ETSI TS 132 107 V17.0.0 (2022-04)

Universal Mobile Telecommunications System (UMTS); LTE; Telecommunication management; Fixed Mobile Convergence (FMC) Federated Network Information Model (FNIM) (3GPP TS 32.107 version 17.0.0 Release 17)

Reference
RTS/TSGS-0532107vh00

Keywords
LTE,UMTS

ETSI

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Contents

Foreword

This Technical Specification has been produced by the 3rd Generation Partnership Project (3GPP).

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Version x.y.z

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z the third digit is incremented when editorial only changes have been incorporated in the document.

1 Scope

On-going industry convergence and pressure to reduce cost is placing an ever-increasing emphasis on the need to rationalize and align various network management aspects across boundaries of standards/specifications producing organizations. The cost, resulting from integration and management challenges, of the lack of a coherent treatment of the whole network has becoming increasingly apparent to the point where operators of networks are demanding action.

This document provides key concepts and principles for the Federated Network Information Model covering all key aspects of a solution to the on-going industry convergence challenge. The proposal focuses on Information Model federation and is constructed to best deal with the various contradictory pressures of the current environment providing a pragmatic and realizable approach. The structure proposed will be called the Federated Network Information Model (FNIM).

The proposal set out in this document:

Explains:

- How, from a technical perspective, a number of standards and specifications generated by different organizations can function together to bring greater coherence to the management of converged networks and hence reduce operations costs.

- Specifically how TM Forum and 3GPP can work with each other and with other industry groups in a Standards Federation to develop a Federated Network Information Model drawing on insights from the broad community (including the TM Forum SID [7], TM Forum MTNM/MTOSI [8], 3GPP SA5 IRPs [14], DMTF CIM [15]).

- How the Federated Network Information Model can be used from a technical perspective (with the focus here being the Network Model).

Recognizes:

- The network is "always on", therefore changes in management solutions should not impact networks in operation.

- There will always be on-going change.

- That this is only a start on a very long journey.

Allows and enables:

- Decoupling of concerns across the industry whilst growing industry coherence.

- Differing delivery pace across the industry whilst aiming for industry convergence.

- Variety from innovation whilst removing unnecessary variety in management infrastructure.

- Temporary divergences and overlaps during the convergence process.

Ensures:

- Change is made only as a result of understanding of specific market needs.

- Progress by providing coherent solutions to satisfy the needs of all participating industry partners in order not to be blocked by the slowest laggard.

Highlights:

- The challenges of dealing with differing methodologies/tooling used across the standards arena and points out that methodology/tooling differences if ignored will significantly slow progress towards the target.

- The need for development of a new governance regime and points to some of the attributes of such a regime.

- An approach of gradual restructuring and a controlled converging coherence starting small and growing step by value-justified step.

- The challenge of presenting the models so all can have an identical understanding.

- The challenge of interpreting models from different origins, with their different terminology and viewpoints, to arrive at a shared understanding through a federated model. This leads to recognition of the need for a deeper uniform semantic analysis of the area covered by the umbrella information model (UIM) and the navigation points among concrete models which may further lead to the need for the development of information architectures and patterns.

This document focuses on the Information Model aspect of the problem as it is clear that the lack of an agreed-upon, coherent information model across organizational boundaries to support the FMC aspects of the industry that defines the things to be managed and the way they should be expressed is one of the first aspects that need to be tackled.

Editor's note: Prior to embarking on a further summary of the proposal and its benefits, it is important to emphasize that the definition of the term "model" has to be carefully considered. A model is comprised of parts that themselves can be seen as models. As a consequence whether this activity results in a single model or a set of models depends upon perspective. The critical consideration is whether the parts of the solution can be interrelated and from the perspective of the problem highlighted above whether the parts can be interrelated across what were previously un-navigable barriers. The solution offers this navigability. Conversely it is critical that the solution offers appropriate decoupling of concerns and of governance. Whether this is considered one model or many is not relevant as long as the solution offers the properties, such as those noted above, that are critical for industry success.

