Dialogic
Making Innovation Thrive™

White Paper

The Architecture and Benefits of IMS

Dialogic White Papers

This white paper is brought to you as part of a continuing series on important communications topics by Dialogic.

Dialogic Corporation is a leading provider of world-class technologies based on open standards that enable innovative mobile, video, IP, and TDM solutions for Network Service Providers and Enterprise Communication Networks. Dialogic's customers and partners rely on its leading-edge, flexible components to rapidly deploy value-added solutions around the world.

The Architecture and Benefits of IMS

White Paper

Executive Summary

The IP Multimedia Subsystem (IMS) is a standardized IP-based architecture that allows the convergence of fixed and mobile communication devices, multiple network types, and multimedia applications. Using IMS, applications can combine voice, text, pictures, and video in seamless call sessions, offering significant ease-of-use to subscribers and allowing service providers to drive branding through a common interface, while substantially reducing operating costs.

The emergence of IMS brings a challenge for Network Equipment Providers (NEPs) and developers to create a new breed of platforms to enable these new services. This white paper provides an overview of the IMS architecture and its benefits, describes the new family of combinational services that IMS can enable, provides some technical highlights and examples of IMS platforms, and gives an overview of the Dialogic® products that can help NEPs and developers get their solutions into service providers' networks.

The Architecture and Benefits of IMS

White Paper

Table of Contents

The Architecture and Benefits of IMS

White Paper

Introduction

The IP Multimedia Subsystem (IMS) is a key enabler for the convergence of fixed and mobile communications — devices, networks, and services. It is designed to allow the gradual migration of existing core infrastructures to a new IP framework that enables the easy and cost-effective launch of new services and can substantially reduce operating costs, providing benefits to both subscribers and service providers.

To enable person-to-person and person-to-content communications, IMS uses a layered architecture in which service enablers and common functions can be reused for multiple applications. This horizontal approach involves a plethora of gateways and media servers. The first layer translates the bearer and signaling channels of traditional networks to packet-based streams and controls. The second provides elementary media functions to the higher-level applications. In addition, IMS uses a higher level of application services and API gateways to allow third parties to take control of call sessions and access subscriber preferences.

The horizontal nature of IMS provides an opportunity for system and application enablers, such as Dialogic, to direct their rich web-based development environments and platforms in line with this paradigm. As a result, taking advantage of our deep understanding of media processing, flow management, signaling, and provisioning, Dialogic is making new offerings available to service providers. At the same time, our family of media servers and gateways and our system building blocks allow equipment providers and developers to economically build modular, highly available, scalable solutions for their service provider customers.

IMS Architecture Overview

The IMS architecture gives service providers the opportunity to deliver new and better services, with reduced operating costs, across wireless, wireline, and broadband networks. IMS is defined by the Third Generation Partnership Project (3GPP) and supported by major Network Equipment Providers (NEPs) and service providers. IMS unifies applications enabled by the Session Initiation Protocol (SIP) to connect traditional telephony services and non-telephony services, such as instant messaging, push-to-talk, video streaming, and multimedia messaging.

The IMS architecture (see Figure 1) involves a clear separation of three layers:

