ETSI GS ZSM 008 V1.1.1 (2022-07)

Zero-touch network and Service Management (ZSM); Cross-domain E2E service lifecycle management

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Foreword

This Group Specification (GS) has been produced by ETSI Industry Specification Group (ISG) Zero-touch network and Service Management (ZSM).

Modal verbs terminology

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1 Scope

The present document investigates the management of End to End (E2E) services across Management Domains (MDs).

It defines the management processes during the lifecycle of E2E services (covering onboarding processes, fulfilment processes and assurance processes) and describes the interactions between E2E service management domain and management domains during these processes.

Furthermore, it maps the management services used in the management processes to the northbound interfaces of selected technology domains and references the underlying specifications of these interfaces. These mappings enable the automation of lifecycle management across domains.

2 References

2.1 Normative references

References are either specific (identified by date of publication and/or edition number or version number) or non-specific. For specific references, only the cited version applies. For non-specific references, the latest version of the referenced document (including any amendments) applies.

Referenced documents which are not found to be publicly available in the expected location might be found at https://docbox.etsi.org/Reference.

NOTE: While any hyperlinks included in this clause were valid at the time of publication, ETSI cannot guarantee their long-term validity.

The following referenced documents are necessary for the application of the present document.

[1] ETSI GS ZSM 002: "Zero-touch network and Service Management (ZSM); Reference Architecture".

[2] ETSI GS ZSM 007: "Zero-touch network and Service Management (ZSM); Terminology for concepts in ZSM".

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[4] ETSI GS NFV-IFA 031: "Network Functions Virtualisation (NFV) Release 3; Management and Orchestration; Requirements and interfaces specification for management of NFV-MANO".

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[7] ETSI TS 128 531: "5G; Management and orchestration; Provisioning (3GPP TS 28.531 Release 16)".

[8] ETSI TS 128 541: "5G; Management and orchestration; 5G Network Resource Model (NRM); Stage 2 and stage 3 (3GPP TS 28.541 Release 17)".

[9] ETSI TS 128 632: "Universal Mobile Telecommunications System (UMTS); LTE; Telecommunication management; Inventory Management (IM) Network Resource Model (NRM) Integration Reference Point (IRP); Information Service (IS) (3GPP TS 28.632 Release 16)".

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[19] BBF TR-411: "Definition of interfaces between CloudCO Functional Modules", Technical Report, Broadband Forum, April 2021.

[20] BBF TR-454: "YANG Modules for Network Map & Equipment Inventory", Technical Report, Broadband Forum, July 2021.

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[22] TMF633 (Version 4.0.0): "Service Catalog Management API REST Specification", TM Forum Specification.

[23] TMF638 (Version 4.0.1): "Service Inventory Management API User Guide", TM Forum Specification.

[24] TMF639 (Version 4.0.1): "Resource Inventory Management API User Guide", TM Forum Specification.

[25] TMF640 (Version 4.0.1): "Service Activation and Configuration API User Guide", TM Forum Specification.

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[30] TMF657 (Version 4.0.1): "Service Quality Management API User Guide", TM Forum Specification.

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[38] IETF RFC 8040: "RESTCONF Protocol".

[39] IETF RFC 8299: "YANG Data Model for L3VPN Service Delivery".

[40] IETF RFC 8345: "A YANG Data Model for Network Topologies".

[41] IETF RFC 8346: "A YANG Data Model for Layer 3 Topologies".

[42] IETF RFC 8466: "A YANG Data Model for Layer 2 Virtual Private Network (L2VPN) Service Delivery".

[43] IETF RFC 8639: "Subscription to YANG Notifications".

[44] IETF RFC 8641: "Subscription to YANG Notifications for Datastore Updates".

[45] IETF RFC 8650: "Dynamic Subscription to YANG Events and Datastores over RESTCONF".

[46] IETF RFC 8795: "YANG Data Model for Traffic Engineering (TE) Topologies".

[47] IETF RFC 8944: "A YANG Data Model for Layer 2 Network Topologies".

[48] IETF RFC 9094: "A YANG Data Model for Wavelength Switched Optical Networks (WSONs)".

[49] IETF RFC 9182: "A YANG Network Data Model for Layer 3 VPNs".

2.2 Informative references

References are either specific (identified by date of publication and/or edition number or version number) or non-specific. For specific references, only the cited version applies. For non-specific references, the latest version of the referenced document (including any amendments) applies.

NOTE: While any hyperlinks included in this clause were valid at the time of publication, ETSI cannot guarantee their long-term validity.

