Management Summary

Network Management

BUTLER COX FOUNDATION

Network Management

Management Summary
Report 65, August 1988

Butler Cox & Partners Limited

Availability of reports
Members of the Butler Cox Foundation receive three copies of each report upon publication;
additional copies and copies of earlier reports may be purchased by members from Butler Cox.

▲ **Network Management**

This document summarises the main management messages from Foundation Report 65, published in August 1988. The full report is available to members of the Butler Cox Foundation.

Effective network management is becoming increasingly important to businesses as their dependence on networks grows. The cost of poor network management can have immediate and dramatic business consequences. For example, one airline's online reservations system failed for 36 hours. During the failure period, bookings dropped by 5 per cent. One year later, the airline had still not regained the market share it held prior to the failure.

The main network-management activities are concerned with planning, operating, monitoring, installing, and maintaining the corporate telecommunications network(s). These networks can include voice, wide-area, and local area data networks, and interfaces to public networks. The aim of these activities is to meet the network users' needs in the most cost-effective way. Users expect the networks to be constantly available and to provide quick responses at the terminals connected to them. Furthermore, they expect any changes (equipment moves, for example) to be carried out in hours or days, not weeks or months. Even organisations that use only public and third-party networks still need to manage their suppliers to ensure that the networks they use meet these needs.

Our research showed that many network managers believe today's networks are approaching a level of complexity and activity where their existing levels of expertise and tools cannot cope. As a consequence, network 'management' can degenerate into a series of ad hoc responses to day-to-day concerns. Most time is spent fixing faults, adding new users and services to the network, or moving existing equipment attached to the network. Little time is left for planning or for performance measurement.

Several factors make network management difficult — the most important being the rapid growth in network size and complexity, shortages of skilled staff, and lack of adequate network-management tools. We believe that in many organisations network management can be improved.

A help desk for systems and network users

(The checklist in Figure 1 overleaf can assist senior management to determine the current effectiveness of their organisation's network-management function.) The main need is to pay more attention to servicing the users and less attention to technology.

Concentrate on user services, not technology

Many network-management teams cannot meet user expectations and do not provide an adequate service. Some network managers are unaware of all the differing service requirements of the various business areas within their organisation. Our research has shown that the major reason for inadequate network management is excessive concentration on solving technology problems with too little attention given to user service.

The excessive technology bias is often caused by a lack of management skills within the network-management area. One of the major symptoms of

<table>
<tr><td>

Figure 1 A checklist for evaluating the effectiveness of the network-management function

The answers to the following questions will indicate whether the network-management team is performing its activities effectively.

Do users rarely complain about poor response times or service interruptions?

Are most faults cleared in less than one working day?

Is it rare for a fault to re-occur after it has been fixed?

Does the network-management team measure and report on trends in network performance?

Does the network manager have charts showing the actual availability of the network or the amount of downtime for the last three months?

Is the average network availability above 95 per cent?

Does the network-management team obtain a good service from suppliers?

Does the network-management function have good working relations with other groups in the systems department?

Are major network upgrades or changes carried out with little impact on existing users?

Are more than 50 per cent of calls for assistance solved by the help desk?

Are users clear about who to call for assistance with queries or to report a fault?

If most of the answers are 'yes', the networks are probably well-managed.

</td></tr>
</table>

over-reliance on technology is the belief of many network managers that better network-diagnostic and performance-monitoring aids (which we call network-management tools) are the answer to most of their problems. They have not recognised that tools are only a part of the solution — organisational, staffing, and procedural problems have to be solved as well.

Network managers are often under pressure to minimise communications costs and they therefore select and install equipment to meet this aim. The resulting networks can be technically complex, which means that the incidence of failure can be unacceptably high for some users. The user community may, in fact, be served better by a more expensive, but more reliable, network. The network-management team has not understood the real user requirements but has instead concentrated on minimising costs.

Basic voice-communications requirements are also often overlooked. The most sophisticated computer system and data network for handling customer queries are of little use if customers cannot speak to the customer-service representatives because the telephone service is inadequate.

