



MobileNext Broadband Gateway

IP Reassembly



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MobileNext Broadband Gateway IP Reassembly

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Documentation and Release Notes

To obtain the most current version of all Juniper Networks® technical documentation, see the product documentation page on the Juniper Networks website at <http://www.juniper.net/techpubs/>.

If the information in the latest release notes differs from the information in the documentation, follow the product Release Notes.

Juniper Networks Books publishes books by Juniper Networks engineers and subject matter experts. These books go beyond the technical documentation to explore the nuances of network architecture, deployment, and administration. The current list can be viewed at <http://www.juniper.net/books>.

Supported Platforms

For the features described in this document, the following platforms are supported:

- MX240 Routers
- MX960 Routers
- MX480 Routers

Documentation Conventions

Table 1 on page x defines notice icons used in this guide.

Table 1: Notice Icons

Icon	Meaning	Description
	Informational note	Indicates important features or instructions.
	Caution	Indicates a situation that might result in loss of data or hardware damage.
	Warning	Alerts you to the risk of personal injury or death.
	Laser warning	Alerts you to the risk of personal injury from a laser.

Table 2 on page x defines the text and syntax conventions used in this guide.

Table 2: Text and Syntax Conventions

Convention	Description	Examples
Bold text like this	Represents text that you type.	To enter configuration mode, type the configure command: <code>user@host> configure</code>
Fixed-width text like this	Represents output that appears on the terminal screen.	<code>user@host> show chassis alarms</code> <code>No alarms currently active</code>
<i>Italic text like this</i>	<ul style="list-style-type: none"> Introduces or emphasizes important new terms. Identifies book names. Identifies RFC and Internet draft titles. 	<ul style="list-style-type: none"> A policy <i>term</i> is a named structure that defines match conditions and actions. <i>Junos OS System Basics Configuration Guide</i> RFC 1997, <i>BGP Communities Attribute</i>
<i>Italic text like this</i>	Represents variables (options for which you substitute a value) in commands or configuration statements.	Configure the machine's domain name: <code>[edit]</code> <code>root@# set system domain-name <i>domain-name</i></code>
Text like this	Represents names of configuration statements, commands, files, and directories; configuration hierarchy levels; or labels on routing platform components.	<ul style="list-style-type: none"> To configure a stub area, include the stub statement at the <code>[edit protocols ospf area area-id]</code> hierarchy level. The console port is labeled CONSOLE.
< > (angle brackets)	Enclose optional keywords or variables.	<code>stub <default-metric <i>metric</i>>;</code>

Table 2: Text and Syntax Conventions (*continued*)

Convention	Description	Examples
(pipe symbol)	Indicates a choice between the mutually exclusive keywords or variables on either side of the symbol. The set of choices is often enclosed in parentheses for clarity.	broadcast multicast <i>(string1 string2 string3)</i>
# (pound sign)	Indicates a comment specified on the same line as the configuration statement to which it applies.	rsvp { # Required for dynamic MPLS only
[] (square brackets)	Enclose a variable for which you can substitute one or more values.	community name members [community-ids]
Indentation and braces ({ })	Identify a level in the configuration hierarchy.	[edit] routing-options { static { route default { nexthop <i>address</i> ; retain; } } }
;(semicolon)	Identifies a leaf statement at a configuration hierarchy level.	
J-Web GUI Conventions		
Bold text like this	Represents J-Web graphical user interface (GUI) items you click or select.	<ul style="list-style-type: none"> In the Logical Interfaces box, select All Interfaces. To cancel the configuration, click Cancel.
> (bold right angle bracket)	Separates levels in a hierarchy of J-Web selections.	In the configuration editor hierarchy, select Protocols>Ospf .

Documentation Feedback

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- Document or topic name
- URL or page number
- Software release version (if applicable)

Requesting Technical Support

Technical product support is available through the Juniper Networks Technical Assistance Center (JTAC). If you are a customer with an active J-Care or JNASC support contract,

or are covered under warranty, and need post-sales technical support, you can access our tools and resources online or open a case with JTAC.

- JTAC policies—For a complete understanding of our JTAC procedures and policies, review the *JTAC User Guide* located at <http://www.juniper.net/us/en/local/pdf/resource-guides/7100059-en.pdf>.
- Product warranties—For product warranty information, visit <http://www.juniper.net/support/warranty/>.
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- Find solutions and answer questions using our Knowledge Base: <http://kb.juniper.net/>
- Download the latest versions of software and review release notes: <http://www.juniper.net/customers/csc/software/>
- Search technical bulletins for relevant hardware and software notifications: <https://www.juniper.net/alerts/>
- Join and participate in the Juniper Networks Community Forum: <http://www.juniper.net/company/communities/>
- Open a case online in the CSC Case Management tool: <http://www.juniper.net/cm/>

To verify service entitlement by product serial number, use our Serial Number Entitlement (SNE) Tool: <https://tools.juniper.net/SerialNumberEntitlementSearch/>

Opening a Case with JTAC

You can open a case with JTAC on the Web or by telephone.

- Use the Case Management tool in the CSC at <http://www.juniper.net/cm/>.
- Call 1-888-314-JTAC (1-888-314-5822 toll-free in the USA, Canada, and Mexico).

For international or direct-dial options in countries without toll-free numbers, see <http://www.juniper.net/support/requesting-support.html>.

PART 1

Overview

- [IP Reassembly Overview on page 3](#)

CHAPTER 1

IP Reassembly Overview

- [IP Packet Fragment Reassembly for Mobility Overview on page 3](#)
- [Understanding Default IP Fragment Handling on page 6](#)

IP Packet Fragment Reassembly for Mobility Overview

You can configure the MobileNext Broadband Gateway so that reassembly of fragmented IP packets is carried out inline (on the Packet Forwarding Engine) instead of performing IP reassembly on the services PIC. By default, IP reassembly is carried out on the services PIC. You can change the default behavior of the gateway; whether the gateway is configured as a Serving Gateway (S-GW), Packet Data Network Gateway (P-GW), or Gateway GPRS Support Node (GGSN). Although Serving Gateway Support Nodes (SGSNs) also reassemble IP packets, the broadband gateway cannot be configured as an SGSN.

Fragmentation of IP packets for transmission and the need to reassemble the IP packets at a destination is a feature of how Layer 2 (the frame layer) and Layer 3 (the packet layer) operate. That is, the maximum size of a frame, set by the Maximum Transmission Unit (MTU) value, and the maximum size of a packet are determined independently. It is usually the case that the packet size can far exceed the MTU size. If the packet size (data plus IP and other headers) exceeds the allowable frame size (usually set by the transport medium limits), the packet must be fragmented at the sender and split across multiple frames for transmission. Frames are always processed immediately, as they arrive (if error-free), but packet fragments cannot be processed until the whole packet has been reassembled. Each packet fragment inside a frame series, except the last, has the more fragments (MF) IP header bit set, indicating that this packet is part of a whole. The last packet fragment inside a frame does not have the MF bit set and therefore ends the fragment sequence. Once all of the fragments of a packet have arrived, the entire packet is reassembled.

When memory buffers for networking were limited, heavy intervals of arriving fragmented traffic easily resulted in performance degradations or even complete “reassembly deadlock,” with buffers occupied only with fragments and no room for any arriving fragment that might complete a packet. In some cases, a packet fragment was discarded only to find that the newly arrived frame would have completed the packet just thrown away. It is clear that efficient reassembly is important for network throughput, scalability, and graceful response to congestion.

In some cases, you can avoid the need to fragment packets on a mobile network by adjusting the MTU size to account for added headers such as GTP. However, in cases where multiple vendors are used or organization lines are crossed, this MTU adjustment might not be possible and IP fragmentation is unavoidable.

Figure 1: Fragmented Packet Requiring Reassembly

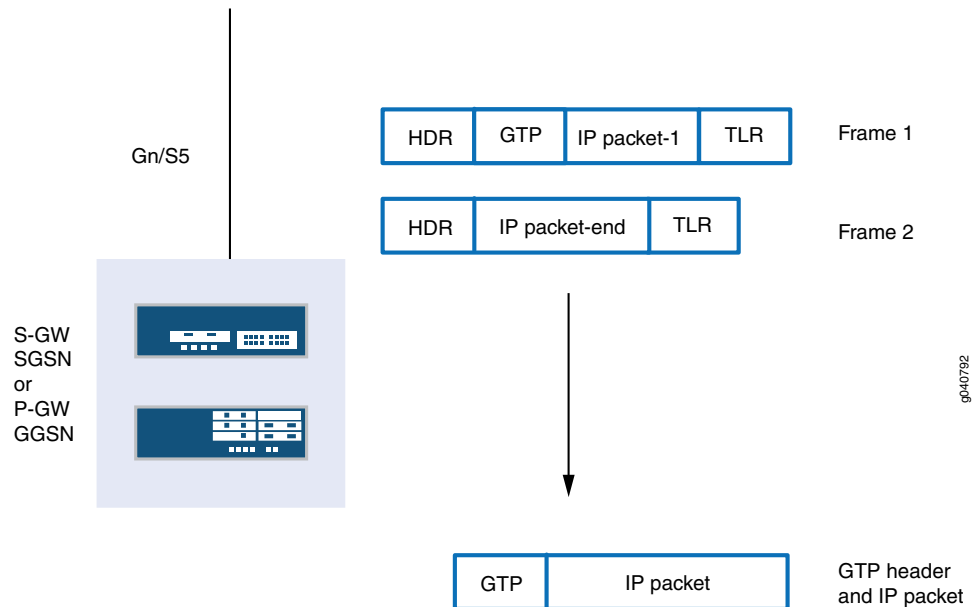
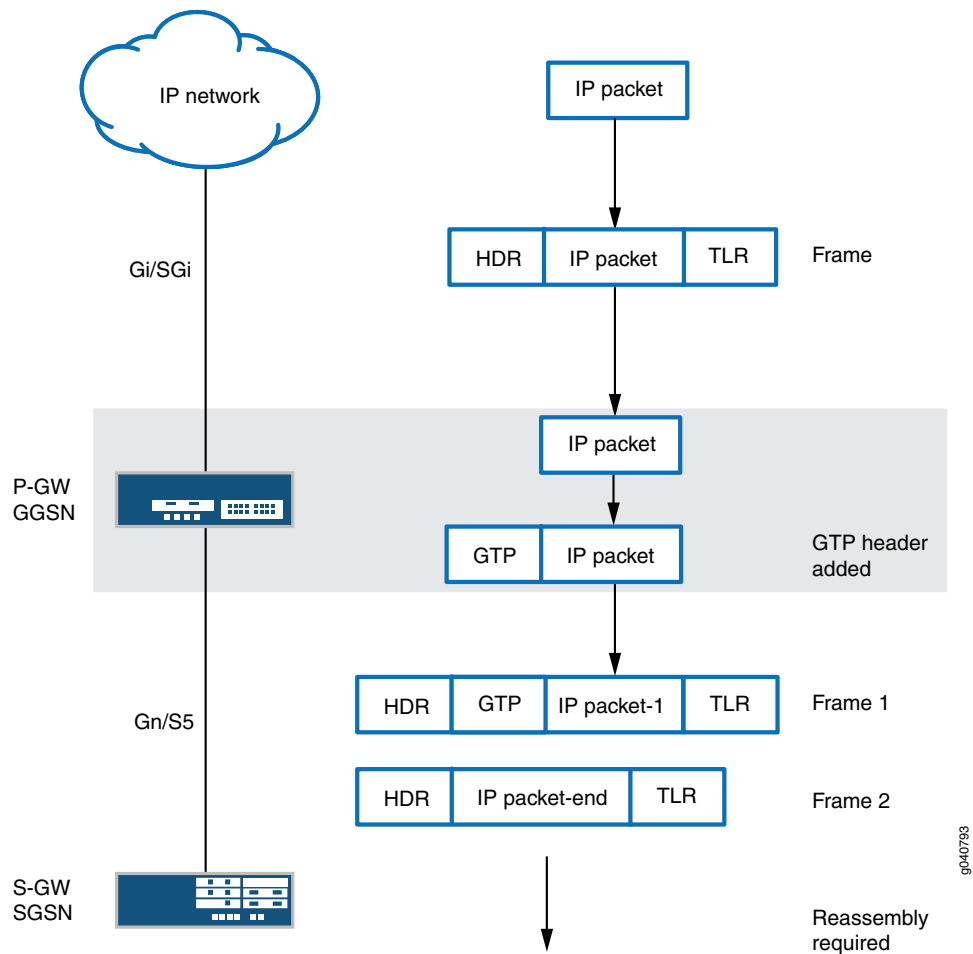


Figure 1 on page 4 shows a fragmented packet containing user data that requires reassembly on arrival on the Gn or S5 interface. On the broadband gateway, by default, IP reassembly is carried out using software on the services PIC. You can configure the broadband gateway to perform IP reassembly of fragmented IP packets inline, on the Packet Forwarding Engine, instead of software default reassembly on the services PIC. However, inline reassembly requires the dedication of Packet Forwarding Engine resources for reassembly, which means these resources cannot be used for their usual purposes. You should consider potential trade-offs before changing the default behavior of the gateway.

