

Azure for Operators

A cloud for network operators

February 2021



Contents

- 03 Accelerating digital transformation**
- 05 A cloud for operators**
- 06 New opportunities**
- 07 Partnering for success**
- 08 The Azure for Operators service stack**
- 10 Cloud security**
- 11 Operator points of control**
 - Network core
 - Network slicing
 - Peering
 - Telco edge cloud
 - Network APIs
- 14 Cloudification stages**
- 15 Working with Microsoft**

NOTICE

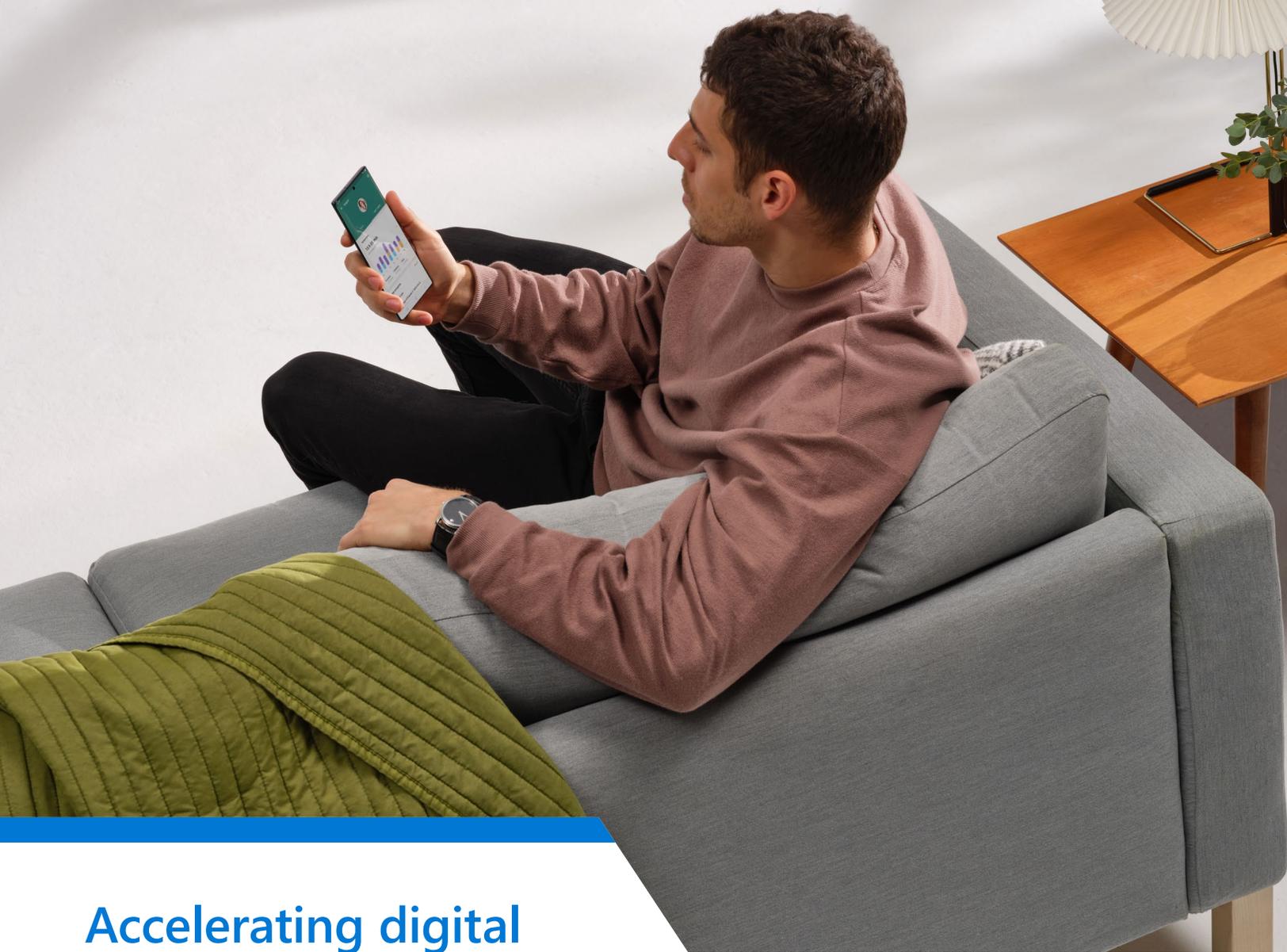
This document contains sensitive confidential and proprietary information and intellectual property of Microsoft Corporation and its affiliates (collectively "Microsoft"). Review, use, and reproduction are only permitted solely as necessary for the purposes for which it was given, and solely subject to the terms of any non-disclosure agreement with Microsoft. No further distribution to third parties is permitted.

The information contained in this document represents the current view of Microsoft on the issues discussed as of the date of publication and is subject to change at any time without notice. This document and its contents are provided AS IS without warranty of any kind and should not be interpreted as an offer or commitment on the part of Microsoft, and Microsoft cannot guarantee the accuracy of any information presented. MICROSOFT MAKES NO WARRANTIES OR REPRESENTATIONS, EXPRESS OR IMPLIED, IN THIS DOCUMENT.

All trademarks are the property of their respective companies.

