ETSI TS 122 278 V11.6.0 (2012-09)

Universal Mobile Telecommunications System (UMTS);
LTE;
Service requirements for the Evolved Packet System (EPS)
(3GPP TS 22.278 version 11.6.0 Release 11)

Reference
RTS/TSGS-0122278vb60

Keywords
LTE,UMTS

ETSI

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Foreword

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Contents

Foreword

This Technical Specification has been produced by the 3rd Generation Partnership Project (3GPP).

The contents of the present document are subject to continuing work within the TSG and may change following formal TSG approval. Should the TSG modify the contents of the present document, it will be re-released by the TSG with an identifying change of release date and an increase in version number as follows:

Version x.y.z

where:

x the first digit:

1 presented to TSG for information;

2 presented to TSG for approval;

3 or greater indicates TSG approved document under change control.

y the second digit is incremented for all changes of substance, i.e. technical enhancements, corrections, updates, etc.

z the third digit is incremented when editorial only changes have been incorporated in the document.

Introduction

To ensure competitiveness in a longer time frame an evolution of the overall 3GPP system needs to be considered.

This document compiles requirements to ensure that an Evolved Packet System can cope with the rapid growth in IP data traffic and demanding requirements for new multimedia type of applications in terms of performance and quality, delivered to the user, whilst at the same time enabling cost effective deployment and operation.

The Evolved Packet System is characterised by:

- Reduced latency
- Higher user data rates equating to broadband performance
- Improved system capacity and coverage
- Lower operational costs

1 Scope

The present document describes the service requirements for the Evolved Packet System. Additional requirements for E-UTRAN are contained in the specifications identified in annex B.

2 References

The following documents contain provisions which, through reference in this text, constitute provisions of the present document.

- References are either specific (identified by date of publication, edition number, version number, etc.) or non-specific.
- For a specific reference, subsequent revisions do not apply.
- For a non-specific reference, the latest version applies. In the case of a reference to a 3GPP document (including a GSM document), a non-specific reference implicitly refers to the latest version of that document *in the same Release as the present document.*

[1] 3GPP TS 22.003: "Circuit Teleservices supported by a Public Land Mobile Network (PLMN)".

[2] 3GPP TS 21.905: "Vocabulary for 3GPP specifications".

[3] 3GPP TS 22.258: "Service Requirements for the All-IP Network (AIPN); Stage1".

[4] 3GPP TR 25.913: "Requirements for Evolved UTRA (E-UTRA) and Evolved UTRAN (E-UTRAN)".

[5] 3GPP TS 22.115: "Service aspects; Charging and billing".

[6] ETSI TS 102 250-1: "Speech Processing, Transmission and Quality Aspects (STQ); QoS aspects for popular services in GSM and 3G networks: Part 1: Identification of Quality of Service aspects".

[7] 3GPP TR 23.882: "3GPP system architecture evolution (SAE): Report on technical options and conclusions".

[8] C.S0001-A Introduction to cdma2000 Standards for Spread Spectrum Systems - Release A.

[9] C.S0002-A Physical Layer Standard for cdma2000 Spread Spectrum Systems - Release A.

[10] C.S0003-A Medium Access Control (MAC) Standard for cdma2000 Spread Spectrum Systems - Release A addendum 2.

[11] C.S0004-A Signaling Link Access Control (LAC) Specification for cdma2000 Spread Spectrum Systems -Addendum 2.

[12] C.S0005-A Upper Layer (Layer 3) Signaling Standard for cdma2000 Spread Spectrum Systems - Release A addendum 2.

[13] C.S0006-A Analog Signaling Standard for cdma2000 Spread Spectrum Systems - Addendum 2.

[14] A.S0007 – A.S0009 Interoperability Specification (IOS) for High Rate Packet Data (HRPD).

[15] A.S0011 – A.S0017 Interoperability Specification (IOS) for cdma2000 Access Network Interfaces.

[16] X.S0011 cdma2000 Wireless IP Network.

[17] C.S0024-A cdma2000 High Rate Packet Data Air Interface Specification.

[18] C.S0024-0 cdma2000 High Rate Packet Data Air Interface Specification.

[19] Void.

[20] WiMAX Forum Mobile System Profile, Release 1.0 .

[21] 3GPP TS 22.101: "Service Aspects; Service Principles".

[22] "Recommendations and Requirements for Networks based on WiMAX Forum CertifiedTM Products" (WiMAX stage 1)

[23] "WiMAX Forum Network Architecture (Stage 2: Architecture Tenets, Reference Model and Reference Points)"

[24] "WiMAX Forum Network Architecture (Stage 3: Detailed Protocols and Procedures)"

[25] Void.

[26] S.R0048-A 3G Mobile Equipment Identifier (MEID)

[27] Void.

[28] Void.

3 Definitions and abbreviations

3.1 Definitions

For the purposes of the present document, the terms and definitions given in TR 21.905 [2] and the following apply.

Evolved Packet System: is an evolution of the 3G UMTS characterized by higher-data-rate, lower-latency, packet-optimized system that supports multiple RATs. The Evolved Packet System comprises the Evolved Packet Core together with the evolved radio access network (E-UTRA and E-UTRAN).

Service Continuity: The uninterrupted user experience of a service that is using an active communication (e.g. an ongoing voice call) when a UE undergoes a radio access technology change or a CS/PS domain change without, as far as possible, the user noticing the change.

Note: In particular Service Continuity encompasses the possibility that after a RAT / domain change the user experience is maintained by a different telecommunication service (e.g. tele- or bearer service) than before the RAT / domain change.

3.2 Abbreviations

For the purposes of the present document, the abbreviations given in TR 21.905 [2] and the following apply.

NRT Non Real Time
RT Real Time

4 General description

4.1 Objectives

The Evolved Packet System is a higher-data-rate, lower-latency, packet-optimized system that supports multiple RATs. The focus of the Evolved Packet System work is on enhancement of Packet Switched technology to cope with rapid growth in IP traffic.

The objectives of the Evolved Packet System are to:

- Provide higher data rates, lower latency, high level of security and enhanced QoS;
- Support a variety of different access systems (existing and future), ensuring mobility and service continuity between these access systems;
- Support access system selection based on a combination of operator policies, user preference and access network conditions;
- Realise improvements in basic system performance whilst maintaining the negotiated QoS across the whole system;
- Provide capabilities for co-existence with legacy systems and migration to the Evolved Packet System.

5 High-level requirements – user and operational aspects

The Evolved Packet System shall be capable of accommodating a variety of different access systems thus providing a multi-access system environment to the user.

The Evolved Packet System shall provide mobility functionality within and across the different access systems.

The Evolved Packet System shall provide capabilities to support the efficient integration of E-UTRAN PS Core Network Nodes and GERAN/UTRAN PS Core Network Nodes.

The Evolved Packet System shall optimize mobility functionality meaning that it shall offer minimal signalling overhead, minimal handover interruption time, secure handover procedure and local breakout.

