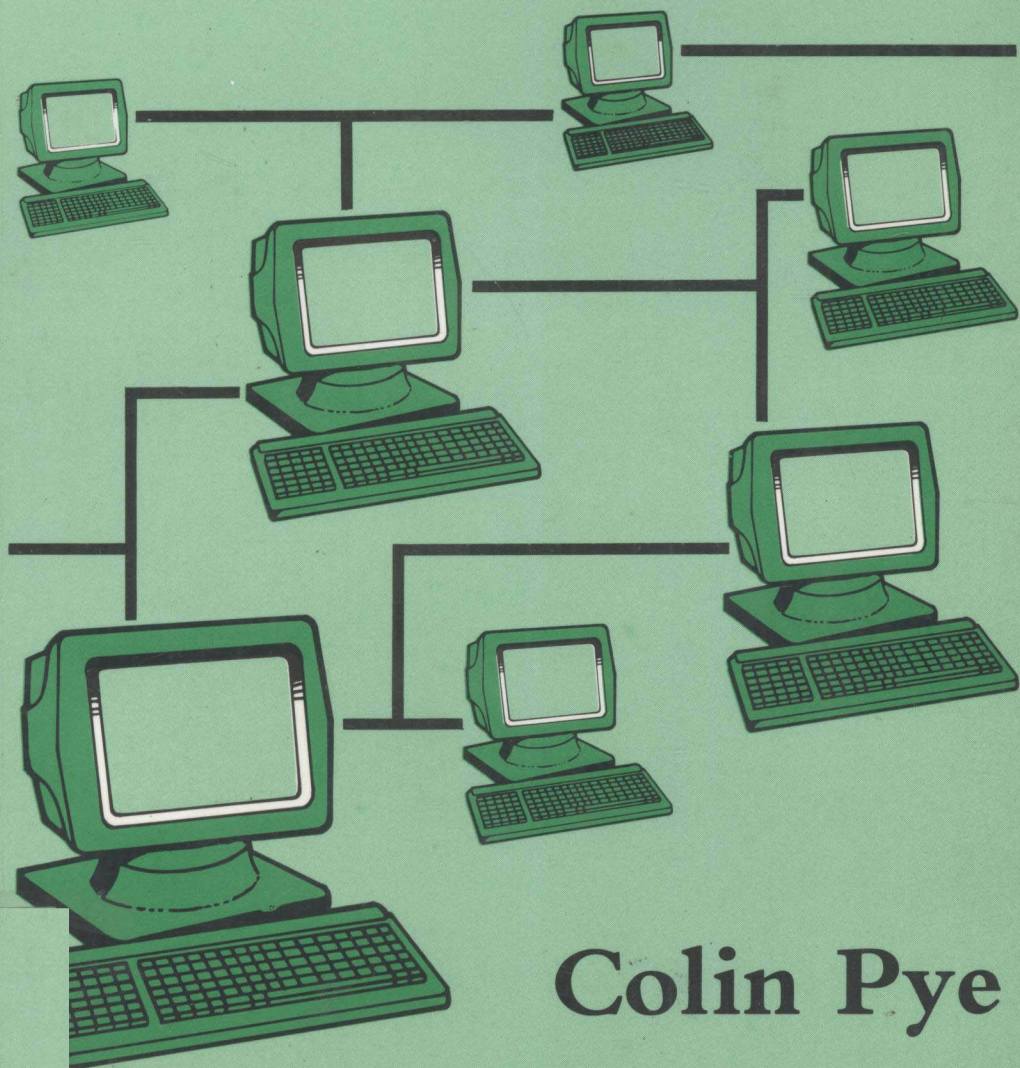


NCC PUBLICATIONS

Networking with Microcomputers



Colin Pye

NETWORKING WITH MICROCOMPUTERS

There is a growing requirement for microcomputers to be linked together for various business and industrial purposes. For example, it is often useful for micros to share such resources as information, communications, printing facilities, etc within a department or over a complete site. Many networks for linking micros are available, ranging from dedicated systems to third-party networks supplied by manufacturers for use solely with their proprietary equipment.

