3GPP TS 22.258 V8.0.0 (2006-03)

Technical Specification

**3rd Generation Partnership Project;
Technical Specification Group Service and System Aspects;
Service Requirements for the All-IP Network (AIPN);
Stage 1
(Release 8)**

Keywords
UMTS, Network, IP

3GPP

Postal address

3GPP support office address
650 Route des Lucioles - Sophia Antipolis
Valbonne - FRANCE
Tel.: +33 4 92 94 42 00 Fax: +33 4 93 65 47 16

Internet
http://www.3gpp.org

3GPP

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

The All-IP Network (AIPN) was the subject of a feasibility study within [2]. The present document contains the stage 1 requirements for the AIPN based upon the conclusions of this feasibility study.

The AIPN is an evolution of the 3GPP system to meet the increasing demands of the mobile telecommunications market. Primarily focused upon enhancements of packet switched technology, AIPN provides a continued evolution and optimisation of the system concept in order to provide a competitive edge in terms of both performance and cost. Moreover, it is important that developments of the 3GPP system are compliant with Internet protocols. The AIPN is not limited to consideration of only the transport protocol used within the 3GPP system but adheres to the general concept of a network based upon IP and associated technologies, able to accommodate a variety of different access systems. Although, it is possible to use a variety of different access systems to connect to the AIPN, the AIPN provides an advanced, integrated service set independent as far as possible from the access system used.

The high level objectives of introduction of the AIPN are to realise: *universal seamless access, improved user experience, reduction of cost* (for AIPN operators)*, and *flexibility of deployment*. There are also a number of motivations and drivers for the introduction of the AIPN which include but are not limited to: diversification of mobile services, need to satisfy user experience of early adopters, anticipation of PS traffic to surpass CS, desire to encompass a variety of access systems, need for increased system efficiency and cost reduction (OPEX and CAPEX), and advances of next generation radio access systems and broadband wireless IP-based networks.

The AIPN builds upon key success factors of the 3GPP system as a mobile network system (e.g. provision of network operator control within the network and the ability to utilise the wireless interface as efficiently as possible) whilst providing improvements in basic system performance and enhancing the capabilities for network operators to provide services to subscribers and users.

For further details on the high level objectives, motivations and drivers, and impacts upon the models of the 3GPP system of the AIPN see [2].

1 Scope

The present document describes the service requirements for the All-IP Network (AIPN) including service requirements for Evolved UTRA and UTRAN. Where appropriate, references are made to service requirements within other 3GPP specifications that are applicable to the AIPN.

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 TR 21.905: "Vocabulary for 3GPP Specifications".

[2]   3GPP TR 22.978 "All-IP Network (AIPN) Feasibility Study".

[3]   3GPP TR 25.913: "Requirements for Evolved UTRA and UTRAN"

[4]   3GPP TS 22.003: "Circuit Teleservices supported by a Public Land Mobile Network (PLMN)"

[5]   3GPP TS 22.101: "Service aspects; Service principles".

[6]   3GPP TS 22.228: "Service requirements for the Internet Protocol (IP) multimedia core network subsystem; Stage 1".

[7]   3GPP TR 22.973 "IMS Multimedia Telephony Service and supplementary services"

[8]   3GPP TS 22.250 "IP Multimedia Subsystem(IMS) Group Management; Stage 1"

[9]   3GPP TS 22.340 "IP Multimedia Subsystem(IMS) Messaging; Stage 1"

[10]   3GPP TR 22.953 "Multimedia priority service feasibility study"

[11]   3GPP TS 22.071 "Location Services (LCS) Service description; Stage 1"

3 Definitions, symbols and abbreviations

3.1 Definitions

For the purposes of the present document, the terms and definitions apply.

All-IP Network (AIPN): A collection of entities that provide a set of capabilities for the provision of IP services to users based on IP technology where various access systems can be connected. The AIPN provides a set of common capabilities (including mobility, security, service provisioning, charging and QoS) which enable the provision of services to users and connectivity to other external networks. An AIPN requires one or more connected access systems to allow users to access the AIPN.

Access system: An entity or collection of entities that provides the user the capability to connect to the AIPN.

AIPN operator: An operator of an AIPN. It is assumed that the AIPN operator will also be a network/PLMN operator as defined within [1].

IP service: A service using an IP bearer provided by an IP service provider. For IP services data traffic is routed according to the IP addresses of the sender and receiver.

IP service provider: A service provider that provides IP services. This may or may not be a network operator e.g. the operator of an IMS would be an IP service provider according to this definition.

IP service subscriber: A subscriber to an IP service provider that uses IP services.

Seamless: A user experience that is unaffected by changes in the mechanisms used to provide services to a user.

> Note: The determination of whether something satisfies the requirement for being seamless or not is dependent on the user's (e.g., human end-user, protocol, application, etc.) perception of the service being received and not necessarily the technology used to provide the service.

Seamless Service: Services provided across access systems and terminal capabilities. Provisioning of this service is continued between and within access systems and between terminals with minimal degradation and no interruption in the service as seen by the user, while adapting to the capabilities of each access system.

End-user mobility: The ability for the subscriber to communicate using the device or devices of his/her choice

Terminal mobility: The ability for the same UE to communicate whilst changing its point of attachment to the 3GPP System. This includes both handovers within the same access system, and handover from one access system to another.

Session mobility: The ability for a communication session to be moved from one device to another under the control of the user.

Ad-hoc Network: A dynamically organized network of mobile terminals that are able to communicate with each other via some means (e.g. using IEEE 802.15 or WLAN in ad-hoc mode). An Ad-hoc Network may contain terminals that are capable of connection to a variety of access systems. In the context of AIPN, it is assumed that every terminal in the Ad-hoc Network is under the control of a separate user, each able to independently access the AIPN. The Ad-hoc Network routes their consolidated traffic towards the AIPN, to an Access system through one or more terminals in the Ad-hoc Network. The Ad-hoc Network may change the terminal carrying the consolidated traffic dynamically according to rules set up by the users. The Ad-hoc Network may move throughout the geographic coverage area.

