
User Service Requirements Telecommunications

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USER SERVICE REQUIREMENTS TELECOMMUNICATIONS

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USER SERVICE REQUIREMENTS TELECOMMUNICATIONS

ABSTRACT

This report analyzes telecommunications user expectations for service in such areas as response time, repair time, parts availability, and the perceived skill level of service technicians and engineers. The report is based on telephone interviews conducted with 162 telecommunication managers and DP managers in charge of telecommunications for PBX equipment, LANs, and wide area networks.

The reader should note that telecommunications vendor support falls short of user expectations in almost every service category. The report identifies key service areas which must be addressed, such as PBX engineer skill level, as opposed to areas which do not require immediate attention (e.g., LAN response time).

In addition to individual product performance, a chapter is included on overall market averages for global telecommunications analysis.

This report contains 84 pages, including 38 exhibits.

USER SERVICE REQUIREMENTS
TELECOMMUNICATIONS

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USER SERVICE REQUIREMENTS TELECOMMUNICATIONS

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I INTRODUCTION

A. SCOPE

- This report, User Service Requirements--Telecommunications, is part of INPUT's Customer Service Program (CSP) of 1985. The report explores the quickly expanding role of service and support to users of telecommunications products, particularly PBX, LAN, and wide-area voice/data networks, and measures user satisfaction with the services received. The report concentrates on these product types due to importance of service and support to users of these products in addition to the rapid growth in usage of these products.
- This report is organized into three main sections.
 - An Executive Summary which summarizes the main findings of the report in a presentation format.
 - A series of chapters which provide details of how LAN, PBX, and network users rate their vendor's performance in key service and support areas, including hardware maintenance, software support, response and repair times, and field engineer (FE) skill level. User satisfaction is measured compared to the level of service required by each user, providing perspectives on actual vendor performance.

- A short discussion of technological trends, with emphasis on the effect on service and support of new products/services.

B. METHODOLOGY

- The information found in this report is the result of 162 user interviews with IS and telecommunications managers and planners. A copy of the questionnaire used for these interviews is contained in Appendix B.
- A breakdown of the user sample by product type follows:
 - LAN users 51
 - PBX users 53
 - Wide-area network users 58162 total users
- Each individual product analysis contains further breakdowns of the sample, including size of installation, type of system, and budget allotment.

II EXECUTIVE SUMMARY

- This Executive Summary is designed in a presentation format in order to:
 - Help the busy reader quickly review key research findings.
 - Provide an executive presentation and script that facilitates group communications.
- The key points of the entire report are summarized in Exhibits II-1 through II-5. On the left-hand page facing each exhibit is a script explaining the exhibit's contents.

A. USER REQUIREMENTS IN TELECOMMUNICATIONS

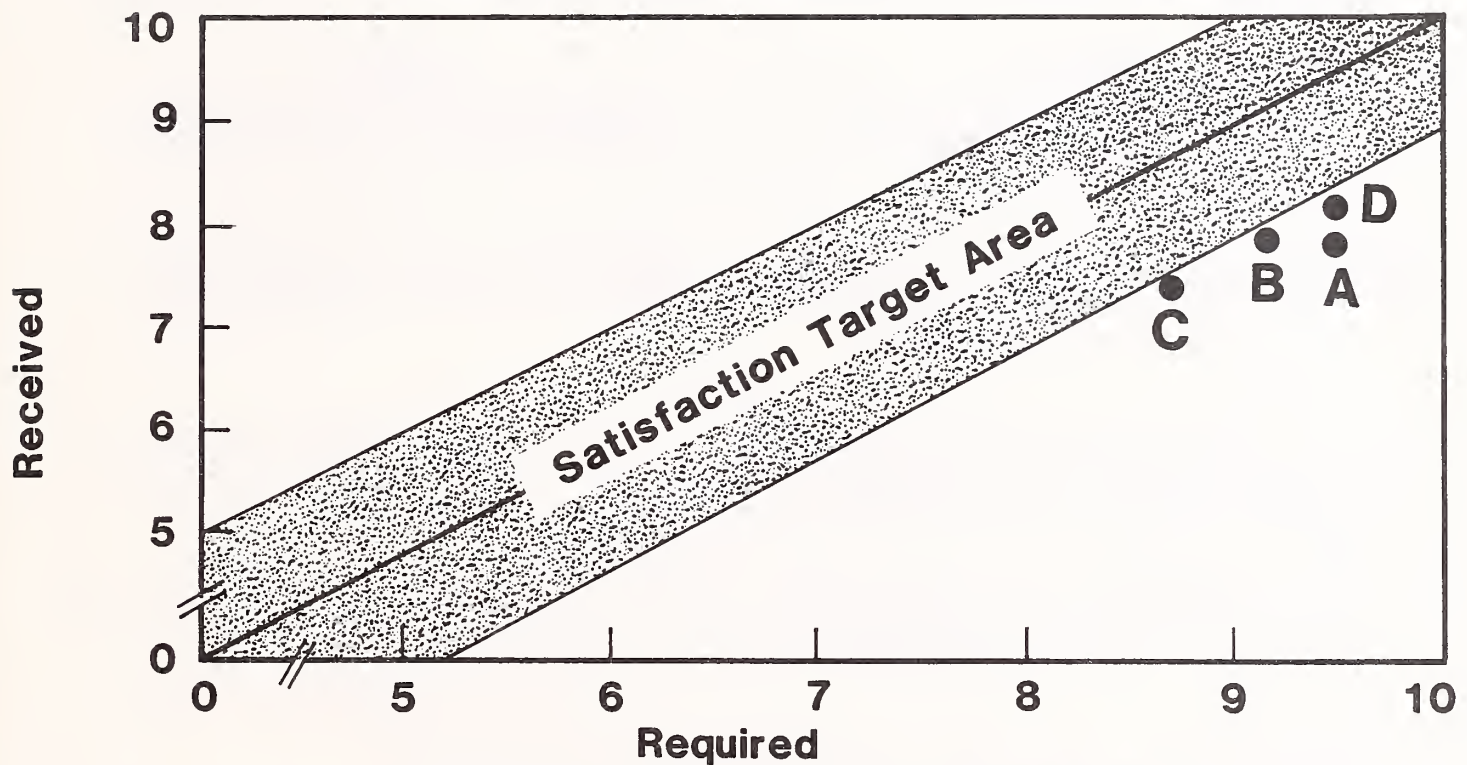
- The users' requirements for telecommunications support can be divided into several categories, shown in Exhibit II-1.
- The vendor's ability to provide adequate levels of hardware or software support (or both where applicable) becomes a significant factor in the development of continually ongoing business relationships with clients.
- Vendor response times are a frequent gauge of quality of support, even though the availability of replacement parts and technical skills are deemed of greater importance. If the vendor fails in this area, no amount of technical skill or surfeit of parts will redeem the vendor-customer relationship from whatever damage is wrought by indifference to the user's need for prompt response and repair times.
- As in the data processing (DP) environment, user expectations for telecommunications service have been escalating rapidly. Even when users employ redundant systems (e.g., third generation PBXs), expectations for response/repair time frequently exceed DP counterparts. User requirements for improved telecommunication service are particularly high in field engineering skills and vendor response time.
- INPUT believes that user expectations for service have been increasing as the result of several major factors:
 - The growing integration of voice/data communication.
 - Increasing reliance on telecommunication products.
 - User concern about the stability of the market as a result of deregulation.

USER REQUIREMENTS IN TELECOMMUNICATIONS

- **Hardware Maintenance and Support Software**
 - **Vendor Response and Repair Times**
 - **Availability of Parts**
 - **Problem Resolution Escalation**
 - **Field Engineering Skills**
-

B. TELECOM USER SERVICE NEEDS UNMET

- With explosive growth in telecommunications usage, service and support issues have often been lost in the resulting confusion. While telecommunications products are highly reliable by their very design, even the most reliable product is subject to downtime. In addition, the increasingly sophisticated applications these "low maintenance" products are being used for necessitate additional support services, such as training, consulting, and planning.
- Given the extremely high (99%) system availability requirements reported by telecommunications users, it becomes increasingly important for vendors to improve their users' perception of, if not the actual performance quality of, their service. Exhibit II-2 indicates that user perception of the value of service, represented by the relatively high user requirement levels, is quite high. On the other hand, user satisfaction with the level of service received is much lower than the user requirement level.
- It would be simplistic to conclude that vendors need to improve their service performance levels to meet their users' requirements--most vendors do not have the resources available to satisfy the extremely high service requirements of their users without drastically redesigning their products. Instead vendors should make an effort to improve service delivery, particularly in the area of remote support. Other important service areas include:
 - Parts availability.
 - Dispatching.
 - Consulting.
 - Planning.

INPUT[®]**TELECOM USER NEEDS UNMET****A: Overall Support****B: Hardware Maintenance****C: Software Support****D: Field Engineering Skill**

C. IMPACT OF DIVESTITURE ON SERVICE

- Many of the maintenance and telecommunications support activities that were formerly free or of minimum cost are now available from the Bell Operating Companies (BOC) only on a "fee-for-service" basis (Exhibit II-3). Frequently, this proves to be a rather expensive charge, especially when large-scale LANs, PBXs, or networks are involved.
- AT&T's areas of interest, especially in high-speed transmission and lines, telecommunications interfaces, and its penetration into the small computer market (and their consequent interfaces), dictates the direction of future development. Consequently, AT&T can reasonably expect to change the present and future support activities in these areas, and to change according to what the traffic will bear.
- For the IS manager, AT&T's impact in the small computer environment is already being felt. In communications, many companies are being guided by what AT&T does about terminal interfaces, high-speed (TI and above) communications links, telephone switches (PBX), integrating LANs, and better and faster communications methodologies.
- For many, it is a great opportunity for development and growth.
 - New startups are entering the third-party support field on an almost daily basis.
 - Many other vendors are following AT&T's lead and are now charging for support activities which were formerly free.
 - New departments in many companies are being dedicated just for the support function, making many companies think seriously about the additional advantages of "bypassing" the BOCs entirely.

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IMPACT OF DIVESTITURE ON SERVICE

THEN (Before Divestiture)

- **Telephones Installed Free**
- **Prices Stable and Predictable**
- **PBX and Network Maintenance Included in Cost of System**
- **IBM had to Match AT&T Interfaces**

NOW (After Divestiture)

- **Significant Charges if Bell Installs**
 - **Price Wars Among Competing Companies**
 - **User Pays For This Separately**
 - **AT&T May Now Have to Match IBM**
-

D. MERGING OF VOICE AND DATA

- The primary candidates for the merging of voice and data into a single operational entity will include conventional data communications, message switching, and electronic mail. Thus, a diverse and well-trained support staff will be required to maintain and repair the different, often marginally-compatible equipment.
- In the past, voice and data were separate entities requiring separate facilities and supported by people with two distinctly different sets of skills (Exhibit II-4 illustrates this point).
- Now, as the distinction between transmission capabilities of voice and data blurs, the support staff must be trained and equipped to handle both technologies, especially where the switch is involved.
 - Most PBX-equivalent switches used for voice and data are able to do so by virtue of "black-box" additions to existing technologies.
 - In the next few years, such switches (often called CXBs) will have been specifically designed to handle these merging technologies.
- No longer will telephone company experience be a prerequisite for hiring support personnel; now, and in the future, they will be required to have computer on date transmission experience and knowledge.
 - This will provide a higher level of employee, costing more to hire and keep and worth more to the organization for its survival and future growth.

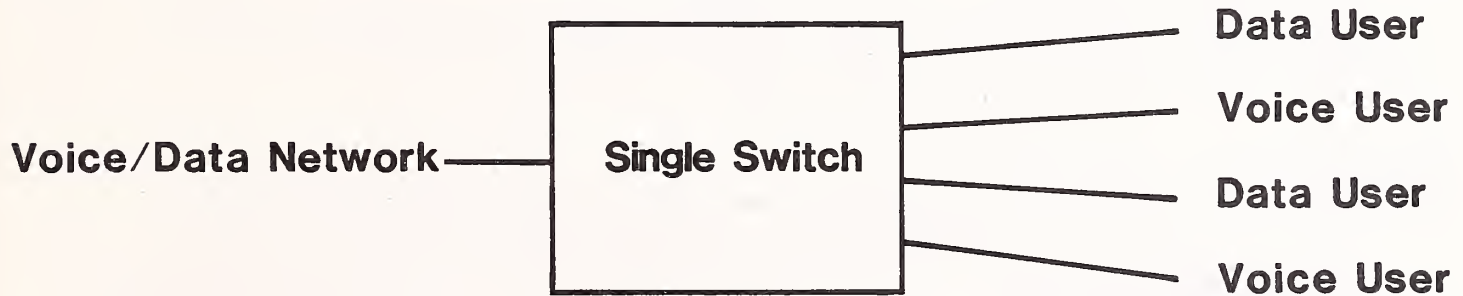
INPUT®

MERGING OF VOICE AND DATA

Now



Soon

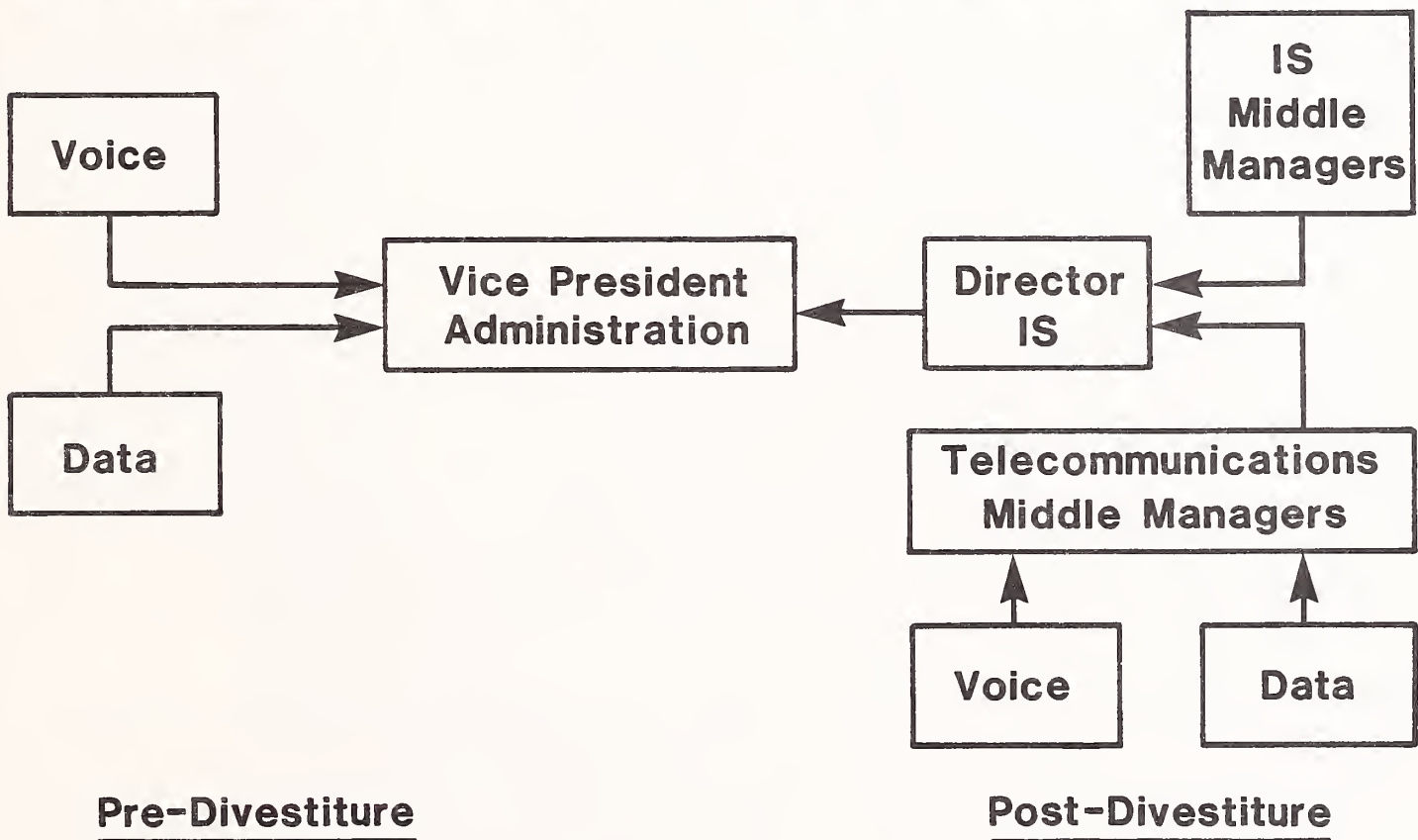


E. CHANGING SUPPORT RESPONSIBILITY MIX

- In the majority of companies interviewed, wherever the voice and data communications functions were combined, they reported to some administrative function such as the vice president of administration, the controller, or the vice president of information systems.
 - Thus, the support activity was buried in bureaucracy and usually executed little influence on the decision-making process.
 - Support was therefore a minor player in a major game.
- In those few cases where the combined departments reported directly to a communications executive, that individual had a peer position with other, nominally administrative managers and executives.
 - Thus, support had a large voice in matters affecting its performance.
 - But voice and data support activities, each with different interests, still had to compete for resources.
- There now seems to be a crossover occurring in the reporting hierarchy of voice and data, especially as the lines between them blur with each technological advance.
- In the most successful companies, voice activities report to data-oriented activities, not vice versa. One reason is that it is much easier for data-oriented personnel to learn the nuances of voice transmission than it is for voice-oriented personnel to acquire the vast amount of knowledge and experience needed to fully comprehend data transmission.