This document proposes a Federated approach to model development and emphasizes the need for the development of an Umbrella Information Model (UIM) and its relationships with the other domain specific models. The document also deals with direct relationships between domain/technology specific concrete models.

It is proposed that:

- The work will be published and expressed in UML and will also be published in formats appropriate for each of the participating bodies to absorb (this may require nothing more than the UML format in some cases). The output form required by a particular body will be generated by resources contributed by that body.

- As necessary the model will be embellished using stereotype to express all aspects/properties of the model.

The proposal recognizes that the TM Forum Information Framework (SID) [7] and the TM Forum Integration Framework (MTNM/MTOSI) [8] work provide an enterprise-wide structure and model that can be used to seed the converged model. The proposal recognizes that the 3GPP SA5 group work [14] provides models relating to mobile networks (including RANs, CNs and IMS) that can be used to seed the converged model.

The proposal:

- Ensures on-going reduction in cost of integration and improvement of degree of integration for the purpose of End-to-End management;

- Enables models from many organizations to be used together for the purpose of End-to-End management (recognizing that there are a number of critical governance issues to be overcome to enable this);

- Provides structure for the alignment on a deeper understanding of the semantics and for the development and maintenance of an information architecture and associated patterns;

- Provides both an initial pragmatic solution form and a longer term target;

- Recognizes that the model will evolve in stages, but will never be "completed" and hence this is an on-going activity;

- Recognizes the importance of providing solutions that are backward compatible to existing standards. See [13, 17]

This content of this document has been jointly developed by 3GPP and TM Forum as part of the Joint Working Group on Resource Model Alignment [18].

2 References

The following documents contain provisions which, through reference in this text, constitute provisions of the present document.

- References are either specific (identified by date of publication, edition number, version number, etc.) or non-specific.
- For a specific reference, subsequent revisions do not apply.
- For a non-specific reference, the latest version applies. In the case of a reference to a 3GPP document (including a GSM document), a non-specific reference implicitly refers to the latest version of that document *in the same Release as the present document*.

[1] ITU-T X.680 "OSI networking and system aspects – Abstract Syntax Notation One (ASN.1)".

[2] 3GPP TS 32.642 "UTRAN network resources IRP: NRM".

[3] ATM Forum, Technical Committee, Network Management, M4 Network View CMIP MIB Specification ("CMIP Specification for the M4 Interface", Sep 1995, http://www.broadband-forum.org/ftp/pub/approved-specs/af-nm-0027.000.pdf).

[4] 3GPP TS 32.622 "Generic network resources IRP: NRM".

[5] MEF Technical Specification MEF 7.1, "Phase 2 EMS-NMS Information Model", October 2009.

[6] 3GPP2 S.S0028-E "OAM&P for cdma2000 (Overview, 3GPP R7 Delta Specification, 3GPP2 Network Resource Model IRP)".

[7] TM Forum GB922, Information Framework (SID) Suite, Release 9.0 (http://www.tmforum.org/browse.aspx?catID=9285&artf=artf2048).

[8] TM Forum MTOSI 2.0 (http://www.tmforum.org/MTOSIRelease20/MTOSISolutionSuite/35252/article.html).

[9] TM Forum SD1-44_ConnectionlessTechnologyManagement.pdf available as part of [8] (Especially Appendix III "Mapping MEF – MTNMETH").

[10] TM Forum SD1-7_DSLOverview.pdf available as part of [8].

[11] TM Forum SD1-18_layers.pdf available as part of [8] (Especially 4.2.7 ATM and SDH capable STM-4).

[12] TM Forum "Connectionless, Connection Oriented Convergence and TP Modelling" (http://tmforum.org/FeatureDescription/ConnectionlessConnection/41718/article.html).

