State of the Art Packet and
Optical Networking

Going Cloud Native

Service Providers Trying to Catch Up

White Paper

Network Value Shifting to Cloud-based Software Applications

When Service Providers (SPs) look to the future, they see a tsunami on the horizon that threatens to drown their traditional world. Over-the-top (OTT) delivery of cloud-based services has already diminished the SP role, in many cases, to being a pipe supplier and bit transporter. Cloud services are now beginning to endanger SP's value-added business, residential, and mobile services.

The threat from the cloud is more than just the services. It is the entire fluid nature of the cloud itself. Not only does the cloud enable creating, customizing, and managing services in a highly agile manner, but it does so with high efficiency, squeezing out the maximum performance from underlying resources. This is a game-changing one-two punch.

To remain competitive, SPs now recognize that they need to learn to swim in the cloud world. They need to introduce service agility and operations automation. Many have started to introduce Network Function Virtualization (NFV) and Software Defined Networking (SDN) technologies. These help shift the value in telecommunications networks from transmission, switching, and routing hardware, to software applications that deliver services and control the network in a holistic and automated manner. According to a recent IHS Technology report, "SDN software and outsourced services will be 66% of the $18B total SDN revenue in 2021."

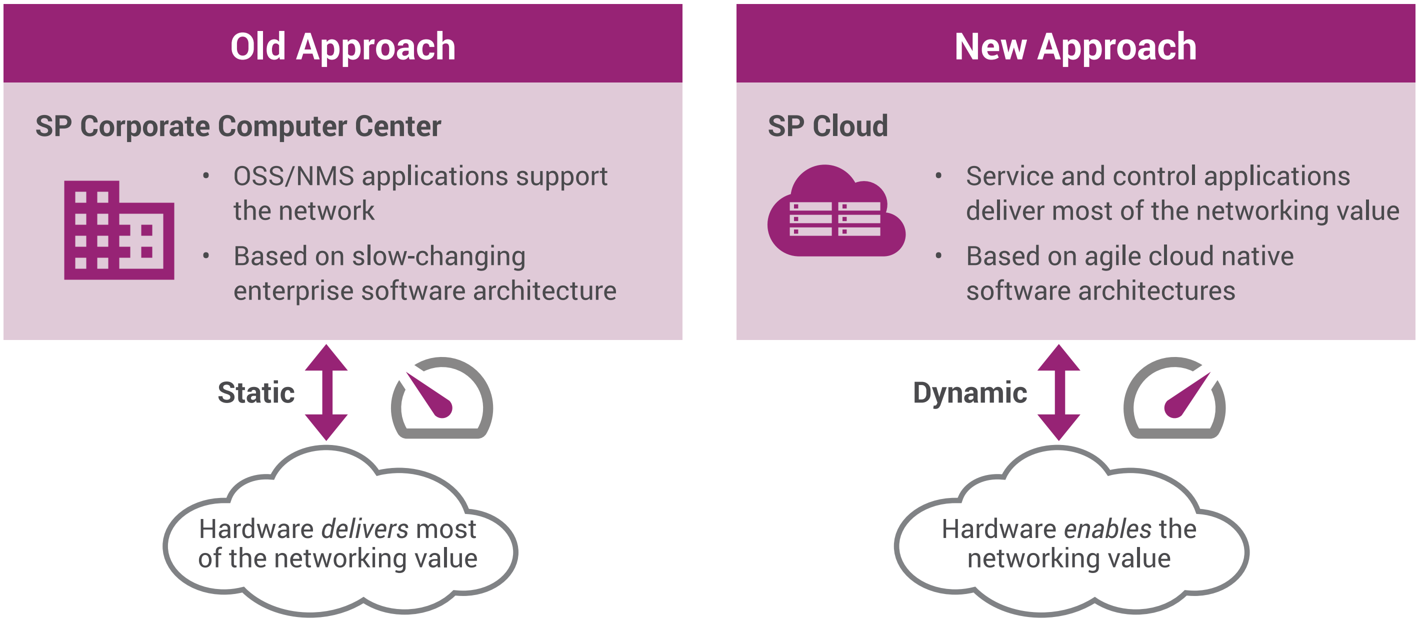
Examples of Service and Control Applications

