F-TEM Letter Original

February 10, 1987

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Dear
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:

Enclosed are the final research deliverables of the telecommunications module of INPUT's 1986 Customer Service Program.

The first report, Telecommunications Service Market Analysis, provides a detailed analysis of telecommunications service, as well as a five-year forecast of future service developments. This report is to be filed in Section V of your Telecommunications Service binder.

In addition, an Executive Summary is provided, to be filed in Section II of the binder. It provides a summary of key research findings in presentation format.

Finally, additional information, such as questionnaires used and a list of definitions, has been included to be filed in the Appendix section at the end of the binder.

It has been our hope that you have found our research products and services helpful. Please call me directly at (415) 960-3990 with any questions or comments about how we could better serve you.

Sincerely,

Rick Brusuelas
Manager, Customer Service Program

RB:ml

Enclosures

LITTON SYSTEMS, INC.
MELLONICS SYSTEMS DEVELOPMENT DIVISION
1001 W. Maude Ave., Sunnyvale, Calif. 94086

Page 1 of 1

DATE 12-1-87

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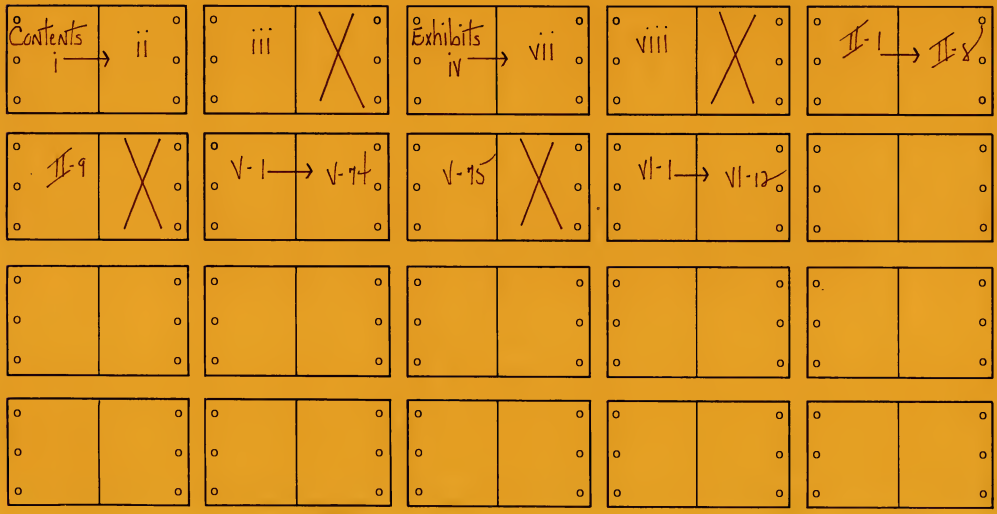

ANALYSIS OF TELECOMMUNICATIONS SERVICE AND SUPPORT

CONTENTS

ANALYSIS OF THIRD-PARTY MAINTENANCE

CONTENTS

EXHIBITS

II EXECUTIVE SUMMARY

- This executive summary is given in presentation format to help the busy reader quickly review key research findings. It also provides an executive presentation to facilitate group communications.

- The key points of the entire report are summarized in Exhibits II-1 through II-4. On the left-hand page facing each exhibit is a script explaining that exhibit's contents.

A. CONSISTENCY AND RELATIONSHIPS ARE KEY USER ISSUES

- In a survey of 200 telecommunications equipment users, most reported receiving on-site service, primarily from their vendors, and few use third-party maintenance vendors. There is some willingness to consider TPM.

- Generally, users do not feel vendor performance matches their expectations. This is partially because user expectations nearly always exceed what is received.

- There is evidence that vendors may be overly providing some service components at the expense of higher user priority areas.

- Vendor service is an increasingly important issue influencing the telecommunications equipment buying decision.

- Users are concerned about vendor staff turnover and inconsistent service quality. These are important areas since they are the most visible and tangible aspects of the support relationship. Users indicate this relationship can be improved through ongoing contact, publications, and more flexibility in service contracts.

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CONSISTENCY AND RELATIONSHIPS KEY USER ISSUES

- Most Users Receive On-Site Service from Manufacturers
- Little Use of TPM, but Some Willingness to Consider It
- Vendors Support Some Service Areas Over Higher User Priorities
- Users Concerned About Vendor Consistency and the Relationships

B. SERVICE APPROACHES ARE CHANGING

- Reduced channels for sales and service by equipment manufacturers caused by intense industry competition are restructuring the market.

- TPM vendors have yet to demonstrate their capabilities in telecommunications servicing. Although TPM vendors face significant obstacles, as data processing and telecommunications functions become increasingly interdependent, more TPM activity should follow.

- Remote diagnostics are proving to be a method of improving service and controlling costs. Independent remote diagnostic services are arising, and opportunities exist for equipment manufacturers to utilize these vendors to improve their own service.

- Service is available on a menu basis, with various levels of coverage priced according to the effort involved and users' requirements.

- User involvement in maintenance and servicing is accommodated by some vendors with service contract discounts, while others discourage users from attempting service. Dissatisfaction with service levels is leading larger users to self-maintenance whenever economically justified, reducing vendor revenue.

- Serviceability has become a consideration in equipment design, with modular configurations (facilitating component "swaps"), internal diagnostics, and remote fix capabilities desirable features.

SERVICE APPROACHES ARE CHANGING

- Reduced Channels
- TPM Vendors Must Demonstrate Telecom Capabilities
- More Remote Diagnostics
- Multiple Service Options, User Involvement

C. MARKET GROWTH UNEVEN

- User expenditures for customer services from telecommunications manufacturers totaled $1.1 billion in 1986, representing 8% of the customer service market.

- In 1991, user expenditures for manufacturer customer service will total $2.9 billion, growing to 13% of this market and representing an average annual growth rate of 21%.

- Third-party maintenance in telecommunications is a $172 million 1986 market based on user expenditures, or 11% of the TPM market and 13% of the combined manufacturer and TPM market.

- In 1991, TPM in telecommunications will become a $620 million market, respresenting 19% of the TPM market and 20% of the entire market, a 29% annual average growth rate.

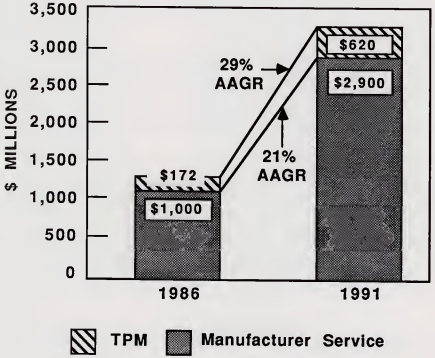
- The relative growth of TPM customer service reflects growing acceptance of TPM vendors in telecommunications. Mainframe customer service has a long history but is a new concept in telecommunications since AT&T's divestiture occurred only in 1984.

- Revenues from the various components of service in the telecommunications market will also grow unevenly.

  - Hardware service will grow at an AAGR of 18% and software support will grow at 33%.

  - Even higher growth will be found for education and training (43%) and professional services (58%), although these two elements will remain a relatively small proportion of the larger 1991 market.

MARKET GROWTH UNEVEN



Hardware: 18% AAGR

Software: 33% AAGR

Education: 43% AAGR

Professional Services: 58% AAGR

D. CONCLUSIONS AND RECOMMENDATIONS

- Two new classes of service providers are emerging:
  - Professional services vendors, particularly those with systems integration capabilities to address multivendor data and telecommunications networks.
  - Remote diagnostic vendors selling monitoring and vendor coordination services to end users and, potentially, to service vendors.
- As data processing and telecommunications are merged in user environments, addressing the entire information systems as a single entity becomes increasingly important.
- Opportunities exist in the rapidly growing professional services area and in software support, allowing vendors to differentiate their offerings from those of competitors while providing valuable, broad-spectrum services to users.
- Vendors may exploit niches in specific industries with special skills, by servicing obsolete equipment, by providing "no frills" service, or conversely with premium priced, highly responsive services for users with critical needs.
- Improvements in customer relations can be made by automating hotline support with publications, improved field staff communications, and technician training.
- The customer craves a return to one-stop shopping. While this is an unrealistic expectation, it may be addressed through vendor cooperation, improved capabilities, and commitment to the service function.

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CONCLUSIONS AND RECOMMENDATIONS

- New Providers: Professional Services and Remote Diagnostics Services
- Data Processing and Telecom as a Single Entity
- Opportunities in Professional Services, Software Support, Niches
- Need Improvements in Relationships

V TELECOMMUNICATIONS SERVICE MARKET ANALYSIS

A. SERVICE MARKET ANALYSIS, 1986-1991

- As shown in Exhibit V-1, the overall U.S. customer services market, excluding the third-party maintenance market (which will be covered later in this section), was $ 13.6 billion in 1986. This estimate reflects the slowed new product sales growth felt in most segments of the computer industry, particularly in the large systems market. Primary contributors to this slowed growth include:

  - An overall downturn in the computer systems and information services marketplaces starting in 1985 and continuing into 1986.

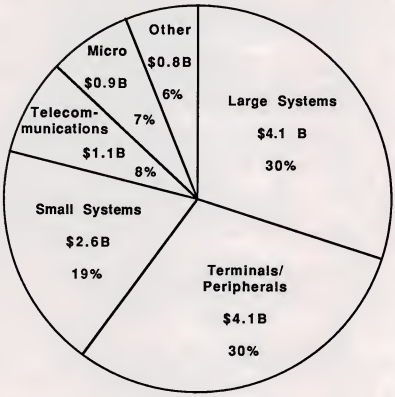
  - Decreased capital spending by medium- and large-sized corporations, which lengthened new product sales cycles.

  - Increased competition for the domestic systems market, caused by an expansion of the number of lower-priced alternatives available for each requirement, dividing the same "pie" into smaller "slices."

- This continued slowdown was also reflected by continued layoffs at major computer manufacturers, such as Data General, Wang, Honeywell, and the newly formed Unisys (formed from the merger of Burroughs and Sperry), to name a few. Even such traditional "full employment" vendors as Hewlett-

EXHIBIT V-1

1986 CUSTOMER SERVICE USER EXPENDITURES*
($ BILLIONS)



Total U.S. Service User Expenditures in 1986: $13.6 Billion

*Excluding TPM expenditures, special purpose systems, and user self-maintenance.

Packard and IBM have frozen new hiring and encouraged attrition through early retirement programs to lower costs. HP, for example, instituted a well publicized "voluntary early retirement" program that reduced the employment by approximately 1,500. And IBM, who has not had layoffs since the depression, reduced the number of college graduate hires and reassigned existing employees to revenue generating positions, both actions demonstrating a increased concern over the current economic state in the industry and at IBM.