Moving Network: A group of user devices (terminals) that move together, e.g. as part of a vehicular network. The user devices (terminals) are interconnected in a way that their consolidated traffic towards the AIPN is routed through a well-defined system (gateway). The elements of the consolidated traffic may originate from PAN and Ad-hoc Networks within a Moving Network.

Mobile gateway: A gateway which is at the edge of the AIPN. A mobile gateway travels together with a Moving Network and is equipped with several wireless technologies which connect the mobile gateway to other parts of the AIPN. Since the mobile gateway works as a gateway of a Moving Network, it routes and forwards all control messages and user data between user terminals in the Moving Network and the AIPN. A variety of wireless or wired access technologies can be used to connect the user terminals to the mobile gateway.

For further definitions see [1].

3.2 Abbreviations

For the purposes of the present document, the following abbreviations apply:

AAA	Authentication, Authorisation and Accounting
AIPN	All-IP Network
SSO	Single Sign-On
EUTRAN	Evolved UTRAN
EUTRA	Evolved UTRA
PAN	Personal Area Network

Further abbreviations are given in 3GPP TR 21.905 [1].

4 General description

The AIPN is a common IP-based network that provides IP-based network control and IP transport across and within multiple access systems. This includes the provision of IP-based mobility control of the high quality appropriate for cellular networks (i.e. no degradation in performance compared to other cellular mobility mechanisms) that is not dependent upon specific access or transport technologies, or IP version. It is the aim of the AIPN to provide a seamless user experience for all services within and across the various access systems. As well as across multiple diverse terminals a user may possess. Interworking with external IP networks (e.g. Internet) and legacy networks (e.g. PSTN) is provided and functionality at the edge of the network enables support of different access systems and legacy equipment.

A visual representation of the AIPN is provided in the figure below:
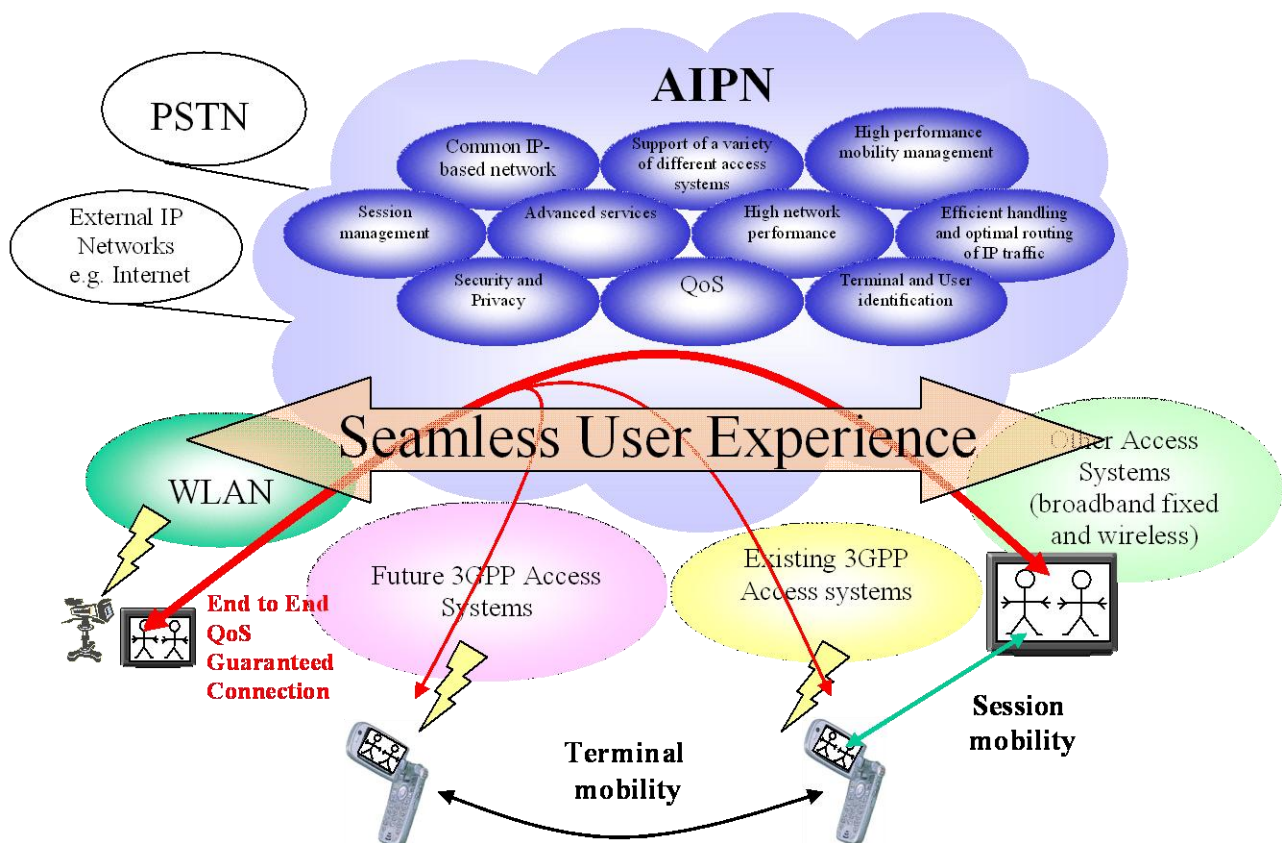
Figure 1: Visual representation of the AIPN

The key aspects of the AIPN can be summarised as follows:

- Support for a variety of different access systems

- Common capabilities provided independent to the type of service provided with convergence to IP technology considered from the perspective of the system as a whole

- High performance mobility management that provides end-user, terminal and session mobility

- Ability to adapt and move sessions from one terminal to another

- Ability to select the appropriate access system based on a range of criteria

- Provision of advanced application services as well as seamless and ubiquitous services

- Ability to efficiently handle and optimally route a variety of different types of IP traffic including user-to-user, user-to-group and ubiquitous service traffic models

- High level of security and support for user privacy e.g. location privacy, identity privacy

- Methods for ensuring QoS within and across AIPNs

- Appropriate identification of terminals, subscriptions and users

- Federation of identities across different service providers

The key aspects of the AIPN are provided in addition to capabilities for efficient resource usage, charging and international roaming that are inherent within the 3GPP system.

