IBM

Navigating the operator journey to cloud-native

Embrace an open, horizontal telecom cloud platform for greater flexibility, agility and innovation at scale

In collaboration with:

Red Hat JUNIPER NETWORKS

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As operators look for ways to monetize 5G, they need to be able to drive faster innovation. Cloud-native networking can be an engine for change and wider business transformation. Operators are under pressure to keep up with the speed of innovation and potential market disruptions from other technology players. Applying cloud-native principles can provide that greater flexibility and agility to facilitate ecosystem-driven innovation.

Cloud-native networking can act as the basic building blocks of the foundation for operators' B2B2X revenue growth and enable them to offer more exciting services in a more agile way. Agile examples include industrial edge computing and private mobile networks, coupled with AI and open radio access networks (RANs).

Many operators are also looking to play a more prominent role in enabling others to grow within ecosystems, which will be a key means to addressing diverse, ever-changing customer needs more quickly and more substantively at scale. The demands of 5G require an evolution of network architectures, from proprietary vertical to horizontal cloud-native, from centralized to distributed, from static to elastic capacities, from manual to autonomous.

...fulfilling a new purpose and role for operators

As economies move towards a more ecosystem-centric environment, with more complex value chains within B2B2X business models, telecoms operators are trying to understand the role they can play beyond connectivity. They're developing and optimizing their business models to unlock entirely new applications, enabled by 5G technologies.

5G and cloud-native networking, combined with highly distributed edge computing and AI, are fundamentally changing what it means to be an operator. 5G, in particular, acts as a catalyst for telecoms operators to re-evaluate their strategies and find ways of monetizing capabilities. Ultimately, success in realizing the 5G promise depends heavily on how telecom operators approach their use of cloud-native technologies to accelerate the delivery of digital services. Industry verticals present a large incremental and adjacent revenue opportunity.

To create the potential for optimal profit from 5G, communications service providers are adjusting their focus away from pure connectivity towards the applications and use cases it enables. It's imperative for operators to collaborate in ecosystems as they work with enterprises and industries to unlock value from 5G. Using the power of 5G, they're focusing on the digital fabric of each industry and providing open platforms to ideate, design and deliver solutions through expansion of their partner ecosystems.

All the aforementioned promises of greater innovation, efficiency and flexibility depend on the way that operators approach the adoption of cloud-native. Cloud-native will deliver what the telecoms industry needs only if it's delivered through an open networking ecosystem. The entire network architecture must be open with interoperable APIs at all layers and software defined to respond quickly to rapidly evolving demands and innovate in a more agile way. Achieving this goal isn't easy: how can operators succeed in their cloud-native journey?

"The future of the edge is creating a new dynamic, one that will improve the quality of lives around the world. Edge opens opportunities for innovative services that more securely combine data, 5G, and human-enhanced machine learning. To capture the business value from 5G and open hybrid cloud technologies, however, requires a wholesale change in mindset to adapt to the needs of our digital economy."

Ian Hood, Red Hat
Chief Technologist, Global Industries

1

Embrace the move to cloud-native
Adopt cloud-native networking as a key enabler of revenue growth and critical business transformation.

2

Adopt a horizontal platform approach
Build a common cloud platform to support any and all telecom applications, now and in the future.

3

Deploy open, flexible platforms
Enable innovation and unlock value at every layer of the telecom stack through true openness and control.

4

Monetize and accelerate new services
Create greater value in a B2B2X ecosystem through enabling your own, customers' and partners' growth.

Figure 1: The journey to cloud-native

A horizontal open platform to accelerate innovation at scale

This section describes and evaluates the function-first and cloud-first approaches to telecom cloud and the different strengths and limitations of each.

There are different approaches to unlock the potential of a telco cloud, but most deployments fall into two main categories: vertical function-first and horizontal cloud-first. While there's no definitive list of factors that indicate the path that services providers will take, we do know that the state of their technology, breadth and depth of their technical expertise, and the maturity of their operational processes figure prominently in the decision.

