

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.

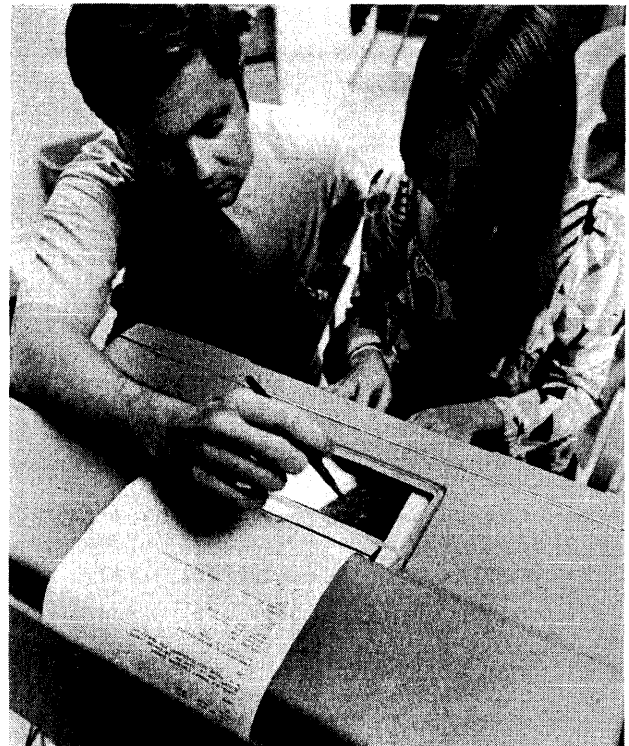
TIME-SHARING TODAY

The economic crunch of 1969 and 1970, together with the sadly misdirected technical and sales efforts of many of the young time-sharing firms, has led to a severe shakeout. Capital to start a new time-sharing company or nurture an existing one is now extremely hard to come by. Of the nearly 200 companies in the field a year ago, it appears that nearly half have now abandoned their time-sharing efforts, merged with other companies, or closed

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 there are also numerous pitfalls awaiting the unwary. This report describes the current state of the art, surveys the offerings of 50 time-sharing service companies, and provides straightforward guidelines for selecting the one that best meets your needs.

their doors completely. Of the remaining firms, many are in shaky financial straits and only a handful are currently showing a profit.

Despite the current problems of most of the 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 ▷



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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▷ revenues for the time-sharing services industry are expected to grow from an estimated \$70 million in 1968 to around \$2 billion in 1975.

The leading U.S. supplier of time-sharing services is General Electric Company, which entered the business in 1965 and is believed to command roughly a 35 percent share of the current market. 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 Complex, Computer Sciences, Com-Share, 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 time-sharing fans out of 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.

- *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, 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 widespread on-line communications network with centralized files at a fraction of the cost of setting up and operating your own. (Note, however, that considerations of communications reliability, access control, and file security 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 ▷

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▷ 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. Things are much better now, but the reliability problem continues to haunt the purveyors of time-sharing services. Even after the computer system and all its software have been completely debugged, problems are likely to keep arising in the facilities of the communications common carrier or in the user's own terminal equipment.

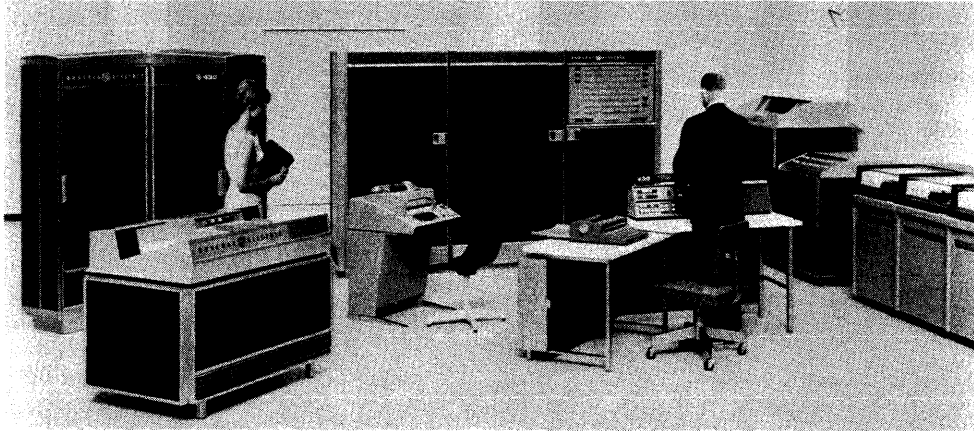
The telephone companies, in particular, are being severely criticized for having neither the facilities nor the personnel to provide the quality of service required for reliable time-sharing communications. In an effort to circumvent the reliability problems of the dialed public telephone network, some of the larger time-sharing companies are setting up communications networks of their own. At present, the reliability level of most 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, but prospective users 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 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 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

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The medium-scale GE-430 time-sharing computer system is the central element of a number of commercial networks.

▷ 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 slow, difficult process. At present, business applications account for only an estimated 10 to 15 percent of 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 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 ▷

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▷ 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 slow and frustrating.

