Abstract

The Communication Service industry has seen unprecedented growth in the last decade driven by the growing demand for traditional voice and broadband services. However, as voice revenues continue to decline and increasing competition from new players impacts the ARPU, it has become imperative for Service Providers to redefine their customer’s communications experience by ensuring continuous innovation in their services whilst protecting their core investment. We explore how an IP Multimedia Subsystem approach can tackle some of the key challenges in the contemporary telecom ecosystem and create new possibilities in service innovation.
Executive Summary

Intense competitive forces, market de-regulation and technological advancement are just some of the many factors that have led Communication Service Providers (CSPs) to focus on differentiating their offerings. As revenues and margins from traditional services decline, CSPs are forced to look for alternate revenue streams, often termed as Value Added Services (VAS), and newer ways of service delivery, whilst keeping a strong focus on customer experience.

All Value Added Services (VAS) are inherently coupled with a definitive way in which these can be accessed by the end-users. This methodology, more often than not, is unique to particular VAS offering. VAS often creates a short window of differentiation before they too end up being just another commodity’ with other CSPs replicating these services. There is little doubt that introducing cost effective new services aligned with operational agility is vital for sustained competitive advantage and long term growth.

Not only should these new services be easy to deploy, they should also have a low cost entry barrier in order to mitigate the risk of unsuccessful products. Additionally, these services also need to be enabled to be delivered across multiple network access types and end user devices to ensure a consistent customer experience.

IP Multimedia Subsystem (IMS) is the enabling standard that is promising to make this network convergence and sustained innovation in service a reality. With IMS, subscribers can communicate, create and exchange multimedia content over a new multi access and service-rich network. The IMS service architecture allows service development without the need to modify the underlying control and connectivity layers. This accelerates the service's concept-to-market time considerably. Also, the standard interfaces defined by IMS framework for service development eases the interoperability between products provided by various vendors. Thus, speed of service innovation is increased dramatically due to CSPs benefitting from service innovation in IP based services coming from multiple third party sources and application providers, and not just from within their own organizations. Presence enabled address book, interactive call and share, call continuity, one number phone service for multiple end-user devices viz. soft-phone, VoIP desk phone, SIP enabled Smart phone are just a few examples of such services.
Convergence Challenges in the Telecom Marketplace

According to analyst firm Informa, in their 2013 Industry Outlook survey, the foremost priority area for telecoms is service innovation. However, the lack of flexibility and agility to adopt new services into legacy networks poses a serious challenge to providers in terms of increased investments, time-to-market and the associated risk for any new product/service. Any new product not only includes an overlaid network infrastructure, but also new management, control and data planes specific to that product and additionally customization of support systems. This increased time to market negatively impacts the strategic competitive advantage of the new product offering and the associated ROI.

Diagram 1.0: Key challenges faced by CSPs in today’s marketplace.

To support this need for speed and agility in service introduction, CSPs need to evolve their networks into a modular layered architecture in which the applications or services are independent of underlying control and connectivity and access layers. Providers also need to bring all their communications - voice, data, information, entertainment, fixed, mobile - together into a ubiquitous compelling user experience.
What is IP Multimedia Subsystem (IMS)?

The IP Multimedia Subsystem (IMS) is a concept for an integrated network of telecommunications that would facilitate the use of IP (Internet Protocol) for packet communications in all known forms of communications over wireless or fixed networks. Examples of such communications include traditional telephony, fax, e-mail, Internet access, Web services, Voice over IP (VoIP), instant messaging (IM), videoconference and video on demand.

IMS initial architecture was conceived in the late 1990s and brought under the ambit of the Third Generation Partnership Project (3GPP) as part of their standardization for mobile systems. Since then there have been multiple 3GPP releases for enhancements in features, support and interoperability. For example 3GPP release 8 added support for 4G LTE (Long Term Evolution). An IMS framework enables convergence of voice, video, data and mobile network technology over an IP-based infrastructure. It brings together multiple media, points of access, modes and purposes of communication, thus bridging the gap between the two most successful revolutions in communications - cellular and internet technologies.

IMS uses IETF protocols e.g. Session Initiation Protocol (SIP) wherever possible to ensure interoperability with Internet. According to the wireless standard body, 3GPP, IMS is not intended to standardize applications but rather to aid the access of multimedia and voice applications from wireless and wire-line terminals, i.e. create a form of fixed-mobile convergence (FMC). IMS achieves this by having a horizontal control layer that isolates the access network from the service layer. From a logical architecture perspective, services need not have their own control functions, as the control layer is a common horizontal layer.
What value can IMS deliver?

