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SERIES Y: GLOBAL INFORMATION INFRASTRUCTURE, INTERNET PROTOCOL ASPECTS, NEXT-GENERATION NETWORKS, INTERNET OF THINGS AND SMART CITIES

Future networks

# IMT-2020 fixed mobile convergence functional requirements for management and orchestration

Recommendation ITU-T Y.3134

International Telecommunication Union

ITU-T Y-SERIES RECOMMENDATIONS

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# Recommendation ITU-T Y.3134

## IMT-2020 fixed mobile convergence functional requirements for management and orchestration


### Summary

Recommendation ITU-T Y.3134 provides specification about IMT-2020 fix mobile convergence (FMC) functional requirements for management and orchestration in order to realize unified network management and resource orchestration functions in the IMT-2020 FMC context. The functional requirements include general aspect, resource aspect, service aspect, user aspect and performance aspect of IMT-2020 FMC functional requirements for management and orchestration. The afore-mentioned functional requirements are beneficial to network operators and service providers to design, deploy and operate network in the IMT-2020 FMC context.



### History

| Edition | Recommendation | Approval | Study Group | Unique ID* |
|---|---|---|---|---|
| 1.0 | ITU-T Y.3134 | 2020-09-29 | 13 | 11.1002/1000/14397 |

### Keywords

FMC, functional requirement, IMT-2020, management, orchestration.


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As of the date of approval of this Recommendation, ITU had not received notice of intellectual property, protected by patents, which may be required to implement this Recommendation. However, implementers are cautioned that this may not represent the latest information and are therefore strongly urged to consult the TSB patent database at http://www.itu.int/ITU-T/ipr/.

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# IMT-2020 fixed mobile convergence functional requirements for management and orchestration

## 1 Scope

This Recommendation specifies IMT-2020 FMC functional requirements for management and orchestration (MO). The scope of this Recommendation includes the following aspects of IMT-2020 FMC functional requirements for management and orchestration:

– general aspect,

– resource aspect,

– service aspect,

– user aspect,

– performance aspect.

## 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.1762] Recommendation ITU-T Q.1762/Y.2802 (2007), *Fixed-mobile convergence general requirements.*

[ITU-T Y.2091] Recommendation ITU-T Y.2091 (2011), *Terms and definitions for next generation networks.*

[ITU-T Y.3100] Recommendation ITU-T Y.3100 (2017), *Terms and definitions for IMT-2020 network.*

[ITU-T Y.3101] Recommendation ITU-T Y.3101 (2018), *Requirements of the IMT-2020 network.*

[ITU-T Y.3110] Recommendation ITU-T Y.3110 (2017), *IMT-2020 network management and orchestration requirements.*

[ITU-T Y.3111] Recommendation ITU-T Y.3111 (2017), *IMT-2020 network management and orchestration framework.*

[ITU-T Y.3130] Recommendation ITU-T Y.3130 (2018), *Requirements of IMT-2020 fixed mobile convergence.*

[ITU-T Y.3131] Recommendation ITU-T Y.3131 (2019), *Functional Architecture for supporting fixed mobile convergence in IMT-2020 networks.*

## 3 Definitions

### 3.1 Terms defined elsewhere

This Recommendation uses the following terms defined elsewhere:

**3.1.1 fixed mobile convergence** [ITU-T Q.1762]: In a given network configuration, the capabilities that provide services and application to the end user defined in [ITU-T Y.2091] regardless of the fixed or mobile access technologies being used and independent of the user's location. In the 5G environment, it means to provide 5G services to end users regardless of the fixed or mobile access technologies being used.

**3.1.2 fixed network** [ITU-T Q.1762]: A network that provides wire-based (e.g., copper, fibre) or wireless access to its services. The fixed network may support nomadism, but does not support mobility.

**3.1.3 management** [ITU-T Y.3100]: In the context of IMT-2020, the processes aiming at fulfilment, assurance, and billing of services, network functions, and resources in both physical and virtual infrastructure including compute, storage, and network resources.

**3.1.4 mobile network** [ITU-T Q.1762]: A network that provides wireless access to its services and supports mobility.

**3.1.5 orchestration** [ITU-T Y.3100]: In the context of IMT-2020, the processes aiming at the automated arrangement, coordination, instantiation and use of network functions and resources for both physical and virtual infrastructure by optimization criteria.

### 3.2 Terms defined in this Recommendation

None.

## 4 Abbreviations and acronyms

This Recommendation uses the following abbreviations and acronyms:

| | |
|---|---|
| AI | Artificial Intelligence |
| API | Application Programming Interface |
| BSS | Business Support System |
| CP | Control Plane |
| FMC | Fix Mobile Convergence |
| GBR | Guaranteed Bit Rate |
| IMT | International Mobile Telecommunications |
| LAN | Local Area Network |
| LTE | Long Term Evolution |
| ML | Machine Learning |
| MO | Management and Orchestration |
| MP | Management Plane |
| NFV | Network Function Virtualization |
| OSS | Operation Support System |
| QoE | Quality of Experience |
| QoS | Quality of Service |
| UNIC | Unified Network Integrated Cloud |
| UP | User Plane |
| VNF | Virtual Network Function |
| WLAN | Wireless LAN |

## 5 Conventions

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

In this Recommendation, the words shall, should, and may sometimes appear, in which case they are to be interpreted, respectively, as is required to, is recommended, and can optionally. The appearance of such phrases or keywords in an appendix or in material explicitly marked as informative are to be interpreted as having no normative intent.