As shown in Figure 2 on page 5, a framed downstream packet from an IP network to a mobile device is sent over a Gi (3G) or SGi (LTE) interface to a GGSN or P-GW. At the GGSN/P-GW, the frame is processed and a 20-byte GTP-U header is added to the packet. If the packets use the most common MTU size of 1500 bytes (for network efficiency), the added 20 bytes put the data unit over the allowable 1500-byte limit ($1500 + 20 = 1520$). To send the 1520-byte packet over the Gn (3G) or S5 (LTE) interface to the SSGN or S-GW, the GGSN or P-GW must fragment the packet and distribute the 1520 bytes into two frames (1500 bytes and 20 bytes). Because frames are processed immediately as they arrive (there is no such thing as "frame 1 of 2"), the first packet fragment must be kept until the second frame is processed and completes the packet. Then the whole packet with GTP-U header can be processed, routed, and sent on downstream. This requires the SSGN or S-GW to perform the reassembly of the IP packet. Heavy traffic loads create an environment that forces the receiving node to keep track of and process many fragments at the same time.

Figure 2: A GTP-U Header Causing Fragmentation



Inline IP reassembly is enabled at the gateway level (for example, the entire P-GW or S-GW). Fragments for all IP addresses associated with the broadband gateway configured for inline reassembly are stored on the same line card as they arrive or redirected to a line card dedicated to inline reassembly based on configuration. The mobility line cards reserve 2 MB of memory for storing fragments (non-mobility line cards reserve 8 MB). When there are multiple line cards performing reassembly, the fragments are load-balanced based on a hash of the fragment's IP source address, IP identifier, and the relevant Virtual Routing and Forwarding table (VRF).

You have two options when configuring inline IP reassembly:

- Using the single **ip-reassembly** statement. However, this option does not reassemble IP fragments arriving on different Packet Forwarding Engines.
- Using a service set and related statements. This option reassembles IP fragments arriving on different Packet Forwarding Engines correctly.



.....

NOTE: If you configure *single statement* IP fragment reassembly with the `ip-reassembly` statement, then the broadband gateway does not reassemble fragments arriving on different Packet Forwarding Engines correctly. These IP fragments are stored, but cannot be reassembled and eventually time out and are dropped. The inline reassembly timeout parameter is 20 milliseconds (ms) and cannot be changed. The timeout values from 2 (default) through 60 seconds are set for an IP reassembly profile at the `[edit services ip-reassembly ip-reassembly-profile-name inline-services]` hierarchy level and apply to IP reassembly on the services PIC only.

.....

Inline IP reassembly does not preclude the use of the services PIC. The Packet Forwarding Engine could run out of memory to store fragments. In that case, new fragments that arrive are directed to the services PIC (if available) as a kind of “backup.” Once the Packet Forwarding Engine memory usage recovers, all fragments are again processed inline in the Packet Forwarding Engine. Inline reassembly enhances the performance of the broadband gateway.

It should be noted that other scenarios involve IP fragment reassembly. For instance, IPsec is often used to encapsulate GTP packets on the S1-U interfaces from eNodeB to S-GW. IPsec encapsulation often causes packet fragmentation as well.

**Related
Documentation**

- [Configuring IP Inline Reassembly for Mobility on page 11](#)
- [Example: Configuring Inline IP Packet Fragment Reassembly on page 17](#)

Understanding Default IP Fragment Handling

The MobileNext Broadband Gateway handles IP packet fragments differently than packets containing a single segment or datagram.

It is most efficient to process GPRS tunneling protocol (GTP) and IP packets immediately, as they arrive at the broadband gateway. Typically, a hardware data path is used to transfer packets to and from the anchor session Dense Port Concentrator (DPC) (for the control plane) or the interface Packet Forwarding Engine (for the data plane). However, fragmented packets require complete reassembly before processing can begin, because upper layer (Layer 4 and above) information will be missing in all but the first fragment. By default, the broadband gateway uses software on the services PIC to reassemble the fragment. You can control many of the parameters associated with the software-based fragment reassembly process.

You can configure the time interval that the anchor session DPCs wait for fragments to arrive. You can also configure the maximum number of packets that can be waiting for fragments. Both of these methods prevent the session DPCs from waiting for fragments that might never arrive.

Fragments arriving on the interface are load-balanced based on a hash of the fragment's IP source address, IP identifier, and the relevant Virtual Routing and Forwarding table (VRF) across the list of services PICs configured for that gateway.

- Gateway-1, a Packet Data Network Gateway (P-GW), has PICs 1, 3, and 4. Fragments for Gateway-1 are load-balanced across PICs 1, 3, and 4.
- Gateway-2, a Serving Gateway (S-GW), has PICs 2 and 5. Fragments for Gateway-2 are load-balanced across PICs 2 and 5.

**Related
Documentation**

- [Configuring Software-Based Fragment Reassembly Parameters on page 13](#)
- Configuring GGSN or P-GW Software Data Path Traceoptions
- Configuring S-GW Software Data Path Traceoptions
- [Example: Configuring Inline IP Packet Fragment Reassembly on page 17](#)
- Understanding the Broadband Gateway Software Data Path
- [Example: Configuring Software-Based IP Reassembly Parameters on page 15](#)

PART 2

Configuration

- [Configuration Tasks on page 11](#)
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- [Configuration Statements on page 27](#)

CHAPTER 2

Configuration Tasks

- [Configuring IP Inline Reassembly for Mobility on page 11](#)
- [Configuring Software-Based Fragment Reassembly Parameters on page 13](#)

Configuring IP Inline Reassembly for Mobility

This procedure shows how to configure the MobileNext Broadband Gateway so that reassembly of fragmented IP packets is carried out inline (on the Packet Forwarding Engine) instead of performing IP reassembly using software on the services PIC. By default, IP reassembly is carried out on the services PIC. This example changes the default behavior of the gateway; whether the gateway is configured as a Serving Gateway (S-GW), Packet Data Network Gateway (P-GW), or Gateway GPRS Support Node (GGSN). Although Serving Gateway Support Nodes (SGSNs) also reassemble IP packets, the broadband gateway cannot be configured as an SGSN.

You can either configure inline IP reassembly for a broadband gateway as a single statement (**set unified-edge gateways ggsn-pgw gateway-name inline services ip-reassembly** or **set unified-edge gateways sgw gateway-name inline services ip-reassembly**), or as part of a service set. This example configures service set inline reassembly, which handles fragments properly even when they arrive on different Packet Forwarding Engines.



NOTE: If you configure *single statement* IP fragment reassembly with the **ip-reassembly** statement, then the broadband gateway does not reassemble fragments arriving on different Packet Forwarding Engines correctly. These IP fragments are stored, but cannot be reassembled and eventually time out and are dropped. The inline reassembly timeout parameter is 20 milliseconds (ms) and cannot be changed. The timeout values from 2 (default) through 60 seconds are set for an IP reassembly profile at the [edit services ip-reassembly *ip-reassembly-profile-name* inline-services] hierarchy level and apply to IP reassembly on the services PIC only.

Before you configure inline IP reassembly, be sure you have:

- Configured the broadband gateway correctly.
- Configured a valid MTU size and GTP-U parameters.

To configure inline IP reassembly:

1. Configure the chassis-level bandwidth used by the inline services (si-) interface on the FPC and PIC slot for inline IP fragment reassembly.

```
[edit chassis]
user@host# set fpc 2 pic 1 inline-services bandwidth 10g
```



NOTE: This configuration is not unique to mobility.

2. Configure the interface-level logical unit used by the inline services (si-) interface on the FPC and PIC slot for inline IP fragment reassembly.

```
[edit interfaces]
user@host# set si-2/1/0 unit 0 family inet
user@host# set si-2/1/0 unit 0 service-domain inside
```



NOTE: This configuration is not unique to mobility. However, you must configure the family (inet) and service domain (inside) as shown.

3. Configure the IP reassembly rule (ip-reassembly-rule-1) for IP reassembly in the input match direction.

```
[edit services]
user@host# set ip-reassembly-rules rule ip-reassembly-rule-1 match-direction input
```

4. Configure the service set (ip-reassembly-set) for the IP reassembly rule in the input match direction (the local option loops the reassembled packets back to the local interface).

```
[edit services]
user@host# set service-set ip-reassembly-set ip-reassembly-rules ip-reassembly-rule-1
user@host# set service-set ip-reassembly-set next-hop-service inside-service-interface
  si-2/1/0.0
user@host# set service-set ip-reassembly-set next-hop-service
  outside-service-interface-type local
```



NOTE: You must configure both inside (si- interface) and outside type (local) service interfaces statements. This next-hop-service configuration is not unique to mobility. However, the ip-reassembly-rules statements are unique to mobility.

5. Configure the service set (ip-reassembly-set) for IP reassembly to bind to the broadband gateway at the [edit unified-edge gateways] hierarchy level.

```
[edit unified-edge gateways ggsn-pgw MBG-PGW-1]
[edit unified-edge gateways sgw MBG-SGW-2]
user@host# set inline-services ip-reassembly service-set ip-reassembly-set
```

Related Documentation

- [IP Packet Fragment Reassembly for Mobility Overview on page 3](#)

- [Understanding Default IP Fragment Handling on page 6](#)
- [Configuring GGSN or P-GW Software Data Path Traceoptions](#)
- [Configuring S-GW Software Data Path Traceoptions](#)
- [Example: Configuring Inline IP Packet Fragment Reassembly on page 17](#)
- [Example: Configuring Software-Based IP Reassembly Parameters on page 15](#)

Configuring Software-Based Fragment Reassembly Parameters

By default, on the MobileNext Broadband Gateway, anchor session Dense Port Concentrators (DPCs) reassemble arriving user plane packet fragments in order to have complete Layer 4 and above information. To prevent reassembly deadlock while waiting for fragments that never arrive, you can configure the time interval that the anchor session DPCs wait for fragments to arrive and the maximum number of packets that can be waiting for fragments.

Before you begin configuring reassembly parameters on the broadband gateway, you should have done the following:

- Configured the chassis of the broadband gateway
- Configured the interfaces of the broadband gateway
- Configured the general redundancy parameters for the broadband gateway

To determine the software-based fragment reassembly behavior, you configure the timeout and maximum packets pending fragment parameters. You can group these parameters into an IP reassembly profile. More than one IP reassembly profile can be configured and applied to a particular gateway.

To configure the reassembly parameters:

1. Configure a value for the **timeout** in the reassembly profile.

```
[edit services ip-reassembly profile reassembly-profile-one ]
user@host# set timeout 4
```



NOTE: You can set the timeout value from 2 through 60 seconds. The default value is 4 seconds.

2. Configure a value for the **max-reassembly-pending-packets** in the reassembly profile.

```
[edit services ip-reassembly profile reassembly-profile-one ]
user@host# set max-reassembly-pending-packets 1000
```



NOTE: You can set the maximum packets pending reassembly value from 100 through 100,000 packets. The default value is 1000 packets.