Overcoming the above difficulties will not be easy. The full report contains much practical advice on how to improve network management. Below we highlight our recommendations for improving user service and for solving the problems of the shortage of skilled staff and the lack of adequate network-management tools.

Use service-level agreements to specify the required service

During our research we found that many network managers are starting to use service-level agreements. Such an agreement is a form of contract between the business areas that use the network(s) and the service provider, in this case the network-management team. The contract terms cover the types and level of service to be provided and the charges for that service.

Service-level agreements are an excellent mechanism for network managers to gain a better understanding of user requirements and to manage user expectations. The agreements can also provide a framework for users to determine whether they are achieving value for money because they can compare their own internal networking costs with those of other users and with those of external network-service providers.

Service-level agreements are determined by a process of negotiation. Users begin by describing the types and levels of service that they require. For example, most organisations aim to keep their data networks fully operational for between 95 and 98.5 per cent of the normal working week. Other organisations (airlines, for example) usually have a target of over 99 per cent availability, 24 hours a day, seven days a week. The network manager then highlights the trade-off that can be made between improved service level and increased cost. On the basis of this information, users decide if the improvement in service justifies the increase in cost. This trade-off enables users and the network-management team to reach a compromise position, where users are not demanding performance levels that are unrealistic compared to the importance of the application. However, when the business consequences of a network failure are potentially very damaging, users should be prepared to pay more for a highly reliable service.

Not all business applications are of equal importance. Users of an online order-entry system, for example, will usually be prepared to pay more for their network service than users of a back-office personnel application. Service-level agreements therefore mean that network-usage charges will be determined by the type and level of service provided. Whilst this is more equitable, it does mean that the billing arrangements are more complicated.

The network-management team will also need to demonstrate that it is providing the agreed levels of service, which means the performance of the network must be monitored regularly. However, we found that few organisations monitor network performance in a way that can be used to demonstrate that the service-level agreement conditions are being met. Those that do typically provide users with monthly reports showing the actual performance compared to the service-level agreement. The result is that users do not have unrealistic expectations and that network managers receive fewer complaints about poor service. If the agreed performance conditions are being met and the users are still dissatisfied, they can then renegotiate the terms of the agreement.

Provide a unified user-support service

The over emphasis on technology in network management has often meant that the user-support activities of the network-management team have been 'bolted on' as an afterthought. In a service-oriented approach, user support is recognised as a vital activity. For example, organisations adopting a service-oriented approach will notify their users when a major network fault occurs, rather than waiting for the users to start complaining about a break in service.

The difficulty in providing user support is that most users cannot tell if a fault or poor response times are caused by the network, the computer hardware or software, or the application program. The division of the systems function into different technical specialities (systems software, applications, networks, and so on) can mean that users are unsure as to which section should deal with a particular problem.

In a service-oriented environment, users should not need to decide if a problem is caused by a network fault. That is the responsibility of the systems department. The implication is that there should be a single unified user-support function that covers all the technical specialities and provides a single contact point for all information technology (IT) related faults or assistance. A unified user-support service will allow users to request changes (whether they be for communications services, application programs, or whatever) in a standard way. It also means that users cannot be told that a complaint about quality of service is the responsibility of another part of the systems department. Experience shows that systems departments that provide a unified user-support service are more highly regarded by their user communities.

The most important element of unified user support is the help desk. For the majority of users, the help desk is the most common point of contact with the systems department. Many large organisations still run several help desks, however (the largest number we found in a single organisation was 23). With a few notable exceptions (international networks, for example), this practice is both inefficient and confusing for users. In all cases, each user should have only *one* help desk number to call. The full report contains guidelines for running a successful help desk.

