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The Information Management Marketplace
Eugene B. Lotochinski

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The Information Management Marketplace

Eugene B. Lotochinski

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Oettinger: Just to remind everybody of what we think we're doing, what I had written was that the seminar is on command, control, and intelligence, and I quote myself, if I may, and check your understanding. "In the past we have emphasized military aspects and national and international security. This year we hope to put more emphasis on intelligence, command and control as practiced — albeit under different labels — in the business world. The focus is on how changes in information technologies present strategic advantages or vulnerabilities for multinational corporations. I expect that your discussion of this topic would draw mainly on your experiences within Northern Telecom itself, but also on your observations of Northern Telecom's customers."

It had seemed to me that Northern Telecom, in many ways, was an ideal case because they have major facilities in both the United States and Canada, and over the last 20 years have become a major multinational corporation. These were things that they understood from within their own sphere. Also, being in the market of selling information goods and services to other companies, Northern Telecom has insights into who is using what hardware for what purposes.

Lotochinski: I'm really delighted to be here, Tony. I'm going to be looking at the topic principally from our perspective of the marketplace in which we deal, and I can talk about our own experiences, but I will tend to do that on an off-the-cuff basis at the end.

I'm going to start out by telling you a little bit about Northern Telecom, just to give you a feeling of where we are in this business. I would like to categorize the business as something that we call information management. I think that is probably the closest thing to the three 'Cs' and an 'I' of the military. We're organized into a structure that looks like this (figure 1).

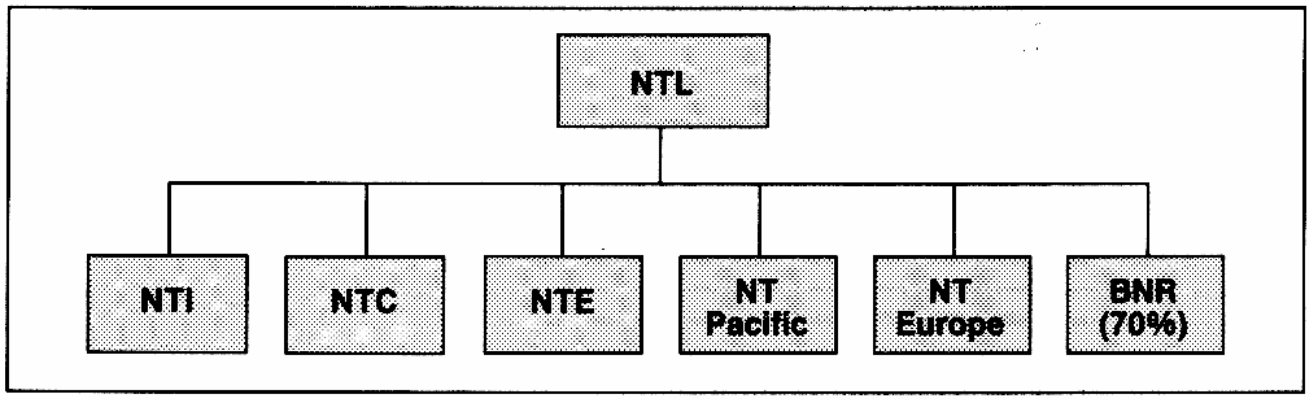

Figure 1. Northern Telecom

Northern Telecom Limited is a holding company, and we have geographic operations: Northern Telecom Inc., in the United States; Northern Telecom Canada, in Canada; Northern Telecom Pacific, serving the Far East; and Northern Telecom Europe, serving Europe and the Middle East. We also have a special company, Northern Telecom Electronics, that manufactures integrated circuits and printed circuit boards — a rather specialized field. And we have a research and development affiliate, BNR. We own 70 percent of BNR, and the other 30 percent is owned by Bell Canada.

To give you a feel for how big we are, these are our global results for 1986: We had $4.4 billion in sales, 46,000 employees, with R&D running around 11 percent of sales, and 43 manufacturing locations.

Oettinger: It occurs to me that it might be useful by way of background to point out that the organization has the benefit of experience, having been divested from the AT&T orbit almost 20 years ago, therefore having had to fend for itself in what is now the contemporary experience of them and everybody else, but with a lead time of some 15 to 20 years. I find Northern Telecom very interesting in that respect. It represents going into the world marketplace on terms that many of the other folks in that business are only now facing.

Lotochinski: I graduated in engineering physics in 1959 and when I told my parents that I was going to work for Northern Telecom, I said, "One of the things I'm very excited about is that it will let me tap into the Bell Labs." But in 1956, when that original consent decree happened, we actually started getting cut off then. So it really goes back 28 or 29 years.

One of the very interesting things we did in about 1972 was to take Northern Electric, which was the Canadian equivalent of Western Electric, and issue shares publicly. The public scrutiny, by the stock market and the analysts, is a very sobering influence on a manufacturer. AT&T at this point has elected not to do that with what they call AT&T Technologies. They retain that as a wholly-owned subsidiary, so their manufacturing operation doesn't get that scrutiny. There are really two things, Tony, with respect to your comment, that we went through. One was having to develop our own research and development capabilities because we literally did get all our products initially from Bell Labs and Western Electric. Secondly, we not only had to compete in the marketplace, but in the stock market place as well. It was very, very sobering.

The next few charts I'm going to show are models that we generated about the information management marketplace. We call the first one (figure 2) the IOS (integrated office systems) map, but probably a better term would be information management map. What we're really doing with these is showing three distinct segments, or, in fact, what had been three distinct industries, and the evolution that has gone on with respect to those industries. The three are telecommunications, data processing, and office automation. This model (figure 2) tries to capture very approximately what the functionality was, with movement toward the center representing time. In fact, if you think about this model as being a tunnel, as you get farther to the light at the end of the tunnel, so to speak, there is progression with time.

In the case of telecommunications, for example, we saw voice distribution, which was really the initial purchase of that industry for a long time. Then, more recently, perhaps since about the late 1970s, we've seen voice and data distribution. Today, we think of information distribution in a much broader sense, where information can mean anything. Take data processing at the top, for example. Originally it was batch processing, and then there was interactive processing, where you were able to go on-line and perhaps do time sharing. To a large extent that's moving now to information processing.

Student: How do you distinguish between data processing and information processing? What's the essential difference?

Lotochinski: Data to me for a long time meant numeric information, the results of a corporation, for example. Information today can be graphics. There are things that can be done with graphics that are far beyond what you could do with just ASCII representations of alphanumeric characters. I guess the term that we use is voice/data/text/graphics and image, or "data streams," which can represent any or all of those things, and any or all of those can be processed.

Next is office equipment, which some might argue isn't a segment, but we really think it is. It started out with text presentation and text manipulation — which might be word processing — and then moved into information presentation and manipulation, such as spreadsheets. Then the question is whether spreadsheets are on the data processing side, or on the office automation side. In principle, telecommunications is the distribution function. Office automation, you might say, is the presenta-

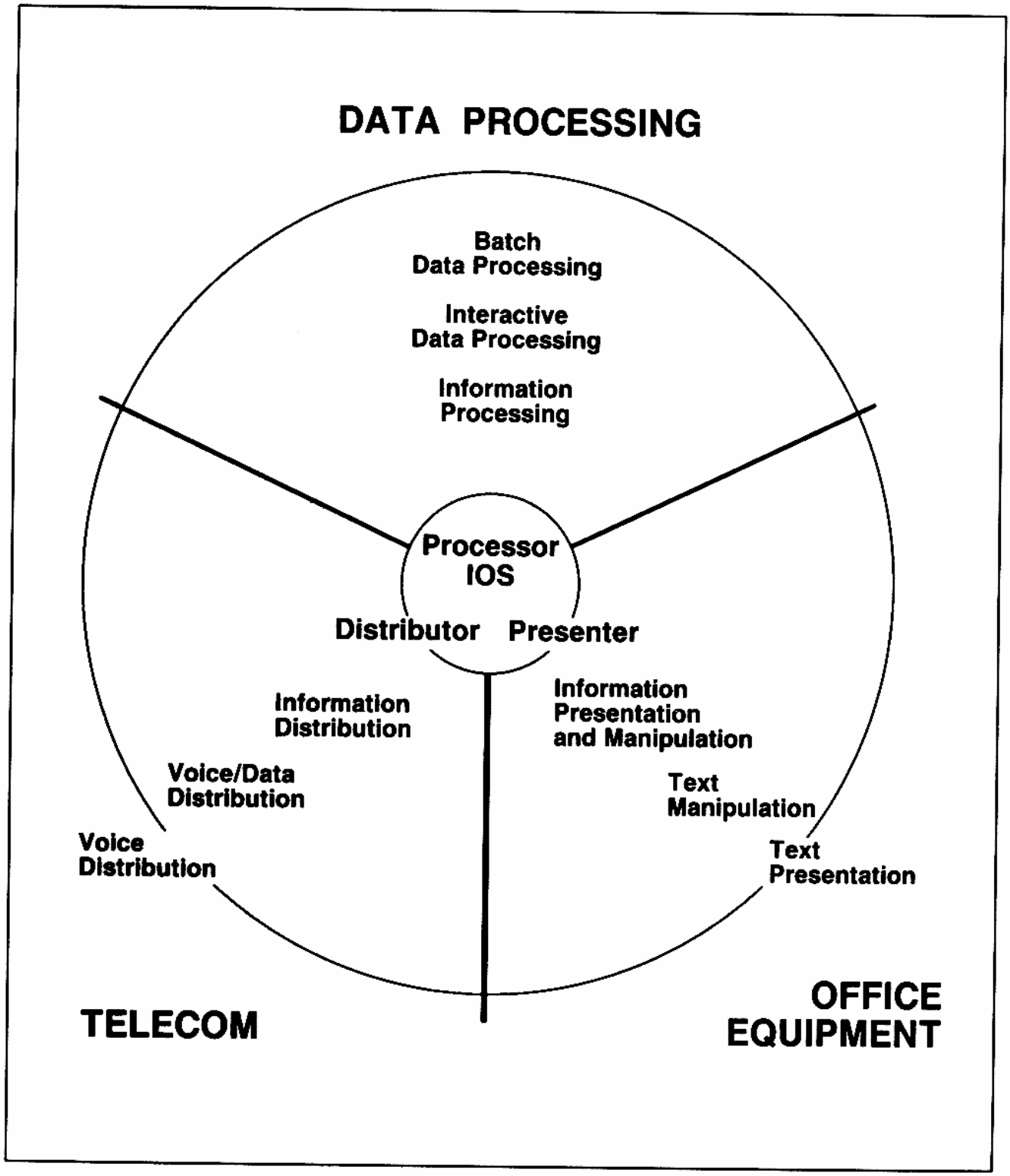

Figure 2. The Integrated Office Systems Map

tion function, and data processing is the processing function.

Student: Where do personal computers fit?

Lotochinski: That's my next chart. This model (figure 3) now tries to take my previous, very generalized, view of the functions, and looks at some products. If you look on the telecommunications side, we use voice PBXs here, but I would also have to say central office switching. Then we see voice/data PBXs. They are PBXs which are digital in nature, able to carry digital data. Then we see voice and data LANs (local area networks) and PBXs, and the distinction between a LAN and a PBX, perhaps, starts to disappear.

A local area network typically is thought of as a very localized mechanism, serving perhaps a department of 10 to 20 people, for interconnecting a number of terminals, because of a very strong community of interest among the users of those terminals. So, it's a local area network. PBX is a private branch exchange. It would be a switching system for a business.

Oettinger: At this stage of development, correct me if I misrepresent it, this is like every battalion having its own proprietary scheme from different manufacturers and presenting huge interoperability questions.

Student: We're seeing that throughout the government, even in the military, where at each level you find different forms of systems, whether facsimile machines or small Apple-based computer systems.

Lotochinski: I will come back to that because it is an issue, in terms of how business is addressing noncompatible systems. But for now, let's look at the data processing side, and I'll get to your earlier question about where personal computers fit. We really have moved away from mainframes, not that they were abandoned (they continue to persist), to minis, to personal computers, and to a large extent, I think we're seeing movement toward integrated data processing services. These are service bureaus, again, integrating, manipulating or processing of all forms of information.

And in office equipment, we have moved from typewriters and copiers towards word processors, office automation systems, and again, finally, a lot more integrated office information systems.

What I've done in this chart is also show some intersections between these three areas. At those intersections, you can see things that serve both, like modems. They are like bridges between both the office automation domain and the telecommunication domain, and between the data processing domain and the telecommunication domain. You can see some of the other things: for example, terminal emulation, where telecommunications systems are able to provide the ability for certain types of terminals to look like other types of terminals or computer systems. That's really what I mean by terminal emulation.

One of the interesting things we have found is that a lot of these boundaries are becoming very, very fuzzy, and, as competitors in these three domains attempt to compete, attempt to improve their offerings, and differentiate themselves, they are moving into each other's fields.

This (figure 4) expands on the previous chart, and reflects in a lot more detail the types of functionality, or capabilities, or services, that are proliferating. I think if you again consider this to be a tube rather than some concentric circles, what you see at the near edge is relatively little functionality; in the telecommunications sector, basically you start with voice connectivity. Office equipment was basically a typewriter, or a printer, or a copier. Data processing typically was report generation. Batch processing maybe involved some data processing management, but what we're seeing is a tremendous amount of functionality surfacing.

A lot of the problems that industry has these days involve trying to keep track of, and understanding, this wealth of capabilities entering the marketplace, both in terms of deciding what they should use, and trying to decide if it should be integrated — that is, should it be connected into a large system, admittedly with some strong communities of interest. It doesn't make sense to allow this all to proliferate separately and individually and in a fragmented way.

