

Cisco 5G Redefining Your Network



Introduction

5G is no longer on the horizon – it is here, now. Several mobile operators have committed to implementing 5G in several cities this year. Mobile device manufacturers have committed to shipping 5G enabled devices in 2018 too. Cisco is taking a Cloud-to-Client approach, unifying multivendor solutions into a single, secure, standards-based architecture. And emphasizing that with the proper secure network customers can start delivering 5G services today for business, consumer, and IOT– bringing in new revenues with a compelling value chain.

Cisco views 5G core as an opportunity for Service Providers to take advantage of the major changes taking place in the data center, networking and the economics of mobility in a standardized multivendor environment. Significant changes are being defined for the mobile core that facilitate new opportunities such as personalized networks through slicing and more granular functions.

5G provides a framework to take advantage of the massive throughput and low latency that new radio provides. Devices and services that we cannot imagine today will become pervasive on this new network and automation and programmatic interfaces will enable rapid innovation.

Many of the network architectures we have longed for are not possible and bringing multi access technologies together; scaling the network dynamically; deploying services effortlessly at the edge are now possible. 5G integrates wireline and wireless in powerful ways through the access agnostic AMF (access management function) interfaces. The network functions are broken down into smaller entities such as the SMF (session management function) and UPF (user plane function) which can be used on a per service basis.

Gone are the days of huge network boxes, welcome to services that automatically register and configure themselves over the Service Based Architecture. Separation of the user plane has freed it from the shackles of the control plane state and permits deployments at the edge with very little integration overhead. Multi access edge computing that spans both wireless and wireline technologies will significantly redefine how the users connect to applications, corporate networks and each other.

The 5G “story” in the core is broken into 3 parts

- a) Architectural enhancements
- b) Enabling speeds and feeds (gigabytes at the edge); and billions of devices

c) Cloud Native 5G functions with Automation

Architectural Enhancements

Control and User Plane Separation

CUPS was introduced in 3GPP release 14 and is a key feature being carried forward in 5G. CUPS defines the separation of the Session Management Function (SMF) and User Plane Function (UPF) of the next generation mobile core. In addition to the promise of **high performance user planes** for eMBB, CUPS enables the UPF to be deployed in a separate data center from the SMF. Use cases such as URLLC (see below) may require the UPF to be deployed at the network edge, close to the end user to achieve the latency requirements associated with the service. Additionally, the UPF can be co-located with applications such as video caches to maximize the quality of experience for the subscriber.

CUPS inherently adds complexity to the orchestration of the mobile core as the control and user plane may be split across data centers or cloud environments. The UPF relies on the SMF for its configuration and management to simplify this complexity. The UPF network, storage and compute resources must still be managed across domain, e.g., via Openstack or Kubernetes.

Network Slicing

Network slicing enables the network to be segmented and managed for a specific use case or business scenario. The operability of a slice can be exposed to a slice owner such as an enterprise delivering and IOT service. Examples of slices include Fixed Mobile Wireless, Connected Car, as well as traditional consumer services. The network operator will end up defining the granularity of a slice to best meet the business requirements.

Network Slicing requires the **ability to orchestrate and manage the 5G network functions as a common unit**. This orchestration requires coordination across individual network functions to ensure services are properly configured and dimensioned to support the required use case. Control and User Plane Separation (CUPS) is commonly coupled in slicing use cases where the User Plane Function is geographically located closer to the end user and the Session Management Function (SMF) is centralized.

Enabling Speeds and Feeds

Enhanced Mobile Broadband

5G Enhanced Mobile Broadband (eMBB) brings the promise of **high speed and dense broadband** to the subscriber. With gigabit speeds, 5G provides an alternative to traditional fixed line services. Fixed wireless access based on mmWave radio technologies enables the density to support high bandwidth services such as video over a 5G wireless connection. To support eMBB use cases, the mobile core must support the performance density and scalability required.

Ultra-reliable Low Latency Communications

Ultra-reliable low latency communications (URLLC) focuses on mission critical services such as augment and virtual reality, tele-surgery and healthcare, intelligent transportation and industry automation. Traditionally over a wired connection, 5G offers a wireless equivalent to these extremely sensitive use cases. URLLC often requires the mobile core User Plane Function (UPF) to be located geographically closer to then end user in a Control and User plane Separation (CUPS) architecture to achieve the latency requirements.

Massive Internet of Things

Massive IOT in 5G addresses the need to support billions of connections with a range of different services. IOT services range from devices sensors requiring relatively low bandwidth to connected cars which require a similar service to a mobile handset. Network slicing provides a way for service providers to enable Network as a Service (NaaS) to enterprises; giving them the flexibility to manage their own devices and services on the 5G network.

User Plane Performance

User plane performance is a key requirement for the 5G user plane function. To meet gigabit throughput and density requirements of eMBB, the UPF architecture needs to be optimized. Additionally, as the **UPF evolves to virtual, this performance must carry over to a cloud** architecture. Cisco's UPF includes the FD.io vector packet process (VPP) as the underlying virtual forwarding engine. This includes interoperability with COTS hardware along with the ability to take advantage of hardware acceleration and Smart NICs.

Cloud Native 5G functions with Automation

Service Based Architecture

5G has introduced a service-based architecture as part of the 5G core design. The 5G service-based architecture introduces new HTTP2 service-based APIs to enhance the interoperability of

control plane functions in the mobile core. As opposed to point to point interfaces like GTP and Diameter in 4G, the service-based architecture supports the ability for a service to be exposed to multiple functions. This web-based approach to enable the communication between 5G network functions provides the foundation for exposing new services in the mobile core.

Cloud Native 5G Functions

In order to meet the orchestration objectives required of the 5G mobile core, lifecycle management of the application and infrastructure must be fully automated. With 5G functions being virtualized, automated lifecycle management requires virtual network function instantiation, in service upgrades, resiliency, service discovery and auto scale. To achieve the orchestration requirements of network slicing and CUPS, lifecycle management must be API driven and designed to be integrated with NFV orchestration systems.

Cisco's 5G mobile core automation strategy includes a roadmap to cloud native technologies and methodologies. This includes the **containerization of network functions** into Microservices to maximize the automation of lifecycle management. Continuous integration, deployment and DevOps enable more frequent access to upgrades and simplified, predictable software lifecycle management in the operator's network.

Telemetry Automation

To achieve data driven and cross domain automation, telemetry must be supported in the 5G core to **expose operational performance indicators** analytics systems. This operational visibility enables the network operator to automate the virtualized network. For example, resource consumption and latency metrics can be used to scale or relocate VNFs based on the service requirements. Additionally, these metrics can be used to manage the services provided by a slice, e.g., ensuring that a service is maintaining a low latency service level agreement.

Automation for 5G – Ultra Automation Services (UAS)

UAS is composed of several functional components, each providing unique services at different parts of the **end-to-end installation and orchestrated workflows**. There are two main categories of UAS modules: VIM installation and VNF deployment. The former provides automated installation of VIM-Orch and VIM (OSP undercloud and overcloud, in the case of RedHat OpenStack). Whereas the latter provides many functionalities of what ETSI-defined NFVO would provide in the NFV-MANO reference architecture framework.

5G is about redefining the network to realize new opportunities and revenues. The 5G network should enable connected experiences and trusted services from the multicloud to client. Cisco is ready to partner with you to create your on 5G connected experiences.