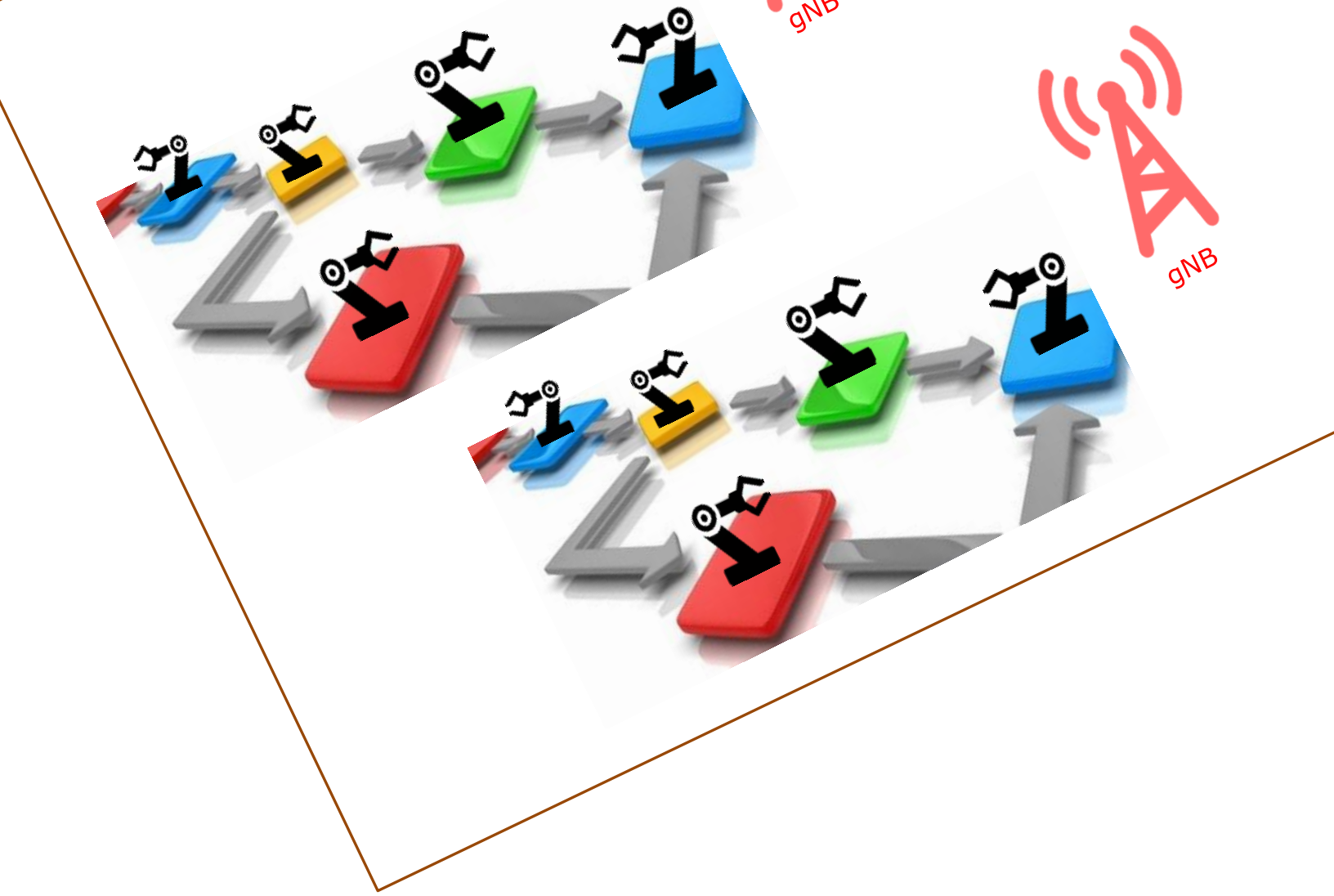

HOW 5G SERVICE PROVIDERS CAN CAPITALIZE ON THE WIRELESS ENTERPRISE MARKET OPPORTUNITY?

WHITEPAPER

Document Date: January 2021
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Introduction

With the advent of the 5G Standalone (5G SA) era, 5G Service Providers (SPs) have the opportunity to increase their revenues from the segments of the enterprise market requiring real-time or near real-time wireless communications. In the past, 3G and 4G wireless network performance was based on best effort. Some networks differentiated themselves with coverage and/or speed, but it was still a best effort network, with no guarantees of specific performance levels or service. The 3GPP 5G mobile network specifications have the features to deliver performance guarantees. A 5G SP can now increase revenues from the enterprise market by offering premium services and performance with guaranteed Service Level Agreements (SLAs).

One of the key features is Multi-Access Edge Computing (MEC), which can guarantee SLAs with lower latency and the option of keeping local traffic and data on-premises (a.k.a. data sovereignty), if required. 5G is fundamentally more secure and more reliable compared to previous generations of wireless networks.

We define MEC in two ways, Public MEC and Private MEC[1]. Public MEC is a service available to all subscribers that can be classified as business-to-consumers (B2C) or business-to-business (B2B). Private MEC has specific MEC services on-premises, such as at enterprise campuses and factories, that are classified as B2B (Figure 1).

