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All About Computer Time-Sharing Services

Time-sharing service companies owe their existence and rapid growth to the generally accepted principles that:

● Because of the inherent economics of computer production and operation, it's usually cheaper to use a small piece of a large computer system than a large piece of a small one.

● Computers should be easy to use and should maximize the efficiency of the *people* who use them.

● Thousands of prospective users want and need a convenient, economical source of computer power.

● Present equipment, software, and communications technology makes it practical to divide the resources of a large computer system among many simultaneous users at remote terminals.

A time-sharing system can be defined as a computer system that allows multiple users to gain simultaneous access to its facilities. Ideally, such a system should give each user the impression that all the computational, storage, input/output, and software resources he needs are continuously at his disposal, while keeping him unaware of the fact that he is actually competing with many other customers for the use of these resources.

Though the concept of computer time-sharing is quite simple, its effective implementation has turned out to be a nightmarishly difficult task for both equipment and software designers.

The first time-sharing systems were developed in the universities in the early 1960's, with M.I.T. and Dartmouth in the vanguard. The first commercial time-sharing services were established in 1965. Both the suppliers and the users of these early services had to overcome many problems, and progress was quite slow at first. But by 1968, time-sharing had become the hottest topic in the computer industry and the darling of Wall Street, and it seemed as if everybody was trying to get into the act.

Unfortunately, the economic crunch that began in 1969, coupled with the sadly misdirected technical and sales efforts of many of the young time-sharing firms, led to a severe shakeout. New customers were hard to find, and it became virtually impossible to raise capital to start a new time-sharing company or nurture an existing one. Dozens of time-sharing service firms merged with other companies, abandoned their time-sharing efforts in favor of more promising activities, or closed their doors completely.

THE TIME-SHARING INDUSTRY TODAY

Surprisingly, in the face of all these adverse conditions, nearly 150 U.S. and Canadian time-sharing companies have managed to survive. What's more, at least 28 of these companies are currently showing profits on their time-sharing operations, according to the July 1971 issue of *Time-Sharing Today*.

Time-sharing service companies are now supplying a broad range of computer services to thousands of business firms of all sizes. Time-sharing offers many attractive benefits—but it's not for everyone. This report describes the current state of the art, surveys the offerings of 68 time-sharing service companies, and provides straightforward guidelines for selecting the one that best meets your needs.

Despite the current problems of many of its suppliers, it's clear that time-sharing is here to stay. It represents an effective solution to the information processing requirements of many (though by no means all) companies, and new developments in equipment and software are steadily increasing the scope of its practical applications. Total revenues for the time-sharing services industry rose from just $20 million in 1966 to an estimated $300 million in 1970 and $400 million in 1971. This figure is expected to grow to approximately $1.3 billion by 1975.

The leading U.S. supplier of time-sharing services is General Electric Company, which entered the business in 1965 and has invested some $150 million in developing an ▷

The economical Teletype Model 33 terminals (shown here with Teletype's new, cartridge-loaded Magnetic Tape Data Terminal) are by far the most widely used terminals for time-sharing applications.

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international network built around "supercenters" containing multiple Honeywell 635 and 235 computers in Cleveland, Ohio, and Teaneck, New Jersey. GE is now placing primary marketing emphasis on its network data management services, which provide rapid remote access to centralized information files for applications such as inventory control, resource scheduling, price quotations, and financial reporting.

Major computer manufacturers with a significant involvement in time-sharing services include IBM (through its Service Bureau Corporation subsidiary), Control Data, and Honeywell. A number of independent suppliers—notably Applied Logic, Computer Sciences, Com-Share, McDonnell Douglas, National CSS, Tymshare, and United Computing Systems—have made multimillion-dollar investments in time-sharing and offer nationwide services. Then there are the dozens of smaller regional time-sharing companies, which offer a wide choice of equipment, software, and services.

WHY USE TIME-SHARING?

Commercial time-sharing services offer numerous attractive benefits to their users. Some of these benefits, indeed, are so compelling that many companies with large in-house computer systems of their own are also heavy users of commercial time-sharing networks. Here are some of the principal reasons for using time-sharing services:

- *Flexibility.* Time-sharing enables you to buy only as much computing power as you need and (except for fixed terminal costs and minimum service charges) to pay only for what you use. Thus, you can effectively "stretch" or "shrink" the size of your computer installation from day to day as your workload expands or decreases. You can use a time-sharing service to handle the peak-period overloads on your in-house computer system. You can explore the possibilities of centralized data bases and management information systems at comparatively low costs and without any long-term commitments. What's more, you can deal simultaneously with two or more time-sharing companies and take advantage of differences in their pricing structures, languages, and program libraries.

- *Ease of use.* In general, time-sharing terminals are straightforward in operation and easy to learn and use. Programming languages such as BASIC, together with conversational-mode compilers and debugging aids, have made programming quite simple and fun to learn. The comparative simplicity of the terminals and their ease of operation has made computational time-sharing an accepted mode of operation for numerous engineers and accountants who previously resisted all efforts to get them directly involved with computers.

- *Man/machine interaction.* Time-sharing permits direct, instantaneous communication between humans and computers at affordable prices. Users can test and debug their programs as they write them, with the computer checking, guiding, and reassuring them at each step in the process. A similar dialog process between man and computer can greatly facilitate the solution of many engineering and scientific problems, and can provide managers with exactly the information they need for informed decision-making. What's more, time-sharing users can spend hours of "head-scratching" time at their terminals without holding up an expensive processor—although it should be noted that the terminal connect time usually costs from $5 to $15 an hour.

- *Fast turn-around.* Time-sharing can greatly reduce the elapsed time between the submission of data to be processed and the delivery of the computed results. In the case of typical in-house batch computer systems, turn-around times usually range from several hours to several days. The time-sharing user can simply sit down at his terminal, enter the data, initiate execution of the appropriate program, and get the results he needs, either at his terminal or on a suitable output device at the computer site, all with a minimum of delay.

- *Choice of languages.* Most time-sharing suppliers offer a choice of several programming languages, making it quite feasible for each user within your organization to work with the language that best suits his problem and his background.

- *Application programs.* Most of the commercial time-sharing companies are placing an ever-increasing emphasis upon the development of ready-made programs for specific applications. The availability of suitable application programs can save you thousands of dollars in programming costs and get you "on the air" much sooner.

- *Networks and data bases.* A number of companies now offer nationwide communications networks that permit users scattered around the country to access a centralized data base. These services can permit your company to enjoy most of the advantages of a wide-spread on-line communications network with centralized files at a fraction of the cost of setting up and operating your own. What's more, recent FCC decisions have opened the way for independent carriers to provide cheaper and more flexible data transmission facilities, which should spur further progress in this area. (It should be noted, however, that considerations of communications reliability, access control, file security, and flexibility of the available data manipulation and retrieval languages

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▷ become particularly important in this type of application.)

● *Dedicated services.* Dozens of companies are now offering time-sharing systems dedicated to providing a specific type of service. These systems can be divided into two basic classes: those that provide specialized computational or data processing services, and those that provide access to a single central data base. Examples of the first class include dedicated systems for hospital accounting, automobile dealer accounting, text editing, and civil engineering computations. Probably the best-known services of the data base type are the stock quotation services furnished by Bunker-Ramo, Scantlin Electronics, and Ultronic Systems. Other examples are the automated credit bureaus and reservation systems.

POTENTIAL DRAWBACKS

Despite its many benefits, time-sharing can be a distinctly mixed blessing. Here are some of the potential drawbacks to watch out for:

● *Questionable reliability.* This is the question that should be uppermost in the minds of prospective time-sharing users: Just how reliable is the service? Many of the early time-sharing networks earned a notorious reputation for being down (out of service) more often than they were up. Fortunately, a great deal of progress has been made since those days. On-Line Systems, for example, boasts that the availability of its system currently averages over 23.8 hours per day. Most of the commercial systems now seem to average roughly one or two "crashes" per week, and these are usually of short duration and followed by effective recovery procedures that minimize their impact upon the users' operations.

Even so, the reliability problem continues to haunt the purveyors of time-sharing services, primarily because of problems arising within the facilities of the telephone companies which provide the vital communications links between the time-sharing computers and their users. The telephone companies are being severely criticized for their failure to provide the quality of service required for reliable data communications. Overall, the reliability of the existing time-sharing services is more than adequate for most applications of the computational variety. But companies contemplating the use of time-sharing for business data processing, where important files must be stored and processed with minimal errors, should pay careful attention to the reliability aspect.

● *Slow input/output.* In many of the current time-sharing networks, input and output speeds are still limited to the 10 to 15 characters-per-second rates of conventional typewriter-style terminals. These low speeds are more than adequate for many applications, but in other cases they impose a severe restriction on throughput. To overcome this limitation, many time-sharing companies now support much faster terminals.

● *Low computational efficiency.* The complex software required to coordinate and control the operations of multi-user time-sharing systems usually requires large amounts of central processor time and memory space. As a result, the computational efficiency of many of the current systems is very low. From the user's point of view, this poor efficiency may or may not be a matter of concern, depending upon the manner in which the central processor costs are allocated.

● *Questionable data security.* When multiple users share a computer system, challenging problems are encountered in safeguarding the confidentiality and integrity of each user's programs and data files. Most of the commercial time-sharing services have paid a good deal of attention to this security problem, combining special access protection with passwords and a variety of other techniques. Recent court decisions have established that access to computer files by unauthorized persons is a crime. Prospective users of any time-sharing system should make sure that the available security provisions will adequately protect their interests.

● *System loading problems.* In addition to down-time resulting from the reliability problems discussed above, a time-sharing system may be unavailable when you need it because the system is "saturated." Saturation occurs when a time-sharing system is being accessed by the maximum number of users it is capable of serving simultaneously. As the load on a system grows heavier, response times tend to increase, turnaround times get longer, and throughput drops. Finally, when saturation is reached, no more users can be served until someone completes his job and disconnects. Unfortunately, the heavy system loading conditions that are so frustrating for users often represent high-profit situations for the time-sharing suppliers.

● *High communications costs.* Unless you choose a time-sharing company that offers "free" or fixed-cost local access in your area, communications costs can easily represent the largest component of your time-sharing bill. One of the problems is that it is usually necessary to use standard voice-grade telephone lines, with a practical data-carrying capacity of 4800 bits per second or more, to transmit teletypewriter data at 110 bits per second. Needless to say, the user pays for this inefficiency. Prospective ▷

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Multiple Honeywell 635 and 265 computers in "supercenters" in Teaneck, N.J., and Cleveland provide the computing power for users of the General Electric Company's international Information Services Network.

time-sharing users should carefully investigate the communications costs they will encounter and make every reasonable effort to minimize them.

● *Loss of control.* When time-sharing terminals are installed in a company, their ease of use and undeniable appeal often leads to their utilization for many problems that could more economically be handled by a desk calculator, a slide rule, an in-house computer, or a conventional service bureau. As a result, the bill for time-sharing services is likely to escalate beyond management's wildest dreams. Therefore, it's important to establish and enforce proper control procedures. But controlling the access to and utilization of multiple time-sharing terminals can be considerably more difficult and frustrating than administering a centralized computer facility. It can help a lot if the time-sharing network requires each user to identify himself with a password and a department or project charge number.

● *Man/machine communication barriers.* A mundane but nonetheless important factor that militates against the dream of giving every manager and/or every engineer direct access to a central computer utility is the fact that most of these prospective users lack the typing skill that is now required for efficient man/machine communication. It is safe to predict that this problem will eventually be solved through

the use of simplified keyboard layouts and through gradual development of the necessary keying skills. In addition, more direct input techniques, such as light pens and touch-sensitive display tubes, will receive increased development emphasis and wider usage.

TIME-SHARING FOR SCIENTISTS

Scientific, engineering, educational, and other predominantly computational applications are the ones for which time-sharing computer systems were originally conceived and developed, and they still comprise the bulk of the workload for the great majority of the commercial time-sharing services. Users with problems of the computational type can take full advantage of most of the previously discussed advantages of time-sharing: flexibility, ease of use, direct man/machine interaction, fast turn-around times, program libraries, etc.

Time-sharing computer systems, when properly utilized, can open up new dimensions in productivity, creativity, and job satisfaction for scientists, engineers, financial analysts, applied mathematicians, and many other professionals. Examples of specific applications have been documented in dozens of articles in the trade press during the past few years.

