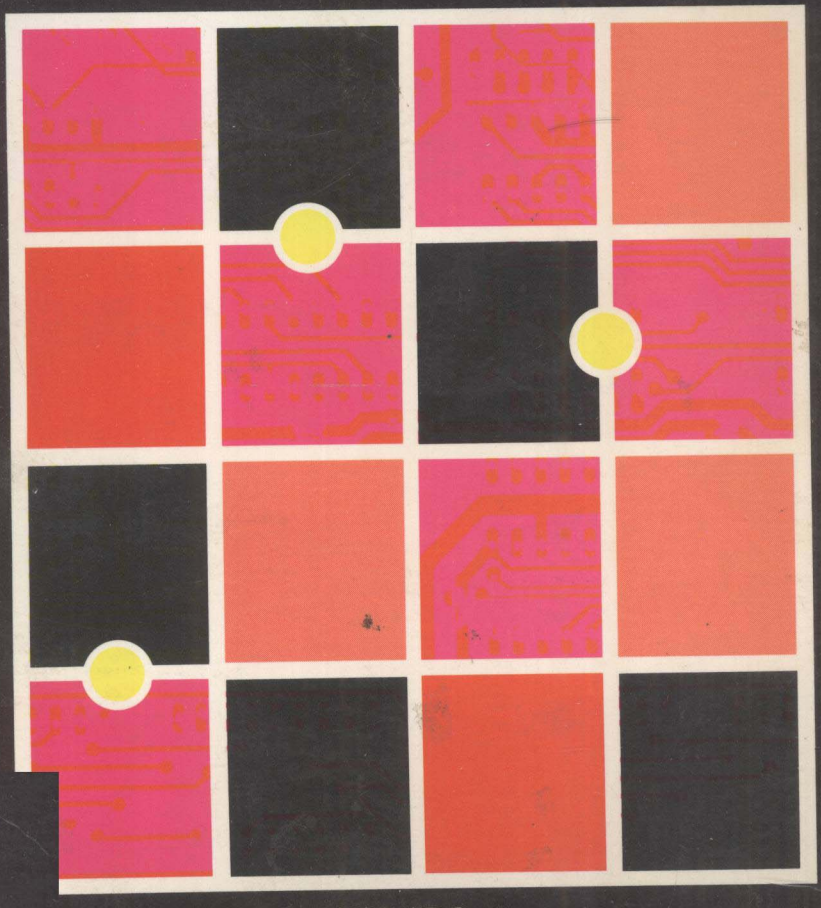
SAMS

22254

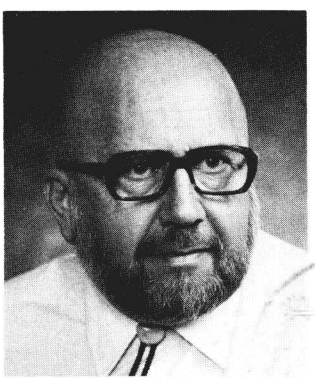
The Local Area Network Book

E. G. Brooner



BLACKSBURG CONTINUING EDUCATION SERIES™
edited by Titus, Titus & Larsen

VORK BOOK



E. G. Brooner is a semiretired engineer who has had a lifetime association with various branches of the electronics profession ranging from two-way radio communication to major military and defense systems. Having majored in business management, his main computer interest is business software and the application of microcomputers to small business use. He has also been a college programming instructor, and has authored three earlier books and numerous magazine articles dealing with microcomputer applications. The present book resulted when he found that potential users had many questions about networks and very little available in the way of answers.

The Local Area Network Book

by

E. G. Brooner

Howard W. Sams & Co., Inc.
4300 WEST 62ND ST. INDIANAPOLIS, INDIANA 46268 USA

FIRST EDITION
FIRST PRINTING—1984

International Standard Book Number: 0-672-22254-X
Library of Congress Catalog Card Number: 83-51227

Edited by: *Jody Bornhorst*
Illustrated by: *D. B. Clemons*

Printed in the United States of America.