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CHANGING SUPPORT RESPONSIBILITY MIX



III SURVEY ANALYSIS: LANs

- In analyzing the survey data, as summarized in Exhibit III-1, it became apparent that the majority of LAN users were using baseband topology (at 76%), while a significantly smaller segment (24%) were still tied to broadband LANs.
- The average number of LANs per respondent installation was four, while the distribution of the number of devices per LAN is graphically defined in Exhibit III-2. These figures are in actual numbers rather than a percentage and clearly demonstrate that for the majority of LAN users (52%), ten or less devices are attached to their individual LAN. A few users (11%) have as many as 200 (or more) devices for each LAN installation within their organization.
- The LAN maintenance budget distribution (Exhibit III-1) shows that internal resources consume slightly fewer budget resources (47.7%) than do external resource budget allocations, reflecting user perception of the lack of focused external LAN support available, particularly on mixed systems.
- Generally, most users have an ongoing requirement for vendor-provided hardware maintenance. However, network planning and installation seem to be the weakest elements within any given organization, irrespective of who provides the service. This has prompted many users to attempt to provide their own support in-house in the areas of installation and network management.

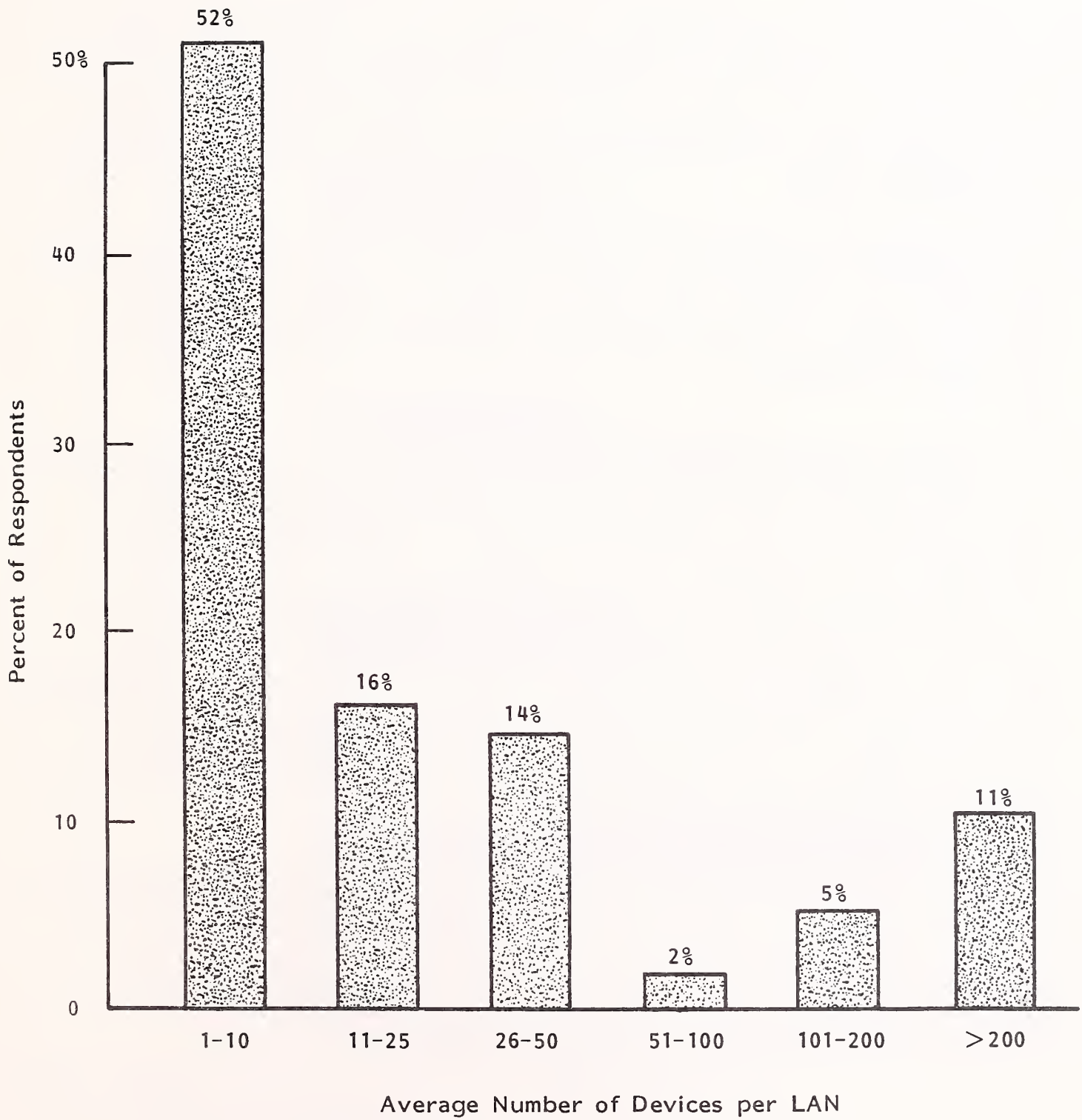
EXHIBIT III-1

LAN DEMOGRAPHICS

Baseband	76%
Broadband	24%
Average LAN/Installation	4
LAN Maintenance Budget	
Internal Resources	47.7%
External Resources	52.3%
Total Respondents	56

EXHIBIT III-2

AVERAGE DEVICES PER LAN



- If the support service activity is divided into the three major components of services provided by in-house staff, services provided by the manufacturer (or vendor), and services provided by third parties, the distribution of support services becomes easier to understand (see Exhibit III-3).
- By first addressing the hardware maintenance issue, the critical role of the manufacturer's support force becomes readily apparent. Of the respondents, 80% relied on the vendor or manufacturer to provide the requisite support in this area while only 33% relied on in-house support staffs to maintain hardware integrity.
- A similar argument is made for software support, particularly when purchased packages are involved. Only 37% of the respondents said they maintain the vendor-supplied software whereas 69% relied upon the software-provider to support their software.
- Third-party vendors have been conspicuous in their absence in the areas of LAN installation and network management. None of the respondents reported using third-party firms in these support areas. It is understandable that users would not use third-party firms for installation service since installation is usually the responsibility of the LAN vendor. What is surprising, however, is the lack of third-party involvement in network management, given that 84% of the users end up providing their own support in this area. Not only does this indicate an area where increased vendor activity could result in improved user satisfaction, but it also represents an area where vendors are missing a promising source of new service revenues.

One way to measure systems performance is to analyze the number (and where possible, the type) of system interruptions. Exhibit III-4 plots the number of system interruptions at two district levels: an acceptable number of interruptions versus an unacceptable number of interruptions. These are based on the respondent's perception of acceptable levels:

EXHIBIT III-3

SUPPORT SERVICE DISTRIBUTION
LAN

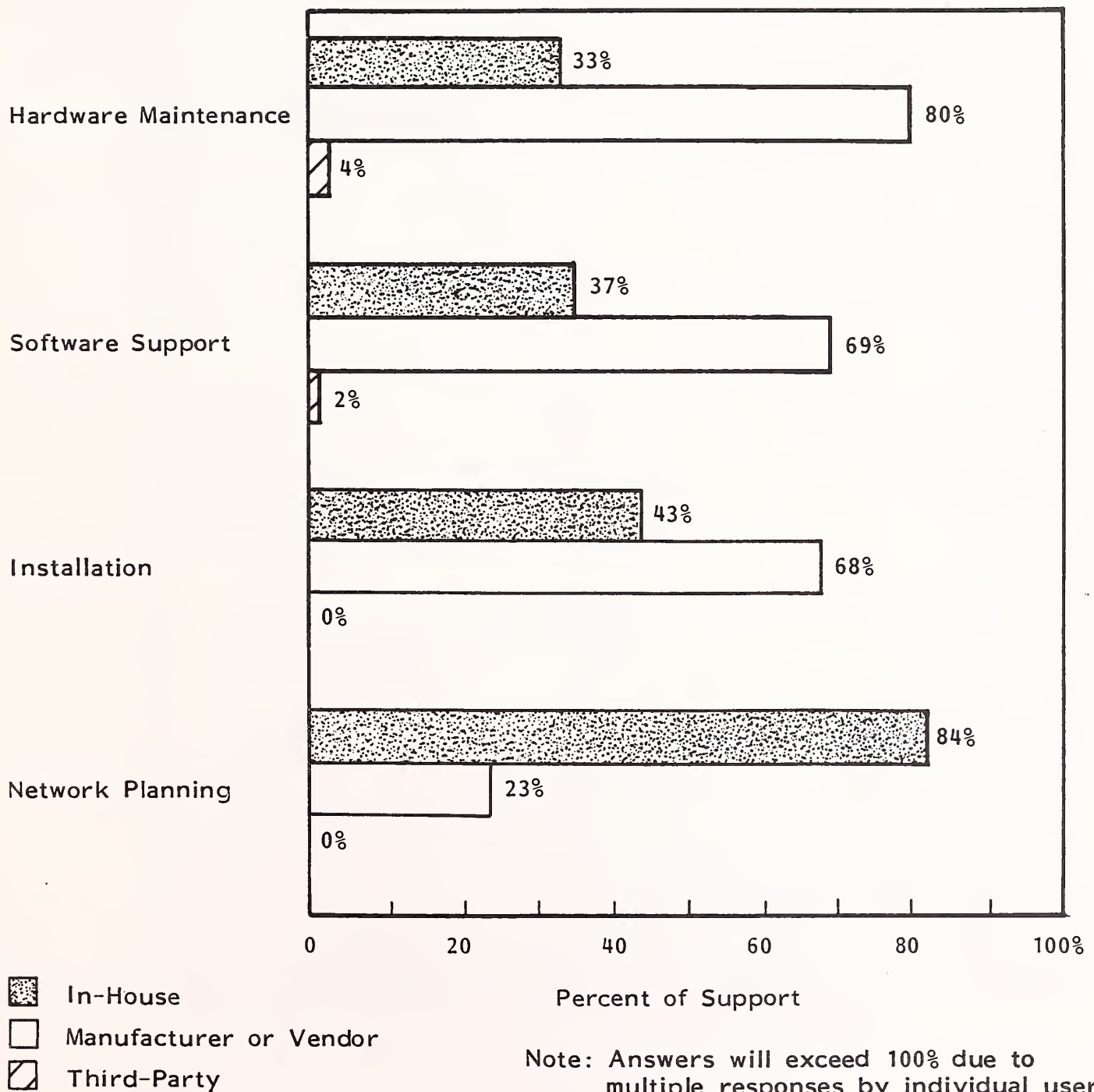
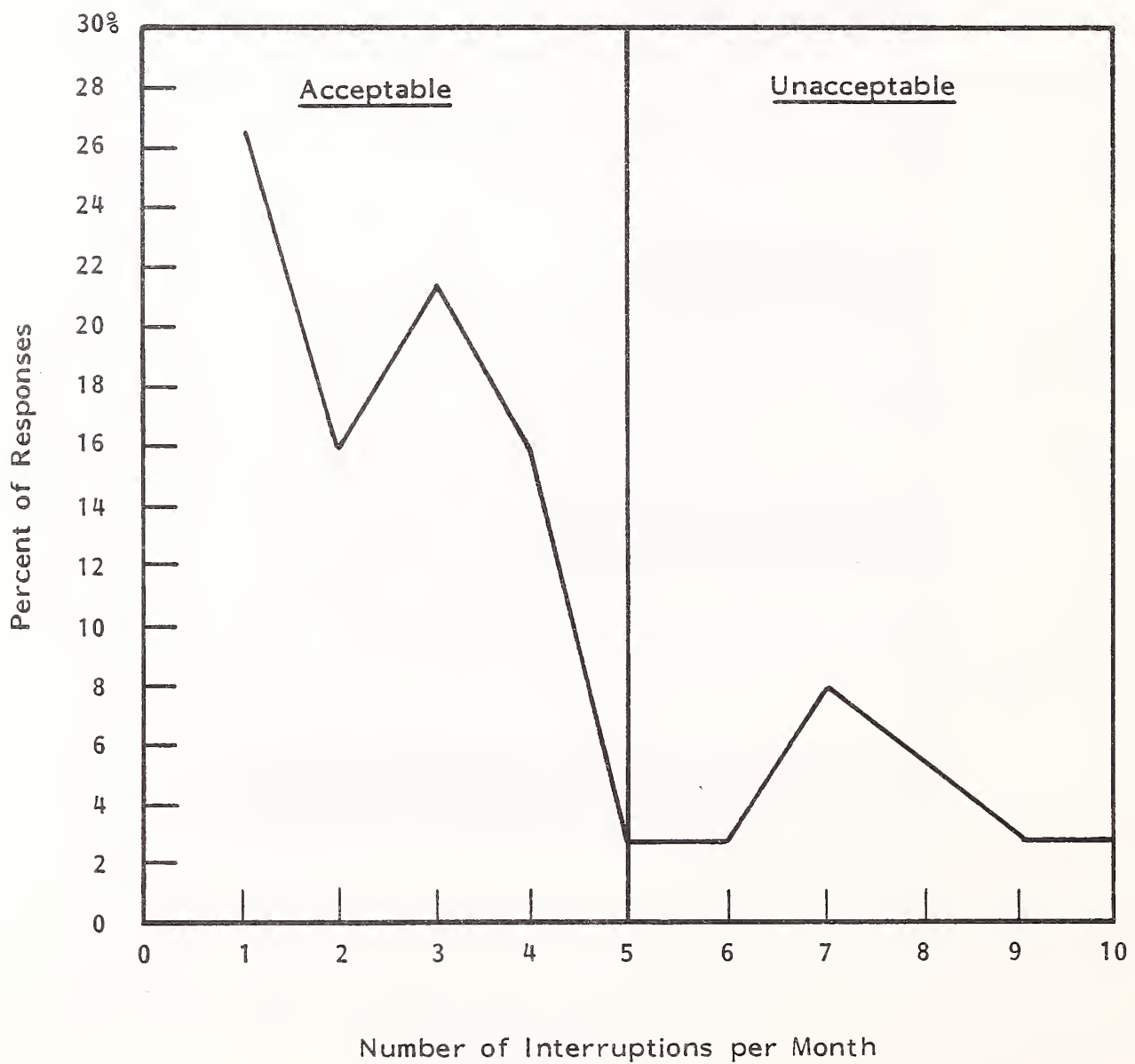


EXHIBIT III-4

AVERAGE NUMBER OF LAN SYSTEM INTERRUPTIONS
(Per Month)



- The largest number of respondents (26.5%) reported between one and two interruptions per month, while 21.1% averaged between three and four system interruptions per month.
- Four to five interruptions per month begins to border on an unacceptable number of interruptions, although 15.8% experienced four and 2.6% five interruptions per month.
- The highest level of an unacceptable number of interruptions was 10 or more per month, with 2.6% of the respondents getting that number. Similarly, those reporting five interruptions account for 2.6%, while another 2.6% had slightly more at six interruptions per month. Thus, it becomes a fine line between those 15.8% who felt that four interruptions were acceptable and that 2.6% who were not willing to concede five or six per month as acceptable. The key is customer perception. If they perceive the number of interruptions as unacceptable, it is unacceptable and must be addressed by the service vendor.
- In evaluating LANs, survey respondents were asked to rank these critical issues: overall satisfaction, user satisfaction with response time, and user satisfaction with repair time (see Exhibit III-5). A scale of 1 to 10, with 10 being the highest, was used for this evaluation.
 - The adjusted mean of responses indicates overall satisfaction was quite high with a rating of 8.1.
 - Satisfaction with response time received an adjusted mean rank of 8.0 on the user rating scale, with satisfaction with repair time receiving a 7.7 rank in the adjusted mean of user rating responses received.
- Exhibit III-5 supports the relatively high satisfaction rating LAN users reported since mean response time actuals exceeds the user requirement. The exhibit reinforces the user's concern about repair times where the performance is slightly more than 2.5 times that which was expected.

