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Telecommunications management network

Framework for the integrated management of hybrid circuit/packet networks

ITU-T Recommendation M.3017

ITU-T M-SERIES RECOMMENDATIONS

TMN AND NETWORK MAINTENANCE: INTERNATIONAL TRANSMISSION SYSTEMS, TELEPHONE CIRCUITS, TELEGRAPHY, FACSIMILE AND LEASED CIRCUITS

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ITU-T Recommendation M.3017

Framework for the integrated management of hybrid circuit/packet networks

Summary

This Recommendation describes the environment in which integrated management of Hybrid Circuit/Packet Networks (including ATM-, IP-, and Ethernet-based networks) must operate.

Source

ITU-T Recommendation M.3017 was approved by ITU-T Study Group 4 (2001-2004) under the ITU-T Recommendation A.8 procedure on 22 June 2003.

FOREWORD

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ITU-T Recommendation M.3017

Framework for the integrated management of hybrid circuit/packet networks

1 Scope

This Recommendation is a part of a series of Recommendations defining the TMN paradigms for management of large-scale carrier networks. It is the scope of this Recommendation to provide an overview of:

- The evolving telecommunications networks architectures that provide for multi-service networking over packet-switched networks (e.g., IP, ATM, Ethernet).
- The interworking architectures and scenarios to allow interworking between traditional circuit-switched and Hybrid Circuit/Packet Networks (HCPNs).
- The services and applications to be provided over the above architectures (e.g., Voice over IP).
- Management paradigms employed in managing packet-based networks.
- Considerations for the extension of TMN toward the management of HCPNs.

Connections across administrative domains are included in the scope, however, in this Recommendation, no explicit provisions are made for these.

2 References

The following ITU-T Recommendations and other references contain provisions which, through reference in this text, constitute provisions of this Recommendation. At the time of publication, the editions indicated were valid. All Recommendations and other references are subject to revision; users of this Recommendation are therefore encouraged to investigate the possibility of applying the most recent edition of the Recommendations and other references listed below. A list of the currently valid ITU-T Recommendations is regularly published. The reference to a document within this Recommendation does not give it, as a stand-alone document, the status of a Recommendation.

- ITU-T Recommendation G.805 (2000), *Generic functional architecture of transport networks*.
- ITU-T Recommendation G.809 (2003), *Functional architecture of connectionless layer networks*.
- ITU-T Recommendation G.872 (2001), *Architecture of optical transport networks*.
- ITU-T Recommendation M.3010 (2000), *Principles for a telecommunications management network*.
- ITU-T Recommendation M.3020 (2000), *TMN Interface Specification Methodology*.
- ITU-T Recommendation Q.811 (1997), *Lower layer protocol profiles for the Q3 and X interfaces*.
- ITU-T Recommendation Q.812 (1997), *Upper layer protocol profiles for the Q3 and X interfaces*.
- ITU-T Recommendation Q.814 (2000), *Specification of an electronic data interchange interactive agent*.
- ITU-T Recommendation Q.815 (2000), *Specification of a security model for whole message protection*.

- ITU-T Recommendation Q.816 (2001), *CORBA-based TMN services*.
- ITU-T Recommendation Q.816.1 (2001), *CORBA based TMN services: Extensions to support coarse-grained interfaces*.
- ITU-T Recommendation X.720 (1992) | ISO/IEC 10165-1:1993, *Information technology – Open Systems Interconnection – Structure of management information: Management information model*.
- ITU-T Recommendation X.722 (1992) | ISO/IEC 10165-4:1992, *Information technology – Open Systems Interconnection – Structure of management information: Guidelines for the definition of managed objects*.
- ITU-T Recommendation X.780 (2001), *TMN guidelines for defining CORBA managed objects*.
- ITU-T Recommendation X.780.1 (2001), *TMN guidelines for defining coarse-grained CORBA managed object interfaces*.
- IETF RFC 1901 (1996), *Introduction to Community-based SNMPv2*.
- IETF RFC 3411 (2002), *An Architecture for Describing Simple Network Management Protocol (SNMP) Management Frameworks*.
- OMG Document formal/99-10-07, *The Common Object Request Broker: Architecture and Specification*, Revision 2.3.1.

3 Definitions

3.1 Definitions imported from ITU-T Recs G.805 and G.809

- access group;
- connection;
- fabric;
- flow;
- flow domain;
- flow point pool link;
- layer network;
- link;
- link connection;
- subnetwork;
- subnetwork connection protection;
- trail.

3.2 Other definitions in this recommendation

This Recommendation defines the following terms:

3.2.1 paradigm: a set of management functionalities that includes a protocol and associated services, as well as a supporting information definition language. It can be used to produce collections of management information including relationships amongst management information to accomplish a given management objective. A paradigm must have mechanisms to support the definition of a library of management information.

3.2.2 Hybrid Circuit/Packet Network (HCPN): a network composed of both circuit-switched and packet-based layer (sub) networks. A packet-based layer may be connection-oriented or

connectionless. ITU-T Rec. G.809 distinguishes Connection-Oriented Circuit Switched (CO-CS) networks, Connection-Oriented Packet Switched (CO-PS) networks, and Connectionless Packet Switched (CLPS) networks; and gives details on CLPS networks implemented with IP (using best effort, destination-based forwarding) and those implemented with Ethernet.

3.2.3 topology: See A.1.1 for details.

