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IMS Service Vision for 3G Markets

UMTS Forum, April 2002

This report has been produced by the UMTS Forum, an association of telecommunications operators, manufacturers and regulators who are active both in Europe and other parts of the world and who share the vision of the Universal Mobile Telecommunications System (UMTS). UMTS is a modular concept, which takes full regard of the trend of convergence of existing and future information networks, devices and services, and the potential synergies that can be derived from such convergence. UMTS will move mobile communications forward from where we are today into the Information Society of third generation (3G) services, and will deliver speech, data, pictures, graphics, video communication and other wideband information direct to people on the move. The study was carried out by the consulting company Telecompetition, Inc. under the guidance of and with contributions from the IMS Project Team of the UMTS Forum.

This report follows on from other outputs which have dealt with: a regulatory framework and spectrum and technical aspects, impact of licence cost levels, licensing conditions, minimum spectrum requirements, an extended vision, market forecasts, and other issues Reports on these and other topics are listed in the Bibliography and can be found on the UMTS Forum Web site, www.umts-forum.org/reports.html.

Many statements in this report represent the views of the original author, Telecompetition, Inc., and have been subject to formal approval in the UMTS Forum. Thus, most operators and manufacturers within the UMTS Forum support the main conclusions and key findings in the report. The National Administrations that are members of the Forum have actively supported the development of the report. However, the views and conclusions expressed in this report do not necessarily represent the views of the National Administrations. Therefore the Administrations cannot be bound by the detailed recommendations contained in the report.

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1 Overview

The introduction of multimedia elements into mobile voice telephony dramatically changes the technology, industry, and market dynamics of a previously "all voice" mobile world. New network and handset technical capabilities, additional licence areas, and partnership opportunities are creating new challenges for mobile operators in a potentially $322 billion market.[1] The marriage of mobility with Internet content and voice with multimedia services introduces requirements for interoperability between mobile networks and Internet networks and higher levels of service integration. The concept of the IP Multimedia Subsystem (IMS) was developed to address the resulting network and end-user requirements.

The understanding of the term IMS has changed over time as the standardisation process has evolved.[2] Although there is no widely agreed definition of IMS today, the vision of what the 'IMS approach' is designed to achieve remains. It adds significant new dimensions to the communications process. To facilitate understanding of this report, the UMTS Forum has agreed on the following definition of IMS:

> IMS is understood to be an evolution of IMT-2000 technology, which brings:
>
> - *the ability to deliver person-to-person real-time IP-based multimedia communications (e.g., voice),*
> - *the ability to fully integrate real-time with non-real-time multimedia and person-to-machine communications,*
> - *the ability for different services and applications to interact, and*
> - *the ability for the user to very easily set up multiple services in a single session or multiple simultaneous synchronised sessions.*

IMS provides a vision of robust, highly valuable services that integrate multimedia activities and allow services to interact with each other, thus enhancing the natural, intuitive process of the end user, in whatever network he is operating, whether fixed, mobile, or roaming. The resultant integration and interaction of media types opens up new possibilities for far richer services than are available today.

The power of this interaction and integration is significant. It is the integration and interaction of services that can turn a frustrated user attempting to manage multiple activities on a small device into a satisfied customer using mobile services involving multimedia activities in a seamless fashion, following a natural, intuitive process. This is the experience that end users want from mobile data services and for which they will be willing to pay.

Still, qualitative differences in user experiences are difficult to quantify. Since IMS deployment is an option for operators, the need for IMS is a subject of debate amongst industry players, especially since many services can be emulated to some extent without IMS. However, consumers have clearly demonstrated a willingness to pay for integration of services.[3] In the mobile environment, ease-of-use has always been highly valued, and

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[1] See UMTS Forum worldwide estimates for 3G revenue in Report 17.

[2] The term IMS was at one stage synonymous with an "all-IP" solution but now more often just refers to the provision of IP in the core network.

[3] For example, consumers buy second dial-up lines and subscribe to cable modem service in part so that they do not need to suspend one activity (making and receiving phone calls) to begin another (accessing the Internet).

users will expect mobile data services that offer comparable convenience. To obtain high adoption levels, the mobile industry must also make mobile data services natural, intuitive, convenient, and easy-to-use.