Just by the very nature of what I've described here, I think you can probably get the idea that a lot more people are looking toward stronger integration. Things that really do cross the boundaries are becoming much more important, and a lot of those things are excursions, either by office automation into telecommunications, or data processing into office automation. To some extent, it becomes harder and harder to identify three distinct boundaries anymore. Perhaps a better term to use, in fact, is information industry. That probably is where a lot of companies these days look at this whole set of capabilities. It's a set of information resources or capabilities that they should look at — not telecommunications, and processing, and office automation.

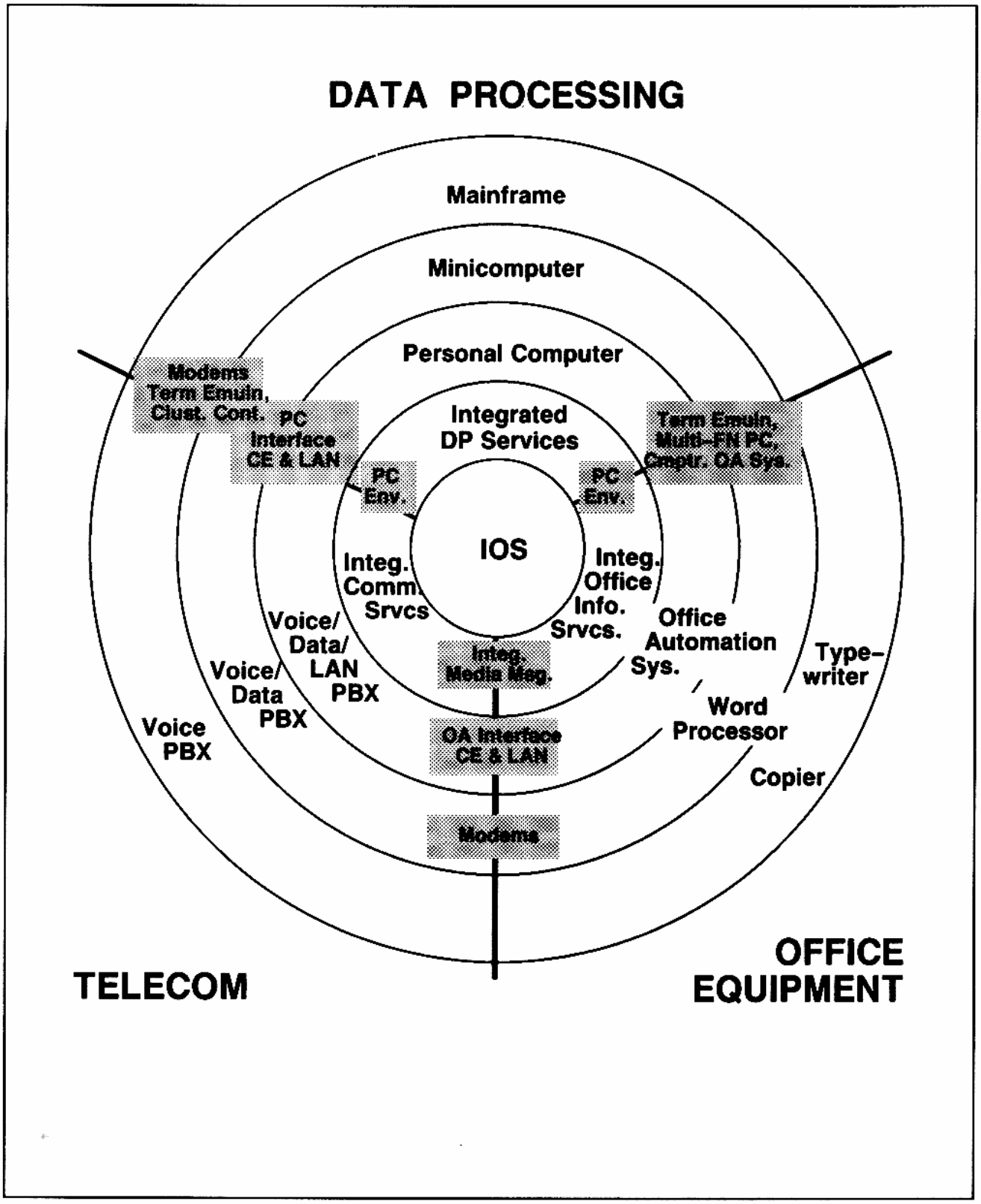

Figure 3. The IOS Map: Basic Products and Overlaps

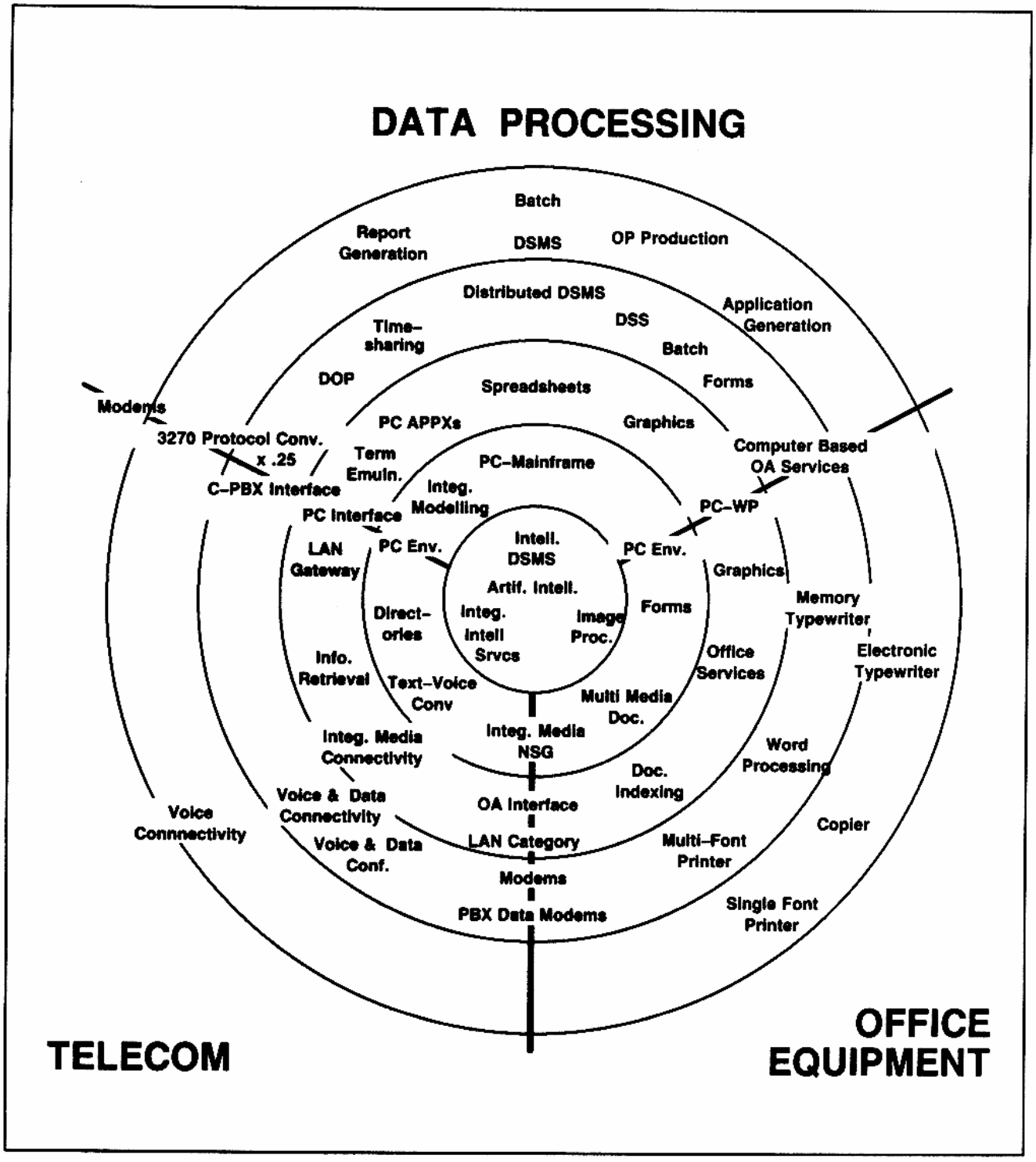

Figure 4. The IOS Map: Product Proliferation

Student: I just want to clarify: What is PC ENV?

Lotochinski: It's PC environment. This is a little bit cryptic.

Oettinger: You've sort of given me a good opening now on your last comment. I want to start with some abstract remarks, hoping that they will lead John McLaughlin to inject some comments that will bring us back to the specifics. In retrospect, with 20/20 hindsight 20 years from now, a lot of what you just said will be obviously right, or obviously wrong, or obviously somewhere in between. A sort of a military classic — what did you know beforehand, and what did you do with it, and so forth. Out of the many messages in the Wohlstetter book on Pearl Harbor* for the practice of intelligence, there are a couple that I want to single out. I hope that you agree with them.

One is that, by and large, everything that was sort of knowable was, more or less, known to somebody. The pieces were there, hither and yon. One, there was an intelligence failure in the sense of raw data never being available. They were there someplace, but they were masked by noise. Second, whatever people saw, and how they interpreted it, depended on what their theory of the world was, or to put it more modestly, their view of things or what they had in their heads — or in the terms you used, it was a model.

This model has three principal elements: data processing, office equipment, and telecoms. I know John has looked at this world saying that, yes, there are those three elements, but it may be more useful to look at it with five elements. Of course our starting point, our view from way back, was that any differentiation like that is in a sense arbitrary, and that, indeed, looking at information resources generically as a unified whole, with some arbitrary and temporary modalities in between imposed on it, is the right way to look at it. You're saying that your industry is sort of heading that way.

What I'm hoping that John might lead into is to what extent it makes or does not make a difference. To what extent does how you partition the world in three parts, five parts, no parts, whatever, govern what you see and what you don't see, in terms of sharpness and success of market intelligence, market planning, product planning, and so on?

McLaughlin: Well, this is Gene's show, not mine, but I'll make the brief observation that I think with the market Gene has in mind, this model is three-quarters complete. We can trace this view back to the old Gartner Group diagram of the telecommunications industry, the data processing industry, and the office equipment industry. In those days, when they started using it in the 1970s, they were really talking about AT&T, IBM, and Xerox as representing those three circles. I think that one of our observations was that there are at least a couple of other big players there in an industry sense, in the general information business, one of which is the whole field of consumer electronics people. But that's more true if you talk about a broader market than perhaps Gene is talking about.

Oettinger: Does office equipment in there make a difference? It's already a broader market than the traditional telecommunications market.

McLaughlin: Okay. Let's say we have seen with the PC market, for example, the tendency for people to buy their own, within the organization. Policies may limit their choices, but ...

Oettinger: Gene, is this a red herring?

Lotochinski: Let me take a stab at a different answer to that. Back in the early 1970s it is my hypothesis that there were three buying responsibilities in most corporations. There was the MIS (management information systems) department, going under many different names, who bought the computers. There were no PCs in those days, and all computers were bought by this group. They were the high priests of technology in a lot of companies. It was very esoteric. There were always a lot of problems with it. It always meant extremely large expenditures. These people, therefore, tended to be quite highly placed in the organization, with access to the executives and the board of directors of the corporations.

Telecommunications typically was purchased by the office manager, because under a monopolistic situation the only choice you had was to go to the telephone company, and they told you what you would have. It was regulated so that the price was fixed by tariff. The office manager would arrange for the paper, the pencils, the erasers, and the telephones. The office equipment may have been ordered by that office manager as a subset, or in fact, it may have been managed by a secretary, or a group of secretaries. There really were three very distinct buying habits with little interaction among them. What you did with the copiers or the word processors had nothing to do with what you did with your telephone system. That, in turn, had nothing to do with what you were doing with your

*Wohlstetter, Roberta. *Pearl Harbor: Warning and Decision.* Palo Alto, CA: Stanford University Press, 1962.

IBM mainframe, or your DEC, or Hewlett-Packard, or whatever, departmental or location computer.

Oettinger: The reality that you're describing is the model of the buying organization?

Lotochinski: Absolutely. And what's happening, and what has happened, is that those things have all migrated together typically under an organization that is principally an outgrowth of the MIS organization. Now these organizations are looking at all of these different things as being tools to their strategy, which is really where I'm going to be leading as I progress through my talk, but that's why I partitioned the model into three sections. If there's anything missing, I'd have to say it's things like, in industry, factory automation where there would be robots or other numeric controlled tools. I would tend to throw those, however, principally into this office equipment category — specialized devices to do specialized functions. Some devices for people working in offices, others for people working in factories.

Student: There are a few others that you can also drag in, such as mobile radio .....

Lotochinski: That's telecommunications.

Student: Not necessarily. Very often those are related to the emergency or customer service activity, and they'll order their own.

Lotochinski: Well, I'm talking in a very generalized sense, and you're absolutely right. In a very high-level sense, there are three buying decision points; when you get into any specific organization, you may find hundreds. I won't argue with that.

McLaughlin: When I said, though, that it was three-quarters complete, I was willing to exclude the consumer sort of thing at this stage. What it doesn't reflect, though, is the information provider market. Increasingly, the people who are worrying about putting in these systems are the people who have to worry about how they integrate a flow of outside information from Quotron, Dow Jones News Retrieval, Dun & Bradstreet Credit Services, and lots of other people who are selling information.

Lotochinski: Yes, and I will address that later in my talk. You are absolutely right. This to some extent, therefore, is an equipment view of the world.

Student: You're talking software then?

Lotochinski: Not necessarily. I'm talking about services. What I want to do in the next bit is look at the dynamics in this information industry. I'm going to address it in these three categories: environment first, market demand second, and technology third.

