

# The Evolution of IMS

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Communication and IT technologies are maturing at an unprecedented rate thanks to rapid technological progress in both fields. The emergence of IP technology has acted as a precursor for the sudden prevalence of Internet applications, which in turn has created a greater reliance on IP-based fixed and mobile network solutions. Consumers are now able to enjoy a variety of communication methods coupled with an increased range of services; the industry has evolved past previous limits that confined services to voice related ones. Within the context of this new era of service provision, network operation and content operation have become separate constituents.

Telecom operators find it extremely difficult to offer new and profitable services that are cost effective. Bearers of TDM-based networks tend to be inflexible; interoperability between different modes is too complicated; and the technologies used to develop value-added services are exclusive. Next Generation Network (NGN) and 3G R4 are gradually emerging at the telecommunications forefront and are attracting the attention of both fixed and mobile network operators.

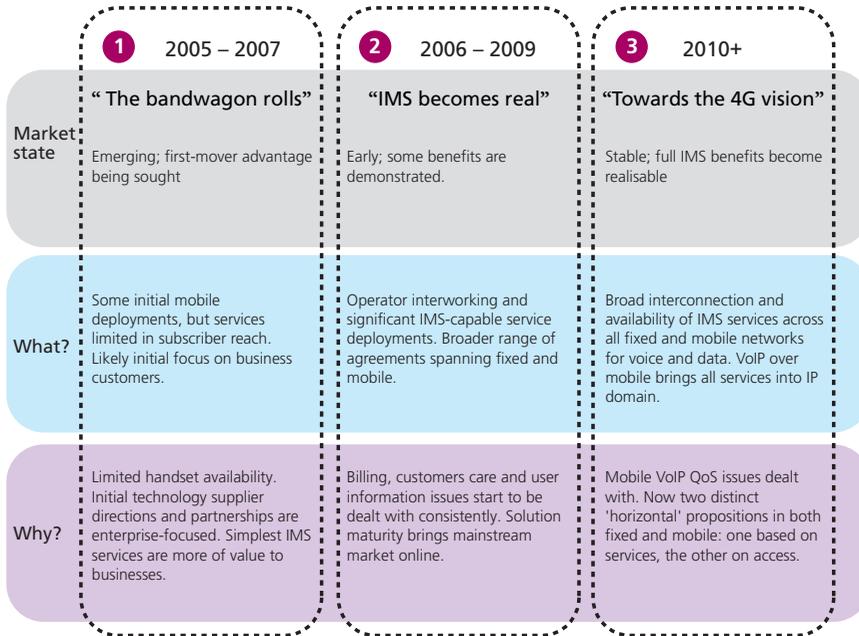
The softswitch-centered NGN products and solutions hailing from different manufacturers have already enjoyed large-scale commercialization and application. Milestones have been reached in IP-based PSTN switching services, mobile circuit-domain services, and the separation between control and bearer.



To meet the rising demands relative to IP multimedia applications, the 3rd Generation Partnership Project (3GPP) promotes the IP Multimedia Subsystem (IMS). 3GPP defines the specifications for radio access by both WCDMA and GSM.

It acts as a facilitator for R99 and R4, inclusive of antenna interface specifications, voice service specifications in circuit switched (CS) domains, and basic data service specifications in packet switched (PS) domains. With respect to R5 and R6 research in relation to IP multimedia applications, R5 defines the core network architecture, public components, and basic service flows of IMS. Based on the extension of some R5 components, R6 defines the key service capability of IMS, Quality of Service (QoS), network interoperability, and also IMS/CS integration.

The IMS architecture derived from 3GPP is broadly recognized as a reasonably comprehensive solution to the IP multimedia domain. 3GPP2 and TISPAN have adjusted their IP multimedia network architectures and service systems according to the 3GPP IMS model. In terms of their responsibilities with regard to IMS, 3GPP2 is handling access for CDMA2000, and fixed networks are under the remit of TISPAN (Telecommunications and Internet Converged



Source: Ovum

Figure 1 The development schedule of IMS

Services and Protocols for Advanced Networking).

## Network evolution

### IMS: The future of the network

Consultants Ovum predict that IMS technology will commence with a series of new applications, before gradually evolving into fixed-mobile converged architecture, as shown in Figure 1.