EXHIBIT III-5

SERVICE COMPONENT DATA LAN

SERVICE COMPONENT	USER RATING*
Overall Satisfaction	8.1
Satisfaction with Response Time	8.0
Satisfaction with Repair Time	7.7

*Rating: 1 = Low, 10 = High

SERVICE COMPONENT	EXPECTED	RECEIVED
Average Number of Software Interruptions per Month	-	1.2
Average Number of Hardware Interruptions per Month	-	2.2
Average Systems Availability	98.7%	96.5%
Average Systems Availability During Normal Business Hours (8am - 5pm)	98.8%	96.9%
Average Vendor Response Time (Hours)	5.2	4.8
Average Vendor Repair Time (Hours)	5.5	13.4

- The average systems availability, at a received 96.5% versus an expected 98.7%, and that availability during normal business hours (98.8% expected versus 96.9% received) further demonstrates the reliability of current LAN offerings.
- Exhibit III-6 lists the service categories used to measure service satisfaction and resultant ratings ascribed by the respondents.
 - "Problem escalation" may be defined as the process of increasing the level of support when and if a field engineer cannot correct a hardware or software problem within a prescribed amount of time, usually two to four hours for hardware.
 - The greatest weakness is in software support. Software is the critical point in most support organizations, in both the telecommunications and data processing environments. The criticality of software support in LAN applications emphasizes the failure of LAN service vendors in this area. Of course, LAN vendors will need to overcome the same hurdles facing all service vendors in this area.
 - Competent software personnel eventually tire of support and maintenance functions and, thus, either transfer or leave the organization for more challenging positions.
 - Constant upgrading and almost continuous training are required to keep software experts reasonably content with their jobs.
 - Software support is a technically demanding job, usually requiring great powers of concentration, strong formal logic capability, a disciplined mind, and a willingness to tolerate repetitive and often unrewarding assignments.

EXHIBIT III-6

1985 USER SATISFACTION LAN

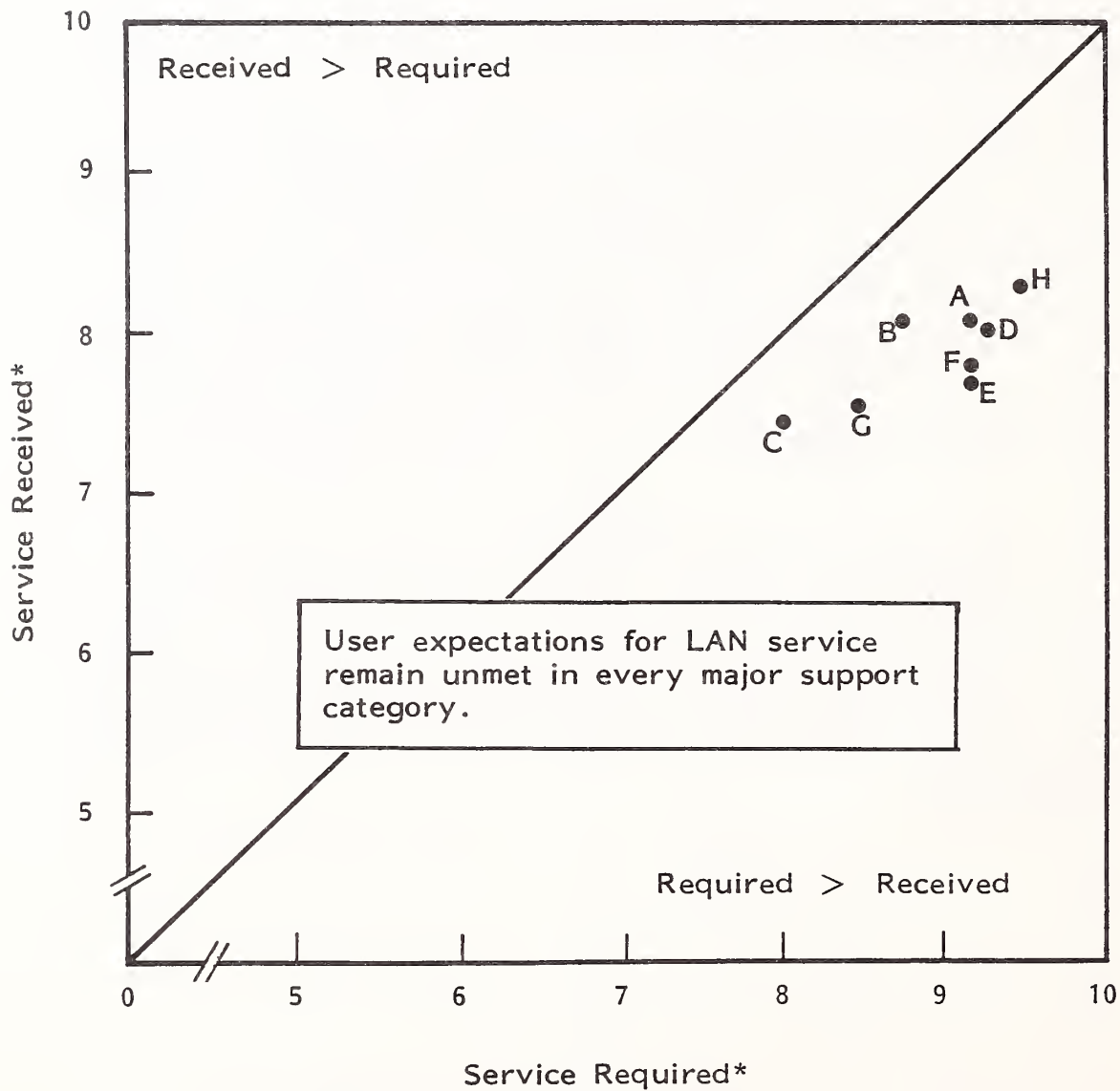
SERVICE CATEGORY	LEVEL OF SERVICE	
	REQUIRED*	RECEIVED*
Overall Support	9.2	8.1
Hardware Maintenance	8.8	8.1
Software Support	8.0	7.4
Vendor Response Time	9.3	8.0
Vendor Repair Time	9.2	7.7
Parts Availability	9.2	7.8
Problem Escalation	8.5	7.5
Field Engineering Skill	9.5	8.3

*Rating: 1 = Low, 10 = High

- As Exhibit III-6 demonstrates, user service requirements are not satisfied in any of the top eight support categories. Critical areas, such as repair time, parts availability, and field engineer skill, are very important to the user, yet vendor performance falls far short of user expectations. INPUT believes that the variance between user requirements for LAN service and the level of service received will ultimately result in customer dissatisfaction.
- Overall, LAN service and support could be considered only adequate at best. Increasingly sophisticated applications are prompting users to consider LAN systems as replacements for minicomputer systems. Therefore, users will also expect the same level of total service and support that they have come to expect from the traditionally service-oriented minicomputer and mainframe vendors. Users will be less willing to think of any system interruption as an individual product problem. Instead, users will treat each LAN as an entire system. Such support and service issues as consulting, training, parts availability, FE skill level, and response and repair times will become increasingly important to users as the total dollar value of processing performance continues to increase dramatically.
- LAN vendors will need to make improvements in almost all service and support as demonstrated in Exhibit III-7. Highest priority should be placed on application-based services, such as consulting, training, and software support, since vendor responsiveness, aided by improved product reliability and increased use of remote diagnostics, continues to provide satisfactory levels of system availability.

EXHIBIT III-7

VENDOR LAN SUPPORT USER REQUIREMENTS VERSUS LEVEL OF SERVICE RECEIVED



- | | |
|--------------------------|-----------------------------|
| A = Overall Support | E = Vendor Repair Time |
| B = Hardware Maintenance | F = Parts Availability |
| C = Software Support | G = Problem Escalation |
| D = Vendor Response Time | H = Field Engineering Skill |

*Rating: 1 = Low, 10 = High

IV SURVEY ANALYSIS: PBXs

- The survey results indicate that the average number of PBX units per installation is 11.9; however, the majority of respondents have between one and three units. This represents all PBX-type switches in any given locale, with many of the units being small- to medium-sized, depending on the organization's size and the physical distribution of the users (see Exhibit IV-1).
- Most PBX users devote 56% of their PBX maintenance budget to external resources, with 44% being dedicated to internal resources.
- The average number of devices attached per PBX unit varied considerably, as illustrated in Exhibit IV-2. The predominate response (33%) indicates that there were between 1 and 100 devices per PBX, while 30% said that they had between 101 and 500 devices per PBX. After 500, the percentages drop dramatically, with 15% stating they had between 501 and 1,000 devices attached and 11% having between 1,001 and 2,000 services.
- Manufacturers and vendors were most active in PBX service and support, as reported in Exhibit IV-3. The combined effects of product low cost and high reliability have slowed TPM involvement in this product area, with third parties capturing considerably less than 10% of most of the four support areas.
- With the growing importance of network planning for those users who build their telecommunications system around PBXs, it is alarming that network

EXHIBIT IV-1

PBX DEMOGRAPHICS

Average PBXs per Installation	11.9
PBX Maintenance Budget	
Internal Resources	44%
External Resources	56%
Total Respondents	53

EXHIBIT IV-2

AVERAGE DEVICES PER PBX

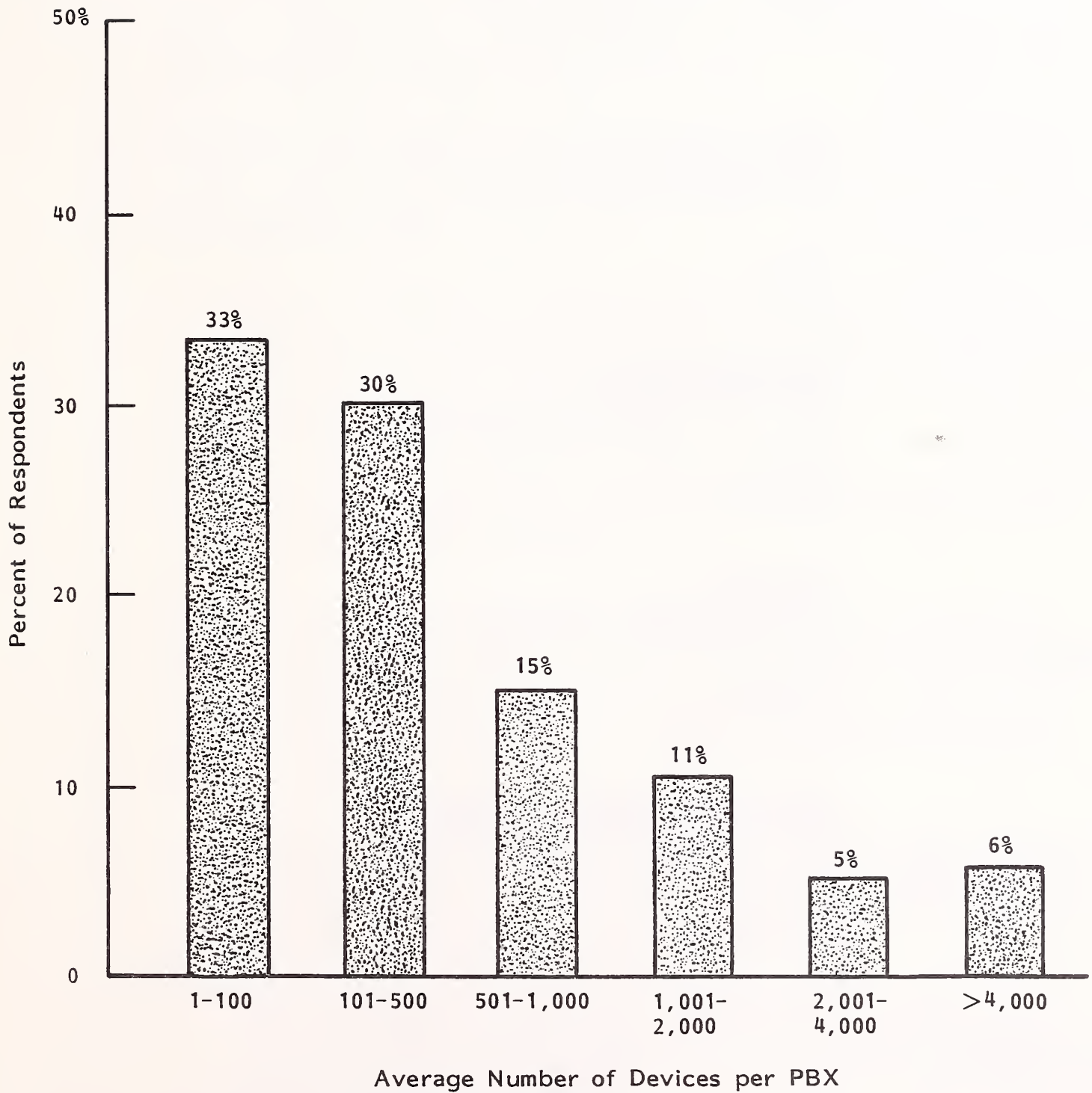
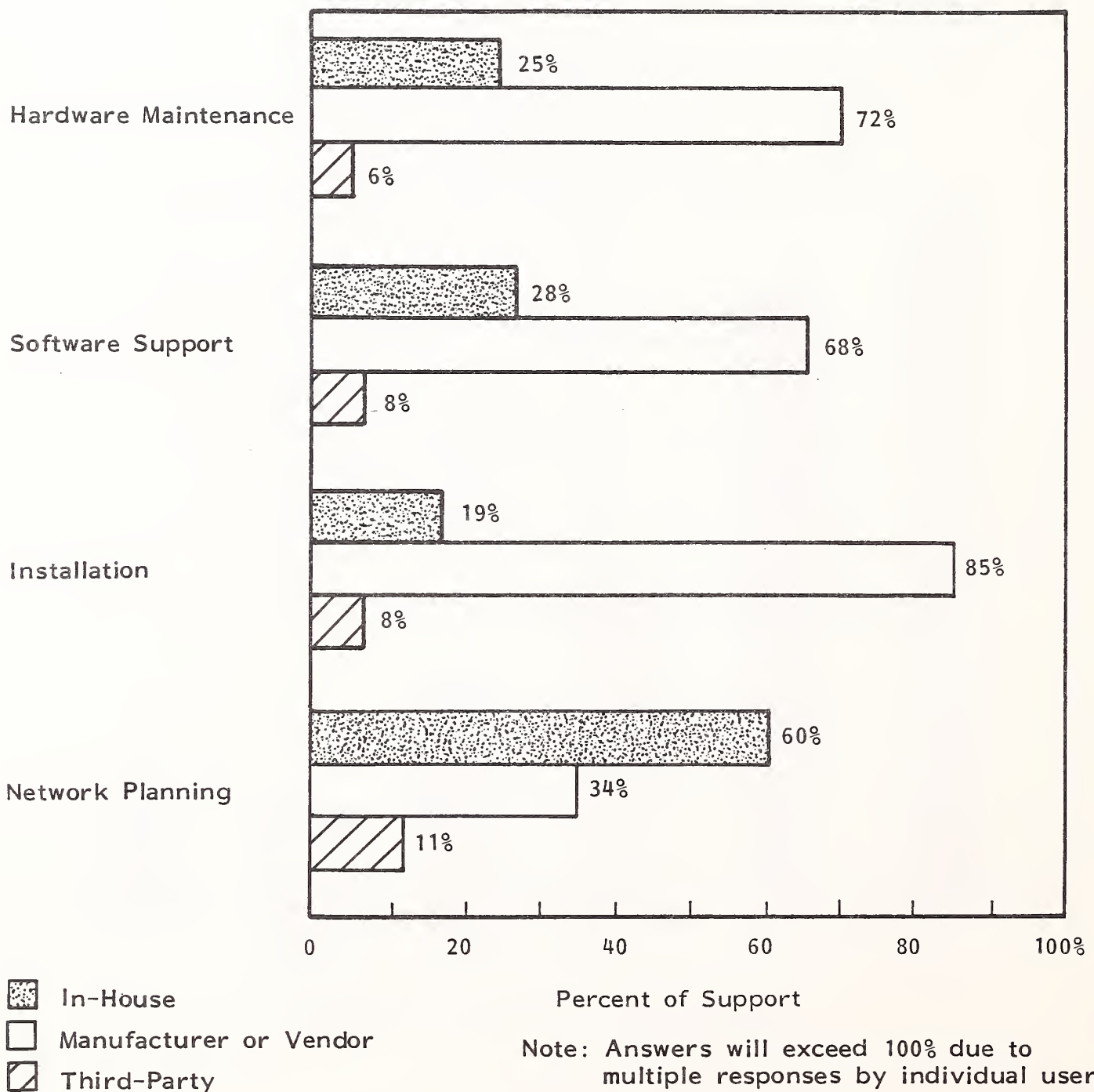


EXHIBIT IV-3

SUPPORT SERVICE DISTRIBUTION PBX



planning accounted for only 34% of the vendor-related support. Instead, 60% of the users have gone in-house for this support.

