



NGMN NGCOR Implementation Query on Inventory Management, Summary Report

by NGMN Alliance

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Abstract: Short introduction and purpose of document

This document is a summary of a query addressed to OSS vendors in December 2014 about NGCOR requirement implementation status on the Inventory management area. It is not representing an NGMN position, but merely a summary of the feedback received from several vendors. The answers in this summary are not weighted in any way.

Document History

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22.01.2015	0.1	Pekka Olli	Initial Version
17.04.2015	0.2	Klaus Moschner	Updates
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EXECUTIVE SUMMARY

NGMN published the main deliverable of NGCOR project, Next Generation Converged Operations Requirements, in 2013, including Inventory Management requirements within it. This report is part of NGCOR project continued activities in 2014 when NGMN NGCOR work mainly focused to influence towards SDOs to enhance standards based on published requirements and towards vendors for enhanced solutions.

The Inventory Management query was sent to all NGMN partner companies and to a few non-NGMN partner companies. The query raised good attention among vendors and many Inventory Management solution vendors sent their answers to the query. According to confidentiality principles of the query the individual company names and responses are not publicly available.

The general summary from the answers is made public by NGMN via publishing this report in order to further facilitate industry collaboration towards common requirements worked by NGMN and for sharing an overview of the state of art in this field of OSS. The observations published in this report are highly generalized from the individual company answers. The evaluation of answers is not including and has not been intended to make any ranking between vendors or weighting between various viewpoints.

As a general outlook from the answers it can be seen a variety of inventory management solutions being available from vendors. The capabilities of today's solutions span from full OSS suites covering both service and resource inventory fulfilling the most of NGCOR requirements to smaller scope focusing e.g. on resource inventory part only or limited process support scope. Regarding the most important gaps identified from the answers can be highlighted that implementations of the NGCOR guided umbrella information model are not there yet although readiness to implement indicated in some answers. This is a very significant requirement for the industry to work on further and has even greater importance for integration of OSS systems in a converged operations environment.

1 NGCOR BACKGROUND

The Next Generation Converged Operations Requirement (NGCOR) project has been running within NGMN since 2011. The NGCOR project is a continuation for the work on NGMN Top OPE (Operational efficiency) Recommendations from 2010. Essential focal point of NGCOR is requirements on **converged operations** of wireline and wireless networks. NGCOR requirements are addressed to standardization organizations to guide harmonization of management interfaces and related O&M capabilities. Secondly NGCOR requirements are addressed to OSS and management system suppliers for developing solutions and products according to requirements.

NGCOR has delivered requirements which are addressing relevant functional areas and interfaces; namely fault management, configuration management, performance management, inventory management, network sharing, overall converged management and modelling and tooling aspects of development. NGCOR project was split in two phases known as NGCOR 1 and NGCOR 2.

As part of NGCOR a comprehensive set of Inventory Management requirements were defined. In the work of NGCOR 1 Resource Inventory Management was the selected prioritized area and several use cases and scenarios on relevant operators' process areas were identified and related requirements were defined. In NGCOR phase 2 Service Inventory Management area was in scope to extend Inventory Management requirements. For Service Inventory Management area also several use cases and scenarios on essential process areas were identified and related requirements were defined. NGCOR Inventory Management stream has described about 20 use cases related to Service and Resource Inventory Management derived 66 specific requirements based on



those. It is understood that there are possibilities to consider tens or hundreds process use cases and various levels of details of them and further additional granularity of the derived Inventory Management requirements.

After publishing the NGCOR 1 and 2 requirements in 2013 a continued project: ***Translation of TOP OPE & NGCOR* Phase 1 & 2 Requirements into Standards*** was initiated during 2014. The project targets for coordination of NGCOR requirements implementation by

- Steering of harmonization of standardisation activities related to NGCOR requirements; in 3GPP, TMF, Multi-SDO
- Contributing for implementation of standards related to NGMN requirements by NGMN Member / Partner representatives active in SDOs
- Liaising with the relevant vendors to drive implementation in solutions.

As a part of liaising with relevant vendors a query on implementation of NGCOR Inventory Management requirements was conducted during period December 2014 to January 2015.

2 PURPOSE OF THE INVENTORY MANAGEMENT QUERY

Purpose of the query was to interact with OSS vendors for sharing state of art information and future direction of their solution/product roadmaps with respect to fulfilment of NGCOR Inventory management requirements. The vendors were asked to indicate how each requirement is fulfilled in their solution/products. The vendors were free to provide additional information in the comment column and reference column when felt appropriate concerning the requirement in question. The query is attached to the end of this report.

Principle for confidentiality

The objective of this activity was not to assess rankings among vendors' commercial solutions/products, but to share information for understanding the overall state-of-art and maturity of the industry regarding NGCOR Inventory Management requirements.

