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Technical Report

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Foreword

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

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Version x.y.z

where:

x the first digit:

1 presented to TSG for information;

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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.

1 Scope

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

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

NEXT MODIFICATION

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 services is stock quote notification.

delivery network: a network that provides connectionless or connection oriented push services. A delivery network may simply be a GPRS network, or it can include additional proxies or equipment (e.g. SIP Proxy, Push Proxy, SMS Service Centre).

application server: a server that provides push services through a delivery network, e.g. via an IP connection

user IP address: an IP address provided by the delivery network that can be used by an application server to access to a push services user. The address can be temporarily assigned to the user so that the network shares the address among multiple users.

user-ID: an identity or name that can be used to deliver push content to a user in a delivery network The format of user-ID is dependent on the protocol for the push services. A telephony number presented in character format an example of a possible user-ID.

user availability: the ability of an delivery network to provide push service to a subscribed user.

user terminal: the end user equipment that receives push content. For a GPRS PLMN, the user terminal is the MS or UE.

NEXT MODIFICATION

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 a bearer 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 identities than IP address are necessary.

The present document examines the feasibility of architecture for a delivery network that provides push services with the requirements stated in this TR. In addition to the push services 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 delivery 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 bearer connection between network and MS is not established, users should be able to enjoy push services.

- It shall be possible to provide push services to a mobile user with a dynamically assigned IP address.

- A protocol for push services shall be independent of the type of delivery network. The initiation procedure for the push services, except the user-ID, shall be the same regardless of delivery network.

- A delivery network supporting push services shall provide restriction and security mechanism to protect user from unwilling access.

A delivery network may be able to provide user availability status to an application server if requested by the application server. This information may also include UE capabilities and QoS support in this delivery network.

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

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

6 General Description

This section defines the general push architecture concepts and environment. In this reference architecture there are three entities that should be considered: a user (includes the user terminal), an application server, and a delivery network. To clarify the functionality of the delivery network, the relationships among these entities are specified.

NEXT MODIFICATION

6.2 Addressing

An application server identifies the user by a user ID or address. The user ID is either a globally unique ID or it may be locally unique within the delivery network when the application server has the ability to uniquely identify the delivery network as well. For example, an Internet E-mail address is an example of a user ID. The user ID may be used to request a connection (step 1, figure 6.2) or to request delivery in a connectionless push (step 1, figure 6.4).

There are multiple methods for addressing push services users. Each addressing method is associated with a specific architecture alternative. The methods identified for addressing the push user are:

- Send push content as an IP packet addressed directly to user's IP address (requires a static IP address).

- Send SIP Invite to end user with user's SIP identity to establish a session, then use the returned IP address to send push content over the SIP bearer connection.

- For connectionless delivery, a SIP Notify may be sent to the SIP identity with the push content embedded in the Notify message body.
- Send a DNS query with the user's Domain Name. Use the returned IP address to deliver push content to the user.
- Send SIP Invite to new PLMN server's SIP identity with the user's push address (e.g. MSISDN) embedded in the Invite message body. Use the returned IP address to send push content after a bearer connection is established.
- Send a request to a new PLMN server with a unique user ID using a push protocol. The PLMN server will return an IP address to the originating application server to allow use of a dedicated connection for push content delivery by the application server.
- For connectionless delivery, the push request to the PLMN server includes the entire push message contents as well as the user ID in the push protocol. The PLMN delivers the push message directly using the user ID (i.e. without returning the IP address to the application server).
- Send push content to the SMS SC (IP address) with the user's SMS address (e.g. MSISDN) embedded in the message delivered to the SMS SC. This is a connectionless push only.

Each addressing method is discussed in detail later in this document.

In dedicated connection case, an IP address for the user is required so that the server can transfer push contents over IP. The architecture shall allow the delivery network to share resource, e.g. IP address. . The application server requests a connection to the user at service initiation and the server or the user may release the connection (and the address) when the service completes. This IP address is used to route push contents in the third phase of figure 6.2. Thus the push services network is responsible for translating the User-ID and supporting allocation of an IP address for the dedicated connection.

