THE COMING COMPUTER UTILITY--LAISSEZ-FAIRE,
LICENSING OR REGULATION?

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INTRODUCTION

Science fiction predicted highly automated information processing in the future. We are now witnessing the dawn of that future. Fuzzy forms of that vague, wonderous, and somewhat fearful notion are now moving into sharper focus. However, society is rarely prepared for the actuality of the predicted event. Full anticipation is no barrier to surprise.

Technology moves swiftly, while its regulatory control mechanisms lag with that erratic form of slow evolution found in institutions.

THE GROWTH OF SYSTEMS

Our first railroads in the 1830s were short routes connecting local population centers. No one sat down and laid out a master plan for a railroad network. With time, an increasing number of separate local systems were built.

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A network gradually grew as economic pressure caused new links to be built spanning gaps between individual routes.

We did not start to build a nationwide telegraph network in the late 1840s--only independent telegraph links. But we soon had an integrated nationwide network. Even the name, Western Union, recalls the pattern of independent links joined together to provide a more useful system.

A nationwide telephone system was not planned in the 1890s. Yet, today we have a highly integrated telephone network.

Such patterns of growth are not accidents. Communication and transportation are services that historically tend to form "natural monopolies." The reason is understandable. It is cheaper to share use of a large entity than to build your own facilities. Hence, if you were to look at the earth, say, from the vantage point of the moon, it would appear that the growth of these integrated networks out of individual pieces is almost biological.

WHERE ARE WE GOING?

So much for history. What is of interest to us is that computer utilities now developing have the same properties as communication and transportation that cause the integrated networks to be self-agglomerating. It is cheaper to share information by tying together independent systems, than by building a very large number of highly duplicating systems without interconnection. But "information" is too treacherous a commodity to be widely disseminated with ineffectual controls. Even a little

information improperly used can do irrevocable harm. Information is readily counterfeited. It can be quickly reproduced and widely transmitted very cheaply.

What are the mechanisms that will form an environment for the growth of this new type of computer or information utility? What are the economic pressures? What sorts of new things will be possible? What are the dangers? And, what is it really all about?

INFORMATION PROCESSING

The new applications possible with developing computer technology are of such significance as to materially affect the quality of our life. Numerical processing, the business that gave the computer its name, has already been relegated to a secondary place as the next generation of computers are used for such tasks as storing and retrieving personal records, checking police files, diagnosing illness, simulating business operations, creating elementary teaching machines, reaching routine business decisions such as investment and inventory policy, reading addresses of letters, and sorting mail. This open-ended list is but a coming attraction of tomorrow's computer. The word "computer" may be a misnomer for it is the automation of information flow that is really at the heart of the computer revolution.

It is striking to examine today's occupations and find that so many can be factored into a programmable series of data-processing tasks. The bulk of today's white-collar occupations are vulnerable to change and possibly obsolescence. Most are relatively simple

programmable information processes. With time, many of these individual tasks will be done better by the computer. The librarian, the teacher, the physician, and even the policeman spend much (but certainly not all) of their time at chores that are better suited to the new information systems that are becoming available. Some "administrators" perform few tasks that cannot be better delegated to a well-programmed computer. The computer will allow an expansion of the time these individuals can devote to handling "exceptions," as their routine work is lifted off their shoulders. Those who do only the completely routine will be candidates for replacement as their capabilities can be better used elsewhere.

AN EXAMPLE

The speed and facility with which computers manipulate numbers is old hat. Our new computers process and rearrange words as readily as their predecessors handled numbers. Today, large files can be processed, stored into the memory banks of the computer and rearranged upon command. Information is being retrieved in an increasingly abstract and sophisticated manner.

Perhaps you wish to send off several slightly different angry letters to editors of different periodicals. You would, in this new era, type a rough draft onto an electric typewriter device; type a few symbols to rearrange the orders of the paragraphs; type a few more to add words and delete others; call up some stock phrases that you may have used before; add your own previously defined symbol to specify your list of addresses; and,

when satisfied with the draft, type a single word, "GO." Out of the typewriter at 150 words per minute would emerge a series of perfectly typed individual letters.

