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Purpose: Proposal

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Abstract: This is the draft Recommendation Y.IMT2020-BM, output of the Q20/13 meeting, Geneva 16-27 July 2018, proposed for consent.

Draft Recommendation Y.3103 (formerly Y.IMT2020-BM)

Business Role-based Models in IMT-2020

Summary

This Recommendation describes business roles, business role-based models and best practice use cases in IMT-2020 from different relevant perspectives.

It can be used as a guideline for further IMT-2020 studies from business point of view as well as for deployment and operation of IMT-2020 networks.

Keywords

IMT-2020, business roles, business role-based models, use cases

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Draft Recommendation Y.3103 (formerly Y.IMT2020-BM)

Business Role-based Models in IMT-2020

1. Scope

This Recommendation describes business roles, business role-based models and best practice use cases of IMT-2020 from different relevant perspectives.

It can be used as a guideline for further IMT-2020 studies from business point of view as well as for deployment and operation of IMT-2020 networks.

NOTE - This Recommendation obviously does not identify, in an exhaustive manner, all business roles, business role-based models and best practice use cases of IMT-2020.

2. References

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

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

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

[ITU-T Y.3502] Recommendation ITU-T Y.3502 (2014), *Information technology – Cloud computing – Reference architecture*

[ITU-T Y.3500] Recommendation ITU-T Y.3500 (2014), *Information technology – Cloud computing – Overview and vocabulary*

3. Definitions

3.1. Terms defined elsewhere

This Recommendation uses the following terms defined elsewhere:

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

NOTE 1 – Network slices enable the creation of customized networks to provide flexible solutions for different market scenarios which have diverse requirements, with respect to functionalities, performance and resource allocation.

NOTE 2 – A network slice may have the ability to expose its capabilities.

NOTE 3 – The behaviour of a network slice is realized via network slice instance(s).

3.1.2 Network slice blueprint [ITU-T Y.3100]: A complete description of the structure, configuration and work flows on how to create and control a network slice instance during its life cycle.

NOTE – A network slice template can be used synonymously with a network slice blueprint.

3.1.3 Network slice instance [ITU-T Y.3100]: An instance of network slice, which is created based on a network slice blueprint.

NOTE 1 – A network slice instance is composed of a set of managed run-time network functions, and physical/logical/virtual resources to run these network functions, forming a complete instantiated logical network to meet certain network characteristics required by the service instance(s).

NOTE 2 – A network slice instance may also be shared across multiple service instances provided by the network operator. A network slice instance may be composed of none, one or more sub-network slice instances which may be shared with another network slice instance.

3.1.4 Role [ITU-T Y.3502]: A set of activities that serves a common purpose.

3.2. Terms defined in this Recommendation

This Recommendation defines the following terms:

None.

4. Abbreviations and acronyms

This Recommendation uses the following abbreviations and acronyms:

API	Application Programming Interface
AR	Augmented Reality
CDN	Content Delivery Network
D2D	Device-to-Device
EC	Edge Computing
IaaS	Infrastructure as a Service
IMT-2020	International Mobile Telecommunications 2020
IoT	Internet of Things
IT	Information Technology
MVNO	Mobile Virtual Network Operator
NS	Network Slice
SLA	Service Level Agreement
VA	VR/AR
VR	Virtual Reality
VS	Vertical Service
V2X	Vehicle-to-everything

5. Conventions

The term “network sub-slice” used in this ITU-T Recommendation is equivalent to the term “sub-network slice” used in other IMT-2020 related ITU-T Recommendations.

The term “business role” used in this ITU-T Recommendation is technically equivalent to the term “role” as defined in [ITU-T Y.3502]. The word “business” intends to highlight the business point of view related to the roles.

6. Business roles in IMT-2020

6.1. Business roles from network slicing perspective

Several players are involved in the network slicing business activities. Each player plays at least one business role [ITU-T Y.3502]. In some cases, however, one player can play more than one business role at the same time. The identified network slicing business roles are shown in Figure 6-1.

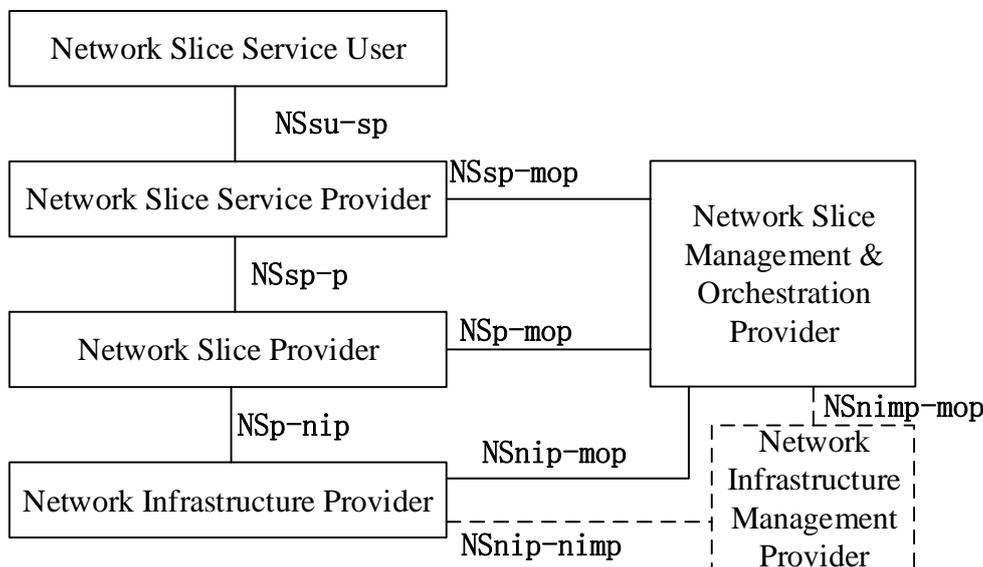


Figure 6-1 – Business roles from network slicing perspective

NOTE – The Network Infrastructure Management Provider and related business interfaces exist only in use cases with multiple players acting as Network Infrastructure Provider. In all other cases, the Network Infrastructure Provider has direct interaction with the Network Slice Management & Orchestration Provider.

The business interfaces shown in Figure 6-1 are described in Table 6-1.

Table 6-1 – Business interfaces from network slicing perspective

Business interface	Business roles	Interactions via the business interface
NSsu-sp	Network Slice Service User and Network Slice Service Provider	The Network Slice Service User interacts with the Network Slice Service Provider for accessing network slice [ITU-T Y.3100] services based on corresponding SLAs and for providing corresponding payment when necessary.
NSsp-p	Network Slice Service Provider and Network Slice Provider	The Network Slice Service Provider interacts with the Network Slice Provider for consuming network slice resources based on corresponding SLAs and for providing corresponding payment when necessary.
NSp-nip	Network Slice Provider and Network Infrastructure Provider	The Network Slice Provider interacts with the Network Infrastructure Provider for consuming network infrastructure resources based on corresponding SLAs and for providing corresponding payment when necessary.
NSsp-mop	Network Slice Service Provider and Network Slice Management & Orchestration Provider	The Network Slice Service Provider interacts with the Network Slice Management & Orchestration Provider for enabling orchestration and management, and runtime operations, of

		network slices at the service level, based on corresponding SLAs, as well as for providing corresponding payment when necessary.
NSp-mop	Network Slice Provider and Network Slice Management & Orchestration Provider	The Network Slice Provider interacts with the Network Slice Management & Orchestration Provider for enabling network slice lifecycle management and runtime operations based on corresponding SLAs, as well as for providing corresponding payment when necessary.
NSnip-mop	Network Infrastructure Provider and Network Slice Management & Orchestration Provider	The Network Infrastructure Provider interacts with the Network Slice Management & Orchestration Provider for enabling management and orchestration, and runtime operations, of network slices at the network infrastructure resource level, based on corresponding SLAs, as well as for providing corresponding payment when necessary.
NSnip-nimp	Network Infrastructure Provider and Network Infrastructure Management Provider	The Network Infrastructure Management Provider interacts with the Network Infrastructure Provider for integrating the network infrastructure resources from different Network Infrastructure Providers based on corresponding SLAs, as well as for providing corresponding payment when necessary.
NSnimp-mop	Network Infrastructure Management Provider and Network Slice Management & Orchestration Provider	The Network Infrastructure Management Provider interacts with the Network Slice Management & Orchestration Provider for providing the integrated network infrastructure based on corresponding SLAs, as well as for providing corresponding payment when necessary.