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 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 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 ▷

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▷ 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 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? ▷

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▷ 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.

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. 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 ▷

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➤ 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 50 commercially available time-sharing services are presented in the accompanying comparison charts. All information in the charts was furnished and/or verified by the 50 suppliers in October 1970; 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 120 companies known or believed to be in the time-sharing business. More than a dozen of these requests were returned as undeliverable, serving as mute evidence of the severe recent shakeout that has driven many of the weaker time-sharing companies out of business. The 50 usable responses summarized in our charts represent a good cross-section of the commercial time-sharing services that are available today. The absence of any specific company from our charts means that the company either was unknown to us or failed to respond to our repeated information requests.

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. 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. When 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 ➤

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▷ 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 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 Dura Typewriter 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 General Electric and the RCA Service 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 discipline technique in one of the 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 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. ▷

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▷ Other commonly supported batch-mode terminals include the Control Data 200 User Terminal, RCA 70/740 Data 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 in 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.

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. The language, however, is not well suited for business applications, and its conciseness 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. ▷

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▷ 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.

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 50 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. 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	Applied Computer Time Share	Applied Logic Corporation	Burlington Management Services Co.	C & C Computer Systems, Inc.	Community Computer Corporation
GENERAL					
Headquarters	Southfield, Mich. 48075	Princeton, N.J. 08540	Greensboro, N.C. 27420	Portland, Ore. 97214	Philadelphia, Pa. 19144
Name of service	ACTS	AL/COM	TSOS	REACT	—
Date operational	Oct. 1968	Jan. 1966	Feb. 1969	March 1969	Jan. 1969
Areas currently served	Michigan, Illinois, Indiana, Ohio	Entire U.S. Toll-free access from 20 cities	Eastern U.S. Toll-free access from Atlanta, Chicago, New York, and Washington	Oregon, Washington, California, Colorado	Delaware Valley
EQUIPMENT					
Computers	GE-265 (2), GE-430 (2), IBM 360/40	PDP-10 (8), in four "Dual AL-10 Systems"	RCA 70/46 (2)	IBM 360/65	HP 2116B (3)
No. of simultaneous users	158 total	200	96	102	48
Conversational terminals supported	TTY 33/35, IBM 2741, Terminat 300, Friden 7701, Datel, Dura	TTY 33/35, IBM 2741, Datel, Dura, Typagraph; CalComp plotters	TTY 33/35/37, IBM 2741, Execuport, Inktronic, RCA 70/752 VDT	Any ASCII or EBCDIC terminal: TTY 33/35/37, IBM 2741, etc.	TTY 33/35 or equivalent
Batch terminals	IBM 2780, IBM 360/20	—	RCA 70/740, UNIVAC DCT 2000	IBM 2780, IBM 1130, IBM 360	—
SOFTWARE					
Conversational programming languages	FORTRAN, BASIC, ALGOL, APL, SNOBOL, etc.	FORTRAN, BASIC, COBOL, AID, SNOBOL, LISP, MACRO-10	FORTRAN, BASIC, COBOL, Edit, etc.	BASIC, RPL (Conversational PL/I)	BASIC
Batch-mode programming languages	FORTRAN, COBOL, PL/I, RPG, Assembler	—	FORTRAN, COBOL, BAL, RPG, etc.	FORTRAN, COBOL, ALGOL, PL/I, etc.	FORTRAN, BASIC, ALGOL
Principal applications	Business & scientific	Business & scientific	Business & scientific	Business & scientific	Business & scientific
CHARGES					
Minimum monthly charge	\$100	\$100	\$100	\$50	None
Terminal connect time	\$5.00-9.50/hr.	\$10.00/hr.	\$9.00-12.00/hr.	\$2.00-6.00/hr.	\$7.00/hr.
Central processor time	\$2.40-3.00/min.	\$0.10/"Core Unit"	\$6.00/min.	\$6.00/min.	None
Amount of "free" mass storage	None	None	50,000 bytes	146,000 bytes	None
Charge for additional mass storage	\$1.00/1000 chars./month	\$0.75/1024 chars./month	\$6.00/25K bytes/month	\$0.90/7.3K bytes/month	\$0.10/160 bytes/month
COMMENTS	One GE-430 in Cincinnati; all other computers in Detroit. ACTS is a Lear Siegler, Inc. subsidiary.	Multiplexers in Boston, Chicago, Dallas, Detroit, L.A., New York, Phila., Wash., & 7 other cities.	A division of Burlington Industries, Inc.	Multiplexers in Denver, Los Angeles, and Seattle.	