The publication deciding to publish your letter would hand it to a typist. She would type your letter into the computer, specifying a desired column width. Such details as the decisions of hyphenation, and insertion of blank spaces to neatly justify the right margin are provided by the computer. (The computer memory might even contain a dictionary to abort most misspellings.) At a later date in the future, automatic print readers would even eliminate the need for the publisher's typist.

TIME-SHARING

This all may sound expensive and impractical. We do not want to buy an entire computer for such simple tasks. It is like buying a cow for a little cream for our coffee. But with the advent of the computer utility we need not. We would merely use a small portion of the large capability possible in our new computer systems. These new computers are becoming more powerful. Even now it is economically feasible to simultaneously share a single machine via electric typewriters among a large number of users.

The major advancement in spreading the access of the computer to an ever wider segment of society is "time-sharing." Our newer computers are becoming so fast relative to human response that a single computer can now rapidly serve a large number of users and maintain the illusion that each has his own computer. The

conversion of raw computer speed into simultaneous service to a large number of users is a key aspect of the coming computer revolution, for it spreads the benefits of computer technology widely. No longer is the computer limited to large agencies.

With a marked decline in the cost of computing power each year, together with a static or increasing labor cost, the usable market for newer information processing systems can only increase with time.

Within the next year or two we can expect to see about 100 separate general-purpose, time-sharing computer systems. These early general-purpose systems can, for the most part, only serve customers economically within 50 to 100 miles from the central computer. For, other than advertising demonstrations (or "experiments," as they are called if performed by academicians), the economic limitation is the high cost of long-distance telephone lines. Communication costs limit the area that can be economically served by any single computer installation. Just as transportation cost relative to the value of a product limits the economic size of a market for a commodity, communication cost limits market size of a computer utility. We therefore expect to see many small, independent "computer utilities"--at least at first.

THE IMPORTANCE OF COMMUNICATIONS

The economics of communications may form the key determinant of the nature and size of the new "computer utilities." Further, the communications interface is the only place where present regulatory mechanisms exist

that can be stretched to even remotely touch upon pricing, ethics, and responsibility of these early time-sharing systems.

The computer field, while dominated by a single large company--IBM--has bred a host of small, fast-moving competitors that have kept the leader on its toes. Competition in the computer business is relatively fierce and the number of losers large. In long distance communications, we have a history of protective governmental regulatory action which allows less room for free enterprise competition. The conflict begins as the totally unregulated computer companies rub up against their highly regulated communications suppliers. As the bounds of technological growth of computers press upon the untested barriers of existing regulatory processes, stresses develop which create pressures for an examination of the entire communications regulatory structure for data transmission.

A COMPUTER IN THE HOME?

While it may seem odd to think of wanting to pipe computing power into houses, it may not be as far fetched as it sounds. We will speak to the computers of the future in a language simple to learn and easy to use. Our home computer console will be used to send and receive messages--like telegrams. We could check to see whether the local department store has the advertised sport shirts in stock in the desired color and size. We could ask when delivery would be guaranteed if we ordered. The information would be up to the minute and accurate. We could pay

our bills and compute our taxes via the console. We would ask questions and receive answers from "information banks"--automated versions of today's libraries. We would obtain up-to-the-minute listing of all television and radio programs. We could use the computer to preserve and modify our Christmas lists. It could type out the names and addresses for our envelopes. We could store in birthdays. The computer could, itself, send a message to remind us of an impending anniversary and save us from the disastrous consequences of forgetfulness.

IS THE COMPUTER UTILITY REALLY A UTILITY?

While the term "computer utility" is commonly used to describe the new computer/communications networks, they are markedly different than in the classical utility. A utility is a "natural monopoly" in which the government issues an exclusive franchise to provide service to the public on a noncompetitive basis. In return for the monopoly granted, the utility acquires a set of obligations. This includes the requirement to provide service to all comers on an equal basis, including those that are highly profitable and those that are not. You pay the same for electricity whether you live next door to the electric generator or on the fringe of the city.

