

Review on Integration of IP Multimedia Subsystem with Femtocells Network

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Abstract:

The IP Multimedia Subsystem (IMS) is the basis for a significant new architecture for mobile applications incorporating voice, video and data services. The IMS is an overlay network on top of IP that uses SIP as the primary signalling mechanism[1]. Femtocells are low-power wireless access points that operate in licensed spectrum to connect standard mobile devices to a mobile operator's network using residential DSL or cable broadband connections". Put simply, a femtocell is a small base station that can be deployed in homes, buildings or other locations that offer limited access to the mobile network. In current scenario Mobile services have gained a reputation for inadequate building penetration, resulting in inferior call quality. This quality issue becomes even more paramount as mobile subscribers begin using advanced services available in 3rd Generation (3G) networks, as nearly 70% of all 3G traffic originates from indoor locations. However, research shows that only two per cent of buildings are currently equipped with purpose-built indoor coverage solutions. With the growing demand for these new services, most industry observers see significant potential for the use of new technology in the form of "femtocell" solutions. Femtocells operate in the same wireless spectrum as the macrocell network, enabling high quality voice and multimedia services to be delivered to mobile devices in indoor settings[14]. A femtocell access point creates a small wireless coverage area, and it is attached to a subscriber's broadband Internet service for connection to the mobile operator. In this paper, Configuring the IMS framework in new approach of network architecture such as femtocell and designing the femtocell network to support IMS services is quite demanding. In this paper we concern on the investigation architecture of integration network and what are all the challenges, what are the problems and solution if that, when it works on environment. The deployment of IMS functionality in

femtocell environment is investigated and overviewed to achieve high-quality voice, data, and video sessions to flow efficiently, securely and reliably using the consumer's existing broadband connection.

Keywords: Femtocell , IMS , Macrocell

INTRODUCTION:

IP Multimedia Subsystem (IMS) is a generic architecture for offering multimedia and voice over IP services, defined by 3rd Generation Partnership Project (3GPP). IMS is access independent as it supports multiple access types including GSM, WCDMA, CDMA2000, WLAN, Wire line broadband and other packet data applications. IMS will make Internet technologies, such as web browsing, e-mail, instant messaging and video conferencing available to everyone from any location. It is also intended to allow operators to introduce new services, such as web browsing, WAP and MMS, at the top level of their packet-switched networks.

IP Multimedia Subsystem is standardized reference architecture. IMS consists of session control, connection control and an applications services framework along with subscriber and services data. It enables new converged voice and data services, while allowing for the interoperability of these converged services .between internet and cellular subscribers[1][3]. IMS uses open standard IP protocols, defined by the IETF. So users will be able to execute all their services when roaming as well as from their home networks. So, a multimedia session between two IMS users, between an IMS user and a user on the Internet, and between two users on the Internet is established using exactly the same protocol. Moreover, the interfaces for service developers are also based on IP protocols.

Femtocells are small power wireless access points that operate in licensed spectrum to connect standard mobile devices to a mobile operator's network using residential DSL or cable broadband connections. Femtocells deliver significantly improved coverage inside the home, small and large offices, and outdoor public spaces (metro hotspots and rural). This means a good signal quality, better voice quality, plus improved data download and upload speeds. Femtocells also facilitate a new variety of mobile service that exploits the technology's ability to detect presence, and connect and interact with existing networks[5][12].The main focus of this paper is to investigate the various integration techniques for IMS with Femtocell and One of the serious problems for femtocell deployment is the incidence of unnecessary handover due to movement of the user. These unnecessary handovers cause the reduction of user's QoS level and system capacity. These unnecessary handovers can be optimized using proper call admission control (CAC) and resource management scheme.

Section II: IMS Overview Section

The IP Multimedia Subsystem defined by the 3rd Generation Partnership Projects (3GPP and 3GPP2) [3] signifies today the global level Service Delivery Platform

(SDP) standard and its provide multimedia applications to Next Generation Networks (NGN). So, IMS aims to provide an open, standard based network that delivers integrated multimedia services to increase revenue, while also reducing network Capital Expenditures (CAPEX) which is related to the cost of physical infrastructure and reducing the Operational expenditures (OPEX) which refers to the cost of managing the physical infrastructure[8].

IMS Core components:

shown in Figure 1, the IMS core functional components are the Call Session Control Functions (CSCF) and the Home Subscriber Server (HSS) [2]. There are three different kinds of CSCFs: Proxy-CSCF (P-CSCF), Interrogating-CSCF (ICSCF) and Serving-CSCF (S-CSCF). These CSCFs components are helps to route the signal and managing the sessions. The PCSCF is the first first entry poing point of the User Equipment (UE) contacts on the IMS Core. It maintains IPsec security associations (SA) with UEs and applies integrity and secrecy protection for SIP signalling[4]. The I-CSCF is responsible for assigning a suitable S-CSCF to the UEs and routes incoming requests to it. The S-CSCF handles registration process, downloads authentication data from the HSS and generate challenge to UE. Finally, the HSS is a database containing all user identities, location information and service-related data. Figure 1 shows a simplified architecture of the IMS[8].