- Throughout the slowdown in new product shipment growth, customer service growth has been fairly constant and steady. More significantly, the customer service organizations of most, if not all, computer manufacturers have been profitable. In fact, the customer service operations are often one of the few profitable parts of computer vendors, which led to the spinning off of the customer service organizations of at least two significant manufacturers, Datapoint and Mohawk Data Sciences, in 1985. This profit contribution has increased the importance of service, and service efficiency, in computer companies, and, as a result, should continue the expected service growth in the next five years.

- Exhibit V-1 also provides a breakdown of the overall customer services market by product type. Not surprisingly, the large systems (mainframe) segment, along with the peripherals segment (which is predominantly attached to large systems), is the largest segment of the overall market, constituting 60% of the total. The large systems market is currently the largest individual segment, at $4.1 billion in 1986, for a number of reasons:

  - Large systems users are least price-sensitive, due to their large capital investment in their systems, both in a purchase sense and in the value of processing performed.

  - Even though typical service price to purchase price percentages are only in the 2-6% range, the initial purchase prices start at $350,000, and fully configured systems easily exceed $15 million. Therefore, a single service contract can bring in up to $9 million a year.

- User reliance on service in this segment is greatest, creating a large "after-market" requirement for additional support services, particularly in the highly profitable areas of consulting, training, and software support. Large systems service providers have responded to this by expanding their service offerings and by unbundling these services, making it easier to effectively (and profitably) price these services.

- The peripherals market is large due to the vast quantity of products that exist and require support. And while the purchase prices, and the resulting service costs, are nowhere near those of large systems, the sheer number of "boxes" installed contribute $4.1 billion in service revenues in 1986. Again, those peripherals attached to large systems contribute the largest share since large systems logically can support more peripherals to begin with. Equally as important, users of large systems place greater importance on the system availability of their peripherals than users of smaller systems and, therefore, are less price sensitive than smaller systems users.

- The small systems segment is comprised of products ranging in price and capabilities from small business systems, such as the DEC PDP 11s that can start at $15,000, up to superminicomputer systems that rival mainframes in power and cost $500,000 and up. While the traditional minicomputer market has shown only marginal growth, the superminicomputer segment has exhibited growth in specific marketplaces such as the scientific and engineering markets as well as commercial users interested in the improved price/performance of these new computers. The company that has taken best advantage of this interest has been DEC with its new VAX 8XXX product line.

- The telecommunications segment of the overall market is one that promises high growth while, at the same time, is very difficult to define currently. INPUT examines the separately billed segment of the market that encompasses "standalone" (or those products not within the DP system) products. These products, predominantly modems, multiplexors, PBXs, local area

networks, earth stations and dish antennas, currently receive little direct support.

- Modems and multiplexors are predominantly hardware-oriented, with typical support delivered in the form of depot maintenance. Product prices are relatively low, and product (hardware) reliability is extremely high.

- Local area networks (LANs) are predominantly software-oriented, with typical support in the form of operational training and, when necessary, mailed revisions and fixes.

- PBXs are a mix of hardware and software, requiring the closest blend of support to that needed in the DP world. Thus, support is usually provided on-site, with emphasis placed on timely response and repair times.

- Given this perspective, the current market size of $1.1 billion may appear small. However, the rapid development of new products within this segment, spurred by the promise of increased coordination and connectivity with traditional DP functions, suggests that service and support functions should grow very rapidly. Early indications of this development already exist:

  - User requirements for service and support, particularly in the areas of planning, training, and consulting, are increasing rapidly. User dissatisfaction with the current state of telecommunications support has moved a number of users to perform the support themselves, leaving potential support revenues "on the table" while doing little to increase user satisfaction with the vendor or the product.

  - Some vendors are already recognizing and addressing this increased requirement for service by increasing the amount of service options and, at the same time, marketing these new services in such a way that

demonstrates their increased importance. Vendors who have already instituted programs in this direction include Pacific Telesis and AT&T.

- TPM interest and activity has increased dramatically in the last year as larger TPM organizations recognize the increased opportunity resulting from the growing disparity between user requirements for service and manufacturers' offerings. Furthermore, the mixed-shop nature of telecommunications systems lends itself well to TPM.

- The main obstacles to further TPM penetration into this market have been the slow development of service expertise and access to technology (e.g., remote and other forms of diagnostics, particularly on mixed-vendor networks).

- Historically, the early explosive growth in the microcomputer market caused much optimism concerning the potential for add-on services and products, including service. While some argued that rapidly declining prices and improved reliability would transform the micro into a disposable commodity, others felt that the rapidly growing product base offered unlimited growth potential.

- To some degree, both groups were correct. Prices did fall dramatically, and the products did become more reliable. At the same time, the expanding product base and increasing economies of scale made it more economical to provide timely on-site support to business users. However, the "disposable" micro did not appear, since business users continued to find larger and more sophisticated applications for their micros and vendors increased the capabilities of their "standard configuration" systems, thus maintaining essentially stable prices (a standard business-use system, while much more powerful, has essentially stayed in the $2,000 to $3,000 range). Furthermore, certain applications required on-site attention, particularly if the internal memory size prohibited the simple replacement of the failed unit or if the user was involved in a connected application (e.g., micro-to-mainframe or micro-LAN application).

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- At the same time, the micro service market did not develop to the optmistic expectations of others, in part due to a trailing off of the micro market. The micro manufacturers and service vendors also had to share in the blame. Few manufacturers established extensive service delivery offerings, preferring to place the responsibility on the distribution source, other third parties, or the end users themselves. After first establishing service pricing as a percentage of the purchase price (typically 15-20%), resulting in prices that appeared excessive to a large percentage of users. By the time that users began to recognize the importance of service, service providers had already begun to price service so competitively low that few vendors could make sufficient margin on micro service. And perhaps the most glaring mistake in micro services was the service franchise efforts, which overestimated the "walk-in" service potential, underestimated the costs involved in setting up a service operation, and eventually found their potential market base consumed by manufacturers, TPMs, and retail distributors.

- On the surface, the micro service market appears large, almost limitless. On closer examination, the market should be broken down into the major CPU manufacturers of IBM, Apple, and the "clones" (PC- and XT-"workalikes"). Then, the market should be further broken down into the peripherals commonly found at micro sites (this number easily exceeds 100). Of course, this breakdown does not take into account the hundreds of various software packages possibly located at each site. It becomes apparent that the reulting breakdowns indicate that possible product densities can become quite small. To properly cover such a dispersed service population can place unreasonable demands on resources, particularly spare parts.

- Still, the picture is not completely bleak. First of all, there is an exceedingly large base of micro users in business use that has become less dispersed (thus less costly to support). Large corporate usage has become increasingly centralized to the extent that corporate MIS now includes the function of microcomputer management. Applications involving micro connectivity

require more complete support offerings, with less price sensitivity as a result. And the increased use of micros in smaller business applications (e.g., small retailers using micros for cash register/inventory management/accounting functions) spawns a new and growing market for vertically-oriented support services.

- By 1991, the overall customer service market composition will change, as shown in Exhibit V-2, reflecting the growth of telecommunications service as more users take advantage of the increased use of networked systems. This is not to suggest that mainframe products are going to be replaced by networked departmental systems. Rather, corporate users will bridge smaller systems more efficiently with centralized mainframes, allowing complete downline loading and uploading of data from the corporate data bases.

- It is safe to expect that mainframe service growth will continue to be slow as manufacturers continue to price service aggressively in order to attract customers. In addition, mainframe service operation efficiency will continue, allowing vendors to continue to price service more competitively while still maintaining healthy service margins. Increased use of remote support services, coupled with continued development of multiprocessor systems, should keep prices at or below 2% of purchase price, while competitive forces (including increased competition from superminicomputer manufacturers) should maintain or even lower purchase prices.

- An existing trend that should continue well into the forecast period is the hesitancy of users to purchase larger systems, preferring to add memory to their existing system until economic conditions improve or until a significantly advanced product emerges that warrants the new purchase. As a result, peripheral sales and service should continue to grow. In fact, by 1991 INPUT projects that terminal/perpheral service will be the largest dollar contributor to the overall customer services market, thus giving credence to the position that many systems manufacturers take a loss on the CPU in order to make money on the peripherals, software, and services business that tags along.

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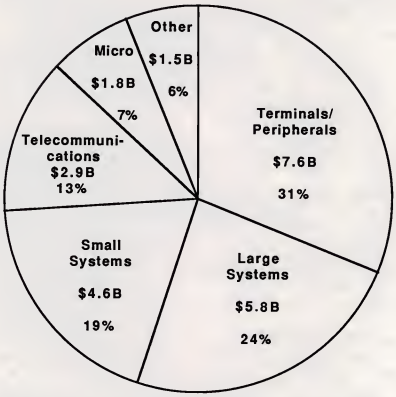
EXHIBIT V-2

1991 CUSTOMER SERVICE USER EXPENDITURES*
($ BILLIONS)



Total U.S. Service User Expenditures In 1991 (Forecast): $24.2 Billion

1986-1991 AAGR: 12%

*Excluding TPM expenditures, special purpose systems, and user self-maintenance.

- Exhibit V-3 presents the expected user expenditure growth for customer services by product category. Note that while large systems growth is expected at only 7%, this area is still extremely significant on a total dollar basis ($5.8 billion by 1991 or more than twice the size of the faster growing telecommunications market). What is key, however, is that faster growing markets represent greater growth potential.

- One such market is the telecommunications product area. Currently, relatively low product prices combined with high reliability rates have made it difficult to build extensive service offerings since traditional theory assumed that users of low cost/high reliability equipment would be extremely price sensitive. This ignores two factors present in the telecommunications market:

  - Telecommunications products are an integral part of the user's total IS (information systems) strategy. Thus, when a telecommunications device (e.g., modem) goes down, the entire IS capabilities are impacted.

  - Telecommunications users have expressed an increased requirement for more and better service. While users may be sensitive toward price increases for "traditional" services (e.g., remedial maintenance), users are quite attracted to premium services, particularly in the professional services areas that improve telecommunications use. INPUT studies have shown that such services as network planning and optimization are extremely attractive to users of "mixed-shop" systems.

B. CURRENT TPM MARKET AND FORECAST, 1986-1991

- Third-party maintenance (TPM), the provision of maintenance and support services on other manufacturers' products, has become an extremely

EXHIBIT V-3

U.S. CUSTOMER SERVICE USER EXPENDITURES*
1986-1991

PRODUCT SECTOR	$ BILLIONS		1986-1991 AAGR (Percent)
	1986	1991	
Large Systems	$4.1	$5.8	7%
Small Systems	$2.6	$4.6	12%
Microcomputers	$0.9	$1.8	14%
Telecommunications	$1.1	$2.9	21%
Terminals/Peripherals	$4.1	$7.6	13%
Other	$0.8	$1.5	13%
Total	$13.6	$24.2	12%

*Excluding TPM, special purpose sytems, and user self-maintenance.

important market for both traditional "independent" suppliers of TPM and, increasingly, for manufacturers who provide support on other manufacturers' products. The U.S. TPM market is currently $1.56 billion, of which independents (e.g., Sorbus, Dataserv, etc.) make up 80%, manufacturers take 15% (up from 12% in 1985), independent board repair firms (such as CPX) make up 4%, and others bring in the remaining 1%.