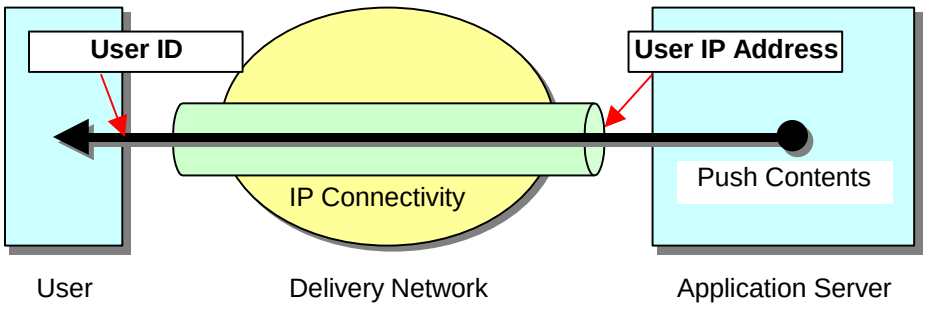

Figure 6.5: User-ID and User IP Address

6.3 Dedicated Connection Establishment

At times, the designated user may not have an active IP connection when the application server initiates a push request. In this case, the network and/or the user will establish a new IP connection.

The application server may provide QoS parameters with the initial push request.

6.4 Push Content Delivery

In the dedicated connection approach, push content is delivered over the established IP connection.

In the connectionless approach, the content is delivered over an existing delivery path. An existing delivery path may be SMS, or it may be an IP connection using a static IP address, or it could be an established SIP message signalling path.

6.4.1 Reliable Delivery

If a user is not available (e.g. not attached to the network) when the application server attempts a push delivery, the delivery would fail. One option for the application server is to simply to retransmit until the user becomes available. Another option is a store and forward mechanism in the delivery network. The third option is presence notification from the user terminal or delivery network.

6.4.1.1 Store and Forward

If the user terminal is not available when the application server wants to push the contents, the delivery network may store the contents and try to send them later Figure 6.6 shows a service scenario with store and forward.

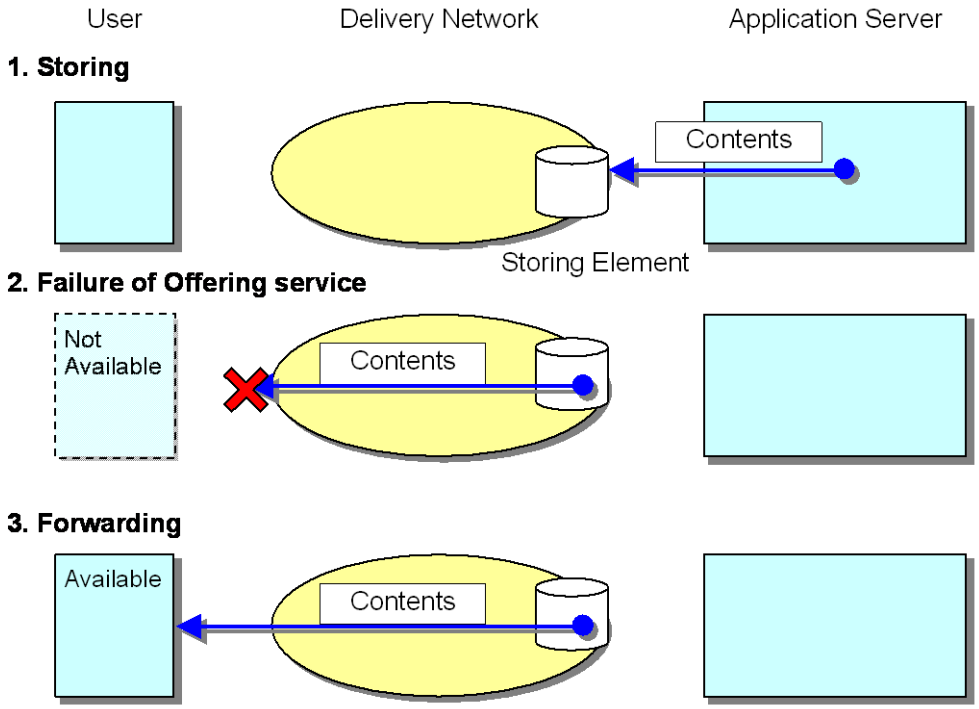

Figure 6.6: Service Scenario with Store and Forward

6.4.1.2 Presence Service

Presence service allows the application server to receive notification when the user becomes available. This notification could come directly from the user terminal in the form of a direct application level registration, or it could come from the delivery network using some form of presence service indication.

Figure 6.7 shows a delivery network based presence service scenario. Presence can be delivered, for example, by SMS or SIP.

Note: For certain presence services the scenario may be optimized by inclusion of a request for notification at the time of the connection request.

