
Generic Requirements for Operations of ATM NEs

Contents

Preface	Preface-1
1. Introduction	1-1
1.1 Purpose of Document	1-1
1.2 Major Changes From Issue 3 of GR-1248-CORE	1-1
1.3 Scope of Document	1-2
1.4 Organization of Document	1-3
1.5 Related Bellcore and Standards Documents	1-5
1.6 Requirements Terminology	1-10
1.7 Requirement Labeling Conventions	1-10
1.7.1 Numbering of Requirement and Related Objects	1-11
1.7.2 Requirement, Conditional Requirement, and Objective Object Identification	1-11
2. Broadband Network, Services, and Operations Model Overview	2-1
2.1 Asynchronous Transfer Mode (ATM)	2-1
2.2 Reserved VCIs	2-3
2.3 ATM Adaptation Layer (AAL)	2-5
2.4 ATM Networks - Soft PVC Capability	2-6
2.4.1 Soft PVC - An Overview	2-7
2.4.2 Soft PVCs and Network Management	2-9
2.5 Broadband Services and Service Support	2-13
2.5.1 Service Access Scenarios	2-13
2.5.2 Service Offerings	2-14
2.6 Operations Architecture Model	2-17
2.6.1 Physical Systems, Logical Layers, and Relationship of Applicable Bellcore Documents	2-18
3. Operations Interface and User/System Interface Requirements	3-1
3.1 Operations Interface for Interactive Applications	3-1
3.1.1 Application Layer Requirements	3-1
3.1.2 Protocol Profiles for OSI Stacks	3-2
3.1.3 Protocol Profiles for TCP/IP	3-4
3.2 Operations Interface for File-Oriented Applications	3-5
3.3 User/System Interface	3-5
4. Physical Layer and ATM Layer Operations Flows	4-1
4.1 Physical Layer Operations Flows	4-1
4.1.1 DS1 Level Operations Flows	4-2
4.1.2 DS3 Level Operations Flows	4-2

4.1.3	PLCP Level Operations Flows.....	4-2
4.1.4	SONET Level Operations Flows	4-3
4.2	ATM Layer Operations Flows	4-3
4.2.1	OAM Cells - Basic Background and Structure	4-4
4.2.2	Segment and End-to-End OAM Flows	4-6
4.2.3	Conditions When OAM Flows Are Active on PVCs and SVCs	4-9
4.2.4	OAM Cell Count: Distinguishing User Cells and Non-User Cells	4-10
4.2.5	Bandwidth Needs for OAM Cells	4-11
4.2.6	OAM Flows for Multipoint Connections	4-12
4.2.7	Operations Support for VCIs 3 and 4.....	4-14
5.	Configuration Management Requirements	5-1
5.1	External Update Support	5-2
5.1.1	ATM NE Configuration Identification and Change Reporting	5-2
5.2	Memory Update Support.....	5-4
5.2.1	Configuration of UNIs, B-ICIs, B-INNI, and Vb Interfaces	5-4
5.2.2	Configuration of Virtual UNIs	5-9
5.2.3	Configuration of VPLs and VCLs	5-12
5.2.4	Configuration of VPC and VCC End Points.....	5-20
5.2.5	Configuration of Point-to-Point and Multipoint ATM VP and VC Cross Connections	5-20
5.2.6	Configuration of VPC and VCC OAM Segment End Points	5-22
5.2.7	Configuration of AAL Connections.....	5-23
5.2.8	Activating and Deactivating ATM NE Functions.....	5-28
5.2.9	Suppression and Duplication of Autonomous Messages: Event Forwarding Discriminator Function.....	5-28
5.3	Database Query Support	5-29
5.4	Database Backup and Restoration.....	5-29
5.5	Software DownLoad Support.....	5-31
5.5.1	Local Downloading of Software Generics.....	5-32
5.5.2	Remote Downloading of Software Generics	5-32
6.	Fault Management Requirements	6-1
6.1	Alarm Surveillance.....	6-1
6.1.1	Physical Layer Defect and Failure Detection, and In-Band Maintenance Signals	6-3
6.1.2	ATM Layer Defect and Failure Detection, and In-Band Defect Indication Signals.....	6-8
6.1.3	Failure Timing and Failure Notification	6-31
6.2	Fault Localization and Testing.....	6-36
6.2.1	Internal Diagnostics	6-38
6.2.2	VPC/VCC Testing Capabilities	6-39
6.2.3	Loopback and Continuity Check.....	6-46
6.3	ATM Layer Protection Switching (PS).....	6-47