Function-first clouds are frequently owned and driven at the departmental level with the singular goal of delivering a specific service. This focus on a single virtual network function, such as the Evolved Packet Core (EPC) or IP Multimedia Subsystem (IMS) in mobile networks, allows operators to contain the project's scope to quickly deliver a new, virtualized implementation of a an existing service.

Cloud first is an alternative approach to develop an open, flexible cloud architecture that's deployed to any operator location and designed to support all present and future cloud computing needs. At its core is an open, fully integrated modular horizontal software platform.

If telecom cloud outcomes were centered merely only on delivering existing connectivity services more cost-efficiently, function first done well could be the path to success. But 5G opens the door to a whole new set of low-latency, high-capacity applications, such as 4K and 8K streaming and gaming services, connected vehicles, remote surgery, augmented reality (AR), virtual reality (VR) and mixed reality. These applications can be delivered only from a highly distributed edge cloud, with compute and data plane capabilities able to process and act upon application data at lightning speeds serve policyholders in new or improved ways.

"Cloud technologies are a perfect complement to a 5G future. The combination of 5G and the cloud will enrich the portfolio of services across the countries we serve. Consumers and essential businesses like manufacturing will benefit from latencies adapted to their specific needs."

Javier Gutiérrez, Telefónica Spain
General Director of Strategy and Network Development, Operations and IT

Consequently, many telecom operators plan to build a single horizontal cloud platform as a foundation to support any and all applications, both those within the IT and network domains, so that they're able to address all present and future needs. This route is crucial for operators to deliver scale economies, reap the full possibilities and capabilities of automation, and simplify the management of the cloud lifecycle.

A horizontal cloud-first approach to your telecom cloud deployment will not only provide better visibility up and down the stack through a uniform, open architecture, but also across the different network domains: core, edge and access, mobile and fixed. This approach enables telecom operators to provide greater agility and efficiencies across their entire business.

IBM, Red Hat® and Juniper offer standard templates that facilitate the ability to automate and orchestrate across multiple domains, including across the entire customer lifecycle, from sales and marketing through to service provisioning and customer care and billing. Their templates provide a basis for certification of network functions—helping to ensure performance and service-level agreements (SLAs) and eliminating the need for expensive customization at the implementation phase.

Flexibility, visibility and control

A functions-first approach to telecom cloud deployments with vertically integrated stacks will inevitably lead to operational silos and issues of fragmentation, even if these technologies are provided by the same vendor partner. Consequently, many operators run two or more separate telecom cloud platforms, each designed for a given purpose, as opposed to working together.

A horizontal platform approach enables operators to unlock the potential provided by true separation of network infrastructure and network functions. This method allows them to move from "best of suite" to "best of breed" where they have the ability to select different leading partners for different functions. By taking this open approach, operators avoid potential lock-in and gain control and flexibility to swap one vendor for another in the future, allowing them to realize the full promise of an open 5G architecture.

Vertical function first versus Horizontal cloud first

Vertical function first
- Focus on a virtualized implementation of a specific existing service or network function, such as Virtual Evolved Packet Core (vEPC) or Virtual IP Multimedia Subsystem (vIMS)
- Often owned and driven at the departmental level
- Contains project's scope to quickly deliver new virtualized service

Horizontal cloud first
- Development of an open and flexible cloud architecture and infrastructure
- Deployed to any operator location and designed to support all current and future network and IT cloud computing needs
- Economies of scale and better visibility, across the stack and across different domains
- Can select different leading partners for different functions
- Innovation not constrained by vendor partners

Figure 2: Two main approaches to telecom cloud deployments

Evolving your approach for greater agility

In the first wave of network functions virtualization (NFV), many operators were virtualizing their EPC. When taking a function-first approach, operators were porting physical functions to a virtual machine (VM). Physical Network Functions (PNFs) were replaced by their Virtual Network Function (VNF) equivalents. This approach resulted in replicating the same functionality and, although they improved their ability to manage capacity demands, they weren't able to realize the actual benefits of innovating on that functionality.

