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Recommendation

ITU-T Y.3119 (01/2023)

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

Future networks

Future networks including IMT-2020 – Capability classification framework for dedicated networks

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Recommendation ITU-T Y.3119

Future networks including IMT-2020 – Capability classification framework for dedicated networks

Summary

In the context of future networks including IMT-2020, dedicated networks are networks designed for application domains with common requirements. The capabilities of dedicated networks include, but are not limited to, core network, transport network, access network, service support, management, infrastructure, and artificial intelligence (AI)/machine learning (ML) enabling capabilities. To evaluate the capabilities of dedicated networks in a standardized way, there exists the need to introduce capability classification for dedicated networks.

With the understanding that the capability level is the level of availability of capabilities in a network, the capability classification is based on the evaluation of the capability level of the network.

Recommendation ITU-T Y.3119 specifies the methods and framework of capability classification for dedicated networks.

History

Edition	Recommendation	Approval	Study Group	Unique ID*
1.0	ITU-T Y.3119	2023-01-13	13	11.1002/1000/15233

Keywords

Capability classification, capability level, dedicated networks, dimensions, framework, future networks, IMT-2020, requirements.

* To access the Recommendation, type the URL http://handle.itu.int/ in the address field of your web browser, followed by the Recommendation's unique ID. For example, http://handle.itu.int/11.1002/1000/11830-en.

FOREWORD

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1 Scope

Dedicated networks have been defined in [ITU-T Y.3114] as networks designed for application domains with common requirements. The capabilities of dedicated networks include, but are not limited to, core network, transport network, access network, service support, management, infrastructure, and artificial intelligence (AI)/machine learning (ML) enabling capabilities [ITU-T Y.3102].

The capability level is the level of availability of capabilities in a network. The capability classification is based on the evaluation of the capability level of the network.

This Recommendation addresses the capability classification for dedicated networks in the context of future networks including IMT-2020, focusing on the following aspects:

- Approach for capability classification;
- Dimensions for capability classification;
- Requirements for capability classification;
- Functionalities for capability classification;
- Framework for capability classification;
- Procedures of capability classification.

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 M.3010] Recommendation ITU-T M.3010 (2000), *Principles for a telecommunications management network.*

[ITU-T Q.3644] Recommendation ITU-T Q.3644 (2019), *Requirements for signalling network analyses and optimization in VoLTE.*

[ITU-T Q.3646] Recommendation ITU-T Q.3646 (2022), *Framework and protocols for signalling network analysis and optimization in VoLTE.*

[ITU-T Y.3102] Recommendation ITU-T Y.3102 (2018), *Framework of the IMT-2020 network.*

[ITU-T Y.3104] Recommendation ITU-T Y.3104 (2018), *Architecture of the IMT-2020 network.*

[ITU-T Y.3105] Recommendation ITU-T Y.3105 (2018), *Requirements of capability exposure in the IMT-2020 network.*

[ITU-T Y.3108] Recommendation ITU-T Y.3108 (2019), *Capability exposure function in IMT-2020 networks.*

[ITU-T Y.3114] Recommendation ITU-T Y.3114 (2022), *Future networks including IMT-2020: requirements and functional architecture of lightweight core for dedicated networks.*

[ITU-T Y.3172] Recommendation ITU-T Y.3172 (2019), *Architectural framework for machine learning in future networks including IMT-2020.*

[ITU-T Y.3173] Recommendation ITU-T Y.3173 (2020), *Framework for evaluating intelligence levels of future networks including IMT-2020.*

3 Definitions

3.1 Terms defined elsewhere

This Recommendation uses the following terms defined elsewhere:

3.1.1 application domain [b-ITU-T Y.4100]: An area of knowledge or activity applied for one specific economic, commercial, social or administrative scope.

NOTE – Transport application domain, health application domain, and government application domain are examples of application domains.

3.1.2 control plane [b-ITU-T Y.2011]: The set of functions that controls the operation of entities in the stratum or layer under consideration, plus the functions required to support this control.

3.1.3 data plane [b-ITU-T Y.2011]: The set of functions used to transfer data in the stratum or layer under consideration.

3.1.4 dedicated network [ITU-T Y.3114]: A network designed for application domains with common requirements.

3.1.5 IMT-2020 [b-ITU-T Y.3100]: Systems, system components, and related technologies that provide far more enhanced capabilities than those described in [b-ITU-R M.1645].

3.1.6 machine learning (ML) [ITU-T Y.3172]: Processes that enable computational systems to understand data and gain knowledge from it without necessarily being explicitly programmed.

