

Monetizing 5G



Technology aspects, future business models, and the impact on revenue management systems

An Oracle industry whitepaper

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THE TRANSFORMATIONAL IMPACT OF 5G

“Not just another G”

5G is much more than just enabling greater speeds and feeds for mobile services; it’s going to fundamentally change the way we live, work, and play with billions of connected people and potentially trillions of connected sensors. Focusing on three core 5G use cases:

- **Enhanced Mobile Broadband (eMBB)** will enable consumers and businesses to take advantage of greater degrees of data connectivity, lower latency, and global reach.
- **Massive Machine Type Communications (mMTC)** will enable the sensor-enabled, real-time society, powering new industry use cases such as smart cities, smart agriculture, fleet management, and shipping and logistics.
- **Ultra-Reliable Low Latency Communications (URLLC)** will enable exciting new concepts such as the tactile Internet, remote surgery, new healthcare services, industrial automation, private networks, and smart energy grids.

All of the devices and sensors communicating in a 5G ecosystem will generate massive amounts of usage-related data that can be used by enterprises and service providers to drive a new level of digital business and consumer experience and to explore new revenue streams across B2X and B2B2X models.

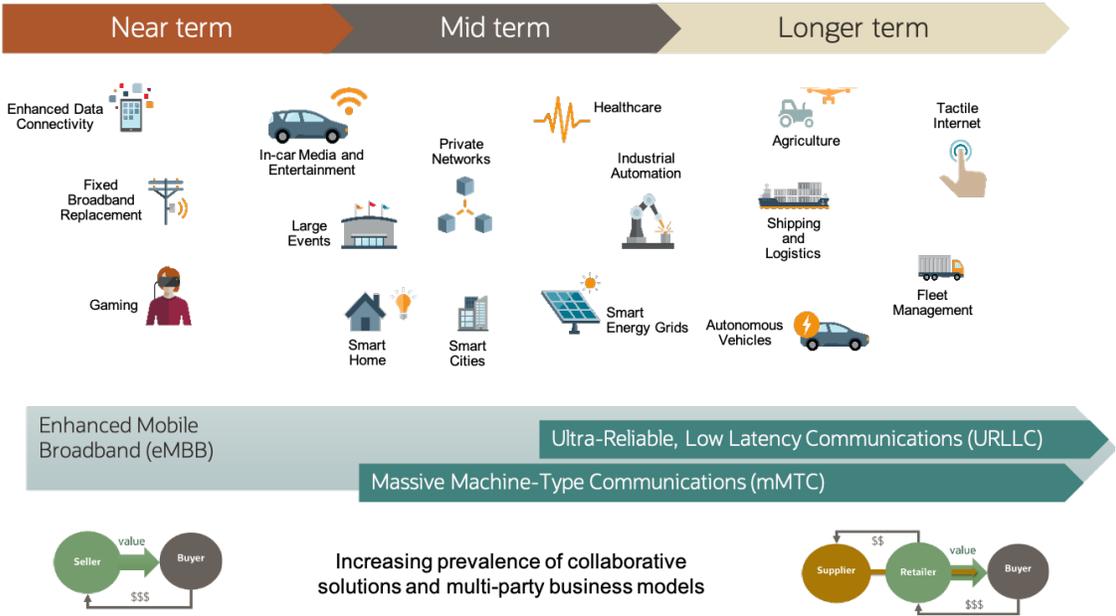


Figure 1: Expected 5G services rollout - familiar and incremental propositions first, while enabling and developing new capabilities

It is likely that as these use cases gradually become reality and 5G core network deployments advance in scope, the types of business models will advance from incremental approaches based on conventional models to encompass greater degrees of multi-party collaboration. This whitepaper will present seven foundational business models that network operators can use as a high-level framework to explore new value propositions and potential business partnerships.

Technology Aspects: The Merging of Web-scale IT with Telco

5G is enabled by a new Radio Access Network (RAN) called the 5G New Radio (NR) and a new core network called the 5G Core (5GC), linked by high-speed backhaul connectivity. It is a revolutionary system architecture in that it is arguably the first time that web-scale IT principles have been applied in a significant way to a telecommunications core network. The sheer scale, performance, and efficiency required to support large-scale, low-latency data sessions across millions of personal devices and potentially trillions of sensors has driven the need for a core architecture that can take optimal advantage of modern innovations in compute, network, and storage technologies to support efficient scaling, high-transaction throughput, security, and resiliency.

Initial 5G deployments will mainly center on what is called the Non-Standalone Architecture (NSA), which involves rolling out 5G NR that works with an existing 4G Evolved Packet Core (EPC). In this model the 4G EPC is used as the control plane, with the 5G NR supporting the user plane traffic (that is, data connectivity sessions to either the Internet or a private network in the operator's domain). The 5G base station is known as the gNode B (as opposed to the 4G eNode B). The benefits of this model are that network operators can gradually deploy NR and launch 5G services with a minimal disruption to their existing 4G infrastructure, enabling them to build out a costly radio access network and additional fiber backhaul infrastructure, if required, over time.

The desired end state for network operators is known as the Standalone Architecture (SA), where the 5G NR is connected to a brand new 5G core network (5GC). The SA model has a new **Service Based Architecture**, initially standardized by the 3GPP Release 15 specifications, based on decoupled network functions that communicate with each other using RESTful service invocations between consumer and producer over the HTTP/2 protocol. This is a fundamental shift from more traditional network protocols such as Diameter, which is the core language of 4G EPC network signaling.

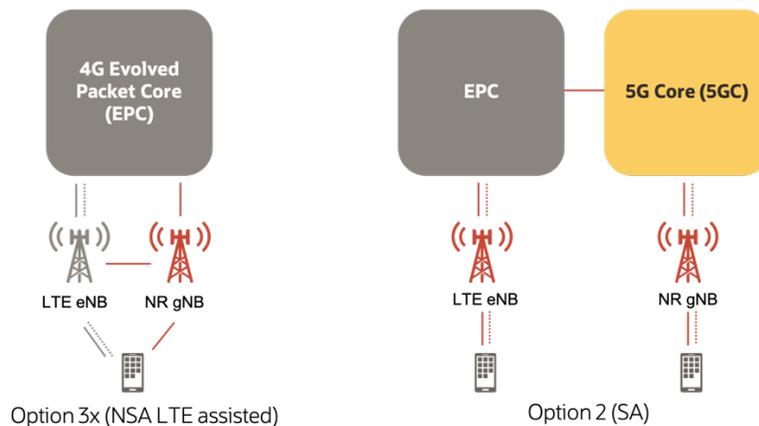


Figure 2: Non-Standalone (NSA) and Standalone (SA) 5G deployment architectures

The 5GC network functions should be implemented as cloud native services to take advantage of modern cloud computing infrastructure and tooling—for example, container orchestration for efficient scaling and built-in resiliency, common logging and observability, and rapid deployment through automated installation.

