SGSN Support for IMSI Manager Scaling

Feature Description

The IMSI Manager is a de-multiplex process that selects the Session Manager instance based on the de-multiplex algorithm logic to host a new session. The IMSI Manager process also maintains the mapping of IMSI/F-PTMSI (UE identifier) to the Session Manager instance. Currently only a single instance of the IMSI Manager task is present on the SGSN or SGSN and MME combo nodes. This feature is developed to increase the number of IMSI Manager Instances. The maximum number of IMSI Managers supported on SSI remains at "1". This feature is only supported on Cisco ASR 5500 and VPC-DI platforms.

The IMSI Manager task is a bottleneck during single event performance testing, the Attach/RAU rates are restricted to a lower value than desired on the ASR 5500 platform. The IMSI Manager receives new session requests from the Link Manager (3G) and Gb Manager (2G) processes in the SGSN. It also receives messages from the MME Manager (12 instances) processes in the MME. On DPC2, one instance of IMSI Manager will not be sufficient to support the number of Session Manager Instances on ASR 5500 and VPC-DI platforms. Scaling up the number of IMSI Manager Instances improves the single event performance numbers of SGSN and MME. It also helps in utilizing the full capability of the ASR 5500 and VPC-DI platforms.

How it Works

Detailed Description

The LINKMGR, GBMGR and the MMEMGR select an IMSIMGR instance that needs to be contacted for session setup. Each subscriber session in the Session Manager maintains the IMSIMGR instance number that "hosts" the mapping for this IMSI. This information is required while communicating during audit and session recovery scenarios.

When a single IMSI manager instance is present, there is only one centralized entry point for new calls into the system. Network overload protection is configured using the command "network-overload-protection", new call acceptance rates are configured and controlled using this command. Once the configured rate is

reached the new calls are dropped. When there are multiple IMSI manager instances, the configured new call acceptance rate is distributed equally across all IMSI Manager instances to throttle new calls.

The IMSI manager manages target (NRI and count) based offloading. Though number of IMSI Manager instances is increased, only the first IMSI Manager instance is allowed to perform the target based offloading. It keeps track of the total offloaded subscribers for every Target-NRI from all Session Managers and notifies all the Session Managers on attaining Target-count for that Target-NRI.

Several race handling scenarios like ISRAU-Attach collision scenario, Inter-MME TAU attach (FGUTI) on attach (IMSI) collision scenario and so on can occur, specific measures have been taken to ensure these race handling scenarios are handled correctly in a multiple IMSI Manager instance scenario.

The control plane messaging throughput on the ASR 5500 platform is increased, therefore Performance degradation or congestion is not observed during multiple IMSI Manager instance recovery after a crash or an unplanned card migration. Also mechanisms are devised to ensure there is no impact on Session Manager recovery and Session Manager Thresholding.

The Monitor subscriber next-call option is used to trace the next incoming call into the system. With multiple IMSI Manager instances, the Session Controller now sends the next-call details to IMSI manager instance 1. So the next incoming call through IMSI manager instance "1" is monitored.

The IMSI managers are updated with information on critical parameters that lead to congestion control. The IMSI managers have to inform the congestion status to all Link Managers and Gb Managers. In order to avoid multiple IMSI managers sending information to all Link Managers and Gb Managers, only the first IMSI Manager instance informs the congestion status to all Link Managers and Gb Managers. Also only the first IMSI Manager instance sends the traps indicating congestion status this reduces the number of traps to be sent.

The Diameter Proxy Server queries the IMSI Manager instances to obtain IMSI/IMEI/MSISDN to Session manager instance mapping information.

Relationships to Other Features

Many SGSN and MME features are based on the assumption that there is only one IMSI Manager and there is only one centralized entry point to the system, this assumption now no longer holds good with multiple IMSI manager instances. Workarounds have been arrived at to ensure there are no changes observed during such scenarios. Examples of such scenarios are listed below:

- **MME per service session limit:** The per MME service session limits are enforced by each IMSI manager instance. The per service session limit is configured by the command **bind s1-mme max-subscribers** *number*.
- **MME traps generated by IMSI Manager:** Each IMSI Manager instance generates traps for new call allowed/disallowed independently. The trap information includes the IMSI Manager instance information

Configuring Support for Multiple IMSI Managers

The following configuration command is used to configure the number of IMSIMGR tasks that are required in the system:

```
config
    task facility imsimgr { avoid-sessmgr-broadcast | max integer_value |
required-sessmgr no_sess_mgrs | sessmgr-sessions-threshold high-watermark
```

```
high_value low-watermark low_value }
    end
```

Notes:

- The keyword **max** denotes the number of IMSI managers spawned in the system. This keyword is supported only on ASR 5500 and VPC-DI platforms. A maximum of "4" IMSI Manager can be configured.