4.1 Development of the AIPN

The AIPN is a development of the 3GPP system including IMS, hence the AIPN should be developed focusing upon mobile network scenarios and the requirements of network operators (e.g. for the provision of network control within the AIPN under the control of the network operator and efficient usage of radio resources). Additionally, introduction of the AIPN should not result in degradation of the performance of the system. In general, introduction of the AIPN should result in increased performance and improvements in user experience.

Note: In some cases it may not be possible for the full capabilities of the AIPN to be utilised if other parts of the 3GPP system based on a release that does not fully support the relevant AIPN capabilities are used. For example, in the case a UTRAN or GERAN based access system is used that belongs to a 3GPP release that does not fully support AIPN, some restrictions to the services and performance may be experienced by the user.

5 High level requirements

The AIPN shall be a common IP-based network providing common capabilities independent to the type of service being provided and the access system being used. Convergence to IP technology within the AIPN system design shall be considered from the perspective of the system as a whole with minimum duplication of functionality.

The AIPN shall be capable of accommodating a variety of different access systems hence providing a multi-access system environment to the user. The AIPN shall support service provision and provide mobility functionality within and across the different access systems.

The AIPN shall be able to accommodate fixed access systems and to inter-work with fixed networks in order to provide seamless services over fixed/mobile converged networks, e.g. charging and supplementary services.

The AIPN shall be able to inter-work with a variety of wireless broadband networks based on IP technologies including those not specified by 3GPP.

The AIPN shall be under the control of the operator of the AIPN. The AIPN shall provide common mechanisms for the AIPN operator to control access to and usage of AIPN resources.

The AIPN shall provide a high level of basic system performance including low communication delay, low connection set-up time and high communication quality.

The AIPN shall provide efficient usage of system resources. In particular, the scarcity of the radio resource shall be respected within the AIPN by ensuring that radio resources are utilised as efficiently as possible. The AIPN shall also support effective usage of power resources within mobile terminals by minimising the impact on mobile terminal battery life (standby and active).

The AIPN shall be able to accommodate a vast number of terminals and users as well as be able to support a wide variety of diverse devices. Examples of terminals that shall be supported by the AIPN include terminals which main purpose is to include a sensor/RF tag, household appliances/media players with a wireless communication module, as well as traditional mobile terminals. Identification, addressing, and routing schemes within the AIPN shall be provided to support this communication environment; in particular the AIPN shall support naming and addressing schemes for a given user/session.

The AIPN 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 (see Figure 2).

The AIPN shall provide functionality as appropriate to support roaming with other AIPNs and Rel-6 and earlier 3GPP systems.

The AIPN shall provide appropriate mechanisms to support independent operation of services, AIPN, and/or access systems.

The AIPN shall support all existing Rel-6 3GPP User-Network Interfaces and, therefore, support all R99/Rel-4/5/6 terminals for all services that these terminals get under Rel-6.

During the initial stages of AIPN introduction it is likely that Rel-6 and earlier 3GPP systems and terminals will exist in parallel with AIPNs. Therefore, the AIPN should be able to support CS terminals and accommodate access systems based on CS. Interworking and interconnection with CS networks shall also be provided.

The AIPN shall be designed to enable efficient coexistence with Rel-6 and earlier PS domains.

5.1 Handset and user identification

Methodologies for handset and user identification provided within Rel-6 and earlier 3GPP systems shall be supported. This means that a unique identity (e.g. IMEI or equivalent) should be provided in the handset and a unique user identity (e.g. IMSI or equivalent) should be provided in the UICC.

5.2 MVNO support

It shall be possible to support and inter-work with virtual operators (MVNOs). There are different types of MVNO: the simplest own only their own identity (i.e. unique MCC+MNC) and rely on a network operator for access and core network functionality. Others may have their own core network as well as their own identity and will need only access capability from a network operator. It should be possible to support all types of MVNO.

5.3 AIPN services

The AIPN shall be capable of providing a wide variety of end-user services. Moreover, the AIPN shall be capable of providing user-to-user and user-to-group real-time conversational and non-real time services, including packet-switched voice/multimedia telephony with appropriate provision for supplementary services.

Examples of types of services/service enablers the AIPN may be capable of supporting are listed below (non-exhaustive list):

- Advanced application services

- Conversational services e.g., voice, multimedia telephony

- Fixed/Mobile converged services

- Group communication services

- Integrated services e.g. a mixture of telephony and messaging services

- Media streaming applications

- Moving Networks, Ad-hoc Networks, Personal Networks and Personal Area Networks

- Non-real time, interactive applications, e.g., Web browsing, chat

- Real-time, interactive applications e.g. real-time gaming applications

- Ubiquitous services (e.g. associations with huge number of sensors, RF tags, etc.)

5.3.1 Service Capability Set

The AIPN shall be capable of supporting and inter-working with services provided on Rel-6 and earlier networks.

A basic service capability set should be defined for AIPN to facilitate inter-working. This service capability set should 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

Furthermore, in order to facilitate rapid service creation and allow for operator specific variations, services and applications to be provided by the AIPN shall be based on the AIPN service capabilities available.

5.4   Home network control of allowing traffic not to traverse the home network

The home operator shall be able to explicitly specify when route optimization is applicable to the traffic of the roaming users in such a way that traffic does not need to traverse the home network. To achieve this, route selection rules shall be communicated from the home operator to the visited operator. Traffic does not need to go through the home network if both the route selection rules and the visited operator allow it. The visited operator shall enforce the route selection rules if they exist.

6   Basic AIPN capabilities

6.1   Network performance

The AIPN shall be able to efficiently handle a variety of different types of IP traffic including user-to-user, user-to-group and ubiquitous service traffic models.

The routing of IP traffic, especially user-to-user traffic, shall be optimized. If possible, the routing of user-to-group traffic shall also be optimized. Multicast should be applicable for user-to-group traffic models.

The AIPN shall enable efficient usage of network resources, especially radio resources (e.g. signalling optimization, compression), including selection of access system, based on the provided service.

6.1.1   IP-based routing and addressing

The AIPN shall enable the accommodation of a vast number of users and terminals. IP technology shall be applied to the addressing and routing technology within the AIPN.