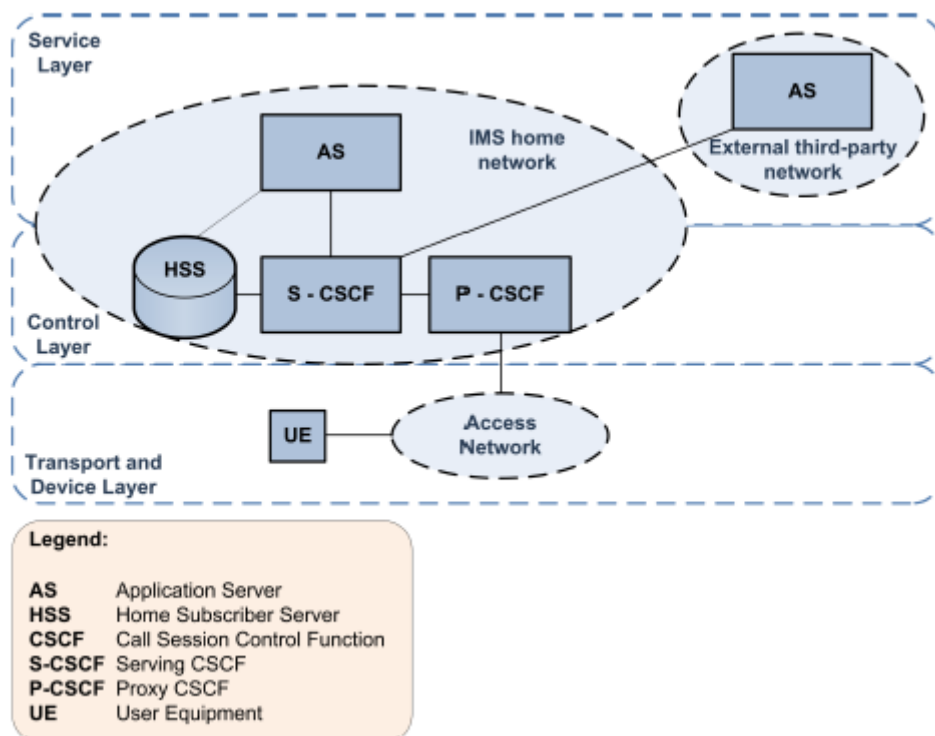


Figure1: IMS Architecture

A. Femtocell architectural components:

Femtocell Access Point, sometimes called a personal (cellular) base station, in the residence or small business. The Femtocell Access Point connects to the Mobile Operator Core Network via a broadband connection such as DSL, Cable or Fiber Optic. The Femtocell Access Point would typically support 2-5 cellular devices. Femtocell access points (FAPs) are small-power radio access points, providing wireless voice and broadband services to customers chiefly in the home setting. The FAP provides cellular access in the home and connects this to the operator's network through the customer's own broadband connection to the Internet[10][2]. FAPs usually have an output power less than 0.1 Watt, similar to other wireless home network equipment, and allow a small number (typically less than 10) of simultaneous calls and data sessions at any time. By making the access points small and low-power, they can be deployed far more densely than macrocells (for instance, one per household). The high density of deployment means that the femtocell spectrum is re-used over and over again, far more often than the re-use that the macro network (with its comparatively large cells) can achieve. Trying to reach the same levels of re-use with macro cellular technology would be absurdly expensive in equipment and site acquisition costs. By using femtocell, the re-use, spectrum efficiency, and therefore the aggregate capacity of the network can be greatly increased at a fraction of the macro cellular cost[10].

