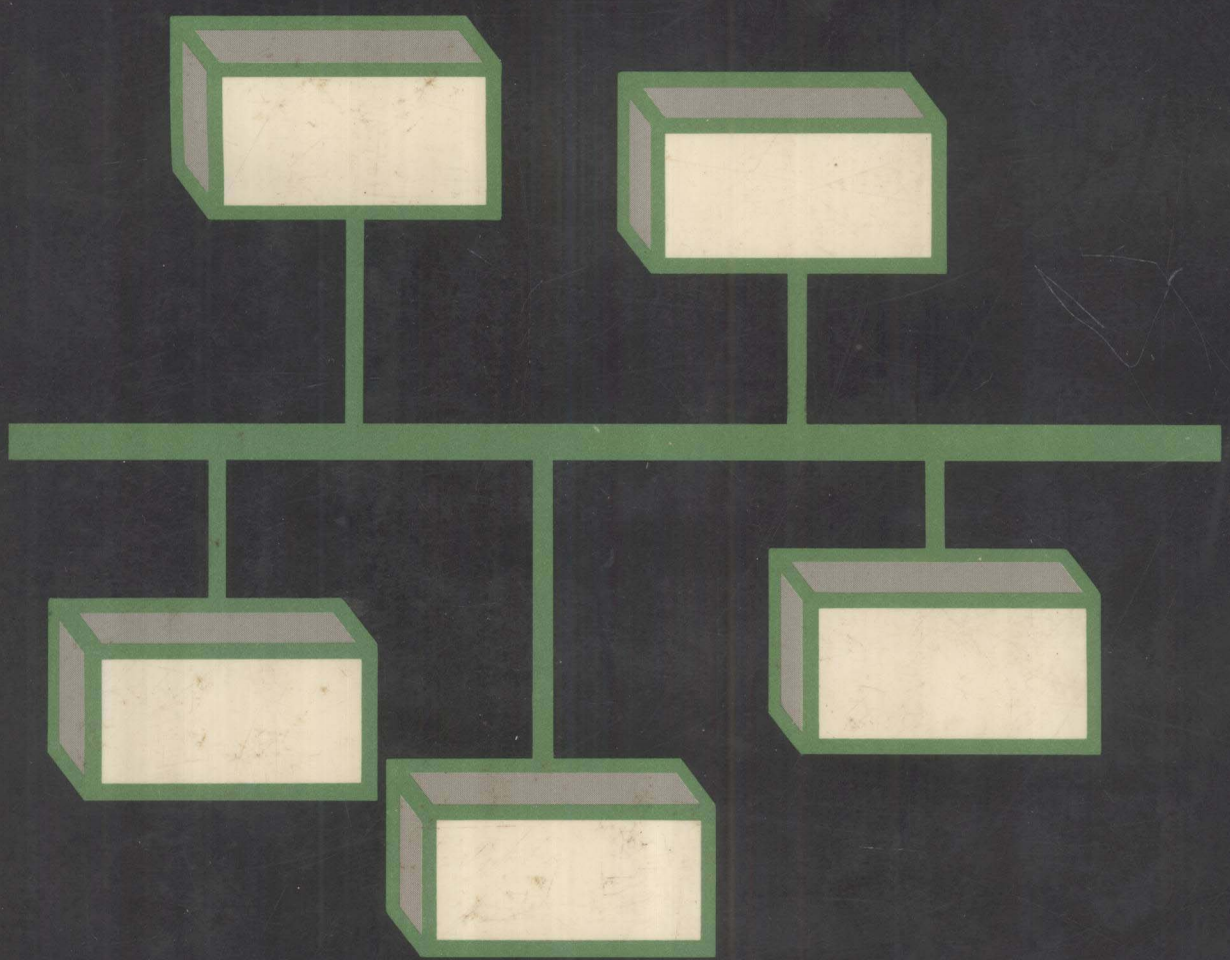
LOCAL NETWORKS

Strategy & Systems



Proceedings of Localnet '83 (Europe)

LOCAL NETWORKS

Strategy & Systems


British Library Cataloguing in Publication Data

Local networks.
1. Computer networks—Congresses
001.64'404 TK5105.5

ISBN 0-903796-93-2

ISBN 0 903796 93 2

Published by Online Publications Ltd., Northwood, UK

Introduction

Local Networks - Strategy & Systems

Local network systems are now developing in Europe and North America at a rate which clearly signals an important future for the technology. The capability to extend high capacity communications throughout the office promises productivity advances long overdue in this environment.

However, as the technology proliferates, so do the problems and issues which must be resolved before they constrain progress further. These are the issues examined by this collection of papers which were presented at the Online conference Localnet '83 (Europe) held in London during March 1983. The book is divided into two main sections : the first looks at the installation and application of networks from the viewpoint of management and overall corporate policy. The second section examines recent developments in local network hardware and software. This book will thus be of benefit and value both to those concerned with overall communications and data processing policy and to technical specialist involved in the design or detailed implementation of local networks systems.