6.2   Support of IP traffic

6.2.1   Support of increased IP traffic demand

The AIPN shall be able to accommodate a very large volume of IP traffic, i.e. a great increase in IP traffic compared to Rel-6 and earlier 3GPP systems.

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

6.2.2   Ability to effectively handle a variety of different types of IP traffic

The AIPN shall efficiently handle user-to-server traffic, user-to-user traffic and user-to-group traffic.

The AIPN shall be able to effectively handle different types of IP traffic, such as real-time (e.g. VoIP), non-real time traffic (e.g. Web browsing), and mission critical traffic (e.g. M-Commerce). In order to achieve this, the AIPN shall be able to support different levels of QoS according the type of the IP traffic.

The AIPN shall be able to efficiently support a huge amount of traffic generated by high frequency trickle traffic (i.e. high communication frequency low data volume) from a vast number of terminals. (e.g. traffic generated from ubiquitous services such as 60 transactions of communications per an hour with a few kilo bytes datagram from 10 times the population of devices, e.g. sensor and tag devices, accommodated by Rel-6 and earlier 3GPP systems)
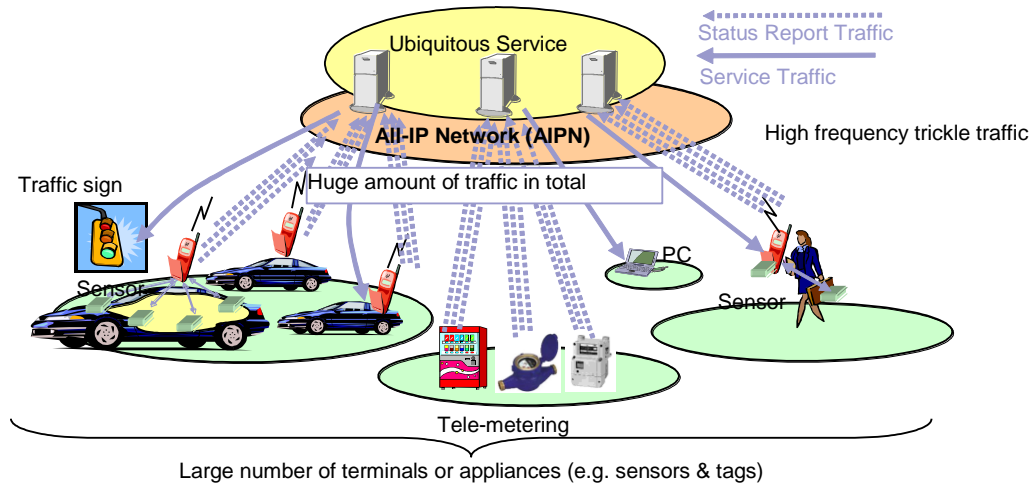
Figure 2: Traffic models of ubiquitous services

6.2.3   IP address support

User device IP addresses should be allocated and managed without user intervention. IP address management should ensure that roaming and mobility between Rel-6 and earlier networks and the AIPN is facilitated within the required performance limits and that security risks are minimised by ensuring that no unauthorised user can obtain an IP address from the AIPN.

6.3   IP session control

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

The AIPN shall support session control for multi-party sessions (e.g. user-to-group) and the solution shall scale with the number of participants.

The AIPN shall be able to provide users with continuous service whilst ensuring the efficient use of wireless resources and the effective usage of power resources within mobile terminals.

6.4   Quality of Service

It shall be possible to assure end-to-end QoS for a user-to-user or multicast (e.g. user-to-multicast) session between AIPNs. This includes the case where more than one network administration is involved in the provision of the end-to-end service.

It shall be possible to support different QoS ensuring methods within the same AIPN and between different AIPNs.

Interworking between different QoS ensuring methods in the end-to-end path shall be supported.

QoS considerations need to be taken into account in handover decisions:

- It shall be possible for the AIPN to assure end-to-end QoS without modification when the terminal or session moves from one access system to another, if the target access system supports the required QoS.

- It shall be possible for the AIPN to assure end-to-end QoS, with QoS modification, when the terminal or session moves from one access system to another, if the target access system has a QoS mechanism but can not be assured to support the required QoS.

- It shall be possible for the AIPN to provide mobility for a terminal or session between an access system that provides QoS and one that does not. However, in this case, seamless experience is not assured, the terminal/application/user may need to be notified via some means and the network may need to adjust service setting for the session(s) accordingly to the change (e.g. charging adjustments, etc).

- It shall be possible for the AIPN to assure QoS of a multicast session without modification to QoS of other terminals when one of the terminals moves from one access system to another (e.g. for multimedia streaming with adaptation to the conditions of each recipient).

- It shall be possible for the AIPN to assure QoS of a multicast session without modification to QoS of other terminals when one of the terminals moves from one access system to another, when the target access system for this terminal does not support the required QoS.

- It shall be possible for the AIPN to assure QoS of a multicast session with QoS modification to one of the terminals, when this terminal moves from one access system to another, if the target access system has a QoS mechanism but can not be assured to support the required QoS. The QoS of the other terminals of the multicast session are unaffected by the modification of QoS of the terminal moving from one access system to another.

Note: Different solutions may result in different requirements for a specific network entity.

6.5 User connection

Users should not have to initiate connection more than once irrespective of whether they start on a Rel-6 and earlier network or an AIPN. The AIPN shall be capable of managing the user identity to ensure that it is passed to and from Rel-6 and earlier networks as the user moves from one network to another.

7 Multi-access and seamless mobility

The AIPN shall support end-user, terminal and session mobility.

The AIPN shall provide high performance and reliable mobility management.

The AIPN shall be capable of providing seamless terminal mobility within and across access systems. The user shall experience no disruption in the service due to terminal mobility.

The AIPN shall be capable of maintaining a service during a change in access system, with no perceivable interruption from a user perspective.

The AIPN shall support adaptation of services to the capabilities provided by the access systems during terminal mobility.

The AIPN shall support terminal mobility based on criteria including radio conditions, service requirements, user preferences and operator policies.

In cases when there is a degradation in service quality due to terminal mobility, it shall be possible to notify end users of the degradation.

The AIPN shall provide appropriate mechanisms to enable users to connect to the AIPN through multiple access systems, including (but not limited to) EUTRAN, I-WLAN and UTRAN & GERAN based access systems.