[13] TM Forum TR 146 "Lifecycle Compatibility Release 1.0" (http://www.tmforum.org/TechnicalReports/TR146LifecycleCompatibility/36664/article.html).

[14] See Appendix B for the list of 3GPP Technical Specification series on Network Resource Models.

[15] DMTF CIM ("Distributed Management Task Force Common Information Model").

[16] 3GPP TR 32.852 "Fixed Mobile Convergence (FMC) 3GPP/TM Forum Model Relationships & Use Cases".

[17] 3GPP TS 32.154 "Backward and Forward Compatibility (BFC); Concept and definitions".

[18] 3GPP / TM Forum JWG RMA: "FMC Federated Network Information Model (FNIM)" V3.0.

[19] 3GPP TR 21.905: "Vocabulary for 3GPP Specifications".

3 Definitions and abbreviations

3.1 Definitions

For the purposes of the present document, the terms and definitions given in TR 21.905 [19] and the following apply. A term defined in the present document takes precedence over the definition of the same term, if any, in TR 21.905 [19].

Encoding: It is the process by which information is converted into symbols to be communicated. In this document, the 'information' is captured by the so-called model.

Operations/Notifications: Specification conveyed over an interface between two interacting parties indicating the action to be performed on some identified entity or set of entities. In general the "operations model"/"business services model"/"action model" (or similar) cover the definitions of the actions performed to change the state/value/etc. of the thing and to receive information on changes that have occurred to the thing and to receive information on changes that have occurred to the thing.

3.2 Abbreviations

For the purposes of the present document, the abbreviations given in TR 21.905 [19] and the following apply. An abbreviation defined in the present document takes precedence over the definition of the same abbreviation, if any, in TR 21.905 [19].

DN	Distinguished Name
FIM	Federated Information Model
FNIM	Federated Network Information Model
FMC	Fixed Mobile Convergent
IM	Information Model
LT	Layer Termination
NM	Network Management
UIM	Umbrella Information Model

4 Characteristics and context of FNIM

4.1 Characteristics

The FNIM is “large scale” in the following sense:

- Different authorities (SDOs or standard organizations including expert group) are responsible for the development, maintenance and evolution of their own domain specific models.
- Operators may use the whole or part of the FNIM depending on their own business cases.
- Vendors can supply products using part of the FNIM depending on their own business cases.
- The FNIM needs to hold thousands of inter-related modelled entities. Different versions of modelled entities can co-exist in FNIM.

