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White Paper

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Enabling Network-Based Presence Aggregation using IMS

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Abstract

As the world moves toward hyper-connectivity, service providers and telecom operators face a crucial challenge. In a scenario where a single user will manage multiple identities across numerous connections and networks, telecom companies need to ensure that each customer enjoys seamless services across devices. As enablers, IP Multimedia Subsystems (IMS) and Presence have become industry buzzwords.

Most major service providers are planning to roll out IMS-compliant networks and value-added services for a rich user experience. Current implementations with presence agents aggregating presence information are found wanting in such a hyper-connected world.

Presence is the ability to detect whether users and devices are online and whether they are available. IMS helps track presence across sources and technologies and aggregate presence information at the network rather than at presence agents. Since IMS is access-agnostic, it makes communication user-centric by enabling a unified identity for a user across multiple device and media types.

This paper explains in detail how IMS architecture can provide network-based presence aggregation and how the information can be used to implement complex new services. It also shows how a person's availability across multiple devices and networks can be traced using a single identity and how the IMS network nodes interwork to achieve the same.

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Introduction

A. Presence: The Horizontal Enabler for Multimedia Services

Presence is emerging as a key technology to fulfill connectivity requirements in a converging world of interactive communication which operates in real time. Service providers and telecom operators consider presence an integral part of multimedia applications to enhance services for end-users and expand their footprint in the market.

A simple concept, presence refers to the real-time network availability and connectivity of entities such as users, devices, services, and applications. The magic of rich presence gives subtle information about the 'presentity' – the entity described by presence information – such as how, when and where an entity is available at a particular moment.

Companies in the enterprise and communication world are competing to make use of presence, seeing it as the horizontal enabler for next-generation communication networks.

B. Challenges in Presence Aggregation

The pre-IMS world used service architecture that was wedged in vertical silos, thus preventing inter-network interaction. Traditional approaches with stove-piped vertical architecture also demand access-tailored services or applications. Since the telecom industry needs to provide service integration to enhance user experience, aggregating presence information across such diverse and fractured platforms requires interoperability.

However, current implementations aggregate presence through presence agents. Such an approach faces difficulty in managing multiple user identities across several devices, thus failing to ensure seamless interoperability and limiting the usage of rich presence.

Meeting the Demands of a Hyper-connected World

Presence technology needs to evolve in an era of hyper-connectivity, signaling the availability of entities across myriad multimedia interactions. Seamless services across multiple access domains – including WiFi, WiMax, UMTS (Universal Mobile Telecommunications System), DSL (Digital Subscriber Line), broadband cable, etc. – are vital for optimum application performance.

This necessitates ubiquitous presence information to be carefully managed and integrated from devices and services across different network technologies. Mostly, applications aggregate presence information around enterprise applications such as email, calendars and instant messengers. When enterprises and service providers attempt to integrate such presence information into real-time telecom systems, the functional limits of such an exercise become clear.

Lack of Horizontal Integration

Divided into service silos, underlying communication networks are not integrated horizontally. Therefore, service providers are unable to deploy a common service architecture and explore the power of presence-enabled systems. Next-generation networks, coupled with presence technology, can enable seamless access interaction and provide feature-rich service offerings.

Network-Based Presence Aggregation

The converged world is foreseeing a network-initiated presence consolidation. The following sections describe some standard presence aggregation approaches which can be utilized in a hyper-connected world.

A. Presence Aggregation – A Staggered Approach

Apart from cross-technology interactions, the challenges for presence aggregation across diverse domains include:

- Availability of presentities in each domain which can collect presence information. In network-based presence aggregation, the presentities in each access domain must keep track of and store presence information of entities connected to the network.
- Availability of an intelligent presence aggregator logic which can gather information from multiple sources, consolidate and publish them for efficient communication usage. For presence to be integrated at the network level, the aggregator service has to act as shown in Figure 1:
  - Interact with presence sources in all technologies
  - Collect availability information of network-connected entities from sources
  - Consolidate the information