The AIPN shall be capable of supporting handover between CS voice services (e.g. Teleservice 11[4]) and AIPN equivalent services (e.g. Voice over IP).

7.1 Support of a variety of different access systems

Within the multi-access environment provided by the AIPN it should be possible to reach a user over multiple access systems simultaneously. It should also be possible to provide access system-aware services.

The AIPN shall support appropriate mechanisms for identification, authentication, addressing, and ciphering over multiple access systems.

7.1.1 Access system discovery

Whenever a terminal has access to an AIPN it should be informed by the network about locally available access systems (3GPP standardized and non-3GPP standardized), that provide access to the AIPN. This information should not be restricted to access systems that provide access to a single AIPN but should include all access systems that provide locally access to any AIPN operator.

> Note: Discovery of access systems needs to be seen separate from network selection. Access system discovery as described above operates on physical level, whereas network selection is a logical function and builds upon information in the terminal on available access systems.

7.1.2 Access system selection

The AIPN shall provide support for access system selection by the UE and/or AIPN based on combinations of AIPN operator policies, user preferences, service requirements of applications, access system conditions, and/or other AIPN operator-defined criteria.

> Note: The user preferences are to be respected as long as they do not negatively effect the operation of the system.

The AIPN shall support both manual and automatic access system selection.

The AIPN should allow a change of the access system at any time.

7.2 Mobility management

7.2.1 Heterogeneous access systems mobility

The AIPN should provide open interfaces to AIPN capabilities such as mobility management in order to ease the terminal mobility across different access systems (see figure 3).

The AIPN shall support appropriate mobility mechanisms for seamless mobility between heterogeneous access systems

The AIPN shall support appropriate methods for harmonizing specific security mechanisms of individual access systems.
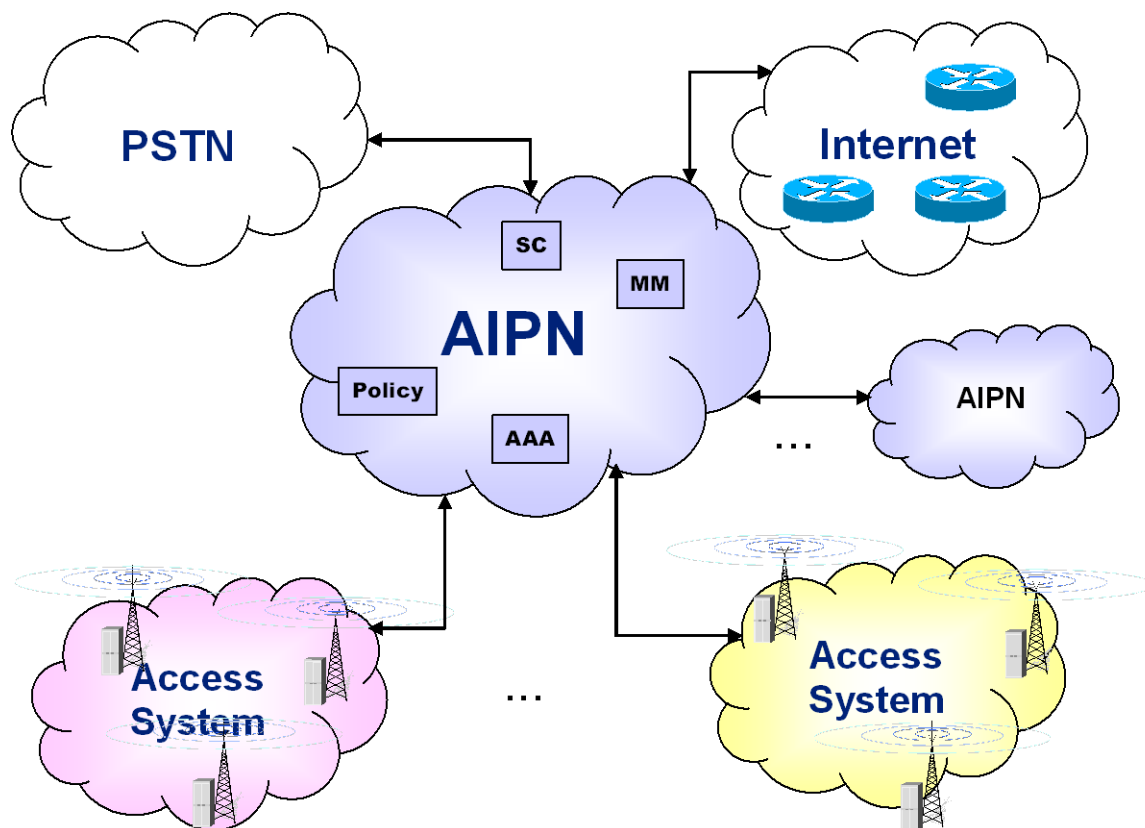
Figure 3: Heterogeneous access system mobility within the AIPN

7.2.2 Heterogeneous mobility mechanisms

Although support for multiple mobility mechanisms may be necessary within the AIPN (e.g. due to varying mobility requirements, need to incorporate multiple administrative domains/local optimisations) the number of different mobility mechanisms within the AIPN should be minimised. Furthermore, the AIPN should work with mobility mechanisms used by the specific networks it connects, including mobility mechanisms provided within Rel-6 and earlier 3GPP CN PS domains.

The AIPN shall be able to support fixed access systems with very limited or no mobility functionality. For user environments involving fixed access systems it shall be possible for a communication session to be stopped and then restarted, without session continuity or handover, to support movement of the user from one access point to another and/or the usage of different terminals by the same user.

The AIPN shall be able to support terminal mobility across multiple administrative domains.

7.2.3 Frequent mobility

The AIPN shall support terminal mobility where handovers within both the AIPN and access systems are very frequent. This may include methods to optimise mobility within geographically or administratively bounded regions.

The AIPN mobility mechanism(s) shall scale with the number of terminals and size of the AIPN.

7.2.4 Service continuity

Service should be maintained during and following changes of access system controlled by the AIPN.

Similarly, service should be maintained during and following a change of network in either direction between a Rel-6 and earlier network and an AIPN.