### Network architecture evolution

To meet operational needs and provide customized, diversified and cost efficient services, traditional switching networks will progressively develop from a traditional voice services’ network provider to a network that offers additional, value-added services. The network architecture will adjust correspondingly and the control will be separated from the three constituent aspects: access, bearer, and service. User data management will also change from a distributed to a centralized mode.

Traditional circuit-based switches exist within the context of an integrated and closed architecture. In broad terms, this architecture is incapable of fulfilling the diversified requirements, which renders

rapid service deployment throughout the whole network impossible. Making the essential connections within this type of architecture is both complicated and expensive, and doing so therefore falls outside the OPEX of constructing a cheap, shared network.

The expedient step of separating the control from the bearer is the catalyst to creating a distributed NGN system. This

type of architecture reduces overall network construction costs, allows easier upgrades and backwards compatibility, and facilitates the accelerated development of new services and applications. In this way the network structure benefits from simplification, resource allocation efficiency becomes optimal, and a new service can be implemented throughout the whole network at little expense.

IMS is a network independent of access technology. Users of the network enjoy the same quality benefits and experiences whether IMS is accessed via ADSL from a fixed terminal or through a WCDMA mobile terminal.

As illustrated in Figure 3, an IMS network may be divided into access interconnection, session control and application layers.

The access interconnection layer provides the following functions: Session origination and termination of various Session Initiation Protocol (SIP) terminals; Conversion of various IP packet bearer types; Various QoS policies based on service deployment and session layer control; Interoperability between conventional PSTN and PLMN.

The access interworking layer incorporates equipment such as various SIP terminals, wired and wireless access, and interoperable gateways.