Types of networks and their applications are described, and attention is given to specific network requirements (hardware and software), technologies, architectures, standards, and selecting a microcomputer network. It is emphasised that network developments in the future will depend upon applications, costs and standards.

Colin Pye, a Senior Consultant in the NCC Communications Division, is Technical Secretary for the FOCUS CSMA/CD Implementors' Group.

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Networking with Microcomputers

Colin Pye

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To my wife, Margaret, and our parents

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Introduction

Microcomputer networks provide a way of linking together microcomputers for the purpose of sharing such resources as information, communications, printing facilities, etc, within a department or over a complete site. The data transmission rates are typically less than 10 Mbps with a very low error rate.

Microcomputer (or personal computer) networks are available in a number of different topologies and utilising a number of different technologies. The main criterion is that the networks are relatively cheap to implement. The networks available range from dedicated networks with the main type of workstation designed for the office environment (but also providing interfaces for the more popular personal computers), to third party networks designed purely to interconnect specific personal computers and networks supplied by manufacturers for use solely with their proprietary equipment. The purpose of this book is to point out the problems and opportunities, should a network of personal computers be contemplated.

The book is meant to highlight some of the practical problems in planning, choosing and installing a personal computer network. Important points are summarised at the end of each relevant section. Continuous reference to these summaries should help in the avoidance of costly mistakes at an early stage in the planning process.

The first chapter puts the microcomputer network into perspective by considering other networks and looking at the history of data communications. The second chapter then looks at the appli-

cations to which these relatively new networks can be put and what this means to the end-user.

The third chapter covers requirements regarding hardware, software, installation, and management. The main aims are to explain what makes one type of personal computer more suitable for networking than another, the practical problems encountered, and the management required. Each section is summarised and can be used, as in other chapters, as a quick reference checklist for the user when talking to suppliers.

Chapters four and five cover the technologies available (and now encountered in suppliers' equipment) and the present standards situation. Chapter six considers the choice of a microcomputer network and the necessary stages involved in the selection process. Future developments are discussed in Chapter seven, and Appendix A provides a summary chart of various manufacturers' equipment.

Networking microcomputers opens up a whole new area of information to a greater number of end-users through communications. Just as cities sprang up as centres of commerce in the past, the reverse will be true in the future as improved communications removes the need for such large conurbations. The benefits of microcomputer networks for the small business user will be obvious as cheaper systems become available, while large businesses can use microcomputer networks as a basis for improved control on local cost centres, in addition to the improved communication and information access.

This book is intended for designers of computing and office systems who are looking at the implementation of microcomputer networks and assessing their potential. Individuals involved in traditional computing and telecommunications will also find the book useful in order to assess the impact of microcomputer networks on future corporate strategies by recognising their current capabilities and future potential.

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1 Networks

INTRODUCTION

Networks can be classified as falling under one of three main headings:

- wide area networks;
- local area networks;
- personal computer or microcomputer networks.

The local area network and the personal computer (or microcomputer) network are confined to a site or department. Providing that no external communication is required, involving wide area networks run by third parties, the network control is left completely in the hands of the end-user. Local area networks may incorporate the company's PABX as part of the overall plan. The emerging personal computer networks are concerned with connecting together personal computers (or microcomputers) in a cost-effective way. Because of how the price of personal computers has dropped over recent years the network used to link them must itself be relatively cheap to implement.

THE DEFINITION OF A NETWORK

A network cannot be defined concisely. It is more useful to classify it by the various components which interconnect and interact to provide, often remote, end-user to end-user communication. The network will have the following basic functions: transmission, switching and signalling (Figure 1.1).

