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Foreword

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1 Scope

The purpose of this technical report is to study the feasibility of architecture for push service over Packet Switched Networks. .

In the present document, the architecture for the access network is examined and the architectures for the user terminal and the application server are out of scope.

2 References

[Editor's note: Chapter to be completed]

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.

[<seq>] <doctype> <#>[([up to and including]{yyyy[-mm]|V<a[.b[.c]]>}[onwards])]: "<Title>".

[1] 3G TS 22.060: " General Packet Radio Service (GPRS); Service description; Stage 1 (Release 2000) ".

3 Definitions, symbols and abbreviations

[Editor's note: Chapter to be completed]

3.1 Definitions

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

push service: is the delivery of information (data/multimedia) from a network node to a user equipment for the purpose of activating the UE, providing information from the network and activate e.g. PDP context if needed.

Editor Note: This definition should align with the definition in TS 22.060. An example of push service is stock quote notification.

access network: a network that provides an IP connectivity service to push service users. A GPRS network can be one of such networks.

application server: a server that provides push services with access networks. An application server may be located out side of an access network and is able to access the network by IP network.

user address: an IP address provided by the access network for an application server to access to a push service user. It shall be possible that the address can be temporarily assigned to the user so that the network shares the address among some users.

user-ID: an identity to specify a user in an access network who can be provided a push service. It is carried in the payload of an IP packet to an access network to initiate a push service. The format of user-ID is dependent on the protocol for the push service. A telephony number presented in character format can be a user-ID.

user terminal: a user device on which the user can have a push service, in the case that the access network is a GPRS PLMN an MS is the terminal.

3.2 Symbols

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

Symbol format

<symbol> <Explanation>

3.3 Abbreviations

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

Abbreviation format

<ACRONYM> <Explanation>

4 Introduction

A number of current and future services require the capability for an external IP network to "Push" data to 3G terminals in PS Domain. R99 specifications allow operators to provide push services by using static IP address (and only when GGSN stores static PDP information for the IP address) or by having long-lasting PDP contexts. However, as mobile application services in the PS Domain are emerging in the future, the following additional service requirements should be considered.

- Push services should be provided whenever networks can reach mobile users. In other words, even though the connection between network and MS is not established, users should be able to enjoy push services.
- When IPv4 connectivity is used, IP address should be assigned not only statically but also dynamically. Also, in order to use dynamic IP address, other identites than IP address are necessary.

The present document examines the feasibility of architecture for an access network that provides push service with the requirements stated in this TR. In addition to the push service principles above, the architecture shall consider the following aspects:

- How common push services can be offered both through an UMTS IP access and through other IP access networks (the work being performed by IETF should be considered to this respect).
- How the service works in a roaming case

5 Requirements

The access network architecture that can provide push services on top of its IP connectivity service shall support following requirements:

- Push services should be provided whenever networks can reach mobile users. In other words, even though the connection between network and MS is not established, users should be able to enjoy push services.
- When IPv4 connectivity is used, it shall be possibly to dynamically assigned an IP address.
- A protocol for push service shall be free from the type of access networks that the user is located. The initiation procedure of the push service except the user-ID shall be same regardless of access network.
- A access network supporting the push service shall provide restriction and security mechanism to protect user from unwilling access.

A network may specify a required type of IP connectivity path for a push service at the initiation of push service. E.g. QoS.

Editor Note: the push service may provide multicasting to multi-users.

6 General Description

This section describes the reference architecture of the network that offers push services. In this reference architecture there are three entities that should be considered: a user, an application server, and an access network. In order to clarify the functionality of the access network, the relationship between them is specified.

6.1 Service Environment and Scenario

An application server offers a push service to a user through an IP connectivity service provided by an access network. The IP connectivity service that the network provides shall be dedicated to the user so that the server can offer wide bandwidth push application.

Figure 1 shows the outline of the environment. A GPRS network is one of the access networks.