Microsoft and Windows are either registered trademarks or trademarks of Microsoft Corporation in the United States and/or other countries.

All rights reserved.



Accelerating digital transformation

In today's world, networking and computing are everywhere, embedded in devices we hold in our hands and distributed across wide areas and smart cities. Advances in the cloud have allowed us to connect billions of devices, to work remotely and efficiently, and to let applications grow at massive scale. Processing power can be distributed to where it's needed most, while maximizing performance and minimizing latency. The cloud can provide colossal amounts of compute, be accessed from anywhere, and can store huge volumes of data, delivering operational efficiencies to businesses across every industry.

Recent events have served to accelerate digital transformation. With many of our customers, Microsoft is seeing years of digital transformation occurring in mere months. With increased numbers of individuals working remotely, there has been an even heavier dependency on the cloud to provide services, connect people, and empower employees. The pandemic has increased remote education and the consumption of entertainment at home. Customers expect an always-on, mobile-connected experience from their communications service providers as their lifeline to work, family, and friends.

Looking ahead, communications service providers and network operators (herein referred to as “operators”) are facing further rapid transformation through the arrival of 5G mobile networks. 5G offers the ability to connect tens of billions of intelligent devices, densely deployed and generating orders of magnitude more data to be handled by the network. Aside from consumers expecting the “next great thing,” operators will be under real pressure from enterprise customers to move quickly, delivering 5G’s low latency, dense device, and high-performance capabilities to enable near real-time management and control of critical business operations.

While the 5G service-based architecture already defines how network functions can be deployed in the cloud, significant new revenue opportunities can only be unlocked by operators if the ultra-low-latency, highly programmable characteristics of 5G networks are able to be seamlessly and securely integrated with hyperscale cloud services (AI, ML, security, analytics, IoT...), and made readily available to a large community of software application developers.

Microsoft’s Azure for Operators initiative has been launched to meet this need. Providing a secure, intelligent, high-performance hybrid cloud platform, along with a broad developer and partner ecosystem, we will not only further accelerate a global digital transformation, but also offer network operators a very real and exciting opportunity to monetize their significant and ongoing investments in 5G.

A cloud for operators

For practical adoption, a cloud must meet the specific needs of operators accustomed to delivering critical, real-time communications services. These operators have their own unique requirements for reliability, resiliency, security, observability, and performance. They need a cloud that allows them to retain control over critical network functions, yet provides easily available programmable interfaces for application developers. They need a hybrid cloud that recognizes the uniquely distributed nature of telecommunications functions and the high resiliency/security needed to support critical national infrastructure. They need a cloud that can scale to accommodate billions of connected devices. They need a cloud that can deliver ubiquitous computing, minimizing latency by being as close to the customer as possible. And they need a cloud that can accommodate the complex ecosystem of equipment and software vendors, business partners, and network architectures that comprise their solutions today.

Microsoft Azure is that cloud. Microsoft Azure is the world’s computer, with more than 170 network points of presence (POPs), 20K+ peering points, and already handling more than 30 billion packets per second. Our global network of more than 160,000 miles of subsea, terrestrial, and metro optical fiber helps billions of people connect all around the world. Our recently announced Azure Space ecosystem further extends this connectivity into particularly remote locations using satellite bandwidth.

Microsoft understands the challenges for scaling to meet the demand for massive IoT, with more than 6 billion devices using our IoT services. Furthermore, Microsoft is able to provide unique insights on the

Artificial Intelligence and Machine Learning technologies that will drive the next generation of 5G applications—already processing more than ten billion cognitive services transactions per month and more than one million machine learning experiments.

To better serve operators, Microsoft Azure has embraced the concepts of intelligent cloud, intelligent edge, and the hybrid cloud. The intelligent cloud is ubiquitous computing enabled by the public cloud and powered by AI. Complementary to the intelligent cloud is the intelligent edge, a continually expanding set of connected systems and devices that gather and analyze information close to the physical world where data resides, to deliver real-time insights and immersive experiences that are highly responsive and contextually aware. Our hybrid cloud solutions are a combination of the two, evolving from the classical integration of data center with the public cloud, to units of computing available at remote locations working in concert with the public cloud.

