

Emergency Bearer Services

This chapter describes the MME's implementation of Emergency Bearer services that support IMS emergency sessions.

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Feature Description

The MME's emergency bearer services are provided to support IMS emergency sessions. Emergency bearer services are functionalities provided by the serving network when the network is configured to support emergency services.

Emergency bearer services are provided to normal attached UEs, depending on local regulation, to UEs that are in limited service state. Receiving emergency services in limited service state does not require a subscription. Depending on local regulation and an operator's policy, the MME may allow or reject an emergency attach request for UEs in limited service state.

The Emergency Bearer Service feature provides a functionality to disable Emergency Bearer Service at a TAI management database level.



Important This feature is license controlled. Please consult your Cisco Account Representative for information about the specific license. This license was not enforced in earlier releases.

Feature Capabilities

The Emergency Bearer Support is equipped with the following capabilities:

UE capabilities

For Emergency Bearer Services in EPS, the UE supports the following functionalities:

- IMS Voice Calls.
- ATTACH requests with IMEI as the mobile identity if SIM is not detected in the network.

- PDN Connectivity procedures with request type set to "EMERGENCY".

MME Capabilities

The MME can accept an Attach Request for an Emergency Bearer Service or a PDN Connectivity Request to an emergency PDN if the network capabilities are configured to support Emergency Bearer Services.

As of 19.2, the MME now also supports:

- Emergency Bearer Service profile configuration. The profile should include the following to complete the profile configuration:
  - APN name
  - PGW FQDN or IP Addresses
  - QoS parameters to setup a session
- Configuration to disable emergency services at TAI management object level to reject emergency calls for a configured list of TAIs

Call Admission Control

All emergency calls are allowed until the configuration limit is reached. Deletion of existing calls to admit emergency attaches is not in scope of this release.

Attach for Emergency Bearers

Emergency Bearer Support supports the following ATTACH behaviors:

- Valid UEs only: Only normal UEs that have a valid subscription, authenticated and authorized for PS service in the attached location, are allowed. The normal Authentication and Attach procedures will be executed. The HSS subscription of the UE should allow the UE to be attached to EPS in its current TAI and in the current CSG (if applicable). The emergency attach procedure is not any different from the normal ATTACH procedure in this case.
- Authenticated UEs: These UEs must have a valid IMSI. These UEs are authenticated and may be in limited service state due to being in a location that is restricted from service. The Authentication procedure should complete successfully. The Update Location procedure to the HSS failing, or any further validation of HSS provided subscription data does not affect the processing of the ATTACH request successfully.
- IMSI: These UEs must have an IMSI. If authentication fails, the UE is granted access and the unauthenticated IMSI is retained in the network for the records purposes.
- All UEs: Along with authenticated UEs, this includes UEs with an IMSI that can not be authenticated and UEs with only an IMEI. In this case, an emergency attach request with the IMEI is accepted by the network.
- ISR is deactivated for an emergency attached UE.



Important When authentication fails, the MME queries the UE for IMEI, and the received IMEI is used as the key for the UE in the network. The IMSI is used for recording purposes only. If IMEI is used as the key for identifying the UE in the network, there will be no backup database context associated with the call.

PDN Connectivity for Emergency Bearer Service

A UE that is already attached to the network for EPS services requests for Emergency Bearer Service using a PDN connectivity request. The request-type in PDN Connectivity request is set to "emergency", and no APN information is supplied by the UE.

The MME does not consider HSS provided information to setup a connection, rather uses the locally configured PGW and APN information to setup the PDN connection. The UE is not allowed to request bearer allocations from this PDN, the requests are rejected.



Important The setup for PDN connection and associated bearers should not be affected by the policy configuration on the MME.

Tracking Area Update Procedure

MME supports the following in the TAU procedure:

- Skip Authentication procedure for a UE that only has PDNs for Emergency Bearer Services.
- If the UE is restricted on the new TAI, and the UE has PDN connection for Emergency Bearer services, the MME:
  - Deactivate all non-Emergency service PDN using with signaling to the UE if the UE is in ECM-CONNECTED.
  - Deactivate all non-emergency service PDN locally, and sending the EPS Bearer Context status IE in the TAU accept message if the UE is ECM-IDLE.
  - The MME shall also indicate to the UE that ISR is turned off
- If re-authentication fails the MME,
  - Deactivate all non-Emergency service PDN using with signaling to the UE if the UE is in ECM-CONNECTED
  - Deactivate all non-emergency service PDN locally, and sending the EPS Bearer Context status IE in the TAU accept message if the UE is ECM-IDLE.
- If a UE attached only for EMERGENCY SERVICES, the MME shall set the mobile reachability timer to the configured T3412 value, and locally detach the UE if mobile reachability timer expires.
- If a TAU for a UE in ECM-IDLE state is received after an emergency attach procedure, which arrives from an area whose emergency services are disabled, MME provides the following functions:
  - Rejection of TAU in case of single emergency PDN.
  - De-activation of all emergency PDNs in case of multiple PDNs.