## 6 Functional architecture for FMC in IMT-2020

### 6.1 Cloud-based functional architecture for FMC in IMT-2020

[ITU-T Y.3131] provides a cloud-based fixed mobile convergence (FMC) architecture in IMT-2020 networks (see Figures 1 and 3 of [ITU-T Y.3131]) called 'unified network integrated cloud' (UNIC), which can also be seen in Figure 6-1. In Figure 6-1, it can be observed that the core function of the architecture is divided into control plane (CP) and user plane (UP), which are UNIC-CP and UNIC-UP in this architecture. UNIC-CP takes most of the control logics, while UNIC-UP mainly provides packets switching under instruction of UNIC-CP. The ‘converged user data' is the central data repository in this architecture, in which most of the permanent and temporary data is stored. The 'service chain' is a supplementary to the UNIC-UP which provides user plane enhancement features.

Besides, for the network operation plane, which can be seen in the left part of the figure, management and orchestration (MO) capability should adapt to the convergence independently in the control plane and the user plane, to provide a converged operation capability for the cloud based infrastructure of FMC network.

There are several interfaces designed in UNIC functional architecture, and the interfaces are listed as follows:

– Umo: the interface between management&orchestration and UNIC-CP.

– Ud: the interface between UNIC-CP and 'converged user data'.

– Uc: the interface between UNIC-CP and UNIC-UP.

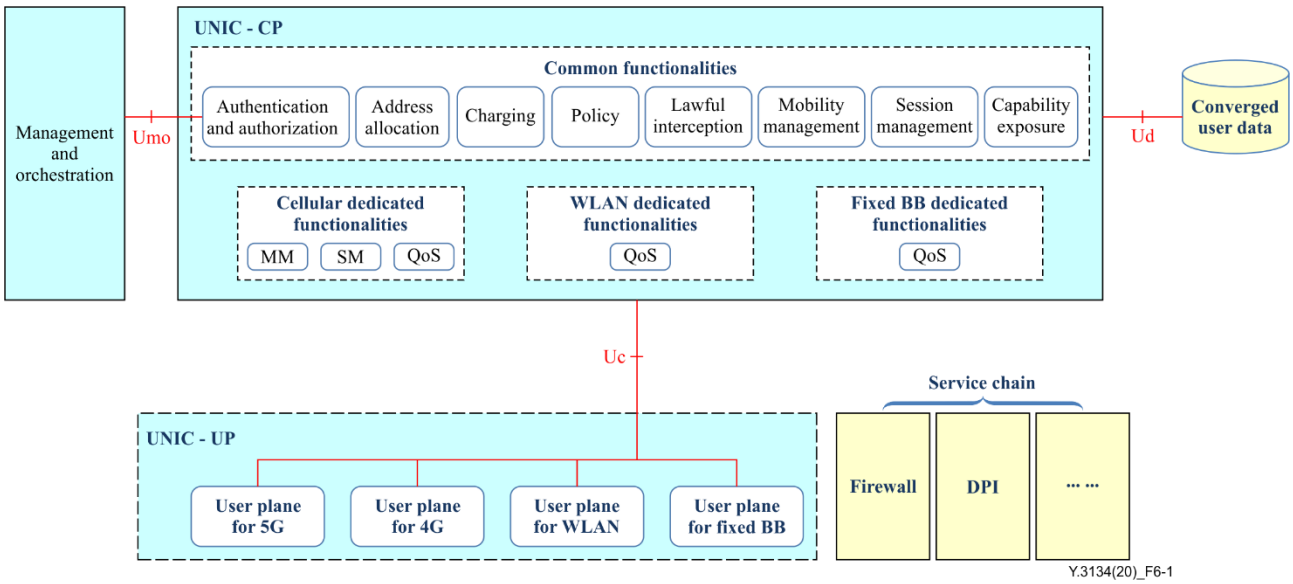


**Figure 6-1 – Functional architecture of UNIC**

## 6.2 Planes related to functional architecture for FMC

There are three main planes related to the cloud-based functional architecture, which are as follows:

– User plane: It is represented by UNIC-UP, and it comprises several sub-user planes such as user plane for 5G, user plane for wireless LAN (WLAN), user plane for fixed broadband and so on.

– Control plane: It is represented by UNIC-CP, and it comprises a group of functions such as QoS assurance, address allocation, authentication, authorization, etc.

– Management plane: Management plane mainly comprises management functions and orchestration functions.

## 6.3 Management and orchestration of the functional architecture for FMC

Management and orchestration are functions and capabilities for network management, service management, user management and resource orchestration.

In the FMC context, different access technologies or network will be unified and convergent, management and orchestration are evolving to a unified functional entity, so, new requirements related to management and orchestration functions should be met.