- It can be concluded that in most organizations, support services reside primarily with the manufacturer or vendor, most companies provide support on an on-site basis, and apparently few go to third-party suppliers or vendors. In this manner, responsibility is easy to fix, and the user role is to maintain control of the level of support they receive.
- In analyzing system interruptions (see Exhibit IV-4), of the two kinds of interruptions that were delineated, most respondents experienced four or less interruptions per month.
 - There is an increase in the number of respondents who had between 4.1 and 6.1 interruptions, then the curve declines again when the number of interruptions reads 6.1, with a continual decline until the curve flattens out after 10 interruptions per month.
 - For survey purposes, more than five interruptions per month were considered to be unacceptable.
- The greatest number of respondents experienced from one to two interruptions per month (21.9%), 18.8% reported three per month, 6.3% said they had four per month, but 12.5% had between four and six per month. Those experiencing seven or more interruptions per month comprise 21.8% of 24 respondents.
- Respondents were asked to evaluate and rank three critical issues: overall satisfaction, user satisfaction with response time, and user satisfaction with repair time. The results are shown in Exhibit IV-5.
 - Using a scale of from 1 to 10 (10 being highest), the adjusted mean of the responses for all three categories was 8.1%, this being quite high a ranking on the use rating scale.

EXHIBIT IV-4

AVERAGE NUMBER OF PBX SYSTEM INTERRUPTIONS (Per Month)

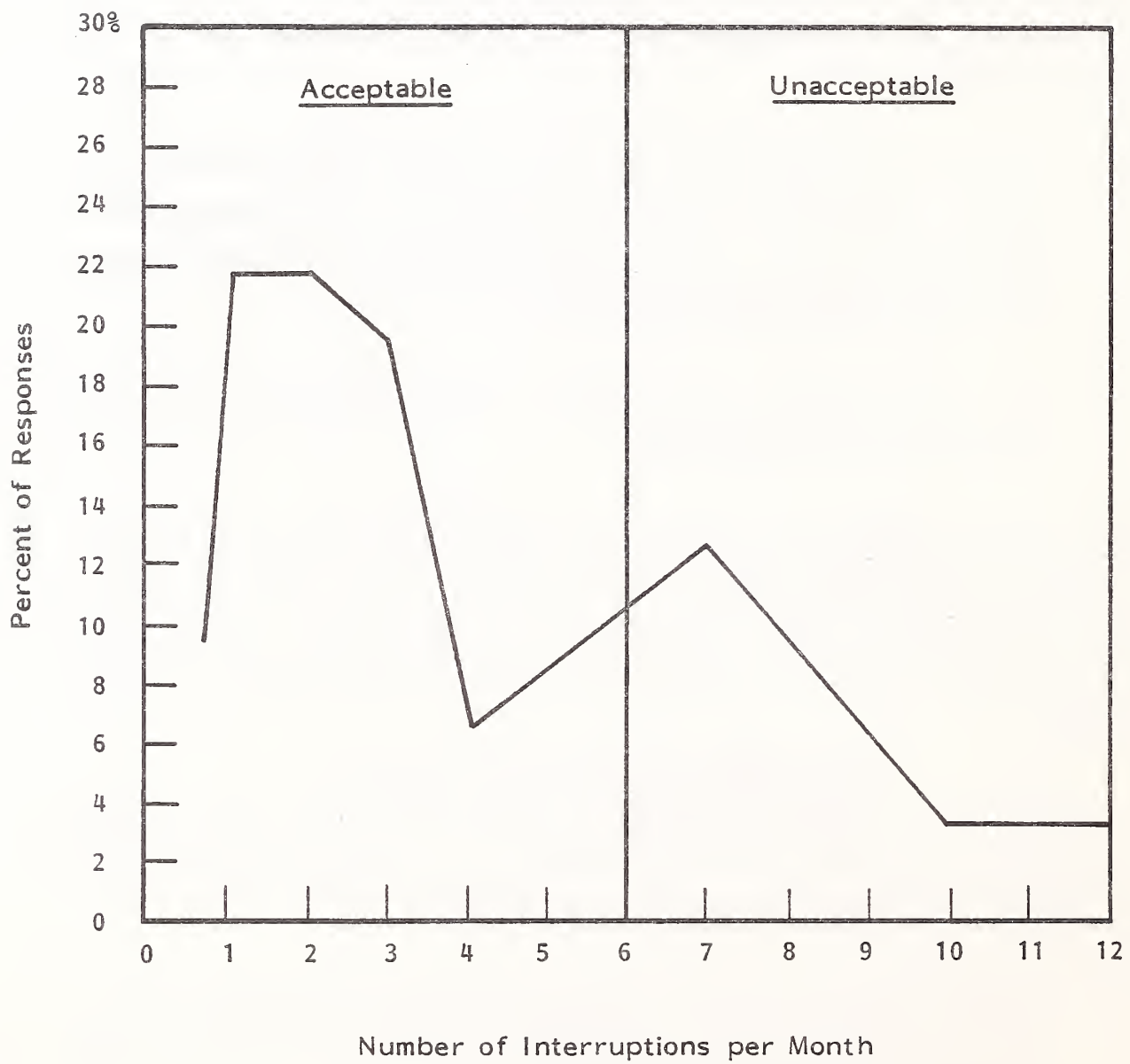


EXHIBIT IV-5

SERVICE COMPONENT DATA PBX

SERVICE COMPONENT	USER RATING*
Overall Satisfaction	8.1
Satisfaction with Response Time	8.1
Satisfaction with Repair Time	8.1

*Rating: 1 = Low, 10 = High

SERVICE COMPONENT	EXPECTED	RECEIVED
Average Number of Software Interruptions per Month	-	1.5
Average Number of Hardware Interruptions per Month	-	1.5
Average Systems Availability	98.9%	97.0%
Average Systems Availability During Normal Business Hours (8am - 5pm)	99.2%	95.8%
Average Vendor Response Time (Hours)	3.5	5.6
Average Vendor Repair Time (Hours)	6.3	13.1

- These figures indicate a fairly high level of PBX service satisfaction, further indicating that support organizations and/or personnel are doing a competent job. However, user service expectations are also quite high, and we will see that vendor performance does not quite match user requirements.
- In evaluating the service component of PBX support, a number of factors were evaluated, similar to the factors used in the section on LANs. Here, again, expectations were measured against received service.
- The average systems availability, that bellwether of service, showed an expectation of 98.9% and a received service value of 97.0%. Here, supplied levels of service almost matched expectations; however, because of the growing dependence on PBX availability, this shortfall in vendor performance is significant.
- A greater discrepancy exists between service expected and service received if we confine the evaluations to normal business hours. Here, the differences are significant--99.2% was expected, but only 95.8% was received.
- In evaluating the vendor response and repair times, the delivered level of service in both cases was worse than expectations. For response time, the figure is 3.5 hours, but the delivery was 5.6 hours; for repair time, the user expected 6.3 hours, but it actually took 13.1 hours.
- This indicates that as far as PBXs are concerned, the user received poorer vendor response than anticipated.
- In measuring user service satisfaction, several criteria were developed; these are delineated in Exhibit IV-6. The overall requirement for PBX support is a survey-high 9.5, but as the exhibit demonstrates, users report a low level of service received (8.1). INPUT believes that user perception of poorly trained

EXHIBIT IV-6

1985 USER SATISFACTION PBX

SERVICE CATEGORY	LEVEL OF SERVICE	
	REQUIRED *	RECEIVED *
Overall Support	9.5	8.1
Hardware Maintenance	9.1	8.3
Software Support	8.7	7.6
Vendor Response Time	9.4	8.1
Vendor Repair Time	9.4	8.1
Parts Availability	9.4	8.4
Problem Escalation	9.0	8.0
Field Engineering Skill	9.5	8.4

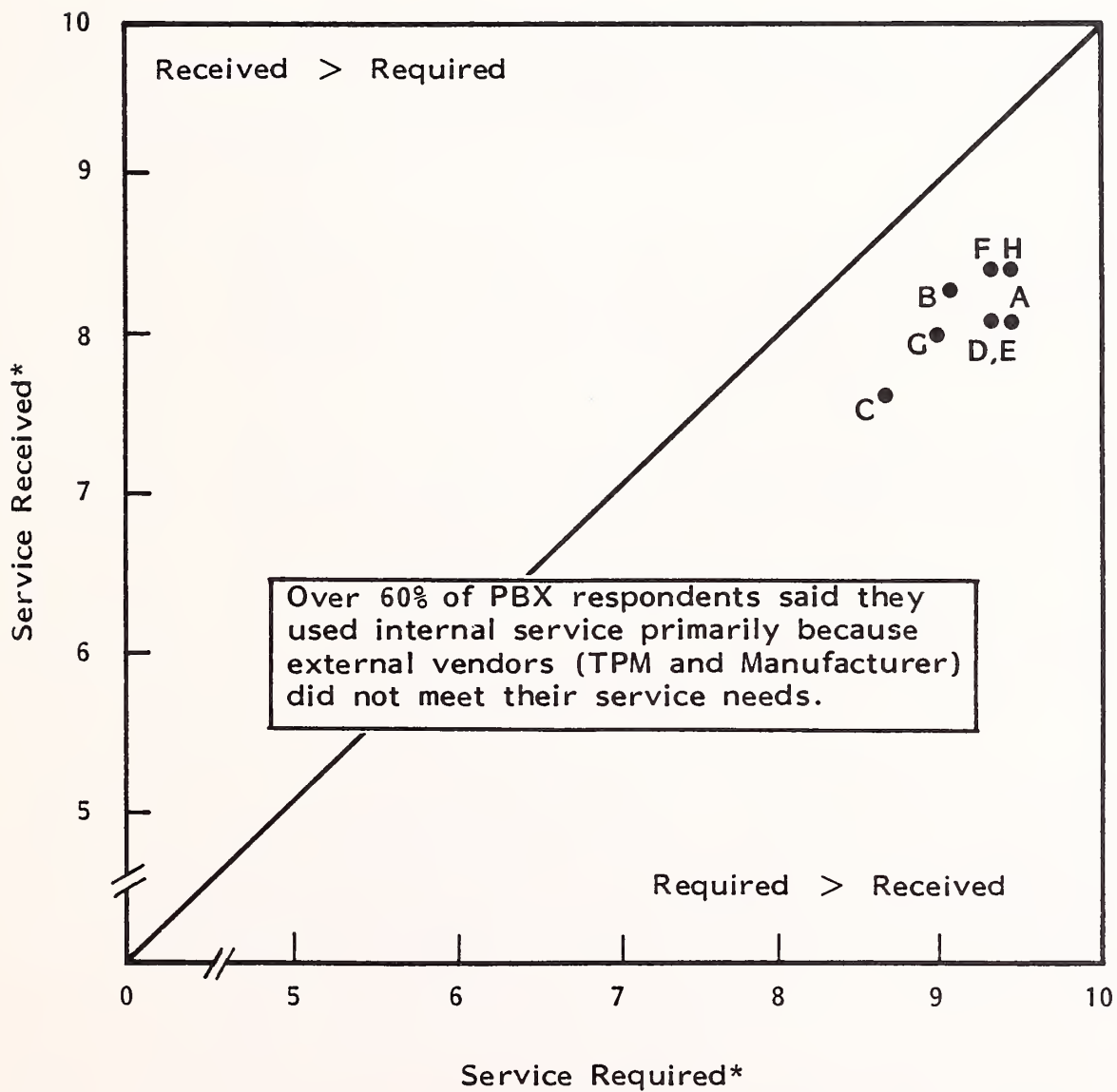
*Rating: 1 = Low, 10 = High

technicians, inadequate parts availability, and far below average software support are instrumental in lowering user satisfaction with PBX service.

- Users expressed a relatively high level of satisfaction with PBX service, particularly in field engineering skill level, parts availability, vendor response, and overall support. Vendor performance, however, does not meet user expectations in any of these high priority areas.
- Exhibit IV-7 graphically demonstrates the inadequacy of PBX service performance. Users reported to INPUT that, in the absence of adequate service from their PBX vendor, many services, such as planning, are carried out internally. Not only does this result in reduced revenues, it lowers the vendor's account control as well.
- As in the case of LANs (discussed earlier), this exhibit graphically depicts the intersection of the level of services the user anticipates and that which they actually receive. Again, the higher the expectation or requirement for service, the less likely they are to receive the level they expect.
- It is significant that even though PBX products are quite correctly referred to as high-reliability products, user requirements for service and support are still very high; much higher, in fact, than the corresponding satisfaction levels they receive. This suggests two factors that many vendors overlook:
 - Many telecommunications users view their individual products as an integral part of a whole telecommunications systems, highlighting the necessity of complete network management versus individual (and selective) product support.
 - Many post-sales support offerings, such as consulting and training, are as important to telecommunications users as more traditional maintenance and support activities.

EXHIBIT IV-7

VENDOR PBX SUPPORT USER REQUIREMENTS VERSUS LEVEL OF SERVICE RECEIVED



- | | |
|--------------------------|-----------------------------|
| A = Overall Support | E = Vendor Repair Time |
| B = Hardware Maintenance | F = Parts Availability |
| C = Software Support | G = Problem Escalation |
| D = Vendor Response Time | H = Field Engineering Skill |

*Rating: 1 = Low, 10 = High

V SURVEY ANALYSIS: NETWORKS

- To better evaluate the demographics of networks, it was necessary to break down the composition factor of respondents' networks. These are classified as shown in Exhibit V-1.
 - The important point to consider is that 84.5% of all the respondents indicated that their networks consisted of leased line networks, while only 5.2% were using Value Added Networks.
 - Switched line networks were used by 63.8% of the respondents. This is not in conflict with the leased line percentage since many respondents use more than one type of network.
- Maintenance budget distribution for networks was 57.3% for external maintenance and 42.7% for internal maintenance.
- The annual line expense (see Exhibit V-2) was \$101,000 to \$500,000 for 28% of the respondents, \$501,000 to \$1 million for 23%, and, for the smaller users, \$11,000 to \$50,000 for 21%, and up to \$10,000 for 16%. Respondents spending \$1 million for line expenses constituted only 5% of all the respondents.
- The support service distribution needs to be examined, this time for networks. As with LANs and PBXs, four major categories were evaluated: hardware maintenance, software support, installation, and network planning (see Exhibit V-3).