The above basic model is further developed to support hierarchical network slicing (via network slices and network sub-slices).

The identified hierarchical network slicing business roles are shown in Figure 6-2

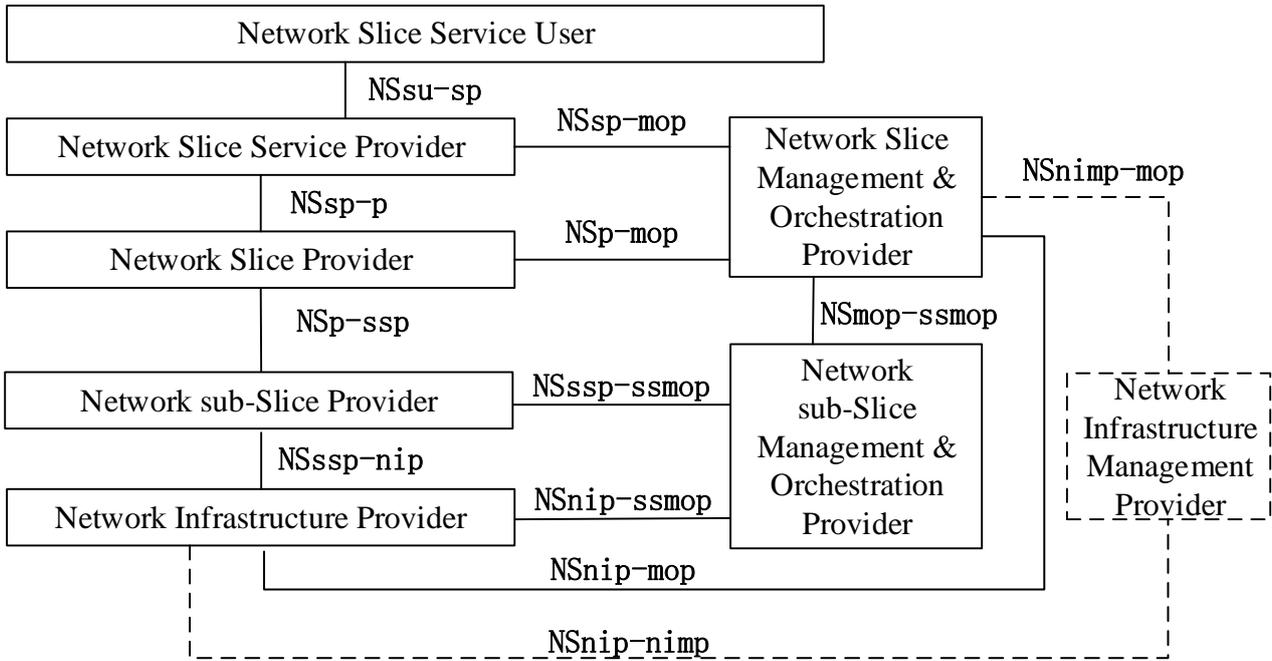


Figure 6-2 – Business roles from hierarchical network slicing perspective

NOTE – The application of the network sub-slice concept depends on the use cases. An end-to-end network slice for domestic services can be a network sub-slice for international services.

Besides the business interfaces shown in Figure 6-1, there are 5 more business interfaces from the hierarchical network slicing perspective as shown in Figure 6-2.

These additional business interfaces are described in Table 6-2.

Table 6-2 – Business interfaces from hierarchical network slicing perspective

Business interface	Business roles	Interactions via the business interface
NSp-ssp	Network Slice Provider and Network sub-Slice Provider	The Network Slice Provider interacts with the Network sub-Slice Provider for consuming network sub-slices based on corresponding SLAs and for providing corresponding payment when necessary.
NSssp-nip	Network sub-Slice Provider and Network Infrastructure Provider	The Network sub-Slice Provider interacts with the Network Infrastructure Provider for consuming network infrastructure resources based on corresponding SLAs and for providing corresponding payment when necessary.
NSssp-ssmop	Network sub-Slice Provider and Network sub-Slice Management & Orchestration Provider	The Network sub-Slice Provider interacts with the Network sub-Slice Management & Orchestration Provider for network sub-slice's orchestration and management, and runtime operations, based on corresponding SLAs, as well as for providing corresponding payment when necessary.
NSnip-ssmop	Network Infrastructure Provider and Network sub-Slice Management & Orchestration Provider	The Network Infrastructure Provider interacts with the Network sub-Slice Management & Orchestration Provider for deployment of network sub-slices on the network infrastructure resources, network infrastructure resource

		management, runtime operations based on corresponding SLAs, as well as for providing corresponding payment when necessary.
NSmop-ssmop	Network Slice Management & Orchestration Provider and Network sub-Slice Management & Orchestration Provider	The Network Slice Management & Orchestration Provider interacts with the Network sub-Slice Management & Orchestration Provider for orchestrating and managing network sub-slices based on corresponding SLAs, as well as for providing corresponding payment when necessary.

6.1.1. Network Slice Service User

The Network Slice Service User uses the service(s) provided by the network slice instance(s) [ITU-T Y.3100].

6.1.2. Network Slice Service Provider

The Network Slice Service Provider is the user of the network slice instance(s), and is responsible for providing services to its Network Slice Service Users via the network slice instance(s).

6.1.3. Network Slice Provider

The Network Slice Provider is the owner of the network slice instance(s) and provides the network slice instance(s).

6.1.4. Network Infrastructure Provider

The Network Infrastructure Provider is the owner, the provider and the manager of the network infrastructure.

6.1.5. Network Slice Management & Orchestration Provider

The Network Slice Management & Orchestration Provider is responsible for orchestrating network slice(s) and managing the lifecycle of the network slice instance(s) based on network slice blueprint(s) [ITU-T Y.3100].

NOTE – The network slice blueprints can be provided by third parties.

6.1.6. Network Sub-Slice Provider

The Network Sub-Slice Provider is the owner and the provider of the network sub-slice instance(s).

6.1.7. Network Sub-Slice Management & Orchestration Provider

The Network Sub-Slice Management & Orchestration Provider is responsible for orchestrating network sub-slice(s) and managing the lifecycle of the network sub-slice instance(s).

6.1.8. Network Infrastructure Management Provider

The Network Infrastructure Management Provider integrates infrastructures of multiple Infrastructure Providers to offer the combined resources to the Network Slice Management & Orchestration Provider.

6.2. Business roles from vertical service perspective

Several players are involved in the vertical service business activities. Each player plays at least one business role. In some cases, however, one player can play more than one business role at the same time. The identified business roles are shown in Figure 6-3.