Note The above functions are applicable for TAU arriving in idle mode

Inbound relocation Procedures

- Handling inbound relocations with no IMSI and security context present in the incoming MM context.
- If the UE is not valid in new location, or if local policy forbids setup of all bearers in the context, ensure that bearers set up for emergency services are not torn down.
- S1 and X2 handovers occurring after an emergency attach from an area where emergency services are disabled, is allowed to continue in connected mode.

MME Emergency Configuration Data

MME is supported with the following configuration data:

- Emergency Access Point Name (em APN): A label according to DNS naming conventions describing the access point used for Emergency PDN connection (wild card not allowed).
- Emergency QoS profile: The bearer level QoS parameter values for Emergency APN's default bearer (QCI and ARP). The ARP is an ARP value reserved for emergency bearers.
- Emergency APN-AMBR: The Maximum Aggregated uplink and downlink MBR values to be shared across all Non-GBR bearers, which are established for the Emergency APN, as decided by the PDN GW.
- Emergency PDN GW identity: The statically configured identity of the PDN GW used for emergency APN. The PDN GW identity may be either an FQDN or an IP address. It has be possible to support multiple PDN GW identity to support PGW redundancy.
- Disable emergency services: MME provides CLI control to disable emergency-services at TAI management object level.

Information Storage

Currently, MME-APP stores UE contexts in lists indexed by IMSI, GUTI or PTMSI. To support emergency IMS bearers for UE without IMSI, MME supports indexing the list of active call lines by IMEI too.

Interdependences

The Emergency Bearer Service feature affects the related features described in this section, during Attach/TAU processing.

Regional Zone Code Restriction

The MME does not release a call if,

- Regional Zone Code restriction for a call in progress, and the TAI is restricted
- UE has emergency PDN connections, and emergency connections are allowed in restricted zone codes

Load Rebalancing

The MME does not impact UEs that are connected for Emergency Bearer Services during load rebalancing procedures (3GPP TS 23.401- 9.6.0 - 4.3.2.7).

SRVCC

If any of the bearers setup for emergency services have a QCI value of 1, such bearers is moved to CS domain on SRVCC activity. There is no conflict between SRVCC and Emergency Bearer Services. The Sv interface accepts messages without an IMSI, and unauthenticated UEs is supported over the Sv interface.

CSFB

The attach type IE is used for signaling either a "combined" or "emergency" attach. A UE that is "combined" attached might send a PDN connectivity request for emergency bearer services. After setup of such a bearer, if CSFB is requested, CSFB procedure will proceed with no interaction. Because the UE has been authenticated in the network, there is successful transfer of the UE context to a Gn/Gp SGSN. The SMS functionality of a UE is unaffected by a PDN Connectivity to a emergency PDN.

Gn/Gp Interface

Since the current version of Gn/Gp interface supported on the MME does not support handover of unauthenticated UE MM contexts to SGSN, Context Requests for an unauthenticated UE context from a Gn/Gp SGSN will be rejected by the MME.

Operator Policy

The interdependency of the Operator Policy that applies to the Emergency Bearer Service are as follows:

- Maximum PDN or Bearers reached
- Current TAI not supported
- Authentication required by policy fails
- Equipment identification through policy fails.

The specifications are only for calls which have both emergency and non-emergency PDNs. In any of the above policy restriction, the emergency PDN stays established, regardless of what validation level is required for emergency attach.

Interface

S11

The following changes are implemented on the S11 interface to support Emergency Service:

- IMSI is made optional in the Create Session Request.
- An indication flag is added to indicate if the IMSI is available but unauthenticated.

NAS

- New header type added to NAS parser to specify if the message header type is "integrity protected" or "integrity protected and ciphered"
- New Attach type.
- Emergency service support indicator for Attach/TAU accept.

S3/S10

The following interface changes apply to Context Response and Forward Relocation Request messages:

- Optional IMSI.
- IMSI Validation flag.
- Security Parameters if available.

S6A

The changes to the S6A interface includes the following:

- Optional HSS handle in UE_CONTEXT.
- Authentication Information Request not mandatory for all call flows.
- Update Location Requests not sent for Emergency Bearer Services Attach, if the configuration does not require it.

- Cancel Location Request will not clear a call in the MME if the associated IMSI has a PDN connection for Emergency Bearer Services.