It is more important for staff in user-support roles to be good at dealing with people than to have a detailed technical knowledge. Amongst other skills, they need to understand and empathise with user problems so that users feel that the help desk is 'on their side' and can resolve their problems, regardless of whether the root cause is the network, an application program, or the systems software.
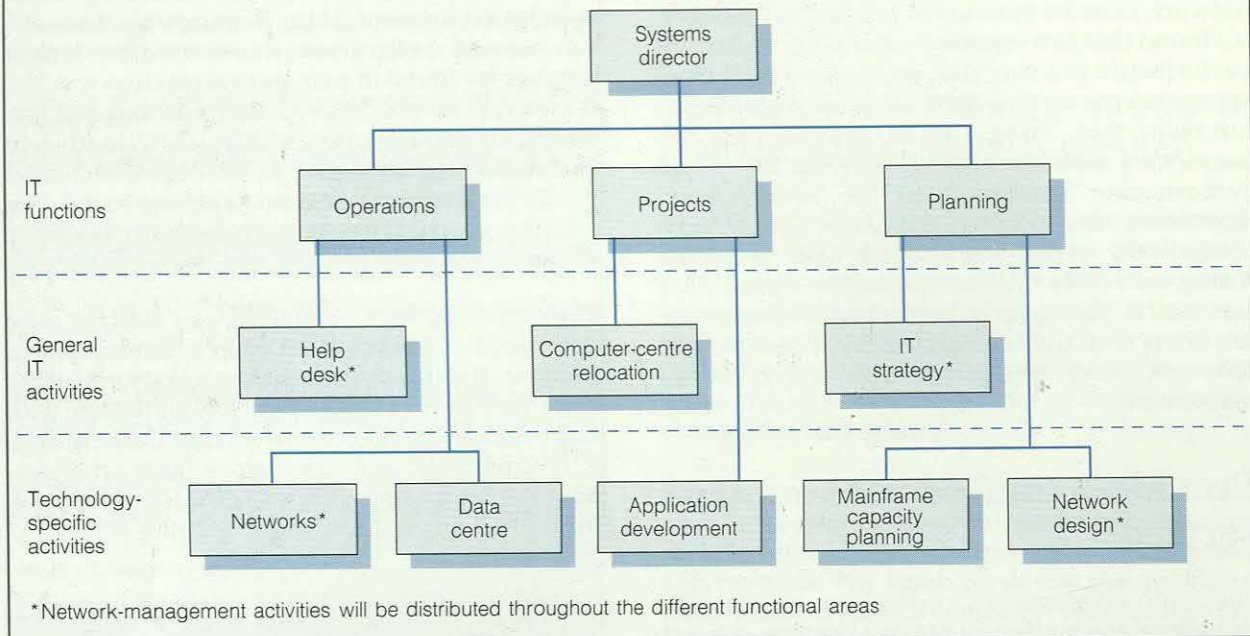
Structure the systems department by function, not by technology area

As information technology systems become more complex, networks and systems are becoming inextricably linked. For example, distributing software updates to remote computers is the responsibility of the systems-management function. However, the network-management function is responsible for ensuring that the distribution is completed successfully. Unfortunately, there is no clear definition of the boundary between network(s) and systems. The definition will vary by organisation, according to the structure of the systems department and the skills resident within the telecommunications area.

In addition, IT suppliers are encouraging the merging of systems and network-management responsibilities by providing tools that are intended to manage both areas. IBM's NetView products are an obvious example of this trend. Under the NetView banner, existing IBM system-management products have been enhanced so they can monitor and control network components such as multiplexors and local area networks.

These factors, together with the need to provide a unified user-support service, will gradually lead to changes in the division of management responsibilities in the systems department. Some organisations have already recognised that a functional division of management responsibilities can provide a better structure than a division by technical specialities. Figure 2 overleaf shows such an organisation structure, where the systems department

Figure 2   In future, systems departments should be organised by function, not by technical speciality

	Systems director

IT functions: Operations — Projects — Planning

General IT activities: Help desk* — Computer-centre relocation — IT strategy*

Technology-specific activities: Networks* — Data centre — Application development — Mainframe capacity planning — Network design*

*Network-management activities will be distributed throughout the different functional areas

is divided into functions such as operations, planning, and projects rather than into tele-communications, systems development, and so forth. In the operations area, the first level of support (such as the help desk) covers all aspects of IT. It is only at the second and third levels that operations support is organised by technical specialities because of the expertise required to solve difficult problems.

We believe that more organisations will move towards this type of functional organisation structure in the future because it reduces intradepartmental conflict and provides a more consistent user interface. The change will be gradual. Merging the help-desk activities into a unified user-support service is one step towards a unified operations area.