The Evolved Packet System shall provide capabilities to inter-work with a variety of broadband networks based on IP technologies including those not specified by 3GPP.

The Evolved Packet System shall provide enhanced performance e.g., low communication delay, low connection set-up time and high communication quality.

The Evolved Packet System shall be able to efficiently support a variety of traffic models e.g. user-to-user, user-to-group and traffic models generated by ubiquitous services.

The Evolved Packet System shall provide functionality to support outbound roaming subscribers on other Evolved Packet Systems and legacy networks.

The Evolved Packet System shall provide functionality to support inbound roaming subscribers from other Evolved Packet Systems and legacy networks.

The Evolved Packet System shall be capable of supporting and inter-working with PS services provided on Rel-7 and earlier networks. The Evolved Packet System shall be capable of inter-working with CS services provided on Rel-7 and earlier networks.

The Evolved Packet System shall support service continuity between 3GPP access systems and also between 3GPP access systems and non 3GPP access systems whether the UE supports simultaneous radio transmission or not.

The Evolved Packet System shall be able to accommodate fixed access systems and to inter-work with fixed networks in order to provide service continuity over fixed/mobile converged networks.

The Evolved Packet System service capability set shall include, as a minimum, support for the following categories of services that are likely to be used by the majority of operators:

- Voice
- Video
- Messaging
- Data file exchange

The Evolved Packet System shall provide for efficient usage of system resources, especially of radio resources through both signalling and transport optimization, e.g. overhead, terminal power, radio resources, mobility state, signalling load.

The Evolved Packet System shall support efficient delivery of text-based broadcast messages received from a legacy CBC.

The Evolved Packet System shall support E-UTRAN only operators. The system shall allow these operators to offer national roaming to their subscribers.

The Evolved Packet System shall be capable of uniquely identifying each device that connects via 3GPP access networks and 3GPP2 access networks. For a dual mode device supporting both 3GPP and 3GPP2 access technologies,

there shall be a single persistent identifier used to identify the device. This device identifier shall be the same even when the device moves between 3GPP and 3GPP2 access types.

Note: The 3GPP2 device identifier structure is consistent with the IMEI structure [26].

The EPC shall be capable of restricting access of specific 3GPP devices, 3GPP2 devices and dual mode 3GPP/3GPP2 devices.

5.1 Requirements for Fixed Mobile Interworking

The Evolved Packet System shall support the following scenarios: a single Operator offering both fixed and mobile access; different Operators collaborating to deliver services across both networks. These scenarios will be supported by interworking between the access networks.

The Evolved Packet System shall support access to services on the mobile network via interworking with a fixed access network for the following scenarios:

- Residential scenarios for operators that own both wireless and wireline access networks
- Residential scenarios for operators that own wireless access networks only
- Enterprise scenarios with managed connectivity between mobile operators and enterprise networks

The Evolved Packet System shall be able to support the following functions for interworking between the fixed access in the above scenarios and Evolved Packet Core:

- connectivity,
- subscriber authentication/authorization,
- offline charging
- online charging for traffic routed via the Evolved Packet Core
- Policy Control and
- Quality of Service.

The Evolved Packet Core shall support the following for fixed access:

- policy management,
- authentication for WLAN terminals and fixed devices,
- charging

The EPS shall be capable to set operator policies to support simultaneous access to PLMN services and traffic offloading to the fixed network.

Interworking shall support the following scenarios:

When traffic is routed via EPC

- When H(e)NB is being used and traffic is offloaded in the local wireline network
- When WLAN is being used and traffic is offloaded in the local wireline network (i.e. non-seamless WLAN offloading)

Additionally the Evolved Packet System shall be able:

- to minimize QoS and Policy management signalling overhead while interworking between the fixed access and Evolved Packet Core.
- to route different simultaneously active PDN connections through different accesses while interworking between the fixed access and Evolved Packet Core.

- to route different IP flows belonging to the same PDN connection through different accesses while interworking between the fixed access and Evolved Packet Core.

The requirements for mobility in chapter 7.1.3 apply also to interworking between the fixed access and Evolved Packet Core.

5.2 Void

5.3 Void

6 Basic capabilities

6.1 Support of IP traffic

6.1.1 Support of increased IP traffic demand

The Evolved Packet System shall be able to provide guaranteed QoS for services and use the resources of the Evolved Packet System with high efficiency i.e. ensure that quality conditions for a particular communication are fulfilled without deterioration between the communicating end-points.

6.1.2 Void

6.1.3 Void

6.1.4 Support of basic IP connectivity

Following registration on the network, the Evolved Packet System shall maintain an IP connectivity with the UE. Following registration it shall be possible for an UE to send and receive IP packets.

6.1.5 Support of IP multicast service

The Evolved Packet System shall support IP multicast service.

6.2 IP session control

The Evolved Packet System shall provide for session mobility and session adaptation to terminal capabilities, user preferences, subscriber priorities, network conditions and/or other operator-defined criteria. Session adaptation shall be under the control of the operator.

The Evolved Packet System shall support session control for multi-party sessions (e.g. user-to-group) and shall provide a scaleable solution.

In order to support the efficient routing of IP traffic, local breakout (see Section 7.1.2) shall be supported.

The Evolved Packet System shall support a UE having simultaneously more than one active PDN connections exchanging traffic with more than one peer (external network or other UE), when the network policies and user subscription allow it.

If a UE is under the coverage of 3GPP access and one or more non-3GPP accesses, it shall be possible for the UE to communicate using multiple accesses simultaneously.

The Evolved Packet System shall provide the system operator with the means to control the number of simultaneously active PDN connections and combinations thereof to and from a UE.

A single application running on the UE shall not be required to send and receive traffic through multiple PDNs.

6.3 Quality of Service

The Evolved Packet System shall have the ability to provide a quality of service equal to or better than the QoS requirements specified for GSM and UMTS. Quality of Service from the customer's perspective is to be considered in phases as specified in ETSI TS 102 250-1[6].

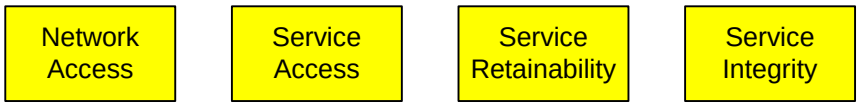

Figure 2: Phases of service use from customer's point of view

Figure 2 shows the different phases (Quality of Service aspects) during service use from the customer's point of view.

The meaning of these QoS aspects are:

1) **Network Access:** The network indication on the display of the mobile is a signal to the customer that he can use the service of this network operator (or any other means to indicate to the user that a network is available).

2) **Service Access:** If the customer wants to use a service, the network operator should provide him as fast as possible access to the service.

3) **Service Integrity:** This describes the Quality of Service during service use.

4) **Service Retainability:** Service Retainability describes the termination of services (in accordance with or against the will of the user).