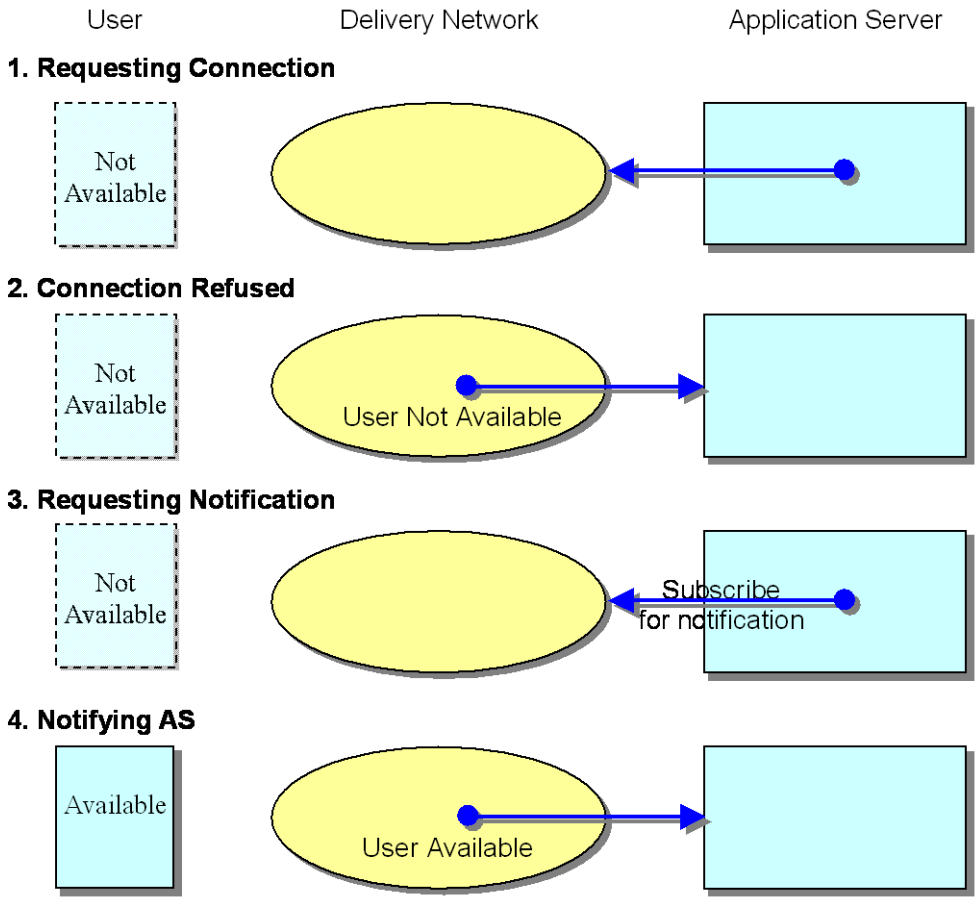

Figure 6.7: Delivery Network Based Presence Service Scenario

Figure 6.8 (below) shows a user terminal based presence service scenario. In this scenario, the user terminal provides a notice to the application server when it becomes available. Since the user terminal is not available when the application server attempts delivery, there is no opportunity for the application server to subscribe with the user terminal at that point for subsequent notification.

User terminal presence is managed end-to-end at the application level. Details of such application level negotiation are outside of the scope of this specification. However, as an example, user terminal presence may be provided in one of the following ways:

- Application protocol requires the user terminal to always "register" with the application server when the User becomes available. In this case, step 0 shown in figure 6.8 is not included.
- When a user requests a specific application/service that requires reliable delivery, the application server negotiates presence notifications to be provided by the user terminal when the User becomes available (optional step 0 below). These would continue to be required until the application server re-negotiates to turn this option off.

