Delivery of Unified Communications over Thin-IMS

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ABSTRACT
This paper describes the architecture, design patterns, and implementation of a Unified Communications Solution (UCS) over a home grown thin implementation of IP Multimedia Subsystem (IMS). This thin-IMS implementation makes use of IMS core components, and can serve as a first step towards migration to full IMS. The unified communications solution offers a rich set of services including duplex VoIP, video conferencing, instant messaging, media sharing, child position tracking, active contacts, and email reading. Subscriber profile is leveraged by a targeted video advertisement preview service as a payment method for calls terminating at landline or mobile networks. Subscribers can also use prepaid service for calls terminating outside of the IP networks. In addition to system and software design patterns, the paper addresses critical deployment issues, such as scalability, NAT traversal, network interconnect, ease of service provisioning and administration, and last but not least, user experience. Finally, the paper contrasts the thin-IMS platform to 3GPP standard IMS release 7 specifications.

Keywords: Active Phonebook, IP Multimedia Subsystem (IMS), Location Tracking, NAT Traversal, Next-Generation Networks (NGNs), Publicity, Unified Communications, VoIP

INTRODUCTION
Next-generation networks (NGNs) are set to offer ubiquitous converged services comprising voice, video, and data services irrespective of the access network. The IP Multimedia Subsystem (IMS) has emerged as one such unifying architecture that allows delivery of identical services to fixed and mobile customers - regardless of whether they are connected through a packet-switched (PS), circuit-switched (CS), wireless, or a cellular network (3GPP, 2007; Jun-Ho, 2010; Jun, 2006). IMS-based services enable communication in a variety of modes including voice, text, location, presence, messaging, pictures and video, or any combination of these (Saxtoft, 2008). IMS distributes functions over specialized network nodes allowing for scalability; that is, as the subscriber base grows, the IMS network can seamlessly scale up by adding extra nodes (Gateways). Thanks to the flexibility of the Session Initiation Protocol (SIP) and Session Description Protocol (SDP) used for signaling (3GPP, 2005), IMS can accommodate convergence, with the potential to meet all the needs of Unified Communica-
tions (IMS SIP, 2009). SIP’s flexibility enables IMS networks to adapt and change signaling protocols to meet dynamic market needs for telecommunication services.

Yet, despite the high initial convergence expectations and the promises of revenue sharing for Telco offered by its open architecture (Cueva, 2006), IMS has been slow in penetrating the telecommunications core network market (Finnie, 2007; iLocus, 2010). This is mainly because of the weakness of IMS business case in the face of complexities in rolling out fully compliant IMS solutions (http://www.openimscore.org/). It is our belief that service providers will/can settled for solutions that are diminished implementations of IMS standard architecture, that can still bring in the power of SIP signaling and core IMS components, that is P-CSCF and HSS nodes, without the complexities of the standard peripheral nodes such as BGs, SBCs, and I-CSCF nodes, perhaps as a first step towards the deployment of a fully compliant IMS core network.

This paper presents a complete solution for subscriber unified communications services (UCS) built on top of our home grown implementation of IMS core components dubbed thin-IMS. While thin-IMS platform uses only a subset of core IMS nodes, it retains high degree of compliance with IMS release-7 standard architecture (3GPP, 2007). The unified communications solution comprises subscriber client software for PC and mobile devices, a rich set of Application servers, and various other modules implemented at the level of the Gateways using proprietary protocols to ease deployment, administration, and client self-care.

From a business model point of view, UCS makes provisions for sponsored publicity spot viewing as a payment method for calls terminating outside of the IP network. This feature offers Telco the means to redirect part of the traffic (and revenue) on their core IP network currently used by VoIP applications such as Skype. In UCS calls can also be made to mobile phones and landlines using prepaid cards. AS such UCS leverages the power of thin-IMS to provide the service operator with an extra stream of revenue from the publicity market, while offering a free alternative to making landline calls.

In addition to delivering targeted ads, the engineering of both thin-IMS and UCS took into consideration a number of key functional and non-functional requirements, namely: low cost of ownership, ease of roll out and administration of services, a rich user experience packaged in a single client console. The latter includes functionalities such as Active phonebook that extends presence to accessibility by voice, video, email or instant messaging channels; a tracking service, that delivers notifications as soon as a target (one’s children, for instance) exit a predefined tracking area (a school for instance).

UCS therefore offers an alternative to major VoIP solutions such as Skype (http://www.skype.com/intl/en/allfeatures/callphones/), Google Talk (http://www.google.com/talk/), and MSN (http://get.live.com/messenger). Though Skype provides a rich set of services (Ran, 2010; Rosenberg, 2003), it is in fact on a philosophical back foot, as it is a closed software solution. UCS, on the other hand, is based on IMS enabling it to transfer sessions across to IMS-based networks, and to integrate Application Servers from different vendors.

The design and implementation of both UCS and Thin-IMS went through numerous challenges, namely system and software design patterns for scalability, NAT traversal, network interconnect, ease of service provisioning and self-care, user experience, and last but not least system and service administration. These will be depicted throughout this paper, at the end of which we give details about the level of compliance of Thin-IMS with standard IMS release 7 (3GPP, 2007).

UC SYSTEM ARCHITECTURE

UCS is a distributed multi-service communication solution. Figure 1 shows the components of UCS (namely the Application Servers located in the Service Layer, and the client software located in the Device Layer) on top of Thin-
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