In particular the Evolved Packet System shall provide for the following:

- There should be no perceptible deterioration of audio quality of a voice call during and following handover between dissimilar CS and PS access networks, and transitions between PS access networks supporting different IP protocol versions.
- There should be no loss of data, as a result of handovers between dissimilar fixed and mobile access systems, including those that support different versions of the IP protocol.
- There should be no discernable difference in perceived service quality for users receiving services via unicast and users receiving the same service via multicast.
- The Evolved Packet System shall support QoS differentiations for unicast bearers.
- The Evolved Packet System shall support QoS backwards compatibility to earlier 3GPP QoS releases.
- It shall be possible for the Evolved Packet System to maintain end-to-end QoS without modification when the terminal moves from one access system to a new access system, and the new access system supports the required QoS.
- It shall be possible for the Evolved Packet System to change QoS, when the terminal moves from one access system to a new access system and the new access system can not provide the same QoS as the old access system or the new access system can provide higher QoS.
- It shall be possible for the Evolved Packet System to support service continuity for a terminal changing access system and the new access system cannot provide the same QoS as the old one.
- The Evolved Packet System shall support transport QoS differentiations for multicast bearers.
- It shall be possible for the Evolved Packet System to maintain QoS within a multicast session without QoS changes for other members of the session when a terminal joins or leaves the multicast session or moves to a new access system.
- The Evolved Packet System network shall support a minimum of 8 levels of QoS in parallel.
- The Evolved Packet System network shall support a minimum of 4 parallel RT QoS levels with the appropriate QoS differentiation.

NOTE 1: The requirement for the number of simultaneously supported QoS levels is independent of any MBMS QoS levels.

- Multiple RT services, with similar QoS requirements, shall be served by the same RT QoS level and multiple NRT services, with similar QoS requirements, shall be served by the same NRT QoS level.

  The maximum number of parallel RT and NRT services shall not be limited in the Evolved Packet System including the UE. Only the number of parallel RT and NRT QoS levels are limited to the upper value supported by the Evolved Packet System.

- Differentiated handling based on QoS is needed for different traffic types.

- The Evolved Packet System shall support parallel operation of RT and NRT services per user.

NOTE 2: The different QoS levels provided for RT and NRT services would be differentiated with regards to e.g. maximum end-to-end delay, packet size, packet drop percentage, etc. Bandwidth is not used to define a QoS level.

6.4 Support of Multicast and Broadcast Services

The Evolved Packet System shall be able to support Multicast and Broadcast Services which shall be enhanced especially from some aspects, e.g. optimized service provisioning procedures, better performance compared to current MBMS system, and support of multiple access systems.

6.5 Support of Emergency Calls

The Evolved Packet System shall support IMS emergency calls applicable to the PS domain, defined in TS 22.101 [21]

7 Multi-access and seamless mobility

7.1 Mobility management

7.1.1 Heterogeneous access systems mobility

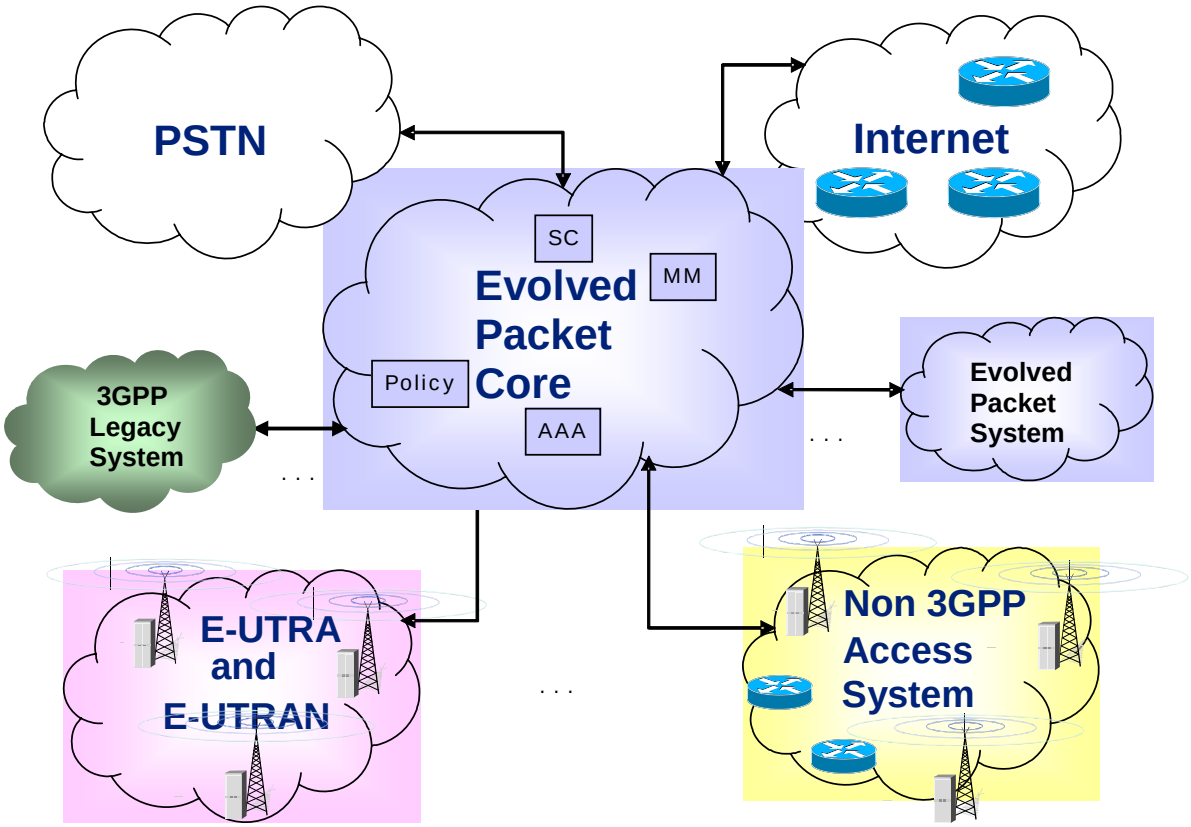

Figure 3: Heterogeneous access system mobility between 3GPP Legacy Systems or E-UTRAN and non 3GPP Access Systems including Fixed Access systems

The Evolved Packet System shall support mobility between heterogeneous access systems.

The Evolved Packet System shall provide mobility mechanisms to support frequent handovers within and across 3GPP legacy systems or E-UTRAN and non 3GPP access systems in order to avoid service degradation.

The Evolved Packet System shall support mobility mechanisms that accommodates access systems within Rel-7 and earlier.

7.1.2 Local breakout

The Evolved Packet System shall allow for local breakout. Local breakout means that for a user which makes mobility within and across one operator-defined network region, routing is optimized such that user plane traffic does not need to leave the current region. An operator may define network regions e.g., according to administrative domains. Local breakout is applicable for user-to-user traffic as well as for 3GPP-operator provided services (including internet access).