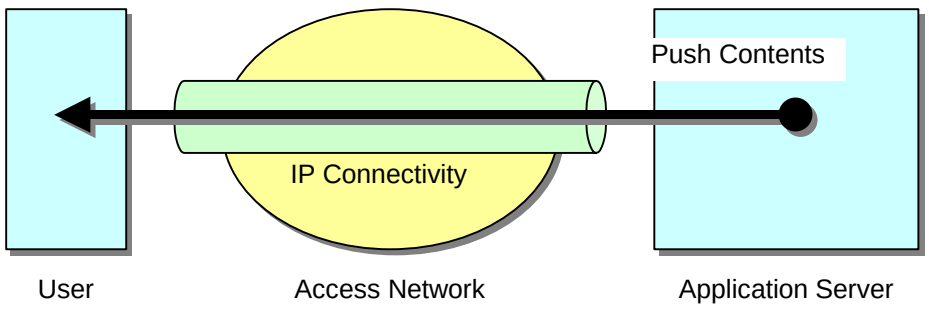

Figure 1: Three entities in the reference architecture

Some networks may only have limited resources for services, e.g. the network can not offer the connectivity service to whole users simultaneously. In such a case the network may share resource among some users and the server shall request a dedicated connection at the service initiation and shall release the connection when the service completes.

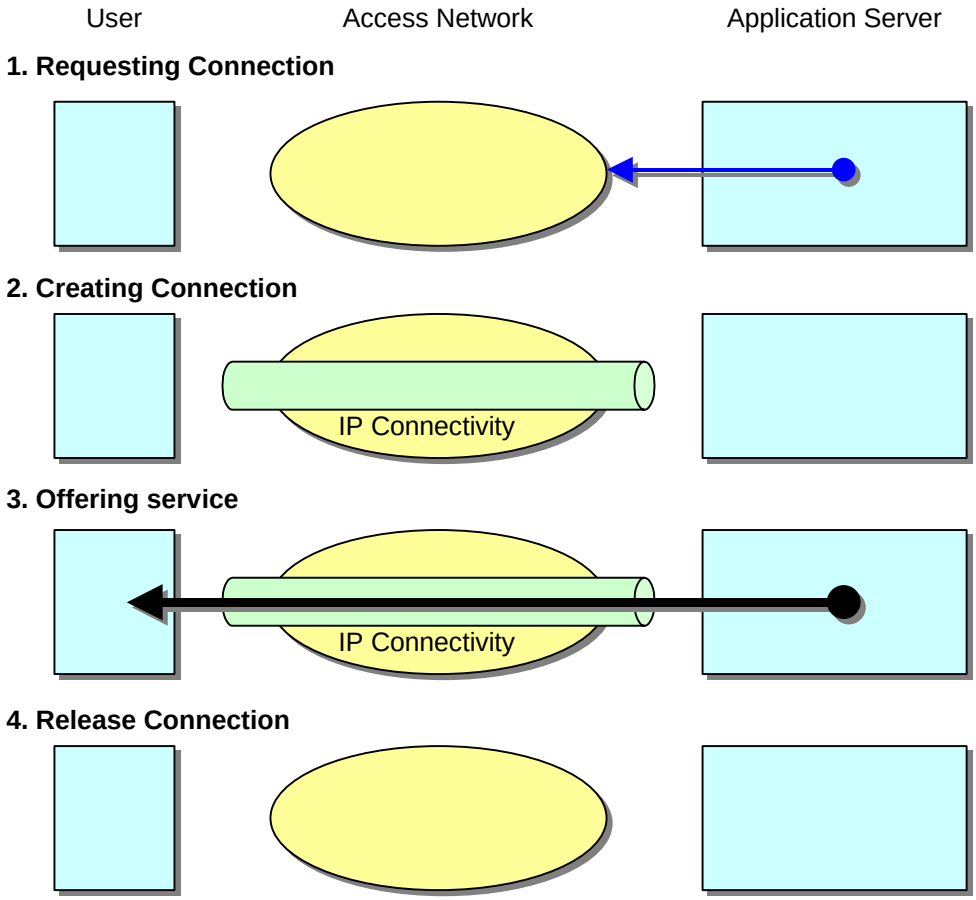

Figure 2: General Service Scenario

6.2 Addressing

A user has an ID in an access network. For example UMTS user has an MSISDN and Internet E-mail address may be a user ID in an access network. By the user ID defined in the access network, an application server identifies the user and the access network to which a service is pushed. A user-ID is used to route the connection request message in the first phase of figure 2.

