Ultra Cloud Core 5G User Plane Function, Release 2023.04 - Release Change Reference

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About this Guide

Note   Control and User Plane Separation (CUPS) represents a significant architectural change in the way StarOS-based products are deployed in the 3G, 4G, and 5G networks. This document provides information on the features and functionality specifically supported by this 5G UPF product deployed in a 5G network. It should not be assumed that features and functionality that have been previously supported in legacy or non-CUPS products are supported by this product. References to any legacy or non-CUPS products or features are for informational purposes only. Furthermore, it should not be assumed that any constructs (including, but not limited to, commands, statistics, attributes, MIB objects, alarms, logs, services) referenced in this document imply functional parity with legacy or non-CUPS products. Please contact your Cisco Account or Support representative for any questions about parity between this product and any legacy or non-CUPS products.

Note   The documentation set for this product strives to use bias-free language. For purposes of this documentation set, bias-free is defined as language that does not imply discrimination based on age, disability, gender, racial identity, ethnic identity, sexual orientation, socioeconomic status, and intersectionality. Exceptions may be present in the documentation due to language that is hardcoded in the user interfaces of the product software, language used based on RFP documentation, or language that is used by a referenced third-party product.

This preface describes the *5G User Plane Function Guide*, how it is organized and its document conventions.

This guide describes the Cisco User Plane Function (UPF) and includes infrastructure and interfaces, feature descriptions, specification compliance, session flows, configuration instructions, and CLI commands for monitoring and troubleshooting the system.

- Conventions Used, on page iii

Conventions Used

The following tables describe the conventions used throughout this documentation.

Notice Type	Description
Information Note	Provides information about important features or instructions.

Notice Type	Description
Caution	Alerts you of potential damage to a program, device, or system.
Warning	Alerts you of potential personal injury or fatality. May also alert you of potential electrical hazards.

Typeface Conventions	Description
Text represented as a `screen display`	This typeface represents displays that appear on your terminal screen, for example: `Login:`
Text represented as **commands**	This typeface represents commands that you enter, for example: **show ip access-list** This document always gives the full form of a command in lowercase letters. Commands are not case sensitive.
Text represented as a **command** *variable*	This typeface represents a variable that is part of a command, for example: **show card** *slot_number* *slot_number* is a variable representing the desired chassis slot number.
Text represented as menu or sub-menu names	This typeface represents menus and sub-menus that you access within a software application, for example: Click the **File** menu, then click **New**

UCC 5G UPF - Release Change Reference

New in Documentation

Information on new features, enhancements, and behavior changes in the Release Change Reference (RCR) document will now be available under the **What's New in this Release** section in the 5G release notes.

> **Note** This document will be deprecated in 2024.01 and later releases.

Features and Behavior Change Quick Reference

The following table indicates the default values of features and behavior changes introduced or modified in this release.

Features/ Behavior Changes	Default	Release Introduced/Modified
Agnostic Micro Checkpoint Strings for RCM Prometheus Labels, on page 2	Enabled – Always-on	2023.04.0
Discard Reason Statistics, on page 3	Enabled – Always-on	2023.04.0
EDR Last Uplink and Last Downlink Packet Time Attributes	Disabled – Configuration Required	2023.04.0
Firewall Support, on page 5	Disabled – Configuration Required	2023.04.0
Multiple GTPU IP Addresses Support	Disabled – Configuration Required	2023.04.0
NAT Support on N4, on page 7	Disabled – Configuration Required	2023.04.0
Recalculate IE on N4 Interface, on page 9	Disabled – Configuration Required	2023.04.0
Roaming Status during Inter-PLMN Handover, on page 11	Enabled – Always-on	2023.04.0
Sending Offending IE during UPF Handover Failure, on page 11	Not Applicable	2023.04.0
Session Manager ID Check in TEID, on page 12	Enabled – Always-on	2023.04.0
Support for 18 N4/Sx Peer Nodes, on page 13	Disabled – Configuration Required	2023.04.0
TLS for X3 Traffic in UPF, on page 14	Enabled – Always-on	2023.04.0
WPS Prioritization on RCM and UPF, on page 15	Disabled – Configuration Required	2023.04.0

Agnostic Micro Checkpoint Strings for RCM Prometheus Labels

Behavior Change Summary and Revision History

Summary Data

Table 1: Summary Data

Applicable Product (s) or Functional Area	5G-UPF
Applicable Platforms	VPC-SI
Feature Default Setting	Enabled – Always-on

Related Changes in this Release	Not Applicable
Related Documentation	Not Applicable

Revision History

Revision Details	Release
First introduced.	2023.04.0

Behavior Change

The Prometheus metrics label for microcheckpoints are made agnostic to the type.

