



## **Timesharing/Professional Services Workshop: Session 7: Operations and Communications**

Moderator:  
Burton Grad

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## Timesharing/Remote Processing Services Session 7: Operations and Communications

**Conducted by Software Industry SIG – Oral History Project**

**Abstract:** There was always a significant amount of expertise and cost involved in running the operational aspects of the TS/RPS companies. In this session the participants discuss the following topics related to operations:

- What platforms were used as the companies grew and why?
- Why did the companies build multiple data centers and how did they decide on the locations?
- What kind of staffing was required for the data centers?
- Were there differences in operating in Europe, Asia and other geographic locations versus operating in the US?
- How were performance and effectiveness measured for these operations centers?
- What were the most significant problems in operations?

### **Participants**

<u>Name</u>	<u>Affiliation</u>
Burt Grad	Moderator, SI SIG co-chair
Dick Bayles	National CSS
Frank Belvin	Interactive Data Corporation
Chris Brook	GE Information Services
Rick Crandall	Comshare
Ann Hardy	Tymshare
Norm Hardy	Tymshare
Mike Humphries	Tymshare
Gary Myers	Tymshare
Dick Orenstein	National CSS
Nick Rawlings	National CSS
Jeffery Stein	Online Business Systems

Mike Wyman	Interactive Data Corporation
Thomas Haigh	Historian, Univ. of Wisconsin
Chris McDonald	Historian, Princeton University
Doug Jerger	SI SIG member
Luanne Johnson	SI SIG co-chair
Ed LaHay	SI SIG member

### **Networking Prior to the Internet**

**Burt Grad:** Let's begin Session 7 to discuss the actual operations for the timesharing and remote processing centers.

**Thomas Haigh:** We've been talking about networking in the mid-1980s and you were running some of the biggest networks around. At that point, had you even heard of the Internet? And what did you know about it?

**Ann Hardy** Oh yes. ARPANET.

**Nick Rawlings:** ARPANET.

**Chris Brook:** It wasn't the Internet.

**Haigh:** Well, it would be the Internet by the 1980s with the switch over to TCP/IP in about 1982. So by the time period we've got to now, the mid 1980s, there would be such a thing as the Internet.

**Brook:** It would become the Internet.

**A. Hardy:** The guys who developed Tymnet and the guys who were developing ARPANET had always exchanged information and been working together from Day One.

**Brook:** In the early days, LaRoy Tymes, myself, Vince Cerf, Larry Roberts and Donald Davies from the National Physical Laboratory in the U.K.... There used to be all of these meetings and we'd be the same five guys going around giving presentations and so on. So there was a huge exchange of information all the way through. That was our part in the Internet. It wasn't public so it didn't do any good. The public side of it was much later in terms of being able to use it.

**Haigh:** And was there any direct technology transfer in the 1980s?

**Brook:** No, X25 was the big thing at that time. ARPANET was not. TCP/IP and all of that stuff was kind of interesting, but I think X25 was what everybody assumed was the current new technology. It came from DATAPAC in Canada.

**A. Hardy:** Right.

**Brook:** So Telenet and DATAPAC were kind of pushing that and the French, obviously. I mean all of the governments went to X25.

**A. Hardy:** And the interesting thing was that none of those X25s could talk to each other. And so what Tymnet did was program a little application in the operating system so that all of those different X25 systems, all of the international ones and all of the U.S. ones, could actually talk to each other and they all needed Tymnet in between.

**Brook:** We didn't have any problems with them interoperating. We talked to TransPAC. We didn't talk to DATAPAC much.

**A. Hardy:** Yes, but they couldn't talk to each other.

**Brook:** Oh, they talked to us so I presumed they could... We didn't do anything special, I don't think.

**A. Hardy:** Yes, they were having trouble communicating.

**Brook:** By certainly the mid-1980s, we were doing X25 connections for EDI to everybody.

### **Issues Related to Operations**

**Grad:** Okay. I've made an executive decision. Let's talk for a while about the physical operations themselves, we haven't talked really much about that, other than the communications. How about physically, was that an important part of your business? The people who actually ran the centers, the means of running them, the costs of running them, was this a significant part? You talked about the hardware costs, you talked about the communications costs.

**A. Hardy:** Power backup?

**Grad:** I don't know. I'm asking you. You have these mammoth centers, lots and lots of machines, all kinds of communications connections, was that an important part of your business? Did you really pay much attention to it?

**Rawlings:** Well, we had a huge issue which Dick mentioned earlier. We had to locate where the phones were available, where there enough phones for us to connect our customers. Then later it was we had to make sure that we had the backup power supply, the air conditioning.