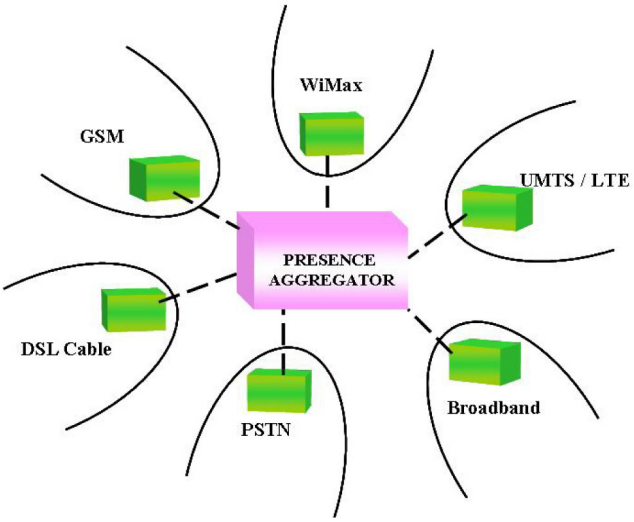

Figure 1: Presence Aggregation - Staggered Approach

Applications or services that require rich presence can subscribe to the aggregator to get integrated presence service.

B. Presence Aggregation – An Integrated Approach

In this approach, each domain can transfer presence information of available entities in their access domains to the presence aggregator service.

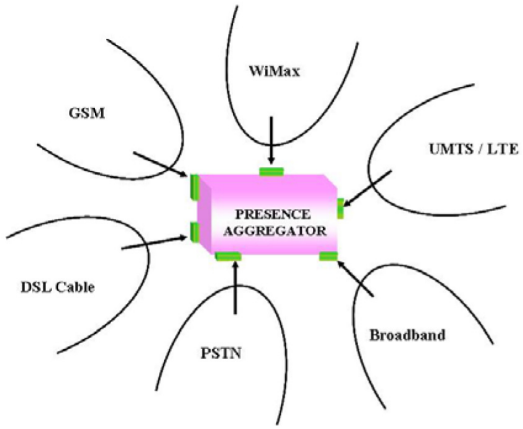

Figure 2: Presence Aggregation - Integrated Approach

The presence aggregator stores / aggregates information at a common location which serves all domains instead of using several presence sources for each domain, as shown in Figure 2. This differentiates the approach as an integrated one, in place of the staggered approach described in the earlier section. Service layer applications use the aggregated presence information to orchestrate rich multimedia services.

The following sections describe how an IMS-based architecture can implement the integrated presence aggregation approach.

Integrated Presence Aggregation Using IMS-Based Architecture

IMS has powered the evolution from existing telecom systems to a converged network. It provides an access-agnostic service delivery platform and efficient service enablers – like Instant Messaging, presence, location service, etc. – to deploy multimedia-rich, integrated solutions to the mass market. The framework enables wireless, wireline and cable operators to provide rich video, voice and multimedia services across even legacy networks.

Unlike the traditional vertical silos, the converged IMS network decouples underlying access network architecture from the services platform with a horizontal-layered approach. This allows services and applications to seamlessly interact with entities in any technology and deliver an access-independent communication experience to the user.

Since the converged network plane no longer faces the challenge of integrating information from multiple sources and technologies, it can reuse common functional / service entities across domains. The architecture allows a high degree of flexibility in integration and eases the task of presence aggregation

Thus, IMS is the best fit for the integrated presence aggregation approach. The high-level architecture of IMS-based presence aggregation is depicted in Figure 3:

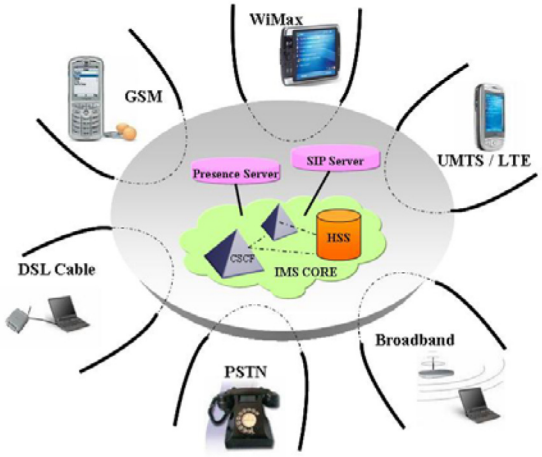

Figure 3: Presence Aggregation: IMS-based Approach

The main advantages offered by IMS for presence service integration are:

- Ease of inter-network interaction
- A single unifying identity (PSI – Public Service Identity – and IMPU – IMS Public User Identities) for services / users across diverse access domains

Session Initiation Protocol (SIP), the common signaling protocol used by IMS service delivery architecture, is the main technological building block. It allows traditional, incompatible networks to interact smoothly. IMS powered by SIP technology is well suited for real-time interaction with both legacy and new-generation networks.

