
ATM Virtual Path Ring Functionality in SONET - Generic Criteria

Contents

Preface	Preface-1
1. Introduction	1-1
1.1 Purpose and Scope	1-1
1.2 Target Audience	1-2
1.3 Structure and Use of This Document	1-3
1.4 Major Changes from Issue 3	1-3
1.5 Requirements Terminology	1-4
1.6 Requirement Labeling Conventions.....	1-4
1.6.1 Numbering of Requirement and Related Objects	1-4
1.6.2 Requirement, Conditional Requirement, and Objective Object Identification	1-5
2. Background and Terminology	2-1
2.1 SONET ATM Transport Networks	2-1
2.2 Terminology and Definitions	2-4
2.2.1 Summary	2-4
2.2.2 Conventional SONET Transport NEs.....	2-12
2.2.2.1 SONET ADM	2-12
2.2.2.2 Unidirectional Path-Switched Ring Overview	2-13
2.2.2.3 Bidirectional Line-Switched Ring Overview	2-14
2.2.2.4 SONET DCS.....	2-16
2.2.3 ATM Transport NEs	2-17
2.2.3.1 ATM SAM.....	2-17
2.2.3.2 ATM ADM.....	2-18
2.2.3.3 ATM Cross-Connect.....	2-18
2.2.4 ATM Switching Systems	2-20
2.2.4.1 ATM Edge Switch (ES).....	2-20
2.2.4.2 ATM Hub Switch (BSS).....	2-20
2.2.5 Hybrid Transport NEs.....	2-21
2.2.5.1 Hybrid ADM.....	2-21
2.2.5.2 Hybrid DCS	2-22
2.2.6 Subnetwork Architectures.....	2-23
2.2.6.1 Access Transport	2-24
2.2.6.2 Interoffice Transport.....	2-30
2.2.6.3 Grooming.....	2-30
2.2.6.4 Switching	2-31
2.3 Efficiency of ATM Transport in Hybrid Rings.....	2-31

2.4	Overview of ATM Protection Switching in SONET ATM VP Rings	2-34
2.4.1	Ring Types and Protection Types	2-34
2.4.2	ATM Traffic Protected via STM Layer Protection.....	2-34
2.4.3	ATM Traffic Protected via ATM Layer Protection	2-36
2.4.4	ATM Traffic Protected Externally	2-36
2.5	Ring Interconnection Overview	2-37
3.	Network Applications	3-1
3.1	Access Rings	3-1
3.2	Interoffice Rings.....	3-2
3.3	Interconnected Rings.....	3-3
3.3.1	Basic Interconnections	3-3
3.3.2	Specific ATM Ring Interconnection Applications	3-6
3.3.2.1	Interconnections Between Pure ATM Rings	3-6
3.3.2.2	Logical Ring Interconnection	3-11
3.4	Point-to-ADM, Dual Homing	3-11
3.5	Ring Hierarchies.....	3-12
3.6	Hubbing via Ring	3-12
3.7	Ring-to-Mesh Interconnection	3-14
4.	Common ATM Transport Functionality and Criteria	4-1
4.1	High-Level Functional Models	4-1
4.1.1	Basic Functional Model	4-1
4.1.2	Functional Model with SAM Functions.....	4-3
4.1.3	Ring Side Interfaces	4-4
4.1.4	Drop Side Interfaces.....	4-4
4.2	Functional Blocks for ATM VP Functionality in a SONET ADM	4-4
4.2.1	PHY - Physical Layer Requirements	4-5
4.2.1.1	Drop Side Interfaces	4-5
4.2.1.2	Ring Side Interfaces.....	4-6
4.2.1.3	Service Access Interfaces	4-7
4.2.2	VPM - Virtual Path Multiplexing Requirements	4-8
4.2.3	VPL - Virtual Path Link Requirements.....	4-8
4.2.4	VPCE - Virtual Path Cross-Connection Entity Requirements.....	4-9
4.3	Other Requirements	4-9
4.3.1	Reliability/Availability.....	4-10
4.3.2	ATM Layer Survivability.....	4-10
4.3.2.1	1+1/1:1 VPG/VP Protection	4-13
4.3.2.2	1:n VPG/VP Protection.....	4-13
4.3.2.3	Protection Performance	4-13
4.3.3	SONET and ATM Layer Protection Interaction	4-14
4.3.4	Ring Interconnection at the ATM Layer.....	4-14
5.	Common ATM Operations Functionality and Criteria	5-1
5.1	TMN Operations Architecture	5-1
5.1.1	Operations Architecture Evolution	5-4