**A. Hardy:** Right.

**Rawlings:** Air conditioning for those [System 360 Model] 67s was as big as the machines themselves.

**Dick Bayles:** And in the case of the Amdahl computers we had to have a water cooling system for the 168.

**Rawlings:** Our machines took a lot of room and a lot of operators.

**Grad:** Operating procedures? I mean training the operators?

**Rawlings:** We had people running around putting up magnetic tapes and taking them down. You could mount a tape for \$10 an hour, but you could also mount a disk. And so we had operators putting on disks for users.

**Bayles:** The principle reasons that we opened up a data center in Sunnyvale eight months after our data center was opened in Stamford, were two-fold. One, it was physical transmission of media, tapes and printout. We ran a courier service from Sunnyvale to our San Francisco office because a lot of the program development business was people looking at using COBOL data files. And if you're going to deal with a West Coast bank or a West Coast SoCal or West Coast whatever, you needed to have physical proximity so that we could get the physical media on the machine.

**Grad:** Okay. So the printing was a significant element.

**Bayles:** Printing and mag tapes.

**Grad:** Now, Rick you said the computer center things just weren't very important to you.

**Rick Crandall:** We had a great operations team. They loved the stuff. You know when we finally funded putting in a UPS [uninterruptible power supply], it was a huge diesel generator with gas tanks under the ground. They [the operations people] were up day and night loving this stuff. And I never worried about operations. We had a major center in Ann Arbor, Michigan for the U.S. We had a huge center in London for Europe and a small center in Japan. And we had network problems like crazy, but I don't really remember ever being worried about the operations.

**Grad:** One of the things that you've all brought up and what's surprised me, is that you had bunches of [Scientific Data Systems] 940s, a much lower cost machine. You had DEC machines. You had these big machines, the [IBM System 370 Model] 168s eventually.

**Crandall:** XDS [Xerox Data Systems] Sigma 9.

**Grad:** You had [Honeywell] 6000s. You had all kinds of machines all over the place. Wasn't there an issue about price performance that the bigger the machine, the more effective output you could get? Why wasn't that a slam dunk? Why didn't you just go to bigger machines?

**Brook:** We did. We went as big as we could.

**Grad:** But you didn't get rid of the old ones?

**Brook:** We did. We got rid the old ones. We traded them in.

**Rawlings:** Rick didn't. He was running 940s, 40 years later.

**Crandall:** [The new machines were only] 3 times the revenue, and six times cost.

**Brook:** We were like Southwest Airlines, we only ran one model. So everything was [GE] 645s. Then we went to 6000s.

**Grad:** So you switched over.

**Brook:** The old stuff went back to NEC/Honeywell.

**Grad:** But the rest of you didn't, why not?

**Gary Myers:** We did. We got rid of it.

**A. Hardy:** Our services were different.

**Grad:** But why does that matter?

**A. Hardy:** The services were different on the different machines.

**Grad:** But wouldn't the economics have made a difference? That's what's puzzling me.

**Mike Humphries:** You had to port the applications and that wasn't always easy.

**A. Hardy:** Yes, right.

**Norm Hardy:** Entirely different instruction sets, different architectures.

**Crandall:** We used to talk about this a lot. We kept running the 940s but we also went to Sigma 9s and developed our own operating system for it. And it is apples and oranges so it's hard to really compare but I think we got a huge amount out of those old machines.

**A. Hardy:** Yes.

**Brook:** I'm not saying it was all homogeneous, all of the Mark III stuff, and all of the timesharing stuff was all 6000s. And then we had the same problem they had; we had IBM 370s to run IBM applications. And then Honeywell GCOS machines to run GCOS-type programs. So we had these three different machines and I think we had some [DEC] PDP-11s around the place or something.

**Crandall:** We never got the margins on the IBM equipment that we did on the Xerox, the SDS.

**A. Hardy:** That's right.

**Brook:** No, absolutely not. That thing was 80 percent overhead. And you get about 10 percent, 20 percent work out of the stupid thing.

**Bayles:** I'm not surprised.

**Grad:** But you had no choices because you were using VM or equivalent, you had to go there



**Bayles:** Yes.

**Rawlings:** We weren't using VM.

### **Relative Cost Effectiveness of Larger Machines**

**Grad:** It would seem to me that there's an economic differentiator in terms of the efficiency of running these systems. And I haven't really heard that from any of you here.

**Brook:** I'm missing the question.

**Grad:** That the bigger the machine, the more performance you can get per dollar.

**Brook:** Yes, it's true.

**Grad:** And yet, the applications seemed to drive you rather than the machine efficiency.

**Brook:** The application is what you get the money for.

**Grad:** But why couldn't you run the application with a bigger machine, what was the problem? They're running on 940s, a bunch of little 940s, why bother?

