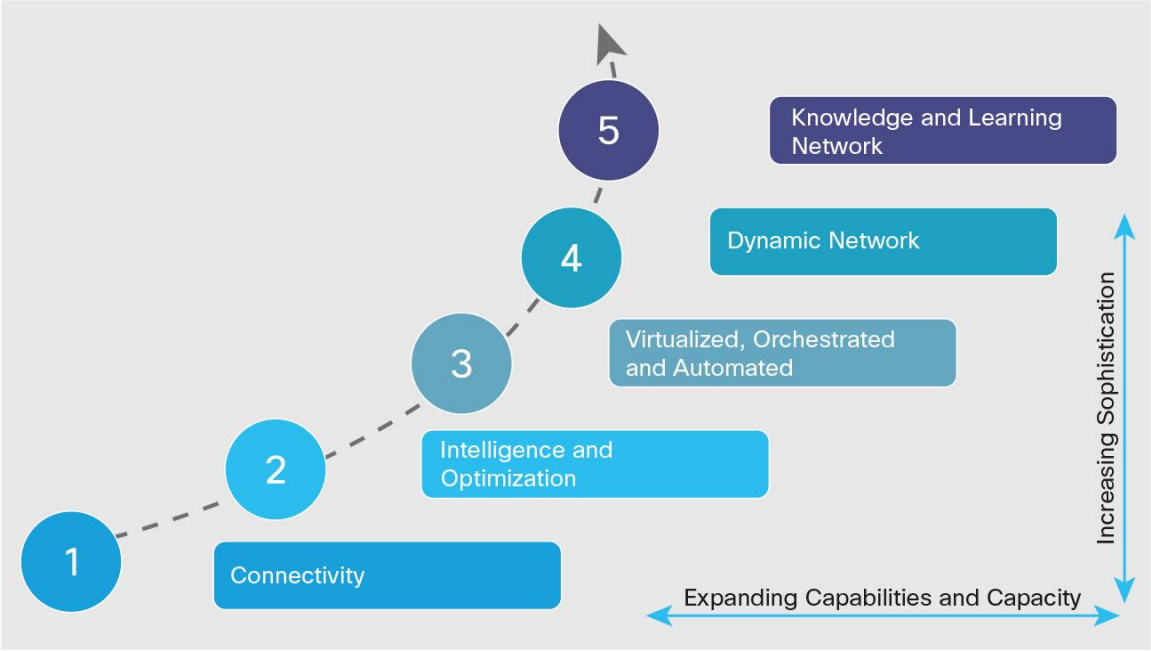
White Paper

Evolution of the Service Provider Mobile Network: Increasing Automation

What would happen if a service provider's network could take advantage of multiple types of analytics to predict changing demands and requirements throughout the network? This network would be highly automated and subscribers (either residential or an enterprise's IT department) could request new services and capabilities on-line through a self-service portal. Upon "check-out" the network would self-provision and validate this new service in seconds. Any gear needed would be sent out to the user immediately.

Figure 1. Cisco Service Provider Mobility Five-Stage Strategy



The evolution of the service provider mobile network is leading to an architecture that is automated, dynamic, and self-learning. This architecture will orchestrate both physical and virtual resources with equal proficiency resulting in optimal network efficiencies. The benefits include greater optimization and new economic opportunities for both service providers and their enterprise customers. This self-sizing, self-healing network will open these new opportunities through virtualization and self-service capabilities for the user. This document examines how we got to where we are today, as well as what needs to be created to successfully reach the next stage.

The Five-Stages of service provider mobile network evolution (Figure 1) are:

1. Connectivity
2. Intelligence and Optimization
3. Virtualization, Orchestration and Automation
4. Dynamic Network
5. Learning and Knowledge Network

These five stages represent a network that is evolving with increased levels of sophistication to become an automated, optimized network with the elasticity to respond quickly to new revenue models. However, keep in mind that each stage is also evolving with increasing functionality, capability, and capacity.

Stage-1: Connectivity

This stage addresses the basic need to support capabilities and provide capacity. The need for capacity continues to grow. The industry needs to innovate to deliver broadband access and greater mobile capacity. Cisco does this with spectrum management and better use of access technology, including licensed and unlicensed small cells along with unlicensed LTE (LTE-U). We also increase capacity in the core with enhancements to routers and switches for mobile backhaul (MBH) and IP transport (IP Edge and Core). This evolution continues within the industry and within Cisco.

As the industry strives to increase capacity and capabilities service providers face increased complexities such as the need to mitigate interference issues and smooth hand-offs in mobility networks. Cisco does this through better integration of small cells working within a macro environment and licensed radio working with unlicensed access (SP Wi-Fi and LTE-U). Stage-2 helps to address some of these complexities.