Table 1 and Figure 3 overleaf describe the key 5GC network functions (NFs) as defined in the 3GPP architecture.

5GC NF	DESCRIPTION
AF	Application Function: Provides a trusted application that interacts with the core network.
AMF	Access and Mobility Management Function: Supports RAN control plane integration, User Equipment (UE) authentication,
AUSF	Authentication Server Function: Manages authentication using user equipment and Unified Data Management (UDM) data
CHF	Charging Function: Supports online and offline charging requests from the Session Management Function (SMF), working
NEF	Network Exposure Function: Securely exposes core network capabilities and events to applications in the trusted and untrusted domains.
NRF	Network Repository Function: Stores network function profiles that are available for use by service consumers.
NSSF	Network Slice Selection Function: Selects the network slice instances and AMFs serving the UE.
PCF	Policy Control Function: Provides policy control for session management, access and mobility management, and UE access selection.
SMF	Session Management Function: Manages setup, modification, and termination of user sessions.
UDM	Unified Data Management: Manages user subscription management, access authorization, registration management, and
UPF	User Plane Function: Handles and forwards user data traffic.

Table 1: Key 5GC Network Functions

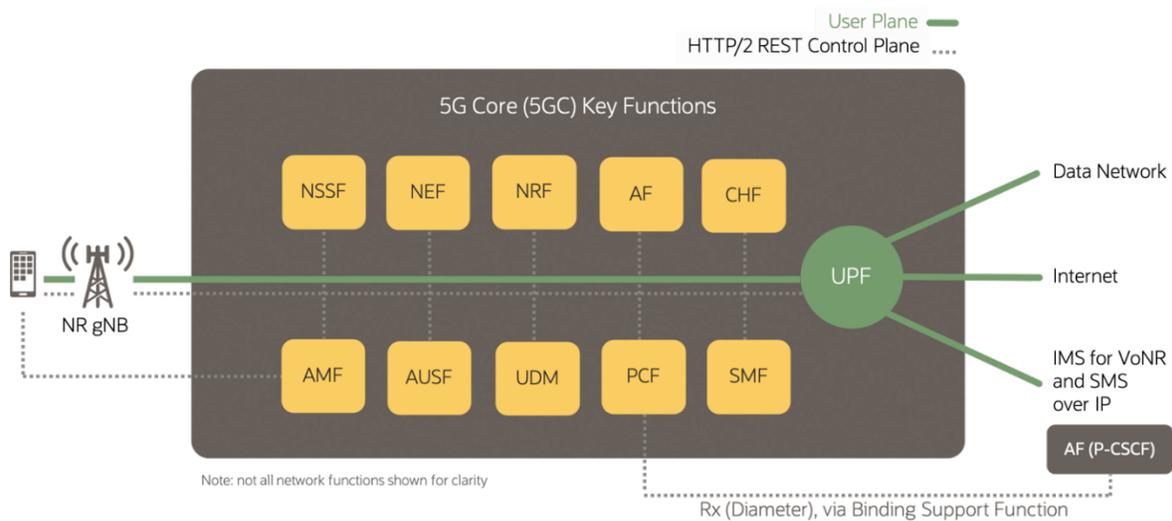


Figure 3: The 5GC Service Based Architecture

A key principal of the 5G Service Based Architecture, as illustrated in Figure 3, is the separation of the user plane and the control plane. This enables core network functions to be efficiently scaled independently from the user plane.

Perhaps one of the most fundamental aspects of this radical new, IT-driven core, is the concept of the **Network Slice**. This is a virtual partition of the 5G network designed to service a specific business domain, supporting specific Quality of Service (QoS) characteristics and independent scaling requirements for that domain. A slice can extend across both the core and the

cloud RAN. Each slice can be identified by the Network Slice Selection Assistance Information (NSSAI), which includes the Service Slice Type (SST) and Service Differentiator (SD). The 3GPP standardized SST values as defined in 3GPP 23.501 are listed in Table 2.

SERVICE SLICE TYPE (SST)	DESCRIPTION
1	eMBB: enhanced mobile broadband services
2	URLLC: ultra-reliable low latency services
3	MIoT: Massive IoT based services
4	V2X: Vehicle to everything services

Table 2: 3GPP Service Slice Type values

Each network slice can support multiple QoS flows, defined by criteria such as the 5QI and whether the bitrate is non-guaranteed best effort (Non-GBR) or guaranteed (GBR). In the example shown in Figure 4, a fixed broadband business service is offered with voice transported over a GBR flow and prioritized Internet access over a non-GBR flow.

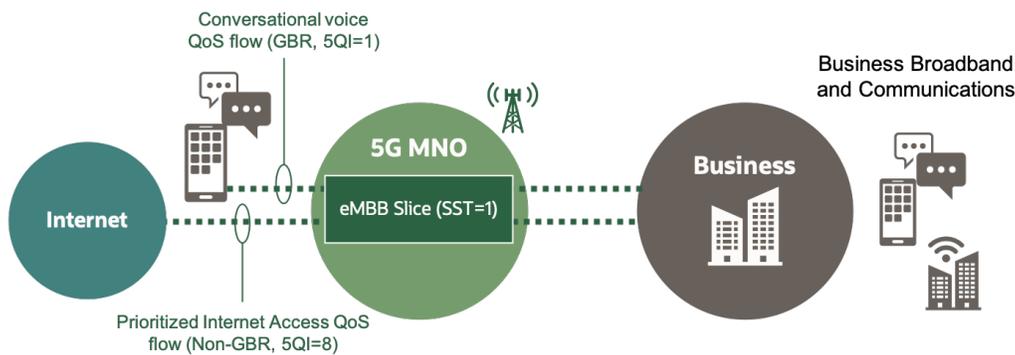


Figure 4: 5G offers granular QoS control for user data sessions

It is likely that network operators will deploy multiple slices to serve different customers and use cases. Some will be long-lived (for example an enhanced consumer mobile broadband slice), while others may need to be spun up and down very rapidly with a short life span (for example a stadium network slice supporting a sports event for a matter of hours). The IT-based cloud native nature of the 5GC architecture, realized by a cloud native, service-based architecture, will be an essential foundation to realize the network slice concept.

