Cisco Control/User Plane Separation (CUPS)

Contents

Cisco Control/User Plane Separation (CUPS) enables cost-efficient scaling through geo-distribution of essential 5G network functions and services.

Product overview

As mobility becomes a more ubiquitous part of our daily lives, the behavior of the network and its associated resource demands change rapidly. Whereas earlier demands involved a relatively predictable level of control and user-plane resource requirements, the mobile network today is seeing an increased variation in resource demands across the control and user planes. Some devices are high control-plane resources (signaling), while other devices may require very little signaling resources but substantial user-plane and data resources. The introduction of EPC as part of 3GPP Release 8 in 2008 addressed this challenge with a degree of user-plane and control-plane separation. But as the mobile network has continued to evolve, the need for a further degree of control-plane and user-plane separation has become apparent.

Network factors such as increased use of mobile video, increasing average per user, and a growing amount of devices on the network (including mobile to mobile [M2M] and Internet of Things [IoT]) are clear drivers for further innovation on the separation of control and user planes. In addition, the operators that own and manage these networks are under increasing pressure to:

1. Lower CapEx and OpEx costs as traffic demand increases and average revenue per user (ARPU) does not

2. Fend off competitive threats from new and agile players, such as OTT vendors

3. Expand into new and different enterprise industries and the public sector

Finally, these operators must begin preparing for the new demands that 5G will bring, such as multi-gigabit-per-second data rates and ultra-low-latency networks. Cisco® Control/User Plane Separation (CUPS) offers the ability to truly separate and independently scale the control plane and user plane of the mobile network on an as-needed basis and in real time. Operators will now have the flexibility to specialize the user plane for different applications, without incurring an associated cost of a dedicated control plane for each application. New use cases such as remotely operated machinery, edge computing, and ultra-high, per-user throughput will now be possible. Finally, CUPS enables operators to optimize data center costs by hosting the control plane and the user plane in different geographic locations as well as save on backhaul costs by terminating data at the edge of the network.

The CUPS capability of Cisco's Ultra Services Platform (USP) involves new network elements for the control plane (SGW-C, PGW-C, and SAE-GW-C) and the user plane (SGW-U, PGW-U, and SAE-GWU), as shown in Figure 1.
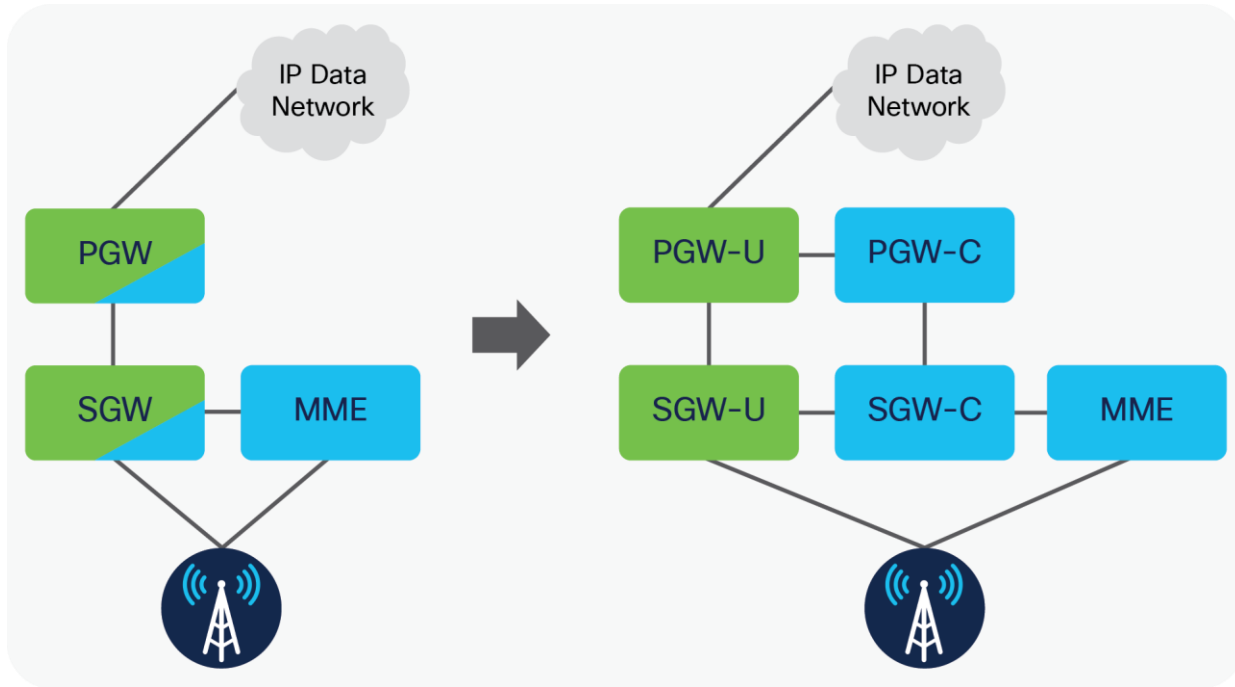

