

Generic Requirements for Hybrid SONET/ATM Element Management Systems (EMSs)

Contents

| | |
|--|-----------|
| Preface | Preface-1 |
| 1. Introduction..... | 1-1 |
| 1.1 Background | 1-1 |
| 1.2 Purpose of Document..... | 1-2 |
| 1.3 Scope of Document | 1-2 |
| 1.4 Major Changes from Issue 1 | 1-4 |
| 1.5 Target Audience | 1-4 |
| 1.6 Structure and Use of This Document..... | 1-5 |
| 1.7 Requirements Terminology | 1-5 |
| 1.8 Requirement Labeling Conventions | 1-6 |
| 1.8.1 Numbering of Requirement and Related Objects..... | 1-6 |
| 1.8.2 Requirement, Conditional Requirement, and Objective Object Identification | 1-7 |
| 2. SONET/ATM Technologies and Network Architectures..... | 2-1 |
| 2.1 Transport Technologies | 2-1 |
| 2.1.1 Conventional SONET Technology..... | 2-2 |
| 2.1.2 ATM Technology..... | 2-3 |
| 2.1.3 Hybrid Technology | 2-3 |
| 2.2 Network Architectures..... | 2-7 |
| 2.2.1 SONET Architectures..... | 2-7 |
| 2.2.2 ATM Architectures | 2-10 |
| 2.2.3 Hybrid Architectures..... | 2-11 |
| 2.3 Connection Protection for STM and ATM Traffic | 2-13 |
| 2.3.1 STM Connection Protection..... | 2-14 |
| 2.3.2 ATM Connection Protection..... | 2-15 |
| 2.3.2.1 Dedicated Point-to-Point VP/VPG Protection..... | 2-15 |
| 2.3.2.2 Dynamic ATM Protection Mechanisms | 2-17 |
| 2.3.2.3 ATM Protection Domains..... | 2-17 |
| 2.3.2.4 ATM Traffic Protected via STM Layer Protection.... | 2-18 |
| 2.3.2.4.1Hybrid BLSRs..... | 2-18 |
| 2.3.2.4.2Hybrid UPSRs | 2-18 |
| 2.3.2.5 ATM Traffic Protected via ATM Layer Protection | 2-19 |
| 3. Management Architectures | 3-1 |
| 3.1 TMN Logical Architecture | 3-1 |
| 3.2 Network Level Management Framework | 3-5 |
| 3.2.1 Motivation for the Network View | 3-6 |

| | | |
|-----------|---|------|
| 3.2.2 | Example Integrated Network Configuration..... | 3-7 |
| 3.2.3 | Layer Network Resource Provisioning | 3-8 |
| 3.2.4 | Interlayer Configuration | 3-11 |
| 3.2.5 | Subnetwork Topology Provisioning..... | 3-13 |
| 3.2.6 | Subnetwork Connection Provisioning | 3-16 |
| 3.3 | EMS Architectures..... | 3-18 |
| 3.4 | EMS Functional Scope | 3-20 |
| 4. | Operations Functional Requirements | 4-1 |
| 4.1 | Configuration Management | 4-1 |
| 4.1.1 | Network Planning and Engineering | 4-2 |
| 4.1.2 | Installation | 4-2 |
| 4.1.2.1 | NE Software Installation | 4-2 |
| 4.1.3 | Provisioning..... | 4-4 |
| 4.1.3.1 | Assignable Inventory Management | 4-4 |
| 4.1.3.2 | Service Feature Software Download | 4-4 |
| 4.1.3.3 | Pending Change Management..... | 4-5 |
| 4.1.3.4 | NE/Subnetwork Administration and Configuration ... | 4-5 |
| 4.1.3.4.1 | General..... | 4-5 |
| 4.1.3.4.2 | Inter-layer Management..... | 4-6 |
| 4.1.3.4.3 | Topology Management | 4-7 |
| 4.1.3.4.4 | Provisioning of Protection Mechanisms..... | 4-9 |
| 4.1.3.5 | NE Database Management | 4-11 |
| 4.1.3.6 | Inventory Notification and Query | 4-13 |
| 4.1.3.7 | Subnetwork Connection Management | 4-16 |
| 4.1.3.7.1 | Step-by-Step Subnetwork Connection Establishment | 4-17 |
| 4.1.3.7.2 | Subnetwork Connection Establishment and Modification | 4-18 |
| 4.1.3.7.3 | Connection Configuration Tracking | 4-20 |
| 4.1.3.7.4 | Subnetwork Connection Release | 4-21 |
| 4.1.3.7.5 | Connection Scheduling..... | 4-21 |
| 4.1.3.7.6 | Connection Protection..... | 4-22 |
| 4.1.4 | Status and Control..... | 4-23 |
| 4.2 | Fault Management | 4-25 |
| 4.2.1 | RAS Quality Assurance | 4-25 |
| 4.2.1.1 | NE(s) Outage Reporting | 4-25 |
| 4.2.2 | Alarm Surveillance | 4-26 |
| 4.2.2.1 | Alarm Reporting and Logging | 4-27 |
| 4.2.2.2 | Alarm Reporting Control..... | 4-27 |
| 4.2.2.3 | Alarm Summary | 4-28 |
| 4.2.2.4 | Current Alarm Summary Control | 4-28 |
| 4.2.2.5 | Alarm Correlation and Filtering | 4-29 |
| 4.2.3 | Fault Localization and Testing..... | 4-30 |
| 4.3 | Performance Management..... | 4-32 |
| 4.3.1 | Performance Management Control (Performance Administration)..... | 4-33 |

