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TECHNICAL SPECIFICATION

**5G;
Management and orchestration;
Architecture framework
(3GPP TS 28.533 version 15.0.0 Release 15)**

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Contents

Foreword

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Introduction

The management of the 3GPP network is provided by management services. The service based architecture and interfaces support various management services of vastly different requirements on network configuration, network performance, and network fault supervision. The 3GPP network management architecture evolves supporting operators' design and management of their service oriented networks.

1 Scope

The present document defines the network management and orchestration architecture for 3GPP networks including network slicing. The use cases and requirements are specified in TS 28.530 [3].

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

[2]   3GPP TS 32.101: "Telecommunication management; Principles and high level requirements".

[3]   3GPP TS 28.530: "Management and orchestration of networks and network slicing; Concepts, use cases and requirements".

[4]   3GPP TS 28.541: "Management and orchestration of 5G networks; Network Resource Model (NRM); Stage 2 and stage 3".

[5]   3GPP TS 28.552: "Management and orchestration of 5G networks; Performance measurements and assurance data".

[6]   3GPP TS 28.554: "Management and orchestration of 5G networks; 5G End to end Key Performance Indicators (KPI)".

[7]   3GPP TS 32.425: "Telecommunication management; Performance Management (PM); Performance measurements Evolved Universal Terrestrial Radio Access Network (E-UTRAN)".

[8]   3GPP TS 28.531: "Management and orchestration of 5G networks; Provisioning; Stage 1".

[9]   3GPP TS 28.xxx: "Management and orchestration; Management services".

[10]   3GPP TS 28.500: "Telecommunication management; Management concept, architecture and requirements for mobile networks that include virtualized network functions"

[11]   3GPP TS 28.510; "Telecommunication management; Configuration Management (CM) for mobile networks that include virtualized network functions; Requirements".

[12]   3GPP TS 28.511; "Telecommunication management; Configuration Management (CM) for mobile networks that include virtualized network functions; Procedures".

[13]   3GPP TS 28.512; "Telecommunication management; Configuration Management (CM) for mobile networks that include virtualized network functions; Stage 2".

[14]   3GPP TS 28.513: "Telecommunication management; Configuration Management (CM) for mobile networks that include virtualized network functions; Stage 3".

[15]   3GPP TS 28.515; "Telecommunication management; Fault Management (FM) for mobile networks that include virtualized network functions; Requirements".[16]   3GPP TS 28.516: "Telecommunication management; Fault Management (FM) for mobile networks that include virtualized network functions; Procedures".

[17]   3GPP TS 28.517: "Telecommunication management; Fault Management (FM) for mobile networks that include virtualized network functions; Stage 2".

[18] 3GPP TS 28.518: "Telecommunication management; Fault Management (FM) for mobile networks that include virtualized network functions; Stage 3".

[19] 3GPP TS 28.520: "Telecommunication management; Performance Management (PM) for mobile networks that include virtualized network functions; Requirements".

[20] 3GPP TS 28.521: "Telecommunication management; Performance Management (PM) for mobile networks that include virtualized network functions; Procedures".

[21] 3GPP TS 28.522: "Telecommunication management; Performance Management (PM) for mobile networks that include virtualized network functions; Stage 2".

[22] 3GPP TS 28.523: "Telecommunication management; Performance Management (PM) for mobile networks that include virtualized network functions; Stage 3".

[23] 3GPP TS 28.525: "Telecommunication management; Life Cycle Management (LCM) for mobile networks that include virtualized network functions; Requirements".

[24] 3GPP TS 28.526: "Telecommunication management; Life Cycle Management (LCM) for mobile networks that include virtualized network functions; Procedures".

[25] 3GPP TS 28.527: "Telecommunication management; Life Cycle Management (LCM) for mobile networks that include virtualized network functions; Stage 2".

[26] 3GPP TS 28.528: "Telecommunication management; Life Cycle Management (LCM) for mobile networks that include virtualized network functions; Stage 3".

[27] ETSI GS NFV 003: "Network Functions Virtualisation (NFV); Terminology for Main Concepts in NFV V1.3.1 (2018-01)".

3 Definitions and abbreviations

3.1 Definitions

For the purposes of the present document, the terms and definitions given in 3GPP TR 21.905 [1] and the following apply. A term defined in the present document takes precedence over the definition of the same term, if any, in 3GPP TR 21.905 [1] or NFV-MANO [27].

Exposure governance management function: Management Function entity with the role of management service exposure governance.

3.2 Abbreviations

For the purposes of the present document, the abbreviations given in 3GPP TR 21.905 [1], in NFV-MANO [27] and the following apply. An abbreviation defined in the present document takes precedence over the definition of the same abbreviation, if any, in 3GPP TR 21.905 [1].

CM	Configuration Management
LCM	Lifecycle Management
MDAS	Management Data Analytics Service
MF	Management Function
MnS	Management Service
NFV-MANO	Network Functions Virtualisation Management and Orchestration
PM	Performance Management

4 Management framework

4.1 Management services

A management service offers management capabilities. These management capabilities are accessed by management service consumers via standardized service interface composed of individually specified management service components.

Figure 4.1.1: Management Service

4.2 Management service components

4.2.1 Introduction

A management service combines elements of management service component type A, B and C. The management service components are combined to allow a management service consumer to interact with a management service producer via a specified service interface.

4.2.2 Management service component type A

Management service component type A is a group of management operations and/or notifications agnostic of managed entities.

4.2.3 Management information

4.2.3.1 Management service component type B

Management service component type B is the management information represented by information model of managed entities.

The following are examples of Management service component type B:

1) Network resource models of 3GPP defined entities for mobile networks such as those found in [4]

4.2.3.2 Management service component type C

Management service component type C is performance information of the managed entity and fault information of the managed entity.

The following are examples of Management service component type C:

1. Alarm information as defined in TS 28.xxx [9].

2. Performance data as defined in TS 28.552 [5], TS 28.554 [6] and TS 32.425 [7].

4.3 Combination of management service components

A management service may contain the combination of the following:

1) management service component type A and management service component type B

2) management service component type A, management service component type B and management service component type C.

