Overview of the TMF MTNM NML-EML Interface

This is an overview of the TMF 814 Solution Set or the TMF MTNM NML-EML interface version 3.5. This is a minor version of the interface. This version replaces TMF814 version 3.0[1] in its entirety.

The interface has been constructed as a result of collaboration between vendors and service providers.

It is recommended that the reader of the solution set starts by reading Multi-Technology Network Management Solution Set NML-EML Interface (available in the directory TMF814_v3.2/TMF814_Documentation in the file SD1-TMF814v3.2-IDL_2008.pdf) for an introduction to the interface and background on its development, then proceeds to this document and finally to the HTML documentation form of the IDL to navigate the interface definition (see below).

TMF 814 Version 3.5 Solution Set

There are 4 major documents associated with TMF MTNM (Multi-Technology Network Management) Version 3.5:

- TMF 513[2] – Multi Technology Network Management Business Agreement
  - This document provides requirements and use cases and should be read prior to embarking on an implementation
- TMF 608 – Multi Technology Network Management Information Agreement
  - This document provides a UML model and should be read to enhance understanding of the IDL implementation model. The two models are related by SD1-21_MappingIASS.pdf which should be used to aid navigation between the two TMF814 and TMF608
- TMF 814 – Multi Technology Network Management Solution Set (CORBA IDL) in file SD1-38_TMF814InterfaceVersion3.5.pdf.
  - This is the IDL implementation solution set of which this document is part (see below for more details)
- TMF814A – Multi Technology Network Management Implementation Statement Template and Guidelines
  - This document provides the conformance statement and should be used to detail the interface implementation

[1] The first release of this interface was referred to as TMF509 or SSIM (SONET/SDH Interface Management), IDL.. This version also supercedes TMF509.
[2] Available from www.tmforum.org. Also see SD1-38 for details

The solution set is a set of packaged files including[3]:

- CORBA IDL files[4] (in directory TMF814_Version_3.5\idl)
- HTML documentation built directly from the IDL files that provide a readily navigable view of the IDL and its in line documentation. This can be accessed by launching the file TMF814_Version_3.5\TMF814_Documentation\html\index.html.
- Supporting documentation files[5] that are referenced from within the IDL (in directory supportingDocumentation) to provide additional information[6]. A brief summary of each of the documents provided below:
    - SD1-1_AdditionalInfoUsage.pdf – A mechanism is provided to apply additional information to operations and to responses from the Managed Elements. The additional information should conform to the list identified in this document.
    - SD1-2_AVC_SC_Notifications.pdf – Provides a list of the attribute value and state change notifications along with the data that should be conveyed over the interface
    - SD1-3_BundledSNC.pdf – The interface supports simultaneous operations on SNCs grouped in Bundles. This document explains the concept and usage of Bundled SNCs.
    - SD1-5_ATMConformanceDefinitions.pdf – ATM service category and conformance definitions
    - SD1-6_ContainedTPs.pdf – provides specific naming details for a number of cases of TP containment using the layered model and is a companion to SD1-25_objectNaming.pdf and SD1-18_layers.pdf
    - SD1-7_DSLOverview.pdf – provides an overview of DSL technology as a companion to SD1-18_layers.pdf
    - SD1-8_encodingX731M3100.pdf – explains how to provide ITU X.731 and M3100 state and status information in the fields provided in the MTNM interface
    - SD1-9_encodingX733.pdf – explains how to provide ITU X.733 alarm information in the fields provided in the MTNM interface
    - SD1-10_equipmentModel.pdf – Specifies the equipment model and equipment states
    - SD1-13_guiCutThrough.pdf – Explains the NMS to EMS GUI cut through
    - SD1-14_IMOverview.pdf – Provides an overview of Inverse Multiplexing
    - SD1-15_iterators.pdf – Iterators are used extensively, this supporting document explains their usage
    - SD1-16_layeredParameters.pdf – The interface is built around a layered[7] model this document provides a specification of and explanation of the parameters may be reported and configured in the context of the layered TP model
    - SD1-17_LayerRates.pdf – Provides a list of supported transport layer along with their naming and a method for adding new layer where currently not supported.
    - SD1-18_layers.pdf (also referred to as "Functional Modelling Concepts") – The interface extends the layered model identified by ITU, this document explains the

[3] The same versions of many of the supporting documents are also available as part of TMF513and TMF608.
[4] These have been compiled prior to release and therefore should be IDL error free. The comments have been sized to fit A4 and US letter paper width for ease of printing.
[5] This document is one of the supporting documents in the folder referenced
[6] These are all .pdf documents that can be accessed directly, however it is recommended that they are read in the context of the interface IDL
[7] See SD1-18_layers.pdf for further details

layered model, the extensions and their usage from both a nodal and a network perspective providing many examples. It provides guidelines for modelling the traffic capabilities of networks of managed elements.