7.	Performance Management Requirements	7-1
7.1	Performance Monitoring Requirements	7-1
7.1.1	Monitoring of Physical Transport Facilities	7-1
7.1.2	Protocol Monitoring	7-3
7.1.3	VP/VC Performance Monitoring	7-24
7.1.4	Protocol Test Access	7-57
7.2	Network Traffic Management Requirements.....	7-59
7.2.1	Congestable ATM Modules	7-60
7.2.2	Measures of Congestion.....	7-60
7.2.3	NTM Surveillance Measurements and Notifications.....	7-64
7.2.4	NTM Controls	7-66
8.	Activation and Deactivation Procedures.....	8-1
8.1	Activation/Deactivation - General Background.....	8-2
8.1.1	PM/CC Cell Flows	8-2
8.1.2	Performance Monitoring and Continuity Check	8-5
8.2	OAM Activation/Deactivation Cell Procedure	8-6
8.2.1	Activation/Deactivation Cell Payload Structure	8-6
8.2.2	Activation Procedure - OAM Cell Approach	8-8
8.2.3	Deactivation Procedure - OAM Cell Approach	8-11
8.3	Activation/Deactivation - The TMN Approach	8-17
8.3.1	Activation/Deactivation Procedures - TMN Approach	8-17
8.3.2	Requirements for Activation/Deactivation Procedure - TMN Approach	8-19
9.	Network Data Collection (NDC) Requirements	9-1
9.1	Introduction	9-1
9.2	NDC Scheduled Measurements	9-2
9.2.1	Traffic Load Measurements for Interfaces and VPL/VCLs.....	9-2
9.2.2	UPC/NPC Disagreement Measurements	9-4
9.2.3	Traffic Load and Congestion Measurements for ATM NE Modules.....	9-6
9.2.4	Summary of NDC Scheduled Measurements	9-8
9.2.5	Applications of NDC Scheduled Measurements	9-9
9.3	Special Studies Measurements.....	9-13
9.3.1	Analysis of Traffic Characteristics	9-14
9.3.2	Analysis of OAM Traffic	9-16
9.4	Data Collection and Reporting Requirements.....	9-17
9.4.1	Data Collection Specifications.....	9-18
9.4.2	Reporting Schedules	9-18
9.5	Miscellaneous ATM NE Reports	9-19
9.5.1	ATM NE Maintenance Reports	9-19
9.5.2	ATM NE Engineering Reports	9-20
10.	Common Requirements for Performance Monitoring, NTM, and NDC	10-1
10.1	Counters and Monitoring Intervals	10-1

10.2	Thresholds	10-2
10.3	Reports	10-3
10.4	Scaling of ATM NE Operations Processes	10-4
10.4.1	Resource Sharing	10-4
10.4.2	Resource Sharing (RS) Scaling	10-6
10.4.3	RS Scaling Requirements - PM Monitoring and Loopback Processes	10-8
11.	Security Management Requirements	11-1
11.1	Security Requirements for Non-Public Access	11-2
11.1.1	Identification	11-3
11.1.2	Authentication	11-3
11.1.3	System Access Control	11-5
11.1.4	Resource Access Control	11-6
11.1.5	Security Log (Audit)	11-7
11.1.6	Data and System Integrity	11-8
11.1.7	Security Administration	11-8
11.2	Security Requirements for Dial-In Access	11-9
11.2.1	Authentication	11-9
11.2.2	System Access Control	11-9
11.2.3	Resource Access Control	11-10
12.	Accounting Management (Usage Information for Billing)	12-1
12.1	Fault Related Requirements	12-1
12.2	Configuration Related Requirements for ATM PVCs	12-3
12.2.1	Memory Update Support	12-3
12.2.2	Memory Backup and Restoration Support	12-10
12.3	Configuration Related Requirements for ATM SVCs	12-11
12.3.1	Memory Update Support	12-11
12.3.2	Memory Backup and Restoration Support	12-18
13.	User-Network Management Requirements	13-1
13.1	Exchange PVC CRS CNM Requirements	13-2
13.2	ILMI Requirements	13-3
13.2.1	ILMI - General Requirements	13-3
13.2.2	ILMI - Address Registration	13-6
13.2.3	ILMI - Miscellaneous Notes	13-8
14.	Management of Signaling Channels: ATM and SAAL Requirements	14-1
14.1	Signaling Overview	14-1
14.2	Operations Support for ATM and Physical Layers of Signaling Channels	14-2
14.3	Signaling ATM Adaptation Layer (SAAL) Operations Requirements	14-4
14.3.1	Overview of SAAL: AAL5, SSCOP, and SSCF	14-4
14.3.2	AAL Type 5 Common Part	14-6
14.3.3	SSCOP/SSCF Configuration Management Requirements	14-6