3. Configure the broadband gateway to use the IP reassembly profile.

```
[edit unified-edge gateways ggsn-pgw MBG1 ]  
user@host# set ip-reassembly-profile reassembly-profile-one
```



NOTE: You can configure multiple IP reassembly profiles, but apply only one to a particular broadband gateway. You can also apply the profile to an S-GW configuration.

**Related
Documentation**

- [IP Packet Fragment Reassembly for Mobility Overview on page 3](#)
- [Understanding Default IP Fragment Handling on page 6](#)
- [Configuring GGSN or P-GW Software Data Path Traceoptions](#)
- [Configuring S-GW Software Data Path Traceoptions](#)
- [Example: Configuring Inline IP Packet Fragment Reassembly on page 17](#)
- [Example: Configuring Software-Based IP Reassembly Parameters on page 15](#)

CHAPTER 3

Configuration Examples

- [Example: Configuring Software-Based IP Reassembly Parameters on page 15](#)
- [Example: Configuring Inline IP Packet Fragment Reassembly on page 17](#)

Example: Configuring Software-Based IP Reassembly Parameters

This example shows how to configure software-based IP reassembly parameters on the MobileNext Broadband Gateway. A software-based IP reassembly profile is configured.

- [Requirements on page 15](#)
- [Overview on page 15](#)
- [Configuration on page 16](#)
- [Verification on page 16](#)

Requirements

This example uses the following hardware and software components:

- An MX Series chassis equipped with session Dense Port Concentrators (DPCs) and three interface Packet Forwarding Engines (housed in DPCs or Modular Port Concentrators [MPCs]).
- Junos OS Mobility package

Before you begin:

- Install the chassis hardware.
- Configure the chassis, as well as interfaces, anchors, and (optionally) redundancy.

Overview

There are four exceptions to the general rule that user packets flow only through interface Packet Forwarding Engine hardware:

- Anchor Packet Forwarding Engine failovers (N:1)
- Reassembly of GPRS tunneling protocol, user plane (GTP-U), and mobility control plane (for instance, authentication, authorization, and accounting [AAA]) fragments

- IPv6 router advertisements and router solicitation packet handling
- GTP-U error indication generation

The first and last items have no configurable parameters. This example configures parameters for software-based IP fragment reassembly (inline IP reassembly is covered elsewhere). The software-based IP fragment reassembly parameters are configured in **reassembly-profile-one** (you can have multiple reassembly profiles) and applied to the gateway (**MBG1**). All of the statements in this example use the default values.



NOTE: Inline IP reassembly configuration, as opposed to the default mode, is covered in other topics.

Configuration

CLI Quick Configuration

The parameters for software-based IP fragment reassembly are configured by:

```
[edit services ip-reassembly profile reassembly-profile-one]
set timeout 4 # The default (seconds)
set max-reassembly-pending-packets 1000 # The default
```

```
[edit unified-edge gateways ggsn-pgw MBG1]
set ip-reassembly reassembly-profile-one # You can apply only one profile to a gateway
```

Results

From configuration mode, confirm your configuration by entering the **show** command at the various hierarchy levels. If the output does not display the intended configuration, repeat the configuration instructions in this example to correct it.

For brevity, these **show** command outputs include only the configuration that is relevant to this example.

```
show services ip-reassembly reassembly-profile-one
timeout 2;
max-reassembly-pending-packets 100;
```

```
show unified-edge gateways ggsn-pgw MBG1
ip-reassembly-profile {
  reassembly-profile-one;
}
```

After you configure the device, enter **commit** from configuration mode.

Verification

Verifying the Software-Based IP Reassembly Configuration

Purpose

Verify that software-based IP reassembly data path handling is operating.

Action

From operational mode, enter the **show unified-edge gateways ggsn-pgw ip-reassembly statistics** command.

Meaning Non-zero values indicate that reassembly is functioning.

- Related Documentation**
- [IP Packet Fragment Reassembly for Mobility Overview on page 3](#)
 - [Configuring IP Inline Reassembly for Mobility on page 11](#)
 - [Example: Configuring Inline IP Packet Fragment Reassembly on page 17](#)
 - [Understanding Default IP Fragment Handling on page 6](#)
 - [Configuring Software-Based Fragment Reassembly Parameters on page 13](#)
 - [Configuring GGSN or P-GW Software Data Path Traceoptions](#)
 - [Configuring S-GW Software Data Path Traceoptions](#)

Example: Configuring Inline IP Packet Fragment Reassembly

This example shows how to configure the MobileNext Broadband Gateway so that reassembly of fragmented IP packets is carried out inline (on the Packet Forwarding Engine) instead of performing IP reassembly on the services PIC. By default, IP reassembly is carried out on the services PIC. This example changes the default behavior of the gateway; whether the gateway is configured as a Serving Gateway (S-GW), Packet Data Network Gateway (P-GW), or Gateway GPRS Support Node (GGSN). Although Serving Gateway Support Nodes (SGSNs) also reassemble IP packets, the broadband gateway cannot be configured as an SGSN.

- [Requirements on page 17](#)
- [Overview on page 18](#)
- [Configuration on page 21](#)
- [Verification on page 24](#)
- [Troubleshooting on page 25](#)

Requirements

This example uses the following hardware and software components:

- A supported MX Series chassis configured with supported line cards and a services PIC.
- A supported and properly installed version of 64-bit Junos OS and the **jmobile** software package.
- Correct configuration as a P-GW, S-GW, or GGSN with corresponding interfaces.

Before you configure inline IP reassembly, be sure you have:

- Configured the broadband gateway correctly.
- Configured a valid MTU size and GTP-U parameters.

Overview

Fragmentation of IP packets for transmission and the need to reassemble the IP packets at a destination is a feature of how Layer 2 (the frame layer) and Layer 3 (the packet layer) operate. That is, the maximum size of a frame, set by the Maximum Transmission Unit (MTU) value, and the maximum size of a packet are determined independently. It is usually the case that the packet size can far exceed the MTU size. If the packet size (data plus IP and other headers) exceeds the allowable frame size (usually set by the transport medium limits), the packet must be fragmented at the sender and split across multiple frames for transmission. Frames are always processed immediately, as they arrive (if error-free), but packet fragments cannot be processed until the whole packet has been reassembled. Each packet fragment inside a frame series, except the last, has the more fragments (MF) IP header bit set, indicating that this packet is part of a whole. The last packet fragment inside a frame does not have the MF bit set and therefore ends the fragment sequence. Once all of the fragments of a packet have arrived, the entire packet are reassembled.

When memory buffers for networking were limited, heavy intervals of arriving fragmented traffic easily resulted in performance degradations or even complete “reassembly deadlock,” with buffers occupied only with fragments and no room for any arriving fragment that might complete a packet. In some cases, a packet fragment was discarded only to find that the newly arrived frame would have completed the packet just thrown away. It is clear that efficient reassembly is important for network throughput, scalability, and graceful response to congestion.

In some cases, you can avoid the need to fragment packets on a mobile network by adjusting the MTU size to account for added headers such as GTP. However, in cases where multiple vendors are used or organization lines are crossed, this MTU adjustment might not be possible and IP fragmentation is unavoidable.

Figure 3: Fragmented Packet Requiring Reassembly

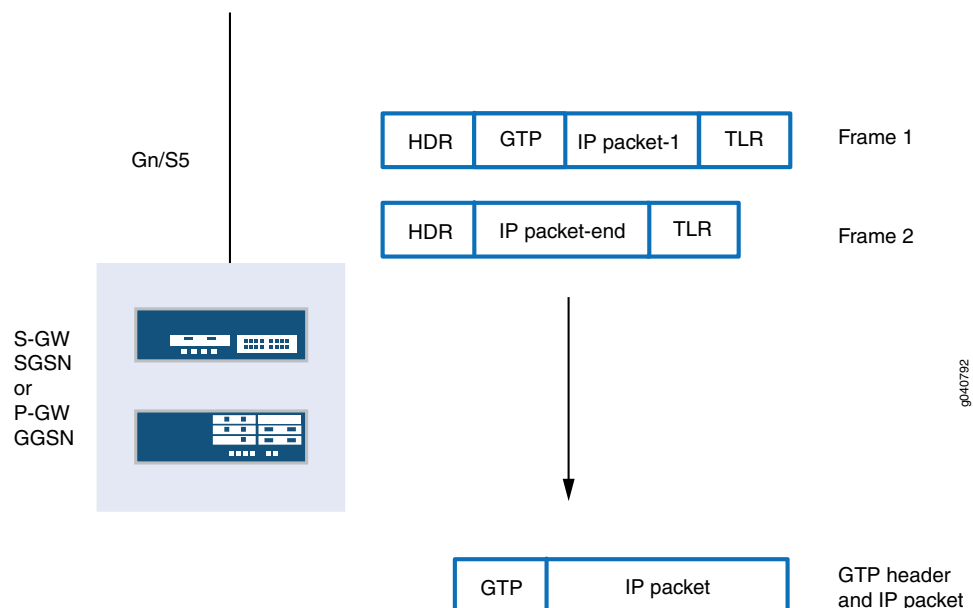
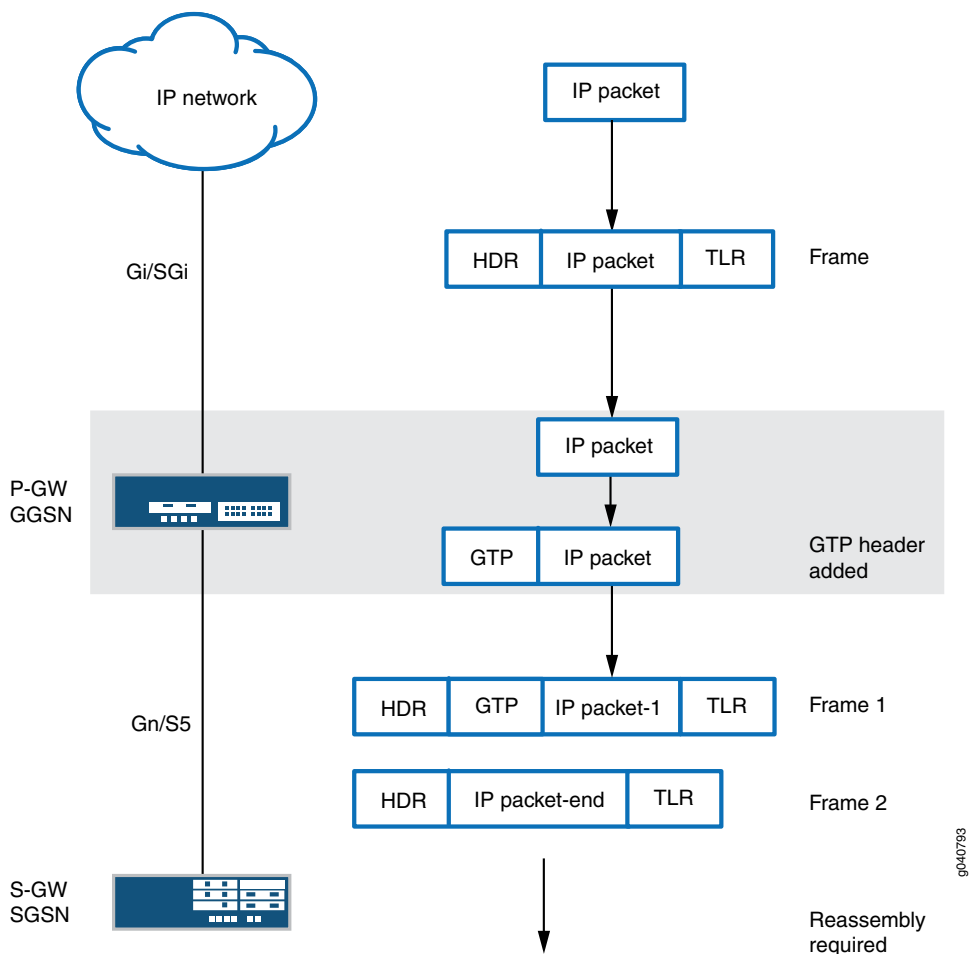


Figure 3 on page 18 shows a fragmented packet containing user data that requires reassembly on arrival on the Gn or S5 interface. On the broadband gateway, IP reassembly is carried out on the services PIC by default. This example configures the broadband gateway to perform IP reassembly of fragmented IP packets inline, on the Packet Forwarding Engine. However, inline reassembly requires the dedication of Packet Forwarding Engine resources for reassembly, which means these resources cannot be used for their usual purposes. You should consider potential trade-offs before changing the default behavior of the gateway.