In terms of the environment, you must realize this chart (figure 5) is a simplified view of a very complex set of topics. In the environment there are

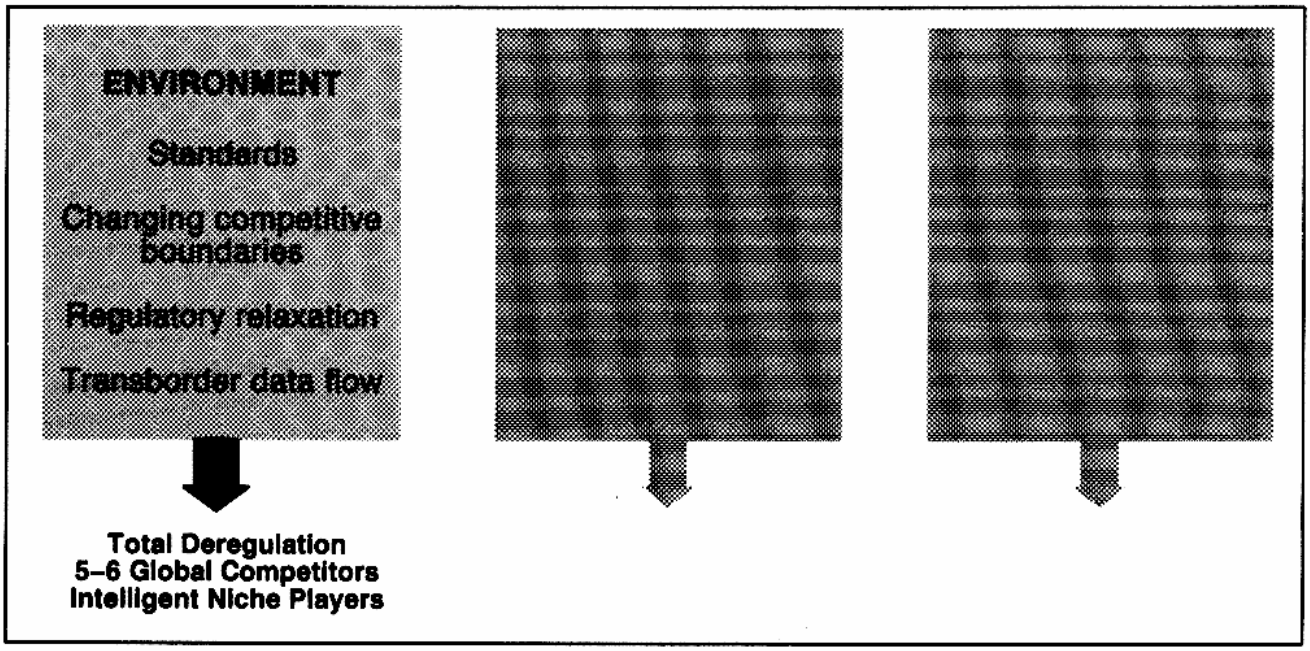

Figure 5. Environmental Dynamics

things like standards, and I'm going to talk about each of these. Changing competitive boundaries — I'll show you some examples of what I mean by that. Particularly in the United States, there is the whole business of the regulation of telephone companies and the deregulation, and the breakup of AT&T, and so forth. In other countries there are a lot of concerns about transborder flow, which in some instances are inhibiting the development of capabilities which might otherwise be possible. In principle, though, a lot of what's going on is leading to deregulation. Deregulation to me means competition, and competition means people trying to do more things better that their customers need, and do those things at a better cost, which may or may not be translated to price. In fact, you may want to get your cost down but keep your price up. What that's leading to, we think, is a trend toward significantly more deregulation and possibly the emergence of five or six global competitors with a lot of niche players in those various segments. So, standards first.

Standards today is an extremely active field. It's a situation where we have people in Northern Telecom, I would imagine about 50, whose entire careers are spent working standards issues and standards bodies. What do I mean by standards? I mean "agreed to" formats, or protocols, or means of interfacing different types of equipment, or different types of information. The standards may be "soft" standards in the sense of information format, or they may be "hard" standards in the sense of which wires connect together, and what the voltages and so forth are on the wires.

One principal model of standards is something known as the Open Systems Interconnection (OSI) model, which is an outgrowth of something called the International Standards Organization (ISO) — it's the OSI of the ISO, which is very confusing — that has defined in its model seven standards layers. It becomes possible to map almost any set of standards against one or another of these layers. I'm not going to go through them because that would be a two-hour lecture in itself.

What I have done on this chart (figure 6), though, is list a number of standards that are either currently defined or currently under definition. I'll just tell you about a few of these. X.400 is a messaging standard. It defines the means of conveying electronic messages from originator to destination. It is a very generalized standard, because when I say electronic messages, those messages might be text, just like electronic mail. They might be graphics. They might be voice. They might be a mixture of all of those. They might be images. The content of the message then, is considered as existing almost like the words on a piece of paper. The X.400 standard, to some extent, almost defines the envelope and the address. When you send a letter through the post office, the post office doesn't care what's on that sheet of paper unless it's postal fraud. But that's an example of a standard that exists and is being supported by a lot of organizations.

Another standard is for directories. I don't mean directories in the sense of the phone book. I mean directories in the sense of actually listing services, people, capabilities, and so forth, which may include log-on procedures and routing procedures for getting to those various services. So a directory, in fact, is a very complex thing, but also very critical.

FTAM (file transfer access and management) is an outgrowth of some activities that are going on toward factory automation. What it means is how a person operating on one system can get into a file on another system and modify it.

EBDI (electronic business data interchange) is a set of standards to help different companies connect together electronically to place orders, acknowledge orders, transmit invoices, and receive payment.

Student: Isn't that already a family of standards, but one for this industry, one for another industry?

Lotochinski: There is a family, but this is a move toward making it a global standard. If we could get something like these EBDI standards universally implemented throughout the United States, then you could start to have a lot of improvement in the ability of businesses to do business. And, of course, I'm starting, Tony, to get to one of your earlier questions, because this now branches out beyond the confines of a particular company.

Today it's not unusual to find tremendous amounts of information regenerated; an order is taken and typed in, and various separate invoices are printed and sent out. At the other end, very separately, a payment is drawn up and mailed, and, very separately, an acknowledgment of the payment is made.

ISDN (integrated services digital network) is another set of standards that deals with how to handle both voice and data in the telecommunications industry. ISDN is a set of standards that has extremely high visibility these days, partly because a lot of companies are attempting to differentiate themselves from their competitors by saying, "We're first with ISDN. We're closer to ISDN.

We've got more running on ISDN than anybody else." We're in that game, too. In fact, next week there's a big conference in Phoenix and we're going to be there. We're running ads this week talking about how great we're doing in ISDN.

ISDN is very peculiar. It's a standard set by an international body known as the CCITT (Consultative Committee for International Telephones and Telegraph). This is an organization of the International Telephone Union, which has its headquarters in Geneva. It issues a number of standards which are updated every four years. The last update was in 1984, and in these little pie charts (figure 7), the shading represents the degree of completion of those standards. For example, terminals and PBX, which is the line standard, is about 80 percent complete. The next update will be in 1988. In these last four years, there has been tremendous activity at agreeing on what that next update will be. It doesn't exist yet. No one can therefore say they meet ISDN standards, because they don't fully exist. You can see the general one is fully complete, because that's just an overview, and the others are progressively less complete.

Why am I talking standards? The reason is it's important to organizations who want to look at information management in a holistic sense, to be able to integrate or link together diverse systems. Again, talking to the point that you made earlier, if you didn't have standards, everything would exist as isolated islands. There is, more often than not, a desire to communicate between these islands, and standards help in that matter. In fact, they can help eliminate the whole concept of islands.

The second thing, with respect to this business of dynamics in the industry that I talked about, is changing competitive boundaries (figure 8). We've seen a lot of mergers. IBM, Rolm, and MCI: what that says is here's an organization, IBM, which originally was exclusively in the data processing sector, moving into telecommunications via Rolm, which is a PBX manufacturer, and originally via Satellite Business Systems, and now through MCI, which is in the inter-exchange carrier or long distance telecommunications business. AT&T and Olivetti: Olivetti is an Italian firm in a lot of fields, but I'd say, from this perspective, particularly office automation.

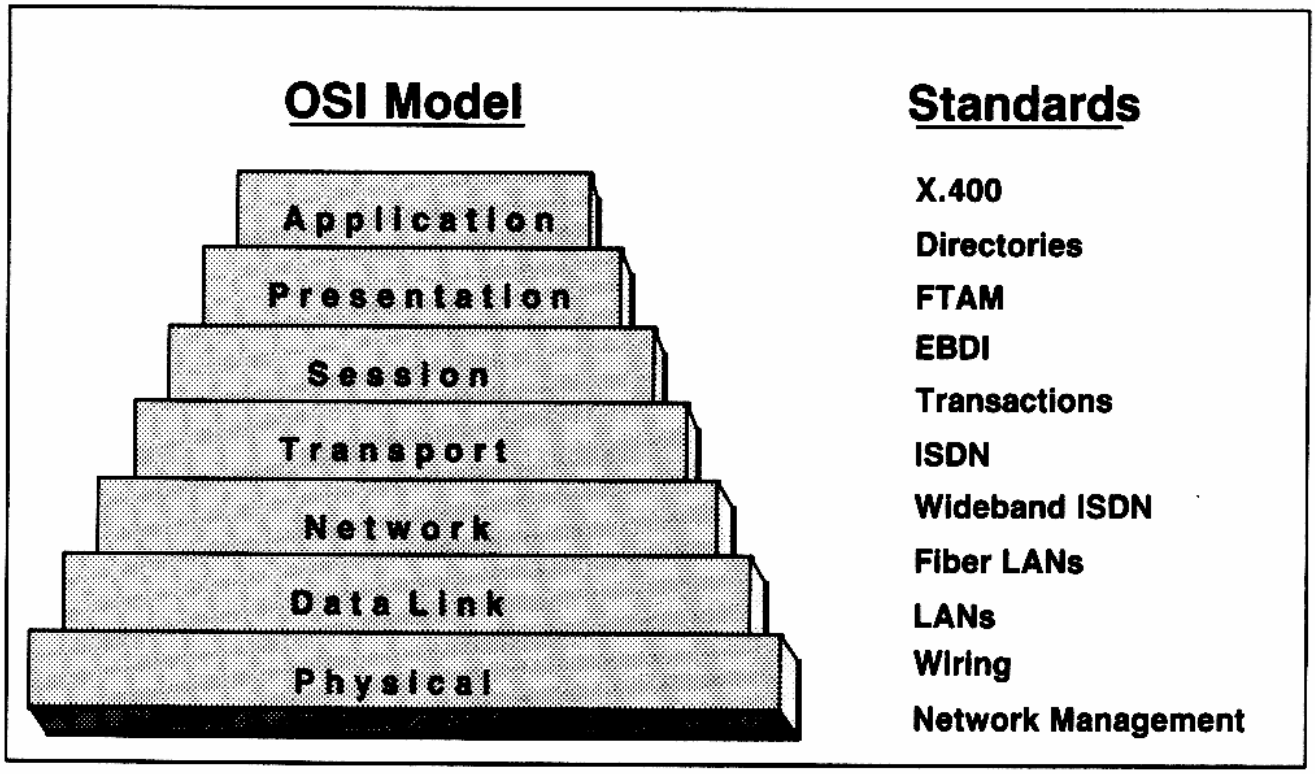

Figure 6. Standards Activities Today

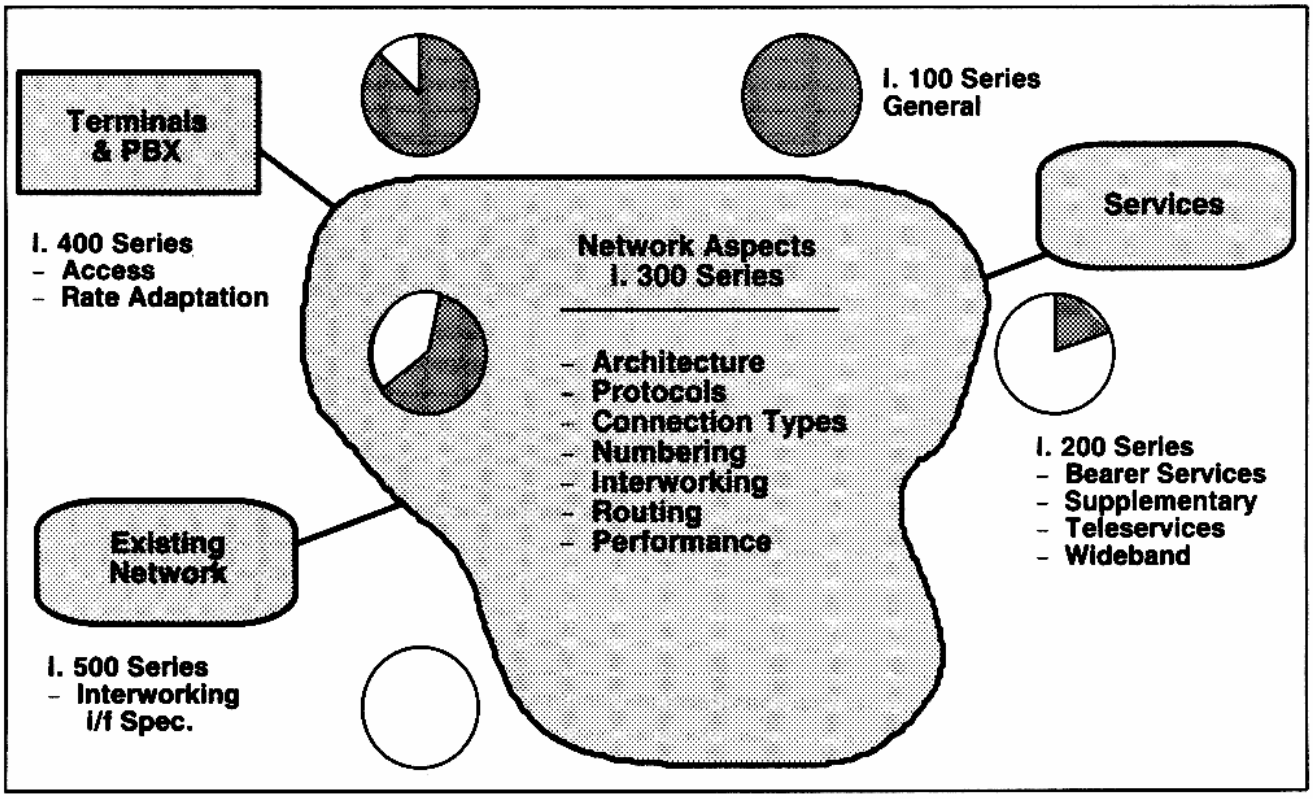

Figure 7. ISDN Standards and Status in CCITT (as of year end 1984)

Mergers

- IBM / Rolm / MCI
- AT&T / Olivetti
- CGE / ITT = Alcatel
- Burroughs / Sperry = Unisys

Global Reach

- Northern Telecom
- AT&T
- Siemens
- Ericsson
- IBM
- DEC

Figure 8. Changing Competitive Boundaries

CGE and ITT: this is a situation where there's been this major merger, forming a new company, Alcatel, taking over the telecommunications operations of ITT and merging them with a French company. And Burroughs and Sperry have merged. Of course, this whole business of mergers is not confined to the information industry, but it is happening here also. Every time there is a merger, it changes the ground rules again.

