A panel discussion

Information services and communications (computer utilities)

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With the continuing increase of computer installations utilizing some form of data communication, experience is being accumulated on the remote terminal operation of computer and information services for interactive usage, batch processing and other data retrieval services. Important factors in the future commercial development of such services are the availability and cost of communication circuits and terminal equipment. Interest has recently been focused on these areas by the Federal Communications Commission's inquiry into the "regulatory and policy problems presented by the interdependence of computers and communications service facilities."

The goals of the panel will be to clarify the interdisciplinary problems and relationships between computers and communications which, as one panel member stated, "have placed the computer and communication industries on a collision course." Specific areas of information services to be reviewed in relation to communications are: experience in operating hardware and software systems, interface requirements, system economics, communication circuits and public policy.

Position papers submitted by three of the panel members follow.

Time-shared information systems: market entry in search of a policy*
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I. INTRODUCTION
Recent developments in computer hardware and programming now enable several users to share the stored information and logic capability of data processing machines. The subscriber, no longer adjacent the computer, may access the computer's logic and memory via telephone lines tied to the data center. Indeed, the combination of data centers, communication lines, and terminal equipment form the elements of what some forecast as a new industry, time-shared services or what others call the computer or information utility. Services arising out of this industry includes bibliographic retrieval, stock quotation, hotel reservations, legal indexing, market reports, banking by phone, hospital information systems, common data files, program libraries, to mention a few. Such services soon promise to be international as well as domestic in operation and scope.

Last year, the Federal Communications Commission initiated an investigation into the policy implications of computer time-shared, operations. The Commission seeks to determine its statutory obligations given what it terms the "growing interdependence" of computers and communications. This paper proposes to examine one of the issues posed by the Commission's investigation. Specifically, we will (1) state the regulatory issues as the Commission views them; (2) discuss the background events that prompted the inquiry; and (3) evaluate some of the competitive issues associated with time-shared computer services. We will conclude that the ground rules for market entry are at stake in the FCC's investigation.

II. The investigation

The Federal Communications Commission announced its computer inquiry on November 10, 1966. Some of the Commission's questions dealt with the adequacy of tariffs, rates, and customs practiced by the communication carrier industry. Other questions focused on the issue of privacy and telephone wire-tapping incident to the growing concentration of information. The central if not the most controversial issue, however, settled on the question of the Commission's regulatory obligations. Specifically, the Commission asked:

The circumstances, if any, under which any of the aforementioned services (data processing, special information services, message or circuit switching) should be deemed subject to any regulation pursuant to the provisions of Title II of the Communications Act.

(1) when involving the use of communications facilities and services;
(2) when furnished by an established communication common carrier;
(3) when furnished by entities other than established communication common carriers.

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These questions may have caught some observers by surprise, particularly members of the computer industry. However, a review of the factors contributing to the inquiry suggests that the FCC may have had little choice in exposing these issues for public discussion. In fact, the Commission's attempt to distinguish between "data processing" and "communications" may prelude a more general policy search in the growing field of time-shared computer services.

III. Source of investigation

First, what prompted the investigation. Obviously the inquiry resulted from the interplay of many factors. However, four can be identified as being singularly important: (1) the Bunker-Ramo case, (2) the IBM letter, (3) diversification efforts of Western Union, a domestic telegraph carrier, (4) diversification efforts of ITT Worldcom, an international telegraph carrier. The background of each follows.

A. The Bunker-Ramo case

The first issue, determining the content of a communication common carrier service, erupted in a service offering by the Bunker-Ramo Corporation. Bunker-Ramo sells a stock quotation service to brokers, bankers and insurance companies. Stock information is gathered from the main Exchange floor in New York, transmitted and stored in Bunker-Ramo's regional offices. Computers in these offices then distribute this information via telephone lines to the firm's customers throughout the country. By means of desk units supplied by the company, subscribers query the computer for a host of market security information. Bunker-Ramo, designating its service as Telequote III, operated an information retrieval system on a real-time or instant use basis.

Under this system, Bunker-Ramo provided its subscribers with stock quotation service, desk display units, and telephone communication circuits, all as a total package. Although Bunker-Ramo owned the former two units, it obviously did not own the latter. Communication lines were necessarily secured from the communication common carrier industry and then resold by Bunker-Ramo to its customers.

As a rule, the common carriers do not lease communication lines to firms who resell them. The carriers hold such activity subsidizes their competition, dilutes revenues, and ultimately translates into higher rates for their telephone or telegraph customers. The carriers argue, moreover, that the exchange or routing of messages among or between persons constitutes the essence of "communications" as conventionally defined. This function is obviously confined to regulated communication firms.

There are, however, exceptions to this policy. Reselling of communications is permitted under the carriers' authorized user tariff. A firm may resell circuits if the carriers determine that both the firm and its customers are engaged in the same business activity. Bunker-Ramo customers, stockbrokers, etc., qualified under the authorized user tariff. Thus, the firm acting as literally a broker between its customers and the carriers, sold leased communication facilities.

