IMS for Enterprise Applications

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Abstract:
In response to the change of communication needs, IP Multimedia Subsystem (IMS) was envisioned to provide a sound session control for the multimedia conversional services. IMS technology has been slowly adopted by operators for variety of services. In fact, the IMS used in the enterprise has different features and capabilities than the one used by the general public. This paper provides a very brief overview of IMS and then investigates the IMS which is used in the enterprise and focuses on the challenges in providing IMS to the enterprise and ZTE's solutions to those issues.

IP Multimedia Subsystem (IMS)[1] technology has been slowly adopted by operators for variety of services. The promise of delivering and controlling the multimedia conversional services for subscribers holds great appeal and potential for a seamless integration of IT technology and telephony technology.

Traditionally, there are two distinct groups of customers in the telephony world. The Public Switched Telephone Network (PSTN)[2] is created to serve the general public and many businesses. The PSTN is operated by a common carrier or a telephone company.

Another group of customers is the business customer, which is normally served by Private Branch Exchange (PBX) located on premises. For a large corporation, a number of PBXs may be used and interconnected by a common carrier. The PBX will also be connected to PSTN for communications outside the corporation. The PBX is normally purchased, managed, and operated by the corporation.

There are many unique characteristics of PBX, such as short number dialing, executive pre-emption, number dialing policies, and numbering plans[3]. Those features are very different from the ones offered to the general public. In general, the ownership of the PBX, the interconnection of them in the multinational enterprise, management aspects, and operational aspects of PBX created a lucrative marketing segment for equipment vendors and service providers, in the case of managed services.

In today's enterprise, the communication needs of the enterprise are no longer telephony centric. For example, the email system in the enterprise will be much more important than the PBX. Furthermore, the communication is more people centered instead of extension centered (i.e. PBX is only capable of communicating to a specific extension, not a specific person). Today, people should communicate with people in multimedia, not an impersonal extension. The merge of corporate IT infrastructure and communication infrastructure seems inevitable, productive, and economical.

In response to the change of communication needs, IMS was envisioned to provide a sound session control for the multimedia conversional services. In fact, the IMS technology created the possibility of merging IT infrastructure with the communication infrastructure. Just like its telephony counterpart, the IMS used in the enterprise will have different features and capabilities from the one used by the general public.

In this paper, the IMS used in the enterprise will be investigated. These discussions will focus on the challenges in providing IMS to the enterprise and ZTE's solutions to these issues. Before the detailed discussion on providing IMS to the enterprise, a very brief overview of IMS is provided in the next section to setup the context for further discussions in the subsequent sections.

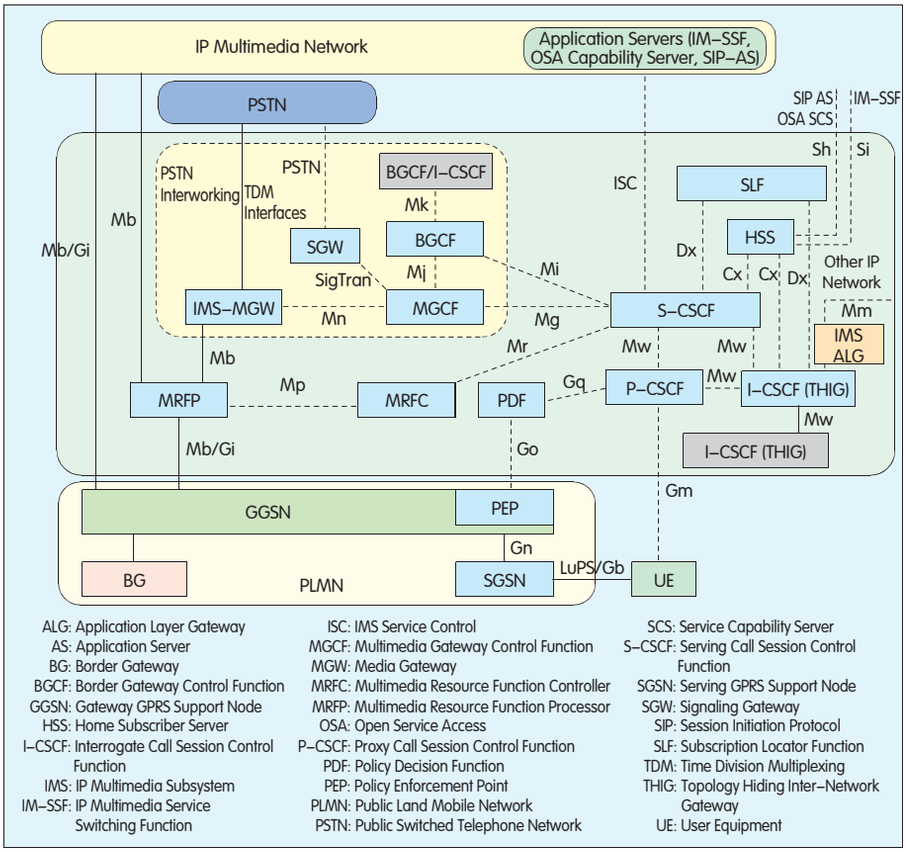
1 IMS Overview

The IMS was originally designed for mobile consumer market by 3GPP. Its main function is to provide session control for the packet-based mobile network. With the advances of mobile access technologies, the packet-based wireless access network demands IMS technology to provide needed control. This fact makes IMS technology an integral part of the future mobile network.

