Introduction to the IP Multimedia Subsystem (IMS): IMS Basic Concepts and Terminology

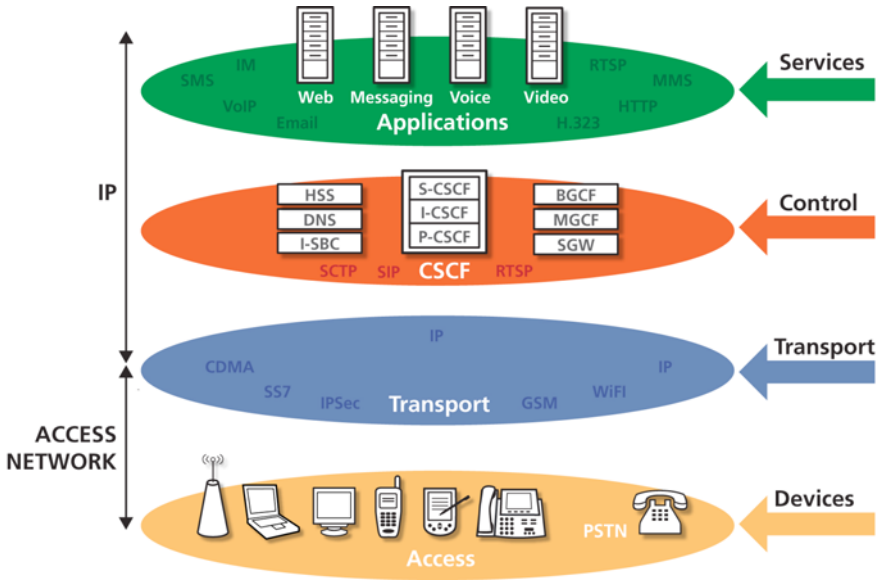
Introduction

Formally, the IP Multimedia Subsystem (IMS) is defined as:

"... a new core network 'domain' (i.e. a new mobile network infrastructure composed of a number of discreet elements)."

This definition is from the 3G Partnership Project (3GPP) and has been further embraced by the 3GPP2, the European Telecommunications Standards Institute (ETSI), and the WiMax Forum. This definition, however, is not only vague, but certainly does not do IMS justice. IMS is a whole new way to deliver multimedia (voice, video, data, etc.) regardless of the device (mobile phone, landline phone, cable, Internet, etc.) or the access medium (cellular, WiFi, Broadband, fixed-line, etc.) and will change the way all of us relate to our increasingly digital world.

This paper is written to achieve two main goals: to explain the basic vision/need for the IMS architecture and to give the reader a high-level understanding of how it works. In the end, the overarching goal is to help educate the reader on this burgeoning and powerful technology change.



IMS Basic Concepts

The Vision

IMS is an evolving definition of an architecture that solves the continuing demands and frustrations of users and enterprises. The ultimate goal of the architecture is to define a model that separates the services offered by fixed-line (traditional telcos), mobile (traditional cellular), and converged service providers (cable companies and others who provide triple-play — voice, video, and data — services) from the access networks used to receive those services. For instance, a classic example would be the ability of a mobile cellular phone to switch to WiFi VoIP — mid-call — when it discovers a valid network to use. In this scenario, your mobile phone would

dynamically move your existing call over the cellular network to a valid WiFi network (for example, your home wireless network) when you came into range, saving your cellular airtime and providing additional bandwidth for data communications. If you had IMS-enabled phones attached to your landline carrier, you could transfer a call from your IMS-enabled cellular phone to your home phone or VoIP soft-phone on your laptop while travelling, transferring the call across service providers (SP) without dropping it. IMS, when fully deployed, will enable you to choose a SP not by the quality or ubiquity of their network, but by the services they offer. These services would be available to all your IMS-enabled devices (cable set-top boxes, computers, landline phones, mobile phones, and more). The "network," or how you connect to those services, will become irrelevant.

