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Draft new Recommendation ITU-T Y.NGNe-DT-reqts

Requirements and framework for NGN evolution to support digital twin

1. Scope

This draft Recommendation provides an overview of the enhancement for NGNe to support digital twin, and specifies the requirements and framework of NGNe abstraction layer to support NGNe abstraction, NGNe modelling and simulation. This draft Recommendation also defines the capabilities of NGNe abstraction layer and NGNe twin to support related requirements.

This draft Recommendation gives an evolved version of NGN evolution which has already been standardized by ITU-T Recommendations [ITU-T Y.2012] and [ITU-T Y.2340] for its requirements, capabilities and functional architectures. This draft Recommendation builds on those published Recommendations, and the content of this draft recommendation is aligned with other NGNe related Recommendations.

2. References

The following ITU-T Recommendations and other references contain provisions which, through reference in this text, constitute provisions of this Recommendation. At the time of publication, the editions indicated were valid. All Recommendations and other references are subject to revision; users of this Recommendation are therefore encouraged to investigate the possibility of applying the most recent edition of the Recommendations and other references listed below. A list of the currently valid ITU-T Recommendations is regularly published.

The reference to a document within this Recommendation does not give it, as a stand-alone document, the status of a Recommendation.

[ITU-T Y.2012] Recommendation ITU-T Y.2012 (2010), *Functional requirements and architecture of next generation networks*.

[ITU-T Y.2340] Recommendation ITU-T Y.2340 (2016), *Next generation network evolution phase 1 – Overview*.

[ITU-T Y.3090] Recommendation ITU-T Y.3090 (2022), *Digital twin network – Requirements and architecture*.

TBD

3. Definitions

3.1. Terms defined elsewhere

This Recommendation uses the following terms defined elsewhere:

TBD

3.2. Terms defined in this Recommendation

This Recommendation defines the following terms:

TBD

4. Abbreviations and acronyms

This Recommendation uses the following abbreviations and acronyms:

TBD

5. Conventions

In this Recommendation:

The keywords "is required to" indicate a requirement which must be strictly followed and from which no deviation is permitted, if conformance to this Recommendation is to be claimed.

The keywords "is recommended" indicate a requirement which is recommended but which is not absolutely required. Thus, this requirement need not be present to claim conformance.

The keywords "can optionally" indicate an optional requirement which is permissible, without implying any sense of being recommended. This term is not intended to imply that the vendor's implementation must provide the option, and the feature can be optionally enabled by the network operator/service provider. Rather, it means the vendor may optionally provide the feature and still claim conformance with this Recommendation.

6. Background and motivations

Contributor's Note: This section would provide an overview of the background, purpose of NGNe enhancements to support digital twin.

With the rapid development of communication and network technologies, next generation network evolution (NGNe) has become a focus of industry attention. NGNe [ITU-T Y.2340] is a non-stop long-term project to design a network architecture for future, aimed at meeting the growing demand for data transmission, improving network performance and reliability, and supporting various emerging technologies.

Due to the increasing number of new technologies, many new services have emerged based on them. In order to support new technologies and carry new services, the capabilities of NGNe are increasing, leading to increasingly complex network architecture and service logic. Due to the increasing number of users and traffic, the burden on the network is becoming heavier. Therefore, before conducting technological iterations, capability enhancements, and introducing new services to the network, it is necessary to first simulate the network operation after the service configurations are distributed. After confirming that the distributed service configurations will not affect existing services in the network, the service configuration will be distributed.