8 End to end performance requirements for the AIPN

8.1 End to end requirements for the AIPN with EUTRAN

As overall system requirements, the AIPN together with EUTRAN shall be capable of providing a connection set-up time and end to end communication delay competitive with other high performance fixed and mobile communication systems.

The AIPN together with EUTRAN shall be capable of providing a connection set-up time (e.g. time to view a web page from clicking a URL/hear a ring back tone from pressing the SEND key) comparable to the connection setup time for fixed broadband Internet access (e.g. time from clicking a URL to a webpage appearing on a PC screen) of less than one second in ideal conditions.

The AIPN together with EUTRAN shall be capable of providing an end to end delay comparable to the end to end delay for fixed broadband Internet access of 50ms in ideal conditions.

8.2 General end to end requirements for the AIPN with an access system

The AIPN together with an access system shall be capable of fulfilling certain end to end characteristics requirements. These requirements, if met by the system, will enable good end-user performance for a variety of end-user services including, but not limited to:

- Real-time, interactive applications, e.g., voice, video and real-time gaming applications

- Non-real time, interactive applications, e.g., Web browsing, remote login, chat

- Media streaming applications

- Conversational services

The present requirement applies to the entire end-to-end path from the user terminal to the other end-host or server including radio network, core network, and backbone network processing, buffering and propagation delays. Since the delay depends on the location of the end-host, the requirements shall be considered as acceptable values when the user is within the same continent.

Round-trip delay requirement:

- The round-trip delay requirement for small IP packets (0 payload) shall be defined such that it will enable real-time applications at good quality when both end-hosts reside within the same continent.

    - Acceptable value is 50-70 ms average round-trip delay.

Packet loss requirement:

- The packet loss at the IP layer requirement shall be defined such that it will enable a certain maximum download data rate for TCP based applications when both end-hosts reside within the same continent with good radio conditions.

    - Acceptable value is 0.001% in good radio conditions but maximum value is a 0.1% packet loss ratio.

  Note: the maximum value for packet loss may also be sufficient for UDP applications.

Delay jitter requirement:

- The delay jitter requirement shall be defined such that it will not harm real-time applications and will not cause significant TCP degradation due to spurious timeouts.

    - Acceptable value for delay jitter is 25 ms (e.g. for real-time gaming), for TCP based download applications occasional bursts of up to 50 ms are still tolerated.

9 Service requirements for Evolved UTRA and UTRAN

This chapter specifies the service requirements for the Evolved UTRA and UTRAN and related system architecture enhancements.

9.1 Introduction to Evolved UTRA and UTRAN

Evolved UTRA and UTRAN is an evolution of the 3GPP Radio Access Technology to ensure its long term competitiveness within the global mobile telecommunications industry. Important aspects of the evolution to EUTRA and EUTRAN include reduced latency, higher user data rates, improved system capacity and coverage, and reduced cost for the network operator.

A study of the Requirements for Evolved UTRA and UTRAN is contained within TR 25.913 [3].

9.1.1 Services supported by EUTRAN

EUTRAN shall be a packet based system that efficiently supports various types of services, including real-time and conversational services. EUTRAN shall support all services provided by the AIPN, including currently available services. Specific examples of services to be supported by EUTRAN include: web browsing, FTP, video streaming, VoIP and more advanced services.

VoIP shall be supported with performance that is at least as good as CS voice services (e.g. Teleservice 11[4]) provided over UTRAN and the CS domain.

9.2 EUTRA and EUTRAN Performance

EUTRA and EUTRAN shall provide development of a high-data-rate, low-latency and packet optimised 3GPP Radio Access Technology.

EUTRA and EUTRAN shall provide peak data rates and user and signalling traffic latencies competitive with other (non-3GPP) high performance fixed and mobile access technologies.

EUTRA shall be capable of providing increased instantaneous peak data rates compared to other 3GPP Radio Access Technologies (GERAN & UTRA), e.g. up to 100 Mbps on the downlink and 50 Mbps on the uplink.

EUTRAN shall be capable of providing a reduced latency for user traffic compared to other 3GPP Radio Access Technologies comparable to that for fixed broadband Internet access technologies e.g. less than 5ms in ideal conditions (e.g. single user with single data stream for a small IP packet).

EUTRAN shall be capable of providing a reduced latency for signalling traffic compared to other 3GPP Radio Access Technologies. This shall provide the user with the ability to set up a communication (e.g. time to view a webpage after clicking a URL/hear a ring back tone from pressing the SEND key) comparable to the experience when receiving services using fixed broadband Internet access technologies (e.g. time from clicking a URL to viewing a webpage on a PC), irrespective of the (powered on and in coverage) connection state of the UE to EUTRA e.g. less than 100ms for transitions from a camped-state to an active state and less than 50ms for transitions from a dormant to an active state in ideal conditions.
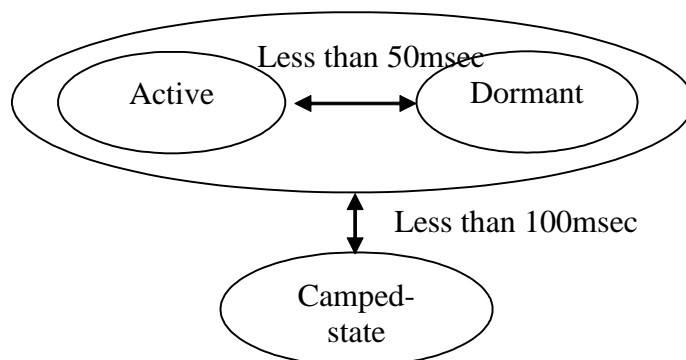
Figure 4: Examples of signalling traffic latency for EUTRAN

EUTRAN shall support end-to-end QoS and provide efficient utilisation of radio resources considering the various types of traffic to be transmitted.

9.2.1 Operating environment

EUTRAN shall be optimised for pedestrian to low vehicular speeds (e.g. 0 to 15 km/h). Standard motor vehicle and low railway speeds (e.g. between 15 and 120km/h) shall be supported with high performance. Mobility shall be maintained from mid to high railway speeds (e.g. between 120km/h and 350km/h) and possibly even higher speeds (e.g. magnetic levitation train/aeronautical speeds of up to 500km/h) depending upon the operating environment.