An IP address for the user is required so that the server can transfer push contents over IP. The architecture shall allow the access network to share resource, e.g. IP address, among some users. Therefore the server shall request an IP address for the user at the service initiation and shall release it when the service completes. This user IP address is used to route the push contents in the third phase of figure 2.

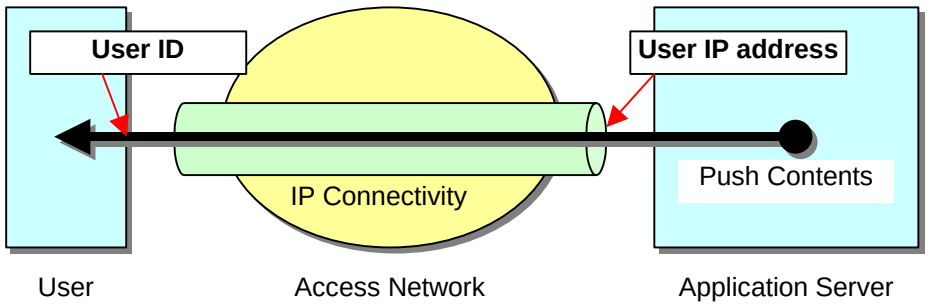

Figure 3: User-ID and user IP address

6.3 Protocol Architecture

According to the service scenario in figure 2,it seems that two protocol stacks shall be identified.

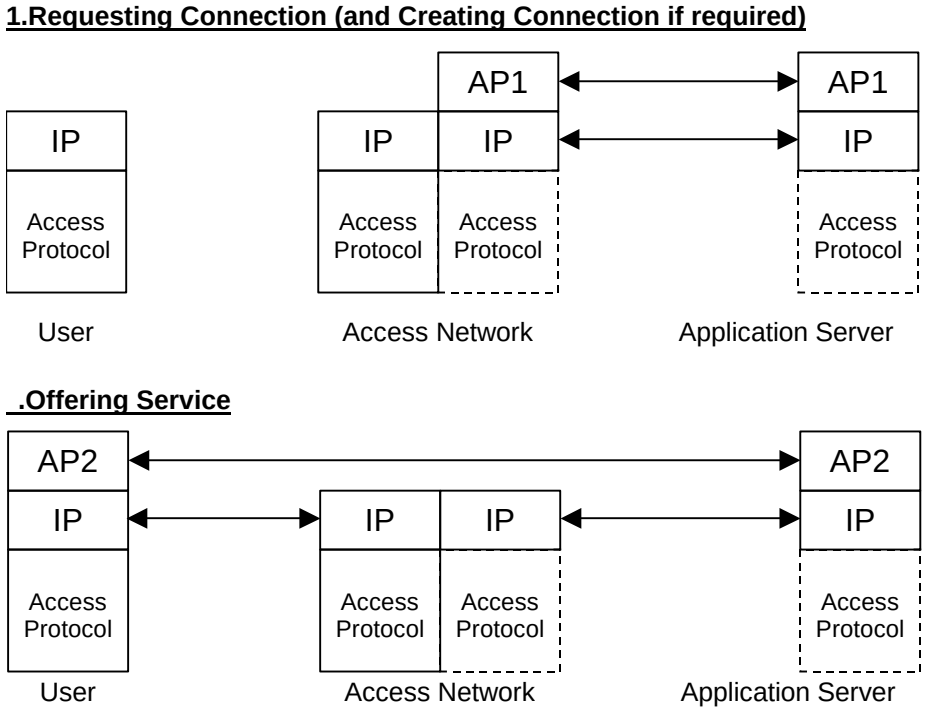

Figure 4:Protocol Stacks for general push service.

In figure 4, AP1 is a protocol for requesting connection and AP2 is one for offering push service. AP1 may be capable of requesting connection and of specifying the transport type and the protocol to offer a push service to a user.