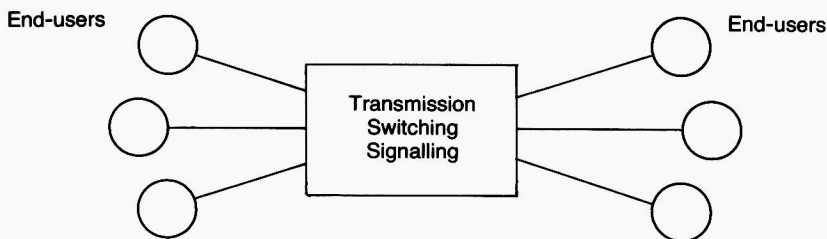


Figure 1.1 Network Functions

The network in common use providing end-user to end-user communication is the telephone network. It is totally invisible when used by individuals to set up voice communications on the network, providing they observe the conversation set-up protocols (ie lift the handset, wait for dial tone, dial the address or number, etc). However, it does provide the functions of transmission, switching and signalling. This network gives remote users the chance to communicate.

Figure 1.1 provides no explanation of where the network functions take place or how they are distributed, ie in the network itself or in the end-user terminals. In order to look at the possible distribution of these functions, consider first of all the telephone network.

The telephone network*, shown in Figure 1.2, is of a hierarchical design. This means that the basic design could be thought of in the form of a pyramid. The top of this pyramid, in the case of the telephone network, provides the International Gateway Exchange(s) which interconnects various countries (Figure 1.3).

At the base of the pyramid a large number of users will be connected to the network in order to take advantage of the facilities it provides. A structured approach such as this alleviates some of the problems encountered with transmission, switching

* The economic considerations for providing a large network are not examined in this book and the reader is directed to the references for this chapter. The general costing considerations for each layer of the network are important and are very relevant to the subject of this book.