14.3.4	SSCOP/SSCF Fault Management Requirements.....	14-11
14.3.5	SSCOP/SSCF Performance Management Requirements	14-13
15.	ATM Access Signaling Operations Requirements	15-1
15.1	Access Signaling Channel Operations Requirements	15-1
15.1.1	Configuration Management Requirements	15-1
15.1.2	Fault Management Requirements	15-3
15.1.3	Performance Management Requirements	15-3
15.2	Operations Requirements in Support of Call/Connection Management.....	15-11
15.2.1	Call/Connection Management: Configuration Management for SVCs	15-11
15.2.2	Call/Connection Management: Fault Management of SVCs.....	15-22
15.2.3	Call/Connection Management: Performance Management of SVCs	15-23
15.3	Management of Proxy Signaling.....	15-23
15.3.1	Configuration of Proxy Signaling	15-24
15.3.2	Fault Management of Proxy Signaling	15-26
15.3.3	Performance Management of Proxy Signaling	15-26
16.	ATM Interoffice Signaling Operations Requirements.....	16-1
16.1	Overview of Interoffice Signaling Architectures	16-1
16.1.1	The Quasi-Associated Mode.....	16-1
16.1.2	The Associated Mode.....	16-2
16.1.3	Terminology	16-3
16.2	Interoffice Signaling Link Operations Requirements	16-4
16.2.1	MTP3 Operations Requirements.....	16-5
16.2.2	BISUP Signaling Link Operations Requirements.....	16-15
16.3	Operations Requirements in Support of BISUP Call/Connection Management	16-29
16.3.1	Call/Connection Configuration Management	16-30
16.3.2	Call/Connection Performance Management: NDC Requirements.....	16-38
17.	Service Operations Requirements.....	17-1
17.1	Support of Switched Multi-Megabit Data Service (SMDS)	17-1
17.1.1	ATM NE Operations Requirements Supporting a SMDS SNI.....	17-3
17.1.2	Support for SMDS on a B-ICI or B-INNI.....	17-4
17.2	PVC-Based Frame Relay Service	17-4
17.2.1	Service Support	17-5
17.2.2	ATM NE Operations Requirements Supporting Frame Relay Service	17-6
17.2.3	PVC-Based FRS Support on a B-ICI.....	17-7
17.3	PVC-Based ATM Cell Relay Service	17-7
17.4	Circuit Emulation Service	17-8
17.5	Unspecified Bit Rate (UBR) and Available Bit Rate (ABR) Services	17-10
17.5.1	Unspecified Bit Rate	17-10

