5G: Network As A Service

How 5G enables the telecom operators to lease out their network

Nikhil Vyakaranam & Dilip Krishna S
5G is enabling a host of new applications for enterprises and consumers, including augmented reality, virtual reality, IoT, autonomous vehicles, enhanced mobile broadband and many more. The “Cloud Native” strategy, separation of control and user planes (CUPS), and service based architecture in 5G, has brought about much needed enhancements in the telecom network. 5G is being developed to enrich the experience of not just the mobile but the entire communications technology ecosystem. It marks the convergence of many industry verticals like healthcare, agriculture, automotive etc. The network architecture has been modified to make it simpler and efficient.

A critical feature introduced in 5G is Network Slicing. With network slicing, a physical network infrastructure can be partitioned into multiple virtual networks, allowing the operator to provide a specific kind of support to a specific customer segment. This provides an opportunity to the operator to have a flexible and dynamic network configuration based on the customer’s requirement instead of an One-Size-Fits-All architecture. It enables them to offer their network as a service to customers and enterprises.
End-to-End Network Slicing

End-to-End network slicing is the cornerstone of the 5G architecture and enables the support for diverse 5G services. It allows the operator to provide dedicated logical/virtual networks for specific requirement and functionality each having their own unique properties. Based on NFV and SDN the physical infrastructure is abstracted from the logical network architecture. Each network slice may have its own network architecture, protocols and security settings.

As shown in the preceding figure, eMBB (Enhanced Mobile Broadband), URLLC (Ultra Reliable Low Latency Communication) and IoT (Internet of Things) slices can be supported independently on a single infrastructure. The eMBB slice has high requirement for bandwidth and will be supported by a physical infrastructure capable of high computations. URLLC is highly sensitive to network latency in application scenarios of self-driving, remote telesurgery equipment and virtual or augmented reality. Mobile Edge Compute should be placed at close proximity to the users to provide a short round trip time. The IoT slice sends very few data packets to the network but requires a large capacity to register millions of devices. This consequently allows low compute physical resources to be used for this slice, thereby, reducing the overall operating expenses.

Network slicing enhances network security as the slices are isolated from each other and the traffic in one slice cannot interfere with the others. End-to-End network slice will include the Core, the RAN and possibly the transport network as well. Software Defined RAN or Cloud RAN facilitates the RAN Slicing. The controller in the cloud RAN can allocate appropriate computational, network and security resources to each slice.
radio resources to various network slices based on their service requirements. It’s relatively easier to implement SDN and NFV on core network. Based on the service type, necessary VNFs can be provided to the network slice. These VNFs can be scaled on demand with changes in service and performance requirements. Considerable effort is being put to improve the transport to satisfy the 5G needs. Leading vendors have already demonstrated network routers that support backhaul slices with independent performance characteristics. SDN will play a crucial role in determining the best path for a packet to traverse through the fronthaul and backhaul elements, to meet the various 5G demands.

### Network-As-A-Service

The rising need for mobility has given way to the adoption of numerous personal mobile devices like smartphones, notebooks, tablets and phablets. Carriers and data centres have an extremely challenging task to continuously scale their compute servers with seamless interconnections. This, in turn, has accelerated the demand for additional network capacity and for improved and robust network solutions. Traditional network elements have given way to a more agile SDN solution.

SDN has given rise to a host of new cloud services like Network-as-a-Service (NaaS). With NaaS, companies can manage their costs better and pay only for the networking services they use. Outsourcing network infrastructure can bring substantial benefits in the flexibility, reliability, availability, recovery and ease of management. It’s expected that NaaS market would reach a valuation of $22.5 Billion by 2022.

Telecom operators are constantly striving to provide the best experience to their customers. Operators have been using SDN and Network as a Service models to maximize the data rates and efficiently manage the network by optimizing the routers and switches during the peak hour. Though operators maintain and manage a vast and complicated network, they never had the opportunity to monetize it. By introducing the concept of Network Slicing, 5G offers additional revenue stream to the operator by providing them the necessary infrastructure to customize the network as per customer’s requirement.
Traditionally, operators had a pre-created network and most of the network data traffic would flow along the same path. 5G Network Slicing features facilitates the creation of dynamic networks. The service provider has the ability to provide a network fine-tuned to the customer’s requirement.