Local breakout shall be allowed independently from the access system being used.

Local breakout shall be allowed in both the non-roaming and the roaming case.

The use of local breakout shall be authorised by the HPLMN. If local breakout is not authorised, the user plane traffic shall be handled in the home routed mode.

7.1.3 Fixed Access Systems

The Evolved Packet System shall be able to support fixed access systems with very limited or no mobility functionality.

The Evolved Packet System shall be able to support mobility within and across 3GPP and non-3GPP access systems including fixed access systems

7.1.4 Service continuity

7.1.4.1 General

Service shall be maintained during and following changes of 3GPP access systems and non 3GPP systems.

Service shall be maintained during and following a change of network in either direction between a Rel-7 and earlier network and an Evolved Packet System.

It shall be possible to support Inter-PLMN handover with seamless service continuity within a 3GPP specified access system (UTRAN, E-UTRAN).

When the access system changes, Multicast and Broadcast services shall be able to continue with their corresponding Multicast and Broadcast services, if the corresponding services are provided in the target access system.

Note: Corresponding Multicast and Broadcast services are the Multicast and Broadcast services in the target access system which is associated to the Multicast and Broadcast services in the source access system, providing similar service experience, e. g. with same content but different bit-rate.

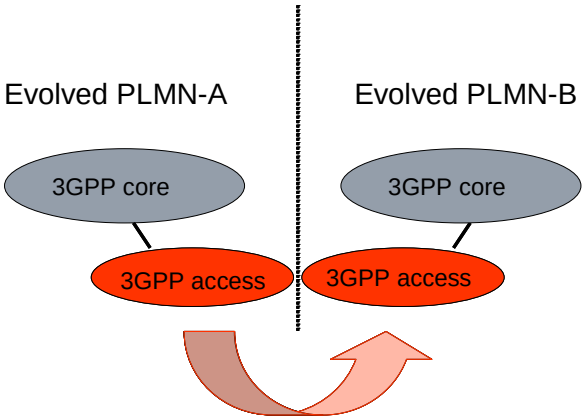

Figure 4: Inter-PLMN handover with seamless service continuity within a 3GPP specified access system

7.1.4.2 Service continuity at domain and RAT change for TS 11, TS 12 and equivalent PS service

It shall be possible to support continuity of an established voice call, i.e. between a TS11, TS12 and an equivalent PS service, when the UE moves between two different domains and RATs. The user experience shall be as far as possible unaffected by the change of domain and RAT. The RAT change procedure executed to enable service continuity for an established voice call shall target an interruption time not higher than 300 ms.

RAT change and domain selection shall be under the control of the registered PLMN. When the UE is roaming, it shall be possible for the VPLMN to take into account any user"s HPLMN operator policy.

To support service continuity of an established voice call a UE shall not be required to support simultaneous radio transmission via different 3GPP defined RATs

NOTE: In the case of CS emergency calls (TS12) the service continuity at domain and RAT change can only be performed if IMS emergency calls are supported by the target system.

7.1.4.2A Voice Call Service continuity between 3GPP defined RATs and non 3GPP defined RATs

Continuity of an established voice call, i.e. between a TS11 and an equivalent PS service, when the UE moves between 3GPP defined RATs and non 3GPP defined RATs, shall be supported provided that the non-3GPP defined RATs is connected to the 3GPP system via the Evolved Packet Core.

The user experience shall be as far as possible unaffected by the change of RAT.

7.1.4.3 Service continuity between E-UTRAN and 3GPP2 accesses on Evolved Packet Core

The Evolved Packet System shall support bidirectional service continuity between cdma2000 1xRTT Revision A [8], [9], [10], [11], [12], [13], [14], [15] and E-UTRAN.

NOTE 1: if bi-directional support is not practical, service continuity from E-UTRAN to cdma2000 1xRTT Revision A should have the higher priority.

NOTE 2: The CS component of cdma2000 1xRTT Revision A is not expected to be connected to the Evolved Packet Core.

The Evolved Packet System shall support bidirectional service continuity between cdma2000 HRPD (1xEV-DO) Revision A [17], [14], [15], [16] and E-UTRAN for best effort and real-time applications.

The Evolved Packet System shall support bidirectional service continuity between cdma2000 HRPD (1xEV-DO) Revision 0 [18], [14], [15], [16] and E-UTRAN for best effort applications.

7.1.4.4 Service continuity between 3GPP and WiMAX access on Evolved Packet Core

The Evolved Packet System shall support bidirectional service continuity between Mobile WiMAX [20], [22], [23], [24] and GERAN PS.

The Evolved Packet System shall support bidirectional service continuity between Mobile WiMAX [20], [22], [23], [24] and UTRAN PS.

The Evolved Packet System shall support bidirectional service continuity between Mobile WiMAX [20], [22], [23], [24] and E-UTRAN.

NOTE: The above requirements assume that the service continuity takes place through the Evolved Packet Core.

7.1.5 Access network discovery

To avoid unnecessary background scan by the UE and to facilitate service continuity by the UE it shall be possible for the VPLMN and the HPLMN to provide the UE with access network information pertaining to locally supported non-3GPP access technologies, in a resource efficient and secure manner. This mechanism is meant to facilitate changes, including service continuity, between 3GPP access systems and non 3GPP access systems and vice versa. The information may be restricted to the access technologies the UE can use. To reduce battery drain, a UE should minimise the frequency of scanning for different access technologies.

When discovering non-3GPP accesses a UE shall be able to receive information from a non-3GPP access network concerning to which PLMN, or PLMNs, the non-3GPP access network provides access.

Note: The capability to provide such information by a non-3GPP access network is out of scope of 3GPP.

When a UE receives service via a non-3GPP access it shall be possible for the PLMN that provides the non-3GPP access to indicate local availability of 3GPP access to the UE,, in a secure manner, subject to capabilities of the non-3GPP access network.

7.1.6 Steering of access

When a UE is accessing the Evolved Packet Core via E-UTRA, the operator of the PLMN that provides the access (registered PLMN or RPLMN for short) may request the UE to use - any or a specific - non-3GPP RAT. Similarly, if a UE is accessing the Evolved Packet Core via a non-3GPP RAT then the RPLMN may want to request the UE to use E-UTRA. The reason for such steering may be load balancing (for camped- and traffic load balancing), operator policy, private networks/home cells, service based mobility control etc.

The RPLMN shall be able to download on the UE a list of preferred access technologies in priority order. If, while the UE is registered on that PLMN, an access technology with higher priority than the one currently used is detected, the UE shall attempt to use the higher priority access network to access the RPLMN.

The UE shall only perform access technology selection within the RPLMN.

In case the UE is connected to the PLMN via a non-3GPP access, then the PLMN reselection procedures specified for that access technology may be executed.

Note 1: The PLMN operator may provide access to the Evolved Packet Core either through an own access network (E-UTRA or non-3GPP access) or in collaboration with an access network operator that operates a non-3GPP access network.