Global reach is another competitive focus. There are a few organizations, and I put us among them, that really are multinational in nature, with the ability to operate in all fields. I think the chart lists the principal ones. The Japanese certainly are also players. And there are going to be a lot of niche players. Technology today is too easy. With just a little bit of silicon and a little bit of software and you can do anything. The trick is to do the right thing, so there are going to be people coming up with niche-type approaches.

Other things going on in respect to the environment are regulatory and judicial: the Huber Report recommendations, the modified final judgment, and the Computer III inquiry. I'll start with the middle one, the modified final judgment that split up AT&T. It broke it up into AT&T, which remains, but is much different, and seven regional holding companies. Computer Inquiry III, which is an activity on the part of the Federal Communications Commission (FCC), really has as an ultimate objective to improve competition in enhanced services. One way of doing that is to let the telephone companies get into that, but since they have a monopolistic attribute, what the FCC is trying to do with these computer inquiries (and this is the third one) is try to figure out how to have a monopolistic aspect and also have a competitive aspect and therefore help the development of enhanced services. It's not an easy task, and again, that topic in itself could occupy a two-day seminar.

As part of the modified final judgment, the outcome was under the control of a judge who requested every three years that the Department of Justice tell him how things are going. The first three years have gone by and a report has been issued called the Huber Report. It recommends a lot of changes to the regulations that have been placed on the regional holding companies by virtue of the modified final judgment. It's causing changes in the environment, forcing organizations who are interested in information management to understand the changes and to use them to their advantage.

The final chart under this category (figure 9) is transborder issues, particularly in Europe. Grave concerns exist about raw data crossing international borders, or information services being provided in another country — databases of, let's say, citizens held in a foreign country. We find some peculiar situations going on in some countries. The reasons for barriers? Politics, privacy, and protectionism. To a large extent, telecommunications in most countries of the world has been deemed to be a national resource, just like roads, railroads, and perhaps airlines. That says most nations are very much concerned about ensuring that it's totally under their control. For organizations that need to work around the world, these sorts of things become issues because, in part, they can mean different standards, different rules, and different regulations.

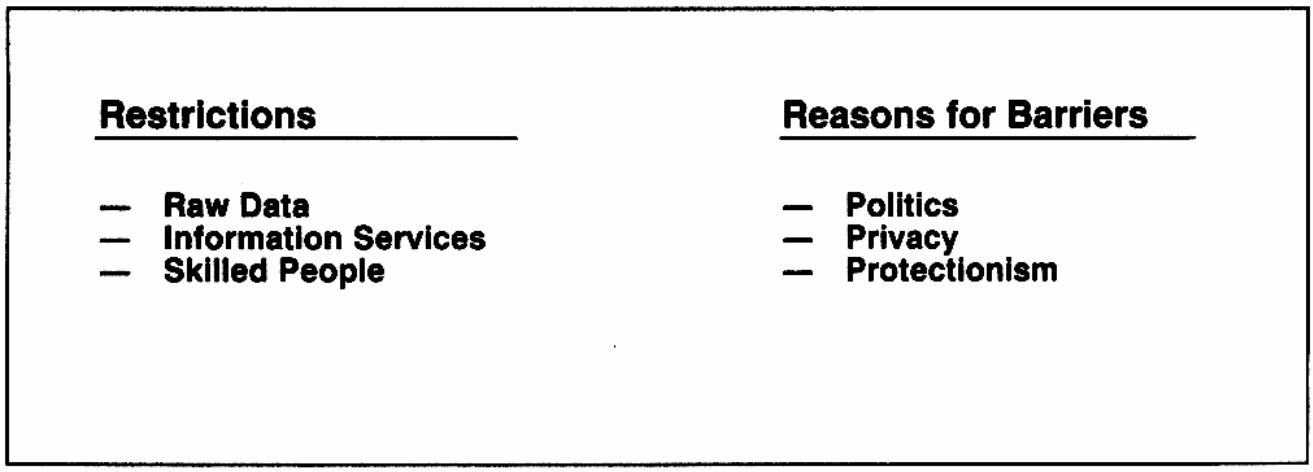

Figure 9. Transborder Issues

The next dynamic is market demand (figure 10). This chart looks beyond simple products and starts looking at some of the things that our customers are asking for, or telling us they're going to look at. One is distributed computing, and I will talk about that. Certainly networks are computers, and I'll also talk about them.

Another is inter-enterprise networks. Yes, you can do a lot if you establish a network within your own organization, but you can also get additional leverage if you can tie in to your suppliers and your customers. The other thing is more and more data communications, which I just put down here as megabit communications. By that I mean megabits per second. There is going to be an increasing demand for higher speed communications.

Student: Do you really mean inter-type networks or primarily intra?

Lotochinski: Inter. Intra have been around for a long time. We're seeing a lot greater demand for inter-enterprise networks.

Student: Intra has not done very well, though. You still have local area network problems.

Lotochinski: I'm sorry to disagree. I think you'll find there are pockets of very good local area networks. In my final few charts, I will categorize three different degrees, and I'll tell you some of the things that we're hearing about the way people are approaching the problem. For some people — yes, it's a mess. Others are in pretty good control.

Student: Well, I think a huge market exists, but you don't know how to get from here to there. The cost of putting in local area networks is ridiculous if only 10 percent of your people use personal computers. Some day, 80 percent of your people will want to have computers.

Lotochinski: That is why the directory system is so extremely important to information management. That is why when I talked about standards, I had directory as the second one. Remember what I said that the directory will do. It will list the services; it will include log-on procedures and routing procedures. If you can do that, then your casual user can access whatever he needs, even if it's on an occasional basis. I have to agree that today, to a large extent, a lot of stuff is very clumsy, and very awkward, and almost impossible for anybody except a computer specialist. Directories are the answer.

Student: And another problem is an awful mass of accumulated files in any corporation which never were designed for remote access, and there's just a heavy over-burden of millions and millions of lines of code in COBOL that paralyzes everybody.

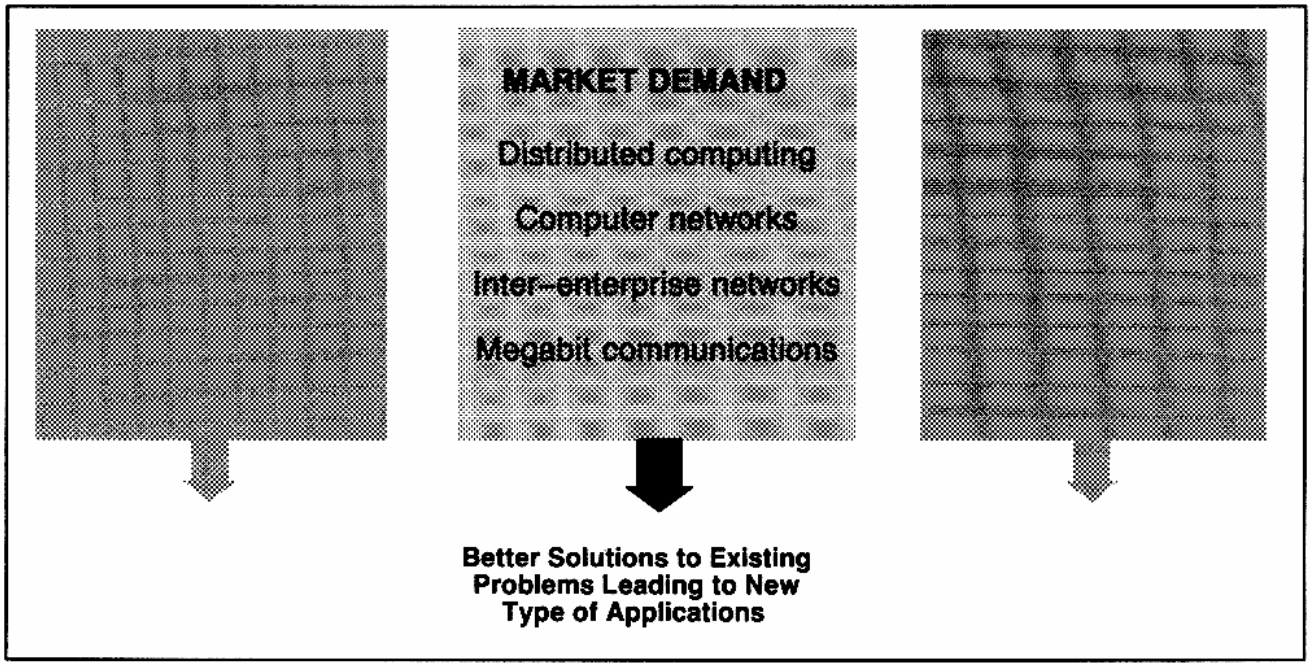

Figure 10. Market Dynamics

Oettinger: Where there's death, there's hope.

Student: Where there's death, there's no proof.

Lotochinski: On the other hand, we were talking about certain people who throw everything away and if they ever need anything, someone will send it to them, and the reason is that historical information is interesting but not very vital. What's vital is stuff that is current, and projections. So, yes indeed, there may be tremendous investment, and a tremendous number of lines of code, but it doesn't say necessarily that your databases have to remain confined by that. The right thing, perhaps, may be to look at restructuring your databases or creating new ones, and allowing the other ones to wither.

Student: I just want to beat this a little more. You're looking at this from a telecommunications point of view, I think, and the cost of redoing the software — I was intimately connected with this — is very, very high to make your current data broadly accessible. I just want to say that when you go down into that kind of level of application, you may have a great technological solution, but the economics of doing what's necessary are very unfavorable at the present. What it leads to is another thing that technically we can do, but that we're not going to do very fast, and this is one of the reasons there has been the slowdown in the sales of computers. And, there's a whole bunch of other stuff. Lord knows in my previous job we had lots of clients who are facing these questions and they've looked at millions, and millions, and millions of dollars of costs for doing what we know we can do technically, and they said we're not going to do it for awhile. Enough said.

Lotochinski: Let me counter that by saying that one very well-known example of a strategic application of computing and communications was American Airlines, who put in the Sabre System and then put in the AAdvantage program. What the AAdvantage program did was generate tremendous customer loyalty by rewarding customers for repetitive use of their services. The way they implemented it was by virtue of a computer system. When American Airlines did that, it put all of the other airlines at a significant competitive disadvantage. Even though those other airlines had millions of lines of code invested, millions of dollars invested in other hardware systems, they had to scramble because strategically they had to do something similar. There are cases where the strategic importance to the organization outweighs the cost of implementing, which also says, "Yes, indeed, understand the cost, but also, indeed, understand the penalty, which is the cost of not doing some of the things that are possible." What I'm saying is I don't disagree there's a large cost. I'm saying there are cases where it makes sense deliberately to swallow the bitter pill.

Oettinger: I'd like to take another moment — the Sabre example is a good one. You've telescoped time. The darn thing started 22 or 24 years ago, a quarter of a century ago.

Lotochinski: But the AAdvantage program is very recent.

Oettinger: That's the point. When Sabre went in, there was no thought of the AAdvantage program. Evolution is a very slow process.

Student: That's not quite true, either, Tony. There was a strategic advantage used much earlier with the Youth Fare program. If you were a youth and there were spare seats on a plane, there was sort of a special standby program. And American killed the other airlines for a while, because youth — they may be young, but they're not stupid. To make sure there were spare seats on the airline, they began to call and make lots and lots of reservations. With Sabre, if you didn't pick up your ticket 24 hours ahead of time, you lost your reservation. The youth discovered that, so they called these reservations on the other airlines that had to copy American, so American got the business traffic and the other people got the youth. It was used strategically very early.

That is an external system and I don't know to what extent the AAdvantage system beat the TWA Frequent Flier. A number of other airlines were able to move very quickly. It's still a different kind of a program.