The instances of management services carry information about specified management service components in the metadata attributes. Figure 4.3.1.illustrates examples of management service instances with various management service components of type A, type B and type C:
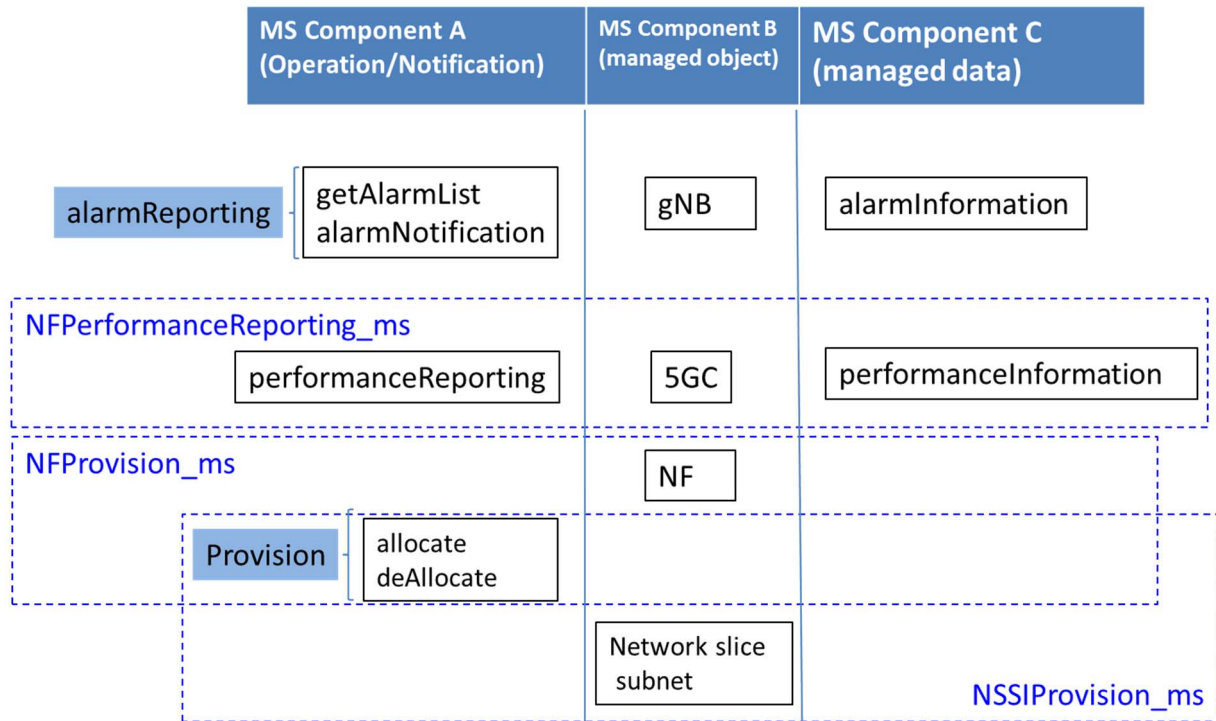

Figure 4.3.1: Example of Management Service and component type A, B and C

4.4 Management capability exposure governance

As precondition for Management Service exposure governance offer, producer of management capability exposure governance should have access to:

An association between information about specified management service components and instances of management services.NOTE: The detail creation of an association is left for implementation and out of scope of 3GPP standardization.

Management capability exposure governance provides exposure governance on basic elements of management function service based interface:

1) Management service component type A

2) Management service component type B

3) Management service component type C

As described in Figure 4.4.1 left hand part, when there is a Management Service A exposure without exposure governance, Management Service A Consumer (e.g. 3rd party) can access all management capability offered by Management Service A Producer.

As described in Figure 4.4.1 right hand part, when Management Service A is exposed with applied exposure governance it becomes Management Service A. Management Service A Consumer can access Management Service A' after following steps:

- Management Service A, exposed by Management Service A' Producer, is consumed by Management Service A' Consumer;

- Management Service B, exposed by Management Service B Producer, is consumed by Management Service B Consumer (e.g. operator) who is authorized to access offered management capabilities exposure governance(s);

- Management Service B Consumer (e.g. operator) request a specified exposure governance on Management Service A;

- Management Service A Producer produces Management Service A' based on applied exposure governance on Management Service A.

NOTE: The Management Service A Consumer, the Management Service A' Producer and Management Service B' Producer can be represented as a single Management Function e.g. a single MF).
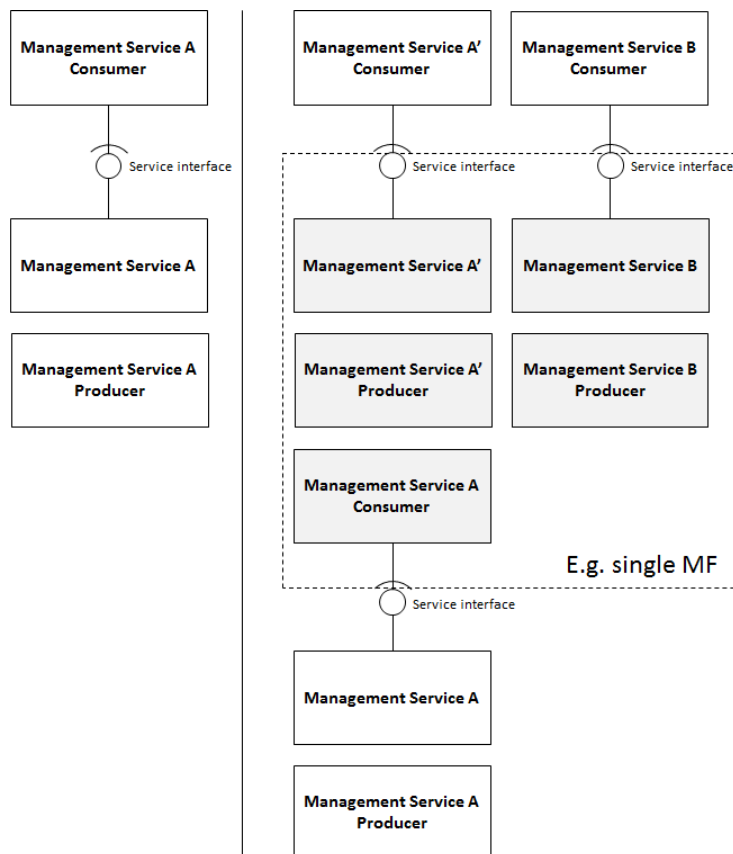
Figure 4.4.1: Management capability exposure governance applied on exposed Management Service A

4.5   Management Function (MF) Concept

A Management Function (MF) is a management entity whose externally-observable behaviour and interfaces are specified by 3GPP.