Topology

The topology for this inline reassembly example consists of two mobile network nodes, the interfaces connecting them to each other, and an IP network such as the Internet. As shown in Figure 4 on page 20, a framed downstream packet from an IP network to mobile device is sent over a Gi (3G) or SGi (LTE) interface to a GGSN or P-GW. At the GGSN/P-GW, the frame is processed and a 20-byte GTP-U header is added to the packet. If the packets use the most common MTU size of 1500 bytes (for network efficiency), the added 20 bytes put the data unit over the allowable 1500-byte limit ($1500 + 20 = 1520$). To send the 1520-byte packet over the Gn (3G) or S5 (LTE) interface to the SSGN or S-GW, the GGSN or P-GW must fragment the packet and distribute the 1520 bytes into two frames (1500 bytes and 20 bytes). Because frames are processed immediately as they arrive (there is no such thing as “frame 1 of 2”), the first packet fragment must be kept until the second frame is processed and completes the packet. Then the whole packet with GTP-U header can be processed, routed, and sent on downstream. This requires the SSGN or S-GW to perform the reassembly of the IP packet. Heavy traffic loads create an environment that forces the receiving node to keep track of and process many fragments at the same time.

Figure 4: A GTP-U Header Causing Fragmentation



Inline IP reassembly is enabled at the gateway level (for example, the entire P-GW or S-GW). Fragments for all IP addresses associated with the broadband gateway configured for inline reassembly are stored on the same line card as they arrive or redirected to a line card dedicated to inline reassembly based on configuration. The mobility line cards reserve 2 MB of memory for storing fragments (non-mobility line cards reserve 8 MB). When there are multiple line cards performing reassembly, the fragments are load-balanced based on a hash of the fragment's IP source address, IP identifier, and the relevant Virtual Routing and Forwarding table (VRF).



NOTE: If you configure *single statement* IP fragment reassembly with the `ip-reassembly` statement, then the broadband gateway does not reassemble fragments arriving on different Packet Forwarding Engines correctly. These IP fragments are stored, but cannot be reassembled and eventually time out and are dropped. The inline reassembly timeout parameter is 20 milliseconds (ms) and cannot be changed. The timeout values from 2 (default) through 60 seconds are set for an IP reassembly profile at the [edit services ip-reassembly *ip-reassembly-profile-name* inline-services] hierarchy level and apply to IP reassembly on the services PIC only.

Inline IP reassembly does not preclude the use of the services PIC. The Packet Forwarding Engine could run out of memory to store fragments. In that case, new fragments that arrive are directed to the services PIC (if available) as a kind of “backup.” Once the Packet Forwarding Engine memory usage recovers, all fragments are again processed inline in the Packet Forwarding Engine.

It should be noted that other topologies could have been used for this example. For instance, IPsec is often used to encapsulate GTP packets on the S1-U interfaces from eNodeB to S-GW. IPsec encapsulation often causes packet fragmentation as well.

Configuration

To configure inline IP reassembly on a Service Gateway (S-GW), perform these tasks:

- [Configuring Inline IP Reassembly on page 21](#)
- [Results on page 23](#)

CLI Quick Configuration

```
set chassis fpc 2 pic 1 inline-services bandwidth 10g
set interfaces si-2/1/0 unit 0 family inet
set interfaces si-2/1/0 unit 0 service-domain inside
set services ip-reassembly-rules ip-reassembly-rule-1
set services service-set ip-reassembly-set rule ip-reassembly-rules ip-reassembly-rule-1
set services service-set ip-reassembly-set next-hop-service inside-service-interface
  si-2/1/0.0
set services service-set ip-reassembly-set next-hop-service outside-service-interface-type
  local
set unified-edge gateways sgw SGW1 inline-services ip-reassembly service-set
  ip-reassembly-set
```



NOTE: You can also configure inline IP reassembly on a GGSN or P-GW.

Configuring Inline IP Reassembly

Step-by-Step Procedure

To configure inline IP reassembly:

1. Configure the chassis-level bandwidth used by the inline services (`si-`) interface on the FPC and PIC slot for inline IP fragment reassembly.
[edit chassis]

```
user@host# set fpc 2 pic 1 inline-services bandwidth 10g
```



NOTE: This configuration is not unique to mobility.

2. Configure the interface-level logical unit used by the inline services (**si-**) interface on the FPC and PIC slot for inline IP fragment reassembly.

```
[edit interfaces]
```

```
user@host# set si-2/1/0 unit 0 family inet
```

```
user@host# set si-2/1/0 unit 0 service-domain inside
```



NOTE: This configuration is not unique to mobility. However, you must configure the family (**inet**) and service domain (**inside**) as shown.

3. Configure the IP reassembly rule (**ip-reassembly-rule-1**) for IP reassembly in the **input** match direction.

```
[edit services]
```

```
user@host# set ip-reassembly-rules rule ip-reassembly-rule-1 match-direction input
```

4. Configure the service set (**ip-reassembly-set**) for IP reassembly in the input match direction (the **local** option loops the reassembled packets back to the local interface).

```
[edit services]
```

```
user@host# set service-set ip-reassembly-set reassembly-rules ip-reassembly-rule
```

```
user@host# set service-set ip-reassembly-set next-hop-service
```

```
inside-service-interface si-2/1/0.0
```

```
user@host# set service-set ip-reassembly-set next-hop-service
```

```
outside-service-interface-type local
```



NOTE: You must configure both inside (**si-** interface) and outside type (**local**) service interfaces statements. This **next-hop-service** configuration is not unique to mobility. However, the **reassembly-rules** statements are unique to mobility. The reassembly rule is not formulated outside of the service set: this statement simply initiates the reassembly process.

5. Configure the service set (**ip-reassembly-set**) for IP reassembly to bind to the broadband gateway at the **[edit unified-edge gateways sgw MBG-SGW-2]** hierarchy level.

```
[edit unified-edge gateways sgw MBG-SGW-2]
```

```
user@host# set inline-services ip-reassembly service-set ip-reassembly-set
```

Results

From configuration mode, confirm your configuration by entering the **show** command at the various hierarchy levels. If the output does not display the intended configuration, repeat the configuration instructions in this example to correct it.

For brevity, these **show** command outputs include only the configuration that is relevant to this example.

```
[edit chassis]
fpc 2 {
  pic 1 {
    inline-services {
      bandwidth 10g;
    }
  }
}

[edit interfaces]
si-2/1/0 {
  unit 0 {
    family inet;
    service-domain inside;
  }
}

[edit services]
ip-reassembly {
  rule ip-reassembly-rule-1 {
    match-direction input;
  }
}
service-set ip-reassembly-set {
  reassembly-rules {
    ip-reassembly-rule;
  }
  next-hop-service {
    inside-service-interface si-2/1/0.0;
    outside-service-interface-type local;
  }
}

[edit unified-edge gateways sgw MBG-SGW-2]
inline-services {
  ip-reassembly service-set ip-reassembly-set;
}
```

Verification

Verifying Inline IP Reassembly Configuration

Purpose Verify that the Packet Forwarding Engine of the Gn or S5 or S8 interfaces associated with the broadband gateway where fragments are arriving have non-zero fragment counters for the interfaces and the interfaces have successfully reassembled packets.

Action From operational mode, enter the **show services inline ip-reassembly statistics** command.

```
user@SGW-2# show services inline ip-reassembly statistics
FPC: 2
```

```
=====
```

	Total	Current Rate
Total Fragments Received	1004681374	6213217
First Fragments	502335971	3106615
Intermediate Fragments	0	0
Last Fragments	502345403	3106602
Total Packets Successfully Reassembled	71135257	432439
Approximate Packets Pending Reassembly	2408	
Fragments Dropped Reasons	1404714	7700
Buffers not available	0	0
Fragments per packet exceeded	0	0
Packet length exceeded	0	0
Record insert error	0	0
Record in use error	1404714	7700
Duplicate first fragments	0	0
Duplicate last fragments	0	0
Missing first fragment	0	0
Reassembly Errors Reasons	0	0
Fragment not found	0	0
Fragment not in sequence	0	0
ASIC errors	0	0
Aged out packets	6147008	37279
Total Fragments Successfully Reassembled	142270514	864878
Total Fragments Dropped	7551722	44979
Buffers not available	0	0
Fragments per packet exceeded	0	0
Packet length exceeded	0	0
Record insert error	0	0
Record in use error	1404714	7700
Duplicate first fragments	0	0
Duplicate last fragments	0	0
Missing first fragment	0	0
Fragment not found	0	0
Fragment not in sequence	0	0
ASIC errors	0	0
Aged out fragments	6147008	37279
Total fragments punted to UPIC	854858289	5303865

Meaning The output associated with FPC 2 (in this case) displays non-zero values for packet fragments and successfully reassembled packets. Errors and dropped fragments are minimal.

Troubleshooting

To troubleshoot inline IP reassembly, perform these tasks:

- [Troubleshooting Non-Incrementing Counters on page 25](#)
- [Troubleshooting Zero Successfully Reassembled Packets on page 25](#)

Troubleshooting Non-Incrementing Counters

Problem The total fragment received counter and current rate fields are not incrementing.

Solution There are no fragments arriving for the gateway, or the inline reassembly statement is set for the wrong gateway.

Troubleshooting Zero Successfully Reassembled Packets

Problem The counters show zero value for successfully reassembled packets.

Solution Examine the reasons for fragment errors and dropped fragments in the **show services inline ip-reassembly statistics** command output. This is usually sufficient to determine the solution to the issue.

- Related Documentation**
- [IP Packet Fragment Reassembly for Mobility Overview on page 3](#)
 - [Configuring IP Inline Reassembly for Mobility on page 11](#)
 - [Example: Configuring Software-Based IP Reassembly Parameters on page 15](#)

CHAPTER 4

Configuration Statements

- [\[edit services ip-reassembly\] Hierarchy Level on page 27](#)
- [\[edit unified-edge gateways\] Hierarchy Level on page 27](#)
- [\[edit services service-set\] Hierarchy Level on page 27](#)

[\[edit services ip-reassembly\] Hierarchy Level](#)

```
ip-reassembly {  
  profile profile-name {  
    max-reassembly-pending-packets number;  
    timeout in-seconds;  
  }  
  rule <rule-name> {  
    match-direction direction;  
  }  
}
```

Related Documentation

- [Notational Conventions Used in Junos OS Configuration Hierarchies](#)

[\[edit unified-edge gateways\] Hierarchy Level](#)

Each of the following topics lists the statements at a sub-hierarchy of the **[edit unified-edge gateways]** hierarchy.

