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Abstract: This is the baseline text for new work item Q.SPAN "Signalling and protocol for Autonomous networks for IMT-2020 networks and beyond", developed at Q6/11 meeting (Geneva,3-11 March 2026).

This document is the initial output of draft new Recommendation ITU-T Q.SPAN "Signalling and protocol for Autonomous networks for IMT-2020 networks and beyond" in Q6/11 meeting (3-11 March 2026).

This document is based on this meeting's discussion and results on the following contribution:

No.	Title	Source	Discussion
SG11-C382	Proposal to start a new work item – ITU-T Q.SPAN "Signalling and protocol for	China Mobile Communications Co. Ltd., China Academy of	Accepted with modifications

	Autonomous networks for IMT-2020 networks and beyond”	Information and Communications Technology, China Telecom, China Unicom	

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Draft Recommendation ITU-T Q.SPAN

Signalling and protocol for autonomous networks for IMT-2020 networks and beyond

1. Scope

This draft new Recommendation is aiming to specify interfaces, signalling flow and message format of network autonomous management, dynamic deployment, dynamic adjustment, evaluation and optimization of network performance of autonomous networks in IMT-2020 network and beyond. The following aspect is addressed in this Recommendation:

- Overview;
- Signalling flow of autonomous networks in IMT-2020 network and beyond;
- Message format of autonomous networks in IMT-2020 network and beyond.

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.

[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.3061] Recommendation ITU-T Y.3061 (2023), *"Autonomous networks – Architecture framework"*

[ITU-T Y.3062] Recommendation ITU-T Y.3062 (2025), *" Trustworthiness evaluation for IMT-2020 and beyond with autonomous network functions "*

[ITU-T Y.3064] Recommendation ITU-T Y.3064 (2025), *"Autonomous networks – Knowledge management"*

[ITU-T Y.3144] Recommendation ITU-T Y.3144 (2024), *Future networks including IMT-2020 – Requirements and functional architecture of distributed core network*

3. Definitions

3.1. Terms defined elsewhere

This Recommendation uses the following terms defined elsewhere:

3.1.1 autonomy engine [ITU-T Y.3061]: An environment in which new controllers are autonomously generated and validated.

3.1.2 autonumous network[ITU-T Y.3064]: A network system characterized by its abilities of continuous exploratory evolution-driven creation, validation and application of controllers, enabling autonomy of the network and the services it provides.

NOTE 1 – An AN possesses self-* properties, such as self-establishment, self-optimization, self-healing and self-configuration capabilities.

NOTE 2 – An AN can realize exploratory evolution, real-time responsive online experimentation and dynamic adaptation by the use of corresponding controllers and knowledge [ITU-T Y.3061].

3.1.3 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.

3.1.4 controller [ITU-T Y.3061]: A workflow, open loop or closed loop of a system under control in an autonomous network, composed of modules, integrated in a specific sequence, using interfaces exposed by the modules, to solve a specific problem or satisfy a given requirement.

NOTE 1 – Modules composing the controller may be workflows, open loops, or closed loops.

NOTE 2 – Modules can be developed independently of the system under control before being integrated into it.

NOTE 3 – Examples of system under control are managed entities, workflows or processes in an IMT-2020 network.

NOTE 4 – Exploratory evolution and real-time responsive online experimentation are examples of processes independent of the development of modules.

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

3.1.6 distributed core network [ITU-T Y.3144]: A core network for future networks including IMT-2020, which builds on network functional units collaborating in a distributed manner to provide the network functions of control plane, user plane, and data plane, in which the network functional unit is a core network software unit consisting of atomic network functionalities on the basis of IMT-2020 core network functions.

3.1.7 energy efficiency (EE) [b-ITU-T L.1330]: The relation between the useful output and energy/power consumption.

3.1.8 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].

NOTE – [b-ITU-R M.1645] defines the framework and overall objectives of the future development of IMT-2000 and systems beyond IMT-2000 for the radio access network.

3.1.9 knowledge [b-ETSI GS ENI 005]: Analysis of data and information, resulting in an understanding of what the data and information mean.

NOTE – Knowledge represents a set of patterns that are used to explain, as well as predict, what has happened, is happening, or is possible to happen in the future; it is based on acquisition of data, information, and skills through experience and education.

3.1.10 knowledge base [ITU-T Y.3061]: An environment that manages storage, querying, export, import, optimization and update of knowledge.

3.1.11 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.

NOTE 1 – This definition is adapted from [b-ETSI GR ENI 004].

NOTE 2 – Supervised machine learning and unsupervised machine learning are two examples of machine learning types.

3.1.12 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 the parallel evolution of functionalities of the two.

3.1.13 management plane [b-ITU-T Y.2011]: The set of functions used to manage entities in the stratum or layer under consideration, plus the functions required to support this management.