From the viewpoint of the time-sharing suppliers, the only disappointing aspect of these computational-type applications has been the gradual realization that the total potential market for them is far smaller than the market for business data processing services. And time-sharing has really only begun to tap the latter market.

TIME-SHARING FOR BUSINESSMEN

Just a few years ago, many observers of the EDP industry were predicting that the availability of time-shared computer services would quickly revolutionize the business world. One or more terminals in every business establishment, tied into a powerful central computer, would handle the company's bookkeeping, billing, payroll, inventory control, and many other vital functions—and do all this at an irresistibly low cost.

These predictions may yet come true, but it has now become painfully apparent that it's going to be a long, gradual process rather than a rapid revolution. Although the use of time-sharing and remote batch processing for business functions is accelerating, business applications currently account for well under half of the total time-sharing revenues. The prognosticators apparently overlooked—or underestimated the impact of—four important factors.

First, a time-sharing computer, like every other computer, must be *programmed* before it can solve anybody's problems. Few small business firms have employees capable of ▷

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▷ analyzing and programming their data processing requirements, and few have been willing to pay an outside firm thousands of dollars to write the programs they need. This means that suitable readymade application programs are a virtual necessity for any time-sharing supplier vying for business data processing accounts—yet the suppliers have been surprisingly slow to develop and offer such programs. There has, however, been significant recent progress in this area. As shown by the chart on the last page of this report, many of the time-sharing companies now offer programs to handle accounts payable, accounts receivable, general ledger, payroll, inventory control, and other common business functions. Moreover, nearly all of the suppliers offer programming services to tailor their "packaged" programs to the specific needs of each user.

Second, small businessmen tend to be quite conservative and set in their ways. Very few of them are anxious to plunge into the use of a new and unperfected technology. They tend to be understandably apprehensive about storing their vital, confidential files in a computer system that is located miles away and shared by many other simultaneous users. The time-sharing suppliers seem to be gradually learning how to answer the questions and dispel the doubts of these prospective customers, but their penetration of the huge business data processing market continues to be relatively slow.

Third, the previously discussed reliability problems have caused many companies to reject the use of time-sharing for applications in which undetected errors and missed deadlines cannot be tolerated. Outright rejection of time-sharing on these grounds alone probably represents an unduly harsh judgement. In designing a time-sharing application—as in any business data processing function—the systems analysts and programmers should attempt to anticipate every possible source of error and then incorporate appropriate controls and checks to detect and overcome these errors. When this is done, present commercial time-sharing systems should be able to satisfy all reasonable requirements for reliability and security in data processing applications.

Fourth, the 10-character-per-second Teletypewriter input/output speeds of the early commercial time-sharing services made them unsuitable for any data processing function that involved large volumes of input and/or output data. In order to qualify for a broader range of business applications, many of the time-sharing companies are now offering both faster typewriter-style terminals, with speeds in the 30-characters-per-second range, and high-speed batch-mode terminals capable of reading cards and printing reports at 150 to 600 characters per second.

Thus, slow but definite progress is being made toward overcoming the main obstacles against widespread use of commercial time-sharing systems for business applications. Three other recent trends seem destined to help accelerate

The large-scale Control Data 6400 computer is the central element in CDC's own KRONOS conversational time-sharing system and other commercial services.

the swing toward time-sharing for business data processing:

● The establishment of dedicated time-sharing systems designed to satisfy the data processing requirements of specific types of businesses.

● The development of nationwide networks that enable users in many different locations to access a central data base.

● The availability of a wide range of time-sharing application programs from sources other than the time-sharing companies themselves. A promising new concept called "piggy-backing" involves the development of application programs by independent software firms and the marketing of these programs for operation on specific time-sharing systems.

THE FUTURE OF TIME-SHARING

The advantages of time-shared access to large computer systems are so obvious and attractive that the number of users and applications are bound to increase dramatically in the years to come.

On the basis of current trends and projections, it seems likely that the time-sharing industry of the future will shape up this way:

● There will be several large, nationwide suppliers of time-sharing services. These will be true "information ▷

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utilities," offering a broad range of computational, information retrieval, and communications services to users throughout the country (and perhaps the world).

- The smaller time-sharing companies that survive will generally do so by offering highly specialized services to specific types of business firms. Companies attempting to market plain "computing power" will find it increasingly difficult to stay alive.

- Many current users of commercial time-sharing services will install their own in-house computer systems. Some companies will install small computers (such as the IBM System/3 Model 6 or the proliferating minicomputers) to replace individual time-sharing terminals, while others will install full-barreled in-house time-sharing systems of their own. To make up for these lost customers and maintain their growth, the time-sharing suppliers will have to keep on attracting new customers, primarily from the huge ranks of small business firms.

- Time-sharing users will have an ever-growing variety of "packaged" application programs to choose from. These will be developed by both the time-sharing companies and independent software firms. "Piggy-backing" of specialized services on existing time-sharing networks will become much more common.

- Finally, both suppliers and users will begin to take advantage of the fact that the nationwide time-sharing networks can be used effectively for a broad range of communications functions, as well as for computation and information retrieval. The same time-sharing system that satisfies a company's computational needs and holds its data files will also be able to handle its message transmission, data collection, report distribution, and other communications requirements.

When the time-sharing companies offer this broad spectrum of services, and when a large number of business firms accept and use them on a daily basis, the age of the "information utility" will have arrived at long last. At the present time, however, time-sharing users have to settle for much less. The guidelines and comparison charts that follow will help prospective users to assess what's available today and how it can aid in solving their information processing problems.

SELECTING A TIME-SHARING SERVICE

In most metropolitan areas of the United States, prospective time-sharing users can choose from literally dozens of suppliers. Choosing the company that will provide you with the most effective service at the lowest overall cost isn't easy, but it can be done. What's needed is a straightforward, logical selection process that will guide you

around the numerous pitfalls which await the unwary. The following procedure, if judiciously applied, will virtually assure the satisfaction of your time-sharing requirements in a reliable, economical manner.

1. *Get all the help you can.* Time-sharing is a complex, fast-changing field. Though the ultimate goal is to make life easier for computer users, selection of the most suitable commercial time-sharing service requires consideration of complex and interrelated hardware, software, communications, and economic factors. Therefore, it's wise to learn as much as you can before making your choice. This report and other related material in DATAPRO 70 will help a lot. So will reading other articles and books, attending time-sharing seminars, talking with various time-sharing sales representatives, and studying their technical documentation. The services of an independent consulting firm with broad time-sharing experience can also be well worth their cost.

2. *Define your requirements.* Before shopping for time-sharing computer services, it's essential to know what you want them to do for you. Try to list all the reasonable applications for time-sharing in your organization. Then rank these applications according to their relative importance and urgency. For each of the key applications, define the required computer functions—usually in terms of the inputs to be supplied, the calculations to be performed, the outputs to be produced, and their associated volumes. Specify the exact manner in which all computer inputs and outputs must interface with your existing procedures, forms, and/or data files, as well as any turn-around time requirements that must be met. Finally, determine the present overall cost of processing each application, so that you'll be in a position to know whether or not time-sharing can really save you money.

3. *Survey the available time-sharing services.* The first step in narrowing down the field is to find out which time-sharing companies are actively marketing their services in your locality and collect the basic information about their capabilities, specialties, and pricing. The comparison charts in this report can help a lot. So can the Yellow Pages of your local telephone directory, the advertisements of the time-sharing companies, and the experience of any acquaintances who are using time-sharing. The salesmen for the various time-sharing companies will usually be more than pleased to give you brief presentations describing their firms' capabilities and to present you with brochures, price schedules, and sample contract forms.

4. *Choose the most likely candidates.* Now it's time to reduce the list of contenders to the three to six that seem best able to meet your requirements. This can ▷

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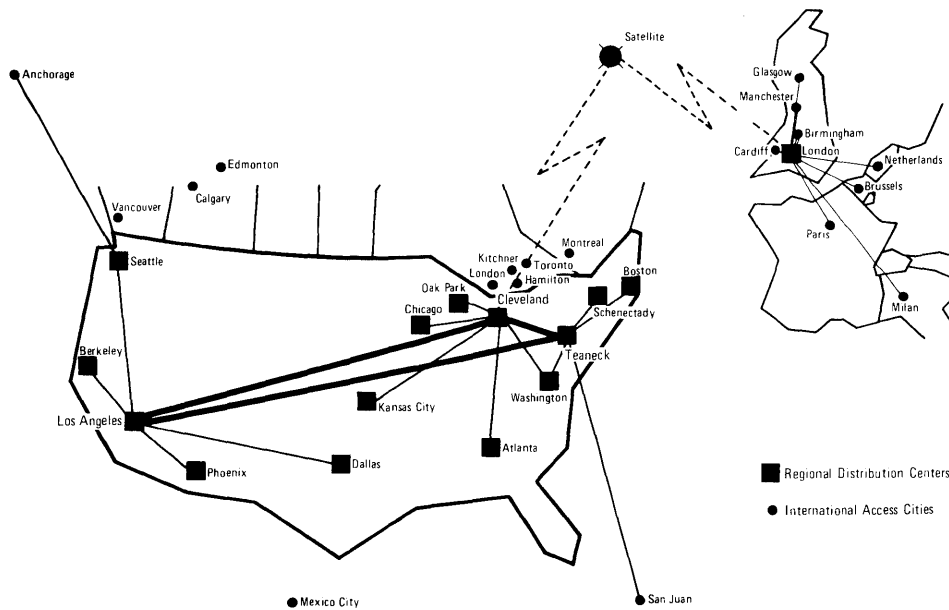
This map shows the principal elements of GE's Information Services Network, the most widespread computer communications network implemented to date. Multiple computers in Cleveland and Teaneck are linked by dual high-speed lines to remote concentrators at 14 regional distribution centers. Local call access is available in 250 cities in the U.S., Canada, Mexico, and Puerto Rico. Service to Europe is provided via a satellite link to London.

■ Regional Distribution Centers

● International Access Cities

usually be accomplished by a selective "weeding out" process. You simply eliminate from consideration those suppliers that fail to measure up on one or more critical questions such as these:

● Are the company's services available in your area at a competitive cost (including all communication and terminal costs)?

● Does the company offer the programming and technical support services you need?

● Does the company offer the specific programming languages and/or application programs you need?

● Does the company support the type of terminal equipment you need (or already own)?

● Can the company satisfy the requirements, if any, for compatibility with your existing programs and/or data files?

● Does the company appear to be able to meet your requirements for operational reliability and data security?

● Are you satisfied that the company is soundly financed and in the business to stay?

5. *Learn all you can about each remaining candidate.* Now it's time to call in the sales representatives of each of the remaining contenders for in-depth discussions about their capabilities, services, and

pricing. By now you'll have a good idea what questions to ask them—and what answers you're looking for. Be sure to find out exactly what each company offers in the way of equipment configuration, program library, programming services, training, documentation, security measures, contract terms, etc. Get the details of each company's pricing structure, including possible "extra" charges for programming, training, manuals, application programs, and other products and services you'll need. Be sure to ask for reference lists of current users. Contact these users, and learn all you can about what their experiences have been; it's likely to be a remarkably informative exercise.

6. *Conduct benchmark tests.* This is probably the most important—and yet the most frequently ignored or misguided—phase of any time-sharing selection project. The essence of benchmark testing is the actual preparation and execution of one or more problems which are representative of the user's planned computer workload. The purpose is threefold:

● To find out exactly what's involved in using each supplier's services.

● To determine the service availability, response time, and anticipated throughput that each supplier can deliver at both peak hours (usually around 10 to 11 a.m. and 3 to 4 p.m.) and off-peak times.

● To determine the cost factors for each service on the types of problems you'll be running regularly.

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▷ If you'll be writing your own programs, go ahead and prepare one or more of them, in the language of your choice. Then ask each of the prospective suppliers to loan you an appropriate terminal plus the computer time required to compile, test, and execute your programs. If you'll be using a ready-made application program supplied by the time-sharing vendor, prepare some representative test data, borrow the necessary terminal, and give the program a real tryout. In either case, be sure to: (1) control all test conditions as carefully as you can; (2) make the benchmark programs and data as representative of your actual workload as time permits; (3) run each test at both peak and off-peak hours (and at the same times of day for all prospective suppliers); and (4) keep detailed records of all pertinent timing and cost data, as well as your impressions about the comparative ease or difficulty of using each service.