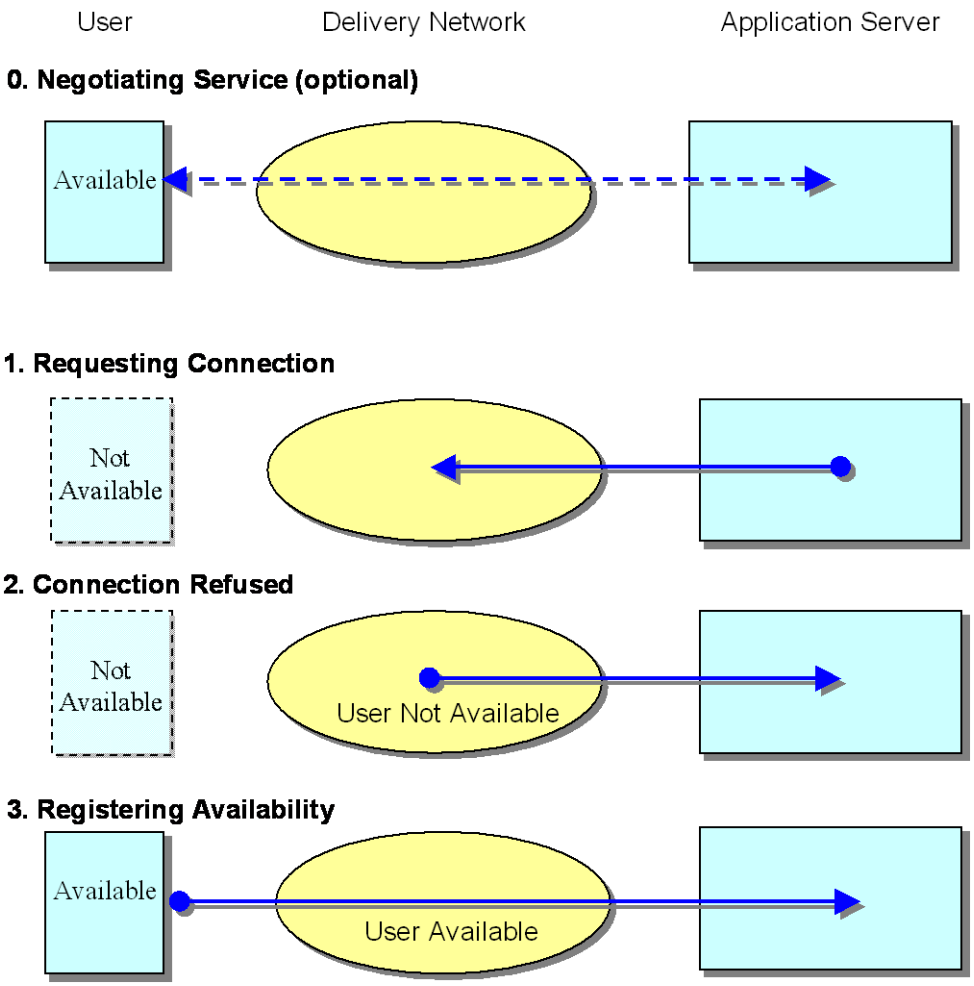

Figure 6.8: User Based Presence Service Scenario

When user based presence is provided, the user terminal is responsible for delivery of each end-to-end application level registration/notification. The user terminal must know which applications require registration, and it must store information for each application server that has negotiated presence notification.

6.5 Multiple Services

A user may subscribe push services provided by multiple application servers. The delivery network shall support delivery of push content from multiple sources simultaneously. This includes support for multiple push service connections.

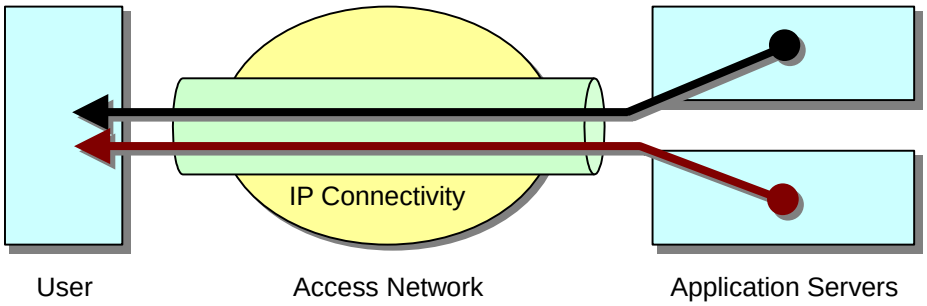

Figure 6.8: multiple push services over single IP connectivity path

6.6 Security and Charging

A delivery network shall protect a user from unwanted attack by application servers. The most basic level of security will be refusal of connection or push content. This may be accomplished via a firewall at the boundary of the delivery network. In addition, push architecture alternatives may include additional subscription control on a per user basis. The delivery network may deny access from application servers that this user has not subscribed to or does not desire content from, based on the registration. The network operator may also charge based on user subscription to specific services.