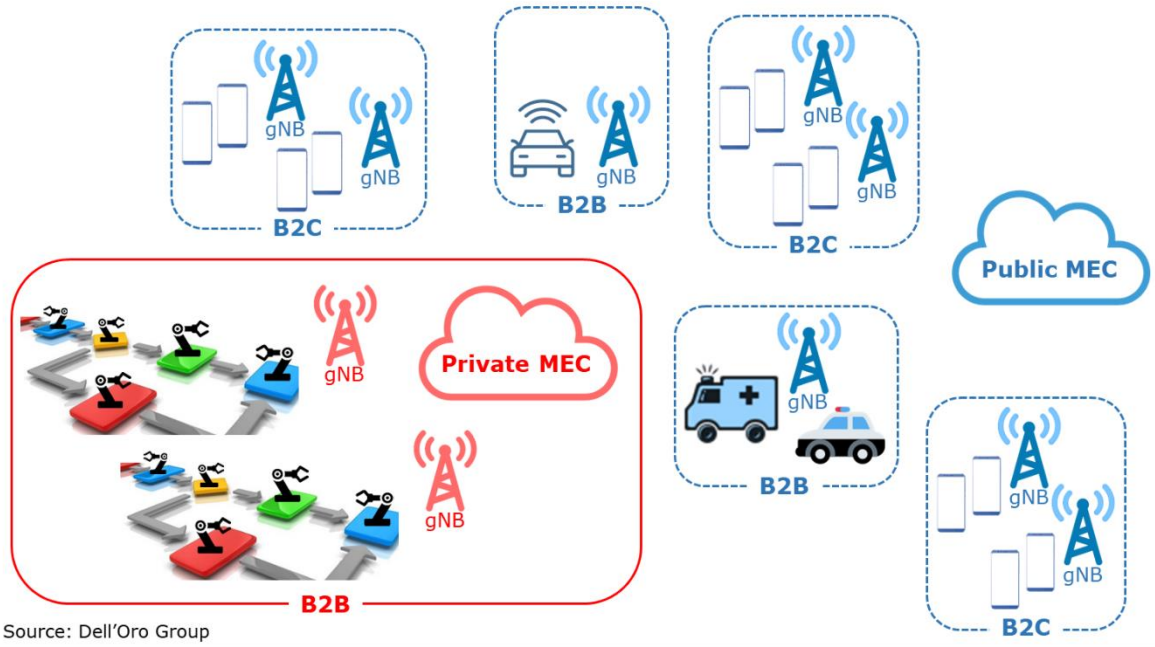


Figure 1: Public MEC versus Private MEC

[1] "Advanced Research Report, Multi-Access Edge Computing," January 2020, Dell'Oro Group

Enterprises that need broad geographic coverage can take advantage of 5G Public MEC networks, such as Smart Health, Public Safety, and V2X (Vehicle to Everything) Communications. In addition, SMEs (Small and Medium Businesses), that do not need broad geographic coverage, can take advantage of 5G Public MEC. To create a private network, Network Slices creates a virtual private network that only allows authorized access to an enterprise or the enterprise's services. Larger enterprises can take advantage of on-premises Private MEC deployments for exclusive uses such as Smart Manufacturing, Smart Ports, and Smart Mines. All of these enterprises are characterized as needing real-time or near real-time communications, translating to a requirement for low latency, which can be enabled by MEC deployments.

So how does a 5G SP meet the challenges of the enterprise market and successfully compete in this arena of real-time and near real-time wireless communications? We explores the following topics:

Enterprise Market Opportunities for 5G SPs

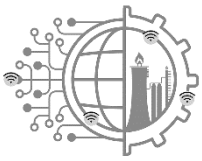
5G MEC can benefit many industries in a variety of ways[2]:

Cloud Virtual & Augmented Reality (AR/VR)

Graphics rendering will be moved to the cloud. AR/VR devices will switch from wired to wireless while becoming lighter and more readily available. 5G can provide data rates of several hundred Mbps and the millisecond-level latency that cloud VR requires. Combined with 5G SPs powerful cloud computing capabilities and application partners' 1 ms ultra-low latency compression technologies, 5G MEC will greatly enhance the user experience. Forecasts are for 300 million VR devices by 2025 for both consumer and business applications.

Connected Automotive

5G MEC can ensure under 10 ms network latency for V2X and reliable connections for high-mobility scenarios, allowing it to be used as a unified vehicle connection technology. Vehicle sharing, ultra-low latency platooning, high-speed tele-operated driving, and autonomous and coordinated driving will all soon be a reality. In addition, 5G SPs can provide cloud and data centers for V2X applications, unleashing the V2X potential of the automotive industry. Forecasts are for 60.3 million connected vehicle subscriptions by 2025.



Smart Manufacturing

In the 5G MEC era, 5G SPs can use 5G Network Slices to provide value-added services for the manufacturing industry, offering solutions that cover the supply chain and entire product life cycle. 5G can satisfy numerous demands posed by robot control by cloud-based Programmable Logic Controllers, wireless cloud machine vision, wireless automated guided vehicles (AGV) and many other applications. Industrial wireless connections are expected to experience a CAGR of 464% from 2022 onwards. Wireless connection technologies—from near real-time (100 ms latency) to hard real-time (10 ms latency), and finally to isochronous real-time computing (1 ms latency)—are set to give rise to connected factories.

Smart Grid

The feeder automation system (FA) integrates new energy into power grids. Compared to fiber-optic cables, 5G networks are easier to deploy and more flexible. 5G with MEC offers less than 10 ms ultra-low latency, secure, and 99.999% reliable dedicated network slices for FA. This allows the automation system to isolate faults within 100 ms, enabling faster, and more accurate power grid control.

[2] "5G Top 10 Use Cases," Huawei

Smart Health

5G wireless makes remote diagnostics available anytime, anywhere. Tactile Internet, in particular, features 5G technologies that deliver 5 ms network latency, providing doctors and surgeons with excellent control of medical robotics. Remote diagnosis and remote surgery could be of especial benefit to aging populations.

Connected Drones

Unmanned Aerial Vehicles (UAVs), also known as drones, are now well-established delivery platforms for a diverse set of commercial, government, and consumer applications, including inspection, security, and 24/7 automated drone flights. 5G can deliver up to several hundred Mbps data rates to support professional-level inspection and detection devices, such as LiDAR. As the Digital Sky initiative evolves from 1.0 (for infrastructure inspection – 50 m), to 2.0 (logistics – 150 M), and 3.0 (flying taxi - >500 m), drones are set to empower the new digital airspace economy.

Smart Cities

Intelligent cameras are invaluable tools for Smart Cities. 24/7 non-stop monitoring and analysis ensure robust security and boost management efficiency. 5G will increase the frame rate of city surveillance. A more diverse range of real-time images will be generated at higher definitions (4K to 8K to 16K). Smart city management in the cloud with AI (artificial intelligence) is set to become more intelligent than ever.

The market opportunity of 5G private networks is vast, given that Public MEC can be theoretically deployed at millions of RAN macro base station sites around the world, and Private MEC can be deployed on-premises at millions of industrial sites. Over 14 M industrial sites have been identified and targeted for Industry 4.0 transformation (Figure 2)[3]. It quickly becomes obvious that the opportunity for Private MEC is as exciting as for Public MEC.

Industrial Type	Industrial Sites
Industrial & manufacturing	10,710K
Warehouses	3,300K
Hospitals & labs	263K
Water utility plants	140K
Mining	54K
Transport venues & ports	50K
Power generation	47K
Military bases	10k
Oil & gas	8k
Total	**14,583K**

Figure 2 Potential Industrial Sites for Private Wireless

[3] "10m factories, 3m warehouses, 50k mines – Nokia counts out its new industrial targets." January 29, 2019, Enterprise IoT Insights

In a recent industry report, the total value of the global, addressable, 5G-enabled market for SPs across 10 industries is projected to be USD 700 billion in 2030, not including mobile broadband. The 10 industries are expected to have CAGRs of at least 65% from 2020 to 2030, with healthcare, manufacturing, and energy and utilities accounting for over half of the gain. North America, Northeast Asia, and Western Europe are expected to represent about 75% of the opportunity (Figure 3)[4].