Regarding push service offering as a session, SIP is a candidate for AP1 protocol. Figure 5 shows the push service sequence. In the figure, SIP is chosen as AP1.

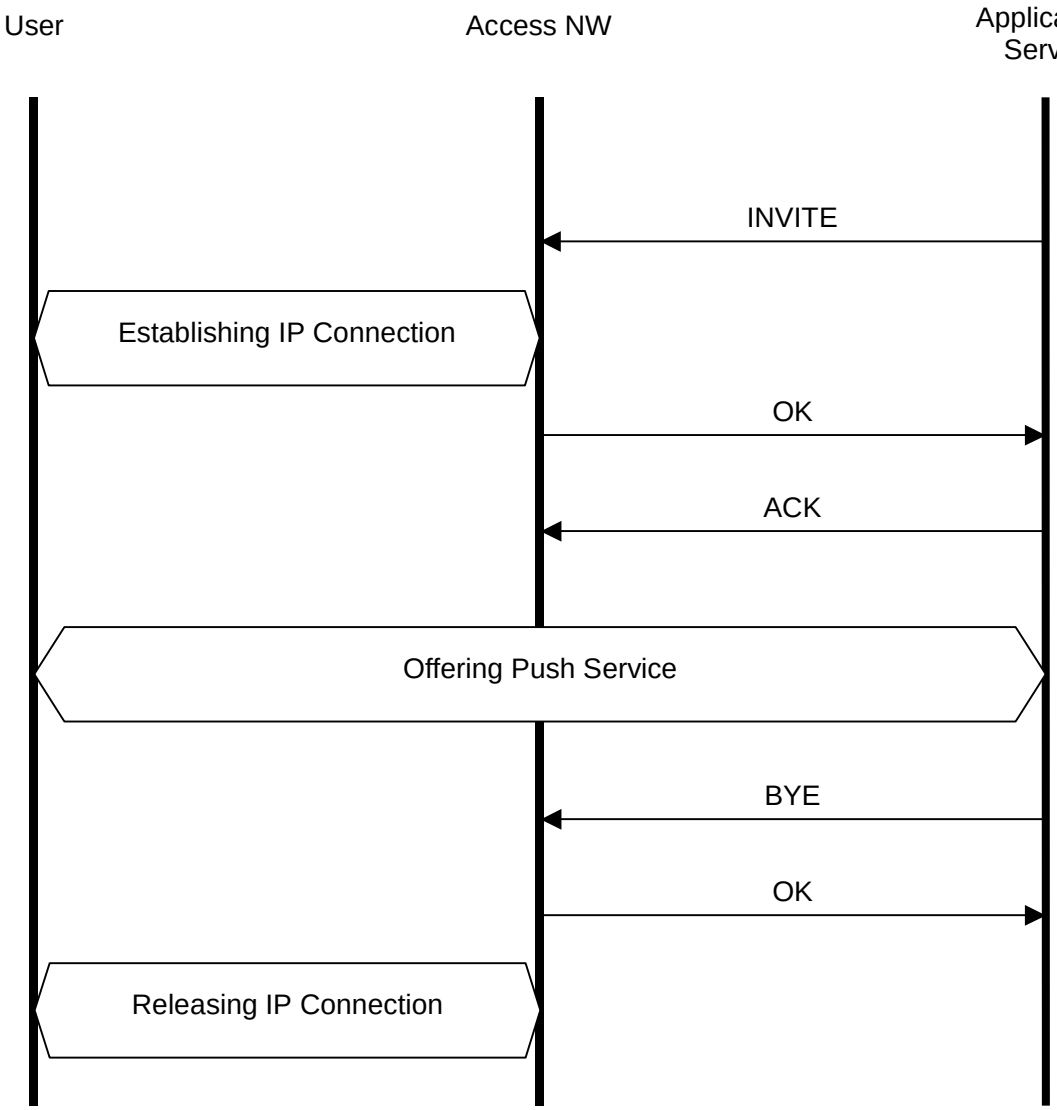

Figure 5:General Sequence of push service with SIP.