The announcement of a new stock quotation service, Telequote IV, reopened not only the question of definition but also the question of circuit availability. In contrast to Telequote III, Telequote IV grafted electronic message switching to the computer's capability of data processing, message switching that permitted brokers to place, execute and confirm stock orders between their offices. The carriers agreed that the message switching element constituted a new and crucial element to Bunker-Ramo's service.

Specifically, the carriers held that the store and forwarding of information constituted a tariff violation. Stated differently, Bunker-Ramo's service embraced enough communications so as to infringe upon an activity reserved to regulated entities. The implication was strong that if communications was Bunker-Ramo's intent then the firm ought to apply for a franchise of convenience and necessity. In the meantime, the denial of communication lines effectively foreclosed the operation of Bunker-Ramo's new service.

This impasse prompted Bunker-Ramo to issue a letter of complaint to the FCC. The firm granted that its message switching of administrative data might be interpreted as the transportation of communications. However,

Such transportation rarely occurs as an incident to another primary business and although a charge is collected for the overall service, the incidental transportation is not supplied with the purpose to profit from whatever transportation service may thus be performed.

In short, Bunker-Ramo invoked the primary business test.

To emphasize the incidental nature of Telequote IV's communications, Bunker-Ramo revealed a breakdown of Telequote IV; 84% was assigned to services of stock quotations; 10% assigned to orders and confirmations; 1% to market opinions, and 3% to customer accounting. The controversial segment, the routing of administrative data, consisted of some 26% of the entire stock quotation service. Clearly, argued Bunker-Ramo, this small portion did not constitute communication activity in its generally accepted sense;
and clearly such activity should not condemn Bunker-Ramo's entire service as illegal.

Ultronics Systems Corporation, a competitive supplier of stock quotation service, volunteered its observations to the FCC. Ultronics submitted that the Telequote IV service embraced enough message switching or communications so as to indict the entire service as a regulated communication activity. Interestingly enough, this position paralleled Western Union's thesis that communication rather than data processing was actually the dominant element of Bunker-Ramo's contemplated service.

In the end, the Telequote IV dispute did not require the Federal Communications Commission to promulgate a formal ruling. Subsequent negotiations between Bunker-Ramo and the Bell Telephone System (AT&T) found room for compromise. Bunker-Ramo agreed to eliminate the 2% administrative segment of its service; Bell agreed to lease circuits under its authorized user tariff. As a result, the policy issues latent with this dispute were merely postponed.

**B. The IBM letter**

The FCC's inquiry was also identified with an open letter submitted to the Federal Communications Commission by IBM. The letter was both cautious and apprehensive. IBM began by drawing a sharp distinction between the terms "communication" and "data processing." Data processing or the transformation consisted of analyzing, classifying, correlating, sorting, calculating, summarizing, and producing records and reports. By contrast, communications embraced the transportation or transmission of information by wire or radio under the Communications Act of 1934.

Lest the Commission confuse the two, IBM observed:

If intelligence is sent from A to a computer and transformed by the computer and the message then goes forth from the computer to B containing the transmitted intelligence, it is clear that there has not been transmittal of a message from A to B through a computer.

The issue in the Bunker-Ramo case, however, was not solely one of determining the appropriate mix between data processing and communications. The parties generally agreed that Telequote IV embraced the electronic routing of message communications. The question, however, turned on the status of activity performed by a firm not licensed as a communication carrier. IBM suggested the primary business test as a guide to resolving any such determination. And if communications were indeed incidental, such activity did not qualify as regulated, limited exclusively to telephone or telegraph companies.

What about the reverse situation, the case when a regulated carrier engages in data processing? Obviously aware of Western Union's diversification into data processing services, IBM cited an FCC decision with respect to the telegraph company's flower service. Though part of its communication plant is so employed, Western Union does not file tariff schedules on the flower segment of the service. This policy, argued IBM, provided sound precedent for Western Union's or any carrier's move into unregulated, data processing services.

In sum, IBM counseled the FCC to consider the primary business test when non-regulated firms find themselves engaged in regulated or message switching activities. By the same token, IBM submitted that data processing services supplied by regulated entities does not automatically redefine that activity as a regulated one.

**C. Western Union's diversification**

Since telephone or telegraph lines are by definition critical to remote data processing services, it was perhaps inevitable that the communication carriers would find computer services an attractive source of market diversification. Indeed, Western Union's concept of a national information utility, a blending of computer and communication facilities, epitomized that diversification. To this end, the telegraph company announced the computerization of its Telex switching centers, the establishment of data processing service centers, the announcement of specific data processing services—legal index, employment service, among others—and the introduction of a management information system available to commercial and government users.