**Crandall:** First of all, they're all written off.

**Grad:** So there was no real cost.

**Crandall:** No, I'm talking about when there was.

**A. Hardy:** Yes.

**Crandall:** I'm trying to remember. I think an 80 percent load on a 940 was producing about \$100,000 a month a revenue. And I think it was costing us about \$15,000, a month as I recall. I mean the real early ones cost more but that was about what it was. Particularly, if we started buying the machines, depreciating them over six or eight years, something like that.

**Grad:** And operator cost wasn't significant?

**Crandall:** No, you had a whole center full of machines. It wasn't operators for each machine. They'd walk around the room.

**Grad:** It just didn't matter.

**Crandall:** No.

**Brook:** You had two or three guys and that was it.

**Jeffery Stein:** In this situation, and maybe I'm saying something that's totally irrelevant, but you had two types of customers. You had one kind of customer that just really wanted to get some results and they didn't care how it was done. And you had another type of customer that actually wanted to buy something that was on a certain type of computer, like an IBM computer, and they paid for that. That's specifically what they wanted. They wanted to be transportable. They wanted to have more control, et cetera, and so you had two types of customers.

**Grad:** Carry it further. Was there a difference in your running your operating centers, different from what any big customer would have? Would you have any different kinds of problems because you had umpteen customers, rather than if I was at Shell or if I was at one of the others?

**Bayles:** In our case, I'd have to say no. We had the same backup issue, power issues, and air conditioning issues.

**A. Hardy:** Yes, communications issues.

**Grad:** I was thinking if you had a cost advantage somehow over an in-house system.

**Brook:** There was some cost sharing. Obviously, if I'm running my own 370 or whatever it is, then I can share that amongst three users, but from the users' point of view, it was facilities management. Sort of. I mean it was a remote... We called it RFM, remote facilities management, because that's all we were doing. We said okay, we have this great big IBM machine or set of machines. We'll run your application for you. And we had an [IBM] 3780 or 2780 [terminal] or whatever it was at the front end and they just ran through.

**Crandall:** We never thought of individual machines. We were running the data center which had a bunch of machines. You didn't have one or several operators per machine or anything like that. So if you were trying to compare against running a single machine versus a whole data center full, of course there was a cost advantage.

**Rawlings:** We did have an issue that since we had multiple 67s so when somebody called in, they had to go to one of the 67s. And so we might have a machine that was fairly idle and another one that was busy and the users were getting bad response time. So our only solution was to move the users and hope that [would improve the response time]. We got a bigger machine and that problem changed. But we had to pay like twice as much for a 168 as we did for the equivalent power.

**Grad:** You had a big step function there whenever you added that second machine.

**Rawlings:** And it was a huge cost.

**Mike Wyman:** That's very key, the size of the step function, for National CSS and us. I mean, because these were very expensive machines. Unlike relatively low cost 940s where the cost of providing incremental capacity is minimal compared to the total hardware.

**Dick Orenstein:** On that point, I remember, actually at one point arguing with the financial guy about whether we should get another machine. He wanted to milk the revenue and the sales guy wanted to do it and that's true. Another point about it, which is kind of related to that, was that buying new equipment, since most of it was rental until we wound up doing the longer term leases, wasn't a big decision. And it was interesting that the board wasn't involved in these because they weren't commitments. So we'd make huge decisions but they were basically monthly decisions.

**Grad:** I see. So knew you could still lease it. You could do short term leases still on the equipment.

**Rawlings:** You could *only* lease it early on. It was the only option you had.

**Bayles:** It was the only option we had.

**Rawlings:** We leased memory by the hour. We got a megabyte of memory for our 67 on which there was a clock and a switch. And Bob Jesurum wrote the code to switch the users from one memory bank to another as the usage dropped so that we could turn off the switch and stop paying by the hour. I remember because we asked the operator to tell us when he had shut down the memory. And what he did was that he typed in "shut down the memory" and "shut down" was the word to stop the CP [central processor]. So it crashed the machine. <laughter> It was a little human engineering problem. But we actually rented a megabyte of memory by the hour.

**Grad:** Who from?

**Rawlings:** IBM. They were the only one and there were little women in Taiwan or something who were weaving the cords.

**Bayles:** Not back then, today yes.

**Wyman:** Two in one, sexist and racist. <laughter>

**Rawlings:** But it was huge. The machine costs were huge. Absolutely huge.

**Grad:** So we have the step functions, but it's not just the computer, we're talking about the memory. We're talking about the storage devices. We're talking about the communication systems, all of those things. How about the back up and restart procedures, things like that, was that a significant issue? Did you spend much? It doesn't sound like from a management standpoint you worried much about this is what I'm hearing.