Clauses 7.1 to 7.3 describe some requirements that are related to management and orchestration for FMC of IMT-2020.

# 7 General aspects of management and orchestration for FMC of IMT-2020

## 7.1 General architecture of management and orchestration for FMC

Generally, the MO of FMC for IMT-2020 should include the following function or aspects:

– Resource aspect,

– Service aspect,

– User aspect,

– Performance aspect.

Appendix I gives a reference architecture of IMT-2020 FMC management and orchestration that can be perceived as an extension of the network function virtualization (NFV) reference architecture described in [b-ETSI GS NFV 002].

Because of the variety of physical hardware and considering that virtualized resources are defined, configured and instantiated based on physical resources, then, virtualized resources would also be of variety.

In the FMC context, service subscribing and service provisioning are access-technology agnostic. This means that various access technologies or modes are transparent in the user view and service provider view. However, the variety of access mode will proliferate the variety of physical resources and as a result the resource orchestration function of MO is required to adapt to such variety.

FMC requires seamless service provisioning from the service provider's perspective across heterogeneous fixed and mobile networks as well as seamless service operation from the end user perspective across heterogeneous fixed networks and mobile networks. Subsequently, service is the focus of FMC for IMT-2020, and the service aspect of MO is necessary.

It is also the basic target of FMC to support multiple user identifiers and authentication/authorization mechanisms as well as ubiquity of service availability in order that the end users can enjoy any service from any location. The user aspect of MO is also essential.

[ITU-T Y.3131] describes the FMC function architecture based on planes, including user plane (UNIC-UP), control plane (UNIC-CP) and management plane (management and orchestration). This is called the plane-based model.

FMC function architecture can also be described based on layers. [ITU-T Q.1762] describes several layers as follows: network layer, control layer, service layer and management layer, etc. This is called the layer-based model.

There is no contradiction between layer-based model and plane-based model, and layer-based model can be perceived as an unfolding formation of the plane-based model. In other words, if the functional architecture is described as a two-dimension model, it can be divided into some layers. On the other hand, if the functional architecture is described as a three-dimension model, it can be divided into several planes. Logically, the network layer corresponds to the user plane, the control layer to the control plane and the management layer to the management plane. The application/service layer could correspond to the control plane or management plane.

[ITU-T Q.1762] describes three convergence modes for FMC as follows:

– Convergence in control layer,

– Convergence in application/service layer,

– Convergence in management layer.

The FMC functional architecture described in [ITU-T Y.3131] implies that convergence takes place in the control layer. The general architecture of management and orchestration for FMC in IMT-2020 context should be in conformance with the above functional architecture.

On the other hand, if it is difficult for multiple different access networks to be convergent in the control layer, it is an alternate solution for the convergence to be implemented in the management layer.

To facilitate the description of the functional requirements of this Recommendation, the layer-based model is used.

## 7.2 Reference point of management and orchestration for FMC

Figure 7-1 illustrates the basic functional architecture of FMC for IMT-2020. This figure is designed based on Figure 3 of [ITU-T Y.3131]. It is noted that Figure 7-1 depicts that management and orchestration in the management plane are two inter-connected functional entities. Although management and orchestration are in the same management plane, it is not implied that management and orchestration are in the same level (see also Figure 3 of [ITU-T Y.3131] and Figure 1 of [b-ETSI GS NFV 002]).

Based on such functional architecture, two reference points named Um and Uo are needed to describe the relationship between MO and UNIC-CP. Figure 7-1 describes these reference points.

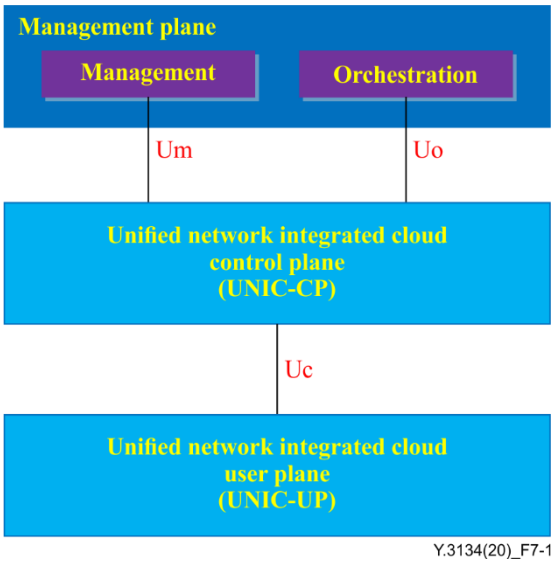


**Figure 7-1 – Reference point related MO of FMC about IMT-2020**

This kind of model is based on the functional architecture described in [ITU-T Y.3131], especially the convergence which is implemented in the control layer. Theoretically, the two reference points, in other words Um and Uo, can also be designed as a single reference point. However, two independent reference points have better flexibility and expandability.

When convergence is implemented in the control layer, a reference point can have a unified implementation which corresponds to multiple access networks,

If the convergence is implemented in the management layer, logically the model is similar to the model described in Figure 7-1, but the main difference is that the two reference points Um and Uo are possibly related to multiple implementations, where a specific implementation corresponds to a specific kind of access network.