- Exhibit V-4 provides a product breakdown of the U.S. TPM market for 1986 and projects into 1991. Note that while TPM represents less than 10% of the total U.S. customer service market (manufacturers comprise 83% of the total $15.9 billion spent on all forms of support, special purpose systems derive 5% of the total, and users make up the remaining), TPM service is growing at a very healthy 16%.

- TPM growth will be greatest in the traditionally strong terminal/peripheral product segment. Historically, TPMs have been successful in this area for a number of reasons:

  - There are a large number of "after-market" peripheral manufacturers who have created large installed bases without the service structure to support these products. Since the CPU manufacturer rarely covered "foreign" products, TPMs were able to pick up this business without much competition. DEC was instrumental in the development of this market, since distributors of DEC systems were encouraged to find ways of keeping system configuration prices down by virtually any means, including using non-DEC peripherals. Thus, the DEC-compatible market became a strong TPM market. Interestingly, DEC has taken steps to recapture this market by offering TPM service on non-DEC peripherals on DEC systems.

  - Even on peripherals manufactured by companies with strong service structures and offerings, TPMs targeted peripherals with extremely low service prices as a way of getting "their foot in the door" at that user

EXHIBIT V-4

U.S. TPM SERVICE USER EXPENDITURES 1986-1991

PRODUCT SECTOR	$ MILLIONS		1986-1991 AAGR (Percent)
	1986	1991	
Large Systems	$177	$197	2%
Small Systems	$232	$425	13%
Microcomputers	$472	$1,065	13%
Telecommunications	$172	$620	18%
Terminals/Peripherals	$447	$820	29%
Other	$60	$130	17%
Total	$1,560	$3,257	16%

site. Since terminals have relatively little to service (thus little service cost to incur), the terminal market was used extensively for this purpose.

- TPMs, led by TRW, developed "service management" philosophies that worked with manufacturers without service capabilities to provide service and sales assistance. Thus, the TPMs became (strategic) partners with these manufacturers (who were often peripheral manufacturers) and each partner hoped to benefit from the arrangement. Since the agreements were almost always multiyear, the TPMs were assuring long-term growth (long term, of course, if the manufacturer was successful in building a product base).

- The micro market was also a target largely by the default of the manufacturers. Early in the development of the micro market, the emphasis was placed on the distribution of micros. Thus, to enter the market quickly enough, many manufacturers relied on their distribution source, typically retail chains, to provide support. Even companies with large service organizations, including IBM, recognized the difficulty in supporting the dispersed product base, and as a result also relied on the distribution sources. During this time, TPMs were already in full swing in the "service management" strategy, so TPMs were able to secure long-term agreements with micro manufacturers (the most notable being the RCA/Apple agreement). Also, TPMs were able to successfully target large corporate users who preferred to deal with a nationwide TPM versus local retailers.

- By 1984, TPMs were able to collar 43% of the micro service market. About this time, manufacturers, most notably IBM, became increasingly active in the micro support area. Improved product densities, increased pressure from corporate users, and decreased price sensitivity all were factors that encouraged manufacturers to assume a more direct participation in micro service and support. Thus, manufacturers assumed 52% of the 1985 micro service market (up from 43% in 1984), causing the TPM portion of the micro service market to shrink to 34%, as shown in Exhibit V-5.

EXHIBIT V-5

TPM PENETRATION, 1986

PRODUCT SECTOR	$ MILLIONS		TPM MARKET PENETRATION (Percent)
	1986 TOTAL	1986 TPM USER EXPENDITURES	
Large Systems	$4,317	$177	4%
Small Systems	$2,854	$232	8%
Microcomputers	$1,408	$472	34%
Telecommunications	$1,316	$172	13%
Terminals/Peripherals	$4,551	$447	10%
Other	$831	N/A	-

- Hardest hit by this development was the micro service franchise movement, which was led by such vendors as Serviceland (now entering Chapter 11), Computer Repair Corporation (CRC), and The Computer Doctor. Basically, service franchise efforts hoped to exploit the tremendous growth in the micro industry by repeating in service what Computerland had done in the hardware sales area. Potential franchisees would pay up-front fees and percentages of sales in order to carry a "nationwide recognizable name" along with additional benefits in marketing and spares acquisition/management. The market would be carry-in (befitting a "storefront" business), although some franchises would emphasize on-site service to business users.

- Although a fundamental problem with the service franchise effort was the slowed growth in the marketplace, service franchises made a number of tactical errors:

  - They entered the market at a time when the manufacturers began to increase their own presence; thus, the service franchises found their market being squeezed from the top by manufacturers who were targeting the large corporate users and TPMs who had already built up nationwide recognition and service coverage, and from the bottom from retailers who had already established themselves and had the built-in advantage of selling the service contract at the time of the sale.

  - Service franchise overestimated the "allure" of storefront service, since business users (the more consistent user of service) were not attracted to carry-in service. As a result, the only franchises that had a remote chance at success were those located near a large number of small users (small businesses, individuals who used their micro for home use, university students, etc.).

- Franchises often erred in the actual placement of their service locations. One specific Serviceland was located 30 miles east of Kennedy Airport, thus missing the Manhattan market. A Chicago Serviceland franchise was located more than an hour's drive from the Loop.

- In some cases, individuals considering entering did not fully appreciate the costs involved in setting up and running a fully functional depot repair facility, let alone one that would also provide on-site support. Even still, potential franchisees shied away from the initial costs (e.g., up-front fees). Serviceland never approached even a third of the 100 service locations that they predicted they would have.

- During the forecast period, this trend of increased manufacturer participation in micro service will reverse itself, due to two major unseen occurrences:

  - IBM limited entrance into the micro TPM market in 1986. In May, IBM announced that it would remove or disconnect a non-IBM machine and/or feature and replace it with a similar non-IBM machine and/or feature. In June, IBM furthered its TPM involvement by announcing on-site and depot prices for the servicing of 13 different manufacturers of PC-compatible peripherals and other add-ons. Previously, IBM viewed its service as a major sales feature, and it was unlikely that IBM would ever allow its service to help the sales of others' products. While IBM's entrance into the TPM market is limited currently to products commonly present at business PC users' systems anyway, one cannot underestimate the service impact of this development.

  - The explosion in the inexpensive "clone" business, which started late in 1985, by 1986 had made enough of an impact to cause concern over IBM's continued involvement in the low-end micro business. When even business users opted for these foreign-made PC- and XT- "workalikes" (e.g., Leading Edge and PC Limited), the fact that these products had

no support opened a new market up to TPMs. Furthermore, these clones not only impacted IBM sales, but to a greater extent displaced sales of other large manufacturers of PC-compatible micros (e.g., Tandy, AT&T, Texas Instruments) with extensive manufacturer support offerings.

- The "clones" issue raises an interesting question--who is going to support these low-priced machines. Even though most of the parts are readily attainable, the already large number of different brands will make it difficult to target a sufficiently dense service base to profitably provide service. Currently, support is being left to the retailers and the users. As more business users choose these lower-priced alternatives, the question remains whether TPMs will, or even should, attempt to go after this market.

- By 1991, INPUT expects that TPMs will capture 47% of the business micro market, as shown in Exhibit V-6. The exhibit also shows the expected increase in activity that TPMs will demonstrate in the telecommunications market, particularly as TPMs gain experience with that technology.

C. CURRENT TELECOMMUNICATIONS SERVICE MARKET AND FORECAST, 1986-1991

- As shown previously in Exhibit V-1, the telecommunications product service segment of the 1986 customer services market (excluding TPM expenditures, special purpose systems, and user self-maintenance costs) is $1.1 billion, which represents a 22% growth over 1985 user expenditures. This growth reflects two principal factors:

  - The increased service potential as user requirements for telecommunications service and support spur user expenditure growth.

EXHIBIT V-6

TPM PENETRATION, 1991

PRODUCT SECTOR	$ MILLIONS		TPM MARKET PENETRATION (Percent)
	1991 TOTAL	1991 TPM USER EXPENDITURES	
Large Systems	$5,997	$197	3%
Small Systems	$5,025	$425	8%
Microcomputers	$2,272	$1,065	47%
Telecommunications	$3,072	$620	20%
Terminals/Peripherals	$8,047	$820	10%
Other	$1,500	N/A	-

- The expected growth in telecommunications product sales as more users further develop their network capabilities.

- In 1991, user expenditures for manufacturer customer service will total $2.9 billion, growing to 13% of the manufacturer provided service market and representing an average annual growth rate of 21%, as shown previously in Exhibits V-2 and V-3.

- Third-party maintenance in telecommunications is a $172 million 1986 market based on user expenditures, or 11% of the total TPM market and 13% of the combined manufacturer and TPM market for all equipment.

- In 1991, TPM in telecommunications will become a $620 million market, respresenting 19% of the overall TPM market and 20% of the entire customer service market, a 29% annual average growth rate. This represents the highest growth rate in the entire customer service market, as shown in Exhibit V-7.

- Currently, telecommunications TPM lags behind service for other equipment.

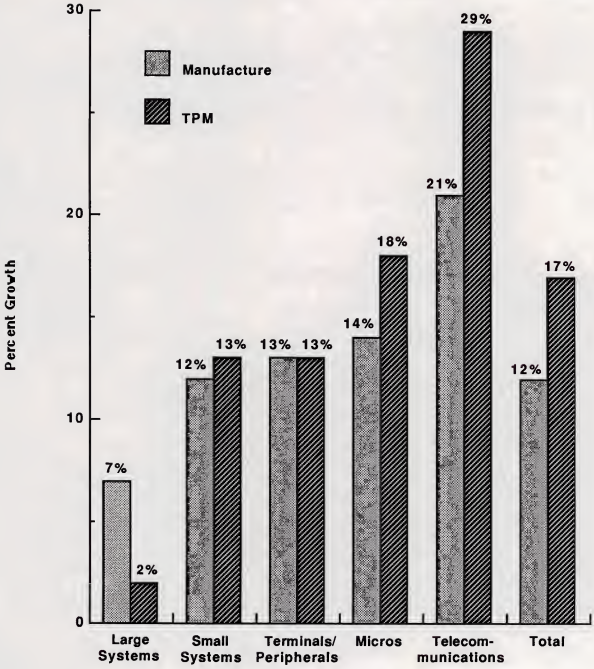
  - The relative growth of TPM customer service in the forecast period over manufacturer services is a function of growing acceptance of TPM vendors participating in telecommunications.

