
Generic Criteria for SONET Digital Cross-Connect Systems

Contents

Preface	Preface-1
1. Introduction	1-1
1.1 Purpose and Scope	1-1
1.2 SONET DCS Definitions and Terminology	1-2
1.3 Motivation	1-3
1.4 Organization of this Document	1-3
1.5 Relation to Other Supporting Documents	1-4
1.6 Requirements Terminology	1-6
1.7 Requirement Labeling Conventions	1-6
1.7.1 Numbering of Requirement and Related Objects	1-7
1.7.2 Requirement, Conditional Requirement, and Objective Object Identification	1-7
2. SONET Digital Cross-Connect Systems (SONET DCSs)	2-1
2.1 Existing SONET DCSs	2-1
2.2 SONET DCS Functionality	2-2
2.2.1 Transport Interface Module	2-2
2.2.2 Operations Interface Module	2-3
2.2.2.1 Test-Access Module	2-4
2.2.3 SONET (STM) Cross-Connect Fabric	2-4
2.2.4 Common Unit	2-4
2.2.5 Synchronization Module	2-5
3. SONET DCS Applications	3-1
3.1 SONET DCS Functions	3-1
3.1.1 Grooming	3-1
3.1.2 Add/Drop	3-3
3.1.3 Facility Rolling	3-3
3.1.4 Broadcast of Digital Signals	3-4
3.1.5 Performance Monitoring	3-5
3.1.6 Test Access	3-5
3.1.7 Remote Reconfiguration	3-6
3.2 Network Applications	3-6
3.2.1 Gateway Applications	3-6
3.2.1.1 SONET Transport Gateway	3-6
3.2.1.2 Operations Communications Gateway	3-7
3.2.1.3 International Gateway	3-8
3.2.1.3.1 Current International Gateways	3-10

3.2.1.3.2	SONET DCS Connecting to International Gateway	3-12
3.2.2	Centralization of Operations Activities.....	3-13
3.2.3	Hubbing Applications	3-14
3.2.4	Mesh Applications	3-14
3.2.5	SONET Ring Applications.....	3-15
3.3	Service Applications	3-17
3.3.1	Bandwidth Management Services.....	3-17
3.3.1.1	Switched Private Network Services.....	3-17
3.3.2	Network Restoration	3-17
3.3.3	Network Unbundling.....	3-18
3.3.4	Video Services	3-19
3.4	SONET DCS Evolution	3-19
4.	Transport Criteria.....	4-1
4.1	Interfaces	4-1
4.1.1	DSn.....	4-1
4.1.2	PDH.....	4-2
4.1.3	SONET.....	4-2
4.1.4	SDH.....	4-3
4.2	Termination Functions	4-3
4.2.1	DSn Termination.....	4-3
4.2.1.1	DSn Line	4-3
4.2.1.2	DSn Path	4-4
4.2.2	PDH Termination.....	4-4
4.2.3	SONET Termination.....	4-4
4.2.3.1	SONET Section	4-4
4.2.3.2	SONET Line	4-5
4.2.3.3	SONET Path	4-6
4.2.3.3.1	STS Path	4-6
4.2.3.3.2	VT Path	4-7
4.2.4	SDH Termination.....	4-7
4.3	Payload Mappings.....	4-8
4.3.1	SONET STS Level Mappings.....	4-8
4.3.2	SONET Sub-STs-1 Level Mappings.....	4-8
4.3.3	SDH AUG Level Mappings	4-8
4.3.4	SDH TUG Level Mappings	4-8
4.3.5	SONET/SDH Payload Multiplexing.....	4-9
4.3.5.1	Signal Conversions at the Path Level	4-9
4.3.5.2	Signal Conversions at the Payload Level	4-10
4.4	Unassigned Channel Patterns	4-11
5.	SONET DCS Feature Criteria.....	5-1
5.1	Cross-Connect Level.....	5-1
5.1.1	VT1.5/DS1 Cross-Connect	5-1

5.1.2	VT2/E1 Cross-Connect	5-2
5.1.3	VT1.5/VC-11 Cross-Connect.....	5-2
5.1.4	VT2/VC-12 Cross-Connect.....	5-2
5.1.5	VT6/VC-2 Cross-Connect.....	5-2
5.1.6	STS-1/DS3/VC-3 Cross-Connect	5-3
5.1.7	STS-Nc/VC-4-Nc Cross-Connect	5-3
5.2	Cross-Connect Type.....	5-4
5.2.1	Unidirectional.....	5-5
5.2.2	Bidirectional.....	5-5
5.2.3	Broadcast.....	5-6
5.2.4	Bundle	5-8
5.3	Facility Rolling.....	5-8
5.4	Upgradability.....	5-9
5.4.1	System Expansion	5-9
5.4.1.1	Hardware and Software Addition	5-9
5.4.1.2	Software Upgrade	5-10
5.4.2	Unavailability.....	5-10
5.5	SONET ADM Functionality	5-11
5.6	Transmultiplexer Functionality	5-12
5.7	Protection Switching	5-12
5.7.1	Line Layer APS Mechanisms	5-13
5.7.2	Path Layer Mechanisms	5-14
5.7.3	Equipment Protection.....	5-16
5.8	WDM Interfaces.....	5-16
6.	System Performance Criteria	6-1
6.1	Bit Sequence and Signaling Integrity.....	6-1
6.2	Transmission Delay.....	6-2
6.3	Cross-Connect Time.....	6-2
6.4	Signaling Delay	6-3
6.5	Jitter and DS _n Phase Variations	6-3
6.6	System Error Performance	6-3
6.7	System Availability.....	6-4
7.	Synchronization Criteria	7-1
7.1	Timing Modes	7-1
7.2	Internal Clock.....	7-2
7.3	Timing Distribution.....	7-2
7.4	Synchronization Status Messaging	7-2
7.5	Pointer Generation	7-2
8.	Operations Criteria.....	8-1
8.1	Operations Communications.....	8-1
8.1.1	OS/NE Interfaces	8-1
8.1.2	NE/NE Interfaces	8-2
8.1.3	Craftsperson/NE Interfaces	8-2