The following referenced documents are not necessary for the application of the present document, but they assist the user with regard to a particular subject area.

[i.1] ETSI GS ZSM 009-1: "Zero-touch network and Service Management (ZSM); Closed-loop automation; Part 1: Enablers".

[i.2] ETSI TS 123 288: "5G; Architecture enhancements for 5G System (5GS) to support network data analytics services (3GPP TS 23.288 Release 16)".

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NOTE: Available at https://datatracker.ietf.org/doc/draft-ietf-ccamp-eth-client-te-topo-yang/.

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[i.16] draft-ietf-opsawg-sap: "A Network YANG Model for Service Attachment Points (SAPs)", Internet draft, Version 04, work in progress.

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[i.17] draft-ietf-opsawg-yang-vpn-service-pm: "A YANG Model for Network and VPN Service Performance Monitoring", Internet draft, Version 07, work in progress.

NOTE: Available at https://datatracker.ietf.org/doc/draft-ietf-opsawg-yang-vpn-service-pm/.

3 Definition of terms, symbols and abbreviations

3.1 Terms

For the purposes of the present document, the terms given in ETSI GS ZSM 007 [2] and the following apply:

domain service: service that is managed by a management domain

3.2 Symbols

Void.

3.3 Abbreviations

For the purposes of the present document, the abbreviations given in ETSI GS ZSM 007 [2] and the following apply:

5G	5th Generation
API	Application Programming Interface
BBF	Broadband Forum
CCAMP	Common Control and Measurement Plane
CCO	Cloud Central Office
CCO DO	Cloud Central Office Domain Orchestrator
CloudCO	Cloud Central Office
CRUD	Create, Read, Update, Delete
CRUD-N	CRUD plus Notify
E2E	End-to-End
E-UTRAN	Evolved Universal Mobile Telecommunications System Terrestrial Radio Access Network
EPC	Evolved Packet Core
ETSI	European Telecommunications Standards Institute
FM	Fault Management
gNMI	gRPC Network Management Interface
gRPC	Google Remote Procedure Call
IETF	Internet Engineering Task Force
IFA	InterFaces and Architecture
IOC	Information Object Class
KPI	Key Performance Indicator
L2	Layer 2
L2NM	Layer 2 Network Model
L2SM	Layer 2 Service Model
L2VPN	Layer 2 VPN
L3	Layer 3
L3NM	Layer 3 Network Model
L3SM	Layer 3 Service Model
L3VPN	Layer 3 VPN
LCM	LifeCycle Management
LTE	Long-Term Evolution
MD	Management Domain
MDA	Management Data Analytics
MDAS	Management Data Analytics Service
MnF	Management Function
MnS	Management Service
MOI	Managed Object Instance

n/a	not applicable
NBI	NorthBound Interface
NFV	Network Functions Virtualisation
NFVO	NFV Orchestrator
NRM	Network Resource Model
NSC	Network Slice Controller
NWDAF	Network Data Analytics Function
ONF	Open Networking Foundation
OTN	Optical Transport Network
PM	Performance Management
SDK	Software Development Kit
SOL	SOLutions
TAPI	Transport Application Programming Interfaces
TEAS	Traffic Engineering Architecture and Signaling
TMF	TM Forum
TR	Technical Report
UC	Use Case
VNF	Virtualised Network Function
VPN	Virtual Private Network
WG	Working group
XML	eXtensible Markup Language
YANG	Yet Another Next Generation

4 Overview of cross-domain E2E service lifecycle management

The E2E service lifecycle is managed using different processes.

Roughly, the processes can be divided into:

- *onboarding processes* that ingest a service model that was created during an out-of-scope service design phase into the ZSM framework;
- *fulfilment processes* that bring up a service instance based on an onboarded service model, configure the service instance, activate it for use and finally terminate it;
- *assurance processes* that ensure a service is free of faults (service problem management) and meets its SLSs (service quality management).

Onboarding and fulfilment processes are typically finite and are executed per request. Assurance processes typically execute continuously once set up, ideally in closed loops. ETSI GS ZSM 009-1 [i.1] defines enablers for closed loops.

The present document focuses on the cross-domain aspects of these management processes and what management services can be used to implement those processes.

Figure 4-1 illustrates the management processes during the E2E service lifecycle. Furthermore, the figure indicates as example the groups of management services introduced in ETSI GS ZSM 002 [1] that can be used to implement the processes. Apart from the processes that start the lifecycle of a service instance (service instantiation and assurance set-up) and end it (service decommissioning and assurance tear-down), the figure depicts sets of processes with no particular order. The processes are further detailed in clause 5.

