Bringing the Power of Hyperscale to Operator-Enabled Private Mobile Networks

Introduction

Private mobile networks, powered by 5G

There is little doubt that private networks, accelerated and enhanced by 5G, will transform the landscape of telecommunications services. Key features in 5G, such as the cloud-friendly Service Based Architecture (SBA) and network slicing, will enable low-latency communications (URLLC), massive machine type communications (mMTC), and time-sensitive networking (TSN), which will allow operators to offer new services oriented to the developers of high-performance industrial applications and empower the introduction of new, disruptive commercial models.

While consumer-based offerings such as voice, text, data, and video will remain an integral part of the telco operator service portfolio, new enterprise-based offerings such as LTE/5G private networks, IoT applications, and augmented/virtual reality (AR/VR) experiences will drive unprecedented revenue opportunities for operators. Yet, to deliver these next-generation enterprise services, telco operators will need to look beyond the traditional telco network architecture to cloud and multi-access edge computing (MEC).

We believe that private mobile networks represent a strong use case for 5G enterprise services, as these capabilities will underpin the more sophisticated services, such as smart cities and Industry 4.0 applications.

A confluence of factors is driving the practicality of private enterprise mobile networks. The limitations of current in-building wireless systems, the rising amount of generated data, the increased need for mobility, security, and the demand for real-time data processing are evidence that a new approach is required. The convergence of 5G, MEC, and the cloud now makes it possible to create private wireless networks that are ultra-fast, secure, scalable, and can take advantage of powerful cloud applications for analytics.

Yet, for all the advantages of a 5G private network, challenges remain for operators and enterprises. First and foremost is the complexity of deploying and managing a 5G network within the enterprise environment. 5G networks have many considerations that lie outside the traditional enterprise skill set, from RF design to 5G mobile core architectures. Simultaneously, many telco operators lack the technology portfolio to deploy 5G networks and cloud edge computing within the enterprise environment.

Microsoft proposes a simplified approach that combines a hyperscale cloud platform, integrated MEC components, a rich ecosystem of cloud applications, and a cloud-native 5G mobile core. Our approach enables the enterprise to collect data from across their network, process it efficiently at the edge, and leverage Azure's robust suite of IoT, analytics, AI, and machine-learning tools to deliver much greater value.

This executive summary explains how mobile operators can build private networks for enterprises using Azure services and leverage the benefits of a hyperscale cloud and integrated MEC architecture to significantly lower CapEx/OpEx, accelerate the pace of innovation, and open up new revenue opportunities.

Benefits of private mobile networks

With 5G comes faster speeds, lower latencies, improved cost efficiencies, and richer capabilities. These features are desirable to industries such as manufacturing and transportation, where geographic challenges and expanding IoT applications require the enhanced network characteristics (e.g., high bandwidth capacity, real-time processing) that 5G can provide. We see the demand for 5G private networks as driven by the following key benefits.

Low latency
5G networks, with applications deployed in local edge compute facilities, can offer much lower latency than 4G networks, which is critical for time-sensitive applications.

Deterministic access support
5G radio supports deterministic access and places a guaranteed upper limit on latency and jitter, moving 5G closer to the performance of wired Ethernet and allowing applications that once required wired connections to be untethered.

Greater coverage
For applications that require wireless connectivity beyond the range limitations of Wi-Fi technology, 5G radio access networks provide high-performance and cost-effective wireless connectivity over large sites such as airports and campuses.

Higher throughput
5G can deliver 10-20x the throughput of 4G demanded by many private network applications.

Data localization/Privacy
Private mobile networks, combined with edge computing, can provide better visibility and control over where data is accessed and processed, enabling highly sensitive information to be kept securely and locally without being exposed over external network connections.

Operational simplicity
Instead of managing multiple versions of network technology for wired, Wi-Fi, and mobile broadband access to corporate resources, private wireless networks will enable corporate IT to build a simplified access architecture that will work for employees in the office and on the go.

Backhaul savings
It makes sense to deploy data-intensive applications in local compute facilities to avoid the high cost of backhauling very large volumes of data to a centralized cloud. Private mobile networks make this possible.

Legal and regulatory compliance improvements
5G radio is inherently more secure than any earlier generation of cellular technology and includes protection from sophisticated attacks (e.g., IMSI-catcher, Stingray).

