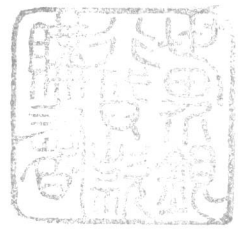


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DIGITAL TELEPHONY AND NETWORK INTEGRATION

**Bernhard E. Keiser
and
Eugene Strange**



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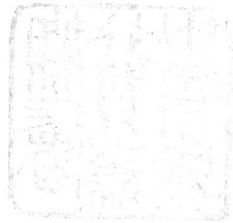
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DIGITAL TELEPHONY AND NETWORK INTEGRATION



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To our wives, Evelyn Keiser and Elsie Strange, who gave unselfishly of vast amounts of their time in typing the manuscript.



Preface

What is “digital telephony?” To the authors, the term digital telephony denotes the technology used to provide a completely digital point-to-point voice communication system from end to end. This implies the use of digital technology from one end instrument through the transmission facilities and switching centers to another end instrument. Digital telephony has become possible only because of the recent and ongoing surge of semiconductor developments allowing microminiaturization and high reliability along with reduced costs.

This book deals with both the future and the present. Thus, the first chapter is entitled, “A Network in Transition.” As baselines, Chapters 2, 3, and 10 provide the reader with the present status of telephone technology in terms of voice digitization as well as switching principles.

The book is an outgrowth of the authors’ continuing engineering education course, “Digital Telephony,” which they have taught since January, 1980, to attendees from business, industry, government, common carriers, and telephony equipment manufacturers. These attendees come from a wide variety of educational backgrounds, but generally have the equivalent of at least a bachelor’s degree in electrical engineering.

The book has been written to provide both the engineering student and the practicing engineer a working knowledge of the principles of present and future voice communication systems based upon the use of the public switched network. Problems or discussion questions have been included at the ends of the chapters to facilitate the book’s use as a senior level or first year graduate level course text.

Numerous clients and associates of the authors as well as hundreds of students have provided useful information and examples for the text, and the authors wish to thank all those who have so contributed either directly or indirectly.

The first chapter, which is a joint effort of both authors, provides an overview of the field. Chapters 2–4 deal with the subject of speech digitization, while Chapters 5 and 6 are devoted to the use of digital technology in the telephone network and for transmission in general. Chapters 7–9 treat three principal facility types for digital transmission: microwave radio, communication satellite systems, and fiber optics.

Chapters 10–12 begin with the present status of telephony switching systems and progress through a description of digital switching architecture and switching systems using stored program control. The evolution of the switched digital network is covered in Chapter 13, leading finally to the integrated services digital network (ISDN), which is the subject of Chapter 14.

Because of the rapidly changing nature of the subjects covered in this volume, the authors invite reader comments, questions and suggestions for future editions.

The authors acknowledge the useful comments and suggestions provided by the reviewers of the text.

Dr. Keiser thanks his daughter, Nancy, for drafting many of the illustrations, and Mr. Strange thanks Mr. Mike Fontana for his drafting support. The book would not have been possible without the contributions of these individuals.

BERNHARD E. KEISER
EUGENE STRANGE

Vienna, Virginia

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1

A Network in Transition

1.1. INTRODUCTION

To say that telephony is in a state of transition is to describe the history of telephony. It always has been in a state of transition and will so continue for the foreseeable future. It is becoming increasingly difficult to distinguish one telephone network from another now that direct dialing is available in most countries, but we still do not have a single, worldwide network.

In this introductory chapter, we look at one network not only as a stand-alone network but also as a very significant portion of worldwide telephony. Since the authors are American and have had more extensive exposure to the network in the United States, it is only natural to focus on that network. Because the networks in the United States and Canada operate as a transparent, integrated network, the evolution of the network in the United States is considered to typify that of the Canadian network as well, and, to a certain extent, of other national networks throughout the world.

In order to focus on the extent of the evolution, this chapter highlights, in snapshot form, some statistics and characteristics of the American telephone network at three 20-year intervals—past, present, and future. The nature of the network 20 years from now, of course, is highly speculative, but some of the trends are readily apparent.

1.2. THE NETWORK YESTERDAY

Over twenty years ago (1964), all telephone calls in the public switched network were switched by operation of metallic elements to establish metallic paths through switching system networks. Some of those electromechanical switching systems had already been in service for over 40 years, and some manual switchboards were still in service. Direct dialing of toll calls was gaining in popularity as more local and toll switching systems were being equipped with the capability for direct distance dialing (DDD), although manual toll switchboards still were handling a high percentage of toll calls.

The development of multichannel transmission systems had been proceeding at a faster pace than that of switching systems. Between 1948 and 1964, there were few major improvements in switching system technology, the