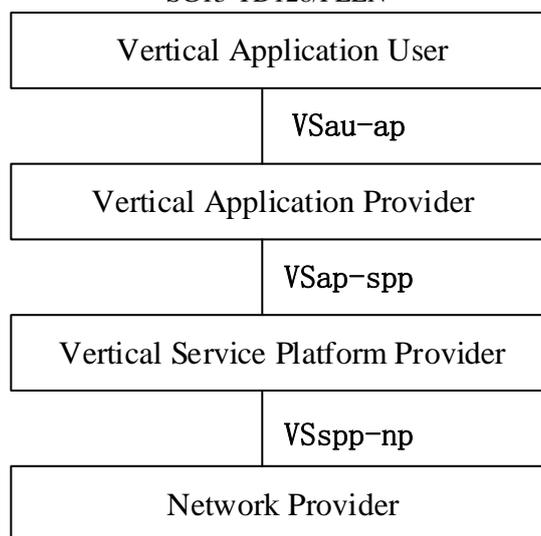


Figure 6-3 – Business roles from vertical service perspective

The business interfaces shown in Figure 6-3 are described in Table 6-3.

Table 6-3 – Business interfaces from vertical service perspective

Business interface	Business roles	Interactions via the business interface
VSau-ap	Vertical Application User and Vertical Application Provider	The Vertical Application User interacts with the Vertical Application Provider for accessing the vertical applications based on corresponding SLAs and for providing corresponding payment when necessary.
VSap-spp	Vertical Application Provider and Vertical Service Platform Provider	The Vertical Application Provider interacts with the Vertical Service Platform Provider for consuming platform capabilities needed by vertical applications based on corresponding SLAs, and for providing corresponding payment when necessary.
VSspp-np	Vertical Service Platform Provider and Network Provider	The Vertical Service Platform Provider interacts with the Network Provider for consuming network infrastructure resources based on corresponding SLAs and for providing corresponding payment when necessary.

6.2.1. Vertical Application User

The Vertical Application User uses the applications provided by the Vertical Application Provider.

6.2.2. Vertical Application Provider

The Vertical Application Provider operates vertical applications and provides them to the Vertical Application User. Examples of vertical applications include: fleet tracking application, remote blood sugar monitoring application, and power metering application.

6.2.3. Vertical Service Platform Provider

The Vertical Service Platform Provider operates a service platform which consists of a set of capabilities which are common to the vertical applications. Examples of capabilities offered by vertical service platforms include: data management, device management, service subscription management, and location services.

6.2.4. Network Provider

The Network Provider provides network connectivity.

6.3. Business roles from VR/AR perspective

Several players are involved in the VR/AR business activities. Each player plays at least one business role. In some cases, however, one player can play more than one business role at the same time. The business roles of VR/AR are shown in Figure 6-4.

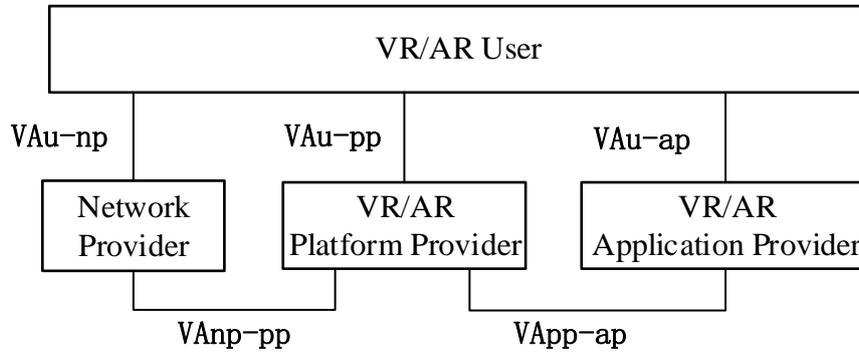


Figure 6-4 – Business roles from VR/AR perspective

The business interfaces shown in Figure 6-4 are described in Table 6-4.

Table 6-4 – Business interfaces from VR/AR perspective

Business interface	Business roles	Interactions via the business interface
V Au-np	VR/AR User and Network Provider	The VR/AR User interacts with the Network Provider for consuming network connectivity based on corresponding SLAs, and for providing corresponding payment when necessary.
V Au-pp	VR/AR User and VR/AR Platform Provider	The VR/AR User interacts with the VR/AR Platform Provider for accessing the applications provided by the platform based on corresponding SLAs and for providing corresponding payment when necessary.
V Au-ap	VR/AR User and VR/AR Application Provider	The VR/AR User interacts with the VR/AR Application Provider for accessing its VR/AR application based on corresponding SLAs, and for providing corresponding payment when necessary.
V Anp-pp	Network Provider and VR/AR Platform Provider	The VR/AR Platform Provider interacts with the Network Provider for consuming network connectivity based on corresponding SLAs, and for providing corresponding payment when necessary.
V App-ap	VR/AR Platform Provider and VR/AR Application Provider	The VR/AR Application Provider interacts with the VR/AR Platform Provider for visibility and accessibility to users based on corresponding SLAs, and for providing corresponding payment when necessary.

6.3.1. VR/AR User

The VR/AR User uses VR/AR applications.

6.3.2. VR/AR Application Provider

The VR/AR Application Provider provides VR/AR applications.

6.3.3. VR/AR Platform Provider

The VR/AR Platform Provider operates the VR/AR platform.

6.3.4. Network Provider

The Network Provider provides the network connectivity to deliver the VR/AR applications.

6.4. Business roles from Device-to-Device service perspective

Several players are involved in the Device-to-Device (D2D) service business activities. Each player plays at least one business role. In some cases, however, one player can play more than one business role at the same time. The identified business roles are shown in Figure 6-5.

NOTE – In D2D service, devices communicate directly with each other via the control of the network.

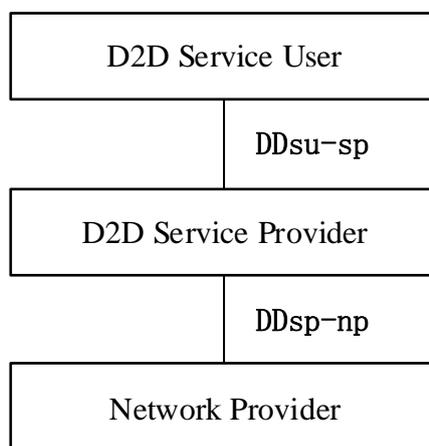


Figure 6-5 – Business roles from D2D service perspective

The business interfaces shown in Figure 6-5 are described in Table 6-5.

Table 6-5 – Business interfaces from D2D service perspective

Business interface	Business roles	Interactions via the business interface
DDsu-sp	D2D Service User and D2D Service Provider	The D2D Service User interacts with the D2D Service Provider for accessing the D2D service based on corresponding SLAs, and for corresponding payment.
DDsp-np	D2D Service Provider and Network Provider	The D2D Service Provider interacts with the Network Provider for using network connectivity based on corresponding SLAs, and for corresponding payment.

6.4.1. D2D Service User

The D2D Service User uses the D2D service via D2D devices.

NOTE – A D2D device is a device which communicates directly with other devices via the control of the network.

6.4.2. D2D Service Provider

The D2D Service Provider provides the D2D service.

6.4.3. Network Provider

The Network Provider provides the network connectivity to D2D devices.

6.5. Business roles from Vehicle to Everything service perspective

Several players are involved in the Vehicle to Everything (V2X) service business activities. Each player plays at least one business role. In some cases, however, one player can play more than one business role at the same time. The identified business roles are shown in Figure 6-6.

