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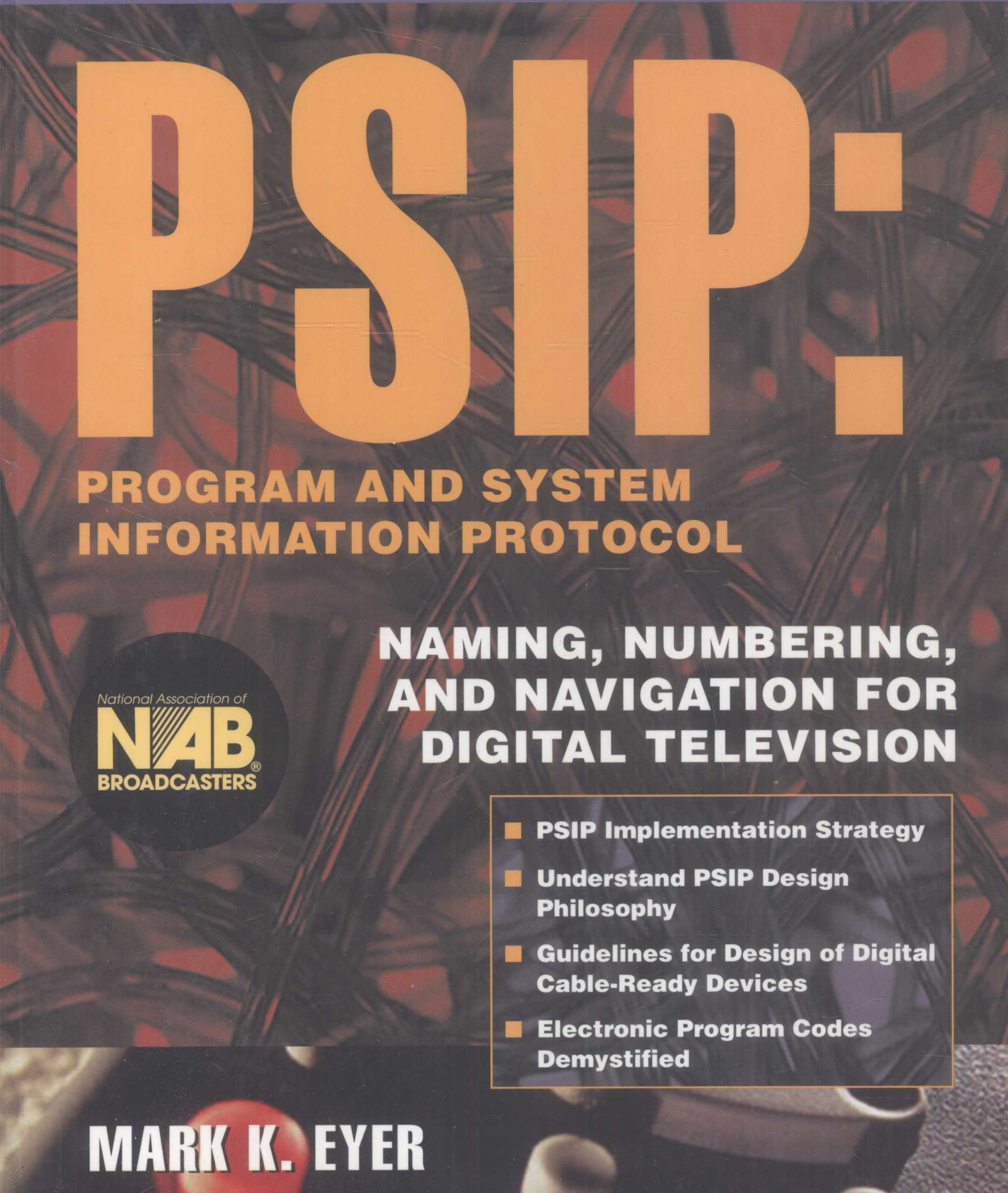

PSIP:

PROGRAM AND SYSTEM INFORMATION PROTOCOL

NAMING, NUMBERING, AND NAVIGATION FOR DIGITAL TELEVISION

National Association of NAB BROADCASTERS®

- PSIP Implementation Strategy
- Understand PSIP Design Philosophy
- Guidelines for Design of Digital Cable-Ready Devices
- Electronic Program Codes Demystified

MARK K. EYER

PSIP: Program and System Information Protocol

Naming, Numbering, and Navigation for Digital Television

Mark K. Eyer

Jerry C. Whitaker, Editor

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For *Ben*

Foreword

Bernard Lechner

This book is a major contribution to the understanding and application of the ATSC PSIP Standard. The author, Mark K. Eyer, was a principal architect of the PSIP Standard and is today, unquestionably, the world's leading expert on PSIP. I am delighted that he found the time to write this outstanding book.

PSIP uses the basic MPEG-2 Systems toolkit to provide a means for broadcasters to include information about their current and future programs as an integral part of the transmitted signal. Once collected by the television receiver, this information can be used to provide a rich user interface that may include an interactive on-screen Electronic Program Guide to facilitate navigating the channels.