The next section describes how the IMS-based presence aggregation solution can be used to deliver complex presence-enabled services.

Presence Aggregation: Use Case Architecture

A. Presence Server Architecture

A presence server in an IMS network with presence aggregation capability can provide network-based presence consolidation. The use case diagram illustrated as follows depicts the high-level architecture of the presence server:

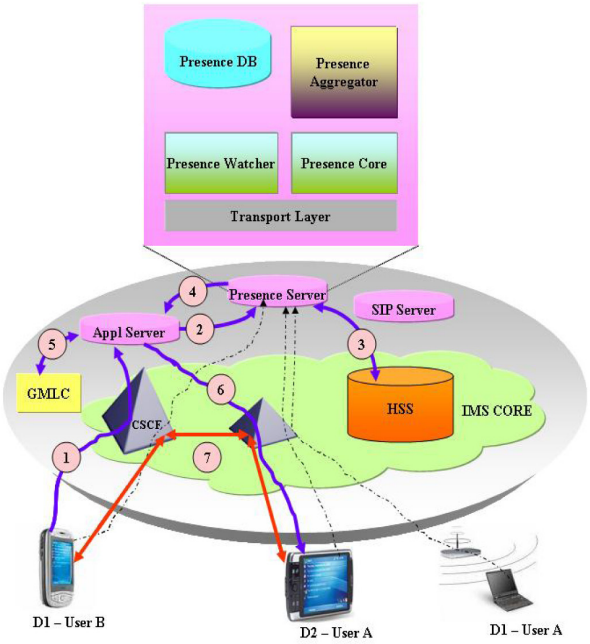

Figure 4: Presence Aggregation Use Case Architecture

The main components of the presence server are as follows:

Interfaces required for presence server are:

- Diameter Sh interface with Home Subscriber Server (HSS) to obtain subscription information
- SIP (SIMPLE) interface with presentities and watchers

Entities that interact with the presence server are:

- HSS which stores the service-specific information
- Presentities (real-time services, user devices or applications) that send availability information to the server
- Watchers: Services that interact with the presence server to get presence information of other services or users.

Functional modules within presence server are:

- Presence database: Stores presence information given by presentities
- Presence core: Handles all publish, subscription and notification events

- Presence aggregator: Consolidates presence information from multiple identities of the same user
- Transport Layer: Provides interfaces of SIP, Diameter Sh, XMPP (Extensible Messaging and Presence Protocol), if required
- Presence subscription / watcher module: Stores a list of subscriptions

B. Enhancement in the SIMPLE Interface

Presence from different sources can be aggregated at a common application server using interfaces in existing IMS architecture, A slight modification in the SIMPLE interface can fully utilize rich presence aggregation and its availability to watchers. The current SIMPLE protocol (RFC 3856) does not support single retrieval of presence information. As per standards:

- If the *"Expires"* header has value "0" in SUBSCRIBE request, then presence server gives NOTIFY only once, but with state as *"Subscription-state"* as *"Terminated"* and with no presence information
- If the *"Expires"* header is set to *"1"*, it will result in two NOTIFY requests (one with presence information and one with empty presence stanza)

Hence, the service logic at the application layer needs to handle the last asynchronous NOTIFY request (which might come even after the end of the service).

A slight enhancement in the SIMPLE interface is proposed to support complex solutions. A new header "Data" with values "Expand" and "Consolidated" is introduced in SUBSCRIBE message. The features of the "Data" header are as follows:

- The "Data" header has significance only if the "Expires" header has a value "0". In this case, the presence server returns only one NOTIFY message, but with the latest presence information
- When the "Data" header is set as "Expand", the presence stanza in the NOTIFY message will include the presence of all the public identities of user 'A' along with the aggregated presence information of the service
- The value "Consolidated" in the "Data" header indicates that consolidated presence information of the presentity is given to the watcher

The next section covers how presence aggregation is utilized to build a complex application service in the IMS network. Using the enhanced SIMPLE interface is also covered in the use case.