How It Works

The UE can request Emergency Bearer Services depending on its current network state using the following options:

- If the UE is in a limited-access service state, that is, if the UE received a Attach-Reject message from the network or if the UE does not have a SIM, the UE can initiate an ATTACH request message to receive emergency bearer services. On successful ATTACH, the UE receives emergency bearer services.
- If the UE is in a regular connected state, the UE can request emergency bearer services by initiating an ATTACH request using the PDN Connectivity procedures.

Call Flows

This sections describes the procedures involved in providing Emergency Bearer Support in the MME

- Management of Security context
- Authentication procedure
- Attach procedure
- Detach procedure
- Tracking Area Update procedure
- Service Request procedure
- PDN Disconnection procedure
- Bearer resource exhaustion
- PDN Connect procedure for emergency bearers services
- PGW initiated Dedicated Bearer creation
- UE requested bearer resource allocation procedure
- UE requested bearer resource modification procedure
- Outbound relocation procedures
- TAU Attach
- Inbound relocation procedures

For details on the call flow procedure refer to the links provided in the *Standards Compliance* section.

Limitations

The Emergency Bearer Support has the following limitations:

- No checks will be made whether the same IMEI is used by UEs that are authenticated using IMSI.
- Only one call shall be allowed for a non-authenticated UE for a particular IMEI.
- Since the MME does not support Context Transfer without IMSI on the Gn/Gp interface, context transfer to a Gn/Gp SGSN will be rejected by MME if the UE has bearers for emergency services.

The following limitations apply to UEs that are ATTACHed for Emergency Bearer Services:

- The UE shall not request for additional PDN Connectivity. Any UE initiated PDN Connectivity requests will be rejected by the network.

The following limitations apply to PDN connection used for Emergency Bearer Services:

- The UE shall not request any Bearer Resource Allocation for such a PDN connection - a request will be rejected by the MME.

The following limitations apply to a EPS bearer context within a PDN connection for Emergency Bearer Services:

- The UE shall not request for Bearer modifications on such a bearer - any requests will be rejected by the MME.

Standards Compliance

The Emergency Bearer Service complies with the following standards:

- 3GPP TS 23.401 v9.7.0 (2010-12), 3rd Generation Partnership Project; Technical Specification Group Services and System Aspects; General Packet Radio Service (GPRS) enhancements for Evolved Universal Terrestrial Radio Access Network (E-UTRAN) access (Release 9)
- 3GPP TS 24.301 V9.5.0 (2010-12), 3rd Generation Partnership Project; Technical Specification Group Core Network and Terminals; Non-Access-Stratum (NAS) protocol for Evolved Packet System (EPS); Stage 3 (Release 9)

Configuring Emergency Bearer Service

Configuring Emergency Bearer Service Parameters

This section describes the configuration of the parameters to support Emergency Bearer Services.

A new object is added to abstract the configuration required for emergency bearer service. This object is then associated with **mme-service**. This object prevents the need to configure the same parameters multiple times for multiple services within the same chassis. It also provides the flexibility to change parameters for different services when required.

The **lte-emergency-profile** command is used to configure a profile, which is associated to a mme-service or sgsn-service to provide emergency bearer services. A maximum of four profile configurations are supported.

```
config
      lte-policy
            lte-emergency-profile test profile_name
                  [ [ default ] ue-validation-level ] {auth-only | full
| imsi | none }
                  [ [ remove ] apn ] apn_name pdn-type {ipv4 | ipv4v6 |
ipv6 } restoration-priority
                  [ [ remove ] qos ] qci  qci_value arp arp_value
preemption-capability { may | shall-not } vulnerability { not-preemptable
 | preemptable }
                  apn-ambr max-ul uplink_value max-dl downlink_value
                  pgw ip-address ip_address protocol { both | gtp | pmip }
 weight weight_value
               exit
         exit
```

```
exit
 context context_name
       mme-service service_name
             associate lte-emergency-profile profile_name
          end
```

Notes:

- A maximum of four LTE emergency profiles can be configured on the system.
- In the **pgw** command, the valid protocol types are: **both, gtp, and pmip**. A maximum of four P-GW IP addresses can be configured per profile. An FQDN can also be configured in place of the IP addresses but only one P-GW FQDN can be configured per profile.
- To configure the MME to ignore the IMEI validation of the equipment during the attach procedure in emergency cases, use the following command in the **mme-service** configuration mode:

  ```
  policy attach imei-query-type <imei | imei-sv | none> verify-equipmentidentity
  verify-emergency
  ```

- To configure the MME to ignore the IMEI validation of the equipment during TAU procedures in emergency cases, use the following command in the mme-service configuration mode:

  ```
  policy tau imei-query-type <imei | imei-sv | none> verify-equipmentidentity
  verify-emergency
  ```

Disabling Emergency Bearer Services

This section describes the configuration to disable Emergency Bearer Services.