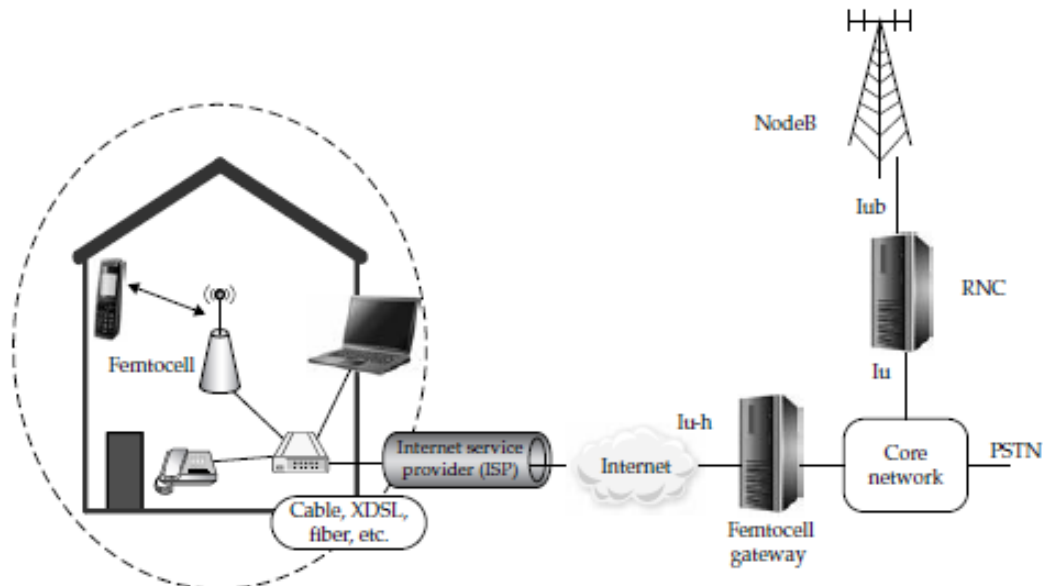


Figure 2:FemtocellArchitectural Components

Section III: Integration architecture between IMS and FAP:

We consider IMS with the femtocell system possible to integrate in two ways .method

one integrate Femtocell to IMS core network through a Mobile Core Network .method Two, the direct integration between IMS core with femtocell system network by using all IP connectivity (IMS-based femtocell). The method can be shown in Fig. 3 The bequest Integrated Service Digital Network (ISDN), Signalling System #7 (SS7) is the protocol signalling method used to connect services in the telephone network[9].

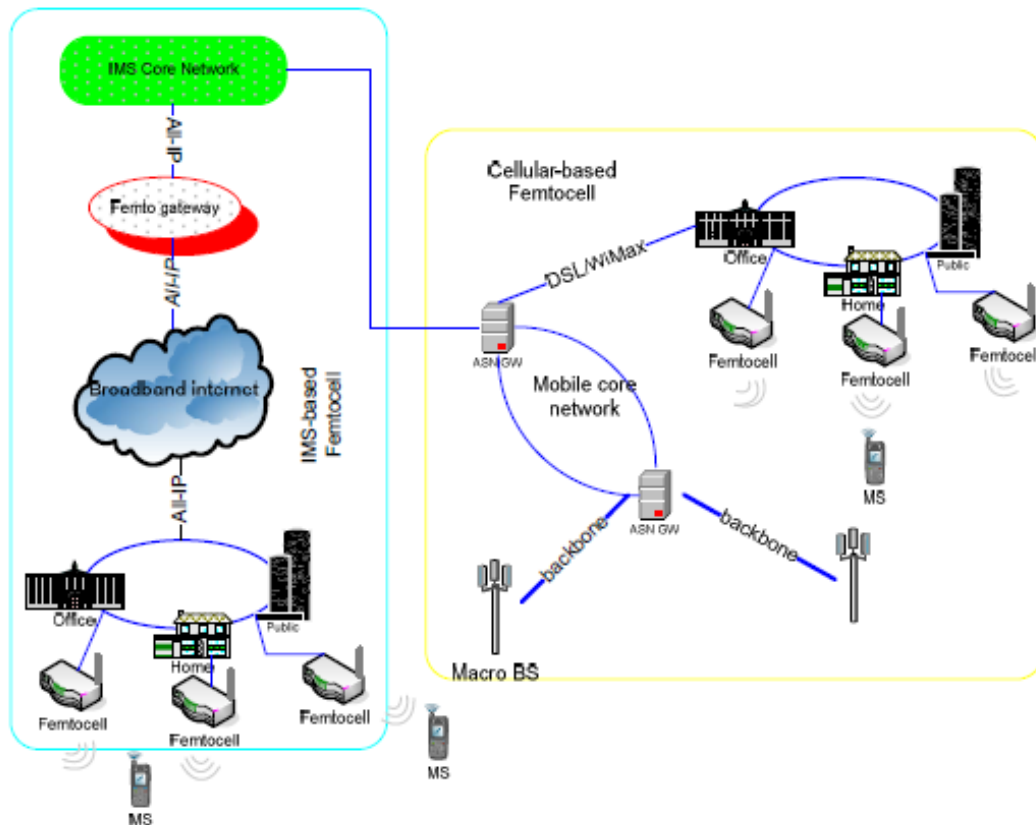


Fig 3: IMS – Femtocell Integrated Network Architecture

SS7 connects different operators’ networks with one another, and connects all of the switches within the network with one another. In IMS, SS7 is replaced with a new signalling method: SIP, which is used to control everything in the network. Based on this Attainment, the SIP/IMS core network with all Functionalities of IMS can be integrated directly to the Femtocells by using all IP connectivity[11]. We much more recommend the direct integration to provide an efficient integration of IMS core network and Femto Base Station[13].