7. *Make your selection.* By now, you've amassed a great deal of pertinent information. Now it's time to "put it all together." From the results of your benchmark tests, calculate the estimated overall costs of satisfying all your time-sharing needs with each supplier's services. Compare these costs with your present costs, and (if appropriate) with the estimated costs of alternative approaches such as a computer of your own or a conventional service bureau. In many cases, one of the time-sharing suppliers will now stand out as a clear-cut choice. In others, it may be practical to contract with two or more suppliers and use the one whose offerings turn out to be the most economical for each of your applications.

If neither of the above solutions is appropriate, you may want to turn to some type of weighted point scoring system, in which each supplier is awarded an appropriate number of points for every desirable characteristic (such as availability, response time, languages, terminals, application programs, costs, etc.). But frankly, if it still looks like a really close race, we'd recommend giving preference to the company that made the best showing on your benchmark tests; there's no more convincing evidence than impressive performance on your own problems.

8. *Negotiate a suitable contract.* At this point, virtually every time-sharing company will ask you to sign its standard contract form. But that's not necessarily your best move. Time-sharing is such a buyer's market these days that there's a good chance the supplier will offer considerably more favorable contract terms if that's what it takes to land your account. So read the contract carefully. Make sure it clearly defines the company's pricing structure, charges for all additional products and services, hours of service availability, length of commitment, termination provisions, etc. If the supplier writes any

programs for you, make sure it's clear whose property they will be. If you're not completely satisfied with the standard contract terms, ask the supplier to amend them.

You'll notice that most of the standard contracts disclaim any liability for damages arising either from the use of the suppliers' time-sharing services or their failure to provide the agreed-upon services. If you feel you need more protection, such as guaranteed file security, it certainly can't hurt to ask for it. Discussions with other customers of the service may be especially helpful in this area. And the advice of your company's lawyer is likely to be well worth having to help ensure that you'll get the services and the protection you need.

9. *Make periodic re-evaluations.* Once you've selected the most suitable time-sharing service for your needs, it's unwise to assume that it will *continue* to represent your best choice. As a time-sharing network becomes more heavily loaded, its performance tends to degrade. As the network's saturation point is approached, the response times to each user's requests are likely to become unbearably long. In addition to user frustration, this condition leads to longer connect times and higher costs. Therefore, it's wise to rerun your benchmark problems every month or two under the original test conditions. This will enable you to spot any deterioration in the service and present your supplier with documentary evidence of the fact. If the supplier cannot satisfy you that the original quality of service will soon be restored, remember that numerous other suppliers are anxious for your business. And, if you've written your own programs and used one of the common programming languages, it should be relatively easy to make the switch.

THE COMPARISON CHARTS

The principal characteristics of 69 commercially available time-sharing services are presented in the accompanying comparison charts. Except where otherwise indicated, all information in the charts was furnished by the suppliers in October 1971; their close cooperation with the Datapro Research staff in the preparation of these charts is greatly appreciated.

DATAPRO 70 sent repeated requests for information to a total of 150 companies known or believed to be in the time-sharing business. The 69 usable responses summarized in our charts represent a good cross-section of the commercial time-sharing services that are currently available in the United States and Canada. *The absence of any specific company from our charts means that the company either failed to respond to our repeated information requests or was unknown to us.* ▷

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▷ The comparison chart entries and their significance to potential time-sharing users are explained in the following paragraphs, together with additional useful guidelines for selecting the time-sharing service that will most effectively meet your needs.

General Information

Headquarters. This entry tells where each company's corporate headquarters are located. The company's computer facilities are in the same city unless otherwise indicated in the entries that follow.

Name of service. The name under which a company's commercial time-sharing services are marketed may or may not be the same as the corporate name. Where they differ, this entry indicates the name of the time-sharing service. Some suppliers offer several different levels of service with different names and capabilities, and in these cases the chart entries differentiate between the various levels.

Date operational. This entry tells when each company's time-sharing services first became available for regular commercial use. Most time-sharing networks require lengthy shakedown periods before settling down to normal operations, so the length of time a service has been operational may serve as a reasonable indication of its reliability—as well as its financial stability. But it is also important to note that few time-sharing networks remain really stable for long periods of time; disruptions can occur at any time through addition or consolidation of computer centers, changes in systems software, communications breakdowns, etc.

Areas currently served. Each time-sharing company was asked to state the geographical areas it can service effectively, and their answers are reported in the charts. Where specific cities are named, the companies generally offer toll-free service in those cities through local computer centers, communications multiplexers, or foreign exchange facilities.

Where a company professes to serve a large region (such as "Eastern Seaboard and Mid-West"), the implication is that the company either offers INWATS (Inward Wide Area Telephone Service) or maintains computer centers, multiplexers, or other toll-free entry points in strategic cities throughout the area. Unfortunately, this is not true in all cases. It's wise to contact all the companies whose services appear to meet your needs, and find out exactly what communications and computational facilities they offer in your area.

Equipment

Computers. This entry describes the number and type of central processors that each company currently employs in its time-sharing network. The cities in which the computers are located are also indicated whenever they differ from the locations of the company's headquarters. The smaller supporting computers which are frequently used as communications processors or remote multiplexers are not listed here because of space limitations.

Space limitations have also precluded the reporting of configuration details such as main storage capacity, type and capacity of mass storage units, number and speed of central-site peripheral devices, etc. These configuration details may or may not be significant, depending upon your applications. Conventional scientific applications are typically coded in FORTRAN or BASIC, require little or no permanent file storage, and can be run without difficulty on most of the commercial time-sharing systems. Conversely, many business data processing applications impose special requirements for mass storage units, central-site peripheral equipment, and compatibility with existing programs and data files. In these cases, it will be necessary to contact the time-sharing vendors for details about their equipment configurations and capabilities.

Number of simultaneous users. This entry indicates the maximum number of users at remote terminals that each time-sharing company claims to be able to serve simultaneously. This figure can serve as a useful—though far from precise—indication of the power of a time-sharing system. The response time to each user's requests will naturally tend to increase as the number of simultaneous users gets larger, and in many cases an attempt to serve the indicated number of simultaneous users will lead to response times which are far too long for effective conversational-mode use.

Conversational terminals supported. The specific remote terminals that each time-sharing system can accommodate for interactive, conversational-mode operations are listed in this entry. The abbreviation "TTY 33/35" stands for the Teletype Model 33 and Model 35 Teletypewriters, which are by far the most widely used time-sharing terminals. These units have conventional typewriter-style keyboards and transmit an 11-unit ASCII code, usually at 110 bits per second. The Model 33 terminals are designed for "standard-duty" usage (up to about four hours a day) and are priced at about $500 to $950, depending on whether or not an integrated paper tape reader and punch and various options are included. The Model 35 terminals are functionally similar but are beefed up for heavy-duty usage, offer a broader range of options, and cost about three times as much as their Model 33 counterparts. (The newer Teletype Model 37 terminals offer higher speeds, upper/lower-case printing, and other attractive features, but comparatively few time-sharing companies support their use to date.)

To capitalize upon the widespread acceptance of the Teletype Model 33 and 35 terminals, numerous peripheral equipment makers have introduced "Teletype-compatible" printers, display units, and other terminals which ▷

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▷ have the same interface characteristics and can utilize the same software support as the Teletype units. Many of these Teletype-compatible terminals are described in the Peripherals section of DATAPRO 70. Examples include the GE Terminet 300, Memorex 1240, and UNIVAC DCT 500 terminals, plus these CRT display units: Computer Terminal Corporation's Datapoint 3300, DATA 100's Model 73, and Delta's TelTerm 1. In general, any Teletype-compatible terminal can be connected to any time-sharing network that supports the Teletype Model 33 or 35 Teletypewriters—but it will generally not be possible to take advantage of the terminal's higher speed and/or improved functional capabilities unless the time-sharing company makes suitable modifications in its equipment and supporting software.

The IBM 2741 is another widely supported conversational-mode terminal. Built around an IBM Selectric Typewriter, it provides keyboard input and typed output in both upper and lower case. Its rated transmission speed is 134.5 bits (14.8 characters) per second. The 2741, however, cannot be equipped with paper tape I/O or any other medium for local storage of programs or data.

Other widely supported conversational terminals include the Datel Model 30 and 31 Terminals, the Friden 7102 (a Flexowriter with integral communications interface) and the Novar Communication Terminals; all are described in the Peripherals section of DATAPRO 70. In addition to these and other typewriter-style terminals, many time-sharing companies also support the use of CRT display units, digital plotters, and/or portable terminals.

Although many of the time-sharing companies offer to supply and maintain the terminals which their systems support, you'll retain more flexibility if you obtain your terminals from the manufacturer or some other independent source. (Companies such as the RCA Service Company and the Western Union Data Services Company, for example, now supply and service the popular Teletype terminals).

Batch terminals supported. In addition to the low-speed, conversational-mode terminals which are usually associated with time-sharing, about half the companies surveyed in our charts support faster terminals designed for batch-mode transmission and reception of comparatively large volumes of data. Batch terminals greatly extend the spectrum of practical applications for time-sharing computer systems by permitting the entry of previously recorded data and the printing of results at comparatively high speeds.

The most widely supported batch terminal is the IBM 2780 Data Transmission Terminal. Four models of the 2780 provide different combinations of card reading, card punching, and/or line printing capabilities, at transmission speeds ranging from 1200 to 4800 bits (150 to 600 characters) per second. Data is transmitted under IBM's Binary Synchronous Communications (BSC) line disci-

pline technique in one of three codes: ASCII, EBCDIC, or Six-Bit Transcode. Rental prices for the 2780 range from about $680 to $1,255 per month, so its installation must be carefully justified by virtue of a real need for the faster input/output speeds it provides.

As in the case of the Teletype terminals, the widespread acceptance of the IBM 2780 has led to the introduction of a number of competitive terminals which offer functional compatibility with the 2780, usually at lower prices. An example is DATA 100 Corporation's 70 Series Terminal.

Many of the time-sharing companies also support the use of small digital computers, such as the Honeywell (nee GE) 105, IBM 1130, IBM System/360 Model 20, and UNIVAC 9200, as remote batch terminals. These independently programmed computers can serve as "intelligent terminals," processing some data locally and providing great flexibility in their communications functions. Their costs, as might be expected, are comparatively high.

Other commonly supported batch-mode terminals include the Control Data 200 User Terminal, UNIVAC DCT 2000 Data Communication Terminal, and University Computing Company COPE Terminals.

All the terminals mentioned above are described in detail in the Peripherals or Computers section of DATAPRO 70; please refer to the Index, beginning on page 70A-100-01a.

Software

Conversational programming languages. This entry lists the programming languages offered by each company for interactive use by customers at remote terminals. The term "conversational" implies a high degree of interaction between the programmer and the computer system throughout the program entry and debugging process.

In most cases, each statement of the source-language program is checked for proper syntax as the user enters it, and any necessary corrections can be made immediately. After the whole program has been entered and checked, one of two basic techniques is usually followed to get it into operation: the program may either be compiled into a machine-language object program and then executed in conventional fashion, or it may be executed immediately in an interpretive mode. Interpretive execution saves compilation time and facilitates program changes, but it also requires that each source-language statement be translated into the appropriate machine instructions every time it is executed—an inherently inefficient process.

FORTRAN and BASIC are by far the most popular conversational programming languages for time-sharing use. Between the two, experienced computer users tend to favor FORTRAN because of its greater power and flexibility, while first-time users often choose BASIC because it is generally considered easier to learn and use. ▷

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▷ FORTRAN has been most widely used scientific programming language for more than a decade. It uses symbols and expressions similar to those of algebra to express the procedures for performing computational and logical processes. Though it was designed strictly for scientific applications, FORTRAN has been successfully used for a wide range of business data processing functions as well. There are many different versions of the FORTRAN language, but conversions of FORTRAN programs from one version to another can usually be made with comparatively little difficulty. Thus, programs which are prepared and debugged in conversational mode can later be converted into efficient production programs through recompilation by a batch-mode compiler.