## 7.3 Other aspects of management and orchestration for FMC

As convergence involves multiple different access networks and the convergence is access-technology-agnostic, the performance aspect of MO is also of significant related importance to FMC for IMT-2020, especially when an identical user is switching over from a network to another network.

Additionally, because of user mobility, it is also necessary to take the security aspect of MO into account.

# 8 Functional requirements of resource orchestration for FMC of IMT-2020

## 8.1 Overview for the FMC convergence scenarios

There are three kinds of scenarios for fixed mobile convergence given in Appendix I of [ITU-T Q.1762/Y.2802] as follows:

– Convergence in control layer,

– Convergence in application/service layer,

– Convergence in management layer.

On the other hand, [ITU-T Y.3131] describes the framework and functional architecture of FMC in IMT-2020 networks (see Figures 2 and 3 of [ITU-T Y.3131] and Figure 6-2 of this Recommendation). From the afore-mentioned framework and functional architecture, it can be implied that FMC in the application layer is outside the scope of [ITU-T Y.3131]. Therefore, convergence in the control layer and the management layer are two kinds of convergence modes to be addressed. Clauses 8.2 and 8.3 describe the functional requirements that are related to convergence in the control layer and the management layer.

## 8.2 Functional requirements related to resource orchestration for convergence in the management layer

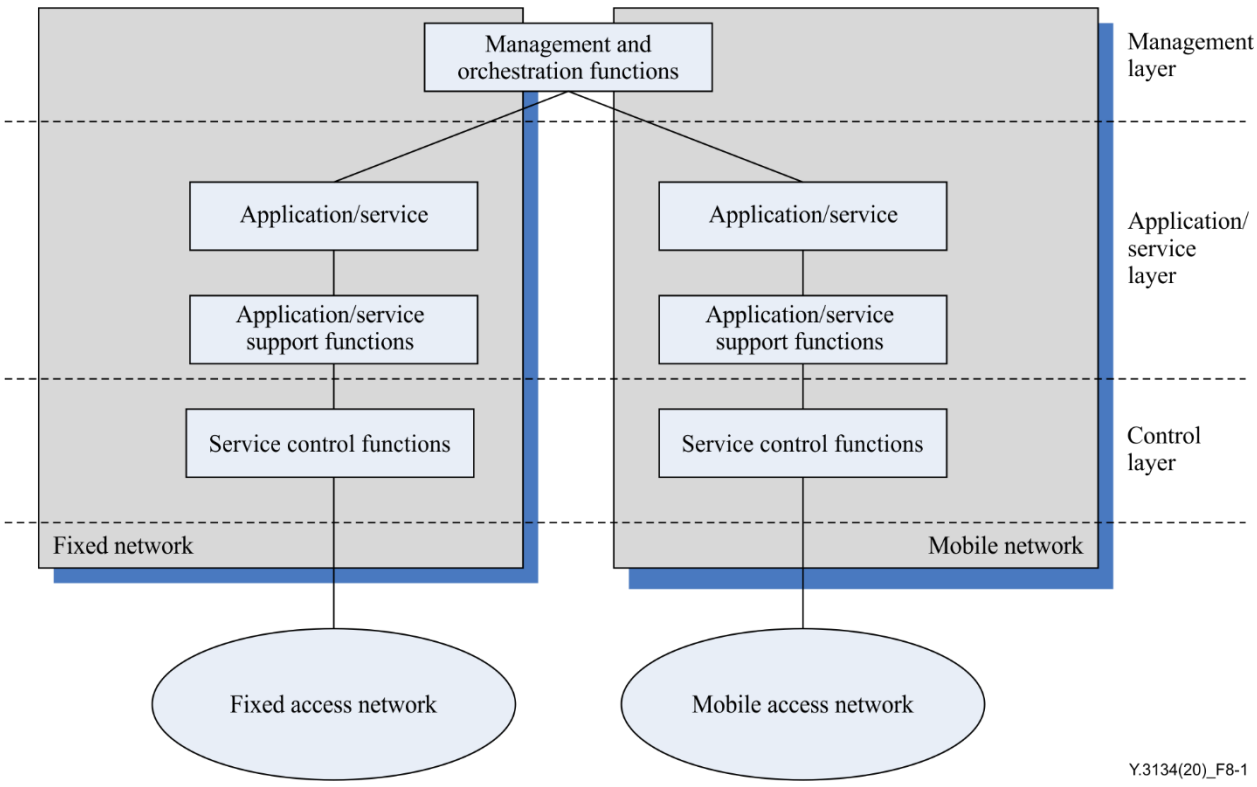


**Figure 8-1 Fixed mobile convergence in management layer**

Figure 8-1 shows a scenario where fixed mobile convergence functions are realised in the management layer. A similar description of the scenario is given in Appendix I of [ITU-T Q.1762].