Many operators also had to deploy hardware acceleration techniques, such as single-root input/output virtualization (SR-IOV), and use field-programmable gate arrays (FPGAs) to deliver the improved functionality, throughput and capacity. Although this process helped to achieve short-term carrier-grade performance gains, it came at the expense of flexibility, as the software and hardware were linked together, reinforcing dependency on a particular vendor or hardware suite.

Looking forward to 5G, operators need the flexibility to mix and match functionality and physical network elements to support the diverse requirements of new use cases. The cloud-native approach is about moving to an open software and hardware framework that's able to adapt to this fast-moving, dynamic application development and delivery environment.

In contrast to previous mobile network generations, 5G functionality and standards have been designed on cloud-native software principles from the outset. To fully realize the potential and service benefits of their 5G network investments, telecom operator therefore need to complete the migration away from hardware-dependent network functions. They need to move from VNFs, which replicate the old PNFs in semi-virtualized form, to CNFs—fully virtual, cloud-native network functions. One example of this method is the standalone (SA) 5G mobile core, a cloud-native mobile core architecture that enables the full set of 5G functionalities, in contrast to the non-standalone (NSA) core, which is basically an upgraded, virtualized EPC offering that's little more than 4G itself, other than improved capacity and throughput.

Another crucial CNF-based technology is open RAN (Radio Access Network), which involves both virtualizing and disaggregating the different parts of the RAN. Some incumbent RAN vendors have been introducing limited open elements, such as centralized RAN (C-RAN) platforms, that support both virtualized and non-virtualized baseband units (BBUs). But this technology is still far from the ultimate vision of open, fully disaggregated, multivendor interfaces between the BBU and remote radio unit (RRU) for open RAN. By taking an open horizontal platform-first approach, operators now also have an opportunity to break away from vendor lock-in to unlock innovation within the RAN.

Embrace the open horizontal platform approach

Bharti Airtel's open hybrid cloud

Bharti Airtel (Airtel), India's premier communications solutions provider, has deployed an open hybrid cloud network built with IBM and Red Hat's portfolio of hybrid cloud and cognitive enterprise capabilities. With this deployment, Airtel has created a flexible foundation to build and deploy innovative applications from a robust ecosystem of partners.

Airtel has been working with IBM to integrate end-to-end advanced automation and plans to embed AI capabilities in the future as a core part of its network transformation. These capabilities will enable Airtel to rapidly improve network connectivity and accelerate its continued core network transformation.

> "Airtel has been at the forefront of adopting leading-edge technologies to modernize our network architecture. By adopting an open hybrid cloud network with the support of IBM and Red Hat we are building a scalable and future-ready network to serve our customers with best-in-class services."[1]
>
> **Randeep Sekhon**
> CTO, Bharti Airtel

Once fully implemented, Airtel's open hybrid cloud network will help millions of partners and customers across industries rapidly harness the power of emerging technologies like 5G and edge computing. For example, a customer could use the network for AI, the Internet of Things (IoT) and edge computing capabilities to power applications that can deliver better insights from factory floors or enable remote doctor visits.