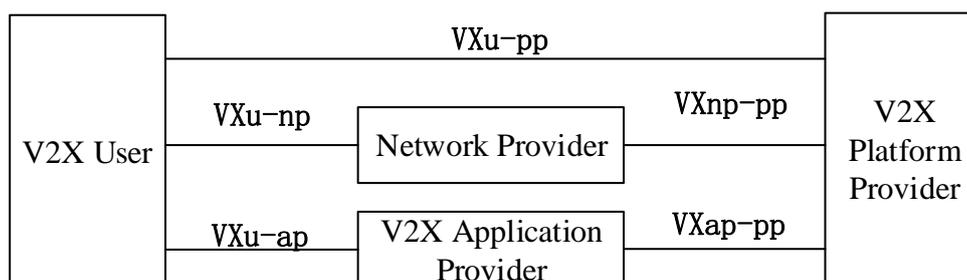


Figure 6-6 – Business roles from V2X service perspective

The business interfaces shown in Figure 6-6 are described in Table 6-6.

Table 6-6 – Business interfaces from V2X service perspective

Business interface	Business roles	Interactions via the business interface
VXu-pp	V2X User and V2X Platform Provider	The V2X User interacts with the V2X Platform Provider for accessing the V2X services based on corresponding SLAs, and for providing corresponding payment when necessary.
VXu-np	V2X User and Network Provider	The V2X User interacts with the Network Provider for consuming network connectivity based on corresponding SLAs, and for providing corresponding payment when necessary.
VXu-ap	V2X User and V2X Application Provider	The V2X User interacts with the V2X Application Provider for accessing V2X application based on corresponding SLAs, and for providing corresponding payment when necessary.
VXnp-pp	Network Provider and V2X Platform Provider	The V2X Platform Provider interacts with the Network Provider for consuming network connectivity based on corresponding SLAs, and for providing corresponding payment when necessary.
VXap-pp	V2X Application Provider and V2X Platform Provider	The V2X Application Provider interacts with the V2X Platform Provider for visibility and accessibility to users based on corresponding SLAs, and for providing corresponding payment when necessary.

6.5.1. V2X User

The V2X User uses V2X services via the vehicle.

6.5.2. V2X Application Provider

The V2X Application Provider provides V2X applications (e.g. navigation with real-time traffic information, entertainment applications, etc.).

6.5.3. V2X Platform Provider

The V2X Platform Provider operates the V2X platform.

6.5.4. Network Provider

The Network Provider provides the network connectivity between the vehicle and the V2X platform.

6.6. Business roles from Edge Computing perspective

Several players are involved in the Edge Computing (EC) business activities. Each player plays at least one business role. In some cases, however, one player can play more than one business role at the same time. The identified business roles are shown in Figure 6-7.

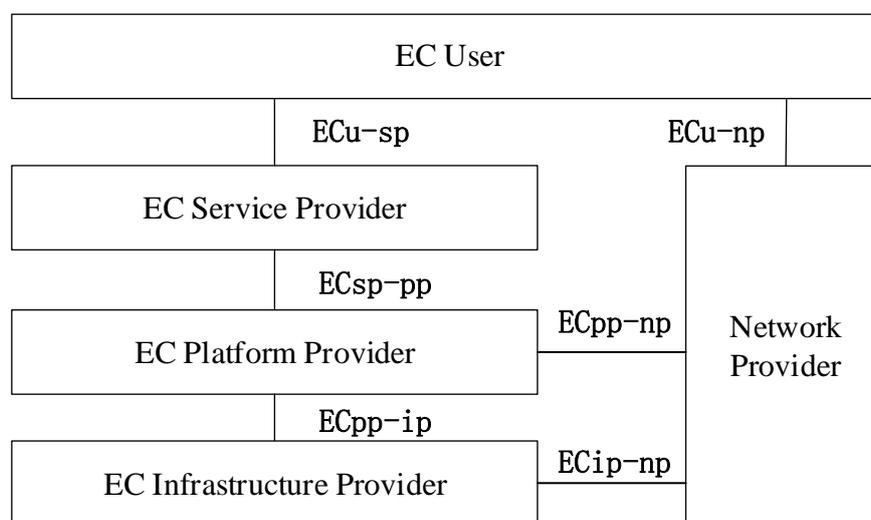


Figure 6-7 – Business roles from EC perspective

The business interfaces shown in Figure 6-7 are described in Table 6-7.

Table 6-7 – Business interfaces from EC perspective

Business interface	Business Roles	Interactions via the business interface
ECu-sp	EC User and EC Service Provider	The EC User interacts with the EC Service Provider for accessing EC applications based on corresponding SLAs, and for providing corresponding payment when necessary.
ECsp-pp	EC Service Provider and EC Platform Provider	The EC Service Provider interacts with the EC Platform Provider for consuming platform capabilities needed by EC applications based on corresponding SLAs, and for providing corresponding payment when necessary.
ECpp-ip	EC Platform Provider and EC Infrastructure Provider	The EC Platform Provider interacts with the EC Infrastructure Provider for consuming the infrastructure resources based on corresponding SLAs, as well as for providing corresponding payment when necessary.
ECu-np	EC User and Network Provider	The EC User interacts with the Network Provider for consuming network connectivity

		based on corresponding SLAs, and for providing corresponding payment when necessary.
ECpp-np	EC Platform Provider and Network Provider	The EC Platform Provider interacts with the Network Provider for consuming network connectivity based on corresponding SLAs, and for providing corresponding payment when necessary.
ECip-np	EC Infrastructure Provider and Network Provider	The Network Provider interacts with the EC Infrastructure Provider for consuming infrastructure resources based on corresponding SLAs, and for providing corresponding payment when necessary.

6.6.1 EC User

The EC User uses the EC services.

6.6.2 EC Service Provider

The EC Service Provider provides the EC services to the EC User.

6.6.3 EC Platform Provider

The EC Platform Provider operates the EC platform.

6.6.4 EC Infrastructure Provider

The EC Infrastructure Provider provides the EC hosting infrastructure to the EC Platform Provider.

6.6.5 Network Provider

The Network Provider provides the network connectivity to the EC User and the EC Platform Provider.

7. Business role-based models and best practice use cases

7.1. Business role-based models and best practice use cases for network slicing

7.1.1. Model 1 for Network Slicing

In this model, there are four players in addition to Network Slice Service User.

Player A plays three roles: Network Slice Provider, Network Slice Management & Orchestration Provide and Network Slice Service Provider.

Player B plays the role of Network Infrastructure Management & Orchestration Provider.

Player C and player D are two different Network Infrastructure Providers.

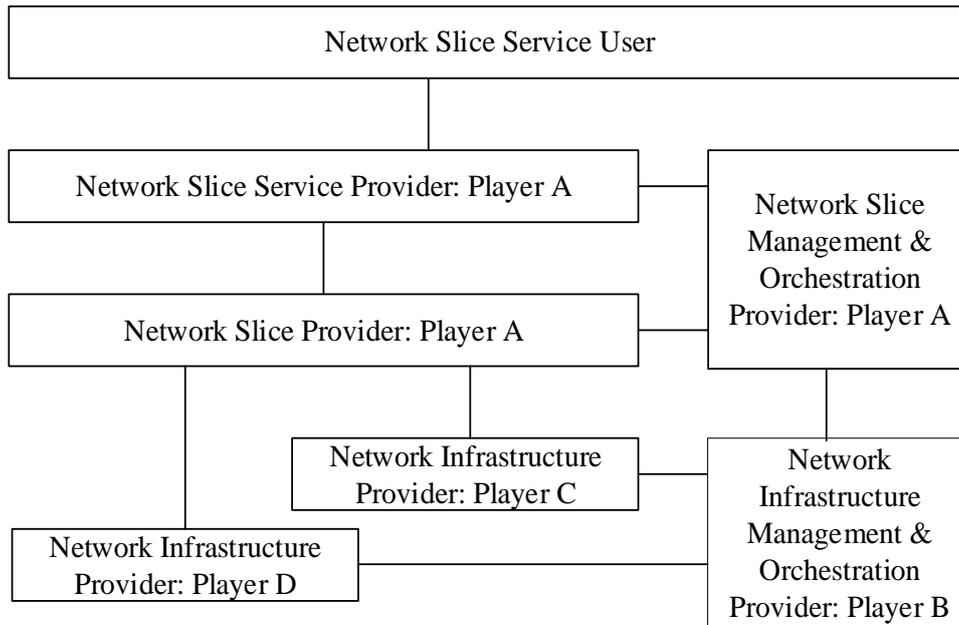


Figure 7-1 – Model 1 for network slicing

7.1.1.1. Use case 1

Player A is a telecom network operator. In this use case, player A provides private mobile network services to enterprises by building separate network slice instances for each enterprise. As the Network Slice Service User, these enterprises make contracts with player A. Player C and player D are two cloud infrastructure companies which provide Infrastructure as a Service (IaaS). Player B is a broker company which integrates infrastructures of player C and player D to offer the combined resources to player A.