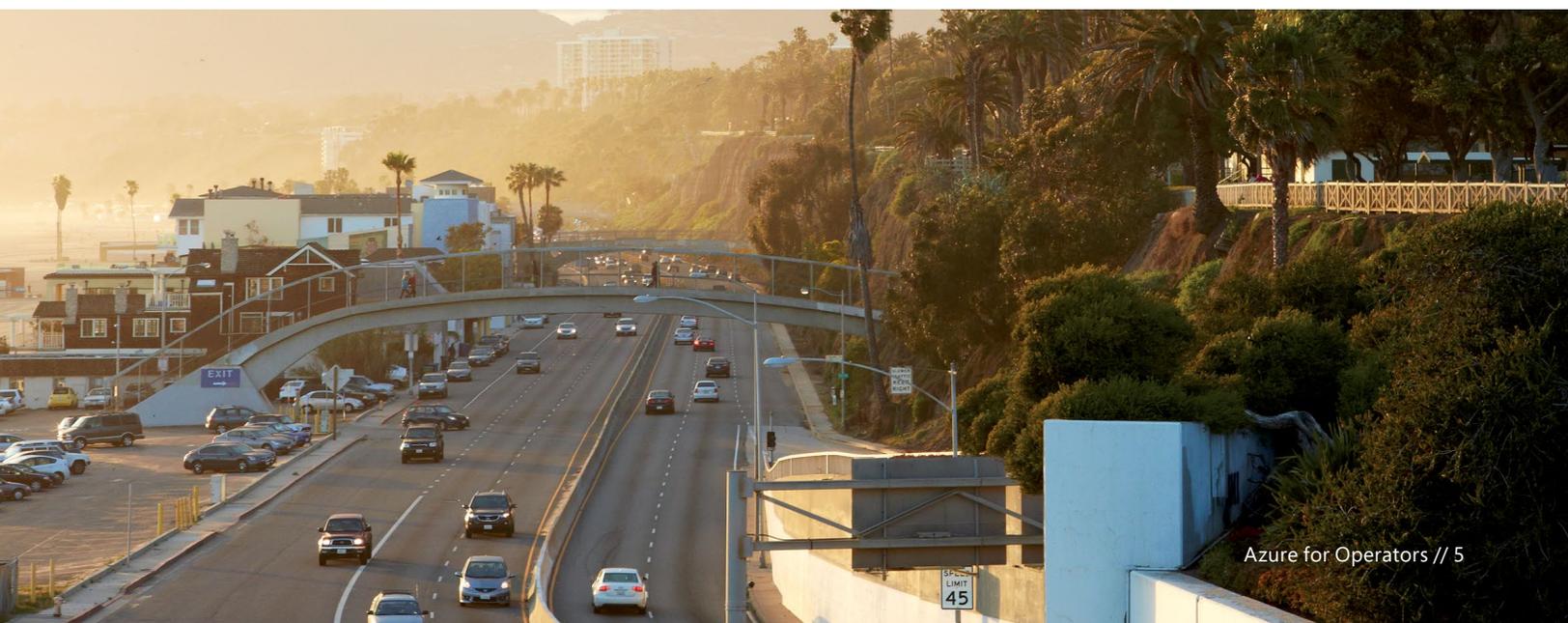
Microsoft's recent Azure Edge Zone Preview¹ offers further details on the Azure edge compute offerings. Part of the Microsoft global network, Azure Edge Zones are extensions of

Azure placed in population centers remote from Azure regions. Azure Edge Zones support VMs, containers, and select Azure services that let operators run latency-sensitive, geo-constrained, and throughput-intensive applications closer to end users.

Microsoft also recently acquired Metaswitch Networks and Affirmed Networks to add hundreds of world-class communications engineers, more than 50 combined years of "telco DNA," and a broad range of high-performance cloud native software products to our portfolio. Adding this level of expertise is a critical and differentiated industry commitment to fully understanding and meeting the needs of our operator partners.

Microsoft's Azure for Operators initiative brings the power of the Azure hybrid cloud, and Microsoft's rich portfolio of cloud services to operators. It's a commitment to work with, not disintermediate, operators. Indeed, our partnering with operators is key to connecting the intelligent edge with the intelligent cloud and to creating new transformative experiences for people and organizations everywhere, across every industry.

¹ <https://docs.microsoft.com/en-us/azure/networking/edge-zones-overview>



New opportunities

Azure for Operators provides many opportunities for operators to unlock more value from their business. Revenues can increase by bundling new forms of content (such as mixed reality or business-critical software like Microsoft 365) with a high-quality network and a brand identity strengthened through better customer experiences. Operators can leverage the power of edge computing, network slices, and exposed APIs, to deliver new services at huge scale, to users and devices.

While 4G and broadband each created tremendous value in the consumer space, SDN and 5G will create similar value within the enterprise market. Compute can now be delivered to the edge of the network and enterprises. 5G will provide low-latency connectivity to autonomous vehicles and devices, facilitate highly tailored service agreements through dedicated network slices, support high-density sensory devices for industrial IoT, and enable the deployment of advanced private mobile solutions.

These solutions will be targeted at specific industries: operators will help advance the agricultural industry, enabling farmers to take data from sensors, drones, and satellites to understand precisely how soil, weather, and management intersect; connected smart buildings will enable inhabitants to use the power of mixed reality, interacting with their environment and navigating spaces like never before; and in manufacturing, businesses will create digital twins of factories, applying new insights to drive better products, reduce costs, and ultimately enable lights-out operations to function during critical times. For operators, these exciting use cases can now be addressed through intelligent cloud and edge strategies.



The availability of compute to solve problems wherever it is needed will empower people and organizations to do more. Deeply connected solutions coupled with advanced AI and ML (creating “ambient intelligence”) will be close enough to a customer or event to react meaningfully in the real world. High speed, high bandwidth connections—coupled with low-latency compute—will fuel entirely new content and experiences. By connecting network functions to Azure’s AI and ML cloud capabilities, operators will fuse virtual and physical worlds, providing real-time service analytics, predictive part maintenance, and accelerated fault identification and corrections. Networks will become self-optimizing, self-defending, and self-configuring. Complex tasks will be automated, provisioning intervals reduced, and outages eliminated.

With Azure for Operators, these opportunities are now within reach. Microsoft’s hybrid cloud solution can help operators deploy, secure, and monetize network services across Azure, and other platforms (in a multi-cloud environment). It’s a digital transformation journey that starts where operators are today, and ultimately ends on future-proof architectures capable of evolving with their business.