The IP Multimedia Subsystem (IMS) provides the media management and session control platform which can be overlaid onto the existing access network infrastructure like xDSL, 2G/2.5G/3G, WiFi etc. As an overlay it helps CSPs to leverage their existing investment while providing an architecture that will stand the test of time. To reap this benefit, Mobile operators across Americas, Asia and Europe are either contemplating or in advanced stage of launching IMS based rich communication services. TeliaSonera, Deutsche Telekom, AT&T, Bell Mobility, Airtel, Orange, Vodafone, Rogers Communications, SFR, SK Telecom, Telecom Italia are some of key supporters of RCS standard.

Key benefits of an IMS architecture over an existing cellular and fixed networks are listed below:

- **Common platform for multimedia services**: New service or product launch is one of the biggest challenges faced by CSPs as it is a costly and extended process. By providing a standardized platform with well-defined interfaces as well as a set of reusable components IMS allows CSPs to adopt services created by third parties and create new services which integrate effectively with other services. In this way IMS facilitates an open system to allow the collaboration of services from multiple vendors, hence giving the CSP flexibility to choose the most effective way to launch new services.

- **Quality of Service (QoS) enablement**: IP traffic has traditionally been “best effort” as it has been used to support non-real time services. For supporting the delay sensitive real-time traffic like VoIP, video conference, interactive gaming etc., QoS is an important consideration. IMS specifies ensuring the Quality of Service within the IP network and takes advantage of the QoS mechanism to guarantee the minimum bandwidth required for carrier grade quality transmission.

- **Uniform service experience irrespective of user location**: Although cellular networks provide roaming, the service experience and type of service depends on the service provider in whose network the user is currently roaming in. IMS solves this problem of inconsistency in service experience, which might arise due to roaming into another provider’s network, by leveraging internet technologies and allowing the user to experience services as if they were in home network irrespective of where the user is currently located. This is made possible as the user services are always provided by the home network thus keeping intact the user preferences and overall service experience irrespective of the user’s location.

- **Access independence**: The IMS platform essentially provides common control capabilities for IP multimedia sessions. It is able to abstract the underlying access mechanism for most access technologies like fixed, mobile, Wi-Fi or any other access technology. This access abstraction is the key to a uniform user experience i.e. anywhere, any type, and any mode of access. It makes the IMS framework future-proof to advances in access technologies viz. GPON, EPON, 4G wireless access– Wimax, LTE etc.

- **Differentiated charging possible**: IMS provides information on various services being instigated by the customer. CSPs therefore have an opportunity to create tariff plans based on a number of parameters such as the number of bytes transferred, session duration (time-based) etc. CSPs can also choose to come up with innovative new criteria for charging the customer.
Each service in a pre-IMS era resembles an island i.e. any new service design & deployment is required to be performed from scratch as there is no common service framework. IMS frameworks implement global enablers, a set of common functions viz. user authentication, profiling, session setup and control, charging and service enablers which can be reused multiple times. This encourages innovation in service creation as people/organizations can innovate without worrying about the complexities of service control and access.

Service development in software has a couple of inherent advantages, namely, allowing Providers to enable their customers to develop and implement services. It also eases integration of service offerings from third party service providers who do not own any network infrastructure.

Typical service enablers i.e. core applications provided by IMS framework are **Presence, Group Management and Instant messaging.** Additionally there may be many more created reusing these service enablers.

Parlay X SOA (Service Oriented Architecture) web services provide simple APIs for service creation and these are connected to the IMS network through the OSA-GW. This facilitates application developers to leverage existing IMS services through these web services, without having to be concerned about complex protocols such as SIP, SS7 etc.
What services can be deployed using IMS?

The following examples are just some of the many services that can be created using IMS:

**Presence** provides the ability to a user to know the other user’s status in terms of willingness to engage in a session and publish his own availability. For instance,

- Readiness to talk (idle, busy, in a meeting, do not disturb)
- Favored mode of communication (messaging, speech etc.)

Presence is used in combination with various other services like PoC, messaging discussed below.

**Push to talk over Cellular (PoC)** provides a “walkie-talkie” like experience to the customers. The group and presence applications provided by IMS help users to customize their friend list, and provide availability information of the users in the group for PoC.

**Instant Messaging:** Desktop based Instant Messengers have been widely providing the ability to initiate a chat session, share a file etc. IMS brings this to the handset by leveraging the presence and group management services. Users can create their own buddy lists, subscribe to presence, and know the willingness or status of the person before initiating a call or multimedia session, group chat, share file, photos etc. Instant messaging can also be associated with ongoing sessions.

