



5G PRODUCT AND SERVICE MODELLING

Abstract

5G is set to transform the way we live and work. It will enable US\$ 13.2 trillion of global economic output by 2035, empowering new services and use cases, and providing infinite opportunities to digital service providers (DSPs). The journey to capitalize on the intrinsic value of 5G beyond high speed mobile broadband starts now, and the possibility of realizing this potential is higher in the next 5-7 years, when market share is established.

Rolling out innovative products and services rapidly requires a reusable, modular, componentized, and flexible product design using an industry-standard framework to provide a single view between business, IT, and network.

Our point of view helps product owners conceptualize new offerings for customers with new use cases; and enables architects and consultants to adopt a product and service modeling approach using an industry-standard framework. We also explore a business model to create and deliver new value propositions by considering various elements. It opens new possibilities of product offerings addressing needs in different market segments, and develops product requirements supported by the underlying technology.

5G and its impact on product domain

About 5G

Each evolution of the mobile wireless network has addressed new areas of applications. 2G predominantly addressed voice and SMS, 3G provided users with video conferencing, video streaming, and voice-over-IP features using mobile Internet, 4G provided fast mobile Web access which facilitates gaming services, high-quality video streaming and conferencing.

With 5G, the network is expected to evolve in terms of high data rate (1+ Gbps), ultra-low latency, and reliability, as well as features such as improved power efficiency, cost optimization, massive IoT density, and dynamic resource allocation to enable a broad spectrum of wireless applications and IoT connections.

The transition from 4G to 5G will be enabled by a combination of technologies such as millimeter wave, small cell, massive MIMO, beamforming and full duplex [1].

This transition will not be limited to the mass-market only, but will also be available to a wide range of use cases across industry verticals, which were previously not possible because of limitations of the existing mobile network. To benefit from this additional revenue from 5G-enabled market opportunities, DSPs must define new products and services enabling these use cases.

Research statistics

5G-enabled industry digitization revenues for ICT players will top US\$ 3.3 trillion by 2026 across key industries.

Operators can benefit from an additional 34% revenue from 5G-enabled market opportunities by 2026.

Source: Ericsson & Arthur D. Little^[2]

In 2035, 5G will enable US\$ 13.2 trillion of global economic output. It is equivalent in current dollars to US consumer spending (US\$ 13.9 trillion) and the combined spending by consumers in China, Japan, Germany, UK, and France (US\$ 13.4 trillion) in 2018.

Source: Qualcomm, 2019^[3]

By the end of May 2020, 386 operators in 125 countries / territories announced that they were investing in 5G. A total of 81 operators in 42 countries / territories launched one or more 3GPP-compliant 5G services. Of those, 73 operators in 38 countries/ territories launched 3GPP-compliant 5G mobile services (67 full launches, six limited availability launches). 39 operators in 24 countries / territories launched 3GPP-compliant 5G FWA or home broadband services (33 full launches, six limited availability launches).

Source: 5G Market Snapshot June 2020 from GSA^[4]

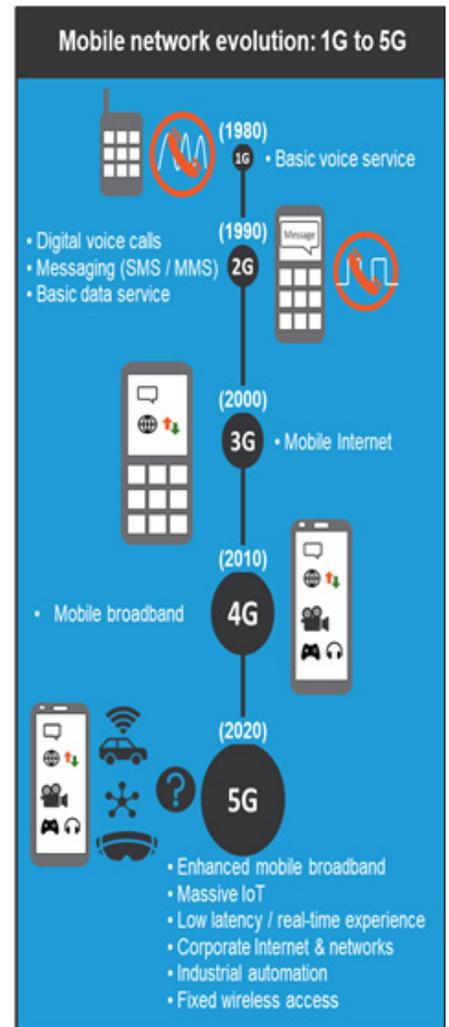


Fig. 1: Mobile network evolution

5G will help DSPs establish a new identity by offering more than just a network to the customer. DSPs can become service enablers or even service creators, and benefit from additional revenue streams. It will provide new opportunities to people and businesses, and expand the mobile ecosystem in new areas.

5G use case categories

The 5G requirements defined by ITU Radiocommunication Sector (ITU-R) and 3GPP broadly cover three main use cases – enhanced mobile broadband (eMBB), massive machine type communication (mMTC) or ultra-reliable low latency communications (uRLLC) category^[5]. These use cases are illustrated in the graphic below.