- Transport and Endpoint
- Session and Control
- Application Services

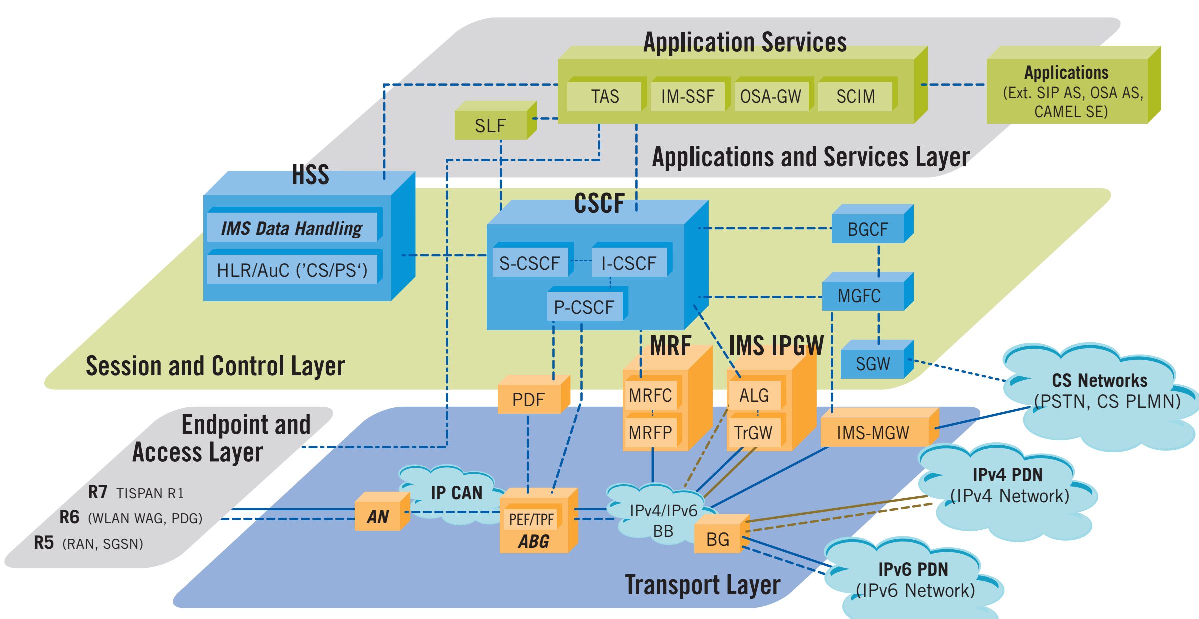

Figure 1. The IMS Architecture

Transport and Endpoint Layer

The Transport and Endpoint Layer unifies transports and media from analog, digital, or broadband formats to Real-time Transport Protocol (RTP) and SIP protocols. This is accomplished by media gateways and signaling gateways. It also includes media servers with media processing elements to allow for announcements, in-band signaling, and conferencing. These media servers are shared across all applications (voicemail, interactive response systems, push-to-talk, and so on), maximizing statistical use of the equipment and creating a common base of media services without "hard-coding" these services into the applications.

Session and Control Layer

The Session and Control Layer orchestrates logical connections between various other network elements. It provides registration of end-points, routing of SIP messages, and overall coordination of media and signaling resources. It contains the two most significant IMS network elements — the Call Session Control Function (CSCF) and the Home Subscriber Server (HSS) database. The HSS maintains the unique service profile for each end user, including registration information, preferences, roaming, voicemail options, and buddy lists. This centralization of subscriber information enables easier provisioning of services, consistent application access, and profile sharing among multiple access networks. For example, HSS allows the same voicemail settings to apply to mobile phones and landline phones, and to be fully integrated with Unified Messaging (UM) applications.

Application Services Layer

The Application Services Layer contains multiple Application Servers (AS), such as a Telephony Application Server (TAS), IP Multimedia Services Switching Function (IM-SSF), Open Service Access Gateway (OSA-GW), and so on. Each of these servers is responsible for performing functions on subscriber sessions, maintaining the state of the call. More importantly, they bridge legacy Advanced Intelligent Network (AIN) services in the new world of IMS. For example:

- An IM-SSF service bridges SIP and Customized Applications for Mobile Network Enhanced Logic (CAMEL) to allow for 800 services and Local Number Portability.
- A TAS provides IP Centrex business features.
- An OSA-GW bridges telephony services to back office applications, enabling IT groups to access instant messaging services, manipulating legs of a call and registration of network resources.

Using Application Servers, service providers have the option to enable developer partners located outside of the core domain to create new applications. Service providers still maintain control of the core services and ensure network integrity, and can offer partners access to the subscriber base with their preferences, along with billing and infrastructure components.