5.1.2	Hybrid Operations Architecture.....	5-5
5.2	Operations Functions	5-6
5.2.1	Configuration Management	5-6
5.2.1.1	External Update Support.....	5-7
5.2.1.2	Memory Update Support	5-7
5.2.1.3	Memory Query Support.....	5-8
5.2.1.4	Memory Backup and Restoration	5-8
5.2.1.5	Software Download Support.....	5-9
5.2.2	Fault Management.....	5-9
5.2.2.1	Alarm Surveillance	5-9
5.2.2.2	Fault Localization and Testing	5-10
5.2.3	Performance Management	5-11
5.2.3.1	Monitoring of Physical Transport Facilities	5-11
5.2.3.2	Protocol Monitoring/Analysis	5-12
5.2.3.3	ATM VP Performance Monitoring.....	5-12
5.2.4	Security Management	5-13
5.2.5	Accounting Management	5-13
5.3	Network Traffic Management.....	5-14
5.3.1	Functions and Procedures for Traffic Management.....	5-14
5.3.1.1	Introduction.....	5-14
5.3.1.2	Connection Admission Control	5-15
5.3.1.3	Policing	5-18
5.3.1.4	Selective Cell Discard.....	5-20
5.3.2	Traffic Contract.....	5-21
5.3.2.1	Traffic Parameters and Connection Traffic Descriptor ...	5-21
5.3.2.2	Traffic Contract	5-21
5.3.3	QoS and Performance	5-22
5.3.3.1	SONET ATM VP Ring Performance Objectives by QoS Class.....	5-22
5.3.3.2	Multicast ATM Connection Performance Objectives	5-22
5.3.3.3	Reference Loads and Measurement.....	5-23
5.3.4	Traffic Management Requirements	5-23
5.3.4.1	Traffic Management Requirements for the UPSR Environment	5-23
5.3.4.2	Traffic Management Requirements for the BLSR Environment	5-25
5.4	Network Data Collection.....	5-27
5.5	Operations Interfaces	5-28
5.6	Operations Flows	5-29
5.7	Operations Communications.....	5-30
5.7.1	Upper Layer Requirements	5-30
5.7.2	Lower Layer Requirements.....	5-31
5.8	Other Requirements	5-32
5.8.1	SONET Function Enabling/Disabling	5-32

5.8.2	Operations and Maintenance of ATM Protection Switching	5-32
5.8.3	Interaction with ATM Switches	5-33
References	References-1
Acronyms	Acronyms-1
Requirement-Object Index	ROI-1
Requirement-Object List	ROL-1