Lotochinski: I fly all the time. The worst frequent flier programs are the ones that are not automated. The ones that are not automated are situations where you have to fill in a form every time you fly, which means you have to remember to carry it with you. You have to hand it to the agent when you board the aircraft. A lot of airlines, and I would even include People's Express, resisted the frequent flier idea. The point is that, by virtue of communications and computing, it gave American a strategic advantage. I will get to other examples later.

McLaughlin: Before you go on, there is a point to note about the inter-enterprise networks and the electronic business document interchange, or data interchange. The fact that the possession of a system can give one enterprise a strategic advantage,

a la Sabre, is one of the reasons why an awful lot of companies resist standardization of business data interchanges, simply because if you standardize enough things, somebody loses their strategic advantage. That's one of the problems we keep having on the standards side.

Lotochinski: That's the counter view, and it's real. Same thing for manufacturers, too. Why accommodate a standard if it diminishes your ability to lock in customers? But I must say that there's also a much greater move toward standards because a lot of companies also see that they can increase their markets.

This is a very simplified view of networking (figure 11). What I'm trying to show here is today's view of computing. Let me do this by explaining yesterday's views of computing. Yesterday's view of computing was a mainframe, with terminals connected to it. The problem of the person running that computer and the network was how to connect those terminals to the computer. What happened was, networks were set up, computer networks, which had absolutely predictable connectivity, terminal-to-computer. A telecommunications problem from day one always had been how to connect a telephone to any other telephone. The way to do that was to establish a very carefully planned network that allowed absolutely unplanned connections.

In other words, you have the original computer network with a planned network and planned connections, opposed to the original telecommunications network with a planned network and unplanned connections. I think that with the significant proliferation of personal computers, that view of computing has changed to the user's view which says, "How do I connect the user to the applications that he or she needs?" It may be a particular program like a Lotus spreadsheet that happens to reside on a hard disk in a PC, or a database that may happen to reside on the mainframe of the company which the individual might like to download and work with, and perhaps load the results back up. Or a messaging system, because this personal computer or this intelligent terminal might be used for messaging.

What has happened is that the computing view of networking today has become pretty well equivalent to the telecommunications view of computing. Let me translate this into IBM terms. This means peer-to-peer communications, which is one of the big things that IBM is working on these days. They used to have a hierarchical one; everything went through the mainframe. If you wanted to go between two subtended terminals, you went through the mainframe. You had to use a lot of mainframe resources, relatively a lot. Now they're talking peer-to-peer. That, in fact, is what we're seeing in terms of the market. Relatively few people just sit at a terminal and work just with one computer. There are still situations like that. Those are software assembly lines, people who take orders, perhaps, or order input.

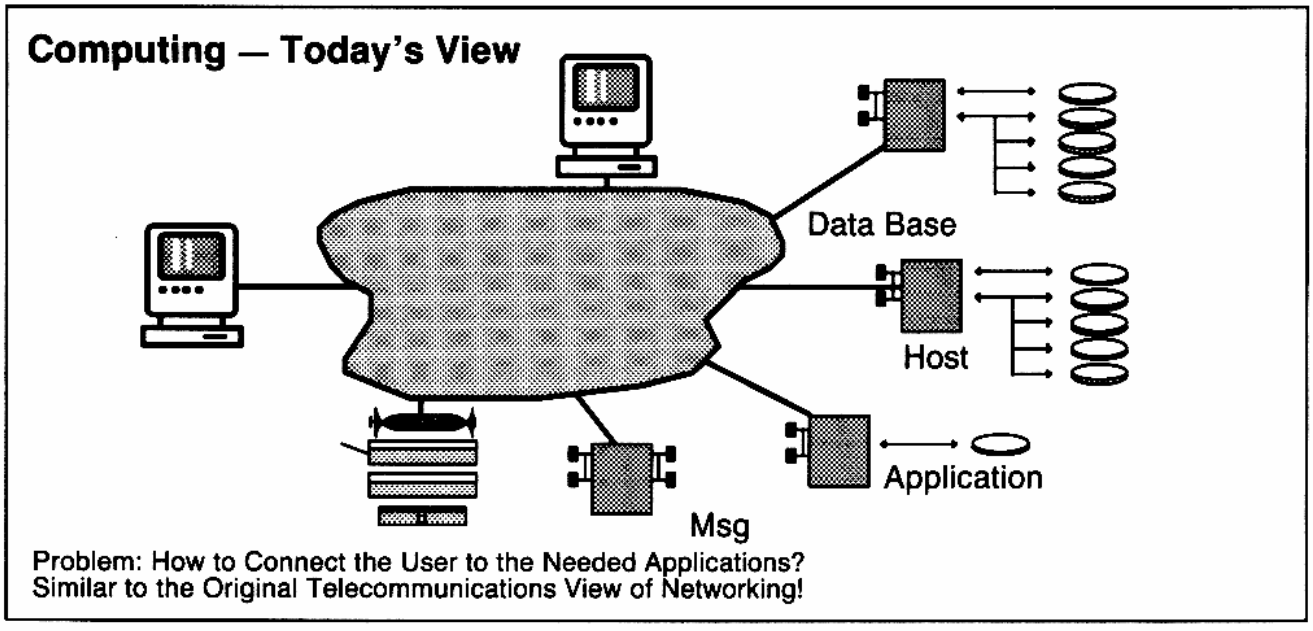

Figure 11. Networking Today

This is what the enterprise network model starts to look like (figure 12). The intra-organization network, linking together whatever makes sense for the enterprise, and the inter-enterprise which links customers, suppliers (two that I've spoken about already), distributors, information sources, and perhaps the public at large. We're seeing in the marketplace a much greater demand for this type of network structure. What that starts to say is it needs to be able to proliferate beyond the borders of an enterprise, which again says maybe this is where standards make sense, because if you don't follow a standard maybe you can't get to all of those external people you need to get to.

Student: There's one thing, one implication, of this for companies, and I wondered if you have any thoughts on it — that is, security. When you start interconnecting with other outside segments, whether it's the public or other enterprises in the same business, or suppliers, or whatever, they're connecting through some gateway into your LAN so that everybody inside can talk to everybody outside, and then you have this security problem. How do you protect what you need to protect and that sort of thing?

Lotochinski: That is an issue, and it has two aspects. One is protection against industrial espionage, which may require things like encryption. I have a whole presumption in here that most things these days are digital in nature, so it does become possible to bulk encrypt. That's one aspect which, of course, is of great concern to the military in a lot of applications. The other is the security against the hacker breaking in — the dismissed employee who still has access to all the access codes being able to break in, and so forth. Indeed, it is a problem. Indeed, there needs to be a lot of work on it. I guess my reading is, it is not yet at the level of perfection, or there is not yet the level of attention being paid to it that needs to be. It tends to be a bit sporadic. We see some organizations being very concerned. We see others who tend to rely on passwords with secure mechanisms for updating.

If you think about ISDN, for example, and if you say maybe ISDN is a standard that will allow this type of thing to happen, one thing you can do is exchange a lot more information about who is calling. You can have a lot more interrogation using a signaling system. I think ISDN, in fact, will allow you to do a tremendous amount with respect to security.

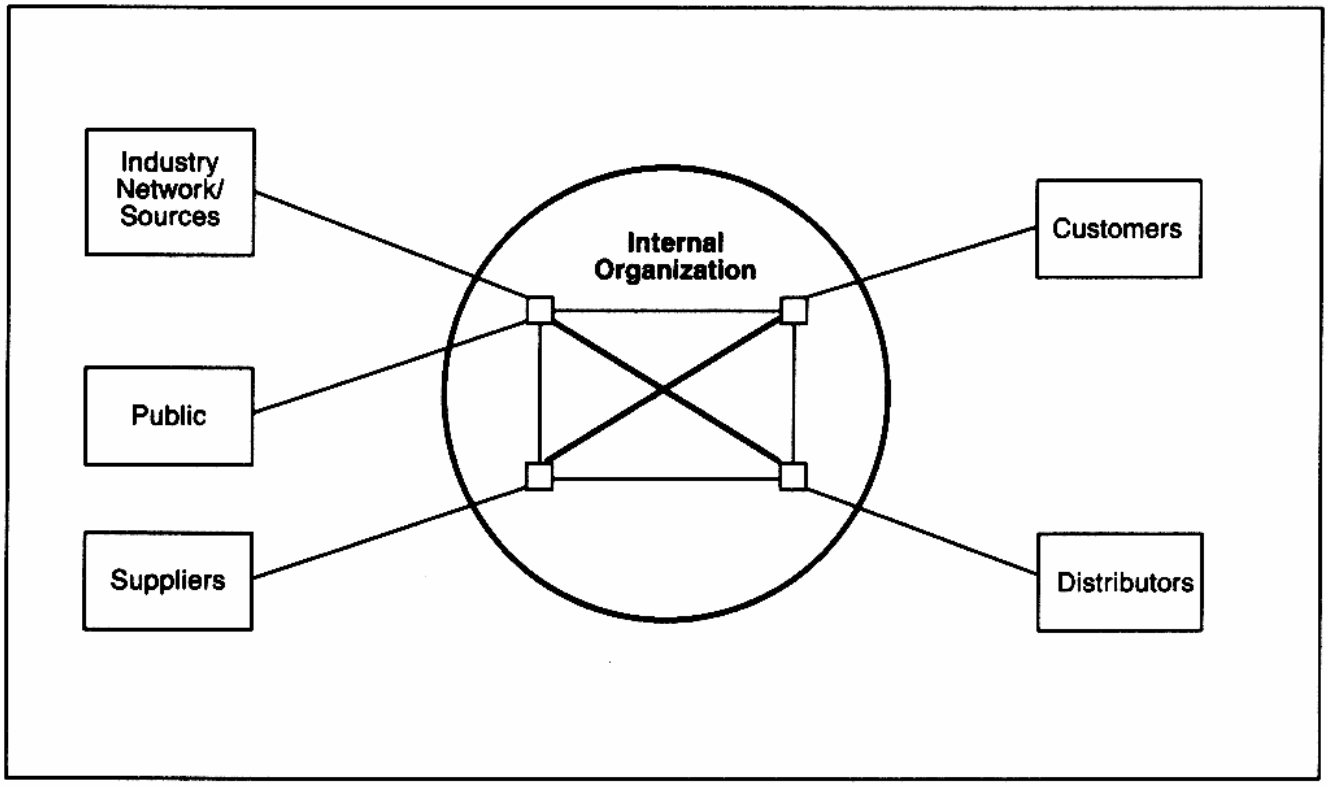

Figure 12. Enterprise Network Model

The next thing I'm going to talk about is technology. There are really just these four dynamics (figure 13). People are going to tell you there's a lot more, but there are just these four. One is high bandwidth. Optical fibers turns out to be an almost ideal technology. It has almost everything going for it. It uses glass which is freely available. One can almost say it has infinite availability. It has a very high bandwidth — thousands of conversations on a single fiber. It's very cheap, and in a technical sense, can go very long distances without requiring applications. In cities, for example, this means that optical fibers can go between telephone company exchanges without any amplifiers in the streets or on the telephone poles. That's absolutely ideal. What is happening is a tremendous installation of optical fibers, both in local areas, and in the interexchange areas. You see U.S. Sprint advertising optical fibers as their major differentiation. It's all digital. It's mostly based on optical fiber. AT&T is putting in huge optical installations. In fact, they've put one a half-block from my house in Nashville. It's going from Chicago through Birmingham to New Orleans. All these bits are running by.

There are a lot of people who claim that there's an overkill happening with respect to optical fibers. My view is it's a little bit like memory. The more that's available, the more will be used. As it's available, and as supply exceeds demand, the price will drop; that will stimulate demand. The interesting thing is when you think about technological items, systems architects always use economic tradeoffs; they use freely that which is very inexpensive, to save that which is very expensive. The prime example I like to give is the computer. I was going to college in 1959. The most difficult thing in computers in those days was core memory. It was difficult to manufacture and there were only a couple thousand bytes available in a computer. That was the most expensive thing, and the stuff that was cheapest was programmer time. You had very elaborate programming techniques to conserve bits. The price of memory has plummeted. What you do today in computers is literally to burn memory to make it easier for users. I'm not talking just programmers; I'm talking also the casual user. A good example of that is Apple with the Macintosh, which literally burns memory to make it very easy for people to use.

This is what's happening with bandwidth right now. It is changing the economic balances of networks. Things that you used to have to cluster, you can distribute. Why do you elect to cluster or to distribute? You look at the economics. It may be that you distribute because you want things closer to where people are, closer to where resources are, rather than clustering them because, gee, you didn't have the bandwidth and you had to have these high priests of the computer center to keep the thing running. I'm really harping on this because I think optical fibers are probably going to result in a much greater change in the architecture of information systems than almost any other technology around.