3.1.7 machine learning overlay [ITU-T Y.3172]: A loosely coupled deployment model of machine learning functionalities whose integration and management with network functions are standardised.

NOTE – A machine learning overlay aims to minimise interdependencies between machine learning functionalities and network functions using standard interfaces, allowing for parallel evolution of functionalities of the two.

3.1.8 network function [b-ITU-T Y.3100]: In the context of IMT-2020, a processing function in a network.

3.1.9 network intelligence level [ITU-T Y.3173]: Level of application of automation capabilities including those enabled by the integration of artificial intelligence techniques in the network.

3.1.10 network slice [b-ITU-T Y.3100]: A logical network that provides specific network capabilities and network characteristics.

3.1.11 user plane [b-ITU-T Y.2011]: A synonym for data plane.

3.2 Terms defined in this Recommendation

This Recommendation defines the following terms:

3.2.1 capability classification: The evaluation of the capability level of a network.

3.2.2 capability level: The level of availability of capabilities in a network.

4 Abbreviations and acronyms

This Recommendation uses the following abbreviations and acronyms:

AF Application Function

AI Artificial Intelligence

API Application Programming Interface

FQDN Fully Qualified Domain Name

GBR Guaranteed Bit Rate

HTTP Hypertext Transfer Protocol

IP Internet Protocol

MEC Multi-access Edge Computing

ML Machine Learning

NFV Network Function Virtualization

PDU Protocol Data Unit

QoS Quality of Service

RP Reference Point

SDN Software-Defined Networking

SDTP Shared Data Transfer Protocol

SFTP Secure File Transfer Protocol

TCP Transmission Control Protocol

UE User Equipment

UPF User Plane Function

URL Uniform Resource Locator

XR extended Reality

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 Introduction

With the deployment of IMT-2020 networks, services and applications related to application domains are increasingly needed to be supported. With regard to dedicated networks of IMT-2020 [ITU-T Y.3114], which are networks designed for application domains with common requirements, there exist differences in terms of requirements and capabilities. Currently, some network deployments are adopting the architecture and network functions of IMT-2020 network specified in [ITU-T Y.3102] and [ITU-T Y.3104], while other network deployments may use dedicated network architectures based on customized IMT-2020 network functions. To meet the specific requirements of application domains, the capabilities of these dedicated networks are (at least partially) different, no matter what architecture and network functions are being adopted.

NOTE 1 – Examples of application domains include, but are not limited to, smart city, industry, education, transport, healthcare, agriculture, finance, and media.

In the context of future networks including IMT-2020, to evaluate the capabilities of dedicated networks in a standardized way, there exists the need to introduce a capability classification for dedicated networks. The capability level is the level of availability of capabilities in a network. The capability classification is based on the evaluation of the capability level of the network. The capability levels of a dedicated network are defined by the network operator, and can be shared between different network operators' domains. The capability classification is performed automatically by the capability classification system.

A standard methodology for capability classification has the following significances:

- It provides the evaluation basis for measuring the capabilities of dedicated networks.
- It helps the industry to reach unified understanding of the capabilities of dedicated networks.
- It helps in realizing roaming between different dedicated networks, also facilitating reuse of dedicated networks, in the case that the dedicated networks have the same capability level.
- It provides a reference for vertical users to choose appropriate dedicated networks, which could possibly meet the requirements of application domains.
- It provides a reference for industry supervisors to formulate the development plans and strategies of dedicated networks.
- It provides a reference for service providers to deploy the services and applications in appropriate dedicated networks.
- It provides a reference for network operators to formulate the development plans of dedicated networks and match specific industry users with specific dedicated networks.
- It provides a reference for equipment vendors to formulate the product roadmaps of dedicated networks.

Figure 6-1 depicts the reference model of capability classification for dedicated networks.