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COMPANY	Compu-Time, Inc.	Computer Complex, Inc.	Computer Network Corporation	Computer Sciences Corporation	Computer Sharing Services
GENERAL Headquarters	Daytona Beach, Fla. 32014	Houston, Texas 77036	Washington, D.C.	El Segundo, Calif. 90245	Denver, Colo. 80223
Name of service	Compu-Time	Computer Complex	Alpha System	INFONET	—
Date operational	Oct. 1967	July 1967	Sept. 1970	Jan. 1970	Jan. 1968
Areas currently served	Southeastern U.S.	Entire U.S. Toll-free access from 24 cities, plus national WATS	Middle and South Atlantic states	Entire U.S. and Canada; 5 computer sites in U.S. and 2 in Canada	Mountain states
EQUIPMENT Computers	GE-435 (2)	XDS 940 (4), XDS Sigma 7	IBM 360/65	UNIVAC 1108 (7)	GE-430 (2)
No. of simultaneous users	80	164	75	Not specified	80
Conversational terminals supported	TTY 33/35, Friden 7102, Terminet 300, Datapoint 3300, Corning 904	Any ASCII terminal, including plotters and CRT's	TTY 33/35, IBM 2741, Datapoint 3300	TTY 33/35, IBM 2741, Datel, Dura, Datapoint 3300, etc.	TTY 33/35, IBM 2741, Dura, or any ASCII terminal
Batch terminals supported	—	—	IBM 2780, IBM 1130	UNIVAC 1004, 9200, 9300, & DCT 2000; IBM 1130	—
SOFTWARE Conversational programming languages	FORTRAN IV, BASIC	FORTRAN II/IV, BASIC, CAL, SNOBOL, QED, etc.	All OS/360 languages	BASIC	FORTRAN, BASIC
Batch-mode programming languages	FORTRAN IV, COBOL	—	All OS/360 languages	FORTRAN V, COBOL, SLEUTH	FORTRAN, COBOL
Principal applications	Business & scientific	Business & scientific	Business & scientific	Business & scientific	Business & scientific
CHARGES Minimum monthly charge	\$10	\$250	None	\$50	\$35
Terminal connect time	\$10.00/hr.	\$12.00/hr.	\$7.00/hr.	\$11.00/hr.	\$5.00/hr.
Central processor time	\$3.60/min.	\$2.40/min.	\$0.20/"CUU"	\$30.00/min.	\$3.00/hr.
Amount of "free" mass storage	None	None	None	None	None
Charge for additional mass storage	\$1.50/1620 chars./month	\$0.025/1024 chars./day	\$1.00/7000 chars./month	\$1.00/3072 chars./month	\$2.00/1800 chars./month
COMMENTS	\$100 initiation fee. Connect time is \$20/hr. for 30 char/sec. lines.		Offers "OS-compatible time-sharing."	Features remote batch processing, at \$600-800 per hour of 1108 CPU time.	\$35 initiation fee. CPU charges are much lower during non-prime periods.

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COMPANY	Comserv	Com-Share, Inc.	Consolidated Computer Ltd.	Control Data Corporation	Cyphernetics Corporation
GENERAL Headquarters	Philadelphia, Pa. 19104	Ann Arbor, Mich. 48106	Toronto, Canada	Minneapolis, Minn. 55440	Ann Arbor, Mich. 48103
Name of service	Comserv	—	CCL	Cybernet	Cyphernet
Date operational	July 1969	June 1966	April 1969	Feb. 1966	Sept. 1969
Areas currently served	Delaware Valley, New York City	Entire U.S. and Canada. Local dial-up capability in 52 cities	Canada (computers in Toronto, Montreal, Halifax, and Edmonton)	Middle Atlantic States (offered nationwide on bulk or wholesale basis)	North Central States (Mich., Ohio, Ill., Ind., Wis., & Western Pa.)
EQUIPMENT Computers	XDS Sigma 7	XDS 940 (9); 4 in Ann Arbor, 4 in Norwood, N.J., 1 in Los Angeles	CCS 2102 (4), CCS 2103 (2)	CDC 6400 (located in Washington, D.C.)	PDP-10 (2)
No. of simultaneous users	40	396 (44 per computer)	96 (16 per computer)	384	100
Conversational terminals supported	TTY 33/35, IBM 2741, Burroughs TC 500, and CRT's	TTY 33/35/37, Terminet 300, Datapoint 3300, plotters, etc.	TTY 33/35, AJ ADT 233, Datapoint 3300, HP plotter & card reader	TTY 33/35, Datapoint 3300, and other TTY-compatible terminals	TTY 33/35/37, IBM 2741, Dura, Datel, Datapoint 3300, etc.
Batch terminals supported	UNIVAC DCT 2000	—	—	CDC 200 User Terminal	Cyphernet Batch Terminal (own design)
SOFTWARE Conversational programming languages	FORTRAN, BASIC, APL, SNOBOL, SYMBOL	FORTRAN II/IV, BASIC, SNOBOL, QED, TAP	BASIC	FORTRAN IV, BASIC, ALGOL	FORTRAN IV, BASIC, COBOL
Batch-mode programming languages	FORTRAN, COBOL, SNOBOL, METASYMBOL	—	—	FORTRAN IV, COBOL, BASIC, ALGOL, etc.	FORTRAN IV, BASIC, COBOL
Principal applications	Business & scientific	Business & scientific	Business & scientific	Business & scientific	Business & scientific
CHARGES Minimum monthly charge	None	\$400	\$50	None	None
Terminal connect time	\$9.00/hr.	\$10.00/hr.	\$7.50/hr.	\$8.00/hr.	\$10.00/hr.
Central processor time	\$7.20/min.	\$3.00/min.	None	\$12.00/min.	Variable
Amount of "free" mass storage	25,600 chars.	None	None	None	None
Charge for additional mass storage	\$1.00/1024 chars./month	\$0.03/1000 chars./day	\$1.00/1000 chars./month	\$0.30/1280 chars./month	\$1.00/1000 chars./month
COMMENTS	\$50 initiation fee. Reduced rates for non-prime and educational use.	Offers special introductory contract with no minimum monthly charge; also volume discounts.	CCL also sells its 2102 & 2103 time-sharing computers, each with 16K 16-bit words.	Cyberpak bulk service is available in quantities of 10 to 50 ports.	CPU charges based on \$0.02 per page (1024 words) per second. Rates are much lower during non-prime hours.