Figure 1.
Network elements supported by Cisco CUPS

In addition, Cisco recognizes that all operators are unique in the way they build and operate their networks. No two operators are alike when it comes to what they do, how they do things, and when they evolve. For this reason, Cisco offers a stepped migration in the adoption process of CUPS with three successive variations of the CUPS solution. Those variations are outlined in Table 1.

Table 1.   CUPS variations

CUPS variation	Details
Inline CUPS	• First logical separation of control- and user-plane processing • VPP-based packet processing • Feature parity with traditional model
Co-located CUPS	• Traditional serving gateway (SGW) and packet data network gateway (PGW) are now decomposed into the gateway control plane (SGW-C, PGW-C, and SAE-GW-C) and user plane (SGW-U, PGW-U, and SAE-GWU) • Control- and user-plane components are located in the same data center
Remote CUPS	• Control and user plane are deployed in geographically separate data centers

Features and benefits

Table 2.   Features and benefits

Feature	Benefit
Independent control- and user-plane scalability	Ability to independently scale control and user planes as the mobile network needs. Provides the ability to dynamically adjust the network to ever-changing demands.
User-plane specialization	CUPS offers the ability to leverage a single control plane for multiple user planes, some of which can be specialized for key applications. Lower equipment costs and operational costs result.
5G readiness	Architectural readiness for 5G provides lower implementation costs in the future.
Lower backhaul costs	Data termination at the edge of the network where appropriate brings substantial savings in backhaul costs.
Traffic offload	The architecture allows for some traffic to be directed to regional and metro caches in cases such as OTT video and certain enterprise applications, improving the overall customer experience.
New use case enablement	Ability to cater to new use cases (e.g., ultra-low-latency applications, multi-gigabit per session, and mobile edge computing) provides opportunities to increase revenue.
Multilevel CUPS offerings	Inline, co-located, remote CUPS offers successive levels of CUPS implementation, bringing maximum flexibility to match an operator's preferred pace of deployment.

Cisco is the industry leader in CUPS and virtualized mobile packet core

Service providers need to support ever-increasing demands for improved network performance and services. It is important to position virtualized network functions and services where they are most needed and can operate most efficiently. Cisco understands the role that dynamic resource allocation plays in carriers' ability to monetize their networks and deliver winning customer experiences. To compete in this rapidly changing environment, mobile operators need a solution that provides the dynamic allocation of network resources in an efficient and timely manner. The Cisco CUPS for Ultra Packet Core and Ultra Cloud Core solutions deliver this capability.

Cisco CUPS for mobile service provides supports the following capabilities and more:

- 3GPP Release 14 recommendations and has been designed to align with 5G core architectures from the inception.
- SAE-GW-C and SAE-GW-U, which aligns with 5G core network Single-Mode Fiber (SMF) and User-Plane Function (UPF) network functions.
- Inline, co-location, and remote CUPS for geo-distribution of core functions (e.g., position UPF at network edge or customer premises).
- Greater scalability, flexibility, efficiency, and resiliency with inline services for service-chaining is implemented via software-defined networking (SDN) technology.
- Improved cost savings through improved utilization of control- and user-plane functions.

Warranty information

Cisco Control/User Plane Separation offers the standard Cisco software warranty.

Cisco and Partner Services

Using the Cisco lifecycle services approach, Cisco and our partners provide a broad portfolio of end-to-end services and support that can help increase your network's business value and return on investment. This approach defines the minimum set of activities needed, by technology and by network complexity, to help you deploy and operate Cisco technologies and optimize their performance throughout the network lifecycle. For more information, please visit https://www.cisco.com/go/services.

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Learn more

Cisco Control/User Plane Separation (CUPS) in your mobile network. To learn more about Cisco CUPS and other 5G products and solutions, contact your local Cisco account team or Cisco partner. Also, please visit us at www.cisco.com/go/mobile.

To get more information about Cisco CUPS contact us or your local Cisco account team or partner.

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Document history

Table 3. Document history

New or Revised Topic	Described In	Date
Major update to Product Overview and Features/Benefits sections	Product Overview, Features/Benefits sections	July 19, 2021

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