Using CORBA and XML to Deliver Unified NGN Management Interfaces - Rationale and Summary

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Abstract. The targets of NGN/BcN Management (NGNM) are packet-based transport strata and converged service strata. NGNM standardisation should develop unified open interfaces for NGN stratum management that are rich in multi-transmission technology and multi-service capabilities and enable lean operations for converged NGN/BcN with unified user experience and presence. This challenge can be met through development of *a single open and component-oriented interface specification for managing next-generation networks and services*, which is in harmony with key related standards. The layer, which exposes the reference points of such a unified (and universal) NGNM interface, is termed *unified Management Layer* (uML) and introduced here. This short paper provides a rationale and a summary of the uML vision. A detailed overview of the novel uML paradigm is available as a full paper [2]. Further results on developing and scoping the uML are available as a Technical Report [3].

1 Introduction and Rationale

Y.2011 [4] introduces the *NGN Basic Reference Model*, which defines the decoupled multi-plane NGN service stratum and NGN transport stratum to realise the separation of services from transport, and the *general NGN functional model*, which consists of services, service resources and transport resources, both with management and control functions, and transfer functions. ITU-T SG13 progresses the Y.2011 models to architectures that allow to delineate the scope of NGN functionality.

Y.NGN-FRA [5] defines the *overview NGN functional architecture* on a functional group (FG) level, the *generalised NGN functional architecture* on a functional entity (FE) level, and *stratum configurations* such as IMS for NGN. Figure 1 depicts the current draft of the NGN functional group architecture. It shows the Management FG and the following targets of NGNM: the FGs of the service stratum, the FGs of the transport stratum, and the End-User FG. This paper proposes a unified approach for the specification of FEs of the Management FG. The term *unified Management Layer* (uML) is introduced here for the universe of all Management FEs that expose their functionality via reference points, and the interface-oriented structure of the

Management FG is here called *NGNM Architecture* (NMA). ETSI TISPAN and ITU-T SG4 have defined NGNM frameworks [6][7][8] that can be used to develop NMA fragments through refinement of the eTOM [9] levels and application of management specifications to NGN functional groups and entities [10].

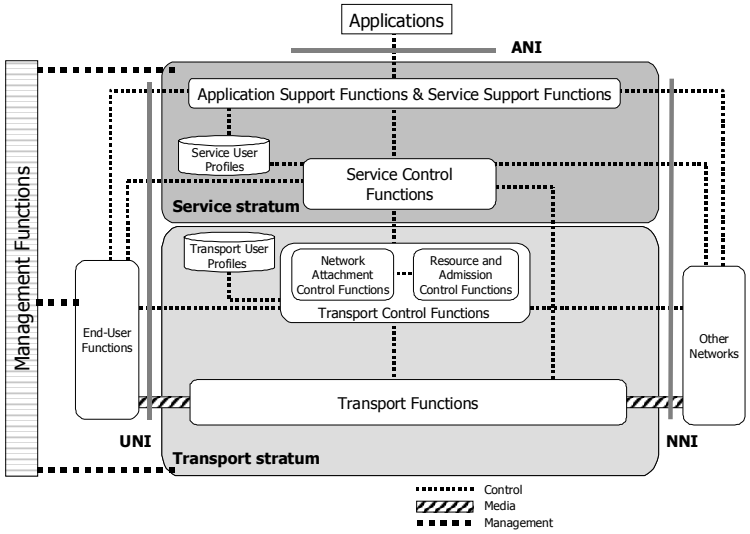

Figure 1. ITU-T's draft NGN functional group architecture [5]

A common understanding between standards development organisations is shaping up well that liaisoning and harmonising NGN *OS-OS interface* (OSI) standardisation work will be beneficial to all participants. The concepts of uML and NMA can provide guidance and focus for this harmonisation challenge. They serve as a *vehicle and catalyst* for the acceleration of the delivery of unified OSIs by scoping and developing an overarching top-down approach based on the NGN functional architecture. Emphasis is laid on *using CORBA and XML* as enabling technologies for the implementation view since they are predominant in today's OSI standardisation.