7.1.2. Model 2 for Network Slicing

In this model, there are two players in addition to Network Slice Service User.

Player A plays three roles: Network Slice Provider, Network Slice Management & Orchestration Provide and Network Infrastructure Provider.

Player B plays the role of Network Slice Service Provider.

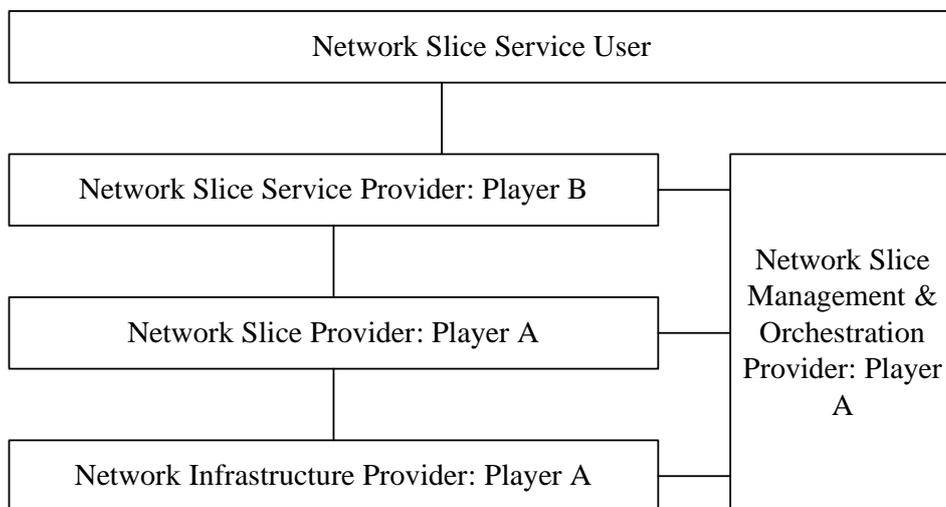


Figure 7-2 – Model 2 for network slicing

7.1.2.1. Use case 2.1

Player A is a telecom network operator. Player B is a virtual network operator which provides services to public users. As the Network Slice Service User, public users make contracts with player B. Player B makes a contract with player A for network resource consumption and network operation. Player A manages the network slice instances and player B provides the services by using the network slice instances.

7.1.2.2. Use case 2.2

Player A is a telecom network operator. Player B is a vehicle manufacturer which produces smart vehicles with functionalities for auto-driving service. Player B makes a contract with player A for V2X network connectivity via one dedicated network slice instance. As the Network Slice Service User, the vehicle owner uses V2X services from player B including auto-driving service. Player A manages the network slice instances and player B provides V2X services to users.

7.1.3. Model 3 for Network Slicing

In this model, there are two players in addition to the Network Slice Service User.

Player A plays two roles: Network Slice Provider and Network Infrastructure Provider.

Player B plays two roles: Network Slice Service Provider and Network Slice Management & Orchestration Provider.

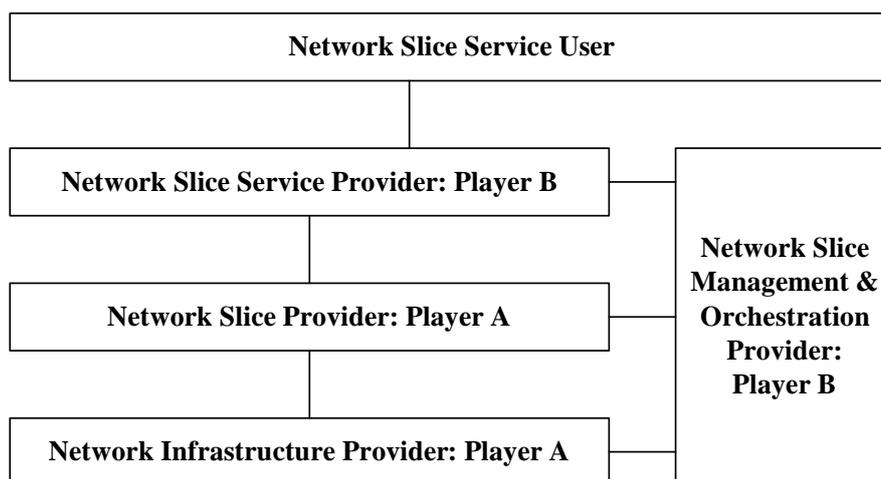


Figure 7-3 – Model 3 for network slicing

7.1.3.1. Use case 3.1

Player A is a telecom network operator which owns network infrastructure and provides network slices. Player B is a virtual network operator which provides services to public users and has operation and management capabilities. Player B makes a contract with player A for consuming network slices. Network slice instances are orchestrated and managed by player B with the authorization of player A. As the Network Slice Service User, public users make contracts with player B.

7.1.3.2. Use case 3.2

Player A is a telecom network operator which owns network infrastructure and provides network slices. Player B is an enterprise with service design and operation capabilities, e.g. a bank or an IT solution provider. Player B makes a contract with player A for consuming network slices. Network slice instances are orchestrated and managed by player B with the authorization of player A. Different branches or departments of player B can play the role of Network Slice Service User.

7.1.4. Model 4 for Network Slicing

In this model, there are two players in addition to the Network Slice Service User.

Player A plays the role of Network Infrastructure Provider.

Player B plays three roles: Network Slice Service Provider, Network Slice Provider and Network Slice Management & Orchestration Provider.

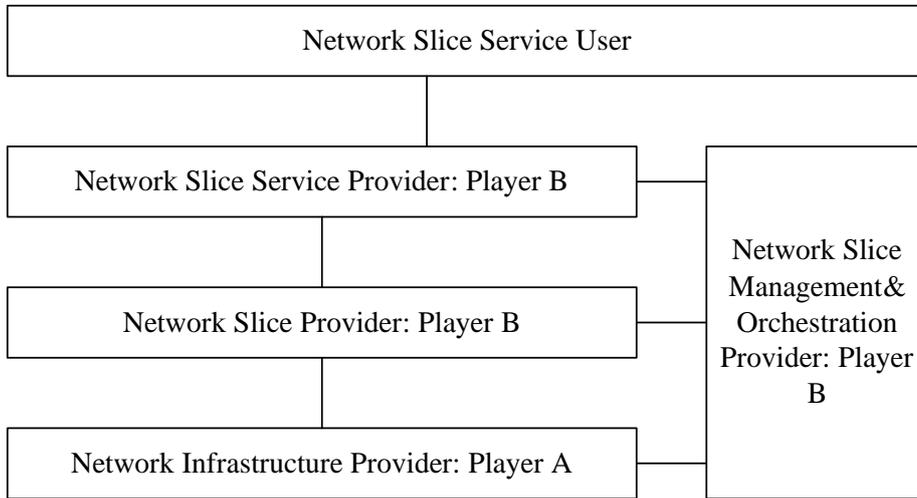


Figure 7-4 – Model 4 for network slicing

7.1.4.1. Use case 4.1

Player A is a network infrastructure equipment vendor and provides the network infrastructure. Player B is a network operator and leases the network infrastructure from player A and shares revenue with player A. Player B manages the network and provides services to enterprises via network slice instances. As the Network Slice Service User, the enterprises make contracts with player B.

