Microcomputer Communications

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PUBLISHED BY NCC PUBLICATIONS

British Library Cataloguing in Publication Data

Gandy, Martin
Microcomputer communications
1. Telecommunication systems – Data processing
2. Microcomputers
I. Title
621.38'0413 TK51055

ISBN 0-85012-495-6

First published in 1985 by:

NCC Publications, The National Computing Centre Limited, Oxford Road, Manchester M1 7ED, England.

Typeset in 11pt Times Roman by UPS Blackburn Limited, 76-80 Northgate, Blackburn, Lancashire, and printed by Hobbs the Printers of Southampton.

ISBN 0-85012-495-6

Introduction

Rapid advances in microcomputer design and a growing awareness of its potential have opened up new application areas. Word processing, spreadsheet and database packages are now well known, and a type of application previously restricted to mainframe systems – communications – has caught the imagination of the microcomputer user. In this book the opportunities open to the microcomputer user through communications links are outlined, with practical guidelines on how these links can be installed.

Today's 16-bit hardware and operating systems offer considerably improved performance over earlier designs and provide the basis for developing the microcomputer into a sophisticated communications device. This book follows the development of the microcomputer and reviews the desirable features required to give the microcomputer useful communications capabilities.

The book first looks at data formats, and the transmission of data at the physical and electrical level. The broad categories of communication are examined next in order of increasing sophistication. These are the microcomputer as a terminal emulator, file transfer and integrated microcomputer-to-host computer communications software. The later sections of the book deal with the microcomputer in local area networks and wide area networks. This includes specially designed high-speed bus and ring networks for a single site, and conventional communications networks based on modems and analogue telephone lines.

Microcomputers are found in many different environments and the users in turn have quite different communications needs. For example, in an office system, the main requirement is for transferring documents between machines. In production management however, access to databases which may be distributed around the site will be the prime need. Scientific and computer support staff are primarily terminal users and are interested in multi-terminal emulations which can access a variety of host computers. There are also some communications facilities which are attractive to all types of user. The most familiar example is electronic mail which can solve the problems of contacting staff by telephone or by the internal post.

The main barrier to successful interworking has been the lack of standards. Fortunately progress is now being made on international communications standards through the International Standards Organisation (ISO). The structure of the ISO model is outlined and the present position of standards work is described.

A great variety of equipment and techniques can be encountered in a computer network and this can lead to an equally wide range of problems. A list of these pitfalls has been compiled from users' experiences and some guidelines are given which should help to avoid them.

Clearly microcomputer communications is a key subject for both the end user and dp professional. The need is growing and once the number of microcomputers in an establishment exceeds a 'critical mass' the benefits can be very significant. The techniques are still at an early stage in their development, but there are some useful products available now, and these are being enhanced to give more flexibility and make them easier to use.

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Acknowledgements

I wish to thank the following organisations for giving up their time and allowing me to benefit from their practical experience:

Bristol University Computer Centre
Edinburgh University Regional Computer Centre
University of Manchester Regional Computer Centre

The following organisations are thanked for providing operating manuals and technical data, and in some cases for supplying equipment for evaluation:

British Telecom
Camtec Electronics Ltd
Gandalf Digital Communications Ltd
Informatics General (UK) Ltd
International Computers Ltd
Racal-Milgo Ltd
Ultracomp Ltd
Vuman Ltd

I would also like to thank the following individuals for their help, advice and comments on the text:

P R D Scott
K C E Gee
P Hardy
A Gardner

Finally the Centre acknowledges with thanks the support provided by the Electronics and Avionics Board of the Department of Trade and Industry.

1 The Role of the Microcomputer

INTRODUCTION

There are clear phases in the history of computing. The 1950s and 1960s were dominated by central mainframes running data processing jobs in batch mode. The end user of the data had very little contact with the computer, which was managed and run in a separate department by professional staff including systems analysts, programmers, operators and clerical personnel. The 1970s saw the emergence of the minicomputer, which placed a strong emphasis on interactive programming using visual display terminals (VDTs). New areas for computing in the small business sector opened up, where costs of changing to a computer system had previously been too high. Mainframe computers still held the dominant position in terms of value of sales however, and probably will for some time. Another major change had become clear by the 1980s: the microcomputer had burst onto the scene, first as a domestic or laboratory tool, and then as a serious business machine.