A new CLI is added at TAI management object level to disable emergency services. If the emergency request is received from a TAC, for which emergency services are disabled, then the request would be rejected.

```
configure
      lte-policy
            tai-mgmt-db db_name
                  tai-mgmt-obj obj_name
                        emergency-services-not-supported
                        end
```

Notes:

- The **emergency-services-not-supported** is a newly added keyword to disable emergency bearer services.

Verifying the Emergency Bearer Service Configuration

Verify the configuration Emergency Bearer Services by entering the following command:

show mme-service all

The output for the above command is as shown below:

```
Service name                                          :   mmesvc
Context                                                 :   ingress
Status                                                  :   STARTED
Bind                                                      :   Done
S1-MME IP Address                                   :   192.20.20.2
Crypto-Template Name                              :   None
Max Subscribers                                       :   4000000
```

```
S1-MME sctp port                                        :   25
MME Code                                                    :   2
MME Group                                                   :   32777
PLMN Id                                                       :   MCC: 123, MNC: 456
Emergency Service Profile                          :   None
EGTP Context                                              :   ingress
EGTP Service                                              :   egtp_mme
```

Monitoring and Troubleshooting the Emergency Bearer Services

The following sections describe commands available to monitor Emergency Bearer Services on the MME

Emergency Bearer Services Show Command(s) and/or Outputs

This section provides information regarding show commands and/or their outputs in support of the Emergency Bearer Services

The show commands in this section are available in support of the Emergency Bearer Services

show lte-policy tai-mgmt-db name db_name

```
TAI Management DB tmd1
    TAI Management Object tmo1
        Time Zone UTC +05:15 DST 2
          Zone Code: 1111
          emergency-service-not-supported
          TAI   mcc 123 mnc 456 tac 2345
          TAI   mcc 123 mnc 456 tac 2348
          TAI   mcc 123 mnc 456 tac 1000
          TAI   mcc 123 mnc 456 tac 1001
          TAI   mcc 123 mnc 456 tac 1002
          SGW  10.6.0.14 s5-s8-protocol gtp weight 100
```

show mme-service statistics mme-service mmesvc

The mme-service statistics command displays the number of attach rejects, TAU rejects and PDN connectivity rejects, on disabling emergency services.

The output of the above command is as follows:

```
Attach Reject:                                                          0
    IMSI Unknown in HSS:                                0    Illegal UE:
              0
    Illegal ME:                                                 0    EPS Not Allowed:
                  0
    Emergency-services-disabled:    1
TAU Reject Total:                           0
    IMSI Unknown in HSS:                                0    Illegal UE:
              0
    Illegal ME:                                                 0    EPS Not Allowed:
                  0
    Emergency-services-disabled:    2
 TAU Reject Intra MME:                      0
    IMSI Unknown in HSS:                                0    Illegal UE:
              0
    Illegal ME:                                                 0    EPS Not Allowed:
                  0
    Emergency-services-disabled:    1
```

```
 TAU Reject Inter MME:                    0
    IMSI Unknown in HSS:                                  0    Illegal UE:
              0
    Illegal ME:                                                   0    EPS Not Allowed:
                  0
    Emergency-services-disabled:    1
PDN Connectivity Reject:             0
    PTI Already in Use:                                  0    Unknown or Missing APN:
     0
    Unknown PDN Type:                                     0    Invalid Bearer Id:
            0
    Invalid PTI:                                                  0    Rejected By PGW/SGW:
               0
    Authentication Failed:                             0    Svc Opt Not Supported:
   0
    Svc Opt Not Subscribed:                           0    Opr Determined Barring:
 0
    Insufficient Resource:                             0    Activation Rejected:
     0
    Svc Opt Tmp OutOfOrder:                           0    Protocol Errors:
        0
    APN Restrict Incomt:                                 0    APN not sup PLMN-RAT:
      0
    Emergency-services-disabled: 1
```

Emergecny Bearer Services Bulk Statistics

The following statistics are included in the MME Schema in support of the Emergency Support Services:

For descriptions of these variables, see "MME Schema Statistics" in the *Statistics and Counters Reference*.

- %emm-msgtx-emergency-disabled%
- %emm-msgtx-tau-emergency-disabled%
- %emm-msgtx-tau-inter-emergency-disabled%
- %emm-msgtx-tau-intra-emergency-disabled%
- %esm-msgtx-pdncon-rej-emergency-disabled%