**Wyman:** Prayer worked reasonably well.

**Bayles:** We certainly worried about backup. I mean our backup.

**A. Hardy:** You worried.

**Grad:** So what did you do about it?

**Rawlings:** We had to come up with a whole new backup scheme because we had so much data to back up, we figured within another couple of months we would be spending 24 hours a day backing up yesterday's work. So we had to come up with incremental backups and then the restore. And then we offered six months' worth of backup, so where do we put all of the tapes?

**Grad:** You built in redundancy across the board.

**Brook:** Yes, I mean in the way the clusters were done, you could just share across them. And we obviously had UPS because we had this huge facility in Brook Park and everywhere else with UPS out there. The only time we had an issue was when a squirrel got in the UPS thing and chewed through the wires and we didn't know it until we needed the UPS and it took out the center. So they're running around trying to find this damn squirrel.  
<laughter>

**Grad:** So you must have somebody who did it.

**Crandall:** No, we had a really good operations team so I never worried about operations, except for networking. That was a whole different category. That was a nightmare.

**Grad:** The networking was thought of separately from the operations part, is that right?

**Crandall:** Well, it was part of operations, but if there was ever going to be a conversation about operations, it was always about the network.

**A. Hardy:** Right.

**Crandall:** It was a nightmare.

**Grad:** Is that true at Tymshare too?

**A. Hardy:** That was the same, yes. Because we had a very good manager of operations. And once you decided how much backup you were going to have, how much redundancy, how many times you were going to checkpoint everything – once you made those decisions, he made it all happen. And the only things that went wrong were the communications.

**Brook:** Because that was the part that wasn't in our control.

**Crandall:** Right.

**A. Hardy:** Yes.

**Brook:** Everything else we had total control over.

**A. Hardy:** Everything.

**Brook:** I know we did sunspot prediction and all of that kind of stuff, and then we'd warn everybody that we were going to switch, this line would go down. All of the operational people knew but you had no control over it. You know like AT&T went down or Japan went down or something. Everything else we owned and controlled. So you had confidence you could run it.

**Grad:** Go ahead, Tom.

## **Staffing of Operations Centers**

**Haigh:** So just to bring the humans into it for a second, where did you hire operators from? What kind of backgrounds and credentials did you look for? And was there a career path for them?

**Bayles:** Well, those are different questions.

**Rawlings:** Those are your 2000 issues.

**Crandall:** They were very junior people in our operation. Occasionally one would bubble up and have a career path. Usually not. Usually they'd stick around for a couple of years and were gone.

**Bayles:** In our case, the original team mostly came from the MIT computation center. And subsequently some homegrown people, I mean, some people in the Stamford area. But the first two layers of operations came out of the MIT computation center.

**A. Hardy:** And there were technical schools that trained people to the level of being a good operator and so we picked some of those up.

**Brook:** Because all of our systems were proprietary, it was all in-house training. You'd hire somebody you thought was smart enough and often they were just high school graduates or whatever.

**Crandall:** Right.

**Brook:** And then you'd train them and see if they worked out. If they didn't work out they went away. If they did work they stayed.

**A. Hardy:** Yes. And the good ones always had a chance to do some programming. If they turned out to be good at programming then they moved up. And if they didn't want to do that, they just stayed operators.

**Wyman:** As I recall, we had three categories of operators. We had console operators, people that watch the computer and figured out what was going on if anything was going wrong. We had tape runners, people who would shag tapes out of the library and mount them. Plus we had printer operators. I think Frank once made the observation that what we were

really running was the world's biggest printing press because the only thing the customer cared about was printed output and everything else was secondary.

**Haigh:** And would those people have been mostly men, mostly women? Did it vary based on the different kinds of work?

**Wyman:** I don't know if we had any female operators at the time.

**Rawlings:** I don't think we did.

**Bayles:** I don't think we did either.

**Wyman:** We did have all female technical consultants, probably the first four years or so of our existence, to the extent that at one point in time, in our monthly newsletter our vice president of marketing wrote this very sexist article, the bottom line of which was: why are they all women? And it didn't go on to say much of anything except to raise this tongue-in-cheek.

**Bayles:** Because they had an astute personnel director doing the hiring, like his brother.  
<laughter>

**Brook:** I think there was a difference in the level of the education, or whatever you want to call it, between our network people and our mainframe people. One was remote where the people were working on the fly and God knows what could wrong in the middle of the night. So they were much more skilled or much more experienced in the network centers.

**Grad:** There's a set of questions I was looking at here. You've answered some of them already. You're basically claiming you had no particular price performance advantage over the larger customers in terms of running your centers versus them running their centers. You feel differently Jeffery?