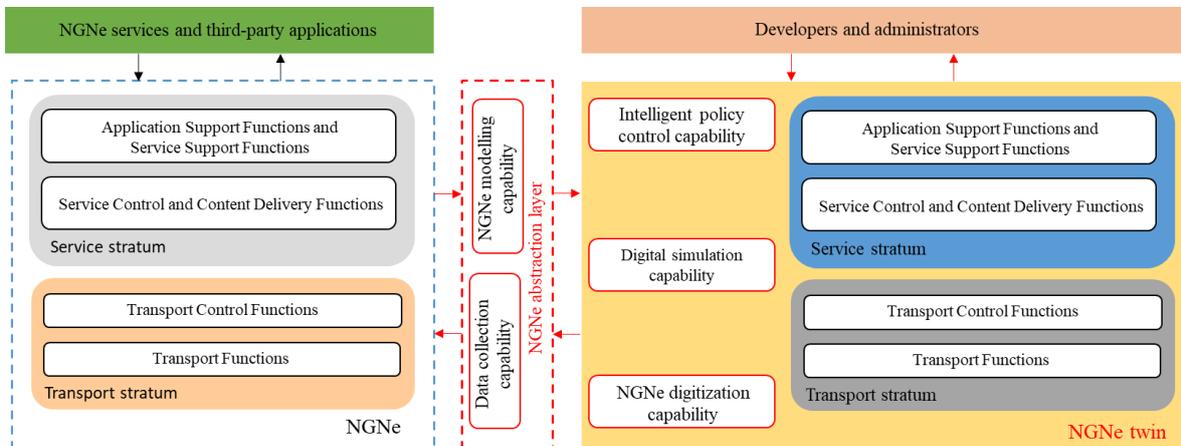


Figure 1 The architecture of enhanced NGNe to support digital twin

The NGNe cannot provide the simulation capability to the developers and administrators. To achieve this goal, we added a NGNe abstraction layer into the NGNe framework as shown in Figure 1. NGNe abstraction layer is able to interact with NGNe and NGNe twin. It collects real-time data from the NGNe and generates a digital network model within the NGNe abstraction layer based on the collected data. The collected data includes service configuration information, network topology, link status, traffic status, etc. When the developers or administrators send a service configuration information for simulation, the NGNe twin performs simulation calculations based on the input, and the results are returned to the developers or administrators for reference.

NGNe contains transport stratum and service stratum. The transport stratum includes the infrastructure of cloud and network, providing efficient connectivity and communication. It handles and forwards data traffic, performs data transmission and reception tasks, as well as handles various network protocols. This stratum provides stable and efficient network support for upper-level applications, enabling various network services and applications to operate smoothly. The service stratum provides service control, content delivery, application support and service support. It receives the user demand input from NGNe services and third-party applications, generates corresponding configuration information and distributed it to network devices.

The intermediate layer is the NGNe abstraction layer. It provides Data collection capability and NGNe modelling capability. Data collection capability collects and processes service configuration information, network topology, link status, traffic status in real-time through the interface with the NGNe. NGNe modelling capability supports data cleaning, data validation, digital modeling, and model management based on NGNe real-time status.

The NGNe twin is an abstract NGNe, which is generates based on the data collected by NGNe abstraction layer. It possesses all the capabilities of NGNe and reflects its real-time status, but it is also detached from NGNe, and the operations performed on NGNe twin will not affect NGNe. NGNe twin can provide three capabilities: NGNe modeling capability, Digital simulation capability and Intelligent policy control capability.

- 1) NGNe digitization capability provides multiple algorithms and strategies to generate NGNe twin based on the data provided by the NGNe abstraction layer.
- 2) Digital simulation capability supports the simulation and analysis of the impact of configuration distribution based on the NGNe real-time status and the input service configuration information from developers and administrators.
- 3) Intelligent policy control capability supports network state prediction, fault localization and root cause analysis in NGNe twin. It provides network strategies optimization suggestions and optimized results presentation.

7. Requirements of NGNe enhancements to support digital twin

7.1. General requirements

Contributor's note: This section will provide the high level general requirements of Y.NGNe-DT-reqts, contributions are welcomed.

7.2. Service requirements

Contributor's note: service requirements of Y.NGNe-DT-reqts will be addressed in this clause, contributions are welcomed.

7.3.Capability requirements

Contributor's note: capability requirements of Y.NGNe-DT-reqts will be addressed in this clause, contributions are welcomed.