8.1.4	Operations Gateway Feature	8-3
8.1.5	Name/Address Translation Services	8-4
8.2	Memory Administration	8-4
8.2.1	Local and Remote Provisioning	8-5
8.2.2	Memory Backup and Restoration	8-5
8.2.3	System Administration and Security	8-7
8.2.4	System Software Generics	8-7
8.2.5	Equipment Identifiers for Ring DCSs	8-8
8.3	Alarm Surveillance	8-8
8.3.1	Directly Detected Defects and Failures	8-8
8.3.1.1	Loss of Signal (LOS)	8-9
8.3.1.2	Loss of Frame (LOF)	8-9
8.3.1.3	Loss of Pointer (LOP)	8-9
8.3.1.4	Equipment Failures	8-9
8.3.1.4.1	APS Troubles	8-10
8.3.2	Alarm Indication Signal	8-10
8.3.3	Remote Defect Indication (RDI) and Remote Failure Indication (RFI)	8-10
8.3.4	Payload Defect Indication (PDI)	8-11
8.3.5	Control of Alarm Processing	8-11
8.4	Performance Monitoring	8-11
8.4.1	Physical Layer PM	8-12
8.4.2	Section Layer PM	8-12
8.4.3	Line Layer PM	8-13
8.4.4	STS Path Layer PM	8-13
8.4.5	VT Path Layer PM	8-13
8.4.6	Monitoring at DS _n Interfaces	8-13
8.4.7	Intermediate-Path PM	8-13
8.5	Testing and Control Functions	8-15
8.5.1	Test Access	8-16
8.5.1.1	Fiber Access	8-16
8.5.1.2	SONET Signal Test Access	8-16
8.5.1.3	Digital Test Access	8-17
8.5.2	Diagnostics	8-17
8.5.3	Loopbacks	8-17
8.5.3.1	Facility Loopbacks	8-18
8.5.3.2	Cross-Connect Loopback	8-19
8.5.3.3	Terminal Loopback	8-19
8.5.4	Control Features	8-20
9.	Software Criteria	9-1
9.1	Software Security	9-1
9.1.1	System Initialization via a Disk Drive	9-1
9.1.2	Software Load via Other Removable Media	9-2
9.1.3	Software Purity	9-2

10. Other Generic System Criteria.....	10-1
Requirement-Object List	ROL-1
Requirement-Object Index	ROI-1
References	References-1
Acronyms.....	Acronyms-1

List of Figures

Figure 2-1.	Generic SONET DCS Functional Blocks.....	2-2
Figure 3-1.	Example of Consolidation in a SONET DCS.....	3-2
Figure 3-2.	Example of Segregation in a SONET DCS	3-2
Figure 3-3.	General Procedure for SONET Facility Rolling Application.....	3-4
Figure 3-4.	Example of the Broadcast Application.....	3-5
Figure 3-5.	Examples of SONET DCSs as Transport Gateway NEs.....	3-7
Figure 3-6.	Examples of SONET DCS as Communication Gateway NE and Intermediate NE.....	3-8
Figure 3-7.	Cable Head and International Gateway	3-10
Figure 3-8.	Use of SONET DCS at International Gateway	3-13
Figure 3-9.	Use of a SONET DCS in the Hubbing Configuration.....	3-14
Figure 3-10.	Use of a SONET DCS in the Mesh Configuration.....	3-15
Figure 3-11.	Example of Ring Transport and Interconnection	3-16
Figure 3-12.	Network Restoration.....	3-18
Figure 3-13.	Multifabric DCS Architecture Example	3-21
Figure 5-1.	Unidirectional Cross-Connection	5-5
Figure 5-2.	Bidirectional Cross-Connection	5-6
Figure 5-3.	1:2 Broadcast Cross-Connection	5-7
Figure 5-4.	Examples of Logical Rings.....	5-15
Figure 8-1.	Intermediate-Path PM.....	8-14
Figure 8-2.	SONET Loopbacks for the SONET DCS.....	8-18
Figure 8-3.	DSn Terminal Loopback	8-19