- SD1-19_LocationIdentification.pdf – Defines the usage of "Contra Directional" in the context of PM location
- SD1-20_maintenanceCommands.pdf – Maintenance operations are supported by the interface, this document summarized the commands
- SD1-21_MappingIASS.pdf – provides a mechanism to relate the detail of the implementation in the solution set (TMF814) to that model provided in the Implementation Agreement (TMF608).
- SD1-22_modelDiagramComponents.ppt – provides the diagram model components used in the layers document to aid in production of compatible diagrams to represent a specific solution. This is a companion to SD1-18_layers.pdf.
- SD1-23_modesOfOperation.pdf – There are several ways that an NMS may choose to use the SNCs, this document explains these various modes of operation.
- SD1-25_objectNaming.pdf – Provides an overview and specification of the object naming used across the interface
- SD1-26_OMGServicesUsage.pdf – The interface makes use of both the Notification Service and the Telecoms Log Service from the OMG, this document explains its usage
- SD1-28_PerformanceParameters.pdf – Provides a specification and explanation of the Performance Parameters
- SD1-29_PGPParameters.pdf – Provides a specification and explanation of the Protection Group Parameters
- SD1-30_PMFileFormat.pdf – The interface supports the reporting of bulk PM data, this document provides a definition of the format
- SD1-33_ProbableCauses.pdf – Provides a specification of the standard probable causes that should be used when reporting an alarm
- SD1-34_protectionSwitch.pdf – Provides an overview of the protection switching model and operations for Trail protection applied to a number of example scenarios
- SD1-35_StateDiagrams.pdf – Provides an explanation and specification of the various states of the SNC
- SD1-36_SNCTypes.pdf – The SNC is a fundamental component in the provision of connectivity across the network. This document defines the SNC types and provides examples of their usage
- SD1-37_TCAs.pdf – Provides a graphical representation of the threshold crossing and alert points.
- SD1-41_TPPoolRelationship.pdf – Explains the relationship between TP Pools and the TP.
- SD1-42_trafficParameters.pdf – Provides a specification of and explanation of traffic parameters in traffic descriptors. **N.B.** Since version 3.0, traffic descriptors (TDs) are superseded by transmission descriptors (TMDs). The document is kept for compatibility with previous versions.
- SD1-43_versioning.pdf – Provides details on how to operate new and old versions of the MTNM interface

- SD1-44_ConnectionlessTechnologyManagement.pdf – Provides details on Connectionless Technology Management (e.g., Ethernet VLANs).
- SD1-45_ASONControlPlaneManagement-Primer.pdf – Provides explanations on Control Plane principles.
- SD1-46_ASONControlPlaneManagement-Scenarios.pdf – Contains scenarios of Control Plane deployment, including upgrades of legacy networks with no Control Plane.

Interface Goals

The interface described in this document is intended for use between the Network Management System (NMS) and Element Management System (EMS) where “NMS” refers to any client and “EMS” refers to any server for the interface.

The innovative modelling concepts allow the single interface using one model and consistent operations paradigm to manage many disparate network technologies (SDH/SONET, WDM, ATM, DSL, Ethernet, Wireless etc) even where intertwined within single network devices

The interface includes mechanisms to allow the NMS to:

1. Discover the resources managed by an EMS both at start up and during normal operation
2. Examine and configure termination points
3. Determine resource usage (via TPs) and connectivity (SNCs, Topological Links etc) within the network managed by an EMS
4. Request the EMS to establish SNCs, modify SNCs (edit shape and add/remove/adjust route) and delete SNCs
5. Request the EMS to establish Topological Links and delete Topological Links
6. Discover the physical resources (e.g. shelves and cards) present in the network
7. Configure and retrieve performance measures from the network
8. Retrieve and manage alarms including creation and use of Alarm Severity Assignment Profiles
9. Manage the ME data backups

Objects Modeled

The objects in the network exposed via this interface is based on the layered concepts and layer decomposition laid out in ITU G.805. An object model that is based on these concepts is assumed to be used by the EMS.

It should be noted that the EMS need not model each detailed object specifically but must map its internal data to the structures in the interfaces that represent the objects identified.