Preface

Most of us can remember when computers were big, expensive, and mysterious and only large institutions could manage them. Then small computers came along. They were smaller, cheaper, and more manageable, and small businesses (and even individuals) could afford to make good use of them. This was a *computer revolution* in every sense of the term.

The next revolution is upon us: it is the *network revolution;* its goal is for different kinds of computer equipment to be able to "talk" directly to one another. If we can connect several small computers together we can do as much as, or even more than, the large expensive computers of a decade or so ago.

Only one problem remains, and that is how to best accomplish this goal. In 1982, some 8000 networks had been installed, worldwide. Although the field was dominated by two or three kinds of network designs, fifty or more companies, in the United States alone, were advertising their own version of a network. Some of them had products on the market and others were frantically trying to produce the networks their marketing departments were already advertising.

As a result of all this activity, it has become fairly easy to find magazine articles praising the virtues of this or that network; it is more difficult to obtain hard facts about real products and techniques. In contacting the various network manufacturers, the author has found some of the "leads" to be fruitless, at least at the time this book was put together, even though there are many excellent products available now or in the process of development.

The author's interest in networks has been stimulated by the questions that invariably arise whenever the subject is mentioned; for this

reason, the entire book has been phrased as a series of questions and answers. The reader may well find here his or her own questions, and the corresponding answers. The answers are basically nontechnical, although there is some material of interest to the engineer or serious hobbyist who has not yet been exposed to network technology.

E. G. BROONER

Acknowledgments

Phillips Publishing, Inc., Bethesda, Maryland, publishers of the *Local Area Networking Directory* and Carnegie Press, Madison, New Jersey, publishers of *Standards and Protocols for Communication Networks,* by James W. Conrad. These reference materials contributed greatly to an understanding of the subject matter they cover.

The manufacturers of, and users of, networks who provided much of the detail for this book. Particular acknowledgment is made to Allan Bowker (Dolby Laboratories), Susan Bosworth of 3COM Corporation, and Steve McGuire of the American Simmental Association.

Contents

CHAPTER 7

CHAPTER 8

CHAPTER 9

CHAPTER 10

APPENDIX

Chapter 1

What Is a Network?

I've been hearing a lot about networks, nets and LANs. Just what are they, and what are they used for?

The terms mean basically the same thing; LAN stands for Local Area Network. In a very general way, an LAN is a number of computers, peripherals and other resources interconnected in a way that permits them to be used either independently or together. The number of devices might be anywhere from two or three, up to several hundred.

Some computers have several terminals connected to them; is that a network?

It's not the kind of network we're tallking about. You're thinking about something called *time-sharing* and although it is useful, it's going to be replaced for many purposes by networks having many advantages over time-sharing.

Then perhaps we should find out, first, just what time-sharing really is.

Well first of all, a time-sharing system is just a computer which several people can use. All of them are connected into the computer and it "shares" its time among them. It might give each user control for a few milliseconds (thousandths of a second) at a time, or it might have an order of priority that allows certain ones to "interrupt" the operation at any time. In any case, each user has only partial use of the facilities although he may feel that he is in complete control at any given instant.

Is time-sharing very common?

Yes, some businesses and schools have a dozen or so terminals connected to one computer. And if you dial into one of the national

information services, or bulletin boards, you are using a time-sharing system.

That sounds pretty efficient. Can networks improve things in some way?

They certainly can; time-sharing has a lot of disadvantages. There is a sort of "master and slave" relationship between the main computer and those people using it. The main computer is in complete control and everything has to be done its way. And if several people are using it, they are isolated from one another.

Within a network, each user can have the use of, and some control over, every device connected to it. For example, the separate users can communicate directly with one another to exchange data and messages, in addition to performing their own normal operations.

With time-sharing, each user takes a part of the computer's resources. If you divide a pie in four pieces, the servings are quite generous; however, if you have to serve eight people, the pieces get a lot smaller and at some point you run out of pie. A time-sharing system works this same way.

Perhaps the biggest disadvantage is that there is a single, central computer that can "turn you off," either accidentally or on purpose, just when you need it.

That doesn't happen with networks?