Defining categories differentiated from each other based on network attributes such as data rate, latency, and availability is possible due to network slicing, closed loop assurance, and edge computing capabilities provided by 5G. These capabilities will help:

- Logically divide shared network infrastructure based on network attributes
- Create self-optimized mobile network which will monitor, identify, adjust, and optimize the network
- Process time-sensitive data at the point of origin or at an intermediate server
- Enable creation of completely new services which will be offered in the market as new product offerings (standalone / bundles), targeted toward different customer segments and offered through various sales channels

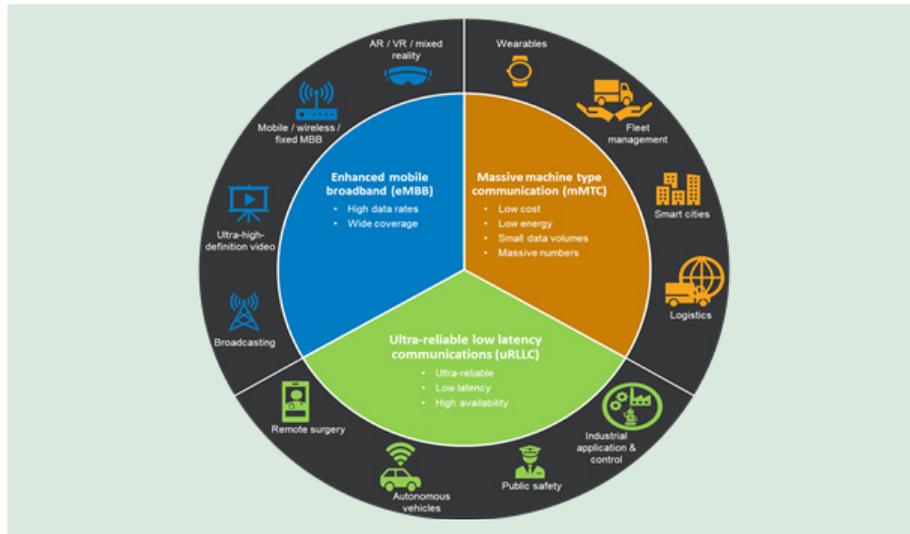


Fig 2: 5G use case categories

On the network, these capabilities are realized as 'CustomerFacingServices', which has 'ResourceFacingServices' (Ref: TM Forum SID).

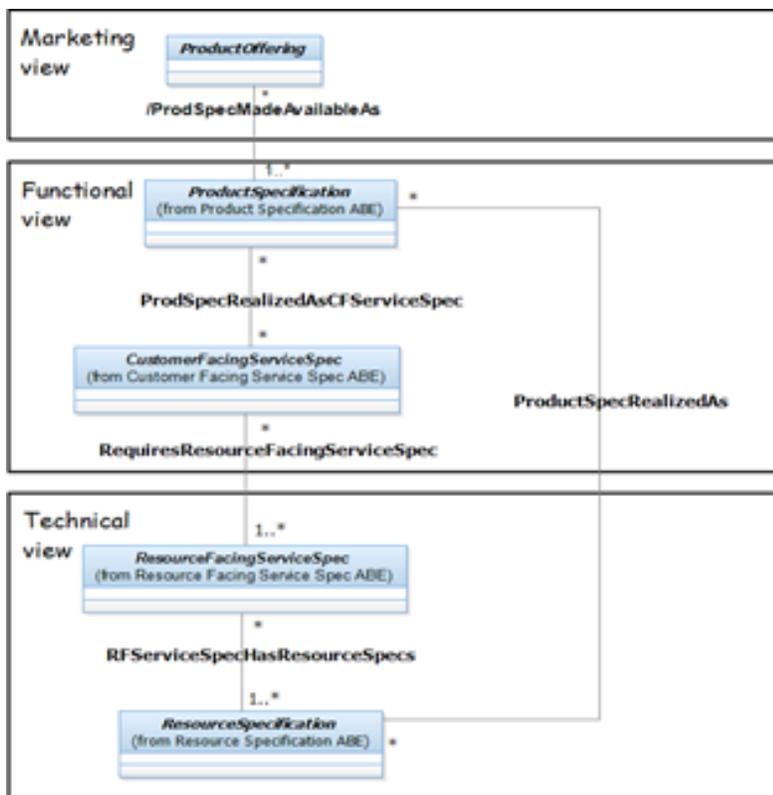


Fig. 3: Product, service, resource specification relationship

Approach toward defining product offers

For end-to-end (E2E) ordering and provisioning of 5G products and services, it is imperative to identify and define applicable ResourceFacingServices and the required resources with applicable attributes and their values.

Once services are identified, it will be possible to define product structure (called ProductSpecification) based on differentiating attributes which can be controlled by the customer.

Out of this product structure, various commercial offers with pricing patterns can be created to cater to different market segments, market verticals and horizontals (e.g. B2B, B2C, B2B2X).