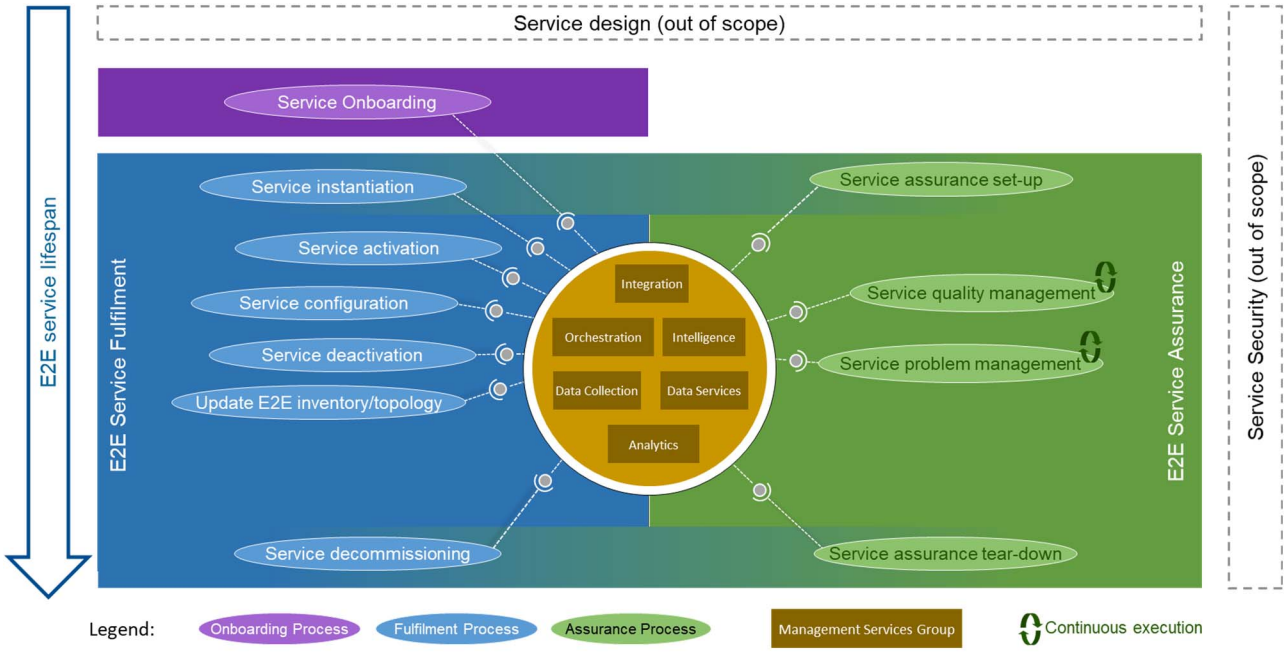


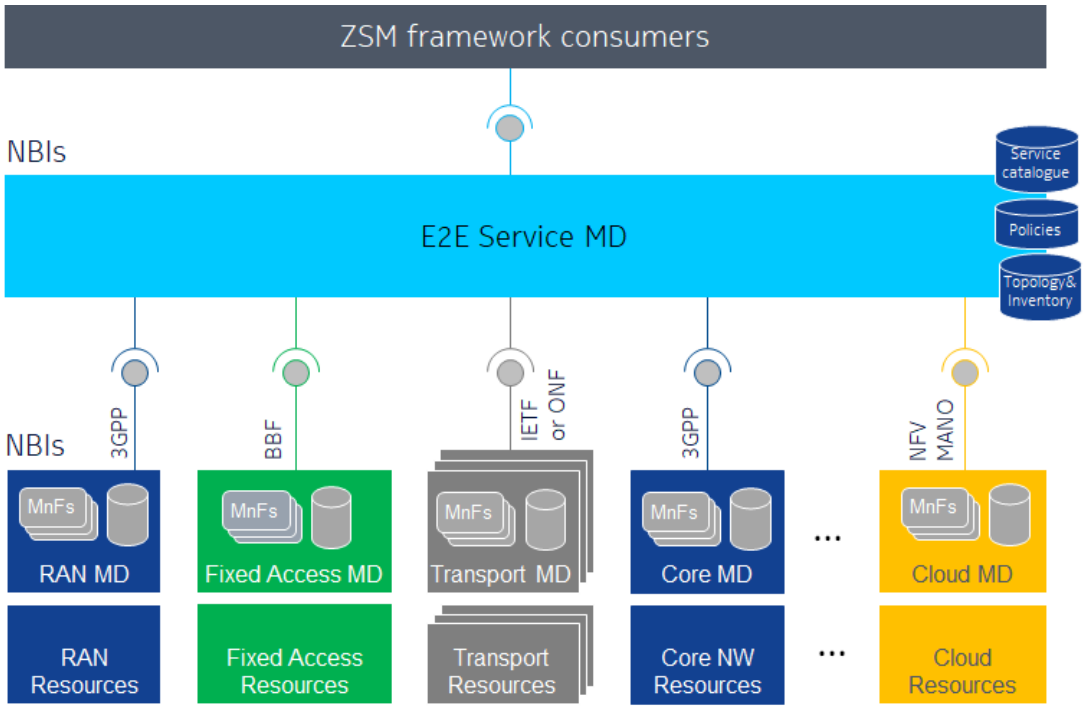
Figure 4-1: Management processes during the lifecycle of E2E services