That's one of the most important things in their favor; each person on the network has his own computer which operates independently of everything else. But if he wants to tap into one of the others for any reason, it's easy to do so. It's like having a number of computers at your disposal, rather than just one.

How is that better than having one very large computer that can do almost everything you want?

First of all, it's done with several small computers rather than one large one. Let's say you are faced with the choice of buying one large computer, or some number of small ones that will do the same jobs when linked in a network. You might find it more economical to buy the small ones and use them as a network. And, your whole operation wouldn't stop if one piece of equipment failed.

But can the small computers do the same things that a large one can?

They can in many cases. If you plan a network right, you might find that those small computers can do a really big job, and do it for less cost.

Then there's that business about the pie. If you need more pieces, you can add them to the network one piece at a time, instead of getting another whole pie when all you want is one or two more pieces.

This sounds interesting. How long have these things been around?

Not very long; in fact, the idea hadn't even been tried until just a few years ago. The technology is relatively new and is still in the process of being refined. There are several ways of putting networks together, and they aren't at all standardized just yet. So you will hear of ARCnets, ETHERnets, OMNInets, and APPLEnets to name just a few.

Do you mean, there is more than one kind of network?

In 1982, there were perhaps 50 separate kinds of networks but, for the most part, few of them were compatible with any other network. Most of these nets were proprietary products of individual manufacturers; a typical net was supported by, at most, a very few companies and, with rare exceptions, there were no alternate sources for the individual components of any given network.

At that time, the ETHERnet system was the most often discussed network system. Its design had been jointly supported by three major companies (DEC, Intel and Xerox) and a dozen or so others were providing hardware, software and other components compatible with the basic system. Some of the newer systems coming on the market appeared to be making an effort to be "Ethernet-compatible" in at least some respects.

Table 1-1 lists the networks that were being advertised in the early 1980s. By now, some of them may have given up, but there are probably more than enough new ones as this book is being written to take their place.

Table 1-1. ***Networks by Vendors/Suppliers***

Network	*Company*	*Address*
ACORN	Computer Automation	Irvine, CA
ARCNET	Datapoint	San Antonio, TX
	Tandy Corp.	Fort Worth, TX
C-NET	Cromemco, Inc.	Mountain View, CA
CABLENET	Amdax Corp.	Bohemia, NY
CCM-200	Data Control Systems	Danbury, CT
CLUSTER ONE	Nestar Systems, Inc.	Palo Alto, CA
COMM-NET	Sykes Datatronics	Rochester, NY
COMNET	Pragmatronics, Inc.	Boulder, CO
COMPUSTAR	Intertec Data Systems	Columbia, SC
CP/NET	Digital Research	Pacific Grove, CA
DCS 2A	Teltone Corp.	Kirkland, WA
DCS 2B	Teltone Corp.	Kirkland, WA
DESNET	Destek Group	Mt. View, CA
DOMAIN	Apollo Computer	Chelmsford, MA
DPC/NET	Action Comp. Enterprise	Pasadena, CA
ETHERNET	Intel	Santa Clara, CA
	Xerox	Palo Alto, CA
	Interlan	Chelmsford, MA
	Three Rivers Comp. Corp.	Pittsburg, PA
	3COM	Mt. View, CA
	(and others)	
GE NET	Intersil Systems, Inc.	Sunnyvale, CA
HINET	Digital Microsystems	Oakland, CA
HYPERBUS	Network Systems Corp.	Brooklyn Park, MN
HYPERCHANNEL	Network Systems Corp.	Brooklyn Park, MN
I S 4000	Infotron Systems Corp.	Cherry Hill, NJ
IBX s/40	Intecom, Inc.	Allen, TX
INFOBUS	Digital Comm. Corp.	Germantown, MD
LCN	Control Data Corp.	Minneapolis, MN
LOCALNET	Sytek, Inc.	Sunnyvale, CA
MESSENGER	Amtel Systems Corp.	Sunnyvale, CA
METRONET	Communication Tech.	McLean, VA
MITRENET	Mitre Corporation	Bedford, MA
MODWAY	Gould-Modicon Division	Andover, MA
NET IV	Four-Phase Systems	Cupertino, CA
NET/ONE	Ungermann-Bass, Inc.	Santa Clara, CA
NORTHNET	North Star Computers	San Leandro, CA
OFFICE DIALOG	CPT Corporation	Minneapolis, MN
OMEGANET	Compucorp	Santa Monica, CA
OMNILINK	Northern Telecom, Inc.	Minnetonka, MN
OMNINET	Corvus Systems, Inc.	San Jose, CA
PANDA II	Seiscor	Tulsa, OK
POLYNET	Logica, Inc.	New York, NY
PRONET	Proteon Associates, Inc.	Waltham, MA
RINGNET	Prime Computer	Natick, MA
SDNET	Software Dynamics	Anaheim, CA

