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# LEADING CSPs ADOPT NEW EDGE NETWORK ARCHITECTURE TO CREATE VALUE IN THE DIGITAL ERA

There is a fundamental need in the telecom industry for a new network architecture. Emerging technologies, most notably cloud, virtualization, 5G, edge computing, AI and machine learning (ML), are coalescing to usher in a new era, often referred to as the digital era, the 5G era or the fourth industrial revolution (Industry 4.0). It is widely expected that during this era industries will be fundamentally transformed, peoples' lives will be greatly enhanced, and productivity will enter a phase of sustained growth, all of which will contribute to an economic boom and improved standard of living. Communication service providers (CSP) have a golden opportunity to play a critical role in the digital era, to provide not only ubiquitous, intelligent connectivity but also value-added services that participate in and enable this economic development.
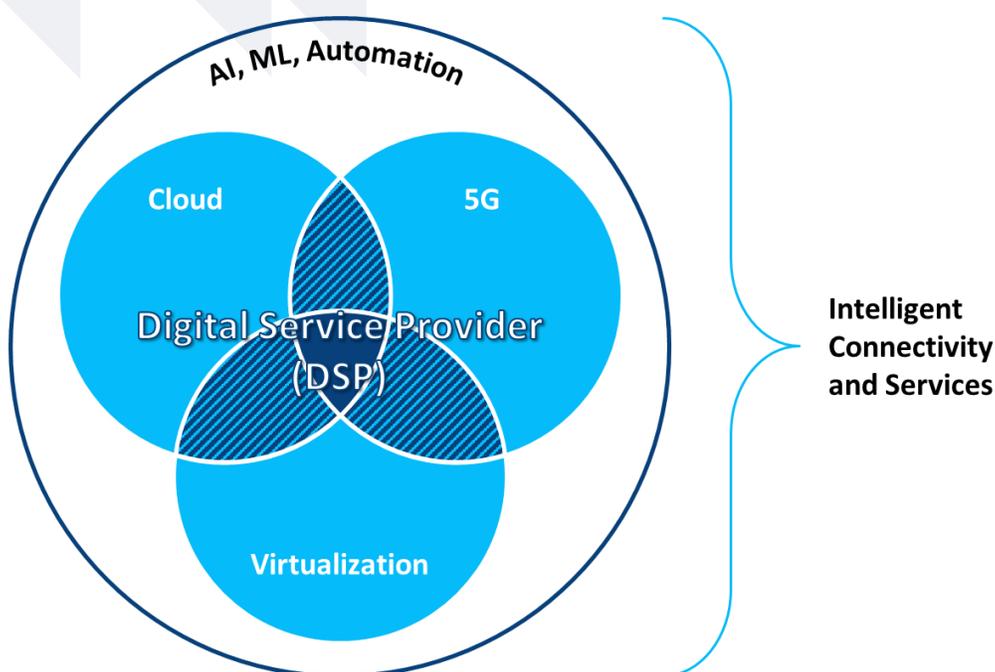
While the future looks bright for participants in the digital era, especially for CSPs, the reality is that CSPs' traditional business models, ways of working, and traditional networks are not relevant in this new era, meaning these companies must evolve into digital service providers (DSPs). As part of this imperative to evolve, leading CSPs are transforming their networks to a virtualized, container- and microservices-based, cloud-native architecture and cloud operating model. This cloud-centric network architecture will enable CSPs to participate in value creation stemming from emerging technologies, such as 5G and edge computing, and adopt next-generation network operations based on data and AI and ML for continuous automation. This new architecture will also enable CSPs to take advantage of network slicing and low latency to realize new services and monetize their investments in innovative ways. Services enabled by this new network include, but are not limited to, the following:

- Autonomous transportation (self-driving vehicles such as drones, cars, boats and trucks as well as asset tracking, traffic management, logistics coordination)
- Real-time, or location-based, video analytics (surveillance, product quality inspection, big data visualization)
- Robotic process automation (warehouse automation, factory automation, retail and food store automation)
- AR/VR (augmented or immersive experience for consumer and enterprise use cases, such as gaming or employee training and problem troubleshooting)
- Healthcare applications (remote surgery, telehealth, embedded device communications)
- Cloud-based gaming

Note: Use case list is intended to illustrate the types of use cases CSPs can enable with an evolved network; there are many others.

To manage these types of use cases and others in real time will require an automated and intelligent network that is able to dynamically compose and partition network resources (aka network slicing) to attach service-level agreements (SLAs) to these workloads in the areas of latency and resiliency thresholds as well as bandwidth commitments. This network composability is required for CSPs to flexibly and dynamically meet customer requirements in a timely and efficient manner.