For the mobile operator, IMS provides the potential for interoperability of mobile and fixed networks and a robust service creation platform, which in turn can be used to increase competitive advantage. Although the UMTS Forum has forecast 3G service revenue at $322 billion in 2010, this potential will only be fully achieved with the robustness and high end-user satisfaction that IMS can provide.

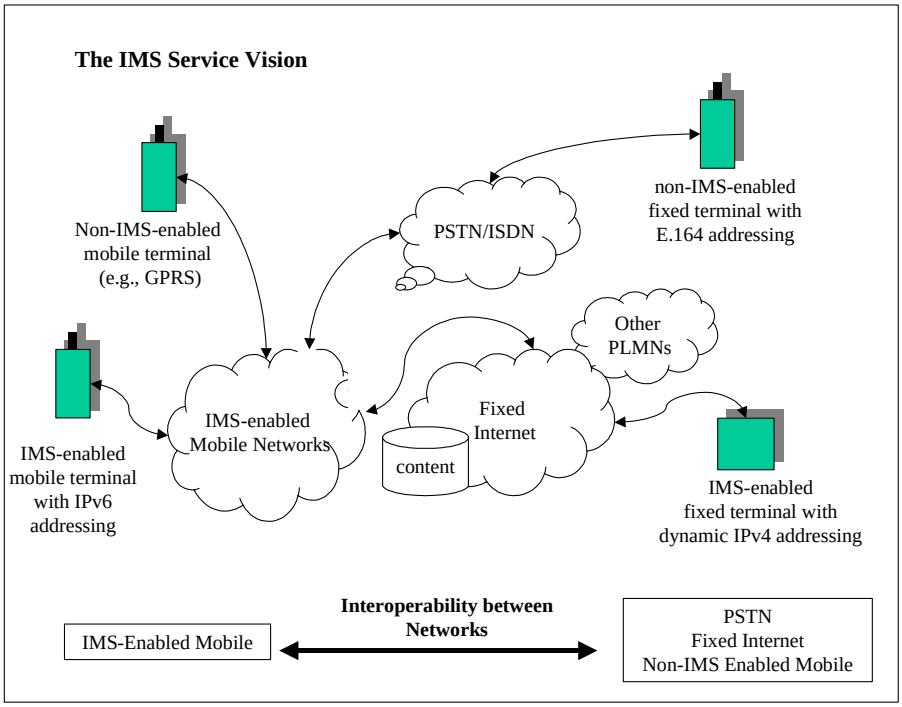
This report explains the IMS concept and illustrates the benefits of IMS to the end-user experience as well as to the mobile operator. It illustrates that IMS provides a standardised solution for enhancing the end-user experience that cannot be easily duplicated by any known technology today. In addition, a vision of IMS is portrayed that includes interoperability between fixed and mobile IP networks that will further the possibility of a common satisfactory end-user experience across services, networks, and devices.

2 The IP Multimedia Subsystem (IMS) Vision

IMS is concerned with the creation and deployment of IP-based multimedia services in 3G networks. Importantly, this includes person-to-person real-time services (such as voice) over packet-switched networks, removing the necessity for a circuit-switched domain in 3G networks.

IMS is designed to integrate mobile communications and Internet technologies, bringing the power and wealth of Internet services to the mobile environment. IMS enables interoperability between fixed and mobile networks and so holds the promise of seamless converged services. This is illustrated in Figure 2.1.

Figure 2.1. The IMS vision of network connectivity[4].



Source: UMTS Forum and Telecompetition, Inc., March 2002.

Two features of IMS are of fundamental importance:

1. IP-based transport for both real-time and non-real-time services.

2. Introduction of a multimedia call model.[5]

This combination is not only extremely powerful but it also radically changes the communications process and could introduce an entirely new dimension to telephony.