BASIC (Beginners' All-purpose Symbolic Instruction Code) was developed at Dartmouth College to provide nonprogrammers with the capability to write programs in an easy-to-use language that resembles standard mathematical notation. BASIC is well suited for use in conversational-mode programming and debugging, and has rapidly gained wide acceptance among suppliers and users of time-sharing services. Like FORTRAN, BASIC was designed for scientific and mathematical programming but has also been successfully used for business data processing. Many of the time-sharing companies offer extended "supersets" of the BASIC language which considerably increase its capabilities. (Note, however, that the use of these extended language facilities in your programs may effectively cause you to become "locked in" to the particular company that offers them.) Most of the existing BASIC compilers emphasize rapid compilation and ease of use rather than efficiency of object-program execution; efficient batch-mode compilers for the BASIC language are rare.

APL is a comparatively new and noteworthy arrival on the time-sharing language scene. Conceived in the early 1960's by Dr. Kenneth E. Iverson of IBM, APL was designed to permit clear, concise expression of computational algorithms. APL's proponents claim (with some justification) that it is "more powerful than FORTRAN and easier to learn than BASIC." APL uses a much larger set of symbols and operators and a considerably different syntax than either FORTRAN or BASIC. Its facilities for handling vectors and arrays are especially powerful, yet simple to use. Some of the commercial implementations of APL include file-handling and formatting facilities that make them quite effective for business as well as scientific applications. The conciseness of the language, however, is a mixed blessing in that it often makes APL programs hard to read and comprehend. Moreover, nearly all of the current implementations of APL are interpreters, which means that the efficiency of object-program execution is usually quite low.

Though COBOL is by far the most widely used programming language for business applications, comparatively

few time-sharing companies offer a conversational-mode COBOL compiler—another indication of the relatively light emphasis on business data processing in the time-sharing field to date. PL/I is another programming language whose rising popularity for both scientific and business applications is not reflected by the current language offerings of the time-sharing companies.

Other general-purpose languages offered in conversational implementations include ALGOL, CAL, and JOVIAL, together with a variety of symbolic assembly languages. In addition, many of the time-sharing companies offer special-purpose languages designed for specialized functions such as list processing (e.g., LISP and SNOBOL), text editing, and program debugging.

Batch-mode programming languages. The languages offered by each time-sharing company for batch-mode (i.e., non-interactive) compilation are listed in this entry. In general, the batch-mode language processors place a considerably greater emphasis upon the generation of efficient object programs than do their conversational-mode counterparts. Therefore, their use can lead to substantial savings in computer time for "production" programs which are run on a regular basis. Batch-mode compilers for virtually every programming language currently in use are offered by one or more of the time-sharing companies. ▷
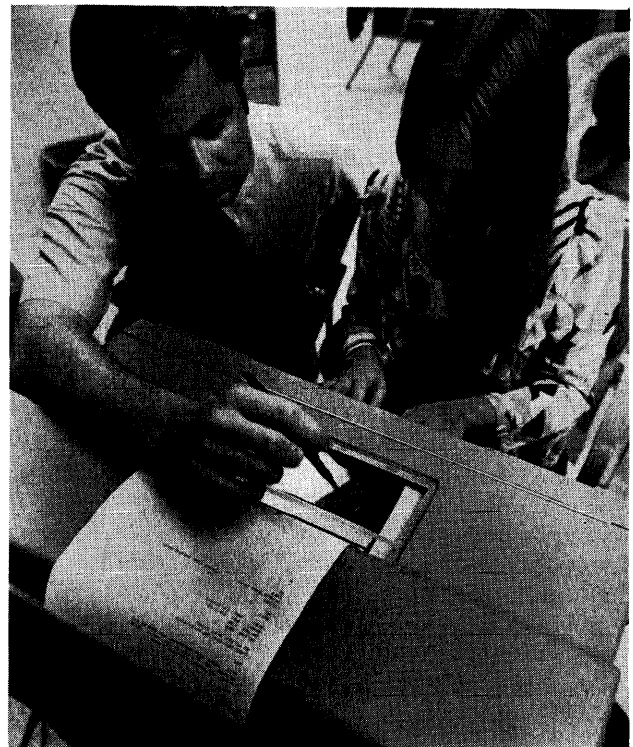
Time-sharing users study a report produced by a Teletypewriter connected to one of Applied Logic Corporation's dual PDP-10 computers.

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▷ *Principal applications.* For most time-sharing users, the range and capabilities of the available application programs rank among the most important factors in choosing a particular supplier. Thousands of dollars worth of programming efforts can often be saved through the use of suitable ready-made programs, and many of the time-sharing companies now offer a broad spectrum of programs to choose from.

Because of space limitations, the main comparison charts show only the principal application areas supported by each company—and the entry "business & scientific" is used for the many suppliers that offer hardware and software designed to support both commercial and scientific applications. The special chart on the last page of this report shows which of 25 important classes of application programs are available from each of the time-sharing companies.

Charges

One of the most complex and confusing aspects of the current time-sharing scene is the pricing of the services. There has been no general agreement to date as to the best technique for accounting and charging for the system resources used by each customer. As a result, prospective users are confronted by a bewildering array of rate schedules. The diverse pricing policies make cost comparisons very difficult and accentuate the desirability of benchmark testing.

Some time-sharing companies impose no minimum monthly charge, while a few charge *only* a single, all-inclusive monthly service fee. Most companies bill the user for each second of central processor time, while others include the processor time as part of the terminal connect charge. Some companies provide each user with a certain amount of "free" mass storage space, while others do not. Some companies impose a one-time charge for initiation of service, and some have special pricing schedules for certain application programs. In addition, there are usually separate charges for the use of central-site peripheral devices (such as card readers and printers), for punched cards and printer forms, and for extra programming manuals and training courses.

The principal pricing elements for each time-sharing company are summarized in the chart entries under the "Charges" heading. In all cases, the indicated rates are for conversational-mode service with low-speed terminals (usually 10 to 15 characters per second) during prime time. Many suppliers offer lower rates during non-prime hours, and discounts for volume usage are common. Remember that in addition to the charges listed in the charts, time-sharing users must bear the cost of their terminals, modems, and communication facilities.

Minimum monthly charge. This is the minimum charge, if any, that is imposed for each month of time-sharing service. (The companies that impose no minimum charge will naturally be of particular interest to users who plan to deal simultaneously with several different suppliers.)

Terminal connect time. This entry shows the charge for each hour of time during which a low-speed terminal is "on-line" (i.e., connected to the central computer). Where terminals with speeds above 15 characters per second are supported, the associated connect-time charges are usually higher.

Central processor time. Most time-sharing companies impose a specific charge for each minute (or second) of time during which the central processor is working on the user's program. In some cases, this charge varies with the amount of main memory occupied by the program. Other companies allocate their central processor charges on the basis of more complex units with names like "Core Unit" or "Computer Resource Unit." Typically, such units are functions of the amount of processor time, main memory space, and input/output activity required by each program.

Amount of "free" mass storage. This entry shows the amount of storage space, if any, on a random-access disc or drum unit at the central computer site that is available to each customer at no extra charge. Mass storage is useful, and in many cases vitally necessary, for on-line storage of programs and/or data files.

Charge for additional mass storage. Virtually every time-sharing service company has large-capacity disk or drum units at its computer site. Users can rent as much of this mass storage space as they need for on-line storage of programs and files, at the rates indicated in this entry. The storage space is usually rented in units of one track or sector, whose capacity depends upon the physical format of the available mass storage device. Storage charges may be computed on the basis of either the average or maximum amount of storage used during each month; it's important to find out which basis your prospective suppliers use. Discounts are frequently granted for large-volume storage requirements.

Comments

This final entry on the comparison charts is used to explain or amplify the preceding entries and/or to provide other pertinent information about each company's services. □

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COMPANY	Academy Computing Corporation	ACTS Computing Corporation	APL Services, Inc.	Applied Logic Corporation	Axicom Systems, Inc.
GENERAL					
Headquarters	Oklahoma City, Okla. 73105	Southfield, Mich. 48076	Trenton, N.J. 08628	Princeton, N.J. 08540	Paramus, N.J. 07652
Name of service	BELSTAR	ACTS	ACTION/APL	AL/COM	—
Date operational	1968	Oct. 1968	July 1970	Jan. 1966	Jan. 1969
Areas currently served	Midwestern U.S.	Michigan, Illinois, Indiana, Ohio	Middle Atlantic and New England states, Florida	Entire U.S.; toll-free access from major Eastern and Midwestern cities and five Western states	Northeastern U.S. (Boston to Washington and west to Pittsburgh)
EQUIPMENT					
Computers	GE-255 (2), Honeywell 1250	GE-265 (2) and GE-440 in Detroit; also IBM 370/155 RJE in Grand Rapids	IBM 370/155 in Richmond, Va.	Multiple DEC PDP-10 computers in dual-processor AL/COM systems	UNIVAC 1108
No. of simultaneous users	114 total	110 total	95	Approx. 200	32
Conversational terminals supported	TTY, Memorex, Bunker-Ramo, Dura, Datel, etc.	TTY 33/35, IBM 2741, GE TermiNet 300, Friden 7701, Dura, Datel, etc.	IBM 2741, Novar, Datel Itel, A-J, Incoterm CRT, etc.	TTY 33/35, IBM 2741, Datel, Dura, Calcomp plotters	TTY, Friden, Datapoint 3300, GE TermiNet 300, UNIVAC DCT 500, Execuport, etc.
Batch terminals supported	—	IBM 2780, IBM 360/20, Data 100	—	—	UNIVAC 1004, 9200, 9300; IBM 1130, UCC Cope, etc.
SOFTWARE					
Conversational programming languages	BELSTAR	FORTRAN, BASIC, ALGOL	APL	FORTRAN, BASIC, COBOL, AID, SNOBOL, LISP, Macro-10	FORTRAN, XBASIC, APL
Batch-mode programming languages	—	FORTRAN, COBOL, PL/I, RPG, Assembler	FORTRAN, COBOL, PL/I, RPG, Assembler	—	FORTRAN V, COBOL, ALGOL, Assembler, etc.
Principal applications	Business & scientific	Business & scientific	Business & scientific	Business & scientific	Business & scientific
CHARGES					
Minimum monthly charge	$1500	$100	$100 (after first 60 days)	$100 (after first 2 months)	$150
Terminal connect time	Depends on application	$5.00-15.00/hr.	$8.00/hr.	$10.00/hr.	$10.00/hr.
Central processor time	Depends on application	$2.40-3.00/min.	$24.00/min.	$0.10/"Core Unit"	$8.40/min.
Amount of "free" mass storage	1,000,000 chars.	None	None	None	None
Charge for additional mass storage	$0.20/1000 chars./month	$1.00/1000 chars./month	$1.00/7200 chars./month	$0.75/1024 chars./month	$1.20/10,700 chars./month
COMMENTS	BELSTAR is mainly a file management system with fixed programs.	Subsidiary of Lear Siegler, Inc. Also offers RJE and conventional batch processing.	Affiliated with The Computer Company. Offers tech. support and education at no extra charge.	Offers deferred unattended execution at reduced rates. Volume discounts of 40 to 70% on mass storage.	Additional charges for core usage, internal data transfers, tape mounts, paper, and cards.