7.1.5. Model 5 for Network Slicing

In this model, there are three players in addition to the Network Slice Service User.

Player A plays the role of Network Infrastructure Provider.

Player B plays two roles: Network Slice Provider, Network Slice Management & Orchestration Provider.

Player C plays the role of Network Slice Service Provider.

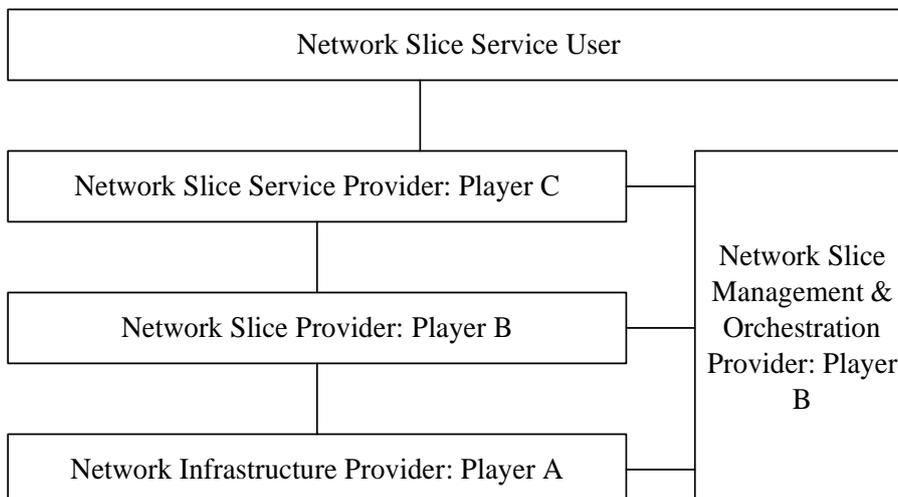


Figure 7-5 – Model 5 for network slicing

7.1.5.1. Use case 5.1

Player A owns the network infrastructure. Player A can be a telecom network operator or other business entity. Player B is a Mobile Virtual Network Operator (MVNO) which provides network connectivity to enterprises including player C. Player C provides specific applications, e.g. IoT applications, via network slice instances provided by player B.

Player B makes a contract with player A for consuming network infrastructure resources. Player C makes a contract with player B for consuming network slice instance(s) provided by player B. As the Network Slice Service User, the IoT application users make contracts with player C for services provided by player C.

7.1.6. Model 6 for Network Slicing

In this model, there are two players in addition to the Network Slice Service User.

Player A plays three roles: Network sub-Slice Provider, Network sub-Slice Management & Orchestration Provider and Network Infrastructure Provider.

Player B plays four roles: Network Slice Service Provider, Network Slice Provider, Network Slice Management & Orchestration Provider and Network Infrastructure Provider.

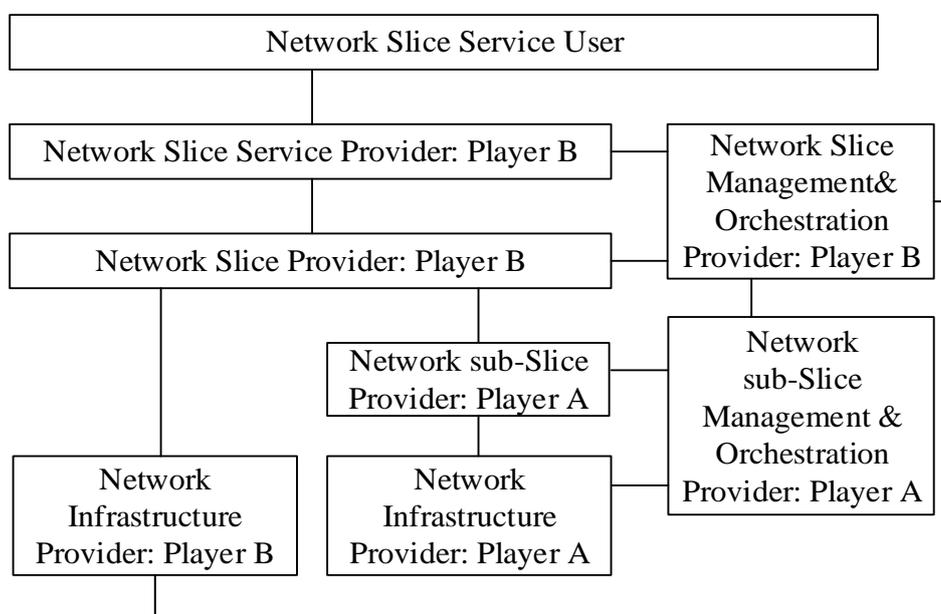


Figure 7-6 – Model 6 for network slicing

7.1.6.1. Use case 6.1

Player A and player B are two telecom network operators. Player B makes a contract with player A to consume some of player A's network resources. Player A creates a network sub-slice instance and provides required information related to the network sub-slice instance to player B. Player B creates a network slice instance using network sub-slice instances from player A combined with its own network resources as necessary. Player B provides services to users via the network slice instance.

7.2. Business role-based models and best practice use cases for vertical services

7.2.1. Model 1 for Vertical Services

In this model, there are three players in addition to the Vertical Application User.

Player A plays three roles: Vertical Application Provider, Vertical Service Platform Provider and Network Provider.

Player B and player C play the role of Vertical Application Provider.

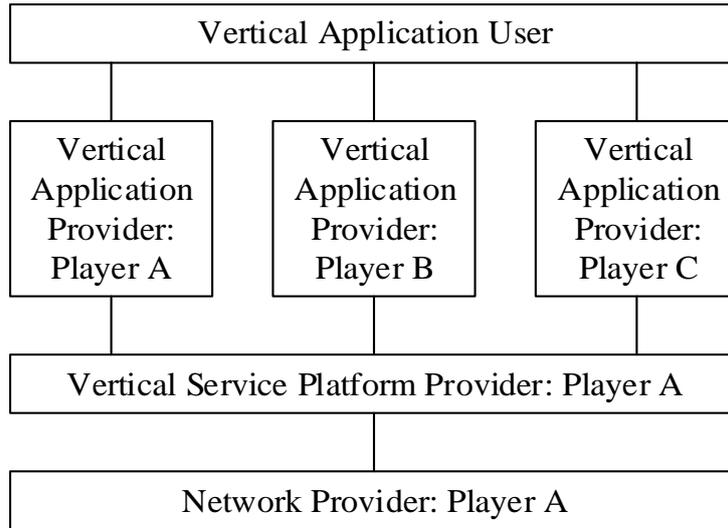


Figure 7-7 – Model 1 for vertical services

7.2.1.1. Use case 1

Player A is a network operator. Player A provides a vertical service platform which is open to vertical applications from multiple Vertical Application Providers. As Vertical Application Provider, player A also provides vertical applications.

Based on the open application programming interfaces (APIs) of the vertical service platform, player A provides fundamental enablers (e.g. connectivity service, user management, user authentication & authorization, service charging, data storage, etc.) for Vertical Application Providers. Vertical Application Providers can create specific vertical applications (such as power metering application, industrial controlling applications etc.) based on the enablers of player A's vertical service platform.