Western Union's entry into information services originated with its government contracts. The Autodin contract, for example, consisted of a joint data processing and message switching system to the Defense Department. A similar service, the Advanced Record System, was also leased to the General Services Administration; a system whereby the telegraph company has been responsible for the automatic dial nationwide circuit switching system, three message switching centers, and the supply and maintenance of software and message switching capability. (The computers route multiple address messages, recognize priorities, and hold messages for specific delivery time.)

The seeds of controversy inherent in a regulated firm engaging in a non-regulated activity commenced with these government contracts. As early as August 1964, the FCC requested Western Union to justify why the data processing segment of the Advanced Record Sys-
tem, was excluded as a tariffed service. The Commission wrote:

We are advised that you do not intend to include in your tariffs on file with the Commission charges for off-line processors furnished in connection with this system. It is requested that you advise us as to what you believe to be the legal justification for furnishing this item of equipment without having charges therefor on file in your tariffs.\textsuperscript{16}

Later, the question of tariffing and contracting arose again with Western Union’s announcement of its management information system for Dun & Bradstreet and Blue Cross.\textsuperscript{17} Finally, last year the FCC urged the telegraph company once again to explain its policy with respect to its data processing services.\textsuperscript{18}

Western Union’s response attempted to place its new activities in perspective. The telegraph company reminded the Commission that it competed directly with firms whose computers were replacing Western Union’s torn-tape switching systems. Rivalry between the carriers and computer firms, explained Western Union, was immediate and direct in the GSA Advanced Record System contract; and Western Union argued that had it tariffed its service, the telegraph company would have been placed in an untenable position vis-à-vis its competitors.

To illustrate the need for flexibility and hence tariff policy, Western Union recalled that its original bid to GSA had been high. A downward revision occurred through the cooperation of Univac’s Division of Sperry Rand—a revision that resulted in a bid that ultimately secured the contract for the telegraph company. Western Union continued:

GSA expressed concern that since the Western Union bid was of a tariffed nature, the quoted price was not firm for (a) tariffs would be necessarily filed months after the award of a contract, and (b) regulatory action would be in effect bring about a superseding of the contract. Western Union was therefore advised that it could have a contract only on the condition that a firm fixed price contract for five years could be offered, and had Western Union not acceded, GSA would have made a contract award to ITT.\textsuperscript{19}

What was true for the government sector was equally true for the private sector. To meet market competition, Western Union responded that its data processing activities need not be subject to regulation despite the fact that the company itself was a regulated carrier.

Finally, Western Union elicited restrained enthusiasm from the primary business test as a policy guide to determining the communication activities of data processing firms. The primary business test, observed the telegraph company, threatened the very concept of regulation.

Such companies as IBM would always be in the position of furnishing a part of the communication business on an incidental basis and hence, would never be subjected to regulation. The safeguards of the utility concept would thus be eroded.\textsuperscript{20}

In specific reference to Telequote IV, Western Union was concerned that the element of direct communication among the subscribers would persist. Although the compromise between Bunker-Ramo and the Bell System may have been workable to Bunker-Ramo, it was less than satisfactory from Western Union’s standpoint.\textsuperscript{21}

D. ITT Worldcom’s diversification

A third element that impelled the Commission’s Notice of Inquiry was associated with developments on the international scene, the international communication carrier. Last year, ITT Worldcom, a subsidiary of International Telephone & Telegraph and an overseas record carrier, filed a tariff on a computer message switching service. The tariff, designated ARX (customer data re-transmission) excluded individual circuits and terminal apparatus. Rather, the subscriber was billed on the number of messages routed through ITT’s computer switching system.

The tariff encountered opposition immediately.\textsuperscript{22} Western Union, for example, objected that as an international carrier, ITT was diversifying into the domestic communication market competing with and eliminating Western Union’s torn-tape relay switching systems, thus diluting needed revenues from the telegraph company. Western Union International Telegraph Company, an overseas record carrier, joined Collins Radio, a manufacturer of computer switching equipment, in voicing further objections to the ARX tariff. Western Union International asserted that the tariff was unclear and ambiguous; and Collins Radio suggested that the tariff was underpriced and hence, non-compensatory.\textsuperscript{23}

ITT Worldcom acknowledged that some of its switching systems would be located within the United States. However, as long as its customers leased one private line circuit overseas, domestic switching was permitted under the Communications Act, Section 222. (The act defines an international carrier as one whose major portion of traffic and revenues is derived from international telegraph operations.)\textsuperscript{24}

Significantly, ITT Worldcom asserted that computerized message switching was an activity subject
to the jurisdiction of the Federal Communications Commission. Indeed, since the ARX tariff had been filed under this assumption, ITT Worldcom requested that the FCC expedite its approval of the ARX service. Its customers, explained the carrier, might seek alternative suppliers of automatic switching, suppliers not subject to FCC jurisdiction. Thus, on October 1, 1966, the Federal Communications Commission denied petitions for tariff suspension and ITT Worldcom’s service took effect.21

As if matters were not complicated enough, RCA Communications, an international record carrier and a subsidiary of RCA, inaugurated a service called Aircon devoted to the needs of international air carriers. Aircon, a computerized message switching service, also contemplated the processing of seat reservations, inventory, accounting, data on cargo, freight information, as well as a wide variety of administrative services. RCA’s service was thus directly competitive with that offered by ITT Worldcom. The difference between the two was crucial; RCA refused to file a tariff.