- [\[edit unified-edge gateways ggsn-pgw <gateway-name>\] Hierarchy Level](#)
- [\[edit unified-edge gateways sgw <gateway-name>\] Hierarchy Level](#)

Related Documentation

- [\[edit unified-edge\] Hierarchy Level](#)
- [Notational Conventions Used in Junos OS Configuration Hierarchies](#)

[\[edit services service-set\] Hierarchy Level](#)


```
service-set service-set-name {  
  interface-service {  
    load-balancing-options {  
      hash-keys {
```

```
        egress-key (destination-ip | source-ip);
        ingress-key (destination-ip | source-ip);
        resource-triggered;
    }
}
service-interface interface-name.unit-number;
}
ip-reassembly-rules {
    [rule-name];
}
next-hop-service {
    inside-service-interface interface-name.unit-number;
    outside-service-interface interface-name.unit-number;
    outside-service-interface-type interface-type;
    service-interface-pool name;
}
[pcef-profile profile-name];
[tag-rule-sets rule-set-name];
[tag-rules rule-name];
service-set-options {
    subscriber-awareness;
}
}
```

**Related
Documentation**

- [Notational Conventions Used in Junos OS Configuration Hierarchies](#)

inline-services (IP Reassembly)

Syntax	<pre> inline-services { ip-reassembly { service-set { service-set-name; } } } </pre>
Hierarchy Level	[edit unified-edge gateways ggsn-pgw <i>gateway-name</i>], [edit unified-edge gateways sgw <i>gateway-name</i>]
Release Information	Statement introduced in Junos OS Mobility Release 11.4W.
Description	<p>Configure inline services for the broadband gateway. Currently, IP reassembly is the only inline service supported.</p> <p>When fragments arrive at the gateway for reassembly, they can be reassembled inline in the hardware (inline IP reassembly), or using software on the services PIC (software reassembly). The ip-reassembly statement lets you specify that fragments should be reassembled inline, and the service-set statement lets you specify that fragments should be reassembled inline as part of a service set.</p> <p>When you configure inline IP reassembly with a service set, the broadband gateway handles fragments properly even when they arrive on different Packet Forwarding Engines.</p>
	<div>  <p>NOTE:</p> <ul style="list-style-type: none"> • Inline IP reassembly can only be carried out on Trio-based FPCs. • When you enable inline IP reassembly based on the service set configuration, then packets are not sent to the backup user plane PIC when the memory threshold is reached. Instead, these packets are dropped. However, if inline IP reassembly is configured without the service set, then the packets are sent to the backup user plane PIC when the low memory threshold is reached. <p>In the current release, the Total fragments punted to UPIC counter in the output of the show services inline ip-reassembly statistics interface counts dropped packets even if inline IP reassembly is carried out based on the service set configuration.</p> </div>
	<p>The remaining statement is explained separately.</p>
Required Privilege Level	unified-edge—To view this statement in the configuration. unified-edge-control—To add this statement to the configuration.
Related Documentation	<ul style="list-style-type: none"> • [edit unified-edge gateways ggsn-pgw <gateway-name>] Hierarchy Level

- [\[edit unified-edge gateways sgw <gateway-name>\] Hierarchy Level](#)
- [Configuring IP Inline Reassembly for Mobility on page 11](#)
- [Example: Configuring Inline IP Packet Fragment Reassembly on page 17](#)
- [IP Packet Fragment Reassembly for Mobility Overview on page 3](#)

ip-reassembly

Syntax

```
ip-reassembly {  
  profile profile-name {  
    max-reassembly-pending-packets number;  
    timeout in-seconds;  
  }  
  rule <rule-name> {  
    match-direction direction;  
  }  
}
```

Hierarchy Level [edit services]

Release Information Statement introduced in Junos OS Mobility Release 11.2W.

Description Configure the IP reassembly parameters to be applied to the broadband gateway.



.....

NOTE: The configuration in the `profile` statement is applicable only to IP reassembly on the services PIC.

.....


The remaining statements are explained separately.

Required Privilege Level interface—To view this statement in the configuration.
interface-control—To add this statement to the configuration.


Related Documentation

- [\[edit services ip-reassembly\] Hierarchy Level on page 27](#)
- [Configuring IP Inline Reassembly for Mobility on page 11](#)
- [Configuring Software-Based Fragment Reassembly Parameters on page 13](#)
- [Example: Configuring IPv6 Router Advertisement Parameters](#)
- [Example: Configuring Inline IP Packet Fragment Reassembly on page 17](#)

ip-reassembly (Inline Services)

Syntax	<pre>ip-reassembly { service-set { service-set-name; } }</pre>
Hierarchy Level	[edit unified-edge gateways ggsn-pgw <i>gateway-name</i> inline-services], [edit unified-edge gateways sgw <i>gateway-name</i> inline-services]
Release Information	Statement introduced in Junos OS Mobility Release 11.4W.
Description	<p>Specify that the reassembly of fragmented IP packets should be carried out inline, on the Packet Forwarding Engine.</p> <p>When fragments arrive at the gateway for reassembly, they can be reassembled inline in the hardware (inline IP reassembly), or using software on the services PIC (software reassembly). If you do not include this statement, then, by default, IP reassembly is carried out on the services PIC for all gateways.</p> <p>Inline IP reassembly can also be carried out on the inline services (si-) interface, using a service set. This method handles fragments properly even when they arrive on different Packet Forwarding Engines.</p>
<div>  <p>NOTE: Inline IP reassembly can only be carried out on Trio-based FPCs.</p> </div>	
Required Privilege Level	unified-edge—To view this statement in the configuration. unified-edge-control—To add this statement to the configuration.
Related Documentation	<ul style="list-style-type: none"> • Configuring IP Inline Reassembly for Mobility on page 11 • Example: Configuring Inline IP Packet Fragment Reassembly on page 17 • inline-services (IP Reassembly) on page 29 • IP Packet Fragment Reassembly for Mobility Overview on page 3

ip-reassembly-profile

Syntax	ip-reassembly-profile { <i>profile-name</i> ; }
Hierarchy Level	[edit unified-edge gateways ggsn-pgw <i>gateway-name</i>], [edit unified-edge gateways sgw <i>gateway-name</i>]
Release Information	Statement introduced in Junos OS Mobility Release 11.2W. Support at the [edit unified-edge gateways sgw <i>gateway-name</i>] hierarchy level introduced in Junos OS Mobility Release 11.4W.
Description	Apply a previously configured IP reassembly profile to the broadband gateway.
	<div> NOTE: Currently, only one IP reassembly profile is allowed for the broadband gateway.</div>
Options	<i>profile-name</i> —Name of the IP reassembly profile to be applied.
Required Privilege Level	unified-edge—To view this statement in the configuration. unified-edge-control—To add this statement to the configuration.
Related Documentation	<ul style="list-style-type: none">• [edit unified-edge gateways ggsn-pgw <gateway-name>] Hierarchy Level• [edit unified-edge gateways sgw <gateway-name>] Hierarchy Level• Configuring Software-Based Fragment Reassembly Parameters on page 13• Example: Configuring IPv6 Router Advertisement Parameters

ip-reassembly-rules (Service Set)

Syntax	<code>ip-reassembly-rules { [rule-name]; }</code>
Hierarchy Level	<code>[edit services service-set service-set-name]</code>
Release Information	Statement introduced in Junos OS Mobility Release 12.1W.
Description	Specify one or more previously configured IP reassembly rules to associate with the service set.



NOTE: The IP reassembly rule must be defined at the `[edit services ip-reassembly rule]` hierarchy level.

Required Privilege Level	interface—To view this statement in the configuration. interface-control—To add this statement to the configuration.
Related Documentation	<ul style="list-style-type: none"> • Configuring IP Inline Reassembly for Mobility on page 11 • Example: Configuring Inline IP Packet Fragment Reassembly on page 17 • service-set (Aggregated Multiservices)

match-direction (IP Reassembly Rule)

Syntax	<code>match-direction <match-direction-name> {</code>
Hierarchy Level	<code>[edit services ip-reassembly]</code>
Release Information	Statement introduced in Junos OS Mobility Release 12.1W.
Description	Configure the direction in which the IP reassembly rule matching is applied. The match direction is used with respect to the traffic flow through the inline services interface. You must configure a match direction for an IP reassembly rule.
Options	<i>direction</i> —Match direction. For inline IP reassembly, input is the only match direction supported.
Required Privilege Level	interface—To view this statement in the configuration. interface-control—To add this statement to the configuration.
Related Documentation	<ul style="list-style-type: none"> • Configuring IP Inline Reassembly for Mobility on page 11 • Example: Configuring Inline IP Packet Fragment Reassembly on page 17 • rule (IP Reassembly) on page 38

max-reassembly-pending-packets (IP Reassembly)

Syntax	max-reassembly-pending-packets <i>number</i> ;
Hierarchy Level	[edit services ip-reassembly profile <i>profile-name</i>]
Release Information	Statement introduced in Junos OS Mobility Release 11.2W.
Description	Configure the maximum number of IPv4 packets pending reassembly that is allowed in each services PIC that belongs to the broadband gateway.
Options	<i>number</i> —Maximum number of packets pending reassembly allowed in each services PIC. Range: 100 through 10,000 Default: 1000
Required Privilege Level	interface—To view this statement in the configuration. interface-control—To add this statement to the configuration.
Related Documentation	<ul style="list-style-type: none">• Configuring Software-Based Fragment Reassembly Parameters on page 13• Example: Configuring IPv6 Router Advertisement Parameters• profile (IP Reassembly) on page 37

next-hop-service (Service Set)

Syntax	<pre> next-hop-service { inside-service-interface <i>interface-name.unit-number</i>; outside-service-interface <i>interface-name.unit-number</i>; outside-service-interface-type <i>interface-type</i>; service-interface-pool <i>name</i>; } </pre>
Hierarchy Level	[edit services service-set <i>service-set-name</i>]
Release Information	<p>Statement introduced before Junos OS Release 7.4.</p> <p>service-interface-pool option added in Junos OS Release 9.3.</p> <p>outside-service-interface-type option added in Junos OS Mobility Release 12.1W.</p>
Description	Specify the interface names for the inside and outside services interfaces, the interface type for the outside interface, or the service interface pool for the forwarding next-hop service set. You cannot specify both a service interface pool and an inside or outside interface.



NOTE: The line cards present in the broadband gateway chassis can have either two Packet Forwarding Engines or four Packet Forwarding Engines (16x10GE MPC) on each FPC. For each FPC, you can configure four inline services interfaces (si-ifds). Therefore, two inline services interfaces map to one Packet Forwarding Engine on each FPC, or one inline services interface maps to one Packet Forwarding Engine on each FPC. Since the net throughput for the inline IP reassembly per Packet Forwarding Engine is constant, we recommend that you configure only one inline services interface per Packet Forwarding Engine to support inline IP reassembly.

For more information on the performance of the line cards, contact the Juniper Networks Technical Assistance Center (JTAC).

Options **inside-service-interface *interface-name.unit-number***—Name and logical unit number of the service interface associated with the service set applied inside the network.



NOTE: When you configure inline IP reassembly based on a service set, you must specify the inline services interface (si-) using the **inside-service-interface** statement.

In addition, the interface-level logical unit (**unit 0**) used by the inline services interface must have family **inet** and service-domain **inside** configured at the [edit interfaces] hierarchy level.

outside-service-interface *interface-name.unit-number*—Name and logical unit number of the service interface associated with the service set applied outside the network.



NOTE: When you configure inline IP reassembly based on a service set, you do not have to include the **outside-service-interface** statement.

outside-service-interface-type *interface-type*—Type of outside service interface associated with the next-hop service. Currently, **local** is the only interface type supported.



NOTE: You include the **outside-service-interface-type** statement only when you configure inline IP reassembly based a service set. After the IP reassembly is completed, the packet is looped back on the routing instance.

service-interface-pool *name*—Name of the pool of logical interfaces configured at the **[edit services service-interface-pools pool *pool-name*]** hierarchy level. You can configure a service interface pool only if the service set has a PGCP rule configured. The service set cannot contain any other type of rule.



NOTE: When you configure inline IP reassembly based on a service set, you do not have to include the **service-interface-pool** statement.

Required Privilege Level	interface—To view this statement in the configuration. interface-control—To add this statement to the configuration.
Related Documentation	<ul style="list-style-type: none"> • Configuring IP Inline Reassembly for Mobility on page 11 • Example: Configuring Inline IP Packet Fragment Reassembly on page 17 • service-set (Aggregated Multiservices)

profile (IP Reassembly)

Syntax `profile profile-name {
 max-reassembly-pending-packets number;
 timeout in-seconds;
 }`

Hierarchy Level [edit services ip-reassembly]

Release Information Statement introduced in Junos OS Mobility Release 11.4W.

Description Configure an IP reassembly profile to be applied to the broadband gateway.

The remaining statements are explained separately.

Options *profile-name*—Name of the IP reassembly profile.



NOTE: To create more than one IP reassembly profile, include the *profile* statement multiple times.



Range: 1 through 32 characters

Required Privilege Level interface—To view this statement in the configuration.
 interface-control—To add this statement to the configuration.