On the other hand, a potential "computer utility" user in a big city can buy his service from any one of perhaps a dozen or more strongly competing time-sharing systems. The computer "utility" user is not restricted to doing business with any one company. If you are not satisfied with your service, or are concerned about price,

you can always "go" elsewhere. Similarly, any single computer installation is not forced to serve all potential customers on an equal basis. The big customer may expect preferential treatment, either in terms of prices charged or speed of service. (Time-sharing systems have peak load problems where service delay times occur.)

In essence, then, computer "utilities" are not utilities.

WHAT'S WRONG WITH LAISSEZ-FAIRE?

There are several reasons why some form of regulations appears required. Let us consider one of the more dramatic ones, that of privacy and freedom from tampering.

Highly sensitive and embarrassing personal information will be stored in many of the systems contemplated. Information will be exchanged over easy-to-tap telephone lines. Yet, nothing more than faith stands in the way of a would-be eavesdropper. Or, hopefully, a lack of the new criminal's technical sophistication. All data flows over the lines of the commercial telephone system. Hanky-panky by an imaginative computer designer, operator, technician, or programmer could have disastrous consequences. As time-shared computers come into wider use, and hold more sensitive information, these problems can only magnify. Today we are lacking in mechanisms to insure that the time-shared system operator will provide adequate safeguards.

Because of the difficulty in rebuilding complex systems to incorporate safeguards at a later date, it appears desirable to anticipate these problems involved

in protecting privacy. The issues here are of common interest to both public and private agencies and for companies as well as individuals. We can no longer count on the protection we give our own files. All our information will be stored elsewhere.

BACKGROUND TO REGULATION

Some sort of protection against abuse appears advisable. The most desirable form of sanctions to insure compliance is, today, an open question. Regulatory mechanisms are strong and expensive medicines that must be prescribed with care. Like many of today's more expensive, strong medicinals, regulation comes complete with an unexpected set of undesirable side-effects--cures cannot be guaranteed and the side effects may be worse than the ailment.

LICENSING

As much of the problem of privacy safeguards hinges on personal integrity, individual licensing is one possibility under informal consideration. Computer programmers, repairmen, designers, and all others responsible for the operation, maintenance, and control of shared computers could be licensed as are doctors, lawyers, and undertakers.

Professional licensing has generally taken place at the state level where the freedom of the local licensees remains greatest. However, the interstate nature of the information systems of the future may make national

licensing more desirable. State-by-state regulation is generally preferred by the entrenched practitioners in a field whether it be medicine or real estate--provided a "grandfather clause" blankets all those presently practicing, regardless of competence or qualifications. As such state or local licensing reduces employment mobility, and new entry of individuals seeking to practice in an area, a broader based licensing may be more appropriate for a volatile a new field as computers.

Whether such licensing would be acceptable to the personnel involved is doubtful. In contrast to those occupations which seek to deny new entries into their field, those in the computer field actively seek to increase their own numbers and competition--a very strange phenomenon by conventional professional standards, but an important factor when considering the "salability" of licensing. Further complicating the matter is that computer programmers often have a diverse educational background, are distrustful of regimentation, and, in general, do not fit the tight mold of uniformity of background that licensing generally demands.

COMPUTER REGULATION VIA COMMUNICATION REGULATION

Some de facto regulation of time-shared systems is already appearing as a by-product of the regulatory rules established for communications of an earlier era.

The utility regulatory process has been fundamentally a backward-looking affair. Rules under which one must live tomorrow have been based on historical experience of the past. Regulatory bodies rarely lay out tariffs on

the expectation of new technology to come; only the dead past is considered. In at least one major instance, "forward-looking tariffs" (tariffs estimated on future costs) have been specifically rejected by the FCC. The communications tariff philosophy for time-shared computers is a legacy from a different era and for a communication system designed for a different purpose--telegraph and telephone communications.

A fresh wind blew last November, when the FCC took the industry by surprise and announced that they planned to investigate its own role in the domain of the "computer-utility." A tentative list of questions was announced. An inquiry of such basic proportions usually takes several years before being resolved. But it is clear that the FCC appreciates that there are new issues that need attention.