ITT Worldcom lost no time in urging the FCC to force RCA Communications to file an appropriate tariff schedule. As requested, the FCC asked for a statement of policy from RCA Communications. The carrier replied that its automatic information reservations service would not only be at a competitive disadvantage with those provided by Collins Radio, but filing a tariff would prejudice the issues posed in the FCC’s computer inquiry which by this time had been announced. Thus, RCA Communications observed:

It must maintain a competitive position that would enable it to compete effectively on a meaningful basis with non-regulated entities. Beyond this, a tariff filing would afford non-regulated companies an unfair advantage by exposing the entire Aircon service offering to their scrutiny while their offerings are beyond the regulatory purview.22

Where is the communication-data processing situation as it now stands? First, firms in both industries do not agree as to the precise limits and hence proper jurisdiction of data processing and data switching. Second, the domestic and international carriers are split among themselves as to what constitutes the relevant market for data switching; third, the international carriers are divied as to the FCC’s jurisdiction over computer switching; and finally, the question of promotional pricing, and rate levels continue to beset carriers and non-carriers alike.

IV. Policy issues

A central theme can be detected in the confluence of events that prompted the FCC’s investigation; and that is the question of establishing ground rules for market entry and competition. Consider this theme as it applies to three questions: 1) the leasing of communication lines, 2) carrier merger policy, and 3) joint cost allocation.

A. Market entry and communication lines

To repeat the obvious, regulated entities are attempting to engage in non-regulated activities, namely data processing, non-regulated firms are attempting to diversify into what is commonly regarded as regulated activities — communications. RCA Communications and Western Union typify the former trend; Bunker-Ramo typifies the latter trend. But as the Bunker-Ramo case suggests, diversification is not a reciprocal relationship. The carriers own and supply the nation’s communication circuits, clearly an activity subject to state and federal regulation. With this as a base, it may be less difficult for regulated entities to diversify into unregulated activities than vice versa. In short, the granting of franchises is slow, expensive and hardly conducive to market entry for data processing firms.

What is important is that the carriers lease circuits to a growing group of firms who pose both as competitors as well as customers. This relationship can be expected to intensify; and as the Bunker-Ramo case testifies, market diversification poses no little problem to the Federal Communications Commission. The Commission may find that carriers deny lines to companies who engage in communication on grounds that such activity is subject to regulation. On the other hand, the carriers may refuse to file tariffs on their data processing packages on ground of market competition. This asymmetrical relationship effectively bars market entry to major candidates who are seeking to offer computer utility services, particularly if those firms reside in the non-regulated sector of the economy. By foreclosing or conditioning market entry, the structure of this new industry obviously will be predetermined.

There is a deeper problem. RCA Communications’ refusal to file a tariff on computer switching suggests a profound policy disagreement, at least within the ranks of the international carriers. At odds with both a domestic carrier (Western Union Telegraph Company) and an international carrier (ITT Worldcom), RCA Communications apparently assumes that its activities now and in the future will be competing directly with those services offered by non-regulated entities.

It is clear that the blurring of data processing and
communications does not lend itself to easy solution. In this search, the primary business test is an unsettling policy guide. Communication and computer firms will obviously employ the test to their own ends, however those ends are defined. That such a test borders on the arbitrary can be seen in its application. In the eyes of Western Union, flower and data processing service are "incidental" to communications. Yet the communication industry becomes less tolerant when the identical test is invoked by the data processing industry, to wit, the Bunker-Ramo case.

Thus, the primary business test cuts both ways; it can be employed to rationalize a movement from communication to data processing; or from data processing to communications. And if such a test is resurrected as a policy guide, it takes little imagination to visualize a backlog of adjudicatory proceedings in which the adversaries seek the magic number of 49%.

B. Market entry and merger

As noted above, non-regulated firms generally seek refuge in the primary business test as a means of avoiding "the burden of regulation and the obligation of service." But it is conceivable that a data processing firm may assume or perhaps even hope that its activities are a legitimate common carrier function. This may occur when a data processing firm merges with a regulated firm.

Any such consolidation poses two questions. First, does merger with a common carrier sanction the conversion of a non-regulated activity to a regulated activity. The answer is, of course, speculative. The merger, however, of the Ultronics Corporation with General Telephone and Electronic Corporation, the nation's second largest telephone carrier, suggests that this possibility is very real. Indeed, it was Ultronics who argued that Bunker-Ramo's Telequote IV encroached upon a regulated communication activity.