Note 2: A specific non-3GPP RAT may e.g. be identified by RAT type and the access network name (as advertized by the access network), or a list of access network names.

The HPLMN may also provide the UE with a list of preferred access technologies in priority order for use in the RPLMN. Only one list of preferred access technologies can be active at a time and the list provided by the RPLMN takes precedence over the list provided by the HPLMN. The list of preferred access technologies received from the VPLMN is specific to that VPLMN and PLMNs equivalent to it.

7.1.7 CS fallback

7.1.7.1 General

For those services delivered via the HPLMN that the HPLMN only supports in the CS domain (e.g. voice services), when such services are invoked while the UE is configured to use CS Fallback and registered in the E-UTRAN (either in the HPLMN or in a VPLMN), it shall be possible for the EPS to request the UE to perform a change of radio access technology in order to deliver the service over UTRAN or GERAN or 1xRTT.

In the case of an incoming CS service to a UE that is registered for CS services and active in E-UTRAN, the EPS shall transfer the CLI to the UE if available and the calling party has not restricted the presentation, prior to triggering CS fallback. Depending on UE configuration and when the UE is in connected mode, the user or an application on behalf of the user may request to accept or reject CS fallback before performing a change of radio access technology. The default behaviour of the UE is to accept the CS fallback.

7.1.7.2 Roaming in a VPLMN not supporting CS fallback

When a UE that is configured to use CS fallback registers over E-UTRAN in a VPLMN not supporting CS fallback the default behaviour of the UE is to attempt to select a GERAN/UTRAN/1xRTT CS radio access technology in the VPLMN or in a PLMN equivalent to the VPLMN. The default behaviour of the UE is not to autonomously attempt to (re-)select the E-UTRAN for the duration of the time the UE stays in a VPLMN and PLMNs equivalent to the VPLMN.

The default behaviour may be changed based on user preference settings.

The UE may offer the user to perform a PLMN scan and display the list of available PLMNs. The selection of a different PLMN is performed using the manual mode.

7.2 IFOM Service requirements

Simultaneous active mode of operation is an optional capability for multimode UEs, which support 3GPP and WLAN access. UE supporting simultaneous active mode of operation between one set of technologies may not be capable to support simultaneous active mode of operation between a different technology set (e.g. due to radio interference limitations).

The following requirements apply to the case of UEs with multiple interfaces which will simultaneously connect to 3GPP access and one single WLAN access.

- It shall be possible to provide service continuity when the UE moves from the 3GPP access to WLAN access and vice versa.
- If the UE is under the coverage of more than one access, including 3GPP and WLAN accesses and communicates using multiple accesses simultaneously, it shall be possible to select one access when a flow is started and re-distribute the flows to/from a UE between accesses while connected.
- It shall be possible for the operator to enable and control via policies the simultaneous usage of multiple accesses.
- It shall be possible to distribute IP flows to/from a UE between available accesses based on the characteristics of the flows and the capabilities of the available accesses, subjected to user's preferences and operator's policies.
- It shall be possible for the operator to define policies for the control of the distribution of IP flows between available accesses. Each policy shall include a list of preferred accesses and whether the policy may be overridden by the user's preferences.

  NOTE: The possibility of manual selection or user override is not precluded.

  These policies may be defined per APN, per IP flow class under any APN or per IP flow class under a specific APN. The IP flow class identifies a type of service (e.g. IMS voice) or an operator defined aggregation of services.

  The policies apply with the following priority order:

  1. Policies per IP flow class under a specific APN.
  2. Policies per IP flow class under any APN.
  3. Policies per APN.
- Distribution of flows to/from a UE between available accesses based on the characteristics of the flows and/or the capabilities of the available accesses shall be possible for flows exchanged by both operator controlled (e.g. IMS) and non operator controlled (e.g. web and mail access) applications/services.
- It shall be possible to move all the flows to/from a UE out of a certain access in case the UE loses connectivity with that access (e.g. UE moves out of coverage of a WLAN access while maintaining connectivity through the 3GPP access).
- Re-distribution of flows to/from a UE between accesses may be triggered by changes to the characteristics of the flows (e.g. QoS requirements) or the capabilities of the available accesses (e.g. due to network congestion, mobility event, or UE discovers a new access) during the connection.

8 Performance requirements for the Evolved Packet System

The Evolved Packet System comprises the Evolved Packet Core together with the evolved radio access network (E-UTRA and E-UTRAN). A study of the Evolved Packet Core can be found in TS23.882 [7] and the evolved radio access network E-UTRA and E-UTRAN in TR25.913 [4].

The performance objectives for the Evolved Packet System include higher user data rates, reduced latency, improved system capacity and coverage, reduced network complexity and lower operating costs.

The Evolved Packet System shall meet or exceed the following performance criteria:

a) The radio access network shall be capable of supporting instantaneous peak packet data rates of 100 Mbps on the radio access bearer downlink to the UE and 50 Mbps on the uplink.

b) The Evolved Packet System shall be capable of providing lower user and control plane latency when compared to existing 3GPP access networks. The maximum delay should be comparable to that for fixed broadband Internet access technologies. [e.g. less than 5ms in ideal conditions]

c) The system shall be capable of supporting large volumes of mixed e.g. voice, data and multimedia traffic. Enhanced load balancing and steering of roaming methods should be used to minimise cell congestion.

d) The level of system complexity and mobility management signalling shall be optimised to reduce infrastructure and operating costs. UE power consumption shall also be minimised accordingly.

e) For the Evolved Packet System the interruption time during handover of RT and NRT services shall be kept to minimum and shall not exceed the values defined in TR 25.913[4].

9 Security and privacy

9.1 General

The Evolved Packet System shall provide a high level of security and privacy for users and Evolved Packet System operators.

9.2 Security requirements

The Evolved Packet System shall provide a high level of security, equivalent or better than Rel-7 3GPP systems.

Any possible lapse in security in one access technology shall not compromise security of other accesses.

The Evolved Packet System should provide protection against threats and attacks including those present in the Internet.

The Evolved Packet System shall support information authenticity between the terminal and Evolved Packet Systems.

The Evolved Packet System shall allow for a network to hide of internal network elements from the UE.

Security policy shall be under the control of the home operator.

The security solution should not interfere with service delivery or 3GPP inter-access handovers in a way that is noticeable to end-users or service providers.

Appropriate traffic protection measures should be provided by the Evolved Packet System.

The Evolved Packet System shall provide appropriate mechanisms to enable lawful intercept.

The Evolved Packet System shall ensure that no unauthorized user can obtain a legitimate IP address that can be used to establish communication or enable malicious attacks on evolved system entities.

Release 99 or later Releases' USIM application on the UICC is required to authenticate a user in an Evolved Packet System and hence allowing the user to get services in the Evolved Packet System according to her/his subscription.

Note: The above requirement is applicable when providing access to the EPC via E-UTRAN.