7.2.2. Model 2 for Vertical Services

In this model, there are six players in addition to the Vertical Application User.

Player A and player B play the role of Network Provider.

Player C plays the role of Vertical Service Platform Provider.

Player D, player E and player F play the role of Vertical Application Provider.

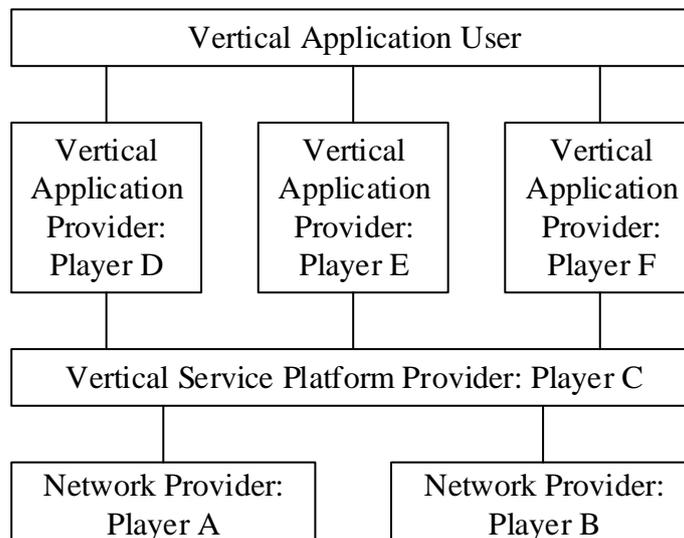


Figure 7-8 – Model 2 for vertical services

7.2.2.1. Use case 1

The vertical service platform of player C can be connected to multiple networks of different Network Providers (player A and player B), to extend its service coverage to different regions or countries.

Vertical Application Providers (player D, player E and player F) can deploy their applications on the vertical service platform of player C. The vertical applications can benefit from reusing the common capabilities (e.g. connectivity service, user management, user authentication and authorization, service charging, data storage, etc.) of the vertical service platform based on open APIs.

7.3. Business role-based models and best practice use cases for VR/AR

7.3.1. Model 1 for VR/AR

In this model, there are three players in addition to the VR/AR User.

Player A plays the role of Network Provider.

Player B plays the role of VR/AR Platform Provider.

Player C plays the role of VR/AR Application Provider.

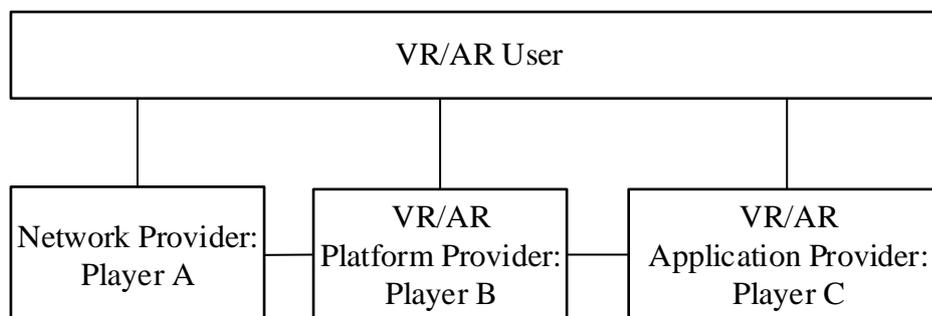


Figure 7-9 – Model 1 for VR/AR

7.3.1.1. Use case 1

Player C is a VR game company. Player B provides a VR game platform which hosts VR games from multiple VR game companies such as player C. Player A is the network operator providing network connectivity for VR users to access player B's VR game platform.

Player C shares revenue with player B when VR users play the VR games offered by player C. Player B may have a contract with player A so that the VR users do not need to pay for the data consumption. The VR users may subscribe to player B's platform for free.

7.4. Business role-based models and best practice use cases for D2D service

7.4.1. Model 1 for D2D

In this model, there are two players in addition to the D2D Service User.

Player A plays the role of D2D Service Provider.

Player B plays the role of Network Provider.

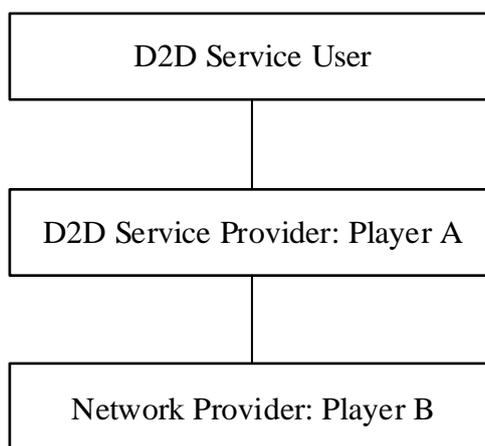


Figure 7-10 – Model 1 for D2D

7.4.1.1. Use case 1

Player A is a manufacturer which produces household electrical appliances with D2D service capability, such as television, washing machine, electric cooker, etc. and provides D2D services. All the D2D devices can communicate with a specific D2D device which works as the controller device. Player B is a network operator which makes a contract with player A to provide network connectivity between the controller device and the other D2D devices.

The D2D service users pay player A for the electrical appliances with D2D service capability. Player A pays player B for network connectivity.

7.5. Business role-based models and best practice use cases for V2X service

7.5.1. Model 1 for V2X

In this model, there are three players in addition to V2X User.

Player A plays the role of V2X Platform Provider.

Player B plays the role of V2X Application Provider.

Player C plays the role of Network Provider.

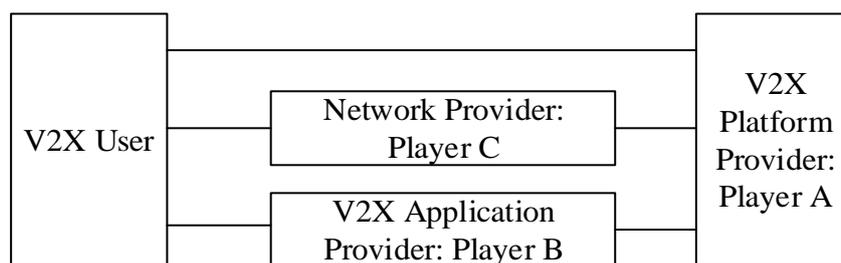


Figure 7-11 – Model 1 for V2X

7.5.1.1. Use case 1

Player A is a vehicle manufacturer which operates a V2X platform and provides V2X services limited to its own brand. Player B is a supplier of V2X applications for player A, e.g. news broadcast, weather forecast, navigation with real-time traffic information, and entertainment applications. Player C is a telecom network operator which provides network connectivity between the V2X users and the V2X platform.

The V2X user pays player A for V2X service-enabled vehicle. The V2X user also pays player C based on data consumption for V2X services. Player A pays player B for V2X applications.

7.5.2. Model 2 for V2X

In this model, there are two players in addition to V2X user.

Player A plays two roles: V2X Platform Provider and V2X Application Provider.

Player B plays the role of Network Provider.

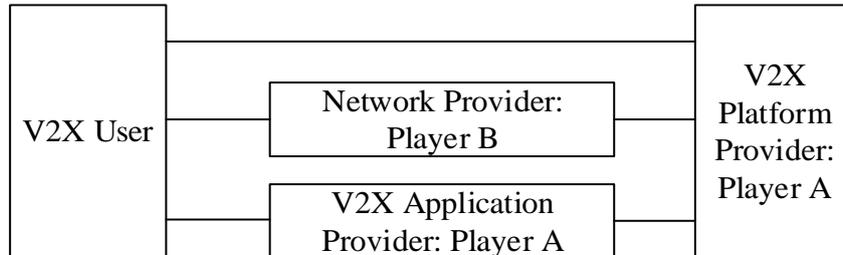


Figure 7-12 – Model 2 for V2X

7.5.2.1. Use case 1

Player A is an independent V2X service company which provides V2X platform and hosted V2X applications for vehicles from different vehicle manufacturers. Player B is a telecom network operator which provides network connectivity between the V2X platform and the V2X users which have contracts with player A.