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COMPANY	Davis Computer Systems, Inc.	General Electric Company	Graphic Controls Corporation	Hobbs Associates, Inc.	Honeywell Information Systems, Inc.
GENERAL					
Headquarters	New York, N.Y. 10017	Bethesda, Md. 20014	Buffalo, N.Y. 14210	Corona Del Mar, Calif. 92625	Minneapolis, Minn. 55408
Name of service	DCS Sigma 7	MARK-II	—	—	—
Date operational	?	1965 (MARK-I)	Nov. 1967	April 1969	Jan. 1969
Areas currently served	New York City and surrounding area	Entire U.S. plus London, England. Local dial-up capability in 236 U.S. cities	Midwestern & northeastern U.S. (triangle formed by Chicago, Boston, and Washington)	Los Angeles, Orange County, San Diego, and Santa Barbara, Calif.	16 metropolitan areas throughout the U.S.
EQUIPMENT					
Computers	XDS Sigma 7	GE-635 systems in Teaneck, N.J., Cleveland, and Los Angeles	PDP-10 (2), GE-265 (2)	HP 2000A	H-1648 systems in Minneapolis (4), Atlanta, Chicago, Boston, & San Francisco
No. of simultaneous users	40	Over 1500	200	16	384 (48 per computer)
Conversational terminals supported	TTY 33/35/37, IBM 2741, Dura, Datel, Datapoint 3300	TTY 33/35, Terminet 300, Datapoint 3300, Dura, Datel, Friden, etc.	TTY 33, IBM 2741, Terminet 300, Execuport 300, Friden 7102	TTY 33/35	TTY 33/35, IBM 2741, Friden 7102, Terminet 300
Batch terminals supported	IBM 1130, UNIVAC DCT 2000, XDS 7670	—	Mohawk 7505	—	—
SOFTWARE					
Conversational programming languages	FORTRAN, BASIC, SYMBOL	FORTRAN, BASIC, ALGOL	FORTRAN IV, BASIC, ALGOL, COBOL, LISP, Assembly	BASIC	FORTRAN, BASIC
Batch-mode programming languages	FORTRAN, COBOL, SYMBOL, METASYMBOL	—	FORTRAN IV, BASIC	BASIC	Offers Control Data's Cybernet batch service
Principal applications	Business & scientific	Business & scientific	Business & scientific	Business & scientific	Business & scientific
CHARGES					
Minimum monthly charge	None	\$100	None	None	\$90 (after 90 days)
Terminal connect time	\$8.00/hr.	\$7.00/hr.	\$10.00/hr.	\$6.00/hr.	\$5.00-10.00/hr.
Central processor time	\$6.00/min.	\$0.33/"Computer Resource Unit"	\$6.00/min.	None	\$2.40/min.
Amount of "free" mass storage	None	None	None	None	None
Charge for additional mass storage	\$0.45/1000 chars./month	\$1.50/6000 chars./month	\$0.50/640 chars./month	\$0.20/128 chars./month	\$1.00/"unit"/month
COMMENTS	Offers volume discounts for use in excess of 10 CPU hours per month.	Other GE services include: MARK-I, using the GE-265; NETWORK, using the GE-635AX; and DESKSIDE, using the GE-605.	Listed rates are for PDP-10; GE-265 rates are lower.	Offers full-time private line for \$750/month.	\$100 initiation fee. Discounts for volume use and fixed commitments.