The role of the help desk is crucial because the growing business dependence on networks means that faults and queries must be cleared up quickly. It is therefore important to understand that the profile of network faults is changing and that this will impact on the way in which networks should be managed. The help desk also has a role to play in facilitating and managing the changes that will be made to the network, particularly in the population of devices connected to the network.

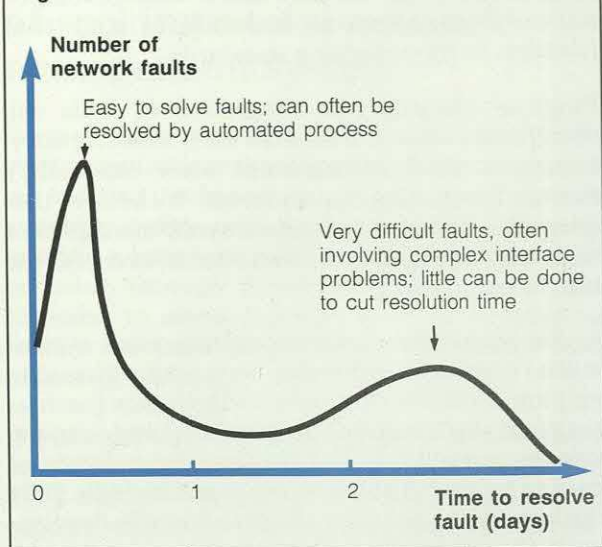## Plan to handle less frequent, but harder to fix, faults

Our research shows that the number of network faults are not increasing in proportion to network usage. Indeed, in some cases, the total number of network faults is decreasing because of the growing use of digital circuits and equipment. However, the increasing complexity of networks means that the average time to resolve a fault is increasing. Figure 3 shows how network faults will polarise into a large number of easy-to-fix faults and a smaller number of hard-to-solve faults. Network managers must plan to handle the two categories of faults in different ways. The easy-to-solve faults should be handled by a combination of increased automation and less-skilled staff. The scarce and highly skilled technical staff can then concentrate their efforts on the more difficult problems.

Set up procedures for managing network moves and changes

Corporate networks are usually in a constant state of change. New connections need to be added, new services provided, and there is a growing requirement to move or change the equipment connected to the network. The organisations we surveyed on average expected the number of moves to increase by 30 per cent in just one year. Managing these changes and moves entails a large amount of time-consuming administrative work. A comprehensive network-inventory and configuration database is essential to contain the number of staff required to perform and record the changes. Major software and hardware changes are also a source of hard-to-solve faults. They require detailed planning and testing to avoid unnecessary downtime.

Figure 3 Future distribution of fault-resolution times

Number of network faults

Easy to solve faults; can often be resolved by automated process

Very difficult faults, often involving complex interface problems; little can be done to cut resolution time

0   1   2   **Time to resolve fault (days)**

Effective procedures for resolving network faults and for change management are a vital element of network management. An added complication is that the procedures must be designed to take account of the shortage of skilled network staff.

Learn to live with the shortage of skilled network staff

The shortage of skilled communications staff is not new. Moreover, the shortages seem likely to continue as networks continue to grow in number, size, and complexity. Many network skills can only be obtained from experience, and Foundation members report that the length of time for a new technician to become fully familiar with their networks is increasing. A recent survey showed that personnel costs accounted for nearly 30 per cent of total network costs. Therefore it is important to use staff effectively.

Another problem is that many communications staff are so highly specialised that it is difficult to offer them a career path. Lack of internal promotion opportunities can increase staff turnover.

There are three main ways in which organisations can tackle these problems:

— Wherever possible, less skilled staff should be used to handle the majority of the workload. Increased automation and use of expert systems can assist in deskilling a number of tasks. Help desks should be encouraged to resolve a higher percentage of faults.

— Organisations need to provide more training. The types of training required will include technical and on-the-job training for less-

experienced staff, and a broader perspective on IT, business, and management issues for skilled technical staff. A range of experience and individual career-development plans should be provided to open up promotion opportunities to more people.