EXHIBIT V-1

NETWORK DEMOGRAPHICS

Composition of Respondent Networks*	
Leased Lines	84.5%
Switched Lines	63.8%
VANs	5.2
Satellites	6.9
Other	3.4
Network Maintenance Budget	
Internal	42.7%
External	57.3%
Total Respondents	58

* Respondents had multiple networks

EXHIBIT V-2

ANNUAL LINE EXPENSE

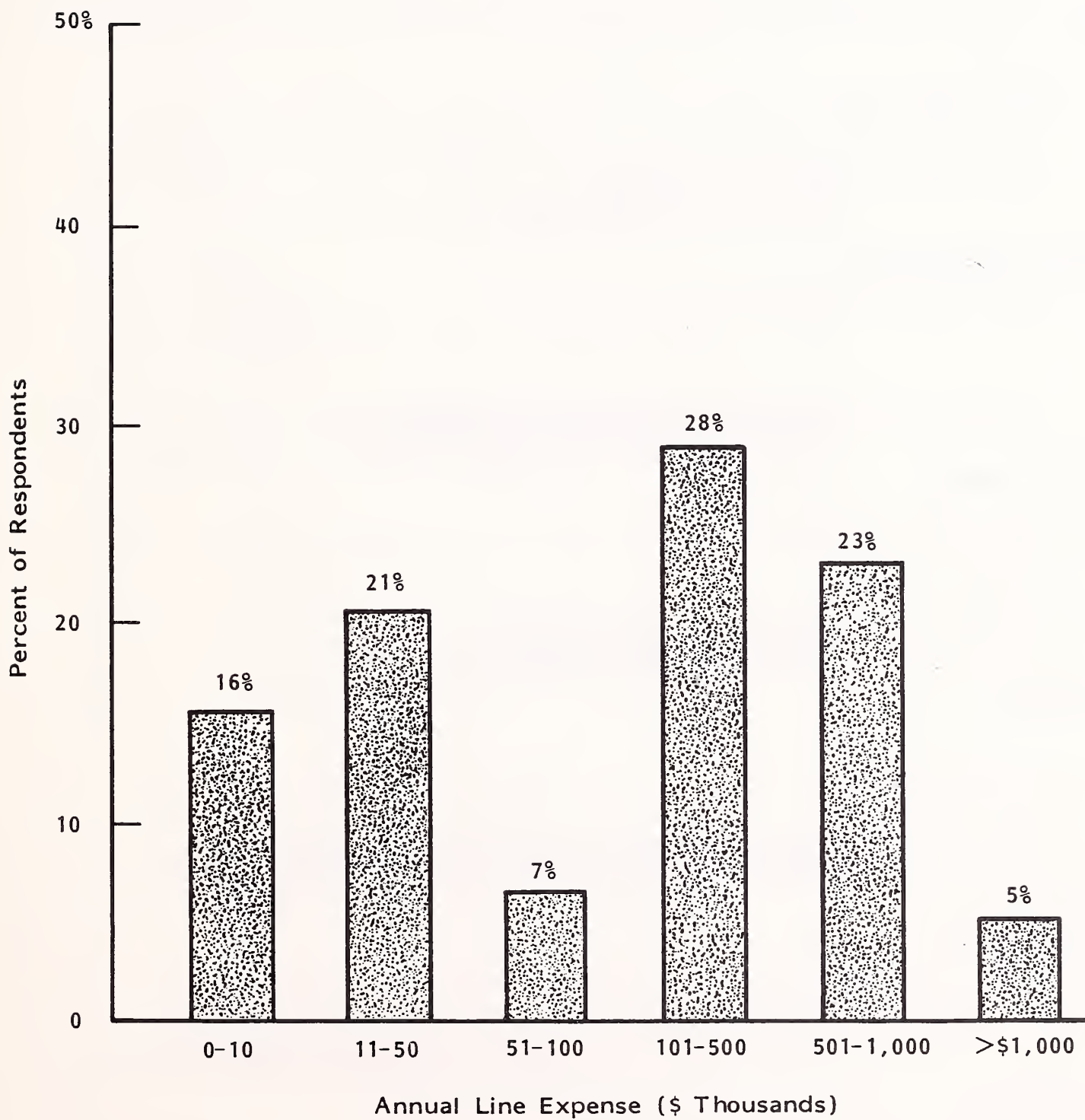
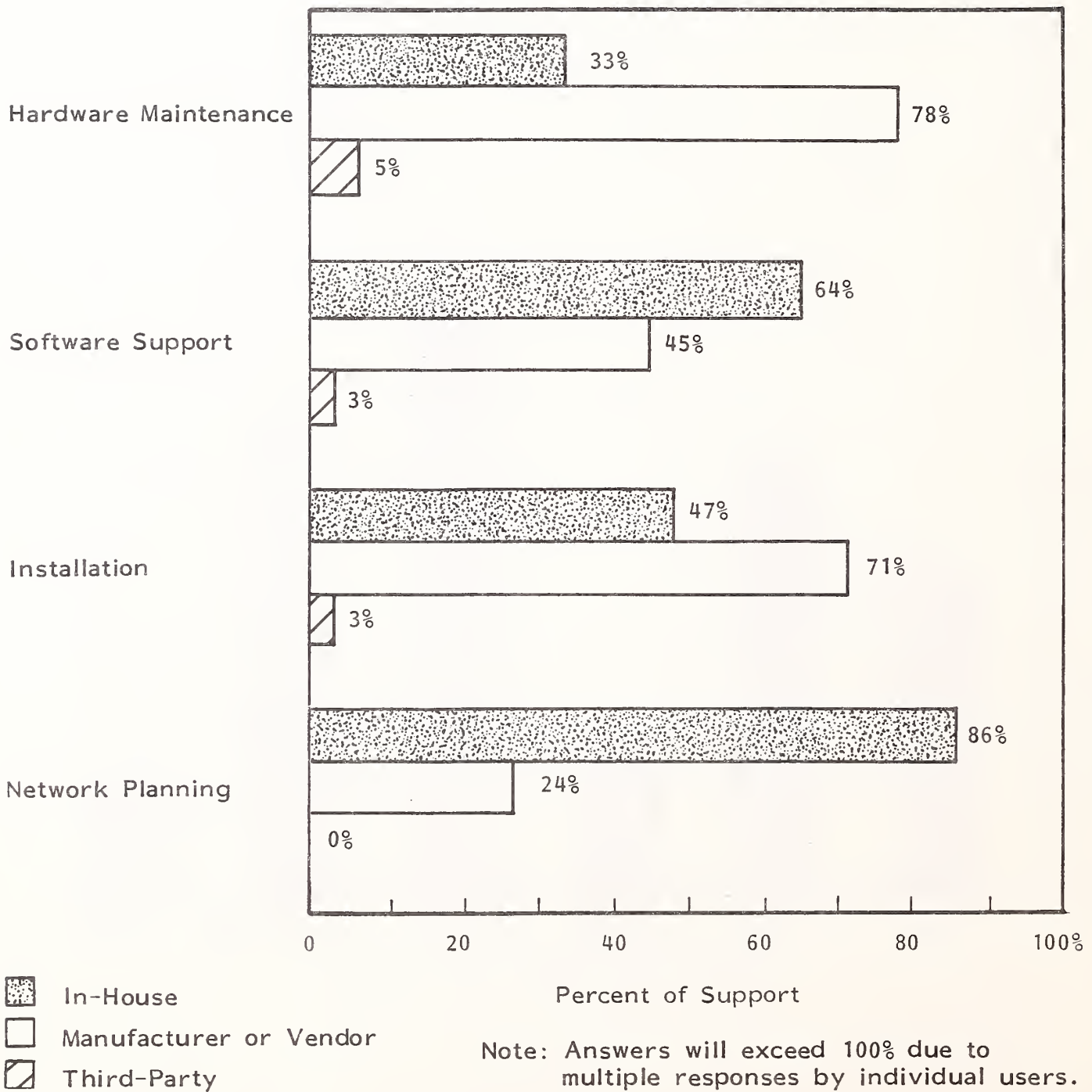


EXHIBIT V-3

SUPPORT SERVICE DISTRIBUTION NETWORK



- Network users appear to rely heavily on the manufacturers or vendors for hardware maintenance (78%) and installation (71%). On the other hand, vendor involvement in software support is surprisingly limited--only 45% of the users receive software support from their vendors and only 24% receive network planning support from the vendors. This leads to two conclusions:
 - Users, frustrated with the quality and quantity of vendor support have taken over the responsibility for software support (64% of the users perform software support in-house) and network planning (performed in-house by 86% of the users surveyed).
 - Although third-party involvement in each area is very limited, these areas represent virtually untapped markets.
- The average number of system interruptions is broken down into two distinct categories--acceptable and unacceptable (see Exhibit V-4).
 - Of the respondents, 28.8% reported two interruptions per month (only 1.9% said they had one), while 25.0% said they experienced 2 to 2.5 interruptions. Of the remaining respondents, 21.1% had between five and seven interruptions, 9.6% had 10 to 18 interruptions, and 13.6% had more than 20 interruptions per month.
- The three elements of the service component are delineated in Exhibit V-5. Note that overall satisfaction with network service and satisfaction with response and repair time are relatively lower than in the other telecommunications areas.
- User dissatisfaction with service is further illustrated in Exhibit V-6, which clearly demonstrates that user service requirement levels in all key service areas are far below what is received.

EXHIBIT V-4

AVERAGE NUMBER OF NETWORK SYSTEM INTERRUPTIONS
(Per Month)

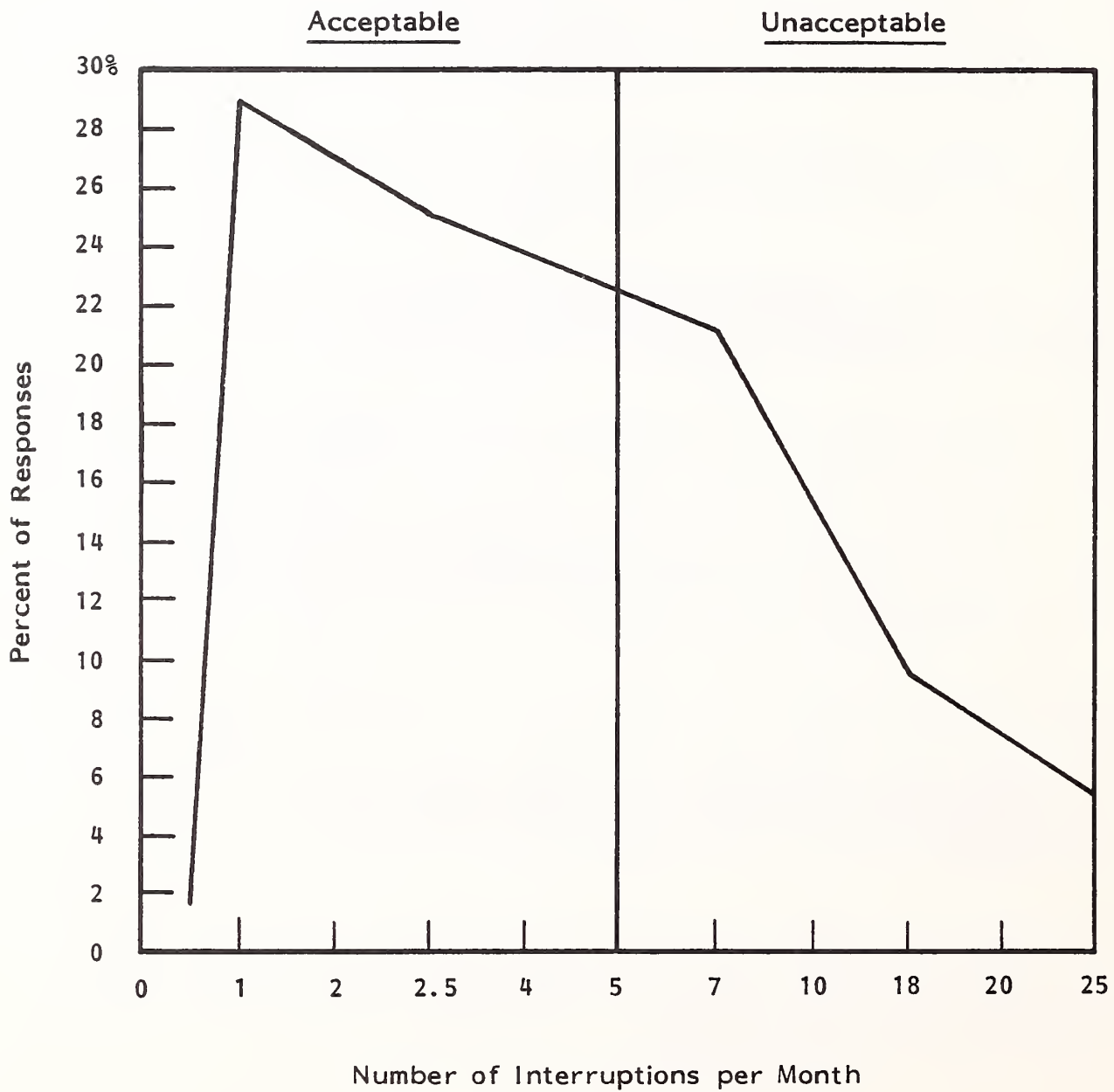


EXHIBIT V-5

SERVICE COMPONENT DATA NETWORK

SERVICE COMPONENT	USER RATING*
Overall Satisfaction	7.7
Satisfaction with Response Time	7.5
Satisfaction with Repair Time	7.5

*Rating: 1 = Low, 10 = High

SERVICE COMPONENT	EXPECTED	RECEIVED
Average Number of Software Interruptions per Month	-	3.4
Average Number of Hardware Interruptions per Month	-	4.7
Average Systems Availability	98.2%	94.3%
Average Systems Availability During Normal Business Hours (8am - 5pm)	98.5%	95.1%
Average Vendor Response Time (Hours)	4.1	7.0
Average Vendor Repair Time (Hours)	5.2	10.0

EXHIBIT V-6

1985 USER SATISFACTION NETWORK

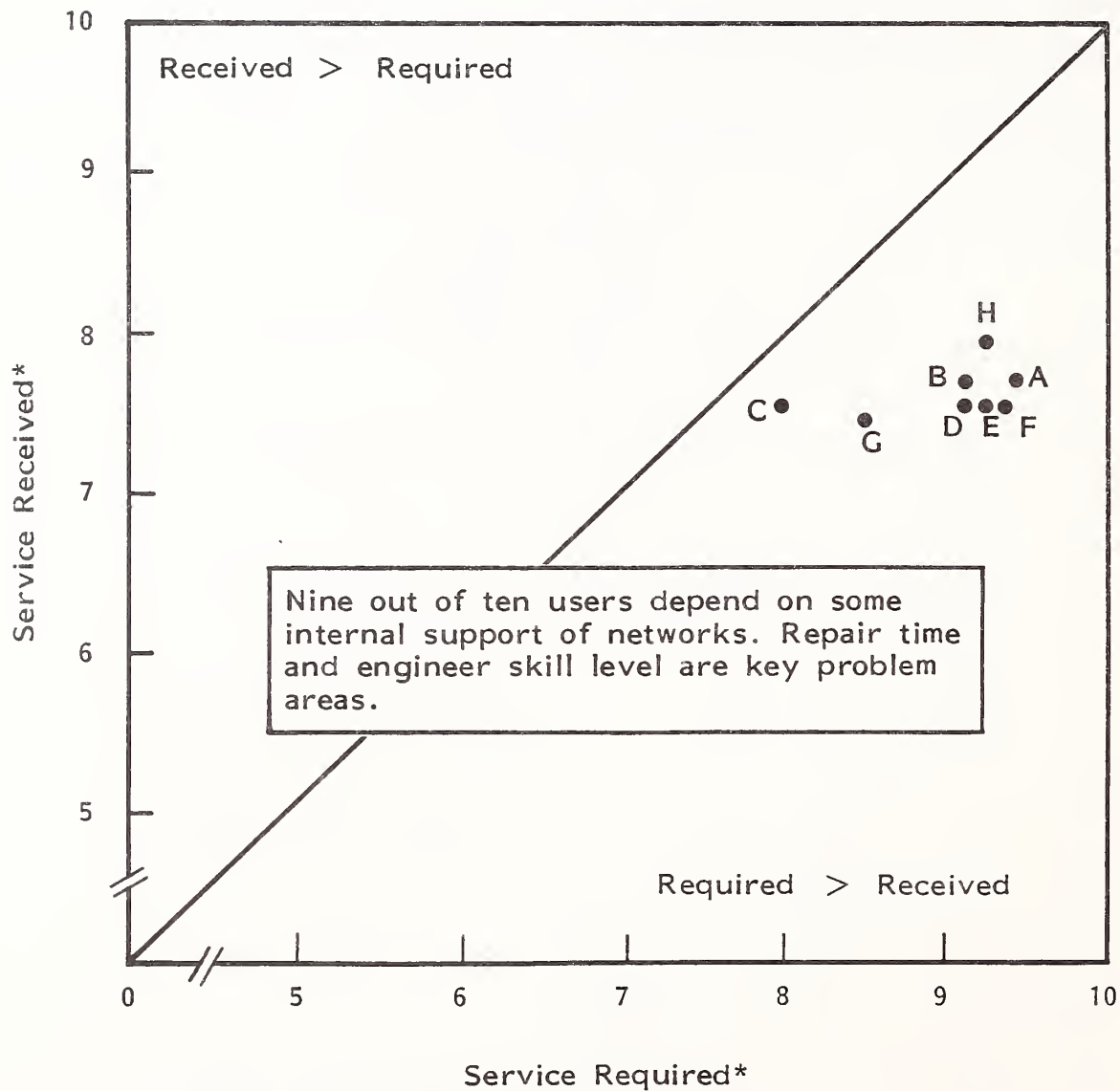
SERVICE CATEGORY	LEVEL OF SERVICE	
	REQUIRED*	RECEIVED*
Overall Support	9.4	7.7
Hardware Maintenance	9.1	7.7
Software Support	8.0	7.5
Vendor Response Time	9.1	7.5
Vendor Repair Time	9.1	7.5
Parts Availability	9.2	7.8
Problem Escalation	8.5	7.4
Field Engineering Skill	9.2	7.9

*Rating: 1 = Low, 10 = High

- Exhibit V-7 again shows the required versus received level of service graphically. Again, it must be stressed that the quality of service needs to be changed to more closely approximate the users' expectations, or users will perceive that the value of all services are dependent upon the quality of a few services.
- The obvious dissatisfaction with network service and support has led many large systems users to develop and maintain their own service and support capabilities. As user reliance on networks increases, combined with the growing complexity of these applications, network support vendors will need to improve their support offerings drastically to provide better service for their users.