List of Figures

Figure 2-1.	Three Methods of Combining ATM and STM Traffic.....	2-1
Figure 2-2.	Conventional ATM Switching and SONET Transport Network	2-2
Figure 2-3.	Hybrid SONET/ATM NEs in an Example Network	2-2
Figure 2-4.	Pure ATM NEs in an Example Network	2-3
Figure 2-5.	Layer Structure of STM and ATM Transport Methods	2-4
Figure 2-6.	Unidirectional Path-Switched Ring (UPSR)	2-13
Figure 2-7.	Two-Fiber Bidirectional Line Switched Ring (BLSR).....	2-14
Figure 2-8.	Four-Fiber Bidirectional Line Switched Ring (BLSR) - Ring Switch ...	2-15
Figure 2-9.	Four-Fiber Bidirectional Line Switched Ring (BLSR) - Span Switch...	2-15
Figure 2-10.	Example of SAM Deployment	2-17
Figure 2-11.	Example of SAM Function Implemented in Hybrid NE.....	2-18
Figure 2-12.	ATM VPX with SONET STM Capability	2-20
Figure 2-13.	ATM VPX with W-DCS 3/1 Capability - More Detailed View	2-20
Figure 2-14.	Hybrid DCS - Segregated Interfaces	2-23
Figure 2-15.	Hybrid DCS - Mixed Interfaces.....	2-23
Figure 2-16.	Customer ATM Access in Conventional SONET Network: Hub Demand ...	2-25
Figure 2-17.	ATM NE Deployment in Conventional SONET Network.....	2-25
Figure 2-18.	Customer ATM Access in Conventional SONET Network with SAM: Hub Demand.....	2-26
Figure 2-19.	Customer ATM Access in Conventional SONET Network: Different Destinations	2-27
Figure 2-20.	Customer ATM Access in Hybrid Network: Different Destinations	2-28
Figure 2-21.	Hybrid Network with SAMs and Edge Switches Near Customer Premise....	2-28
Figure 2-22.	Deployment of Hybrid Cross-Connects with Ring Functionality	2-29
Figure 2-23.	Conventional SONET OC-12 BLSR (2-Fiber) - Hubbed ATM Traffic	2-32
Figure 2-24.	Conventional SONET OC-12 UPSR - Hubbed ATM Traffic	2-32
Figure 2-25.	Hybrid OC-12 BLSR (2-Fiber) - Hubbed ATM Traffic.....	2-33
Figure 2-26.	Hybrid OC-12 UPSR - Hubbed ATM Traffic	2-33
Figure 2-27.	Hybrid UPSR with ATM Protection off the Ring	2-37
Figure 2-28.	Dual-Node Ring Interconnection Between SONET UPSRs	2-38
Figure 2-29.	Dual-Node Ring Interconnection Between SONET BLSRs	2-39
Figure 3-1.	Access Hybrid Ring.....	3-2
Figure 3-2.	Interoffice Hybrid Ring	3-3
Figure 3-3.	Direct Ring Interconnection Between ADMs	3-4
Figure 3-4.	Ring Interconnection Between ADMs Through DCS	3-4
Figure 3-5.	Ring Interconnection Through Ring DCS	3-4
Figure 3-6.	Direct Dual-Node Ring Interconnection Between ADMs.....	3-5

Figure 3-7.	Dual-Node Ring Interconnection Between ADMs Through DCS	3-5
Figure 3-8.	Dual-Node Ring Interconnection Through Ring DCS	3-6
Figure 3-9.	Dual-Node Ring Interconnection Between ATM UVPSRs	3-7
Figure 3-10.	Single-Node Ring Interconnection with 1+1 Ring Interconnection Interfaces	3-8
Figure 3-11.	Dual-Node Ring Interconnection Between ATM UVPSRs - One NE Serving more than One Ring Interconnection.....	3-9
Figure 3-12.	VP Multicasting in Dual-Node Ring Interconnection Between ATM UVPSRs.....	3-10
Figure 3-13.	SONET ATM VP Ring to SONET Ring Interconnection.....	3-11
Figure 3-14.	Point to ADM, Dual Homing	3-12
Figure 3-15.	Ring Hierarchy	3-13
Figure 3-16.	Hubbing Via Hybrid Ring	3-13
Figure 3-17.	Ring-to-Mesh Interconnection, with Distinct Boundary	3-14
Figure 3-18.	Ring-to-Mesh Interconnection.....	3-15
Figure 4-1.	Basic Functional Model of ATM Functionality Being Added to SONET Ring ADM.....	4-2
Figure 4-2.	Basic Functional Model of ATM Functionality with SAM Functions Being Added to SONET Ring ADM	4-3
Figure 4-3.	Minimum ATM VP Functionality in a SONET ADM.....	4-5
Figure 5-1.	Multi-Tiered Operations Architecture, TMN Model.....	5-2
Figure 5-2.	TMN Layers and Management Functional Areas	5-3
Figure 5-3.	Operations Architecture Evolution	5-4
Figure 5-4.	TMN Architecture - Hybrid Operations	5-5
Figure 5-5.	An Example CAC Algorithm	5-17
Figure 5-6.	An Example Policing Algorithm for VBR Cells.....	5-19
Figure 5-7.	An Example Selective Cell Discard Algorithm.....	5-20
Figure 5-8.	Policing and Shaping of UPSR Traffic.....	5-25
Figure 5-9.	Policing and Shaping of BLSR Traffic.....	5-27

List of Tables

Table 2-1.	Summary of SONET ATM VP Ring Types	2-9
Table 2-2.	Summary of Ring Transport Multiplexing and Protection Switching Alternatives.....	2-11
Table 2-3.	Properties of DCS ATM Functionality Levels	2-22