End-to-End Solutions

The power of the IMS is unleashed only when all three of these layers, including the devices (for example, mobile phones, PCs, and so on), are harmonized and working together. Services like push-to-talk, collaborative multimedia conferencing, and other combinational services, require a direct capabilities exchange between the IMS services on one end and the IMS devices on the other end. These end-to-end associations are possible through special brokers residing in the IMS Application Services Layer, called Service Capability Interaction Managers (SCIM). The SCIM exploits the power of SIP to connect the two extreme end points together — the specific IMS service with the specific IMS device. Figure 2 shows these end-to-end connections:

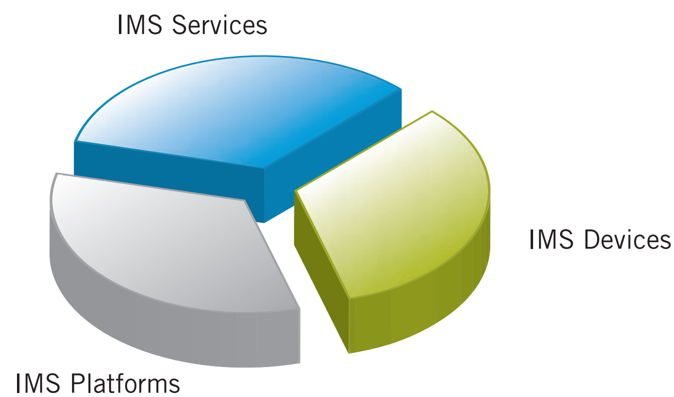

Figure 2. IMS End-to-End Solutions

In summary, new, commercially successful applications rely upon:

- Intelligent SIP IMS devices to auto-negotiate features and capabilities directly with other end-points
- Horizontal IMS platforms to abstract the access layers and core services
- Network-based IMS services where the business logic and application functionality reside

This is an exciting opportunity for technology companies to create attractive solutions for service providers, especially as they combine their skills in devices, platforms, and services.

IMS Benefits

Separating the network into the Transport and Endpoint Layer, Session and Control Layer, and Application Services Layer allows true convergence of devices, networks, services, and applications. Convergence of devices implies that mobile or stationary terminal devices can be managed and enabled by the network, including phones, PDAs, computers, and TV sets. Convergence of networks implies that the wireless access network, the legacy PSTN, and the broadband networks appear as one manageable entity to the appropriate IMS abstraction layer. In this fashion, network services are offered independently of the access and transport type, either over Time-Switched (TS) or over Packet-Switched (PS) channels. Convergence of network services involves all necessary network functionality to enable subscriber-level applications. These services include consistent mechanisms for accessing user profiles, authentication and billing, location services, and media control services via open, standards-based Application Programming Interfaces (APIs). Finally, converged IMS applications can reside either within the service provider's domain or anywhere in the network, can take advantage of common network services, and can reach subscribers via different types of network and devices.

IMS is said to be "breaking application silos," and "restructuring stovepipes." Currently, applications have to incorporate specific network services, and quite often specific access transports, in both time-switched and packet-switched channels. With the proliferation of multiple handset types (smart-phones, feature-phones, value-phones), certain applications have to "reach down" to the handset.

The IMS architecture can provide the following major benefits to service providers:

Easier to Create and Deploy New Applications and Services

- Enhanced applications are easier to develop due to open APIs and common network services.
- Third-party developers can offer their own applications and use common network services, sharing profits with minimal risk.
- New services involving concurrent sessions of multimedia (voice, video, and data) during the same call are now possible.
- Reduced time-to-market for new services is possible because service providers are not tied to the timescales and functions of their primary NEPs.

Capture New Subscribers, Retain Current Subscribers

- Better voice quality for business applications, such as conferencing, is possible using wideband coders.
- Wireless applications (like SMS, and so on) can be offered to wireline or broadband subscribers.
- Service providers can more easily offer bundled services.

Lower Operating and Capital Costs

- Cost-effective implementation of services is possible across multiple transports, such as Push-To-Talk (PTT), presence and Location-Based Services (LBS), Fixed-Mobile Convergence (FMC), mobile video services, and so on.
- Common provisioning, management, and billing systems are supported for all networks.
- Significantly lower transport costs result when moving from time-switched to packet-switched channels.
- Service providers can take advantage of competitive offerings from multiple NEPs for most network elements.
- IMS results in reduced expenses for delivering licensed content to subscribers of different types of devices, encodings, or networks.