Previous Behavior: The Prometheus label string was the underlying microcheckpoint type which prevented the RCM checkpoint manager to be agnostic to the checkpoint types.

For example: UPLANE_PDR_INFO

New Behavior: The new Prometheus label strings are now agnostic strings.

For example: MicroType234

Discard Reason Statistics

Behavior Change Summary and Revision History

Summary Data

Table 2: Summary Data

Applicable Product (s) or Functional Area	5G-UPF
Applicable Platforms	VPC-SI
Feature Default Setting	Enabled – Always-on
Related Changes in this Release	Not Applicable
Related Documentation	Not Applicable

Revision History

Revision Details	Release
First introduced.	2023.04.0

Behavior Change

Previous Behavior: In the **show sx-service statistics all** CLI command, some discard reason statistics were listed under "Session Management Messages:".

New Behavior: All discard reason statistics will now be listed under "Session Rejection Stats:" in the output of the **show sx-service statistics all** CLI command.

EDR Last Uplink and Last Downlink Packet Time Attributes

Feature Summary and Revision History

Summary Data

Applicable Product(s) or Functional Area	5G-UPF
Applicable Platform(s)	VPC-SI
Feature Default Setting	Disabled – Configuration Required
Related Changes in this Release	Not Applicable
Related Documentation	*UCC 5G UPF Configuration and Administration Guide*

Revision History

Revision Details	Release
• NAT Support on the N4 interface has been added. • Subscriber Firewall support in a TCP Idle Timeout has been added. • Support added for capturing data stall issues using 2 new attributes.	2023.04.0
Support has been added for the following functionality: • IP Readdressing • RTP Dynamic Flow Detection • Rule-matching for Bearer-specific Filters • QUIC IETF implementation	2021.02.0
New L7 protocols have been introduced as part of Deep Packet Inspection (DPI).	2021.01.0

Revision Details	Release
The following EDR attributes have been added for TCP: • SYN and SYN-ACK packet • SYN-ACK and ACK packet	2021.01.0
New DNS attributes have been introduced in EDRs.	2021.01.0
First introduced.	2020.02.0

Feature Description

The EDR configuration supports two new attributes **sn-last-uplink-pkt-time** and **sn-last-downlink-pkt-time** to identify the data stall issue.

For more information, refer to the UCC 5G UPF Configuration and Administration Guide > Deep Packet Inspection and Inline Services chapter.

Firewall Support

Feature Summary and Revision History

Summary Data

Applicable Product(s) or Functional Area	5G-UPF
Applicable Platform(s)	VPC-SI
Feature Default Setting	Disabled – Configuration Required
Related Changes in this Release	Not Applicable
Related Documentation	*UCC 5G UPF Configuration and Administration Guide*

Revision History

Revision Details	Release
• NAT Support on the N4 interface has been added. • Subscriber Firewall support in a TCP Idle Timeout has been added. • Support added for capturing data stall issues using 2 new attributes.	2023.04.0

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The following EDR attributes have been added for TCP: • SYN and SYN-ACK packet • SYN-ACK and ACK packet	2021.01.0
New DNS attributes have been introduced in EDRs.	2021.01.0
First introduced.	2020.02.0

Feature Description

The Firewall feature inspects subscriber traffic performing IP session-based access control to protect subscribers from security attacks.

UPF supports the TCP Idle Timeout action to drop the subscriber flow or send reset on TCP timeout expiry.

For more information, refer to the UCC 5G UPF Configuration and Administration Guide > Deep Packet Inspection and Inline Services chapter.

Multiple GTPU IP Addresses Support

Feature Summary and Revision History

Summary Data

Table 3: Summary Data

Applicable Product(s) or Functional Area	5G-UPF
Applicable Platform(s)	VPC-SI
Feature Default Setting	Disabled – Configuration Required
Related Changes in this Release	Not Applicable

Related Documentation	*UCC 5G UPF Configuration and Administration Guide*

Revision History

Table 4: Revision History

Revision Details	Release
Added support for binding multiple GTPU IP addresses to ensure even distribution of traffic across the VPP worker threads on UPF.	2023.04.0
Added support for IP separation per interface to allow separate networks for N3 and N9 interfaces.	2023.03.0 2023.02.0
First introduced.	2020.02.0

Feature Description

UPF allows binding of multiple GTPU IP addresses to provide high uplink throughput in Private 5G deployments. UPF creates unique GTPU 3-tuple hash entries to ensure uniform distribution of ingress traffic on all VPP worker threads.

For more information, refer to the UCC 5G UPF Configuration and Administration Guide > UPF Ingress Interfaces chapter.