3.2.4 Technology-Specific Network (TSN): a single layer network of the layer-based network model, which is only concerned with one technology, e.g., IP, ATM, SDH or Optical network.

3.2.5 Multi-Technology Networks (MT): For the purpose of providing multiple services, assuring QoS and reducing operating costs, the core networks of service providers are usually composed of several technology-specific communication networks. There are various relations between these networks, and they may cooperate with each other to provide services. In this Recommendation, core networks composed of several interacting TSNs belonging to the same operator, are called Multi-Technology Networks (MTN).

3.2.6 Integrated Network Management System (INMS): the managing system performing the integrated management of MTN. It is responsible for analyzing and processing of the management information collected from TSNs, and the integrated management of topology, configuration, fault and performance of several TSNs.

3.2.7 Technology-Specific Network Management System (TS-NMS): the managing system performing the management of a TSN, including the management of the subnetworks and their relations. TS-NMS provides INMS the management information of topology, configuration, fault and performance of this TSN.

4 Abbreviations

This Recommendation uses the following abbreviations:

AAA	Authentication Authorization and Accounting
ADM	Add and Drop Multiplexer
ATM	Asynchronous Transfer Mode
BLSR	Bidirectional Line Switched Ring
CMIP	Common Management Information Protocol
COPS	Common Open Policy Service
CORBA	Common Object Request Broker Architecture
DCS	Digital Crossconnect System
DEN	Directory Enabled Networking
EDI	Electronic Data Interchange
EMS	Element Management System
FCAPS	Fault management, Configuration management, Accounting management, Performance management, Security management
GSM	Global System for Mobile Communications
HCPN	Hybrid Circuit/Packet Network
HTTP	HyperText Transfer Protocol
IIOP	Internet Inter-ORB Protocol
IMS	IP Multimedia Subsystem

INML	Integrated Network Management subLayer
INMS	Integrated Network Management System
IP	Internet Protocol
LC	Link Connection
LDAP	Lightweight Directory Access Protocol
MPLS	Multi-Protocol Label Switching
MS SPRING	Multiplex Section Shared Protection Ring
MTN	Multi-Technology Networks
NE	Network Element
NML	Network Management Layer
NMS	Network Management System
OS	Operations System
OSI	Open System Interconnection
OTN	Optical Transport Network
POTS	Plain Old Telephone Service
PSTN	Public Switched Telephone Network
QoS	Quality of Service
RMI	Remote Method Invocation
SDH	Synchronous Digital Hierarchy
SMS	Service Management System
SNCP	SubNetwork Connection Protection
SNMP	Simple Network Management Protocol
SONET	Synchronous Optical Network
SS7	Signalling System No.7
STM-N	Synchronous Transport Module (level) N
TCP	Transmission Control Protocol
TMN	Telecommunications Management Network
TSN	Technology-Specific Network
TS-NML	Technology-Specific Network Management subLayer
UDP	User Datagram Protocol
UML	Unified Modelling Language
UPSR	Unidirectional Path Switched Ring
USM	User-based Security Model
VC	Virtual Circuit
VP	Virtual Path
WDM	Wavelength-Division Multiplexing
XC	Cross-Connect

5 Overview

This Recommendation describes a framework for the integrated management of Hybrid Circuit/Packet Networks (HCPN). It begins in clause 6, with a description of the network environments in a HCPN that needs to be supported within the integrated management framework. This description includes reference architectures and topologies. Clause 7 describes the Service environment, namely, the relationship between technology-specific networks in the HCPN environment. Clause 8 describes the management environment itself.

6 Network environment of HCPN

This clause proposes transport network architectures for use as a description of the network environment applicable to integrated management of HCPNs. The focus is on the transport view of network architectures. Signalling and control architectures are beyond the scope of this version of the Recommendation. Transport services for the control plane are supported by the transport architectures.

6.1 Overview of network environment

A set of reference architectures is provided. The architectures were developed on the basis of collective architectural input from service providers and are intended to provide the basis for multi-technology network architectures subject to study by the service providers.

Each reference architecture captures a grouping of technologies and configurations. The set of architectures exhibit a progression from current technology networks to future networks that will be based on technologies that in some cases are just now beginning to emerge. Due to the ample options allowed in the reference architectures, refinements will generally be needed to define use cases for specific network management functions.

Each reference architecture is constructed by overlaying a physical architecture with a layer domain architecture. The physical architecture identifies relationships among network elements and transport media; the layer domain architecture identifies specific adaptation relationships among transport layer domains. Four reference architectures are defined, building on three distinct physical architectures.

An overview of concepts pertaining to generic network topology is provided in the Annex A. Clause 6.2 presents the reference architectures including an explanatory overview, a description of three physical architectures, and descriptions of the four reference architectures.

6.2 Reference architectures

In this clause, four reference architectures are presented. Each reference architecture consists of two views of a network:

- Physical Architecture: the configuration of physical transport media and NEs. The possible types of NEs that may be included are identified. NE types are defined in terms of the types of cross-connect or switching fabric(s) supported and may include supported adaptations of transport layers at trail terminations.
- Layer Domain Architecture: the configuration of transport layers related through adaptation of server layer bandwidth to client layer connections. This view indicates support of flexible connections or inflexible connections within each transport layer. In addition, it shows mappings of services to layer domains. These mappings do not exhaust real-world possibilities.