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COMPANY	Bowne Time Sharing, Inc.	Burroughs Corporation	Chi Corporation	Community Computer Corporation	Comp-Time Corporation
GENERAL					
Headquarters	New York, N.Y. 10014	New York, N.Y. 10022	Cleveland, Ohio 44106	Philadelphia, Pa. 19144	San Diego, Calif. 92106
Name of service	Word/One	New York City Data Center	—	—	RCC Time-Sharing
Date operational	Nov. 1969	1966	May 1969	Jan. 1969	1968
Areas currently served	Sales and service offices in Boston, Chicago, New York, Philadelphia, and Washington, D.C.	New York, New Jersey, Connecticut	Ohio, Pittsburgh, Detroit	Delaware Valley	San Diego area
EQUIPMENT					
Computers	IBM 360/40	Burroughs B 5500 (2)	UNIVAC 1108 & Honeywell 430	HP 2116B (2)	Burroughs B 5500 (3); 2 in Los Angeles & 1 in Palo Alto
No. of simultaneous users	100 plus	30	63 total	30	56 total
Conversational terminals supported	IBM 2741, A-J 841, Datel 303, Dura 1021, Novar 5-41 & 5-50	TTY 33/35, Burroughs TC 500 & 9352, Datapoint 3300	TTY 33/35, Datapoint 3300, GE TermiNet 300, UNIVAC DCT 500, Memorex	TTY and equivalent terminals operating at 110, 220, or 440 bps	TTY 33/35, IBM 2741, Execuport, Novar, etc.
Batch terminals supported	—	—	UNIVAC 1004, UNIVAC 9000, IBM 1130, IBM 1800	—	—
SOFTWARE					
Conversational programming languages	Word/One	FORTRAN, ALGOL, COBOL, BASIC	BASIC, FORTRAN IV	BASIC	FORTRAN, BASIC, COBOL, ALGOL,
Batch-mode programming languages	COBOL, FORTRAN, PL/I, RPG, Assembler	FORTRAN, ALGOL, COBOL, BASIC	FORTRAN IV, BASIC, ALGOL, COBOL, RPG, etc.	FORTRAN, ALGOL, BASIC	FORTRAN, BASIC, COBOL, ALGOL
Principal applications	Text editing, typesetting, etc.	Business & scientific	Business & scientific	Business & scientific	Business & scientific
CHARGES					
Minimum monthly charge	$150 (after first 3 months)	$100 (after first 2 months)	None	None	None
Terminal connect time	$2.15/hr.	$15.00/hr.	$6.00/hr.	$7.00/hr.	$7.00/hr.
Central processor time	$4.00/min.	$8.35/min.	$3.60/min.	No charge	$6.00/min.
Amount of "free" mass storage	None	None	None	None	None
Charge for additional mass storage	$0.24/1550 chars./month	$0.03/1000 chars./day	$0.25/1152 chars./month	$0.20/160 chars./month	$0.02-0.05/2400 chars./day
COMMENTS	Specializes in text editing, typesetting, and address file maintenance. Volume discounts available.	CP time costs $6.65/min. during non-prime hours. Formerly Real-time Systems Inc.	Owned by Case Western Reserve Univ. Offers both time-sharing and remote batch services. Substantial volume discounts.	High-speed printer, punch, and plotter available at $25/hour.	Sells time on Remote Computing Corp. systems.

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COMPANY	Compu-Serv Network, Inc.	The Computer Company	Computer Complex, Inc.	Computer Innovations	Computer Network Corporation
GENERAL					
Headquarters	Columbus, Ohio 43212	Richmond, Va. 23219	Houston, Texas 77036	Chicago, Ill. 60610	Washington, D.C. 20016
Name of service	Compu-Serv	ACTION/APL	—	Advanced APL, Advanced ATS	Alpha System
Date operational	March 1970	Sept. 1969	July 1967	Aug. 1969	Sept. 1970
Areas currently served	Mid-West and East Coast; offices in Cincinnati, Cleveland, Dayton, Indianapolis, New York, & St. Louis	Virginia, D.C., Boston, New York, Philadelphia, Miami, Chicago, San Francisco, and Los Angeles	Houston, Dallas, L.A., San Francisco, New York, Chicago, and 9 other cities, plus national WATS	Illinois, Michigan, Indiana, Wisconsin, etc.	Middle and South Atlantic states
EQUIPMENT					
Computers	DEC PDP-10 (2)	IBM 370/155	XDS 940 (4)	IBM 360/50 in Van Nuys, Calif.	IBM 360/65
No. of simultaneous users	100	156	160 total	35 in Chicago	75
Conversational terminals supported	TTY 33/35/37, IBM 2741, Friden 7100, 7102, Execuport, CRT displays, etc.	IBM 2741, Novar, Datel, Itel, HP 7200, A-J, etc.	Any ASCII terminal at 10-30 cps	IBM 2741, IBM 1050, Datel 30 & 31, Novar, Itel	TTY 33/35, IBM 2741, any TTY or 2741-compatible units at 10 to 120 CPS
Batch terminals supported	DEC PDP-11	—	—	—	IBM 2780, IBM 1130, Data 100
SOFTWARE					
Conversational programming languages	BASIC, FORTRAN, COBOL, SNOBOL, GASP, etc.	APL	XTRAN, FORTRAN II/IV, BASIC, CAL, SNOBOL	APL	All OS/360 languages
Batch-mode programming languages	FORTRAN, COBOL	FORTRAN, COBOL, PL/I, RPG	—	FORTRAN, COBOL, PL/I, etc.	All OS/360 languages
Principal applications	Business & scientific	Business & scientific	Business & scientific	Business & scientific	Business & scientific
CHARGES					
Minimum monthly charge	None	None	$250	None	$100
Terminal connect time	$8.50/hr.	$8.00/hr.	$12.00/hr.	$13.00/hr.	$7.00/hr.
Central processor time	$1.20/min.	$24.00/min.	$2.40/min.	$3.00/min.	About $12.00/min. (200K bytes)
Amount of "free" mass storage	None	None	None	48,000 bytes	None
Charge for additional mass storage	$0.50/1000 chars./month	$1.00/7200 chars./month	$0.025/1024 chars./day	$13.00/48K bytes/month	$1.00/7000 chars./month
COMMENTS	Subsidiary of Golden United Investment Co. Discounts for non-prime time and volume usage.	Offers file management system, remote job entry, and conventional batch processing.	The company's time-sharing operations were acquired by Tymshare, Inc. in mid-1971.	Affiliated with Proprietary Computer Systems, Inc. Also offers Advanced ATS text editing system.	Offers "OS-compatible time-sharing services." Remote job entry of programs in any IBM-supported language.

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COMPANY	Computer Sciences Corporation	Computer Sharing Services, Inc.	Computility, Inc.	Compu-Time, Inc.	Computone Systems, Inc.
GENERAL Headquarters	El Segundo, Calif. 90245	Denver, Colo. 80223	Boston, Mass. 02108	Daytona Beach, Fla. 32014	Atlanta, Ga. 30305
Name of service	INFONET	TSPS	Comp/Utility	Compu-Time	—
Date operational	Jan. 1970	Nov. 1967	March 1969	Nov. 1967	1965
Areas currently served	Entire U.S. and Canada; 5 computer sites in U.S. and 2 in Canada	Colorado	Greater Boston, metropolitan New York, and Long Island	Southeastern states; Fla., Ga., N.C., S.C., Ky., Tenn., Ala., La.	Entire U.S.
EQUIPMENT Computers	UNIVAC 1108 (7)	GE-400, GE-430, IBM 370/155	DEC PDP-10	GE-430 (2)	IBM 360/40
No. of simultaneous users	Not specified	80 (on GE systems)	63	84	28
Conversational ter-	TTY 33/35, IBM 2741, Datel, Dura, Datapoint 3300, etc.	TTY, ASCII terminals at 110 or 300 bps	TTY 33/35/37 & compatible units, graphic displays, IBM 2741, Novar 5-50, Datel 30, etc.	ASCII units at 110, 300, & 1200 bps; IBM 2741 & equivalent units at 134.5 bps	IBM 1050, Memorex 1240, Keypact portable terminal (mfd. by Computone)
Batch terminals supported	UNIVAC 1004, 9200, 9300, & DCT 2000; IBM 1130	—	—	—	—
SOFTWARE Conversational programming languages	BASIC	BASIC, FORTRAN	FORTRAN, BASIC, COBOL, Macro-10, LISP, etc.	FORTRAN, BASIC	—
Batch-mode programming languages	FORTRAN V, COBOL, SLEUTH	COBOL, FORTRAN	FORTRAN, COBOL	COBOL, FORTRAN, RPG	—
Principal applications	Business & scientific	Business & scientific	Business & scientific	Business & scientific	Life insurance, linear prog'g.
CHARGES Minimum monthly charge	$50	$35	None	$10	$20
Terminal connect time	$11.00/hr.	$5.00/hr.	$8.00/hr.	$10.00/hr.	$36.00/hr.
Central processor time	$30.00/min.	$3.00/min.	$1.80/min.	$3.60/min.	No charge
Amount of "free" mass storage	None	None	None	None	Not applicable
Charge for additional mass storage	$1.00/3072 chars./month	$2.00/1800 chars./month	$0.50/1280 chars./month	$1.50/1620 chars./month	Not applicable
COMMENTS	Features remote batch processing, at $600-800 per hour of 1108 CPU time. (Information supplied in Nov. 1970.)	CP charges are much lower during non-prime periods. IBM 370/155 is used for batch processing.	Subsidiary of Grumman Data Systems Corp. Core storage costs $0.01/1024 words/second.	$100 initiation fee. Offers guaranteed maximum hourly rates, with substantial volume discounts.	Charges shown are for dedicated life insurance service; also offers linear programming service for feed and sausage mfrs.

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COMPANY	Com-Share, Inc.	Com-Share Limited	Control Data Corporation	Cyphernetics Corporation	Dataline Systems Limited
GENERAL					
Headquarters	Ann Arbor, Mich. 48106	Rexdale, Ont., Canada	Minneapolis, Minn. 55435	Ann Arbor, Mich. 48103	Toronto, Ont., Canada
Name of service	Commander I & Commander II	Com-Share	Cybernet/KRONOS Network	Cyphernet	—
Date operational	June 1966	July 1970	Feb. 1966	Sept. 1969	Sept. 1969
Areas currently served	Entire U.S. and Canada; local dial-up capability in 52 cities	Eastern Canada	Middle Atlantic states, Chicago, Detroit, Dallas, Houston, Omaha, Tulsa, Atlanta, Los Angeles, etc.	Michigan, Ohio, Illinois, New York, New Jersey, Pennsylvania	Ontario and Quebec; local dial-up in Toronto, Ottawa, and Montreal areas
EQUIPMENT					
Computers	XDS 940 (9), XDS Sigma 7	XDS Sigma 7 in Toronto	CDC 6400 (located in Bethesda, Md.)	DEC PDP-10 (3)	DEC PDP-10 (2)
No. of simultaneous users	524 total (44 per XDS 940)	48	200	180	80
Conversational terminals supported	TTY 33/35/37, GE TermiNet 300, Datapoint 3300, IBM 2741, plotters, etc.	TTY 33/35, GE TermiNet 300, Datapoint 3300, Memorex 1240, plotters, etc.	TTY 33/35, Datapoint 3300, and other TTY-compatible units	TTY 33/35/37 & other ASCII Terminals at 10, 15, & 30 CPS; also IBM 2741, etc.	TTY 33/35, IBM 2741, ASCII terminals at 110 or 300 bps
Batch terminals supported	IBM 2780 and 2780-compatible terminals (on Sigma 7 only)	UNIVAC DCT 2000	CDC 200	Cyphernet Batch Terminal (own design)	Honeywell 105, UNIVAC 9200
SOFTWARE					
Conversational programming languages	FORTRAN II/IV, BASIC, QED, SNOBOL, TAP, DAP	FORTRAN, BASIC, COBOL, QED	FORTRAN, BASIC, KRONOS	FORTRAN IV, BASIC, COBOL, Macro-10	FORTRAN IV, BASIC, COBOL, Macro-10, LISP, etc.
Batch-mode programming languages	FORTRAN, DAP	FORTRAN, BASIC, COBOL	FORTRAN, COBOL, ALGOL, COMPASS, etc.	FORTRAN IV, BASIC, COBOL, Macro-10	FORTRAN IV, BASIC, COBOL, Macro-10, etc.
Principal applications	Business & scientific	Business & scientific	Business & scientific	Business & scientific	Business & scientific
CHARGES					
Minimum monthly charge	None	$100	None	None	None
Terminal connect time	$10.00/hr.	$9.00/hr.	$8.00/hr.	$10.00/hr.	$10.00/hr. (any speed)
Central processor time	$4.20/min.	$4.80/min.	$12.00/min.	See COMMENTS	$6.66-23.33/min.
Amount of "free" mass storage	None	None	None	None	None
Charge for additional	$1.00/1000 chars./month	$0.30/1000 bytes/month	$0.30/1000 chars./month	$0.12-1.00/1000 chars./month	$0.20/640 chars./month
COMMENTS	Proprietary operating system for Sigma 7 handles both batch and time-sharing operations.	Also offers Com-Share, Inc. Commander I service on XDS 940. Volume discounts available.	CDC also offers remote batch processing through its nationwide Cybernet network of CDC 6600 and 3300 computers.	CP time charges based on $0.02 per 4096 words per second. Rates are much lower during non-prime hours.	CP time charge depends upon core usage. Rates are much lower during non-prime hours.