Once authenticated via a 3GPP or Evolved Packet System, the USIM shall not be required to re-authenticate upon changing between these systems, unless specifically requested by the operator (PLMN).

NOTE: It may be possible to use other applications on the UICC in order to provide authentication on the 3GPP or Evolved Packet System (e.g. for connection to IMS). In addition, in case it is desirable to improve the level of security or to add new security mechanisms for accessing the Evolved Packet System compared to the one provided in Rel-7, a revised/upgraded application on the UICC may be required.

9.3 Privacy requirements

The Evolved Packet System shall provide several appropriate levels of user privacy including communication confidentiality, location privacy, and identity protection.

The privacy of the contents, origin, and destination of a particular communication shall be protected from disclosure to unauthorised parties.

The Evolved Packet System shall be able to hide the identities of users from unauthorised third parties.

It shall be possible to provide no disclosure, at any level of granularity, of location, location-related information, e.g. geographic and routing information, or information from which a user"s location can be determined, to unauthorised parties, including another party on a communication.

10 Charging Aspects

The Evolved Packet System shall support various charging models including all those supported by the 3GPP system contained within TS22.115 [5] .

Charging models that shall be supported by the Evolved Packet System include (non-exhaustive list):

- calling party pays
- charging based on assured QoS
- charging based on the transport
- charging based on an event
- charging based on content
- charging adjustment (e.g. based on subscription bands)
- alternate party charging

The Evolved Packet System shall also be able to support introduction of new charging schemes including online and offline schemes, and charging schemes for the multi-access system environment

Charging mechanisms of the Evolved Packet System shall provide (non-exhaustive list):

- Cost effective Control and Charging of IP Flows
- Perform online charging
- Support differentiated charging including zero rating of the bearer and event charging
- Awareness of subscriber identity, time-of-day, roaming status, QoS, Service input etc

Annex A (informative): Requirements for further study

A.1 Management of access networks

The Evolved Packet System shall be able to allow for self-managing technologies (e.g. Plug-and-Play) for dynamically adding and removing non-3GPP defined access networks.
Such self-managing technologies shall take into account the Evolved Packet System and access network policies.

E.g. depending on such policies it shall be possible to for the 3GPP system operator to request encryption of user traffic that is transmitted over the access network.

NOTE 1: The non-3GPP access network needs to have defined interworking with 3GPP.

An example could be a WLAN (operated by some WLAN operator) that can, if needed, automatically be connected to a PLMN to serve as an I-WLAN access. This would enable the PLMN operator to provide additional access resources on a dynamic basis and to provide service to more customers (e.g. at mass events).

NOTE 2: The degree of automation provided for network attachment is yet to be determined, but is intended to simplify (or completely automate) administration procedures.

A.2 Use cases for Fixed Mobile Convergence

A family has purchased a family subscription plan that is independent of access (e.g. fixed or wireless) and location (e.g. both when at home and away from home). The subscription contains at least the following components:

- Internet access: Operator specific service such as firewall and content filtering (parental control) independent of access for selected devices within the family. The service should be available at home, within the home mobile network and when roaming to a visited mobile network.
- Voice/Multimedia: QoS and mobility between home WLAN and LTE wide area
- Charging schemas connected to access type, preference and location
- Video: Premium Video on Demand Service incl. guaranteed bandwidth and QoS regardless of access network.

Description

Use case 1: Internet access with Parental control and personal firewall

The kids leave their house and take a bus to their grandparents" house.

The operator specific services, like parental control and personal firewall, are invoked for specific users and terminals from both fixed network and from mobile network; this allows the kids to get the same service and filtering inside the home, in the bus going to grandparents and at the grandparents. In this use case the grandparents have a separate service provider than the family but the services will still be provided by the service provider where the family has a subscription.

Use case 2: Voice/Multimedia and Charging

The father travels home after work while talking on the phone with his colleague.

The ongoing Voice/Multimedia call between the father and his colleague is maintained while switching over between LTE Wide area and residential fixed broadband WLAN network. Once the call is switched over to WLAN charging for home-based access is applied. Bandwidth and QoS is maintained for the duration of the call to guarantee the same service delivery.

Use case 3: Video

The kids in the backseat of the car are watching an Internet TV show on their laptop using LTE while driving home from the grandparent"s house.

The TV show is sent from an Internet TV provider. Once home the terminal detects indoor WLAN coverage where the subscriber has a WLAN Residential Gateway connected to his Fixed Broadband network. The user or the terminal automatically may select to switch the IP connection to the wireline broadband connection and enable the user to resume watching the same TV show on the same laptop, possibly with a better quality picture as allowed by the available bandwidth, user-specific policy, network policy and QoS setting.

Use case 4: H(e)NB/Femtocell

A subscriber desires to improve coverage and access speed for their 3GPP device in their home. They purchase and install a small eNodeB (Femtocell AP) device for their home which attaches to the home LAN and establishes a connection back to the subscriber"s mobile service provider network. The mobile network provider coordinates with the broadband access provider to deliver proper bandwidth and QoS to support a good QoE for calls and data sessions made within the home that access services from the mobile network. The Femtocell also allows some types of data traffic to be shared with the home LAN, including traffic for Internet applications. Local traffic can be discerned and accounted for differently than traffic that is carried on the mobile network.

Use case 5: Application Mobility

A subscriber is in a multimedia call on their mobile device, and then wishes to change the device they are using to a fixed network attached device (e.g. Set Top Box / TV). The multimedia call is handed over from the mobile network to the fixed network after the subscriber chooses to transfer the multimedia call to a STB / TV. Bandwidth and QoS is maintained for the large screen experience to be meaningful. Accounting and settlement is supported among the application and network service providers, and reflects the changes to the access technology and required bandwidth.

Use case 6: Common Quota

A Common Quota (CQ) can be assigned for both fixed and mobile accesses for a limited time period for a defined set of subscriptions. During each session the network elements monitor the CQ which may be consumed by one or more devices over either the wireless or fixed networks.

When a defined percentage of the CQ and/or all the CQ has been consumed, one or more subscribers in the defined set can be notified of the event (e.g. via SMS and/or email).

When the CQ has been consumed the access to the services is blocked.

Use case 7: Video On Demand Service

Video On Demand (VoD) service is provided to the subscriber via the Set Top Box to the TV or to the PC. A user orders a VoD service interacting with the VoD infrastructure, which sends a resource request to the network. The user may also request mid-session requests triggering the increase/decrease of network resources. The requests will be accepted or rejected according to the available network resources.

Use case 8: Broadband Access Wholesale

In Broadband network the wholesale scenario is quite important as it may be required by the regulation, known as unbundling (access, connectivity and services). For example the operator of the broadband access network lease/sell transport of the connection through its own network from the user to the buyer / leased network. So in the wholesale scenario the renting operator has the end-to-end Service responsibility to the customer and is viewed as the 'Retailer' of the service or application. While the leasing network operator has the responsibility for the access network and for the connectivity.