Partnering for success

With the announcement of Azure for Operators, Microsoft has launched a strategy to partner with network operators to create new opportunities and provide core infrastructure, combining the power of cloud and edge for low latency, broad reach, and service intelligence. Our work with operators, enterprises, and government plays a critical role in delivering experiences that previously would have been unimaginable, and breakthroughs that would have been impossible.

The Azure for Operators portfolio is optimized to support the unique needs of the telecommunications industry. Our approach is guided by three key principles:

- Bringing the power of the intelligent cloud and edge to operator networks
 - New solutions at the network edge offer step-change advancements in cost, speed, and security, enabling operators to serve customers with new low-latency compute applications.
- Taking an ecosystem-wide approach
 - Azure for Operators brings the scale of the Microsoft developer and partner ecosystem across everything from network functions to cognitive services, exposing new use case capabilities and spurring innovation.

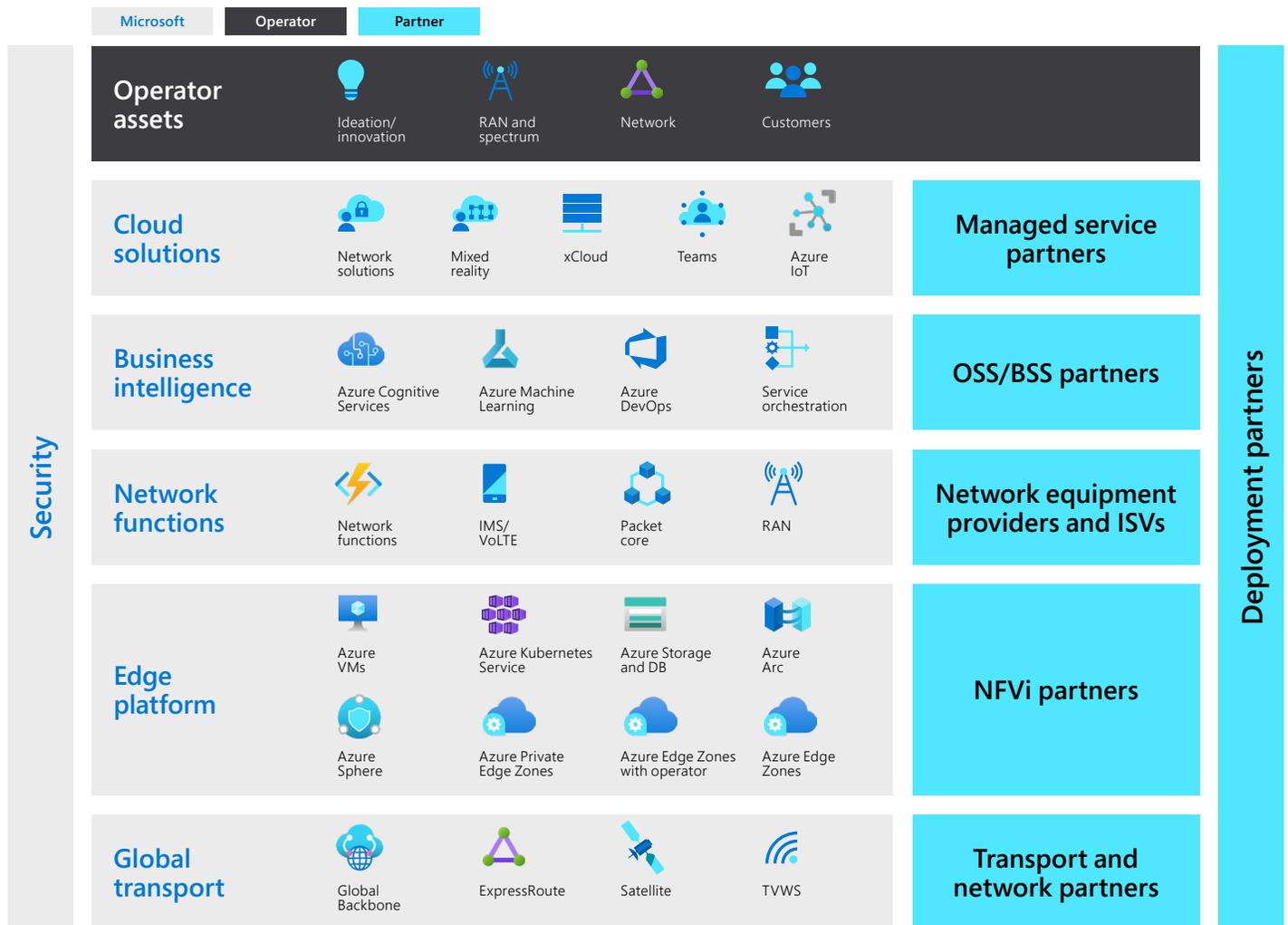
- Helping to reduce costs and increase revenue
 - A software-based cloud native alternative to traditional network infrastructure will disrupt the economics of providing communications services and allow for increasing sophisticated end user experiences and services.