Figure 3 demonstrates the relationships between product, service, and resources^[6].

Modelling 5G products and services

The models detailed below are based on the industry-standard framework (TM Forum's SID).

Product modelling

A few use cases are shown below to offer insights into how DSPs can model and sell 5G products and services in the marketplace. Technical views i.e. ResourceFacingServiceSpec and ResourceSpecification (logical / physical) are not detailed in the models. In addition, detailed modelling of ProductUsageSpecification is not covered.

Use Case 1: (Target customer segment: B2B, B2C)

Tom is a college student pursuing a post-graduate diploma in marketing. He lives with his parents and spends more than two hours every day commuting between home and college. He likes to spend his travel time watching online

videos. He has heard that 5G will provide high data rates and ultra-high-definition videos, and is keen to buy a new 5G subscription which will make his online streaming experience better.

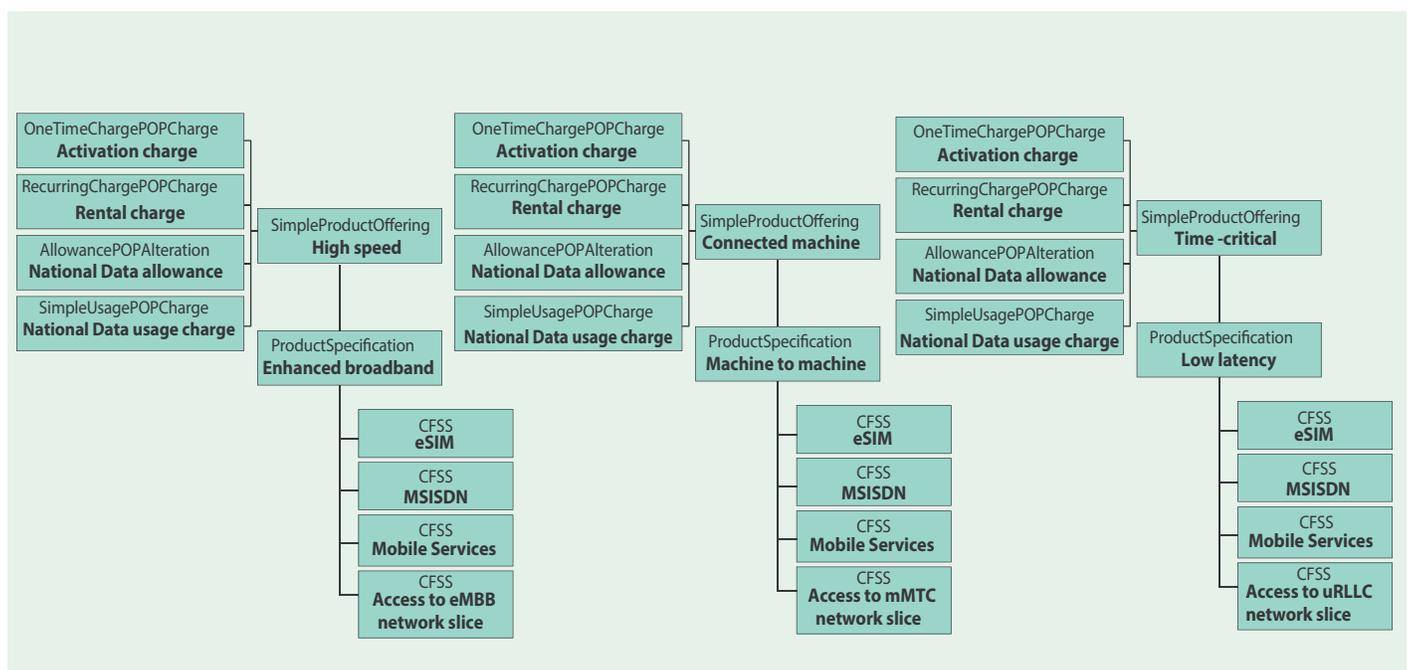


Fig 4. Use case 1

To address Tom's requirement, the DSP can offer a 'High Speed' subscription which provides a data rate of >100Mbps (this is an indicative figure and will depend on the spectrum allocated to the DSP). This subscription will provide access to the eMBB network slice to ensure that a committed data rate is given to Tom.

Similarly, the DSP can create subscriptions providing access to mMTC and uRLLC network slices to meet the specific needs of the customer. Network parameters of such slices can be differentiated based on data rate, latency, and availability. For example, a connected machine subscription will

provide access to the mMTC slice which ensures 1Gbps data rate, less than 5ms latency, and 98.999% availability, while the time-critical subscription provides access to the uRLLC slice which ensures 1Mbps data rate, less than 1ms latency, and 99.999% availability.

Use case 2: (Target customer segment: B2B, B2C, B2B2X)

Tom uses a leading video-on-demand subscription on his new 5G connection, which includes an HD experience. But Tom wants a 4K experience, and is willing to pay a premium for this service.