In the service-based management architecture MF plays the role of either Management Service producer or Management Service consumer. A Management Service produced by MF may have multiple consumers. The MF may consume multiple Management Services from one or multiple Management Service producers. An example of MF playing both roles (Management Service producer and consumer) illustrated in the figure 4.5.1 below.
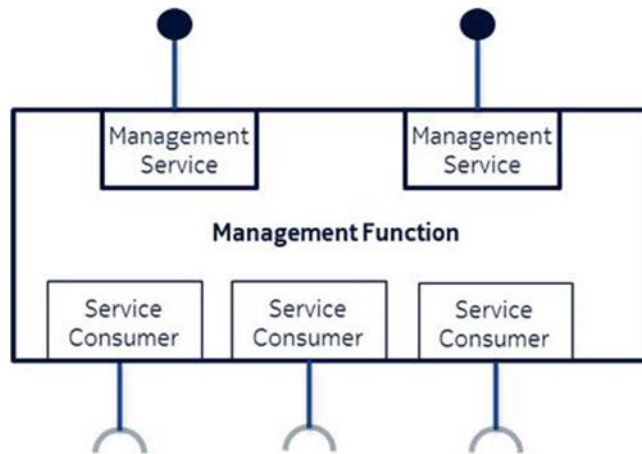
Figure 4.5.1: Example of Management Function and Management Services

Management Functions may interact by consuming Management Services produced by other Management Functions. The figure 4.6.2 below illustrates multiple scenarios:

- MF1 produces Management Service MnS-a;

- MF2 consumes Management Service MnS-a produced by MF1 and produces Management Services MnS-b and MnS-c;

- MF3 produces Management Service MnS-c;

- MF4 consumes Management Service MnS-b produced by the MF2;

- MF5 consumes Management Services MnS-c produced by the MF2 and MF3, and in turn produces the same Management Service MnS-c. The behaviour of MF5 may be seen as aggregation of Management Services MnS-c.

Figure 4.5.2: An example of interactions between Management Functions

NOTE: The concrete MF is left for implementation and out of scope of 3GPP standardization.

4.6   Management data analytics capability

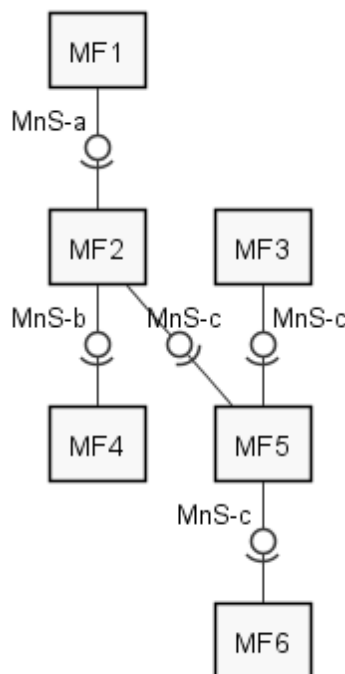Mobile networks have the capability to support a wide variety of services and requirements. This, along with increasing flexibility of the network may present management and operational challenges and complexities. The management system can therefore benefit from management data analytics services for improving networks performance and efficiency to accommodate and support the diversity of services and requirements. The management data analytics utilize the network management data collected from the network (including e.g. service, slicing and/or network functions related data) and make the corresponding analytics based on the collected information. For example, the information provided by PM data analytics services can be used to optimize network performance, and the information provided by FM data analytics services can be used to predict and prevent failures of the network. MDAS can be deployed at different levels, for example, at a domain level (e.g., RAN, CN, NSSI) and/or in a centralized manner (e.g., at a PLMN level).
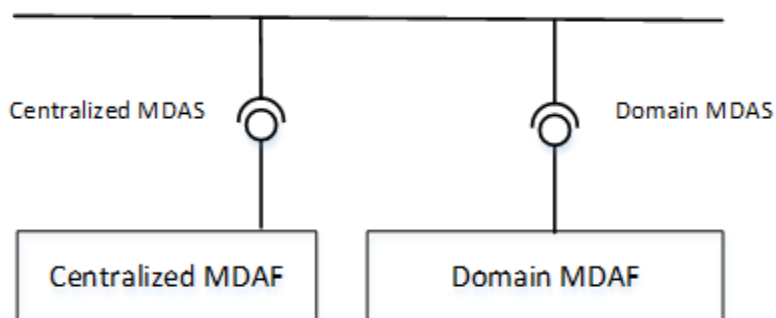
Figure: 4.6.1: Service based architecture for management data analytics

5   Architecture reference model

5.1   General concepts

5.1.1   Management service providers, consumers and exposure

The management services for a mobile network with or without network slicing may be produced by any entity. For example, it can be a Network Functions (NF), or network management functions. The entity may provide (produce) such management services as, for example, the performance management services, configuration management services and fault supervision services.

The management services can be consumed by another entity, which may in turn produce (expose) the service to other entities. Figure 5.1-1 shows an example of the management service X which is initially produced by the entity A which is an NF , then consumed by another entity B which is a network management function. Then B in turn exposes it to the entity C.
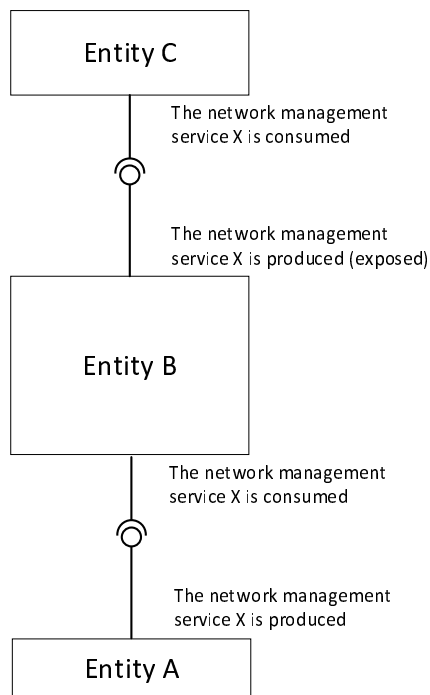
Figure 5.1-1. Example of producers and consumers of the management service

5.1.2 Interactions between management service producer and management service consumer

The interactions between the management service producer and management service consumer follows one of the two following paradigms:

- "Request-response": A management service producer is requested by a management service consumer to invoke an operation, which either performs an action or provides information or both. The management service producer provides response based on the request by management service consumer.

Figure 5.1.1.1: Request-response communication paradigm

- "Subscribe-notify": A management service consumer requests a management service producer to establish a subscription to receive network events via notifications, under the filter constraint specified in this operation.

