Data Communications: Facilities, Networks, and Systems Design, Dixon R. Doll, John Wiley and Sons, Inc., New York, New York, 1978. 493 pp. (ISBN 0-471-21768-9, $21.00).

Data communications, with its wide scope of technical disciplines and rapid evolution, is a challenge to any textbook. Meeting the challenge, Dixon Doll's volume should become a well-accepted reference and text for academic or industrial instruction.

With a pragmatic approach, Mr. Doll largely eschews theoretical development, emphasizing instead practical concepts developed while dealing with concrete design problems. Examples of serviceable notions include configurations with split-stream modems and inverse multiplexing. Both techniques would allow a user to adapt a limited variety of public transmission services to his specific requirements. Another instance encountered by the author is an improvement in the performance of satellite links achieved simply by increasing block length instead of adopting more complex data-link control. Techniques and empirical methods of this nature are scattered throughout the book.

In chapter three, on common carrier services and tariffs, Mr. Doll manages to bring the uninitiated successfully through tariffs for direct-distance dialing, wide-area telephone service, high density/low density, and multischedule private lines.

Books

Other interesting aspects of the book are his comparative treatment of synchronous data-link control and binary synchronous communications, and his brief assessment of network architectures developed by computer manufacturers and by common carriers. The much-needed simplified treatment of the current interface between data terminals and modems, EIA-RS232 in the U.S. and Canada and V.24 in most other places, includes many explanatory drawings and tables. A more extensive treatment of X.25, X.21, and other protocols for new public data networks would have been useful for many readers.

With a few minor exceptions, the reader needs only a high-school mathematics background. Even forward-error control is explained without too much demand on the reader's mathematical acumen. There are very few pages without figures; the artwork is simple and clear. Questions and problems for the student appear at the end of each chapter.

The book's well-constructed index, detailed listing of contents for each chapter, and the tables of useful data allow for easy reference use. The best tables are those dealing with common carrier services and tariffs. Each of the nine chapters has a carefully selected bibliography, frequently including less well-known works such as manufacturers' literature.

In sum, Dixon Doll has produced a timely, broad, readable overview. It is recommended as a course textbook and as a reference.

Frank Corr

Communications Architecture for Distributed Systems, R. J. Cypser, Addison-Wesley Publishing Company, Inc., Reading, Massachusetts, 1978. 711 pp. (ISBN 0-201-14458-1 ABCDEFGHIJK-HA-798, $20.95).

All too often, it seems that a definitive tutorial volume on an emerging area of science or technology is not written until the field is so mature that most of the real innovation has already occurred. Until such a book finally appears, the student of the subject must learn from a sampling of fragmentary journal articles, working papers and so forth, usually incomplete and uncoordinated. It is thus most gratifying to have Dr. Cypser's book on unified network architectures at a time when this difficult field is still vigorously evolving.

This extensive volume is actually several books in one. First and principally, it is an attempt (and quite a successful one in this reviewer's opinion) to explain Systems Network Architecture (SNA) to such a level of detail that it can be used by systems designers. As such, it goes well beyond the available technical articles on SNA, and in places approaches surprisingly closely the level of detail in the official Format and Protocol Manual.[1] This volume may well prove to be indispensable to anyone who needs a knowledge of SNA. This includes implementers dealing with SNA and requiring an introduction before delving into the Manual and specific product documentations. There is also discussion of ARPANET, the Digital Equipment Corporation DECNET, and the Univac DCA, but these are very brief and serve mostly as occasional reminders that there are several ways of skinning some particular cat.