Traditionally, each access network (e.g., fixed, mobile) has its own management system. However, in some scenarios, there is a need for the management functions to be implemented in a unified management system, and the unified management system is responsible for the resource orchestration of different access networks. Therefore, the following requirements are required or recommended:

– It is required for the management layer to use unified and unique identification for resources from both fixed network and mobile network.
– It is required for the management layer to assign, store, distribute and manage unified identification for resources from both fixed network and mobile network.
– It is required for the management layer to orchestrate resources from both fixed network and mobile network to instantiate and manage resource slices.
– It is required for the management layer to provide independent or unified resource orchestration interfaces for both fixed network and mobile network to meet requirements from application/service layer and control layer.
– It is required for the management layer to accept different description information for resources from both fixed network and mobile network.
– It is required for the management layer to transform different resource description information from both fixed network and mobile network into unified resource description information that can be used by management layer.
– It is required for the management layer to monitor the resource usage status and give out an alarm/warning message to the upper application when abnormal resource usage occurs.
– It is required for the management layer to report the resource usage status to application/service periodically.
– It is recommended for the management layer to use artificial intelligence (AI)/machine learning (ML) technologies to assist in resource orchestration, in the aspects of resource instantiation, resource management, resource monitoring, etc.

## 8.3 Functional requirements related to resource orchestration for convergence in the control layer

Figure 8-2 describes a scenario where fixed mobile convergence function is realised in the control layer, and a similar description of this scenario is given in Appendix I of [ITU-T Q.1762].

In such a scenario, the control layer is responsible for connecting different access technologies with the upper layer and providing unified service to the upper layers. Thus, the following requirements are required or recommended:

– It is required for the control layer to provide control functions for both fixed network and mobile network.
– It is required for the control layer to receive, synthesize and store resource information about physical and logical resources from both fixed network and mobile network.
– It is recommended for the control layer to provide unified application programming interfaces (APIs) about both fixed network and mobile network to application/service layer.
– It is recommended for the control layer to provide unified description for physical and logical resource from both fixed network and mobile network to the application/service layer.
– It is required for the control layer to receive the instruction from the application/service layer and transform the instruction to actions that can be understood by fixed network and mobile network.
– It is required for the control layer to send the corresponding actions correctly to fixed networks and mobile networks based on resource description information.
– It is recommended for the control layer to apply AI/ML technologies to assist in resource orchestration, in the aspects of information synthesis, instruction transformation, etc.

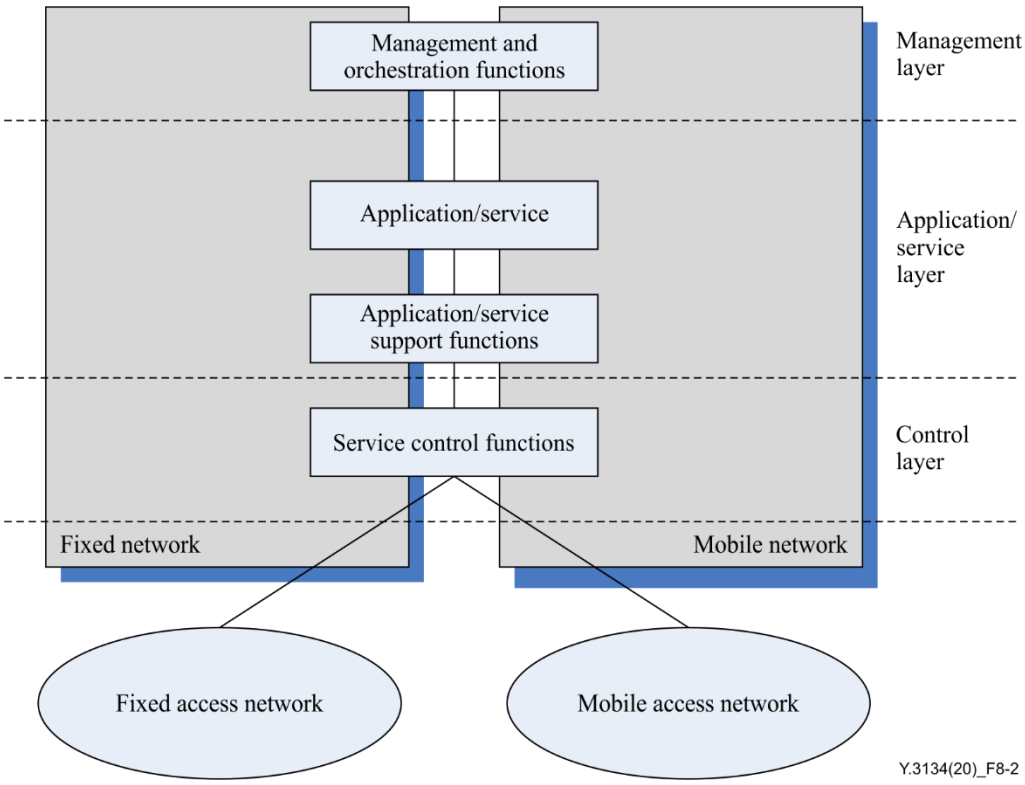


**Figure 8-2 – Fixed mobile convergence in control layer**

# 9 Functional requirements of service management for FMC of IMT-2020

## 9.1 Functional requirements of service provision matchable to access technologies and terminal device

When an identical user accesses the network with a user terminal device (e.g., a mobile phone or a laptop computer.), it is possible for the user terminal device to work in one of the following access modes: long term evolution (LTE), local area network (LAN), wireless LAN (WLAN), a combination of LAN and a different access mode. It is noted that the different access modes will provide different network access capability and performance. The convergent network should then provide capability and performance corresponding to the access technology and the user terminal device, where in the first instance capability and performance provided by the convergent network should correspond to the user service profile. In addition, the capability and performance provided by the convergent network should match the capability and performance of the access technology and user terminal device.