  - Mainframe TPM customer service has a long history, but it is a relatively new concept in telecommunications since AT&T's divestiture only occurred in 1984.

- Revenues from the various components of service in the telecommunications market will grow unevenly. While hardware maintenance represents, and will continue to represent, the bulk of user expenditures in 1991, the other elements in service (and particularly in professional services) will grow at faster rates.

EXHIBIT V-7

U.S. SERVICE GROWTH, 1986-1991



- Hardware service will grow at an AAGR of 18% and software support will grow at 33%.

- Even higher growth will be found for education and training (43%) and professional services (58%), although these two elements will remain a relatively small proportion of the larger 1991 market.

- The telecommunications service revenue mix and the respective annual average growth rates are shown in Exhibits V-8 and V-9.

- The telecommunications service market has been fragmented, both in terms of the products served and the type and level of service required by each product type.

  - Certain products, such as modems, carry price structures and hardware reliability characteristics that make service revenue growth potential modest. This is reflected both in low service pricing and in limited service offerings (typically provided via mail-in exchanges).

  - Other products offer attractive service pricing and result in higher revenue potentials. These areas include multiplexers, PBXs, local area networks, satellite network service equipment, and emerging fiber optic equipment.

- The telecommunications service market is a centrally important one, tying formerly separate data processing and communications together in the form of teleprocessing. The market is changing as the players forge their appropriate roles, answer competitive challenges, and adapt their service mixes to meet user needs as computing and communications become increasingly perceived as a information services continuum.

EXHIBIT V-8

TELECOMMUNICATIONS SERVICE REVENUE MIX, 1986-1991

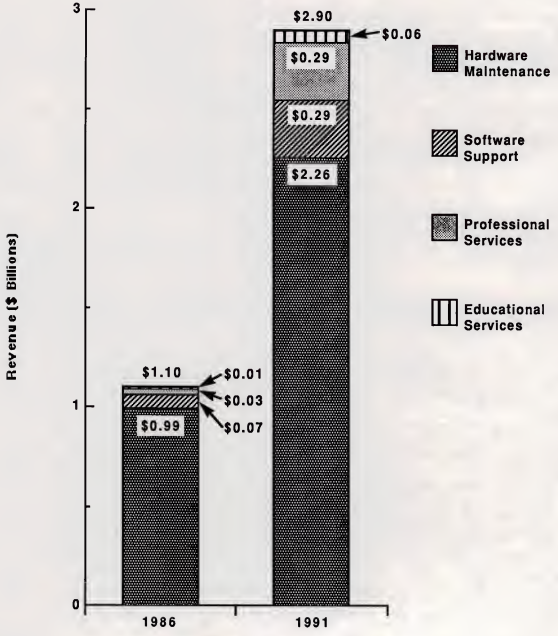


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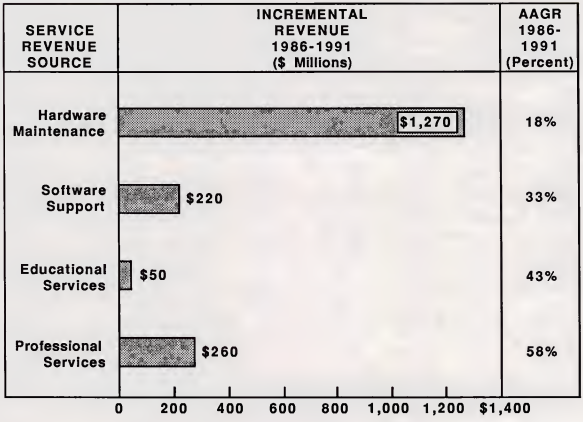
EXHIBIT V-9

TELECOMMUNICATIONS SERVICE GROWTH BY REVENUE SOURCE 1986-1991



D. TELECOMMUNICATIONS SERVICE AND SUPPORT ISSUES/TRENDS

1. INTRODUCTION

- This section examines issues and trends in telecommunications service and support with subsections examining hardware, software, network services, and an analysis of market needs for professional services beyond maintenance and repair such as education and training and systems integration.

2. TELECOMMUNICATIONS SERVICE MARKET TRENDS

a. A Complex Telecommunications Vendor Environment

- Whereas once AT&T dominated the telecommunications environment, now the market is far more complicated with a variety of vendors participating. These participants include:
  - Equipment manufacturers.
  - Bell Operating Companies (BOCs).
  - Independent telephone companies.
  - Supply houses and distributors.
  - Interconnects.
  - Retailers and dealers.
- Typically, the entity which sells to the end user provides at least the first level of customer service but, increasingly, large users are establishing their own maintenance organizations.

- New external entities have arisen to help service the multivendor network environment found in today's corporations.

  - Third-party maintenance (TPM) organizations, not the user or the equipment manufacturer but an unaligned service provider, are increasingly visible.

  - Emerging are third-party services which monitor, manage, and coordinate network repairs.

b. Deregulation Opens BOC Opportunities

- In November 1986, the FCC granted BOC requests for freedom to sell hardware and services without subsidiaries, allowing them to consolidate service and equipment packages through one unit. This followed a similiar ruling for AT&T.

- This FCC action provides greater efficiencies than the previously structurally separate BOC units and will impact direct services from telecommunications equipment manufacturers.

  - The action signals a partial return to "one-stop" solutions for users.

  - BOC service organizations will likely assume greater market shares at the expense of manufacturers, interconnects, and TPM vendors.

c. Reducing Channels for Sales and Service

- Northern Telecom's sale of its 650-member western regional operations division to a BOC (discussed in the Northern Telecom vendor profile, Section IV-F) may signal a trend affecting other equipment manufacturers.

- The BOCs are inheriting AT&T's image of "the phone company," at least on the local level.

- Changing previous business relationships with BOCs by transferring entire sales and service organizations to them makes sense to many manufacturers.

  . In Northern Telecom's case, the manufacturer found prospects faced with multiple proposals featuring their equipment.

  . This often meant that several comparable proposals were eliminated with one remaining to compete with the others.

  . By pulling out of the competition and allowing the BOC to be the primary bidder, the manufacturer hopes to increase its chances of making the sale.

- The BOC will also maintain sold systems, eliminating what has been a marginally profitable, high-cost, manufacturer function.

- Although TPM vendors have had success in servicing computer equipment, telecommunications TPM vendors are finding a tough market, and since the installed base of telecommunications equipment (particularly PBX switches) is not large and the user population not dense, establishing a sufficient service base, even on a regional level, is difficult.

  - Also, the newness of the equipment and its rapidly changing technology limits parts availability to manufacturer service organizations rather than alternatives such as salvage and after-market manufacturing.

  - In addition, advancing technology requires constant field engineer training.

- Finally, diagnostic procedures are not readily available to TPM vendors or easily established on newer equipment.

- For manufacturers, service becomes important both as a means of containing installed base erosion and for account control. This potentially leads to additional sales of peripherals and services. Further, as equipment sales fluctuate, service business can help stabilize revenues.

d. Emerging Remote Diagnostic Services

- After completing focus group market research, Pacific Telesis identified a need among medium and large companies for a private network monitoring service using remote diagnostics, providing proactive as well as reactive services.

  - Pactel Spectrum Services, profiled in Section IV-G, assumes network management functions for the customer, including the option of coordinating vendors for network equipment repairs.

  - AT&T offers a similiar although more limited service called Dataphone I Plus.

  - Exhibit V-10 compares AT&T's and Spectrum's Services.

- Rotelcom, a unit of the Rochester Telephone Company, has also introduced a remote diagnostic service in the southeast U.S. Pricing is based on a small retainer and hourly rates, with limits on daily charges.

  - The service identifies problems and the vendor at fault.

  - Users are responsible for service contracting.

EXHIBIT V-10

COMPARING TWO REMOTE DIAGNOSTIC SERVICES

	AT&T DATAPHONE I PLUS	PACTEL'S SPECTRUM
Networks and Vendors Supported	Analog/AT&T Modems, Multiple Terminal Vendors	Analog and Digital/ Multiple Vendors
Capacity per Basic Configuration	32 Modems	132 Devices
Data Base/ Reports	Equipment Inventory With Modem Serial Numbers, Speed, Network Addresses, Hosted at Single Control Center	Similar But Redundant at Backup Service Centers. Similiar Reports Plus Optional Response Time and Loading Reports By Application
Proactive?	No - Customer Must Report Malfunction for Testing	Yes - Continually Monitors Customer Networks
Vendor Coordination for Repairs	Customer Responsible for Repair of Owned Equipment But AT&T Dispatches Field Serivce for Leased Equipment, Refers Transmission Line Problems to Carriers	Optionally Coordinates Vendors for Repairs

- Codex has announced the 1987 introduction of the Online Remote Network Monitoring Service for small- to medium-sized companies (fewer than 50 lines).

  - As with the other remote services, Codex technicians monitor a customer's network, resolving problem conditions by coordinating vendors, rerouting network traffic around failed equipment, reducing line speeds, or using backup dial links.

  - A variety of management reports covering performance, repair history, and equipment inventories are available for analysis.

- More information about Codex can be found in Section IV-B.

- These services do not actually handle repairs but can be considered a part of maintenance. Remote diagnostics has implications for all telecommunications service vendors:

  - Manufacturer cooperation is necessary for diagnostic firms to coordinate repairs and for loop testing. Firms are considering relationships with diagnostic service vendors to improve their responsiveness.

  - Remote diagnostics done by a manufacturer add expense and also raise customer expectations for higher quality service--repairs made right the first time, prompt installations, and better systems management.

  - These expectations create challenges for the service industry which already has difficulty keeping pace with user requirements.

- Telecommunications environmental trends are summarized in Exhibit V-11.

EXHIBIT V-11

TELECOMMUNICATIONS ENVIRONMENTAL TRENDS

- Complex Service Marketplace
- BOCs Benefit from Deregulation
- Service Channels Narrowing
- Remote Diagnostic Service Vendors Are Emerging

3. NETWORK SERVICE TRENDS

- The network services market is one characterized by rapid growth and new services based on new technologies and the opportunities created by a deregulation. Examples include:

  - BOC-operated local packet switched networks called Local Area Data Transport (LADT).

  - Fiber optic networks.

  - Satellite services, particularly those using very small aperture terminals (VSATs).

  - T-1 carrier services using a variety of media (cable, microwave, or satellite links).

  - Software Defined Networks (SDN--also called virtual private networks) which allow users to configure a portion of the public network for private, dedicated use.

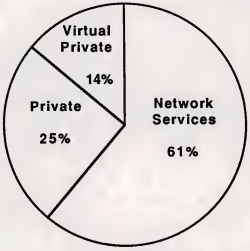
  - Integrated Services Digital Networks (ISDN), currently in field trials, which integrate text, data, voice, and image over existing media.