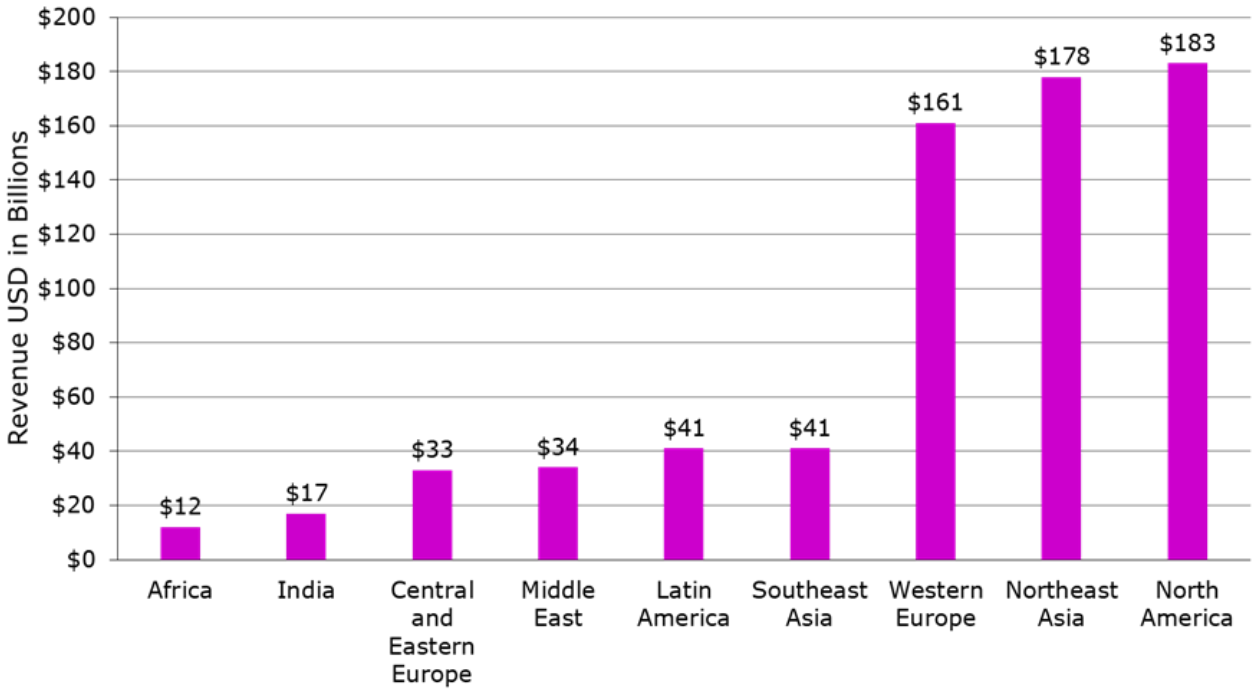


Figure 3: Regional Addressable 5G-Enabled Market for SPs across 10 industries in USD 2030

The size of the enterprise market has not gone un-noticed. The Cloud SPs are attempting to leverage their existing enterprise relationships for IT (Information Technology) cloud services and move into OT (Operational Technology) cloud services. The flexibility that wireless brings to the factory floor has also created a market for private wireless networks, for which enterprises need to have certain performance SLAs and/or network controls to meet their requirements.

[4] "5G for business: a 2030 market compass." October 2019, Ericsson

5G MEC Background

What is MEC? Dell'Oro Group defines MEC as the infrastructure edge of a 5G Network, as shown in Figure 4[5]. A MEC System enables the implementation of MEC applications as software-only entities that run on top of a virtualization infrastructure that is located in or close to the network edge.

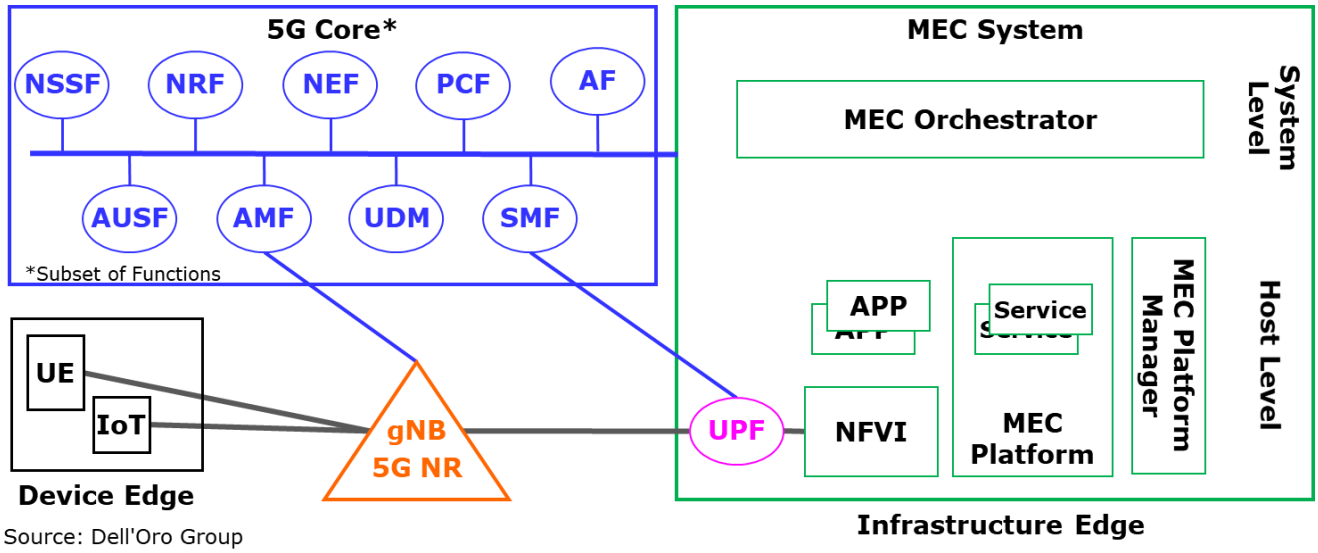


Figure 4 5G MEC System Architecture integrated into a 5G Network

Key MEC functions are listed below[6]:

- The MEC host is an entity that contains a MEC platform and a virtualization infrastructure that provides compute, storage, and network resources to run MEC applications.
- The MEC platform is a collection of essential functionalities required to run MEC applications on a particular virtualization infrastructure. The platform enables the applications to provide and consume MEC services, and the platform itself can also provide services.
- The virtualization infrastructure includes the 5G data plane, i.e., User Plane Function (UPF), which executes the traffic rules received by the MEC platform and routes the traffic among applications, services, DNS server/proxy, and the 5G network.