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

3.1.15 quality of service (QoS) [b-ITU-T Q.1743]: The collective effect of service performances, which determine the degree of satisfaction of a user of a service. It is characterized by the combined aspects of performance factors applicable to all services, such as:

– service operability performance;

– service accessibility performance;

– service retainability performance;

– service integrity performance; and

– other factors specific to each service.

3.1.16 service continuity [b-ITU-T Y.3204]: The ability for a moving object to maintain ongoing service, including maintaining current states such as the user network environment and session.

3.1.17 service level agreement (SLA) [b-ITU-T Y.3106]: A formal agreement between two or more entities reached after a negotiating activity with the scope to assess service characteristics, responsibilities and priorities of every part. A SLA may include statements about performance, billing, service delivery but also legal and economic issues.

3.1.18 third party (3rd party) [b-ITU-T Y.3100]: In the context of IMT-2020, with respect to a given network operator and network end-users, an entity which consumes network capabilities and/or provides applications and/or services.

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

3.1.20 workflow [ITU-T Y.3061]: Sequence of activities to describe or realize a given task executed by a system.

3.2. Terms defined in this Recommendation

This Recommendation defines the following terms:

4. Abbreviations and acronyms

This Recommendation uses the following abbreviations and acronyms:

AF	Application Function
AI	Artificial Intelligence
AN	Autonomous Network
API	Application Programming Interface
CEF	Capability Exposure Function
CNC	Coordination of Networking and Computing
EE	Energy Efficiency
E2E	End-to-End
KB	Knowledge Base
KPI	Key Performance Indicator

ML	Machine Learning
NACF	Network Access Control Function
NF	Network Function
NFR	Network Function Registry function
NSSF	Network Slice Selection Function
O&M	Orchestration and Management
QoS	Quality of Service
PCF	Policy Control Function
SBI	Service Based Interface
SLA	Service Level Agreement
SMF	Session Management Function
UE	User Equipment
UPF	User Plane Function
USM	Unified Subscription Management function

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. Overview

[Editor's Note] This clause presents the overview of autonomous network interface architecture and other related information in IMT-2020 network and beyond.

The autonomous network is a self-operating network system with autonomy capabilities, applied in areas of network planning, network deployment, network operation, network optimization, network service provisioning and assurance, etc.

Figure 6-1 depicts the high-level architecture framework for autonomous networks [ITU-T Y.3061]. The goal of this architecture is to support continuous evolution-driven creation, validation and application of a set of controllers to a network and its services to render them autonomous. As shown in Figure 6-1, the high-level architecture framework for autonomous networks consists of the autonomy engine, the dynamic adaptation subsystem, the knowledge base subsystem, the autonomous network orchestrator, the underlay network, and the E2E network orchestrator. In which, the autonomy engine embodies the key concepts of exploratory evolution and online experimentation and is responsible for the creation and validation of controllers; the dynamic adaptation subsystem embodies the key concept of dynamic adaptation and is responsible for

equipping the underlay network with autonomy via controllers; the knowledge base subsystem manages the lifecycle and optimization of knowledge; the autonomous network orchestrator is responsible for managing the workflows and processes in the autonomous network, as well as the steps in the lifecycle of controllers; the underlay network is a telecommunication network with its network functions; the E2E network orchestrator is responsible for managing and orchestrating control entities within the autonomous network, including the underlay.