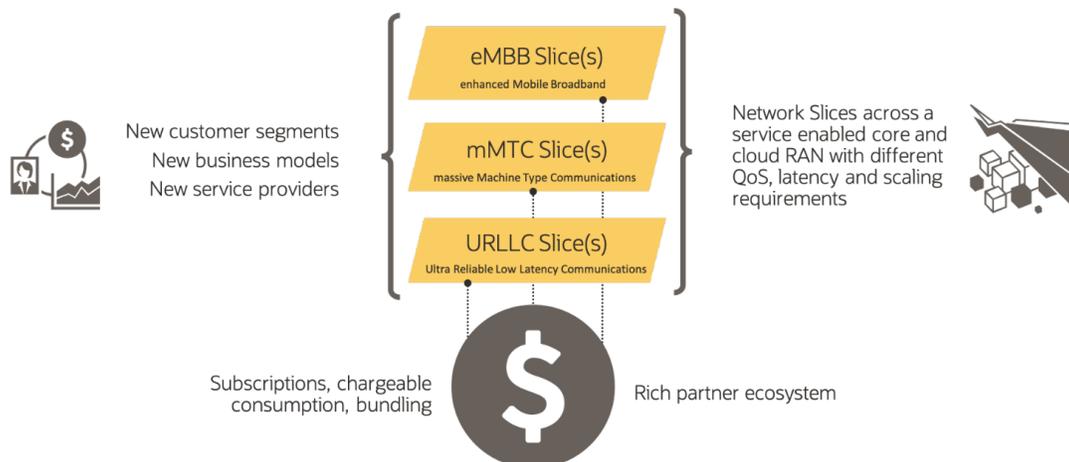


Figure 5: 5G will provide a significant opportunity for service providers to monetize new slice based B2X and B2B2X services

From a monetization perspective, this new 5G system architecture provides a wealth of potential pricing factors that network operators can use to develop differentiating offers, including:

- Quality of Service (QoS)—for example, based on the 5QI value
- Service availability
- Latency
- Bandwidth (uplink and downlink)
- Slice type (SST)
- Specific slice instance (NSSAI)
- Device location

To summarize so far, 5G is a revolution both in terms of IT and cloud native technology adoption within a telecommunications network. But more importantly, 5G is a revolution in terms of the way digital services can be delivered, and businesses can interact with each other. With that in mind, let's now look at some foundational business models that can be implemented to drive new revenue streams from this transformative technology.

FOUNDATIONAL 5G BUSINESS MODELS

The variety and complexity of future revenue flows is unknown at this early stage in the 5G maturity curve, but one thing we know for certain is that communications service providers will need the tools and flexibility to explore the long tail of possible business models. To provide a high-level framework that serves as a starting point for 5G business model exploration, the following table highlights several foundational business model patterns.

BUSINESS MODEL PATTERN	NUMBER OF PARTIES	DESCRIPTION
Network Operator Direct (B2X)	2 parties	Network operator as the retailer (seller) with a direct commercial relationship with the end customer . Seller offers a product that is
Network Operator Direct (B2B2X Supplier Model)	3 or more parties	Network operator has a direct commercial relationship with the end customer . Seller offers a product that is composed, at least in
Network Operator to Partner (B2B2X Channel Model)	3 or more parties	Network operator's channel partner owns the commercial relationship with the customer . Seller offers a product that is

Table 3: Foundational 5G business model patterns

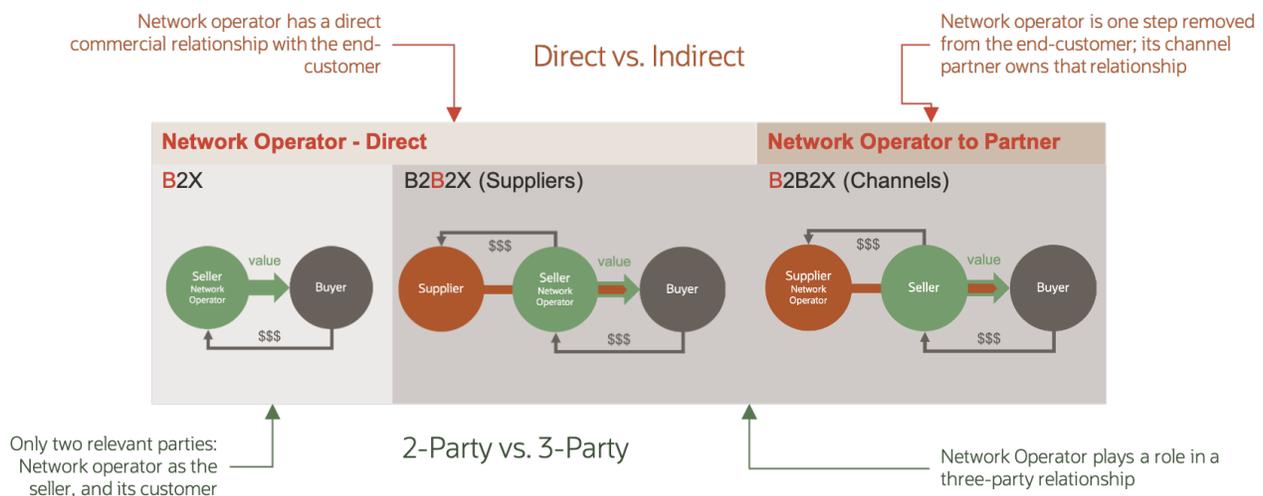


Figure 6: Foundational 5G business model patterns

Network Operator Direct Models

Business Model 1: Connectivity offers for consumers, alongside third-party offers

This is a classic and familiar business model which will continue to evolve into the 5G era (Figure 7). The network operator typically has little or no involvement in the marketing or commercial relationship between the content/media provider and the consumer, focusing on its core competency, which is delivering data connectivity.

The network operator has at its disposal all of the pricing and discounting options available with a 4G/3G/2.5G mobile data offer, which are typically based on the data rate and data volume (bundles, a-la-carte, on-demand, prepaid, postpaid, etc.). With the advent of 5G, the operator can include various QoS parameters in the charging mix.