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COMPANY	Interactive Data Corporation	International Telecomputer Network Corp.	ITT Data Services	Keydata Corporation	Megasystems, Inc.
GENERAL					
Headquarters	Waltham, Mass.	Bethesda, Md. 20014	Paramus, N.J. 07652	Watertown, Mass. 02172	New York, N.Y. 10018
Name of service	—	ITN	Reactive Terminal Service (RTS)	—	—
Date operational	Dec. 1968	Dec. 1968	March 1968	Nov. 1965	1968
Areas currently served	Northeastern & Middle Atlantic States, Illinois, Los Angeles, & San Francisco	Washington, Baltimore, Cincinnati, Syracuse, & Cleveland; also WATS	Entire U.S. (from computer center in Paramus)	Entire U.S. and Canada (multiplexer in New York City)	Middle Atlantic States, especially New York, Philadelphia, & Washington
EQUIPMENT					
Computers	IBM 360/67 (2)	GE-615 (2)	IBM 360/65, IBM 360/67	UNIVAC 494 (2)	IBM 360/67 & GE-430 in New York; XDS 940 (2) in Philadelphia
No. of simultaneous users	Not specified	192	Not specified	800	208 total
Conversational terminals supported	"The whole spectrum"	TTY 33/35, IBM 2741, Datel	TTY 33/35, IBM 2741, IBM 1050	TTY Model 28	TTY 33/35/37, IBM 2741, IBM 1050, Friden 7102, Dura, Datel
Batch terminals supported	IBM 2780, Data 100, UCC COPE, Remcon	GE-105, GE-115, Honeywell 120, IBM 1130, UNIVAC 9200	—	—	IBM 2780, UNIVAC DCT 2000
SOFTWARE					
Conversational programming languages	XSTAT, XPORT, FFL (First Financial Language)	FORTRAN, BASIC, TABS	FORTRAN IV, BASIC, COBOL, Assembler	Offers standard commercial applications only	FORTRAN II/IV, BASIC, PL/I, CAL
Batch-mode programming languages	FORTRAN, COBOL, PL/I, Assembler	FORTRAN IV, COBOL, ALGOL, JOVIAL, etc.	—	—	FORTRAN IV, COBOL, SNOBOL, BRUIN
Principal applications	Business & scientific	Business & scientific	Business & scientific	Business	Business & scientific
CHARGES					
Minimum monthly charge	None	None	None	On request	\$200
Terminal connect time	\$13.00/hr.	\$10.00/hr.	\$10.00/hr.	On request	\$8.00/hr.
Central processor time	\$16.00/min.	\$0.30/min./1000 words	\$0.03/"Computer Work Unit"	On request	\$18.00/min.
Amount of "free" mass storage	360,000 bytes	None	60,000 bytes	None	None
Charge for additional mass storage	\$25.00/120K bytes/month	\$1.00/1280 chars./month	\$0.01/"Storage Unit"/day	On request	\$10.00/120K bytes/month
COMMENTS	Connect time costs \$8.00/hr. during non-prime hours.	Company suspended operations in Nov. 1970 due to financial difficulties.	A division of International Telephone and Telegraph Corp.; also offers conventional batch processing.	Dedicated system for conventional business data processing applications.	Charges shown are for IBM 360/67; CPU rates are much lower for GE-430 and XDS 940.

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COMPANY	Metridata Computing, Inc.	National CSS, Inc.	On-Line Systems, Inc.	Philco-Ford Corporation	Princeton Time Sharing Services, Inc.
GENERAL					
Headquarters	Louisville, Ky. 40221	Stamford, Conn. 06901	Pittsburgh, Pa. 15237	Philadelphia, Pa. 19134	Princeton, N.J. 08540
Name of service	Metridata	VP/CSS	—	Computer Services Network (CSN)	—
Date operational	Jan. 1969	Dec. 1968	Dec. 1967	Dec. 1968	April 1969
Areas currently served	Louisville, Indianapolis, Cincinnati	Conn., Mass., N.J., N.Y., Eastern Pa., Calif., Ariz., Montreal, & Toronto	Eastern U.S. Toll-free access from New York, Philadelphia, Chicago, and 7 other cities	Philadelphia, N.J., Del., Chicago, and Dearborn, Mich.	Boston-New York-Philadelphia-Washington corridor
EQUIPMENT					
Computers	GE-430	IBM 360/67 (3); 2 in Stamford & 1 in Sunnyvale, Calif.	PDP-10 (3)	Burroughs B 5500	IBM 360/50
No. of simultaneous users	30	Not specified	192 total	48	60
Conversational terminals supported	TTY 33/35, Terminet 300, Execuport	TTY 33/35, IBM 2741, Terminet 300, Datapoint 3300, Datel, etc.	TTY 33/35/37, IBM 2741, Execuport Dura, Datel, etc.	TTY 33/35 or equivalent; Typagraph	TTY 33/35/37, IBM 2741, Friden 7102, Datapoint 3300, Dura, Datel, etc.
Batch terminals supported	GE-105	IBM 1130, IBM 2780, UNIVAC DCT 2000, etc.	—	—	IBM 1130, IBM 2780, IBM 360/20, Data 100, etc.
SOFTWARE					
Conversational programming languages	FORTRAN IV, BASIC	FORTRAN II/IV, BASIC, COBOL, PL/I, etc.	FORTRAN IV, BASIC, AID, MACRO-10, LISP 1.6, etc.	FORTRAN IV, BASIC, COBOL, ALGOL	CPL/I (Conversational PL/I)
Batch-mode programming languages	FORTRAN, COBOL, RPG, Assembly	FORTRAN II/IV, BASIC, COBOL, PL/I, etc.	FORTRAN IV, BASIC	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	None	None	\$5.00	\$25.00	\$100.00
Terminal connect time	\$10.00/hr.	\$10.00/hr.	\$10.00/hr.	\$9.00/hr.	\$7.00/hr.
Central processor time	\$0.04/"Processor Unit"	\$22.80/virtual minute	\$0.05/"CP Unit"	\$7.20/min.	Depends upon core usage
Amount of "free" mass storage	Normally none	None	None	75,000 chars.	1,000,000 bytes
Charge for additional mass storage	\$1.75/1000 chars./month	\$20.00/120K bytes/month	\$1.00/3200 chars./month	\$1.00/1000 chars./month	\$10.00/100K bytes/month
COMMENTS	Discounts for volume use. \$125 initiation fee. Also offers batch processing on IBM 360/40.	CPU charges based on time spent in pure problem state. Offers on-line COBOL Symbolic Debug service.	Service is available 24 hours/day, 7 days/week.	Lower rates during non-prime hours; educational discounts.	Offers Remote Job Entry of programs in any IBM-supported language.