All About Computer Time-Sharing Services

COMPANY	Datalogics, Inc.	First Data Corporation	Fulton National Bank of Atlanta	General Electric Company	Genesee Computer Center, Inc.
GENERAL					
Headquarters	Cleveland, Ohio 44120	Waltham, Mass. 02154	Atlanta, Ga. 30302	Bethesda, Md. 20014	Rochester, N.Y. 14605
Name of service	DL/70	—	Fulton Data Systems	GE Network Info. Service	GIANT
Date operational	March 1969	Oct. 1969	1967	Oct. 1965	Aug. 1968
Areas currently served	Cleveland and Chicago areas	New England, New York, and Washington, D.C.	Southeastern states	Entire U.S. plus Canada, Mexico, Puerto Rico, and Europe; local-call access in 250 cities	Upstate New York, Atlantic Coast, Toronto, Chicago, and 5 other cities
EQUIPMENT					
Computers	XDS Sigma 7	DEC PDP-10	Honeywell 440 (2), dual-processor Honeywell 6050	Multiple Honeywell 635 and 235 systems in Teaneck, N.J., and Cleveland, O.	CDC 3500 in Toronto, CDC 6400 in Washington, XDS 940 in Phila., IBM 360/67 in N.Y.
No. of simultaneous users	40	64	228 total	200 per 635 system	Differs for each system
Conversational terminals supported	TTY, Friden, Datapoint 3300, GE TermiNet 300, UNIVAC DCT 500, Memorex, etc.	TTY 33/35, IBM 2741, Novar, Datel, Datapoint 3300, Execuport, etc.	All TTY-compatible terminals	TTY 33/35/37/38, GE TermiNet 300, Memorex 1240, Execuport 300, IBM 2741, etc.	TTY 33/35 and compatible terminals
Batch terminals	XDS 7670	UNIVAC DCT 2000, DC-71	—	Honeywell 115, IBM 1130	CDC 200, IBM 1130, UNIVAC 9200
SOFTWARE					
Conversational programming languages	FORTRAN IV, BASIC, Symbol	FORTRAN, BASIC, ALGOL, COBOL, LISP, etc.	BASIC, FORTRAN	BASIC, FORTRAN, ALGOL	FORTRAN, BASIC, ALGOL, PL/I, CAL
Batch-mode programming languages	FORTRAN IV, COBOL, Meta-Symbol	FORTRAN, COBOL, ALGOL	FORTRAN, COBOL	BASIC, FORTRAN, COBOL, ALGOL, JOVIAL, etc.	FORTRAN, COBOL, ALGOL, PL/I
Principal applications	Business & scientific	Business & scientific	Business & scientific	Business & scientific	Business & scientific
CHARGES					
Minimum monthly charge	None	None	None	$100	$200
Terminal connect time	$9.00/hr.	$7.50/hr.	$7.00/hr.	$7.00-13.50/hr.	$8.00-15.00/hr.
Central processor time	$4.80/min.	$3.00/min. (20,000 bytes)	$1.80/min.	$0.33/"CRU"	$2.40-15.00/min.
Amount of "free" mass storage	None	See COMMENTS	None	None	0-30,000 chars.
Charge for additional mass storage	$0.50/2048 chars./month	$0.50/1000 chars./month	$1.00/1000 chars./month	$1.10/1280 chars./month	$0.08-1.00/1000 chars./month
COMMENTS	Connect charge for 30-cps terminals is $14.50/hr.	No charge for mass storage used during daytime—only for files left on at night.	—	Charges shown are for Mark II Service on Honeywell 635 computers. GE also offers several other types of service.	Sells time on Control Data, Megasystems, and Multiple Access General systems. Rates depend upon system used.

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All About Computer Time-Sharing Services

COMPANY	Grumman Data Systems Corporation	Hobbs Associates, Inc.	Honeywell Information Services, Inc.	Interactive Data Corporation	Interactive Sciences Corporation
GENERAL					
Headquarters	Bethpage, N.Y. 11714	Corona Del Mar, Calif. 92625	Minneapolis, Minn. 55408	Waltham, Mass. 02154	Braintree, Mass. 02184
Name of service	CALLDATA	—	Honeywell Time-Sharing	—	ISC/10
Date operational	Feb. 1970	April 1969	Jan. 1969	Dec. 1968	May 1969
Areas currently served	New York metropolitan area and New England	Los Angeles, San Diego, and Orange County, California	Entire U.S.; service in most large cities	Northeast, Mid Atlantic, Northern Midwest, Los Angeles, and San Francisco	Boston, New York, & Pittsburgh regions
EQUIPMENT					
Computers	IBM 360/67	HP 2000	Honeywell 1648A (6)	IBM 360/67 (2); 1 in Waltham, 1 in San Francisco	DEC PDP-10 (2)
No. of simultaneous users	60	16	288 total	Not specified	128 total
Conversational terminals supported	IBM 2741, TTY 33/35, or equivalent units	TTY 33/35/37 and equivalent units (CRT displays, etc.)	All ASCII and EBCDIC devices at 10 and 30 cps	TTY 33/35, IBM 2741, Datapoint 3300, Memorex 1240, Execuport, etc.	TTY 33/35, IBM 2741, GE TermiNet 300, Datapoint 3300, plotters, etc.
Batch terminals	IBM 2780 or equivalent units	—	—	IBM 2780, Data 100, Remcom, etc.	—
SOFTWARE					
Conversational programming languages	FORTRAN, COBOL, PL/I	BASIC	FORTRAN IV, BASIC, SOLVE, TEACH	FORTRAN, BASIC, COBOL, PL/I, etc.	FORTRAN IV, BASIC, COBOL, Macro-10, etc.
Batch-mode programming languages	FORTRAN, COBOL, PL/I, Assembler	BASIC	—	FORTRAN, BASIC, COBOL, PL/I, etc.	FORTRAN IV, BASIC, COBOL, Macro-10, etc.
Principal applications	Business & scientific	Business & scientific	Business & scientific	Business & scientific	Business & scientific
CHARGES					
Minimum monthly charge	$50 if any service is rendered	None	$90 (after first 90 days)	None	None
Terminal connect time	$7.50/hr.	$6.00/hr.	$5.00-10.00/hr.	$10.00/hr.	$7.50/hr.
Central processor time	$22.20/min.	None	$2.40-3.00/min.	$16.80/min.	See COMMENTS
Amount of "free" mass storage	None	None	None	None	None
Charge for additional mass storage	$12.50/120K bytes/month	$0.20/128 chars./month	$1.00/1024 chars./month	$20.00/120K bytes/month	$1.00/3200 chars./month
COMMENTS	Runs under CP/CMS (Cambridge Monitor System). Volume discounts available.	24-hour service, 7 days/week. Full-time private line costs $750/month. Discounts for volume usage and education.	Special rates for dedicated ports and off-line storage.	Offers on-line financial data bases with proprietary software for accessing and processing.	CP charges based on $0.01 per "Interacton" (approx. 1024 words of core/CP second).

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All About Computer Time-Sharing Services

COMPANY	Interstate Computing, Inc.	ITT Data Services	Keydata Corporation	Leasco Response, Inc.	McDonnell Douglas Automation Co.
GENERAL					
Headquarters	New Orleans, La. 70130	Paramus, N.J. 07652	Watertown, Mass. 02172	Bethesda, Md. 20016	St. Louis, Mo. 63166
Name of service	ICI Timesharing	Reactive Terminal Service (RTS)	—	Response/360, Response I	Direct Access Computing
Date operational	June 1969	March 1968	Nov. 1965	1969	Jan. 1968
Areas currently served	Louisiana and Mississippi	Entire U.S. (from computer center in Paramus)	Entire U.S. and Canada (multiplexer in New York City)	Eastern and Midwestern U.S. plus Los Angeles; facilities in over 20 cities	Entire U.S.; toll-free access from New York, Chicago, Washington, D.C., Houston, L.A., and 4 other cities
EQUIPMENT					
Computers	GE-430 (2) in Daytona Beach, Fla.	IBM 360/65, IBM 360/67	UNIVAC 494 (2)	IBM 360/65 in Bethesda; HP 2116 in each branch office	XDS Sigma 7 (2), Honeywell 440
No. of simultaneous users	84 total	Not specified	800	Not specified	178 total
Conversational terminals supported	ASCII devices at up to 300 bps	TTY 33/35, IBM 2741, IBM 1050, etc.	TTY Model 28	All 10 cps ASCII and 30 cps terminals, IBM 2741	TTY 33/35 and all compatible terminals at 10 or 30 cps; IBM 2741
Batch terminals supported	—	—	—	—	XDS 7670
SOFTWARE					
Conversational programming languages	FORTRAN, BASIC	FORTRAN IV, BASIC, COBOL, Assembler	Offers standard commercial applications only	BASIC, FORTRAN, PL/I	FORTRAN IV, BASIC, SL/I, Symbol
Batch-mode programming languages	COBOL, FORTRAN	—	—	—	FORTRAN, COBOL, BASIC, Metasymbol
Principal applications	Business & scientific	Business & scientific	Business	Business & scientific	Business & scientific
CHARGES					
Minimum monthly charge	None	None	On request	$100	None
Terminal connect time	$10.00/hr.	$10.00/hr.	On request	$9.00	$8.00/hr.
Central processor time	$3.60/min.	$0.03/"Computer Work Unit"	On request	$18.00	$12.00/min.
Amount of "free" mass storage	None	60,000 bytes	None	None	None
Charge for additional mass storage	$1.50/1620 chars./month	$0.01/"Storage Unit"/day	On request	$0.35/half track/month	$0.40/1024 bytes/month
COMMENTS	Sells time on Compu-Time, Inc. system.	A division of International Telephone and Telegraph Corp. (Information supplied in Nov.1970.)	Dedicated system for conventional business data processing applications. (Information supplied in Nov.1970.)	Rates shown are for Response/360 service. Response I service on HP 2116 costs $6 to $8 per hour of connect time.	Charges shown are for Sigma 7 systems. Time-sharing users can submit batch jobs; files and languages are compatible.

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All About Computer Time-Sharing Services

COMPANY	Megasystems, Inc.	National CSS, Inc.	On-Line Systems, Inc.	Philco-Ford Corporation	Princeton Time-Sharing Services, Inc.
GENERAL					
Headquarters	Bala Cynwyd, Pa. 19004	Stamford, Conn. 06901	Pittsburgh, Pa. 15237	Philadelphia, Pa. 19134	Princeton, N.J. 08540
Name of service	–	VP/CSS	–	Computer Services Network (CSN)	–
Date operational	Jan. 1968	Dec. 1968	Dec. 1967	Dec. 1968	April 1969
Areas currently served	Middle Atlantic states, especially New York City, Philadelphia, Harrisburg, and North Carolina	N.Y., N.J., Conn., Eastern Pa., Mass., Ill., Calif., Ore., Wash., Ariz., Montreal, and Toronto	Eastern, Midwestern, and Southern U.S.; toll-free access from 16 cities	Delaware Valley, Washington, D.C., Northern N.J., Detroit, Chicago, Cincinnati, and Baltimore	Boston-New York-Philadelphia-Washington corridor
EQUIPMENT					
Computers	XDS 940 (2)	Duplex IBM 360/67 in Stamford; simplex 360/67 in Sunnyvale, Calif.	DEC PDP-10 (3)	Burroughs B 5500	IBM 360/50
No. of simultaneous users	52	160 in Conn.; 65 in Calif.	192 total	48	60
Conversational terminals supported	TTY 33/35/37, IBM 2741, Datapoint 3300, UNIVAC DCT 500 & 1000, etc.	TTY 33/35, IBM 2741, Datel, Datapoint 3300, Execuport, plotters, etc.	TTY 33/35/37, IBM 2741, Dura, Datel, Execuport, etc.	TTY 33/35, Memorex 1240, or equivalent	TTY 33/35/37, IBM 2741, Friden 7102, Datapoint 3300, Dura, Datel, etc.
Batch terminals supported	–	IBM 1130 & 2780, Data 100, Remcom, UNIVAC DCT 2000, etc.	–	UNIVAC DCT 1000 or equivalent	IBM 1130, IBM 2780, IBM 360/20, Data 100, etc.
SOFTWARE					
Conversational programming languages	FORTRAN IV, BASIC, CAL, TAP	FORTRAN IV, BASIC, COBOL, Assembler,	FORTRAN IV, BASIC, AID, COBOL, APL, Macro-10, etc.	FORTRAN BASIC, COBOL, ALGOL	CPL/I (Conversational PL/I)
Batch-mode programming languages	FORTRAN, TAP	FORTRAN IV, COBOL, PL/I, Assembler	FORTRAN IV, BASIC, COBOL	FORTRAN IV, BASIC, COBOL, ALGOL	FORTRAN IV, COBOL, PL/I, ALGOL, RPG, SNOBOL, etc.
Principal applications	Business & scientific	Business & scientific	Business & scientific	Business & scientific	Business & scientific
CHARGES					
Minimum monthly charge	$200	None	$5/user no.	$25.00	$100
Terminal connect time	$11.00/hr.	$10.00/hr.	$10.00/hr.	$9.00/hr.	$7.00/hr.
Central processor time	$2.75/min.	$22.80/min.	$0.05/"CP Unit"	$7.20/min.	Depends upon core usage
Amount of "free" mass storage	20,000 chars.	None	None	75,000 chars.	1,000,000 bytes
Charge for additional mass storage	$1.00/1000 chars./month	$20.00/120K bytes/month	$1.00/3200 chars./month	$1.00/1000 chars./month	$10.00/100K bytes/month
COMMENTS	Accounting packages priced on transaction basis. Company's former New York operations were sold to Boeing.	CP charges are for time spent in pure problem state. Offers remote OS batch with on-line, JCL syntax checking.	Service available 24 hours/day, 7 days/week. Supports terminals at 110, 134.5, 300, and 1200 bps.	Lower rates during non-prime hours; educational discounts. Dedicated lines available at negotiated prices.	Offers services for subscription fulfillment, list management, associations, and fund raising management.