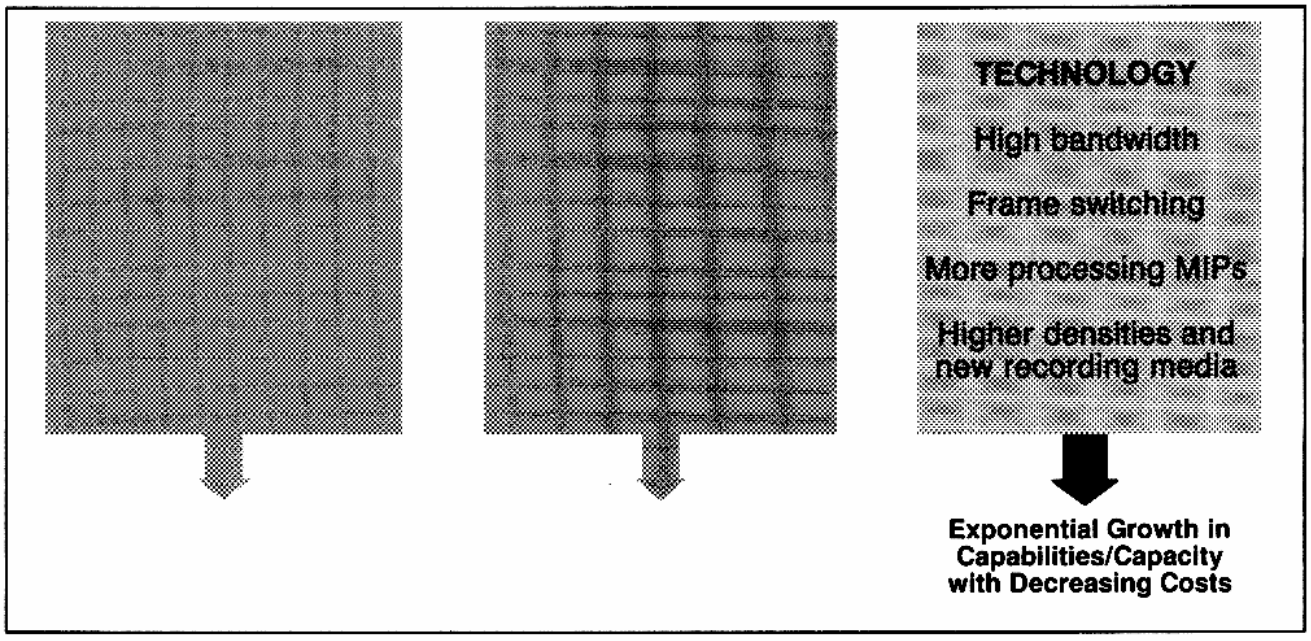

Figure 13. Technology Dynamics

Another thing in technology is switching. Frame switching is just a way of switching at higher and higher speeds, and we're even looking at switching at the optical rates right now — very, very high, matching the transmission capabilities.

Another technology dynamic is processing. Clearly, processing is plummeting, and there's lots of activity in there. Memory is plummeting, and so more MIPS (millions of instructions per second) are becoming available. You can put them on your desk. All of this points to exponential growth and capabilities and capacity with significantly decreasing costs. Information system managers, information system directors, need to understand these things. They need to take them into account in determining what their strategies are.

I've put together another model that describes these technologies as the networking components (figure 14). We break them down into three. There are a couple of others: the pipes, which are the optical fibers and some other stuff, and network management, which is very important, but not particularly germane to this discussion. Then there are the three principal components. Input and output to the network are typically terminals, telephones, data terminals, intelligent terminals, scanners, printers, whatever — facsimile machines. It could be robots. Then, things which access and transport the messages which these devices generate or need. Those may be public switches, read telephones, private switches, read PBXs, which are a combination of access and transport in very local environments, like this building.

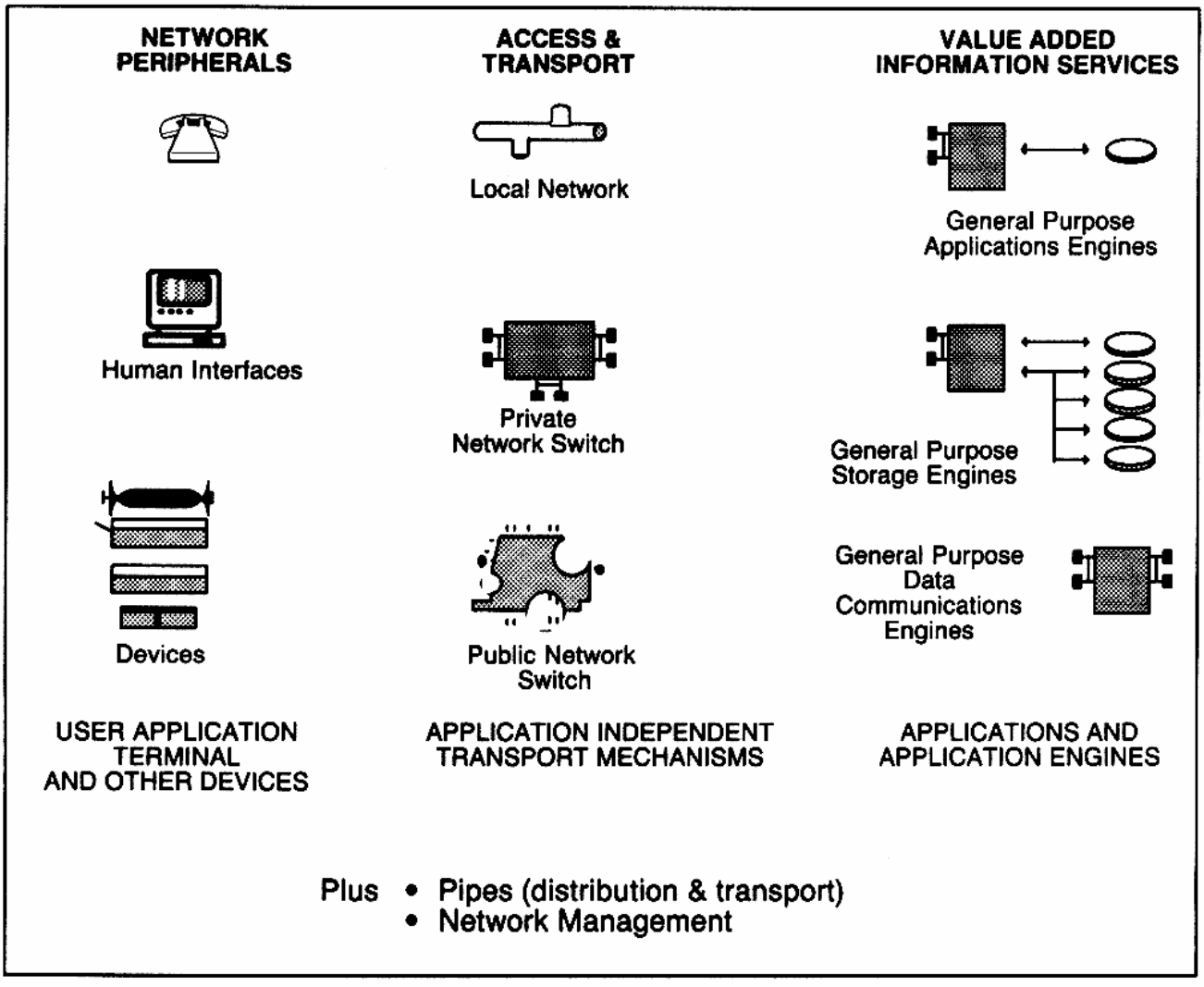

Figure 14. Networking Components

This access and transport capability becomes — if you think about it this way — application independent. Why? It's because people use it to access services. What are those services? Databases, general-purpose storage agents, computing capabilities, general-purpose application images, communications images, general purpose data communications. What do I mean by that? I'll give you an example: a machine that will handle integrated voice, text, graphics, and image messaging. It's extremely powerful. You've got some capabilities that we offer on our private switches right now that do this. It's extremely powerful.

As soon as I start talking voice, information-managers can't really see doing that on a general-purpose computer unless it's a special-purpose machine. With optical fibers causing the costs of transmission to plummet and, in turn, the prices to plummet, what we're seeing is information managers being able to look at their networks and plan them on the basis of, "Where are all my people? How should I connect them into my application-independent access and transport mechanism? Where's the best place to locate all of my various devices?" The answer may very well be, a lot of that stuff should go in individual buildings, individual locations, rather than centralizing it all on my mainframes. You can translate that another way. I believe that separate capabilities mean that there will be much greater distribution of functionality around an organization, and we are seeing it. There will still be mainframes, principally for large databases. There'll be a lot more distribution of functionality around the mainframe linked by networks.

Now we come back to my three dynamics (figure 15). We talked about the environment. We talked about the market. We talked about technology. That means that we're seeing telecommunications moving from voice to multimedia. It's possible. It's desirable. We're seeing a significant upgrading of public carrier networks. In fact, there were a lot of people who predicted when the Bell System was broken up, it would sound the death knell of the local telephone companies. They have emerged stronger than a lot of people had thought. Some people say even stronger than AT&T in some ways — such as public carrier provisioning of private virtual networks. It becomes possible now, with these technologies and everything that's going on with respect to deregulation and so forth, for public carriers to partition chunks of their network and offer them to customers as virtual networks.

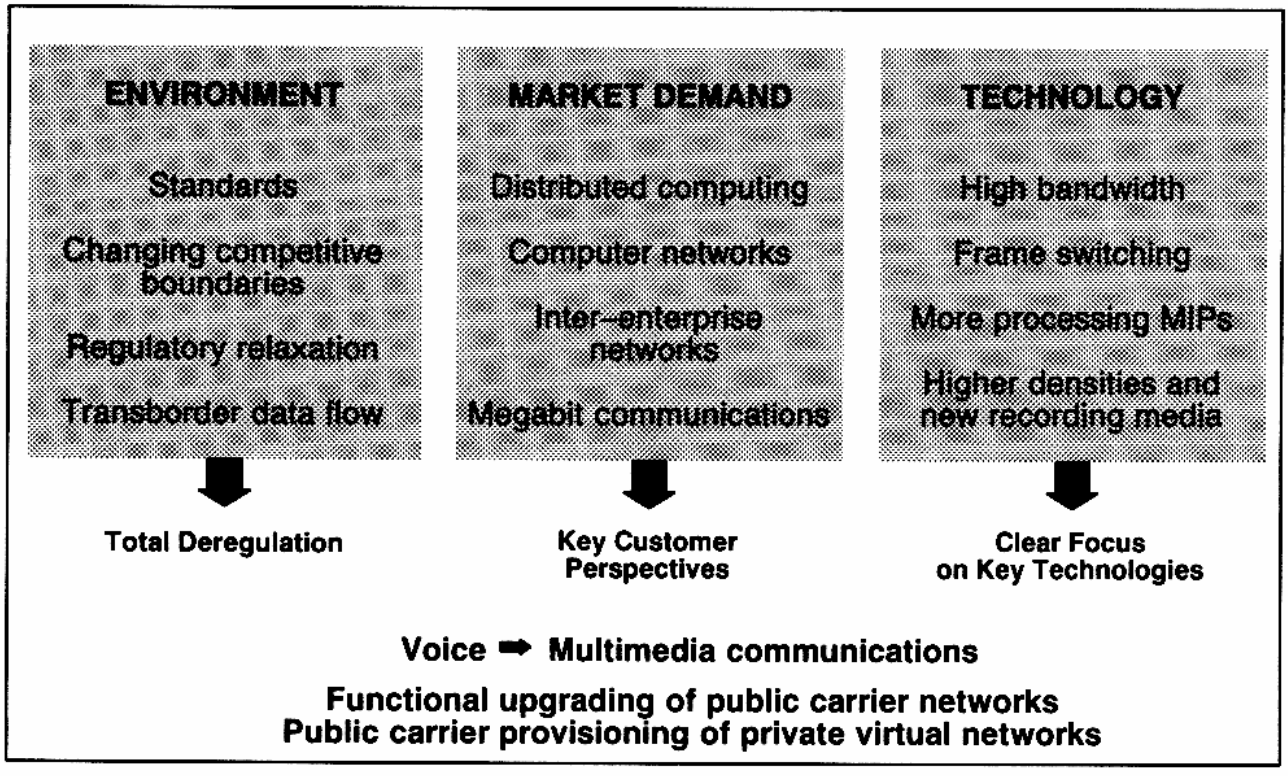

Figure 15. Converging Dynamics

Why would a customer want to do that? To handle peaks. It may very well be that most of his communications traffic he can predict quite accurately. He'll own that — absolutely own that — and use the public network for peaks. It may very well be that it makes sense for the interexchange portion, which is the long distance portion, to be provided by AT&T or MCI or U.S. Sprint, or maybe all three — a triple source, for security virtual networks. Also, there is then an ability to look at computing as peripheral to communications infrastructure rather than computing as the core of information systems. That is a major change we think is happening.

But what are the customer perspectives of all of this? I'm going to categorize commercial users in three categories (figure 16). The first is the category that looks at communications as a commodity. Let me give you an example. There are companies or corporations which are highly decentralized and have perhaps just a holding company name; they have individual operating units which, for all intents and purposes, are totally autonomous. There may be multiple brand names, with little communication among those organizations and little communication between those organizations and the holding company. In those cases, communications is just a commodity. Anything we need to do is local, so we'll look maybe at a PBX. We'll maybe look at some local area networks, and if we need to have anything beyond that, we'll just take some circuits or we'll sign up with AT&T, or New England Telephone, or whomever.

Another class of customer that might look at communications as a commodity is one that is perhaps highly manual in terms of what it does, or perhaps is very large, but really gains very little strategic advantage from looking at communications other than that. Perhaps some of those are fast food chains. It might be interesting to have some inventory capabilities, but in principle they just put a pay phone in, and maybe one at the franchise head office or whatever.

Another category of customer is one that looks at communications as an operational necessity. An example might be some manufacturing companies. It's pretty important that we should get our results added up every month and every quarter, so we want to make sure we collect all that. It's fairly important that we get information out to our field offices about the latest changes in prices, so we'll communicate that. Let's try and make sure that we have enough and we'll do it at a very low cost. We'll just treat it as a cost. There's quite a large group of customers who do it this way.