The session layer implements and/or maintains the following functions: basic

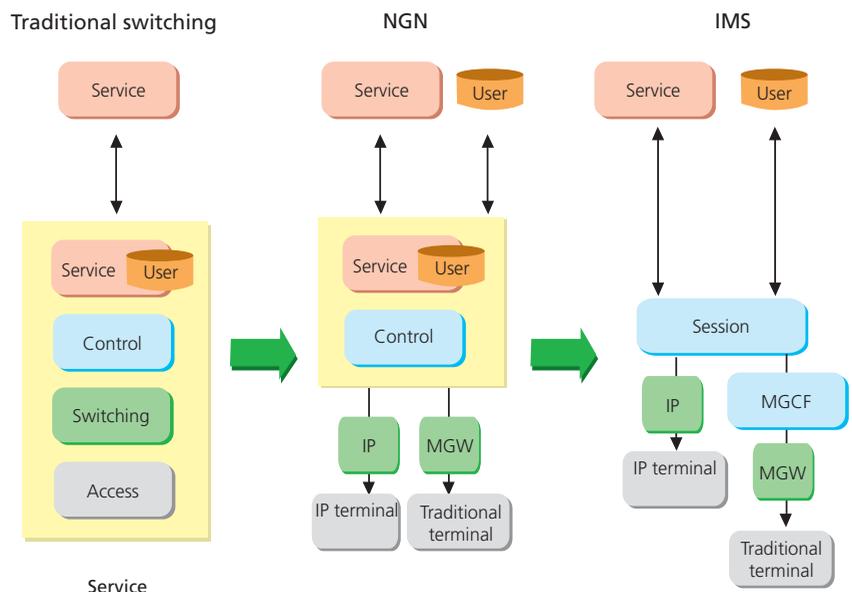


Figure 2 The evolution of switching network to IMS

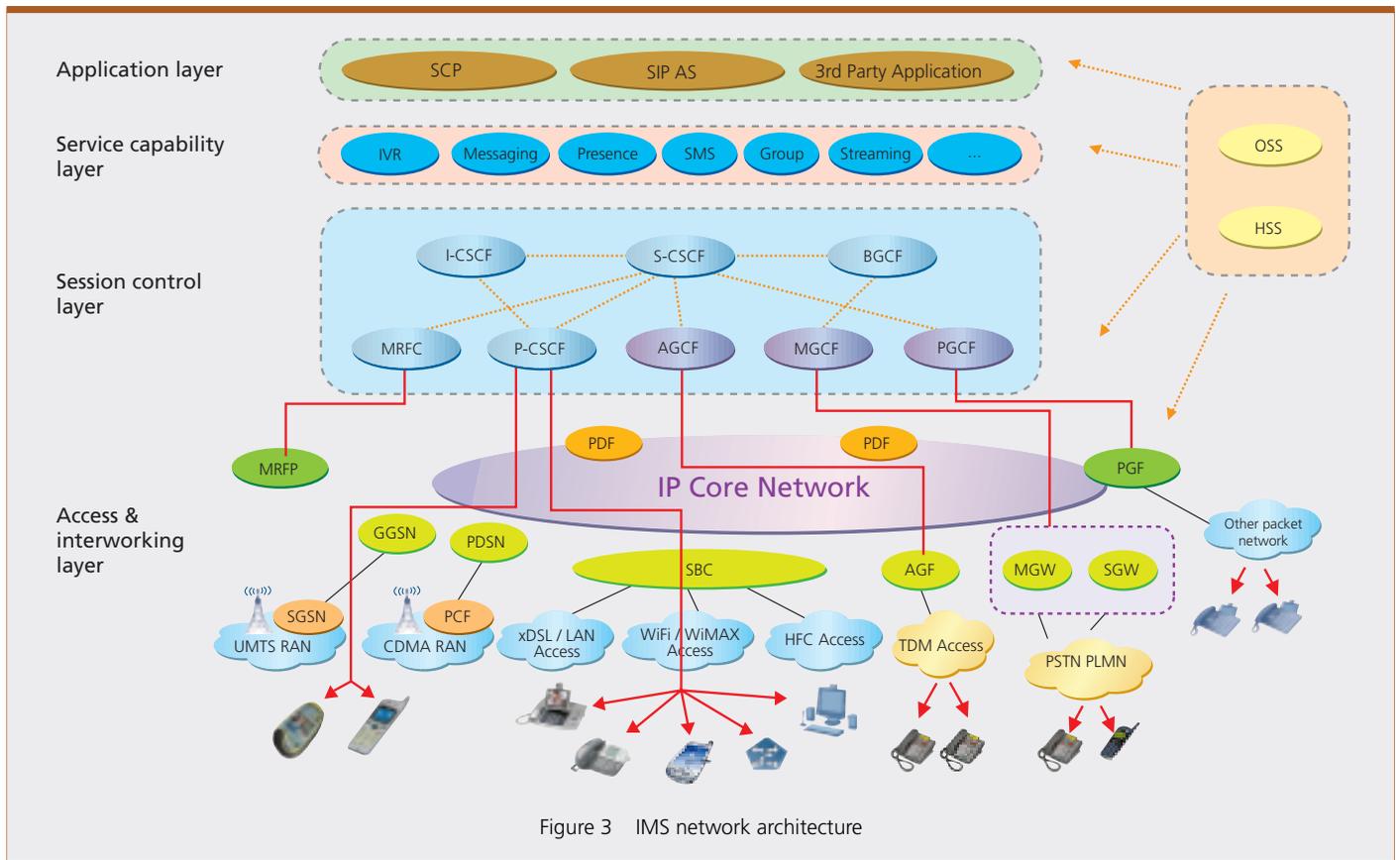


Figure 3 IMS network architecture

session control; user registration; SIP session route control; Interaction with the application server to enable application service session; user data maintenance and management; QoS service policies' management; provision of a consistent service environment for all users within the application layer.

The session layer includes a spectrum of functional entities, as shown in Figure 3, such as Call Server Control Function (CSCF), Multimedia Resource Function Controller (MRFC), BGCF and IM-SSF. CSCF features encompass Proxy CSCF (P-CSCF), Interrogating CSCF (I-CSCF), and Serving CSCF (S-CSCF), which can be physically integrated or set. Important related factors to consider are the IMS service access mode and access point position. In terms of CSCF, capacity, capability and user traffic requirements for service allocation and deployment during networking must be taken into account. Service allocation and deployment also relate to the operator's network topology-hiding and interoperability requirements.

Entry for the UE to access IMS, P-CSCF

implements the Proxy and User Agent functions in the SIP. The core positioned S-CSCF implements the following functions: registration authentication and UE Session Control; basic session route function of calling and called IMS users; value-added services (VASs) to the Application Server (AS) based on the IMS triggering rule subscribed to stipulated conditions being reached by a given user; service control interaction.

The I-CSCF acts as the gateway node in the IMS core network, and functionally allocates local domain user service nodes, routes queries and expedites topology hiding between different IMS domains. I-CSCF also determines which S-CSCF will provide a given service for users via combined conditions.