NOTE 1 – For example, if the user service profile illustrates that the bandwidth is 100 Mbit/s ('Mbit/s' means one million bits per second), the convergent network should support network access capability up to 100 Mbit/s. But if the user device has only 10 Mbit/s connection capability, the convergent network should also allocate 10 Mbit/s bandwidth to the user in order to save network resource.

As to the capability and performance matchability, the functional requirements of service provision matchable to access technologies and terminal device are as follows:

– It is required for the convergent network to provide service to the user based on the access capabilities of the terminal device and service subscriptions of the user.

– It is required for the convergent network to provide service to the user based on the capabilities and resource status of fixed access network and/or mobile access network.

– It is required for the convergent network to inform the user about the service provision status.

– It is recommended for the management layer and the control layer to coordinate to provide service that is matchable to access technologies and terminal device.

– It is required for the convergent network to allocate more network bandwidth when the user switches over from a lower-speed access mode to a higher-speed access mode.

– It is recommended for the convergent network to free redundant network bandwidth when the user switches over from a higher-speed access mode to a lower-speed access mode.

– It is required for the control layer to store the user real-time service information including access technology type, access interface speed, network bandwidth, etc. when convergence is implemented in the control layer.

– It is recommended for the control layer to store the user service profile when convergence is implemented in the control layer.

– It is required for the management layer to store the user real-time service information including access technology type, access interface speed, network bandwidth, etc., when convergence is implemented in the management layer.

– It is required for the management layer to store the user service profile information.

NOTE 2 – User service profile is user QoS agreement between the user and the network service provider, e.g., the network access bandwidth of the user is 100 Mbit/s.

## 9.2 Functional requirements of service assurance when access technologies and/or terminal device change

When a single user employs multiple access modes, the type of access used often changes from one moment to the next. Then, the convergent network should guarantee that the influence that the access mode change brings to the service will be limited to the acceptable threshold. In other words, active user service should be continually provided or recovered after a short-time period of interruption even if the access technology and/or user terminal device change.

NOTE 1 – For example, if a user is on a remote meeting through a wireless LAN connection and the connection is interrupted, then the user would need to switch to LTE connection. The user should be able to stay connected in the meeting when the switch over happens.

The functional requirements of service guarantee when access technologies and/or terminal device change are as follows:

– It is required for the convergent network to support service handover and service continuity when access technologies and/or terminal device change.

– It is recommended for the convergent network to provide service assurance based on the worst resource condition of the possible access technologies.

NOTE 2 – For example, when possible access technologies include access mode a, b and c, and resource condition of access mode c is the worst, the convergent network needs also to provide service assurance when the current access mode is c.

– It is required for the convergent network to provide service assurance based on the application/service requirements of the user in the aspects of bandwidth, end-to-end latency, handover latency, etc.

NOTE 3 – Application/service of the user means different network traffic which needs different network performance assurance. For example, some network traffic should be transported under low latency.

– It is recommended for the convergent network to provide service assurance to application/service of the user through APIs when the access technology and/or terminal device change.

– It is recommended for the management layer and the control layer to coordinate to evaluate the resource condition and produce the service guarantee when the access technology and/or terminal device change.

– It is required for the convergent network to provide availability within a specified time when the access technology and/or terminal device change.

NOTE 4 – For example, the user service profile gives the time specification explicitly.

– It is recommended for the convergent network to guarantee that user service data should be lossless when the access technology and/or terminal device change.

– It is required for the control layer to update the user real-time service information when the access technology and/or terminal device change if convergence is implemented in the control layer.

– It is required for the management layer to update the user real-time service information when the access technology and/or terminal device change if convergence is implemented in the management layer.

### 9.3 Functional requirements of service provision for multiple simultaneous access technologies and/or terminal device

An identical user possibly uses multiple access modes simultaneously, for example, the user has two or more user terminal devices, and those terminal devices are on-line simultaneously. Under such circumstance, the network should take the multiple access modes into account.

When multiple active user terminal devices belong to a single user, there are two options:

– User service profiles for those user terminal devices are independent of each other. Under such circumstance, multiple user devices are equivalent to multiple users and no special consideration is needed.

– The services for those user terminal devices are corresponding to an identical user service profile. Under such circumstance, the service management for those user terminal devices should be based on the user service profile. Active services on different user terminal devices are independent of each other, so, the service based on one user terminal device should not be influenced by services based on other user terminal devices.