- Some network service vendors require users to buy appropriate network interface equipment such as multiplexers, packet assemblers/dissemblers (PADS), and satellite terminals, although they sometimes provide (and service) this equipment as part of the contract.

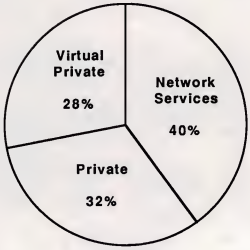
- According to INPUT's study Network Services Directions, users are anticipating increased use of private and virtual private, or software defined, networks. As Exhibit V-12 shows, these directions will be at the expense of dial-up network services.

EXHIBIT V-12

CORPORATE NETWORK USE
USER VIEWS



1986



1991

- Users are also anticipating that the mix of voice, data, and image will change, with data taking up a larger portion of network traffic in the future, as Exhibit V-13 shows.

- As voice and data integration increases, service providers will be required to exhibit expertise in supporting telecommunications equipment handling all elements. These trends are summarized in Exhibit V-14.

4. HARDWARE TRENDS

   a. A Complex Telecommunications Equipment Environment

- Equipment serviced by telecommunications service vendors consists of a range of voice and data products:

  - Private Branch Exchanges (PBXs), primarily for controlling corporate voice traffic but increasingly being used to switch data.

  - Telephones, key systems, and integrated voice/data terminals.

  - Satellite and microwave "dishes" and associated electronics.

  - Data-only PBXs.

  - Modems, multiplexers, and concentrators.

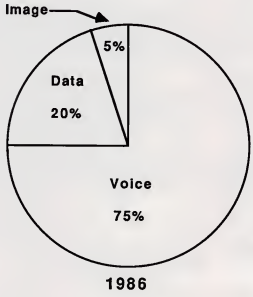
  - Network interface equipment such as controllers, front-end processors, protocol converters, and packet network equipment.

  - Local area networks.

  - Mobile communications equipment.

EXHIBIT V-13

CORPORATE NETWORK PROPORTIONS
USER ESTIMATES



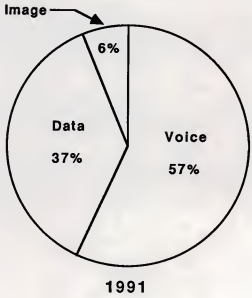


EXHIBIT V-14

NETWORK SERVICE TRENDS

- New Services Require New Equipment - Creating Service Opportunities
- More Private and Virtual Private Networks
- More Data Communications

- Sales of many of these products (particularly PBXs) have become very competitive with narrowing margins, requiring vendors to find ways other than equipment sales to increase profits. Examples include:

  - Peripheral sales.

  - Wiring and installation services.

  - Repair and maintenance services.

  - Value-added services such as reconfiguration and optimization services, network planning, network facilities management, systems integration, and network services themselves.

b. Increasing Hardware Complexity and Reliability

- Demands for improvement in data communications are leading to increased equipment capabilities and technical complexity. Examples of this include:

  - Higher speed modems are now available operating on dial-up networks at 9,600 bps and faster.

  - Equipment with integrated functionality is also becoming available. INPUT expects modems and other equipment such as protocol converters to eventually become computer integrated options rather than remain as standalone devices.

- Hardware with integrated self-diagnostics and continual diagnostic routines are increasingly becoming available.

- The concept of the self-healing network means intelligent equipment is able to bypass failed components. This ability is found in the distributed architec-

ture of advanced PBXs. Most vendors cite the importance of artificial intelligence (AI) and expert systems in new product design and development.

- With each generation of equipment, the hardware generally becomes more robust. Hardware is only part of a system and software is another. The ability to support software is becoming increasingly important.

c. Private Branch Exchanges (PBXs)

- The so-called "fourth generation" PBX is a distributed processor integrating local area network functions, forming a core for corporate office systems and telecommunications.

- INPUT's research indicates that half of those surveyed are integrating voice and data management functions. Since advanced PBXs can involve both voice and data communications, there are implications for service vendors; for example, the contact point may no longer be responsible solely for voice or data.

- Purchasers of PBX equipment are moving beyond interest in advanced features to explore how an evaluated company provides service. Increasingly, telecommunications users are following the lead of DP equipment and software users and choosing products as much on the basis of support as on the product's capabilities.

d. Local Area Networks (LANs)

- The per-connection price of LANs is dropping; however, the multiplicity of standards has caused users to take a cautious approach.

- Since LANs connect disparate equipment, LAN service is becoming an increasingly important part of servicing a multivendor environment.

- Hardware trends impacting service are summarized on Exhibit V-15.

5. SOFTWARE SERVICE DIRECTIONS

- On average, telecommunications users indicated they were satisfied with software support received. However several respondents indicated this is a problem area. Representative comments are:

  - "There needs to be better coordination between hardware and software service functions."

  - "We want a telecommunications software service similiar to the support given mainframe software."

  - "Our service company is too enamored of the hardware. They must become more conscious of software maintenance."

- Telecommunications service vendors need to recognize that support for software (and firmware) in the form of fixes, upgrades, and patches is becoming more important as hardware is increasingly driven by these instructions. That this awareness is growing as shown by the BOCs purchasing software firms.

6. PROFESSIONAL SERVICES

- Industries such as banking, insurance, and telecommunications are looking to professional services vendors for help in developing transaction systems that will work to establish and maintain the company's competitive edge. More often than not, these systems have telecommunications components.

- Further, systems are being upgraded, requiring selection, installation, and management, all functions provided by professional services firms.

EXHIBIT V-15

HARDWARE TRENDS

- Vendors Seeking New Revenue Sources Due to Price Competition
- More Complex Hardware
- More Reliable Hardware
- Integrated Functions
- Integrated Voice and Data

- While large companies may have adequate staffs to handle such projects, smaller firms may not have the resources, or the desire, to hire staff which will be needed only short term.

- Even in larger firms, IS staffs are often dedicated to operation and maintenance of aging systems and are unable to adequately address development. This means new starts are contracted out.

- Also driving professional services are "super systems," integrating various applications bound to fourth generation languages, data base management systems, code generators, and the like, using data hosted in processors ranging from micros to mainframes and which therefore require micro-mainframe telecommunications links.

- Another driver is the fact of multivendor environments calling for integration of voice, data, and image. This becomes important in electronic publishing and medical research applications, among others.

- Vendors may eventually be forced to unbundle services to remain price competitive and to accurately assess the costs of individual services provided. Through unbundling, vendors hope to:

  - Increase revenues for services previously included in basic support contracts.

  - Improve user perception of service flexibility through more options.

  - Enhance the manufacturer's competitive position in relation to TPM vendors by maintaining low basic service prices with higher level options available.

  - Underscore the importance of professional services as a separate, identifiable service option.

- Professional services are viewed not only as profit generators. Several vendors report professional services are important primarily because they influence equipment and other service sales. INPUT believes this influence is the main benefit of expanded professional services offerings.

- The following subsections examine several professional services components.

a. Systems Integration

- INPUT defines Systems Integration (SI) as a single firm undertaking responsibility for the design, development, and implementation of a system or subsystem. This could include integration of hardware, software, and communications facilities. When the system is complete and fully tested, it is turned over to the customer for operation.

- Commercial customers are learning from the federal government the place of systems integration which brings together systems design and development under one contractor, whereas earlier the two elements were treated separately.

- INPUT is publishing a report on SI and has done preliminary work which may help telecommunications service vendors gain an understanding of users' requirements.

- Among the most important characteristics of systems integrators is the ability to select and integrate the needed hardware, software, and communications facilities. Primary considerations include:

  - Other important factors such as overall project management, system design skills, and the ability to define project requirements.

- Less important characteristics such as the ability to design custom hardware and to integrate voice and data.

- In a survey asking users what type of firm they would most likely use, professional services firms, aerospace vendors, computer manufacturers, and communications suppliers were evenly rated. However, when rating specific companies, AT&T fared rather poorly while the major hardware manufacturers (when named) were rated highest.

- The types of business contracts preferred (by a wide margin) are fixed-price with performance guarantees.

- One of the central findings of the survey is the critically important role of communications networking, even though voice/data integration was not deemed very important.

- Systems integrator requirements are shown in Exhibit V-16.

- Telecommunications systems integration opportunities will be found in linking together multivendor equipment to form an integrated data network.

- Other opportunities may be found in linking marketing support systems to telecommunications equipment such as automatic call distributors for telemarketing and other customer service applications.

- The leaders in commercial SI are primarily vendors with a history of federal government contracts. They are IBM, GM/EDS, Sperry, BB&N, Science Applications International, Martin Marietta, and Planning Research Corporation. However, as awareness of SI grows, several telecommunications services vendors are targeting SI as a value-added service opportunity.

EXHIBIT V-16

SYSTEMS INTEGRATION REQUIREMENTS

- Ability to Select and Integrate Hardware, Software, and Communications
- Project Management Skills
- Fixed Price but Profitable Bids

b. Custom Software Development

- Software development is generally the largest segment of professional services, driven by the lack of skilled in-house personnel, who at any rate are mostly responsibile for maintaining existing systems, leaving little time to develop new systems.

c. Network Design and Management Services

- The need for network management services and systems (and the software to drive them) by corporate end users is extremely high since users are assuming more network operation and management responsibilities.

  - The line of demarcation between customer premise responsibility and telco or product vendor responsibility is increasingly esoteric. Hence, if the telecommunications services vendor can offer a system or service which assist the telecommunications manager to monitor, design, diagnose, and administrate the network, it is in a good position of controlling the account and capturing future revenue streams.

- Network design and management service needs are expected to increase as companies seek to optimize their networks.

  - The primary direction in this area is believed to be in relatively inexpensive microcomputer software packages and customized network control centers.

  - INPUT believes spending on products and services will be substantial, fueled by the explosion of data communications services and special network considerations required for optimization.

  - The variety of data communications services available coupled with expanding demand and improved performance requirements will necessitate continued spending for these services.

d. Education and Training

- Almost every professional services vendor offers education and training, but what is available is of an ancillary, add-on, customer service nature.

- Demand will be stimulated by continuing penetration of telecommunications and the resulting need to train users in utilization and application.

- Among critical success factors here include the ability to identify the key contacts at the work unit level requiring these services. These users tend to be price sensitive, impacting profitability.

- As currently presented, education and training are not generally profitable.

  - First of all, vendors must incur early expenses to set up educational offerings, and these expenses are often continued as vendors are required to keep materials current in the rapidly changing technological environment.

  - Education service profitability is also hurt by vendors who are likely to continue to offer free or minimal cost training since they engender good will and increase user satisfaction. Vendors also hope to increase demand and use of telecommunications which leads to increasing needs for service.

- However, technical training is an ongoing need recognized by a variety of vendors including the major equipment providers, service organizations, technology training institutes, and an increasing number of academic institutions.