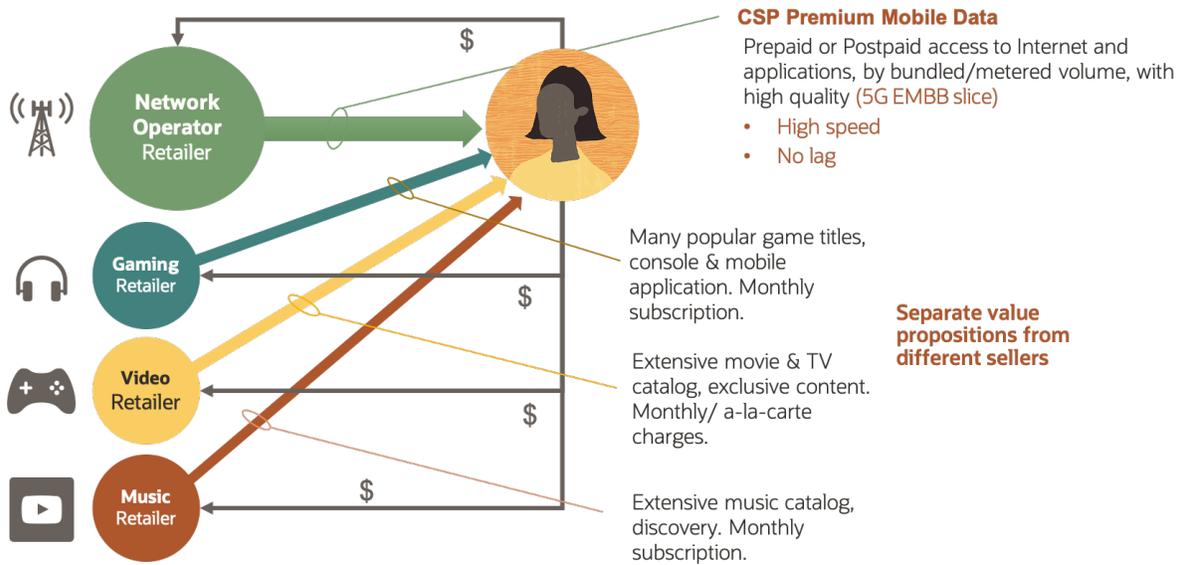


Figure 7: Connectivity offers for consumers, alongside 3rd party offers

Business Model 2: Offers for consumers, powered by supplier partners

This model has been gaining popularity, taking advantage of the network operator’s billing relationship with consumers and their ability to co-brand with already-popular content/media/application providers seeking additional channels for themselves (Figure 8).

The network operator value proposition is strong when multiple media are bundled, and even stronger when it is presented by a multiplay operator who can offer premium quality regardless of access (mobile or fixed).

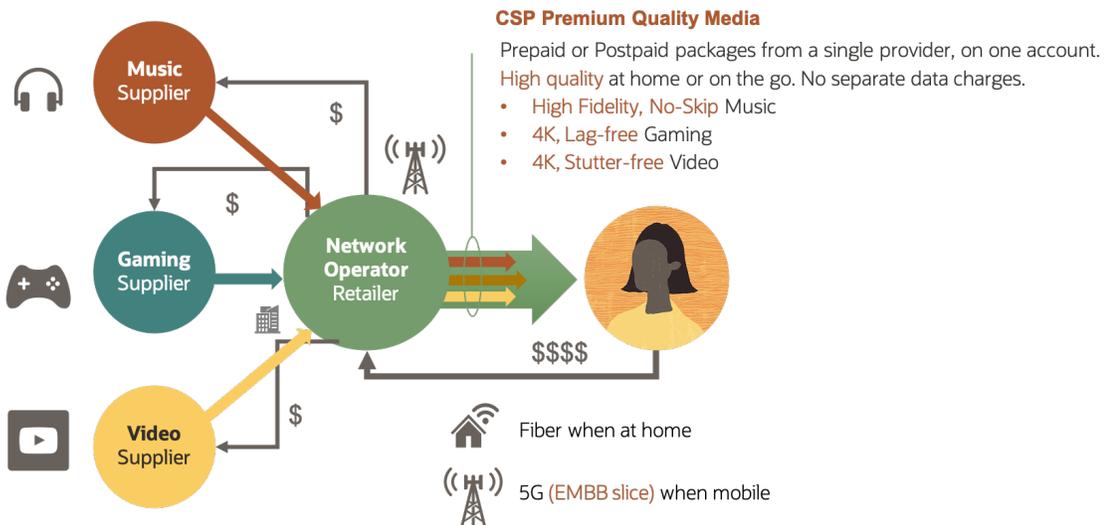


Figure 8: Offers for consumers, powered by supplier partners

Business Model 3: Connectivity+ private network offers for organizational customers’ internal use

In this model (Figure 9), the network operator proposes industry vertical offers directly to enterprises and organizations sophisticated enough to use specialized connectivity, combining it with their own applications and devices. These private networks will be realized through a 5G slice that is offered to the organization as a complete private network that is configurable using APIs (for example the ability to configure IP subnets, VLANs, firewalls, and access controls). This use of 5G network slicing provides the organization with a high degree of isolation and security which could be a monetization factor when designing the commercial offer. This model has the potential for significant new B2B revenue streams for the network operator with vertical industries such as smart energy grid providers, manufacturing, and local governments.

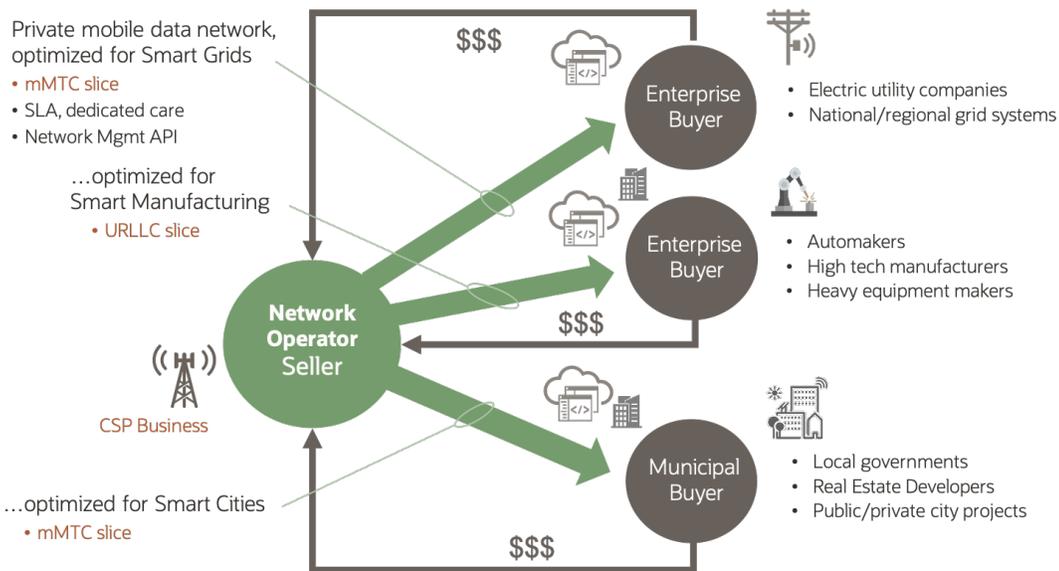


Figure 9: Connectivity+ offers for organizational customers' internal use ("Slice as a Service")