The V2X user pays player A for V2X services. Player A shares revenue with player B, on a per V2X user basis yearly, for network connectivity.

7.5.3. Model 3 for V2X

In this model, there are two players in addition to V2X user.

Player A plays the role of V2X Application Provider.

Player B plays two roles: V2X Platform Provider and Network Provider.

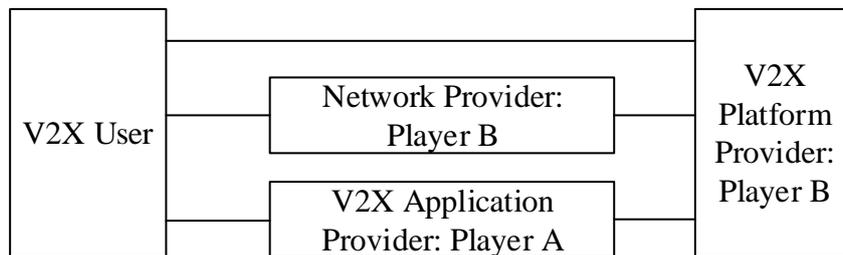


Figure 7-13 – Model 3 for V2X

7.5.3.1. Use case 1

Player B is a telecom network operator which also operates a V2X platform for different partner vehicle manufacturers. Player A is an independent V2X application company which provides V2X applications to different V2X platform providers such as player B.

The V2X user pays player B for network connectivity and V2X services. Player B shares revenue with player A, on a per V2X application installation basis.

7.6. Business role-based models and best practice use cases for EC

7.6.1. Model 1 for EC

In this model, there is one player in addition to EC User.

Player A plays four roles: EC Service Provider, EC Platform Provider, EC Infrastructure Provider and Network Provider.

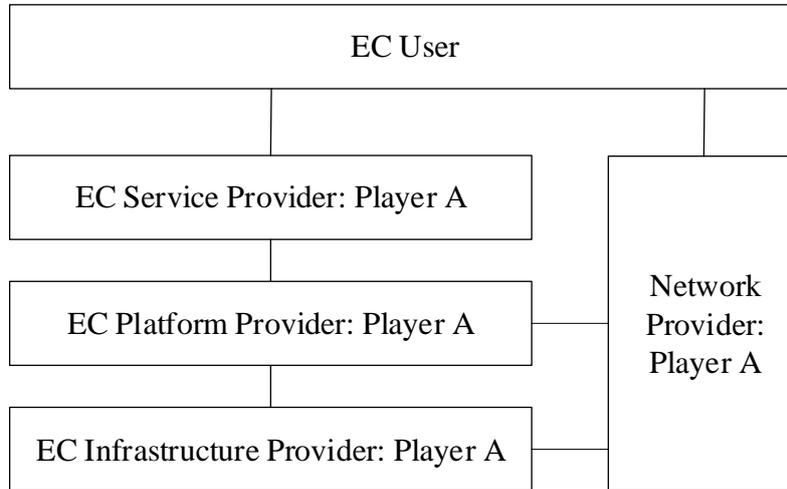


Figure 7-14 – Model 1 for EC

7.6.1.1 Use case 1

Player A is a telecom network operator. Player A builds the EC infrastructure at the edge of its network and deploys an EC application platform to provide EC applications e.g. CDN, local breakout to Internet and other local applications. The EC users are subscribers of player A and pay for the network connectivity.

7.6.2. Model 2 for EC

In this model, there are two players in addition to EC User.

Player A plays three roles: EC Platform Provider, EC Infrastructure Provider and Network Provider.

Player B plays the role of EC Service Provider.

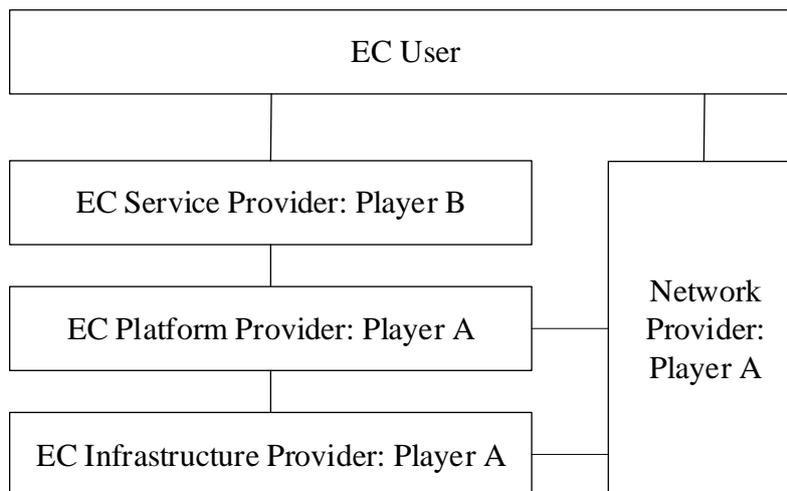


Figure 7-15 – Model 2 for EC

7.6.2.1 Use case 1

Player A is a mobile network operator, and provides EC infrastructure and EC platform for player B. Player B is a university which would like to deploy some local applications to be used by its teachers and students as EC users, e.g. to facilitate lab testing for their research and information exchange.

Player B pays player A based on the usage of the EC infrastructure and platform. The EC users, who are subscribers of player A, use EC services for free.

7.6.3. Model 3 for EC

In model 3, there are two players in addition to EC User.

Player A plays two roles: EC Platform Provider and Network Provider.

Player B plays the role of EC Service Provider and EC Infrastructure Provider.

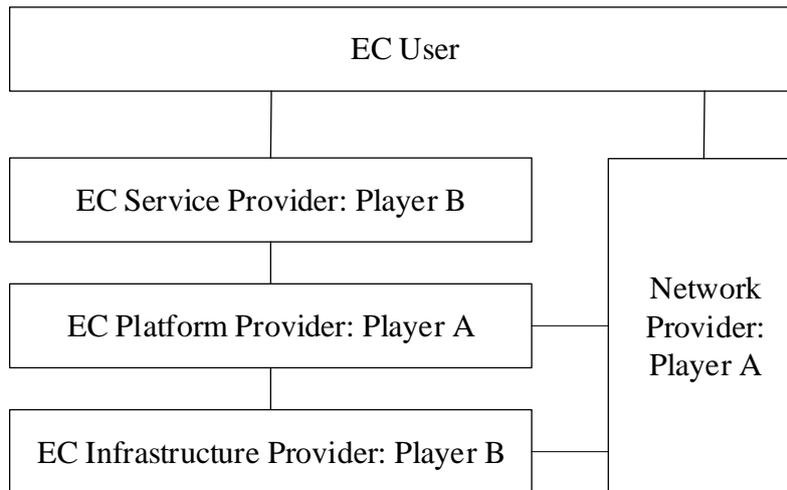


Figure 7-16 – Model 3 for EC

7.6.3.1 Use case 1

Player A is a telecom network operator and an EC platform provider. Player B is an oil refinery company. During player B's oil refinery process, some dedicated equipment and applications have to be deployed locally at player B's factory due to e.g. ultra-low latency requirement and harsh environment. So player B builds its own EC infrastructure on its premises and deploys its own EC applications. Player A provides the EC platform to player B as well as the network connectivity between the EC users and the EC infrastructure. Player B pays player A for the EC platform as well as the network connectivity.