    Subscriptions can be created also by other means than by using such operation.
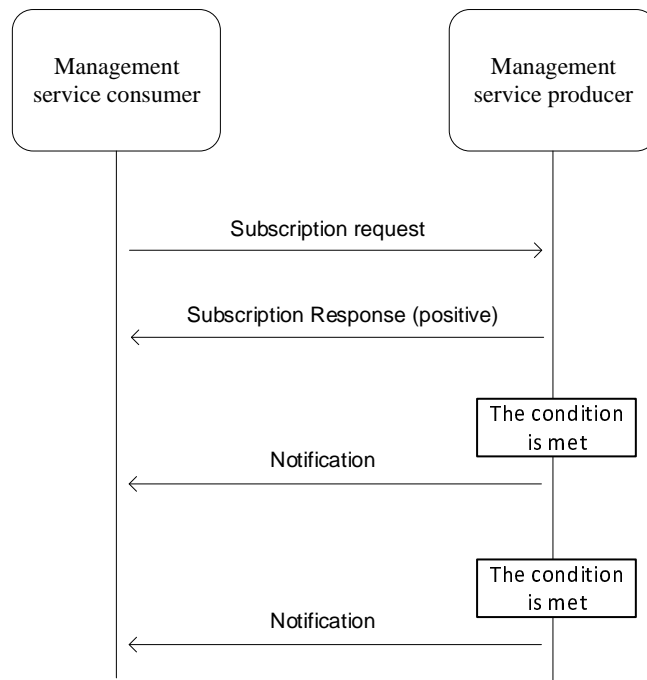
Figure 5.1.1.2: Subscribe-notify communication paradigm

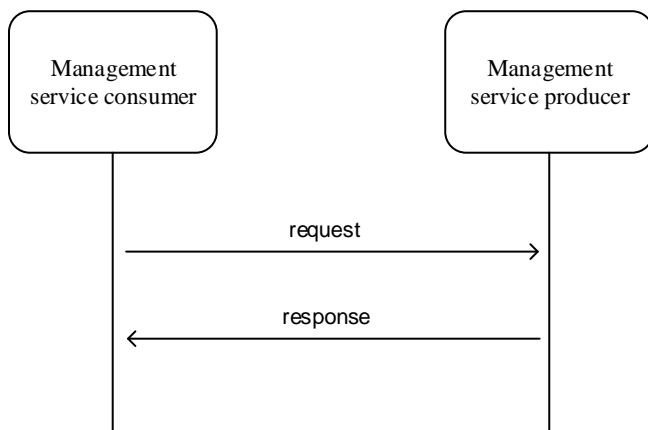NOTE: Example of a common aspect applicable to all management services is the use of notifications. For a management service to use notifications the management service consumer needs a subscription to notifications it is interested in. The management service consumer requests the creation of a subscription by sending a subscribe operation to the management service producer. To cancel a subscription the consumer sends an unsubscribe operation to the producer.

5.2 Management interactions with NFV MANO

3GPP management system shall be capable to consume to NFV MANO interface (e.g. Os-Ma-nfvo, Ve-Vnfm-em and Ve-Vnfm-vnf reference points).

Producer of management services can consume management interfaces provided by NFV MANO for following purposes:

- NS LCM.

- LCM VNF, PM, FM, CM on resources supporting VNF.

Annex A (informative):
Example of deployment model with utilization of management services

A.1　Utilization of Management services in network and subnet layers

To deploy a management and orchestration system for the mobile network including network slice(s), the management system can follow the network and network slice management model, subnetwork and network slice subnet management model, and network function management model. As an example, management models are shown in Figure A.1.1, management services in each management model.
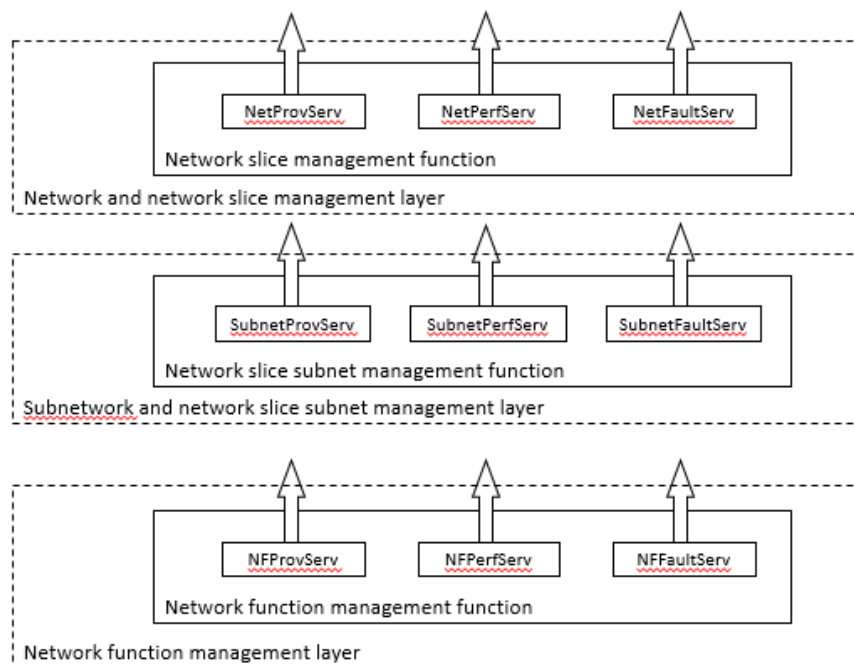
Figure A.1.1: Example management layers in layered management model

A.2　Utilization of management services in network function management.

This subclause describes the network function management model in the example of management services deployment. In case that a deployment requires management service in NF management model, management services in NF management model can provide specific management capability for NFs to authorized management service consumer through service based interface.

NF management function is an execution entity to provide NF Management services in NF management model. NF Management function (NFMF) may manage more than one network functions.

NF management function for multiple managed network functions as shown in Figure A.2.1 provides:

- Management services exposure; and

- Data governance for management service exposure.

  NOTE 1: One example of a management object with multiple management services is NF pooling design. Another example of a management object with this multiple NF management services is 5G Core control plane.

NOTE 2: NF management function can behave as consumer to ETSI ISG NFV MANO interfaces (e.g. Ve-Vnfm-em interface exposed by VNFM).

Figure A.2.1: Example NF management function layer structure
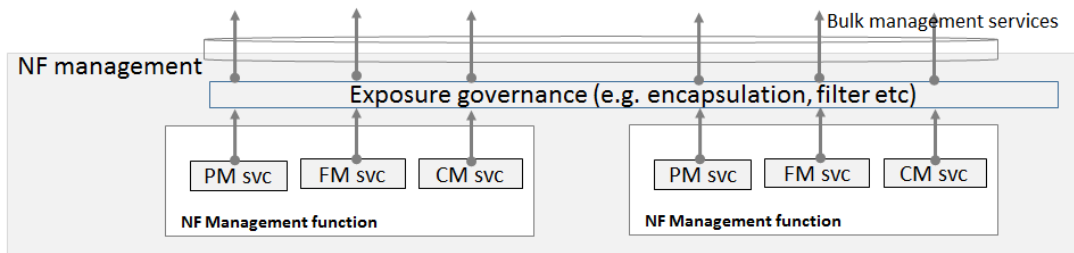
As shown in Figure A.2.1, an example of NF management function model structure is given. Exposure governance management function (EGMF) shown in Figure A.2.1 is management function in network function model with the role of management service exposure governance (i.e. abstraction, simplification, filtering, etc.). When multiple NF management services are exposed to network management, the particular group of multiple NF management services can be represented by a set of NF management services. This set of NF management services are exposed as a bulk NF management service, by NF management function. Additional management service abstraction may be needed based on NF management services because of lack of trust relationship between management service provider/consumer cannot address management services to build a global view of subnet or meaningful management purposes.