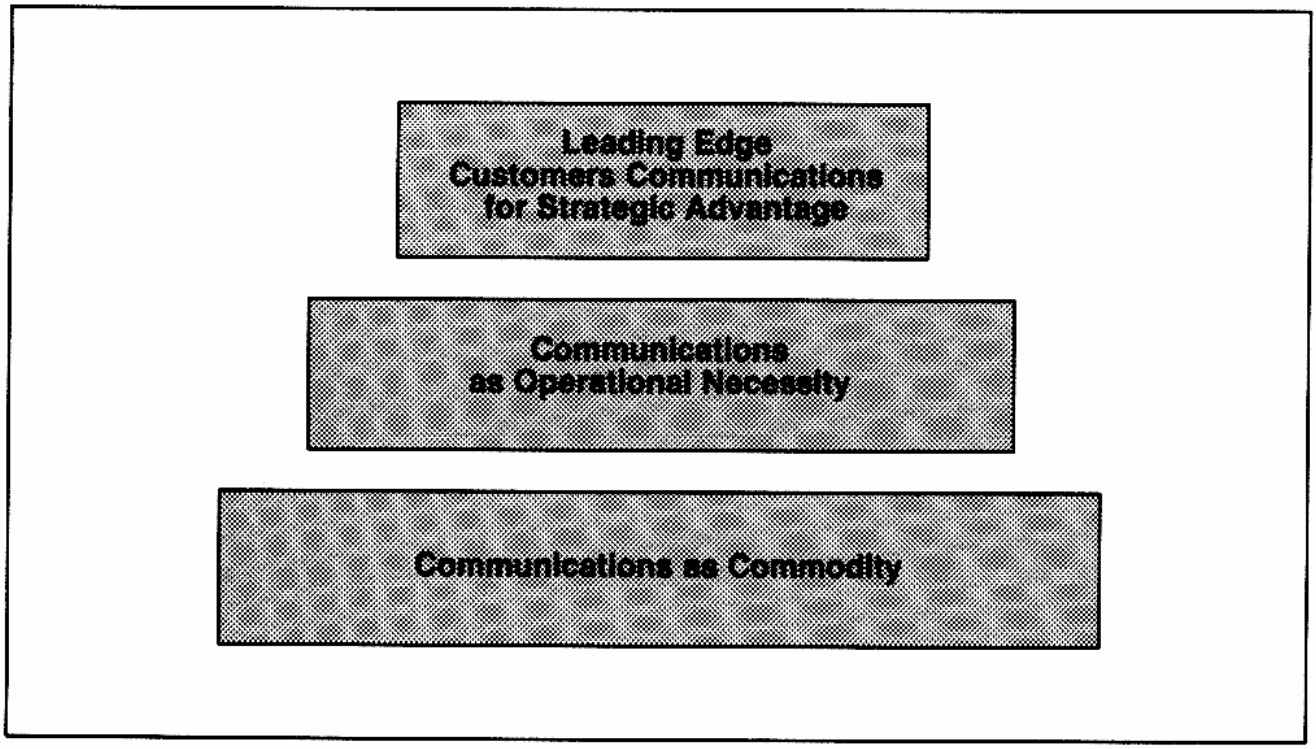

Figure 16. Customers' Perspectives

The customers that are most interesting are the ones that treat communications as a strategic advantage. Now we get into some examples. The business of banks, when you really think about it, has changed from the business of handling currency to the business of handling information transactions. When the business of banks is information transactions, which may in fact be global in extent, then communications will offer that bank either a strategic advantage, compared to its competitors, or quite possibly a strategic disadvantage compared to its competitors. A large number of industry types fall into that category. Insurance is another one. The business of insurance is underwriting. What is most important is contact with customers, rapid ability to provide quotations, and for service, rapid ability to satisfy claims, doing all that in an era in which money is changing rapidly. Exchange rates, interest rates — the whole investment thing is changing very rapidly. The insurance industry, to a large extent, perceives communications as a strategic advantage.

Another example is any industry that has a "perishable" product. Good examples are airlines. When a plane flies with an empty seat, the opportunity for revenue is gone. Another example is a hotel. An empty bed in a hotel is lost revenue. How can these customers fill those seats, or fill those beds? With communications — with information management, really. There are lots of other organizations that might on first blush fall into these other categories. They're saying, "My goodness, if we really think out ahead we will be able to make information management a strategic advantage for us."

I had a meeting Monday with one such organization. I cannot tell you the name of the company, because I would be divulging confidential information, but I will tell you some of the conclusions. Number one, they elected to look out to 1992. The marching orders for this study were, first, we don't want you to be a long-term employee with our company, because if you are you'd be too ingrained in doing things the way we've always done things. So they went outside. Secondly, just assume that anything that you think you might need in the way of technology is going to be available. Technology is galloping so fast; just presume it's going to be available. What should our information system look like in 1992? Their conclusion: We have to establish for our corporation two ground rules. Number one, we will allow nothing to be bought that does not connect to our network. We will sacrifice functionality for connectivity. They will not tolerate unconnected equipment, or local area networks, or terminals, or anything. Their perception is, every time they set up an island like that, because the added functionality gives them another 2 percent, or 3 percent, or 4 percent efficiency or something, they wind up putting in whole teams of people trying to figure out how to get information from that island over to the rest of their system. They spend a lot more money at that than they saved in the first place. The interesting thing about this is you'll say, "Maybe they're going to cut themselves off from a lot of innovative things." I don't think they are. I think they're on the right track.

The second thing. We will set up a network that will be the absolute core of our information system. There's going to be a corporate-wide network and there's going to be a network at every one of our locations. A corporate-wide network is going to be mainframes. The number of MIPS that we will have in 1992 will be 20 times the number of MIPS we have today. MIPS is a measure of processing capability. You might measure a typical mainframe as a hundred. Their perception is you can have that on the desk. It's very interesting.

Why did they do this? Because their perception is it's extremely important to have connectivity of all devices whether they be devices in the factory, or devices in the office. That is a leading-edge customer. What's going on today in the industry is everybody who wants to play in this game is going after leading-edge customers. We are. AT&T is. The Bell operating companies are. IBM is. Digital Equipment is. We all are. Why?

Interestingly enough, those people tend to be the larger companies. They tend to have the staff that can understand the future advantages. They tend to have the money to be able to experiment and make it work, and as they do it, we vendors will all build capabilities that can proliferate to everybody else. Go after those leading-edge customers first, and the capabilities then become available for the other large companies, for small companies, and for the public at large. There's just a tremendous attack on that market sector.

My final slide is implications (figure 17). Okay, so what is it that people are doing? You have to develop an information technology strategy. I think in the military to a large extent communications, information, always has been perceived as a strategic necessity. I say always. I don't mean modern times. Always. Certainly that awareness is coming to business and what we're saying to business is, "You'd better develop that. You'd better under

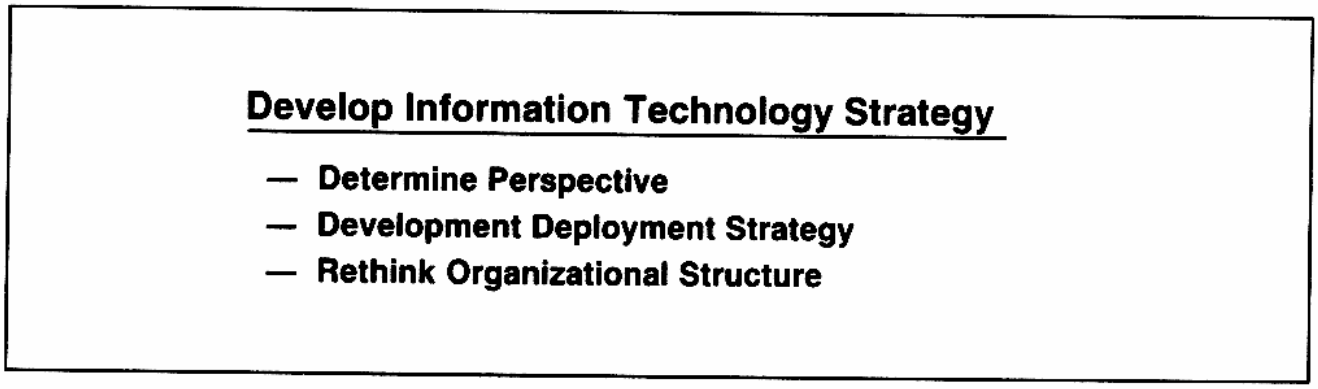

Figure 17. Implications

stand why. If you just look at it as a commodity, you're not going to get the strategic advantage it might offer you, so you'd better figure out why. You'd better figure out how you're going to do it." How do you get there from here? By recognizing these millions of dollars of investment. If you just allow yourself to look at that as a millstone, it won't work. You had better think of your people. In fact, my claim is that the human resources organization of leading-edge companies should probably report to the chief information officer, because people are sources and destinations of information just as much as machines or terminals.

Chief information officer is a term I've used here for the first time. You see it in the press. It's creeping in. It means a very high-level individual in the organization of companies — who might not even have that title, it's just a nice convenient one to use — who has the responsibility for all areas of information technology in a company, in a corporation. He's got a very interesting role to play, because his role is the bridge between business strategy and technology strategy — between the goals and objectives of his organization, whatever it is, and how to support those goals and objectives with his information system. More and more, these people are absolutely key in the formulation of the strategies of companies. It is happening, and that's why it's very exciting.

So, that's my presentation, and I'm prepared to discuss any of these points or anything else you want to get into.

Student: There's something that I've been waiting for throughout your presentation that hasn't come. Having implemented a major NATO command and control communication system in the military, I found something that always stuck in the craw at the company (I won't embarrass it by saying which one I had) was the matter of support when a system got implemented, whether or not it was nice enough, and capable enough to be useful. My question really falls into two categories. First of all, is it pure support, whether it be documentation of the software that you're putting in, whether it be the training of the personnel who are going to use the equipment ultimately and fix it, and finally the spare parts and so forth? That's part one. The second part of it is how interoperability and interface and let us say protocols would exist between existing equipment in the system that we're trying to replace and enhance, whether you want more megabytes per second or whether you want greater reliability or whether you want more peripherals on the mainframe, whatever that might be. Who is the system analyst, and how is he overlooking and saying, "Yeah, that's going to fit, that's not going to fit"? If it doesn't, who is coming back so he doesn't have to point at two different companies and say, "No, it's his fault." How are we going to settle the problem?

Lotochinski: You've asked about five questions, so I'll try to partition your questions, and if I miss any please come back to me again.

First of all, in a very detailed sense, product support, product documentation, and all that, obviously are the responsibility of the manufacturer. Also, spare parts, and recommendations with respect to complements of spare parts. Responsibility of the manufacturer, in my opinion, should be part of the decision process in terms of acquisition. Don't buy from someone who doesn't have documentation. Don't buy from someone who doesn't have a good view of spare parts, and repair of parts, if you're

talking complex boards or something like that. I think that was one of your questions.

I think probably the more important question though, is how do you avoid finger-pointing when stuff doesn't work. One of the things that we did to that end is, we embarked on a series of agreements with a number of data processing vendors — Digital Equipment, Hewlett-Packard, Wang, and others — and the objective of those agreements was threefold.

The first was to verify that the equipment would work together. Standards are very interesting, but they can exist on paper, and there's many a difference between a standard that's written on paper and an interpretation implementation. It is necessary to test. One of the things we've done with a lot of those companies is test it, verify that it works.

The second objective of these agreements was that we would try to take the finger-pointing problem away from our mutual customers. Where we had tested and verified interoperability, the customer could call either of us and we, either of us, would determine where the problem was and have it resolved, which to me is one great way of avoiding finger pointing.

The third was joint marketing, and that is a little more difficult. It does happen, but it's spotty. Still, that is the way. That's very nice if you've got a Northern Telecom and a DEC, and we're working together and have some agreements, but if I apply your question in a more general sense, well, how can you be sure that all this stuff that's out there works together? One of the answers to that is something known as the Corporation for Open Systems.

The Corporation for Open Systems is an organization formed about two years ago, I think. It is an organization with the stated intention of supporting standards, establishing labs to test equipment against those standards, and so forth. Again, there is a situation where, on a voluntary basis, I would have to say that every major vendor is a member. A tremendous number of users who are vendors as well, both in North American and non-North American countries, have that objective in mind.

The industry is tackling those problems. Have we resolved it yet? No, not totally, but we're on the way. That was the second question.

Student: I think the other question I had, though, was how long is it reasonable to expect a vending company to support a piece of his equipment in terms of consumables, repairs, and things of that nature? Will it be ten years, five years, six?

Lotochinski: It's not unusual for us to see ten-year requirements.

Student: Because if you say that the whole technology and the whole industry is zooming so fast, and obviously it is, then it's expensive to begin with, and program updates may or may not be compatible with the mainframes of the systems that you have at this time.

Lotochinski: There are a couple of very different approaches to that problem, by two of these three sectors I talked about. Let's talk about the telecommunications sector. One of the principal objectives of the communications sector was backward compatibility. In fact, the biggest problem that people have in designing switching systems is that they still have to work with crossbar systems and, for a while, with panel systems, which was a technology earlier than crossbar.

When you think about it, the latest, most modern digital telephone switching system installed today in Boston still has to work with those old telephones that were made in 1923. People in Boston undoubtedly still have those. Every switching system that goes into the whole telecommunications network has to work directly or indirectly with every other switching system that's there. The telecommunications industry has had, as a basic principle, backward compatibility. The data processing industry, on the other hand, didn't really deal with that type of well-meshed system. It tended to deal with standalone computers. As technology evolved, it was possible to say, "We've got a whole new one that's faster, with more memory. We will still run, maybe by an emulation capability, the software that existed on that old one, but we've got a whole bunch of new stuff." A little while later along comes another — a new generation. The interesting thing is that the computer industry for a long time would describe computers, or consultants would describe computers, by which generation they were. You don't really see that in communications.