THE CHALLENGE

Migration from the traditional network architecture to the new network architecture must be looked at from the core network all the way to the customers' (i.e., enterprises' or consumers') premises in order for CSPs to derive maximum value from their investments and realize the full benefit and revenue-generation opportunities derived from the use of the new architecture. This end-to-end network approach is necessary because new use cases will need distributed computing to enable and support, which requires compute resources to be sited in the central cloud, edge cloud and on-premises cloud, all of which will be dynamically orchestrated together to achieve the desired outcome.

The edge is a focus area of this distributed computing framework due to the latency, bandwidth, security and privacy requirements new use cases of the network will require, and regional data centers, central offices and hub locations, such as cell aggregation points, will all be key environments where edge infrastructure will be sited. The CSPs' edge will need to be access medium-agnostic and multi-access in nature so that it can leverage the full breadth of network resources in the access layer to support the performance requirements of new use cases. The most common access mediums include cellular, Wi-Fi, Ethernet and fiber.

The end-to-end and complex nature of implementing and operationalizing this new network architecture, while also concurrently transforming the business model, is a massive undertaking, and CSPs are encountering myriad challenges during migration attempts. Some of the common challenges are as follows:

- Achieving sustained low latency (target is sub-10 milliseconds for mission-critical workloads)
- Network resiliency (five 9s or higher uptime)
- Scale
- Bandwidth constraints
- Spectrum constraints
- Security
- Data sovereignty (e.g., General Data Protection Regulation [GDPR])
- Procurement shift from capex-centric to opex-centric model
- Managing revenue and profit pool shifts
- System complexity
- Shortage of skilled labor resources

Note: List is intended to illustrate the types of challenges CSPs are facing as they migrate toward the new network architecture; there are others.

The marathon to the new network architecture: From humble beginnings to end-state utopia		
Phase 1: Virtual Machines (2013-2017)	Phase 2: Containers (2018-2021)	Phase 3: Cloud-native/Microservices (2022 and Beyond)

Pioneering CSPs that began their migrations to the new network architecture several years ago are now transitioning from running virtual network functions (VNF) on virtual machines to running VNFs in containers, with cloud-native being their end goal. Openness is also a key consideration on leading CSPs' agendas, as the new network must shed the proprietary-centric elements of the past and become more flexible and lower cost to operate.
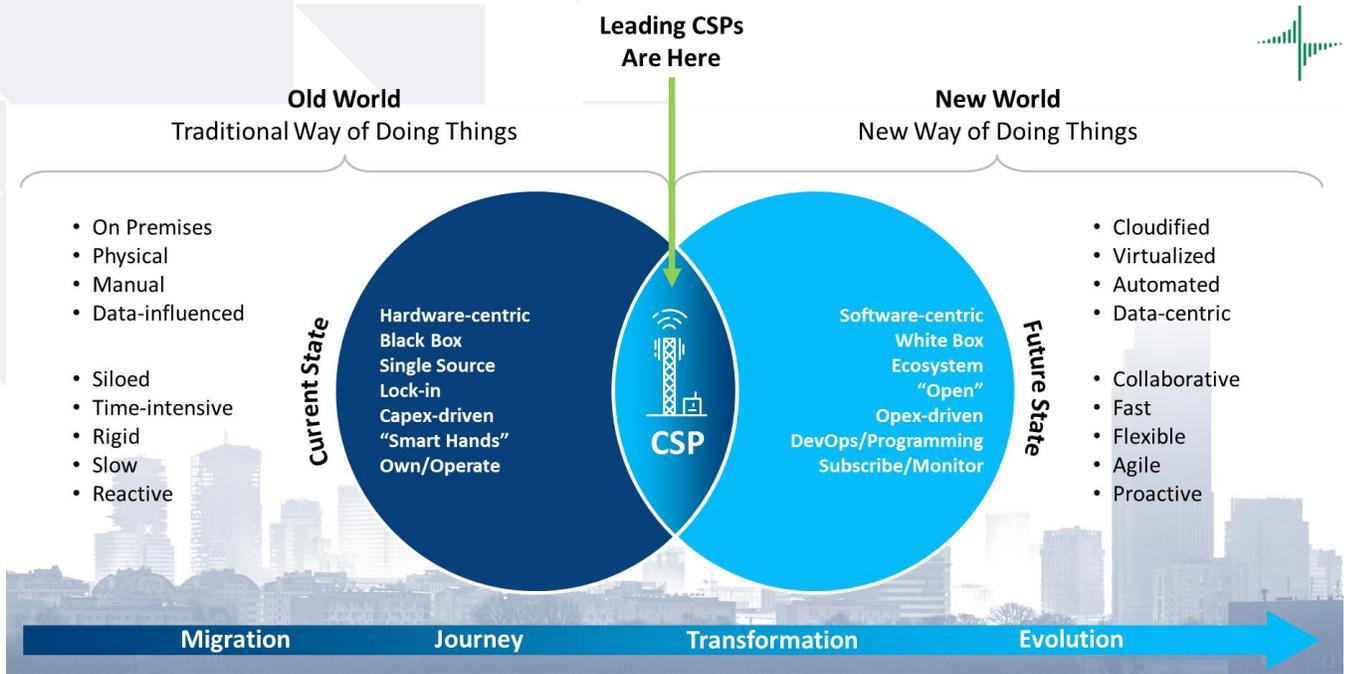
The transition from the old network architecture to the new network architecture will be a multiyear journey for CSPs.