Until now, communication services in telephony such as voice calls or data transfers from a server have essentially been restricted to one service per bearer. More complex communications processes can be constructed and deployed but these require multiple

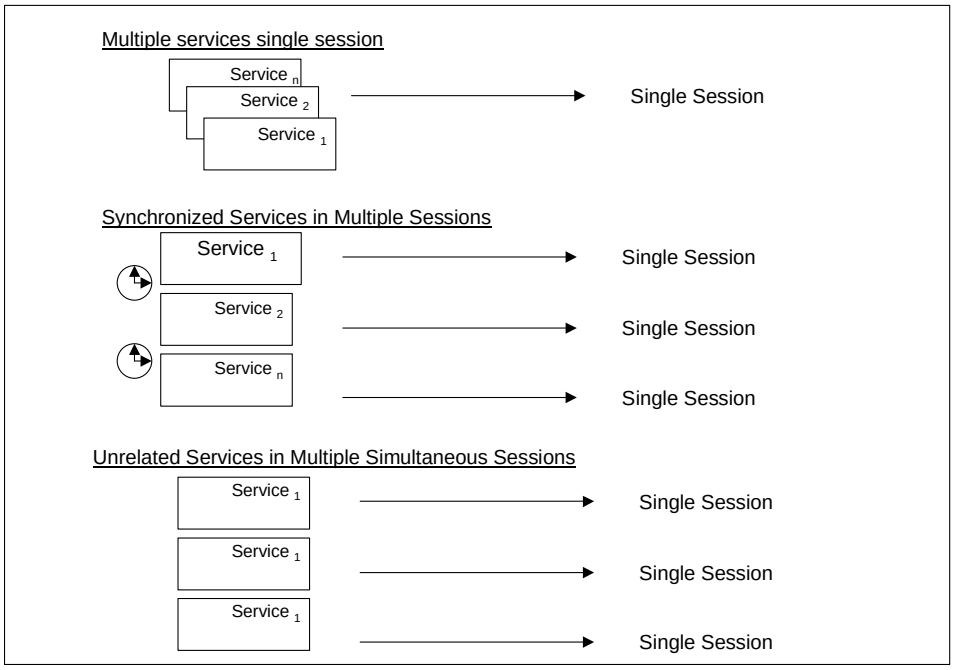
[4] An IMS-enabled terminal includes those terminals utilising the multimedia call model or SIP protocol.

[5] Both 3GPP and 3GPP2 have selected the IETF's Session Initiation Protocol (SIP) for multimedia call control. Windows XP, Microsoft's latest operating system, incorporates SIP in its Windows Messenger capabilities.

bearers, leading to an inefficient use of network resources and an unwieldy user interface. IMS removes these constraints.

IMS enables communications sessions to be established between multiple users and devices. It allows multiple services to be carried on a single bearer channel. IMS allows the integration of real-time and non-real-time services within a single session and provides the capability for services to interact with each other. These session arrangements are illustrated in Figure 2.2

Figure 2.2. Session arrangements made possible by IMS.



Source: UMTS Forum and Telecompetition, Inc., March 2002.

IMS gives users the ability to set up separate services within a single session, multiple simultaneous synchronised sessions, or multiple simultaneous single sessions of unrelated services. It will provide a significantly enhanced user experience and promises to enable radically new services. IMS thus provides three key features to end-user services:

- *Integration of Services*
- *Interaction of Services*
- *Presence*

Integration of Services is the ability to dynamically modify the media types active during a multimedia call session. The range of media types in use is dictated only by the media capabilities of the user terminal. In this way, IMS "integrates" into a single session what are today separate services. For the user, this single session capability means users can multitask. This means that they do not have to terminate a voice call (or place it on hold) in order to send a text message or video clip.

Interaction of Services is the ability to bundle services together, creating a new capability and user experience. As an example, a user could be browsing a Web site and then with a simple click, launch a voice or video call. In this way, the services interact with each other to create a seamless user experience.

The third feature, Presence, is the ability to know if a user is currently online. Though seemingly a simple capability, in an IMS environment, Presence and its extensions[6] provide a set of extremely powerful service enrichment capabilities. The incorporation of location-based information with Presence in IMS-based networks allows for innovative services, which leverage the proximity of a user to specific locations or users, and can be available even when roaming.

Table 2.3 summarises some of the key network capabilities to be provided in the IMS.[7]

Table 2.3. Key IMS-based network capabilities.

Capability	Comments
Real-time, Person-to-Person, IP-Based (e.g., voice)	Once development work is completed, IMS will include the ability to transmit real-time, person-to-person services such as voice over the IP network.
Real-time and non-Real-time Media Interaction	IMS allows for the interaction of both real-time and non-real-time media types in a single session.
Multimedia Call Model	IMS allows simultaneously use of ▪ Multiple media services within a single session, ▪ Multiple sessions between multiple users and devices For the end-user this allows the interaction and integration of services.
Network Interoperability	IMS includes the ability to exchange real-time person-to-person communications, including presence and location information, between IMS and other IP networks.

