

UE Context Retention

This chapter describes the support of UE Context Retention during SCTP Association recovery in the following sections:

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Feature Summary and Revision History

Summary Data

Applicable Product(s) or Functional Area	MME
Applicable Platform(s)	• ASR 5500 • VPC-DI • VPC-SI
Feature Default	Disabled - Configuration Required
Related Changes in This Release	Not Applicable
Related Documentation	• *Command Line Interface Reference* • *MME Administration Guide* • *Statistics and Counters Reference*

Revision History

Revision Details	Release
First introduced.	21.3

Feature Description

During an SCTP Association Recovery, radio resources allocated to subscribers are released. The subscribers are moved to IDLE state when an S1 link is re-established. These links are re-established individually based on subscriber-specific activities.

Releasing radio resources and re-establishing radio links is sacrificial to the process. Retaining the subscriber's contexts in the connected state until SCTP association recovery is a viable solution. The MME is enhanced with UE Context Retention, which retains the subscriber's contexts in the connected state until the S1 link is operational.

The subscriber's contexts are held in the connected state until the S1 link is back and operational, based on a configurable retention timer.

Earlier, when S1 notifies S1-AP about a lost signal during an SCTP association recovery, the following scenarios were observed:

- The MME either locally changes the state of the UEs to ECM-IDLE or retains the UEs in ECM-CONNECTED state.
- The eNodeB either releases the RRC connection of the corresponding UEs or keeps the UEs in the RRC_CONNECTED state.

The UE Context Retention feature attempts to re-establish the lost signal connection using the S1-Setup procedure to retain the UE-related contexts. The UEs are retained in the ECM-CONNECTED state during SCTP Association failures and recovery.

How It Works

The UE Context Retention feature is enabled using the **s1-ue-retention** command, in the MME service configuration. The configuration also provides a Retention Timer, which retains the SCTP connection until the timer expires.

The r etention timer is pushed to the SCTP stack as S1-AP layer and SCTP layer identities are coupled for an association: spAssocId (SCTP assigned association Id) and suAssocId (S1AP assigned association Id).

Having association information at S1-AP layer alone, and freeing SCTP assigned spAssocId for an association at SCTP stack is achieved by dethe coupling SCTP layer and S1-AP layer for an association together. Decoupling of the SCTP layer and the S1-AP layer for an association is achieved by migration of SCTP associations between MMEMgrs.

The retention timer value is pushed to the SCTP stack when the stack is initialized during start of the MME service. A retention timer value is provided to all S1-MME SCTP associations if the UE retention feature is enabled in the MME service.

Handling SCTP Association Failures with UE Context Retention

This section describes the handling of SCTP Association failures for the following:

- eNodeB detected SCTP Association Failure
- MME detected SCTP Association Failure

eNodeB Detected SCTP Association Failure

MME retains UEs in the ECM-CONNECTED during SCTP failures, or during SCTP recovery triggered from eNodeB for an association.

An SCTP PDU is sent to the SCTP stack to process the received chunk. On completion, the SCTP stack indicates an association restart to the MME manager after re-establishing an SCTP association.

On the arrival of S1-Setup Request, SCTP stack sends a data indication to the MME manager, which sends the data indication to S1-AP stack for further processing.

S1-AP stack maintains a peer control block consisting of a peer state and a peer association state. A peer state update will be sent to SESSMGR when peer state changes from normal state to setup in progress state and another update for setup in-progress state to normal state. S1-AP stack sends an update to its peer MME DEMUX and SESSMGR (Session Manager) and sends a data indication to the MMEMGR, indicating the SCTP peer state change during the re-establishment of a broken association, by S1-Setup Request message and S1-Setup Response message.

On receiving a peer state update from the S1-AP stack for an eNodeB association, SESSMGR sends a release indication to all UEs connected through that eNodeB association. SESSMGR moves all the ECM-CONNECTED state UEs to ECM-IDLE state by sending Release Access Bearer Request message to SGW.

The purpose of a peer state update request from S1-AP stack to SESSMGR is to inform peer state change to SESSMGR, and force the SESSMGR to move the ECM-CONNECTED state UEs to ECM-IDLE state by sending Release Access Bearer Request message to SGW.

With the UE Context Retention feature, the S1-AP stack does not send an update to the SESSMGR when a UE Retention Information IE is received in the S1-Setup Request message. This is because the S1-Setup Request message after a restart of SCTP association only changes the peer state (Normal to Set up in-progress) when eNodeB detects SCTP association failure before MME detects.

S1-AP stack can check S1-AP PDU to check presence of UE Retention Information IE in S1-Setup Request message, and need not to send peer state change update to SESSMGR if MME supports UE retention feature and UE Retention Information IE is present in S1-Setup Request message. MMEMGR shall include UE Retention Information IE in S1-Setup Response message if UE Retention Information IE received in S1-Setup Request message and UE retention feature enabled in MME service.

During inbound SCTP Abort or SCTP Shutdown, MME starts the retention timer when it detects SCTP association failure.