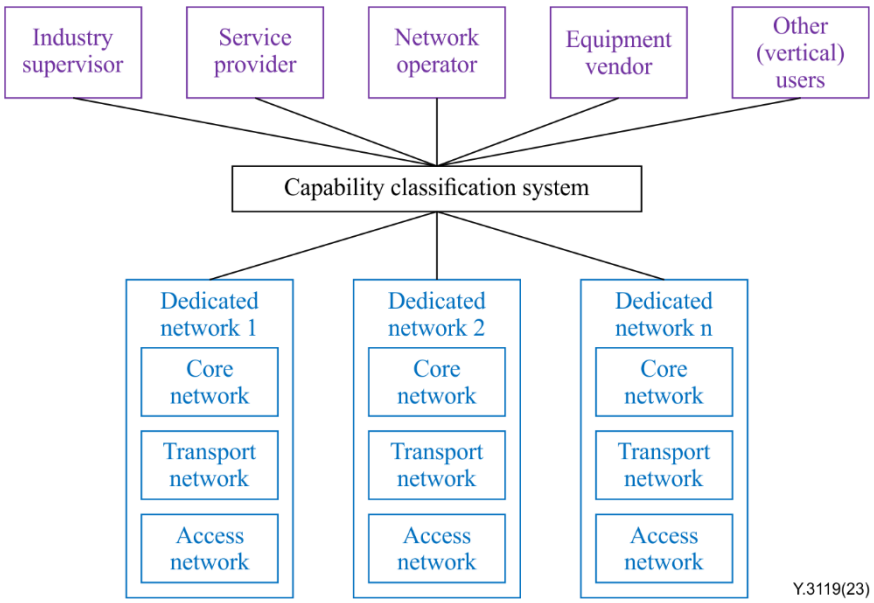

Figure 6-1 – Reference model of capability classification for dedicated networks

In Figure 6-1, the capability classification system collects information from the core network part, transport network part, and access network part of dedicated networks deployed in the network operator's domain; it evaluates the capability level of each dedicated network; it provides the capability levels of dedicated networks to users; and it provides the results to dedicated networks as feedback.

As a specific applicability scenario of this reference model, Figure 6-2 depicts the capability classification for dedicated networks with end user mobility between two network operators' domains with their own capability classification system.

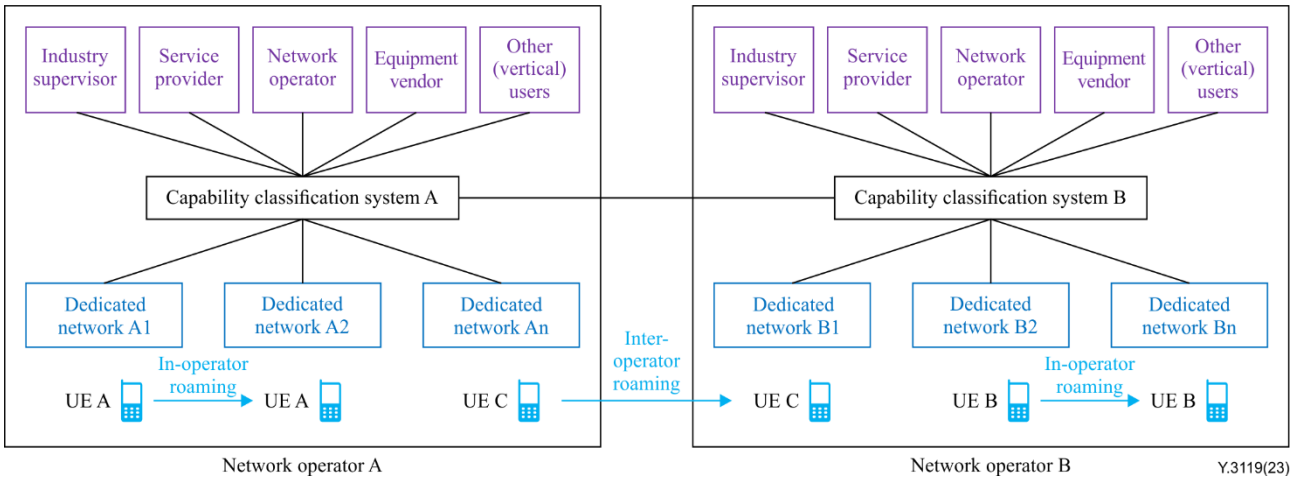

Figure 6-2 – Capability classification for dedicated networks with end user mobility between two network operators' domains

In Figure 6-2, for dedicated networks of the same capability level, it is possible for an end user equipment (UE) to perform in-operator roaming and inter-operator roaming between these dedicated networks with the precondition that roaming policies are in place.

NOTE 2 – For example, if the capability classification system A in network operator A evaluates that dedicated networks A1 and A2 have the same capability level, then UE A may perform in-operator roaming between dedicated networks A1 and A2. The capability classification system A in network operator A and capability classification system B in network operator B evaluate that dedicated networks An and B1 have

the same capability level, then UE C may perform inter-operator roaming between dedicated networks An and B1.

NOTE 3 – It is possible for the capability classification system in one network operator to interact with capability classification systems in other network operators, for sharing the knowledge of capability classification methodology and results.