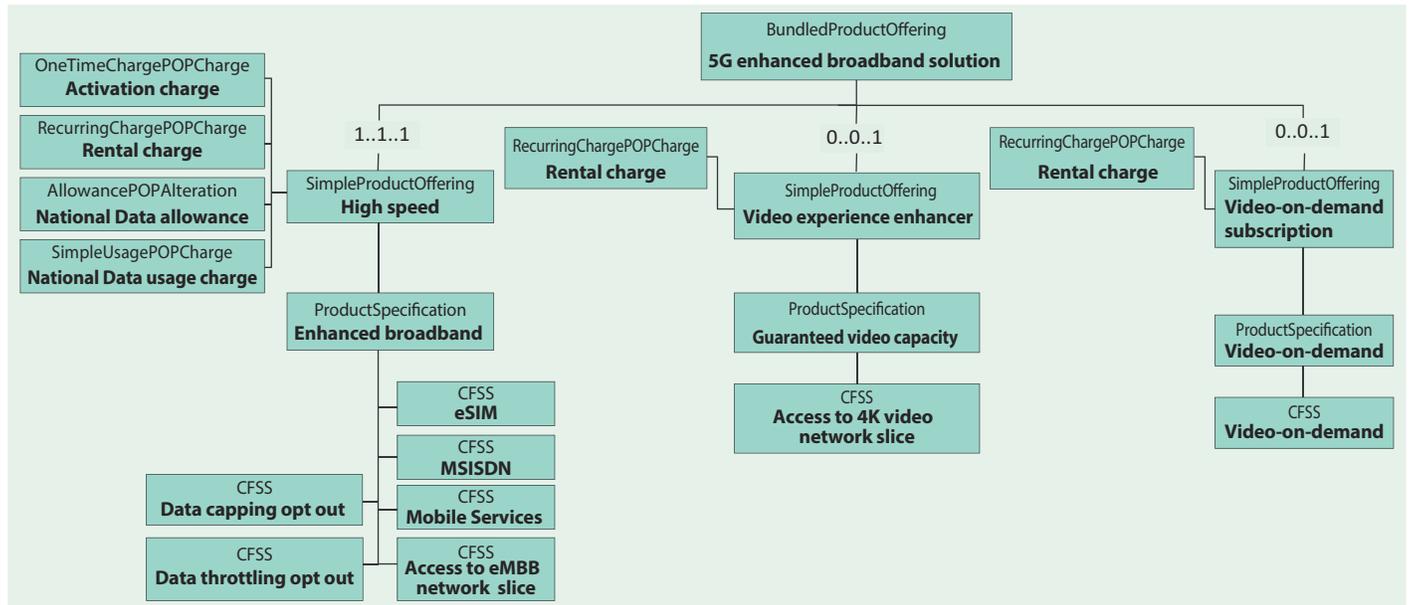


Fig 5. Use case 2

To address Tom's requirements, his DSP can offer additional options such as a video experience enhancer, with which the DSP can place Tom in an appropriate network slice where higher bandwidth is ensured to stream online 4K videos.

The DSP can also sell partner products such as video-on-demand subscriptions offered by OTT players with an assurance that it will provide high data rates to watch ultra-high definition videos without buffering. The DSP can earn a commission from OTT players for offering this experience to end users.

It is also possible to provide cost control options to avoid bill shocks, such as:

- Data capping for home and roaming networks, enabling the end user to define the capping threshold, beyond which data access is barred

- Data throttling, so that once the in-bundle allowance is exhausted, the speed will be decreased



Use case 3: (Target customer segment: B2B, B2B2X)

NextGenGaming runs gaming sports bars across Europe and is looking to enhance the virtual reality (VR) gaming experience for customers. They have two categories of games, weak interactive VR (wi-VR)

and strong interactive VR (si-VR). In weak interactive-VR, end users do not have direct interaction with the virtual environment, while in strong interactive-VR, end users can interact with the virtual environment. There are three genres of games in each of these categories,

Beginner, for age group 10-14 years; Intermediate, for 14-18 years; and Advanced, for customers aged 18 years and above. These genres have different network requirements to provide an enhanced gaming experience.