Achieve platform flexibility through an open platform

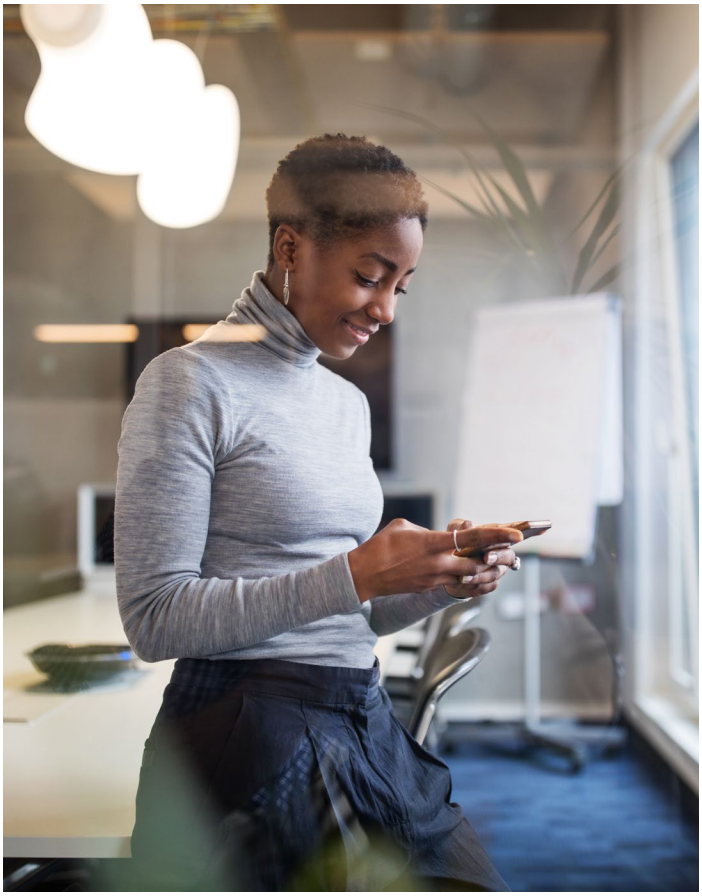
This section elaborates upon the tangible benefits of deploying an open, horizontal platform to enable flexibility as a future-proof approach to telecom cloud.

Dynamic service delivery

A horizontal platform approach to telecom cloud is about delivering network functions dynamically, on demand and across distributed multidomain infrastructure to support a myriad of applications and use cases. Operators can avoid any potential lock-in and dependencies to specific vendor partners and their proprietary platforms and applications that may compromise larger long-term opportunities.

However, the journey to embracing platform flexibility and openness doesn't stop once the decision to move away from vertically integrated stacks has been made. Although different horizontal platforms also involve ecosystems of certified interoperable virtual network functions, the degree of openness of different platforms can vary. This varied degree of openness has a significant impact on the subsequent management and evolution of the platform.

The introduction of more closed elements or control points can take different forms. One example is the insistence on proprietary or customized elements in the stack to guarantee the required SLAs, such as specific hardware configurations, software enhancements or API variations. Others may come in the form of proprietary integrations between different components or layers in the stack. While technically shifting towards a multivendor environment, it's a far cry from a blueprint for an open, collaborative vendor-neutral platform deployment.



Unlocking scalability and adaptability

End-to-end automation will be key to supporting the increasing capacity demands and data volumes expected with 5G, and to enabling a greater speed of innovation. However, your ability to automate can also be restricted by the nature and degree of openness of your vendor ecosystem.

An open, cloud-native approach, coupled with preintegration and precertification of network functions, brings the combined benefits of flexibility and reliability from a wide range of network functions proven to work together.

This combination allows operators to automate processes and tasks much more easily and, more importantly, at a greater scale. With the orchestration layer provided by IBM to bind all components of the stack together, operators can reap the full benefits of automation, such as zero-touch provisioning. Operators are then able to create greater competitive differentiation from new services involving use case-specific network functions and slices implemented without the need for custom integration.

Monetize and accelerate new services

This section looks at the implications of taking an open, horizontal platform approach to cloud-native on communications services providers (CSPs') wider goals for digital transformation, innovation and B2B2X revenue growth.

Create the innovation flywheel effect

With growing demands for faster and greater innovation across the stack, we're moving towards a new normal where a telecom operators' success will be determined by how quickly it can deploy the next innovative service, measured in hours or days. Industry-leading telecom operators consistently innovate within the network to provide differentiation for themselves and their partners. Telecom operators that create differentiation within the applications and services that they deliver over the network have a compelling basis to outperform others in the market.

An open approach to cloud-native networking is integral to unlocking this innovation, by enabling innovation to happen at every layer of the disaggregated stack. As a result it enables network infrastructure and functions to be adapted more effectively to the new applications that run over them. This ability means that your speed of innovation won't be dependent on and constrained by the speed of innovation of a single vendor partner or a restricted group of partners. The openness of a platform means that other ecosystem players, such as developers and independent software vendors (ISVs), can create and deploy applications that integrate easily into the telecom cloud. This ease of integration is key for driving service innovation and the ability of telecoms to deliver more business value to their end customers.

