting their own product strategies, and that sort of myopic focus can really get you locked in to where you miss seeing an opportunity. I suspect that the other --

Pelkey: Why didn't AT&T have a product?

MacLean: Well, they do, but that's an arrogance issue, and I'll talk about that in a minute. The other thing that affects all of those companies is the sheer magnitude of the operational problem they have on their hands. That, I think, takes people who, in the beginning, may have been very good strategists, and they get so bogged down -- usually the same people who were the strategists are running the company, and they're saddled with a huge operational problem. Take PBXs: they were starting to see the early indications of the commodity sort of pricing war that was going to be their demise. You take the Codexes of the world, who are -- they're focused on what is their competition doing? What is Infotron thinking of doing in terms of stat multiplexing networking capability, or what is Caisse going to do? They're not really thinking about, particularly if they're in a leading edge position as Robbie pointed out, I think, very astutely earlier, Timeplex was in trouble. Maybe that's why Timeplex had to really search for "'Where is a leap for us,' because we can't compete head on with these guys. We've got to go some other direction," and I think the real breakthroughs occur when you're looking at the problem from a new vantage point; either out of intent purpose of doing that, or maybe out of desperation, as the case might have been with Timeplex. There's the perceptual frozen- ness; there's the operational problem; the sheer scope of that that they're dealing with; there's the politics of who's running it; there's the case of the Cinderella Syndrome of companies like Rolm who just were so successful it never occurred to them that they could be wrong, perhaps. There's all of those things.

Pelkey: Let me go back, if I might, because -- this is a part of my understanding of the marketplace that's as weak as any; this area of the VANs and X.25. You were out there and you were selling and you saw what the competitive environment was like and what the customer needs were. If I can ask you to enlighten me a little bit about what that environment was like in the '70s, in terms of the packet switching and, in essence, the VANs coming into being. I think,

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given what you said, that you would agree that the profound changes happened, it's not a technology driven environment, it's a user driven environment, and that the user driven environment certainly happens -- the point of it happening is deregulation, and you articulated the reasons for that, but the setting for that, and the awareness of the possibilities, happened before that, although the need to act happened with deregulation, and I suspect that some of it was the VANs and X- 25.

MacLean: That's very true.

Pelkey: Obviously, distributed computing, but it was starting to get people aware of it, and people started to develop some concepts about network management and that there are alternatives in network management, other than just modems and multiplexers, and lastly, you must have had to compete against modems and multiplexers constantly. What was that like and why did the modem and multiplexer guys come to X.25 late and why -- X.25 is obviously dominant in Europe. The PTTs haven't forced the issue, but X.25 has been a non-issue in the United States up until the last few years when all of a sudden X.25 and multi-vendor interoperability has become the savior of X.25. Now everybody wants X.25. That's a lot, but --

MacLean: Well, again, there's lots of different reasons for that. I guess we could go in reverse order there. When you talk about the international view versus the domestic view, the primary thing you need to consider there is the role that IBM plays, because IBM is such a dominant force in the US marketplace. For example, today, in the market segment that we market to, which is the major corporations, better than 95% of those corporations are predominantly SNA networks. SNA is really a small component of the international networks that you will look at. There are pockets of SNA: South Africa, Australia, there's a few places where it's been reasonably widely adopted, but by and large, it's never caught on internationally. So, the sheer strength of IBM in the US market, in terms of SNA as a dominant networking architecture, and AT&T in the US market, have slowed down what you would think of as the CCITT ISDN X.25 momentum that you've seen elsewhere in the world, because AT&T has always done a little bit different than CCITT ISDN. They've always had their North American standards approach to it, and it's just so ubiquitous here, that it is de facto what the US market does, and similarly, IBM sets the de facto standards for the US market. So that's why you'll see a difference between the international and the US complexion of things. I suspect that, to an IBM, although I don't think they ever encouraged the adopting of statmuxes and diagnostic modems by their customers, I think it was considered to be relatively innocuous. I don't think that they fought as hard against that as they did against X.25, because X.25 -- as a VAN supplier, you must have competed heavily with the statmux alternative. In reality, we competed far more directly with the SNA alternative. The customer who was interested in really building a network with management control over it, was thinking about the architecture for that network, was far more focused on whether SNA or X.25 was the right approach for them. The people who were doing more of the multiplexing tended to be folks that had a couple of datacom guys down somewhere in their organization who knew the black art, knew what they were doing, and they could make some things happen with some statmuxes cheaply, but it was more the cheaper solution. Anybody who was looking at a real systems architecture for their network was really considering either X.25 or SNA, and in fact, one of the things that I loved when I was out competing against IBM, selling X.25 private networks, was that I personally talked to six different customers just on the