17.5.2	ABR	17-13
18.	Inverse Multiplexing for ATM (IAM) Requirements.....	18-1
18.1	IMA Overview	18-1
18.2	Operations Support for IMA	18-3
18.2.1	IMA Configuration Requirements	18-4
18.2.2	IMA Fault Management Requirements.....	18-10
18.2.3	IMA Performance Management Requirements	18-12
Appendix A:	Supporting PVC FRS on a B-ICI/B-INNI	A-1
A.1	Operations Criteria for FRS Above AAL Type 5	A-1
A.1.1	Architectural Perspective	A-2
A.1.2	Configuration Management Criteria	A-2
A.1.3	Performance Management Criteria	A-5
A.1.4	Fault Management Criteria	A-8
A.1.5	Network Data Collection Criteria	A-9
Appendix B:	Supporting SMDS on a B-ICI/B-INNI	B-1
B.1	SMDS/ATM Network Interworking Functions	B-1
B.2	ICIP_CLS Layer Specification	B-3
B.2.1	ICIP_CLS_PDU Format	B-3
B.2.2	ICIP_CLS Layer Procedures.....	B-7
B.3	Operations Criteria to Support SMDS	B-9
B.3.1	Configuration Management Criteria for Inter-Carrier SMDS	B-11
B.3.2	Configuration Management Criteria for Inter-Switch SMDS.....	B-12
B.3.3	Performance Monitoring Criteria	B-19
B.3.4	Fault Management Criteria	B-24
B.3.5	Network Data Collection Criteria	B-26
Appendix C:	Requirement-Index Table	C-1
Appendix D:	Requirement-Object List.....	D-1
	Requirement-Object Index	ROI-1
	References	References-1
	Glossary	Glossary-1
	Acronyms.....	Acronyms-1

List of Figures

Figure 1-1.	Scope and Relationship of Selected ATM Documents	1-9
Figure 2-1.	Virtual Channel Connections.....	2-2
Figure 2-2.	Virtual Path Connections.....	2-3
Figure 2-3.	Reserved VCIs at a UNI.....	2-4
Figure 2-4.	BISDN/ATM Network Access Scenarios	2-14
Figure 2-5.	Example Initial BISDN/ATM Network Architecture	2-16
Figure 2-6.	TMN Layers and Scope of this Document	2-17
Figure 2-7.	Example of Physical Implementation Architectures	2-19
Figure 4-1.	Common OAM Cell Fields.....	4-6
Figure 4-2.	Illustration of VP/VC Connections and Segments	4-7
Figure 4-3.	Placement of UPC/NPC Relative to Segment End Points.....	4-9
Figure 4-4.	Point-to-Multipoint ATM Connection.....	4-13
Figure 4-5.	Example Point-to-Multipoint OAM Loopback	4-14
Figure 5-1.	Example Configuration of Two Virtual UNIs	5-10
Figure 6-1.	State Transition Diagram for Maintenance States	6-6
Figure 6-2.	VPC/VCC Defect Indications.....	6-10
Figure 6-3.	State Changes and Message Flows for Example Connection.....	6-11
Figure 6-4.	Relationship Between VP Defect Indications and VC Defect Indications.....	6-13
Figure 6-5.	Propagation of DS _n /SONET and VPC/VCC Level Defect Indications	6-15
Figure 6-6.	AIS/RDI Fault Management OAM Cell Format	6-16
Figure 6-7.	Segment AIS/RDI Defect Indications via TMN Assigned Segment Endpoints	6-17
Figure 6-8.	SONET/ATM Maintenance Signal Interaction	6-22
Figure 6-9.	Generic PDH/ATM Maintenance Signal Interaction	6-23
Figure 6-10.	Two Methods for Inserting CC Cells at the Transmitting Interface.....	6-24
Figure 6-11.	DS _n Generation AIS at Different Points of a Circuit Emulated Connection.....	6-27
Figure 6-12.	AIS Propagation Behavior for Different Fault Locations	6-28
Figure 6-13.	Interactions Between Frame Relay Status Signaling and ATM OAM Cells.....	6-31
Figure 6-14.	Example of Alarm Notification at Different ATM NEs.....	6-37
Figure 6-15.	Loopback Examples	6-40
Figure 6-16.	Example of ATM NE Actions Upon Receiving Loopback Cell	6-42
Figure 6-17.	Loopback Fault Management OAM Cell Format.....	6-45
Figure 7-1.	Sending and Receiving IWFs	7-10
Figure 7-2.	Format of the SAR-PDU for AAL Type 1	7-11
Figure 7-3.	Performance Problems Detected by the Receiving AAL Type 1	7-12