C. Presence-based Call Disposition Using Presence Aggregation: Solution Overview

The IMS network's horizontal architecture and the presence function at the service enabler layer allows the creation of complex presence-enabled services. This section describes how network-based aggregation assists in creating such a service.

The Presence-Based Call Disposition (PBCD) service uses a unified identity to make communication user-centric in the hyper-connected world. Once deployed, this service logic can enable application service providers and operators to deliver "anytime, anywhere, any device communication" using a single identity.

Figure 4 depicts how this service is deployed using IMS architecture. User 'A' has multiple devices, each having unique public and private identities. PBCD uses IMS to provide a new service through which user 'A' can be contacted by a unique PSI on any of his devices. The device on which communication – IM, voice call, message, video call, etc. – terminates is based on various parameters such as the presence, location, service rule engine (which is configurable by the user).

For example, to contact user 'A', user 'B' dials user 'A's' PSI instead of one of his device-specific identities. Depending on the service logic at the IMS core, which, in turn, uses presence aggregation, the call will be routed to the device of user A's choice and availability.

The presence aggregator plays a major role in providing the PBCD service. It interacts with various IMS nodes like HSS and external location provider (GMLC – Gateway Mobile Location Center) to provide the user's aggregated presence information from multiple devices. The following sub-sections describe various service requirements and how the service is implemented using IMS.

At the high-level, a PBCD service needs to:

- Interact with devices connected to multiple technologies
- Use a single unified identity across all networks
- Enable users to select their preferred mode of communication. At any point of time, users will be connected using many devices and hence must be able to prioritize each of their identities
- Get a user's consolidated presence information or the detailed presence information of all identities of the user from the presence server

A presence server in the IMS core for PBCD service needs to:

- Be able to aggregate presence
- Get presence information of all user identities when provided with a unified single identity
- Consolidate information
- Pass it as a consolidated single presence or detailed presence list to the service which has requested for it

Implementing PBCD solution through IMS

PBCD is a service logic which, with the help of a unique unified identity for each subscriber (PSI), determines his availability across multiple devices and networks in the IMS world. In the architecture diagram (Figure 4), the service logic lies in the application server. The application server uses:

- The presence server to obtain aggregated presence information
- GMLC to get the latest location information of a mobile device

A user uses the PBCD service for real-time multimedia communication. When he subscribes to the service:

- A user needs to provide a list of all device identities (IMPU), along with their priority
- This is used as an input for the rule engine in the application server
- Along with aggregated presence information from presence server, the rule engine routes the call to the appropriate user device

Whenever a user connects / registers to the network through a device:

- The device's presence information is updated in the presence server as part of ***Publish*** procedure
- The presence server stores the availability information of its presence sources in the database. This is depicted in the Figure 4 in dotted lines

Refer the use case architecture in Figure 4 to map the steps given below.

Step 1

In the use case, user 'A' subscribes to a PBCD service. Other users can request this service for a video / voice call by calling user 'A's' unique PSI instead of his device-specific public identity. PSI is the identity published to all. In this example, user 'B' is trying to call user 'A' on user 'A's' PSI – UserA@call_disposition.com.

Step 2

The service logic at the application server contacts the presence server to get the presence information for 'user 'A's' PSI. This is achieved by sending a SUBSCRIBE request for the PSI to the presence server with a "Data" header with value ***"Expand"*** or ***"Consolidated"*** and ***"Expires"*** header with value "0".

Step 3

After receiving the caller's PSI, the presence server contacts the HSS to get his service-specific information. The presence server uses UDR / UDA dialog over the Sh-interface for this purpose (with Data-Reference AVP for the UDR Diameter message as IMSPublicIdentity). HSS provides the list of the user's registered public identities to the presence server as it already contains the mapping between the PSI and all related public identities

The presence aggregator module in the server fetches the presence information of each of the identities. It prepares the consolidated presence information based on the aggregator rule engine, The rule engine is based on XML format and can either be stored in the presence server or in the HSS (in which case, it could be fetched by a UDA for service data).