— The skills of in-house staff can be supplemented by experts from suppliers and consultants, particularly for specialised and infrequently needed areas of technical expertise.

Some organisations choose to overcome the skills shortage by using third-party networks or facilities management, rather than an internal service. However, external network providers must be carefully managed to ensure that their service meets user needs and that there is no conflict or overlap with the services provided by systems department.

Recognise the inadequacies of tools

Effective network management requires that a strong organisation with good staff and procedures is backed up by adequate network-management tools. Most network managers find the tools available today inadequate because they are difficult to use and normally only work with one manufacturer's equipment. Most organisations purchase network (and computer) equipment from several suppliers. Therefore, a large organisation needs a portfolio of tools to support all its network-management activities.

Tools from different suppliers use different formats for displaying data and often produce duplicate inventory databases and alarm messages. This adds to the difficulties of using tools and increases the level of skill required to interpret the information.

Network managers would like to integrate their management tools into a total network-management system that provides a consistent user interface and minimises duplicated information. Their requirements are summarised in Figure 4 overleaf. An integrated set of tools (a network-management system) should manage the complete range of network components (and, increasingly, computer systems) and support a variety of activities. Figure 5 (also overleaf) indicates the current range of suppliers of network-management tools classified by network component. Today, no supplier covers the entire range of components and activities.

Integration, however, cannot be achieved until there are standards for transferring network-management information between network

components. Such standards are only just beginning to emerge from the International Standards Organisation (in the form of extension to the OSI model for open systems interconnection) and from leading suppliers. Moreover, the range of messages and commands defined is limited. It will therefore be several years before standards for network management are so advanced that all modems, multiplexors, and other network components produce the same information in the same format.

Foundation members should select new network components that already have well-developed network-management capabilities and that conform to the emerging standards.

Progress towards full integration of tools will therefore be slow. It will be the early 1990s, or later, before network-management tools can satisfy current integration requirements. We believe that integration of voice and data network-management tools will be particularly slow to occur, except at the transmission level.

A comprehensive network-management system will be expensive to develop because it will need to employ a variety of newer technologies (such as realtime high-resolution graphics and expert-system techniques) and because the volumes of data to be stored and processed will be high. Only the largest suppliers can afford to invest in developing such systems. Smaller computing and communications suppliers will respond by merging or forming alliances with larger suppliers or with PTTs. The trend towards such alliances is already apparent — Unisys's purchase of Timeplex being one example. (Unisys is a manufacturer of mainframes and minicomputers, while Timeplex manufactures data-communications equipment, particularly high-bandwidth multiplexors.) Figure 5 indicates that certain combinations of suppliers could produce network-management tools covering the whole range of computer and network hardware.

Figure 4   Requirements for integrated network-management systems

Most network managers believe that an integrated network-management system should:

Perform as an integrated whole, even though the system may consist of several pieces of equipment and software from different suppliers. The term frequently used to describe this feature is 'seamless'