The Real Drivers of IMS — Combinational Services

Service providers are primarily interested in making new services available and gauging their success. If subscribers are ready to pay for an offered service, then that service needs to be able to scale quickly and inexpensively. If subscribers do not see the value of a new service, it needs to be phased out. The possibility of "killer applications" rises as service providers experiment with new offerings. Killer applications are poised to emerge from the following application classes based on the IMS framework:

Application Class	Associated IMS/network capability
Fixed-Mobile Convergence	Seamless mobile, wireline, and broadband call roaming
Push-to-Talk	Ability to work across multiple service providers
Presence and Instant Messaging	Ability to span both the Internet and telephony domain
Content Sharing and See-What-I-See	Increased wireless bandwidth
Enhanced Multimedia Conferencing	Readily-available wideband audio

IMS is simply the means to an end for applications and is primarily geared toward next-generation combinational services, and not toward all types of services. For example, the legacy platforms for services such as broadcast, messaging, call centers, and so on, will not be replaced by IMS counterparts, at least not for several years. The real drivers of IMS are new combinational services that combine multiple sessions per call, often requiring multiple types of media (including voice, video, pictures, and text). In addition, these new IMS services are facilitated by rich web development tools such as Java environments, VoiceXML forms, and other XML (eXtensible Markup Language) derivatives, which can dramatically reduce application development cost.

IMS Technical Highlights

IMS specifications focus on functional network elements and not physical implementations. Implementers have the choice to either collect one or more functions in a single physical shelf or distribute functions across multiple shelves. The main emphasis of the specifications is on the interfaces between functional network elements. This section of the white paper clarifies several specifications of particular interest to IMS implementers.

- IMS is not concerned with the media itself. Negotiation of media encoding is left to the endpoints and gateways. Instead, IMS is closely involved with call signaling. The Call Session Control Function (CSCF) intercepts call signaling and passes it to the application services for them to handle.
- The Home Subscriber Server (HSS) database is one way of pulling subscriber data together under a single interface versus replacing the repositories for that information. There is no need to replace existing directories.
- Media are handled by the Media Resource Function (MRF), which consists of the Media Resource Function Controller (MRFC) and Media Resource Function Processor (MRFP), also called the Media Server (MS). According to the 3GPP standard, the MRFC interfaces with other IMS network elements using SIP, but controls the MRFP using the H.248 protocol (see Figure 3).

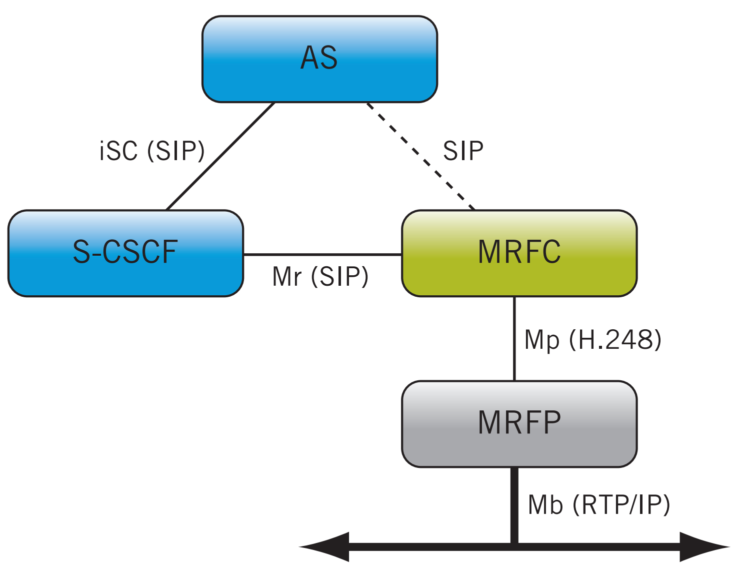

Figure 3. IMS Network Element Topology

- 3GPP has taken the view that the media server functionality is delivered by the same hardware as the media gateway (MGW), for which H.248 is the logical choice, as shown in Figure 4.