[5] "Advanced Research Report, Multi-Access Edge Computing," January 2020, Dell'Oro Group
[6] ETSI GS MEC 003, Multi-access Edge Computing Framework and Reference Architecture

A MEC System is connected to the 5G Control Plane (CP) as an Application Function (AF), giving the MEC System exposure to all the 5G Core capability, especially the Network Slice Selection Function (NSSF), which can tailor performance for an enterprise, guaranteeing a subscribed SLA by creating a secure logical network (i.e., virtual private network).

For the latest information about the status of MEC standards by ETSI and 3GPP, see "Advanced Research Report, Multi-Access Edge Computing," July 2020, by Dell'Oro Group.

An important factor for 5G SPs to consider is the demand for backhauling user data. Mobile data traffic is forecast to grow at a CAGR of 28% from 2020 to 2026 (Figure 5)[7]. It might not be practical or cost effective to backhaul non-latency-sensitive data all the way back to a central data center. Instead, processing data at an aggregation edge site could reduce backhaul costs while improving the end-user experience, a win-win scenario.

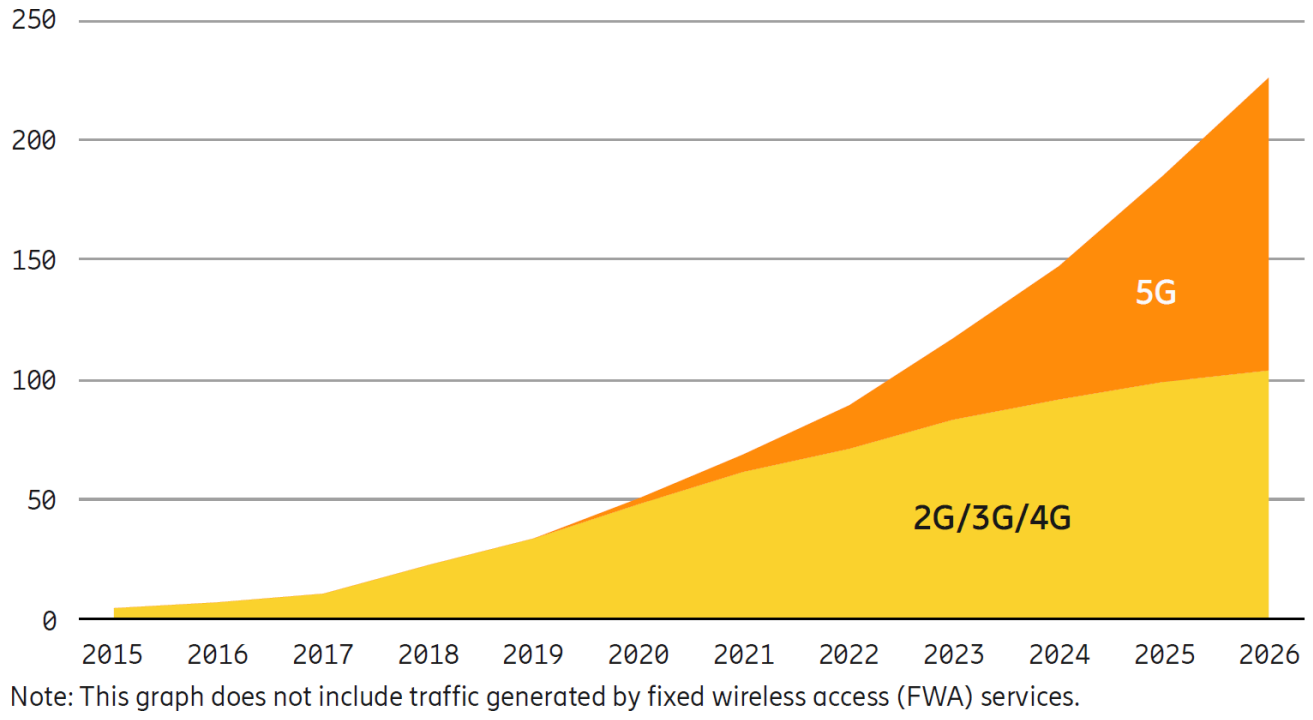


Figure 5 Global Mobile Data Traffic (Exabytes per month)

[7] "Ericsson Mobility Report," November 2020, Ericsson

Three Network Architectural Options for Enterprises

NPN (Non-Public Networks), per 3GPP, are intended for the sole use of a private entity, such as an enterprise. NPNs can be deployed in a variety of configurations, utilizing both virtual and physical elements. NPNs might be offered as a network slice of a Public Land Mobile Network (PLMN), be hosted by a PLMN, or be deployed as completely standalone networks[8].

5G networks can meet the needs of enterprises requiring wireless real-time communications or near-real-time communications with three architectural options:

1

5G PNI-NPN (Public Network Integrated - NPN) w/Public MEC is a 5G private network offered as a network slice of a PLMN. All network functions are shared with the PLMN, with the proviso that the 5G SP has provided Public MEC nodes deep enough into the edge to meet the enterprise latency requirements.

2

5G PNI-NPN w/Private MEC is a 5G private network hosted by a PLMN. The 5G SP must integrate its public network with an on-premises RAN and an on-premises MEC exclusively reserved for private enterprise use. The CP is shared with the PLMN. The RAN spectrum can be owned by the enterprise, supplied by the 5G SP, or utilize unlicensed spectrum.

3

5G SNPN (Standalone NPN) (w/Private 5G Core) is deployed as an on-premises 5G SA private network that includes on-premises RAN and on-premises 5G Core exclusively reserved for private enterprise use. No network functions are shared with the 5G PLMN.

[8] "Service requirements for the 5G system," 3GPP TS 22.261 [6.25]

Dell'Oro Group has identified seven important network characteristics:

1

Time-to-Market

Each network architectural option has a different time-to-market. Regardless of the option, a 5G SP needs to be able to implement the option faster than its competition.

2

Coverage

Some enterprises need outdoor and/or indoor coverage. For those needing indoor coverage, the closest outdoor RAN site may provide enough indoor signal strength. If not, indoor coverage with an on-premises RAN site will be required.

