

Next Generation SDH

José M. Caballero - Francisco J. Hens



Trend Communications Ltd.

www.trendcomms.com

Trend Communications - Training

© 2007 José M. Caballero-Artigas — Francisco J. Hens-Rodriguez

Trend Communications Ltd.

All rights reserved

Whitebrook Park, Lower Cookham Rd.

Maidenhead, Berkshire

SL6 8YA, UK

No part of this book may be reproduced, stored in a retrieval system, or transmitted in any form or by any means, or by any means, electronic or mechanical without prior writing permission of the publisher.

Printed by Printulibro Intergrup, S.A.

B-4818-2007

P/N: 405620

Reprinted with corrections: *16 March 2007*

Contents

Chapter 1 Classic SDH/SONET	1
1.1 The Emergence of SDH/SONET Networks	1
1.1.1 Limitations of Plesiochronous Networks	1
1.1.2 The SDH/SONET Challenge	3
1.2 Comparison of SDH and SONET	5
1.3 Functional Architecture	6
1.3.1 Network Elements	6
1.3.2 Network Topology	7
1.3.3 Topology Partitioning	8
1.3.4 SDH/SONET Layers	8
1.4 SDH/SONET Formats and Procedures	11
1.4.1 SDH/SONET Frame Structure	12
1.4.2 Multiplexing Map	15
1.5 SDH Transport Services	15
1.6 Transporting PDH/T-Carrier Tributaries	19
1.6.1 Transport on VC-4 or STS-3c SPE	20
1.6.2 Transport on VC-3	21
1.6.3 Transport of 2-Mbit/s Circuits	23
1.7 Pointers and Timing Compensation.....	26
1.7.1 Payload Synchronization	26
1.7.2 Pointer Formats and Procedures	27
1.8 Overheads	30
1.8.1 Path Overhead	32
1.8.2 Section Overhead	33
1.8.3 The SDH/SONET Hierarchy	35
1.9 Concatenation	37
1.10 Maintenance	38
1.10.1 SDH/SONET Events	38
1.10.2 Monitoring Events	41
1.10.3 Event Tables	41
1.11 Performance Monitoring	44
1.11.1 Bit Error Checking	44

1.11.2	Tandem Connection Monitoring	45
1.11.3	Forward Error Correction	45
1.12	Defects	46
1.13	SDH Resilience	49
1.13.1	Protection Basics	50
1.13.2	Multiplex Section or Line Protection	53
1.14	Operation, Administration, and Management	57
1.14.1	The TMN Standard	57
1.14.2	TMN Benefits	58
Chapter 2	Next Generation SDH/SONET	61
2.1	Streaming Forces	61
2.2	Legacy and Next Generation SDH	62
2.2.1	Evolution of the Transmission Network	62
2.3	The Next Generation Challenge	62
2.3.1	The New Network Elements	64
2.4	Core Transport Services	65
2.4.1	Next-Generation SDH	65
2.5	Generic Framing Protocol	66
2.5.1	Frame-Mapped GFP	69
2.5.2	Transparent GFP	69
2.6	Concatenation	71
2.6.1	Contiguous Concatenation of VC-4	71
2.6.2	Virtual Concatenation	73
2.6.3	VCAT Setup	76
2.7	Link Capacity Adjustment Scheme	78
2.7.1	LCAS Protocol	78
2.7.2	Light over LCAS	80
2.7.3	LCAS Applications	83
2.7.4	NG SDH Event Tables	86
2.8	Conclusions	87
Chapter 3	Test and Measurement	91
3.1	Areas of Application for Test and Measurement	91
3.2	Tests in the Interfaces	92
3.2.1	Line Interfaces	92
3.2.2	Connection Modes in Electrical Interfaces	93
3.2.3	Measurements in Electrical Interfaces	95
3.2.4	Measurements in Optical Interfaces	97
3.2.5	Measuring Frequency	99
3.3	In-Service and Out-of-Service Measurements	100
3.3.1	Bit Error Rate	101
3.3.2	Out-of-service Measurements	101
3.3.3	In-Service Measurements	109

3.3.4 Connecting a Measurement Device for ISM	112
3.4 Synchronization of NE-Test Set in SDH	114