An application server sends an INVITE method to an access network that is derived from the user ID. The server may request the property of required IP connection for the service. The access network receiving the INVITE method establishes the required IP connection for the user and the network return the user IP address by OK response. Then the server can initiate the push service. When the service finishes the server sends BYE method to the network. At the moment the user may release the connection if it is not necessary any longer.

6.4 Multiple Services

A user may subscribe push services provided by multiple application servers. Therefore the access network shall offer the user some services simultaneously even if the user terminal may only support a single IP connectivity path. To support such a user, the access network may reuse an existing IP connectivity path for the user at the activation of push service.

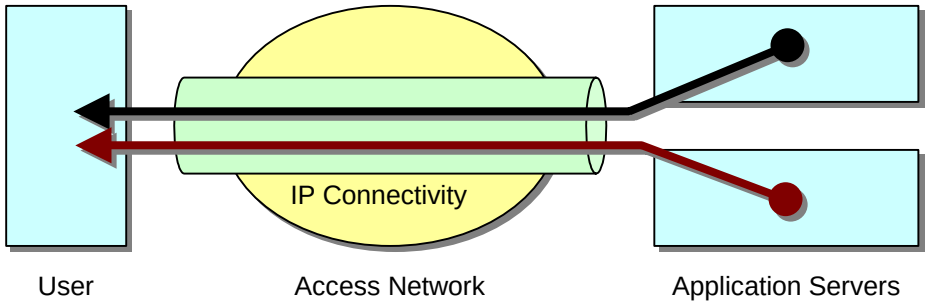

Figure 3: multiple push services over single IP connectivity path

6.5 Security and Charging

An access network shall protect a user from the unwanted attack by application servers. At first the network shall not connect to an unauthorized application server.

To support various push services a network may use multiple servers. In the case a user may only choose some of services to subscribe. The network and the user may have an offline contract on the selection of push services in order for the network not to deliver unsubscribed services. Then the network shall deny the IP packets from the un-subscribed application server by checking the source address in their IP header.

The network may charge the fee for the special subscription with the user.

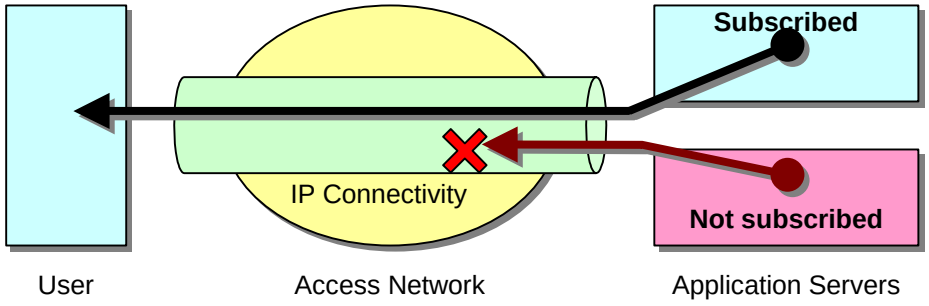

Figure 4: denial of the service by the access network

6.6 User Terminal

A user terminal capable of push services may have similar features to a server. This feature may be activated by the reception of an initial message from an application server through access network or during an IP connectivity setting up procedure by the access network.

6.7 Roaming Support

PLMNs support roaming service. If a user, who is offered a push service, roams to another access network, the access network receiving a request of a push service shall transfer the request to the roamed network.

There are two possibilities for an access network to transfer a push service request to another network. One is to redirect the request via the application server. For example SIP supports this facility. Another is to forward the request to the visited network directly. This is similar to the Gn I/F connection between GGSN in the originate network and SGSN in the visited network.