However, the most viable implementation will be an aggregation rule engine that is configurable at the presence portal. The portal presents a list of public identities fetched from HSS only using UDR and UDA and the user can configure the aggregation information.

Step 4

The presence service notifies the PBCD service about the aggregated availability information. The service logic uses the information to contact user 'A's' available public identity, as follows:

- If "Data" is set as "Expand", the presence stanza in the NOTIFY message will include the presence of all of user 'A's' public identities along with the aggregated presence information of service
- If "Data" is set as "Consolidated", it indicates that only the consolidated presence information of user 'A' is required by the service

Step 5

Based on the service rule engine in the application server, it sends a request to the external location provider – like GMLC. This is to obtain the latest location information if the aggregated presence indicates that a mobile device needs to be Consider a situation where user 'A's' mobile device is on international roaming facility. Therefore, he may not want to receive incoming calls on the device. In such a case, the presence information received by the "Expand" value of the "Data" header of SUBSCRIBE request is used to make further decisions on where to route the call.

In case the request in Step 2 does not have the "Expand" field, another SUBSCRIBE request will be triggered with "Expires" as "0" and "Data" as "Expand" values to obtain a NOTIFY message with detailed presence information and consolidated presence.

Step 6

The service logic redirects or places the multimedia call based on the consolidated presence information and user location. In this case, it is routed to user 'A's' D2.

Step 7

Once the call is connected, signaling takes place directly between user entities. contacted.

Presence Stanza in NOTIFY and SUBSCRIBE Message Extensions (RFC 3856)

The IETF draft on Rich Presence Information Data Format for Presence based on the Session Initiation Protocol (RPIDS) provides a detailed data format to handle the aggregated presence information of a service from multiple devices, users, etc. The same format can be reused to send aggregated availability information from the presence server to the application server.

In this sample RPIDS for aggregated presence information, the entity element indicates the PSI. The sample RPDIS is as follows:

```
<presence xmlns="urn:ietf:params:xml:ns:cpim-pidf"
  xmlns:cap="urn:ietf:params:xml:ns:sip-prescaps"
  xmlns:ep="urn:ietf:params:xml:ns:sip-rpids">
  <entity="UserA@call_disposition.com">
  <tuple id="35bs9r" class="service">
    <status> <basic>available on softphone
    </basic> </status>
    <contact=UserA@service.com</contact>
```

```
    </tuple>
    <tuple id="35bs9s" class="softphone">
      <status> <basic>open</basic> </status>
      <contact priority="10">
      D2_UserA@infosys.com</contact>
    </tuple>
    <tuple id="35bs9t" class="mobile">
      <status> <basic>not reachable</basic> </status>
      <contact priority="10">
        9995557777@mobile.com</contact>
    </tuple>
  </presence>
```

The sample of the SUBSCRIBE request with the proposed extension is as follows:

```
SUBSCRIBE sip:UserA@call_disposition.com SIP/2.0
Via: SIP/2.0/TCP userB.example.com;branch=z9hG4bKnashds7
To: <sip:UserA@call_disposition.com>
From: <sip:UserB@example.com>;tag=xfg9
Call-ID: 2010@UserB.example.com
CSeq: 17766 SUBSCRIBE
Max-Forwards: 70
Event: presence
Accept: application/pidf+xml
Expires: 0
Data: Expand
Content-Length: 0
```

Conclusion

Presence-enabled services have become all-pervasive as the world moves toward better connectivity. However, until presence information can be obtained and utilized across multiple identities, varied networks and numerous devices, its concept fails to deliver a satisfying experience to users. It is only when network-based presence aggregation is enabled using next-generation networks like IMS, that service providers and operators have the capability to provide the benefits of rich presence.

Service logic supported by aggregated presence and other service enablers allows IMS architecture to deliver presence-enabled multimedia services. The proposed service logic architecture in IMS can be used in application services to deploy network-initiated presence aggregation. The extensions proposed for RFCs, when included, can provide more flexibility to watchers while getting aggregated presence information from presence servers.

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