Business Model 4: Network Operator branded business solutions powered by supplier partners

In this model the network operator offers a modular service which may be powered by partner suppliers to small and medium enterprises. An example use case shown in Figure 10 is a fleet management offering powered by services from multiple providers. The value to the customer is a complete domain-specific solution with a single bill and support channel. 5G will provide another means for service differentiation, using the high bandwidth, low latency, low power consumption, and improved mobility characteristics of its network to enhance the customer's experience. New application use cases that are simply not feasible with earlier generation mobile technologies may also be realized.

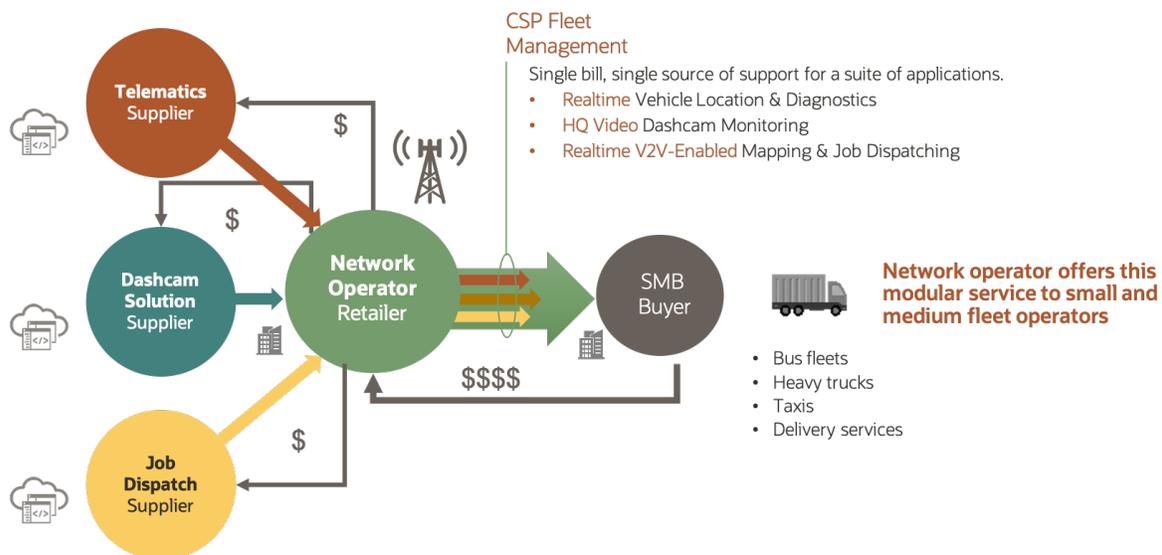


Figure 10: Network Operator branded business solutions powered by supplier partners

Network Operator to Partner Models

Business Model 5: Offers to businesses providing consumer solutions

In this model (Figure 11) consumer offers are managed and marketed by brands known for their specific value propositions. Connectivity is a behind-the-scenes enabler that the network operator has tailored to their industry utilizing 5G network slicing and QoS control. The end offering may be white labeled by the brand retailer, or co-branded with the network operator.

An example scenario is a cloud gaming service, where the consumer does not require a high-end gaming PC, but simply a modest end user device and good Internet connectivity. The actual game runs in the network operator's compute server farm with powerful GPUs. For this service to be successful, it is critical that the user experience is not hampered by poor "last mile" connectivity, which is where high bandwidth, low latency 5G connectivity can play a significant role. In fact, it is likely that the gaming industry is set to be transformed by 5G enabled cloud gaming, providing a new channel for game developers and driving a significant new revenue stream that will complement the traditional console market.