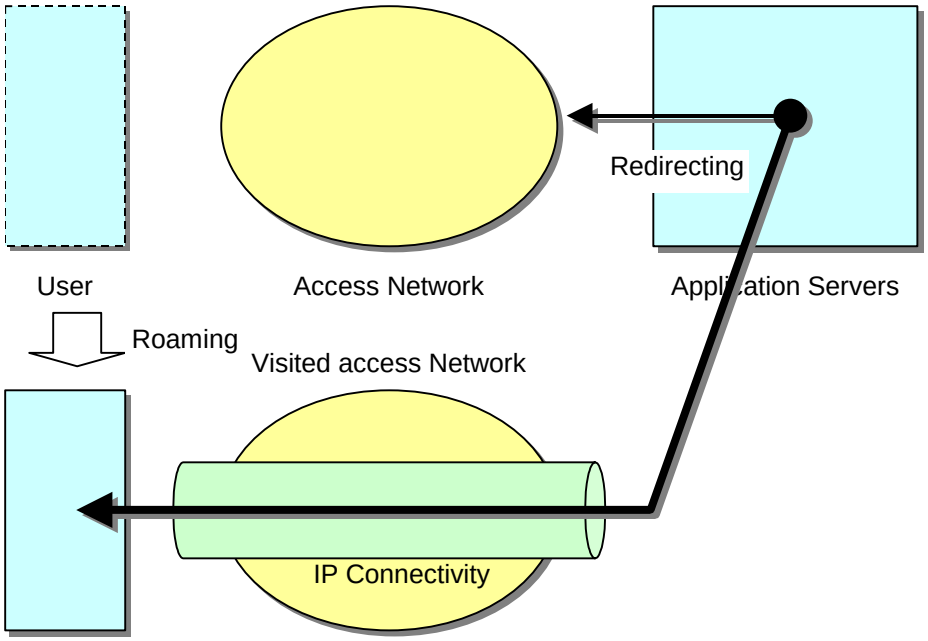

Figure 5: Roaming support by redirecting

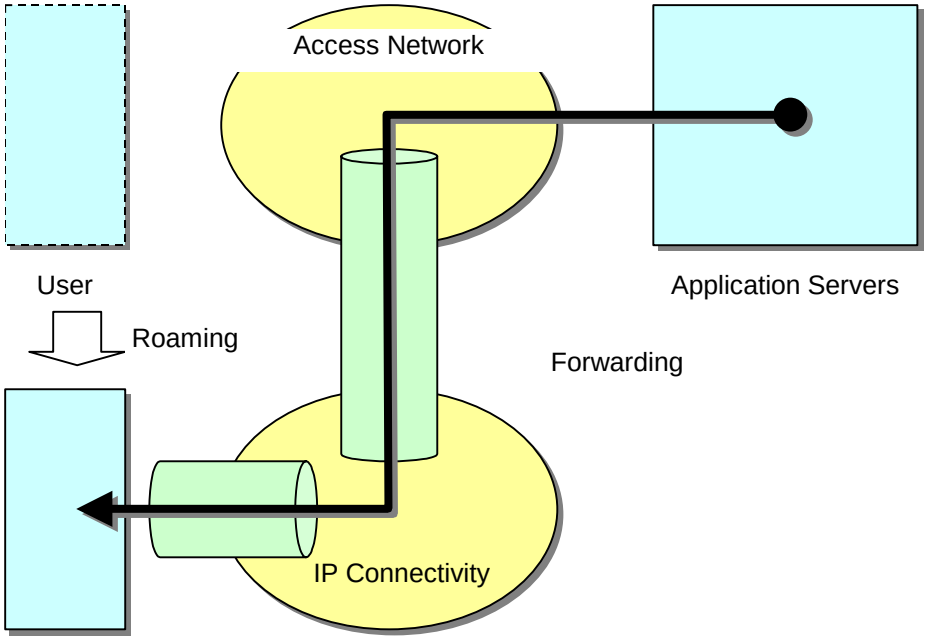

Figure 5: Roaming support by forwarding

7 Architecture for GPRS

7.1 Introduction

In this section, the general architecture for GPRS is described. The principles in section 6 shall be applied

[Editor's note: Checking whether all principles have been considered is needed.]

7.2 Functional Architecture

The architecture includes the following entities: Application server (AS) in the external PDN that wants to communicate with GRPS MS, a GRPS Mobile Station (MS) that waits requests from ASs, Notification Agent (NA) in GGSN that processes the requests from the ASs, Address Resolver (AR) that keeps relations between user-ids and their correspond IMSI, and other GPRS network entities (see Figure 6).