"The potential is enormous in every sector, from public infrastructure to large enterprises or consumer services. However, unlocking 5G's true value depends on more than just the connectivity itself, it requires cloud technology and artificial intelligence (AI), supported by new thinking about how these services are created, delivered and managed."

Sally Bament, Juniper Networks
Vice President of Cloud and Service Provider Marketing

Drive greater value in a B2B2X ecosystem

Operators are increasingly seeing ecosystems as a means of addressing the speed and need for innovation, defending against disruption and risk, and adding new capabilities. However, to fully participate in and manage ecosystems, CSPs face a new set of requirements around open infrastructure, cloud-native skills and a mindset to participate in and manage their partner ecosystems.

An open, cloud native approach makes the network more accessible to ecosystem partners and to customers. The advent of the cloud-native approach to network infrastructure means that networks become increasingly programmable, intent-based and "instructable." In other words, the networks are functionality driven by declared outcomes and specific application requirements. These characteristics of the cloud-native network create significant opportunities for operators to provide unique value within ecosystems.

With cloud-native approaches to networking infrastructure enabling a more tightly integrated relationship between the network and applications that run over it, operators are increasingly seeing this as a means of building and sustaining competitive business advantage over others. It's also a means to capture both mindshare and revenue share in the digital economy. Operators can start providing richer network insights as well as more control and instruction capabilities between the network and the applications running on it, to enable their own growth and others.

Open APIs play an important role in this process: Telecom operators can make more, and potentially richer, network insights available through more API exposure within the network domain and the underlying network functions themselves.

These insights will help them bring unique benefits not only to their existing customers and partners, but also create new opportunities with new types of ecosystem partners for example, managed service provides, application providers, device manufacturers and so on. These players can use this network intelligence to drive their own requirements and innovate more easily around network services. Using these tools will ultimately enable these ecosystems to provide better business outcomes for customers.

About the joint partnership

IBM, Red Hat and Juniper Networks have jointly committed to the realization of an open, cloud-native approach and making a horizontally integrated, multivendor telecom cloud platform a realistic proposition for service providers. They have deep experience in helping operators realize the benefits of adopting an open, truly cloud-native approach with service reliability and security ingrained as part of it. They work with their operator partners to simplify the journey and process as much as possible.

Their philosophy is to allow operators to have full visibility and software-defined control over their network infrastructure while providing the reassurance that all elements can coexist to deliver high-quality services harmoniously and reliably. Together, they enable the best of both worlds: greater innovation while assuring the highest system levels of security, reliability and availability.

Choose open platforms, tools and ecosystems

The value that IBM, Red Hat and Juniper bring is deeply embedded in their open-source philosophy. Open source is inherently ecosystem-based and enables the innovation of their solutions to be driven and powered by a well-established independent software community and developer base. In contrast to others that may offer a select list of certified partners, the open nature of their ecosystem offers a plethora of prevalidated and certified partners across the stack, including original equipment manufacturers (OEMs), ISVs, NEPs and solution providers. This open ecosystem means that if an operator is looking to deploy a particular function, for example, a virtual firewall, they have an extensive list of validated and certified functions—both VNFs and CNFs—from multiple suppliers available for selection.

Their proposition is about providing cloud-native open platforms and tools where operators have the choice and ability to add any piece to the puzzle. The Red Hat OpenShift offering acts as the open platform that can be deployed on a private or essentially any public cloud, and upon which operators can build applications. This platform is combined with Juniper Contrail SDN technology, which provides an SDN overlay that works with your existing network infrastructure or can be deployed in underlay mode as the foundation for your core IP network fabric. IBM's multidomain service orchestration solution then enables operators to automate and orchestrate services and network elements using whichever vendor applications they choose to deploy on top of this foundational horizontal platform.