Secondly, this book partially fills an important gap in the catalog of texts available for use in university computer science curricula. Such texts almost universally treat a computer system as a central processor. Although all manner of advanced topics—such as multiprogramming, virtual storage, and multiprocessing—are extensively and elegantly dealt with in computer science courses, the fact that the host is so often really executing application programs on behalf of remote terminals or remote other application programs is usually dismissed by describing teleprocessing support as simply a minor and incidental piece added onto the operating system. The result has been a generation of computer sci-

ence students who have had to learn the methods by which commercial computers support their networks of controllers and terminals after graduation, when real life is confronted on the job. (The exception to this situation has been several texts, such as References 2 and 3, that have described the ARPANET technology as used by a number of universities, principally in the U.S.)

In this second setting, the present volume is less successful, since the mass of SNA detail often obscures the essence of why each function has been designed as it is and how alternative realizations might have been arrived at. Still, until someone writes the definitive computer science university text that explains teleprocessing control structures in a terse and generic fashion, the Cypser volume will probably remain the best available substitute. A case study course based on SNA and using this book should be quite effective. The chapter showing how a certain finite state machine formalism can be (and has been) used to put the various module interactions on an unambiguous and concise basis for analysis and synthesis is so generally useful that it should be of great value in preparing computer science students for dealing with any kind of communication protocols and architectural details at the basic level.

Third, this book traces historically the evolution of two parallel streams, whereby both the common carrier community and the computer industry have tried to relieve the user of the need to worry about communication and format details, so that he can concentrate on programming the applications. Cypser handles this story not only by discussing SNA (and also to a minor extent DCA and DECNET), but also by providing (in Chapters 1, 2, and 17) a first-rate description of public data networks and the evolution of international standards, such as X.21 and X.25, in which the common carriers have taken the lead.

A few words about how the book is organized: Chapters 1 to 5 set the stage by tracing the history of transmission and computer hardware and software technologies and the evolution of user requirements to the point where coherent architectures for providing orderly distribution of function and control of communication resources have become the imperative that they are today. These chapters are fairly loosely written, and most can be skipped by the reader who is reasonably familiar with communications and computers. The exception is Chapter 3 (Evolution of Configuration and Function Distribution), which is "must" reading to put into perspective the material that follows.

Chapter 6 is the pivotal one, since it provides a "once through" the SNA layers and functions in preparation for dealing with each in detail in individual chapters. There follow five chapters, one on each of the five principal SNA layers. Reading from the interface

to the end user down to the common-carrier-provided transmission lines, these layers are the following: NAU Services, Data Flow Control, Transmission Control, Path Control, and Data Link Control. The function of the centralized control organism (System Services Control Point) in the host is not broken out into a separate chapter, but appears at the appropriate points in each of the five chapters at which the control of each layer is defined.

Chapter 12 integrates the whole picture by following in detail several typical scenarios that involve putting two end users into session with each other, starting from the very beginning when, for example, one node calls up another on the telephone. This chapter, as well as Chapter 14 on reliability and security control and Chapter 15 on multidomain SNA networks (interconnected tree topologies), completes the presentation of SNA details. At many places, in presenting these details, the author takes the time to discuss not only the architecture (SNA) but also the implementations (NCP, VTAM, TCAM, CICS, and IMS, and appropriate microcode).

Chapter 13 presents the finite-state machine formalism that has proved to be such a powerful tool in synthesizing and documenting SNA. Routing is briefly discussed in Chapter 16. The reader who is deeply interested in this subject is advised to seek the better treatments in the books by Kleinrock[3] and Schwartz.[4] Chapter 17 describes the new public data network interface standards, X.21 and X.25.

All in all, this extensive volume is a rather heroic achievement. It is the most complete and readable single reference available on SNA or any other network architecture. It has definite possibilities as an advanced computer science text, and it has much valuable information on such closely related topics as common carrier facilities, how teleprocessing technology has evolved, and how it is still evolving.

CITED REFERENCES

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3. L. Kleinrock, *Queuing Systems*, Vol. II, John Wiley and Sons, Inc., New York, NY (1976).
4. M. Schwartz, *Computer-Communication Network Design and Analysis*, Prentice-Hall, Inc., Englewood Cliffs, NJ (1977).

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