Microsoft is committed to working with operators as a partner, not as a competitor. Microsoft remains a platform company with the mission of empowering others to achieve more. Microsoft is committed to bringing operator-grade technology to operators who can and will continue to retain their customers, brand, ideation, and user experience. Recognizing the unique needs of operators, Microsoft will meet them where they are—on-premises, at the edge, and in the cloud. This is a journey, and Microsoft will act as a trusted partner to help operators transform their networks at a pace that makes sense for their business.



Azure for Operators service stack

Microsoft's Azure for Operators assets operate in harmony to create a tailored experience for any operator. Our full-service stack is designed to complement an operator's existing assets, allowing operators to select complete solutions, or only the elements that they need.



Global transport

Microsoft has one of the largest network backbones on the planet, connecting with operators at more than 170 points of presence and 20K+ peering connections. More than 200 operators have chosen to integrate with the Azure network through our ExpressRoute

service, enabling enterprises and partners to link their corporate networks privately and securely to Azure services. We also provide additional connection routes through options as varied as satellite connectivity and by using TV White Space technology.

Edge platform

Using this deep connectivity reach, Microsoft can supply operators with cloud computing options that meet the customer wherever those capabilities are needed: at the enterprise edge, the network edge, the network core, or in the cloud. The various form factors, optimized to support the location in which they are deployed, are supported by the Azure platform — providing a common management framework for VM and container services, DevOps support, and security control.

Network functions

The Azure for Operators portfolio provides a choice of first-party and third-party composable cloud native functions to support modern solutions for mobile packet cores, voice and interconnect services, session border control, and radio access networks.

Business Intelligence

By building on the Azure platform, operators can now gain access to sophisticated business intelligence capabilities that help organizations transform data into intelligent, easy-to-understand visualizations that are used wherever decisions are made. Predictive decision making allows operators to analyze patterns and optimize outcomes in near real-

time. Azure Cognitive Services brings this artificial intelligence within reach of every developer, while the Azure Machine Learning service empowers operators with a wide range of productive experiences for building, training, and deploying machine learning models.

Cloud solutions

The Azure cloud is home to a powerful developer environment for testing and deploying new applications, creating customer experiences, and gaining insights from data. This broad developer base is already deeply familiar with Azure cloud services. For example, more than one million developers have discovered or tried Azure cognitive services alone, processing more than ten billion transactions each month.

Operators will interact with the cloud in different ways. Some will choose to purchase individual network functions as on-premises solutions, or as hosted functions in the cloud, while others may wish to consume more end-to-end services from Microsoft as our library grows.

Because the technology needs of operators are complex, Microsoft and our extensive array of partners prioritize being available to ensure appropriate deployment support for operators as they embark on their personal path to the cloud.



Cloud security

Inherent to our commitment to providing the leading cloud platform for operators is a deep and holistic approach to digital security. Organizations are more security-conscious than ever, but trust is about more than just security features. It's also about protecting personal privacy while at the same time promoting the free flow of data. It's about reliability and resiliency. It's about preventing cybercrime and reducing technology-related fraud and online exploitation. It's about providing affordable and accessible connectivity everywhere, for everyone. This requires a consistently trusted, responsible, and inclusive cloud policy.

At Microsoft, we take these principles seriously, and we have invested heavily in building trust. Based on Zero Trust networking principles, Microsoft Azure provides a collection of integrated cloud services that you can use to help protect your business assets while reducing security costs and complexity. Building on the principles of security, privacy, compliance, resiliency, and intellectual property protection, Microsoft strives to earn and keep your trust.

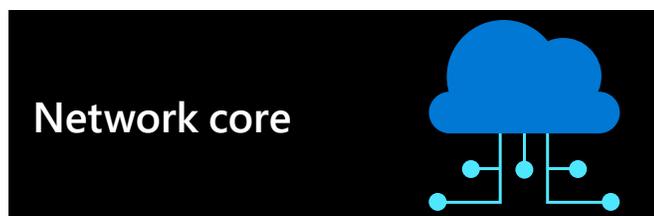
Our mission is to deliver the highest levels of security, privacy, compliance, and availability to private and public sector organizations and to help you protect your business assets while reducing security costs. Toward that end, Microsoft invests over \$1 billion annually in cybersecurity, including the Azure platform, and employs over 3,500 dedicated cybersecurity professionals.



Operator points of control

Implementing a new technology service is typically a time-consuming and expensive proposition for operators. Any underlying infrastructure must also be highly reliable, able to perform at scale, simplify operational automation, and securely manage customer data. For technologies like 5G, these requirements increase by another order of magnitude, all while operators are faced with a heavily competitive environment, downward pricing pressure, and a need to increase the average revenue generated per user. An intelligent cloud approach can be used to address these problems, provided that an operator can also retain control in some critical areas.

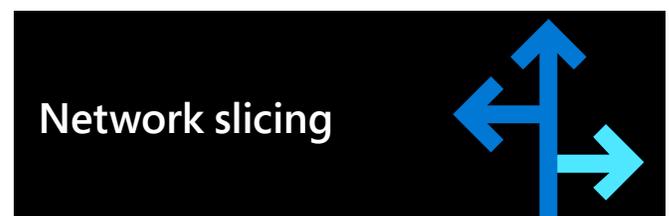
These points of control are critical to operators' ability to attract and retain customers, address security and performance, and monetize their network and services assets. Azure for Operators has been designed to provide the appropriate controls for the operator to retain end-to-end control and visibility over the network and its operations.