- DynamicVPNs
- Managed Security
- Virtual CPE
- Bandwidth on Demand
- Zero-Touch Provisioning Service Instantiation
- Predictive Maintenance
- Network Analytics
- Multilayer Path Computation

However, SPs are also realizing that simply shifting value to software-based service and control applications is not enough; equally important is how applications are developed, deployed, and managed. So, some SPs have started adopting cloud architectures (using private cloud models for security and control) to enjoy the cloud's multiple agility and economic benefits. In this vein, SPs will expect that software-based application solutions, including those coming from their traditional networking vendors, use the latest cloud software engineering techniques. This is needed to integrate the applications easily and extract maximum value over their lifecycle.

To recap:

- Cloud-based services are changing the game.
- SPs want to move up the value chain: from bit-moving hardware to cloud-based software applications.
- SPs will expect application software to be based on current cloud software engineering techniques, to facilitate their deployment and life-cycle management.



Old Approach

SP Corporate Computer Center

- OSS/NMS applications support the network
- Based on slow-changing enterprise software architecture

Static

Hardware *delivers* most of the networking value

New Approach

SP Cloud

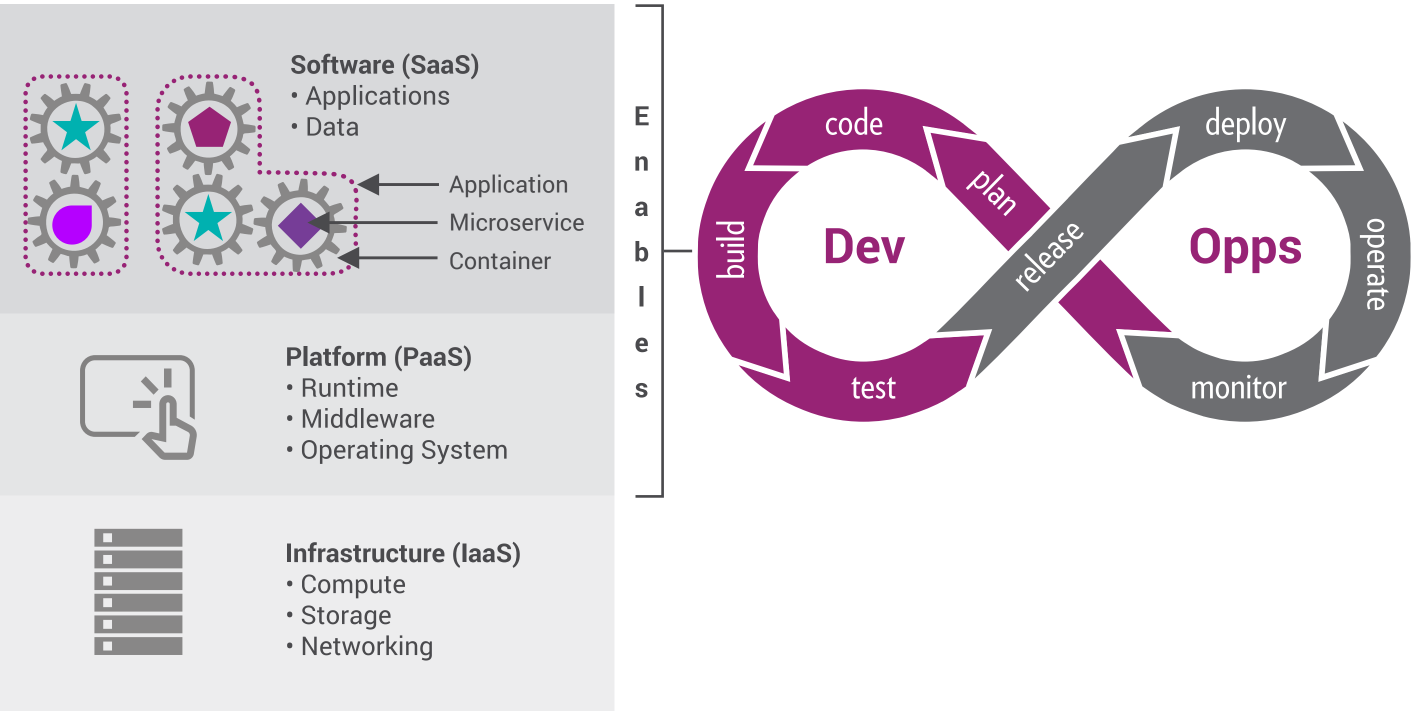
- Service and control applications deliver most of the networking value
- Based on agile cloud native software architectures