- There are also needs for what could best be called strategic training: recognizing how technology can be used internally for improved functionality

and externally for better customer service. Strategic training would encompass telecommunications-intensive areas such as customer response and service centers, on-line order entry systems, electronic data interchange, and telemarketing applications.

- These points are summarized in Exhibit V-17.

e. Consulting

- Consulting ranges from special studies to the specification of systems. The services provided are management-oriented and include feasibility studies, requirements analysis, system audits, technical direction, and assistance consulting.

- Critical success factors here include the vendor's ability to establish technical credentials within a vertical industry segment.

- In an earlier 1986 survey, 100 users were asked to rate the liklihood they would use an independent consultant or the consulting services of a vendor and to rate their self-reliance for network planning.

- Exhibit V-18 shows the average responses. Most users are highly self-reliant. Some comments from those rating the use of an independent consultant highly were:

  - "We have limited resources internally. Also, our objectivity in the view of our multiple divisions is important. I would use an outsider to show that I was not building a power base."

  - "There are services being offered which are technically not strong enough. We need a consultant to guide us around potential pitfalls."

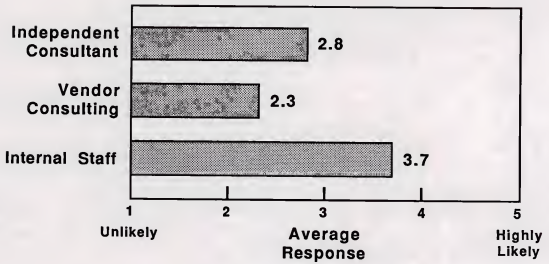
EXHIBIT V-17

EDUCATION AND TRAINING

- Most Offer Education and Training but Profits are Elusive
- Sold at Work Unit Level
- Generates Goodwill
- Needed: Strategic Training

EXHIBIT V-18

USE OF CONSULTANTS



- "You don't have fingerpointing if you use a single source of information."

- "In this dynamic and volatile industry you need currency of information. They have the ability to bring their vast experience to us. Plus, they are an unbiased source of help."

- Users rating their use of outside consultants low typically felt they had the internal expertise necessary.

- The inclination to use vendor consulting services was rated below the other alternatives. Typical comments were:

  - "Their objectivity is in question. We wouldn't get a comprehensive view of the facilities available. Besides, we don't like to have our eggs in one basket."

  - "I don't trust them. I don't think a lot of them know what they're doing."

- However, some of those giving favorable ratings said:

  - "If you're already using a vendor, it makes sense to use his other services."

  - "A vendor will do extra work to get the customer's business, and usually such services are free. Frankly, we expect this service from them."

  - "I would only use them to verify our internal decisions and impressions after the decision is made."

- INPUT feels the demand for consulting services will continue to be strong among telecommunications users. This is implicit by the very nature of the

technology which is rapidly changing, improving, innovating, and growing. Consulting is a cost-effective way for large companies to obtain specific expertise without incurring any long-term liabilities.

f. Overall Critical Success Factors in Professional Services

- Important factors in telecommunications professional services include the business relationship between the vendor and customer and the vendor's ability to build a critical mass of business to leverage expertise.

- Because professional services activities involve close working relationships, the match between the vendor's and the customer's culture is also important.

- Other critical success factors facing vendors are understanding the user organization and early executive management involvement. Frequently, professional services vendors enjoy repeat business due to understanding the client better than another vendor.

- Fixed-price contracts are preferred by users, requiring the vendor to accurately appraise in advance the costs of the specified project.

- Vendors need to be alert to the possibility of labor pool shortages in specific hardware or software areas or in particular geographic areas. These shortages must be resolved in the pre-bid stage to avoid unanticipated expenses in overhead and management costs after contract award.

- Finally, vendors without specific skills or expertise should evaluate strategic partnering in professional services, understanding that such partnering cannot compensate for fundamental weaknesses.

- Key points in professional services are summarized in Exhibit V-19.

EXHIBIT V-19

PROFESSIONAL SERVICES

- Multivendor, Multimedia Environments Create PS Needs
- Adds to Vendor Flexibility, Competitiveness, Image
- Influences Hardware Buying
- Requires Critical Mass for Success
- Requires Cultural Match
- Staffing Issues Need Pre-Bid Resolution
- Strategic Partnering May Be Desirable

7. CONCLUSIONS

- Several conclusions can be drawn from this brief review of service, hardware, software, professional service, and market issues.

  - Telecommunications equipment servicing will become more competitive as the BOCs win market share for equipment sales (and service) from other firms (principally interconnects).

  - While telecommunications equipment becomes more reliable, it is also becoming more complex with integrated functionality requiring additional technical skills from service vendors. Also, servicing and maintaining telecommunications software which controls hardware will become more of a user concern.

  - Remote diagnostics services suggest a niche trend which may offer full service vendors opportunities to improve customer service through cooperative agreements.

  - New network services, such as software defined networks which require users to have network interface equipment, offer additional field service opportunities, often in conjunction with the network service providers.

  - Substantial opportunities exist in the professional services arena for systems integration, consulting, network design and management services, customized software development, and training.

- The next section analyzes user service requirements based on the findings of INPUT's survey.

E. IMPACT OF USER TELECOMMUNICATIONS SERVICE REQUIREMENTS, 1986-1991

1. INTRODUCTION

- As reported in Section III of this report, in September and October 1986, INPUT interviewed nearly 200 users of telecommunications equipment in 12 industry categories.

- On-site support is received by 83% of the sample, 87% received service from their vendors, and 13% used third-party maintenance vendors.

2. USE OF THIRD-PARTY VENDORS

- Users were asked to rate their willingness to use TPM in support of their telecommunications equipment.

  - The average response (with a "10" indicating very willing) was 4.9.

  - Currently, few TPM vendors have established a reputation as a reliable telecommunications support source.

  - INPUT feels this rating will increase as TPM vendors gain more of a market presence and as users' confidence in TPM increases.

  - DP managers are recognizing TPM vendors as a viable alternative to manufacturer support. As telecommunications and computing become more functionally integrated, more TPM use for telecommunications support will result.

3. IN-HOUSE SERVICE

- Users interviewed handle most of their network planning internally, and 61% take responsibility for moves, changes, and relocations. Over 40% handle their own installation, and a similar number handle their own software maintenance.

- These are areas of opportunity for telecommunications service vendors. Not only do users need these services, but as telecommunications and data processing systems become more interdependent, users will require technical expertise which may be beyond what they have in-house, particularly in the middle market.

4. SERVICE PERFORMANCE REQUIREMENTS

- On average, respondents experienced two system interruptions per month, resulting in uptimes averaging 98.1%. However, nearly half of the users reported no interruptions in the past six months, and 78% had fewer than two. Seventy percent of the interruptions were caused by hardware failure, and the balance were caused by software problems.

- However, users expect uptimes of 99.2%, and in industries highly dependent on their telecommunications equipment, this expectation was even higher. Accordingly, there is a link not only to equipment reliability but also to service response and repair times.

5. RESPONSE AND REPAIR TIME REQUIREMENTS

- Users reported an average of 5.7 hours for response to trouble calls, but this ranged widely. The median response was two hours.

- Average repair times were reported over an even broader range, with an average of 27.6 hours, while 90% reported repair times within 48 hours.

- The ranges related to whether users received on-site or depot repairs.

- However, users on average expected responses within 4.4 hours and repairs within 22.2 hours, with their expectations falling short by 1.3 and 5.4 hours respectively when compared to the average response.

- Granted, users may always expect more than they receive but, nevertheless, vendors must recognize that quick responses mean more satisfied customers. The quantitative ratings given these elements reveals that, on average, users are fairly satisfied.

6. SATISFACTION LEVELS OVERALL

- Users were asked to rate their satisfaction levels against a scale of 10, with "10" being highly satisfied.

  - Overall, users rated their satisfaction with support received at "8."

  - Response time, repair time, and the vendor's proper handling of the problem through escalation were individually rated near this point.

  - Only the cost of maintenance was rated lower (at 6.7) among the general evaluation factors.

7. SATISFACTION IN SPECIFIC SERVICE AREAS

- Users were also asked to rate specific areas of support and variations with their overall satisfaction ratings appear.

  - Over 60% of the sample were satisfied with moves/changes/relocations, consulting, and training.

- Only 37% were satisfied with hardware maintenance.

- The responses, when compared to requirements, show that almost every user group considered vendors lacking in hardware maintenance, parts availability, and engineer skill levels.

- However in other areas (specifically moves/changes/relocations, software maintenance, training, and consulting) service exceeded user requirements. This suggests these services were overly provided, perhaps at the cost of performance in higher priority areas.

- Exhibit V-20 shows these findings.

8. REQUIREMENTS AND PERFORMANCE BY DELIVERY MODE

- Recall that 83% of those surveyed received on-site support. This is reflected in the rating of on-site support most highly, and, on average, users received on-site service meeting their requirements. Similiarly, telephone support was highly rated and met requirements.

- Carry-in and mail-in support were used by only 18% of the sample and were therefore rated lower. Vendors exceeded user expectations in these areas.

- Similiarly, users reported that remote diagnostics/support also exceeded their requirements.

- However, when asked how satisfied they were with each individual delivery mode, less than half were satisfied with on-site service, slightly more than half were satisfied with telephone support, and upwards of 62% were satisfied with the other delivery modes.

  - The low rating of on-site service received is related to low satisfaction with hardware maintenance and problems areas such as parts procurement and engineer skill.

EXHIBIT V-20

USER TELECOMMUNICATIONS SERVICE SATISFACTION

- Users Are Unhappy With:
  - Cost
  - Hardware Maintenance
  - Parts Availability
  - Engineer Skill Levels
- Users Are Happy With:
  - Moves/Changes
  - Software Maintenance
  - Training
  - Consulting
- Vendors May Overly Provide Low-Priority Service Elements At the Expense of High-Priority Areas

- User comments show concern over engineering support staff turnover and inconsistent service quality, usually based on the user's contact with hotline staff and on-site engineers. These areas are often the only "tangible" aspects of the support relationship. Typical user comments were:

  - "Uniformity of response is important. It's different in various geographic areas."

  - "They have a terrible 800-service operation. They need to improve this service."

  - "They could be a little more personal. They're too big and need to become more customer-oriented."

  - "Too many changes in staff. They shouldn't fire good technicians."

  - "Improve the help line and the technical staff. Maybe they should send the field engineers back to school. They could use the training."

- Other comments related to a lack of communication and flexibility on the part of the vendor, again reflecting on the relationship. For example:

  - "We need ongoing user contact. Either leaflets or flyers would do the job."

  - "Better repair system, better communications, and quicker callbacks are needed."

- "They need to be more flexible with changing work orders, and they should drop the $50 administrative fee on larger orders."