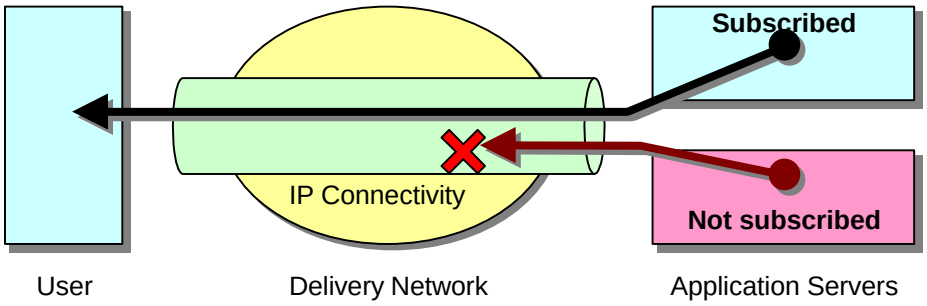

Figure 6.9: Denial of Service Based on Subscription

6.7 User Terminal

A user terminal capable of push services must support the application protocols used for push content. Additional user terminal requirements vary depending on the push architecture.

The push application in the user terminal may be activated by the reception of an initial message from an application server or during an initialization/provisioning procedure initiated by the delivery network.

6.8 Roaming Support

PLMNs support roaming service. Push service shall be available to subscribed users when they roam. The method used to deliver or follow a user when he roams is dependent on the push architecture. However, each alternative architecture uses either a redirection method or a forwarding method.