A.3 Utilization of management services by Exposure Governance Management Function (EGMF)

Exposure Governance Management Function (EGMF) offers following management capability (Figure A.3.1):

- Exposure governance

NOTE: Details of EGMF management capability exposure governance is FFS.

In Figure A.3.1, EGMF produces exposure governance management capability that operators can apply on Management Function (MF) 1 MnS for exposing different derivation of MF 1 MnS to:

- MF 2 (e.g. from another Operator) and

- 3rd party (e.g. from Vertical industry).

NOTE: Exposure governance can be controlled by a policy for different type of MF 1 MnS consumers (e.g. other operator, other management system, 3rd party, other administrative domain, etc.)
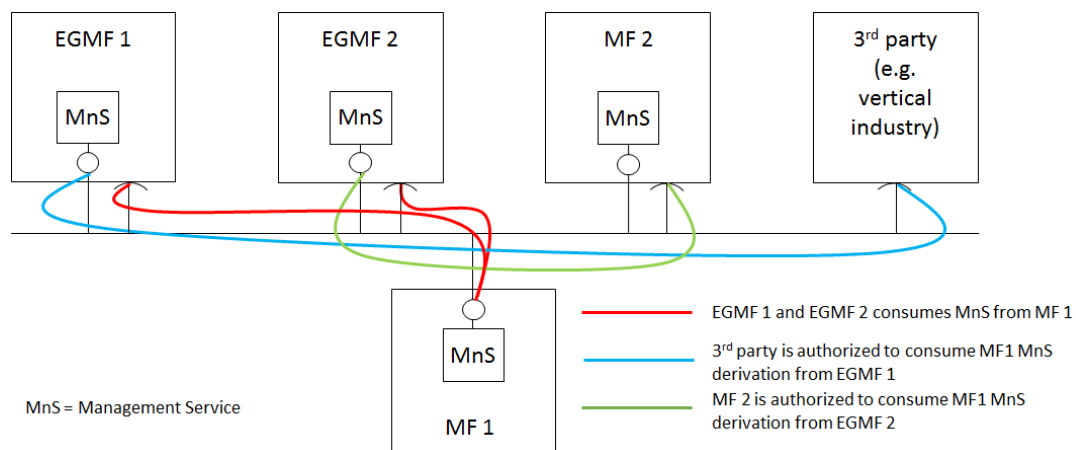

Figure A.3.1: MF-1 Management Service (MnS) exposed through Exposure Governance Management Function 1 (EGMF 1) and through Exposure Governance Management Function 2 (EGMF 2)

A.4 Utilization of interface to NFV-MANO by the producer of management services

In this deployment scenario the providers of the NSS related management services and NF related management services are also consuming the management interfaces provided by the NFV-MANO:

- -VNF PM, FM and LCM

- NS PM, FM and LCM

These interfaces are provided via the Os-Ma-nfvo and the Ve-Vnfm-em reference points as specified in the following specifications:

- Configuration Management (CM): TS 28.510 [11], TS 28.511 [12], TS 28.512 [13], TS 28.513 [14],

- Fault Management (FM): TS 28.515 [15], TS 28.516 [16], TS 28.517 [17], TS 28.518 [18],

- Performance Management (PM): TS 28.520[19], TS 28.521 [21], TS 28.522 [22], TS 28.523 [23],

- Life Cycle Management (LCM): TS 28.525[24], TS 28.526 [25], TS 28.527 [26], TS 28.528 [27].

In this deployment scenario:

- the entity denoted as NSSMF (NSS Management Function), is capable of consuming the VNF LCM and NS LCM related services provided by the NFV-MANO (NFVO). Same entity is also a provider of the NSS related management services.

- the entity denoted as NFMF (NF Management Function), is capable of application level management of VNFs and PNFs and is a producer of the NF Provisioning service that includes Configuration Management (CM), Fault Management (FM) and Performance Management. Same entity is consumer of the NF Provisioning service produced by VNFs and PNFs.
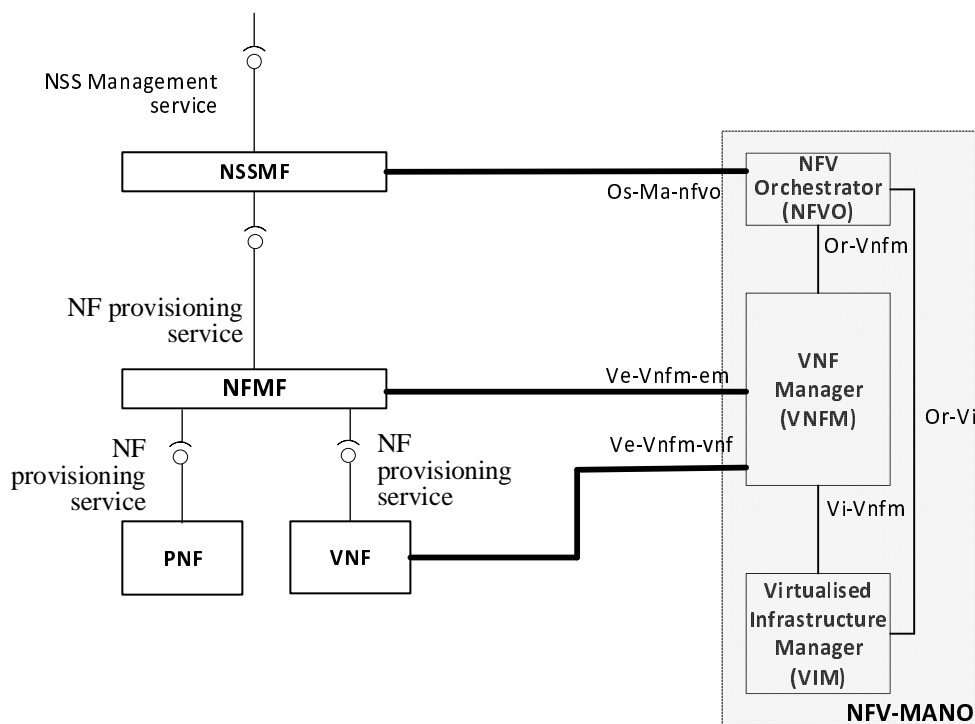

Figure A.4.1 The deployment scenario for NSSI management with interface to NFV-MANO

The use case Network slice subnet instance creation in the clause 5.1.2 of the TS 28.531 [8] shows example of interaction between:

- the consumer of the NSS related management services (e.g. NSS provisioning service) and the NSSMF as the provider of the NSS related management services.