Secondly, if movement from a non-regulated to a regulated status offers a solution to Ultronics, what options are open to Bunker-Ramo, Scantlin, and other rivals of Ultronics. Does the existence of direct competition among these firms stimulate what Kaysen and Turner term "parallel integration." And what are the implications of these activities in terms of the long-term environment for computer utility services. Merger policy, particularly the consolidation of non-regulated with regulated entities, raise provocative issues in terms of market entry.

C. Market entry and joint cost

Finally, the straddling of communications and the data processing package half regulated, half unregulated, conjures major accounting problems associated with joint costs. Like any regulatory body, the Commission is not entirely unacquainted with the problems of cost separation. Although it granted the telegraph company an accounting waiver for the data processing segment of the ARX service, the announcement by Western Union of its management information systems for Blue Cross and Dun & Bradstreet prompted the Commission to inquire as to the feasibility of separating the telegraph company's communication activities. In response, Western Union observed:

Certain non-communication activities which are now clearly incidental to communication activities are expected to become significant in the future. The whole field of computer applications and information storage and retrieval is in a state of development; more important, many matters such as the method of operation remaining unsolved.

Western Union's position of incipiency hardly eases a problem that is likely to become aggravated over time. The question of cost separation, in short, will undoubtedly command the attention of all participants in the FCC's computer inquiry.

That cost separation is no easy task is demonstrated by past experience. The carriers generally prove more receptive to discussions of rate of return rather than questions of rate structure. Even when the Commission persuades a carrier, as it did the Bell System, to calculate rate of return on fully allocated costs, the carrier tends to regard its studies as less than meaningful for purposes of public policies. Thus, the search for cost separation standards within the regulatory sector is fraught with complexity. But more important, the search for standards applicable to a firm half in and half outside the bounds of regulation is equally imposing.

Yet, regulatory experience suggests that such separation is crucial. The telegraph investigation indicated, for example, that the Bell System was not above emplying its monopoly markets to carry its competitive markets — all within the regulated sector. No one doubts that the Telpak tariff has throttled the innovation of private microwave communication systems. If then, internal subsidization places a continual burde non regulation, the accounting hazards of a firm partly regulated and partly unregulated are no less challenging. To repeat, market structure and rate structure are inseparable. Both bear on the viability of market entry.

There is a final issue. The carriers are in one sense integrating forward, packaging communication lines
together with computer services. At the same time, the carriers lease circuits to potential competitors — the computer industry. Will wholesale, retail rates distort prices sufficiently in the final product market to rule out meaningful market competition? Bluntly stated, will the carriers accord themselves internal line discounts denied their customers? And if the carriers lease circuits from themselves or from other carriers, will such transactions, now apparently residing beyond the province of FCC jurisdiction, accord the carriers competitive advantages that ultimately spell who survives in the computer services industry? Again, market entry rides on these issues, no matter how premature they might appear today.

V. CONCLUSION

In sum, the Commission's computer inquiry is confronted with an imposing agenda of policy questions. Not the least is the issue of definition and jurisdiction, for out of their determinations rests the question of market entry and market structure. Two options are clearly open to time-shared computer services: competition or regulation. But these choices apparently assume that the firm is restricted to the either/or extreme of data processing or message switching. The imperatives of technology suggest, however, that the pure case may be the exceptional case. As the amalgam of data processing and communications continues, a third choice, namely de-regulation, may pose as a policy alternative worthy of consideration. Perhaps it is unthinkable that a government agency cut the Gordian knot of regulation with any degree of seriousness. But the solutions to the computer utility question are sufficiently urgent to warrant broadening the search for unique policy prescriptions.

REFERENCES

1 Before the Federal Communications Commission. In the matter of regulatory and policy problems presented by the interdependence of computer and communication services and facilities, Notice of Inquiry, Docket No. 6979, November 25, 1966.
2 Ibid., p. 1.

As we understand the Telequote IV proposal, the service would be offered to the brokerage industry, the conclusion is inescapable therefore that under the proposal, there would be a holding out to the general public as that term is used in the law of common carriage.

See also American Telephone & Telegraph letter to the FCC, September 29, 1965, p. 2.

It would appear that the transmission of communications is at the heart of its (Bunker-Ramo) proposal for 'message switching' services, which services might prove in fact a most significant element of Telequote IV. The so-called 'data processing' to the extent they exist at all in such cases might be deemed ancillary to the transmission of communications. In such circumstances, we believe a conclusion that Bunker-Ramo was not engaged in a common carried undertaking subject to regulation under the Communications Act would be open to serious question.

5 Ibid., p. 3.
9 Ibid., p. 7.
10 Ibid., p. 6.

We are advised you do not intend to include in your tariff on file with the Commission charges for off-line processors furnished in connection with the system (ARS). It is requested that you advise us as to what you believe to be the legal justification for furnishing this item of equipment without having charges thereon on file in your tariff.