It is increasingly evident to the computer community that the new generation of time-sharing systems are best served by a somewhat different widespread communication capability between computers and from computers to people than the traditional telephone connections. The voice common-carrier communications systems of today were designed primarily to provide a voice-to-ear or typewriter-to-typewriter link between humans. Today's communications regulation doctrine still regards the computer merely as another user of these existing telephone, typewriter, and telegraph networks. It isn't merely the matter of jamming a size ten foot into a size five shoe. The fundamental desired communications characteristics are so different

that we are living on a procrustean operation basis. For example, the computer user wants short, high-speed spurts of data. He is intolerant of the errors caused by background noise. He doesn't want to have to pay for a long-time telephone-call-like connection, as his line will be idle most of the time. He would like to share it with other similar, short-burst, computer "party-line" users serving other systems--with time sliced very finely.

The subtle nature of the more complex interaction and the interface between the communications system and the computer is long overdue being acknowledged as a problem by the regulatory agencies--let alone appreciated. This shouldn't be interpreted as a narrowly directed indictment. Many computer manufacturers, and the key communications suppliers themselves, have also been slow to respond in proportion to the significance of the occurring change.

MONETARY PRESSURES

Regulation, when it comes, will probably not center on the libertarian issue of privacy, but rather on an even more emotional subject--money.

What is best for the new computer utility may not, at first, be what is most profitable for the telephone company. This is a game for high stakes and high emotions. So high, in fact, that the lawyers' position papers quibbling over tariffs, rules, and the Government's right to investigate some of these early issues resemble the exaggerated outrage tone of diplomatic letters preceding wars. To the detached technologist, all the lawyers'

huffing and puffing is but an involuntary action responsive to an irreversible set of technological changes. The evolving issues are beyond the sole domain of the participants. All are swept into a situation not of their choosing. It has become a "Federal" case. But the pitiful technical resources of government required to unravel the legal obfuscation of the contestants are small in comparison to the complex task ahead of them. The budget of that portion of the FCC that must serve in the public interest in this new field is incommensurate with the magnitude of this complex task. One could hardly think of a more expensive way to save the taxpayer money. As a result, the overburdened staff of the FCC and other regulatory agencies must play the game of keeping their jobs simple--not leading, but only responding to countervailing pressures. They act passively in their roles on a day-to-day basis as protector of both the public and the utilities. Allow none to make too high a profit; allow none to jeopardize the profit of previous investments of the common carriers; disallow income from one majority set of users to be used to subsidize a new service which may be subject to outside competition; and indirectly delay the evolution of the technology by avoiding taking on tasks which call for a more complicated regulatory process.

Let us examine some of the economic forces at play in the new computer utility field, and compare them to the limited regulatory staff power.

THE ECONOMICS OF THE NEW COMPUTER AND
COMMUNICATIONS TECHNOLOGY

Yearly, the cost of computation equipment declines drastically. A computer system only a few years old is ready for the junk heap. The parts are as good as new, but later models are faster, smaller, and less expensive to operate (per equivalent unit of computation). "Last generation's" computers are too expensive, though incompletely amortized. Rapid obsolescence takes a tremendous capital investment burden upon the computer manufacturer. The more successful it is selling computers, the more money it ties up. It is no secret that the computer divisions of most companies are not paying dividends. Striving for merger or looking to the far future before expecting a payoff is the common strategy. The decision of a large electronics company to stay in the high-stake poker game is not one of choice. The major future element of electronics growth lies in the computer-technology art. To drop out of this no-limit poker game is like the icebox maker choosing to drop out of the electrical refrigeration business. You either go where technology takes you or you cash in your chips and leave the game. Corporate management's goal is synonymous with self-preservation of the corporate manager. The tendency to stay in the game is overwhelming even though the opportunity cost for the invested capital may be temporarily higher elsewhere.

In the unregulated computer business, free enterprise is at its competitive best aiding rapid technological growth. The computer consumer is reaping the benefits of

large, high-risk capital investment. The tab for rapid equipment obsolescence is picked up to a large extent by the competitive computer manufacturers.

Now, let us consider the other partner of the joint technology of computers and communications. Communications between the unregulated computers and their remote users is over circuits provided by regulated utilities. The costs and tariffs in the regulated communication business cannot be identical. To charge each user what his service actually costs would be unmanageable. It would possibly require more accountants (and lawyers to adjudicate differences) than telephone repairmen--and one out of 70 people in this country already works for a telephone company or its suppliers.