The functional requirements of service provision for multiple simultaneous access technologies and/or terminal devices that are corresponding to an identical user service profile are as follows:

– It is recommended for the convergent network to provide service based on multiple simultaneous access technologies and/or terminal devices and service subscriptions of the user.

– It is recommended for the convergent network to provide service based on multiple simultaneous access technologies and resource status of both fixed access network and mobile access network.

– It is recommended for the convergent network to inform the user about the service provision status for multiple simultaneous access technologies and/or terminal devices.

– It is recommended for the management layer and the control layer to coordinate in service provision for multiple simultaneous access technologies and/or terminal device.

– It is required for the convergent network to guarantee that change related to one access mode has no influence on other access mode.

– It is required for the control layer to store the user real-time service information branches meanwhile each user real-time service information branch is corresponding to an access mode when convergence is implemented in the control layer.

– It is required for the management layer to store the user real-time service information branches meanwhile each user real-time service information branch is corresponding to an access mode when convergence is implemented in the management layer.

## 10 Functional requirements of user/customer management for FMC of IMT-2020

### 10.1 Management functional requirements related to user/customer identifier for FMC in IMT-2020 context

When an identical user possibly visits the network with multiple access modes, the user privacy issues are required to be handled with care. For example, when a user has switched over from access mode A to access mode B, some information remained in access network A has possibly negative influence on the user privacy. As to the user privacy, the following are the requirements:

– It is required for the convergent network to transmit the data related to user privacy in data encryption mode, including transmitting data between network entities, and transmitting data between UE and network entities.

– It is required for the convergent network to store the data related to user privacy safely and prevent the data from unauthorized visiting.

– It is required for the convergent network to perform data desensitization when the data is transmitted from management layer to application/service layer and from control layer to application/service layer.

– It is recommended for the convergent network to clear data related to user privacy and stored in access network A when the user has switched over from access mode A to access mode B.

– It is recommended for the convergent network to acquire the authorization of users before storing or using privacy-sensitive data.

### 10.2 Management functional requirements related to user privacy and privacy-sensitive data for FMC in IMT-2020 context

When an identical user possibly visits the network with multiple access modes, the user privacy issues are required to be handled with care. For example, when a user has switched over from access mode A to access mode B, some information remained in access network A has possibly negative influence on the user privacy. As to the user privacy, the following are the requirements:

– It is required for the convergent network to transmit the data related to user privacy in data encryption mode, including transmitting data between network entities, and transmitting data between UE and network entities.

– It is required for the convergent network to store the data related to user privacy safely and prevent the data from unauthorized visiting.

– It is required for the convergent network to perform data desensitization when the data is transmitted from management layer to application/service layer and from control layer to application/service layer.

– It is recommended for the convergent network to clear data related to user privacy and stored in access network A when the user has switched over from access mode A to access mode B.

– It is recommended for the convergent network to acquire the authorization of users before storing or using privacy-sensitive data.

### 10.3 Management functional requirements related user QoS/QoE for FMC in IMT-2020 context

When an identical user visits the network by multiple access modes, quality of service/quality of experience (QoS/QoE) for different access modes is also different. Besides, it is the convergent network that is responsible for assurance of user QoS/QoE. As to the user QoS/QoE issue, the following are requirements:

– It is required for the convergent network to provide best-effort (such as non-GBR) QoS/QoE for the user no matter which kind of access mode the user uses.

– It is required for the convergent network to map QoS/QoE of different access modes.

– It is recommended for the convergent network to provide guaranteed (such as GBR) QoS/QoE for the user no matter which kind of access mode the user uses, if network capabilities and network resources allow.

– It is recommended for the convergent network to report real-time QoS/QoE information to the user no matter which kind of access mode the user uses.

NOTE 1 – Real-time QoS/QoE information includes bandwidth, latency and latency variation, etc.

– It is recommended for the convergent network to propose access mode to the user when multiple access modes are available.

NOTE 2 – For example, when a user can visit the network through WLAN access mode or LTE access mode, and LTE access mode can provide better QoS/QoE, then the LTE access mode can be recommended to the user.

## 11 Functional requirements related to performance aspect

When an identical user visits the network by multiple access modes, performance aspect is as important as capability aspect. The following are the requirements related to performance aspect:

– It is required for the convergent network to guarantee that the performance for the user's visit to the convergent network should not be worse than the performance in the non-convergent network.

NOTE 1 – For example, when the user visits the non-convergent network, it is 5 seconds from when the user starts connecting to the network to when the communication connection is established, then the time should not exceed 5 seconds when the user visits the convergent network.

– It is required for the convergent network to guarantee the network availability within a time length that is illustrated in the user's service agreement when the user switches over from one access mode to another.

NOTE 2 – For example, if the service agreement illustrates the switchover time is no more than 50 ms, the convergent network shall guarantee that switchover time will not exceed 50 ms.

– It is recommended for the convergent network to provide better performance in the aspects of reliability and availability compared to the non-convergent network.

– It is recommended for the convergent network to keep the user service uninterrupted when the user switches over from one access mode to another.