**VoIP and Multimedia:** IMS enhances the voice and multimedia service experience by extending it across the boundaries of access types, facilitating interactive video and converged mobility. IMS allows simultaneous communicating, sharing and interacting of content in the same session.

**Enhanced Voice Features:** IMS supports multiple identities for the same customer i.e. Public and private identities. Users can have multiple numbers or alias’s but still all terminate on the same end device. For example a user can have an office number and personal number but can use the same handheld device for receiving calls to both the numbers. Calls can also be set to the office number to be automatically forwarded to Voice mailbox after office hours. Users can use multiple devices with same identity, thus providing the capability of simultaneous ringing. The calling party calls the public SIP URI of the customer and all devices in the simultaneous calling group are alerted, be it an office desk phone, cell phone, home fixed line etc.

**Enhanced Voice Mail:** Providers can enhance the voice mail experience by providing web based interface to the customers to customize their voice mail-box with personalized greeting etc., and support enhanced features related to message forwarding, retrieval, call back etc.
A Service Use Case

Following use case shows how an IMS framework can provide seamless user communications with advanced features.

Anna is at the airport using her Smartphone. She checks the availability of her colleague John over the Wi-Fi network in her buddy list, finds him available and calls his personal number. The call is routed to John’s desk number instead and he answers to it from his desk phone. John intends to leave the office after a few minutes and but wants to continue the call using his mobile device. The call is transferred to the mobile device and the conversation can continue. After sometime Anna activates the video mode to point to what they are talking about. Whilst talking they need to share documentation with another colleague Michelle, Anna finding her available prompts her to join the video conference. Michelle gets invited through the soft-phone on her desktop and on accepting it is able to join the on-going video-conference through her desktop. Michelle privately instant messages Anna and shares the desired documentation with both her colleagues during the call.

IMS makes such a call scenario a reality.

Is IMS the future of accelerated service innovation?

The introduction of an IMS framework can truly enable service providers to provide their customers with new innovative services in rapid time. These new services can be personalized to the customer’s needs, accessible across a variety of devices and promise uniform experience from anywhere, anytime thus keeping subscribers engaged and providing newer revenue streams for service providers.

As CSP’s transform from legacy TDM Networks to all IP based networks, Fixed-mobile convergence moves out of text books, and consumer’s ever increasing appetite for access to content and services anywhere, anytime, anyway gets satiated. An IMS framework has many positive attributes that position it as a strong candidate for accelerated delivery of new services in a cost effective manner.
Appendix

IMS Architecture

IMS supports a wide range of services which are based on Session Initiation Protocol (SIP) and where the underlying architecture is 'layered'. The abstraction of application layer from the control, transport and access layers in the IMS framework is the one which gives it capabilities such as Fixed-mobile convergence and speedy service development and deployment. While the lower layers provide the integrated and standard network platform, the topmost layer is host to numerous applications or services.
The following layers make up the IMS architecture:

**Access Layer:**

The bottom-most layer is the device or access layer. Any type of device is able to connect to the IMS network including PCs, Smart-phones, PDAs, mobile phones, VoIP phones as well as traditional analogue phones through a residential gateway. The IMS network is reached from PSTN/PLMN through a PSTN gateway.

**Transport Layer:**

The transport layer is an IP network or the existing PSTN/PLMN network. IMS Service devices connect with the IP transport network through any of the access technologies viz. DSL, GPRS/EDGE, W-CDMA etc. The transport layer provides the capability to setup the SIP session hence any access technology that supports IP protocol transport can act as transport layer for IMS.

**Control Layer (IMS Core):**

At the IMS core is CSCF (Call Session Control Function) which is the common name for multiple SIP proxies viz. P-CSCF, S-CSCF, I-CSCF, BGCF. These are primarily used for SIP registration, messaging and session control.

- HSS (Home Subscriber Subsystem) is the central database of the subscribers and contains subscriber service profiles. It performs AAA and SLF functions.
- MRF (Media Resource function) provides media related capabilities such as playing of tones and announcements.
- MGW and MGC: Media Gateway (MGW) and Media Gateway controller (MGC) provide the capabilities of signaling and media translation for IMS and PSTN interconnection.
- SBC (Session Border Controller) is typically deployed and sits at the edge of the IMS core provides the security by shielding the core topology from the IMS end-point.

**Service Layer (Application Servers):**

The multimedia services are hosted and executed at the service layer. The lower layers provide the control and routing of the SIP sessions up to the Application servers over which various services are supported. Providers can add more and more services at this layer into the same or multiple application servers giving them much desired scalability and room for service innovation and deployment, re-using their investment in the lower layers which are performing the common functions of service control and routing.
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