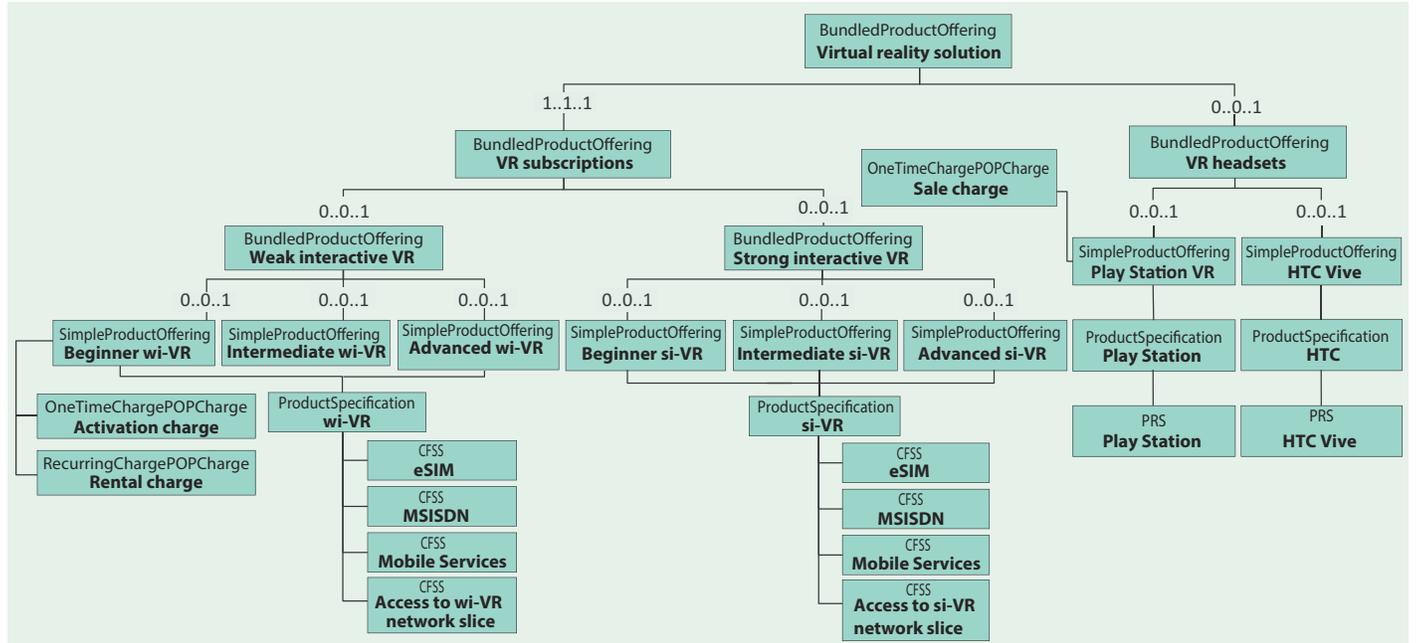
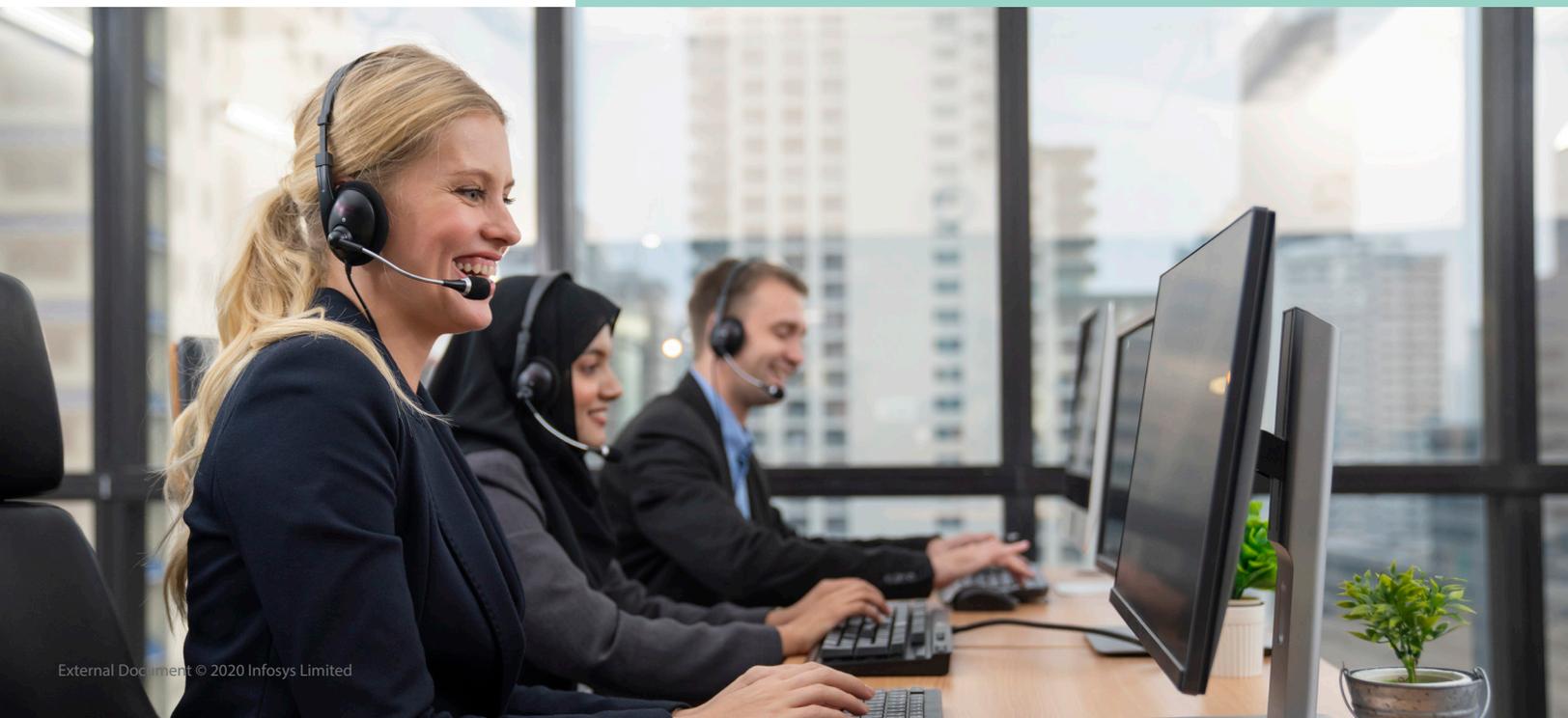