3

Spectrum

RAN spectrum can be part of the PLMN supplied by the 5G SP, an enterprise's private spectrum, or unlicensed spectrum.

4

Latency

Latency is dependent on how close the UPF is to the edge of the network. A 5G SP can meet the latency requirements of most enterprises when the MEC nodes are located deep in the edge of the network. The deepest edge site with the lowest possible latency is at the RAN location, whether for outdoor or indoor coverage.

5

Network Access

For PNI-NPN, a private network slice creates a virtual private network that restricts access to the enterprise's subscribers to their services (Public MEC) or only within the enterprise (Private MEC). For SNPN (w/Private 5G Core), network access is private and only available within the enterprise.

6

Data Sovereignty

On-premises MEC and 5G Core allow enterprises to retain data on campus for security reasons, isolating the data from the Internet and the PLMN.

7

SP Network Control

Each architectural option has different degrees of control, from the 5G SP with total network control to a fully autonomous private network under enterprise control.

One network characteristic not listed above is reliability, which applies equally to all three network options. To meet the 3GPP specifications for Ultra-Reliable Low Latency Communications (URLLC), geo-redundancy is required, so there cannot be a single point of failure anywhere in the network, including the RAN, MEC, 5G Core, or transport.

The three network options are described below:

PNI-NPN (w/Public MEC)

The 5G PNI-NPN (w/Public MEC) is offered as a network slice of a PLMN, sharing PLMN network resources. PNI-NPN (w/Public MEC) is most viable for enterprises that need wide-area outdoor coverage, like Smart Health, or V2X application (Figure 6). The higher the density of its RAN and MEC sites, the more enterprises a 5G SP can potentially serve.

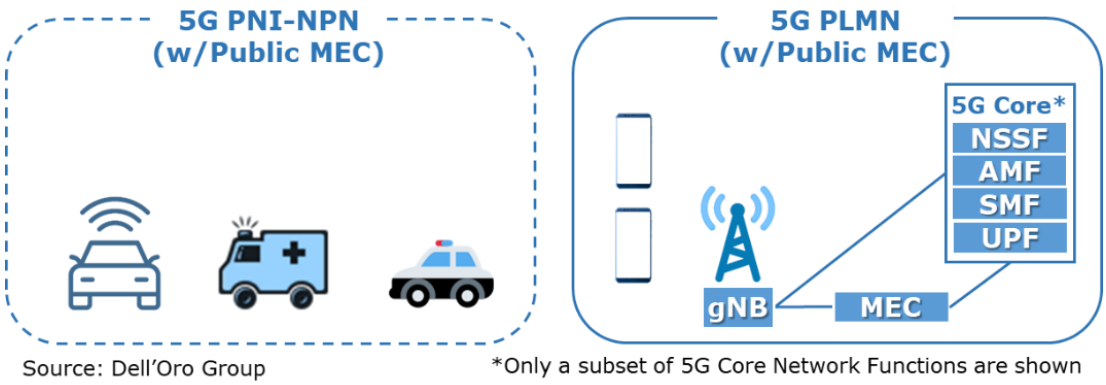


Figure 6: 5G PNI-NPN (w/Public MEC) Network Architecture

5G PNI-NPN (w/Public MEC) is the quickest option to implement since no additional infrastructure needs to be added to get an enterprise up and running. The logical private network created by network slices affords the enterprise partial data sovereignty. The 5G SP retains full network control in this scenario (Figure 7). The 5G PLMN (w/Public MEC) can attract both B2B and B2C business (e.g., cloud gaming) to gain a quicker return on investment in the Public MEC network. The Network Slice feature from the PLMN creates a virtual private network that differentiates the SLAs for each type of enterprise.

Time-to-Market	Optimized Coverage	Spectrum	Latency	Network Access	Data Sovereignty	SP Network Control
Quickest	Outdoors	PLMN	Low	Private Network Slice	Partial	Full

Source: Dell'Oro Group

Figure 7: 5G PNI-NPN (w/Public MEC) Network Characteristics

PNI-NPN (w/Private MEC)

5G PNI-NPN (w/Private MEC) is hosted by a PLMN with on-premises MEC for private use by an enterprise. This configuration provides the most flexible architecture for 5G SPs to meet the needs of industry with on-premises requirements for data sovereignty (Figure 8).

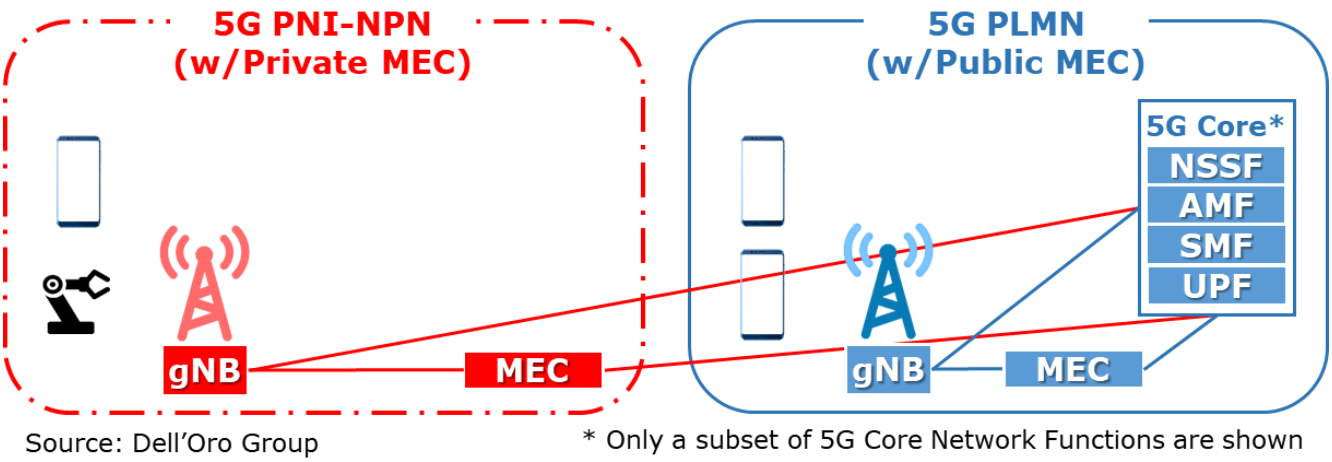


Figure 8: 5G PNI-NPN (w/Private MEC) Network Architecture

This configuration takes a little longer to deliver, requiring the addition of an on-premises Private MEC and RAN infrastructure on the enterprise campus. The 5G RAN can run on the 5G PLMN's public spectrum, run on the enterprise's private spectrum, or utilize unlicensed spectrum (Figure 9).