The answers provided by individual vendors are handled in an utmost confidential manner by NGMN and individual answers will be shared only to NGMN operator members. As one result of the *Translation of TOP OPE & NGCOR* Phase 1 & 2 Requirements into Standards* project this report as an aggregated view from the answers is produced without any reference to individual suppliers with the purpose to communicate main observations from the query as well as for considerations of overall Inventory Management area development and evolution.

Usage of information

Aggregated information from answers is delivered as one outcome of the project: *Translation of TOP OPE & NGCOR* Phase 1 & 2 Requirements into Standards* and will be used for example for

- Understanding overall readiness of industry when planning inventory management development at operators
- Technical obstacles and immaturity of guiding standards
- Identifying future development needs of inventory management standardization and alignment

3 SUMMARY OF RECEIVED ANSWERS

3.1 Scope of Query in Terms of Vendors

The query was sent to all NMGN partner companies and to a few non-NGMN partner companies which were identified and well-known Inventory Management solution vendors. The query raised good attention among vendors and many leading Inventory Management solution vendors sent their answers to the query. According to confidentiality principles of the query the individual company names and responses are not publicly available.

3.2 General Outlook of Inventory Solutions

NGCOR emphasizes and points out as the principal scope and purpose of Inventory Management in general an inventory centric OSS architecture, i.e. Inventory Management acts as master source of service and resource information and supporting all lifecycle and operations processes of operators. Inventory systems data to be kept synchronized with actual service and resource data. In TM Forum eTOM process terms, Inventory Management to support SMO (service management and operations) layer as well as RMO (resource management and operation) layer processes and in horizontal sense processes from specifications and planning to operations. Related OSS systems supporting the SMO and RMO processes are interfacing with service and resource inventory systems and are accessing and updating the specific information they need and that inventory systems are mastering.

According to the answers the solutions from OSS vendors the principal scope and purpose of inventory management is well supported. Some bigger actors are providing full OSS suites covering both service and resource inventory with pre-integration of inventory applications with their own assurance, fulfilment and planning applications. Some vendors are more focusing on smaller scope e.g. on resource inventory part only or limited process support scope. Some vendors indicate also solution support for cloud assets and more complex value chain model. Principally all vendors are enabling also integration with 3rd party OSS applications and not assuming usage their own full suite.

3.3 Inventory Solutions from General Functionality Point of View

NGCOR expresses multiple general features that are required from inventory systems functionality point of view. According the main purpose of inventory systems service and resource data is required to be managed in multiple ways covering all service and resources in a converged fixed-mobile environment. Required generic functionalities are covering for example such as; maintaining, entering and visualization of inventory data, requirements for accessing and updating inventory data. Requirements for identification, control, security, verify quality and auditing of inventory data.

The answers from the vendors indicate overall alignment with functionality requirements, limitations and varieties how to approach these questions though exists. The answers are highlighting for example following features and aspects:

- Service inventory supported with service catalog acts as a detailed centralized repository of abstract and specific different service types, components and instances
- Modelling of services based on multi-domain fixed-mobile converged network is supported
- Use of service metadata concepts for facilitating other functions e.g. service fulfilment
- Inventories are to have capability to support in end-to-end manner various processes for BSS/OSS landscape

- Resource inventory is designed to collect and store information about all physical and logical resources and is the starting point to the efficient resource management.
- Resource inventory handles all resource-related data in an accurate, integral way, and feeds necessary data to design and planning activities and service fulfilment & assurance
- Resource inventory has vendor agnostic approach and supporting hardware from different manufacturers
- Possibilities to define the operational domains for service models components
- Resource inventory stores configurations for devices – device has single specification but can have several configurations
- With use of network synchronization features, inventory system can automatically follow network configuration changes
- Security subsystem that allows customers/business owners to protect their inventory data, e.g. each user (can be a sub-contractor) during logging to the system is authorized and authenticated, reference specifications X.500, X.509,
- Data Validation feature to guarantee the correctness of data and assuring that data modifications adhere to process rules definition during full data lifecycle
- Discrepancy reporting for fallouts and errors that occurred when data does not meet verifying criteria
- Tracking and auditing capabilities which enable to identify who changed the data and track back the data history.
- Automatic and/or manual data modification features

3.4 Inventory Solutions from Information and Data Modelling Point of View

NGCOR requirements are addressing various specific information modelling capabilities. Most important in this category is for example; Information and data models need to adhere to standards and to provide modular and structured hierarchies to relate products with associated services and services with associated resources. Information and data models need to hold and manage versatile set of attributes and enable configurability to model in uniform way different services and reach to technology specific resource model details. Information and data needs to be provided to the interfacing systems in a standard form to simplify and to reduce integration costs etc. Information and data models need to be flexible to enable technology evolution over time and capability to bind different technology models together on the umbrella model level to support convergence. Modelling requirements of NGCOR Inventory Management are referring for more details in NGCOR modelling and tooling, but those requirements were not explicitly asked in this query.