NAT Support on N4

Feature Summary and Revision History

Summary Data

Applicable Product(s) or Functional Area	5G-UPF
Applicable Platform(s)	VPC-SI
Feature Default Setting	Disabled – Configuration Required
Related Changes in this Release	Not Applicable
Related Documentation	*UCC 5G UPF Configuration and Administration Guide*

Revision History

Revision Details	Release
• NAT Support on the N4 interface has been added. • Subscriber Firewall support in a TCP Idle Timeout has been added. • Support added for capturing data stall issues using 2 new attributes.	2023.04.0
Support has been added for the following functionality: • IP Readdressing • RTP Dynamic Flow Detection • Rule-matching for Bearer-specific Filters • QUIC IETF implementation	2021.02.0
New L7 protocols have been introduced as part of Deep Packet Inspection (DPI).	2021.01.0
The following EDR attributes have been added for TCP: • SYN and SYN-ACK packet • SYN-ACK and ACK packet	2021.01.0
New DNS attributes have been introduced in EDRs.	2021.01.0
First introduced.	2020.02.0

Feature Description

The Network Address Translation (NAT) feature translates non-routable private IP addresses to routable public IP addresses from a pool of public IP addresses.

UPF supports NAT on the N4 interface to configure network addresses and send NAT binding records to N4. The NAT policy and IP pool for NAT public IP addresses are configured on UPF for N4.

For more information, refer to the UCC 5G UPF Configuration and Administration Guide > Deep Packet Inspection and Inline Services chapter.

Recalculate IE on N4 Interface

Feature Summary and Revision History

Summary Data

Table 5: Summary Data

Applicable Product(s) or Functional Area	5G-UPF
Applicable Platform(s)	VPC-SI
Feature Default Setting	Disabled - Configuration Required
Related Changes in this Release	Not Applicable
Related Documentation	*UCC 5G UPF Configuration and Administration Guide*

Revision History

Table 6: Revision History

Revision Details	Release
UPF supports Recalculate IE on the N4 interface for PGWCDR generation.	2023.04.0

Feature Description

UPF supports the Recalculate Measurement custom IE as received over the N4 interface. This IE is added to the Update-URR process (URR-ID: Gz-Bearer) to support the PGW-CDR generation due to the max_LOSDV change condition.

For more information, refer to the UCC 5G UPF Configuration and Administration Guide > Charging Support chapter.

Returning Correct PFCP Cause Code

Behavior Change Summary and Revision History

Summary Data

Table 7: Summary Data

Applicable Product (s) or Functional Area	5G-UPF

Applicable Platforms	VPC-SI
Feature Default Setting	Enabled – Always-on
Related Changes in this Release	Not Applicable
Related Documentation	Not Applicable

Revision History

Revision Details	Release
First introduced.	2023.04.0

Behavior Change

UP now sends the PFCP error cause code PFCP_CAUSE_NO_RESOURCE_AVAILABLE in the following failure scenarios during:

- Sx Establishment Request and Sx Modification request message processing

    - Bearer stream creation failure for Sxa

    - TEP row add failure for Sxa

    - Local local_gtpu_endpt address mismatch or unavailable

    - Above failure scenarios for N4 visited call

- PFCP_IE_QGR_INFO IE processing memory failures

- NAT rulebase change or policy change cases and failure due to

    - FW-and-NAT policy initilization failure during call setup or rulebase change

    - Invalid clp destination context

    - Memory allocation failure

- Sx Establishment or Sx Modification message processing – local GTPU TEID allocation failure

Previous Behavior: UP sent the error cause PFCP_CAUSE_REQUEST_REJECTED for the above failure scenarios.

New Behavior: UP sends the error cause PFCP_CAUSE_NO_RESOURCE_AVAILABLE instead of PFCP_CAUSE_REQUEST_REJECTED for the above failure scenarios.

Roaming Status during Inter-PLMN Handover

Behavior Change Summary and Revision History

Summary Data

Table 8: Summary Data

Applicable Product (s) or Functional Area	5G-UPF
Applicable Platforms	VPC-SI
Feature Default Setting	Enabled – Always-on
Related Changes in this Release	Not Applicable
Related Documentation	Not Applicable

Revision History

Revision Details	Release
First introduced.	2023.04.0

Behavior Change

Previous Behavior: The Old Roaming Status field in the output of the **show subscribers user-plane-only full all** command was defined for both intra-PLMN and inter-PLMN handover.

New Behavior: The Old Roaming Status field in the output of the **show subscribers user-plane-only full all** command is applicable for inter-PLMN handover only. This field will not be defined for intra-PLMN HO.