All About Computer Time-Sharing Services

COMPANY	Programs & Analysis Inc.	Proprietary Computer Systems, Inc.	Rapidata, Inc.	Realtime Systems Inc.	Remote Computing Corporation
GENERAL Headquarters	Burlington, Mass.	Van Nuys, Calif. 91406	Fairfield, N.J. 07006	Saddle Brook, N.J. 07662	Los Angeles, Calif. 90017
Name of service	—	—	Rapidata	—	—
Date operational	Dec. 1968	Oct. 1968	Dec. 1967	1966	Aug. 1968
Areas currently served	Boston, Cincinnati	Multiplexers in 12 cities, including New York, Chicago, San Francisco, & Washington	New York, New Jersey, Boston, Philadelphia, Western Pa., Los Angeles, San Francisco	New York City, New York State, New Jersey, Connecticut	Western states; also Washington, D.C., & Eastern states
EQUIPMENT Computers	GE-425	IBM 360/50	GE-437 (6); 4 in Fairfield, 2 in New York	Burroughs B 5500 (2)	Burroughs B 5500 (3); 2 in L.A. & 1 in Palo Alto
No. of simultaneous users	29	Not specified	192 total	30	180 total
Conversational terminals supported	TTY 33	IBM 2741, Dura, Datel, Novar, & other EBCDIC terminals	TTY 33/35/37, IBM 2741, Terminet 300, Datapoint 3300, Dura, Datel, etc.	TTY 33/35, Burroughs TC 500 & 9352 Display, Victor 520	TTY 33 and Inktronic, IBM 2741, Datapoint 3300, etc.
Batch terminals supported	—	IBM 2780 or equivalent	—	Varian 520i, Burroughs DC 1200	Burroughs TC 500
SOFTWARE Conversational programming languages	FORTRAN, BASIC	APL	FORTRAN IV, BASIC	FORTRAN IV, BASIC, COBOL, ALGOL	FORTRAN, BASIC, COBOL, ALGOL
Batch-mode programming languages	—	FORTRAN, COBOL, PL/I, etc.	COBOL	FORTRAN IV, BASIC, COBOL, ALGOL	FORTRAN, BASIC, COBOL, ALGOL
Principal applications	Business & scientific	Business & scientific	Business & scientific	Business & scientific	Business & scientific
CHARGES Minimum monthly charge	None	None	\$10.00	\$100 to 500	None
Terminal connect time	\$10.00/hr.	\$10.00-12.00/hr.	\$11.00/hr.	\$15.00/hr.	\$7.00/hr.
Central processor time	\$3.60/min.	\$6.00/min.	\$3.60/min.	\$8.65/min.	\$6.00/min.
Amount of "free" mass storage	None	64,000 chars.	None	None	None
Charge for additional mass storage	\$0.85/1000 chars./month	\$1.75/7294 chars./month	\$0.60/1000 chars./month	\$0.60/"file"/month	\$0.35/1000 chars./month
COMMENTS		\$100 initiation fee. Also offers batch processing and Remote Job Entry.	Connect charge for 30-cps terminals is \$13.00/hr.	Subsidiary of Chemical New York Corp. Will upgrade to a B 6500 early in 1971.	Connect charge ranges from \$7.00/hr. at 110 bps to \$25.00/hr. at 1200 bps.