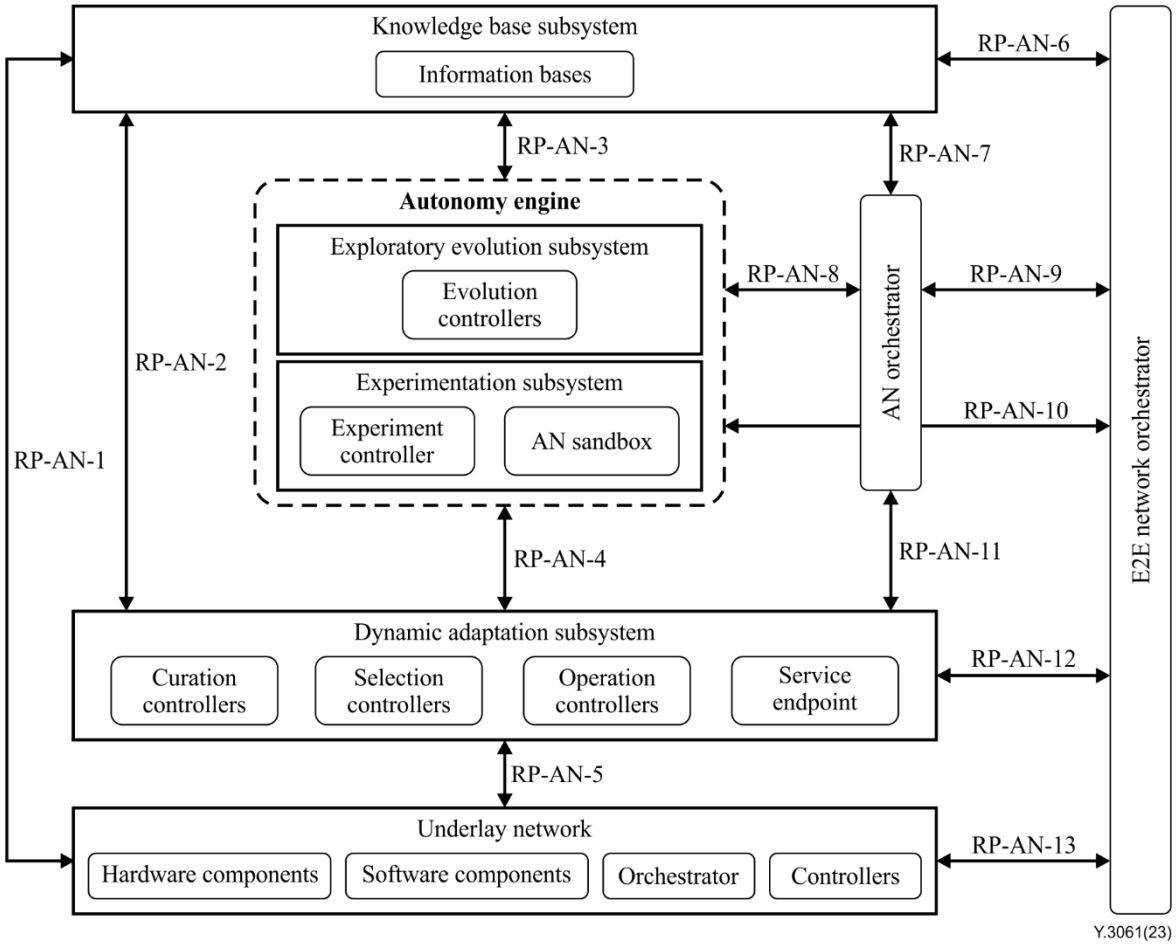

Figure 6-1 – High-level architecture framework for autonomous networks [ITU-T Y.3061]

With the introduction of artificial intelligence (AI) / machine learning (ML) related capabilities, the IMT-2020 network is able to support the applications of autonomous behaviors. In IMT-2020 network, could use autonomous network to enhance network dynamic deployment, dynamic adjustment, evaluation and optimization of network performance, capabilities enhanced for network reliability and network robustness, efficient service provision in IMT-2020 network and beyond.

7. Signalling flow

[Editor's Note] This clause specifies procedure of network dynamic deployment, dynamic adjustment, evaluation and optimization of network performance in IMT-2020 network and beyond.