Sending Offending IE during UPF Handover Failure

Behavior Change Summary and Revision History

Summary Data

Table 9: Summary Data

Applicable Product (s) or Functional Area	5G-UPF
Applicable Platforms	VPC-SI
Feature Default Setting	Enabled – Always-on

Related Changes in this Release	Not Applicable
Related Documentation	Not Applicable

Revision History

Revision Details	Release
First introduced.	2023.04.0

Behavior Change

Previous Behavior: During an error scenario where incorrect IMSI is used due to wrong TEID for the same UPF combo call, handover used to pass.

New Behavior: If IMSI mismatches during the same UPF combo call handover, then Handover Modify Request fails with offending IE Outer Header Creation (OHC).

Customer Impact: The customer will observe handover failure in the error scenario.

Session Manager ID Check in TEID

Behavior Change Summary and Revision History

Summary Data

Table 10: Summary Data

Applicable Product (s) or Functional Area	5G-UPF
Applicable Platforms	VPC-SI
Feature Default Setting	Enabled – Always-on
Related Changes in this Release	Not Applicable
Related Documentation	Not Applicable

Revision History

Revision Details	Release
First introduced.	2023.04.0

Behavior Change

The behavior of UPF has changed in the following scenarios for a converged core call when:

- N4 and SxA are on the same UPF

- S-GW relocation is triggered where target SGW-u is same as that of source SGW-u

- SMF initiates N4 Modification to update downlink FAR with new TEID and IP

- UPF uses the TEID and finds the target Sxa session

Previous Behavior: If the Sxa session was not found, then UPF updated FAR and retained the N4 call as combo only.

New Behavior: UPF inspects SMGR-ID in TEID:

- 1. If SMGR-ID in TEID does not match, then UPF marks the N4 call as non-combo and updates FAR.

- 2. If SMGR-ID matches and the corresponding Sxa session is not present, then UPF rejects N4 Modification with cause *Mandatory IE Incorrect* and faulty IE *Outer Header Creation*.

Support for 18 N4/Sx Peer Nodes

Feature Summary and Revision History

Summary Data

Table 11: Summary Data

Applicable Product (s) or Functional Area	5G-UPF
Applicable Platforms	VPC-SI SMI
Feature Default Setting	Disabled – Configuration Required
Related Changes in this Release	Not Applicable
Related Documentation	*UCC 5G UPF Configuration and Administration Guide*

Revision History

Revision Details	Release
The number of Sx/N4 peer nodes is increased from 16 to 18.	2023.04.0
First introduced.	2021.01.0

Feature Description

A single UPF can establish multiple N4 or Sx interfaces with any number of control plane network functions such as SMF, cnSGWc, SAEGW-C, PGW-C, and SGW-C. The maximum number of supported N4/Sx peer nodes has been increased from 16 nodes to 18 nodes in this release.

For more information, refer to the UCC 5G UPF Configuration and Administration Guide > Roaming Support chapter.

TLS for X3 Traffic in UPF

Feature Summary and Revision History

Summary Data

Table 12: Summary Data

Applicable Product (s) or Functional Area	5G-UPF
Applicable Platforms	VPC-SI
Feature Default Setting	Enabled – Always-on
Related Changes in this Release	Not Applicable
Related Documentation	*UCC 5G UPF Configuration and Administration Guide*

Revision History

Revision Details	Release
First introduced.	2023.04.0

Feature Description

UPF uses TLS for protection of X3 traffic towards the mediation server (MDF).

For more information on this feature, contact your Cisco account representative.

WPS Prioritization on RCM and UPF

Feature Summary and Revision History

Summary Data

Table 13: Summary Data

Applicable Product (s) or Functional Area	5G-UPF
Applicable Platforms	VPC-SI
Feature Default Setting	Disabled – Configuration Required
Related Changes in this Release	Not Applicable
Related Documentation	*UCC 5G UPF Configuration and Administration Guide*

Revision History

Revision Details	**Release**
First introduced.	2023.04.0

Feature Description

The Wireless Priority Services (WPS) feature provides finer control for priority handling over multiple interfaces.

UPF supports WPS services based on the message priority indicated by SMF. The configured priority value set on SMF will be sent to UPF over N4 as part of the PFCP header.

For more information, refer to the UCC 5G UPF Configuration and Administration Guide > WPS Prioritization on RCM and UPF chapter.

RCM supports WPS prioritization based on the priority determined between UPF and RCM. Earlier, RCM supported up to 4 queues with precedence values of 1, 2, 3, and 0 (no precedence) to create corresponding queues with the same session priority. Now, it is extended to 5 queues with precedence values of 1, 2, 3, 4, and 0 (no precedence). The session-priority-profile configuration (UPF) maps the received session priority (0–15) to precedence values 1-4.

For more information, refer to the UCC 5G UPF Configuration and Administration Guide > WPS Prioritization on RCM chapter.