



## Page Throttling

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This chapter describes the Page Throttling feature.

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## Feature Description

The Page Throttling feature limits the number of paging messages going out of the SGSN. It provides flexibility and control to the operator who can now reduce the number of paging messages going out from the SGSN based on the network conditions. In some of the customer locations, the amount of paging messages initiated from the SGSN is very high due to the bad radio conditions. A higher number of paging messages results in the consumption of bandwidth in the network. This feature provides a configurable rate-limit, in which the paging message gets throttled at:

- Global level for both 2G and 3G accesses
- NSE level for 2G only
- RNC level for 3G only

This feature improves the bandwidth consumption on the radio interface.



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### Important

A RLF license is required to configure a RLF Template.

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## Relationships to Other SGSN Features

The Page Throttling feature inter-works with common RA paging, in which paging messages are initiated from both 2G and 3G accesses or vice versa.

Introduction of the Page Throttling feature does not result in any changes to the existing paging procedures.

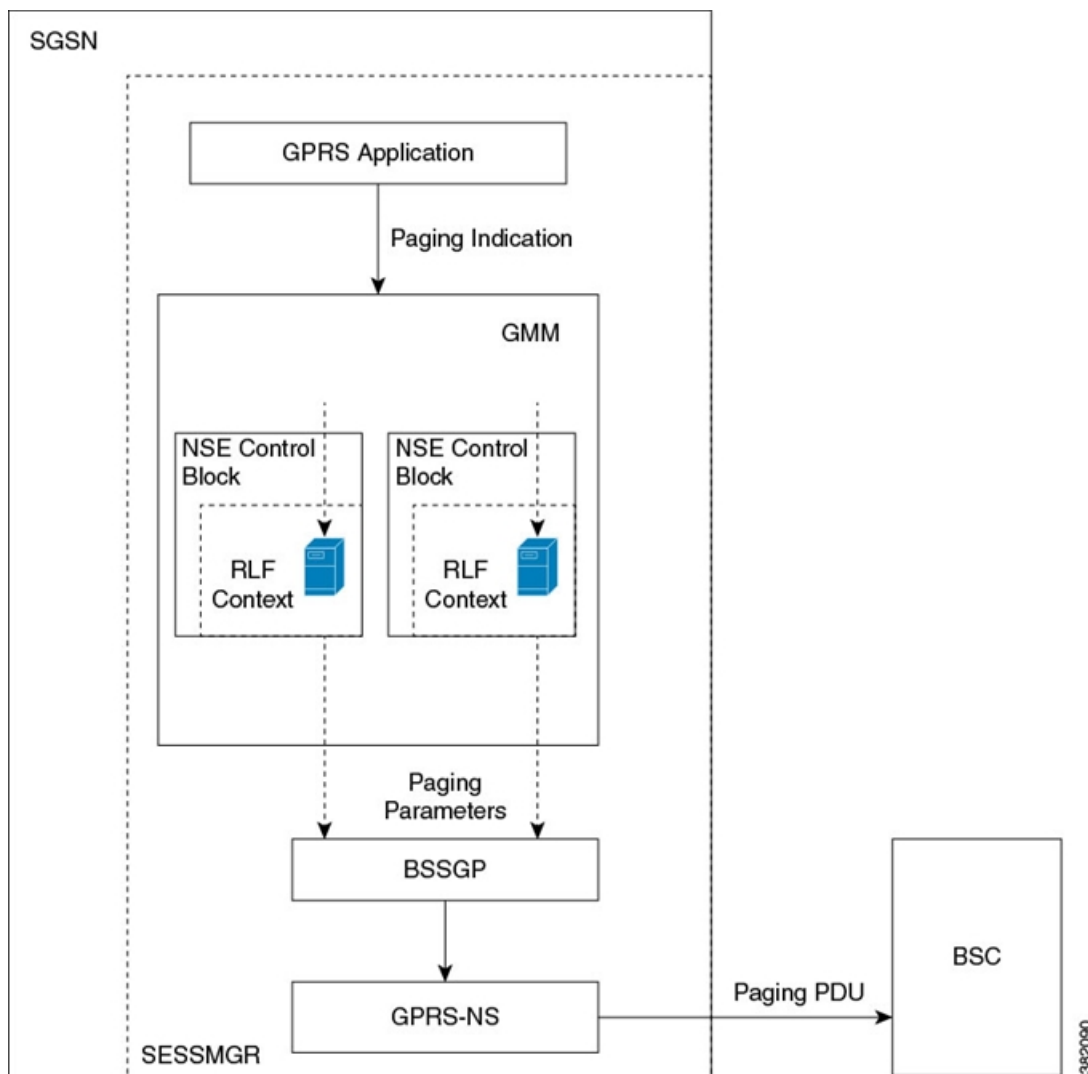
## How it Works

The Rate Limiting Function (RLF) framework is used to limit the paging load sent from the SGSN. The Rate Limiting function is a generic framework which provides the rate-limiting functionality using the Token Bucket algorithm to achieve rate-limiting.