Stage-2: Intelligence and Optimization

This stage addresses the use of end-to-end intelligence to optimize the network. For example, some of these capabilities are found in the Radio Access Network (RAN), the packet core, and the transport network. In the RAN you can have centralized-self-optimizing network (SON) technology which uses data from the RAN to dynamically optimize the radio network by implementing small changes and then receiving immediate feedback. If these changes worsen the situation they are immediately rolled-back and other changes are made using analysis of the real-time dynamic looped feedback. When the changes improve the situation they are kept and new data is continually analyzed. All of this is done automatically by the centralized-SON which interoperates with all major radio vendors.

Another way of using network intelligence to optimize the network can be found with a RAN-aware packet core. It can analyze a variety of data (including RAN congestion metrics, subscriber, application, and traffic) and take advantage of policy and other functions to better manage network congestion and deliver a better user experience. For example, if the packet core finds that a specific sector is congested, it can identify the affected users, and then pull the user and policy information to make “per-user” decisions. For example, it could employ video optimization, or implement priority control of traffic between real-time applications such as video, and near real-time applications, such as email.

Development in this area continues to further automate this intelligent optimization. It also connects different optimization functions together, like the RAN and packet core, to create end-to-end optimization capabilities.

Stage-3: Virtualization and Orchestration

This is where the industry is focusing its attention today. This stage builds on both the “Connectivity” and the “Intelligent and Optimization” stages to provide greater elasticity and agility through automation.

The idea is to virtualize and orchestrate the network functions to create more options and greater control over the network. The orchestration should provide the automation to reduce complexity while increasing network and operational agility. This stage has the potential to open new economic opportunities for the mobile service provider. It can also provide its customers (both enterprise and individual users) with greater choice and more capabilities. But this is only the first step in what can be done with this new architectural paradigm.

Stage-4: Dynamic Network

Once a mobile service provider has virtualized and fully orchestrated the network it can add a dynamic services capability. This capability allows the mobile service provider to give enterprise and other third-party customers greater agility and control with features like self-service portals and hosted cloud services.

For example, an enterprise’s IT department could use the self-service portal to gain greater access and actually leverage the carrier’s infrastructure. This would be an Infrastructure-as-a-Service (IaaS) functionality. The enterprise customer could then select the services it wants to deploy, and after “check out”, the orchestration would modify the network infrastructure resources which are all virtualized and routed via service chaining. The mobile service provider’s self-service portal makes ordering new services and functionalities as fast and easy as shopping for a gift or a vacation on an Internet site.

In another example, the mobile service provider could use the dynamic network to provide hosted cloud services like cloud Content Delivery Network (CDN) which can help the enterprise deliver a better user experience and places the mobile service provider in the value chain.

Once implemented, the dynamic network can be further optimized with a knowledge and learning capability. This brings us to stage-5.

Stage-5: Knowledge and Learning Network

At this stage the network responds automatically to changing conditions and changing demands. While this does not automatically grow base stations it can control the network behind it.

When carriers want to introduce a new service, they can simply roll out that service and the network will spin-up and shift resources to meet the new demand. This contrasts with current requirement to introduce a new service. Typically when marketing departments want to add a new service they bring their requirements to the engineers who then need to evaluate the added demands and calculate what needs to be changed or expanded. Once complete, the new service must be tested and validated. This process can take several months and could impact success. In another example, the Knowledge and Learning Network is able to predict potential changes in demands on resources based on a combination of historical data, big data and real-time analytics. This capability can automatically mitigate issues that arise from major events, holidays, emergencies, and so forth.

The network will pull and analyze data and make more intelligent decisions based on a growing knowledge base tied to its dynamic capabilities. This enhanced level of automation further reduces the complexities of a more sophisticated network while delivering agility and supporting the growing capabilities and capacity demand on the network.

Conclusion

The industry is eagerly focused on newly emerging technologies. While software-defines networks (SDN), network function virtualization (NFV), and orchestration are all quite intriguing from an intellectual perspective, businesses do not deploy new technology just to play. Rather, they deploy new technology once it proves that it can enable new services and solutions that previously were not available, or deliver services in a greatly improved, optimized manner.

To this end, Cisco is working to virtualize their entire portfolio and already offers more virtualized functions than all of their combined competitors. But the real value of these efforts is that Cisco is building architectures of solutions to deliver new services and new agility and to solve real-world challenges.

Please watch for future papers from Cisco that will provide an in-depth look at the evolution of the service provider mobile network.

For More Information

- **Cisco's Open Network Environment (ONE) for Service Providers:** http://www.cisco.com/c/en/us/solutions/service-provider/open-network-environment-service-providers/index.html
- **Cisco's Evolved Programmable Network (EPN):** http://www.cisco.com/go/epn
- **Cisco's Evolved Services Platform (ESP):** http://www.cisco.com/c/en/us/solutions/collateral/service-provider/service-provider-strategy/solution-overview-c22-731090.html

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