The proposed capability classification system consists of capability collecting component, capability analysis component, capability evaluation component, and AI/ML support component, which interact with core network, transport network, access network, AI/ML overlay, and capability classification users to perform capability classification. The functionalities for capability classification include capability collecting, capability analysis, capability evaluation and AI/ML support.

NOTE 4 – The capability classification takes a similar approach for evaluating the capability levels to that specified in [ITU-T Y.3173] for network intelligence levels.

In the following clauses, the methodology for capability classification is first specified, then the architectural framework for capability classification is proposed, finally the procedures are described enabling the capability classification process.

7 Capability classification methods for dedicated networks

7.1 Approach for capability classification

The approach for capability classification for dedicated networks in the context of future networks including IMT-2020 is as follows:

- Determining the dimensions for a dedicated network, taking into account the capabilities of core network, transport network, and access network of dedicated networks. This is customized by the network operator.
- Determining the capability level of each dimension and the overall capability level for a dedicated network. This is customized by the network operator.
- Collecting the capability related information from a dedicated network. This can be shared between different network operators.
- Analysing the capabilities of all dimensions of a dedicated network. This can be shared between different network operators.
- Evaluating the capability levels of a dedicated network. This can be shared between different network operators.
- Providing the capability levels of a dedicated network to users and feeding back to the dedicated network. This is customized by the network operator.

7.2 Dimensions for capability classification

The dimensions for capability classification for dedicated networks in the context of future networks including IMT-2020 include, but are not limited to, the following examples [ITU-T Y.3102] [ITU-T Y.3104] [ITU-T Y.3105] [ITU-T Y.3108] [ITU-T Y.3114] [ITU-T Y.3172] [ITU-T Y.3173] [ITU-T M.3010]:

- Core network control plane

This dimension is related to the core network control plane capabilities, including, but not being limited to, mobility management capability, session management capability, connection management capability, subscription management capability, authentication and authorization capability, policy control capability, capability exposure capability, network slicing capability, and multi-access edge computing (MEC) capability.

- Core network user plane

This dimension is related to the core network user plane capabilities, including, but not being limited to, traffic routing and forwarding capability, traffic filtering capability, protocol data unit (PDU) session tunnel management capability, quality of service (QoS) enforcement capability, service identification capability, local traffic off-load capability, local fully qualified domain name (FQDN)/uniform resource locator (URL) resolution capability, and MEC capability.

- Transport network

This dimension is related to the transport network capabilities, including, but not being limited to, fronthaul network capability, backhaul network capability, and synchronization network capability.

- Access network

This dimension is related to the access network capabilities, including, but not being limited to, fixed access capability, mobile access capability, and satellite access capability.

- Service support

This dimension is related to the service support capabilities, including, but not being limited to, support of communications services, support of third party applications, and QoS support capability.

- Management

This dimension is related to the management capabilities, including, but not being limited to, performance management capability, fault management capability, configuration management capability, accounting management capability, security management capability, and network data analytics capability.

- Infrastructure

This dimension is related to the infrastructure capabilities, including, but not being limited to, support of cloud based architecture, support of network function virtualization (NFV) capability, support of software defined networking (SDN) capability, computing capability, storage capability, and networking capability.

- AI/ML enabling

This dimension is related to the AI/ML enabling capabilities, including, but not being limited to, intelligent networking capability, intelligent service capability, and intelligent management capability.

7.3 Requirements for capability classification

The requirements for capability classification to support dedicated networks for application domains in the context of future networks including IMT-2020 are as follows:

- It is required for capability classification to support different types of dedicated networks.

  NOTE 1 – The dedicated networks may adopt the architecture and network functions of IMT-2020 network specified in [ITU-T Y.3102] and [ITU-T Y.3104], or use dedicated network architectures based on customized IMT-2020 network functions.

- It is required to collect capability related information from core network, transport network, and access network of a dedicated network in the process of capability collecting for subsequent capability analysis.
- It is required that the collected capability related information be customizable, based on the requirements of capability classification users.

- It is required to use the collected capability related information to calculate the quotas of all dimensions of a dedicated network in the process of capability analysis for subsequent capability evaluation.