| | | |
|-----------|---|------|
| 4.3.1.1 | NE Threshold Setting..... | 4-33 |
| 4.3.1.2 | Control of Raw PM Data Collection..... | 4-33 |
| 4.3.1.3 | Control of Activation/Deactivation of VP Segment PM OAM Cell Flows | 4-34 |
| 4.3.2 | Performance Monitoring..... | 4-35 |
| 4.3.2.1 | NE(s) Threshold Crossing Alert (TCA) Processing .. | 4-35 |
| 4.3.2.1.1 | Suppression of TCA Processing During Failures | 4-36 |
| 4.3.2.1.2 | Root Cause Impairment Analysis (RCIA)..... | 4-36 |
| 4.3.2.1.3 | Impairment Persistence Determination and Reporting | 4-40 |
| 4.3.2.1.4 | Collection of Raw PM Data in Response to TCAs | 4-41 |
| 4.3.2.2 | Performance Monitoring Data Accumulation..... | 4-41 |
| 4.3.2.3 | NE(s) Trend Analysis..... | 4-42 |
| 4.3.3 | Performance Analysis | 4-42 |
| 4.3.3.1 | Traffic Capacity Analysis..... | 4-42 |
| 4.4 | Security Management..... | 4-43 |
| 4.4.1 | EMS Security Features..... | 4-43 |
| 4.4.2 | Prevention..... | 4-44 |
| 4.4.2.1 | Identification..... | 4-44 |
| 4.4.2.2 | Authentication | 4-44 |
| 4.4.2.3 | System Access Control | 4-45 |
| 4.4.2.4 | Resource Access Control | 4-45 |
| 4.4.2.5 | Security Log (Audit)..... | 4-45 |
| 4.4.2.6 | Data and System Integrity | 4-46 |
| 4.4.2.7 | User Interface | 4-46 |
| 4.4.3 | Detection..... | 4-47 |
| 4.4.3.1 | Security Alarm Reporting..... | 4-47 |
| 4.4.4 | Containment and Recovery | 4-48 |
| 4.4.4.1 | NE(s) Intrusion Recovery | 4-48 |
| 4.4.4.2 | Administration of NE(s) Revocation List..... | 4-48 |
| 4.4.4.3 | Protected Storage of NE(s) Configuration Data | 4-49 |
| 4.4.5 | NE Security Administration | 4-49 |
| 4.4.5.1 | NE(s) and EMS Audit Trail Management..... | 4-49 |
| 4.4.5.2 | NE(s) and EMS Security Alarm Management..... | 4-50 |
| 4.4.5.3 | Administration of keys for NEs | 4-50 |
| 4.4.6 | DCN Security..... | 4-50 |
| 4.5 | Accounting Management | 4-51 |
| 4.6 | Common Operations Management | 4-51 |
| 4.6.1 | User Layer Management | 4-51 |
| 4.6.2 | Data Management | 4-53 |
| 4.6.2.1 | Reporting..... | 4-53 |
| 4.6.2.1.1 | Resource Provisioning Selection and Assignment (RPSA) Reporting..... | 4-53 |
| 4.6.2.1.2 | Inventory Notification and Query (INQ) Reporting | 4-55 |