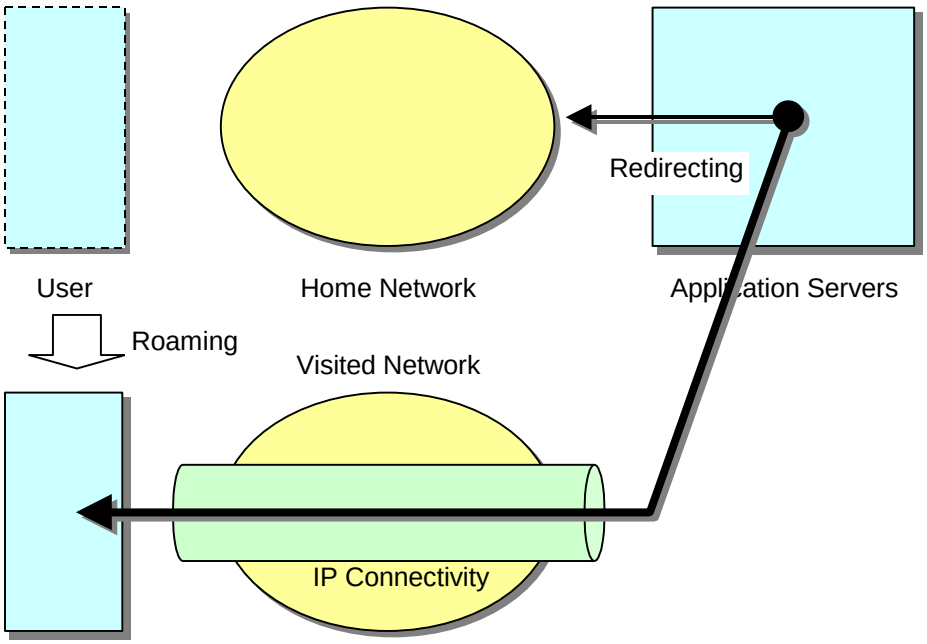

Figure 6.10: Roaming Support by Redirecting

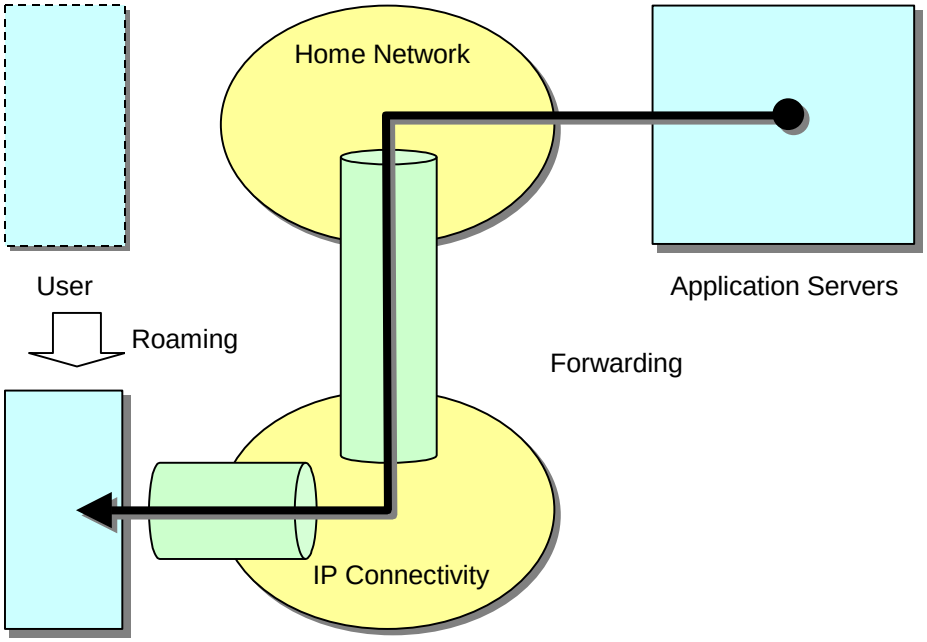

Figure 6.11: Roaming Support by Forwarding

7 Architecture for GPRS

7.1 Introduction

This section describes various solutions to be applicable to the GPRS PLMN. The principles in section 6 shall be applied

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

7.2 Network requested PDP Context activation with User-ID

7.2.1 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 7.2.1).

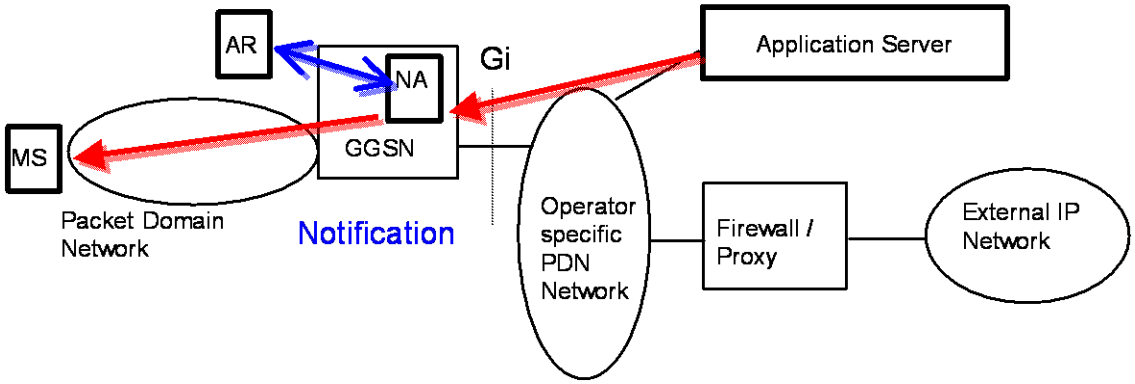

Figure 7.2.1: architecture for PDP context activation with User-ID through GPRS

7.2.1.1 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.

7.2.1.2 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.

7.2.1.3 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.

7.2.1.4 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.

7.2.1.5 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.

7.2.3 Protocol Architecture

According to the service scenario in figure 6.2,it seems that two protocol stacks shall be identified.

