

Recommendation

ITU-T Y.2350 (09/2024)

SERIES Y: Global information infrastructure, Internet protocol aspects, next-generation networks, Internet of Things and smart cities

Next Generation Networks – Enhancements to NGN

Requirements of next generation network evolution (NGNe) to support container-based network entities

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Global information infrastructure, Internet protocol aspects, next-generation networks, Internet of Things and smart cities

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Recommendation ITU-T Y.2350

Requirements of next generation network evolution (NGNe) to support container-based network entities

Summary

Recommendations ITU-T Y.2320 and ITU-T Y.2321 provide requirements and architecture for the virtualization of control network entities in next generation network evolution (NGNe). The container-based network entity, making full use of the advantages of cloud native technology and realizing the rapid construction, operation and elastic expansion of telecommunication networks, can evolve the next generation network (NGN) furthermore.

Recommendation ITU-T Y.2350 provides the requirements of container-based network entities, requirements of container-based network entities management system, and requirements of infrastructures of NGNe to support container-based network entities.

History *

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Container, NGN, NGNe, network entity.

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Recommendation ITU-T Y.2350

Requirements of next generation network evolution (NGNe) to support container-based network entities

1 Scope

This Recommendation provides the requirements of next generation network evolution (NGNe) to support container-based network entities (CNE). This Recommendation addresses the following subjects:

- overview of NGNe with CNE;
- requirements of CNE in NGNe;
- requirements of CNE management system in NGNe;
- requirements of infrastructures in NGNe to support CNE.

This Recommendation also provides appendices describing:

- scenarios of container-based network entities in NGNe;
- comparison of using containers on virtual machine (VM) versus physical machine in NGNe.

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 Q.3054] Recommendation ITU-T Q.3054 (2019), *Signalling architecture for virtualization of control network entities*.
- [ITU-T X.1643] Recommendation ITU-T X.1643 (2022), *Security requirements and guidelines for virtualization containers in cloud computing environments*.
- [ITU-T Y.2320] Recommendation ITU-T Y.2320 (2015), *Requirements for virtualization of control network entities in next generation network evolution*.
- [ITU-T Y.2321] Recommendation ITU-T Y.2321 (2016), *Functional architecture for supporting virtualization of control network entities in next generation network evolution*.
- [ITU-T Y.2322] Recommendation ITU-T Y.2322 (2018), *The functional architecture of virtualized control network entities management and orchestration in next generation network evolution*.
- [ITU-T Y.3535] Recommendation ITU-T Y.3535 (2022), *Cloud computing – Functional requirements for a container*.

3 Definitions

3.1 Terms defined elsewhere

This Recommendation uses the following terms defined elsewhere:

3.1.1 container [ITU-T Y.3535]: A set of software to provide isolation, resource control, and portability for virtualization processing of the application.

NOTE 1 – Container runs on the kernel in a bare-metal machine or virtual machine.

NOTE 2 – The application implies business logic including a required library or binary to run in a container.

3.1.2 container file [ITU-T Y.3535]: The information about a container image for use with a container engine such as the execution commands, resource information, service port, user, the architecture of host machine, its relationship to file system changes in a container image, etc.

3.1.3 endpoint [b-ITU-T J.380.2]: An address, a uniform resource identifier (URI), or a specific location where a logical service function or functions shall be found and consumed via message exchange.

3.1.4 microservice [b-ITU-T J.1301]: An architectural and organizational approach to software development where software is composed of small independent microservices that communicate over well-defined application programming interfaces. Microservice architecture makes applications easier to scale and faster to develop, enabling innovation and accelerating time-to-market for new features.

3.1.5 microservice architecture [b-ITU-T J.1305]: Design approach that divides an application into a set of microservices.

3.1.6 physical machine [b-ITU-T Y.3507]: A type of computing machine providing physical resources.

NOTE – A computing machine provides allocation and scheduling of processing resources. Types of computing machine are physical or virtual [b-ITU-T Y.3510].

3.2 Terms defined in this Recommendation

None.

4 Abbreviations and acronyms

This Recommendation uses the following abbreviations and acronyms:

API	Application Programming Interface
CNE	Container-based Network Entities
CNED	Container-based Network Entities Descriptor
CPCI	Compact Peripheral Component Interconnect
CPU	Central Processing Unit
DPDK	Data Plane Development Kit
eBPF	Extended Berkeley Packet Filter
FPGA	Field-Programmable Gate Array
GPU	Graphics Processing Unit
IOPS	Input/Output Operations Per Second
NGN	Next Generation Network
NGNe	Next Generation Network evolution
NPU	Neural Processing Unit
NUMA	Non-Uniform Memory Access
PFCP	Packet Forwarding Control Protocol

QoS	Quality of Service
SCTP	Stream Control Transmission Protocol
SIP	Session Initiation Protocol
SLA	Service Level Agreement
SR-IOV	Single Root I/O Virtualization
VCN	Virtualization of Control Network Entities
VCNMO	Virtualized Control Network entities Management and Orchestrator
VIM	Virtualized Infrastructure Manager
VM	Virtual Machine

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.

6 Overview of NGNe with CNE

The hardware of telecommunication networks is changing from dedicated compact peripheral component interconnect (CPCI) to general purpose servers, and virtualization technology is being applied to telecommunication networks. Virtualization technology decomposes general computing, storage, network and other hardware devices into a variety of virtual resources. This realizes hardware decoupling and dynamic deployment of network functions.

[ITU-T Y.2320] provides requirements for the virtualization of control network entities (VCN) in next generation network evolution (NGNe), including the requirements of virtual infrastructures, virtualized network entities, and VCN management systems. This Recommendation introduces virtualization technology into next generation networks (NGNs). Based on the requirements, [ITU-T Y.2321] describes the functional architecture, functional entities, reference points and information flow to support the virtualization of the control network entities (VCN) for NGNe. [ITU-T Y.2322] focuses on the functions, functional entities and reference points of virtualized control network entities management and orchestrator (VCNMO) and its subcomponents in the architecture of VCN. This Recommendation defines the functional architecture of VCNMO and specifies the related reference points of VCNMO, which includes the orchestrator, VCN management and virtualized infrastructure manager (VIM) of VCN. And [ITU-T Q.3054] specifies the signalling requirements for interfaces supporting the reference points in the architecture in [ITU-T Y.2321]. [ITU-T Q.3054] defines the protocols used for interfaces and also provides security considerations.

However, achieving genuine network decoupling, customization, and agile delivery of services still remains challenging. They are characterized by the following key issues:

- Extended delivery cycles: the development of virtualized network entities adheres to conventional methodologies. A multitude of functional modules are compacted into a single deployment package, leading to rigid interdependencies and a loss of agility in developing and deploying workflows. Consequently, version releases are delayed, stretching the software delivery cycle to several weeks or even months, thus delaying the fulfilment of customer needs.