**Stein:** Yes. With our operation, and I think for everyone else's too, we could run a customer's application on a faster machine than they could buy internally. And they got the job done faster. The second thing is that they had a situation where if one month they needed more disk space or they needed more computer time, in an internal installation they probably couldn't handle it, but the next month they maybe needed half as much. By using a data services firm, because you had a larger facility, you could accommodate their peaks and their valleys on demand and still give excellent service.

Going back to the other point about people. I feel data services firms attracted really top notch people and they became excellent at what they did because we offered a tremendous amount of variety all of the time. If you went to work for Standard Oil or you went to work for Levi Strauss, it was the same thing, every day, week in and week out. They're going to do the monthlies and the weeklies and the dailies. And they have this issue and all of that. But when you work for a data services firm you're working for so many different customers at one time and the variety is just so stimulating and I think information processing people thrive on change. They love change. It just stimulates them. It gives them a challenge every moment.

**Crandall:** There's a couple of other marginal benefits. For example, if there were any problems that cropped up in the data center you had your own R&D team that created the operating system. So I mean it was a phone call and the guy that knew everything about it could answer a question. So there were some benefits there. Also we, and I suspect everybody in this room, spent some time developing operator software. I mean we had some utilities that were aimed at operator productivity and reducing the need for geniuses running the equipment. So in terms of reporting and so forth, we actually invested some amount of development doing that. Eventually, of course, the software [available for customers in-house] got quite mature. But in the earlier days of running online systems in-house, I don't know how much of that was available.

### **Locations of Operations Centers**

**Grad:** The choice of locations, where you put your centers, how was that determined? By where your customers were?

**Crandall:** You'd find out where the phone lines were.

**Brook:** Where the phone lines were.

**A. Hardy:** The phone lines, yes.

**Brook:** Yes, where you get the communication access. I mean that's what we have in Brook Park, which if anybody's been there, Cleveland is a God-awful place in the middle of nowhere. You fall in the Cuyahoga River and set fire to yourself, which happened to one of our operators. But it was there because there's a lot of phone lines.

**Grad:** Why was there so much phone stuff there?

**Crandall:** Ask AT&T.



**Brook:** Yes.

**Grad:** So it's where AT&T happened to have done things.

**Brook:** Or the local Bell company in that case because we were all direct connections.

**Grad:** So decentralization, the early part may have been to get closer to customers, but later the centralization is where you had good communications power.

**Bayles:** Well, in our case, we ended up never having more than two locations. We had one in Sunnyvale and... well, we ended up having two in Stamford but they were within a block of each other.

**Grad:** And why Sunnyvale as against Redwood City?

**Bayles:** That's an interesting question. Do you remember why Sunnyvale?

**Orenstein:** I think we just got a good real estate deal.

**Bayles:** I think we had a hell of a good real estate deal. We ended up building our own building right behind the Sunnyvale Civic Center at the time. It's gone now.

**Grad:** So it wasn't the communications access per se.

**Bayles:** In Sunnyvale it was never an issue. It was an issue in Stamford, in Connecticut. We couldn't have gotten more than five phone lines in Wilton probably versus 200 in Stamford.

**Grad:** Anything with Tymshare in that regard?

**Humphries:** Yes, this was told to me because it happened before I joined, but originally Tymshare was located fairly close to the Stanford campus. And with student unrest in the 1960s, [Tom] O'Rourke decided that the computer center needed to be somewhere so it wasn't easy for students to walk over and burn the place or whatever. So you can also locate for other reasons than just the real estate part.

So our computer centers, a couple of them, were camouflaged so that – you guys probably did the same thing – you could hardly tell what it was. The first one for the 370 was totally non-descript, which was kind of interesting because up to that point in time nobody that I knew

thought much about whether where you put your computers looked like it or not. We ended up on...What was the name of the street, Bob Road?

**A. Hardy:** Bob Road.

**Humphries:** We ended up leasing almost every building on Bob Road, didn't we, sooner or later?

**A. Hardy:** Some of those buildings were built for us. And the computer center on Bob Road was certainly designed and built as a computer center. On East Meadow, where the first computer center was, there wasn't enough room to grow. When they started on East Meadow, they had no idea how big the company was going to get.

**Humphries:** That's in Palo Alto.

### **Differences between US and non-US Operations Centers**

**Grad:** In running the centers in other locations outside of the United States, were there any significant differences or problems in running those centers outside the U.S. versus in the U.S.?

**Brook:** Labor rules. In Holland, the labor rules are very, very strict. You can't fire anybody whatever happens. Once you've hired somebody, you've got them for life without paying a huge amount of money. So the biggest issue in operating in a lot of European countries is the labor laws. The whole issue of how you treat your people. That was the biggest issue.