"Open standards clearly provide the most flexible approach to support the integration of the largest ecosystem of third-party VNFs. Operators will require a strategic partner that supports an open platform, free from vendor lock-in and proprietary features."

Craig Farrell, IBM
Chief Technology Officer, Telecom

Need for experience where it counts

As networks move towards an IT model and as the competitive dynamics have been affected by the likes of the webscale players and hyperscale cloud providers, operators are now trying to navigate this transition as they strive towards becoming digital players themselves. Therefore, operators need to work with partners who can bring that experience in both domains to navigate and manage this transition.

IBM, Red Hat and Juniper have a longstanding relationship and history of working together to deliver telecom cloud, virtualized enterprise networking, and SDN solutions at scale for operators of virtually all sizes around the world. Their partnership brings together deep IT, networking and cloud experience to help operators accelerate the move to cloud-native.

This experience includes:

- Juniper's carrier-grade networking pedigree, expertise and integration of SDN to meet specific requirements of VNFs and CNFs[2]
- Red Hat's trusted expertise and capabilities in delivering open-source cloud-native platforms, hybrid cloud solutions and tools
- IBM's extensive experience in delivering cloud and large-scale integration services

Their combined experience, expertise and capabilities enable them to comprehensively meet customer requirements around security, reliability and availability as operators realize their open, cloud-native vision while unlocking greater innovation, growth and value creation in a scalable, automated way.