Voice and other real-time services supported in the CS domain up to and including Rel-6 shall be supported by EUTRAN with at least equal quality to that supported by UTRAN over the whole speed range.

The interruption time for intra EUTRAN handovers shall be less than or equal to that provided by CS domain handovers in GERAN.

9.2.2 UE requirements

The complexity of EUTRA and EUTRAN UEs should be minimized/optimized in terms of size, weight and power consumption (standby and active).

9.3 Interworking with other 3GPP radio access technologies

EUTRAN UEs that also support UTRAN and/or GERAN should be able to support handover from and to these other 3GPP Radio Access Technologies with an acceptable impact on UE complexity and performance.

The capability for handover between CS services over GSM/UTRA and EUTRA in both directions shall be supported.

EUTRAN shall support load balancing and policy management across EUTRA and other 3GPP Radio Access Technologies (GERAN, UTRA) and may provide mechanisms to direct UEs toward appropriate RATs.

9.4 Enhanced support for MBMS

EUTRA shall provide enhanced support for MBMS services compared to UTRA. Specifically, the user should be able to use both MBMS and voice services simultaneously.

10 Ad-hoc network and Moving Network support

10.1 Ad-hoc network support

For supporting Ad-hoc Networks, the AIPN shall satisfy the following requirements.

The AIPN shall be able to accept consolidated traffic from a device acting as a gateway from a group of users arriving through various access systems.

The AIPN shall be able to forward traffic to Ad-hoc Network devices via alternate access routes.

The AIPN shall support changes of access systems bearing the consolidated traffic from an Ad-hoc Network. The AIPN shall support appropriate mechanisms for identification, authentication, addressing, ciphering and charging of members of an Ad-hoc Network.

10.2 Moving Network support

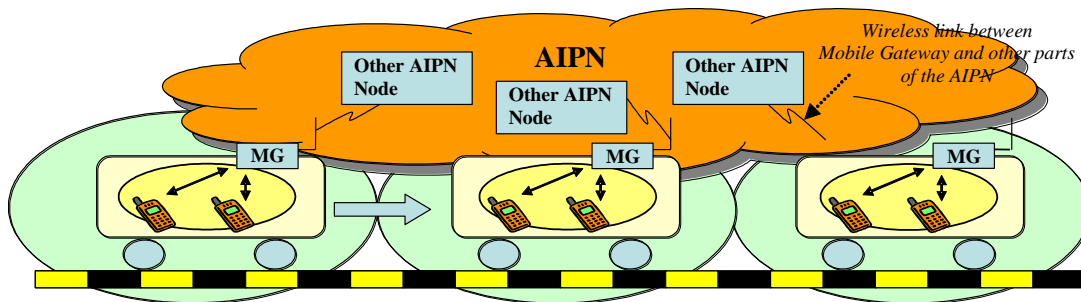The AIPN shall be able to support Moving Networks.

The AIPN shall accept consolidated traffic from a group of terminals connected to a mobile gateway.

The AIPN shall be able to route consolidated traffic from/to a group of terminals in a Moving Network connected to a mobile gateway when the mobile gateway moves, even when this results in a change in the connection of the mobile gateway to other parts of the AIPN.

The AIPN should minimise the amount of control message processing needed by terminals within a Moving Network as they move.

When supporting Moving Networks the AIPN shall manage mobility of mobile gateways.

For terminals within a Moving Network a mobile gateway shall route and forward all control messages and user data between terminals in Moving Network and the AIPN.

Figure 5: AIPN support for Moving Networks with a Mobile Gateway (MG)

11 Security and privacy

The AIPN shall provide a high level of security and privacy for users and AIPN operators.

11.1 Security requirements

The AIPN shall provide a high level of security, equivalent or better than Rel-6 3GPP systems. This includes portability of subscriber identities to different UEs and cost effective protection against duplication of security information. Additionally, it shall be possible for the AIPN operator to control security related information and its distribution to devices for the purpose of accessing the AIPN.

Security mechanisms shall be provided with high usability i.e. unified security mechanisms shall be provided with minimum user involvement across multiple access systems and heterogeneous systems.

For multi-access, it shall be possible to use a common extensible authentication and key management framework, independent of access technology.

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

The AIPN shall provide protection against threats and attacks including those present in the Internet.

The AIPN shall provide information authenticity so the information received can be trusted.

Security mechanisms shall be applicable across and between networks. The AIPN shall provide hiding of internal network elements.

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

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

It should be possible for the AIPN operator to select among several levels of AIPN security.

Appropriate traffic protection measures should be provided by the AIPN.

The AIPN shall provide appropriate mechanisms to enable lawful intercept.

11.2 Privacy requirements

The AIPN shall provide appropriate levels of user privacy including communication confidentiality, location privacy, and identity protection.

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

The AIPN shall be able to hide the identities of users from unauthorised third parties.

11.2.1 Location privacy

Location information may need to be known by some elements within the AIPN in order to provide and maintain communication services. However, only these elements, for which location information is necessary to provide and maintain communication services, shall be aware of a user's location.

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

12 Charging

The AIPN shall support various charging models including all those supported by the 3GPP system in Rel-6.

Charging models that shall be supported by the AIPN 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)

The AIPN shall also be able to support introduction of new charging schemes including real-time and non-real-time schemes, and charging schemes for the multi-access system environment (e.g. authorisation of a handover from one access system to another consistent with the charging scheme/subscription class for a particular user).

Charging mechanisms of the AIPN shall provide (non-exhaustive list):

- Cost effective Control and Charging of IP Flows

    - Identify IP flows for charging and policy control in a generic manner

    - Perform real-time charging

    - Support differentiated charging including zero rating of the bearer and event charging

    - Authorization of IP Flows

    - Awareness of user identity, subscription class, time-of-day, roaming status, QoS, Service input etc

13 Relationship of the AIPN to other functionalities of the 3GPP system

13.1 IP Multimedia Core Network Subsystem (IMS)

The AIPN incorporates IMS as a service and session control platform [6]. Specifically, the AIPN incorporates the following features of IMS:

- Provision of IMS services [6]

    - Support for IP multimedia sessions

        - IP Multimedia Session control [5]

    - QoS for IP multimedia sessions

    - Support of multiple UEs with a single IMS subscription.