**Grad:** At that time, salary costs were probably lower in Europe than they were in the United States?

**Brook:** Yes.

**Grad:** Rick, what was your experience in London? You had a big London operation, if I remember correctly.

**Crandall:** It was very humorous because we were on Kings Row. The building that we were in had been an auto dealership, so it was a large building with a lot of showcase windows, which we were not allowed to close up. So we had to build a whole false building inside the building. And it was really difficult keeping everybody in doing the work because the girls that

would walk by the windows were phenomenal. Aside from that humorous stuff, you know everything in England is a hell of a lot more bureaucratic in every dimension. So it was different than running a data center here but we got it done.

**Grad:** Economics, the centers outside the United States versus inside for the two of you?

**Crandall:** Well, the real estate was more expensive if you were going to be in London.

**Grad:** Why were you in London?

**Crandall:** That's where the guys wanted to be.

**Humphries:** It's where the girls were.

**Brook:** Especially in Kings Row. You picked an expensive spot because the girls were there. I mean, there are a lot cheaper places in London than Kings Row because we were up northwest and it was much cheaper, less desirable.

**Crandall:** We never thought it was going to be that big. You know, we'd drop a machine or two in there and that was it, but then it just kept exploding.

**Grad:** That was actually larger than your U.S. operation at one point, I believe?

**Crandall:** The total non-U.S. was, it was 55/45 but that included Japan.

### **Factors Affecting Decisions on Types of Equipment Used**

**Grad:** Yes, interesting. These are just some odd questions. We've talked about all of these different machine decisions on the different computers you decided to get. Basically with NCSS and, I guess with IDC, once you locked into using a VM derivative, you were locked to using IBM equipment.

**Wyman:** Or Amdahl.

**Grad:** That's my point, when did Amdahl produce a machine with a DAT [Dynamic Address Translation] box, when did that happen? Does anybody remember?

**Bayles:** Amdahl did it in 1973, I think. Yes.

**Grad:** So why did you stay with IBM or did you?

**Rawlings:** They came out with a 168.

**Grad:** And that was a much better price performer than the Amdahl?

**Bayles:** Actually, no, but speaking for NCSS, I don't think we wanted to put all of our eggs in an Amdahl basket.

**Grad:** How about IDC?

**Wyman:** I'm trying to recall when we got our first Amdahl which was 1976 maybe?

**Frank Belvin:** I don't remember. We stayed with non-IBM pretty much after that.

**Bayles:** Did you really?

**Belvin:** Yes.

**Wyman:** Right. And eventually ended up with Fujitsu or whatever.

**Rawlings:** We did look at Fujitsu.

**Bayles:** We did look at Fujitsu? Didn't they buy Amdahl?

**Wyman:** Yes. That's how we ended up with it.

**Bayles:** Well, we very early on went away from IBM peripherals, storage, tape units and everything else. But for the CPU, we weren't comfortable putting all of our eggs in an Amdahl/Fujitsu basket.

**Grad:** Now, printers you mentioned as important. Was that important to the rest of you, high speed, high volume printing? Where did you get your printers from?

**Crandall:** Data Products.

**N. Hardy:** Tymshare early on decided that we were charging so much for disks and we were having reliability problems with disks, so we designed IBM compatible channels to go in our 940s, and later the PDP-10s, so that we could buy IBM devices, the expensive IBM devices, because of their capacity and reliability. Then we shortly went to IBM plug-compatible devices.

**Bayles:** Memorex.

**Rawlings:** Memorex for disks and Telex for tapes.

**Grad:** Storage Tech, did you go with them?

**Crandall:** I don't actually remember, but I know we built our own channels so that we could get away from what SDS provided. We had Data Products also.

**Brook:** We had the virtual memory disks and used those for a while. We started with using IBM servers, unreliable, expensive, and all of the rest of it, so we went out of them. And then eventually they came back with a much better product.

**Rawlings:** The memory disk became a swapping device.

**Brook:** Right. Yes, it was very fast. It worked very nicely. They had a lot of capacity. They were pretty good.

**Grad:** Besides the CPU, leaving communications aside, what were your expensive hardware purchases?

**Wyman:** Memory.

**Grad:** Disk memory.

**Bayles:** Disk space.

**Crandall:** No, I think it was main memory wasn't it?

**N. Hardy:** Yes.

**Myers:** At first.

**N. Hardy:** I believe on the PDP-10s the core memory was a real problem. And, indeed, Tymshare did a moderately successful job of converting early on to the transistor, the DRAMs [dynamic random-access memory].

**Grad:** At GEIS [GE Information Services], anything you did differently there?

**Brook:** Disks. I mean we had acres and acres. We designed our own disks to some extent, disk controllers. A lot of them were removable for redundancy and backup and so on. In fact, I think pretty much all of them were removable disks.