Network-as-a-service workflow could be very similar to the Infrastructure-as-a-service providers like Amazon Web Services (AWS). An intuitive dashboard is presented to the customer to precisely capture the customer requirements. The requirements are then forwarded to the operator’s 5G network, which would analyse the current infrastructure to create a network slice befitting the customer’s needs. Operator can charge the customer based on an subscription pricing model.
Various organizations will benefit from the Network-as-a-Service model provided by the operator. By providing a custom network suiting the requirements of the underlying traffic, the operator can deliver the best customer experience.
The world is steadily moving towards mobile devices. Cisco VNI predicts that by 2021, 78% of the total mobile traffic will be Video. Viewer behavior is changing with more and more people watching streaming content over the mobile devices. Over-the-top (OTT) streaming revenue is expected to increase to more than $50 billion by 2020. There is a steady increase in the number of Video Service providers. The intense competition will push the OTT providers to deliver high quality videos with very low buffering times. The use of Mobile Edge Computing (MEC) in 5G, will trigger a decrease in the network latency. Telecom operators can tap into the rising demand for streaming content by providing a network capable of delivering high quality content with extremely low latency.
Telecom operator partnership with video service providers

Jill is the president of a new Video Service Provider company, VideoStreamer, that offers high resolution ultraHD and 4K videos. In order to compete with Netflix and Amazon, Jill wants to provide high quality videos with minimum buffering to all her customers. Telco1 is 5G telecom service provider with presence across many countries and offers its network as a service. Telco1 has an intuitive dashboard and allows the customers to create their own custom network. Jill requests for a network with latency less than 5ms and data traffic isolation for security. Telco1 provisions a dedicated network slice as per her request and Jill can now provide enhanced user experience to her subscribers.

“Streaming TV shows, movies, and other types of video over the Internet to all manner of devices, once a fringe habit, is now a squarely mainstream practice. Even people still paying for cable or satellite service often also have Netflix or Hulu accounts.”

- Walt Mossberg
There has been a massive growth in the number of Internet of Things (IoT) devices over the past few years. It is forecasted that by 2022 there will be around 29 billion connected devices, out of which 18 billion will be IoT devices. In the age of IoT, we would live in a highly connected environment – connected workplace, connected infrastructure and connected homes. According to IHS, by 2025 10 percent of households will be smart homes. Connected homes would eventually lead to connected communities. Common resources such as water, electricity, security, parking, elevators, broadband etc. are shared and consumed by all residents living in the same geographical area or locality. Future IoT devices will automate not just home but the entire community resources. Telecom operators can play an important role in the development of connected communities. An isolated network slice can be provided to each community of a geographical area to take care of their specific automation needs.
Bob is the president of a SmartPlace, which is a community of 100 homes. Bob wants to automate his locality to ease the lives of the residents. He has installed Smart Security Gates at entry and exit which open automatically when they detect a resident, Smart Parking which automatically parks the car at the designated place, Smart Electricity Grid which optimizes the electricity usage, Smart Clinic which is capable of telemedicine and telesurgery and Smart Water Meters to optimize water usage and reduce wastage. Bob needs to connect all these devices in an efficient and secure network. Bob requests telecom operator Telco1 to create a custom network catering to his needs. Telco1 creates a dedicated private network slice to which SmartPlace can securely connect all the IoT devices and provide high speed broadband to its residents.

“The Internet of Things tell us that a lot of computer-enabled appliances and devices are going to become part of this system, too: appliances that you use around the house, that you use in your office, that you carry around with yourself or in the car. That's the Internet of Things that's coming.”

- Vint Cerf
Augmented and Virtual Realities are becoming mainstream and could surpass $120 billion by the end of this decade. Virtual Reality is providing real life like experiences in an artificially generated environment. Augmented Reality enhances the real-life experiences by superimposing a layer of interactive digital information over existing reality in order to make it more meaningful. Early Virtual Reality products are being mainly targeted to the gaming fraternity. However, the device manufacturers have quickly realized the huge business potential in other sectors and are finding ways to integrate VR to various other areas. Augmented and Virtual reality technology requires heavy computational and extremely low network latency. To provide the best experience, the AR/VR applications have to be placed very close to the user location. Telecom operators can leverage Mobile Edge Computing (MEC) to assist the AR/VR manufacturers. AR/VR data can be steered to the edge cloud which is situated near to the user thereby providing high network bandwidth and very low network latency.
Telecom operator partnership with local stadiums

Jack is a manager for a football stadium in PlayTown which is scheduled to host a world cup match. More than 150,000 PlayTown residents are interested to watch the match but the stadium can seat only 50,000. Jack realizes that there is a huge untapped market. RealSports is a Virtual Reality device manufacturer. RealSports has agreed to provide required infrastructure and VR headsets to Jack. Jack approaches telecom operator Telco1 for a network that can provide high download speed with an extremely low network latency. Telco1 creates a dedicated network slice for Jack, which steers all traffic to the edge compute for faster processing. RealSports connects all VR devices to this network slice. Jack can now sell the VR devices to customers who couldn’t purchase a ticket and give them a stadium like experience at their home.

“*As the Internet of things advances, the very notion of a clear dividing line between reality and virtual reality becomes blurred, sometimes in creative ways.*”

- Geoff Mulgan
The devices and applications of the future will be very different to the ones existing today. From high mobility to heavy data throughput to extremely low latency, the network should have the capability to handle these various kinds of data flow requirements. The gradual shift from fixed to mobile devices, provides the telecom operators a unique advantage. 5G architecture has further enhanced the operator capabilities to prepare their networks more closely to the customer’s data traffic needs. By creating a more flexible and dynamic network architecture and providing their network as a service to the customers and enterprises, the operators will have a substantial impact in enriching user experiences.