9. SURVEY CONCLUSIONS

- The survey findings lead to two conclusions:

  - The areas of highest priority among users show the lowest levels of satisfaction.

  - Contact between the user and support staff, no matter how inconsequential it may be to actual uptime or repair procedures, is a key to user satisfaction and vendor market success.

- These conclusions are shown in Exhibit V-21.

- Recommendations drawn from these findings are presented in the next section.

F. CONCLUSIONS AND STRATEGIC RECOMMENDATIONS

- This section offers concluding remarks about the telecommunications service industry, identifies support opportunities, and provides specific recommendations for vendors participating in the market.

1. THE CHANGING SERVICE MARKET STRUCTURE

- Two new classes of service providers are emerging to join the others in the service market mix:

EXHIBIT V-21

TELECOMMUNICATIONS SERVICE USER SURVEY CONCLUSIONS

- Highest Priority Areas Have Lowest Satisfaction Ratings
- Key to Success is User/Vendor Contact/Relationship

- Those offering professional services, with systems integration services of high user interest to address multivendor telecommunications and data communications networks as an entire entity.

- Remote diagnosistic monitoring and service coordination vendors, with Pactel Spectrum Services the prime example.

2. USERS ARE EMERGING AS SERVICE MARKET PARTICIPANTS

- Clearly, larger users are taking more responsibility for the telecommunications functions, and service is no exception.

- Self-maintenance is not only intended to decrease service expenses but also to meet availability requirements where service is either not available or is lacking from an external supplier.

- Vendors are accommodating users by offering training and discounts for user involvement.

3. THE CHANGING USER ENVIRONMENT

- Voice and data hardware purchasing is being centralized at corporate communications, information systems, or at a corporate administration executive level. Service has become an important selection criteria.

- While voice and data administrative functions are being merged, the tendency is to give data managers voice responsibilities rather than vice versa. Accordingly, service issues increase in importance, reflecting the data manager's experience.

  - Since the telecommunications network is the key system link, the availability of that link is visible to all end users. User expectation of constant access means downtime is more visible throughout the corporation.

- The growing interdependence of telecommunications and data processing confronts users with the complication of which vendor to call for service. While a sole source is desired, most vendors do not meet this need.

4. TELECOMMUNICATIONS SERVICE PRICING

- As hardware pricing has become competitive, value-added services (as well as add-on sales) are being viewed as increasing narrowing margins. The task becomes identifying needed services and properly pricing them to achieve stated goals.

- However, service pricing is also becoming competitive as more firms, particularly TPM vendors, enter the market and gain acceptance.

- Users also perceive that telecommunications services costs are higher than they should be, particularly in comparison to large systems service which is frequently used as a benchmark. Users see telecommunications, by its nature, as requiring less "hand holding" than computer systems and, therefore, it should cost less.

- However, these perceptions are being mitigated by growing user demand and new applications supported by telecommunications. This dependence increases users' perceptions of the value of service to maintain equipment and, therefore, they become less price sensitive.

- As noted, service has become a critical factor in equipment selection. While this has tended to stall the onset of price sensitivity, as the telecommunications service market matures this will change.

  - Hardware prices will continue to decline, and users will expect service prices to follow.

- Equipment reliability will lead users to be reluctant to spend increasing amounts for fewer needed services.

- However, user requirements for increased professional services will create a new source of service revenue.

- Service pricing is affected by several factors:

  - The serviceability of equipment from improved modular design, remote support, and redundant systems.

  - The cost of providing service and the success of cost-control measures (discussed below).

  - Manufacturer strategy of using service pricing on older models to leverage equipment upgrade sales.

- Users want flexibile pricing plans which allow discounts for their involvement in maintenance and provide for full-time, daily, 24-hour coverage and response times if necessary, yet offer lower prices for lower levels of service.

- This reinforces the "menu" pricing strategy most vendors have taken.

- The activators and inhibitors of these telecommunications services trends are shown in Exhibit V-22.

5. CONTROLLING SERVICE COSTS

- One strategy to achieve increased service profitability is to reduce costs. A key to both improved and lower cost service is the degree of centralization possible without impairing repair times. For example, centralization can take advantage of efficient "just-in-time" inventory forecasting procedures.

EXHIBIT V-22

TREND INFLUENCES

TREND	INHIBITORS	ACTIVATORS
Internal Maintenance Departments	Technical Knowledge	Cost Control, Network Size at the Threshold for Self-Maintenance Efficiency
Customer Involvement in Maintenance	Qualified Technical Labor Pool	Cost Control, Vendor Training, Menu/Remote Diagnostics, Module Swaps, Software Uploading
Voice/Data Management Mergers	Personnel and Political Issues	Integration of Telecom and Data Processing
Lower Service Pricing	Increasing Dependence on Telecommunications	Competition, Nature of Telecom, Equipment Reliability
Remote Diagnostics	Proprietary Diagnostic Loops in Multivendor Environments	Third Party "Unbiased" Vendor Coordination/Agent/ Network Management Services

- Another aspect of centralization is remote support, with the following advantages:

  - Improved response time by initiating diagnostics during the initial problem call.

  - Improved repairs through remote fixes without a site visit.

  - Reduced no-fault calls and callbacks.

  - Efficiencies from using lower level technicians who are supported by more senior experts at the remote support center.

- The primary disadvantages of remote support are:

  - Reduced personal contact with the customer and isolation of the customer from the problem determination process. Vendors can counteract this with increased consulting and other professional service visits.

  - Customer concerns about security breaches due to unauthorized remote access. Increased customer education concerning the benefits (e.g., faster problem resolution, less expensive service costs) plus additional safeguards to assure data security can lessen this concern.

- For technological and economic reasons, service vendors may consider appropriate relationships with a remote diagnostic firm, such as Pactel Spectrum Services.

- Another cost-control measure is involving the user through depot maintenance and user-initiated repairs and diagnosis. These elements are often related to equipment with vendors considering serviceability at the design stage leading

to modular parts and self-diagnosis features built into the equipment. This direction works well with inexpensive, portable equipment; however, users of more involved equipment, such as PBXs, require on-site support.

6. TELECOMMUNICATIONS SERVICE OPPORTUNITIES

a. Professional Services

- As described in Section B, there are substantial opportunities for telecommunications service vendors to provide support beyond repair and maintenance. Professional services are a way for vendors to differentiate themselves from competitors, particularly hardware-only service vendors. However, costs do escalate as vendors strive to become proficient in professional services and in multiple lines of equipment.

- For small- to mid-sized companies, opportunities continue to exist for vendors to provide management services, handling the selection, installation, configuration, maintenance, and repair of the entire corporate network and perhaps into facilities management services.

b. Software Support

- While the statistical ratings suggest users are satisfied with the software support received from vendors, there are indications such services will become more important. Accordingly, vendors focused on hardware need to develop expertise in maintaining telecommunications software as part of a full-service offering.

c. Integrated Telecommunications/Data Processing Support

- Systems integration is of high interest. The integration of voice and data is proceeding as technology and management issues are addressed. Vendors need to strengthen their capabilities of supporting both elements to prevent account loss to more capable competitive firms.

d. Niche Opportunities

- Vendors may choose to specialize by exploiting markets identified by:
  - Industry (such as financial institutions, i.e., servicing trading currents, long-distance resellers, hotels, educational, and health care institutions).
  - Function (such as telemarketing or customer support).
  - Company size.
  - Regional markets.
  - Needed special skills which the vendor can emphasize (such as call accounting analysis or specialized applications expertise).
  - Obsolete equipment, particularly when service is not otherwise available or the manufacturer is not price competitive.
  - Price. For users who believe manufacturers' service contracts are too expensive, "no-frills" service options may find success.
  - Service. A similiar opportunity may be found with premium-priced services for users requiring extremely fast response time due to the critical importance of telecommunications to their business.
- These opportunities are shown in Exhibit V-23.

EXHIBIT V-23

TELECOMMUNICATIONS SERVICE OPPORTUNITIES

- Professional Services
- Software Support/Customization
- Integrated Voice/Data Service
- Niches: Industry, Function, Equipment, Skills, Price

7. STRATEGIC PARTNERING

- It is not always possible for one firm to build the necessary expertise to handle all the complexities of the modern telecommunications network. There is competition for personnel, and many companies choose to focus on certain areas.

- However, as customers' requirements grow, the service vendor may need to expand capabilities in ways other than adding staff. One method is strategic partnering.

  - Vendors have entered agreements with others for equipment servicing. An example is modem manufacturer Racal-Vadic's relationship with Honeywell for servicing in Honeywell installations.

  - Being discussed are service vendor relationships with remote diagnostic firms to improve responsiveness.

  - Other forms of strategic partnering should be explored by companies facing user demands beyond currently provided services with the caution that alliances should not be used to overcome fundamental weaknesses, but rather to build synergistic strengths.

8. USER/VENDOR RELATIONSHIPS

- As described in Section C, the key to vendor success largely depends on the quality of the relationship between the vendor's staff and the user.

- This contact can be manifest in several areas.

a. Hotline Support

- Users require rapid response to their problems, and as the comments reported in the previous section show, many users are unhappy with the time it takes vendors to return trouble calls and with hotline personnel.

- Companies with large customer bases have often grown rapidly, with service unable to keep pace with growth. Many have already addressed these issues, but others need to examine automating their customer support operations for improved efficiency and responsiveness.

- The techniques and technologies needed are similiar to those used in incoming telemarketing operations, adapted to the service function. Elements include:

  - Integrated voice/data stations for customer service agents.

  - Automatic call distribution to ensure a phone does not go unanswered.

  - Problem and customer profile data bases to track recurring conditions and to bring the company and the customer closer.

  - Twenty-four hour coverage and/or call forwarding for emergency, off-hour situations.

- A company unable to support a full-time response center must make arrangements for off-hour coverage, perhaps through commercial services or sharing response center resources with another company.

- Hotline service personnel should have sufficient technical expertise to properly diagnose or isolate problems and to suggest possible user fixes.

  - They should also be able to establish the links necessary for remote diagnostic testing.

- Further, hotline personnel must be trained to deal with the customer professionally, courteously, and, as necessary, diplomatically. They are the primary contact point between the user and the vendor.

- A well designed, automated system will lead the vendor's hotline staff through a series of in-context menus and supporting scripts with fill-in-the-blank screens to direct the questionning for maximum positive effect.

b. Field Services

- IBM's field service personnel use a mobile radio data system jointly developed with Motorola, and Motorola is marketing this messaging system for other field operations.

  - Field engineers carry a alphanumeric terminal which receives dispatch messages and allows messaging between engineers, support centers, problem and repair data bases, and individual field engineers.

  - Mobile data systems for vehicle installation are also available.