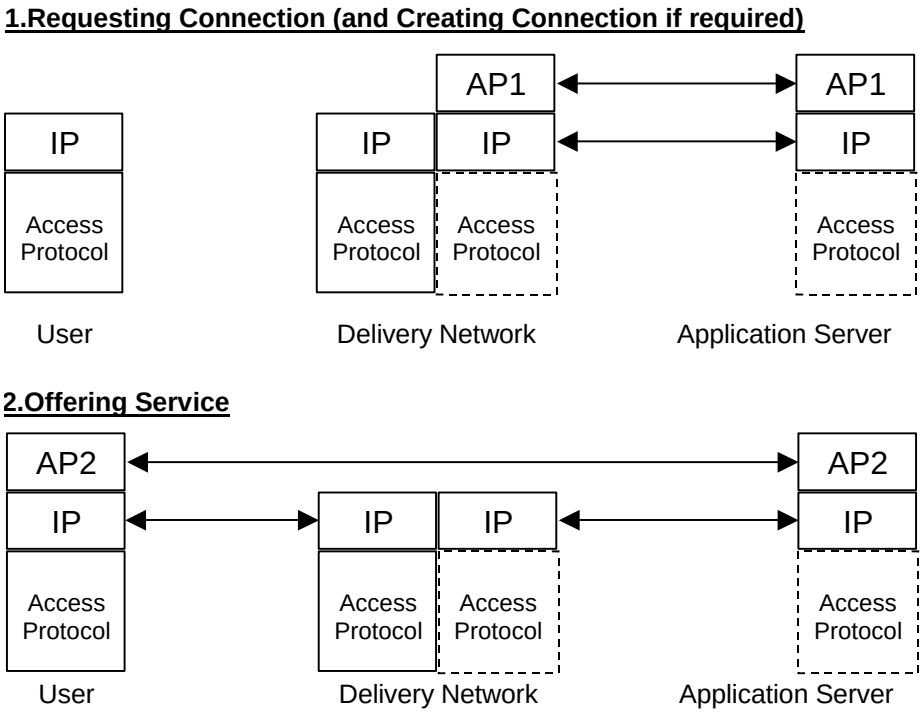

Figure 7.2.2:Protocol Stacks for general push service.

In figure 7.2.2, 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 7.2.3 shows the push service sequence. In the figure, SIP is chosen as AP1.

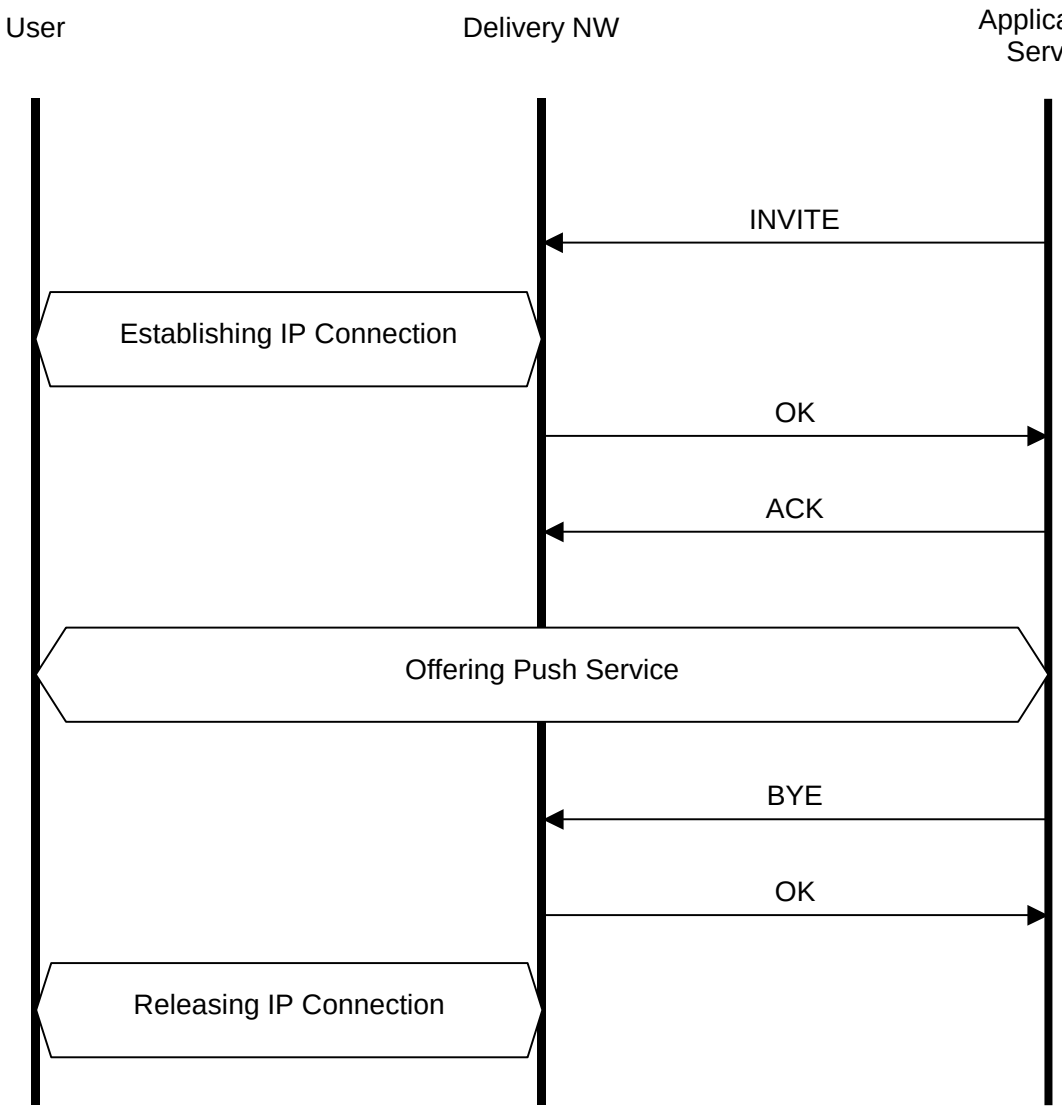

Figure 7.2.3: General Sequence of push service with SIP.