IBM 5G and edge computing solutions

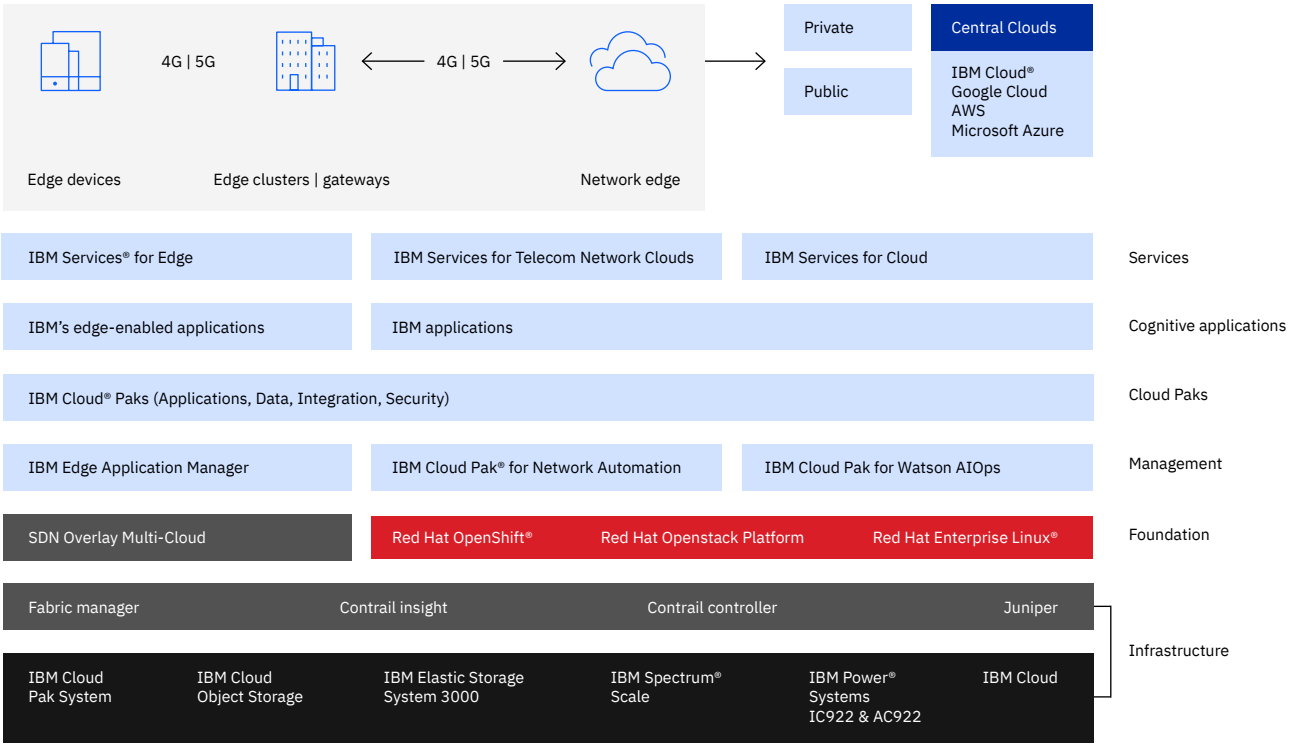


Figure 3: A horizontal platform approach to telecom cloud delivers network functions dynamically, on demand and across distributed multidomain infrastructure to support a myriad of applications and use cases.

Flexible solutions, trusted at scale

IBM 5G and edge solutions provide a comprehensive private cloud architecture from infrastructure all the way to service creation, delivery and billing. An open architecture is critical to telecoms operators who are increasingly looking for ways to modernize their networks for greater agility and efficiency, and provide new services today as 5G adoption expands and applications are launched. Service providers also have the ability and choice to manage workloads on both Red Hat OpenShift and Red Hat OpenStack platforms.

IBM telecom network cloud solutions includes Juniper Contrail tools to build and automate service-ready telecom clouds and use AI to significantly improve the customer experience. Contrail integrates with IBM Cloud Pak for Network Automation to let users dynamically adapt and geographically distribute capabilities based on performance and requirements.

Juniper Contrail acts as the end-to-end software-based network architecture to deliver security-rich, consistent policy to applications regardless of their location and the physical underlay. The Juniper Contrail analytics engine monitors the health and performance of virtualized networks and seamlessly integrates existing network elements with virtualized services and network elements.

Customers can effectively choose to deploy IBM Cloud® services essentially anywhere—in the cloud, on premises or at the edge and through automation, realize greater utilization of the bandwidth, avoiding the heavy investment in their physical networks.

IBM Cloud Pak® for Network Automation delivers intelligent automation capabilities to orchestrate virtual and cloud-native network functions in minutes and a portfolio of edge-enabled applications and services. This portfolio includes a range of IBM software, such as IBM Visual Insights, IBM Production Optimization, IBM Watson IoT® for Connected Manufacturing, IBM Asset Optimization, IBM Maximo® Worker Insights.

IBM, Red Hat and Juniper bring tried and tested solutions for telecoms operators globally. Their joint proposition delivers a powerful combination of flexibility, scalability and openness, while their combined wealth of experience helps ensure key customer requirements around reliability, security and performance are consistently met.