The IMS architecture has also been slightly modified for the fixed network by Telecommunications and Internet converged Services and Protocols for Advanced Networking (TISPAN) of ETSI. By encompasses both the fixed and mobile networks, the IMS became the only standard means of session control for the packet-based network.

IMS is both network architecture and a set of standards which were proposed and standardized by the IETF. Instead of proposing new standards by IMS, those IETF standards have been "profiled" (i.e. IMS articulates how those standards should be used) to build an end-to-end solution for the service providers.

In the protocol aspects of IMS, the basic protocols are RTP (Real-Time Transport Protocol) for the media flow, Session Initiation Protocol (SIP) for session control, and Diameter for authentication and accounting related matters. In IMS technology, those protocols are to be implemented over a predefined architecture for



▲Figure 1. IMS architecture in mobile network.

conversational services over the packet network using IP technology.

In the architecture aspects of IMS, the service control will always be provided by the home network, which the subscriber and the service provider have business relationship. In fact, the services will be provided by the application servers in the home network where the session information is provided by an architecture component called Serving Call Session Control Function (S–CSCF). The S–CSCF in the IMS network has to handle subscriber registration and session control (session setup, maintenance, and tear–down).

In order to support mobility, two more Call Session Control Functions have been defined in the IMS architecture. One is the Proxy Call Session Control Function (P–CSCF) which may be located in the visited network or the home network, depending on subscriber's location. The subscriber may not have business relationship with the service provider whose P–CSCF is used (i.e. P–CSCF located in the visited network). But the home network service provider and the service provider whose P–CSCF is used will need to have roaming agreement.

The other CSCF to support mobility is Interrogate Call Session Control Function (I–CSCF) whose purpose is to locate the S–CSCF in the home network. In general, I–CSCF is the entry point of the home network from any roaming partners. The IMS architecture is shown in Figure 1 for easy reference in the subsequent sections.

The IMS technology also addresses several issues which are important for service providers, including roaming control, QoS negotiation, application invocation and sequencing, charging, and interoperation with circuit switched networks.

Developed for public mobile users, the IMS has also been deployed in the enterprises. There is certainly a lot of similarities and differences between session control mechanisms for both general public and enterprises. In the next section, these similarities and differences will be articulated.

2 Enterprise IMS

At the session control level, there is little difference between an enterprise focused IMS system and a general public focused IMS system, in both mobile and fixed environment. In technical terms, there is no difference at the call flow level between those two different environments (i.e. enterprise environment and public environment).

The differences will be in the applications, and the management of those applications. In the IMS world, the applications are provided by the application servers. Hence, all the enterprise specific features will be provided by the application servers. There are three different scenarios on how those applications are provided.

2.1 Managed Applications

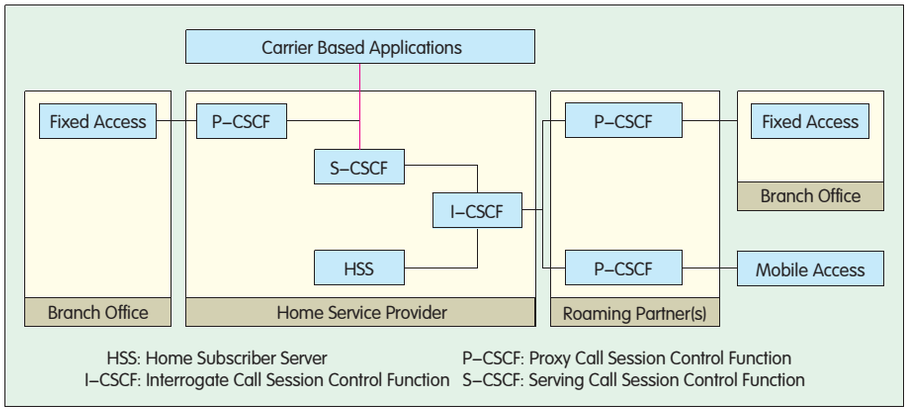
In this case, the service provider will provide applications with enterprise specific features, just like the managed Centrex services provided by carriers.