THE SOLUTION

To address these challenges, CSPs are turning to the vendor community and are looking for partners, particularly system integrators, to help them complete their evolution into DSPs. System integrators will help oversee, organize and manage the patchwork of vendors used in the composition of CSPs' new networks. For example, multiple cloud providers and multiple management and orchestration (MANO) providers will likely compose most CSPs' new architecture networks. When looking across the vendor landscape, IBM rises as one of the best positioned players to support this hybrid multicloud, multivendor world and accelerate CSPs' evolution into DSPs.

IBM, which includes Red Hat, is uniquely positioned because it can provide much-needed capabilities at scale as well as pertinent technology, such as network management, orchestration platform for automation and multicloud management platforms, to help CSPs in their migrations to the new network architecture. There are several key reasons why IBM is one of the best positioned payers in the vendor ecosystem to support and accelerate CSPs' evolution into DSPs:

- The acquisition of Red Hat greatly enhances IBM's capabilities pertaining to the new network architecture, enabling the combined company to provide foundational platforms (the connective tissue) that serve as the glue for these next-generation networks, as well as the integration of these platforms, not only with IBM/Red Hat platforms but also with other ecosystem players, such as hyperscale cloud providers. An example of this is OpenShift, but IBM is also able to integrate with other platforms, such as those from hyperscale cloud providers, to enable hybrid multicloud environments for CSPs.

- IBM is uniquely positioned in the global ecosystem to provide hybrid multicloud solutions that can be tailored to support and accelerate CSPs' transformations and realize opportunities from the digital era. IBM not only provides its own platforms and services to provide these transformational solutions but is also vendor agnostic, meaning it can provide integration services that span any cloud ecosystem. Essentially, IBM, with Red Hat, can pull together all of the disparate components necessary to enable and support an end-to-end next-generation network for CSPs.

- IBM can host a CSP's network in its own cloud or can create a private cloud for the CSP that will house the CSP's network. This flexibility in a go-to-market model can appeal to a wide range of CSPs.

- Red Hat OpenShift platform and Red Hat Enterprise Linux (RHEL) are the leading Kubernetes platform and operating system, respectively, for the top hyperscale cloud providers, which enables IBM to provide large-scale hybrid cloud integration and multicloud management.

- IBM, with Red Hat, is a leader in its open-based approach and technology for cloud environments, which is aligned with CSPs' desire to adopt open-based systems as part of their next-generation networks.

- In addition to having tight integration with the Red Hat stack, IBM also supports other key vendors that will compose the new architecture, most notably VMware, which is a longtime partner of IBM.

- IBM can bring a cloud-centric, DevSecOps model into the network domain. IBM is proficient at this model as the company has adopted it in its own cloud.

- IBM has significant cognitive-operations capabilities (e.g., IBM Agile Lifecycle Management, Agile Service Management, Netcool Operations Insight) that can support complex and efficient network function orchestration.

- IBM has a proven track record of helping companies automate key aspects of their businesses. IBM is applying its expertise with automation to the new network architecture to help CSPs realize their automation goals.

- IBM possesses deep industry expertise and has relationships with key players across all of the major verticals, which enables the company to co-create and bring to market new enterprise services that the CSP can monetize.

BETTER TOGETHER

The digital era promises to unlock significant economic value across industries as well as significantly enhance people's standard of living. CSPs are uniquely positioned to enable and support this value creation, but to do so they too must transform into DSPs and adopt a new network architecture that is able to meet the dynamic needs of the market. A cloud-centric, container-based network architecture is currently the most efficient way for CSPs to automate their networks and efficiently and profitably participate in this value creation, with cloud-native as the end-state goal of their network evolution. In light of the myriad challenges CSPs face in taking this evolutionary step in the architecture of their networks, there is a need for partners from the vendor ecosystem to provide CSPs with critical technology and resources.

These transformations are complex and require specialized knowledge and specific resources. IBM, with Red Hat, is positioned as a trusted partner that has the capability and scale to address this complexity and help CSPs evolve into DSPs so that they can capitalize on value creation in the digital era enabled by 5G, edge computing and AI.

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