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west coast, each of whom told me they were the very first SNA implementation in the US, which gave me a sense of exactly how IBM operated; that all these guys felt that they were the first ones to begin to adopt SNA, which at the time was fledgling.

Pelkey: SNA was fledgling?

MacLean: SNA.

Pelkey: When did SNA arrive on the scene?

MacLean: My guess would be '76 time frame. It was very -- it was really just being positioned by IBM.

Pelkey: So when you went out, the competition was, in fact, the early installation of SNA networks. It wasn't an SNA that you had to replace?

MacLean: No. You weren't replacing SNA.

Pelkey: What was being replaced, multi-drop multi-poll modem networks? IBM was coming in with their SNA networks and front- end FEPs and all this sort of thing --

MacLean: Right, the way it started was, initially, you were saying: "I can offer you a more elegant solution than what your statmuxes are doing for you," so there was some multiplexer positioning, but very quickly then, they bought into the notion of having more network management control, etc., over the network. Then you were in a new category, because now IBM was already talking to that customer about SNA, and so even if it was from a preemptive selling standpoint, they had been in talking about where things were going and what SNA was going to bring to them. So, you had to start -- basically, at that time, just to give you a view, if a customer wanted to have -- if they had an IBM host here, and a front-end, and another one over there --

Pelkey: I'd like to have you draw it here --

MacLean: Oh, ok, so you can take it with you.

Pelkey: I have everybody, when they write their notes, all write in my notebook. That way I get to keep them, so I have all these great notes in here.

MacLean: Yes. Back in the early days, what you had is you had IBM hosts with their front-ends, which at the time were 3705s, rather than 25s, and you would have, down from there, you would have Series I's and then, ultimately, you would have cluster controllers, etc., but, the main point was that it was a host- dominant view of the network to the point where, if you had another IBM host in another city, with its 3705, it had an entirely separate network, and it's all hierarchical, ok, with the host as the center, at this juncture. If you had a cluster controller over here with a terminal off it, at 37xx, that needed to talk to this host, you couldn't do it. Then, eventually, they began to offer MSNF, a multi-system network function capability, where one

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host in one location could talk to another, but you literally had to do a new sysgen in each of these 3725s -- 3705s at the time -- every time you added a new terminal to this network, anytime you wanted to let something over here ever talk to there. It was very, very cumbersome. So what X.25 offered as an alternative was more of a global network concept, where you could attach a number of hosts to them, IBM and others, so you had the multi-vendor approach to networking. You could put your DEC VAXs on there, you could put your HPs on the same network, and now you could have all your terminals access any host on the network, which is what gave birth to the whole protocol conversion activity, which was to take async terminals and allow them to talk to IBM SNA hosts, primarily. So, that's basically what you were positioning against when you were selling.

Pelkey: These were just leased line modems that -- the customer would buy these modems from a Paradyne or a Codex or a Racal- Milgo.

MacLean: Right. Now, these were all leased line, typically multi- drop, networks. There was no redundancy, in terms of alternate paths. If you wanted to have a disaster backup to another host site, you needed and entirely redundant leased line multi-drop network, which was extremely expensive.