Related Documentation

- [Configuring Software-Based Fragment Reassembly Parameters on page 13](#)
- [Example: Configuring IPv6 Router Advertisement Parameters](#)
- [ip-reassembly on page 30](#)

rule (IP Reassembly)

Syntax	rule <rule-name> { match-direction direction; }
Hierarchy Level	[edit services ip-reassembly]
Release Information	Statement introduced in Junos OS Mobility Release 12.1W.
Description	<p>Configure an IP reassembly rule, which is used for inline IP reassembly on the inline services (si-) interface. The IP reassembly rule can be attached to a service set to indicate that the service set is of type IP reassembly. For inline IP reassembly, each rule must include the match-direction statement, which specifies the direction in which the match is applied.</p> <p>The remaining statement is explained separately.</p> <div style="margin-top: 10px;">  <p>NOTE: If you configure an IP reassembly rule, then you must configure the match-direction statement.</p> </div>
Options	<p>rule-name—Name of the IP reassembly rule.</p> <div style="margin-top: 10px;">  <p>NOTE: To create more than one IP reassembly rule, include the rule statement multiple times.</p> </div> <p>Range: Up to 63 characters</p>
Required Privilege Level	<p>interface—To view this statement in the configuration.</p> <p>interface-control—To add this statement to the configuration.</p>
Related Documentation	<ul style="list-style-type: none"> • Configuring IP Inline Reassembly for Mobility on page 11 • Example: Configuring Inline IP Packet Fragment Reassembly on page 17 • ip-reassembly on page 30

service-set (Inline Services IP Reassembly)

Syntax	<pre>service-set { service-set-name; }</pre>
Hierarchy Level	[edit unified-edge gateways ggsn-pgw <i>gateway-name</i> inline-services ip-reassembly], [edit unified-edge gateways sgw <i>gateway-name</i> inline-services ip-reassembly]
Release Information	Statement introduced in Junos OS Mobility Release 12.1W.
Description	Specify the service set that the broadband gateway uses to carry out the inline reassembly of fragmented IP packets, on the Packet Forwarding Engine. When you configure inline IP reassembly to be carried out using a service set, the broadband gateway handles fragments properly even when they arrive on different Packet Forwarding Engines.
	<div>  <p>NOTE: If inline IP reassembly is configured based on the service set (at the gateway level) and if the inline service interfaces are down for the configured service set, then reassembly will be performed using software on the services PIC on the gateway and fragments will be load balanced.</p> </div>
Options	<i>service-set-name</i> —Name of the service set.
	<div>  <p>NOTE: The service set must be previously configured at the [edit services <i>service-set</i> <i>service-set-name</i>] hierarchy level.</p> </div>
Required Privilege Level	unified-edge—To view this statement in the configuration. unified-edge-control—To add this statement to the configuration.
Related Documentation	<ul style="list-style-type: none"> • Configuring IP Inline Reassembly for Mobility on page 11 • Example: Configuring Inline IP Packet Fragment Reassembly on page 17 • ip-reassembly (Inline Services) on page 31 • IP Packet Fragment Reassembly for Mobility Overview on page 3

timeout (IP Reassembly)

Syntax	timeout <i>in-seconds</i> ;
Hierarchy Level	[edit services ip-reassembly profile <i>profile-name</i>]
Release Information	Statement introduced in Junos OS Mobility Release 11.2W.
Description	Configure the maximum time to wait for all IPv4 fragments of a packet to arrive for reassembly.
Options	<i>in-seconds</i> —Timeout for the fragments arriving for reassembly. Range: 2 through 60 seconds Default: 4 seconds
Required Privilege Level	interface—To view this statement in the configuration. interface-control—To add this statement to the configuration.
Related Documentation	<ul style="list-style-type: none">• Configuring Software-Based Fragment Reassembly Parameters on page 13• Example: Configuring IPv6 Router Advertisement Parameters• profile (IP Reassembly) on page 37

PART 3

Administration

- [Operational Commands on page 43](#)

CHAPTER 5

Operational Commands

clear services inline ip-reassembly statistics

Syntax	clear services inline ip-reassembly statistics
Release Information	Command introduced in Junos OS Mobility Release 11.4W.
Description	<p>Clear the inline IP reassembly statistics for the Packet Forwarding Engines on one or more Trio-based FPCs.</p> <p>If this command is executed when traffic is flowing, then the inline IP reassembly statistics are cleared up to the instant of running the command. If traffic is stopped, then all inline IP reassembly statistics are cleared.</p>
Options	This command has no options.
Required Privilege Level	clear
Related Documentation	<ul style="list-style-type: none">• show services inline ip-reassembly statistics on page 49
List of Sample Output	clear services inline ip-reassembly statistics on page 44
Output Fields	When you enter this command, you are provided feedback on the status of your request.

Sample Output

<code>clear services inline ip-reassembly statistics</code>	<code>user@host> clear services inline ip-reassembly statistics Cleared inline ip-reassembly statistics</code>
---	---

clear services inline ip-reassembly statistics fpc

Syntax	<code>clear services inline ip-reassembly statistics fpc <i>fpc-slot</i></code> <code><pfe <i>pfe-slot</i>></code>
Release Information	Command introduced in Junos OS Mobility Release 12.1W.
Description	Clear the inline IP reassembly statistics for the specified FPC. If this command is executed when traffic is flowing, then the inline IP reassembly statistics are cleared up to the instant of running the command. If traffic is stopped, then all inline IP reassembly statistics for the specified FPC are cleared.
Options	fpc <i>fpc-slot</i> —Clear the inline IP reassembly statistics for all Packet Forwarding Engines on the specified FPC. pfe <i>pfe-slot</i> —(Optional) Clear the inline IP reassembly statistics for the specified Packet Forwarding Engine slot. You must specify an FPC slot number before specifying a Packet Forwarding Engine slot.
Required Privilege Level	clear
Related Documentation	<ul style="list-style-type: none"> • show services inline ip-reassembly statistics fpc on page 55
List of Sample Output	clear services inline ip-reassembly statistics fpc <fpc-slot> on page 45
Output Fields	When you enter this command, you are provided feedback on the status of your request.

Sample Output

```
clear services inline ip-reassembly statistics fpc <fpc-slot>
user@host> clear services inline ip-reassembly statistics fpc 1
Cleared inline ip-reassembly statistics
```

clear services inline ip-reassembly statistics interface

Syntax	clear services inline ip-reassembly statistics interface <i>interface-name</i>
Release Information	Command introduced in Junos OS Mobility Release 12.1W.
Description	<p>Clear the inline IP reassembly statistics for the specified interface.</p> <p>If this command is executed when traffic is flowing, then the inline IP reassembly statistics are cleared up to the instant of running the command. If traffic is stopped, then all inline IP reassembly statistics for the specified interface are cleared.</p>
Options	interface <i>interface-name</i> —Clear the inline IP reassembly statistics for all FPCs on the specified interface. Currently, the inline services interface (si-) is the only interface supported.
Required Privilege Level	clear
Related Documentation	<ul style="list-style-type: none">• show services inline ip-reassembly statistics interface on page 58
List of Sample Output	clear services inline ip-reassembly statistics interface <interface-slot> on page 46
Output Fields	When you enter this command, you are provided feedback on the status of your request.

Sample Output

```
clear services inline  
ip-reassembly  
statistics interface  
<interface-slot>
```

```
user@host> clear services inline ip-reassembly statistics interface si-4/2/0  
Cleared inline ip-reassembly statistics
```

clear unified-edge ggsn-pgw ip-reassembly statistics

Syntax	clear unified-edge ggsn-pgw ip-reassembly statistics <fpc-slot <i>fpc-slot</i> > <gateway <i>gateway</i> > <inet> <pic-slot <i>pic-slot</i> >
Release Information	Command introduced in Junos OS Mobility Release 11.2W. gateway option introduced in Junos OS Mobility Release 11.4W.
Description	Clear the IP reassembly statistics for one or more gateway GPRS support nodes (GGSNs) or Packet Data Network Gateways (P-GWs). If a GGSN or P-GW is not specified, then statistics for all GGSNs and P-GWs are cleared.
Options	<p>none—Clear the IP reassembly statistics for all GGSNs and P-GWs.</p> <p>fpc-slot <i>fpc-slot</i> pic-slot <i>pic-slot</i>—(Optional) Clear the IP reassembly statistics for the specified Flexible PIC Concentrator (FPC) and PIC slot numbers.</p> <p>gateway—(Optional) Clear the IP reassembly statistics for all the services PICs in the specified GGSN or P-GW.</p> <p>inet—(Optional) Clear the IP reassembly for IPv4 packets.</p>
Required Privilege Level	clear, unified-edge
Related Documentation	<ul style="list-style-type: none"> • show unified-edge ggsn-pgw ip-reassembly statistics on page 60
List of Sample Output	clear unified-edge ggsn-pgw ip-reassembly statistics on page 47
Output Fields	When you enter this command, you are provided feedback on the status of your request.

Sample Output

```
clear unified-edge
 ggsn-pgw
 ip-reassembly
 statistics
user@host> clear unified-edge ggsn-pgw ip-reassembly statistics
Cleared IP re-assembly statistics
```

clear unified-edge sgw ip-reassembly statistics

Syntax	<code>clear unified-edge sgw ip-reassembly statistics</code> <code><fpc-slot <i>fpc-slot</i>></code> <code><gateway <i>gateway</i>></code> <code><inet></code> <code><pic-slot <i>pic-slot</i>></code>
Release Information	Command introduced in Junos OS Mobility Release 11.4W.
Description	Clear the IP reassembly statistics for one or more Serving Gateways (S-GWs). If a gateway name is not specified, then statistics for all S-GWs are cleared.
Options	<p>none—Clear the IP reassembly statistics for all S-GWs.</p> <p>fpc-slot <i>fpc-slot</i> pic-slot <i>pic-slot</i>—(Optional) Clear the IP reassembly statistics for the specified Flexible PIC Concentrator (FPC) and PIC slot numbers.</p> <p>gateway—(Optional) Clear the IP reassembly statistics for all the services PICs in the specified gateway.</p> <p>inet—(Optional) Clear the IP reassembly statistics for IPv4 packets.</p>
Required Privilege Level	clear, unified-edge
Related Documentation	<ul style="list-style-type: none">• show unified-edge sgw ip-reassembly statistics on page 63
List of Sample Output	clear unified-edge sgw ip-reassembly statistics on page 48
Output Fields	When you enter this command, you are provided feedback on the status of your request.

Sample Output

<code>clear unified-edge sgw ip-reassembly statistics</code>	<pre>user@host> clear unified-edge sgw ip-reassembly statistics Cleared IP re-assembly statistics</pre>
--	--

show services inline ip-reassembly statistics

Syntax show services inline ip-reassembly statistics

Release Information Command introduced in Junos OS Mobility Release 11.4W.

Description Display the inline IP reassembly statistics for the Packet Forwarding Engines on one or more Trio-based FPCs. Inline IP reassembly statistics are collected at the Packet Forwarding Engine level.



NOTE: Inline IP reassembly can only be carried out on Trio-based FPCs.

Options This command has no options.

Required Privilege Level view

Related Documentation

- [clear services inline ip-reassembly statistics on page 44](#)
- [show services inline ip-reassembly statistics fpc on page 55](#)
- [show services inline ip-reassembly statistics interface on page 58](#)

List of Sample Output [show services inline ip-reassembly statistics on page 53](#)

Output Fields [Table 3 on page 49](#) lists the output fields for the **show services inline ip-reassembly statistics** command. Output fields are listed in the approximate order in which they appear.

Table 3: show services inline ip-reassembly statistics Output Fields

Field Name	Field Description
FPC	FPC slot number for which the statistics are displayed.

NOTE: The output fields displayed (aggregated across all the Packet Forwarding Engines on the FPC) are arranged in a logical sequence from top to bottom to enable users to understand how the inline IP reassembly statistics are gathered.

The information about the total number of fragments received is displayed first, then the information about the reassembled packets and those pending reassembly are displayed. Then, the reasons why the fragments were dropped or not reassembled are displayed. Finally, the information about the fragments reassembled, fragments dropped, and fragments sent to the backup user plane PIC (services PIC) are displayed.