Time-to-Market	Optimized Coverage	Spectrum	Latency	Network Access	Data Sovereignty	SP Network Control
Slower	Indoors/Outdoors	PLMN/Private/ Unlicensed	Lowest Possible	Private Network Slice	Yes	Partial-Full

Source: Dell'Oro Group

Figure 9: PNI-NPN (w/Private MEC) Network Characteristics

With the addition of a Private MEC on-premises, the enterprise receives the lowest latency possible and has data sovereignty (localized-traffic data that is isolated from the PLMN). The 5G SP still retains the operational control of the network but may have limited access to on-premises equipment, depending on the arrangement with the enterprise. Additional SLAs can be added with Network Slices from the 5G SP.

5G SNPN (w/Private 5G Core)

SNPN (w/Private 5G Core) deployed as a completely standalone 5G private network has 5G RAN and a 5G Core on-premises and does not rely on the network functions provided by a 5G PLMN. An SNPN operator could be the enterprise itself, outsource operation to a 5G SP, or other entity. In this configuration, the RF spectrum is either private spectrum, spectrum from a PLMN, or unlicensed spectrum (Figure 10).

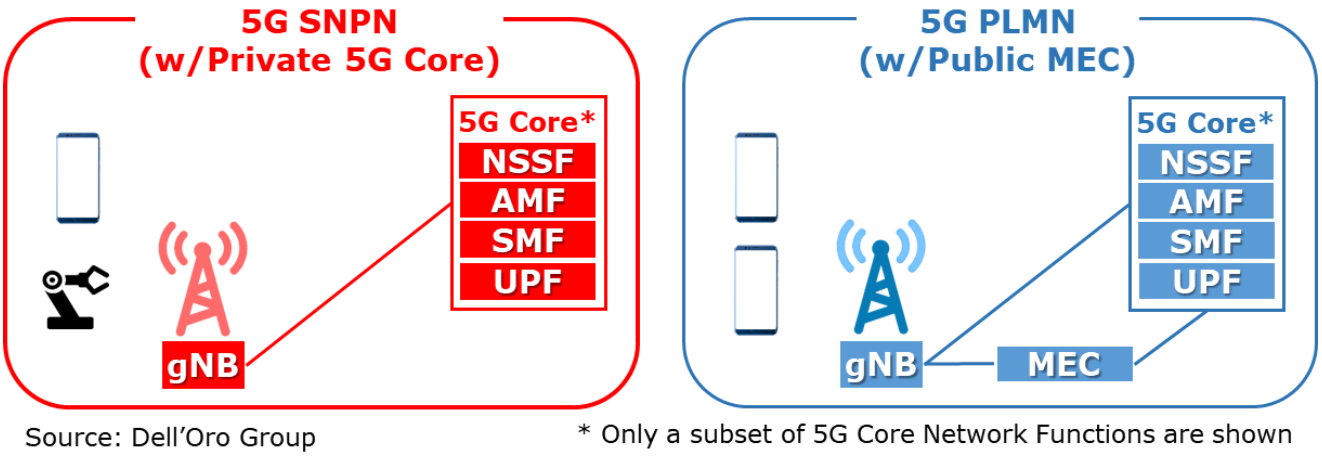


Figure 10 5G SNPN (w/Private 5G Core) Network Architecture

For multi-site locations, the Private 5G Core would not have to be extended to every site. Private MEC nodes can be used to cost-effectively extend the SNPN to other locations. 5G SNPN (w/Private 5G Core) takes the longest time to implement, and the 5G SP loses network control, since the SNPN is an autonomous network as far as the PLMN is concerned (Figure 11).

Time-to-Market	Optimized Coverage	Spectrum	Latency	Network Access	Data Sovereignty	SP Network Control
Slowest	Indoors/Outdoors	PLMN/Private/ Unlicensed	Lowest Possible	Private Dedicated Network	Yes	None

Source: Dell'Oro Group

Figure 11: 5G SNPN (w/Private 5G Core) Network Characteristics

5G Competitors

Private Network Vendors

Several countries have allocated industrial spectrum to enterprises that wish to build their own private networks with 5G PNI-NPN (w/private MEC) or 5G SNPN (w/5G Private Core) network options. New private network vendors have emerged to leverage the 5G SNPN (w/5G Private Core) opportunity.

Cloud Service Providers

Cloud SPs have a very strong presence within the enterprise market via their Cloud IT ecosystem solutions. It is a natural step for them to leverage their relationships with enterprises to also offer Cloud OT solutions. Most Cloud SPs don't have the required network connectivity (RAN and 5G Core) for OT systems and are therefore forging relationships with 5G SPs to offer 5G B2B services to enterprises. The PNI-NPN (w/Public MEC) network architecture has been the most popular when partnering with PLMNs. This partnering strategy will also work for PNI-NPN (w/Private MEC) network architectures. However, some Cloud SPs have begun developing and acquiring their own 5G connectivity capability (5G Core), which would diminish the use of PLMNs. And, there is nothing preventing a Cloud SP from partnering with or acquiring Private Network Vendors to expand their scope (RAN and 5G Core), and, therefore, supply the needs of 5G SNPN (w/5G Private Core) network architectures, which would result in no need to rely on the PLMNs of 5G SPs.

5G SP Market Positioning

The overarching positioning for a 5G SP is to be first to market, establishing itself as the most credible wireless network provider for enterprises and therefore gaining the largest market share and maximizing its revenues. To position themselves as the leader in enterprise real-time and near real-time wireless communications, 5G SPs need to take the following operational steps to address the three network options:

- **Rapidly build out 5G SA networks with 5G PNI-NPN (w/Public MEC) network option.** Exploiting the 5G SPs inherit advantage of abundant edge sites by pre-installing Public MEC sites to be ready to serve enterprise needs as they arise. By having Public MEC connectivity in place, compute power can be added quickly, positioning 5G SPs with rapid go-to-market offerings for enterprises. When combined with the B2C market, the Public MEC market becomes the largest MEC segment.

- **Leverage the enterprise on-premises market with 5G PNI-NPN (w/Private MEC) network architecture from the 5G PNI-NPN (Public MEC) network architecture.** The Public MEC network showcases 5G SPs capabilities, and a Private MEC is a natural extension of the Public MEC, with the only real difference being its on-premises location. The Private MEC market is the second largest market opportunity, and can be implemented on a case-by-case basis in parallel with the Public MEC build-out. Usually, Private MEC is thought of being offered with PLMN's spectrum, but Private MEC can be implemented with private spectrum or unlicensed spectrum, if so desired.