Another compelling advantage of the IMS network is the ability to multi-task services more readily and seamlessly than the current systems. Anyone who uses a BlackBerry on a Global Packet Radio Service (GPRS) network knows that while you are talking on the phone, you cannot send/receive email or do anything else other than use the voice features of the phone. In order to achieve the portability of these additional services, the IMS architecture requires a unified way of delivering them. By choosing TCP/IP, the most robust and widely used mechanism on the most widely used network in the world as the standard delivery mechanism, IMS promises the ability to seamlessly blend services together on IMS devices. Just like using a web browser to surf the web while also talking on a VoIP phone to your mother, IMS—using TCP/IP will be able to provide mobile handsets that can simultaneously handle voice and data, as well as video

Finally, IMS provides the unique ability for enterprise customers and private individuals to directly deliver applications and services of their own creation regardless of the method of access, location, or chosen SP — as long as the device is IMS-compliant. Imagine being able to instantly deliver a company directory or internal company news to any device at anytime, simply by registering the device to have access. New employees can receive company email simply by enabling the service on their mobile device, home computer, or even their IMS-compliant home theater system. Individuals can create IMS-compliant solutions to publish family news, pictures, and videos to any IMS-compliant device anywhere in the world.

Reasons behind the Need and Desire for IMS

There are drivers behind the need and desire for IMS from both the SP standpoint as well as from the enterprise or end user standpoint.

From the SP standpoint, the IMS infrastructure gives them the flexibility and adaptability to survive in the modern information world. Currently, each service that a SP provides is built within a single-purpose siloed environment due to the constraints of the existing architecture. This poses several problems. First of all, it is expensive; every application must re-invent its own subscriber database, authentication systems, billing systems, and more. Secondly, it adds significant complexity to the network; the systems are not integrated, cannot talk directly to each other, and must be managed separately — including subscriber provisioning and billing. Combine these two issues and it becomes apparent that developing new services and applications for the user is an extremely risky proposition. If the application does not have sufficient uptake to recoup the cost of deployment and cover the cost of maintenance, the SP can suffer a severe economic impact. As a result, SPs are reluctant to develop new services unless they know definitively that they are "sure things." This effectively stifles the development of the services or applications that users truly want. Unfortunately for the SP, as voice revenues continue to decline in the face of competition, it is exactly these new services that attract and retain customers. Without this differentiation, SPs are quickly becoming providers of commoditized services with declining revenues.

The IMS architecture solves many of these problems for the SP. Not only does the separation of the services from the access network enable them to open up new markets (for example, a cellular carrier can now provide services to fixed-lines), but the modular nature of IMS significantly reduces the cost and complexity of developing these new services. The IMS

architecture breaks down the silos of application and service deployment by enabling the reuse of services, much like Service Oriented Architecture (SOA) is proliferating the enterprise IT department. Instead of each application handling all aspects of the service, IMS enables them to share centralized subscriber databases, authentication, billing, and even the services of other applications. This, consequently, will spur the development of applications, and also accelerate innovative new applications while simultaneously lowering the operational and capital costs of delivering applications. IMS reduces the risks associated with creating the applications needed to capture and retain customers.

We can already see how the vision of IMS will completely change what end users and enterprises expect from their communications experience. Finally, instead of having to wait until SPs provide the services they want, SPs will be delivering services never before fathomed. Another important aspect of IMS is the significant reduction in the number of devices — and the complexity of the devices — needed to maintain control of the digital world. First, all IMS-compliant devices will be able to access all IMS-compliant applications identically, not just “translations” or “simulations” of them which may differ from device to device. Regardless of whether it is a home phone, wireless terminal, or mobile device, the access to, and operation of, the applications will be identical. Second, IMS promises to consolidate the number of devices and reduce the churn on devices. The IMS-compliant devices will be more capable of handling multimedia reducing the need for different devices to handle different types of media (voice, video, and data). In addition, as previously intimated, one device could easily take the place of multiple devices; your phone is your mobile when you leave home and join the cellular network, but becomes your home phone when you are in the house using WiFi, and even becoming your office desk phone when you enter your place of employment. Since all applications will be delivered via the same IMS infrastructure, there will be less need to ”upgrade” devices to handle the latest applications and the same device would work across all SP networks; no longer would you need to get a new device simply to change SPs.