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  > **Important**   After you configure the **task facility imsimgr max** command, you must save the configuration and then reload the chassis for the command to take effect. For information on saving the configuration file and reloading the chassis, refer to the *System Administration Guide* for your deployment.

- The default number of IMSI Managers supported is "4" on ASR 5500 and VPC-DI platforms.

- This is a boot-time configuration and should be added in the configuration file before any SGSN/MME related configuration is created or any IMSI Manager is started. Run-time configuration of this CLI is not valid. Any such attempt will result in the following error message being displayed:

  ```
  New config requires system restart to be effective. Please save config and restart.
  ```

- This configuration should be added in the configuration file and the system should be re-loaded to apply this new configuration.

The **sgsn imsimgr** command in the Exec mode initiates audit for managing the SGSN's IMSI manager's (IMSIMgr) IMSI table. The command is updated with a new keyword **instance** to extend support for multiple IMSI Managers. The audit is initiated from only one specified instance of IMSI Manager at a time.

sgsn imsimgr { instance *instance_id* **} { add-record** *imsi* **sessmgr instance** *sessmgr* **| audit-with sessmgr { all | instance** *sessmgr* **} | remove-record** *imsi* **}**

Verifying the Configuration

Execute the **show configuration** command to verify the number of IMSI Managers configured:

task facility imsimgr max 4

Monitoring and Troubleshooting the Multiple IMSI Manager Support

This section provides information on the show commands available to support this feature.

Multiple IMSI Managers Show Command(s) and/or Outputs

show linkmgr all

The following new parameters are added to this show command to display the statistics for this feature:

- IMSIMGR Selection counters
- IMSIMGR 1
- IMSIMGR 2
- IMSIMGR 3
- IMSIMGR 4

show linkmgr instance parser statistics all

The following new parameters are added to this show command to display the statistics for this feature:

- Messenger Counters
- IMSIMGR Selection counters
- IMSIMGR 1
- IMSIMGR 2
- IMSIMGR 3
- IMSIMGR 4

show gbmgr instance parser statistics all

The following new parameters are added to this show command to display the statistics for this feature:

- Messenger Counters
- IMSIMGR Selection counters
- IMSIMGR 1
- IMSIMGR 2
- IMSIMGR 3
- IMSIMGR 4

show demuxmgr statistics imsimgr verbose

The following new parameter is added to this show command to display the statistics for this feature:

- IMSIMGR instance number

show demux-mgr statistics sgtpcmgr instance < id >

The following new parameters are added to this show command to display the statistics for this feature:

- Interactions with IMSI Manager
- Num requests sent to IMSIMgr
- Num requests not sent to IMSIMgr
- Num requests bounced from IMSIMgr
- Num responses received from IMSIMgr
- Num responses with unknown IMSI
- Num Forwarded Relocation Request forwarded
- Num Relocation Cancel Requests With IMSI forwarded
- Num Forward Relocation Requests rejected by IMSIMGR
- Num Relocation Cancel Requests rejected by IMSIMGR

show session subsystem facility mmemgr instance < id >

New counters are added in the MME manager to count the number of requests sent towards the IMSI managers:

- IMSIMGR Selection counters
- IMSIMGR 1
- IMSIMGR 2
- IMSIMGR 3
- IMSIMGR 4

show subscribers mme-only full all/ show mme-service session full all

The IMSI Manager instance holding the mapping entry for a subscriber session is displayed as part of the subscriber session information:

- Imsimgr Instance

show mme-service db record call-id <id>

The following new parameters are added to this show command to display the statistics for this feature:

- Sessmgr Instance
- Imsimgr Instance
- MME Service
- Lookup Keys
- IMSI
- Service-id

show mme-service db record call-id <id>