Figure 7-4.	Format of the SAR-PDU for AAL Type 3/4	7-16
Figure 7-5.	Format of the Common Part of the AAL Type 3/4 PDU	7-19
Figure 7-6.	Format of the Common Part of the AAL Type 5 PDU	7-22
Figure 7-7.	A Performance Monitoring Block	7-26
Figure 7-8.	Segment and End-to-End Performance Monitoring Concurrence.....	7-27
Figure 7-9.	Variability of PM Block Sizes.....	7-29
Figure 7-10.	Example of Bi-directional End-to-End Performance Monitoring	7-31
Figure 7-11.	Example of Uni-Directional Segment Performance Monitoring.....	7-34
Figure 7-12.	Performance Management OAM Cell Format	7-39
Figure 7-13.	Role of PM Cell Block Results in Estimating QOS Parameters	7-42
Figure 7-14.	Alternative Methods of Counting Transmitted User Cells at Non-End Points	7-47
Figure 7-15.	Additional Parameters Used for Performance Analysis	7-51
Figure 7-16.	Example of Probability Density of Cell Arrival Delays.....	7-53
Figure 7-17.	Relative Positioning of Congestion Thresholds	7-63
Figure 8-1.	Format of Activation/Deactivation OAM Cell.....	8-7
Figure 8-2.	Activation Handshaking Procedure	8-9
Figure 8-3.	Deactivation Handshaking Procedure	8-12
Figure 9-1.	Example of Time in Each MC Level.....	9-8
Figure 9-2.	Estimation of Cell Loss in an ATM NE	9-11
Figure 10-1.	ATM NE Resource Aggregation Scenarios.....	10-5
Figure 10-2.	Model for Management of OAM Resources Used by Interface to Perform OAM Processes	10-6
Figure 11-1.	An Example ATM NE Operations Access Interfaces	11-2
Figure 13-1.	ATM Interface Management	13-1
Figure 13-2.	PVC CRS CNM Access Architectures and CNM Protocol Stack.....	13-3
Figure 13-3.	ILMI Protocol Stack	13-4
Figure 14-1.	Signaling Protocol Below the Signaling Layer	14-3
Figure 14-2.	Sequence of State Changes During Successful Proving of an Interoffice Signaling Link	14-5
Figure 14-3.	Transitions to Failure of an Interoffice Signaling Link.....	14-12
Figure 15-1.	Access Signaling on a UNI.....	15-2
Figure 15-2.	Example Signaling Configuration of Two V-UNIs.....	15-20
Figure 15-3.	Proxy Signaling	15-24
Figure 16-1.	The Quasi-Associated Mode of Interoffice Signaling	16-2
Figure 16-2.	Protocol Stack for the Associated Mode of Interoffice Signaling.....	16-3
Figure 16-3.	An Example Signaling Configuration	16-4
Figure 16-4.	Example of Signaling Link Configuration	16-7
Figure 16-5.	Example of Signaling Link Configuration	16-8
Figure 16-6.	Sequence of Events for Destination Unavailable Notification	16-21
Figure 16-7.	Sequence of Events for User Part Unavailable Notification	16-22
Figure 16-8.	Sequence of Events During Consistency Check.....	16-24
Figure 16-9.	An Example Configuration of VPCIs.....	16-33
Figure 16-10.	An Example of Physical and “Trunking” Topologies	16-35

Figure 17-1.	Interfaces Supporting SMDS.....	17-2
Figure 17-2.	Example Architecture Supporting SMDS	17-3
Figure 17-3.	Interfaces Supporting Frame Relay Service	17-6
Figure 17-4.	Examples of AAL Type 1 Supported Circuit Emulation Service	17-9
Figure 17-5.	ABR Service Cell Flows.....	17-14
Figure 17-6.	RM Cell Flows at ATM NE With VS/VD	17-17
Figure 18-1.	Inverse Multiplexing for ATM	18-2
Figure A-1.	Configuration Management Related Elements.....	A-3
Figure B-1.	Examples of Remote (a) SMDS SNI and (b) SMDS UNI Configurations	B-2
Figure B-2.	Intra-Carrier/Inter-BSS Service Specific Information Field Format	B-6