- the NSSMF and the NFMF.

and also, the interaction between:

- the NSSMF and the NFV-MANO,

- the NFMF and the NFV-MANO.

NOTE: Figure A.4.1 shows an example of a deployment scenario, not all scenarios are captured by this figure.

A.5 Management Data Analytics Service (MDAS)

A management data analytics service (MDAS) provides data analytics of different network related parameters including for example load level and/or resource utilisation. For example, the MDAS for a network function (NF) can collect the NF's load related performance data, e.g., resource usage status of the NF. The analysis of the collected data may provide forecast of resource usage information in a predefined future time. This analysis may also recommend appropriate actions e.g., scaling of resources, admission control, load balancing of traffic, etc.

A MDAS for a network slice subnet instance (NSSI) provides NSSI related data analytics. The service may consume the corresponding MDAS of its constituent NFs'. The NSSI MDAS may further classify or shape the data in different useful categories and analyse them for different network slice subnet management needs (e.g., scaling, admission control of the constituent NFs etc.). If an NSSI is composed of multiple other NSSIs, the NSSI MDAS acts as a consumer of MDAS of the constituent NSSIs for further analysis e.g., resource usage prediction, failure prediction for an NSSI, etc.

A MDAS for a network slice instance (NSI) provides NSI related data analytics. The service may consume the corresponding MDAS of its constituent NSSI(s). The NSI MDAS may further classify or shape the data in different useful categories according to different customer needs, e.g., slice load, constituent NSSI load, communication service loads. This data can be used for further analysis e.g., resource usage prediction, failure prediction for an NSI, etc.

A.6 Utilization of management services in functional management architecture

The management services for a mobile network including network slicing may be produced by a set of functional blocks. This annex shows an example of such deployment scenario where functional blocks (such as NSMF, NSSMF, NFMF and CSMF) are producing and consuming various management services.
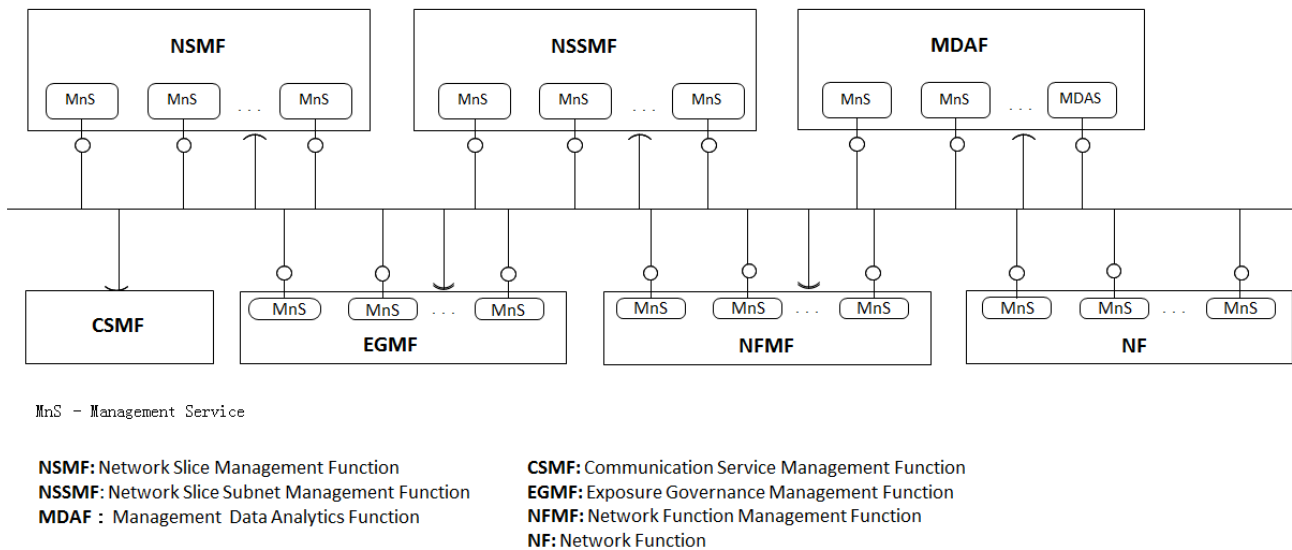
MnS – Management Service

NSMF: Network Slice Management Function
NSSMF: Network Slice Subnet Management Function
MDAF : Management Data Analytics Function

CSMF: Communication Service Management Function
EGMF: Exposure Governance Management Function
NFMF: Network Function Management Function
NF: Network Function

Figure A.6.1: Example of functional management architecture

In this deployment example:

- NFMF (Network Function Management Function) provides the management services for managing one or more NF(s) and may consume some management services produced by other functional blocks.

- The NF provides some management services, for example the NF performance management services, NF configuration management services and NF fault supervision services.

- NSSMF provides the management services for one or more NSSI and may consume some management services produced by other functional blocks.

- NSMF provides the management services for one or more NSI and may consume some management services produced by other functional blocks.

- MDAF provides the Management Data Analytics Service for one or more NF, NSSI and/or NSI, and may consume some management services produced by other functional blocks.

- CSMF consumes the management service(s) provided by the other functional blocks. This deployment example does not illustrate what management services the CSMF consumes.

- EGMF provides management service(s) with applied exspoure governance and a management service with management capability exposure governance to one or more management service consumers and may consume some management services produced by other functional blocks.

- One functional block may consume the management service(s) provided by another functional block, depending on the management scope of the functional block(s). The scope may be expressed in the terms of Management Service Components (see clause 4.3).

A.7 Utilization of management data analytics services

A management data analytics service (MDAS) provides data analytics for the network. MDAS can be deployed at different levels, for example, at domain level (e.g., RAN, CN, NSSI) or in a centralized manner (e.g., in a PLMN level). A domain-level MDAS provides domain specific analytics, e.g., resource usage prediction in a CN or failure prediction in a NSSI, etc. A centralized MDAS can provide end-to-end or cross-domain analytics service, e.g., resource usage or failure prediction in an NSI, optimal CN node placement for ensuring lowest latency in the connected RAN, etc. Figure A.7.1 illustrates an example of deployment model of the MDAS:

- Domain MDAF produces Domain MDAS

- Domain MDAS is consumed by the Centralized MDAF and the other authorized MDAS Consumers (for example, infrastructure manager, network manager, slice manager, slice subnet manger, other 3rd party OSS, etc.)