  NOTE 2 – [ITU-T Q.3644] provides examples of calculation of quotas.
- It is required to use the calculated quotas to evaluate the capability level of each dimension and the overall capability level of a dedicated network in the process of capability evaluation.
- It is required for capability classification to adopt extensible architecture to meet the emerging requirements of capability classification users, and adapt to the evolution of dedicated networks.
- It is required for capability classification to have no impact on the functions of dedicated networks.
- It is required for capability classification to minimize the impact on the performance of dedicated networks.
- It is required to support the high-level architectural requirements specified in [ITU-T Y.3172].
- It is recommended for capability classification to adopt user-friendly interface and protocol to capability classification users, such as application programming interface (API) or graphical interface, which adopts the protocol stack of hypertext transfer protocol (HTTP) [b-IETF RFC 7540]/transmission control protocol (TCP)/Internet protocol (IP).
- It is recommended for capability classification to support both manual operation and automatic operation in the processes of capability collecting, capability analysis, and capability evaluation.
- It is recommended for capability classification to use AI/ML support functionalities provided externally as an AI/ML overlay in the processes of capability collecting, capability analysis, and capability evaluation.

7.4 Functionalities for capability classification

The functionalities for capability classification for dedicated networks in the context of future networks including IMT-2020 are as follows:

- Capability collecting functionalities

Capability collecting functionalities aim to collect capability related information from core network, transport network, and access network of a dedicated network for subsequent capability analysis.

NOTE 1 – The protocols for capability collecting can be shared data transfer protocol (SDTP), secure file transfer protocol (SFTP), or other trustable protocols, which are required to ensure the data integrity and security of raw data collection. These protocols are also used in signalling network analysis as specified in [ITU-T Q.3646].

- Capability analysis functionalities

Capability analysis functionalities aim to use the collected capability related information to calculate the quotas of all dimensions of a dedicated network for subsequent capability evaluation.

NOTE 2 – The dimensions for capability analysis can be customizable, based on the requirements of capability classification users.

- Capability evaluation functionalities

Capability evaluation functionalities aim to use the calculated quotas to evaluate the capability level of each dimension and the overall capability level, as the results of capability classification which can be provided to capability classification users and dedicated networks.

NOTE 3 – The dimensional and overall capability levels can be customizable, based on the requirements of capability classification users.

NOTE 4 – The evaluation of the capability level of AI/ML enabling capabilities conforms to the evaluation of the network intelligence level specified in [ITU-T Y.3173].

- AI/ML support functionalities

AI/ML support functionalities aim to use external AI/ML enabling capabilities to facilitate the processes of capability collecting, capability analysis, and capability evaluation.

8 Capability classification framework for dedicated networks

8.1 Architectural framework for capability classification

Figure 8-1 depicts the architectural framework for capability classification for dedicated networks, in the context of future networks including IMT-2020.

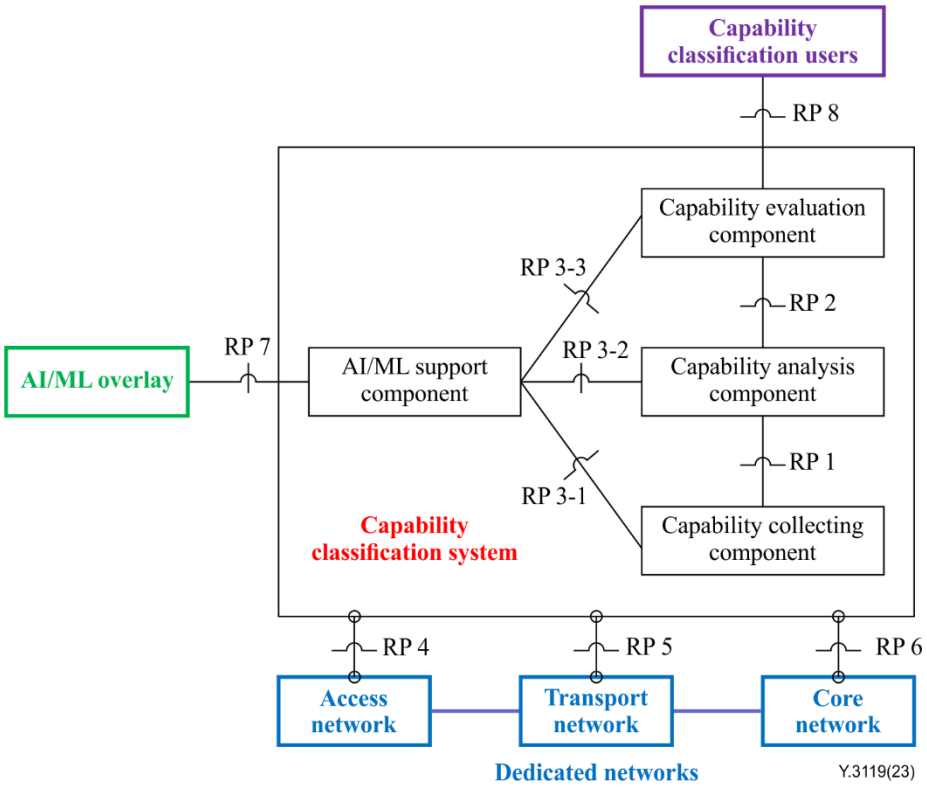

Figure 8-1 – Architectural framework for capability classification for dedicated networks

