The Intriguing Background of 5G Core Network Architecture

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5G Core (5GC) networks provide a superior cellular experience for end users and service flexibility for Mobile Network Operators (MNOs). But there are some key infrastructure considerations that service providers should understand before pursuing this opportunity. At the heart of every cellular network is the underlying **architecture**. That's why it's so important for operators to analyze the pillars of 5G core network architecture and compare it to traditional Evolved Packet Core (EPC) networks, which are used in 4G/Long-Term Evolution (LTE) and 5G Non-Standalone (NSA) networks.

This article will answer the following questions answered:

- What makes 5G core network architecture different from EPC architecture?
- How will the new architecture impact 5G Core Network Functions (CNFs) and network elements?
- In what ways does 5G core network architecture benefit Communication Service Providers (CSPs)?
- Where does the value of Control and User Plane Separation (CUPS) exist in 5G core networks?

What Makes 5G Core Network Architecture Different from EPC?

The technological evolution of 5G core network architecture creates a considerable gap between it and EPC architecture. The technological underpinnings of 5G core architecture consist of a **cloud-native**, granulated configuration of loosely coupled and autonomous network components. Moreover, 5G core uses **Service-Based Architecture (SBA)**, which is software-based and hosted in the cloud.

With point-to-point EPC architecture, you're dealing with element interfaces delineated by box-specific "reference points." Moreover, an EPC network involves a responsibility overlap between the various network elements. The architectural advancements of the 5G core come from the way Network Functions **(NFs)** operate. More specifically, 5G core network elements are no longer "boxes"; instead, the elements are "software NFs." Additionally, core network elements go from being "protocols" to "Application Programming Interfaces (APIs)."

Figure 1: EPC versus 5G Core Architecture
(Source: ABI Research)

	Service-Based Architecture	MEC Offloading	QoS Flow	CUPS	FMC
Key Benefits	Network programmability, customization, & openness based on service/micro-service	Offload computational-intensive tasks to nearby edges for better QoS	Service-tailored QoS management for differentiated value-added services	CUPS Centralized C-Plane & distributed U-Plane	Fixed & Mobile Convergence (FMC)
NSA EPC	Does Not Support	Limited Support	Less Flexible	Supports with Limitation	Does Not Support
5G Core	Fully Supports	Fully Supports	Fully Supports	Fully Supports	Fully Supports

Service Atomicity Gives You 5G Agility

Service "atomicity," which refers to **microservices** running in isolation from concurrent processes, is one of the greatest benefits of 5G core network architecture for CSPs. This 5G core feature translates into the ability for NFs to scale and upgrade independently of each other.

As a result of the disaggregated nature of 5G core architecture, CSPs gain greater network flexibility. For example, mobile operators can introduce upgrades and new functionalities without affecting any running services.

Benefits of CUPS in 5G Core Network Architecture

5G core fully supports **Control and User Plane Separation (CUPS)**, which is a transformative change in 5G NSA network architecture compared to EPC NSA networks. Whereas CUPS is supported in a limited capacity for 4G/LTE networks, the full potential of this architecture is realized in 5G core networks. Plus, CUPS is a necessity for 5G core in order to support use cases such as **network slicing**.

As seen with many CSPs in China, CUPS enhances resource distribution within the 5G network. The greatest value of CUPS for 5G core lies in its ability to bring cellular service closer to users. To elaborate, the functional separation with CUPS enables Control-Plane (C-Plane) workloads to be hosted centrally, while User-Plane (U-Plane) workloads can be scaled separately from the C-Plane.

Crucially, this architecture removes the requirement for network traffic to be backhauled to a central location. Accordingly, mobile service providers and end users can expect improved latency and bandwidth—each of which is key to applications like video, **connected cars**, gaming, etc.

Because 5G core network architecture is software-defined and decentralized, CSPs can accelerate the time to develop network applications and services. More than that, a convergence of CUPS and SBA allows MNOs to employ Information Technology (IT)-centric nimbleness. This architectural approach is favorable to EPC software, which is not lightweight, necessitates manual mediation, and often requires dedicated maintenance windows for latency-sensitive and high-throughput operations.

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