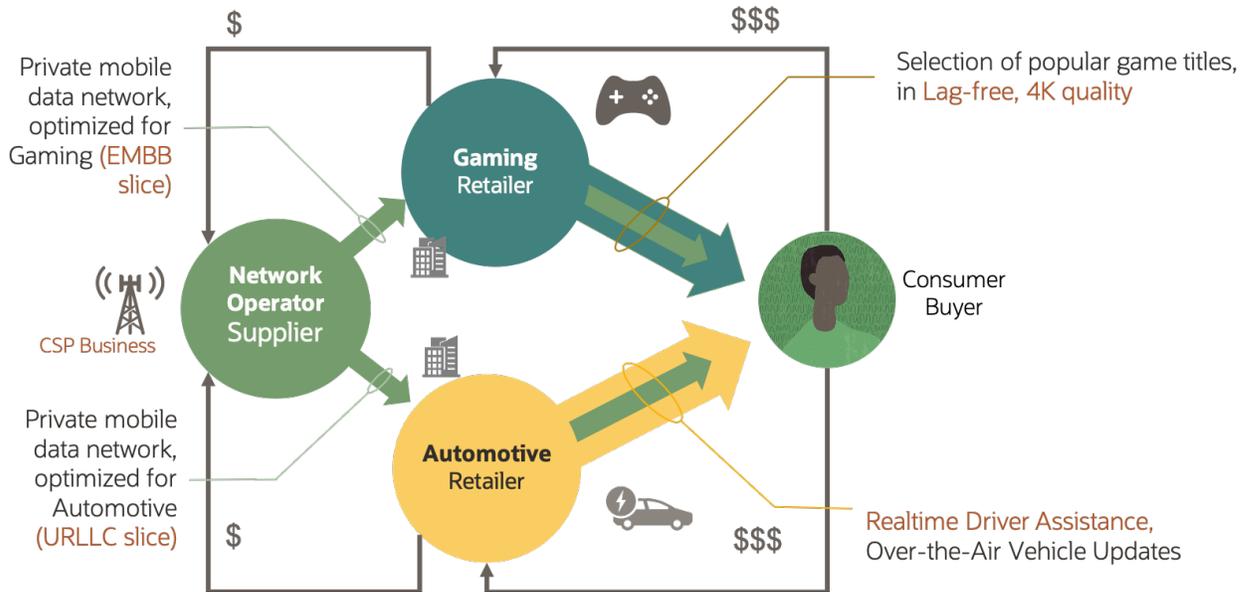


Figure 11: Offers to businesses providing consumer solutions

Business Model 6: Offers to businesses providing industry solutions

This is a similar model to model 5, but with the network operator providing B2B solutions to brands whose end customers are vertical industries, two examples being healthcare and smart agriculture (Figure 12). These offers are integrated, managed, and marketed by brands known in their industry for specific value propositions and as with model 5 may be white-labeled or co-branded ("powered by") with the network operator. This model requires the network operator to foster new wholesale relationships with solution providers and understand the technical implications of the end use cases without necessarily understanding the nuances of the industry.

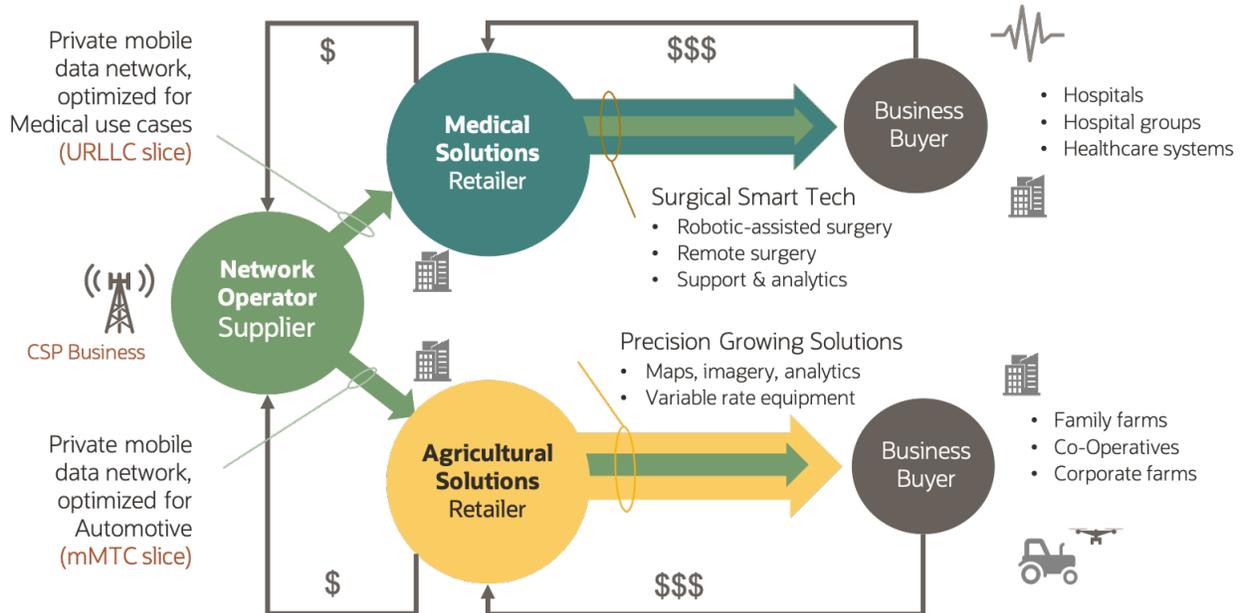


Figure 12: Offers to businesses providing industry solutions

Business Model 7: Connectivity+ offers for Mobile Virtual Network Operators (MVNOs)

In this final model (Figure 13), the network operator provides wholesale value-added connectivity to B2B MVNO customers who have their own suppliers of other capabilities and services. MVNOs provide a range of consumer or business offers aligned with their brands and target market segments (for example consumer prepaid mobile). It may be just as useful to think of this as a pure wholesale B2B play, but it is apparent that the end user of the network operator's connectivity is actually the MVNO's customers. For the network operator this is a channel play, giving it access to customer segments it would not otherwise be able to reach.

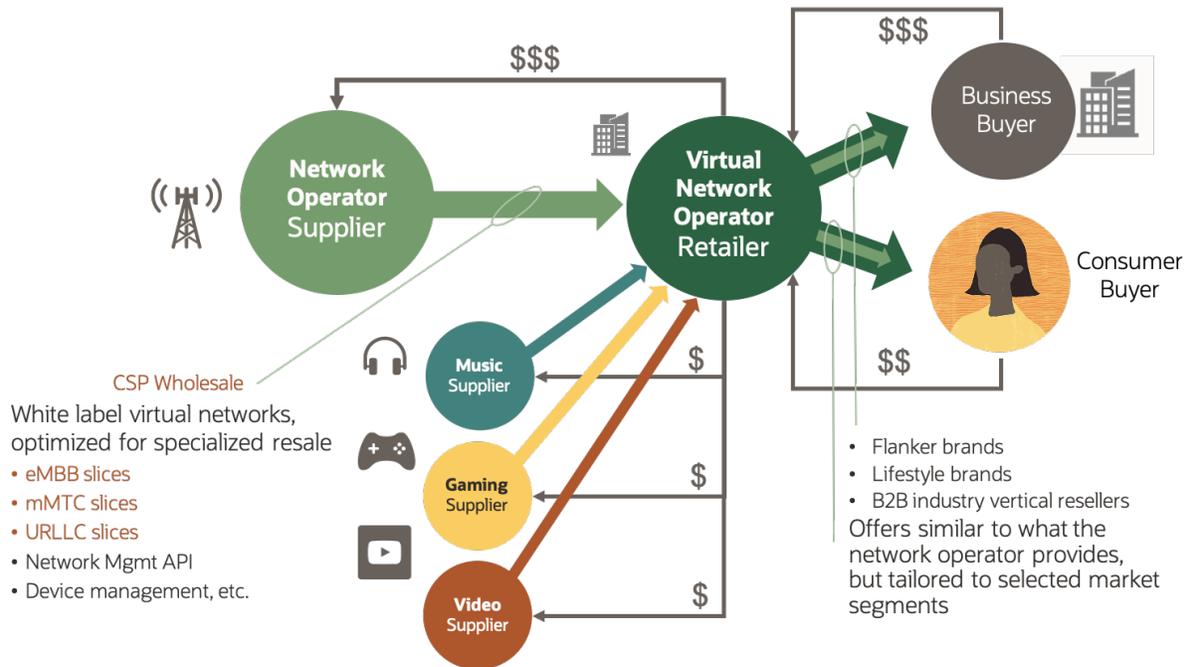


Figure 13: Connectivity+ offers for MVNOs

Business Model Wrap Up

These foundational business models are by no means the whole story; they are simply a high-level framework to help you consider some of the likely future business opportunities for 5G network operators. Indeed, there will be many more variations on the above and completely new models not yet considered as 5G becomes a part of our lives over the coming decade. What these seven business models do highlight however, is the opportunity for network operators to deliver and monetize dramatically enhanced digital lifestyle services and forge new B2B co-creation partnerships serving both consumers and industry. This may require the necessary organizational structure to be put in place and agile monetization tooling to cost effectively explore and experiment with new business models, and then to develop and launch (and retire if unsuccessful) the derived offerings.