- **Consider expanding the 5G PNI-NPN (w/Private MEC) network architectural offering to enterprises considering the SNPN option, by running the RAN on the enterprise's private spectrum.** The enterprise would be in control of its spectrum, receive the same performance, and gain the benefit of working with the 5G SP, which is arguably the most credible supplier, since the SP is experienced in designing, deploying, and operating its own 5G network. 5G SPs can bring their experience and expertise to the private wireless market for RF planning for optimal RAN placement, helping to build and operate the private wireless networks. In addition, 5G SPs have the resources to keep private wireless networks up to date as technology evolves.

- **Provide enterprises with operational online portals that provide an intelligent O&M.** The portals should be self-provisioning to accelerate service delivery via plug-and-play deployments.

- **Provide enterprises with operational portals or dashboards that include the status and performance of the enterprise's network to see if SLAs are being met.**

To attract customers and demonstrate their seriousness about the enterprise market, 5G SPs must:

- Implement 5G innovation labs to cultivate application developers and to be able to showcase those applications to enterprises.

- Add specialized sales teams that understand the differentiated needs of the verticals in the enterprise space.

To provide an optimal customer experience, 5G SPs must:

- **For the Public MEC enterprise market, provide online customer portals to make it easy for enterprises to quickly select from a menu of performance standards** for building their SLAs and a menu of features they require. Enterprises need to know the geographic locations that the SLAs and features can be met in. If the standards and features are not available system wide, 5G SPs must be able to communicate their build-out schedules so that enterprises can adjust their marketing plans for rollout of services depending on a Public MEC system. Ideally, enterprises should be able to order services on-line and get service the same day. Portals should be updated as enterprise needs evolve.
- **For the Private MEC enterprise market, provide online portals to make it easy for enterprises to select a Private Network option**, and provide the cost and delivery time for each option. Provide a punch list for each architectural option so an enterprise can be ready for delivery for on-premises equipment. As for Public MEC, performance standards and features need to be easily specified and their geographic availability specified, in case an enterprise needs services at multiple locations.
- **Ensure that online portals include pricing options with a mix of upfront costs, subscription costs, and/or maintenance costs** to meet the financial needs of enterprises.

Review of a Commercial 5G SA Network with MEC and Its Enterprise Use Cases

As we enter 2021, only China Mobile has launched a 5G SA network with widespread MEC deployments, and it is clear that it has carefully planned its roll-out. As of September 2020, the firm had built eight Regional Data Centers with 5G Core, Public MEC nodes in all 31 provinces, and well over 100 cities had Public MEC nodes deployed (Figure 12). The firm is now adding city-level Pubic MEC nodes in hundreds of medium-sized and large cities. China Mobile can now offer B2C and B2B services using specific integrated applications based on customer requirements. For more demanding enterprise on-premises applications, the firm can build Private MECs in parallel with its Public MEC network based on enterprise demand.

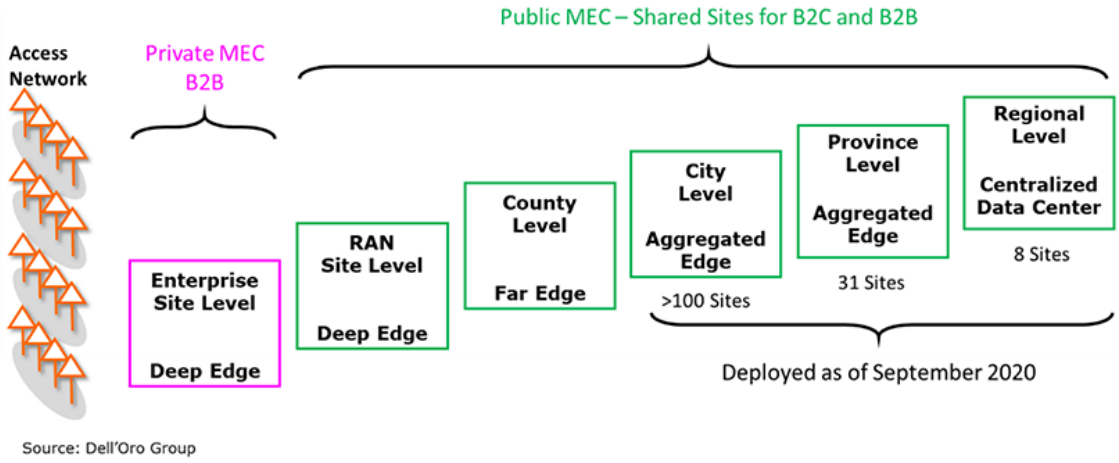


Figure 12 China Mobile 5G MEC Deployment Strategy in Mainland China

Before embarking on its MEC journey, China Mobile verified the performance and benefits of the technology with pre-commercial trials. These trials verified the importance of MEC (whether Public or Private) in improving productivity across multiple industries[9]:

- **Smart Port (w/Public MEC)** Zhenhua Port Machinery Company: Shipment efficiency was improved by 20% and the number of operational accidents reduced to zero.
- **Smart Factory (w/Public MEC)** Huzhou JiuLi Hi-Tech Metals: Data collection and analysis efficiency increased by 50%.
- **Smart Factory (w/Private MEC)** Haier Group factory Qingdao: Quality detection accuracy improved by 18%.
- **Smart Grid (w/Private MEC)** China Southern Power Grid: Power distribution automation rate improved from 20% to 80%, and power supply interruption time was reduced from 4 hours to 20 minutes.

[9] "Huawei's XEDGE 5G MEC Solution," 2019 analyst presentation, Huawei

Conclusions

The enterprise wireless real-time and near real-time communications market is an undeniably large opportunity for 5G SPs to grow their revenues. 5G MEC is the enabling technology to meet low latency requirements, as well as data sovereignty when required. Autonomous driving is on the horizon, requiring a Public MEC System be deployed at millions of RAN macro base station sites, and Private MEC Systems address the needs of millions enterprise locations, translating into increasing revenues for 5G SPs. At the same time, MEC systems reduce the cost of backhauling all user data to the central 5G Core.

Three private networks options were reviewed: Public MEC, Private MEC, and Private 5G Core. The enterprise network options are summarized in Figure 13, with the addition of relative cost to enterprises and relative size of the market opportunity for SPs.