The PSIP Standard was developed by the ATSC Specialist Group on Service Multiplex and Transport Systems Characteristics (T3/S8). I was privileged to be the Chairman of T3/S8 from its inception in January of 1994 until April of 2002 and was thus able to witness and guide the development of the PSIP Standard. The work on PSIP began in the latter part of 1996 and the finished Standard (A/65) was adopted by the ATSC a little over a year later on December 23, 1997. Mark Eyer participated in the development process from start to finish and made major contributions to the resulting standard. He continues today, now as Chairman of T3/S8, to work on improvements and extensions to the standard. He is also an active participant in related standards work of CEA and SCTE.

The book not only describes the syntax and semantics of the PSIP Tables and Descriptors but also includes an excellent tutorial on the relevant aspects of MPEG-2 Systems. The relationship between the required Program Specific Information (PSI) elements of MPEG-2 Systems and PSIP is described. In addition to everything you ever wanted to know about PSIP, from two-part channel numbers to Directed Channel Change, the author has included a wealth of information about related EIA/CEA and SCTE standards. Especially informative is the discussion of how PSIP relates to digital cable-ready television receivers and the current, and planned future, practices for System Information used on cable television systems, as documented in SCTE standards.

Mark Eyer has provided a wealth of examples to help the reader understand how PSIP works and how to implement it in the broadcast plant and the consumer digital television receiver. This very readable book is destined to become the definitive reference on PSIP.

Bernard J. Lechner
Princeton, New Jersey
June 2002

Acknowledgments

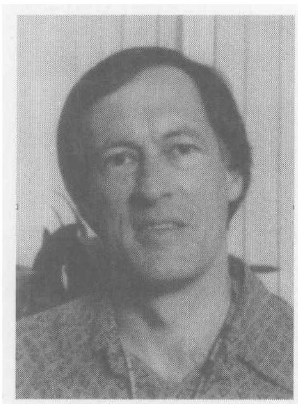
Just after the ATSC *Data Broadcasting* book was published by McGraw-Hill last year, one of the authors, Michael Dolan, called to suggest that PSIP would be a natural topic for another book in the DTV series and that I ought to take on that challenge. My thanks goes out to Mike for the initial idea and for putting me in touch with Steve Chapman, Executive Editor at McGraw-Hill Professional who has supported the project and all my various needs throughout the process. My thanks also to Henry Derovanessian and Mike Fidler at Sony for supporting my request to take on this assignment.

I would like to express my deep appreciation to everyone who helped review the manuscript: Art Allison, Richard Chernock, Michael Field, Adam Goldberg, Matthew Goldman, Edwin Heredia, Michael Isnardi, Steve Johnson, Jeff Krauss, Bernie Lechner, Don Moore, Gomer Thomas, and Joe Weber. My sincere thanks goes to Jerry Whitaker for his support of the project from the beginning, for introducing me to the mechanics of the authoring process (and answering endless questions about it), and for encouraging me to tackle the production and layout aspects of the job. Many thanks to Sharon Sears for her diligent work in copy editing and helping to convert the manuscript to camera-ready format.

One of the tasks in preparation of this book involved creation of actual example PSIP tables. The folks at Triveni Digital were kind enough to loan me one of their PSIP generator products, the GuideBuilder, to assist in that work. My thanks to Russell Wise, Brian Lee, and Luis Don for their help and support.

The standard that is the topic of this book, ATSC A/65, came into being as the result of the collaborative effort of engineers representing various industries, including broadcasters, consumer electronics manufacturers, and those involved with digital cable television. I would like to especially thank Bernard Lechner, under whose leadership in the ATSC Transport Specialists group the ATSC A/65 Standard was crafted. Bernie's expertise and guidance created the environment that allowed all those involved to do their best and most creative work. In addition to Bernie, those who played a significant role in the initial PSIP standard include Jack Chaney, Mehmet Ozkhan, Andy Teng, Edwin Heredia, Art Allison, Warner W. Johnston, and Matthew Goldman. Matthew's contribution has, and continues to be, to help us keep strict adherence to the philosophy and terminology established in the MPEG-2 *Systems* standard.

ABOUT THE AUTHOR



Mark K. Eyer is currently Director of Systems at the Technology Standards Office of Sony Electronics. He graduated Cum Laude with a B.S. degree from the University of Washington in 1973 and received an MSEE degree in 1978 from the same institution. For the past twenty years, Mr. Eyer has been involved with the development of technologies and products related to secure and digital television and he holds twelve US patents in these areas.

After joining General Instrument (now Motorola) in 1982, he was responsible for design of decoder firmware and system control software. Beginning in 1988, Mr. Eyer designed firmware for products employing digital video compression technology. In 1990, he was given responsibility for the development and maintenance of the protocols used to deliver data and control across the satellite link to individual decoders. This work formed a contribution to ATSC that led to the A/56 System Information for Digital Television standard in 1994.