Dynamic

Hardware *enables* the networking value

Software Engineering in the Cloud

So what are these cloud software engineering techniques? Three essential "cloud native" techniques covered in this paper are: 1) Microservices, 2) Containers, and 3) Platform-as-a-Service (PaaS). They facilitate taking advantage of large clusters of server resources and meeting the needs of a dynamic end-user services environment, where changes need to be delivered quickly.



DevOps – A Common Goal

Before discussing these techniques, it should be noted that they share an important collective goal of enabling a successful DevOps environment. This is being able to develop, test, release, update, and maintain software rapidly and reliably, to provide a competitive advantage in delivering applications to end-users.

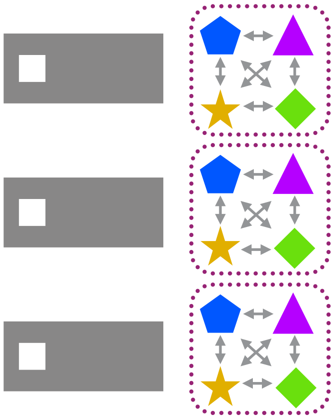
DevOps encompasses a set of practices meant to facilitate smooth collaboration between software developers (Dev), responsible for writing and testing application software; and software operations (Ops), responsible for deploying and managing the applications. It aims to overcome the "throw-it-over-the-wall" culture that previously separated these organizations, which slowed down application delivery. DevOps makes extensive use of automation, and is decoupled from scaling of the underlying infrastructure.

DevOps aligns with a fail-fast culture. It is changing the business dynamics between network solutions providers who develop the applications and the SPs who deploy them. To realize the full benefits of DevOps, it is expected that both parties use common or complementary cloud software engineering techniques.

Microservices

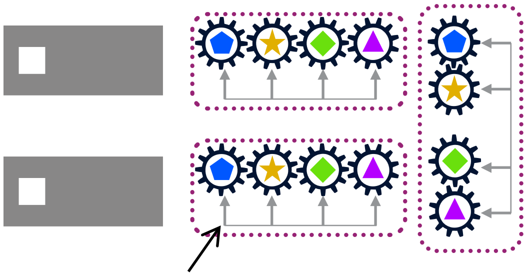
Microservices is an architectural style that structures an application as a collection of autonomous loosely-coupled services. Each microservice fulfills a well-defined business function and is responsible for its own data, so that it has no external dependencies. Microservices communicate with each other using well-defined stateless protocols like HTTP. They are a sharp departure from the previous mainstream enterprise Service-Oriented Architecture.

Enterprise Service-Oriented Architecture (SOA)



- Applications constructed using tightly integrated processes
- New releases are time consuming to verify all interdependencies
- Scalability depends on replicating the entire application
- A process failure usually kills the entire application

Cloud Microservices Architecture



Stateless communications between container-based microservices

- Applications constructed using loosely coupled microservices
- Continuous new releases, based on updating individual microservices
- Microservices scale individually, leading to more efficient server use
- A microservice failure usually harms, but does not kill the entire application

For example, an SDN predictive maintenance application might be composed of microservices for: a) packet networking equipment, b) optical networking equipment, and c) a holistic network view that combines information from 'a' and 'b'.

Microservices enable a highly modular development and deployment environment, whereby each microservice can be individually upgraded, repaired, or replaced in an application without affecting other ones. Microservices enable applications to scale effortlessly. If a particular microservice is a bottleneck, then it can be moved to more powerful hardware, or additional instances of the microservice can be spun-up. Microservices also make applications more robust. If an individual microservice fails, then the application carries on as best as it can with the remaining microservices.