13 Telecommunications Reports, November 22, 1965, Volume 31 No. 51, p. 14. Western Union states: The type of computer equipment furnished varies according to the requirements of each customer. Depending upon the capabilities of the particular equipment furnished, such equipment may be utilized for electronic processing of business data and for electronic switching of message communications. The telegraph company also undertakes on request to provide programming of the computer equipment on an initial or a continuing basis.

14 Telecommunications Reports, November 29, 1965, Volume 31 No. 52, p. 3.
15 Letter from Western Union Telegraph Company to the Federal Communications Commission regarding computer lease and service arrangements, March 14, 1966, p. 10.
16 Ibid., pp. 37-38.
17 Ibid., p. 34.
18 In the matter of ITT World Communications Inc., Tariff No. 54, June 9, 1966.
19 Ibid.; Petitions of Western Union International for suspension; Reply of Collins Radio to reply of ITT World Communications, Inc. to petitions of the Western Union Telegraph Company, Western Union International Inc., and Collins Radio, Inc.
There is a fable about a king who was so vain that he wanted only his image on the coin of the realm. Therefore, he ordered his goldsmith to make him a coin with just one side. After many tries the goldsmith confessed that he couldn't make such a coin, and, in the best tradition of fairy tales, he had his head chopped off. We can learn a lesson from this story. Just like a coin, a computerized information system has two sides — communications on one side of the interface and a computer on the other. It isn’t possible to construct a successful system by considering just one side. If one tries, he too may lose his head — or at least go out of his mind.

The telephone industry can speak with experience about total information systems because the nationwide dial telephone network is in reality a giant “computerized” information system. Even though the telephone network provides the user with communications services rather than data processing, the technology used closely parallels that of a general purpose computer system. Even the concept of shared use, which is the basic building block of the so-called computer utility, has been used for years in telephone switching systems.

When I try to convince people that there is nothing really new in the basic idea of a time-shared information system, I feel like Sisyphus, the legendary king of Corinth. He was condemned, you may remember, to roll a heavy rock up a steep hill in Hades, only to have it roll all the way down again when he got it near the top. Then he had to start all over.

I’m getting tired of pushing this rock up the hill, so for the moment I’ll concede that perhaps the time-shared information system is something new. But I still feel sure that many of the lessons learned by the telephone industry over the years can be applied in planning and implementing computer utilities. Furthermore, we in the telephone business have an important role to play in providing the vital communications links which give life to computer utilities.

These communications channels can be compared to arteries or pipes. A pipe carries a stream of fluid; a communications channel carries a stream of electrical signals. A pipe can transport a variety of different liquids, so, too, for communications channels. Whether what goes in be voice, handwriting, machine data, still or motion pictures, or Beethoven's Fifth Symphony — so long as it can be translated into electrical signals — it can be transmitted.

The world’s greatest arterial system for the flow of data signals already exists in this country — the nationwide telephone network. Today it reaches over 100 million telephone sets, and each of these locations can be arranged to send or receive data. The suitability of the dial telephone network to carry data signals was demonstrated by a series of Bell System tests in the late 1950's. The results of these tests were published in the now famous Alexander, Gryb, Nast Report.

Since then, of course, data communications needs have changed drastically — and they continue to change. The capabilities of the telephone industry are expanding right along with those needs. In fact, the real success of our business has been its ability to anticipate the future, to introduce new services even before users have requested them. For example, nationwide dial teletypewriter facilities were ready for time-shared computer use by the time prototype computers were being laboratory tested.

To date, Bell Laboratories has developed over 80 different models of data modems, 40 of which are now being offered to the using public. These together with the associated channels and a variety of station gear comprise a wide spectrum of data communications services. But we don't stop here. More are on the way, in a variety of common user and private line offerings — from narrowband telemetry services at one end to megabit and higher services at the other. I’d like to tell you about some of these new services, paying special attention to communications costs and interdisciplinary problems.
We talk about service rather than about hardware because service is what we offer — our end product. Hardware is only a means to an end. The two most important ingredients of the services we offer are innovation and reliability. I want to direct my comments today to the first one — innovation — and skip the second. But I want to assure you that the telephone industry doesn't skip reliability; reliable service demands hard work on the part of many people.

We think it's important to provide service rather than hardware because it allows the greatest scope for flexibility, economy and innovation. Improvements in technology can be introduced when and where they will provide the greatest benefits to users. The careful phasing in of technological innovations is essential in keeping facilities cost down. Naturally, this has a beneficial effect on rates, even though cost of equipment is only one factor in setting rates. Similarly, by avoiding unnecessary duplication of useful plant, we also help keep costs down.

There are computer users who want the telephone industry to serve them only with the new digital transmission systems, instead of leaving the choice of facilities to the telephone company. They claim that this would let them get more data throughput for their dollar. Such proposals are impractical. They fail to recognize that perfectly usable plant would be unnecessarily duplicated by such digital systems. To do so would mean higher cost to the telephone companies. What's more, they ignore the prohibitively high amounts of capital needed for such an undertaking.