Pelkey: And IBM didn't provide these modems. The customer would go to Codex or whatever --

MacLean: Initially. Then, IBM introduced its line of modems, which is interesting because even today, when people ask me how do you define a True Blue customer -- is that somebody who has an SNA network? I say: "Absolutely not. Ninety-five percent of the customers have SNA networks. It's anybody who buys IBM modems that's a True Blue customer," and IBM kind of looks at me and goes: "Now why do you say that?" It's just so obvious to me that they're paying more for less because they have to have Blue Blanket on at night or they can't sleep. So, absolutely, that is why the Racal-Milgos, etc., of the world were able to really build a big and thriving business for their intelligent modem lines, which today is still a very large market.

Pelkey: So, IBM, at this point in time, was coming in and trying to convince these customers to do these -- put SNA in, which is a hierarchical approach, because network management -- it sat on the vision of network management off the host. It was a very host-centric view of the world, which is compatible with IBM's MIS dominance --

MacLean: Exactly.

Pelkey: -- where you were coming in and saying: "Wait a minute, this thing can be much more of a local approach," which was a little more threatening to the, at that point, center of authority, which was the MIS guy.

MacLean: That's correct.

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Pelkey: During this period of time, you've seen the market go from the power of the MIS guy to -- it's moved to the CIO guy, and it's now, the CEOs are much more concerned about this issue of networking an so on.

MacLean: That's right. At this time, there weren't CIOs. You would find resonance on the packet switching approach typically with VPs of Network Planning, VPs of Technology Assessment, people who were aware of new technologies coming on line that were going to allow them to more efficiently run the network, more reliably, because of the alternate routing, more flexibility in terms of multiple hosts -- they might want to buy some Tandems, they might want to buy a number of different host environments. They didn't like the vendor dependence and host dominance of this view, but all of these guys reported to MIS directors who remember to this day the fact that, when the 360 architecture came out, some of their friends didn't buy it, some of their friends went with Honeywell or Burroughs or whatever, and that subsequently, if they still had their jobs, they ended up going through massive conversions. They know that if they bought from IBM, they had all the software they needed, all the MIPs they needed to run their company's business, etc. So, when IBM put a full court press on SNA, there's no way that these guys were not going to buy SNA. In the early stage, it looked like X.25 had so much to offer that it would be successful selling against SNA, but as SNA began to pick up momentum and suddenly everybody was going on the SNA ship, it became very clear that X.25 had to offer SNA support, and that's where the whole protocol conversion activity began coming on-line quickly.

Pelkey: And NetView was an outgrowth of -- was the management facility on top of an SNA network?

MacLean: Oh, yes, exactly. NetView is now intended, for the first time, actually -- and it's a major architectural variation for IBM -- is intended to address the interoperability of not only non-SNA, but non-IBM devices.

Pelkey: In the late '70s, were there other VAN companies that didn't make it, or was it primarily just Telenet and Tymnet?

MacLean: There was Telenet and Tymnet -- it depends on how you define 'making it.' Tymnet was profitable, Telenet wasn't, to the best of my knowledge. They were subsequently bought out, as you know. The other main player was UniNet, which was bought out as well.

Pelkey: Was it UniNet back then?

MacLean: Yeah. UniNet was, no my knowledge, its first and only name. UniNet was a late comer. Tymnet and Telenet had been there for quite a while, and of course the ARPA/BBN effort had really only focused on private networks, primarily government networks. So, most of the ARPA folks, although some of them were the seed for Telenet, most of them ended up with BBN, which marketed private networks to the government marketplace. Telenet established a VAN, as did Tymnet. Tymnet's, interestingly enough, development of its VAN did not really come out of Arpanet. It came more out of Tymshare's own need to have more cost effective communications foundation so its timesharing business could be profitable. So, although the

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inventors of Tymnet certainly were current, in terms of reading the literature on X.25 and tracking very closely to Arpanet, their objective was different. They wanted to make sure Tymshare could be profitable, which is why, I believe, Tymnet made money, whereas Telenet never did, because they worked more on the efficiency aspects of the network, so that Tymshare's business could have the most cost-effective communications possible.