	5G PNI-NPN (w/Public MEC) (off-premises)	**5G PNI-NPN** (w/Private MEC) (on-premises)	**5G SNPN** (w/Private 5G Core) (on-premises)
Time-to-Market	Quickest	Slower	Slowest
Optimized Coverage	Outdoors	Indoors/Outdoors	Indoors/Outdoors
Spectrum	PLMN	PLMN/Private/Unlicensed	PLMN/Private/Unlicensed
Latency	Low	Lowest Possible	Lowest Possible
Network Access	Private Network Slice	Private Network Slice	Private Dedicated Network
Data Sovereignty	Partial	Yes	Yes
SP Network Control	Full	Partial/Full	None
Cost to Enterprise	$	$$	$$$
SP Market Potential	Largest	Large	Smallest

Source: Dell'Oro Group

Figure 13: Enterprise Network Architectural Options and Characteristics

A comparison of on-premises architectural options costs indicates they have a different mix of operating expenses (opex) versus capital expenditures (capex), with 5G PNI-NPN (w/Private MEC) tilted towards opex and 5G SNPN (w/Private 5G Core) tilted towards capex.

In competing for private on-premises business, 5G SPs can make the case that 5G PNI-NPN (w/Private MEC) is a better option than a 5G SNPN (w/Private 5G Core) solution, since Private MEC can meet enterprise need for data sovereignty and have the best coverage and lowest latency possible, at a lower cost with quicker delivery, all without sacrificing performance, running on the enterprise's private spectrum. At the same time, the 5G SP would be able to keep the network up to date with the latest 3GPP standards.

Market positioning is paramount to a 5G SP capturing the enterprise market, as summarized in Figure 14.

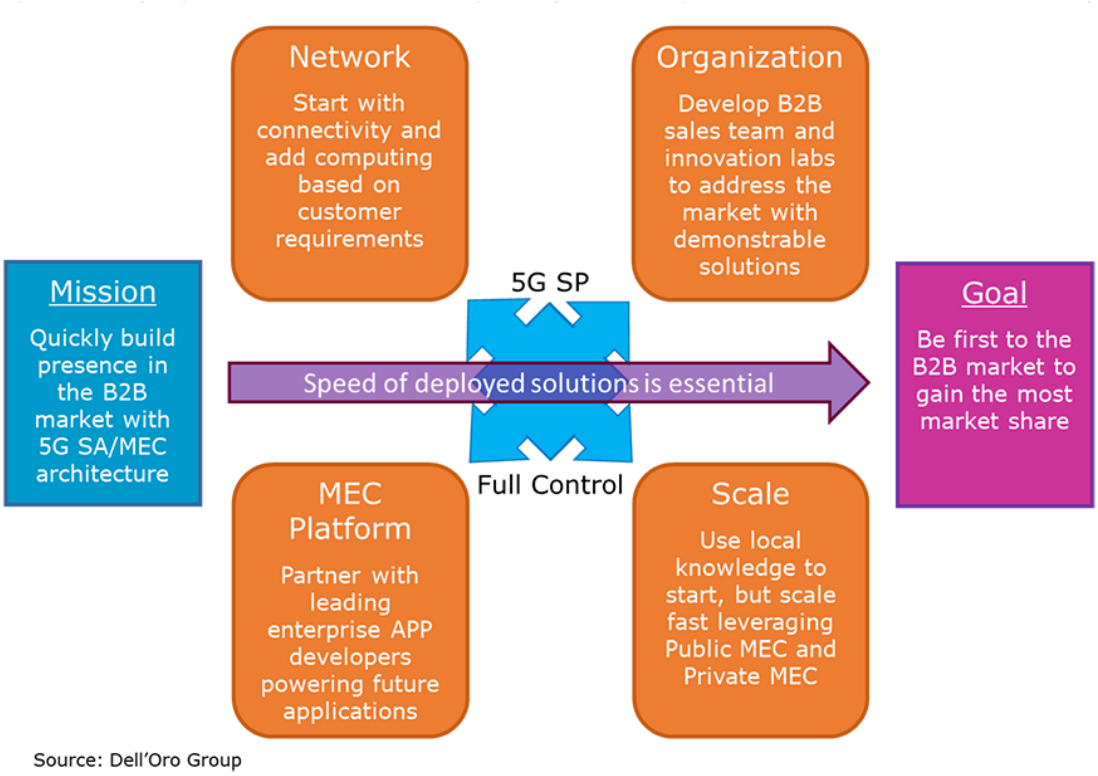


Figure 14 5G SPs Market Positioning

China Mobile proves that MEC is ready for prime time and that 5G SA networks with Public and Private MEC can deliver value for enterprises. China Mobile has focused on addressing the two largest segments, Public MEC and Private MEC.

5G MEC is the key infrastructure component that can enable 5G SPs to provide premium services and performance to enterprises needing real-time or near real-time communications. A 5G SP that cultivates relationships with enterprises and deliver solutions faster than the competition will gain the most market share and generate new sources of revenue.

Glossary of Terms

3GPP	3rd Generation Partnership Project
5G SA	5G Standalone
AF	Application Function
AGV	Automated Guided Vehicles
AI	Artificial Intelligence
AMF	Access and Mobility Management Function
AR	Augmented Reality
AUSF	Authentication Server Function
B2B	Business-to-Business
B2C	Business-to-Consumers
CP	Control Plane
ETSI	European Telecommunications Standards Institute
FA	Feeder Automation
gNB	gNodeB
IT	Information Technology
MEC	Multi-access Edge Computing
NEF	Network Exposure Function
NFVI	Network Function Virtualization Infrastructure
NR	New Radio
NRF	Network Repository Function
NSSF	Network Slice Selection Function
O&M	Operation and Maintenance
OT	Operational Technology
PCF	Policy Control Function
PLMN	Public Land Mobile Network
PNI-NPN	Public Network Integrated Non-Public Network
RAN	Radio Access Network
SLA	Service Level Agreement
SME	Small and Medium Businesses
SMF	Session Management Function
SNPN	Standalone Non-Public Network
UAV	Unmanned Aerial Vehicles
UDM	Unified Data Management
UPF	User Plane Function
URLLC	Ultra-Reliable Low Latency Communication
V2X	Vehicle to Everything
VR	Virtual Reality

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Founded in 1995 with headquarters in the heart of Silicon Valley, Dell'Oro Group is an independent market research firm that specializes in strategic competitive analysis in the telecommunications, networks, and data center IT markets. Our firm provides world-class market information with in-depth quantitative data and qualitative analysis to facilitate critical, fact-based business decisions. Visit us at www.delloro.com.

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