Section IV :IMS Advantage of Femtocell Integration

Femto-access points (FAPs) are low-power, small-size home-placed Base Stations (also known as Home NodeB or Home eNodeB) that create islands of increased

capacity in addition to the capacity provided by the cellular system. These areas of increased capacity are referred to as femtocell. Femtocells operate in the spectrum licensed for cellular service providers[15]. The key feature of the femtocell technology is that users require no new equipment (UE). However, to allow operation in the licensed cellular spectrum, coordination between the femtocell and the microcell infrastructure is required. Such coordination is realized by having the femtocell connected to the local mobile operator's network using one or more of the following backhaul network technologies: residential xDSL, cable TV (CATV), Metro Ethernet, or WiMAX.

It is envisioned that a FAP would be typically designed to support simultaneous cellular access of two to six mobile users in residential or small indoor environments. Predictions show that in the near future about 60% of voice traffic and about 90% of data traffic will originate from indoor environments, such as a home, an office, an airport, and a school [10]. Therefore, there is the need for improved indoor coverage with larger data rates[15]. However, due to the limited cellular capacity, it might be difficult and too expensive to accommodate this increased traffic demand using the current macro cellular coverage. Femtocells are a new candidate technology that is capable of providing expanded coverage with increased data rates.

Even though there are several technical approaches to improve the indoor coverage, femtocell appears to be the most attractive alternative. Compared with the Fixed Mobile Convergence (FMC) framework, femtocell allow servicing large numbers of indoor users.

Section V:THE TECHNICAL CHALLENGES OF FEMTOCELL/MACROCELL INTEGRATED NETWORKS:

The provision of QoS in femtocellular networks is more difficult than for the existing microcellular networks due to the large number of neighbouring FAPs and the possible interference conditions among the femtocell and between macrocells and femtocell There are a number of technical challenges to support satisfactory QoS to the users in a femtocellular network, solutions of which are being studied. The QoS of femtocellular networks is influenced by procedures such as resource allocation, network architecture, frequency and interference management, power control, handover control,Femtocell hold significant promise for mobile and integrated wire line/wireless service providers, but this technology must also overcome a number of challenges[6]. The industry and vendors are now working to address issues related to microcellular interference, cost of femtocell, and simple installation at the femtocell with auto-configuration, support for regulatory services, Quality of Service (QoS) for backbone backhaul, and a plethora of femtocell solution architectures. These and other issues are briefly covered below[7].

Interference Management:

Seen as perhaps the most crucial hurdle, the existence of many small microcells - in contrast to a few macrocells --changes the ways in which operators must manage their transmission power; some operators are also expressing uncertainty as to which

frequency allocation scheme they would use to support this implementation.

Proprietary Interfaces:

The variety of transport mechanisms and a lack of standardization are potential roadblocks, with many operators looking to vendors to provide end-to-end femtocell solutions, complete with full system integration; a number of organizations – including the Femto Forum, 3GPP and 3GPP2 – are currently working to address standards and interoperability issues relating to the deployment of femtocell[14].

Access Model:

Most industry observers say a closed access model - where only direct subscribers could access service over the femto device -will likely be the preferred service model in early deployments; later, consumers may be willing to accept a more open access model that would allow calls from various users to transit a femtocell device.

Access Point Costs:

Surveys show that operators will pay up to a high-end limit of \$250 for initial deployment of femtocell in the consumer marketplace – an all-in network cost that includes the device, gateway and other requirements. More acceptable price points, however, are at \$200 or less.

Core Network Integration:

Femtocells are essentially small base stations in a mobile core network that was designed for fewer, much larger base stations; integrating these many access points into a mobile core poses a considerable operator challenge[10].

Even through lot of challenges are there in this integrated network, the main challenge is Frequent and unnecessary handover is another problem for hierarchical network environment that must be optimized to improve the performance of macrocell/femtocell integrated network. In this paper, we propose a modified handover procedure between macrocell and femtocell. An asymmetric handover scheme using Double Threshold Algorithm (DTA) and Call Access Control (CAC) is proposed to reduce the unnecessary handovers.

CONCLUSION:

In this paper we have taken the review on the investigation architecture offemtocell which has been the subject of growing attention as a new integration network and what are all the challenges, what are the problems and solution are analysed. When it works on this environments user will get more benefits enabling high quality voice, video and multimedia services to be delivered to mobile devices in indoor settings. IMS provides a seamless handoff to the mobile devices and provide good quality of service. IMS is an coupling mediator to connect all IP Network for feature generation network technologies.

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