All About Computer Time-Sharing Services

COMPANY	Programs & Analysis, Inc.	Proprietary Computer Systems, Inc.	Remote Computing Corporation	Scientific Time Sharing Corporation	Sci-Tek, Inc.
GENERAL					
Headquarters	Burlington, Mass. 01803	Van Nuys, Calif. 91406	Palo Alto, Calif. 94301	Washington, D.C. 20007	Wilmington, Del. 19806
Name of service	—	PCS/APL, Advanced ATS	RCC Time-Sharing	APL Plus	—
Date operational	May 1969	Oct. 1968	Oct. 1968	Aug. 1969	Jan. 1967
Areas currently served	Boston, Providence, Cincinnati, Dayton	Multiplexers in New York, Phila., Washington, D.C., Chicago, Miami, L.A., San Fran., & 5 other cities	11 Western states plus New York and Washington, D.C.	Washington, New York, Phila., Boston, Chicago, L.A., San Fran., & 7 other cities	Eastern Seaboard
EQUIPMENT					
Computers	Honeywell 430	IBM 360/50	Burroughs B 5500 (3); 2 in Los Angeles and 1 in Palo Alto	IBM 360/65	UNIVAC 1108 (2); one in Wilmington and one in Mineola, N.Y.
No. of simultaneous users	29	100	56	96	128 total
Conversational terminals supported	TTY and other 110 and 300 bps terminals	IBM 2741, Novar, Datel, Itel, A-J, etc.	TTY 33/35 and Inktronic, IBM 2741, and many others	IBM 2741, Datel 30 & 31, A-J 841, Novar 5-50, IBM Mag. Card Selectric	TTY 33/35, IBM 2741, etc.
Batch terminals supported	—	IBM 2780 or equivalent	—	—	UNIVAC 1004, 9000, DCT 2000; IBM 2780, 1130, etc.
SOFTWARE					
Conversational programming languages	BASIC, FORTRAN	APL	FORTRAN, BASIC, COBOL, ALGOL	APL	BASIC, RALPH
Batch-mode programming languages	—	FORTRAN, COBOL, PL/I, etc.	FORTRAN, BASIC, COBOL, ALGOL	—	FORTRAN, COBOL, SLEUTH
Principal applications	Business	Business & scientific	Business & scientific	Business & scientific	Business & scientific
CHARGES					
Minimum monthly charge	None	None	None	None	None
Terminal connect time	$8.00/hr.	$10.00-12.00/hr.	$7.00/hr.	$12.00/hr.	$10.00/hr.
Central processor time	$6.00/min.	$6.00/min.	$6.00/min.	$21.00/min.	$12.00/min.
Amount of "free" mass storage	None	48,000 chars.	None	None	None
Charge for additional mass storage	$0.50/1000 chars./month	$1.75/7294 chars./month	$0.02-0.05/2400 chars./day	$10.00/million byte-days	0.04/1792 words/day
COMMENTS	Serves business applications only. All programs are customized. Will install CDC Cyber 72 system in April 1972.	Rates shown are for APL; one CP minute is free with each connect hour. Marketing affiliates in Trenton, Chicago, Richmond.	Connect charge ranges from $7.00/ hr. at 110 bps to $25.00/hr. at 1200 bps. Rates are 15% lower after 7 pm.	APL Plus File Subsystem facilitates processing of large shared files and data bases.	Offers APT, ICES, graphics systems, file management system, and Securities Validation System.

All About Computer Time-Sharing Services

COMPANY	Service Bureau Corporation	Shared Computer Systems, Inc.	I.P. Sharp Associates	Statistical Tabulating Corp.	Structural Dynamics Research Corp.
GENERAL					
Headquarters	Harrison, N.Y. 10528	Miami, Fla. 33131	Toronto, Ont., Canada	Chicago, Ill. 60606	Cincinnati, Ohio 45227
Name of service	Call/360	—	APL Plus	StatiCom	SDRC Computer Operations
Date operational	May 1968	June 1969	Aug. 1969	Oct. 1969	Jan. 1969
Areas currently served	43 cities, including Boston, Chicago, Denver, Detroit, L.A., New York, Phila., San Fran., Washington, etc.	Florida	Canada, East Coast of U.S., Chicago, Dallas, Los Angeles, and San Francisco	Illinois	Nationwide access, currently toll-free
EQUIPMENT					
Computers	Multiple IBM 360/50 systems in Cleveland and San Jose	IBM 360/40, IBM 360/30	IBM 370/145	IBM 360/65	CDC 6500 in Pittsburgh; XDS 940 (9) in Ann Arbor; GE-430 in Louisville, etc.
No. of simultaneous users	Not specified	60	120	20	Varies with system
Conversational terminals supported	IBM 2741, TTY 35, Datel, Novar, Memorex 1240, etc. at 10, 15, or 30 cps.	IBM 2741, Memorex 1240, Datel 1031	IBM 2741, IBM 1050, TTY 33, Datel, Novar	IBM 2741, Datapoint, Novar	TTY 33/35 and other ASCII terminals at 10 and 30 cps
Batch terminals supported	—	—	—	IBM 2780, 1130, 360/20; Atron, Mohawk, UCC COPE	CDC 200, IBM 1130, UNIVAC 9200, UCC COPE (on 6500 only)
SOFTWARE					
Conversational programming languages	BASIC, FORTRAN,	APL, Assembler	APL Plus	—	FORTRAN IV, BASIC
Batch-mode programming languages	—	All IBM languages	—	FORTRAN IV, COBOL, PL/I, ADPAC, Assembler	FORTRAN, COBOL, Assembly, etc.
Principal applications	Business & scientific	Business & scientific	Business & scientific	Business & scientific	Engineering & business
CHARGES					
Minimum monthly charge	$100	None	None	None	None
Terminal connect time	$11.00/hr.	10.00/hr.	$12.00/hr.	$10.00/hr.	$7.50-13.00/hr.
Central processor time	$9.00/min.	3.60/min.	$18.00/min.	$11.00/min.	$3.00-24.00/min.
Amount of "free" mass storage	None	72,000 bytes	65K bytes	None	None
Charge for additional mass storage	$1.50/3400 bytes/month	$1.00/7294 chars./month	$12.00/32K bytes/month	$0.25/2314 disk track/week	$0.90-1.75/1000 chars./month
COMMENTS	Extra charges for national network, on-line stock data bank, and other special services. SBC is a subsidiary of IBM	Terminal users can address any device for high-speed printing, punching, etc.	—	CPU charge varies with core usage and priority. Full-time connect charge is $175 per week.	Sells time on U.S. Steel, ACTS, Com-Share, and Metridata systems. Features mechanical design & structural analysis programs.

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All About Computer Time-Sharing Services

COMPANY	System Development Corporation	Technical Advisors, Inc.	Technology for Information Management, Inc.	Tel-A-Data, Inc.	Telstat Systems, Inc.
GENERAL					
Headquarters	Santa Monica, Calif. 90406	Wayne, Mich. 48184	Albany, N.Y. 12205	Miami, Fla. 33162	New York, N.Y. 10022
Name of service	TS/DMS	TECH-MAC	TIM-Sharing	Tel-A-Data	TELAC/70
Date operational	Sept. 1969	June 1967	Sept. 1968	Dec. 1966	Jan. 1971
Areas currently served	Los Angeles & Washington, D.C.	Entire U.S. (toll-free, except Michigan)	Illinois & New York	South Atlantic States	New York City area
EQUIPMENT					
Computers	IBM 360/67	Varian 620i (2), Varian 620A	GE-430 (in Chicago)	Burroughs B 500	XDS Sigma 7
No. of simultaneous users	40	24 total	30	· 64	40
Conversational terminals supported	TTY 33/35, IBM 2740, and other compatible devices, including display units	TTY 33/35	TTY 33/35, GE TermiNet 300, Memorex 1240, & other ASCII terminals	TTY 33/35, GE TermiNet 300, Burroughs TC 500	TTY 33/35, IBM 2741, GE TermiNet 300, Datapoint 3300, Execuport
Batch terminals supported	—	—	—	—	XDS 7670, IBM 1130, UNIVAC DCT 2000
SOFTWARE					
Conversational programming languages	FORTRAN IV, COBOL, JOVIAL, TINT, Assembler	—	FORTRAN IV, BASIC	Assembler	FORTRAN, BASIC, Symbol, ASSIST
Batch-mode program-	—	—	—	—	FORTRAN, COBOL, BASIC, Metasymbol
Principal applications	Data management, info. retrieval	Civil engineering & surveying	Business & scientific	Business	Financial services
CHARGES					
Minimum monthly charge	$380	None	$25	$1,000	None
Terminal connect time	$23.00/hr.	$10.00-30.00/hr.	$10.00/hr.	No extra charge	$9.00/hr.
Central processor time	No charge	No charge	$3.00/min.	No extra charge	$7.20/min.
Amount of "free" mass storage	17,500 K bytes	None	None	5 to 10K chars.	None
Charge for additional mass storage	$0.03/1000 bytes/month	$12,50/1000 words/month	$0.75/1000 chars./month	$0.20/300 chars./month	$0.01/1000 chars./day
COMMENTS	Offers unlimited use during 4-hour time-sharing day for $2000/month.	Offers specialized services for civil engineers and surveyors only. $25 initiation fee.	$50 initiation fee. Reduced rates for non-prime hours and volume usage.	Main emphasis is on statistical reports and inventory control. Monthly charge includes CP and connect time.	Provides access to TELPRICE/70, an extensive financial data base, at a cost of $350/month.