Path to private 5G networks

Enterprise applications will place a variety of new and different demands such as multiple users, deployment flexibility on private networks. 5G provides unmatched capabilities for multitenancy and managed services. It provides better flexibility, greater management with a dynamic mobile core allowing much more optimized solutions for enterprise customers. The architecture of 5G networks, and in particular, the separation of control and user plane, also makes it possible to use an existing centralized mobile packet core to provide the control plane for private 5G networks while keeping user plane traffic local to the enterprise.

Private 5G networks sit at the intersection of the traditional enterprise LAN space, specialized industrial networks, and the public mobile network space. They offer telcos a chance to expand the scope of the 5G services they offer into new markets. Operators have a great deal of expertise in successfully deploying and operating secure and reliable mobile networks; depending on local spectrum licensing laws, there may be a regulatory requirement for an enterprise to partner with a mobile operator in order to deploy private 5G.

In considering how to deploy private 5G networks, many enterprises will look favorably on mobile network operators as potential suppliers of the solution. Operators are viewed by enterprises as trusted partners in communications, and commercial relationships between them are already well established.

Critical attributes of a private mobile network

What does an effective private mobile network solution—one that operators and enterprises alike can feel confident in deploying—look like? The answer can be summarized in three key solution attributes.

1. Managed connectivity
While many enterprises have experience with managing their Wi-Fi network and mobile access points, few have experience with 4G/5G radio network design and deployment. This presents an opportunity for the operator to bring a managed radio and spectrum solution to meet the enterprise's needs.

2. Managed services
A private mobile network partner that can provide managed services adds significant value to the customer. These managed services would ideally address the RAN, core, and edge components in the solution. Moving the total solution management into a centralized, cloud-based environment allows operators and Managed Service Providers (MSPs) to deliver end-to-end managed services from a single pane of glass.

3. Self-management options
Use cases for private mobile networks are as unique as the businesses they serve. For example, a remote oil-drilling platform will have very different mobile network considerations than an automotive manufacturer. To address these varied use cases, there must be flexibility and simplicity in how these networks are configured, deployed, and managed. Where possible, portals and dashboards can simplify service customization. Service level assurance must also be customizable and visible to the enterprise.

Building a private mobile network

An integrated approach with Azure

There are four critical components to a private mobile network: the local radio resources, the edge compute platform, the application ecosystem, and the cloud. Today's private mobile network solutions are often built as a collection of loosely integrated components. While this loose integration approach may make sense in terms of physical and organizational demarcation points, it has several critical drawbacks: it is challenging to deploy, complex to manage, costly to scale, and inherently insecure.

Microsoft offers operators a different approach: a fully integrated, yet open, private mobile network solution that features cloud-native mobile core technology, advanced edge computing, and a hyperscale cloud environment. Microsoft's architectural approach to private mobile network provides unique advantages to both operators/MSPs and enterprises, such as integration with multiple radio access technologies and an advanced edge computing platform that can host both the mobile core and O-RAN components (e.g., vCU, vDU) from Microsoft's partner ecosystem.
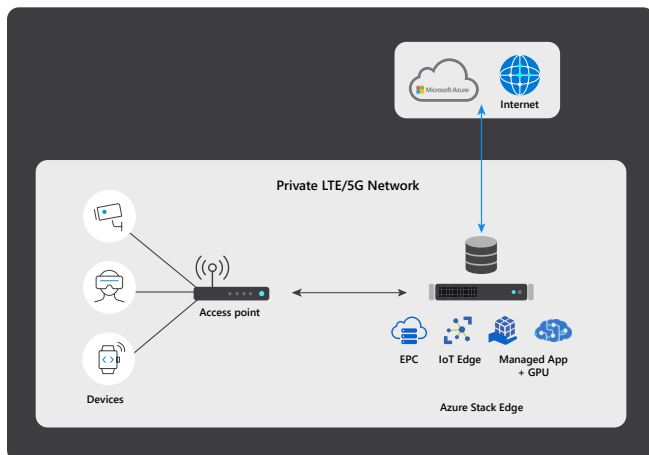
Azure Stack Edge: the edge, simplified
Microsoft proposes a shared, secure edge approach where both the mobile network functions and local edge applications run side-by-side in a common zero-trust security framework provided by Azure Stack Edge. This approach offers seamless integration between the 5G network, edge computing, and the cloud, and significantly reduces CapEx and OpEx. Azure Zero Trust security model ensures that every application and all traffic is secure from end to end.