Online Conferences Limited has established a unique reputation as the world's premier organiser of significant and prestigious events concerned with the business implications of leading-edge technology. During the last 12 years it has co-ordinated over 300 highly respected events in the UK, on the Continent of Europe and in North America.

The proceedings of most of these conferences have been published by and are available from Online Publications Ltd. A fully descriptive catalogue is available upon request.

Online Conferences Limited
Argyle House, Northwood Hills, HA6 1TS, Middlesex, UK
Phone: Northwood (09274) 28211 Int'l phone: 44-9274 28211
Telex: 923498

Contents

Distributed Operating Systems

Standards

Protocols for useful systems

Authors

THE SELECTION OF A LOCAL COMMUNICATIONS NETWORK

David Flint
Senior Consultant
Butler Cox & Partners
UK

Local communications networks may be installed as part of an applications system or as a general utility. In the former case the choice of system must depend principally on how it meets the requirements of the application.

In the latter case it is the nature of the site and of the communicating devices that determine the best choice of network.

In both cases procurement should start from a consideration of the requirements, not of the technology.

INTRODUCTION

There are now over one hundred commercially available local area networks and a wide variety of other local communications products. This paper considers the selection of a local communications network for use on a single site.

It does not discuss the selection of a wide-area network to link a number of such sites. Networks that connect a number of large computers within a single computer room are also excluded.

This paper is based on a comprehensive analysis of the need for and value of Local Area Networks that is fully reported in my book 'The Data Ring Main' (Flint, 1983).

Local networks are generally installed either as part of an applications system or as part of a general communications infrastructure. The considerations in these two cases are quite different and I will discuss them separately.

THE LOCAL NETWORK AS PART OF AN APPLICATION SYSTEM

The term 'application system' must be considered broadly. It may include word processing, data processing, office automation and process control systems. What all these have in common is that the system is expected to provide processing facilities to users, or data processing staff, or both. A LAN may be included in some of the possible configurations, though not in all, and it will rarely account for more than 10% of the total cost.

The key consideration in the selection of an application system must be whether it meets the application requirements. The nature and features of the local network will thus play only a small part in the selection of such systems.

Though the local network is initially acquired as part of an application system it may subsequently find other uses. This suggests three requirements:

- High speed
- Standard interfaces
- Standard internal structure.

A high speed is desirable to give scope for extra traffic to be carried in the future.

Standard interfaces are desirable to enable additional equipment to be connected. The most relevant standards are CCITT V.24 (EIA RS232), CCITT X.25, IBM bisynchronous and IEEE488 (the 'Hewlett-Packard interface bus'). Other interfaces may be important in particular circumstances.

A standard internal structure is desirable in order to support those devices that use the low-level internal protocols directly. The only international standard at present is Ethernet. (Although the UK Science and Engineering Research Council has published a specification for the Cambridge Ring (SERC 1982) this is of limited significance outside the UK.) Regrettably, Ethernet remains too expensive to be used with most microcomputers. There is no official standard for micros; neither has the market created a de facto standard.

The main and most distinctive virtue of a LAN is that it allows expensive resources to be shared between distributed computers (Flint, 1982). This allows new systems architectures to be developed by suppliers and these architectures will become more important in the future as computer power is distributed round organisations. The architectures of many existing systems are monolithic and will be difficult to adapt to the distributed environment of the future.

It will be relatively easy to adapt an architecture if it:

- is modular, rather than monolithic.
- uses message passing, rather than shared memory, for inter-process communication.
- is based on a coherent set of communications protocols.

The purchaser of a system generally wants to be assured that it can be modified and extended to new hardware so as to remain appropriate in the future. The criteria given above should ensure one aspect of the necessary flexibility. They may therefore be used when evaluating systems for DP, WP, plant automation and other application.

The criteria may readily be applied to computer operating systems. It is clear that Unix does, and that most mainframe operating systems do not, meet the criteria.

THE LOCAL NETWORK AS PART OF A COMMUNICATIONS INFRASTRUCTURE

Many organisations have begun to encounter problems with their data communications facilities. Often they have separate networks for terminals of different kinds and they find the maintenance and extension of these networks increasingly expensive. The problems include:

- Inability to use existing terminals to access incompatible computers.
- Excessive costs, delays and disruption in installing new cables.
- Lack of space in ducts.
- Dependence of the network on host computers.
- Lack of peer communications facilities for, as an example, word processors.

It is now not unusual to find that the costs of data transmission add 50%, or even 100%, to the costs of the terminals.

Many organisations are therefore looking for a unified approach to data communications that will enable them to avoid or mitigate these problems. Some have decided to commit themselves to a particular technology or proprietary system. Most are still undecided.

The correct starting point for any selection exercise is a consideration of the requirements. Contrary to the suggestions of some pundits and journalists, local networks are not an exception to this.