## Page Throttling in a GPRS Scenario

The diagram below represents the design of the Page Throttling feature in a 2G scenario:

Figure 1: Paging Process in 2G with Rate Limiting



The following modules inter-work with each other to achieve page throttling in a GPRS scenario:

1. The Session Manager

2. The GPRS Application
3. The GMM Layer
4. The GPRS Stack
5. RLF Module

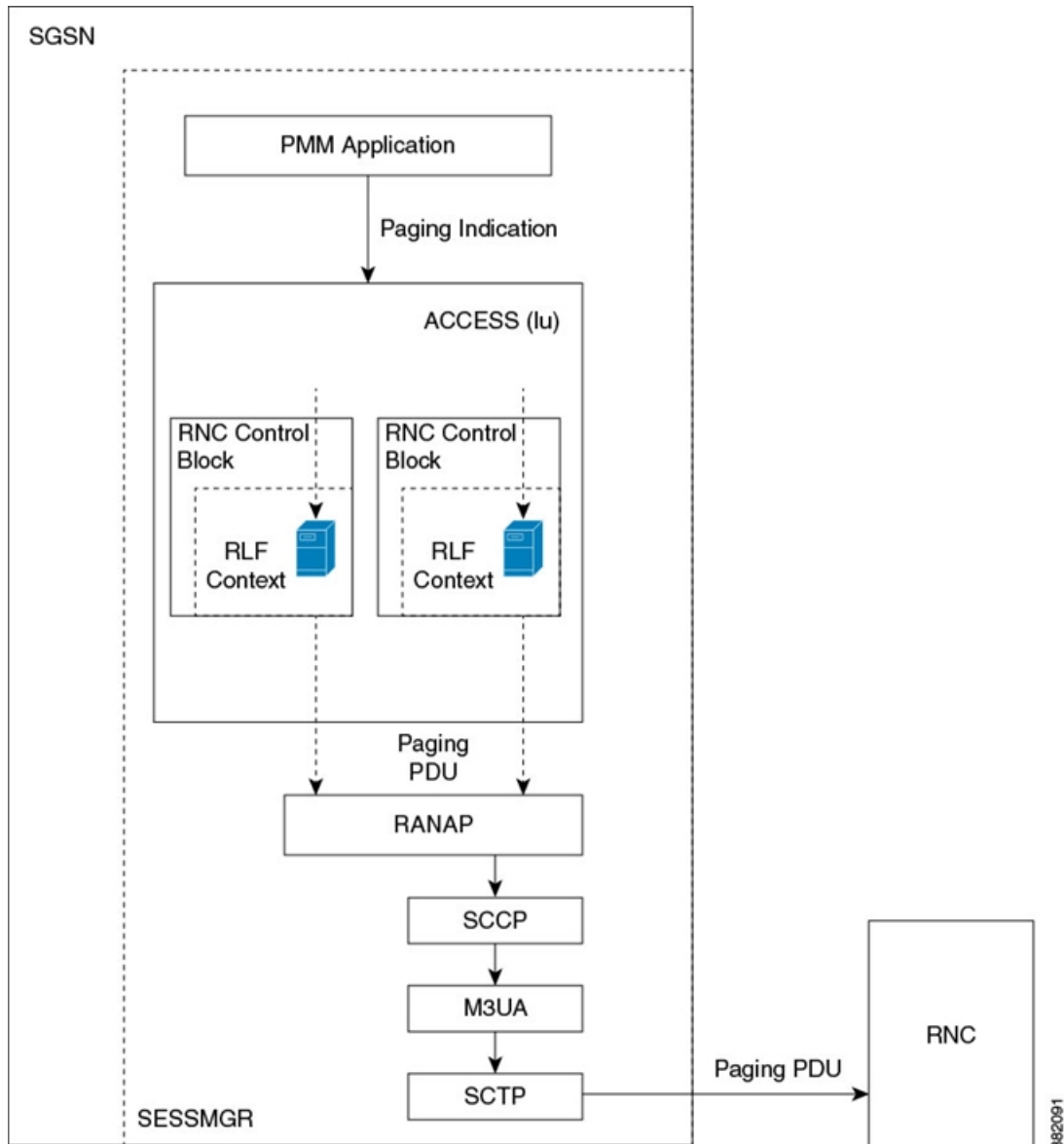
Consider the following GPRS scenario, where the SGSN wants to send downlink data or signaling messages to a subscriber and the subscriber is in a STAND-BY state:

1. The SGSN initiates a paging message to identify the subscriber's current location.
2. The GPRS application sends an indication to the GMM layer whenever it wants to page the MS either for signaling or data packets. Throttling of paging messages for GPRS is performed at the GMM layer in the Session Manager (SESSMGR). Throttling can be performed either at the Global or NSE level.
3. For throttling at the global level, the RLF context is created at the Session Manager level and is maintained in the GMM Control block in the GMM layer.
4. For throttling at the NSE level, the RLF context is created at the Session Manger level for each NSE and is maintained in the NSE control block in the GMM layer.
5. The GMM layer collects the information about the subscriber to be paged and sends it to the RLF module for throttling. The RLF template is configurable, and the RLF module performs the throttling function based on the thresholds configured in the template.
6. The RLF module applies the rate limiting algorithm based on the configured limits. It sends or queues paging message based on the configured limits, once the maximum rate or the configured threshold is reached the paging messages are dropped by the RLF module.
7. The GMM layer registers the call-back functions which are used by RLF module to send the paging messages out of SGSN.

## Page Throttling in an UMTS Scenario

The diagram below represents the design of the Page Throttling feature in a 3G scenario:

Figure 2: Paging Process in 3G with Rate Limiting



The following modules inter-work with each other to achieve page throttling in a UMTS scenario:

1. The Session Manager
2. The PMM Application
3. The Access Layer
4. The RANAP Stack
5. RLF Module

Consider the following UMTS scenario, where the SGSN wants to send downlink data or signaling messages to a subscriber and the subscriber is in a STAND-BY state:

1. The SGSN initiates a paging message to identify the subscriber's current location.
2. The PMM application sends an indication to the Access layer whenever it wants to page the MS either for signaling or data packets. Throttling of paging messages for UMTS is performed at the Access layer in the Session Manager (SESSMGR). Throttling can be performed either at the Global or NSE level.
3. For throttling at the global level, the RLF context is created at the Session Manager level and is maintained in the Access layer.
4. Currently, the SGSN does not allow configuring the same RA in different RNCs across the IuPS services, instead it allows only within the same IuPS service. For throttling at the RNC level, the RLF context is created for each RNC and is maintained in the RNC control block of the Access layer in the Session Manager.
5. The Access layer collects the information about the subscriber to be paged and sends it to the RLF module for throttling. The RLF template is configurable, and the RLF module performs the throttling function based on the thresholds configured in the template.
6. The RLF module applies the rate limiting algorithm based on the configured limits. It sends or queues paging message based on the configured limits, once the maximum rate or the configured threshold is reached the paging messages are dropped by the RLF module.
7. The Access layer registers the call-back functions which are used by RLF module to send the paging messages out of SGSN.

## Limitations

Listed below are the known limitations of the Page Throttling feature:

- In the SGSN Global configuration mode "interface" command, the NSE-NAME (already existing) and RNC-NAME (added as part of this feature) are not validated against the configuration under GPRS-SERVICE or IuPS-SERVICE. This configuration is used only for the purpose of associating the paging-rlf-template for the peer entity (either NSE/BSC or RNC). It is possible to change the ID to NAME mapping of both BSC and RNC. The BSC/RNC ID is used for associating the paging-rlf-template as well as throttling the paging messages internally even though the user can associate the paging-rlf-template using NAME explicitly.
- The rate limiting parameters for the rlf-template associated at global level should be configured in such a way that it applies to all configured NSE and RNC's. The SGSN does not guarantee a uniform distribution of message rate for each NSE/RNC while throttling at a global level.
- Page throttling is applicable to all RNC's whenever the operator configures the same RNC-ID with different PLMN-ID in different IuPS services. If the operator associates the Paging RLF template for that RNC-ID, the SGSN starts page throttling for both the RNC's irrespective of the PLMN.
- No mechanism is present to identify if the operator associates the paging-rlf-template by either configured RNC name or RNC identifier while generating the CLI for "show/save configuration". The paging-rlf-template CLI is always generated with the RNC name if the operator configured the name mapping even though the association is done using the RNC-ID otherwise the output is always generated with the RNC-ID.
- Currently, the show output "show sgsn mode interface-mgmt-status" displays a maximum of "32" characters (truncated value) of the name configured for both NSE/RNC and the RLF template name.
- The SGSN does not support paging load limitation to the common RA paging initiated in the other access.