- Centralized MDAF produces Centralized MDAS

- Centralized MDAS is consumed by different authorized MDAS Consumers
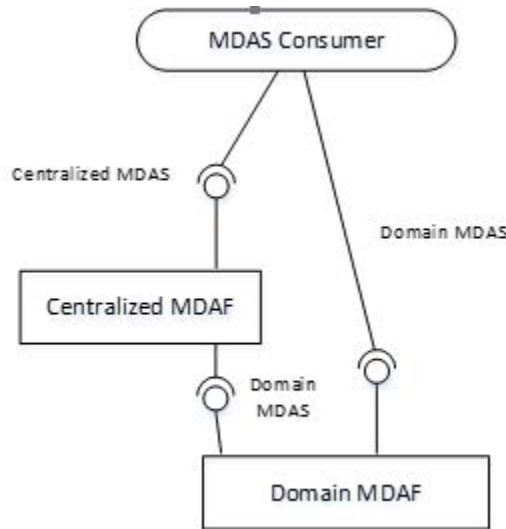

Figure A.7.1: MDAS provided at different levels

A.8 An example of deployment scenario for network and network slice

This annex shows an example of deployment scenario for management of a mobile network including network slicing.
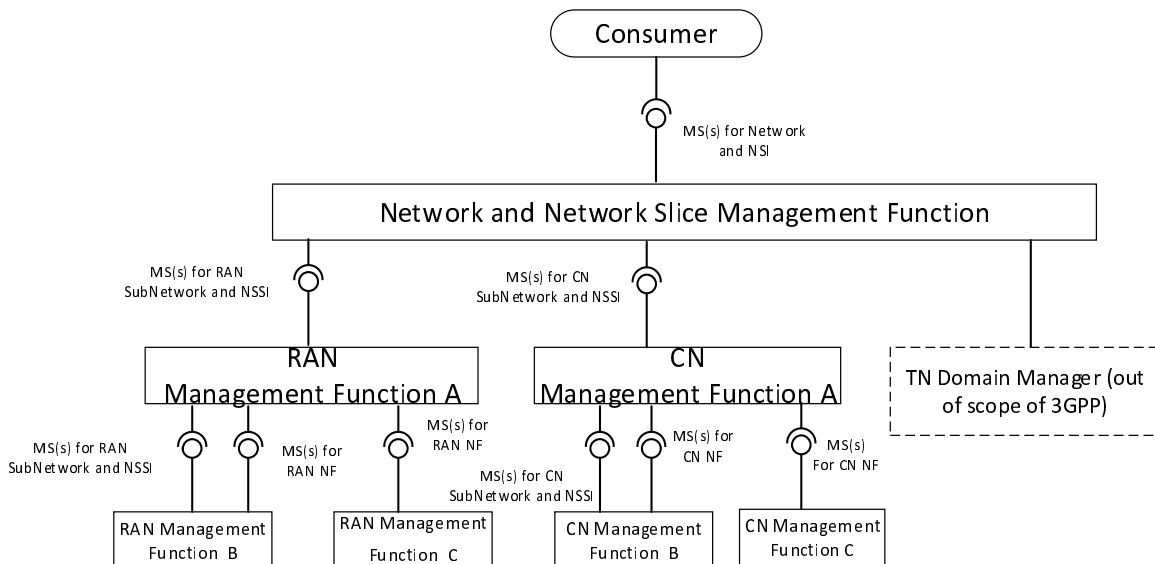
Figure A.8.1: An example of deployment scenario for management of a mobile network including network slicing

In this deployment scenario:

- Network and Network Slice Management Function provides the management services for network or NSI which includes RAN part, CN part and TN part to the Consumer. Network and Network Slice Management Function consumes management services for RAN SubNetwork or NSSI produced by RAN Management Function,

management services for CN SubNetwork or NSSI produced by CN Management Function and interface produced by TN Manager.

- RAN Management Function provides the management services for RAN SubNetwork or NSSI and/or management services for RAN NF(s). RAN Management Function may consume management service for RAN SubNetwork or NSSI and management services for RAN NF. In this scenario, the following RAN Management Function(s) are described:

  - RAN Management Function A provides the management services for RAN SubNetwork or NSSI to Network and Network Slice Management Function. RAN Management Function A consumes the management services for RAN NSSI(s) and management services for RAN NF produced by RAN Management Function B, and management services for RAN NF produced by RAN Management Function C.

  - RAN Management Function B provides the management services for RAN NSSI and management services for RAN NF to RAN Management Function A.

  - RAN Management Function C provides the management services for RAN NF to RAN Management Function A.

- CN Management Function provides the management services for CN NSSI and/or management services for CN NF. CN Management Function may consume management service for CN NSSI and management services for CN NF. In this scenario, the following CN Management Function(s) are described:

  - CN Management Function A provides the management services for CN NSSI to Network and Network Slicing Management Function. CN A consumes the management services for CN NSSI and management services for CN NF produced by CN Management Function B and management services for CN NFs produced by CN Management Function C.

  - CN Management Function B provides the management services for CN NSSI and management services for CN NF to RAN Management Function A.

  - CN Management Function C provides the management services for CN NF to CN Management Function A.

Annex B (normative): Solutions for management of 5G network and network slicing

Figure B.1 shows the two solutions for managing the mobile network including network slicing:

Solution1: Management with combination of existing interface IRP where applicable and 5G management information (Management service component type B and Management service component type C).

Solution2: Management with using the management services (Management service component type A, Management service component type B and Management service component type C).
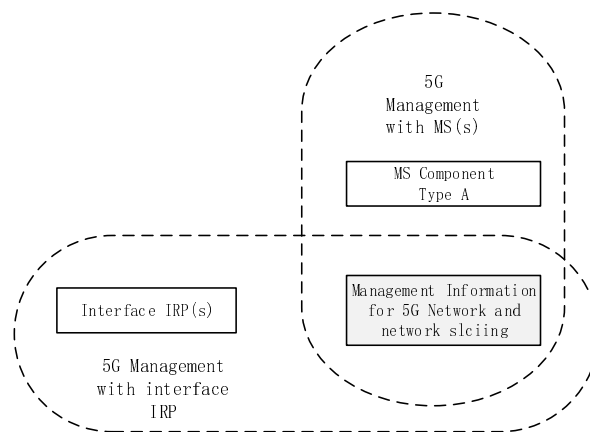

Figure B.1: Two solutions for managing a 5G network including network slicing

Annex C (informative): Example of mapping Management Services (MnS) to pre-Rel-15 management framework