Collect information from, and control, any network component

Support the majority of, and preferably all, network-management activities

Minimise the duplication of information. Ideally, there should be no duplication

Automate routine tasks

Provide a consistent and easy-to-interpret user interface

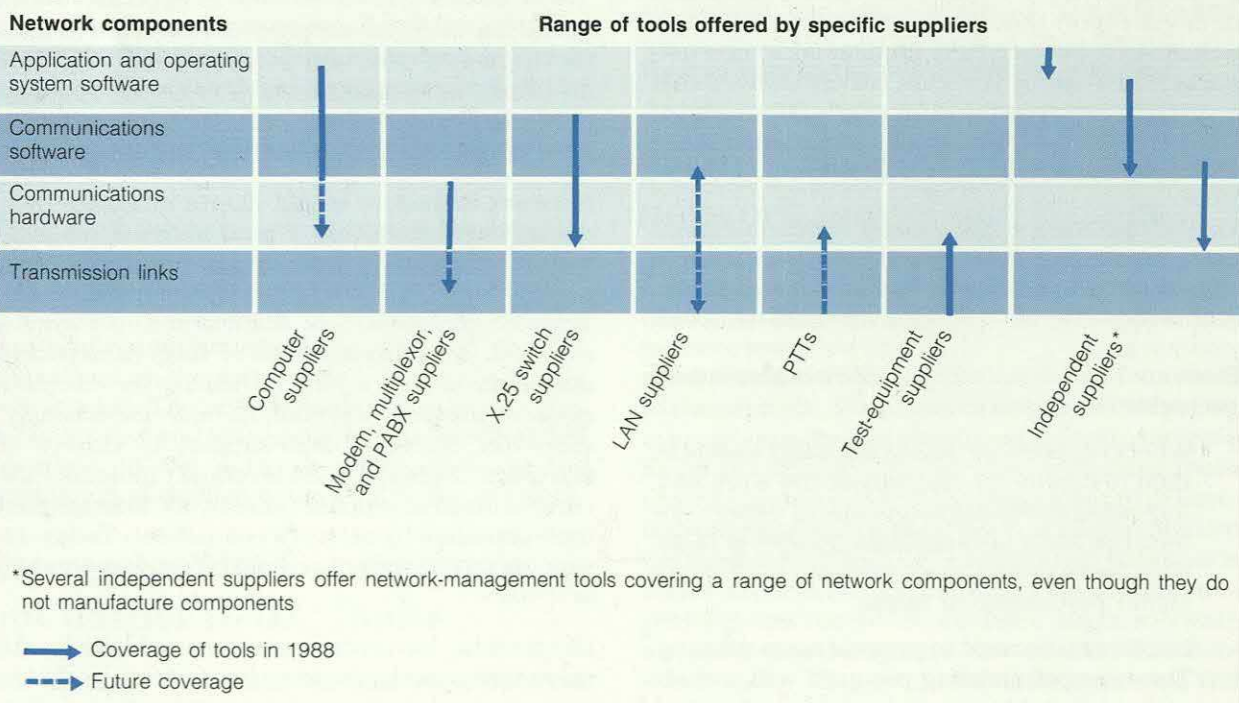Display graphically, in realtime, the network's current configuration and status

Reduce the expertise or time required to perform an activity

Figure 5   Network-management tools have traditionally been linked to specific network components

*Several independent suppliers offer network-management tools covering a range of network components, even though they do not manufacture components

→ Coverage of tools in 1988
- - -▶ Future coverage

Enhance existing tools instead of seeking a total network-management system

Because integrated tools will emerge only slowly, most organisations should concentrate on improving existing tools and purchasing the best tools available today, rather than on attempting to procure a long-term solution. Improvements can be made through increased automation of the response to alarm messages and by developing small-scale customised analysis programs and expert systems.

Improved tools will become available between now and 1990, but they will have a short useful life. They will need to be replaced when a newer tool offers greater benefits. In order to justify investment in network-management tools with a short life span, network managers must build a good business case. The business case should be built on one of two bases:

— Estimates of productivity improvements and

reduced downtime that will be realised through the use of the tool.

— Estimates of the reduction in risk to the business that will result from the better management of the network and the consequent reduction in the probability that the network will suffer a substantial failure.

The latter is likely to be most appropriate where a very high level of network availability is crucial for the operation of the business. An airline reservation system is a typical example. The former is likely to be most appropriate where the network is used mainly for business-support functions such as management accounting or time recording. In such cases, the main objective is likely to be to minimise the total costs. The reduction in downtime therefore needs to be converted to cost savings or revenue gains for the business.

Thus, while there are no easy solutions to today's network-management problems, there are several steps that Foundation members can take to improve the situation. The improvements will benefit the whole organisation, not just the network-management function.

Network Management ▲

Butler Cox is an independent management consultancy and research organisation, specialising in the application of information technology within commerce, government, and industry. The company offers a wide range of services both to suppliers and users of this technology.

The Butler Cox Foundation is one of the services provided by Butler Cox. It provides the executives responsible for information systems in large organisations with a continuous analysis of major developments in the technology and its application.

The Foundation publishes six Research Reports each year together with a series of special Position Papers. The programme of activities includes a wide range of meetings that provide Foundation members with a regular opportunity to exchange experiences and views with their counterparts in other large organisations.