The time-sharing systems of the future will make heavy demands for a new form of communications between computer elements. The differences between communication costs and tariffs widen as communications is simultaneously undergoing technological improvements--especially in systems designed primarily for the transmission of digital data. Although such systems exist today only as paper studies, it may not understate the case to say that the full momentum of this new technological force is blunted by the inertia of present regulatory policy which isolate tariffs from the type of equipment used to provide a service and limits the type of equipment that may be connected to the line.

THE RATIO OF COMMUNICATIONS TO COMPUTER COSTS

A period of rapid technological innovation can produce temporary dislocations during which time obsolescence can occur before amortization. The end result will be markedly different, depending on whether the industry is regulated or unregulated. And, if regulated, whether the utility is totally free of competition from substitute goods.* In the real world, as costs and tariffs of communication are (almost by definition) not usually identical, only a long-term decline in tariff rates may be expected. But, if the change in technology is sufficiently abrupt to allow a new entrant to create an entirely new communications system or a portion of a system at a lesser cost than tariffs based upon the unamortized cost of existing equipment, then a new range of possible alternatives presents itself. Some of these could be violent. (There are some who hold that because of developments in digital technology, microwave, and satellites, it will be possible to build entirely new special communication systems designed solely for digital communication at a lower cost than present tariff offerings.) Present data tariffs are based upon using a communications plant designed primarily for voice

*Computer manufacturers try to write their equipment off as fast as possible. Contrast this with the seemingly strange behavior of telephone companies that refuse to use the newly allowed seven-year writeoff permitted by the Internal Revenue Service--preferring a twenty-year write-off. The reason is that the legal tariffs are established by the book value of the plant. You can charge the customer more if you are a regulated utility, and can show a larger unamortized plant investment.

communications. Today's limited number of data subscribers are minority users of the system. Digital transmission and switching is being adopted by the telephone company in their future plans as the most economical way to serve new voice and personal television users. But the full advantage in switching to digital communications techniques is not felt by the data user because the savings are watered down by the flywheel mass of the large size of the slowly amortized telephone plant which is used in the overall tariff calculation. This being so, the plunging cost possible (in a system designed for data transmission or at least optimized for data transmission) does not appear as major savings to the computer user. There are some companies eager to enter the data communications field but for the legal restriction to competition and a well founded fear that the telephone company might change its offerings and wipe out the new competition.

Only a few years ago this would have been of minor importance. The data users were few and communication cost was low compared to computation. But now the cost for computation is dropping so rapidly that relative to computation the cost of the communication needed to tie together many users of a single machine is the overriding cost limitation. A few years ago the cost of communication was only about 10 or 15 percent of the total computer-communication system cost. In some of the larger systems now being considered, communications cost is 50 percent or more of the total system cost. Estimates of over 60 percent are anticipated for some later time-shared systems.

This increasing imbalance where most of the expected giant computer dollar will be spent to purchase communications causes the computer user to press the communications supplier to reduce his tariffs to prevent throttling the technological growth of the computer industry. This desired price reduction has in the past only appeared as a polite request. It was not a major cost factor, and it was hardly worth any single computer company's time to press the issue. All computer suppliers paid the same price for communications. (This phenomenon is similar, for example, to the practice of building contractors not strongly opposing craft labor union demands for higher salaries. There is little advantage to any single contractor, because in the end all contractors pay the same rate, so little is lost, other than by the consumer, in granting generous wage increases.)

In the impending time-sharing system evolution certain mechanisms exist that can bring these gentlemen's agreements to an end, and a Donneybrook might result.

DATA CONCENTRATION

It is both technically feasible and necessary to concentrate the traffic from a large number of separate users in order to share expensive transmission circuits. Each telephone circuit, plus a little storage to smooth peak loads, is capable of handling as much as a few hundred times the average load generated by first-generation remote terminals. Obviously, if communications costs continue to be overriding, there is a tremendous payoff for "concentrating" a large number of users together over a

single telephone circuit and splitting the bill among them. Today, a small time-sharing system cannot economically serve customers more than 50 to 100 miles away. But if a group of people in Los Angeles wished to share a communications circuit to tie into separate computer systems in the Boston area, it is perfectly feasible to build a small computer-like device called a "digital concentrator" and gather all the signals together and transmit them over a single circuit leased from the telephone company. The cost of communications per user would become so low by this arrangement that it would be possible to economically place the computer almost anywhere in the country in many applications. There is only one catch--this is in violation of present-day laws! We would have created an unregulated common carrier.