**Grad:** But during this time your output, though, was heavily paper?

**Brook:** For us not at all. We didn't have any paper. If anything needed printing, they had a remote printer. We had our own printers we delivered to them. So everything would go out to them. They could do card input if they wanted to, God knows why, or mag tape, but then paper would go out and they'd print it on-site. We never did any of that stuff.

**Bayles:** I think I pointed out one of the early reasons for putting a machine on the West Coast, ignoring the communications issues for the moment, was physical media transfer. That ended up after five years being relatively small.

**Grad:** And the reason why that happened?

**Bayles:** Well, we had the remote printers. And so the physical transport of media became much less of an issue as time went on. And then by 1979 or so I'm guessing we did very little of that.

**Grad:** I was wondering about how much of it was just people reading screens and doing non-paper output at that point on inquiries and things like that. Were people doing it for printing? Or were they using it just to see answers? Gary, you had a comment.

**Myers:** There was one exception in our peripheral mix that was really odd. At one time we were printing tax returns which is obviously all paper, and we had huge [IBM] 3800 printers and we tried to distribute them but that was a massive logistics issue. But other than that, we tried to shove all of the print requirements through the remote printers.

**Grad:** Okay. Thank you.

**Brook:** We had a lot of big users that had their own machines coming on as terminals. So in fact, things ended up going machine to machine in a lot of cases.

**Humphries:** The nature of most of the timesharing applications that I was involved with did not cause huge amounts of printouts to be required. So you had these other devices that you would either lease from us – we had our own section that was set up with devices that were selected – or others like Univac which had a printer that was a wheel that spun around. So there were all kinds of ways for people with reports, graphs, and little things like that, but it was very seldom that you had a customer that had an application where you needed a line printer that would dump out a four foot stack of paper.

**Grad:** Okay. We talked about performance measurement. You have these centers running. Did you create your own tools to measure performance effectiveness, usability, what did you do in that regard? Did you use IBM's tools? How did you go about it?

**Crandall:** We had fake users running on the system to measure response time. We created all of the tools.

**Grad:** But you created your own tools to do that.

**Crandall:** Yes.

**Grad:** How about at Tymshare?

**N. Hardy:** Yes.

**A. Hardy:** Yes.

**Grad:** Same thing. How about you at National CSS?

**Bayles:** Well, there are two aspects of measurement. One is the proportion of supervisor-state versus problem-state which we've talked about before. And the other is perception of the user as opposed to reality, I guess. <laughter> And we did do some of the same things. We had what I'll call fake users that would have a standard [job] and see what it would run. So it was a combination of the two. We did not concentrate as much on the fake user characteristics as we did on how many cycles were we squeezing out. How many billable cycles were we squeezing out of the machine?

**Grad:** IDC?

**Wyman:** Yes, I think we were in the same situation as National CSS. We had our own monitoring tools which kept track of, like them, the ratio of problem to supervisor states. And response time for both interactive users and non-interactive users.

**Belvin:** And since we were our own customer, a lot of our people depended on response time for their work. So we heard very quickly when there were problems. <laughter>

**Grad:** Were there a lot of downtime problems? You were mentioning about communications lines problem, how about machine problems?

**Wyman:** The first years.

**Crandall:** In the early days of the 940...

**A. Hardy:** It was awful.

**Crandall:** It was a nightmare.

**Bayles:** The early days with the 67 it was awful.

**Crandall:** If you were up for a full hour in a row... <laughter>

**Grad:** What sort of things went wrong?

**Crandall:** Well, I mean SDS just hung hardware on there that they didn't design in the first place.

**A. Hardy:** Yes.

**Crandall:** They had no idea what was going on.

**A. Hardy:** They had no idea what was happening with our hardware.

**Crandall:** We had to get very self-sufficient in the hardware.

**Grad:** Did it eventually get cleaned up so you could rely upon it?

**Crandall:** Eventually, yes.



**A. Hardy:** Yes, eventually.

**Crandall:** And the signal was good.

**Wyman:** I recall back in the mid-1970s, where I felt we were doing well if the system crashed once a day or less.

**Crandall:** That would be very good.

**Bayles:** And that's all software. I mean in our experience.

**Wyman:** Hardware and software.

**Belvin:** By the time we got the 67 and the peripherals, IBM had had it installed in multiple sites.

**Bayles:** It was rarely a hardware issue.

**Belvin:** It was rarely a hardware problem. I don't remember once a day as being okay.

**Grad:** You remember it more frequently or less frequently?

**Belvin:** Less frequent. Reliability... I mean Jack Arnow used to say, "If the machine isn't running we have no revenue." And that was a pretty big carrot or sword of Damocles hanging over our heads. So our emphasis was on reliability.