The entire network and its applications will reside inside the network. The employees will be able to use the network services via mobile devices, and fixed devices. The fixed access will be connected to a set of P–CSCF inside the carrier while the mobile access may use one of the carrier's P–CSCF or a roaming partner's P–CSCF.

Geographic coverage will be provided by the service provider and its roaming partners, even for the fixed access, due to the geographic locations of various branch offices. Considering that the home service provider provides the applications, the user interface will be consistent regardless of geographic locations.

The managed application scenario will be more suitable for small business for its lack of technical expertise, small working force, and less sophisticated application requirements. Figure 2 depicts this particular scenario.

This application scenario is simple for enterprise but with limitations. First, the enterprise features will be limited to whatever the service provider is offering. Second, the change of anything, from



▲Figure 2. Service provider centric IMS.

employee enrollment to security policy, has to be coordinated with the service provider. Third, because the geographic coverage is provided by the roaming partners, the cost would also be an issue.

ZTE's IMS portfolio will fully support this application scenario.

2.2 Enterprise–Based Applications

In this application scenario, the enterprise will use the premises–based application server. The S–CSCF in the carrier will interact with the premises based application server, across the standard ISC interface, to perform the session management related activities.

In the enterprise based application approach, it is possible for the service provider to provide value–added applications in the network in conjunction with the enterprise–based application servers. In this case, the service provider may maximize the addressable market for certain applications while refraining from getting involved into enterprise specific applications and its related management. This application scenario is shown in Figure 3.

If a mixture of network based application server and premises based application server is used, the feature interaction and sequencing between those applications need to be carefully arranged. Any modification of enterprise application may involve data modification in HSS, which may not always be feasible.

The advantage of this approach is the flexibility of application management which may be tailored towards the specific enterprise and its working model. In the enterprise based application scenario, the geographic coverage will also need to be covered by the roaming partners which would be a cost issue. On the other hand, because it is the home service provider that provides the needed applications, interface consistence can be achieved.

Considering that ZTE's IMS portfolio is completely standard based, this mode of operation can be accomplished.

2.3 Enterprise–Based IMS

In this case, the enterprise takes the complexity of owning and managing the IMS network. In particular, the enterprise may own various CSCFs, the HSS, and the application servers. In practice, only large multinationals will have the budget and the technical expertise to manage a complete IMS network.

The advantage of such approach is user experience consistence across different regions, management flexibility, and security. There are two means to provide geographic coverage: via the enterprise based IMS directly and via a roaming partner, whose P–CSCF will interact with the I–CSCF in the enterprise.

A deployment scenario which could be of interest is that the enterprise based IMS will be responsible for the fixed access and Wi–Fi access which is also premises based. The cellular access will be provided by roaming mobile operators due to mobile licenses issues and geographic coverage issues. The enterprise based IMS will be the home IMS for the enterprise and all cellular access will be considered to be roaming access. Figure 4 illustrates this scenario.

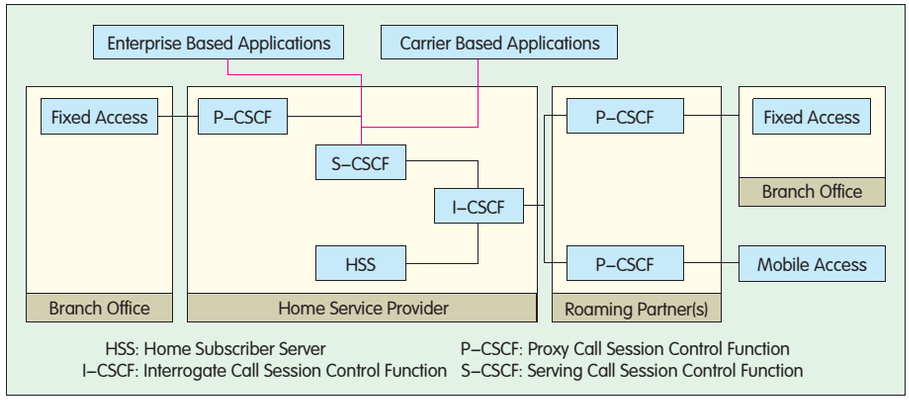
In this approach, in particular, various branch offices may be connected to a centralized P–CSCF for management and cost reasons. ZTE has deployment experience for such network configuration (an enterprise based IMS network with centralized P–CSCF).

While this approach has many freedoms and flexibilities, the cost of such approach, especially the maintenance and operation of such network, would be prohibitive for small– or medium–sized businesses.