Containers

Each microservice pictured above is shown in a geared circle – or its container. It is useful to think of software containers as having similar functionality to shipping containers. A shipping container holds virtually any type of goods, and facilitates their transport in a common manner over multiple modes of transportation, like trucks, railways, and ships. A software container holds virtually any type of software code (and it is especially compatible with microservices) enabling the code to run transparently over multiple runtime environments, like development, testing, integration, and production. As such, containers are a central pillar in realizing DevOps. They make applications portable, facilitating seamless handoff of code both within and between development and operations organizations.

A container essentially is a thin virtual machine layer that isolates the software code from the underlying operating system. It enables the containerized software to run identically, regardless of the environment. The most popular container standard is Docker, which has built up a large ecosystem and has widespread use. A colorful term you may have heard is Docker Swarm, which is a tool that lets administrators and developers manage a large number of Docker containers.

Service Provider PaaS

Think of PaaS as the operating system for applications wherever they are located in the SP cloud, within a SP data center, or within the network itself. It provides an abstraction layer for the compute-storage-networking infrastructure that makes it easier to develop, configure, deploy, and manage applications in the cloud. It allows infrastructure to innovate and evolve at its own pace. PaaS supports the DevOps objective by automatically provisioning and scaling infrastructure resources for developers and operations based on application needs. It can also provide tools to assist in monitoring, failure recovery, and life-cycle management of applications. PaaS is critically important to deploy software smoothly in the cloud.

When a PaaS is used by service providers to support real-time SDN- and NFV-based networking applications – which are located in the SP cloud, but provide control over the wide area network – then it is called an SP PaaS. This must support specific capabilities to make it "carrier-grade", such as:

- High Availability
- Geographical Redundancy
- Load Balancing
- Scaling, In and Out
- Application Health Monitoring & Alarms
- Application Upgrading
- Authorization and Authentication
- Log Management
- License Management and Enforcement

One final thought on PaaS is about how it relates to containers. A classic PaaS function is to provide virtualization for applications. This is beginning to be infringed upon by the virtualization layer provided by containers, and is a matter of hot industry debate. This does not undermine the overall value of PaaS, which provides so much more, but reflects the way some "middleware" functionality is evolving and the dynamic nature of the cloud.

Summary of Advantages and Benefits

Cloud Software Technique	For Application Development Organization	For Service Provider
Microservices	• Develop applications in a modular fashion → continuous introduction of functionality per DevOps objective • Focused development on specific business functions → boosts innovation • Code re-use through replication → fast coding • Small autonomous teams, using any language → efficient coding	• Rollout applications in a modular fashion → fast TTM, per DevOps objective • Rapid application upgrades and fixes → customer responsiveness • Granular scalability → optimum resource use • Contained failures → application survivability
Containers	• Portable code between different runtime environments → central to DevOps objective of seamless and continuous application rollout; eases development and testing, and handoff to SP users	• Portable code between different runtime environments → central to DevOps objective of seamless and continuous application rollout; eases acceptance from application providers, integration, and production • Lightweight virtualization layer → dense packing of applications on servers for high resource usage
SP PaaS	• Infrastructure abstraction → supports DevOps objective of focusing on application value and rollout without concern for underlying resources; provides similar application look & feel • Applications life-cycle tools → efficient development	• Infrastructure abstraction → supports DevOps objective of automatic scaling of infrastructure resources, based on application needs for efficient deployment • Carrier grade → provides the necessary availability and robustness for real-time networking applications to run in the cloud • Industry-standard tools with open interfaces → enables SP and third-party application development

Ribbon's DevOps Software Architecture paves your road to SDN and NFV

About Ribbon

Ribbon Communications (Nasdaq: RBBN), which recently merged with ECI Telecom Group, delivers global communications software and network solutions to service providers, enterprises and critical infrastructure sectors. We engage deeply with our customers, helping them modernize their networks for improved competitive positioning and business outcomes in today's smart, always-on and data-hungry world. Our innovative, end-to-end solutions portfolio delivers unparalleled scale, performance, and agility, including core to edge IP solutions, UCaaS/ CPaaS cloud offers, leading-edge software security and analytics tools, as well as packet and optical networking leveraging ECI's Elastic Network technology.