Others suggest that the best way to lower the cost of data communications is to establish a totally new digital network provided by a new data communications common carrier. This would duplicate the high-quality data services offered by present common carriers. To provide the using public with the same data service capabilities as available with DATA-PHONE service would mean a digital network the size of the present telephone network!

The advantages of planned, systematic innovations are demonstrated by the Bell System's T-Carrier program. We are now installing T-1 digital carrier systems to meet growing communications needs — both voice and data. These systems, by using pulse code modulation, can transmit up to 1.5 megabits per second or 24 simultaneous voice calls over two regular twisted cable pairs. We are adding these facilities wherever the needs warrant it. Today these digital systems are available only in selected locations, but eventually a large part of our plant will be of this type. Even higher speed digital systems are now being developed. A 281 megabit per second T-type facility is planned for 1971.

Our program for introducing T-Carrier is somewhat analogous to the way airlines have phased in jet aircraft. They didn't immediately junk all their propeller-driven aircraft. Instead, they added jets where they could do the most good, to improve service and to reduce costs. We have the same objectives for T-Carrier.

Innovations are also being planned to improve the effectiveness of our existing plant to carry data signals. For example, a new DATA-PHONE data set, capable of transmitting 3,600 bits per second over the dial telephone network, is now in the technical trial stage and will be available in the near future. A similar data set has been developed for private line service, but this one is able to handle 7,200 bits per second. Even higher speed versions are being planned for later on.

We are constantly looking for new ways to meet the expanding data communications needs of the public, including the need for lower priced new services. One such approach, now being studied, is a limited distance data communications system which uses extremely low-cost data sets and line concentrators. Such a system looks especially attractive for use with a time-shared computer at a university campus, in an industrial complex or within a community or other limited geographical area. As planned, this system would be able to serve distant terminals at a somewhat higher cost, but the greatest cost savings would be for stations within a limited service area.

Data line concentrators and multi-channel data sets (multiplexors) are being developed. The sub-channels of these data sets will match the bandwidths of our other narrowband service offerings. For some time now, our tariffs have allowed customers to do this kind of channel deriving on our private line voice channels, using their own equipment.

At the wide band of the data spectrum we find requirements for the transmission of occasional high speed bursts of data — to update computer memories, to load-share a computer or just for back-up in case of computer failure. While these and other applications need wideband channel capacity, they can't justify the costs of full-time wideband private lines. Recognizing this need, we are now introducing on a trial basis a service called DATA-PHONE 50 — a 50 kilobit per second common user switched service. Initially, it's being offered in Chicago. Additional trial offerings may be made in other cities in the near future.

These and other planned new services reflect a continuing research and development effort that began way back in the earliest days of the telephone.
continues today in the realms of both voice and data communications. Our basic function hasn't changed at all; the computer and its requirements have simply added a new dimension to our historic function.

Communications common carriers are the vital link between the computer and those who use it. We provide the transparent channel to interchange signals. We provide some input-output devices, such as teletypewriters and TOUCH-TONE telephones. And we are working constantly with designers of computer systems to establish plans for total computer communications systems. In this process we are blending old technology with new—Rembrandt with Picasso, Bach with the Beatles. If we can be as creative as they are—or were, computers and communications will make beautiful music together for decades to come.

Communication needs of remotely accessed computer

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There are a variety of problems posed by increasing interest in remote access to computers. These problems are further compounded by the circumstances facing firms such as mine which have the audacity to attempt a commercial offering in the face of these problems. This entire area has been much the center of considerable attention as a result of the FCC notice of inquiry. The question has now been raised as to what are the real demands of a remotely accessed computer complex.

On the broadest and most philosophical level there is a problem in the basic environment of a highly regulated utility, especially in the face of a rapidly changing technology. The basic proposition that it is possible for a group of men without substantial exposure to intricacies of this business to adequately regulate communication is suspect. This is not intended as criticism of the job done by the commissioner, but a question of the assignment. It is my firm belief that except in the case of natural monopolies (montonic decreasing cost functions or industries where the public inconvenience and implied cost of competitive service would be disruptive) regulation should be aimed at creating and maintaining a competitive environment. Any attempt to engage in regulation of substantive issues (specific rates, services) presumes a competence on the part of regulatory bodies which is hard to maintain. If such regulation to substantive issues were felt necessary in the computer industry, I feel that it would clearly require a specialized agency. Can you imagine the problems of setting tariff schedules on custom programming or on such things as a payroll service considering all the variations that such a service could provide.

Let me develop my thesis in the context of the services of a commercial time sharing venture. What are the communication services require by the firm and its customer? They include terminals, modems, and lines. Of these, only the lines or channel capacity are inherently a common carrier function (even though a common carrier might well do a better job of providing the others). Even here it is possible to consider private microwave.

Private microwave offers a good case to illustrate my point. There is a basic economic consideration as to whether or not it is economic for a user to consider. The competitiveness of microwave can be reduced beyond economic arguments by having arbitrary restrictions on interfacing microwave lines with the lines of a common carrier. Where interface specifications are met, say by using the common carriers' equipment, in my opinion no objection should be raised.