EXHIBIT V-7

VENDOR NETWORK SUPPORT USER REQUIREMENTS VERSUS LEVEL OF SERVICE RECEIVED



- | | |
|--------------------------|-----------------------------|
| A = Overall Support | E = Vendor Repair Time |
| B = Hardware Maintenance | F = Parts Availability |
| C = Software Support | G = Problem Escalation |
| D = Vendor Response Time | H = Field Engineering Skill |

*Rating: 1 = Low, 10 = High

VI SURVEY ANALYSIS: OVERALL

- This section has been provided to demonstrate overall trends in telecommunications service and support. In general, all telecommunications users have similar service and support needs, primarily a high level of system availability with assistance in the optimum use and management of their systems.
- Support budgets for LANs, PBXs, and networks are distributed as follows: 56% of the budget is used for external support and 44% for internal support. Exhibit VI-1 shows the breakdown for each of these telecommunications categories and defines the allocation for both internal and external support activities.
- With respect to the distribution of support services by type of support required, Exhibit VI-2 shows the breakdown by possible delivery modes, whether in-house, by manufacturer or vendor, or by third-party maintenance (TPM) contract.
 - In analyzing the exhibit, note particularly that 76% of the respondents said that hardware maintenance was left primarily to the manufacturer or vendor, 59% said they left software support to that group, and 74% stated they entrusted installation to either the equipment or software manufacturer or vendor. Only in the case of network planning was the majority of the support service left resident in-house, with 77% of the users saying they performed this service themselves.

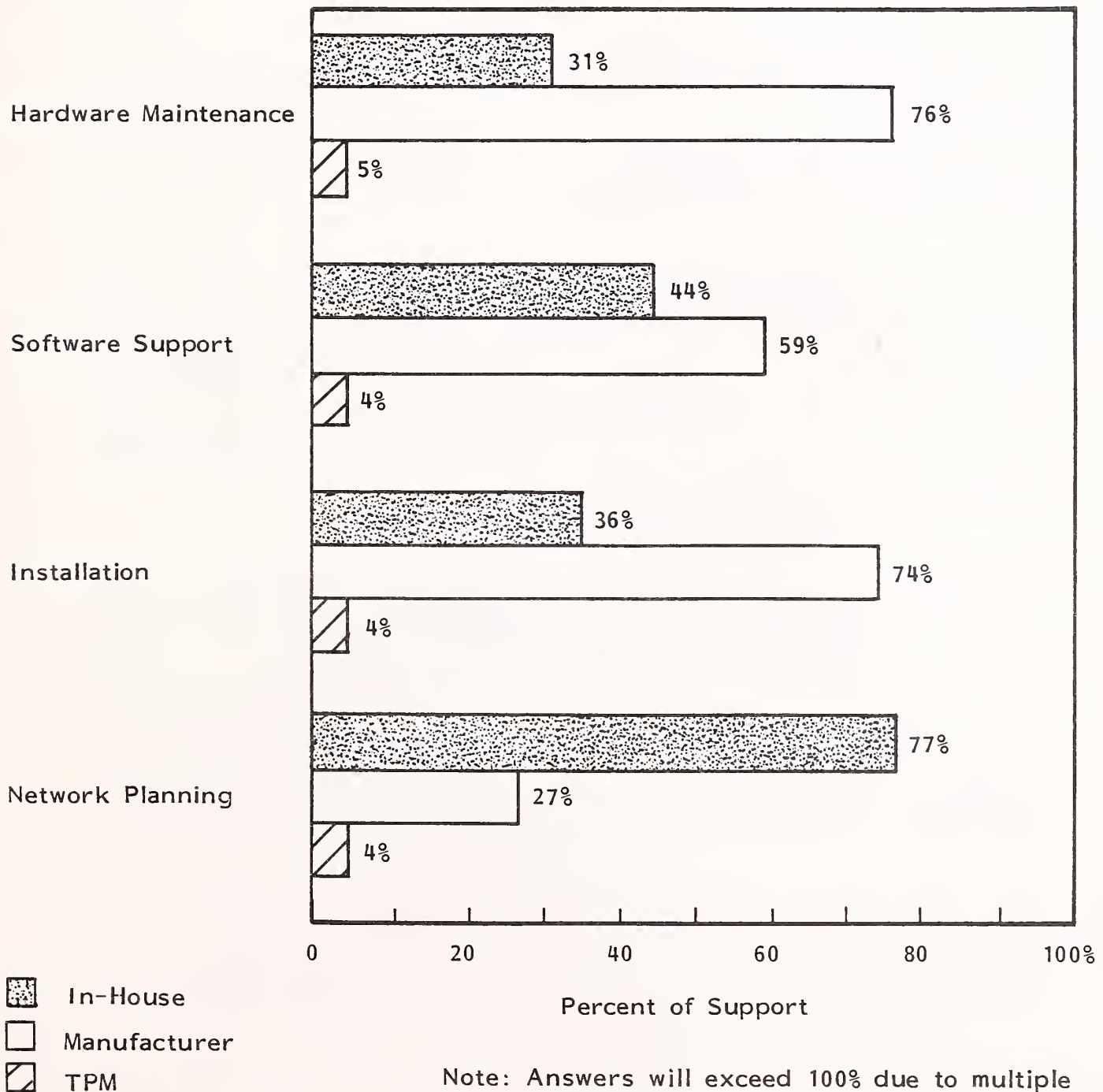
EXHIBIT VI-1

OVERALL SUPPORT BUDGET DISTRIBUTION

	INTERNAL	EXTERNAL
LAN	47.7%	52.3%
PBX	44.0	56.0
Network	42.7	57.3
Overall	44.0%	56.0%

EXHIBIT VI-2

TELECOMMUNICATIONS SUPPORT SERVICE DISTRIBUTION



- As far as third-party maintenance was concerned, in no case was overall support left in their hands. The telecommunications market in general has been, at least up until now, untouched by third-party service.
- Furthermore, there appears to be little differentiation in support responsibility breakdown between the three product types, as demonstrated by Exhibits VI-3, VI-4, and VI-5. The only exception is in the area of software support, where LAN users have assumed the responsibility of supporting themselves.
- In discussing the three critical service component issues (see Exhibit VI-6), overall satisfaction starts out relatively high at an 8.0 rank, satisfaction with response time ranks 7.9, and repair time has a 7.8 rank. (Ranking is still on a 1 to 10 scale, with 10 being the highest.)
- Actual performance by telecommunications vendors further illuminates the concern expressed by survey respondents, particularly regarding repair times. While prime time (Monday through Friday, 8 a.m. to 5 p.m.) system availability is quite high (96.5%), users requirement levels approach an extremely high 99%. Overall system availability received versus that required exhibits similar user/vendor differences.
- Although user requirements for system availability might be considered excessive, user requirements for response (4.2 hours) and repair (7.3 hours) are very realistic and quite achievable. Vendor performance, especially in the area of repair time, clearly suggests that improvements in service delivery need to be made. Improved serviceability in product design is one method generally accepted by telecommunications vendors, particularly increased remote diagnostics, remote fixes, and further development of redundant capabilities.
- The overall average number of software interruptions per month was 2.3; hardware interruptions numbered 3.4. Plotting the overall number of interruptions per month by the three different media (or products) produces the