In the architectural framework, the capability classification system collects capability related information from core network, transport network, and access network of a dedicated network; it evaluates the capability level of this dedicated network by using the capability classification method; it provides the capability classification results to capability classification users; and it provides the results to this dedicated network as feedback.

The capability classification system consists of capability collecting component, capability analysis component, capability evaluation component, and AI/ML support component. The AI/ML support component is optional, while the other three components are required.

The capability classification system has the required reference points (RPs) RP 4, RP 5, RP 6, and RP 8 to access network, transport network, core network, and capability classification users respectively; also has the optional reference point RP 7 to the AI/ML overlay. With reference points RP 4, RP 5, and RP 6, the capability classification system not only collects capability related

information from a dedicated network, but also provides the results to this dedicated network as feedback; SDTP, SFTP, or other trustable protocols can be used in RP 4, RP 5, and RP 6 for collecting capability related information and providing feedback. With reference point RP 8, the capability classification system provides the capability classification results (including the capability level of each dimension and the overall capability level) to capability classification users; user-friendly interfaces and protocols, such as APIs or graphical interfaces adopting the protocol stack of HTTP/TCP/IP, can be used in RP 8. With reference point RP 7, the capability classification system utilizes the AI/ML capabilities of the AI/ML overlay.

NOTE – The AI/ML overlay is an optional external system which provides AI/ML capabilities to the capability classification system; it may adopt the framework of the high-level architecture specified in [ITU-T Y.3172].

8.2 System of capability classification

The capability classification system for dedicated networks of future networks including IMT-2020 consists of four components, which are as follows:

- Capability collecting component

The capability collecting component is a required component that collects capability related information from core network, transport network, and access network of a dedicated network. The reference points RP 4, RP 5, and RP 6 are used by the capability collecting component for capability collecting. The reference point RP 3-1 is used by the capability collecting component for utilizing the AI/ML capabilities.

- Capability analysis component

The capability analysis component is a required component that uses the collected capability related information to calculate the quotas of all dimensions of a dedicated network. The reference point RP 1 is used by the capability analysis component for obtaining the collected capability related information. The reference point RP 3-2 is used by the capability analysis component for utilizing the AI/ML capabilities.

- Capability evaluation component

The capability evaluation component is a required component that uses the calculated quotas to evaluate the capability level of each dimension and the overall capability level of a dedicated network. The reference point RP 2 is used by the capability evaluation component for obtaining the calculated quotas. The reference point RP 3-3 is used by the capability evaluation component for utilizing the AI/ML capabilities. The reference point RP 8 is used by the capability evaluation component for providing the capability classification results to capability classification users. The reference points RP 4, RP 5, and RP 6 are used by the capability evaluation component for feeding back the results to the dedicated network.

- AI/ML support component

The AI/ML support component is an optional component that uses AI/ML support functionalities provided externally as an AI/ML overlay in the processes of capability collecting, capability analysis, and capability evaluation.

8.3 Procedures of capability classification

Figure 8-2 depicts the procedures of capability classification for dedicated networks of future networks including IMT-2020.