Since 1994, Mr. Eyer has made contributions to various digital television standards including ATSC A/65 *Program and System Information Protocol (PSIP) for Terrestrial Broadcast and Cable*, part of which was derived from the earlier A/56 work. He became involved in digital interconnection standards in 1997, and co-chaired the committees in EIA/CEA that created the EIA-775-A *DTV 1394 Interface Specification*, EIA-775.2 *Service Selection Information for Storage Media Interoperability* and EIA-849 *Application Profiles for EIA-775-A Compliant DTVs*. Mr. Eyer was a primary contributor to various SCTE Digital Video Subcommittee (DVS) standards including ANSI/SCTE 26 *Home Digital Network Interface*, DVS 216 *POD Extended Channel Specification*, and SCTE 65 *Service Information Delivered Out-of-Band for Digital Cable Television* and he led the team that developed EIA-814/SCTE 18 *Emergency Alert Message for Cable*. Currently, Mr. Eyer chairs the ATSC T3/S8 Transport Specialists group, works with various SCTE, ATSC, and EIA/CEA standards committees, and contributes systems engineering expertise to the development of Sony's digital television and cable set-top box products.

Contents

Chapter

1

Introduction

If you are involved in any technical way with digital television sent either via terrestrial broadcast or cable means, chances are good you will need to deal in some way with the Program and System Information Protocol, or PSIP. This book was written to serve as an introduction to the general concepts embodied in the protocol, to explain how PSIP builds on the MPEG standards, and to describe the design philosophy the architects had in mind when the protocol was conceived. It offers a variety of helpful guidelines and insights to engineers involved in the design of consumer electronic and professional-grade products that support the PSIP protocol. It will also be helpful to broadcast station engineers and cable headend operations managers, or anyone who is involved with the creation and transmission of PSIP data.

In this introductory chapter, we start at the beginning by answering the most basic question, "what is PSIP?" Next we look at the reasons why the protocol was needed in the first place. We then discuss the conventions used in the book for table syntax and semantics, and then outline the structure of the book.

What is PSIP?

Simply put, the Program and System Information Protocol, or PSIP, is the part of the US Digital Television Standard that lets the digital television receiver know such things as the name of the channel and the name and description of current and future programs on that channel. In addition, PSIP is actually much more than that, as this book will show.

PSIP defines "system information" (sometimes called "service information" or just SI) for the Advanced Television Systems Committee (ATSC) standard developed in the United States. The ATSC A/65 PSIP Standard describes a method for delivery of program guide and system data tables carried in any compliant MPEG-2 transport multiplex.

The primary purpose of PSIP is to facilitate acquisition and navigation among the analog and digital services available to a particular receiver or set-top box, but it also serves as a support platform for applications such as data broadcasting. Delivery of PSIP data is essential for digital terrestrial broadcasts in North America, and cable operators have pledged to support it as well for the benefit of cable-ready digital televisions.

Why PSIP?

One might ask "why is PSIP necessary?" To answer that question it is helpful to look at the difference between analog and digital television signals. An analog television broadcast or cable signal includes at most one video component and one or two audio components. One analog signal represents one "channel" of programming, so that if a receiver acquires the signal, it has acquired that channel. If a user commands an analog-only television receiver to go to channel 4, the receiver looks for an analog signal in the 66-72 MHz band because "channel 4" is known to map to this portion of the spectrum.

Digital television, on the other hand, provides for the possibility that one broadcast or cable signal includes several television channels. Digital compression allows as many as a dozen or more standard-definition programs to be delivered within the same multiplex signal. Each program has a video component, one or more audio tracks, and may include accompanying data as well.

The FCC ruled that the RF spectrum currently in use for analog terrestrial broadcast must be relinquished for use by other digital services by the year 2006. In compensation, each broadcast licensee has been assigned a second 6-MHz channel for transmission of digital TV. The FCC's table of DTV channel allotments, defined in 47 CFR 73.622, was designed to minimize use of the spectrum at channels 60-69 and 2 through 13 as well. As originally conceived each 6-MHz channel would carry a single High Definition TV (HDTV) channel. Presumably, users would re-learn the new channel number for each of their favorite local broadcasters when the shift to digital occurred.

Early on, the flexibility of the MPEG-2 video compression standard was recognized. ATSC defined a set of possible compression formats including not only HDTV formats but standard definition (SD) formats as well. Clearly a broadcaster could choose to deliver a signal that included not just one channel but several. Typically, part of the broadcast day would be devoted to HD content. During that time, the other channels would have to go off the air because the HD channel would consume the full bandwidth of the channel. For other parts of the day, several channels of programming could be provided—all in the same broadcast multiplex.

It soon became clear that some guidance would have to be provided to the receiver (and hence to the viewer) to make sense of such a multi-channel signal. How would channel numbers work when the familiar RF-related channel number could be associated with more than one "TV channel"? Broadcasters realized their