As IMS constitutes the service and session control platform of the AIPN, the AIPN may place new requirements upon the IMS, in particular for IP session control.

13.2 Voice Call Continuity (VCC)

The AIPN shall support voice call continuity [5], in particular voice call continuity shall be extended to include EUTRAN.

14 Regulatory requirements

Regional regulatory requirements for Rel-6 and earlier 3GPP systems are also expected to apply to AIPN and EUTRA and EUTRAN based access systems. Such regional requirements may include support for emergency voice calls (with location information), confidentiality of subscriber data, user privacy, lawful interception, network access restrictions and radio spectrum usage. In some cases, regulatory requirements are satisfied by IMS e.g. IMS emergency sessions including appropriate provision of location information.

Annex A (normative):
Support of existing 3GPP services within the AIPN

This annex describes the service requirements for AIPN support of existing services included within the 3GPP stage 1 specifications under the responsibility of 3GPP TSG SA WG1.

A.1 General

On a general level, as the AIPN together with EUTRA(N) and other access systems is a packet-only system optimised for providing services over IP bearer services, CS teleservices and bearer services shall not be supported by the AIPN. The IP bearer services for the AIPN shall be specified according to the requirements contained within this technical specification. Although CS services will no longer be supported, equivalent AIPN services, in particular telephony and supplementary services shall be provided (e.g. IMS multimedia telephony instead of Teleservice 11/CS Multimedia Calls, IMS supplementary services instead of the legacy GSM supplementary services). As the AIPN incorporates IMS [6], in many cases these services shall be provided by IMS together with the IMS Multimedia Telephony Service and supplementary services feature [7].

Furthermore, it is necessary to identify existing services for which an equivalent service does not need to be provided by the AIPN. The following services have been identified as not requiring an equivalent service to be provided by the AIPN:

Service	Relevant 3GPP Specification	Comments
Facsimile transmission services (Teleservice 61 & 62, transparent and non-transparent)	TS 22.003	
Voice Group services (Teleservice 91 & 92)	TS 22.003, TS 42.068 (VGCS), TS 42.069 (VBS)	GERAN A/Gb mode only services
Cordless Telephony Service (CTS)	TS 42.056	GERAN only service
Support of Local Service Area (SoLSA)	TS 22.011, TS 42.043	GERAN only service
Closed User Group (CUG)	TS 22.085	Similar service possible using IMS Group management [8]
User-to-User Signalling (UUS)	TS 22.087	Similar service possible using IMS messaging [9]
Follow Me service	TS 22.094	GSM Railways only service
Calling Name Presentation (CNAP)	TS 22.096	Similar service possible using IMS [6]
Multicall	TS 22.135	UTRAN CS only service
High Speed Circuit Switched Data (HSCSD)	TS 22.034	CS only service for CS bearer services (Multi-slot mechanism only applies to GERAN)
Priority Service	TR 22.950, TR 22.952	Only defined for CS services. The AIPN shall provide priority functionality for IMS services based on

	the Multimedia Priority Service [10]

A.2 LoCation Services (LCS)

In addition to the LCS functionalities specified in TS 22.071[11], in alignment with the capability for the AIPN to accommodate multiple access systems it shall be possible for the AIPN to provide LoCation Services independent to the underlying access system.

This enhancement to LCS should have no impact upon LCS functionality specified for UTRAN and GERAN in Rel-6 and earlier.

A.3 Multicast/Broadcast Services

As specified in this technical specification EUTRA shall provide enhanced support for MBMS services.

Note: The support of CBS is FFS.

The AIPN shall support multicast/broadcast services over multiple access systems including handover of these services between different access systems.

A.4 Customised Applications for Mobile network Enhanced Logic (CAMEL)

AIPN should support CAMEL procedures for IP multimedia sessions for the support of legacy services as specified for IMS [6]. Support for CAMEL procedures for GPRS data transmission is not required.

Annex B (informative):
Change history

TSG SA#	SA Doc.	SA1 Doc	Spec	CR	Rev	Rel	Cat	Subject/Comment	Old	New	WI
								Change history			
4/4/2005			22.258					Initial draft produced by AIPN Rapporteur and provided to the SA1 AIPN email exploder for comment.	-	0.0.0	
6/4/2005			22.258					Updates based on discussions during SA1#28 and comments received to v0.0.0.	0.0.0	0.1.0	
6/4/2005			22.258					Updates based on discussions during AIPN SWG during SA1#28.	0.1.0	0.2.0	
6/4/2005			22.258					Updates based on discussions during AIPN SWG during SA1#28.	0.2.0	0.3.0	
8/4/2005			22.258					Incorporation of S1-050505 agreed @ SA1#28	0.3.0	0.4.0	
20/6/2005			22.258					Update provided by AIPN Rapporteur in preparation for SA1#29	0.4.0	0.5.0	
13/7/2005			22.258					Updates based on discussions during AIPN SWG during SA1#29.	0.5.0	0.6.0	
14/7/2005			22.258					Updated to v1.0.0 for presentation @ SA#29.	0.6.0	1.0.0	
11/10/2005			22.258					Update provided by AIPN Rapporteur in preparation for SA1#30.	1.0.0	1.1.0	
26/10/2005			22.258					Updates based on discussions during AIPN SWG during SA1#30.	1.1.0	1.2.0	
26/10/2005			22.258					Raised to version 2.0.0 for approval at SA1#30.	1.2.0	2.0.0	
SP-30	SP-050740	S1-051240	22.258			Rel-7		Approved for Rel-7 at SA #30	2.0.0	7.0.0	AIPN
SP-31	SP-060209	-	22.258	0001	1	Rel-8	F	Support of legacy services in the AIPN	7.0.0	8.0.0	AIPN
SP-31	SP-060209	-	22.258	0002	1	Rel-8	F	Handover between GSM/UMTS CS and EUTRAN	7.0.0	8.0.0	AIPN
SP-31	SP-060209	-	22.258	0003	1	Rel-8	C	Access system discovery and -information in AIPN	7.0.0	8.0.0	AIPN