8. Framework of NGNe enhancements to support digital twin

8.1. Overview

Contributor's note: overview of the framework of NGNe enhancements to support digital twin will be addressed in this clause, contributions are welcomed.

8.2.NGNe abstraction layer

Contributor's note: the NGNe abstraction layer of the framework of NGNe enhancements to support digital twin will be addressed in this clause, contributions are welcomed.

8.3.NGNe twin

Contributor's note: the NGNe twin of the framework of NGNe enhancements to support digital twin will be addressed in this clause, contributions are welcomed.

9. Security considerations

Contributor's Note: The security considerations of this draft recommendation except for the general security issues of NGNe will be addressed in this clause, contributions are welcomed.

Annex 1

A.1 justification for Proposal on initiating the study of the requirements and framework for NGN evolution to support digital twin

| | | | |
|--|---|--|-------------------------|
| Question: | 2/13 | Proposed new ITU-T Recommendation | Geneva, 4-15 March 2024 |
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| <p>Scope (defines the intent or object of the Recommendation and the aspects covered, thereby indicating the limits of its applicability):</p> <p>This draft Recommendation provides an overview of the enhancement for NGNe to support digital twin, and specifies the requirements and framework of NGNe abstraction layer to support physical network abstraction, NGNe modelling and simulation, and capability exposure. This draft Recommendation also defines the capabilities of NGNe abstraction layer to support related requirements.</p> <p>This draft Recommendation gives an evolved version of NGN evolution which has already been standardized by ITU-T Recommendations [ITU-T Y.2012] and [ITU-T Y.2340] for its requirements, capabilities and functional architectures. This draft Recommendation builds on those published Recommendations, and the content of this draft recommendation is aligned with other NGNe related Recommendations.</p> | | | |
| <p>Summary (provides a brief overview of the purpose and contents of the Recommendation, thus permitting readers to judge its usefulness for their work):</p> <p>Due to the increasing number of new technologies, many new services have emerged, leading to increasingly complex network architecture and service logic. Due to the increasing number of users and traffic, the burden on the network is becoming heavier. Therefore, before conducting technological iterations, capability enhancements, and introducing new services to the network, it is necessary to first simulate the network operation after the service configurations are distributed. After confirming that the distributed service configurations will not affect existing services in the network, the service configuration will be distributed.</p> <p>In ITU-T Q2/13 has already standardized next generation network evolution (NGNe) related Recommendations such as Y.2012(<i>Functional requirements and architecture of next generation networks</i>) and Y.2340(<i>Next generation network evolution phase 1 – Overview</i>). This new draft recommendation will specify how NGNe can abstract and model real-time information in NGNe through the newly added NGNe abstraction layer, and simulate calculations based on the input requirements of developers and administrators, providing them with a reference for network strategies optimization suggestions.</p> <p>To achieve the goal of enhancing NGNe to support digital twin, a NGNe abstraction layer should be added into the NGNe framework. NGNe abstraction layer is able to interact with NGNe and NGNe twin. It collects real-time data from the NGNe and generates a digital network model within the NGNe abstraction layer based on the collected data. The collected data includes service configuration information, network topology, link status, traffic status, etc. When the developers or administrators send a service configuration information for simulation, the NGNe twin performs simulation calculations based on the input, and the results are returned to the developers or administrators for reference.</p> | | | |

Relations to ITU-T Recommendations or to other standards (approved or under development):

ITU-T Y.2012, ITU-T Y.2340, ITU-T Y.3090, ITU-T Y.DTN-CapLevel, ITU-T Y.IMT2020-DTNMO, ITU-T Y.DTN-DataFrame, IETF draft-irtf-nmrg-network-digital-twin-arch, ETSI GR CIM 017 V1.1.1

Liaisons with other study groups or with other standards bodies:

ITU-T SG15, ITU-T SG20, IETF NMRG, ETSI CIM, 3GPP SA5

Supporting members that are committing to contributing actively to the work item:

China Telecom, China Unicom, CICT, MIIT(China)