Table 1-1 cont.—*Networks by Vendors/Suppliers*

Network	*Company*	*Address*
SDSNET	Scientific Data Systems	Venice, CA
STARNET II	Protex Industries, Inc.	Denver, CO
SYNNET	Syntrex, Inc.	Eatontown, NJ
SYSTEM 1800	Digilog Systems, Inc.	Montgomeryville, PA
TIC	Contel Info Systems	Bethesda, MD
TOKEN NET	Concord Data Systems	Lexington, MA
ULTRANET	Inforex	Burlington, MA
VIDEODATA	Interactive Systems/3M	Ann Arbor, MI
WANGNET	Wang Laboratories, Inc.	Lowell, MA
XODIAC	Data General Corp. (ISD)	Westboro, MA
Z-NET	Zilog, Inc.	Campbell, CA
ZEDANET	Digital Technology, Inc.	Provo, UT

What kind of business or other activity would be likely to have a network?

Networks are especially suitable for businesses, schools and institutions too large to get by on a single minicomputer or microcomputer, and too small to make good use of one of the large, expensive mainframe computers they might otherwise have to install.

In general, local networks are an extremely efficient way of using and sharing resources. In the next decade, they will find many uses and will be found in many places.

I've heard the term *PCN*. Is this some kind of network?

The term PCN, for Personal Computer Network, is being used to describe a local network based on "personal computers" as contrasted with more elaborate and costly equipment. A PCN generally uses lower-priced components that operate with less speed and efficiency than some other nets. Nevertheless, PCNs are true networks and more than adequate for many applications.

Could I buy a PCN at my local computer store?

Probably not, but the store might represent a manufacturer who can supply the necessary components and the special engineering that goes into such a system.

Putting together a Local Network of any kind requires careful planning; you don't just jump into it unprepared.

Why is that?

To be sure that everything is compatible—that is, that all of the various parts will work together. You probably know that not all software will work on all computers, neither will every computer work with just any printer you might want to connect to it. There are even differences in the way the pieces plug into one another. Since networks are more complicated than single computers, these problems are greater. But there are sometimes ways around these differences; that's where the planning comes in.

For now, it's best to stay with a network designed by experts; but progress is being made in standardizing software and the way things are connected, and the communication "rules" that are needed when we tie all of these things together. By the way, these rules are referred to as *standards* and *protocols.* Defining them precisely lets us know just what will work with what. We'll talk more about them later.

Just how *local* is a *local network?*

LANs are confined, by definition, to a single building or complex of buildings grouped rather closely. The maximum distance is limited by, among other things, the time it takes signals to travel along the complete path. The physical and electrical connections between the separate elements in the network set the limits.

Depending on the kind of network and how the signals are transferred, maximum distance from one end of the network to the other may be anywhere from 1000 yards, or so, up to a very few miles. Some networks provide for "repeaters" which can join two otherwise separate networks, but only over rather short distances. You may see these distances quoted in either yards and miles, or meters and kilometers. Some companies are trying to use the metric system in their literature; for all practical purposes a yard and a meter are about the same.

What if I want to expand my network to another city?

One way around the distance limitation is to set up a Wide Area Network, or WAN.

This is really "cheating" because a WAN merely joins several otherwise independent LANs. When protocols are discussed, you will see some ways of connecting LANs together. In some cases, the