Fig 6. Use case 3

For example, Beginner wi-VR subscription ensures 70Mbps data rate, 25ms round trip time, and 2.4E-5 packet loss, while Advanced si-VR subscription ensures 3.36Gbps data rate, 5ms round trip time, and 1.00E-6 packet loss^[7]

The DSP can bundle these subscriptions along with VR headsets and provide discounts. Also, if

required, the VR headset can be sold as a standalone product in the market through DSPs selling channels.



Slice on demand:

The DSP can also offer self-optimized subscriptions, which provide access to dynamic slice, where, based on the type of usage, an appropriate usage charge is applied to the customer.

For example, if the customer is playing a game which requires network parameters such as 'Advanced si-VR', the DSP can charge US\$ 5 per GB of usage. If the customer is playing a game which requires network parameters such as 'Beginner wi-VR', the DSP can charge US\$ 3 per GB of usage.

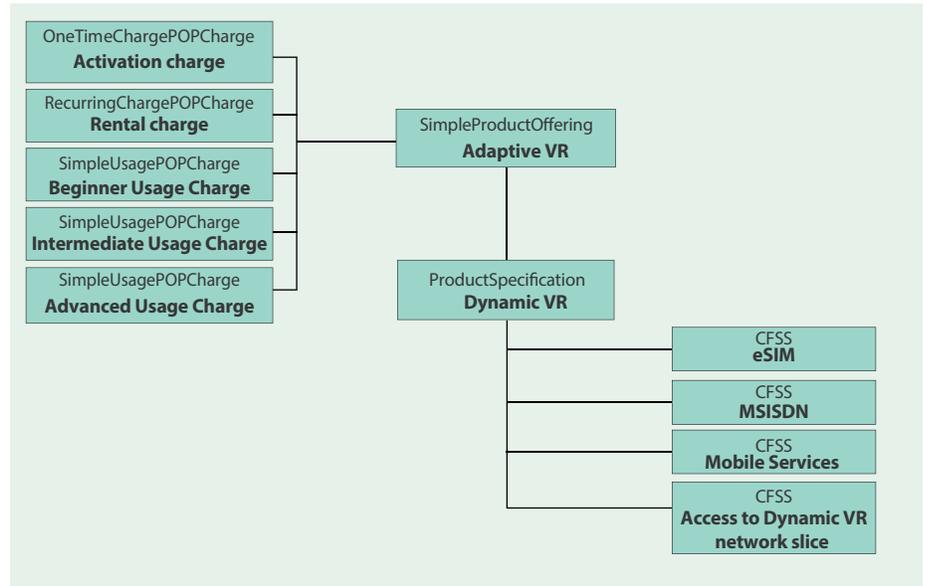


Fig 7. Use case 3 (b)

Use case 4: (Target customer segment: B2B, B2B2X)

Advance Motors is a luxury car manufacturer targeting middle- and higher-income group customers. The company is looking for a 5G connected car solution to provide differential services based on type of usage. The usage could be related to entertainment, telematics, and safety. It wants to offer this solution as an out-of-the-box feature in cars.