Figure C.1 depicts an example of management service consumer and producer interaction shown in the context of the 3GPP pre-Rel-15 management reference model [10] where Integration Reference Point (IRP) information services are replaced by the management services. One or more management service producers are provided by a management function that applies to a network resource model representing the managed network.
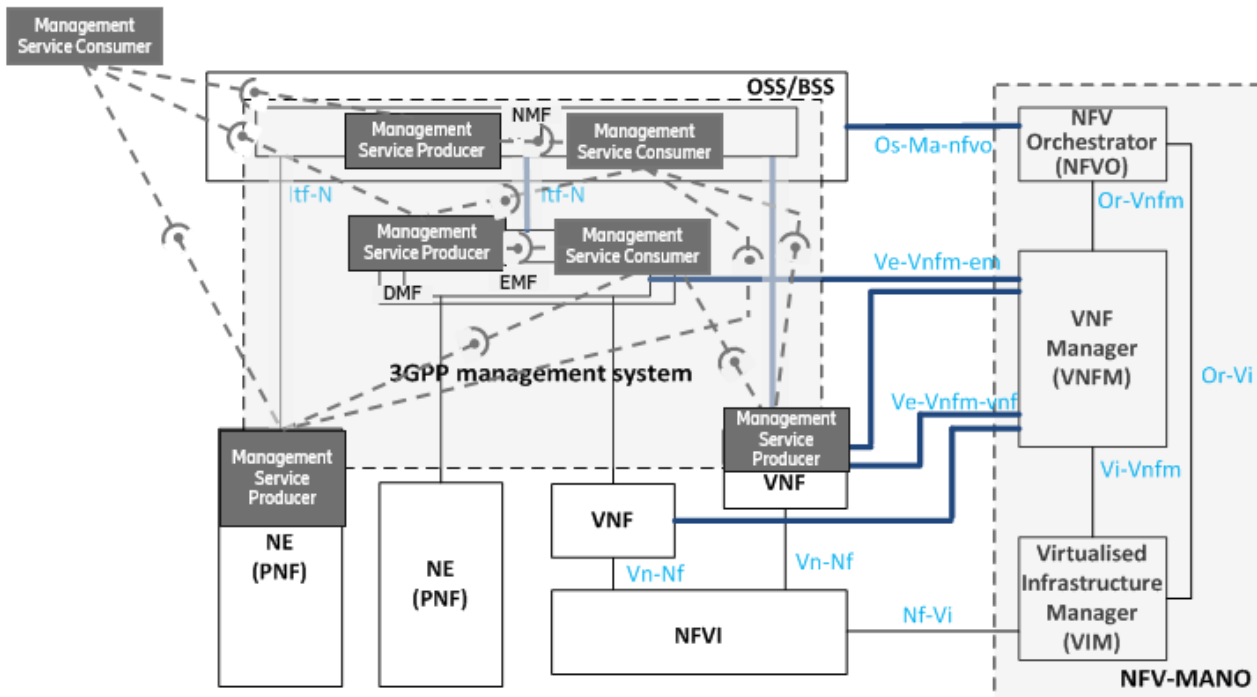

Figure C.1: Example of Management service producer and consumer interaction mapped into the pre-Rel-15 management reference model [10]

Annex D (informative): Change history

Change history							
Date	**Meeting**	**TDoc**	**CR**	**Rev**	**Cat**	**Subject/Comment**	**New version**
2018-01						First skeleton TS 28.533	0.0.0
2018-02	SA5#117	S5-181354				Update to implement the agreed pCRs in SA5#117: S5-181354 pCR 28.533 Add introduction and scope.	0.1.0
2018-04	SA5#118	S5-182393 S5-182545				Update to implement the agreed pCRs in SA5#118: S5-182393 pCR 28.533 Add Management Service Concept S5-182545 pCR 28.533 Network Function management service	0.2.0
2018-05	SA5#119	S5-183611 S5-183502 S5-183560 S5-183434 S5-183435 S5-183406 S5-183409 S5-183481 S5-183436 S5-183629				Update to implement the agreed pCRs in SA5#119: S5-183611 pCR 28.533 Interface to NFV-MANO S5-183502 pCR 28.530 Add grouping of the management services S5-183560 pCR 28.533 Add Data Analytics Management Service for Network Slice and Network Slice Subnet S5-183434 pCR 28.533 Exposure governance management function S5-183435 pCR 28.533 Management function services exposed as bulk management service S5-183406 pCR 28.533 Network management architecture interaction with NFV-MANO S5-183409 pCR 28.533 Add example of functional management architecture S5-183481 pCR 28.533 Add general description on MF S5-183436 pCR TS 28.533 Rapporteurs update S5-183629 pCR 28.533 Subscribe-notify paradigm	0.3.0
2018-06	SA5#119 Ad-hoc	S5-184322 S5-184066 S5-184236 S5-184316 S5-184317 S5-184319 S5-184345 S5-184344 S5-184374				Update to implement the agreed pCRs in SA5#119 Ad-hoc: S5-184322 pCR 28.533 Update title S5-184066 pCR 28.533 Re-organize the deployment model sections S5-184236 pCR 28.533 Solutions for management of 5G network and network slicing S5-184316 pCR 28.533 Exposure governance precondition S5-184317 pCR 28.533 Exposure governance clarification S5-184319 pCR 28.533 add deployment model for management of network and network slice S5-184345 pCR 28.533 Update functional management architecture to include MDAF S5-184344 pCR 28.533 Add MDAS Diagram S5-184374 pCR 28.533 Management service unique identifier	0.4.0
2018-07	SA5 Conference call						0.5.0
2018-08						EditHelp review	0.5.1
2018-08	SA5#120	S5‑185118 S5‑185119 S5‑185407 S5‑185442 S5‑185408 S5‑185121 S5‑185445 S5‑185410 S5‑185412 S5‑185413 S5‑185486 S5‑185487 S5‑185409 S5‑185601				S5‑185119 pCR 28.533 Edit help - insert new clause in section 4.3 S5‑185407 pCR 28.533 Edit help - remove empty clauses S5‑185442 pCR TS 28.533 Editorial changes to clause 4.2 and 4.4 S5‑185408 pCR TS 28.533 Further clarification into clause 4.7 Management data analytics capability S5‑185121 pCR 28.533 Edit help - update references to include references from A.4 S5‑185445 pCR 28.533 Update list of abbreviations S5‑185410 pCR TS 28.533 Normative architecture aspects S5‑185412 pCR 28.533 Exposure governance and EGMF further clarification S5‑185413 pCR 28.533 Update of utilization of management services in functional management architecture S5‑185486 pCR 28.533 Update type C definition to include CM S5‑185487 S5-185xxx pCR 28.533 Update style of code for Figure 4.6.2 S5‑185409 pCR 28.533 Resolution of Editors notes S5‑185601 pCR 28.533 Include management reference model	0.6.0
2018-09	SA#81	SP-180798				Presented for information and approval	1.0.0
2018-09	SA#81					Upgrade to change control version	15.0.0

History

Document history		
V15.0.0	October 2018	Publication