4.2 Contexts of FNIM

4.2.1 A broad standardization context

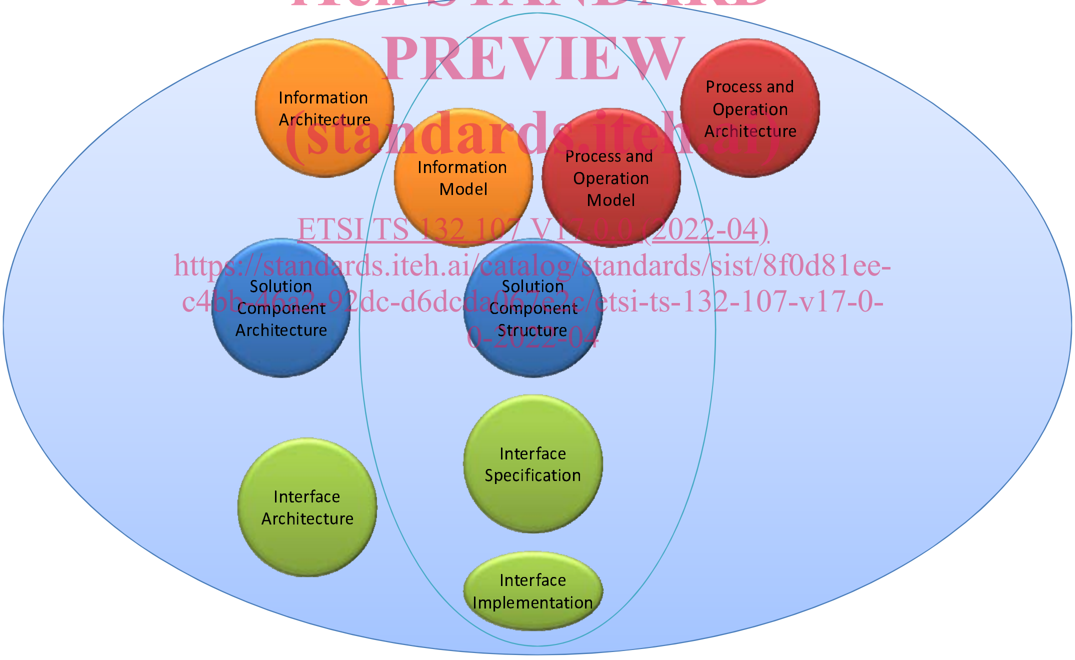

Figure 1: Broad standardization context

The figure depicts a broad standardization context. The concept embodied by the term Information Model (of Managed Elements etc.), abbreviated as IM, is separable from the concept of Process and Operation Model (covering definitions of activities). Clearly the Process and Operation Model influences and is influenced by the IM.

Encoding in general (of information defined in IM Process and operation model) to achieve an Interface Implementation is also separable and is not considered further here. Each aspect of the problem is guided and constrained by an appropriate Architecture (e.g. Metamodel) that defines the breadth and scope of the aspect.

The things in the IM are relevant to some activity identified in the Process and Operation Model. That relevance is necessary in order to fulfil some purpose of the system. The things in the IM are in many cases relevant to expose at some Interface in which case they will dictate some aspects of structure of information defined in IM and Process and Operation Model.

The IM can be broken down into two parts:

- Broad conceptual model that articulates the concepts of the problem space (alternative names are **purpose neutral, implementation neutral views**)

- Specific purpose models that each articulate the solution to a specific problem (alternative names are **purpose specific, implementation neutral views**)

In summary, the following definitions apply to terms of the above figure:

- Information Model (IM): The representation of things, their properties and their relationships. Example: TopologicalLink and TerminationPointEncapsulation are things that are interrelated and have properties represented via attributes.

- Process and Operation Model: The representation of the relevant activities required to facilitate the running of the business including the flows and interactions. Example: “IsolateCustomerProblem” and “Track&ManageCustomerProblem” are relevant activities that are interrelated by flows of control and information. “getAlarmList”, “getAttribute” and “createFlowDomainFragment” are examples of operations.

- Solution Component Structure: The representation of the units of functionality assembled to support the information defined in the IM and in the Process and Operations Model. Example: NMS and EMS are solution components that support various process activities and maintain information. The two are interconnected as part of the structure of the management solution.

- Interface specification: The definition of the interactions between the solution components supporting the exchange of information and control associated with running of the business. This interaction is in terms of the information defined in the IM and in the Process and Operations Model.

- Interface implementation: The implementation form of the interfaces appropriate for the runtime environment.

- Architecture: The patterns, rules, metamodels and structures derived from the fundamental properties of the problem space that guide and constrain the development of the model of each aspect of the problem space.

4.2.2 Integration with 3GPP/SA5 standard production processes

This context describes how 3GPP/SA5 would use the FNIM to produce its specifications that would be used for FMC network management purpose.

This context only refers to the model part. Note that the FNIM is not related to the design of any network management protocol.

The FNIM has multiple components. Two such components are the Umbrella Information Model (UIM) and a number of concrete models (see definition of FNIM in section 0). The right-most box of the following diagram depicts the classes of the UIM. The middle box depicts one of the concrete models, i.e. the 3GPP IRP NRM concrete model. The concrete classes are designed as extension of UIM and must use the appropriate relations defined (see clause 6.1).

Using the concrete classes (of the concrete model) as input, 3GPP/SA5 uses appropriate tools to generate and publish the various specifications.