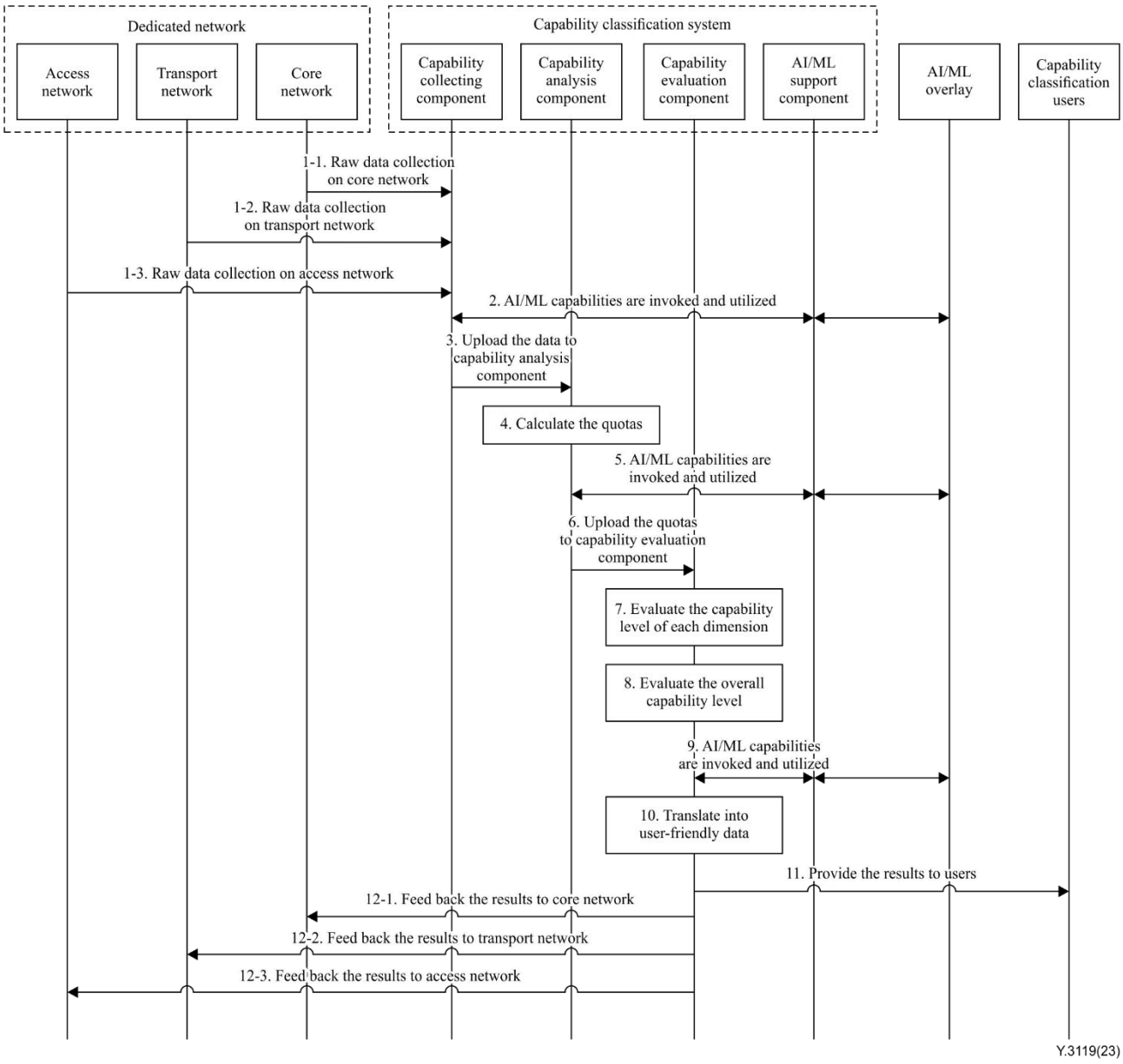

Figure 8-2 – Procedures of capability classification for dedicated networks

The steps shown in Figure 8-2 are as follows:

- Steps 1 and 2: procedures of capability collecting

1-1) The raw data collection on network entities of the core network of the dedicated network is performed on RP 6.

1-2) The raw data collection on network entities of the transport network of the dedicated network is performed on RP 5.

1-3) The raw data collection on network entities of the access network of the dedicated network is performed on RP 4.

2) The AI/ML capabilities are invoked and utilized in the processes of capability collecting with the support of the AI/ML support component by using RP 7 and RP 3-1.

- Steps 3, 4, 5 and 6: procedures of capability analysis

3) The data of the dedicated network generated by the capability collecting component is uploaded to the capability analysis component by using RP 1.

4) The capability analysis component performs analysis on the collected capability related information and calculates the quotas of the dedicated network.

5) The AI/ML capabilities are invoked and utilized in the processes of capability analysis with the support of the AI/ML support component by using RP 7 and RP 3-2.

6) The quotas of the dedicated network generated by the capability analysis component are uploaded to the capability evaluation component by using RP 2.

- Steps 7, 8 and 9: procedures of capability evaluation

7) The capability evaluation component uses the calculated quotas to evaluate the capability level of each dimension of the dedicated network.

8) The capability evaluation component evaluates the overall capability level of the dedicated network.

9) The AI/ML capabilities are invoked and utilized in the processes of capability evaluation with the support of the AI/ML support component by using RP 7 and RP 3-3.