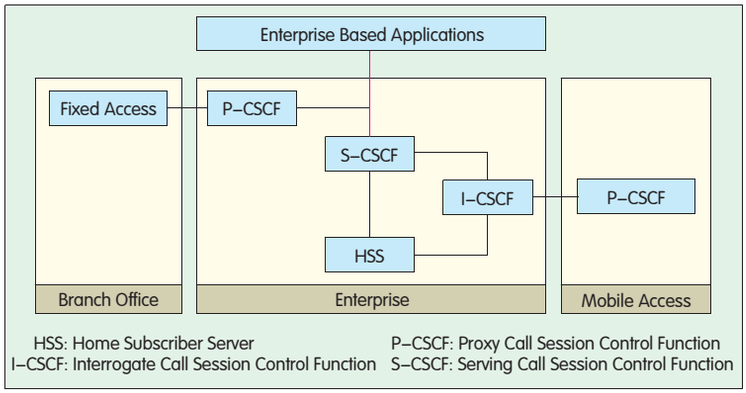
ZTE's IMS solution has been providing this type of access mechanism from the very beginning and is well poised to take challenges presented in the enterprise–based IMS, which is be discussed in the next section.

3 Challenges of IMS in Enterprise Environment

There are many challenges in deploying the IMS in the enterprise. In this paper, two of such challenges, together with ZTE's solutions, will be discussed. The first challenge is emergency support for centralized P–CSCF, and the other would



▲Figure 3. Promises–based application.



◀Figure 4. Enterprise–based IMS.

be the Network Address Translation (NAT) and IP version (IPv4 v.s. IPv6) mismatch.

3.1 Emergency Call Support

The emergency call support for deployment in Figure 2 does not provide any challenges due to the fact that the P–CSCF will be local, and the standard emergency handling mechanisms can be used.

The emergency call support for deployment in Figure 3 may not present any issue if the enterprise based application does not perform special processing of the emergency call. If the enterprise based application provides special processing for the emergency call, how to support such call is an open question. In practice, if the enterprise based application server processes the emergency call in a specific way, the enterprise should consider deploying the complete IMS inside the enterprise, such as the one depicted in Figure 4.

Due to the sharing nature of the P–CSCF among many different branches for the centralized P–CSCF setup, the emergency call processing by the P–CSCF needs to direct the call to the proper public safety site. This can be achieved via careful arrangement of the source IP addresses of the different branch offices.

If special processing of the emergency call is required in the application, the P–CSCF can be configured to handle the emergency call as a normal call and the proper application can be a trigger to further process the emergency support.

3.2 NAT and IP version

In the previous discussions, the branch office is depicted as if there is only one fixed access point. In practice, this is much more complicated. In fact, the branch office will have the complexity of a complete IT infrastructure of the enterprise

In particular, there will be NAT[4] involved to solve the IPv4 address shortage problem and provide certain security features. There could be IP version mismatch among communication partners (IPv4 and IPv6[5]).

If the service provider (in the case of scenarios depicted in Figures 2 and 3) does not have control of the NAT in the branch offices, the IMS clients inside the branch office need to obtain a public address before the first SIP message can be sent out. There are many means to obtain a public address, such as Interactive Connectivity Establishment (ICE) and Traversal Using Relay NAT (TURN), which has to be used in any SIP messages.

For the scenarios in Figure 4 (or the service provider can manage the NAT in the enterprise IP gateway in Figures 2 and 3), the P–CSCF, together with its SIP Application Layer Gateway (ALG) function, can be used to support NAT traversal and IP version mismatch issues. In particular, ZTE has developed technology which will satisfy the following criteria:

(1) The solution will ensure that Network Address and Port Translation Protocol Translation (NAPT–PT) will only be invoked once inside the network for the media path.

(2) NAPT operations will be combined with the NAPT–PT operations whenever possible.

(3) The solution will cause detour of the media traffic due to NAPT–PT usage only when there is no NAPT–PT capable network elements along the normal media path.

(4) The solution will be independent of network IPv4 addressing plans in the access network.

(5) The solution will avoid unnecessary invocation of service logic in S–CSCF because of recursion of the signaling path.

ZTE's solution, which satisfies the abovementioned criteria, will provide the most cost–effective solution to the NAT and IP version mismatch problem.

4 Conclusions

Providing IMS in the enterprise will have a lot of issues and challenges. In this paper, various possible deployment scenarios, along with issues with those scenarios, have been discussed. The enterprise IMS for establishing the multimedia conversational services can be analogue to the PBX in the telephony for voice services, where flexibility, security, and manageability are very different from the IMS system defined for general public.

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Biography

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Li Mo holds a PhD degree from Department of Electrical Engineering of Queen's University. He is CTO of ZTE USA (a wholly owned subsidiary of ZTE Corporation) and is a member of the Global Marketing Team for ZTE. Dr. Mo has over 20 years of experience in the telecommunication industry, including extensive work in Fujitsu, Nortel and IBM, prior to his joining ZTE in 2001. His current research interests include P2P network, IMS, and Fixed Mobile Convergence (FMC). Dr. Mo is an active member of IEEE, ETSI, and ITU, where he is an editor for five recommendations, and is an associate rapporteur of Q1/SG13.