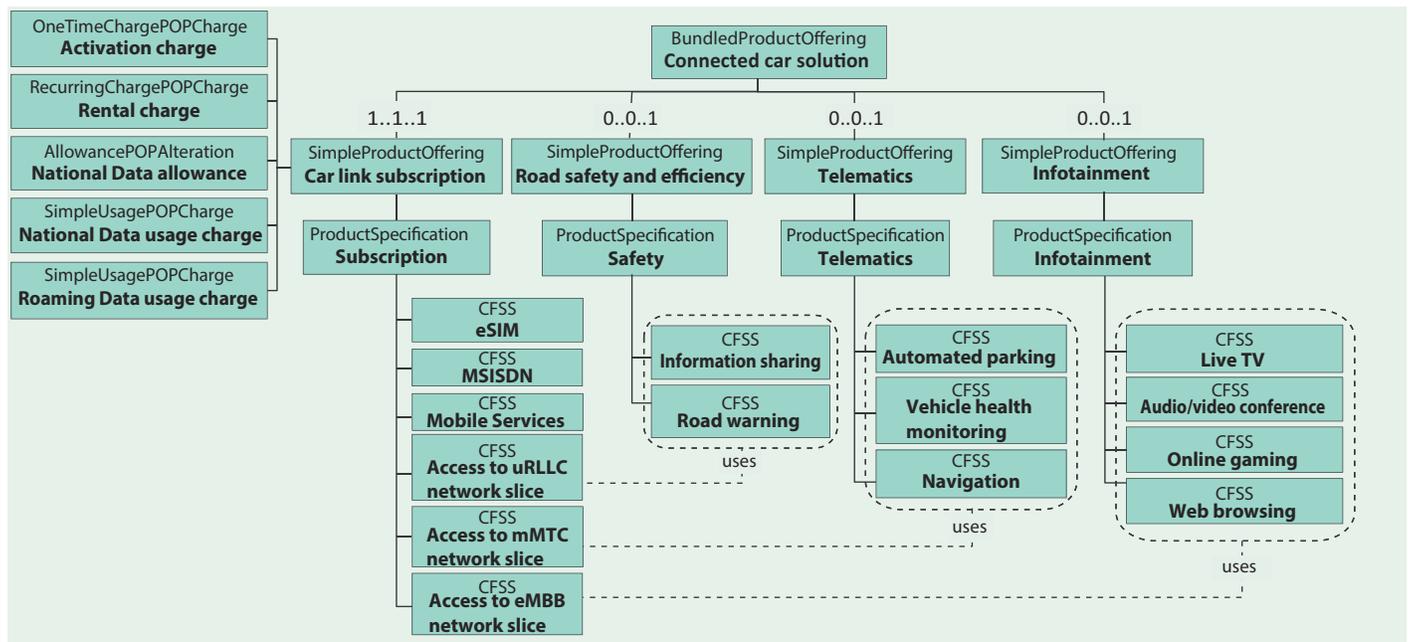


Fig 8. Use case 4

To address this requirement, the DSP can sell different variants of connected car solutions, which can be used by the car manufacturer for different models of cars. These subscriptions can be differentiated based on access to the slice they provide, as well as the allowance provided per slice usage, out of bundle usage charge with respect to slice.

The connected car is a good example of the B2B2C model, where it is possible to define a split bill solution. The car manufacturer buys a connectivity and split bill offer from the DSP, and based on data traffic usage, liability of payment can be divided between the

car manufacturer and the end customer. For example, the car manufacturer only pays the rental charge and for usage generated from the 'Road Safety and Efficiency' feature. The payment for 'telematics' and 'infotainment' is made by the end user^[8].



Service modelling:

A network slice consists of one or more network services which in turn consist of network functions (virtual and physical).

Physical network functions (PNF) are vendor-provided network function(s) implemented using a set of software modules deployed on a dedicated hardware element, while virtual network functions (VNFs) use cloud resources to provide network functions through virtualized software modules.

The VNF forwarding graph (VNFFG) shows the graph of logical links connecting VNF nodes for the purpose of describing the traffic flow between these VNFs.

Finally, network service is a combination of the above-mentioned functional blocks, which includes VNFs, VNF forwarding graph and PNFs.

Using these parameters, a service-oriented network slice can be modelled as shown in Figure 9.

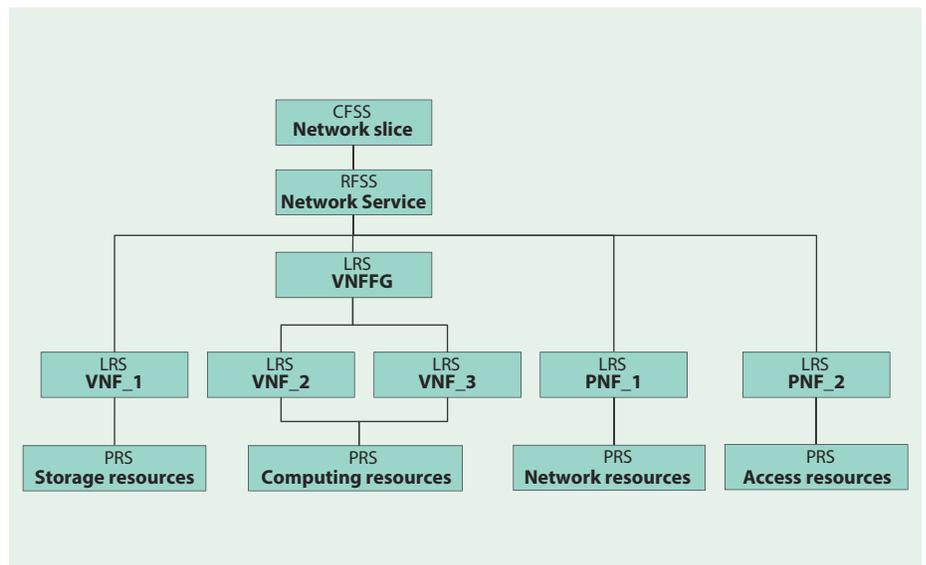


Fig 9. Network slice service model

A network slice can have several attributes (some mentioned below). The appropriate values for these attributes characterize one network slice from other:

Downstream bandwidth per slice	Upstream bandwidth per slice	Downstream bandwidth per user	Upstream bandwidth per user
Latency	Round trip time	Cyclic traffic	Availability
Predictive QoS	Packet loss	Maximum supported packet size	Synchronicity