All About Computer Time-Sharing Services

COMPANY	Scientific Time Sharing Corporation	Service Bureau Corporation	System Development Corporation	Technical Advisors, Inc.	Technology for Information Management
GENERAL					
Headquarters	Washington, D.C. 20008	White Plains, N.Y. 10601	Santa Monica Calif. 90406	Wayne, Mich. 48184	Albany, N.Y. 12302
Name of service	APL Plus	CALL/360	TS/DMS	TECH-MAC	TIM
Date operational	Aug. 1969	June 1968	Sept. 1969	June 1967	Sept. 1968
Areas currently served	Washington, Philadelphia, New York, N.J., Conn., Los Angeles, & San Francisco	Entire U.S. (service in most large cities)	Los Angeles & Washington, D.C.	Entire U.S. (about 70% in Mid-West and East Coast)	Illinois & New York
EQUIPMENT					
Computers	IBM 360/50	IBM 360 (multiple 524K systems)	IBM 360/67	Varian 620i (2)	GE-430 (in Chicago)
No. of simultaneous users	60	100 per system	40	11	40
Conversational terminals supported	IBM 2741, Datel, Novar, TST 707	TTY 33/35, IBM 2741	TTY 33/35, IBM 2741, TST 707, CCI-30	TTY 33/35	TTY 33/35 and other 110-bps terminals
Batch terminals supported	—	—	—	—	—
SOFTWARE					
Conversational programming languages	APL	FORTRAN, BASIC, PL/I	FORTRAN IV, COBOL, JOVIAL, Assembler, TINT, etc.	—	FORTRAN IV, BASIC
Batch-mode programming languages	—	—	—	—	—
Principal applications	Business & scientific	Business & scientific	Information retrieval	Surveying & engineering	Business & scientific
CHARGES					
Minimum monthly charge	None	\$100	\$380	None	None
Terminal connect time	\$12.00/hr.	\$11.00/hr.	\$23.00/hr.	\$10.00-36.00/hr.	\$11.00/hr.
Central processor time	\$6.00/min.	\$9.00/min.	No charge	No charge	No charge
Amount of "free" mass storage	32,000 bytes	None	29,170,000 bytes	None	45,000 chars.
Charge for additional mass storage	\$10.00/32K bytes/month	Not specified	None	\$15.00/1000 words/month	\$0.10/180 chars./month
COMMENTS	APL/360 Terminal System handles large shared files. Company offers APL language courses.	Additional charges for national network and other specialized services. SBC is a subsidiary of IBM.	Offers unlimited use during 4-hr. time-sharing day for \$2,000 per month.	Offers specialized services for civil engineers and surveyors only. \$25 initiation fee.	\$50 initiation fee.

All About Computer Time-Sharing Services

COMPANY	Tel-A-Data, Inc.	Telcomp Corporation of America	Time Sharing Resources, Inc.	TransNet Corporation	Tymshare, Inc.
GENERAL					
Headquarters	Miami, Fla. 33162	Cambridge, Mass. 02138	New York, N.Y. 10036	Red Bank, N.J. 07701	Palo Alto, Calif. 94301
Name of service	Tel-A-Data	Telcomp	Big APL, Big Call	TransNet	Tymnet
Date operational	Dec. 1966	Sept. 1965	Jan. 1970	Jan. 1970	Nov. 1966
Areas currently served	South Atlantic States	New England, Middle Atlantic States, Maryland, Virginia	New York, New Jersey, Connecticut, Philadelphia, Chicago, Tampa	Metropolitan New York and New Jersey	Entire U.S. and Eastern Canada; WATS service to most states, plus over 60 multiplexers
EQUIPMENT					
Computers	Burroughs B 500	PDP-10 (2), PDP-7/8 (2)	IBM 360/50	XDS Sigma 7 & GE-430 in New York; PDP-8 in Red Bank	XDS 940 (19), XDS Sigma 7 (2); 18 computers in Calif., 2 in N.J., 1 in Paris
No. of simultaneous users	64	192 total	60	180 total	32 per 940; 40 per Sigma 7
Conversational terminals supported	TTY 33/35, Burroughs TC 500	10, 15, & 30 char./sec. ASCII terminals	IBM 2741, Datel, Dura, Datapoint 3300; TTY 33/35/37 (Call/360 only)	Any ASCII terminal	TTY 33/35/37, IBM 2741, Dura, Datel, Datapoint 3300, Novar, etc.
Batch terminals	—	—	IBM 1130, IBM 2780, Data 100, CP-4	Most ASCII terminals (on Sigma 7)	—
SOFTWARE					
Conversational programming languages	Assembler	FORTRAN IV, BASIC, TELCOMP, MACRO-10	FORTRAN, BASIC, APL, PL/I	FORTRAN II/IV, BASIC, FOCAL, Assembler	FORTRAN IV, BASIC, COBOL, CAL, etc.
Batch-mode programming languages	—	—	FORTRAN, COBOL, PL/I, RPG, Assembler	FORTRAN IV, Assembler	FORTRAN II/IV
Principal applications	Business	Business & scientific	Business & scientific	Business & scientific	Business & scientific
CHARGES					
Minimum monthly charge	\$1,000	None	None	None	\$80
Terminal connect time	No extra charge	\$10.00/hr.	\$11.00/hr.	\$8.00/hr.	\$13.00-16.00/hr.
Central processor time	No extra charge	\$3.00/"Core Unit"	\$6.00/min.	\$6.00/min.	\$2.40/min.
Amount of "free" mass storage	As agreed	None	None	None	None
Charge for additional mass storage	\$20/30K chars./month	\$0.40/640 chars./month	\$1.50/7200 bytes/month	\$0.45/1024 chars./month	\$1.00/1000 chars./month
COMMENTS	Specializes in standard business applications. Monthly charge includes CPU and connect time.	Charges shown are for PDP-10 systems.	Markets time-sharing services on computers owned by GT&E Data Services Corp.	Charges shown are for Sigma 7 system. Connect charge for high-speed batch terminals is \$15.00/hr.	Charges shown are for XDS 940 systems. Tymshare acquired Dial-Data, Inc. in Feb. 1970.