Pelkey: How about that.

MacLean: It's really interesting; what are your motivations in designing affect substantially what comes out.

Pelkey: They were incompatible networks, other than if you bumped them up to the level of X.25 or X-75. Then you could communicate between them.

MacLean: Right, well all of them ended up with an X.25 gateway, which is why all the packet assembler/disassembler manufacturers were able to build pads that could connect into the VANs, and they all developed X-75 inter-network gateways, and that was essential primarily for the international marketplace. There was very little requirement, domestically, for Tymnet to talk to Telenet.

Pelkey: Right. The reason for the X-75 gateways was so that Tymnet could talk to international X.25 networks?

MacLean: And equally importantly, Tymnet was building many of the international X.25 networks. Many of the countries in Europe built their networks using Tymnet engines and Tymnet switching architecture. Then they all had to talk to each other.

Pelkey: Oh. Tymnet is not truly an X.25 network.

MacLean: That's true.

Pelkey: It's a different kind of an architecture.

MacLean: That's right, but a number of the countries in Europe built their networks using Tymnet engines.

Pelkey: Which Tymnet designed and built?

MacLean: Correct.

Pelkey: That's fascinating. I wasn't aware of that. During those days, you must have been aware of Arpanet?

MacLean: Oh, yeah, sure.

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Pelkey: What was the reaction about that whole thing? When you read about it in the early '70s, what was your reaction?

MacLean: Well, I didn't read about Arpanet in the early '70s. I didn't, myself, focus on Arpanet until I was making the move from Tymshare to Tymnet, and -- I looked with respect on the folks from Arpanet because they had done the pioneering technical effort in the X.25 area, but I also saw them more as the academics of the business, and, quite frankly, had enormous respect for those folks at Tymshare who had said: "Hey, this is interesting intellectually. Now, let's apply it real-world in a way that saves money." So, I found it, personally, very easy to make the Tymnet case when I was out in front of customers, because that is effectively what Tymnet did. They took the early academic work on X.25 that Arpanet had pioneered and put it into practical use for corporations, starting with themselves.

Pelkey: Whom, within Tymshare, could I talk to in order to understand what happened when they made the decision to go off and do Tymnet?

MacLean: Gosh, well, there's a whole bunch. You could certainly talk to Tom O'Rourke right down here in Saratoga, and he would be able to --

Pelkey: He's still at Tymshare?

MacLean: Now, he's no longer at McDonnell/Douglas. Tymshare, of course, sold to McDonnell/Douglas. Tom O'Rourke was the president of Tymshare. He sold it to McDonnell/Douglas.

Pelkey: When was that?

MacLean: It was subsequent to my departure. I left in July of '82, so it was subsequent to that, and Tom, after leaving Tymshare, when he sold it McDonnell/Douglas, worked for H&Q, Hamburg & Quist, and now he's down in Saratoga just doing his own private investments in things. So, I'm sure he'd love to talk to you. There's just a ton of people. There's guys like Bob Harchorek who was the president of Tymnet during the stage that the experiment was going on, knew me, knew Art Caisse, knew Al Zucchino, etc., knew Robbie Forkish, Roger Chrisman. He went to MCI, was there for a while. He now does, primarily, consulting and things like that.

Pelkey: Were there any other companies that your aware of that spun out of Tymnet or Tymshare in the communications business?

MacLean: Not to my knowledge. There may be -- nothing else of consequence. There may be other things that happened, but nothing that was substantial.

Pelkey: You've been incredibly helpful. This has been exciting and fun. I think you've answered most of the questions that I've had. Thank you very much.

MacLean: Well, you're welcome, and I encourage you to get back with Robbie, because I think he can put, sort of, the next couple of skins off the onion on a technical front.

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Pelkey: Absolutely tell him I will contact him in an effort to get together with him.

END OF THE INTERVIEW

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