UNLOCKING THE POTENTIAL OF 5G WITH MODERN MONETIZATION

The seven previous business models highlight the need for communications service providers with a 5G strategy to consider how their charging, billing, and revenue management systems will be able to help them effectively navigate this future complexity, support new B2B2X business models, and profitably monetize their significant investments in 5G RAN, backhaul, and core networks.

5G Monetization Requirements and the Impact on Legacy IT

Let's now explore some of the challenges that communication service providers should consider when evaluating whether their existing monetization systems are prepared for the 5G future. Figure 14 highlights the key considerations.



Figure 14: 5G monetization challenges

The ability to support the anticipated high volumes of charging events from 5G network slices will be critical. This has fundamental implications on the underlying monetization architecture; many charging engines currently deployed by mobile network operators were designed in the earlier era of 2G and 3G networks, which had different scaling and performance requirements. The ability to support high throughput and low latency charging across multiple devices and services will require the adoption of modern IT technologies, concepts, and tooling that take maximum advantage of the underlying compute infrastructure and in many respects mirrors the service-based approach taken with the new 5G core network architecture.

The concept of converged charging is nothing new and has been the target architecture of network operators for many years. However, the adoption of this deployment model, where a single charging engine supports both online and offline charging, has been slower than the industry initially expected. The reasons for this are many, both technical (deployed postpaid billing systems did not have network grade online charging capabilities) and organizational (the network team owned the Intelligent Network (IN) based online charging systems and the IT team owned the postpaid billing systems). Adoption of converged charging systems has certainly increased more recently, with innovative service providers seeing the advantages of applying the same degree of service and spend control that their prepaid customers have traditionally had to their postpaid customer base as well.

The 5G 3GPP charging architecture has embraced the concept of converged charging in the Release 15 standards—supporting a new RESTful interface (Nchf) between the Session Management Function (SMF) and Charging Function (CHF) that supports both online and offline charging in a single architecture. It is expected that the 5G charging architecture will drive increased need and adoption of converged charging systems as new 5G core networks are deployed in the Standalone Architecture model. Figure 15 illustrates the 3GPP charging architecture with the key service interfaces. A point to note is that the CHF is essentially a mediation layer that receives the Nchf requests and then routes these to the rating and balance management functions. This entire grouping of functions is known as the converged charging system (CCS).

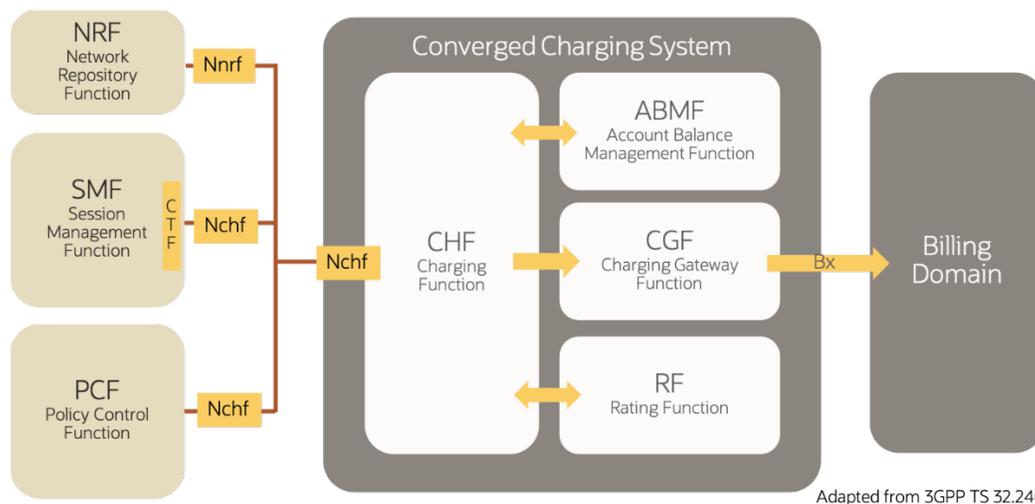


Figure 15: 3GPP 5G converged charging architecture

As new 5G core networks will most likely be a second deployment phase after the Non-Standalone Architecture, the need for monetization systems to concurrently support existing charging protocols will be essential. Support for Diameter charging and spending limit control (the Gy, Rf, and Sy interfaces) will be required for early 5G NSA deployments and indeed for many years to come—meaning that 5G will not be the only game in town. Concurrent support will also be required for charging standards that support Time Division Multiplexing (TDM) based circuit switched calls and sessions, principally the IN CAMEL (Customized Applications for Mobile network Enhanced Logic) standard.

Clearly, modern monetization systems will need to take optimal advantage of compute, network, and storage infrastructure to operate and scale efficiently, and essentially become an extension of the 5G core network. These requirements translate into the need for monetization systems to support a **cloud native, multi-service, containerized, and orchestrated** deployment architecture. Let's unpack three of these terms:

- **Containerized** – portable, lightweight application components that can be rapidly spun-up and down, taking advantage of core Linux kernel capabilities (namespaces and control groups) that are much more efficient than Hypervisor-based virtualization technologies.
- **Orchestrated** – managing the lifecycle of the multiple containers that comprise the application by abstracting the underlying infrastructure and providing built-in scalability and resiliency through the definition of a desired state of deployment. Container orchestration technology enables simpler application management and dramatically reduces operational complexity.
- **Multi-service** – an architecture where application components representing specific functional concerns are deployed in separate containers to aid scalability, resiliency, and observability. Core business functions should be deployed as multi-replica containers.