List of Tables

Table 3-1.	OSI Operations Interface Protocol Stack for the Interactive Class	3-3
Table 3-2.	TCP/IP Operations Interface Protocol Stack for the Interactive Class.....	3-4
Table 4-1.	OAM Type / Function Type Identifiers.....	4-5
Table 4-2.	ATM OAM Function Usage.....	4-9
Table 5-1.	Parameters Required in Each Service Category	5-13
Table 5-2.	Service Categories, Service Class, QoS, and AAL	5-13
Table 5-3.	Applicable Parameters for Conformance Definitions of TM 4.0	5-14
Table 5-4.	Applicable Parameters for Conformance Definitions in UNI 3.1	5-15
Table 5-5.	Additional Feedback Related Parameters for ABR Service	5-15
Table 6-1.	FR-to-ATM IWF Fault Indications	6-30
Table 6-2.	ATM-to-FR IWF Fault Indications	6-30
Table 6-3.	List of Generic Troubles, and Default Severities	6-34
Table 7-1.	Requirements Status of Physical Rates at Each Interface	7-2
Table 7-2.	Parameters for Monitoring ATM Cell Header Processing	7-6
Table 7-3.	AAL Type 1 Performance Monitoring Parameter	7-15
Table 7-4.	AAL Type 3/4 Performance Monitoring Parameters	7-21
Table 7-5.	AAL Type 5 Performance Monitoring Parameters	7-24
Table 7-6.	Examples of Lost/Misinserted Counts, and Inferred Number of Lost CLP=0 Cells	7-45
Table 7-7.	VP/VC Performance Monitoring Parameters	7-55
Table 7-8.	NTM Surveillance Measurements, per Congestable ATM Module.....	7-65
Table 8-1.	Potential Configuration Options of OAM PM Cell Flows	8-3
Table 8-2.	Message ID Values	8-7
Table 8-3.	PM Block Size Encoding.....	8-8
Table 9-1.	NDC Scheduled Measurements: Per Interface and Per Virtual Connection.....	9-9
Table 9-2.	NDC Scheduled Measurements: Per ATM NE Module.....	9-9
Table 12-1.	Parameters for ATM PVCs.....	12-3
Table 12-2.	Parameters for Intra-Network ATM SVCs.....	12-11
Table 12-3.	Parameters for Inter-Network ATM SVCs.....	12-14
Table 12-4.	Parameters for Message Detail Recording	12-16
Table 12-5.	Parameters for the Network Call Correlation Identifier	12-17
Table 12-6.	Parameters for Point-to-Multipoint ATM SVCs	12-17
Table 14-1.	Parameters and Timers for SSCOP	14-7
Table 14-2.	Parameters and Timers for SSCF-NNI and SAAL Layer Management	14-9
Table 14-3.	SSCOP Protocol Monitoring Parameters	14-16
Table 15-1.	Cause Values for Unavailable Routes	15-4
Table 15-2.	Cause Values for Resource Unavailability	15-4

Table 15-3.	Cause Values for Called Party Events	15-5
Table 15-4.	Cause Values for Incorrect Messages	15-6
Table 15-5.	Cause Values for Calling Party Events	15-6
Table 15-6.	DSS2 Performance Monitoring Counters	15-11
Table 15-7.	Locations at Which Subscription Features Apply	15-16
Table 15-8.	An Example of VPI Mapping at the Vb Interface	15-21
Table 16-1.	BISUP Timers	16-17
Table 16-2.	BISUP Performance Management Parameters	16-29
Table 16-3.	Example of Route List for Call Destined to D from A	16-36
Table 17-1.	Related SMDS Requirements Documents	17-2
Table 17-2.	Related Frame Relay Service Requirements Documents	17-5
Table 18-1.	IMA Group States	18-7
Table B-1.	GR-1063-CORE Administered Data Distribution Across Two BSSs	B-13
Table B-2.	Distribution of Administered Data Across Two BSSs	B-20
Table B-3.	Summary of Inter-Switch SMDS Scheduled Measurements	B-28
Table C-1.	Requirements Index	C-2