Annex B (Normative): Evolved Packet System (EPS) applicable specifications

The specifications listed in clause B.1contain requirements applicable to the Evolved Packet System (EPS).

B.1 EPS Applicable Specifications

TS	Title
21.905	Vocabulary for 3GPP Specifications
22.011	Service accessibility See note
22.016	International Mobile Equipment Identities (IMEI)
22.022	Personalisation of Mobile Equipment (ME); Mobile functionality specification
22.030	Man-Machine Interface (MMI) of the User Equipment (UE)
22.038	USIM Application Toolkit (USAT/SAT); Service description; Stage 1
22.041	Operator Determined Call Barring
22.042	Network Identity and Time Zone (NITZ) service description; Stage 1
22.066	Support of Mobile Number Portability (MNP); Stage 1
22.067	enhanced Multi-Level Precedence and Pre-emption service (eMLPP); Stage 1
22.071	Location Services (LCS); Service description; Stage 1
22.078	Customised Applications for Mobile network Enhanced Logic (CAMEL)
22.101	Service Principles
22.105	Services and Service Capabilities
22.115	Charging and Billing
22.129	Handover requirements between UTRAN and GERAN or other radio systems
22.146	Multimedia Broadcast/Multicast Service (MBMS); Stage 1
22.153	Multimedia priority service
22.173	IP Multimedia Core Network Subsystem (IMS) Multimedia Telephony Service and supplementary services; Stage 1
22.174	Push service; Stage 1
22.182	Customized Alerting Tones (CAT) Requirements
22.226	Global text telephony (GTT); Stage 1: Service description
22.228	Service requirements for the Internet Protocol (IP) multimedia core network subsystem (IMS); Stage 1
22.233	Transparent end-to-end packet-switched streaming service; Stage 1
22.234	Requirements on 3GPP system to Wireless Local Area Network (WLAN) interworking
22.240	Service requirements for 3GPP Generic User Profile (GUP); Stage 1
22.242	Digital Rights Management (DRM); Stage 1
22.246	Multimedia Broadcast/Multicast Service (MBMS) user services; Stage 1
22.250	IP Multimedia Subsystem (IMS) Group Management; Stage 1
22.259	Service requirements for Personal Network Management (PNM); Stage 1
22.279	Combined Circuit Switched (CS) and IP Multimedia Subsystem (IMS) sessions; Stage 1
22.340	IP Multimedia Subsystem (IMS) messaging; Stage 1
Note: In case the UE is connected to the PLMN via a non-3GPP access, then the PLMN (re)selection procedures specified for that access technology may be executed.	

Annex B1 (Informative): Void

Annex C (informative): Change history

Change history											
TSG SA#	SA Doc.	SA1 Doc	Spec	CR	Rev	Rel	Cat	Subject/Comment	Old	New	WI
SP-35	SP-070128	S1-070187	22.278	0001	2	Rel-8	F	Clarification on QoS classes for evolved 3GPP system	8.0.0	8.1.0	SAE-R
SP-35	SP-070127	S1-070197	22.278	0002	-	Rel-8	B	Provision of access network information to the UE	8.0.0	8.1.0	SAE-R
SP-36	SP-070365	S1-070806	22.278	0003	3	Rel-8	B	Requirement for handovers between LTE and 3GPP2 access networks	8.1.0	8.2.0	SAE-R
SP-36	SP-070369	S1-070556	22.278	0005		Rel-8	D	Editorial correction for performance requirements for evolved 3GPP system	8.1.0	8.2.0	SAE-R
SP-36	SP-070367	S1-070807	22.278	0006	1	Rel-8	B	Performance requirements for evolved 3GPP system	8.1.0	8.2.0	SAE-R
SP-36	SP-070370	S1-070764	22.278	0008	1	Rel-8	B	Requirement for national roaming between LTE-only operators and 2G/3G-only operators	8.1.0	8.2.0	SAE-R
SP-36	SP-070483	S1-070805	22.278	0009	5	Rel-8	B	Requirements for service continuity between 3GPP system and WiMAX	8.1.0	8.2.0	SAE-R
SP-37	SP-070566	S1-071324	22.278	10	2	Rel-8	D	Addition of 3GPP reference for the evolved 3GPP packet system (EPS)	8.2.0	8.3.0	SAE-R
SP-37	SP-070566	S1-071096	22.278	11	1	Rel-8	B	Multiple IP session	8.2.0	8.3.0	SAE-R
SP-37	SP-070566	S1-071097	22.278	12	1	Rel-8	B	Voice service continuity between 3GPP RAT and non 3GPP RAT	8.2.0	8.3.0	SAE-R
SP-37	SP-070566	S1-070994	22.278	13	1	Rel-8	B	Alignment of terminology with SA2	8.2.0	8.3.0	SAE-R
SP-37	SP-070566	S1-071122	22.278	14	1	Rel-8	B	Access network discovery	8.2.0	8.3.0	SAE-R
SP-38	SP-070855	S1-071856	22.278	0021	2	Rel-8	C	Support for efficient delivery of text-based broadcast messages	8.3.0	8.4.0	AIPN-SAE
SP-38	SP-070855	S1-071912	22.278	0022	1	Rel-8	B	Emergency Call Support	8.3.0	8.4.0	AIPN-SAE
SP-38	SP-070856	S1-071913	22.278	0015	3	Rel-8	B	Enhancements to Access network discovery and steering of access	8.3.0	8.4.0	AIPN-SAE
SP-38	SP-070856	S1-071915	22.278	0017	1	Rel-8	F	Multi-access MBMS	8.3.0	8.4.0	SAE-R
SP-38	SP-070856	S1-071916	22.278	0018	1	Rel-8	B	QoS change requirement clarification	8.3.0	8.4.0	SAE-R
SP-38	SP-070929	-	22.278	0024	2	Rel-8	C	Addition of list of applicable specifications for the EPS and amended scope	8.3.0	8.4.0	AIPN-SAE
SP-40	SP-080306	S1-080740	22.278	0028	2	Rel-8	F	Clarification of EPS access using pre-Rel-8 USIMs	8.4.0	9.0.0	AIPN-SAE
SP-40	SP-080306	S1-080720	22.278	0030	1	Rel-8	F	WIMAX Forum specification reference in TS 22.278	8.4.0	9.0.0	AIPN-SAE
SP-40	-							Creation of v.9.0.0. Content identical to 8.4.0 + CRs 28r2 and 30r1 (but not including CR 27r1, applicable to Rel-8 only, to remove Features which Stage 3 was not completed on time)	8.4.0	9.0.0	-
SP-41	SP-080495	S1-082018	22.278	0037	-	Rel-9	A	Service continuity (mirror to a Rel-8 CR)	9.0.0	9.1.0	AIPN-SAE
SP-41	SP-080639	-	22.278	0039	3	Rel-9	A	Access Network Discovery and Steering of Access	9.0.0	9.1.0	AIPN-SAE
SP-41	SP-080495	S1-082398	22.278	0041	2	Rel-9	A	Update IP session control and local breakout requirements	9.0.0	9.1.0	AIPN-SAE
SP-41	*SP-080495*	*S1-082386*	*22.278*	*0043*	*3*	*Rel-9*	*A*	*Requirement on support of CS Fallback*	*9.0.0*	*9.1.0*	*AIPN-SAE*
SP-41	SP-080652	-	22.278	0043	5	Rel-9	A	De-implementation of CR43r3 and implementation of 43r5, as approved during SA#41	9.1.0	9.1.1	AIPN-SAE
SP-42	SP-080774	S1-083114	22.278	0045	-	Rel-9	A	Deletion of redundant reference	9.1.1	9.2.0	AIPN-SAE
SP-42	SP-080783	S1-083465	22.278	0049	2	Rel-9	B	Terminal Identification of 3GPP and 3GPP2 devices	9.1.1	9.2.0	TEI9
SP-42	SP-080778	S1-084334	22.278	0051	1	Rel-9	B	Support for Multimedia Priority	9.1.1	9.2.0	AIPN-SAE