To take advantage of today's DevOps aligned Continuous Integration/Continuous Delivery (CI/CD) toolchains to minimize time-to-value, scale efficiently, and improve operational quality, the above-mentioned cloud native characteristics will be essential. Some business benefits of cloud native deployment include:

- Significantly reduced vanilla installation time
- Rapid environment replication for development, testing and faster root cause analysis of potential production issues
- Self-healing capabilities for greater service availability
- Simpler updates with less downtime
- Efficient scaling that takes maximum advantage of the available underlying compute resources (nodes)
- Faster launch of reliable market offerings by taking advantage of CI/CD toolchain integration

In summary, if the 5G core network has an IT-based, cloud native architecture, then so should a converged charging and billing system.

Finally, modern revenue management systems should provide a richness of features and flexibility to support the exploration, offer design, and monetization of the sophisticated services and business models that the 5G future holds.

Modern Monetization from Oracle Communications

Oracle Communication Billing and Revenue Management (BRM) provides industry proven, modern monetization for communications and any digital business. BRM Release 12 has been designed with the 5G future in mind and has a planned evolution path aligned with the 5G service-based architecture while offering a feature rich (table 4) converged charging, billing and revenue management system that is network grade and extensible. BRM provides a foundation for monetizing initial 5G Non-Standalone Architecture based services and future Standalone Architecture slice-based offerings, available in a DevOps aligned cloud native deployment model to significantly reduce costs and accelerate innovation:

- Flexible service, industry and partner-enabled business model support.
- Faster innovation: rapidly launch digital offers with design-time flexibility.
- I.T agility: modern cloud native deployment models with low total cost of ownership.

Get ready to monetize 5G and select a proven, scalable, modern monetization solution: [Oracle Communications BRM](#)

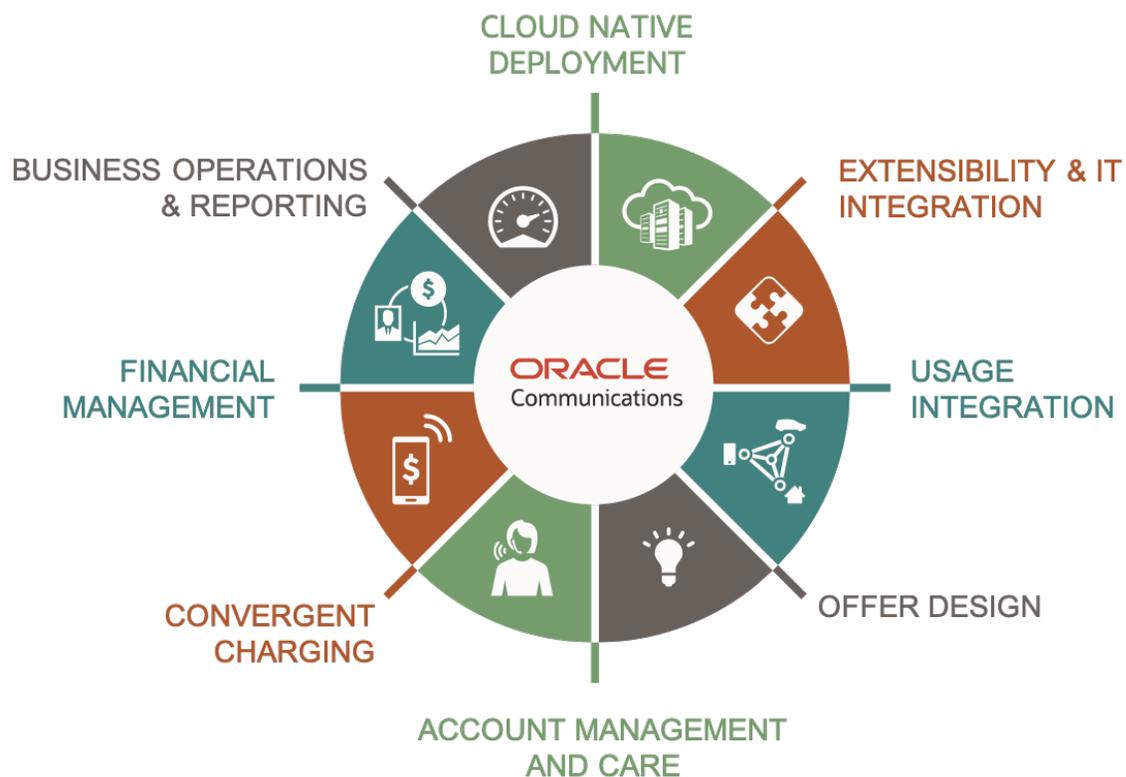


Figure 16: Modern Monetization with BRM

CAPABILITY	KEY FEATURES
Cloud Native Deployment	Multi-service architecture Containerized and Orchestrated Automated deployment
Extensibility and IT Integration	CX Self Service Order Management ERP Tax Engines Payment Gateways Extensible Data Model and Business Logic
Usage Integration	Diameter Gy, Sy, HTTP/2 Nchf (<i>planned future functionality</i>) CAMEL INAP Flexible Offline Mediation
Offer Design	TM Forum SID aligned pricing design Charge offers Discount offers Bundles Sharing offers

Converged Charging	Advanced data charging Real-time balance management Sharing models Prepaid voucher management
Financial Management	Usage and Subscription billing Invoicing AR, GL & Taxation Payments and collections
Business Operations and Reporting	Create, schedule and view billing, collections and invoicing jobs Customer & Billing activity reports

Table 4: BRM Key Capabilities

ABBREVIATIONS AND ACRONYMS

3GPP	Third Generation Partnership Project
5GC	5G Core
AF	Application Function
AMF	Access and Mobility Management Function
AUSF	Authentication Server Function
BRM	Oracle Communications Billing and Revenue Management
CHF	Charging Function
CCS	Converged Charging System
eMBB	enhanced Mobile Broadband
EPC	Evolved Packet Core
GBR	Guaranteed Bit Rate
mMTC	massive Machine Type Communications
NEF	Network Exposure Function
NF	Network Function
NR	New Radio
NRF	Network Repository Function
NSA	Non-Standalone Architecture
NSSAI	Network Slice Selection Assistance Information
NSSF	Network Slice Selection Function
PCF	Policy Control Function
QoS	Quality of Service
RAN	Radio Access Network
SMF	Session Management Function
UDM	Unified Data Management
UE	User Equipment
URLLC	Ultra-Reliable Low Latency Communications
V2X	Vehicle to Everything

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