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.

7.2.4 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.

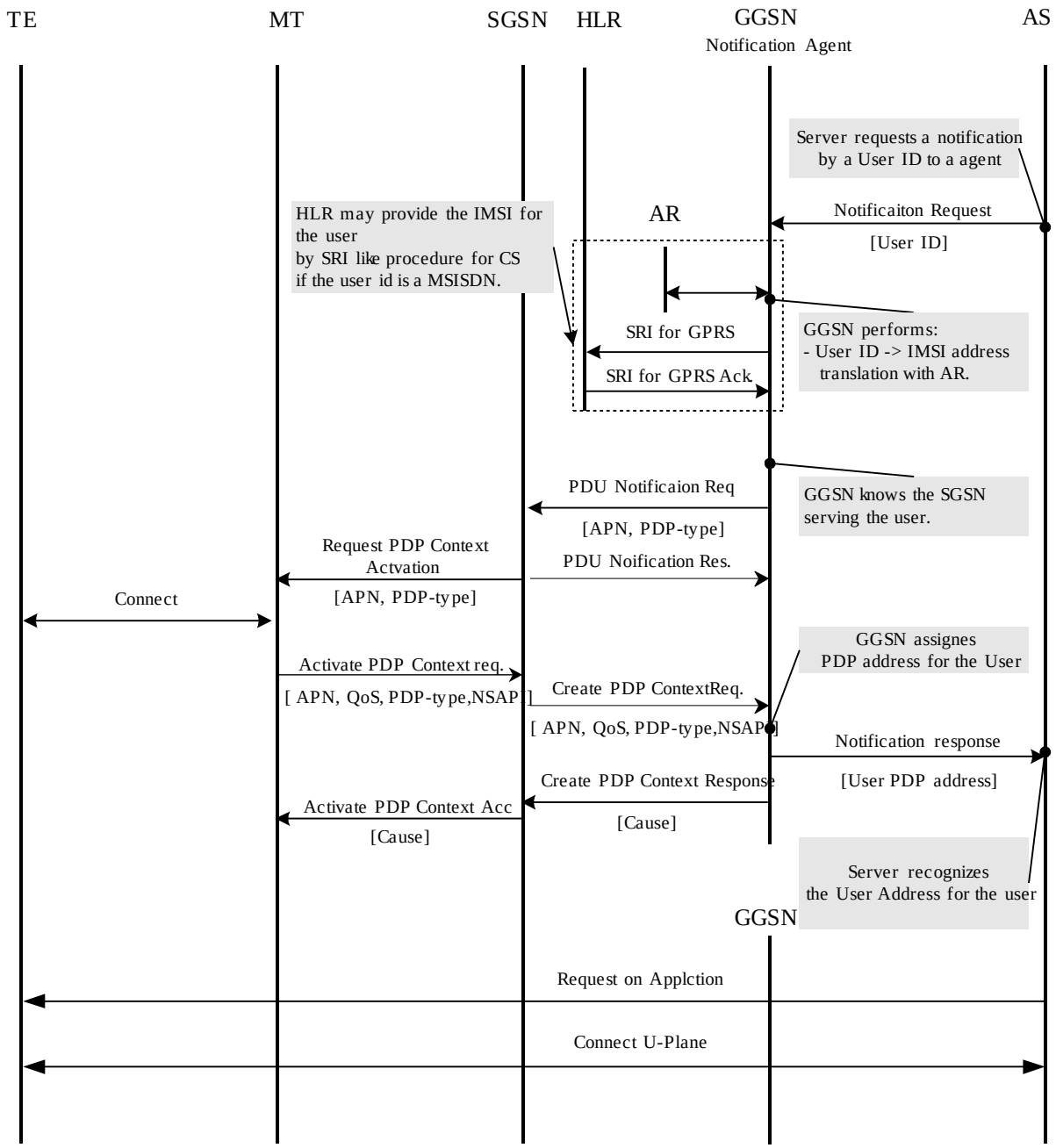

Figure 7:Network requested PDP Context Activation procedure with delayed PDP address allocation

7.2.5 Impacts on 3G specifications

[Editor's note: Chapter to be completed]

End of modified sections