Each management process during the E2E service lifecycle requires that the E2E service management domain consumes management services from the management domains. For example, a fulfilment process might use Orchestration services for service configuration, and Data Collection services to validate if the service quality requirements are met initially. As another example, an assurance process might be realized as a closed loop using Data Collection services, Data Analytics Services, Intelligence services together with Orchestration services to improve the configuration in order to maintain the desired service quality.

A large set of these management services depends on the technology used in the underlying management domain. The E2E service management domain needs to be able to consume the various management services from the management domains via the endpoints that make up the northbound interface of the domain.

Figure 4-2 illustrates the set of technology domains considered in the present document. In deployments, there may be additional technology domains. Clause 6 documents the northbound interfaces of management domains based on different technologies.

In the present document, the NBIs of the E2E service management domain are defined in terms of ZSM management services (see ETSI GS ZSM 002 [1] with extensions defined in Annex A of the present document). The technology mapping of these NBIs is out of scope of the present document.



NOTE 1: NBIs depicted in figure 4-2 are neither mandatory nor exhaustive ones, but examples to be utilized.
NOTE 2: The cross-domain integration fabric is not depicted in figure 4-2 for simplicity.

Figure 4-2: Domain NBIs consumed during the management of the lifecycle of E2E services

Clause 7 documents gaps and commonalities between the different technology domains with respect to their northbound interfaces.

5 Cross-domain E2E service lifecycle management processes

5.1 Overview

Clause 5 introduces typical lifecycle management processes that the E2E service management domain performs to manage E2E services throughout their lifespan and during which it interacts with the underlying management domains that manage resources and domain services which are needed for the E2E service.

In deployments, processes may be combined or split.

For each process, a description, a process flow and a list of related management services are provided. The description explains the overall purpose and task of the process. The procedure flow provides a graphical and a textual representation of the individual steps of the process. For simplicity's sake, only requests are shown in the flows and responses and acknowledgements are omitted. Furthermore, for the unsuccessful execution of the procedures, only error conditions are defined, but no detailed error flows are specified. The list of related management services includes management services that are produced or consumed by the E2E service management domain and therefore represent a cross-domain integration point. Management services that are invoked internally by the management domain or E2E service management domain (i.e. where producer and consumer are in the same domain) are not listed as these do not require cross-domain integration or coordination.

In the following, the term "domain service" is used as shorthand for "a service that is managed by a management domain".

The processes are split into three categories: Service onboarding, Service fulfilment and Service assurance, as depicted in figure 4-1.

5.2 Service onboarding

5.2.1 Overview

The following sub-clauses introduce typical onboarding processes, i.e. processes that the E2E service management domain performs to obtain E2E service models from service design (which is out of scope of the present document) and that prepare the E2E service management domain and the management domains for the instantiation of such services.

5.2.2 Process: Service onboarding

5.2.2.1 Description

The "Service onboarding" process imports a new service model into the service catalogue of the E2E service management domain, following the service design phase that is outside the scope of the present document. The E2E service model is introduced in clause 6.6.5.2.3 of ETSI GS ZSM 002 [1].

Onboarding may optionally include the importing of a service template that allows to parameterize the service model when a subsequent service instance creation is requested. A service template contains a customer-facing part and a resource-facing part. The customer facing part, called the service offer descriptor, defines a set of parameters with their allowed values or value ranges which can be used by the ZSM framework consumers to configure the characteristics of the service they request to instantiate. The resource-facing part defines how to map the parameters in the service offer descriptor to the realization of the service.