Network core functions such as Mobile Packet Core, IMS, session border control, and Unified Communications application servers are the engines of service delivery and network monetization. Operators typically achieve differentiation in these services through a choice of vendor, their network equipment products, and the ways in which these products

can be composed and configured to deliver services. When considering a move to a hybrid or cloud environment, operators want to know that they can still retain this flexibility.

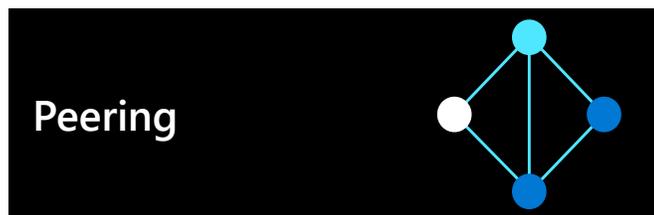
Azure for Operators preserves that choice, offering operators both first-party and third-party network functions, as well as the complete freedom to compose and configure these functions to meet service needs. Traditional services are well suited to deployment in the Azure cloud, with elastic scaling to provide on-demand capacity, long-term service preservation on a platform that won't go EOL (end of life), simplified provisioning through a "single pane of glass," and elimination of expensive 1:1 system redundancy configurations. But Azure for Operators goes further, offering operators additional choices with network-functions-as-a-service that offer simpler and faster deployment of new services, seamless integration with intelligent cloud capabilities, and reduced operating complexity. On Azure, operators can retain complete control over the fine-grained configuration of these network functions to meet the specific needs of any given service.



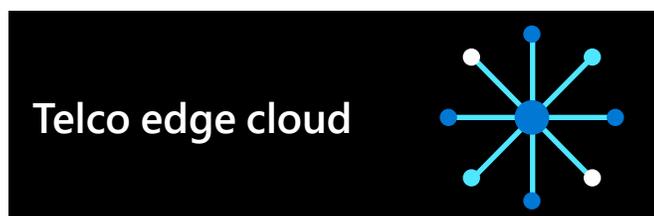
New technologies bring new opportunities. One of the key innovations of 5G comes in the form of network slicing, which offers the ability to create software-defined virtual networks on demand, thereby creating new opportunities for monetizing network assets.

Azure for Operators provides an excellent foundation for network slicing. Rapid and highly automated instantiation and configuration of the software instances that

create network slices all remain under the total control of the network operator. From a business model perspective, Microsoft sees clear value in the exposure of these capabilities to a broad developer ecosystem and the need for flexible commercial models as operators seek new approaches to monetization.

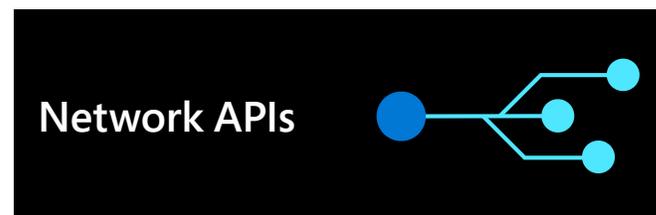


All operators control how traffic enters and exits the network. Any move to cloud-based services should not disrupt these arrangements. Azure for Operators supports the preservation of existing arrangements for peering, while creating interesting new options for network interconnection. By leveraging Microsoft's global network and Software-Defined Networking-based (SDN) solutions, operators gain access to deterministic routing to support services such as Ultra Reliable, Low-Latency Communications (URLLC).



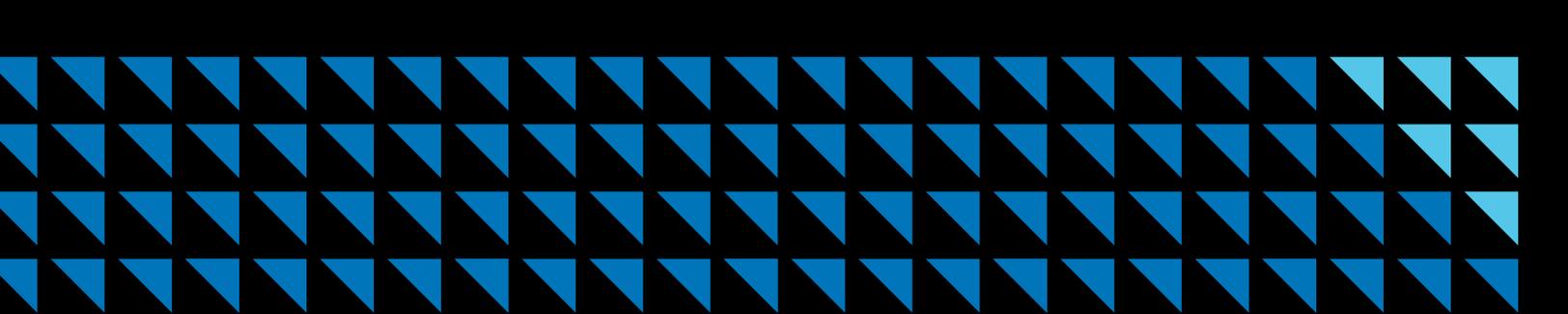
As owners of the access network infrastructure, operators control the key assets that make edge computing possible. Edge computing is key to the monetization of the 5G infrastructure, supporting new classes of applications that rely on low-latency connectivity, high localized processing for privacy/security considerations, or the pre-processing of locally generated data streams such as high definition video or large volumes of sensor data.

