containerized Multi-Access Gateway – controller

Release 25.7

cMAG-c Overview Guide

3HE 21889 AAAA TQZZA
Edition: 01
July 2025

Nokia is committed to diversity and inclusion. We are continuously reviewing our customer documentation and consulting with standards bodies to ensure that terminology is inclusive and aligned with the industry. Our future customer documentation will be updated accordingly.

Table of contents

List of figures

1 Getting started

Find general information about this guide.

1.1 About this guide

This document provides an overview of the Nokia control and user plane separation (CUPS) solution. The Nokia containerized Multi-Access Gateway – controller (cMAG-c) functions as the control plane (CP) and has the ability to control SR OS-based user planes (UPs). The various UP functions include the broadband network gateway (BNG), the combined service gateway/packet data gateway (SGW-U/PGW-U), and the 5G user plane function (UPF).

Note: This guide generically covers content for the release specified on the title page of the guide, and may also contain some content that will be released in later maintenance loads. See the applicable *cMAG-c Release Notes* for information about features supported in each load of the software release.

1.2 Conventions

This section describes the general conventions used in this guide.

1.2.1 Precautionary and information messages

The following information symbols are used in the documentation.

DANGER: Danger warns that the described activity or situation may result in serious personal injury or death. An electric shock hazard could exist. Before you begin work on this equipment, be aware of hazards involving electrical circuitry, be familiar with networking environments, and implement accident prevention procedures.

WARNING: Warning indicates that the described activity or situation may, or will, cause equipment damage, serious performance problems, or loss of data.

Caution: Caution indicates that the described activity or situation may reduce your component or system performance.

Note: Note provides additional operational information.

Tip: Tip provides suggestions for use or best practices.

1.2.2 Options or substeps in procedures and sequential workflows

Options in a procedure or a sequential workflow are indicated by a bulleted list. In the following example, at step 1, the user must perform the described action. At step 2, the user must perform one of the listed options to complete the step.

Example: Options in a procedure

1. User must perform this step.
2. This step offers three options. User must perform one option to complete this step.
   - This is one option.
   - This is another option.
   - This is yet another option.

Substeps in a procedure or a sequential workflow are indicated by letters. In the following example, at step 1, the user must perform the described action. At step 2, the user must perform two substeps (a. and b.) to complete the step.

Example: Substeps in a procedure

1. User must perform this step.
2. User must perform all substeps to complete this action.
   a. This is one substep.
   b. This is another substep.

2 Introduction to CUPS

CUPS is an architecture that gains popularity in the mobile core. The architecture was first adopted in the 4G Long Term Evolution (LTE) mobile core and later became the standard architecture for the 5G core. In 2019, Broadband Forum (BBF) began a BNG CUPS project and subsequently standardized the BNG CUPS architecture in TR-459, TR-459.2, and TR-459.3. BBF continues to define new standardized features and solutions contributed by service providers and vendors.

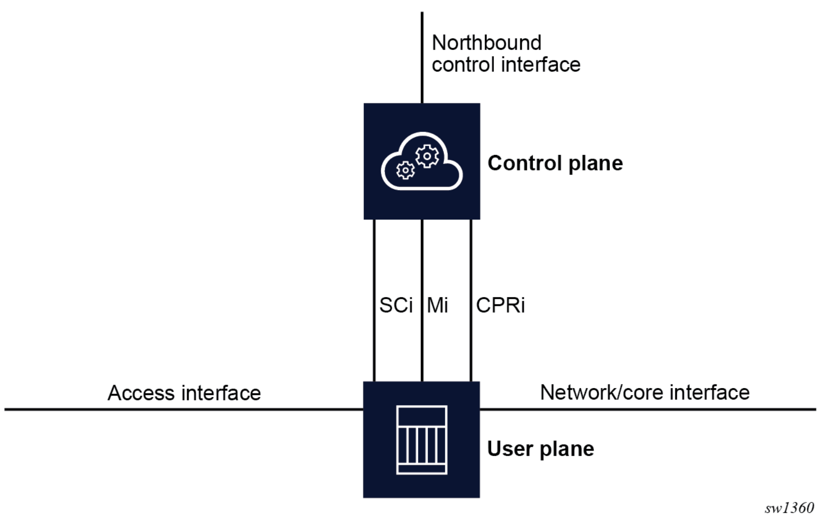
2.1 Multi-Access Gateway

Nokia offers the Multi-Access Gateway (MAG) solution with an access-agnostic core that supports both broadband wireline and fixed wireless use case. Today, the MAG solution can be deployed in a virtualized network function (VNF) environment or a cloud-native (CN) environment. The CN version of the MAG is called the containerized MAG controller (cMAG-c). The cMAG-c supports the wireline use case, as defined by BBF.

The following figure shows a high-level CUPS architecture as defined in TR-459. The interfaces between the CP and the UP are:

- state control interface (SCi)
- control packet redirect interface (CPRi)
- management interface (Mi)

Figure 1: Broadband wireline CUPS architecture



BBF defines BNG CUPS as a disaggregated BNG (DBNG) where the CP of the DBNG is known as the DBNG-CP and the UP of the DBNG is known as the DBNG-UP. The DBNG-CP in the context of this document is the Nokia cMAG-c. The following terms are used interchangeably in the industry:

- DBNG and BNG CUPS

- user plane (UP) and data plane (DP)

2.1.1 Control plane overview

The Nokia cMAG-c is equivalent to the BBF defined DBNG-CP. It provides subscriber management functions including authentication, authorization, and accounting (AAA), IP address management, and policy management. The cMAG-c has northbound control interfaces (NCIs) to communicate with external systems such as remote authentication dial-in user service (RADIUS) servers and policy services. The cMAG-c uses standard interfaces defined in TR-459 to interact with the UP like programing data traffic forwarding rules.

