

Understanding Telecommunications Networks

2nd Edition

Andy Valdar

IET TELECOMMUNICATIONS SERIES 71

Understanding Telecommunications Networks

Other volumes in this series:

- Volume 9 **Phase noise in signal sources** W.P. Robins
- Volume 12 **Spread spectrum in communications** R. Skaug and J.F. Hjelmstad
- Volume 13 **Advanced signal processing** D.J. Creasey (Editor)
- Volume 19 **Telecommunications traffic, tariffs and costs** R.E. Farr
- Volume 20 **An introduction to satellite communications** D.I. Dalgleish
- Volume 26 **Common-channel signalling** R.J. Manterfield
- Volume 28 **Very small aperture terminals (VSATs)** J.L. Everett (Editor)
- Volume 29 **ATM: The broadband telecommunications solution** L.G. Cuthbert and J.C. Sapanel
- Volume 31 **Data communications and networks, 3rd edition** R.L. Brewster (Editor)
- Volume 32 **Analogue optical fibre communications** B. Wilson, Z. Ghassemlooy and I.Z. Darwazeh (Editors)
- Volume 33 **Modern personal radio systems** R.C.V. Macario (Editor)
- Volume 34 **Digital broadcasting** P. Dambacher
- Volume 35 **Principles of performance engineering for telecommunication and information systems** M. Ghanbari, C.J. Hughes, M.C. Sinclair and J.P. Eade
- Volume 36 **Telecommunication networks, 2nd edition** J.E. Flood (Editor)
- Volume 37 **Optical communication receiver design** S.B. Alexander
- Volume 38 **Satellite communication systems, 3rd edition** B.G. Evans (Editor)
- Volume 40 **Spread spectrum in mobile communication** O. Berg, T. Berg, J.F. Hjelmstad, S. Haavik and R. Skaug
- Volume 41 **World telecommunications economics** J.J. Wheatley
- Volume 43 **Telecommunications signalling** R.J. Manterfield
- Volume 44 **Digital signal filtering, analysis and restoration** J. Jan
- Volume 45 **Radio spectrum management, 2nd edition** D.J. Withers
- Volume 46 **Intelligent networks: Principles and applications** J.R. Anderson
- Volume 47 **Local access network technologies** P. France
- Volume 48 **Telecommunications quality of service management** A.P. Oodan (Editor)
- Volume 49 **Standard codecs: Image compression to advanced video coding** M. Ghanbari
- Volume 50 **Telecommunications regulation** J. Buckley
- Volume 51 **Security for mobility** C. Mitchell (Editor)
- Volume 52 **Understanding telecommunications networks** A. Valdar
- Volume 53 **Video compression systems: From first principles to concatenated codecs** A. Bock
- Volume 54 **Standard codecs: Image compression to advanced video coding, 3rd edition** M. Ghanbari
- Volume 59 **Dynamic ad hoc networks** H. Rashvand and H. Chao (Editors)
- Volume 60 **Understanding telecommunications business** A. Valdar and I. Morfett
- Volume 65 **Advances in body-centric wireless communication: Applications and state-of-the-art** Q.H. Abbasi, M.U. Rehman, K. Qaraqe and A. Alomainy (Editors)
- Volume 67 **Managing the Internet of Things: Architectures, theories and applications** J. Huang and K. Hua (Editors)
- Volume 68 **Advanced relay technologies in next generation wireless communications** I. Krikidis and G. Zheng
- Volume 69 **5G wireless technologies** Dr. Angeliki Alexiou (Editor)
- Volume 70 **Cloud and fog computing in 5G mobile networks** Dr. Evangelos Markakis, Dr. George Mastorakis, Dr. Constandinos X. Mavromoustakis and Dr. Evangelos Pallis (Editors)
- Volume 71 **Understanding telecommunications networks, 2nd edition** A. Valdar
- Volume 73 **Network as a service for next generation Internet** Q. Duan and S. Wang (Editors)
- Volume 905 **ISDN applications in education and training** R. Mason and P.D. Bacsich

Understanding Telecommunications Networks

2nd Edition

Andy Valdar

The Institution of Engineering and Technology

Published by The Institution of Engineering and Technology, London, United Kingdom

The Institution of Engineering and Technology is registered as a Charity in England & Wales (no. 211014) and Scotland (no. SC038698).

© The Institution of Engineering and Technology 2017

First edition published 2006

Second edition published 2017

This publication is copyright under the Berne Convention and the Universal Copyright Convention. All rights reserved. Apart from any fair dealing for the purposes of research or private study, or criticism or review, as permitted under the Copyright, Designs and Patents Act 1988, this publication may be reproduced, stored or transmitted, in any form or by any means, only with the prior permission in writing of the publishers, or in the case of reprographic reproduction in accordance with the terms of licences issued by the Copyright Licensing Agency. Enquiries concerning reproduction outside those terms should be sent to the publisher at the undermentioned address:

The Institution of Engineering and Technology

Michael Faraday House

Six Hills Way, Stevenage

Herts, SG1 2AY, United Kingdom

www.theiet.org

While the author and publisher believe that the information and guidance given in this work are correct, all parties must rely upon their own skill and judgement when making use of them. Neither the author nor publisher assumes any liability to anyone for any loss or damage caused by any error or omission in the work, whether such an error or omission is the result of negligence or any other cause. Any and all such liability is disclaimed.

The moral rights of the author to be identified as author of this work have been asserted by him in accordance with the Copyright, Designs and Patents Act 1988.

British Library Cataloguing in Publication Data

A catalogue record for this product is available from the British Library

ISBN 978-1-78561-164-3 (hardback)

ISBN 978-1-78561-165-0 (PDF)

Typeset in India by MPS Limited

Printed in the UK by CPI Group (UK) Ltd, Croydon

*To
Melanie Johnston and
Mathew Valdar*