We started sensing that with PBXs a few years ago. "Well, it's PBX; it's digital; it has this and it has that. Therefore, it's a third generation." The reality is I don't think there are generations in the systems. What I'm saying is, if you as an organization — it doesn't matter if it's military, or corporate, or whatever — base your information system on your communication system, you have a greater assurance that you'll have an evolvable network. Then you want to change that computer? Do so. But

do what this other company did. If you buy a new one, it must have connectivity.

McLaughlin: Let me go back to that a bit, Gene, because when you described these parameters of a leading-edge user requiring universal connectivity, assuming technology will allow you to do anything within the next five years, and massive bandwidth, it brings back memories of any number of systems modernization task forces I served on in the government at various points in time. Without necessarily arguing the validity of all those points, and I think they're interesting, I wonder if those organizations ever get done with their planning. My impression thus far of most of the organizations I have ever seen that have a chief information officer, or someone who has taken that title to himself, tend to be those in or coming out of monopoly industries. They talk a lot about systems, but they are probably 10 years behind people in competitive industries who are doing a lot of evolutionary patching together. That's just an observation. Tony, does that strike any responsive cords with you?

Lotochinski: One of the things that has clearly happened in a lot of companies is the data processing manager, I don't care what you call him or her, lost control of the personal computer. Who buys personal computers? Anybody buys them, because they're under most approval limits. You can buy them for $2,000 now, depending on what you want. At the same time, though, people get these in and one of the first cries that comes up after about a year of use is, "I'd like to connect to this, I'd like to share with that, I want connectivity." And companies have to plan, if they want to wind up with connectivity.

My view of local area networks is maybe a little different than a lot of people's. To a large extent, local area networks are do-it-yourself jobs. Coaxial cable, some kind of bridge device or something at any point that you want to tap off. There may or may not be something that goes in the various machines. It may in fact be a very limited area. It might be just this floor, or two floors in a building like this. That says there must have been a champion. The champion probably existed within the particular organization that wanted that local area network. That champion decided the technology, the products, the manner of running the cable, the specific place of tapping onto it, and so forth. As long as he's still around, he's going to be able to run it. Transfer him, or find out that he resigns and goes to work for someone else, and you've lost your champion. You've lost the design parameters of the thing, and I think that there are a lot of local area networks today that are falling into sad disuse because there's nobody there who can really manage them.

Part of the communications thrust says maybe we should acknowledge that there are several kinds of local area networks, and we, the organization, or the chief information officer, will be the internal consultant resource to help those people get it up and running, in return for which they have to give us the records.

Oettinger: It's just not clear that that model would necessarily win out over the bottom-up extensions. Your inference from the chaos of the PC users is that we should restore control to the central folks. Why?

Lotochinski: Not control of the network, but you need someone to facilitate the unplanned connections that people really need.

Oettinger: Availability of the network, but not necessarily under the control of the chief information officer. I've got a local area network which is a lonely one. It reaches my secretary by going down a mile to the Ware Street central office and coming back. As long as New England Telephone keeps upgrading it I've got no problems.

Lotochinski: That's the central office LAN and that's a very different one from the kind I'm describing, which is coaxial cable. You just made my point because you said, "Let them manage it." All you want is to be able to communicate. Let them manage it. My point is there are a lot of local area networks that have gone in on the basis of, "We want to communicate; we'll do it." Then the champion disappears.

Student: What do you mean exactly by connectivity? I can think of multiple levels of connectivity. It's a little bit of a problem with your seven levels of standards.

Lotochinski: I dragged this chart out because I thought I was going to use it for one of these other questions, but I didn't. Connectivity means that all of these devices can connect to the access and transport function of the network, and can instruct the access and transport to establish a connection to a desired device.

Student: Does that mean for example a voice-coupling modem with a standard dial-up telephone?

Lotochinski: Yes, except you're limited at that point to 1200 or 2400 bits.

Student: As long as that does it, I'm willing to accept it.

Lotochinski: Yes. In terms of, "Can you exchange information with the device?" That becomes compatibility and that gets into the issue of the higher layers of standards. For example, it doesn't do a telephone much good to connect to a robot on the shop floor. You might be able to connect and have a 64 kilobit channel, but you can't communicate.

Oettinger: I don't know about that. Suppose it has voice recognition circuitry?

Lotochinski: You've introduced a different hypothesis than mine. It might; on principle, it wouldn't. What you've done, though, is you've added the compatibility, because you said voice synthesis, which says compatible with the human at the other end.

Student: That's a very important thing because it's partly a question of where you, so to speak, put the intelligence, and you've got a lot of options there. You've described an approach that is not unreasonable and is very characteristic of telecommunications-oriented companies. They put a lot of intelligence in the networks.

Lotochinski: Intelligence is distributed everywhere. The network carries the communications.

Student: Then all that Tony did was to put intelligence in the robot.

Lotochinski: I said this *could* be a robot. A lot of intelligence is needed in the network to make the network run. A lot of people think "network intelligence" means these communication engines like servers that will do protocol conversions ...

Student: Intelligence in the network allows you to get by a lot of the compatibility issues.

Lotochinski: But not the connectivity.

Student: But the connectivity you just discussed is a simple modem.

Lotochinski: It's much more complex than that, I'm afraid.

Oettinger: Why?

Lotochinski: Because there are hundreds of suppliers, and I'll go back to my earlier pie charts (figure 7). Hundreds of suppliers all have worked to their own standards, and it does get to some of the higher layers in the ISO model.

Oettinger: I understand, but implicit in what you're saying is mass market or unknown, unplanned connections. I guess the notion of the unplanned connection with voice is a sensible one because of the presumption that there is inherent compatibility. Even there, somebody who speaks a different language has had it. I'm lost. There's something wrong with your argument, but I can't put my finger on it.

Student: You're assuming all this interconnectivity in which all these millions of different kinds of equipment communicate with each other, which creates a huge amount of telecommunications traffic which drives your industry. My question is where in this picture do you fit in CD ROM, and videotapes, and standalone technologies with large amounts of memory which can handle things with a long shelf life?

Lotochinski: CD ROMs, in initial implementations at least, are read only. What you may do with a CD ROM, for example, is put encyclopedias on them.

Student: But a lot of the access to databases is of that category. They have a long shelf life.

Lotochinski: There are also a lot of other databases that are very volatile, that change all the time.

Student: But, how does it affect your rosy picture for the future of telecommunications?

Lotochinski: I don't think it affects it at all. I think it just complements it. Let me try answering your question a different way. This is absolute hypothesis. Suppose it cost you a penny an hour to connect to any information resource anywhere in the country. That's the connection cost. Suppose it cost you a penny an hour to be actually accessing the service. Would you want to buy a CD ROM for an encyclopedia, or would you be willing to spend two cents an hour?

Student: The occasional user won't, but there are large institutions that may have costs in which it's very cheap to do it by the other method.

Lotochinski: But supposing it would be two cents an hour?

Student: You just can't say it's two cents an hour. You have to make the comparison between what it costs an organization to use the stand-alone technology as compared with telecommuting to the source.

Lotochinski: A lot of databases are very volatile. One use of this that we are looking at right now is distribution of our documentation to our customers. Why is that so volatile? Because we are continuously modifying our equipment. We're continuously

adding features and capabilities. You may think that that's static; just send books. But it isn't. The biggest problem is to get the information from the designer, onto paper, to the customer. The number of trees that we cut down every year — have cut down — is enormous.

I want to answer your question. So, CD ROMs and that type of mass memory complements that, but doesn't replace it. When I said two cents an hour connect charge, the economics change. If paper is very cheap, and telecommunication costs are very high, send paper. If telecommunication costs are very cheap, and paper starts to go up, use telecommunications. Economic tradeoffs. Use that which is less expensive to conserve that which is more expensive. My message, my single message if I can leave one today, is that the economics are changing.

Oettinger: But you're implying that they're changing inexorably to the advantage of the electrical side. I guess I was with you until 10 seconds ago, when you were talking about the tradeoffs, and talking about connectivity in the larger sense; use paper for connectivity if you will when it makes sense. One good example of that is the recent swing of the see-saw in the substitution, temporary perhaps, of the video cassette carried in a shopping bag for equivalent bandwidth on coaxial cable, or fiber optics, or whatever. You've slanted your example, obviously when time is of the essence and things have to be updated rapidly, continuously, etc., etc., there's a strong presumption of electrical advantages.

There are other things where connectivity is of the essence, but your implication that it's sort of inexorably electrical connectivity is not as clear.

Lotochinski: I absolutely agree with you. In fact, as far as I'm concerned we will never have a paperless office, ever.

Student: But my other point is that there's always a charge, even if it's an encyclopedia that's held on a micro or a mainframe down the way. If the connection cost is a penny an hour, the overhead on the computer, if it's like anything we used to get charges for, is $40 an hour.

Lotochinski: My other hypothesis is, what if that would be a penny, too?

Oettinger: If it were a penny, too, and updating is not of the essence, I ship the damn CD ROM to that local standalone thing by Pony Express. One of your earlier slides — this is what I want to go back to — one of the first slides there, I don't think you made the connection between the two facts that you were stating. One is the gross decline in transmission costs, but there's also the gross decline in processing and memory costs. The point is that when both of those are happening you are retaining this see-saw between putting it all at the terminal and having it centralized.

Lotochinski: Yes!

Oettinger: Somehow I'm mishearing you. Somewhere along the line I think you keep sliding into the notion that the electrical communications side will prevail.

Lotochinski: No, no. You can do a lot right here on the desk, but there are also a lot of things you want to do over here on the network. What this does is it provides a means for doing it, and it's costing less and less. I'm not saying replace PCs. They're great! I'm not saying have all the programs reside over here and load them down when you want them. There's nothing like a floppy disk. The question of encyclopedias — they're great, if you can hold them on a CD ROM and just slip them into a machine and read them, it's great.

Student: In reference to the local area networks, the last time I had occasion to look at it, more than half the cost was the physical labor of installing them. You had to pay for the taps and things of that sort. Your fiber optics are great, but as far as I know getting good, cheap taps on fiber optics is still unsolved.

Lotochinski: If you want me to go on to a sales pitch, our view is twisted pair wire for LANs, optical fiber for broadband. We're running two and a half megabits on twisted pairs, 2,000 feet.

Student: As long as we can keep it simple ....

Lotochinski: It's very simple, and twisted pair is going to remove all that coax that is probably strewn in this building.

Student: If you hadn't brought up coax, I wouldn't have brought up the cost factor, because we looked into that. You can do a lot with twisted pairs; a limited amount of very high volume stuff. That leads to a particular kind of organizational implications.

Lotochinski: Meaning what?

Student: It's somewhat related to what you showed. It means you have some local computers that almost don't have mainframes.

Lotochinski: Yes, that's what I said.

Student: You have large micros and you have small micros, and you may have a number-cruncher that might be left over.

Lotochinski: Right, and you may need some common databases, and the degree of commonality could be a whole organization or a single building.

Student: Then if you use twisted pairs to your computers, I can't have much argument.

Student: When you talked about transborder issues you listed some reasons for barriers and they included things such as politics, and privacy, and protectionism which I suspect are not only transborder type issues or problems or even barriers, but something you may even find within a border; government regulations, government restrictions of some type or another, privacy questions which get into copyright issues, as well as politics, when you're talking government agencies or anything else. How do you, as either an international organization or as a U.S. organization operating within the United States, deal with those types of issues, particularly in the long term when you've got to convince bureaucrats, if you will, that there are other ways of doing it than the way they've been doing it?

Lotochinski: I think typically that within either Canada or the United States we do not see intercountry issues. There's free enterprise, and companies can pretty well do what they want. Obviously, they have to respect copyright and so forth.

Student: What about your standards problem?

Lotochinski: Standards is a whole different issue. I'm talking about people like the French who are very concerned that databases on French citizens will reside in the United States, out of their control, and if, heaven help us, there comes to be some kind of conflict and the French want to distance themselves from the United States, the American government can suddenly go in and get access to information on all their citizens. So, their view is, "We don't want that stuff outside." So, they'll establish laws.

Student: I would also say that even within the United States there are many people who would say there is a problem between U.S. government information being used or being extended, and the safeguards of it. That problem does exist here, too, but how as a company do you sell people on the idea that you're not in fact endangering them? I guess we can get back to the security problems.

Lotochinski: All we can do is agree with them that there is an issue. If we happen to know what the situation is, we try to help them understand it. To a large extent it's up to them, though, to deal with it. For example, some of our customers are banks that are operating in the Far East, Europe, and the United States. Citibank, for example, applied tremendous leverage to the French government and got interconnect rights that everybody said were impossible. What are they doing? They're really transferring transactions which deal with currency deals as opposed to databases. The equipment they put in had to meet the standards of the French network, as it did in Tokyo, it had to meet the standards of the Japanese network. But if there are rules, if there are laws, they have to conform. Is there any easy answer? No.

Think about the world standard. It doesn't say you can't do something within that country, using some of these ideas. It doesn't say you can't do that in the United States. That's where your principal operation is. We have a very skimpy connection between them, but so what? You get that problem anywhere.

Student: So, you've never thrown in the towel and said, "There is too much regulation here for me to deal with." You've always found the connectivity someplace?

Lotochinski: Yes. I think the military in particular has some very strong disadvantages. You have the right to a lot of your own facilities in other countries. In Korea, for example, we're putting in a big system for the Army. A whole bunch of systems. The transmission facilities belong to the Korean telephone administrators, but the switches are the Army's.

Oettinger: It is time. We thank you very much.

Lotochinski: I enjoyed it.