Today we can concentrate only if: 1) we have enough users served by the same computer company to divide the costs of the concentrator; 2) the communications are used only for computation; and 3) not to exchange "messages" between users. In other words, if all the computer companies could get together this would increase the economic area that can be served by a time-sharing system from 75 miles to over 3000 miles. While technically feasible, this approach would be illegal unless all the users or all the end computers were owned by a single company. Smaller computer companies cannot share communications facilities to compete for distant users. If they did so, they would become illicit common carriers--unless they were regulated. But, there is little precedent upon which to create such new common carriers. Hence, the

legal roadblocks anticipated, if they sought this avenue of relief, could jeopardize their activities for years. Clearly then, it would appear in the best interest of free enterprise to allow any group of users and/or computer installations to create their own shared-computer data carriers.

THE LARGE GET LARGER

With the increasing cost component falling on communications, there is a new advantage falling to the larger time-sharing computer companies. Because of limitations as to who may concentrate traffic, the larger time-sharing system receives an advantage of economy scale by being able to concentrate traffic from a large number of users. This provides a cost advantage to the larger time-sharing systems and is a detriment to the smaller.

CREATION OF A NEW COMMON CARRIER

The creation of a new concentrator service to provide this service appears indicated. But there are barriers mitigating against this approach.

Although the telephone company has expressed no interest in doing so,^{*} there are computer manufacturers willing to enter the field provided that they are protected from the uncertainty of the telephone company later entering the business after the market is proved out, and before their special-purpose equipment is amortized.

^{*}Or some people say "can't" according to their interpretation of the 1956 AT&T-Western Electric anti-trust consent decree.

The strongest barrier to the proposed common concentration approach is that the telephone company itself may be expected to raise strong objection to the proposal on the legally correct grounds that one has created a new common carrier which apparently would not be subject to regulation. Whether this objection would vanish if this "new communications utility" were to be regulated in some manner is difficult to predict. While the telephone company would temporarily lose business because of concentration, it would still be the supplier of the basic links required by the new regulated communications service.

Another cloud of doubt is the possible enforcement of the ancient Western Union Telegraph Company franchise as the carrier of "record traffic" (written text). Some hold that even though the computer did not exist at the time of the granting of the Western Union franchises, if the computers exchange "record traffic" Western Union's legacy from a dead era gives it a case upon which to argue that it alone can legally provide the desired services. This viewpoint is not willingly accepted by most computer manufacturers. Seemingly underlying the strong opposition to the exclusive control of this potential market by the telegraph company are several factors. Western Union is already in the time-sharing computer services market. By taking on the role of a competitor as well as supplier, it has placed itself in a position where it has aroused the animosity of the time-shared service suppliers. Further, few computer companies wish to see the rate of technological development of their industry hinge on any single organization.

THE ALTERNATIVE--STATUS QUO

Assuming the maintenance of the present regulatory status quo pattern, we may still expect to find concentrators being developed. But their growth pattern will be different. The small time-sharing company will not be able to serve enough users to do very much concentration economically except within a few major cities. Conversely, the large computer companies will serve a large number of customers earlier in the game. As such, they will be able to provide an earlier and broader concentration, and so reduce the communications cost to their own users only.

As the cost of communications will be expected to be the overriding consideration in many instances, merely by standing still we will allow a situation of dynamic instability to occur. This force will cause the larger computer utilities to grow larger as they service the entire nation economically; the smaller companies could compete only in a few major cities. The larger companies possess a sufficient economy of scale to serve to the disadvantage of the smaller companies.

Therefore, unless independent users and independent companies are permitted free access to concentrate their traffic, we could impede the development of the technology by placing a disproportionate advantage in the hands of the large computer companies at the expense of the smaller time-sharing supplier.