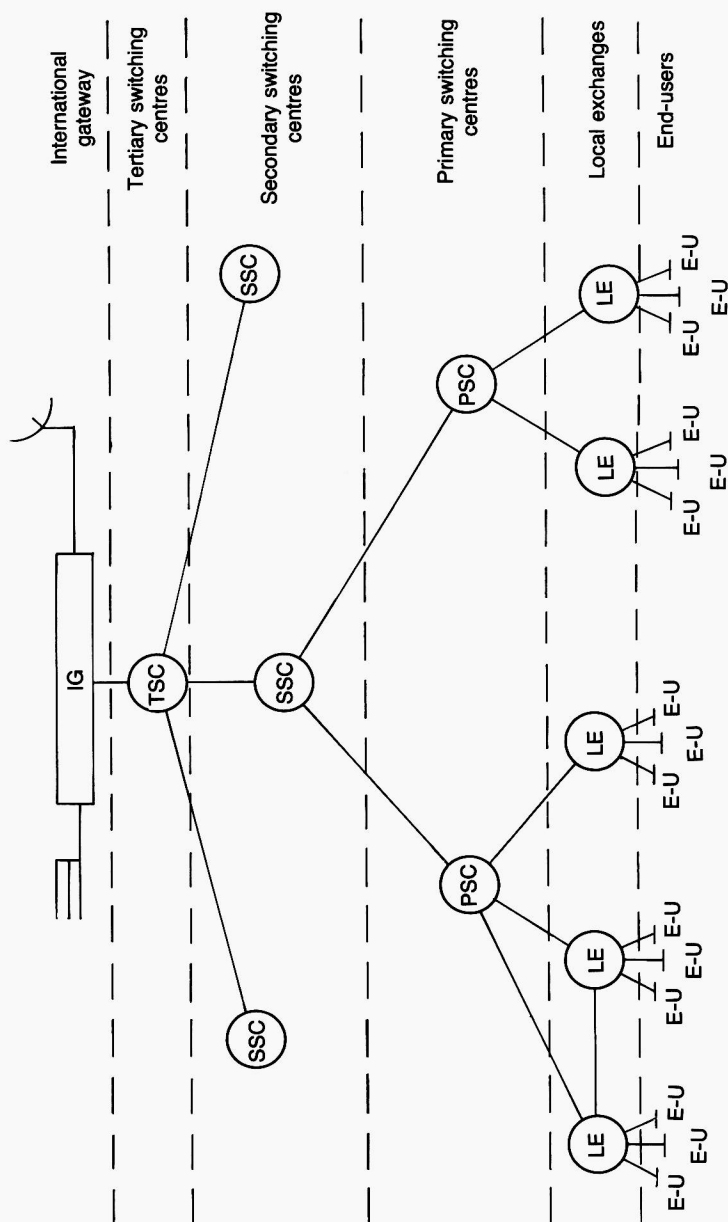


Figure 1.2 Hierarchical Design of the Public Switched Telephone Network

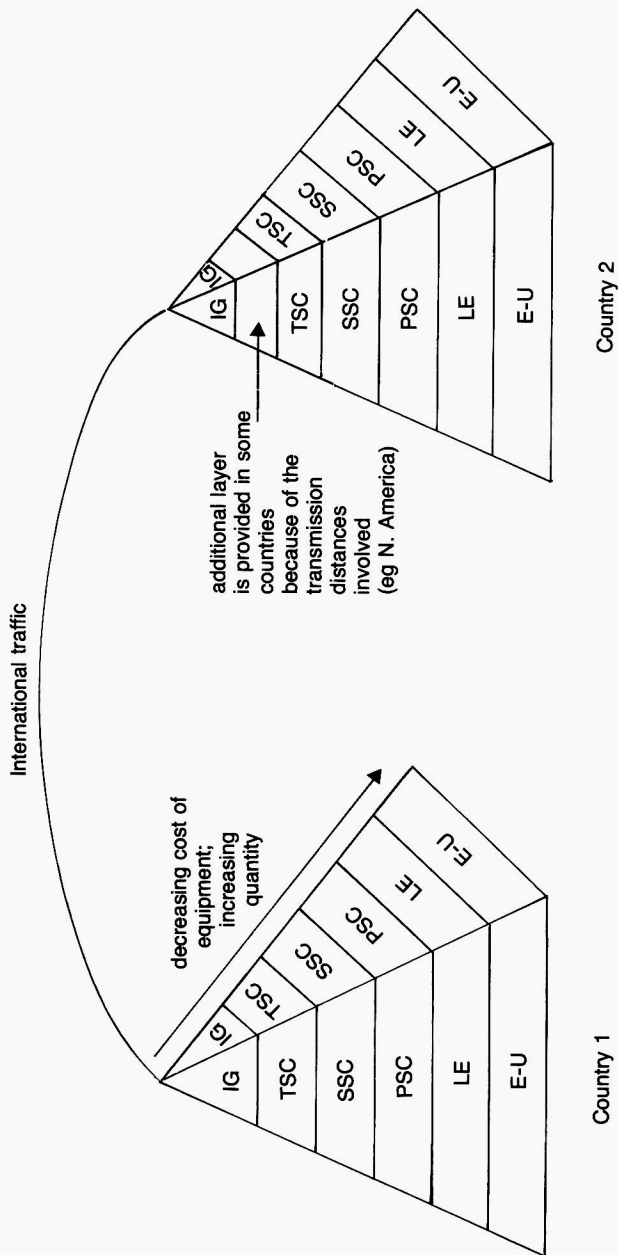


Figure 1.3 Pyramid Structure (Layers)

and signalling. Only a very small percentage of users will be using the international facilities at a given time and because the cost of providing international equipment is high (the equipment needs to be of a better quality in order to transmit over longer distances) it can be suitably dimensioned.

On the other hand, end-users at the base of the pyramid may only require local communications for the majority of cases so the transmission and terminal equipment may be of a low cost (lower quality because of the relatively short distances involved).

The pyramid structure thus provides a cost-effective solution to the geographical problems of providing a network where less of it is required.

An additional benefit of this type of structure is that all telephone exchanges at the Primary Switching Centre level, for example, can be slid out and replaced hence taking advantage of advances in technology. It is essential, of course, that the interfaces with the layer above it and the layer below it remain compatible.

In this type of system both star and mesh topologies, when the traffic demands a direct link (see Chapter 4), may co-exist.

The transmission function is provided both between levels and across levels. The switching function is provided at each level, even at the end-user level if for example a PABX (see Chapter 7) is employed. The signalling function is used to provide a cost-effective and efficient way of controlling the network.