Business model

According to a TM Forum survey report, in the long term, business-to-business (B2B) services account for more than 50% of DSPs' annual revenue. 5G will offer new opportunities for DSPs to target

enterprises, governmental organizations and virtual operators with not just connectivity services, but also platform-based services delivered in conjunction with partners. So it is imperative to identify

opportunities provided by 5G to create the right business model for target customers. Considering the overall understanding of 5G and the use cases above, the business model for 5G can be defined as:

<p>Key partners</p> <ul style="list-style-type: none"> ➤ OTT players ➤ Mobile virtual network operators ➤ Original equipment manufacturers ➤ System integrators ➤ Software vendors (BSS / OSS) ➤ Consultants ➤ Cloud services / solution providers ➤ Telecom network vendors 	<p>Key activities</p> <ul style="list-style-type: none"> ➤ Market evaluation and readiness ➤ Creating a platform to deliver 5G use cases ➤ Working with partners to bring new services ➤ Adopting DevOps and CI / CD models ➤ Transition to microservices <p>Key resource</p> <ul style="list-style-type: none"> ➤ Network resources ➤ Cloud infrastructure ➤ Business support systems to support 5G requirements ➤ Consulting services ➤ SW / HW development teams ➤ Operation teams ➤ Financial resources 	<p>Value proposition</p> <p>B2C market Provide broadband services and mobile subscriptions with add-ons, guaranteeing high data rates, coverage, best quality of service and customer experience</p> <p>B2B market Customize network slice for large enterprise customers to satisfy specific application needs related to data rates, latency, availability Dynamically providing access to a specific network slice based on the customers' usage to provide guaranteed customer experience</p> <p>B2B2X market Provide dedicated slice connection to MVNOs, who engage with end customers Bill split solution to implement cost control between enterprise customer and its end customers Guaranteed customer experience for OTT provided services over telco's connectivity</p>	<p>Customer relationship</p> <ul style="list-style-type: none"> ➤ Customer support ➤ Customer conference (voice of customer) and surveys ➤ Feedback analysis ➤ Digital presence and social network ➤ Business fairs <p>Channels</p> <ul style="list-style-type: none"> ➤ Online e-shops ➤ Telephone ➤ Shops / stores ➤ Social media ➤ Application programming interfaces 	<p>Customer segments</p> <p>B2C market Mass market users</p> <p>B2B market Small, medium, and large</p> <p>B2B2X market MVNOs selling their own product and services on telco's network slicing platform Manufacturers selling their equipment, vehicles along with telco-provided network slicing platform OTT partners providing their service on telco-provided connectivity</p>
<p>Cost structure</p> <ul style="list-style-type: none"> ➤ 5G spectrum ➤ Cloud services (storage, computing) ➤ Network and access resources ➤ Business support systems ➤ Advertising 		<p>Revenue stream</p> <ul style="list-style-type: none"> ➤ Subscriptions with recurring and one-time fee based on selected network attributes ➤ Charging based on type usage ➤ Add-ons (guaranteed throughput, HD video) with recurring fee ➤ Commission from OTT players ➤ Recurring fees from MVNOs for serving its end customer over telco-provided slice ➤ OEM sales 		

Fig 10. 5G business model canvas

Conclusion

5G will expand the mobile ecosystem to new industries, and DSPs can position themselves as connectivity providers, service enablers, or service creators to facilitate E2E use cases. It is imperative for DSPs to identify industry-specific E2E 5G use cases and decide the role they wish to play, and accordingly create value propositions for end customers. While creating a value proposition, it is essential to decide what commercial flexibility can be offered to customers so that it is aligned with IT architecture and network capabilities.

By adopting this approach, it will not only help the DSP to position itself as an E2E service creator in the mobile ecosystem, but also open new revenue streams.

This point of view is designed to help DSPs conceptualize how 5G-enabled use cases can be modelled in the product and service catalog by focusing on:

- Different categories of 5G use cases catering to various market segments and industries
- How much control is to be given to the customer while negotiating product parameters
- Different elements to consider while defining value proposition for customers

Efficiently modelled products and services will help reduce operational expenditure since product design and development cost become lower. It will also help to achieve faster time-to-market by creating a reusable, modular, componentized, and flexible product design framework.



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Key Abbreviations

Term	Description
DSP	Digital service provider
MIMO	Massive input massive output
eMBB	Enhanced mobile broadband
uRLLC	Ultra reliable low latency communication
mMTC	Massive machine type communication
FWA	Fixed wireless access
VR	Virtual reality
AR	Augmented reality
OTT	Over-the-top
VNF	Virtual network function
PNF	Physical network function
VNFFG	Virtual network function forwarding graph
PS	Product specification
CFSS	Customer facing service specification
RFSS	Resource facing service specification
LRS	Logical resource specification
PRS	Physical resource specification
OneTimeChargePOPCharge	One time charge prod offer price charge
RecurringChargePOPCharge	Recurring charge prod offer price charge
AllowancePOPAlteration	Allowance prod offer price alteration
SimpleUsagePOPCharge	Simple usage prod offer price charge

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