EXHIBIT VI-3

MANUFACTURER OR VENDOR SUPPORT

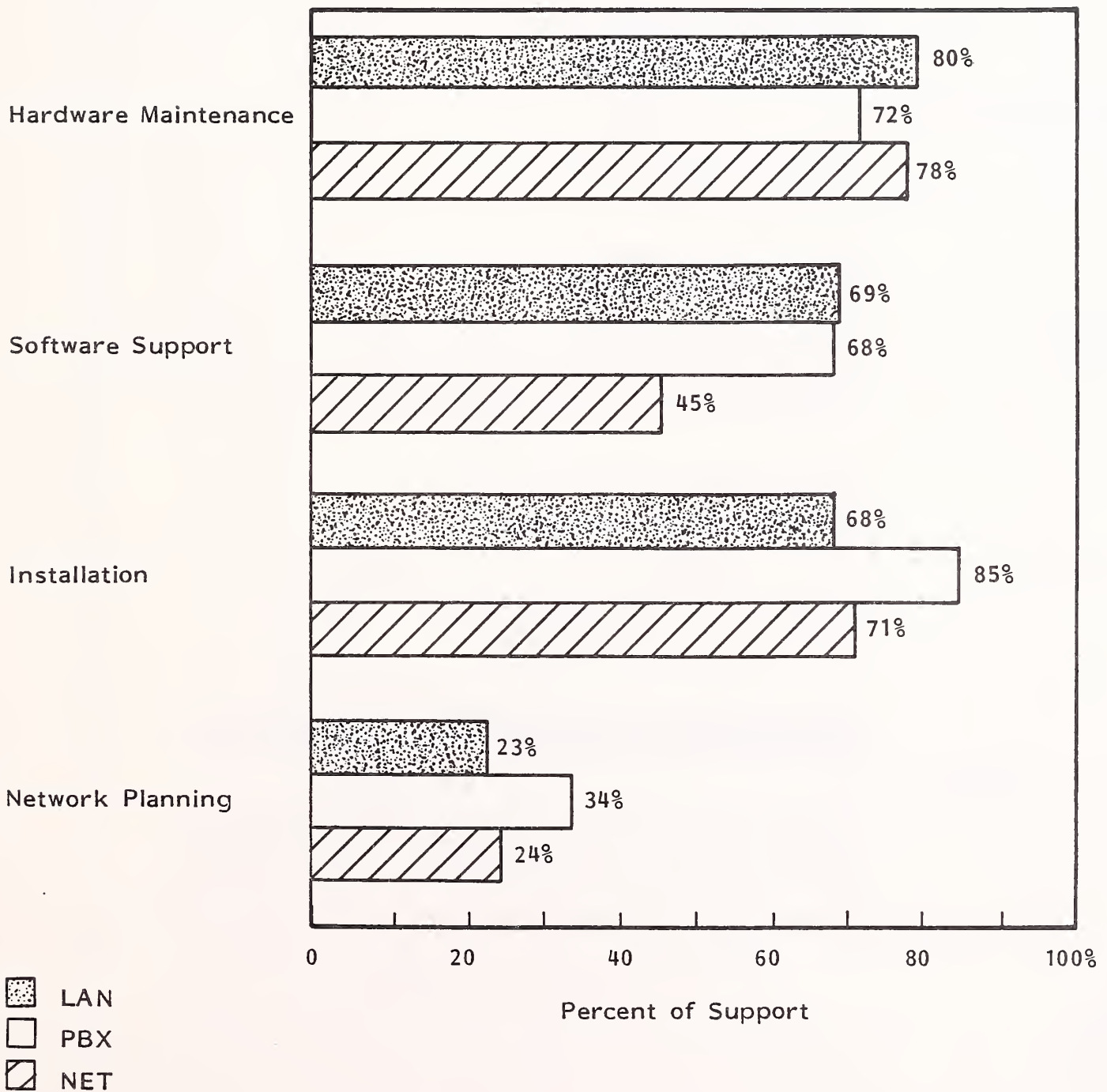


EXHIBIT VI-4

IN-HOUSE SUPPORT

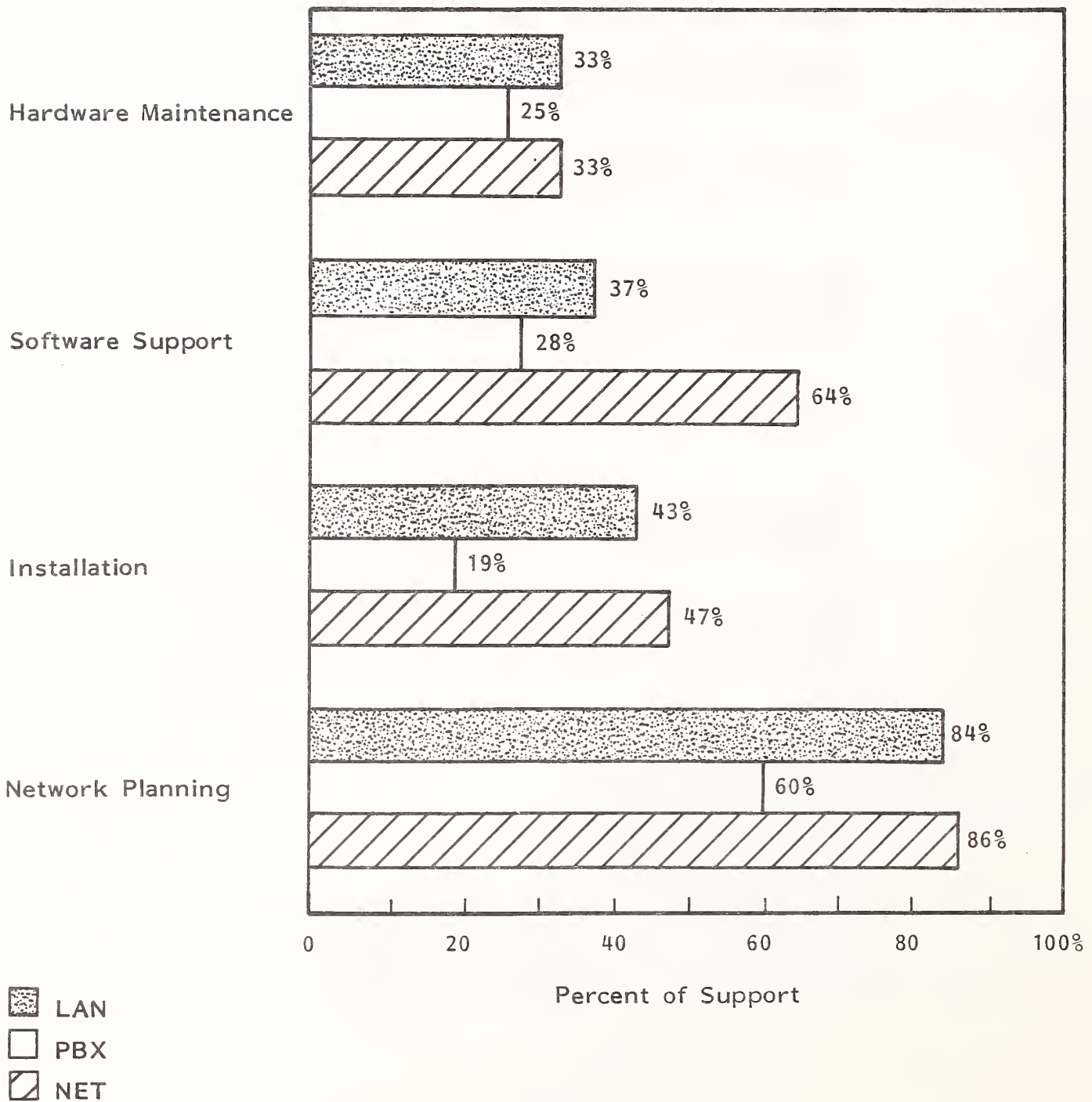


EXHIBIT VI-5

THIRD-PARTY MAINTENANCE SUPPORT

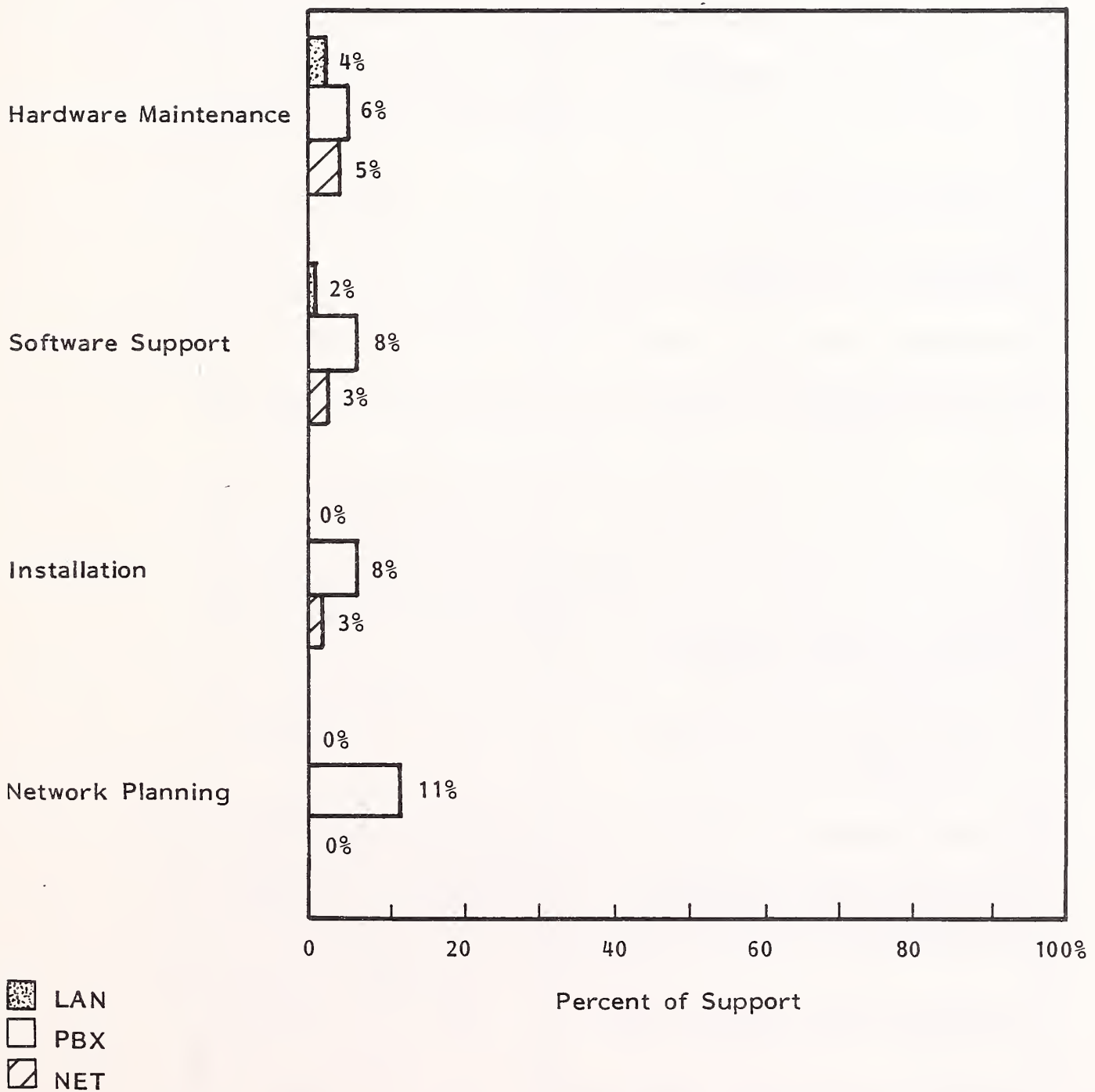


EXHIBIT VI-6

SERVICE COMPONENT DATA OVERALL

SERVICE COMPONENT	USER RATING*
Overall Satisfaction	8.0
Satisfaction with Response Time	7.9
Satisfaction with Repair Time	7.8

*Rating: 1 = Low, 10 = High

SERVICE COMPONENT	EXPECTED	RECEIVED
Average Number of Software Interruptions per Month	-	2.3
Average Number of Hardware Interruptions per Month	-	3.4
Average Systems Availability	98.4%	95.9%
Average Systems Availability During Normal Business Hours (8am - 5pm)	98.9%	96.5%
Average Vendor Response Time (Hours)	4.2	5.9
Average Vendor Repair Time (Hours)	7.3	16.4

graph shown in Exhibit VI-7. Again, the vertical line is the cutoff point between acceptable and unacceptable performance. The differential between LANs, PBXs, and networks shows networks far in front in number of interruptions per month. The fact that the network graph extends out further than does LANs or PBXs may be attributed to the inherent complexity of networks, providing more opportunities for failure.

- The combined overall number of interruptions, shown in Exhibit VI-8 explains what is really happening from a larger view.
 - There is continued degradation of the graph as the number of interruptions per month increases.
 - A slight leveling off of the graph occurs at approximately seven to ten interruptions and then continues to decline as the number of responses to the survey decreases. A slight upswing occurs after 25 interruptions as the number of responses increases.
 - The value of this exhibit lies in the dramatic representation of the overall quality of service for LANs, PBXs, and networks.
 - In-house staff, manufacturers, and third-party maintenance organizations all have some fence-mending to do if they are to achieve and retain credibility in the service support area. The continued decline in service quality cannot be tolerated by the users indefinitely. Training and hiring better quality employees are essential components in the solution.
- Exhibit VI-9 further breaks down telecommunications user service requirements versus vendor actual performance levels for each key service area. It is clear that telecommunications users have very high requirement levels in almost all areas of service, much higher, on a subjective level, than even their data processing counterparts.

