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An Introduction

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Data Communications and Transmission Principles

An Introduction

Andrew Simmonds
School of Engineering
Sheffield Hallam University

To my family and friends

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Preface

Data communications can be a 'dry' subject. To help make it relevant and more interesting this book highlights significant applications of data communications, explains the use of familiar equipment (e.g. the IBM PC), and gives ideas for readers to do some investigating themselves. The theory in this book is explained in terms of the operation of standard communications equipment or protocols. This serves two purposes: firstly to gain an appreciation of the technology; and secondly to develop a necessary degree of familiarity with the standards and jargon. There is an extensive glossary at the back to help with this jargon.

The main aim of communication is to enable people to obtain information, so, although this is a technical subject, it is bound up with how people organize themselves in society, for example, in setting standards or controlling markets. The achievements of individuals and interactions with society are therefore mentioned in passing to set the subject in context.

Each chapter concludes with a number of questions to help readers to test their understanding, with answers provided at the back of the book.

Intended readership

This book is written for students on an undergraduate degree or HND course, studying a unit on data communications, communications engineering, information engineering, or similar. A minimum amount of prior knowledge is needed for the early chapters, whilst later chapters build naturally on the work covered in earlier chapters. The book is based on lectures given over a period of some years to different courses (including short courses for industry); hence much of the material covered has been successfully field tested! However, in producing this book the opportunity was taken to expand on the material covered in the lectures. The aim in doing this is to make the book more useful than a collection of lecture notes, allowing students to gain a deeper understanding of a particular topic where they have the time and interest. The book is suitable for self-study, with an extensive glossary and a set of questions and answers on each chapter.

As anyone involved in the subject knows only too well, data communications is going through a period of rapid change. The fundamentals, however, remain constant and some of the older technologies stubbornly refuse to die. The aim of the book is to enable students to build their own framework of data communication concepts, into which they can fit their own existing (and future) knowledge and experiences.

Although the book is intended primarily for electrical engineering students, it is also suitable for many students of computer studies who need to understand the technological base of the communications industry and how it will determine the future shape of that industry.

Plan of the text

I shall not write at length on this, as a good overview of the material and level can be gained by looking at the contents. Briefly then, the book is divided into three main parts:

- Part I - Basic Data Communications (chapters 1-3). This deals with definitions and basic signal characteristics, as well as covering modem links in detail as a means of introducing ideas on interfaces, protocols, and standards. This enables work to be discussed with reference to practical communications equipment.
- Part II - Transmission Principles (chapters 4-6). This covers transmission lines, free space links and fibre optics. The emphasis here is on how these topics are interrelated, although each is treated separately so that it is possible to cover the topics in isolation.
- Part III - Protocols and Networks (chapters 7-10). Chapter 7 introduces this part by considering synchronous protocols for point-to-point links, especially the bit oriented protocol HDLC. Wide Area Networks (WANs) are then covered, which allows the OSI seven layer reference model to be introduced whilst explaining X.25. TCP/IP is also covered, which leads on to a comparison of open standards. Local Area Networks (LANs) such as Ethernet and Token Ring are then dealt with. Finally, new network protocols and ideas are discussed in the last chapter.

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The impetus for writing this book came from the development of a video-based learning package on Data Communications [MAD]. I worked with Richard Madin and Richard Gibson on that project and would especially like to thank them for their ideas and help; indeed Richard Madin is co-author of chapters 1 and 3. Richard has gone on to produce some Computer Aided Learning packages on data communications [CAL]. Although this book has been written as a stand-alone text-book, it is divided into much the same topic areas as the CAL material and can be used as a back-up text.

Finally, my grateful thanks to my wife Roma, for her help and encouragement.

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