Answers are highlighting following information and data modelling features

- TM Forum SID is in most cases referenced as the standard for service and resource inventory information and data modelling. For technology specific and resource related information and data modelling 3GPP NRM and relevant IRPs as well as ITU M3100; X730, X.731 and X7.32 are also used.
- Event management compliancy with X.733 is indicated
- Extensions to standard models are possible depending on the network, technologies and specific equipment types and vendors, these can be provided pre-configured
- Data Model extensions and adaptations can be configuration tasks without the need of coding
- Resource inventory can contain pre-configured data models for a variety of technologies for mobile and fixed network management and IT resources, which define managed entities, their parameters and relations
- Set of attributes for the support of external applications can be changed and this change is configurable
- Adding new attributes can be more complex and may require some additional effort.
- Readiness for NGCOR guided umbrella information model implementation was indicated although not yet implemented by some vendors
- Metadata approach allows a consolidated view of the network and ensures unified way of inventory information management,

- Metadata approach enables for example that managed inventory entities (devices, network elements, ports, circuits etc.) have common functionality relevant to the entity type and sub-types can extend it with specific functions in a converged environment
- Physical and logical network links can be displayed in a way that conforms to the ITU-T G.805 specification.
- Resource inventory supports mobile networks domains with unified Mobile Core / Mobile RAN models that fully cover all technological and operational parameters of such networks including eNodeB's specific parameters
- Resource Inventory supports number management for many types of structured identifiers including telco numbers, e.g. IP ranges, VPNs, VLANs, VRFs, etc.

3.5 Inventory Solutions from Interfacing/Integration Point of View

NGCOR requests flexible, versatile and standard interfacing between inventory systems and surrounding systems within OSS, including assurance systems, fulfilment systems and planning and deployment support systems. Of crucial importance is also synchronization of inventory data with actual network status and data. Service and resource inventories are requested to support the surrounding applications with specific data for interest for different applications. Extensive support is available in the existing solutions in optimal case, limitations though in some vendors

The answers are highlighted following interfacing/integration features of solutions

- Pre-integration of inventory modules and other OSS applications within vendors own suite and adaptation to 3rd parties OSS applications
- Service inventory and resource inventory modules are typically closely related when having suite packages and supporting each other with same design principles
- Support automation and flow-through provisioning driven by inventory and catalog data model
- Support for top-to-bottom customer impact and root cause analysis identification of the service affected by resource faults
- Support for enriching problem tickets by providing additional data about affected object and by delivery of logical hierarchy for correlate service problems with resource topology information, add information about devices and sub-services (CSF, RFS).
- Support for enriching Service Quality Management by providing additional data about objects and by delivery logical hierarchy of services for e2e correlation of them with resource objects and calculation of specific KPIs and KQIs.
- Support for enriching tickets with information about specific devices and allowing forecasting influence of incident by providing tree of logical relations between queried object and all devices connected to it.
- Support by providing consolidated view on physical resource topology, configuration, status, connectivity, and assignment information to Performance Management to identify the performance collection points and their relationship
- Resource inventory supported by discovery and reconciliation provides capabilities to integrate with NMS/EMS or directly to equipment for keeping resource inventory data up-to-date. Discovery and reconciliation can be manual, scheduled and event-based.
- Resource inventory is typically closely related with configuration management module which acts as a single, centralized access point for storing, viewing, and changing network configurations. Configuration management handles active, planned and archive configuration versions, allows configurations update, validation and activation Configurations are associated to resource inventory entities and are linked to their lifecycles streamlining the process of network rollout and update. Configuration data can be aggregated to configuration files for configuration activation. Configuration management supports to translate generic configurations into vendor-specific models..
- Real-time synchronization scenarios require careful considerations due to potentially large volumes of data and frequency of changes impacting the solution and network environment and capacity



- Resource inventory supports network planning and design tools and typically shares or is associated with compliant data model. Resource inventory can be extended with planning tool specifics so that both actual and planned inventory can be presented on consolidated view to evaluate current and future inventory states. The entities and their parameters are seamlessly transferred from planned to active states after plan is implemented.
- Typical integration scenario is where a central inventory database is shared to other applications
- For OSS interworking systems that support standardized models the TM Forum SID model based interfaces and usage of OSS/J Inventory compliant interfaces provide common object identification models and OSS data exchange format
- Inventory data can be provided as replicated database which contains flat formatted read-only copies of pre-configured data sets available for external systems
- A big number of integration adapters using different interfacing protocols are available: OSS/J, MTOSI, 3GPP IRPs such as Corba Bulk CM, TMF814, SNMP, TL1, CLI, Telnet, SSH 1-2, Q3 HTTP/S, Web Service, RMI, CORBA, Restful, JMS, XML, SOAP, Netconf, and FTP or native API as well as integration via file interfaces supporting different formats (XML, XLS, CSV, TXT etc.)

4 ANNEX: NGCOR INVENTORY MANAGEMENT QUERY

Attached is the query which was sent to OSS vendors



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