Single-pane-of-glass management
Microsoft provides a single, centralized management environment for the mobile core, edge, and cloud services through the Azure portal. This makes it much easier for operators and enterprises to manage and control the network experience as well as provide full-service assurance and automation, including configuration, fault, and performance management.

Integration with Azure Services
Microsoft's approach opens up a rich ecosystem of applications to operators and enterprise customers, including business intelligence/analytics, artificial intelligence, and machine-learning applications from Microsoft and many others.

Private mobile networks-as-a-service
Affirmed Networks's revolutionary core technology, now part of Microsoft, allows operators, for the first time, to deploy a complete CBRS/4G/5G mobile core in the cloud as a service. Operators can deliver the mobile core functionality as a hosted and fully-managed service within the Azure for Operators cloud, whether on-premises or in the cloud.

Solution components

Microsoft's approach to private mobile networks is a completely integrated solution from the mobile core to the edge to the cloud. This solution architecture has several key components: Azure Stack Edge, Affirmed Service Manager, Azure Network Function Manager, and Affirmed Mobile Core.

Azure Stack Edge
Azure Stack Edge provides a single point for processing mobile network data at the edge. Integration between Azure Stack Edge and Affirmed's 4G/5G mobile core technology enables local, intelligent breakout of data processing and seamless data sharing for faster processing and lower bandwidth consumption.

Affirmed Service Manager
Affirmed Service Manager provides the speed, agility, and automation required to deploy and manage private mobile networks at scale. It automates the lifecycle management of private network services.

Network Function Manager
Azure Network Function Manager (NFM) is a fully managed cloud-native orchestration service that enables customers to deploy and provision network functions on Azure Stack Edge Pro with GPU for a consistent hybrid experience using the Azure portal.

Affirmed Mobile Core
Affirmed's 5G core solution provides a fully virtualized, cloud-native solution that includes all standard 5G core network functions plus enhanced functionality such as virtualized network probes, Wi-Fi interworking, and service automation platform.

Key benefits

Microsoft's cloud-based, MEC-enabled, fully integrated approach has clear benefits to operators looking to deploy private mobile networks, including:

- A carrier-grade network experience built on a proven 5G mobile core architecture.

- A cloud-managed and operated solution hosted in a global, hyperscale cloud environment explicitly designed for tier one (and smaller) carriers.

- Automated lifecycle management that simplifies administration, security, and operation.

- Service assurance that meets five nines of reliability and availability to support mission-critical applications.

- A multi-tenant model that allows operators to cost-effectively manage private network services through a single management console, including full integration with existing billing and customer care systems.

- The ability to tap into powerful cloud and IoT applications, including Azure's built-in AI and machine-learning capabilities.

- The flexibility to deploy the solution in a 4G-only, 5G-only, or hybrid 4G/5G environment, allowing enterprises to start with a 4G implementation and migrate seamlessly to 5G or deploy a hybrid 4G/5G private mobile network solution.

- A telco-grade solution that delivers the high-performance, high-availability, low-latency requirements that enterprises expect from their service providers.

Looking forward

To the Edge and beyond

The cloud and multi-access edge computing can unlock the potential of private mobile networks in new and exciting ways. This includes real-time analytics, artificial intelligence, and machine learning—applications that will enable enterprises to harness data from retail stores, manufacturing floors, and warehouses to improve business processes, tighten supply chains, and create better customer experiences. Microsoft is committed to helping telecommunications operators deliver this future by providing an approach that deploys 4G and 5G private mobile networks more effortlessly than ever before.

We believe the path to private mobile networks is clear: a single platform with a fully integrated mobile core, edge, and cloud that supports rapid and repeatable deployment, delivers best-in-class performance, reduces CapEx/OpEx costs, and simplifies management through a single pane of glass. By solving the critical infrastructure challenges to managing and deploying a private mobile network, the barriers to the future have been removed. The only limits that remain are those of the imagination.