								Service in EPS			
SP-42	SP-080783	S1-084368	22.278	0054	1	Rel-9	C	EPS operational deployment and mobility optimization	9.1.1	9.2.0	TEI9
SP-42	SP-080783	S1-084069	22.278	0055	-	Rel-9	B	Removal of chapter 6.1.2 and 6.1.3	9.1.1	9.2.0	TEI9
SP-42	SP-080783	S1-084425	22.278	0056	3	Rel-9	D	Enhanced ANDSF Requirements	9.1.1	9.2.0	TEI9
SP-42	SP-080783	S1-084414	22.278	0057	1	Rel-9	C	Basic support for multiaccess	9.1.1	9.2.0	TEI9
SP-42	SP-080783	S1-084363	22.278	0058	1	Rel-9	B	Adding an appendix with FMC uses cases to 22.278	9.1.1	9.2.0	TEI9
SP-44	SP-090417	S1-091153rev	22.278	0062	2	Rel-9	A	Access Technology Selection across PLMNs	9.2.0	9.3.0	SAES
SP-44	SP-090371	S1-091169	22.278	0066	-	Rel-9	A	Move sentence about non-3GPP access	9.2.0	9.3.0	SAES
SP-44	SP-090371	S1-091352	22.278	0067	-	Rel-9	A	Frequency of Scanning for Different Access Technologies	9.2.0	9.3.0	SAES
SP-45	SP-090476	S1-093272	22.278	0060	4	Rel-9	A	Alignment about accepting/rejecting CSFB	9.3.0	9.4.0	AIPN-SAE
SP-46	SP-090843	S1-094500	22.278	0070	2	Rel-9	F	One active policy ruleset in ANDSF	9.4.0	9.5.0	eANDSF
SP-46	SP-090904	-	22.278	0071	7	Rel-10	B	Adding of IFOM Requirements	9.5.0	10.0.0	IFOM
SP-47	SP-100185	S1-100236	22.278	0080	5	Rel-10	B	Requirements for Fixed Mobile Interworking	10.0.0	10.1.0	BBAI
SP-49	SP-100575	S1-102056	22.278	0089	-	Rel-10	A	Removal of references to 3GPP OSA	10.1.0	10.2.0	TEI10
SP-49	SP-100582	S1-102032	22.278	0083	-	Rel-11	B	Adding a H(e)NB use case to FMC use cases	10.1.0	11.0.0	BBAI
SP-49	SP-100582	S1-102303	22.278	0084	1	Rel-11	B	Adding a Application Mobility use case to FMC use cases	10.1.0	11.0.0	BBAI
SP-49	SP-100582	S1-102307	22.278	0086	1	Rel-11	D	Clarifications on FMC use cases	10.1.0	11.0.0	BBAI
SP-49	SP-100582	S1-102308	22.278	0085	2	Rel-11	B	Adding a Common Quota use case to FMC use cases	10.1.0	11.0.0	BBAI
SP-49	SP-100582	S1-102309	22.278	0087	2	Rel-11	B	New Requirements for Fixed Mobile Convergence scenario	10.1.0	11.0.0	BBAI
SP-50	SP-100802	S1-103263	22.278	0090	1	Rel-11	F	Clarifying the scenarios supported by FMC interworking, including building block II	11.0.0	11.1.0	BBAI
SP-50	SP-100802	S1-103266	22.278	0091	2	Rel-11	B	New Requirements for Enterprise Interworking scenario	11.0.0	11.1.0	BBAI
SP-50	SP-100802	S1-103242	22.278	0093	3	Rel-11	B	3GPP EPC based FMC	11.0.0	11.1.0	BBAI
SP-50	SP-100802	S1-103321	22.278	0095	1	Rel-11	B	Use cases for BBAI Building Block 3 - Converged scenario	11.0.0	11.1.0	BBAI
SP-50	SP-100802	S1-103323	22.278	0097	-	Rel-11	B	Evolved Packet Core support for fixed access	11.0.0	11.1.0	BBAI
-								LTE logo changed into LTE Advanced logo	11.1.0	11.1.1	-
SP-51	SP-110165	S1-110297	22.278	0094	2	Rel-11	B	Scenarios for Interworking between Mobile Operators and Application Providers	11.1.0	11.2.0	MOSAP
SP-51	SP-110165	S1-110404	22.278	0098	3	Rel-11	B	New requirements for MOSAP	11.1.0	11.2.0	MOSAP
SP-51	SP-110165	S1-110302	22.278	0100	2	Rel-11	B	Use cases for MOSAP	11.1.0	11.2.0	MOSAP
SP-51	SP-110169	S1-110181	22.278	0099	2	Rel-11	B	Fixed Broadband Access Network Requirements for BBAI Building Block 3 - Convergent scenario	11.1.0	11.2.0	BBAI
SP-52	SP-110372	S1-111223	22.278	0101	2	Rel-11	B	User consent-based charging use case for MOSAP	11.2.0	11.3.0	MOSAP
SP-52	SP-110372	S1-111412	22.278	0103	2	Rel-11	B	Non-collaboration requirements for MOSAP	11.2.0	11.3.0	MOSAP
SP-53	SP-110575	S1-112357	22.278	0110	3	Rel-11	F	MOSAP - Roaming LBO Architecture Correction	11.3.0	11.4.0	MOSAP
SP-56	SP-120294	S1-121328	22.278	0115	2	Rel-11	F	Removal of MOSAP requirements from Rel-11 Specs	11.4.0	11.5.0	MOSAP
SP-57	SP-120525	S1-122052	22.278	0117	-	Rel-11	B	Removal of BB III - Fixed Mobile Convergence requirements from Rel-11	11.5.0	11.6.0	BBAI

History

Document history		
V11.6.0	September 2012	Publication