- Steps 10, 11 and 12: procedures of capability classification result provision

10) The capability classification results are translated into user-friendly data including the information required by a specific capability classification user.

11) The capability evaluation component provides the capability classification results to capability classification users by using RP 8.

12-1) The capability evaluation component feeds back the capability classification results to the core network of the dedicated network by using RP 6.

12-2) The capability evaluation component feeds back the capability classification results to the transport network of the dedicated network by using RP 5.

12-3) The capability evaluation component feeds back the capability classification results to the access network of the dedicated network by using RP 4.

9 Security considerations

The security and privacy considerations of capability classification include the following aspects:

- Dedicated network security, which includes the security considerations on the core network, transport network, and access network of a dedicated network.
- Capability classification system security, which includes the security considerations on the capability collecting component, capability analysis component, capability evaluation component, and AI/ML support component. In the capability classification system, the secure operations of the components and the information exchange between the components are to be addressed.
- User privacy, which includes the privacy considerations on the capability collecting component, capability analysis component, and capability evaluation component, which could store, cache and process privacy sensitive user data and network data. The transmission of privacy sensitive data inside and outside of the capability classification system is subject to authentication, authorization and privacy management.

In addition, the security and privacy considerations of capability classification should be aligned with the requirements specified in [b-ITU-T Y.3101] and [b-ITU-T Y.2701].

Appendix I

Use case of capability classification for dedicated networks

(This appendix does not form an integral part of this Recommendation.)

Use case: Matching of user to dedicated network with capability classification

A large-scale network operator has deployed several dedicated networks, the capabilities of these dedicated networks are different in the aspects of core network control plane, core network user plane, transport network, access network, service, management, infrastructure, and AI/ML. However, the network operator has several users who have different requirements for the capabilities, resources, and services of dedicated networks. The network operator needs to match a specific user with an appropriate dedicated network: in this way, the different requirements of users may be satisfied, and the capabilities, resources, and services of dedicated networks may be utilized with high efficiency.

The network operator may use the capability classification methods, framework and procedures proposed in this Recommendation to evaluate the capability level for each dedicated network, and provide the capability levels of these dedicated networks to users. The capability levels for dedicated networks are defined by the network operator, ranging from level 0 to level 4 (as shown in Table A.1). It is expected that the capability level of a dedicated network may impact on the service price. The user may choose the best-suited dedicated network based on the capability level and corresponding service price. With the support of capability classification, the choice of dedicated network can be made easier for users.

Table A.1 presents an example of matching of users to dedicated networks with capability classification.

Table A.1 – Example of matching of user to dedicated network with capability classification

Overall capability level of dedicated network	Users of dedicated network	Requirements of dedicated network
Level 0 IMT-2020 network for all users	Internet application. An Internet application may provide video service and extended reality (XR) service to users.	The requirements of the network include maximum connectivity and best-effort QoS. The application function (AF) of Internet application could be deployed in IMT-2020 network for all users. Dedicated network is not needed.
Level 1 Basic IMT-2020 dedicated network	Educational institution. An educational institution may provide online course service and online experiment service to staff and students in the campus.	The requirements of the network include physical/logical isolation from public network and best-effort QoS. The AF of educational institution could be deployed in the basic IMT-2020 dedicated network.

Table A.1 – Example of matching of user to dedicated network with capability classification

Level 2 IMT-2020 dedicated network with network slicing capabilities	Power grid. A power grid covers a large-scale area. It may provide site monitoring service and differential protection service to staff and equipment in the power grid.	The requirements of the network include end-to-end resource allocation and tracking, and guaranteed bit rate (GBR) QoS. The AF of the power grid could be deployed in IMT-2020 dedicated network with network slicing capabilities. An independent network slice could be allocated to the AF.
Level 3 IMT-2020 dedicated network with dedicated user plane function (UPF) and MEC platform	Port. A port covers a small-scale area. It may provide container packing service and shipping service to staff and equipment in the port.	The requirements of the network include local data processing, low latency, and GBR QoS. The AF of port could be deployed in IMT-2020 dedicated network with dedicated UPF and MEC platform.
Level 4 IMT-2020 dedicated network with dedicated radio equipment and customized network functions	Mining. A mine covers a small-scale area deep underground. It may provide unmanned truck service and unmanned mining service to staff and equipment in the mine.	The requirements of the network include dedicated base stations and on-demand core network functions for specialized communications. The AF of mining could be deployed in IMT-2020 dedicated network with dedicated radio equipment and customized network functions.

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