5.2.2.2 Procedure flow

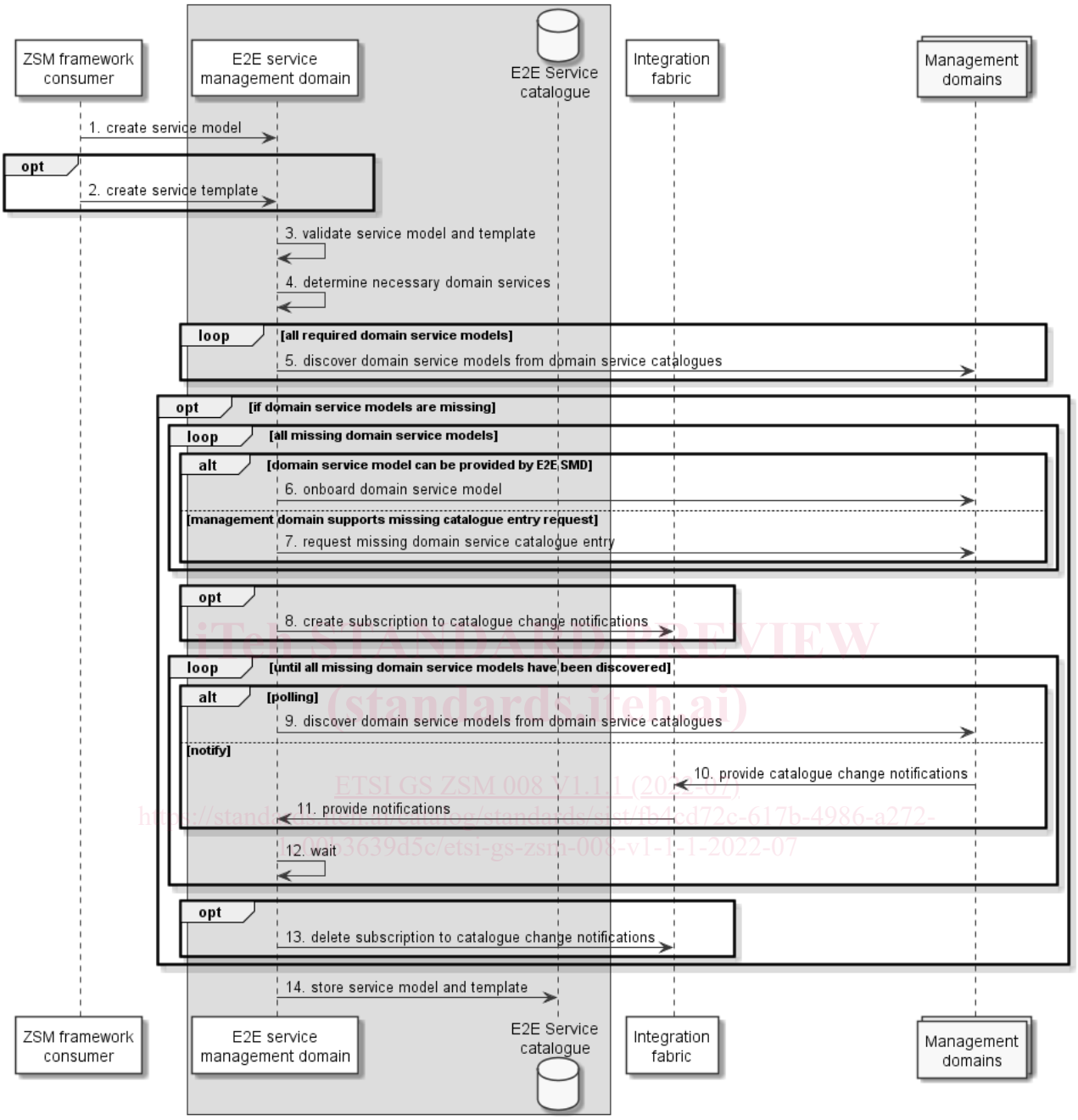


Figure 5.2.2.2-1: Service onboarding

PRECONDITIONS:

- None.

The procedure, as illustrated in figure 5.2.2.2-1, consists of the following steps:

1. The ZSM framework consumer requests the creation of a service model and its import into the service catalogue managed by the E2E service management domain by consuming the "Manage service models" capability of the "Managed services catalogue management service".

2. Optionally, the ZSM framework consumer also requests the creation of a related service template and its import into the service catalogue, consuming the same service.