High-Level Functioning

Now that we have a basic idea of the vision of IMS as well as the drivers pushing it into fruition, let’s take a look at some of the basic terminology that is used when discussing IMS. IMS architecture is broken into at least three distinct layers: the transport layer, the control layer, and the service layer. Each layer abstracts the functions of the adjacent layer and has a specific purpose. In addition, the IMS architecture is based on TCP/IP standards, so some terminology that should be familiar to many readers.

Transport Layer

The transport layer is responsible for the abstraction of the actual access networks (fixed-line, packet-switched radio, and so on) from the IMS architecture. In essence, this layer acts as the intersection point between the access layers and the IP network above it. It is responsible for doing initial IP provisioning (assigning IP address and default gateway via DHCP) as well as facilitating the registration of devices with the higher layers. The important thing to remember about the transport layer is that, in general, everything above it (in the control and service layer) is IP-based, while the access networks below it may not be truly IP-based.

Control Layer

The control layer does exactly what it sounds like it should—it controls the authentication, routing, and distribution of IMS traffic between the transport layer and the service layer. Most of the traffic in this layer is based on the session initiation protocol (SIP) that is often associated with VoIP technology. In addition to routing SIP messages to their appropriate services (either on the home IMS network or IMS networks with a different SP), the control layer also provides the capability to interface the services layer with other services. For example, a pay-per-download service that enables users to buy ringtones or video not only needs to be able to deliver those purchases to

the user, but also needs to interact with billing services, authentication services (to determine user privileges), and potentially quality of service (QoS) services to ensure the appropriate delivery and handling of the purchased content.

The main component in the control layer is the Call Session Control Function (CSCF) which facilitates the correct interaction between the application servers, media servers, and the Home Subscriber Service (HSS), which is the centralized repository for all subscriber account information. This is also the layer that is responsible for the "blending" of services, that is, providing the capability for both voice (which is now nothing more than IP packets) to be blended with data and video. This enables the IMS devices to have multiple services delivered nearly simultaneously over a single session.

Service Layer

The service layer is where all of the actual services live. This includes traditional voice services (like voicemail, announcements, interactive voice response, and so on) as well as new applications built on the IMS architecture. Unlike the siloed efforts of the second generation (2G) networks, these services do not need to completely replicate all aspects of the network (HSS, routing, session control, and more). This is the final layer of abstraction that gives IMS architecture the power and flexibility to rapidly deploy new services.

Putting it all Together

The power of IMS architecture is the fact that the transport and control layers effectively disassociate the services provided from the access networks used to reach them. The services themselves can focus directly on providing their service and not worrying about how the service reaches the device or details of the specific access network used. This works in both directions as well; the IMS-enabled device doesn't need to know anything about where the service is located or the access network it is currently using — the service is simply available.

This disassociation is the key characteristic that will push the next wave of IMS services, which will include roaming between cellular and WiFi, the ability to transfer to any device, and the ability to use an IMS device to access any IMS-based service.

Summary

The world of digital communications is quickly moving from a dependence on the method of access to a preference for the services being provided. This commoditization of the 'network' and the reduced revenue streams associated with simple voice services are driving SPs to look for new revenue ideas and new markets—all while attempting to reduce the costs associated with delivering these new services. IMS provides the architecture that allows the SPs the flexibility to focus on these services and do so with the alacrity necessary for their highly competitive market. As IMS-based SP networks continue to be designed and deployed, it will completely revolutionize the way we interact with our digital world.