EXHIBIT VI-7

NUMBER OF INTERRUPTIONS PER MONTH

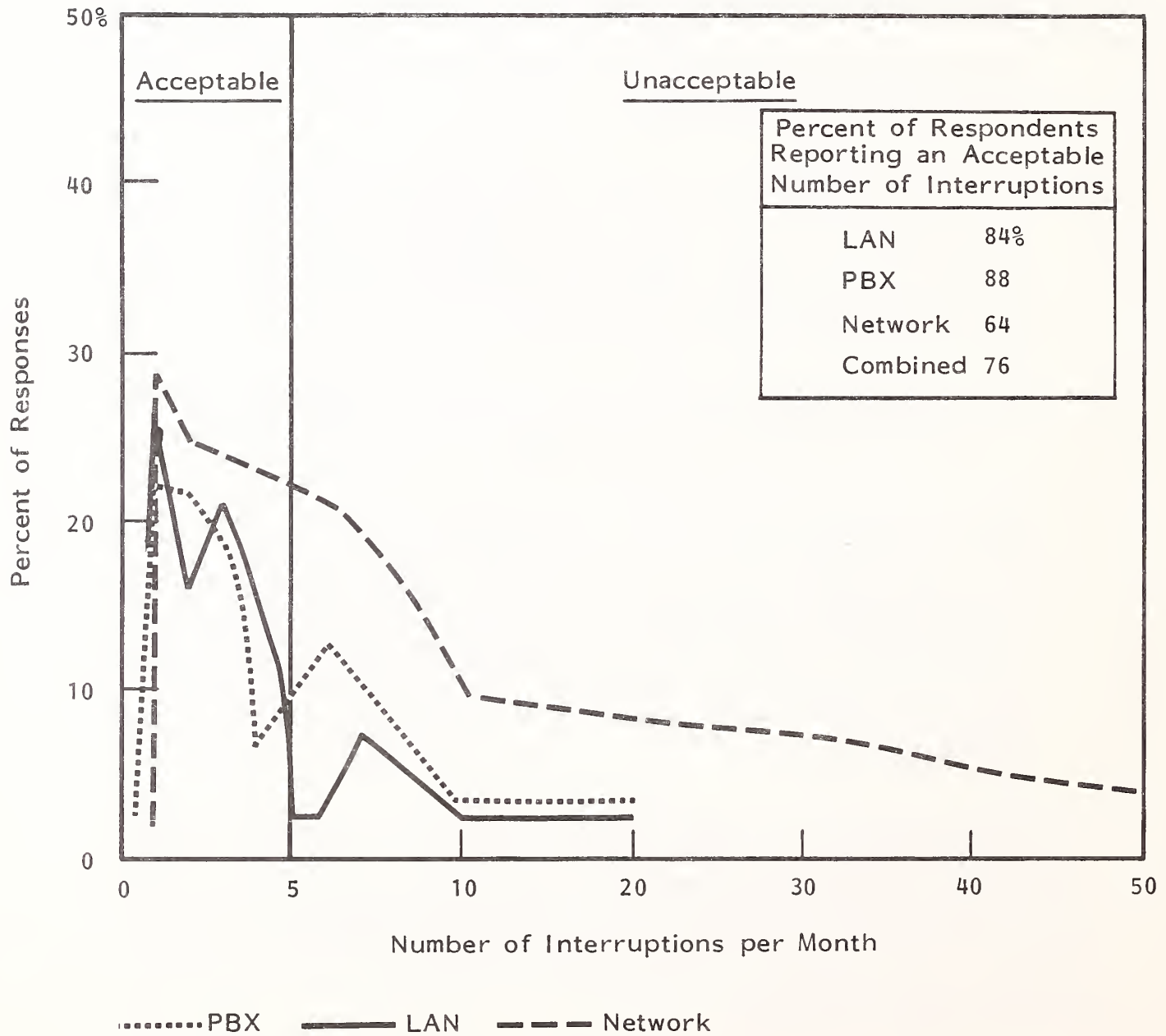


EXHIBIT VI-8

NUMBER OF INTERRUPTIONS PER MONTH
LAN, PBX, AND NETWORK COMBINED

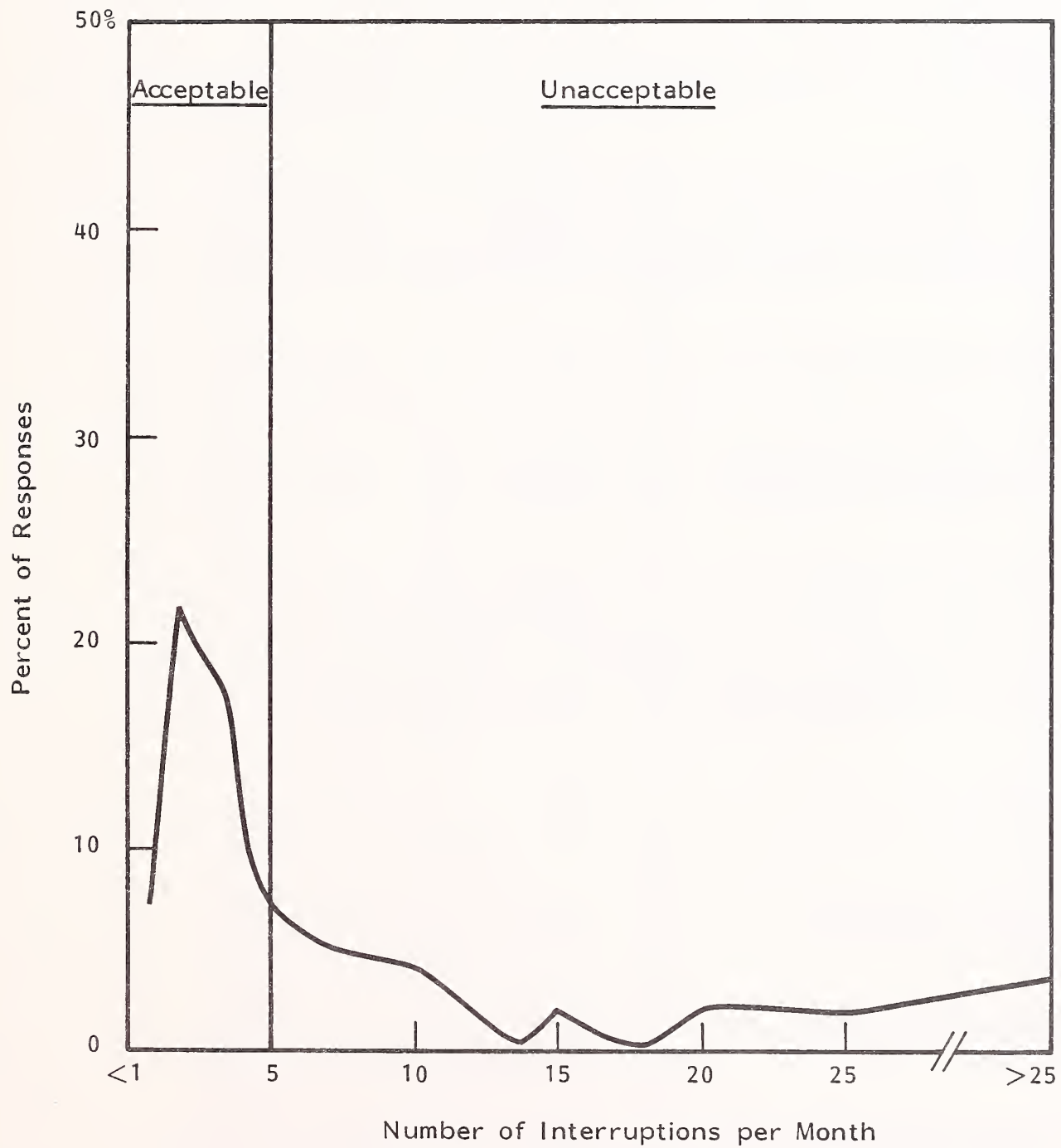


EXHIBIT VI-9

1985 USER SATISFACTION OVERALL

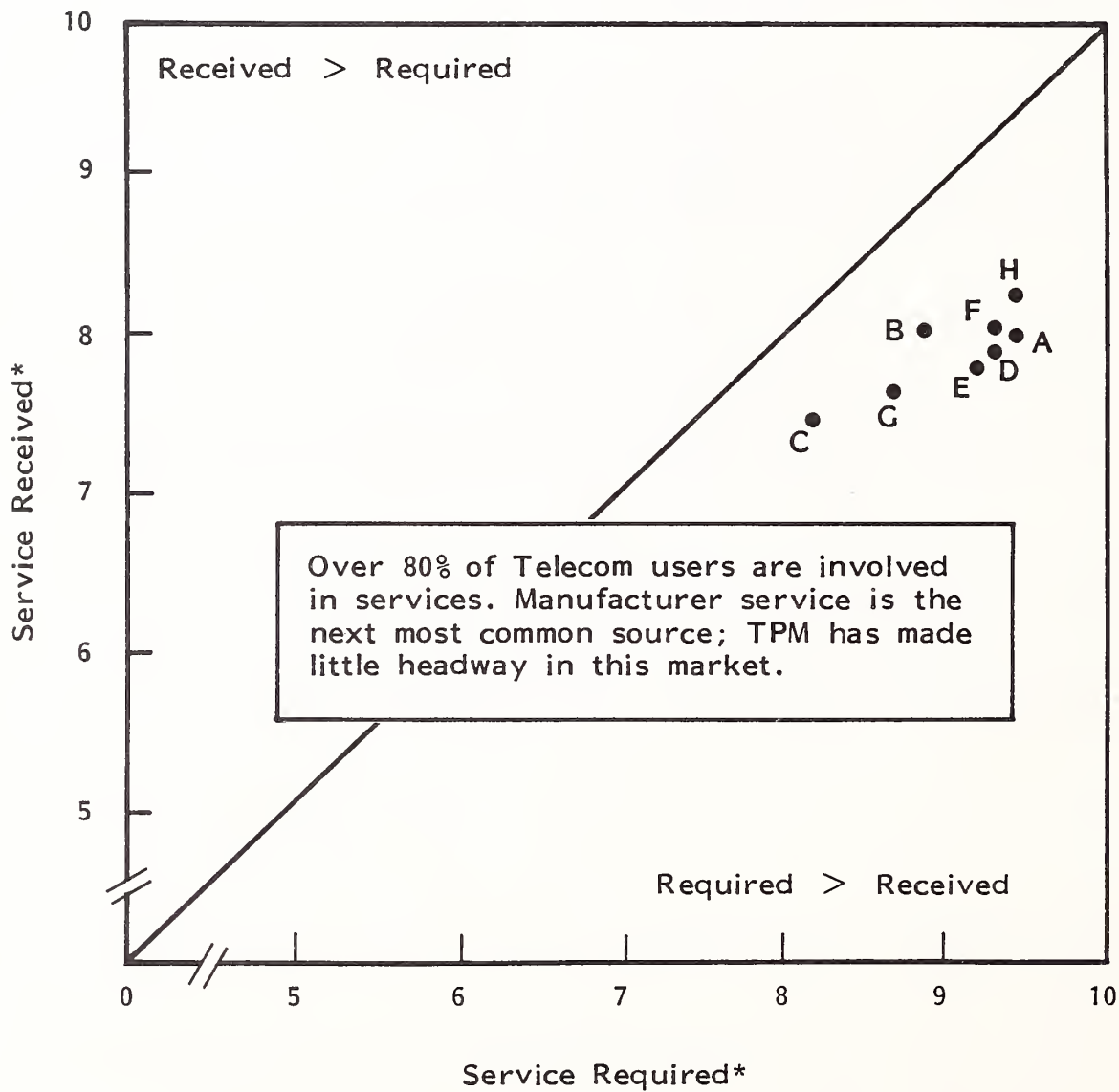
SERVICE CATEGORY	LEVEL OF SERVICE	
	REQUIRED*	RECEIVED*
Overall Support	9.4	8.0
Hardware Maintenance	9.0	8.0
Software Support	8.2	7.5
Vendor Response Time	9.3	7.9
Vendor Repair Time	9.2	7.8
Parts Availability	9.3	8.0
Problem Escalation	8.7	7.7
Field Engineering Skill	9.4	8.2

*Rating: 1 = Low, 10 = High

- It would be simplistic to conclude that vendor performance, which did not come close to user expectations in any of the eight service areas reported by the user sample in Exhibit VI-9, needs to be significantly improved. Realistically, the effort needed to raise performance levels to the levels required by users would be beyond the resource level of most vendors.
- Instead, vendors should attempt to increase user satisfaction using a two-prong strategy.
 - Make needed improvements in service delivery structure, including better recruiting and training of service personnel, improved spares management, and more effective problem escalation procedures.
 - Better educate the user base on service through existing service areas such as training and consulting. These service areas, often left to others as part of the sales function, are high visibility, high satisfaction services that increase user perception to the value of service received.
- Exhibit VI-10 graphically demonstrates the current disparity between user requirements for service versus vendor actual performance. Again, as user service requirements increase, the need for vendors to at least come close to the satisfaction line should become an even higher priority.

EXHIBIT VI-10

OVERALL VENDOR SUPPORT USER REQUIREMENTS VERSUS LEVEL OF SERVICE RECEIVED



- | | |
|--------------------------|-----------------------------|
| A = Overall Support | F = Vendor Repair Time |
| B = Hardware Maintenance | F = Parts Availability |
| C = Software Support | G = Problem Escalation |
| D = Vendor Response Time | H = Field Engineering Skill |

*Rating: 1 = Low, 10 = High

VII TECHNOLOGICAL TRENDS

- In the course of conducting the survey, a number of technological trends among the user community became apparent.
 - There are strong indications of the growth of a national fiber network, particularly among telephone-related companies such as AT&T, SPRINT, and MCI.
 - There is a trend toward microwave and away from leased lines. Microwave is cheaper to install and maintain, although leased lines give better quality transmissions. Transmissions quality for microwave may improve as the advancing technology contributes toward tighter microwave beam width, particularly at higher transmission frequencies.
 - Existing line capacities are constantly being improved as the need for more lines becomes apparent. Faster equipment and greater line capacities per line are contributing to greater throughput and increased traffic.
 - There is a trend toward integrating data terminals with voice telephone switches, thereby permitting a single entity to carry both voice and data.
 - The trend toward higher speed communications (to carry still more traffic) is centered around the growth of T1 communication speeds (1.544 Mbps).

- The demands for higher speeds is also speeding the growth and development of satellites tied into T1 (or higher) transmission speeds.
 - Direct broadcast satellite use is growing, permitting the user to avoid communications middlemen (BOCs, etc.) and receive communications directly from the sender.
 - Fiber optics is another fast growing media, coming into increased use because of its low cost, high speed transmission, and capabilities for handling multiple transmissions.
 - Electronic mail is growing in use, but its continued growth is predicated upon adequate network control systems, which are themselves coming into increased use.
 - Dial-up security is becoming increasingly important, leading to better quality and more secure data transmission (using voice guide lines). This is an important field of development, and increasing emphasis on communications security will see great strides in this area for some years to come.
- The need for adequate telecommunications support is growing, especially with the user preception of vendor concern only with sales and not the service aspects of the business.
 - There is a need to develop LANs for voice and image transmission. Image is a particularly difficult media to transmit over voice lines because of space (size) requirements and difficulties in keeping the transmission intact throughout its journey downline.
 - More sophisticated diagnostics are making it easier to repair or correct equipment and software deficiencies as well as identify where the problem

lies in mixed-vendor shops. It would be even better if a single vendor serviced all telecommunications equipment, but this is not too likely to happen for some years yet.

- The advent of X.25 network protocols to compete with IBM's SNA offering will give users a wider choice and better control over their network configurations, particularly where packet switching and distributed processing are concerned.

APPENDIX A: TABULAR SUMMARY

- Exhibit A-1 summarizes the service component data, and Exhibit A-2 summarizes the user satisfaction data.
 - These exhibits provide a basis for comparison between LAN, PBX, and network data for expected and received levels of service. The percentages of variance between these two factors are included for comparative purposes.
 - Note that the categories are the same as in the survey analysis discussed throughout this report.
- As a general statement, vendor responses are better than expected, even though the satisfaction level is lower than the user would like.

EXHIBIT A-1

SERVICE COMPONENT SUMMARY

SERVICE CATEGORY	EXPECTED			RECEIVED			PERCENT VARIANCE		
	LAN	PBX	NET	LAN	PBX	NET	LAN	PBX	NET
Average Systems Availability Normal Business Hours	98.8	99.2	98.5	96.6	95.8	95.1	(1.9)	(3.4)	(3.5)
Average Vendor Response Time (Hours)	5.2	3.5	4.1	4.8	5.6	7.0	(7.7)	(60.0)	(70.7)
Average Vendor Repair Time (Hours)	5.5	6.3	5.2	13.4	13.1	10.0	(143.6)	(107.9)	(92.3)

EXHIBIT A-2

USER SATISFACTION SUMMARY

SERVICE CATEGORY	EXPECTED			RECEIVED			PERCENT VARIANCE		
	LAN	PBX	NET	LAN	PBX	NET	LAN	PBX	NET
Overall Support	9.2	9.5	9.4	8.1	8.1	9.4	(12.0)	(14.7)	(18.1)
Hardware Maintenance	8.8	9.1	9.1	8.1	8.3	7.7	(8.0)	(8.8)	(15.4)
Software Support	9.3	8.7	8.0	8.0	7.6	7.5	(14.0)	(12.6)	(6.2)
Vendor Response Time	9.2	9.4	9.1	7.7	8.1	7.5	(16.3)	(13.8)	(17.6)
Parts Availability	9.2	9.4	9.2	7.8	8.1	7.8	(15.2)	(13.8)	(15.2)
Problem Escalation	8.5	9.0	8.5	7.5	8.0	7.4	(8.2)	(11.1)	(12.9)
Field Engineering Skill	9.5	9.5	9.2	8.3	8.4	7.9	(12.6)	(11.6)	(14.1)

APPENDIX B: QUESTIONNAIRE

PBX

1. How many PBXs do you have and how long have they been installed?

<u>Number of PBXs</u>	<u>Vendor</u>	<u>Number Devices/PBX</u>	<u>Install Data</u>
_____	_____	_____	_____
_____	_____	_____	_____
_____	_____	_____	_____

2. Who performs the following services on your PBXs?

	<u>In-House</u>	<u>Manufacturer</u>	<u>TPM</u>
Hardware Maintenance	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Software Support	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Installation	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Network Planning	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>

- 3a. 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.

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

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

- 5a. What percent uptime have you experienced for your PBX over the last six months? _____%

- b. What level of uptime is expected? _____%

6a. During the last six months, what percent uptime was experienced during normal business hours (e.g., from 8am to 5pm)? _____%

b. What percent uptime is expected during this period? _____%

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

b. What percent were hardware related? _____%

c. What percent were software related? _____%

8. Please rate on a scale of 1 - 10 (1 = Low, 10 = High), a, the importance of the following services.

b, your satisfaction with the vendor support of these services.

	a. Importance	b. Satisfaction
Overall Support	_____	_____
Hardware Maintenance	_____	_____
Software Support	_____	_____
Vendor Response Time	_____	_____
Vendor Repair Time	_____	_____
Parts Availability	_____	_____
Problem Escalation	_____	_____
Field Engineering Skill	_____	_____

9. What percent of your company's PBX maintenance budget is allocated to:

a. Internal Resources _____%

b. External Resources _____%

10. In your organization, which technological trends are having the greatest impact on PBX support and why?

_____	(trend)	_____	(why)
_____	(trend)	_____	(why)
_____	(trend)	_____	(why)

11a. If voice and data communications report to the same function, which organization do they report?

- ☐ IS
- ☐ Communications
- ☐ Administration
- ☐ Controller
- ☐ Other _____

b. When was voice and data communications support merged? _____

12. What change would you like to see in the way PBXs are currently serviced?

- a. Internally _____
- b. By Vendors _____

LAN

1. How many LANs do you have installed and how long have they been installed?

<u>Number of LANs</u>	<u>Vendor</u>	<u>Type</u>		<u>Number Devices/LAN</u>	<u>Install Date</u>
		<u>Baseband</u>	<u>Broadband</u>		
_____	_____	_____	_____	_____	_____
_____	_____	_____	_____	_____	_____
_____	_____	_____	_____	_____	_____

2. Who performs the following services on your LANs?

	<u>In-House</u>	<u>Manufacturer</u>	<u>TPM</u>
Hardware Maintenance	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Software Support	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Installation	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Network Planning	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>

- 3a. 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.
- 4a. What repair time, (in hours) do you expect from vendors on serious problems?
_____ hours.
- b. On average, how many hours does it take your vendor to repair serious
problems? _____ hours.
- 5a. What percent uptime have you experienced for your LAN over the last
six months? _____%
- b. What level of uptime is expected? _____%

6a. During the last six months, what percent uptime was experienced during normal business hours (e.g., from 8am to 5pm)? _____%

b. What percent uptime is expected during this period? _____%

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

b. What percent were hardware related? _____%

c. What percent were software related? _____%

8. Please rate on a scale of 1 - 10 (1 = Low, 10 = High), a, the importance of the following services.

b, your satisfaction with the vendor support of these services.

	a. <u>Importance</u>	b. <u>Satisfaction</u>
Overall Support	_____	_____
Hardware Maintenance	_____	_____
Software Support	_____	_____
Vendor Response Time	_____	_____
Vendor Repair Time	_____	_____
Parts Availability	_____	_____
Problem Escalation	_____	_____
Field Engineering Skill	_____	_____

9. What percent of your company's LAN maintenance budget is allocated to:

a. Internal Resources _____%

b. External Resources _____%

10. In your organization, which technological trends are having the greatest impact on LAN support and why?

_____ (trend) _____ (why)

_____ (trend) _____ (why)

11a. If voice and data communications report to the same function, which organization do they report?

- ☐ IS
- ☐ Communications
- ☐ Administration
- ☐ Controller
- ☐ Other _____

b. When was voice and data communications support merged? _____

12. What change would you like to see in the way LANs are currently serviced?

- a. Internally _____
- b. By Vendors _____

NETWORK

1a. What is the composition of your network?

- ☐ Leased Lines ☐ Satelites
☐ Switched Lines ☐ Other _____
☐ VANs

b. What is your annual line expense? (excluding hardware and software) \$ _____

2. Who performs the following services on your Networks?

	<u>In-House</u>	<u>Manufacturer</u>	<u>TPM</u>
Hardware Maintenance	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Software Support	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Installation	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Network Planning	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>

3a. 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.

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

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

5a. What percent uptime have you experienced for your Network over the last six months? _____ %

b. What level of uptime is expected? _____ %

6a. During the last six months, what percent uptime was experienced during normal business hours (e.g., from 8am to 5pm)? _____%

b. What percent uptime is expected during this period? _____%

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

b. What percent were hardware related? _____%

c. What percent were software related? _____%

8. Please rate on a scale of 1 - 10 (1 = Low, 10 = High), a, the importance of the following services.

b, your satisfaction with the vendor support of these services.

	a. <u>Importance</u>	b. <u>Satisfaction</u>
Overall Support	_____	_____
Hardware Maintenance	_____	_____
Software Support	_____	_____
Vendor Response Time	_____	_____
Vendor Repair Time	_____	_____
Parts Availability	_____	_____
Problem Escalation	_____	_____
Field Engineering Skill	_____	_____

9. What percent of your company's Network maintenance budget is allocated to:

a. Internal Resources _____%

b. External Resources _____%

10. In your organization, which technological trends are having the greatest impact on Network support and why?

_____	(trend)	_____	(why)
_____	(trend)	_____	(why)
_____	(trend)	_____	(why)

11a. If voice and data communications report to the same function, which organization do they report?

☐

IS

☐

Communications

☐

Administration

☐

Controller

☐

Other _____

b. When was voice and data communications support merged? _____

12. What change would you like to see in the way Networks are currently serviced?

a. Internally _____

b. By Vendors _____

APPENDIX C: DEFINITIONS

- APPLICATIONS SOFTWARE - Software that performs processing to service user functions.
- 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.
- 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 his 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 follow-up to ECNs which include parts and a bill of material to effect the changes 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.
- 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.
- 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.
- LOCAL AREA NETWORK (LAN) - A system of computer(s), peripheral devices, interface units, and communications cables that can distribute data over a distance, usually under six miles and most often within the same building or office area.
- 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 engineer.

- MINICOMPUTER - See Small System.
- MODEM - A contraction of "modulator-demodulator." A device that translates the digital signal to an analog signal and vice versa.
- OPERATING SYSTEM SOFTWARE (SYSTEMS SOFTWARE) - Software that enables the computer system to perform basic functions. Systems software, for the purpose of this report, does not include utilities or program development tools.
- PRIVATE BRANCH EXCHANGE (PBX) - A computerized switch owned by a private organization used to connect telephones within the organization and provide a communications interface outside the organization.
- 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.
- SMALL BUSINESS COMPUTER - For the purpose of this study, a system which is built around a Central Processing Unit (CPU), has the ability to utilize at least 20M bytes of disk capacity, provides multiple CRT workstations, and offers business-oriented systems software support.

- SMALL SYSTEM - Refers to traditional minicomputer and superminicomputer systems ranging from a small, multiuser, 16-bit system at the low end to a sophisticated 32-bit machine at the high end.
- 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 system 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.
- SYSTEM INTERRUPTION - Any system downtime requiring an Initial Program Load (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 systems software products for license to end users.
- 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 fulfill the processing requirements of a single application completely.

INPUT provides planning information, analysis, and recommendations to managers and executives in the information processing industries. Through market research, technology forecasting, and competitive analysis, INPUT supports client management in making informed decisions. Continuing services are provided to users and vendors of computers, communications, and office products and services.

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