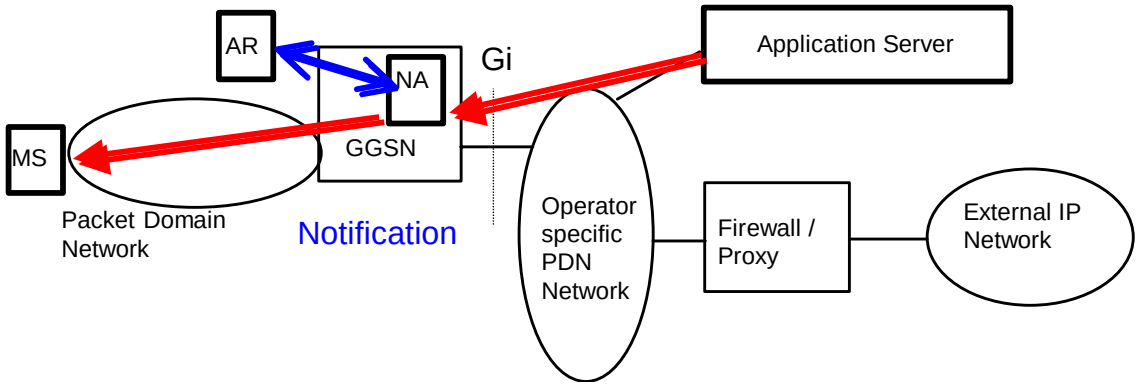

Figure 6 architecture for PDP context activation with User-ID through GPRS

7.2.1 Application Server (AS)

AS serves application that requests MS to communicate with the server over GPRS like VoIP or push application. AS may or may not be able to know in advance that there is no PDP context for the MS. If AS wants to be aware of the status of the user's PDP context, it is a necessary procedure for GPRS network to inform AS, but the procedure is FFS. As one possibility, there is a method that AS decides the status of users PDP context by means of the status of other session to the same user. AS sends application's PDUs to the user's address (it is PDP address for the user) that NA assigns while PDP context activation procedure and is sent to AS by NA.

7.2.2 Notification Agent (NA)

NA in GGSN controls the users PDP context activation with dynamic PDP address requested by AS. The GGSN receiving the request may be chosen statically or may change dynamically on session basis depending on the load of PDN or GGSN etc. To achieve dynamic GGSN selection, there may be DNS in the external PDN and AS inquires the IP address for GGSN to the DNS.

NA identifies the requested MS by means of AR that resolves its IMSI from user-ID and activates network requested PDP context activation for MS to invite PDP context activation with dynamic IP address. This delays the PDP address allocation as far as possible and it enables the efficient use of GGSN PDP address or other Gn I/F resources. After assigning the address, NA sends it to the AS.

7.2.3 MS Address Resolver (AR)

AR keeps the relations between external User-IDs and IMSIs and provides the information for NA to identify the requested MS. AR may be integrated with GGSN. In case of the type of user-ID is MSISDN, it is realistic for HLR to integrate AR. By this integration, a visited network or a GGSN in the visited network via which AS wants to connect to a MS doesn't have to equip AR for the visited MS.

7.2.4 Mobile Station (MS)

MS may deactivate a PDP context but still keep the application active when the application enters the state waiting requests from the server. This helps the GPRS network to save the resources. When some applications run at the same time in the MS, the coordination function in the MS may be required.

7.2.5 GPRS Network

GRPS network may release a PDP context of the MS for which the radio connection becomes broken, then NA in the GGSN notifies AS that the PDP address for the MS shall be released and AS enters the state for the MS that there is no valid PDP context.

7.3 Message Flow

MS to activate PDP context with APN and PDP type and without PDP address. SGSN sends this request to the MS and MS replies it with the same APN and the PDP type and without PDP address. GGSN assigns the PDP address for the MS when it receives the requests and sends it both the MS and the AS. With this PDP address MS and AS are able to communicate with each other via GPRS network.