NOTE 3 – For example, when the user uses the network to make a phone call, the call is recommended to remain on-line when the user switches over between access modes.

– It is recommended for the convergent network to provide the customized service agreement in the aspects of bandwidth, delay, reliability, availability, etc., based on the conditions of network capabilities and network resources.

## 12 Security considerations

An IMT-2020 FMC network is required to be aligned with the security requirements contained in [ITU-T Q.1762] and the security requirements and personal data protection contained in [ITU-T Y.3101], with the following additional ones:

– An IMT-2020 FMC network is required to provide mechanisms to support data confidentiality and integrity for fixed and mobile access networks.

– An IMT-2020 FMC network is required to provide secure storage, handling, and enforcement of policies.

– An IMT-2020 FMC network is required to provide a security coordination function for coordinating security policies for all involved access networks.

# Appendix I

## A reference architecture of IMT-2020 FMC management and orchestration

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

[b-ETSI GS NFV 002] describes the network functions virtualisation architecture framework of ETSI, Figure 4 of [b-ETSI GS NFV 002] depicts the architecture framework and the right half of the Figure describes the management and orchestration aspect of the architecture.

Based on the afore-mentioned figure, Figure I.1 is used to depict a reference architecture of IMT-2020 FMC management and orchestration. The main difference between Figure I.1 and Figure 4 of [b-ETSI GS NFV 002] is related to NFVI (see the blue box). Figure I.1 focuses on various access technologies or network.

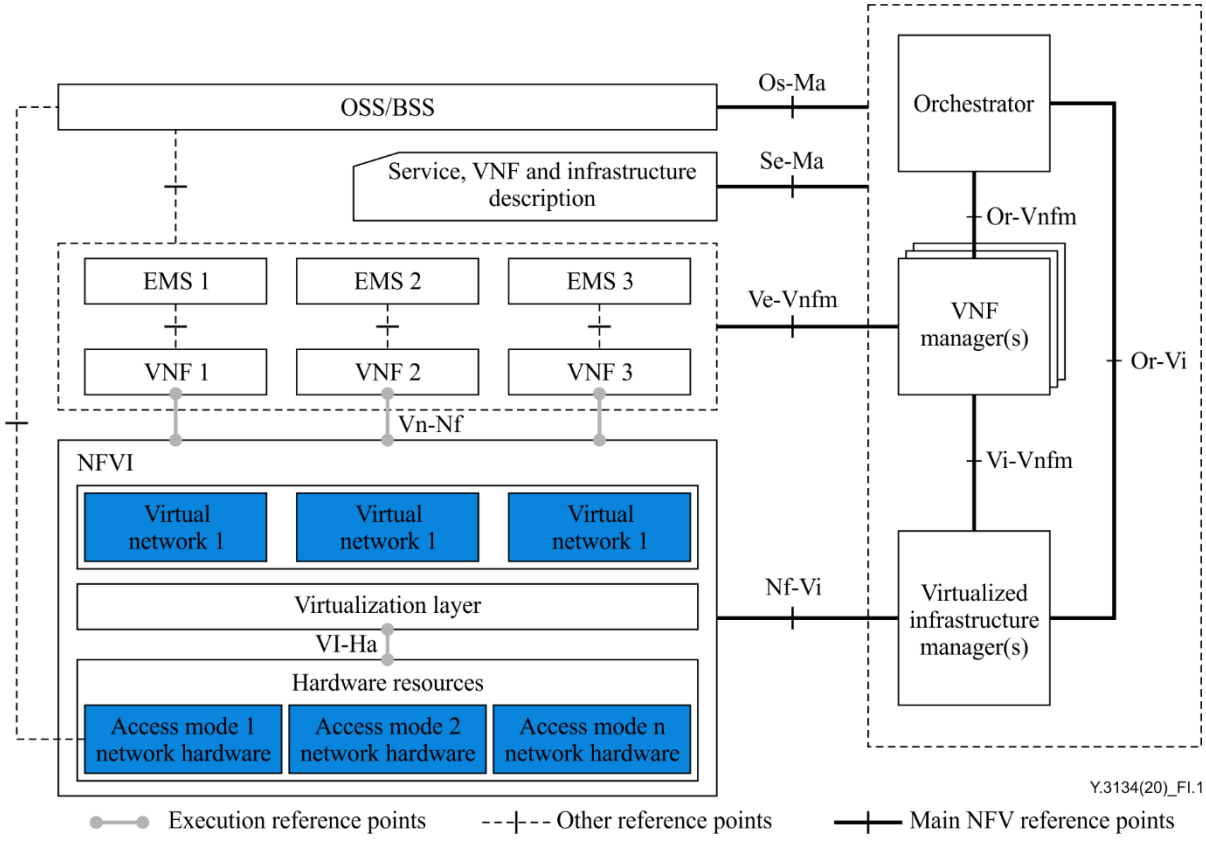


**Figure I.1 – A reference architecture of IMT-2020 FMC MO**

# Bibliography

[b-ETSI GS NFV 002] ETSI GS NFV 002 v1.2.1 (2014-12), *Network functions virtualisation (NFV); Architecture Framework*.

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