| | | |
|--------------------------------|---|------|
| 4.6.2.1.3 | Root Cause Alarm Analysis (RCAA) Reporting... | 4-55 |
| 4.6.2.1.4 | Performance Reporting | 4-55 |
| 4.6.2.1.5 | Security Reporting..... | 4-55 |
| 4.6.2.2 | Subnetwork Inventory and Topology Data | 4-56 |
| 4.6.2.3 | Configuration Management Data | 4-56 |
| 4.6.2.4 | Fault Management Data..... | 4-57 |
| 4.6.2.4.1 | Intelligent Alarm Filtering (IAF) Data | 4-57 |
| 4.6.2.4.2 | RCAA Data | 4-57 |
| 4.6.2.5 | Performance Management Data | 4-57 |
| 4.6.2.6 | Security Management Data | 4-58 |
| 4.6.2.6.1 | User Identification..... | 4-58 |
| 4.6.2.6.2 | System log-on record | 4-59 |
| 4.6.2.7 | Data Management Practices | 4-59 |
| 4.6.2.7.1 | Database Management Systems (DBMSs) ... | 4-59 |
| 4.6.2.7.2 | DBMS Access Methods..... | 4-60 |
| 4.6.3 | Operations Control Management..... | 4-61 |
| 5. | Operations Interfaces..... | 5-1 |
| 5.1 | EMS/NE Interface | 5-1 |
| 5.2 | NMS/EMS Interface | 5-6 |
| 6. | System Requirements..... | 6-1 |
| 6.1 | System Administration | 6-1 |
| 6.2 | System Reliability and Availability | 6-3 |
| 6.3 | System Capacity and Performance..... | 6-4 |
| 6.3.1 | System-to-System Interface..... | 6-4 |
| 6.3.2 | Real Time Performance | 6-4 |
| 6.3.3 | Performance Measurements/Alarms | 6-5 |
| 6.4 | Data Communications..... | 6-6 |
| References..... | References..... | 1 |
| Glossary..... | Glossary..... | 1 |
| Acronyms | Acronyms..... | 1 |
| Requirement-Object Index | ROI..... | 1 |

List of Figures

| | | |
|--------------|---|------|
| Figure 2-1. | Techniques for Combining STM and ATM Traffic | 2-4 |
| Figure 2-2. | High Level Hybrid Model of ATM Functionality Added to SONET Ring ADM | 2-5 |
| Figure 2-3. | High Level Hybrid Model of ATM Functionality Added to SONET DCS | 2-6 |
| Figure 2-4. | Layer Structure of STM and ATM Transport Methods | 2-7 |
| Figure 2-5. | UPSR Example - Operation in Response to a Fiber Break | 2-9 |
| Figure 2-6. | BLSR Example | 2-10 |
| Figure 2-7. | Example of ATM transport Network | 2-11 |
| Figure 2-8. | Conventional SONET and ATM Network..... | 2-12 |
| Figure 2-9. | Hybrid SONET/ATM NEs in an Example Network..... | 2-13 |
| Figure 2-10. | Generic cases for protected connections..... | 2-14 |
| Figure 2-11. | UPSR-UPSR Interconnection (logical ring) | 2-15 |
| Figure 2-12. | UPSR-UPSR Interconnection (drop and continue)..... | 2-15 |
| Figure 2-13. | ATM Point-to-Point Protection Switching Mechanism..... | 2-16 |
| Figure 2-14. | Examples of PDs for a Single ATM Connection..... | 2-18 |
| Figure 3-1. | TMN Functional Structure | 3-4 |
| Figure 3-2. | Examples of System Implementation of TMN Logical Layer Functions..... | 3-5 |
| Figure 3-3. | Example Hybrid Network Configuration of DCS and UPSR..... | 3-8 |
| Figure 3-4. | Network Layers Supported on OC-3 Facility and OC-12 UPSR..... | 3-11 |
| Figure 3-5. | Inter-layer Configuration..... | 3-12 |
| Figure 3-6. | Layer Network Domains for Example Network Configuration | 3-13 |
| Figure 3-7. | Basic Subnetwork Topology Relationships | 3-14 |
| Figure 3-8. | Example of Partitioning | 3-15 |
| Figure 3-9. | Different Partitioned Views of STS-3c Path Layer Network..... | 3-15 |
| Figure 3-10. | Different Partitioned Views of STS-1 Path Layer Network..... | 3-16 |
| Figure 3-11. | A Subnetwork Connection in Unpartitioned and Partitioned Views..... | 3-17 |
| Figure 3-12. | SONET, Hybrid SONET/ATM, and ATM EMSs and respective managed element types | 3-19 |
| Figure 3-13. | Hybrid SONET/ATM EMS in the context of other systems | 3-20 |

List of Tables

| | | |
|------------|--|------|
| Table 3-1. | General Types of SONET and ATM Network Layers..... | 3-10 |
| Table 4-1. | Criteria for Reporting NE or Circuit Pack Disabled While in Service | 4-26 |
| Table 4-2. | Hierarchy of Trail Types..... | 4-37 |
| Table 4-3. | Hierarchy of Reported TCA Types - SONET..... | 4-38 |
| Table 4-4. | Hierarchy of Reported TCA types - PDH..... | 4-39 |
| Table 4-5. | Hierarchy of Reported TCA Types - RCA..... | 4-40 |
| Table 4-6. | User Identification Data | 4-58 |
| Table 5-1. | Hybrid SONET/ATM EMS/NE Operations Interface Requirements. | 5-3 |
| Table 5-2. | SONET/ATM NMS/EMS Operations Interface Requirements. | 5-8 |