Microsoft recognizes the desire for operators to have control over how workloads are processed and managed across edge computing assets within their network, while also leveraging the sophisticated interworking between cloud and edge environments in hybrid cloud architectures. Azure Edge Zones provide network operators with the opportunity to connect networks, applications, and developers at shared colocations (Azure Edge Zone with Operator) or with interconnection at a Microsoft facility (Azure Edge Zone). By partnering with Microsoft, operators can access a large community of developers that will turn the vision of edge computing into important new revenue streams.



Network operators increasingly view their networks as platforms on which new applications can be built by third parties, offering additional opportunities to generate new revenue streams. The 5G standards have formalized this concept of 5G network-as-a-platform by defining the Network Exposure Function (NEF). Other network elements such as IMS application servers also expose APIs that enable offerings such as Communications-Platform-as-a-Service (CPaaS).

Exposing network APIs through Azure makes it easier for operators to secure those APIs, to attract developer communities to make use of the APIs, and to avoid compromising the ability to monetize them. Microsoft also recognizes the need for operator APIs to be exposed, based on intent-based or outcome-based APIs that provide the appropriate functionality while also allowing the operator control over the underlying implementation (to ensure adequate security and performance).



Lessons learned: impact of cloud on operators

As we work with operators to bring the power of the cloud to support core network functions, we are seeing several changes based on how they approach product development, infrastructure deployment, and organizational capabilities. These operators intend to respond to the evolving network market and for that they need to use an agile product development methodology with a fail-fast mentality that allows them to adapt to customer needs quickly. An approach of this kind allows operators to expose network functionality as Application Programming Interfaces (APIs) and to create services that offer end-to-end SLAs for performance and reliability from the network to the cloud.

Many of our operator partners see the cloud as a means to scale services that meet the growing demands of highly connected customers, as well as those driven by an exploding number of IoT consumer and enterprise devices. These operators are focusing on managing an end-to-end service instead of being forced to test, deploy, and integrate individual infrastructure components.

Furthermore, they see advantages in consuming elastic capability with services used in a plug-and-play fashion to reduce both CAPEX and OPEX costs. Software-based services are being combined with automation and orchestration capabilities to drive dramatic productivity improvements. This has become

a necessity to achieve the scale required when supporting 1:1 personalization of consumer services, and billions of connected machines serviced by IoT platforms and applications.

Software-based services are being combined with automation and orchestration capabilities to drive dramatic productivity improvements.

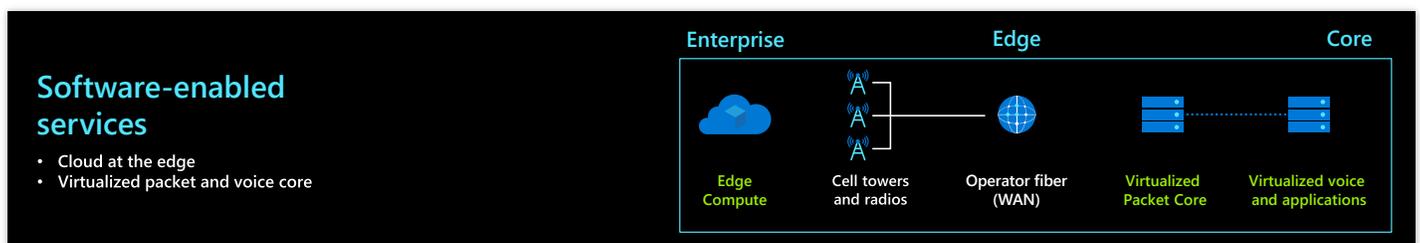
These technology shifts are also driving organizational transformation. Operators are finding the need for new skills, processes, and approaches to delivering services effectively when leveraging the power of software and cloud-native infrastructure. Many are shifting toward lean and agile product development methodologies and away from the more traditional waterfall delivery approaches. This transformation often leads to changes in how services are delivered, supporting multiple monthly software releases via a DevOps pipeline rather than a more typical biannual or annual upgrade schedule.

Engineering and design approaches are also changing to focus on more predictive methods of problem detection and resolution, using big data correlation techniques rather than the current causal fault detection and recovery methods. These enhanced engineering and design approaches will result in more reliability of services and optimization of costs.

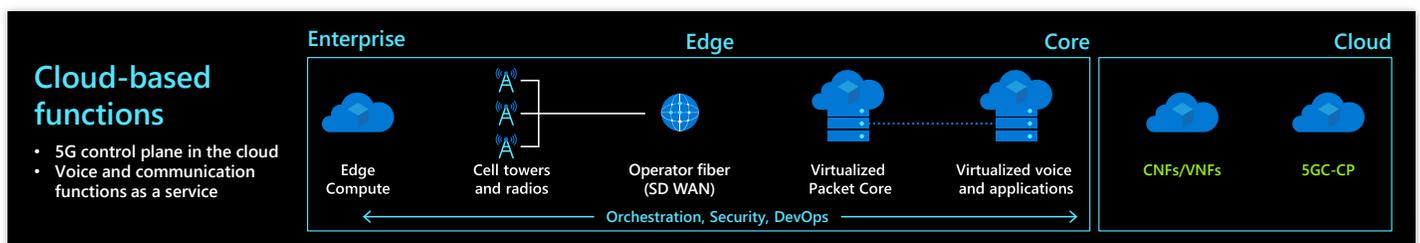
Cloudification models

Operators migrating to the cloud are free to move at their own pace, but will likely settle on one of three models for cloudification.