The specific object model exposed via the facade is detailed elsewhere. In brief the model (which is represented as data structures used in the interfaces) includes the following objects:

1. TerminationPoint_T:
    1. Connection Termination Point (CTP): an aggregate of ITU G.805/G.803 Connection Point (CP) and G.805/G.803 Termination Connection Point (TCP). The TCP is not specifically modeled in this specification.
    2. Physical Termination Point (PTP): an aggregate of a number of G.805/G.803 CPs and G.805/G.803 TCPs that are related to an individual physical port.

    3. Termination Point Pool (TPPool): a logical pool of CTPs grouped for administrative purposes. An example is the partitioning of VP CTPs for bandwidth management.
2. MultiLayerSubnetwork_T:
    1. The Multi-Layer Subnetwork (MLSN) represents an aggregate of G.805 conformant single layer subnetworks.
    2. In ASON Control Plane Management, this structure is also used to represent a Multi-Layer Routing Area (MLRA).
3. EMS_T: Holds EMS identification information.
4. ManagedElement_T: Represents a single Network Element.
5. SubnetworkConnection_T:
    1. The Subnetwork Connection (SNC) represents a single cross connection or a number of cross connections.
    2. In ASON Control Plane Management, this structure is also used to represent a Connection.
6. Equipment_T: represents physical resources managed by an EMS.
7. EquipmentHolder_T: Represents the physical resource of a network element that is capable of holding other physical resources.
8. ProtectionGroup_T: Is used to discover and query protection information.
9. TopologicalLink_T: A topological view of the network managed by the EMS.
10. TrafficDescriptor_T: (Obeslete) Defines bandwidth and Quality of Service characteristics of a TP.
11. TransmissionDescriptor_T: Defines bandwidth, Quality of Service and other characteristics of a TP.
12. ASAP_T: Defines Alarm Severity Assignment Profiles.

The following structures were added for ASON Control Plane Management:

13. Call_T: Represents a Call.
14. MultiLayerSNPP_T: Represents a MultiLayer Subnetwork point pool (MultiLayerSNPP).
15. MultiLayerSNPPLink_T: Represents a Multi Layer Subnetwork Point Pool Link (MultiLayerSNPPLink).

The following structures were added for Connectionless Technology Management:

16. FlowDomain_T: Represents a Flow Domain (FD).
17. MatrixFlowDomain_T: Represents a Matrix Flow Domain (MFD).
18. FlowDomainFragment_T : Represents a Flow Domain Fragment (FDFr).
19. MatrixFlowDomainFragment_T : Represents a Matrix Flow Domain Fragment (MFDFr).
20. TCProfile_T: Defines Traffic Conditioning Profiles (TCProfile).

Coarse Grain Approach

A coarse grain approach has been used for the definition of the interfaces.

The coarse grain approach for modeling the interface between the EMS and the NMS leads to the adoption of a Facade Design Pattern and of a Singleton design Pattern for the Facade objects (i.e. the Facades are Singleton objects) extended to CORBA objects.

The CORBA Facade design pattern offers the following advantages:

- It naturally leads to a lesser number of objects across the interface; this is a desirable goal when performance is a winning factor.
- Provides operations and services that focus on the primary problem to be solved and provide efficiency and atomicity for these operations
- The client (NMS) is shielded from the EMS object Model. It provides for loose coupling between the NMS objects and the EMS objects. Even if the internal implementation of the object model of the EMSs changes, the NMS need not be aware of it. In the fine grain approach every change to the object model of the EMS directly impacts the NMS.

The choice of the coarse grain approach needs to be viewed from the perspective of system architecture and current technology capability instead of that of pure object oriented modeling.

Object Managers

The coarse grain approach requires that access to the objects modeled through the interface is done with the appropriate Object Manager.

As a consequence a number of object managers are defined that have services to obtain data about the objects in the network managed by the EMS via its detailed object model. The definition includes interfaces to the following object Managers:

1. EMSMgr_I
2. MultiLayerSubnetworkMgr_I
3. ManagedElementMgr_I
4. EquipmentInventoryMgr_I
5. GuiCutThroughMgr_I
6. PerformanceManagementMgr_I
7. ProtectionMgr_I
8. TrafficDescriptorMgr_I
9. MaintenanceOperationsMgr_I
10. SoftwareAndDataMgr_I
11. TransmissionDescriptorMgr_I

The following managers were added in MTNM version 3.5:

12. FlowDomainMgr_I
13. MLSNPPMgr_I
14. MLSNPPLinkMgr_I

There is also a Common_I interface inherited by the interfaces mentioned above.

Use of CORBA services

The CORBA services that are intended to be used along with this specification are the:

- Naming Service
- Notification Service
- Telecoms Log Service