Network Requirements

The requirements should be established by considering existing systems, future plans and general trends. Table 1 lists the issues that most effect network selection and I will consider each in turn.

TABLE 1: KEY NETWORK REQUIREMENTS

a. What are the requirements for video communications? Is there any requirement to integrate this with other services?

b. Are there any special data requirements?

c. What reliability and availability are required?

d. Is there any requirement to support computers and workstations that need high transmission rates?

e. How many host computers must be supported and with what interfaces?

f. How many terminals and other simple digital machines must be supported? What interfaces and protocols do they use? Where are they and how much with they be used?

g. What special services does the site network require? (Possible services include public network gateways, gateways to existing local computers and networks, file and print servers and electronic mail.)

a) Video Requirements: Video communications may be needed for security, TV distribution or teleconferencing.

Security video usually involves cameras at doors and on roofs, the pictures from which are viewed at a central security office. In some systems the cameras can be controlled from the security office.

TV distribution may be required in hospitals and colleges. There is unlikely to be any requirement to integrate video with voice and data in such cases but non-integrated voice and data services may be needed at the same places.

Teleconferencing is rarely needed on a single site but its use between sites is likely to grow during the 1980s. In many cases freeze-frame or slow-scan video will be used and these may be provided over 50k bit/s circuits rather than video channels.

If video, data, and voice services will be needed at a number of places throughout the site then a broadband network is indicated for these locations and, in the interests of simplicity and if it mets the other requirements the same network may be adopted as the standard for the whole site. If these needs are uncertain, or are likely to be found at only one or two places, then it will be easier to support those places with CATV cable and to make an independent choice of data network.

In cabling a site for a network most of the expense is associated with the work of pulling cables rather than with the purchase of the cable. To pull two cables costs about 25% more than pulling one, not 100% more, so that two specialised networks may be cheaper than one integrated one.

b) Special Requirements: In some environments a few special requirements may indicate, or exclude, whole classes of networks:

- A need to pass through areas with a high risk of fire or explosion may require the use of optic fibres.
- Some military sites require encryption and special shielding to reduce stray radiation.
- Particular interfaces may require particular networks, for example, Ethernet. As the market matures, however, it is likely that the same interfaces will be supported on a variety of networks. Ethernet interfaces, for instance are being provided on broadband and fibre optic networks.

c) Reliability and Availability: During the 1980s many organisations will greatly increase their dependence on information systems. This dependence will impose increasingly strict requirements on data networks. Like a telephone exchange, the network will be expected to be available 24 hours per day and seven days per week. It must also be able to recover quickly from component failures.

But most organisations do not need such high reliability and availability now. Their requirements will therefore be for a phased increase in availability. For instance, an organisation might specify an initial availability of 99% (30 minutes unavailability during the working week) rising over 5 years to 99.95 (one and a half minutes unavailability per week).

To obtain a high availability for a network requires the ability to locate and replace failed units quickly. On large sites this usually requires faults to be reported to a central point.

To obtain very high availability (over 99.99%, say) requires the installation of duplicate cables and of enough logic to switch to the backup cable when a fault occurs. These facilities are found in rings such as Racal's Planet and the Hasler SILK.

d) Transmission Requirements: LANs were originally developed to support fast, bursty, traffic of the kind produced by intelligent workstations. This kind of traffic will become increasingly prevalent during the 1980s as systems evolve to exploit the new local communications systems. Organisations that have already invested heavily in conventional computers and terminals may, however, be unable to exploit these new systems and will thus retain a more conventional traffic pattern. They will thus have less need to install LANs.

All the main LAN technologies - contention slotted ring, token passing, register insertion and reservation - are able to support this kind of traffic whilst conventional circuit switches are not.

In some systems the delay before a packet can be transmitted increases rapidly with increasing load. Contention systems such as Ethernet show this problem particularly acutely (Bux, 1981). It is usual, however, (Shock and Hupp, 1980) to run LANs at very low load. The excessive delays will therefore only rarely arise in practice.

Current workstations, however, are often based on proprietary networks that cannot be used to provide a general utility. These systems will therefore have to be wired separately with, at most, a gateway to the utility network. Organisations that use current workstations networks may find themselves with a requirement for a utility network as well as for the proprietary product.

Some LANs have difficulty in supporting systems like Unix that send and receive single bytes. Broadcast LANs such as Ethernet usually have a large minimum packet size and thus impose a very high overhead on this kind of traffic. Under unfavourable circumstances traffic of this kind may overload a broadcast LAN, though this problem can usually be surmounted by installing a set of linked networks.

These sites will be better served by a ring or a circuit switch.

If the terminals are widely scattered, the costs of installing and maintaining the physical cables will be a large part of the total costs. In these cases economy favours any network that can make use of existing wires.

The expected usage of the terminals is also important. If usage is expected to be low, then the costs of the cables are again a major