Table 3: show services inline ip-reassembly statistics Output Fields (*continued*)

Field Name	Field Description
Total Fragments Received	<p>Total number of fragments received and the current rate of fragments received for inline IP reassembly. The following information is also displayed:</p> <ul style="list-style-type: none"> • First Fragments—Number of first fragments received and current rate of first fragments processed. • Intermediate Fragments—Number of intermediate fragments received and current rate of intermediate fragments processed. • Last Fragments—Number and rate of last fragments received. <p>NOTE: Rate refers to the current number of fragments processed per second in the instant preceding the command's execution.</p>
Total Packets Reassembled	<p>Total number of packets reassembled and current rate, in the instant preceding the command's execution, at which the packets are reassembled.</p>
Approximate Packets Pending Reassembly	<p>Approximate number of packets pending reassembly.</p>
Fragments Dropped Reasons	<p>Total number of fragments dropped reasons and the current rate of total fragment dropped reasons. The number of dropped reasons and rate corresponding to each of the following reasons are also displayed:</p> <ul style="list-style-type: none"> • Buffers not available • Fragments per packet exceeded • Packet length exceeded • Record insert error • Record in use error • Duplicate first fragments • Duplicate last fragments • Missing first fragment <p>NOTE:</p> <ul style="list-style-type: none"> • The fragment dropped reasons indicate <i>why</i> a fragment was dropped. When a fragment is dropped, the corresponding reason field (under the Fragment Dropped Reasons field) is incremented by 1. For example, when a fragment is dropped because the memory runs out, the Buffers not available field is incremented by 1. • Rate refers to the current number of fragment dropped reasons per second in the instant preceding the command's execution.
Reassembly Errors Reasons	<p>Number of errors during reassembly and the current rate of reassembly errors. The number of errors and the rate for each of the following types of errors are also displayed:</p> <ul style="list-style-type: none"> • Fragment not found • Fragment not in sequence • ASIC errors <p>NOTE: Rate refers to the current number of reassembly errors processed per second in the instant preceding the command's execution.</p>

Table 3: show services inline ip-reassembly statistics Output Fields (*continued*)

Field Name	Field Description
Aged out packets	<p>Number of aged out packets and the current number of packets aged out per second in the instant preceding the command's execution.</p> <p>NOTE: In some cases, aged out packets could refer to aged out fragments. This is because if previous fragments of the packet have already been discarded, then there is no way of linking the dropped fragments to the aged out fragments.</p>
Total Fragments Successfully Reassembled	Number of fragments successfully reassembled, and the current number of fragments reassembled per second in the instant preceding the command's execution.

Table 3: show services inline ip-reassembly statistics Output Fields (*continued*)

Field Name	Field Description
Total Fragments Dropped	<p>Total number of fragments dropped and the current rate of total number of fragments dropped. The number of fragments dropped and rate corresponding to each of the following reasons are also displayed:</p> <ul style="list-style-type: none"> • Buffers not available • Fragments per packet exceeded • Packet length exceeded • Record insert error • Record in use error • Duplicate first fragments • Duplicate last fragments • Missing first fragment • Fragment not found • Fragment not in sequence • ASIC errors • Aged out fragments <p>NOTE:</p> <ul style="list-style-type: none"> • The total fragments dropped indicates <i>how many</i> of the packet fragments received were then dropped due to a particular reason. <p>For example, consider a packet that has 10 fragments, 9 of which have been received and stored in memory. When the tenth fragment arrives, if the memory runs out (buffers not available), then this fragment is dropped. Since the tenth fragment has been dropped, the other nine fragments must also be dropped. In this case, the Buffers not available field (under the Fragments Dropped Reasons field) is incremented by 1 and the Buffers not available field (under the Total Fragments Dropped field) is incremented by 10.</p> <p>Now, consider the next packet arriving, which also has 10 fragments. If the first four fragments are stored but the memory runs out for the fifth fragment, then the first five fragments (fifth and the first four) are dropped. In this case, the Buffers not available field (under the Fragments Dropped Reasons field) is incremented by 1 and the Buffers not available field (under the Total Fragments Dropped field) is incremented by 5.</p> <p>For the remaining fragments of the packet, consider the case where the memory becomes available; the next 5 fragments (6 through 10) that arrive are stored in memory. The fragments are stored until the timeout period elapses, and are eventually dropped. In this case, the Aged out packets field is incremented by 1 and the Aged out fragments field (under the Total Fragments Dropped field) is incremented by 5.</p> <p>Therefore, the fragment counters (after both packets have been processed) will be as follows:</p> <ul style="list-style-type: none"> • Fragments Dropped Reasons <ul style="list-style-type: none"> • Buffers not available 2 • Aged out packets 1 • Total Fragment Dropped <ul style="list-style-type: none"> • Buffers not available 15 • Aged out packets 5 • Rate refers to the current total number fragments dropped per second in the instant preceding the command's execution.
Total fragments punted to UPIC	Number of fragments sent to the backup user plane PIC (services PIC), and current rate of fragments sent per second in the instant preceding the command's execution.

Sample Output

show services inline
ip-reassembly
statistics

user@host> show services inline ip-reassembly statistics

FPC: 0

=====

	Total	Current Rate
Total Fragments Received	0	0
First Fragments	0	0
Intermediate Fragments	0	0
Last Fragments	0	0
Total Packets Successfully Reassembled	0	0
Approximate Packets Pending Reassembly	0	
Fragments Dropped Reasons	0	0
Buffers not available	0	0
Fragments per packet exceeded	0	0
Packet length exceeded	0	0
Record insert error	0	0
Record in use error	0	0
Duplicate first fragments	0	0
Duplicate last fragments	0	0
Missing first fragment	0	0
Reassembly Errors Reasons	0	0
Fragment not found	0	0
Fragment not in sequence	0	0
ASIC errors	0	0
Aged out packets	0	0
Total Fragments Successfully Reassembled	0	0
Total Fragments Dropped	0	0
Buffers not available	0	0
Fragments per packet exceeded	0	0
Packet length exceeded	0	0
Record insert error	0	0
Record in use error	0	0
Duplicate first fragments	0	0
Duplicate last fragments	0	0
Missing first fragment	0	0
Fragment not found	0	0
Fragment not in sequence	0	0
ASIC errors	0	0
Aged out fragments	0	0
Total fragments punted to UPIC	0	0

FPC: 2

=====

	Total	Current Rate
Total Fragments Received	1004681374	6213217
First Fragments	502335971	3106615
Intermediate Fragments	0	0
Last Fragments	502345403	3106602
Total Packets Successfully Reassembled	71135257	432439

Approximate Packets Pending Reassembly	2408	
Fragments Dropped Reasons	1404714	7700
Buffers not available	0	0
Fragments per packet exceeded	0	0
Packet length exceeded	0	0
Record insert error	0	0
Record in use error	1404714	7700
Duplicate first fragments	0	0
Duplicate last fragments	0	0
Missing first fragment	0	0
Reassembly Errors Reasons	0	0
Fragment not found	0	0
Fragment not in sequence	0	0
ASIC errors	0	0
Aged out packets	6147008	37279
Total Fragments Successfully Reassembled	142270514	864878
Total Fragments Dropped	7551722	44979
Buffers not available	0	0
Fragments per packet exceeded	0	0
Packet length exceeded	0	0
Record insert error	0	0
Record in use error	1404714	7700
Duplicate first fragments	0	0
Duplicate last fragments	0	0
Missing first fragment	0	0
Fragment not found	0	0
Fragment not in sequence	0	0
ASIC errors	0	0
Aged out fragments	6147008	37279
Total fragments punted to UPIC	854858289	5303865

[...output truncated...]

show services inline ip-reassembly statistics fpc

Syntax `show services inline ip-reassembly statistics fpc fpc-slot`
`<pfe pfe-slot>`

Release Information Command introduced in Junos OS Mobility Release 11.4W.

Description Display the inline IP reassembly statistics for the specified FPC. Inline IP reassembly statistics are collected at the Packet Forwarding Engine level.



NOTE: Inline IP reassembly can only be carried out on Trio-based FPCs.

Options *fpc-slot*—Display the inline IP reassembly statistics for the specified FPC.

pfe pfe-slot—(Optional) Display the inline IP reassembly statistics for the specified Packet Forwarding Engine slot. You must specify an FPC slot number before specifying a Packet Forwarding Engine slot.

Required Privilege Level view

Related Documentation

- [clear services inline ip-reassembly statistics fpc on page 45](#)
- [show services inline ip-reassembly statistics on page 49](#)

List of Sample Output [show services inline ip-reassembly statistics fpc <fpc-slot> on page 55](#)

Output Fields [Table 4 on page 55](#) lists two of the output fields for the **show services inline ip-reassembly statistics fpc** command. For the rest of the output fields, refer to the output fields for the **show services inline ip-reassembly statistics** command, which has the same output fields as the **show services inline ip-reassembly statistics fpc** command.

Table 4: show services inline ip-reassembly statistics fpc Output Fields

Field Name	Field Description
FPC	FPC slot number for which the statistics are displayed.
PFE	Packet Forwarding Engine on the FPC for which the statistics are displayed.

Sample Output

```
show services inline ip-reassembly      user@host> show services inline ip-reassembly statistics fpc 2
FPC: 2 PFE: 0
=====
```

statistics fpc
<fpc-slot>

	Total	Current Rate
Total Fragments Received	0	0
First Fragments	0	0
Intermediate Fragments	0	0
Last Fragments	0	0
Total Packets Successfully Reassembled	0	0
Approximate Packets Pending Reassembly	0	
Fragments Dropped Reasons	0	0
Buffers not available	0	0
Fragments per packet exceeded	0	0
Packet length exceeded	0	0
Record insert error	0	0
Record in use error	0	0
Duplicate first fragments	0	0
Duplicate last fragments	0	0
Missing first fragment	0	0
Reassembly Errors Reasons	0	0
Fragment not found	0	0
Fragment not in sequence	0	0
ASIC errors	0	0
Aged out packets	0	0
Total Fragments Successfully Reassembled	0	0
Total Fragments Dropped	0	0
Buffers not available	0	0
Fragments per packet exceeded	0	0
Packet length exceeded	0	0
Record insert error	0	0
Record in use error	0	0
Duplicate first fragments	0	0
Duplicate last fragments	0	0
Missing first fragment	0	0
Fragment not found	0	0
Fragment not in sequence	0	0
ASIC errors	0	0
Aged out fragments	0	0
Total fragments punted to UPIC	0	0

FPC: 2 PFE: 1

=====

	Total	Current Rate
Total Fragments Received	0	0
First Fragments	0	0
Intermediate Fragments	0	0
Last Fragments	0	0
Total Packets Successfully Reassembled	0	0
Approximate Packets Pending Reassembly	0	
Fragments Dropped Reasons	0	0
Buffers not available	0	0
Fragments per packet exceeded	0	0

Packet length exceeded	0	0
Record insert error	0	0
Record in use error	0	0
Duplicate first fragments	0	0
Duplicate last fragments	0	0
Missing first fragment	0	0
Reassembly Errors Reasons	0	0
Fragment not found	0	0
Fragment not in sequence	0	0
ASIC errors	0	0
Aged out packets	0	0
Total Fragments Successfully Reassembled	0	0
Total Fragments Dropped	0	0
Buffers not available	0	0
Fragments per packet exceeded	0	0
Packet length exceeded	0	0
Record insert error	0	0
Record in use error	0	0
Duplicate first fragments	0	0
Duplicate last fragments	0	0
Missing first fragment	0	0
Fragment not found	0	0
Fragment not in sequence	0	0
ASIC errors	0	0
Aged out fragments	0	0
Total fragments punted to UPIC	0	0

[...output truncated...]

show services inline ip-reassembly statistics interface

Syntax `show services inline ip-reassembly statistics interface interface-name`

Release Information Command introduced in Junos OS Mobility Release 11.4W.

Description Display the inline IP reassembly statistics for the specified interface. Inline IP reassembly statistics are collected at the Packet Forwarding Engine level.