**Bayles:** Yes, if we look at the first year or less of commercial operation, once a day would have been a delight. But a year or two later, it was a relatively rare occurrence.

**Rawlings:** I remember a couple of times there was a particular instruction set that the COBOL compiler generated that caused the DAT box to overload, the execute of a branch across the page boundary, and they couldn't handle it. This was generated by some COBOL compiler for a PERFORM verb. And so some user crashed it. Well, what we had learned a couple of years earlier, was these guys at Perkin Elmer were running a vanilla version of CP and whenever their system crashed because of something they did, they would dial up our system and try the same thing. When ours crashed, they knew that the problem hadn't been solved yet. When it didn't crash, they would call us up and ask what we had done. <laughter>

**Grad:** What's the fix?

**Rawlings:** Early on we would quickly print out who the user was who was running at the time of the crash. And so if we saw the same user the next crash, we would call them up and talk to them and in some cases it was on purpose, but frequently it wasn't. They were doing something that we hadn't figured out how to deal with properly in our software. In one case, it happened to be a hardware failure which we got IBM to fix. But before we got them to fix it, I changed the guy's COBOL program so that it wouldn't generate this particular weird combination of things and he was quite happy and this combination of events didn't occur again.

**Grad:** Ann, you had a comment.

**A. Hardy:** Just a couple of points, about the 940. You had to take down the 940 every day whether it crashed or not because the clock had to reset.

**N. Hardy:** And it would overflow in 30 hours. <laughter>

**Crandall:** Sort of a Y2K problem. <laughter>

**N. Hardy:** Every day.

**A. Hardy:** Every day.

### **Backup Procedures**

**Grad:** We're finishing this session, the last thing is backup and restart. Did you do your own backup and restart procedures? What did you do about that? How did you handle that? Who wants to start?

**Brook:** Everything was set up pretty much to go online because we had removable disks so we just kind of flipped that one off, put a new one in and then backed up the other one independently.

**Grad:** Two levels, three levels, grandfather the thing?

**Brook:** They were certainly grandfathered, but I can't remember what the level was. It wasn't that much. Back on the other thing, we also had the same. We had Honeywell hardware engineers on site the whole time for exactly the same thing. In case something happened, he'd be there just like that. A lot of the hardware, we designed ourselves but they were all trained by Honeywell.

**Grad:** Rick, backup, restart?

**Crandall:** We designed our own. I can't remember what the archiving was. Yes, and we had offsite storage. And it was our own program.

**Grad:** It was your own program that did it. Norm, same thing?

**N. Hardy:** Yes.

**Grad:** Ann.

**A. Hardy:** One other early thing about the 940. When we first got the 940s, we allowed the users to program in assembler not just in compilers. We had a number of universities on the system and we actually had a lot of crashes because of people just like today putting viruses in. So that started way back in 1966.

**Grad:** Interesting.

**Wyman:** One of the advantages with the virtual machine environment was that it was very difficult for a user to crash the system. Anyway, with respect to backup and restore, yes, we initially had our own backup procedures. I can't for the life of me remember what it was. Obviously, after the VM 370 was available we purchased the commercial backup package which allowed at least internal users to request files to be restored.

**Grad:** Were you archiving offsite and so forth or not?

**Wyman:** Yes.

**Grad:** And you all did the same thing.

**Bayles:** Yes, we developed our own and backed up every day for a week, every week for a month and every month went off offsite. They all went offsite eventually.

**Grad:** So it was a whole sequence that you went through.

**Bayles:** And a whole year's worth was there...

**Rawlings:** In the vaults. And you had a system whereby you could ask for a specific file, a specific date, and we'd go...

**Bayles:** It may take a day to get it back from wherever.

**Humphries:** For most customers that was something that they wouldn't have in-house. My customers frequently screwed up. When I was a customer, I screwed up and I would call in and I would get a restore. And at first I didn't understand the value of it. But when I also started relying on some of our in-house stuff, I found out that our in-house guys didn't have any of the discipline that Tymshare did. So in retrospect it's something that we probably could have sold harder when people started buying minicomputers because I'm sure all of the guys with minicomputers also didn't bother to backup and you'd lose several days.

**Crandall:** Or they'd back up day two on top of day one, and when that tape failed...

**Grad:** That's a very interesting point. Because you had so many customers and that was your business, you had to set up very serious procedures for doing these kinds of things.

**Crandall:** But we also had equipment crashing all of the time.

**Grad:** We are ending this session. We're going to take a break. We'll come back at 11:30 please, and then we have a couple of small things and then we'll have lunch at 12:30.