MME Detected SCTP Association Failure

Normally, without UE Context Retention IE, the SCTP closes the SCTP association and send a termination indication to the MME Manager to clear eNodeB data structures, which in turn sends an update to the SessMgr to move the UEs in ECM-CONNECTED state to the ECM-IDLE state, or detaches the UEs connected and its association based on the **sctp-down** command configurable under the MME Service configuration, in the following cases:

- When all paths of that association are down
- Association retransmission exceeds the configured maximum association retransmission

With UE Context Retention IE, the SCTP stack starts the retention timer when an association failure is detected. Unlike the normal process, the association and termination indication is not sent to the MMEMgr.

On expiry of the timer, the SCTP stack clears the association and sends a termination indication to the MMEMgr. An update is sent to the SessMgr, which decides the further process based on the configuration

under MME service. The SCTP stack stops the retention timer only on successful re-establishment of broken connections (INIT, INIT ACK, COOKIE and COOKIE ACK). The SCTPs provision to stop the retention timer keeps the association intact as signaling transport is re-established for the association.

Runtime Modification of Retention Timer in MME Service

Runtime update of a changed retention timer value is not applied an association in the SCTP stack without explicit MME restart. This is similar to the **sctp-param-template** configuration because the changes applied to the stack only during MME service initializes SCTP stack again for that service, but runtime update of the UE Retention feature does not restart MME service automatically as it is not a critical parameter for MME service.

Enabling of the UE Retention feature during runtime reflects immediately in the MME service; MMEMgr can check the MME service configuration in SCTP association restart cases (without abort) when it handles the S1-Setup Request message. But, enabling of the retention timer at SCTP stack happens only if MME service has restarted. Therefore, MME detected association failures will close the association.

Disabling of UE Retention feature during runtime reflects immediately in the MME service; MMEMgr can check the MME service configuration in SCTP association restart (without abort) when it handles the S1-Setup Request message. But, SCTP stack initiates the retention timer whenever an SCTP association failure is detected even when the UE retention feature disabled in MME service, and when the MME service is not restarted. Therefore, disabling the retention timer needs an MME service restart for immediate effect.

Handling MME Manager Recovery with UE Context Retention

Using UE Context Retention IE, the **mmemgr-recovery reset-s1-peers** configuration does not move the UEs in the ECM-CONNECTED state to ECM-IDLE state. Instead MME waits for the S1-Setup Request message. The MME does not move the UEs to ECM-IDLE state once it recognizes the UE Context Retention IE in the S1-Setup Request message.

Standards Compliance

The following standard is supported for the UE Context Retention Feature

- 3GPP TS 24.301 LTE; Evolved Universal Terrestrial Radio Access (E-UTRA) and Evolved Universal Terrestrial Radio Access Network (E-UTRAN); Overall description; Stage 2

Configuring UE Context Retention

This section describes the configuration procedure for UE Context Retention.

There is no specific external configuration required to use this feature. The operator can configure the UE Context Retention feature during boot time and runtime, but runtime needs MME Service restart. Once the operator completes the configuration, MME enables UE Context Retention during SCTP association failures. There are no specific pre-post configuration requirements for this feature. The configuration done by the operator can be verified using the **show** commands in the execution mode discussed in the *Monitoring and Troubleshooting* section.

Use the following configuration in the MME Service configuration to enable UE Context Retention feature with a mandatory retention timer value.

```
configure
  context context_name
    mme-service service_name
      s1-ue-retention retention-timer timer_value
      no s1-ue-retention
      end
```

NOTES:

- **retention-timer** *timer_value*: Configures the retention timer for UE context retention when SCTP is down in milliseconds. *timer_value* specifies the timer value for retaining SCTP association and must be an integer from 1 to 1200. The configuration must be a minimum of 100 ms and maximum of 120000 ms with granularity of 100 ms.
- **no**: Disables the configuration.
- By default, the **s1-ue-retention** command is disabled.
- This CLI takes effect immediately at MME service and can be applied to process the S1-Setup Request message. But, disabling the retention timer takes effect at SCTP stack whenever SCTP initialized during start and restart of the MME service. Therefore, disabling and changing the retention timer value needs MME service restart during runtime configuration change. Runtime changes will be reflected in MME service, but not at the SCTP stack.

Verifying the Configuration

The UE Context Retention configuration can be verified using the following command:

show mme-service name *service_name*

On executing the above command, the following output is displayed:

```
Service name                    : mmesvc
Context                         : ingress
Status                          : STARTED
Bind                            : Done
S1-MME IP Address               : 192.80.80.2
...
...
...
S1 UE Retention                 : Enabled
S1 UE Retention Timer           : 100000ms
```

Monitoring and Troubleshooting UE Context Retention

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

UE Context Retention Show Command(s) and/or Outputs

This section provides information regarding show commands and/or their outputs in support of this feature.

show mme-service name *service_name*

On executing the above command, the following new fields are displayed in the output for this feature:

- S1 UE Retention
- S1 UE Retention Timer

show mme-service enodeb-association full all

On executing the above command, the following new fields are displayed in the output for this feature:

- S1 UE Retention Information

The following commands can also be used to monitor and troubleshoot the UE Context Retention feature:

- show mme-service enodeb-association full
- show mme-service enodeb-association full enodeb-name *enb-name*
- show mme-service enodeb-association full peer-id *peeri-id*
- show mme-service enodeb-association full mme-service-name *service-name*
- show mme-service enodeb-association full peer-address *enode-ip-address*