NOTE: Inline IP reassembly can only be carried out on Trio-based FPCs.

Options *interface-name*—Display the inline IP reassembly statistics for the specified interface. Currently, the inline services interface (si-) is the only interface supported.



NOTE: Since inline IP reassembly statistics are collected at the Packet Forwarding Engine level, for each interface, the aggregated statistics for inline IP reassembly at the Packet Forwarding Engine level are displayed, even when the interface level statistics are requested.

Required Privilege Level view

Related Documentation

- [clear services inline ip-reassembly statistics interface on page 46](#)
- [show services inline ip-reassembly statistics on page 49](#)

List of Sample Output [show services inline ip-reassembly statistics interface <interface-name> on page 58](#)

Output Fields [Table 5 on page 58](#) lists an output field in the `show services inline ip-reassembly statistics interface` command. For the rest of the output fields, refer to the output fields for the `show services inline ip-reassembly statistics` command, which has the same output fields as the `show services inline ip-reassembly statistics interface` command.

Table 5: show services inline ip-reassembly statistics interface Output Fields

Field Name	Field Description
Interface	Name of the interface for which the statistics are displayed.

Sample Output

`show services inline ip-reassembly`

```
user@host> show services inline ip-reassembly statistics interface si-4/2/0
Interface : si-4/2/0
=====
```

statistics interface
<interface-name>

	Total	Current Rate
Total Fragments Received	565041662	5307666
First Fragments	282495144	2653550
Intermediate Fragments	0	0
Last Fragments	282546518	2654116
 Total Packets Successfully Reassembled	 49491017	 461468
Approximate Packets Pending Reassembly	735	
 Fragments Dropped Reasons	 35977736	 335069
Buffers not available	0	0
Fragments per packet exceeded	0	0
Packet length exceeded	0	0
Record insert error	35977736	335069
Record in use error	0	0
Duplicate first fragments	0	0
Duplicate last fragments	0	0
Missing first fragment	0	0
 Reassembly Errors Reasons	 0	 0
Fragment not found	0	0
Fragment not in sequence	0	0
ASIC errors	0	0
 Aged out packets	 8287119	 79867
 Total Fragments Successfully Reassembled	 98982034	 922936
 Total Fragments Dropped	 44264855	 414936
Buffers not available	0	0
Fragments per packet exceeded	0	0
Packet length exceeded	0	0
Record insert error	35977736	335069
Record in use error	0	0
Duplicate first fragments	0	0
Duplicate last fragments	0	0
Missing first fragment	0	0
Fragment not found	0	0
Fragment not in sequence	0	0
ASIC errors	0	0
Aged out fragments	8287119	79867
 Total fragments punted to UPIC	 421791501	 3972173

show unified-edge ggsn-pgw ip-reassembly statistics


Syntax	show unified-edge ggsn-pgw ip-reassembly statistics <brief detail> <fpc-slot fpc-slot> <gateway gateway> <inet> <pic-slot pic-slot>
Release Information	Command introduced in Junos OS Mobility Release 11.2W. gateway option introduced in Junos OS Mobility Release 11.4W.
Description	Display the IP reassembly statistics for one or more gateway GPRS support nodes (GGSNs) or Packet Data Network Gateways (P-GWs). If a GGSN or P-GW is not specified, then statistics for all GGSNs and P-GWs are displayed.
Options	none —(Same as brief) Display the IP reassembly statistics for all GGSNs and P-GWs. brief detail —(Optional) Display the specified level of output.
	<div>  <p>NOTE: The brief option displays the aggregated statistics from all the services PICs for each GGSN or P-GW. The detail option displays the statistics for each services PIC separately for each GGSN or P-GW.</p> </div>
	fpc-slot fpc-slot pic-slot pic-slot —(Optional) Display the IP reassembly statistics for the specified Flexible PIC Concentrator (FPC) and PIC slot numbers.
	gateway —(Optional) Display the IP reassembly statistics for the specified GGSN or P-GW.
	inet —(Optional) Display the IP reassembly for IPv4 packets.
Required Privilege Level	view
Related Documentation	<ul style="list-style-type: none"> • clear unified-edge ggsn-pgw ip-reassembly statistics on page 47
List of Sample Output	show unified-edge ggsn-pgw ip-reassembly statistics brief on page 62 show unified-edge ggsn-pgw ip-reassembly statistics detail on page 62
Output Fields	Table 6 on page 60 lists the output fields for the show unified-edge ggsn-pgw ip-reassembly statistics command. Output fields are listed in the approximate order in which they appear.

Table 6: show unified-edge ggsn-pgw ip-reassembly statistics Output Fields

Field Name	Field Description	Level of Output
Gateway	Name of the GGSN or P-GW.	All levels

Table 6: show unified-edge ggsn-pgw ip-reassembly statistics Output Fields (*continued*)

Field Name	Field Description	Level of Output
IP Reassembly Statistics		
FPC Slot	FPC slot number for which the statistics are displayed.	detail
PIC slot	PIC slot number for which the statistics are displayed.	detail
First fragments	Number of first fragments.	All levels
Non-first fragments	Number of non-first fragments.	All levels
Total fragments	Total number of fragments.	All levels
Reassembled packets	Total number of reassembled packets. In this case, all fragments of the packets have been received.	All levels
Merged packets	Total number of merged packets. In this case, all the fragments of a packet have been merged into a single packet.	All levels
Packets pending reassembly	Total number of packets pending reassembly.	All levels
Timed out packets	Total number of fragmented packets that exceeded the reassembly timeout.	All levels
Timed out fragments	Total number of fragments that exceeded the reassembly timeout.	All levels
Exceeded maximum packet length	Number of packets dropped because the defragmented packets exceeded the maximum packet size.	All levels
Fragments Dropped		
Invalid Length	Number of fragments of invalid length received.	All levels
Overlap	Number of overlapping fragments received.	All levels
Duplicate	Number of duplicate fragments received.	All levels
No buffers	Number of fragments dropped because the system ran out of the packet buffer.	All levels
Packet limit exceeded	Total number of fragments dropped because the maximum allowed number of fragments was exceeded.	All levels
Total fragments dropped	Total number of fragments dropped.	All levels

Sample Output

**show unified-edge
ggsn-pgw
ip-reassembly
statistics brief**

```
user@host> show unified-edge ggsn-pgw ip-reassembly statistics brief
Gateway: gw1
IP reassembly statistics:
  First fragments:          1
  Non-first fragments:      1
  Total fragments:          2
  Reassembled packets:      1
  Merged packets:          1
  Packets pending reassembly: 0
  Timed out packets:        0
  Timed out fragments:      0
  Exceeded maximum packet length:0
Fragments Dropped:
  Invalid length:           0
  Overlap:                  0
  Duplicate:                0
  No buffers:               0
  Packet limit exceeded:    0
  Total fragments dropped:   0
```

**show unified-edge
ggsn-pgw
ip-reassembly
statistics detail**

```
user@host> show unified-edge ggsn-pgw ip-reassembly statistics detail
Gateway: gw1
IP reassembly statistics (FPC 5 PIC 0):
  First fragments:          1
  Non-first fragments:      1
  Total fragments:          2
  Reassembled packets:      1
  Merged packets:          1
  Packets pending reassembly: 0
  Timed out packets:        0
  Timed out fragments:      0
  Exceeded maximum packet length:0
Fragments Dropped:
  Invalid length :          0
  Overlap :                0
  Duplicate :              0
  No buffers:              0
  Packet limit exceeded:    0
  Total fragments dropped:   0
```

show unified-edge sgw ip-reassembly statistics


Syntax	<pre>show unified-edge sgw ip-reassembly statistics <brief detail> <fpc-slot fpc-slot> <gateway gateway> <inet> <pic-slot pic-slot></pre>
Release Information	Command introduced in Junos OS Mobility Release 11.4W.
Description	Display the IP reassembly statistics for the one or more Serving Gateways (S-GWs). If a gateway name is not specified, then statistics for all S-GWs are displayed.
Options	<p>none—(Same as brief) Display the IP reassembly statistics in brief for all S-GWs.</p> <p>brief detail—(Optional) Display the specified level of output.</p>
	<div>  <p>NOTE: The brief option displays the aggregated statistics from all the services PICs for each S-GW. The detail option displays the statistics for each services PIC separately for each S-GW.</p> </div>
	<p>fpc-slot fpc-slot pic-slot pic-slot—(Optional) Display the IP reassembly statistics for the specified Flexible PIC Concentrator (FPC) and PIC slot numbers.</p> <p>gateway—(Optional) Display the IP reassembly statistics for the specified gateway.</p> <p>inet—(Optional) Display the IP reassembly statistics for IPv4 packets.</p>
Required Privilege Level	view
Related Documentation	<ul style="list-style-type: none"> clear unified-edge sgw ip-reassembly statistics on page 48
List of Sample Output	show unified-edge sgw ip-reassembly statistics brief on page 65 show unified-edge sgw ip-reassembly statistics detail on page 65
Output Fields	Table 7 on page 63 lists the output fields for the show unified-edge sgw ip-reassembly statistics command. Output fields are listed in the approximate order in which they appear.

Table 7: show unified-edge sgw ip-reassembly statistics Output Fields

Field Name	Field Description	Level of Output
Gateway	Name of the S-GW.	All levels

IP Reassembly Statistics

Table 7: show unified-edge sgw ip-reassembly statistics Output Fields (*continued*)

Field Name	Field Description	Level of Output
Gateway	Name of the S-GW.	All levels
FPC Slot	FPC slot number for which the statistics are displayed.	detail
PIC slot	PIC slot number for which the statistics are displayed.	detail
First fragments	Number of first fragments.	All levels
Non-first fragments	Number of non-first fragments.	All levels
Total fragments	Total number of fragments.	All levels
Reassembled packets	Total number of reassembled packets. In this case, all fragments of the packets have been received.	All levels
Merged packets	Total number of merged packets. In this case, all the fragments of a packet have been merged into a single packet.	All levels
Packets pending reassembly	Total number of packets pending reassembly.	All levels
Timed out packets	Total number of fragmented packets that exceeded the reassembly timeout.	All levels
Timed out fragments	Total number of fragments that exceeded the reassembly timeout.	All levels
Exceeded maximum packet length	Number of packets dropped because the defragmented packets exceeded the maximum packet size.	All levels
Fragments Dropped		
Invalid Length	Number of fragments of invalid length received.	All levels
Overlap	Number of overlapping fragments received.	All levels
Duplicate	Number of duplicate fragments received.	All levels
No buffers	Number of fragments dropped because the system ran out of the packet buffer.	All levels
Packet limit exceeded	Total number of fragments dropped because the maximum allowed number of fragments was exceeded.	All levels
Total fragments dropped	Total number of fragments dropped.	All levels

Sample Output

show unified-edge sgw
ip-reassembly
statistics brief

```
user@host> show unified-edge sgw ip-reassembly statistics brief
Gateway: sgw1
IP reassembly statistics:
  First fragments:          1
  Non-first fragments:      2
  Total fragments:          3
  Reassembled packets:      1
  Merged packets:          1
  Packets pending reassembly: 0
  Timed out packets:        0
  Timed out fragments:      0
  Exceeded maximum packet length:0
Fragments Dropped:
  Invalid length:           0
  Overlap:                   0
  Duplicate:                 0
  No buffers:                0
  Packet limit exceeded:    0
  Total fragments dropped:   0
```

show unified-edge sgw
ip-reassembly
statistics detail

```
user@host> show unified-edge sgw ip-reassembly statistics detail
Gateway: sgw1
IP reassembly statistics (FPC 5 PIC 1):
  First fragments:          1
  Non-first fragments:      2
  Total fragments:          3
  Reassembled packets:      1
  Merged packets:          1
  Packets pending reassembly: 0
  Timed out packets:        0
  Timed out fragments:      0
  Exceeded maximum packet length:0
Fragments Dropped:
  Invalid length :           0
  Overlap :                   0
  Duplicate :                 0
  No buffers:                0
  Packet limit exceeded:    0
  Total fragments dropped:   0
```


PART 4

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