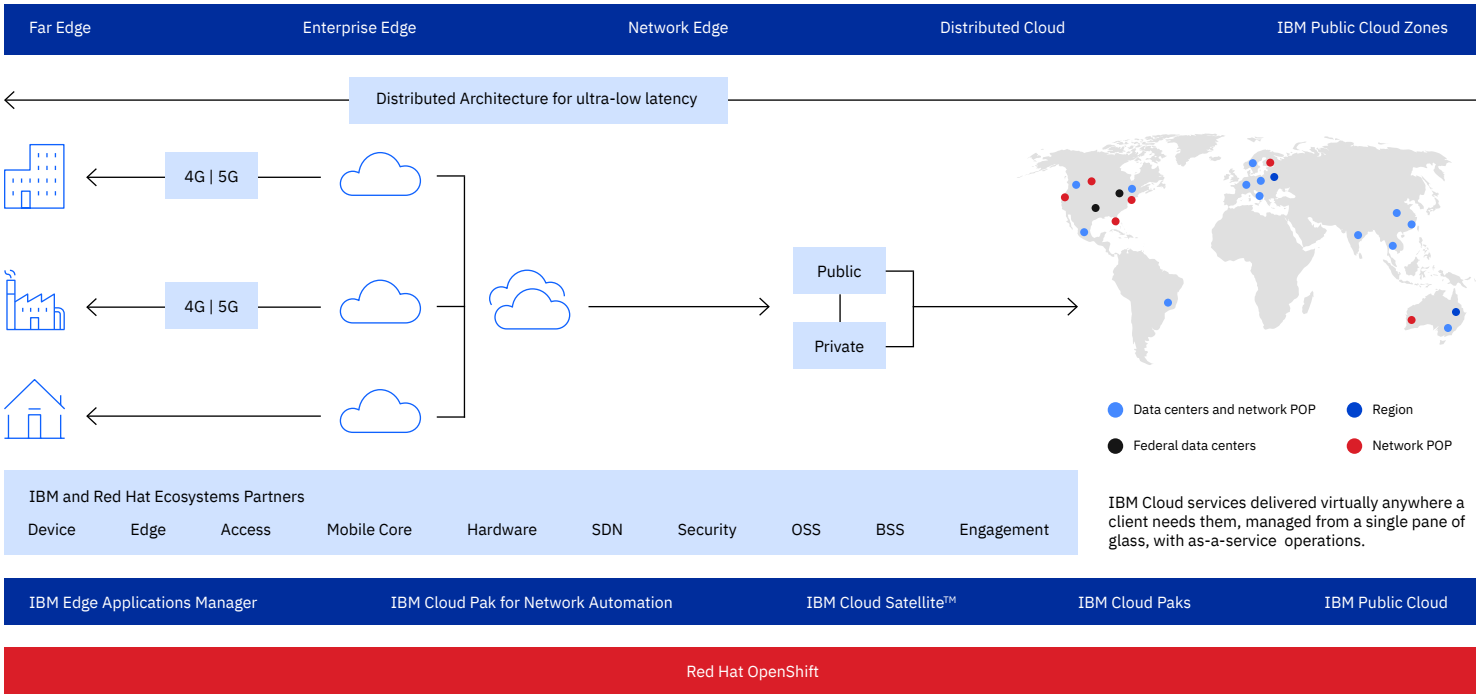


Figure 4: IBM Cloud for Telecommunications

Comfort of preintegration, prevalidation and certification

IBM, Red Hat and Juniper bring and manage an ecosystem of over 35 different best-in-class partners,[3] deployed on an industry-leading cloud-native platform, and help ensure alignment across these partners asthey continuously innovate. Their ecosystem is committed to helping operators globally not only accelerate their business transformation, but also enhance their ability to innovate in an agile way as they look to unlock the power of 5G and edge computing to deliver new innovative solutions to their customers.

They offer practical pre-existing service configuration and automation templates for operators looking to adopt an open horizontal platform approach for their telecom cloud deployments, minimizing discrepancies and reducing the burden in testing and service validation efforts.

Alongside these tried and tested templates, they have invested heavily in their VNF certification program, based on open-source industry best practices, and preintegration labs around the world. This well-tested approach, using continuous integration, continuous deployment for network infrastructure, helps make the automated testing and certifying of network functions much easier, enabling operators to deliver new services much faster.

Their lab environment and program are designed to deliver the ease and speed of deployment that customers want, eliminating the potential burnin period, and provide the comfort of knowing that these network functions will perform as expected in a reliable and security-rich manner.

End-to-end support for your transformation

IBM, Red Hat and Juniper recognize that the journey to cloud-native is more than just about technology, it's also about managing the change and impact on people and processes, so they work closely with and support their customers to manage the lifecycle of the entire stack.

Using its extensive experience as a large-scale solutions integrator, IBM provides the additional support and open service assurance framework, enabling end-to-end SLAs as part of the wider ongoing operator partnerships for scalable production deployments.

This process ultimately helps ensure that their customers have the comfort and assurances of a seamless transition and are able to realize their cloud-native vision in a reliable and security-rich way.

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Produced in the United States of America
June 2021

1. Bharti Airtel accelerates its Open Hybrid Cloud Network deployment with IBM and Red Hat." IBM News Room, 8 December 2020.
2. Partners in Telco Cloud Network Automation: Juniper Networks, IBM Video.
3. Evolve to hybrid cloud with AI-powered network automation.