2 Prerequisites for Unified NGNM Interface Development

Development of the reference points that make up the uML requires assessment and unification of methodologies, deliverables structures, and approaches of the current management interfaces. The following prerequisites have been identified [2][3]:

- view-centric *lean Operations Systems Engineering* (OSE) and *rapid Operations Software Development & Deployment* (OSD) by using TM Forum's NGOSS lifecycle and methodology framework [11] and a *unified OSI deliverables structure*;
- *five steps* (Coverage, Gap analysis, Product planning, Harmonisation, Revision) to enable joint evolution of today's most prevalent OSI standards;
- application of *SOA and SDP principles* to NGNM (coarse-grained interfaces that realise the separation of state and behaviour, orchestration/federation, et al.);

- using CORBA and XML to deliver unified OSIs: *harmonisation of the CORBA approaches* and detailed definition of a *unified XML approach*.

3 Developing the *unified Management Layer* (uML)

The TM Forum *NGOSS initiative* with its OSS/BSS lifecycle and methodology [11] has a shaping impact on the implementation and deployment views of OSS/BSS solutions. NGOSS steadily facilitates the rapid development of OSS/BSS components, or SOA services, for all TMN layers. The revolutionary challenge of NGOSS to componentise and SOA-structure OSS/BSSes [12] across all layers of the *TMN pyramid* [8] [9] effectively results in first razing the TMN pyramid and then reconstructing the TMN layers (except the BML) into the *unified Management Layer* (uML). This is shown in Figure 2, which reorganises the building blocks of the TMN pyramid.

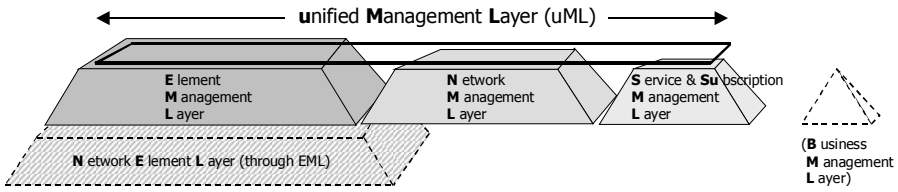

Figure 2. Paradigm of layer co-management by uML components

A similar figure applies to the transformation of the multi-tier NGNM functional architecture framework [6][7] to a *one-tier NGNM physical architecture*.

The uML is composed of NGOSS components [12] that collectively offer SML, NML, EML and NEL (through EML) functionality. Therefore

- NGOSS is shifting the "ITU-T paradigm of the TMN pyramid" to the "paradigm of layer co-management by uML components".

Subscription Management (SuM) is located at the SML; it manages links from services to subscribers of services and to users, and all related profiles and subscription data. Consideration of BML functionality for uML development is for further study.

The uML interface is opaque, i.e. EML/NML/SML interworking is invisible to the users of the OSI. To enable multi-vendor interoperability of uML components, the northbound/southbound uML user interface should be complemented by a westbound /eastbound uML interface for peer-to-peer use by uML component vendors.

TMN layers are aggregations of function blocks of the same type [8]. Since a function block corresponds to an SOA service [7], the uML is a *grouping of SOA services* that are made of uML components exposing service interfaces with uML-defined operations. Thus the uML is also a grouping of service interfaces, i.e. a *Service Interface Group* (SIG) [6]. It is in fact the *universal SIG* with regard to SML/NML/EML /NEL(throughEML) functionality. All SM/SuM-, NM- and EM-features are offered by some uML service interface, and so the uML incorporates *all* NGNM features required to manage the (consolidated) NGN functional (group) architecture, i.e.

- developing the unified Management Layer (uML) amounts to developing the entire Management functional group of the NGN FG architecture (see Figure 1).

For example, specification of uML components managing the End-User functional group could be accomplished through OSI specification, according to the principles developed in [2][3], of End-User functional entities defined by (either, some, or all)

- features for *management of customisable IP networks*: see Y.2241 [13];
- *remote CPE management* features: see DSL Forum's WT-131 [14];
- *device management* features: see OMA DM[1]-compliant OSGi Service Platform[2];
- *home network management* features: see Joint Co-ordination Activity on Home Networking (JCA-HN)[3], Home Gateway Initiative (HGI)[4], and DVB Project[5].

Further examples of uML components would address features of *multi-technology transport stratum management* (access, aggregation, edge and core networks) and *converged service stratum management*. See next section for an initial feature list.