The hierarchical nature of computer products may be thought of as falling into three basic categories:

- mainframe – used for number crunching;
- minicomputer – I/O transaction oriented;
- microcomputer – manipulative oriented (eg word processor).

In the future the end-user will probably see only two types of host-attached terminals:

- the very basic dumb terminals;
- the full capability microcomputer.

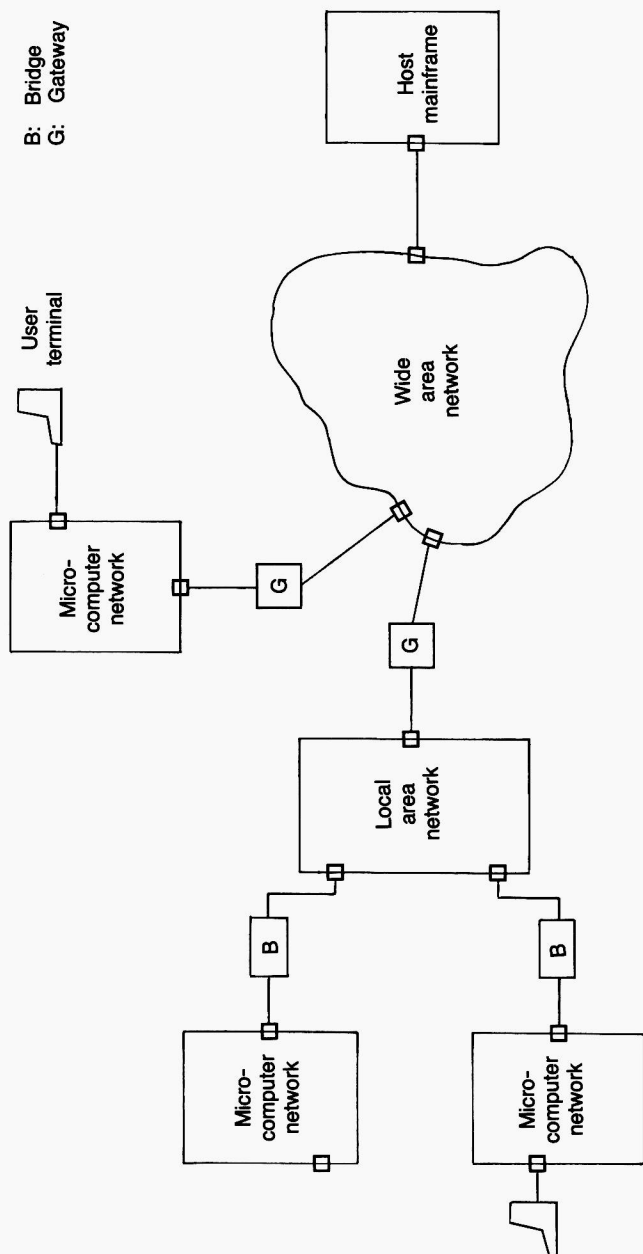


Figure 1.4 Possible Computer Network Configuration

All of the various products may require interconnection, preferably over some sort of network.

If, for example, there was a requirement for a database, held on the mainframe, to be downloaded to a microcomputer (or microcomputers) for manipulation then the microcomputer(s) may well be given access to the mainframe by clustering them on an intermediate minicomputer into which the database would be loaded.

The configuration of a computer network could well take the form shown in Figure 1.4.

The local area network could include a PABX. This aspect, along with wide area networks, microcomputer (or personal computer) networks, gateways and bridges will be discussed in the following sections of this chapter.

The final section considers the impact of networks. It must be noted that integrated networks are being designed today to support a diverse range of communications:

- voice;
- video;
- data;
- text.

New microcomputer-based devices are becoming available to support a number of these communications activities.

WIDE AREA NETWORKS

The geographical area of a wide area network is much wider than that of a local area network.

To put networks into perspective: the microcomputer network may be used within an individual department in a company; the local area network will be confined to one site within the company; and the wide area network is used whenever the communications leaves that site in the form of electrical signals on a cable, or using a satellite, providing it involves a third party, eg PTT.

Wide area network systems are rarely offered as commercial