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**Group Specification**

Zero Touch Network and Service Management (ZSM);

Network Digital Twin for enhanced zero-touch network and service management

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# Foreword

This Group Specification (GS) has been produced by ETSI Industry Specification Group Zero Touch Network and Service Management (ZSM).

# Modal verbs terminology

In the present document "**shall**", "**shall not**", "**should**", "**should not**", "**may**", "**need not**", "**will**", "**will not**", "**can**" and "**cannot**" are to be interpreted as described in clause 3.2 of the [ETSI Drafting Rules](https://portal.etsi.org/Services/editHelp!/Howtostart/ETSIDraftingRules.aspx) (Verbal forms for the expression of provisions).

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# 1 Scope

This work item will specify extensions and new capabilities to support and integrate digital twin technologies with the ZSM framework reference architecture in order to enhance end to end zero-touch network and service management and automation.

The work will define use cases related to Network Digital Twin (NDT) to derive specific requirements. The work will also document ZSM NDT principles and zero touch governance and management of the NDT operation.

The deliverable will be a stage 1 and 2 normative document based on the reference architecture and will refer to available standards and open source works where appropriate. The content of the ETSI GR ZSM 015 will be used as inputs to this work item.

*Editor’s note: TODO: update scope description as document matures.*

# 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.

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## 2.2 Informative references

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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] <Standard Organization acronym> <document number><version number/date of publication>: "<Title>".

[i.2] etc.

# 3 Definition of terms, symbols and abbreviations

## 3.1 Terms

For the purposes of the present document, the [following] terms [given in ... and the following] apply:

*Editor’s note: TODO: where needed, provide definition of terms aligned with terminology used in industry and literature.*

**Network Digital Twin (NDT)**: a virtual replica of a communications network or part of one.

NOTE 1: Communications network can for example include objects, systems, processes, software or environments of physical network elements and components, virtualized network functions, services and traffic.

## 3.2 Symbols

For the purposes of the present document, the [following] symbols [given in ... and the following] apply:

## 3.3 Abbreviations

For the purposes of the present document, the [following] abbreviations [given in ... and the following] apply:

# 4 Concept and Principles of Network Digital Twin for Enhanced Zero Touch Network and Service Management

*Editor’s Note: This clause will document ZSM NDT concept and principles for zero touch management of the NDT operation.*

## 4.1 Concept

## 4.2 Principles

1. **NDT should be use case specific**

The NDT, including the input and output as well as the data on which the NDT depends, etc. should be use case-specific. NDT may use data from various sources and are needed to be at right level of granularity, abstraction level, meets the quality, quantity criteria and other data characteristics (like peak hour KPI) requirements of the use case.

1. **Different actions in NDT may be executed concurrently**

NDT can be executed concurrently and independently, instead of sequentially, to greatly boost the processing efficiency.

1. **Separation of Concerns in NDTs**

In order to support the separation of concerns in management, described in principle 8 from ETSI ZSM 002 (clause 4.2.8), the ZSM framework supports the same separation of concerns in NDTs as follows:

* E2ESMD NDT: Provide management services (MnS) and capabilities as described in clause 6.3 which support the management of end-to-end managed services that span multiple management domains
* MD NDT: Provide management services (MnS) and capabilities as described in clause 6.3 which support the management of management domain entities

1. **NDT enables improved decision-making through its dynamic behaviour modelling capability**

NDT’s dynamic behaviour modelling capabilities like simulation, emulation and prediction enable network and service management to have improved decision-making capabilities compared to traditional methods without any adverse impact on the physical twin.

1. **NDT is aware of the dynamic changes of the physical twin environment.**

The NDT is environment-aware based on information received from telemetry data, sensors, anomaly detection, failure prediction etc. The dynamic behaviour models of the NDT should consider the dynamic changes in the physical twin and its environment.

# 5 Use cases

*Editor’s Note: The clause will define use cases related to Network Digital Twin (NDT) to derive specific requirements*

*Editor’s Note:* *Use cases here should (optionally) provide information on what data is needed, what capabilities are provided (ie analytics) and what further management services are associated to what purpose.*

*Editor’s Note: Every use case must be used to extract NDT requirements and these will be summarised in clause 6*

# 6 Requirements for Network Digital Twin

*Editor’s note: This clause will capture requirements described in clause 5*

* NDT-Gen-1: The ZSM framework shall support capabilities to integrate the NDT MnS in the management domain and / or E2E service management domain.
* NDT-Gen-2: The ZSM framework shall support capabilities for NDT MnS to register services and capabilities.
* NDT-Gen-3: The ZSM framework shall support capabilities for NDT MnS consumers to discover the NDT management services and capabilities.

# 7 Specialized Management Services for Network Digital Twin in the ZSM Framework

*Editor’s note: This clause will describe new specialized services needed for the NDT. The current subclauses are just examples*

## 7.1 Introduction

## 7.2 NDT Management

### 7.2.1 NDT Governance

*Editor’s Notes: NDT Governance is a set of capabilities that allows entities to manage the life cycle of Network Digital Twins and configure their behaviour.*

### 7.2.2 NDT Coordination

*Editor’s Notes: NDT Coordination is a set of capabilities that allows multiple NDTs running within the ZSM framework to be coordinated, with the main objective of improving their performance and the fulfilment of their requirements.*

## 7.X NDT XXX Services

*Editor's note: This clause is for including specialized management services related to the NDT in addition to those not explained in clause 7.2*

# 8 Network Digital Twin Architecture based on ZSM Framework Management Services

*Editor’s Note: Definition of NDT architecture based on ZSM framework management services.*

# Annex A (informative): Relationship between NDT and other ZSM Elements

*Editor’s Notes: This clause will specify relationships between the NDT and other ZSM elements or concepts:*

* *NDT and Closed loop relationship*
* *NDT usage for CI/CD*
* *Intent-driven NDT*

# Annex B (normative): Specification of management services relevant to NDT in the ZSM Framework

*Editor’s Notes: This clause will specify new services, extended services and existing services required to support and integrate digital twin technologies with the ZSM framework reference architecture in order to improve end to end zero-touch network and service management and automation.*

*Editor’s note: An analysis similar to that in zsm12 for usage of ZSM management services will be provided either in this clause or as an informative annex*

Change history

| Date | Version | Information about changes |
| --- | --- | --- |
| March 2024 | 0.0.1 | Initial skeleton approved  Incorporated contributions:   * ZSM(24)000059r2\_ZSM018\_Network\_Digital\_Twin\_Terms * ZSM(24)000060r2\_Add\_Principles\_for\_Network\_Digital\_Twin * ZSM(24)000062r2\_ZSM018\_Add\_requirements\_for\_NDT |
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# History

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| **Document history** | | |
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