4 Multi-technology and Multi-service Capabilities

The multi-layer nature of transport strata and the convergence of services in service strata has great impact on NGNM requirements and influences uML development. The following *initial scope of the uML* has been developed [2][3]:

- management of packed-based NGN transport strata by using the *multi-technology capabilities of TM Forum's MTNM standard* [15][16][17] and focussing on
  - o management of multiple adjacent transmission layers with inter-layer and intra-layer interactions as requested by clause 9/Y.2011 [4];
  - o Control Plane management and management of Ethernet bridging;
  - o management of carrier-grade IP transport (IPv4 and IPv6) and MPLS;
  - o all kinds of VPN management;
- unified Service Management (SM) approach by using ITU-T SG13's *Converged Services Framework* (CSF) [18] and TM Forum's novel profile-based *mTOP SM interface development framework* [2][3] for the management of
  - o *connectivity services* inside a transport stratum (and across transport strata);
  - o *converged NGN services* inside a service stratum, which either use connectivity services or are transport-independent, and interworking beyond the stratum;
- assessment of SM-related specification, proof-of-concept and liaison *activities of the TM Forum* that are of considerable interest for uML development;
- attach importance to IMS-based Fixed-Mobile Convergence (FMC) and Telecom Media Convergence (TMC) as the key drivers for NGN convergence by defining FMC and TMC services that fit well in the CSF, diverse SDP frameworks, and the unified *Service and Resource Management Framework* conceptualised in [2][3];

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[1] http://www.openmobilealliance.org/tech/wg_committees/dm.html
[2] http://www.osgi.org/osgi_technology/download_specs.asp
[3] http://www.itu.int/ITU-T/special-projects/jca-hn/index.phtml
[4] http://www.homegateway.org/index.html
[5] http://www.dvb.org/index.xml

- pursue NGNM paradigm of *lean and rapid service provisioning and conditioning* through profile mechanisms for NGN services and related managed object classes.

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   NOTE – This Recommendation is a multipart document with the following structure:
   M.3050.0 – *eTOM - Introduction*;
   M.3050.1 – *eTOM - The business process framework*;
   M.3050.2 – *eTOM - Process decompositions and descriptions*;
   M.3050.3 – *eTOM - Representative process flows*;
   M.3050.4 – *eTOM - B2B integration: Using B2B inter-enterprise integration with the eTOM*;
   M.3050/Suppl.1 – *eTOM - ITIL application note*;
   M.3050/Suppl.2 – *eTOM - Public Business Operations Map (BOM)*;
   M.3050/Suppl.3 – *eTOM to M.3400 mapping*.
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Appendix: Abbreviations

This paper uses the following abbreviations:

ANI	Application-to-Network Interface
BcN	Broadband Convergence Network(s)
BML	Business Management Layer
BSS	Business Support System
CORBA	Common ORB Architecture
CPE	Customer Premises Equipment
CSF	Converged Services Framework
DM	Device Management
DVB	Digital Video Broadcasting
EM	Element Management
EML	EM Layer
eTOM	enhanced Telecom Operations Map
FE	Functional Entity
FG	Functional Group
FMC	Fixed-Mobile Convergence
IMS	IP-based Multimedia Subsystem
IP	Internet Protocol
MPLS	Multi-Protocol Label Switching
MTNM	Multi-Technology Network Management
mTOP	multi-Technology OSS Program
NE	Network Element
NEL	NE Layer
NGN	Next Generation Network(s)
NGNM	NGN/BcN Management
NGOSS	New Generation OSS
NM	Network Management
NMA	NGNM Architecture
NML	NM Layer
NNI	Network-to-Network Interface
OMA	Open Mobile Alliance
ORB	Object Request Broker
OS	Operations System
OSD	Operations Software Development & Deployment
OSE	Operations Systems Engineering
OSGi	trademark of the OSGi Alliance
OSI	OS-OS Interface
OSS	Operations Support System
OSS	Operations Systems and Software
SDP	Service Delivery Platform
SG	Study Group
SIG	Service Interface Group
SM	Service Management
SML	SM & SuM Layer
SOA	Service-Oriented Architecture/Approach
SuM	Subscription Management
TMC	Telecom Media Convergence
TMN	Telecommunications Management Network
uML	unified Management Layer
UNI	User-to-Network Interface
VPN	Virtual Private Network
XML	eXtensible Markup Language