All About Computer Time-Sharing Services

COMPANY	United Computing Systems, Inc.	U.S. Time-Sharing, Incorporated	Wabash Computer Corporation	Westinghouse Tele-Computer Systems Corp.	World Wide Time-Sharing, Inc.
GENERAL					
Headquarters	Kansas City, Mo. 64111	Reston, Va. 22070	Phoenix, Ariz. 85021	Pittsburgh, Pa. 15222	Chicago, Ill. 60601
Name of service	UCS-II, UCS-VI	SOS/360	—	RITS	—
Date operational	Dec. 1967	Jan. 1969	Nov. 1968	Jan. 1969	Jan. 1970
Areas currently served	Entire U.S. Toll-free access from 30 cities	Serves "customers located all over U.S. and as far away as Puerto Rico"	"Currently servicing customers as far away as Maine"	Eastern U.S. Offices in New York, Chicago, Boston, Atlanta, and 8 other cities	Mid-West
EQUIPMENT					
Computers	CDC 6400, GE-265	IBM 360/65	IBM 360/44	IBM 360/75, IBM 360/65, IBM 360/30	CDC 3150
No. of simultaneous users	Not specified	96	42	8 (under OS/360 MVT)	Not specified
Conversational terminals supported	TTY 33/35/37, IBM 2741, Dura, Datel, Datapoint 3300, etc.	TTY 33/35, IBM 2741, Dura, Datel, Datapoint 3300, etc.	TTY 33, IBM 2741, Dura, Datel, Terminet 300, etc.	TTY 33/35, IBM 1050	TTY 33, Friden 7102, and other ASCII terminals
Batch terminals supported	IBM 1130, IBM 360/20, CDC 200 (on CDC 6400 only)	IBM 1130, IBM 2780	—	IBM 2780, IBM 360/20, UNIVAC 9200	—
SOFTWARE					
Conversational programming languages	FORTRAN, BASIC, ALGOL	FORTRAN, BASIC, PL/I.	Shared Access Reactive Processor (a proprietary language)	—	FORTRAN, COMPASS
Batch-mode programming languages	FORTRAN, COBOL, COMPASS, etc.	FORTRAN, COBOL, PL/I, RPG, Assembler	FORTRAN, COBOL	FORTRAN, COBOL, PL/I, etc.	FORTRAN, COBOL, ALGOL, COMPASS
Principal applications	Business & scientific	Business & scientific	Business	Business & scientific	Business
CHARGES					
Minimum monthly charge	None	None	\$100	None	\$660
Terminal connect time	\$15.00/hr.	\$10.00/hr.	\$5.00/hr.	\$12.00/hr.	Not applicable
Central processor time	0 to \$36.00/min.	\$10.00/min.	No charge	\$6.75/"CRU"	Not applicable
Amount of "free" mass storage	None	140,000 chars.	None	None	None
Charge for additional mass storage	\$0.50/1280 chars./month	\$25.00/140K chars./month	\$0.10/615 bytes/month	\$1.50/track (2314)/month	Varies
COMMENTS	Charges shown are for CDC 6400; CPU charges vary with program size. Offers nationwide common data base.		Specializes in standard business applications. Most services are priced on a functional or transaction basis.	Provides remote batch services under OS/360.	Specializes in standard business applications. Charges are based on storage and activity over dedicated lines.

All About Computer Time-Sharing Services

AVAILABILITY OF TIME-SHARING APPLICATION PROGRAMS

COMPANY \ APPLICATION	ACCOUNTS RECEIVABLE					GENERAL LEDGER					INVENTORY CONTROL					PERSONNEL					SCIENTIFIC									
	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					
Applied Computer Time Share Inc. Applied Logic Corp. Burlington Management Services Co. C & C Computer Systems, Inc. Community Computer Corp.	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•
Compu-Time, Inc. Computer Complex, Inc. Computer Network Corp. Computer Sciences Corp. Computer Sharing Services	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•
Comserv Com-Share, Inc. Consolidated Computer Ltd. Control Data Corp. Cyphernetics Corp.	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•
Davis Computer Systems, Inc. General Electric Co. Graphic Controls Corp. Hobbs Associates, Inc. Honeywell Information Systems	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•
Interactive Data Corp. International Telecomputer Network Corp. ITT Data Services Keydata Corp. MegaSystems, Inc.	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•
Metridata Computing, Inc. National CSS, Inc. On-Line Systems, Inc. Philco-Ford Corp. Princeton Time Sharing Services, Inc.	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•
Programs & Analysis Inc. Proprietary Computer Systems, Inc. Rapidata, Inc. Realtime Systems Inc. Remote Computing Corp.	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•
Scientific Time Sharing Corp. The Service Bureau Corp. System Development Corp. Technical Advisors, Inc. Technology for Information Mgmt.	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•
Tel-A-Data, Inc. Telcomp Corp. of America Time Sharing Resources, Inc. TransNet Corp. Tymshare, Inc.	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•
United Computing Systems, Inc. U.S. Time-Sharing, Inc. Wabash Computer Corp. Westinghouse Tele-Computer Systems World-Wide Time-Sharing, Inc.	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•