Note: Subscriber routing, including the IGP or BGP routing control plane, is located on the UP only. CUPS is only applicable to the subscriber management function within the UP.

2.1.2 User plane overview

The Nokia 7750 SR platforms are equivalent to the BBF defined DBNG-UP, and are also referred to as MAG-u. The UP is responsible for subscriber data traffic forwarding. The UP performs the following key functions:

- traffic management, including filtering and multicast replication
- policy enforcement, such as QoS and charging
- subscriber statistics collection

The UP installs the subscriber forwarding rules communicated by the CP through the SCi.

Note: For the CUPS architecture, the subscriber routing function, which includes the IGP and BGP routing control and packet forwarding, remains entirely on the MAG-u. The cMAG-c can install subscriber routes on the UP but is not involved in how these are exposed to the routing control function.

2.1.3 cMAG-c interfaces

The Nokia cMAG-c supports BBF defined standard CUPS interfaces.

State control interface

The state control interface (SCi) is responsible for programming subscriber data forwarding rules on the UP. The CUPS solution uses the 3GPP packet forwarding control protocol (PFCP) protocol as specified in 3GPP TS 29.244. 3GPP designed the PFCP to be fully extensible. To accommodate the broadband wireline use case, BBF extended the PFCP information elements (IEs) and published the extension in TR-459. Nokia extended the PFCP IE set to offer additional feature sets.

For wireline access, the SCi programs, at minimum, the following types of rules:

- control packet redirection rules – bidirectional rules to redirect subscriber wireline control packets, via the UP, from the residential gateway (RG) to the CP and from the CP to the RG
- subscriber data forwarding rules – bidirectional rules to forward subscriber traffic between the access interface and the network interface

Control packet redirect interface

The purpose of the control packet redirect interface (CPRi) is to tunnel the control packets of the RG that are received on the UP to the CP and from the CP to the UP and back to the RG. The tunnel encapsulation is the GPRS tunneling protocol - user plane (GTP-U) as specified in 3GPP TS 29.244. GTP-U is extended with an optional network service header (NSH) as defined in RFC 8300 to carry UP-specific metadata such as the ingress port. There are two types of CPRi tunnels:

- per-session CPRi tunnels
- common CPRi tunnels

The SCi installs each CPRi tunnel on the UP.

Note: The terms "CPRi" and "IBCP" (the Nokia in-band control plane) are used interchangeably; both indicate the same interface and function.

Management interface

The cMAG-c uses the management interface (Mi) to program the MAG-u for everything that is not related to subscriber forwarding rules. BBF TR-459 has no specifications for this interface.

3 Nokia cMAG-c CUPS solution

The cMAG-c is a containerization of the MAG-c solution and is based on cloud-native software architecture.

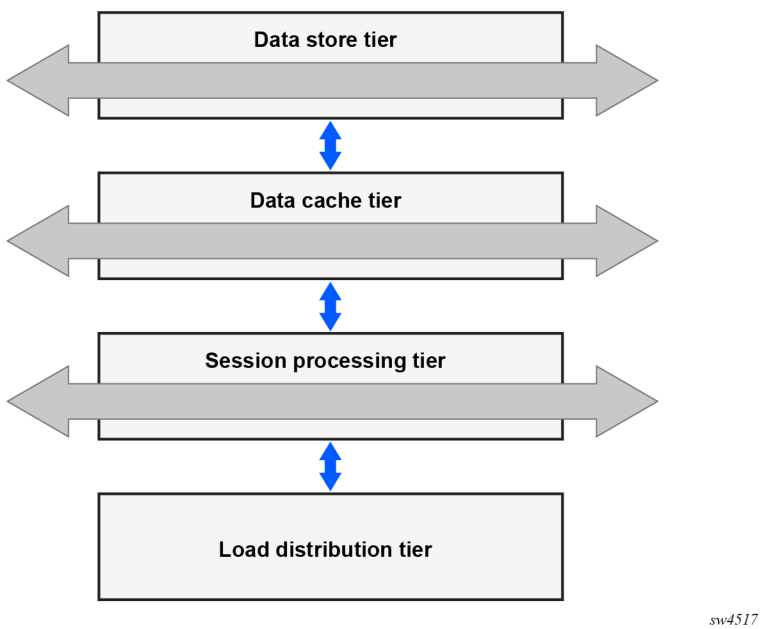
The MAG control plane applications are divided into different microservices to achieve scalability, resiliency, and flexibility. Additional benefits of cloud-native architecture allow operators to:

- monitor the consumed resources and the performance of various broadband applications
- automatic scale pods based on performance needs or resources required
- apply the cloud-native clustering technology for resiliency

3.1 cMAG-c high level architecture

The cMAG-c application is divided into 4 layers, as shown in the following figure.

Figure 2: cMAG-c high level architecture



Both the data store and data cache are responsible for storing state information and scale dynamically based on performance and subscriber scale. The data store is intended to store more permanent data such as configurations, while the data cache is for transient data such as the DHCP lease of a subscriber. The session processing tier handles processing of the subscriber session which scales according to the subscriber footprint. The load distribution tier serves as a load balancer for all incoming control messages.

For more information about the cMAG-c architecture, see the *cMAG-c Installation Guide*.

4 More information

Find references to documentation for more information about the cMAG-c.

See the *cMAG-c Guide to Documentation* or the *cMAG-c Release Notes* for a list of guides with more information about the cMAG-c installation.

Customer document and product support

Customer documentation

Customer documentation welcome page

Technical support

Product support portal

Documentation feedback

Customer documentation feedback