Service logic for users is allowed through the application layer, which triggers conventional basic call services such as call forwarding, call waiting, conference calling and other user required features. IMS interacts with conventional IN services, such as CAMEL and INAP, through the IP Multimedia Services Switching Function

(IM-SSF), thus inheriting the existing IN CS and PS services. In addition to the existing CS and PS services, IMS also provides non-conventional AS channelled telecom services including, amongst others, IM, PTT and Presence. A simple API interface channelled through the Open Services Access Gateway (OSA-GW) is also provided by IMS, which allows a third party to make use of network resources and provide secure services for feature rich functions such as games and entertainment.

## Fixed-Mobile convergence trends

2005 marked the culmination of 6 years R&D for Huawei's softswitch-centric NGN. Huawei began developing its softswitch in 1999 and, to date, large-scale applications and deployments have proven the softswitch system capable of replacing the traditional PSTN switch and the MSC in mobile networks. Although actual deployment might vary according to place and circumstance, developments in technology, interconnectivity and standardization betrays the direction of network evolution.

The Figure 4 shows the possible phases of network evolution.

2005: Large-scale NGNs will be built to replace the legacy PSTN. Prior to 2010: Softswitch is part of an IMS solution, which takes care of PSTN migration. Early CSCF will focus on new services provision. 2010 –2020: SoftSwitch will migrate to AGCF/TGCF in IMS architecture. Finally, the fixed-mobile converged (FMC) core network will become mainstream, but early phase operators may select different IMS for different services.

The significance of TDM-based PSTN and 2G-network transformation to IP-based NGN cannot be underestimated. As bearer networks converge, distributed networks based on standard architecture and interfaces reduce operation costs and are adaptive to the provision of new services as and when necessary.

### Why IMS is attracting so much attention...

The IMS-based convergence architecture describes a conceptual architecture for fixed and mobile converged network development. It is set to transform telecommunications and this explains and justifies the attention IMS is receiving. Network operators hope to use this scheme to provide identical services for fixed-line and mobile

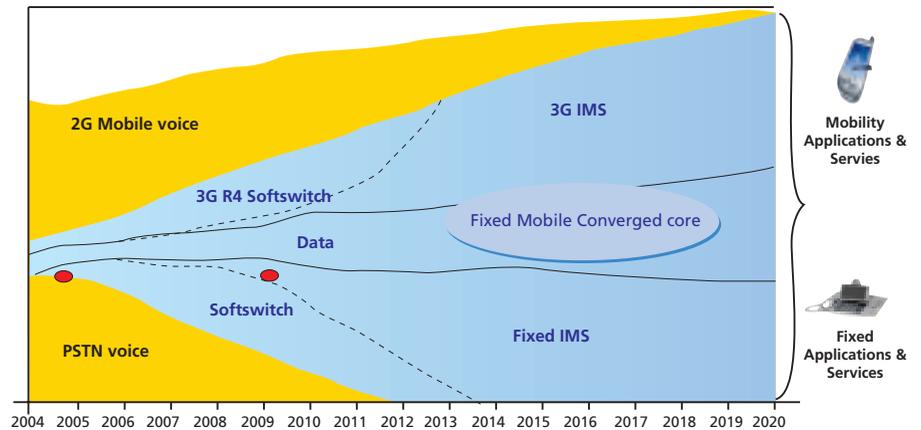


Figure 4 The phases of the evolution of the network

users over a unified core network. This will in turn simplify network structure, lower operational and maintenance costs, and achieve flexible service provision.

While IMS structure boasts a range of unparalleled advantages, many network, service, management, operation, and administration related issues have yet to be resolved. Numerous functions require improvement. IMS, for instance, does not holistically consider all aspects of fixed access, and therefore the relevant specifications need to be expanded.

The introduction of various fixed access modes complicates the network, which requires further analysis in terms of fixed and mobile access network features. Otherwise problems are likely to occur when

attempting to provide services to all kinds of terminals and also avoid conflict with systems in existing networks. These problematic factors increase the difficulties of standards' formulation. When viewing service integration, for example, the IMS is not a complete packet-based service system, so improvements are by necessity a dynamic and ongoing process. The involvement of the bearer layer also requires solutions in terms of QoS, security, insufficient address problems, user management, service management, and lawful interception. It is clear that to reach the other side of this technological cusp, much further study is required, particularly in terms of IMS application over the fixed network domain. [H]