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All About Computer Time-Sharing Services

COMPANY	Time Sharing Resources, Inc.	TransNet Corporation	Tymshare, Inc.	United Computing Systems, Inc.	University Computing Company
GENERAL					
Headquarters	New York, N.Y. 10036	Union, N.J. 07083	Palo Alto, Calif. 94301	Kansas City, Mo. 64111	Dallas, Tex. 75222
Name of service	Big APL, Big Call	TransNet	Tymnet	UCS-II (GE-265), UCS-VI (CDC 6400)	FASBAC
Date operational	Jan. 1970	Oct. 1969	Nov. 1966	Dec. 1967	May 1969
Areas currently served	New York, New Jersey, Conn., Phila., Chicago, Tampa, Atlanta, Houston, Dallas, L.A., San Fran., etc.	New York, New Jersey	Entire U.S. (thru WATS and multi-plexers), and most of Europe (thru Cegos Tym-share affiliate)	Entire U.S.; toll-free access from 44 cities	Entire U.S. (thru WATS and multi-plexers), plus Eng-land, Western Europe and Australia
EQUIPMENT					
Computers	IBM 360/50	XDS Sigma 7 & GE-430 in New York; DEC TSS-8 in N.J.	XDS 940 (23), DEC PDP-10 (3), GE-265 (1); computers in 5 locations	CDC 6400(2), GE-265	UNIVAC 1108's in Dallas (2), Chicago, El Segundo, East Brunswick, London, and Sydney
No. of simultaneous users	60	86 total	1230 total	Not specified	25 per FASBAC system (175 total)
Conversational ter-minals supported	IBM 2741, Dura, Datel, Novar, Datapoint 3300, etc.; TTY 33/35/37 for Call/360 only	IBM 2741 and ASCII Terminals at 110 to 1200 bps	TTY 33/35/37, IBM 2741, TI 720, Portacom, Memorex 1240, CRT displays, etc.	TTY 33/35, Friden, and all ASCII, EBCDIC, and Selectric terminals	ASCII devices at 10, 15, & 30 cps, IBM 2741, Datel, and plotters
Batch terminals supported	IBM 1130, IBM 2780, Data 100	—	—	CDC 200 (on CDC 6400 only)	UCC COPE, IBM 2780 and System/360, UNIVAC 1004, etc.
SOFTWARE					
Conversational pro-	APL, BASIC, FORTRAN, PL/I	FORTRAN, BASIC, COBOL, CAL, FOCAL	BASIC, FORTRAN, CAL, TYMTAB, etc.	BASIC, FORTRAN, ALGOL	BASIC, CASH, CALC, SHOBOL, Fastext
Batch-mode program-ming languages	FORTRAN, COBOL, PL/I, RPG, Assembler	FORTRAN, COBOL	FORTRAN II/IV, COBOL	FORTRAN, COBOL, ALGOL, COMPASS, etc.	FORTRAN V, COBOL, ALGOL, Assembly
Principal applications	Business & scientific	Business & scientific	Business & scientific	Business & scientific	Business & scientific
CHARGES					
Minimum monthly charge	None	None	$80	None	$100
Terminal connect time	$11.00/hr.	$9.00/hr.	$13.00/hr.	$5.50-16.00/hr.	$7.50/hr.
Central processor time	$6.00/min.	$7.20/hr.	$2.40/min.	0 to $36.00/min.	$20.00/min.
Amount of "free" mass storage	None	None	None	None	None
Charge for additional mass storage	$1.50/7200 chars./month	$1.00/1024 chars./month	$0.50-1.00/1000 chars./month	$0.50/1280 chars./month	$0.50/2096 chars./month
COMMENTS	Markets time on computers owned by GTEIS. System handles large shared files. One free CP minute per hr. of connect time.	Charges shown are for Sigma 7; GE-430 & TSS-8 rates are lower. Technical advisors are assigned to each customer.	Charges shown are for XDS 940 systems. Acquired time-sharing activ-ities of Dial-Data, Graphic Controls, & Computer Complex.	Rates depend on computer and pricing option used. Offers nationwide access to common data bases.	Also offers con-versational service on PDP-10 in Dallas and remote batch service on CDC 6400 in California

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All About Computer Time-Sharing Services

COMPANY	USS Engineers and Consultants, Inc.	Wabash Computer Corporation	Westinghouse Tele-Computer Systems Corp.	World Wide Time-Sharing, Inc.
GENERAL				
Headquarters	Pittsburgh, Pa. 15230	Phoenix, Ariz. 85021	Pittsburgh, Pa. 15221	Chicago, III. 60601
Name of service	UEC	—	Remote Input Terminal System	—
Date operational	May 1970	Nov. 1968	Nov. 1968	Jan. 1970
Areas currently served	Conn., Del., Ind., III., Ky., Mass., Mich., N.Y., Ohio, Pa., & Va.	Arizona	Middle Atlantic & New England States, plus III., Ind., Mich., Va., and Ga.	Illinois
EQUIPMENT				
Computers	CDC 6500 (2 CP's)	IBM 360/44	IBM 360/65, IBM 360/75	CDC 3150
No. of simultaneous users	64 TTY, 16 CDC 200, 2 CDC 1700	52	Not specified	Up to 256 lines
Conversational terminals supported	TTY 33/35, GE TermiNet 300, Datapoint 3300, Syner-Data	TTY 33/35, IBM 2741, GE TermiNet 300, Courier CRT, Datel	—	TTY 33/35, Beta, Friden, Olivetti, Memorex
Batch terminals supported	CDC 1700, CDC 200, IBM 1130, UCC COPE 25	—	TTY 33/35 & compatible units; IBM 1130, 360; West'house 9000	—
SOFTWARE				
Conversational programming languages	FORTRAN, COBOL, BASIC, ALGOL	Shared Access Reactive Processor (a proprietary language)	—	None (dedicated services)
Batch-mode programming languages	FORTRAN, COBOL, BASIC ALGOL	FORTRAN, COBOL, PL/I, Assembler	COBOL, FORTRAN, APT	None (dedicated services)
Principal applications	Scientific & engineering	Business	Business & scientific	Business
CHARGES				
Minimum monthly charge	None	$100	None	$330
Terminal connect time	$9.00/hr.	$5.00/hr.	$8.00-12.00/hr.	Not applicable
Central processor time	$24.00/min. (conversational)	No charge	$675/"CRU"	Not applicable
Amount of "free" mass storage	None	None	None	Not applicable
Charge for additional mass storage	$1.00/10,000 chars./month	$0.10/615 bytes/month	$1.50/5760 bytes/month	Not applicable
COMMENTS	Subsidiary of U.S. Steel Corp. Lower rates for batch mode and volume usage.	Specializes in standard business applications. Most services are priced on a functional or transaction basis.	Emphasizes remote batch services under OS/360. Volume discounts available.	Dedicated order entry, invoicing, inventory control, & other services. Charges based on activity and file sizes.

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All About Computer Time-Sharing Services

AVAILABILITY OF TIME-SHARING APPLICATION PROGRAMS

COMPANY / APPLICATION	Accounts Payable	Accounts Receivable	Banking	Billing	Educational	Engineering	General Ledger	Hospital Administration	Information Retrieval	Insurance	Inventory Control	Numerical Control	Medical Research	Operations Research	Payroll	Personnel	Project Control	Sales Analysis	Scheduling	School Administration	Scientific	Simulation	Statistical	Text editing	Typesetting
Academy Computing Corp.	●	●		●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	
ACTS Computing Corp.	●	●	●	●	●	●	●		●		●	●		●	●	●	●	●	●	●	●	●	●	●	
APL Services, Inc.	●	●			●	●			●		●		●	●	●	●	●		●	●	●	●	●	●	
Applied Logic Corp.			●			●			●					●				●	●		●	●	●	●	
Axicom Systems, Inc.						●			●					●							●	●	●		
Bowne Time Sharing, Inc.																								●	●
Burroughs Corp.			●		●	●			●				●	●							●	●	●	●	●
Chi Corp.					●	●		●	●		●	●		●			●	●	●	●	●	●		●	●
Community Computer Corp.	●	●	●	●	●	●	●		●		●	●	●	●	●	●	●	●	●		●		●	●	
Comp-Time Corp.	●	●	●	●	●	●	●		●		●		●	●	●	●	●				●		●	●	
Compu-Serv Network, Inc.	●	●	●	●	●	●	●		●	●	●		●	●	●	●	●	●			●	●	●		
The Computer Company	●	●	●	●	●	●	●		●		●		●	●		●	●	●			●	●	●		
Computer Complex, Inc.	●	●		●		●						●			●						●	●	●	●	
Computer Innovations			●		●	●	●	●	●	●	●	●	●	●		●	●	●	●	●	●	●	●	●	●
Computer Network Corp.		●		●	●	●	●	●	●	●	●	●		●	●	●	●	●	●		●	●	●		
Computer Sciences Corp.		●			●	●			●	●			●	●			●				●	●	●		
Computer Sharing Services, Inc.	●	●	●			●	●		●		●	●		●		●	●	●	●		●	●			
Computility, Inc.	●	●	●	●		●	●		●				●	●		●	●	●			●	●	●	●	
Compu-Time, Inc.						●	●				●		●	●							●	●	●	●	
Computone Systems, Inc.									●				●												
Com-Share, Inc.			●			●	●		●		●	●		●		●	●	●	●		●	●	●	●	
Com-Share Limited	●	●	●	●	●	●	●		●		●	●		●	●	●	●	●	●		●	●	●	●	
Control Data Corp.						●			●												●	●	●		
Cyphernetics Corp.			●			●			●					●			●	●	●		●	●	●	●	●
Dataline Systems Limited			●		●	●			●		●		●				●	●	●		●	●	●		
Datalogics, Inc.			●		●	●	●				●	●					●	●			●	●	●		
First Data Corp.			●		●	●		●							●	●		●			●	●	●	●	
Fulton National Bank			●		●	●	●								●	●				●	●	●	●	●	
General Electric Co.			●		●	●	●	●	●		●	●		●	●		●	●			●	●	●	●	
Genesee Computer Center, Inc.	●	●		●	●	●	●	●	●	●	●	●	●	●	●		●	●			●	●	●	●	
Grumman Data Systems Corp.	●	●			●	●	●	●	●		●	●		●	●		●	●		●	●	●	●	●	
Hobbs Associates, Inc.					●	●	●	●									●	●	●	●	●		●		
Honeywell Information Services	●	●	●	●	●	●	●		●		●	●		●	●	●	●	●	●	●	●	●	●	●	
Interactive Data Corp.		●	●						●					●								●	●		
Interactive Sciences Corp.	●	●				●	●						●	●	●	●		●	●		●	●		●	
Interstate Computing, Inc.			●	●		●	●			●	●			●		●	●	●			●	●		●	●
ITT Data Services	●	●	●			●			●		●					●	●		●		●	●		●	
Keydata Corp.	●	●	●		●																				
Leasco Response, Inc.	●	●	●	●	●	●	●		●	●				●		●	●	●	●		●	●			
McDonnell Douglas Automation Co.	●	●		●	●	●			●		●	●		●	●		●		●	●	●	●		●	
Megasystems, Inc.	●	●	●	●	●	●	●		●		●	●		●	●	●	●	●			●	●	●	●	
National CSS, Inc.			●			●	●		●	●				●		●	●	●	●		●	●	●	●	
On-Line Systems, Inc.			●		●	●	●		●		●	●		●		●	●	●	●		●	●	●	●	
Philco-Ford Corp.		●		●		●	●		●		●				●						●	●	●	●	
Princeton Time Sharing Services	●	●		●	●	●	●		●		●			●		●	●	●	●	●	●	●			
Programs & Analysis, Inc.	●	●				●	●		●		●	●		●	●		●	●	●		●	●	●	●	
Proprietary Computer Systems	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●		●	
Remote Computing Corp.	●	●				●	●		●		●			●			●				●	●	●	●	
Scientific Time Sharing Corp.	●	●			●	●	●	●	●	●	●	●	●	●			●	●			●	●	●	●	
Sci-Tek, Inc.					●	●			●		●								●		●	●	●	●	
Service Bureau Corp.		●		●	●	●	●		●		●			●	●	●	●				●	●	●		
Shared Computer Systems, Inc.	●	●	●	●	●	●	●		●		●			●	●	●		●	●	●	●	●	●		
I.P. Sharp Associates					●	●	●		●	●		●		●			●	●	●		●	●	●		
Statistical Tabulating Corp.	●	●			●	●	●	●	●	●				●	●		●	●	●	●	●	●	●		
Structural Dynamics Research	●	●	●	●	●	●	●		●	●	●	●		●	●	●	●	●	●		●	●	●	●	
System Development Corp.					●				●					●		●					●				
Technical Advisors, Inc.						●																			
Technology for Information Mgmt.	●	●		●		●	●		●		●				●		●	●	●		●		●	●	
Tel-A-Data, Inc.	●	●		●					●		●														
Telstat Systems, Inc.									●				●										●	●	
Time Sharing Resources, Inc.	●	●			●	●	●		●		●		●	●			●	●	●	●	●	●	●	●	
TransNet Corp.		●	●	●	●	●	●		●		●		●	●		●	●	●	●	●	●	●	●	●	
Tymshare, Inc.	●	●	●	●	●	●	●		●		●	●		●	●		●	●	●		●	●	●	●	
United Computing Systems	●	●	●	●	●	●	●		●		●	●	●	●		●	●	●	●		●	●	●	●	
USS Engineers and Consultants						●			●		●	●		●		●		●		●	●	●	●		
Wabash Computer Corp.		●		●		●	●		●		●				●	●		●		●		●	●	●	
Westinghouse Tele-Computer Systems			●			●	●		●		●	●					●		●	●	●	●	●		
World Wide Time Sharing, Inc.	●	●		●			●		●	●	●				●			●							