In another example the ownership of a piece of communication equipment obviously does not affect its performance and hence should not be an issue. If one uses AT&T lines there is no clear reason why Bell Modems need be used. In the case of private lines this is no longer true. Restrictions do apply to the dial-up network. The need for some control of the signals to go through the switched network cannot be argued. However, if GTE modems give acceptable signals coming from an independent telephone company, they should also yield acceptable signals from a private firm. Similarly, other models that conform to interface specifications should be acceptable.

This does not mean that I would suggest that one is better off with non-Bell equipment; quite the contrary. However, if the prices Bell charged got too far out of line or their service too inferior they would than run the disk of losing business. This competitive pressure will do for more to ensure that Bell offers the best service they are able to than any mission.

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This does not mean that I would suggest that one is better off with non-Bell equipment; quite the contrary. However, if the prices Bell charged got too far out of line or their service too inferior they would than run the disk of losing business. This competitive pressure will do for more to ensure that Bell offers the best service they are able to than any amount of FCC inquiry. Similarly, individual users might chose to accept lower levels of safety as far as reliability is concerned in order to get faster transmission. If AT&T feels that they cannot announce service, they are not prepared to make generally available, then the customer should have the right to run the risk of using faster devices within a Bell System guarantee.
The entire question of technological development is a serious one. The more closely regulated an industry is, the slower technological progress will tend to be. The administrative process alone will tend to slow down the provision of new offerings. Similarly procedures used in rate base calculations can serve to remove economic incentive from new developments. Since the development of new transmission technologies, the savings they can bring have substantial affects on the economics of remote computation. It is of particular interest to our industry that means be found to encourage the offering of new services that represent the best state of the art techniques. If there are risks in the utilization of such services or if it is not practical to make them uniformly available, restricted offerings should still be available. In light of recent FCC decisions on the regulation of AT&T's rate of return, an examination of incentives to provide new state of the art offerings may have increased importance.

Let us turn to the areas of message switching. A question has been raised as to whether message switching is inherently a common carrier function. Although the channel capacity is purchased from a common carrier, we fail to see how the public is benefited by restrictions on the nature of the data sent down the line. The situation is analogous to having the computer manufacturers say they will happily sell you a computer but tell you that you are not allowed to run your payrolls on the machine. For that purpose you must buy time on their data center machine even if you have substantial quantities of idle time on your own computer.

One of the problems in the regulation of major portions of this area is that the common carrier himself constitutes a court of first resort. If he thinks you propose a use of his lines which he feels is improper he will refuse to sell you the lines. Now you carry the burden of proof and its attendant legal costs. Minimally, it would appear that it would be only fair to presume that the service is legitimate and force the common carrier to prove that he should be allowed to discontinue service.

This situation is exemplified in the Bunker Ramo case where Western Union had refused to sell lines for a version of Telequote (because Western Union felt that features of the service impinged on common carrier prerogatives). Bunker Ramo then negotiated a system specification that AT&T felt acceptable. Though this explication is oversimplified, it bothers us that the common carrier, which in the case of Western Union desires to be a major competitor in the service bureau industry, should have the prerogative of deciding whether or not a service violates the law. We feel that they should be required to sell to anyone and, if they feel that a particular use is not legitimate, they should bear the burden of proof as to why they should be allowed to discontinue service. This important difference would give the brunt of the legal cost and risk to the common carrier and would give the user service during the period of dispute.

It is clearly a matter of opinion in many cases as to whether a specific computer service provides message switching functions. Not only commercial services are affected, but those of any firm providing service or communicating with its customers and suppliers. In an area this unclear it would appear to me that (1) there is no public interest served by a prohibition of message switching; (2) if prohibited, any decisions as to the presence or absence of a violation should be made only by a disinterested party.

The last item that I would like to suggest is the desirability of including line standards and transmission characteristics (envelop delays, noise, etc.) in the tariff filings (perhaps with deviations by city or major trunk). This might be helpful in having a standard against which one could test in case of disputes on the quality of lines. As I am sure many of you are aware, problems arise when multiple suppliers are involved in an installation. Hardware suppliers typically blame lines for most problems and vice versa. Though we have always found Bell to be cooperative in trying to run down the source of problems, an objective standard against which one could test could aid in the resolution of many of these disputes.

In closing, then, let me summarize by simply verbalizing the hope that these ideas will at least prove sufficiently provocative to stimulate some thought and new ideas. If so, they will have served their purpose. If nothing else, the FCC inquiry should demonstrate the need for considerable thought. Ignoring the specific illustrations, I have tried to advance the thesis that the needs of remote computational usage would be best advanced by as open, competitive, and generally unrestricted an atmosphere as can be created. Where regulation or restriction is deemed absolutely essential, every effort should be made to see that such regulation does not retard technological progress.