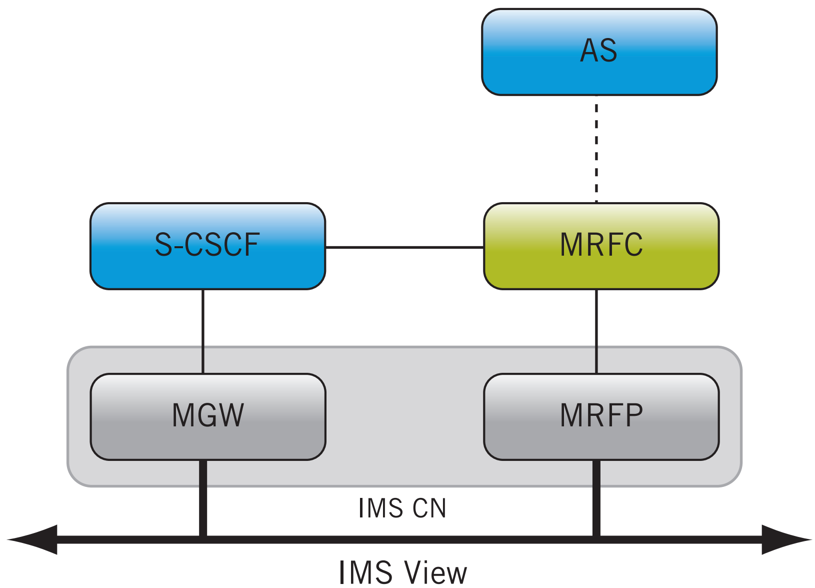

Figure 4. 3GPP Release 8 View

- Several second-tier NEPs disagree about various aspects of the MRFC, MRFP, MGW, CSCF, and AS network elements. The following opinions are pertinent but conflict with the IMS standard as approved by 3GPP:

  1. MRFC+MRFP must be always viewed as one entity controlled by SIP, and separation via H.248 is not necessary, as shown in Figure 5.

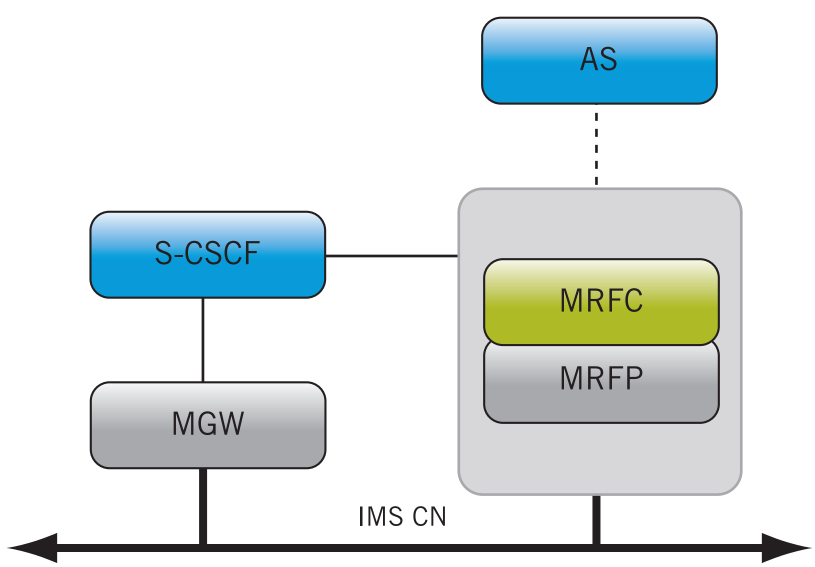

Figure 5. Collapsing MRFC and MRFP

2. MRFC should be associated more closely with the ASs, and MRFPs should be associated more closely with MGWs, maintaining the H.248 control protocol.

3. MRFPs should be separate from MGWs, and at least the first MRFP should also be controlled by SIP.

4. Because the main MRFC functions are charging, conference control, and subscriber roaming, the MRFC should be absorbed by the AS and CSCF. This is illustrated by Figure 6.