At this stage, ineffectual regulation will drive out the smaller "computer utilities." While this would greatly

simplify the burden of regulation (because of fewer companies to regulate) we should appreciate the secondary price we may pay and should carefully consider the alternatives.

POSSIBLE POLICY MEASURES

We have touched upon a series of problems facing the development of a new technology. The criteria for the choices facing us would preferably:

- 1) Aid the development of the new computer technology;
- 2) Offer maximum protection to the preservation of the rights of privacy of information;
- 3) Encourage the development of competitive free enterprise in all sectors of the new "utility," recognizing that preservation of free choice is not only economically feasible but desirable;
- 4) Minimize the complexity of the regulatory process so that it does not stand as a potential hindrance to new entrants.

To these ends we might wish to consider the following policy choices:

1) Initiation of Professional Licensing Standards

The time is propitious for the professional/technical societies whose members include programmers, design engineers, technicians, and managers of the new computer utilities to address the licensing issue. An early dialogue on standards of ethics, fiscal responsibility, and penalties for abusing the proposed licensing standards would provide a better picture upon which to construct privacy protection schemes. Although licensing would

probably be performed on a state-by-state basis, a model National Code would be helpful in expediting reciprocal licensing agreements. As data is already flowing on an interstate basis, the issue of national licensing should also be considered.

2) Remove the Economic Advantage to Large Computer Utilities by Changing the Ground Rules on Concentration

Unless the rules prohibiting smaller computer utilities from gathering together their traffic from remote cities and concentrating it for transmission are modified, we can expect the larger computer utilities to drive out the smaller ones merely on the basis of communications cost. While this problem can be solved by the creation of new common data carriers, the price and time delay of the certain litigation may kill off the smaller litigants before their cases are adjudicated. Either simpler licensing procedures or redefinition of "common carriers" is indicated.

3) The Right of Free Exchange Across System Interfaces

A new pronouncement by the regulatory agencies of a doctrine of free interchange of signals across the boundaries of individual systems would be of tremendous technological benefit.

Once, when the telephone company sold only a mouth-to-ear service, constraints on all equipment connected to the system may have been justified. But today, the telephone plant is carrying a heterogeneous mixture of signals. The nature of the signals should be of no concern to the

telephone company (provided the mean value of the loading signal strength and passbands are limited so as not to cause interference to other signals). The user should be allowed to connect any mixture of computer and other signals without having to use a different tariff depending upon who is sending what.

4) The Right of Attaching Foreign Devices

Telephone companies have jealously guarded their right to control all devices attached to the telephone system by a euphemism called the "foreign attachments doctrine." They have even hauled into court those who would issue free plastic binders for telephone directories as a violation of this doctrine. Today, no computer can be connected to the switched telephone system unless a box called a "Dataphone"* is inserted between the telephone line and the computer. The computer manufacturers feel that they could reduce the cost of their remote terminals if they were allowed to build their own circuitry (and still protect the telephone from a potential source of interference). This would mean fewer pieces of equipment on a customer's premises requiring service by another organization. Computer manufacturers would like to receive a definitive standard of the electrical signal required to feed telephone lines. They feel that telephone utility should provide communications and not data-processing equipment.

*A registered trademark of AT&T.

5) Encourage the Use of Radio for Data Transmission

The FCC could stimulate competition in the local communications field by encouraging the use of the lightly occupied Super High Frequency spectrum for the transmission of data. In the future, there will be a growing need for a single computer (or concentrator) located in the center of a city to spurt data to inexpensive TV-like displays at a large number of remote terminals. Highly directive microwave offers an economical solution to this requirement, provided the licensing red tape is reduced and we allow some newer forms of signal modulation (such as spread spectrum) to serve a large number of highly intermittent computer users, to share a common frequency band. FCC rules and standards here delay the development of new communications technology.

CONCLUSION

We are moving headlong into an era where information processing will be available the same way one buys his electricity. But the attributes that distinguish heterogeneous information from the homogeneous products distributed by the earlier utilities are so different that a fresh regulatory approach is needed for technological progress, safety, and the public interest. We may want to think of this as tomorrow's problem. But tomorrow is here.