7.1. Network management initiate a subnetwork

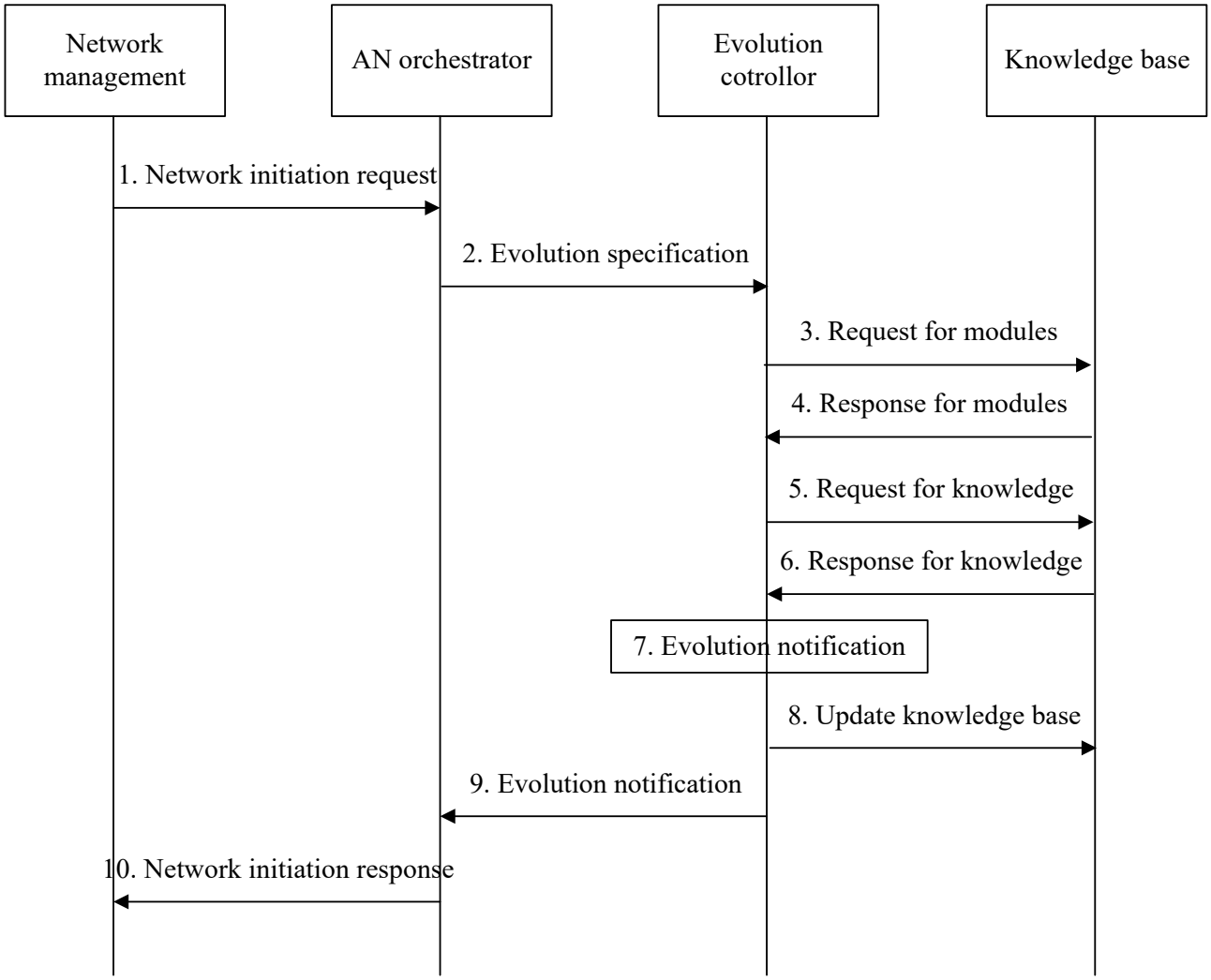

Figure 7-1 – Signalling flow of a subnetwork initiation

1. The network management provides a network initiation request to AN orchestrator, including NF, relationships, topology and other information.

2. AN orchestrator derives an evolution specification from that network initiation request. The evolution specification has a controller specification with the metadata corresponding to the necessary functionality of the controller and a utility function to be achieved (after the exploratory evolution process).

3. The evolution controller queries the KB for modules corresponding to the controller specification.

4. The KB replies to the evolution controller with the available modules corresponding to the request.

5. [Optional] where the evolution controller requests knowledge from the KB relevant to the use case specification or the exploratory evolution process.

6. Corresponding to the optional step 5, the KB Base responds with the knowledge requested.

7. The evolution controller applies the exploratory evolution process to create new controller(s).

8. The evolution controller updates the KB. This includes storing the generated controllers in the KB.

9. Evolution controller send evolution notifications to AN orchestrator.

10. AN orchestrator sends network initiation response to network management.

7.2. Network autonomous adjustment

[Editor's Note] This clause specifies signalling flow of network autonomous adjustment in IMT-2020 network and beyond.

7.3. Network autonomous evaluation and optimization

[Editor's Note] This clause specifies signalling flow of network autonomous evaluation and optimization in IMT-2020 network and beyond.

8. Message Format

[Editor's Note] This clause specifies message format of network dynamic deployment, dynamic adjustment, evaluation and optimization of network performance in IMT-2020 network and beyond.

8.1. Subnetwork initiation

This message is sent to AN orchestrator to request for subnetwork initiation:

Table 8-1 Subnetwork_Initiation_Request

Information element	Status	Data type	Cardinality	Description
Network instance	M	string	1	Identity which network instance
Network function information	M	string	1..N	Identity which network function that subnetwork is requires for.
Network KPI	M	string	1..N	Indicate KPI information of subnetwork.
Serving area	M	string	1..N	Indicate serving area of subnetwork.

Table 8-2 describes the details information of Subnetwork_initiation_Response:

Table 8-2 Subnetwork_Initiation_Response

Information element	Status	Data type	Cardinality	Code value	Description
Result	M	num	1	201 400 500	Indicates the success or failure of the subnetwork initiation request. 201 Created 400 Input Parameter Error 500 Server Internal Error
Network instance	M	string	1	N/A	Identity which network instance.

8.2. Network autonomous adjustment

[Editor's Note] This clause specifies message format of network autonomous adjustment in IMT-2020 network and beyond.

8.3. Network autonomous evaluation and optimization

[Editor's Note] This clause specifies message format of network autonomous evaluation and optimization in IMT-2020 network and beyond.

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