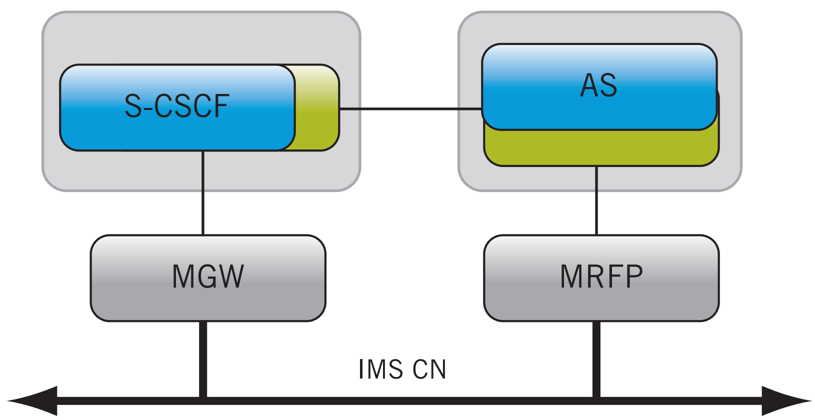

Figure 6. Collapsing MRFC into AS and CSCF

Summary

Service providers are attracted to IMS because it enables them to provide new services and reduce operating costs across wireless, wireline, and broadband networks. The three layer IMS architecture promises true convergence of devices, networks, services, and applications, and breaks the existing “applications silos” within current service provider networks. This will help service providers to win new subscribers and retain current ones.

Strategies are in place for service providers to begin rolling out IMS-based services and take advantage of flexible service creation and provisioning capabilities. Infrastructure equipment for IMS services must provide carrier-grade availability and functional flexibility so that service providers can integrate multiple IMS functional network elements into a minimal number of physical devices to reduce costs.

Dialogic is leveraging decades of experience in the media processing and signaling space, SIP-enabled handset technologies, and web-based development environments to participate in the IMS era. Dialogic offers a wide range of products for the IMS space, ranging from signaling stacks for SS7, CAMEL, SIGTRAN and SIP-SIP interoperability to media gateways and media servers. Today’s multimedia applications can be addressed by Dialogic® products, which are prepared to evolve with the latest IMS standards to enable end-to-end solutions.

Acronyms

3G	Third generation wireless technology
3GPP	Third Generation Partnership Project
AIN	Advanced Intelligent Network
API	Application Programming Interface
AS	Application Servers
ATCA	Advanced Telecom Computing Architecture
CAMEL	Customized Applications for Mobile Network Enhanced Logic
CCXML	Call Control eXtensible Markup Language
COTS	Commercial Off-the-Shelf
CPU	Central Processing Unit
CSCF	Call Session Control Function
FMC	Fixed-Mobile Convergence
HSS	Home Subscriber Server
IM-SSF	IP Multimedia Services Switching Function
IMS	IP Multimedia Subsystem
IP	Internet Protocol
IPv6	Internet Protocol version 6
ISDN	Integrated Service Digital Network
IVR	Interactive Voice Response
LBS	Location-Based Services
MGW	Media Gateway
MPEG	Moving Picture Experts Group
MRF	Media Resource Function
MRFC	Media Resource Function Controller
MRFP	Media Resource Function Processor
MS	Media Server
MSML	Media Sessions Markup Language
NEP	Network Equipment Provider
OAM	Operations, Administration and Maintenance
OCAF	Open Communications Architecture Forum
OEMs	Original Equipment Manufacturers
OSA-GW	Open Service Access Gateway
PDA	Personal Digital Assistant
PS	Packet-Switched
PSTN	Public Switched Telephone Network
PTT	Push-to-Talk
QoS	Quality of Service
RAID	Redundant Arrays of Independent Disks
SCIM	Service Capability Interaction Managers
RTP	Real-time Transport Protocol
SAF	Service Availability Forum
SGW	Signaling Gateway
SIP	Session Initiation Protocol
SMS	Short Message Service
SNMP	Simple Network Management Protocol
SS7	Signaling System No. 7
TAS	Telephony Application Server
TDM	Time Division Multiplexing
TS	Time-Switched
UM	Unified Messaging
VoiceXML	Voice Extensible Markup Language

Dialogic

Making Innovation Thrive™

www.dialogic.com

Dialogic Corporation
9800 Cavendish Blvd., 5th floor
Montreal, Quebec
CANADA H4M 2V9

08/09 11297-01