- Whenever the operator removes the association of paging-rlf-template from a particular NSE/RNC and if the page-limiting is already enabled at global level, all the queued messages in RLF context maintained for that NSE/RNC will be flushed out by RLF and it does not accept any new paging messages for throttling. The RLF context for that NSE/RNC will be cleaned up after all the messages in the queue flushed out. All the new paging messages for that NSE/RNC will use the global RLF context for further rate-limiting.
- Currently, the paging message initiated for both signalling and data packets are treated with same priority as the generic RLF framework does not support priority for throttling.
- Run time association of Paging RLF template to global or per entity level (NSE/RNC) results in statistics discrepancy (when it gets associated during re-transmission of paging messages already in progress).
- This feature results in a performance impact whenever the GPRS service is configured with many NSE's and when the service is stopped or removed.

## Configuring Page Throttling

The following commands are used to configure the Page Throttling feature. These CLI commands are used to associate/remove the RLF template for Page Throttling at the Global level, NSE level and RNC level at the SGSN.

### To map RNC Name to RNC Identifier

The **interface** command is used to configure the mapping between the RNC Id and the RNC name. The operator can configure the paging-rlf-template either by RNC name or RNC identifier.

```
config
sgsn-global
interface-management
[ no ] interface {gb peer-nsei | iu peer-rnc} {name value | id value }
exit
```

Notes:

The **no** form of the command removes the mapping and other configuration associated for the RNC paging-rlf-template configuration from the SGSN and resets the behavior to default for that RNC.

Example configurations:

```
configure
sgsn-global
interface-management
interface iu peer-rnc id 250 name bng_rnc1
end
```

### To associate a paging RLF template

This command allows the SGSN to associate a RLF template either at the global level which limits the paging messages initiated across both 2G (NSE level) and 3G (RNC level) access or at the per entity level either at RNC level for 3G access or at NSE level for 2G access.

```

config
sgsn-global
interface-management
[ no ] paging-rlf-template { template-name template-name } { gb peer-nsei
| iu peer-rnc } { name value | id value }
exit

```

Notes:

If there no rlf-template is associated for a particular NSE/RNC then the paging load is limited based on the global rlf-template associated (if present). If no global rlf-template associated then, no rate-limiting is applied on the paging load.

```

sgsn-global
interface-management
paging-rlf-template template-name rlf1
end

```

```

configure
sgsn-global
interface-management
paging-rlf-template template-name rlf2 gb peer-nsei id 1
end

```

```

configure
sgsn-global
interface-management
paging-rlf-template template-name rlf2 iu peer-rnc name bng_rnc1
end

```

For more information on the CLI commands, see the *Command Line Interface Reference*.

The RLF template can be configured under the global configuration mode which provides the option to configure the message-rate, burst-size, threshold and delay-tolerance for throttling or rate-limiting. To configure the RLF template, see the *Command Line Interface Reference*.

## Verifying the Page Throttling Configuration

The Page Throttling feature configuration can be verified by executing the following show commands:

- **show configuration**

Listed below are the parameters added for the Page Throttling feature:

- **paging-rlf-template *template-name***
- **paging-rlf-template *template-name* gb peer-nsei id**
- **paging-rlf-template *template-name* iu peer-rnc id**
- **interface iu peer-rnc id *rnc\_id* name *name***

- **show sgsn-mode interface-mgmt-status**

Listed below are the parameters added for the Page Throttling feature:

- **Global Paging RLF template**

- Paging RLF Template

## Monitoring and Troubleshooting the Page Throttling feature

This section provides information on the show outputs updated with new statistics to support the Page Throttling feature.

### Page Throttling Show Command(s) and/or Outputs

Listed below are the show outputs and new statistics added for the Page Throttling feature:

#### show gmm-sm statistics verbose

The following new statistics are added in the **show gmm-sm statistics verbose** status command to support the Page Throttling feature:

- 3G Page Throttling statistics
- PS-Page-Req sent by RLF
- Ret-PS-Page-Req sent by RLF
- PS-Page-Req dropped by RLF
- Ret-PS-Page-Req dropped by RLF
- PS-Page-Req dropped due to no memory
- 2G Page Throttling statistics
- Paging Request sent out by RLF
- Total-Page-Req sent
- Ret-Total-Page-Req sent
- Page-Requests-LA
- Ret-Page-Requests-LA
- Page-Requests-RA
- Ret-Page-Requests-RA
- Page-Requests-BSS
- Ret-Page-Requests-BSS
- Page-Requests-Cell
- Ret-Page-Requests-Cell
- Paging Request dropped by RLF
- Total-Page-Req dropped



- Ret-Total-Page-Req dropped
- Page-Requests-LA
- Ret-Page-Requests-LA
- Page-Requests-RA
- Ret-Page-Requests-RA
- Page-Requests-BSS
- Ret-Page-Requests-BSS
- Page-Requests-Cell
- Ret-Page-Requests-Cell
- PS-Page-Req dropped due to no memory

For detailed information and description of the parameters see, *Statistics and Counters Reference*.