- Naturally, field service staff must be trained in courtesy and good grooming habits.

c. Publications

- With the advent of desktop publishing, there is little reason a company cannot maintain its presence with customers efficiently and effectively, presenting a high-quality image through service bulletins, newsletters, and documentation.

d. Technical Staff and Training

- As noted in the previous section, users often feel the technical staff is not properly prepared for their responsibilities. There were also concerns about staff turnover.

- New products require constant staff technical training, but progressive service vendors also support employee training to improve customer relation skills. Properly trained and motivated, technicans cannot only fulfill their primary roles but can increase sales for additional products, perpherials, supplies, and services, thus increasing profit margins.

- Methods of improving the user relationship are shown in Exhibit V-24.

9. VENDORS MUST FOCUS ON USERS' REQUIREMENTS AND THE COMPLETE NETWORK

- As voice and data departments within large organizations are being merged, service organizations must consider both elements.

- No longer can service be viewed as oriented toward specific hardware. There are multiple brands found in the corporate network, many driven by sophisticated software.

- Network services themselves often enter into the service equation since many of the newer network offerings require that the customer place into service ancillary interface and access equipment.

- Increasingly, a "gestalt" view of telecommunications services is required, particularly as users grow weary of vendor fingerpointing. Vendors must find ways of treating the entire network as a single entity.

EXHIBIT V-24

IMPROVING USER RELATIONSHIPS

- Automated Full-Time Hotline Functions
- Improved Field Staff Communications
- Increased Communications With User
- Engineer Training

- The emerging awareness looks beyond the pieces of the network to recognize that the network as a whole requires a uniform service approach, ideally one source with capabilities spanning the range of network functionality.

- Although one-stop telecommunications shopping and service largely disappeared with divestiture, there is evidence that while the monopoly will never return, users crave something to replace it.

- This may be an oligopoly, vendor cooperation, or a third-party to manage service requirements. Regardless of the name placed on the situation, the intent is the same--to serve the customer effectively and efficiently.

VI APPENDIX

- The following section contains additional information sent at various times throughout the year to supplement the research findings for this module. Examples of such additional information includes sample questionnaires, definition lists, and industry summary exhibits.

1. a. Manufacturer: _____

   b. Model: _____

   c. Product type: _____

   (if PBX, how many trunks: _____; stations: _____)

   d. Service vendor: _____

2. How do you receive your support?

   a. on-site _____ c. contract _____

   b. depot _____ d. T&M _____

3. Who performs the following services on your equipment?

	(1) in-house	(2) manufacturer	(3) TPM	(4) other
a. Hardware mainteneance	_____	_____	_____	_____
b. Software maintnenance	_____	_____	_____	_____
c. Installation	_____	_____	_____	_____
d. Moves/Changes	_____	_____	_____	_____
e. Network planning	_____	_____	_____	_____

4. a. What response time (in hours) do you expect from vendors on serious problems? _____ hours

   b. On the average, how many hours does it take your vendor to respond to these problems? _____ hours

5. a. What repair time (in hours) do you expect from vendors on serious problems? _____ hours

   b. On the average, how many hours does it take your vendor to repair serious problems? _____ hours

6. a. What percent uptime have you experienced over the last six months?

_____ %

b. What percent uptime do you require? _____ %

7. a. Over the last six months, what has been the average number of system interuptions experienced per month? _____

b. What percent were hardware related? _____ %

c. What percent were software related? _____ %

8. a. Please rate, on a scale of 1-10 (1=low, 10=high), the importance of each of the following services:

	(1) importance	(2) satisfaction
a. Hardware maintenance	_____	_____
b. Software maintnenance	_____	_____
c. Training	_____	_____
d. Consulting	_____	_____
e. Parts availability	_____	_____
f. Engineer skill level	_____	_____
g. Moves/changes/relocation	_____	_____

9. Please rate your satisfaction with the following areas of service (1=low, 10=high):

	Satisfaction
a. Vendor response time	_____
b. Vendor repair time	_____
c. Problem escalation	_____
d. Overall support	_____
e. Price of maintenance	_____

10. Please rate your requirement for the following service delivery methods (1=low, 10=high):

	(1) requirement	(2) satisfaction
a. On-site	_____	_____
b. Carry-in depot	_____	_____
c. Mail-in depot	_____	_____
d. Telephone support	_____	_____
e. Remote diagnostics/support	_____	_____

11. a. How willing, on a scale of 1-10 (1=unwilling, 10=very willing), are you to use a TPM vendor for maintenance? _____

b. Why? _____

_____

_____

12. How important, on a scale of 1-10 (1=unimportant, 10=very important), is a single source of service to you? _____

13. How many moves/relocations were performed in the last year on your equipment? _____

14. How many stations will you add in the next year? _____

15. What single improvement would you like to see your service vendor make?

_____

_____

_____

_____

_____

_____

THANK YOU !!

(to show our appreciation for their help, we will be sending the respondent an Executive Summary of the report these findings will go into -- INPUT's 1986 Telecom User Requirements report ... remember to check the address information, and confirm the correct spelling of the respondents name.)

APPENDIX VI-B: DEFINITIONS

- APPLICATIONS SOFTWARE - Software that performs processing to service user functions.

- BOC - Bell Operating Company.

- CONSULTING - Includes analysis of user requirements and the development of a specific action plan to meet user service and support needs.

- DISPATCHING - The process of allocating service resources to solve a support-related problem.

- DIVESTITURE - The action, stemming from antitrust lawsuits by the Department of Justice, which led to the break-up of AT&T and its previously owned local operating companies.

- DOCUMENTATION - All manuals, newsletters, and text designed to serve as reference material for the ongoing operation or repair of hardware or software.

- END USER - May buy a system from the hardware supplier(s) and do own programming, interfacing, and installation. Alternatively, may buy a turnkey system from a systems house or hardware integrator.

- ENGINEERING CHANGE NOTICE (ECN) - Product changes to improve the product after it has been released to production.

- ENGINEERING CHANGE ORDER (ECO) - The followup to ECNs which include parts and a bill of material to effect the change in hardware.

- ESCALATION - The process of increasing the level of support when and if the field engineer cannot correct a hardware or software problem within a prescribed amount of time, usually two to four hours for hardware.

- FIBER OPTICS - A transmission medium which uses lightwaves.

- FIELD ENGINEER (FE) - For the purpose of this study, field engineer, customer engineer, serviceperson, and maintenance person were used interchangeably and refer to the individual who responds to a user's service call to repair a device or system.

- HARDWARE INTEGRATOR - Develops system interface electronics and controllers for the CPU, sensors, peripherals, and all other ancillary hardware components. May also develop control system software in addition to installing the entire system at the end-user site.

- ISDN - Integrated Services Digital Network. A proposed standard for digital networks providing transport of voice, data, and image using a standard interface and twisted pair wiring.

- LADT - Local Area Data Transport. Data communications provided by the BOCs within local access transport areas (LATA).

- LARGE SYSTEM - Refers to traditional mainframes including at the low end IBM 4300-like machines and at the high end IBM 308X-like machines. Large systems have a maximum word length of 32 bits and a standard configuration price of $350,000 and higher.

- MEAN TIME BETWEEN FAILURES (MTBF) - The elapsed time between hardware failures on a device or a system.

- MEAN TIME TO REPAIR - The elapsed time from the arrival of the field engineer on the user's site until the device is repaired and returned to the user for his utilization.

- MEAN TIME TO RESPOND - The elapsed time between the user placement of a service call and the arrival at the user's location of a field engineeer.

- MICROCOMPUTER - A microprocessor-based single- or multi-user computer system typically priced less than $15,000. A typical configuration includes an 8- or 16-bit CPU, monitor, keyboard, two floppy disk drives, and all required cards and cables.

- MINICOMPUTER/ - See Small System.

- OPERATING SYSTEM SOFTWARE (SYSTEMS SOFTWARE) - Software that enables the computer system to perform basic functions. Systems software, for the purposes of this report, does not include utilities or program development tools.

- PBX - Private Branch Exchange. A customer premises telephone switch.

- PERIPHERALS - Includes all input, output, and storage devices, other than main memory, which are locally connected to the main processor and are not generally included in other categories, such as terminals.

- PLANNING - Includes the development of procedures, distribution, organization, and configuration of support services. For example, capacity planning, "installation" planning.

- PLUG-COMPATIBLE MAINFRAME (PCM) - Mainframe computers that are compatible with and can execute programs on an equivalent IBM mainframe. The two major PCM vendors at this time are Amdahl and National Advanced Systems.

- PROFESSIONAL SERVICES - A category services including system design, custom programming, consulting, education, and facilities management.

- RBOC - Regional Bell Operating Company. One of seven holding companies coordinating the activities of the BOCs.

- RESELLER - A marketing organization which buys long-distance capacity for others at wholesale rates, selling services at retail but discounted prices, and profiting on the difference.

- SMALL BUSINESS COMPUTER - For the purpose of this study, a system which is built around a Central Processing Unity (CPU), has the ability to utilize at least 20M bytes of disk capacity, provides multiple CRT workstations, and offers business-oriented system software support.

- SMALL SYSTEM - Refers to traditional minicomputer and superminicomputer systems ranging from a small multi-user, 16-bit system at the low end to sophisticated 32-bit machine at the high end.

- SOFTWARE DEFINED NETWORK - A private network which uses public network facilities, and which is configurable on an as-needed basis by the user (see Virtual Private Network).

- SOFTWARE ENGINEER (SE) - The individual that responds (either on-site or via remote support) to a user's service call to repair or patch operating systems and/or applications software.

- SOFTWARE PRODUCTS - Systems and applications packages which are sold to computer users by equipment manufacturers, independent vendors, and others. Also included are fees for work performed by the vendor to implement a package at the user's site.

- SUPERMINICOMPUTER - See Small System.

- SYSTEMS INTEGRATION - The action of a single service vendor's design, development, and implementation of a system or subsystem including integration of hardware, software, and communications facilities for a customer.

- SYSTEM INTERRUPTION - Any system downtime requiring an Initial Program Lod (IPL).

- SYSTEMS HOUSE - Integrates hardware and software into a total turnkey system to satisfy the data processing requirements of the end user. May also develop system software products for license to end users.

- T-1 - Refers to a standard 1.544 megabit per second digital channel used between telephone company central offices and is now used for microwave, satellite, fiber optics, or other bypass applications.

- THIRD-PARTY MAINTENANCE (TPM) - Any service provider other than the original equipment vendor.

- TRAINING - All audio, visual, and computer-based documentation, materials, and live instruction designed to educate users and support personnel in the ongoing operation or repair of hardware and software.

- TURNKEY SYSTEM - Composed of hardware and software integrated into a total system designed to completely fulfill the processing requirements of a single application.

- VSAT - Very Small Aperture Terminal. A small satellite dish system, usually using Ku-band frequencies.

- VIRTUAL PRIVATE NETWORK - A portion of a public network dedicated to a single user.