The changes have only been possible because of the rapid developments in technology, particularly in large-scale integration and mass storage. The development of smaller and more powerful computers has not taken much work away from the central computer services department; instead new application areas, not possible with the early mainframe computers, have been opened up. It is likely that some applications – for example in banking, insurance and management – will remain dependent on mainframes, centralised, and under the responsibility of professional data processing staff.

A good example of the progress being made in large-scale integration is the short history of random access memory (RAM) integrated circuits ('chips'). For example, progress has been made by doubling the dimensions of the silicon chip to give four times the area and four times the component count. So far we have seen the state-of-the-art RAM increase in memory capacity in steps from 1K (1970), 4K (1974), 16K (1976), 64K (1980) and to a 256K chip during 1984. The 1 Mbyte chip is expected by 1986.

This rapid development has been made possible by increasing the purity of the silicon crystal growing process, so that larger fault-free areas can be obtained. Improved mask production using electron beam techniques has also increased the packing density that can be obtained. The scaling-up process of circuit layout has been a relatively simple problem. This continuing evolution of large-scale integration technology has led to:

- greater memory capacity per chip;
- more powerful CPUs;
- smaller-size printed circuit boards with fewer components;
- lower power consumption;
- greater reliability;
- faster performance;
- more powerful operating systems;
- multi-tasking operating systems;
- better applications.

If the aim of information processing can be stated as getting the right information to the right person at the right time in the right place in the right form and at the right cost, then the microcomputer is helping to meet this aim. The first microcomputers were stand-alone devices with limited power and memory, but the potential of the microcomputer as a business machine was soon evident: and the number of effective business application programs rapidly increased. This caught the imagination of the end user of information, and the microcomputer was quickly accepted as an office machine and management tool.

The key features in the microcomputer that have made this possible are:

- low cost;
- cheap mass storage;
- integrated screen and CPU;
- small number of CPU chips;
- small number of operating systems;
- high quality of software, which can run on many different machines.

The cost of a typical business microcomputer is now comparable with that of a computer terminal ten years ago, when discrete components were still widely used. Cheap mass storage is another technological development which, although not so dramatic as chip technology, is still impressive. Personal mass storage using Winchester technology is now affordable, in units of 5, 10, 20 and 100 Mbytes, with 500 Mbytes promised in 1985. These storage volumes were not available to the mainframe market 20 years ago.

The integrated screen and CPU connected by the internal high-speed bus is another key feature which has made possible some of the new applications, such as word processing and spreadsheets. Traditional data processing was adequately served by terminals which could be updated from the central host computer over a serial line connection. The fastest transmission speed usually possible over local connections is 9600 baud, which takes two seconds to fill a screen. This is too slow for spreadsheets and graphics packages, and poor for word processing. The microcomputer, however, can update a screen an order of magnitude faster than this because the display system and CPU are connected by a high-speed bus.

The last three factors are closely linked together. As integrated circuit development is very costly, relatively few microprocessor chips, the heart of the microcomputer, have been developed and used successfully. Hence only a few operating systems able to run on a variety of different machines have become widely established.

With many common families of machines coming onto the market the incentive to write software was very great and the competition fierce. This has resulted in some excellent software products available at very lost cost. In contrast, in the mainframe market every machine is different, and there is little possibility of transferring software from one machine to another. This has kept software costs high, and the availability of good software low.

As the business community accepted the microcomputer as an essential business machine, the limitations of a stand-alone machine were soon realised. Information is of little use until it is distributed, and microcomputers, linked together and linked to central computing facilities, can improve communications flow throughout a business.

Direct links between computing equipment have been in widespread use since the earliest days of computing development. These links either used special data-quality cable for on-site applications, or used the telephone network for longer-distance communications. This type of computer network does not provide an easy or cheap way to pass information between users. A new development, the local area network, was introduced to meet this new need and is the key to office automation. The main feature of a local area network is a data highway which is common to all users. Network software allows the users to access shared resources, such as high-cost printers, and can offer important new services such as electronic mail.

HARDWARE

All microcomputers (and other digital computers) have the same basic structure, as shown in Figure 1.1. Information is represented by binary digits (BITS), which can only take the values 0 or 1. This coding scheme is used as it is very easy to represent logical 0 accurately as approximately 0 volts and logical 1 as approximately 5 volts. These are the most popular voltage levels for digital electronic components. By choosing a threshold midway between these voltage levels, a digital system will have very good immunity to interfering noise voltages. For example, levels of 1 volt and 4 volts will be clearly interpreted as logic levels 0 and 1 respectively.

To represent information adequately, binary digits must be