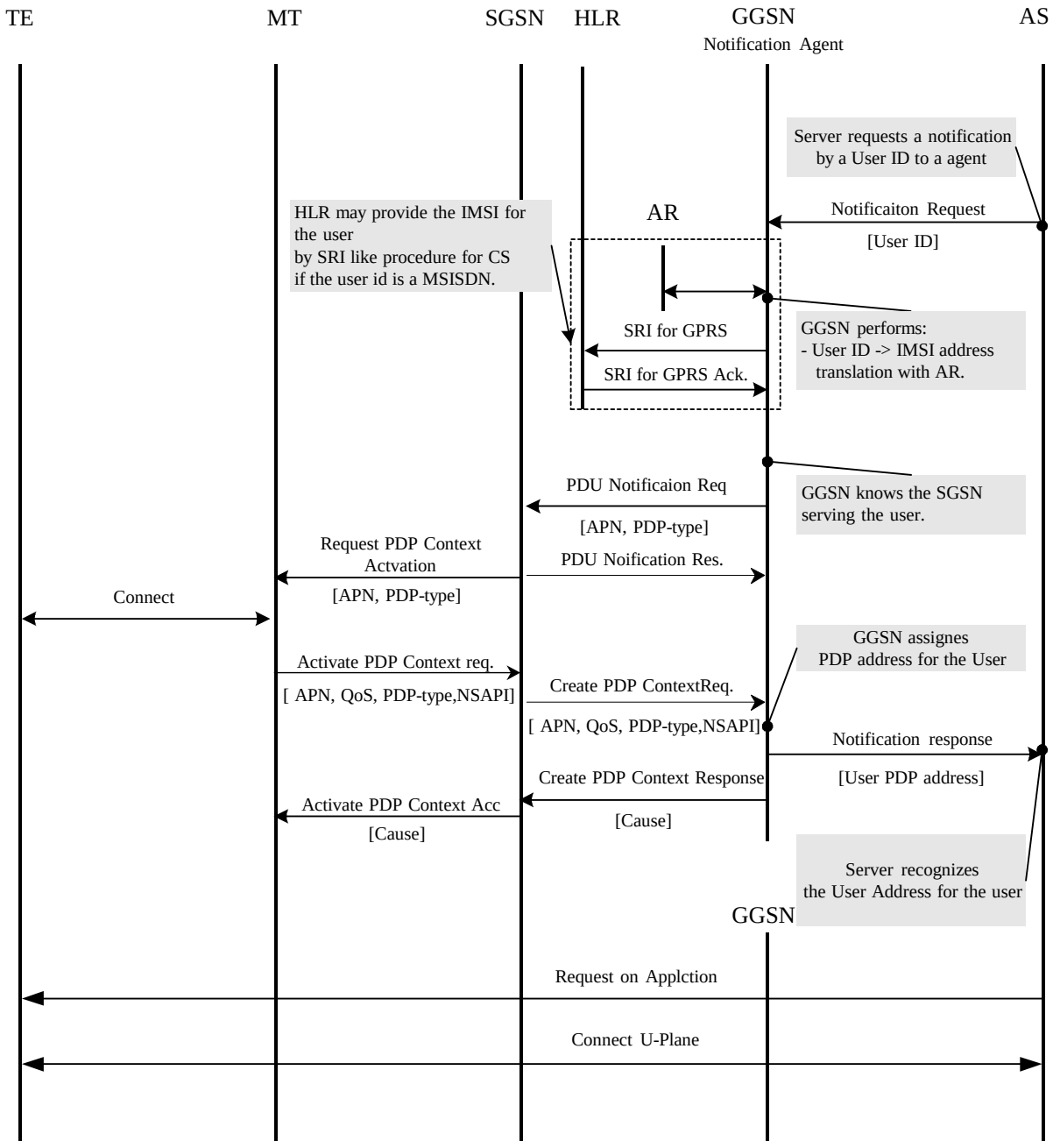

Figure 7:Network requested PDP Context Activation procedure with delayed PDP address allocation

7.4 Impacts on 3G specifications

[Editor's note: Chapter to be completed]

8 Conclusion and Recommendations

[Editor's note: Chapter to be completed]

Annex <X>:
Change history

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Date	TSG #	TSG Doc.	CR	Rev	Subject/Comment	Old	New