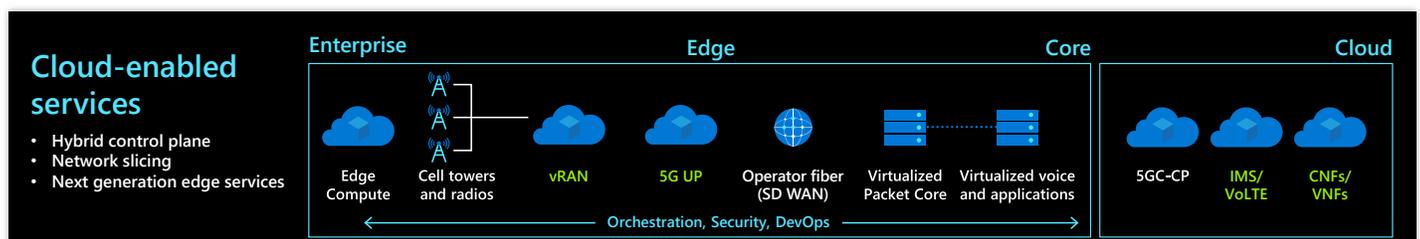
In the first model, **software-enabled services**, operators deploy virtualized software solutions in the core of their network, and then seek to partner with public cloud providers at the edge of the network or the edge of the enterprise. Today, Microsoft has more than 100 customers with virtualized packet core implementations, and more than 400 virtualized voice customers. More than a dozen operators have announced edge computing partnerships with us, reaping the operational cost savings from automation and opening new sources of revenue at the enterprise edge.



In the second model, **cloud-based functions**, operators decide to move select functions (often those most easily centralized) to the cloud. Here, we work closely on the deployment of virtualized or containerized network functions in the cloud for new services such as the 5G core, or for reducing cost and simplifying the management of more traditional, legacy services.



The third model is about **cloud-enabled services**. As the network edge adopts cloud technology and becomes more dynamic and scalable, operators focus on deploying sophisticated access technologies like open RAN, and handle user plane traffic at the edge for compute-intensive, low-latency applications.



Working with Microsoft

Microsoft has engaged with a number of operators around the world to digitally transform their back office, driving the costs out of IT infrastructure, using business intelligence and online tools to support digital channels and more personalized services, and bringing the power of AI and ML to derive better insights for customers and to optimize business processes. This has naturally led to discussions about how to simplify the underlying network—treating infrastructure as software—because the ability to reduce the complexity of network services provides significant opportunity to further reduce costs.

This transition to cloud is now an important event horizon for operators—a transition that can redefine business models, speed the innovation of new services, and reduce the operating cost and end-of-life risks associated with dedicated equipment and hardware appliances. The traditional, capital intensive, dedicated equipment model will give way to new partnerships that allow for the deployment of infrastructure as a service, platform as a service, and ultimately software as a service to provide solutions that scale incrementally and are consumed as needed, with no notional limits. Microsoft is incredibly well-positioned to help our partners leverage the power of the cloud as they transform their businesses to these more contemporary models.

Around the world we are seeing possibilities for 5G—for consumers, operators, enterprises and governments—and announcing multiple operator partnerships and continuous edge zone deployments. Microsoft recently joined the [5G Open Innovation Lab](#) as the founding public cloud partner to accelerate enterprise startups and launch new innovations that foster exciting new 5G use cases. The lab will create long-term, sustainable developer and commercial ecosystems that will accelerate the delivery of exciting new capabilities at the edge, including pervasive IoT intelligence and immersive mixed reality.

With Azure for Operators, Microsoft is enabling operators to harness the power of the cloud, drive down costs, and monetize new services. We bring extensive experience to these engagements, supporting operators in the transition and recognizing that our technology and that of our ecosystem partners is used to deliver critical, high-availability services to their customers.

The transition to cloud-based technologies is a journey that will take place over time, driven by the unique needs of each operator. With Azure for Operators, Microsoft is ideally positioned to be your trusted partner and guide.

Click [here](#) or contact your Microsoft sales representative for more information.



Achieve scale

Operator-grade network functions as a service powered by AI



Operate hybrid seamlessly

Consistent performance and scalability across edge, hybrid, and cloud



Monetize with new business models

Edge compute, IoT, 5G, network slicing



Trust

Global, secure, and compliant, empowers you and your business

Built on a foundation of Telco DNA

Backed by Microsoft's developer ecosystem



©2021 Microsoft. All rights reserved. This white paper is for informational purposes only. MICROSOFT MAKES NO WARRANTIES, EXPRESS OR IMPLIED, IN THIS DOCUMENT.

This document is provided "as is." Information and views expressed in this document, including URL and other internet website references, may change without notice. You bear the risk of using it. This document does not provide you with any legal rights to any intellectual property in any Microsoft product. You may copy and use this document for your internal, reference purposes.