Source: UMTS Forum and Telecompetition, Inc., March 2002.

IMS enables communications sessions to be established between multiple users and devices. It allows multiple services to be carried on a single bearer channel. IMS allows the integration of real-time and non-real-time services within a single session and provides the capability for services to interact with each other.

The ability to deliver the full promise of IMS requires the resolution of some outstanding technical issues. The provision of appropriate quality of service for real-time services in a packet-switched environment is one. Interworking between E.164 numbering schemes and IP addresses is another.

Within IMS, services and networks are completely distinct. Service creation is therefore accessible by a broad community of developers[8] – a similar situation to the development of web content and access in the fixed Internet environment. IMS provides the tools to deliver what the PSTN Intelligent Network concept only promised.

A key feature of IMS is that control and intelligence is largely transferred to the edge of the network, or even into the terminal device itself. Such an architecture facilitates the

[6] One extension under development incorporates Presence, "caller preferences," and "callee capabilities" information into the SIP message, allowing a caller to be connected to the most appropriate terminal for a given user. Presence also would permit a user to launch a "when available" conference call with multiple users and have that call established when all required parties are available

[7] The 3rd Generation Partnership Project is in the process of developing a number of standards for IMS. When released, the 3GPP standards will address capabilities and toolkits needed to provide person-to-person and person-to-machine capabilities that will run on the packet-switched domain. Release 5 will include user service requirements for multimedia session access and management, end-to-end quality of service, and support for interworking with the Internet and the PSTN. Subsequent releases will be needed to complete the specifications for an end-to-end IMS system.

[8] In principle, IMS could allow voice services to be provisioned by any service provider independently of any specific network, creating some commercial and regulatory challenges.

provision of connectivity between networks. In principle, IMS enables interoperability between 3G mobile networks and fixed networks such as the PSTN and the Internet.

In practice, seamless service provision across different network types will take some time to achieve. Initially, an IMS-provisioned 3G mobile network could have richer service capability and functionality than the current fixed networks.

2.1 Advantages to the Mobile Industry

An IMS-based network is superior to a non-IMS-based network in many areas.

The key advantage of IMS is that it incorporates all of the IMS capabilities described earlier into a standards-based implementation thus enabling interoperability between IMS-based networks and fixed IP networks. One could successfully argue that a mobile operator[9] could, at considerable expense, create a non-IMS-based network that provides IMS-like features at a point in time. The technical feasibility exists. However, new end-user desirable services created for this proprietary network would not likely be fully interoperable with other networks. This would limit the user ability to fully utilise the new IMS-like services as they roam from one network to another.

Additionally, third-party service developers in a non-IMS environment would be less aggressive in their development of new services, because the market potential has been limited to the user base of the proprietary network mobile operator. Also, the costs and challenges of supporting multiple proprietary networks are prohibitive. Therefore, the business and market feasibility of the proprietary non-IMS-based network and its new service capabilities are greatly reduced.

Another significant benefit of IMS is the establishment of a platform environment to rapidly create, deploy, and modify new advanced mobile services for end users. The value of IMS that integrates voice with data IP services comes from integration—not at the network layer (i.e., run voice services on top of data services), but at the services layer (i.e., combine voice services with data services).[10] In so doing, the rapid new services deployment and customisation capabilities of the fixed Internet which has brought innovative multimedia information services to end users can be brought to the mobile world.

Table 2.4 summarises the advantages of IMS to the mobile operator.

Table 2.4. Advantages of the IMS approach to operators.

Operator Advantages
Network Deployment and Operations ▪ Standards-based implementation enables interoperability between mobile and other IP networks ▪ Infrastructure and administrative cost savings which decrease the investment threshold for new services deployment ▪ Standard network elements (e.g., routers) are used thereby reducing infrastructure deployment and expansion costs

[9] The term “mobile operator” in this report refers to mobile network operators as well as mobile service providers and Mobile Virtual Network Operators (MVNO).

[10] Source: dynamicsoft Inc.,“Session Initiation Protocol, an Overview.” 2001, www.dynamicsoft.com.

Operator Advantages
Service Creation ▪ Improved service creation capability with shorter development time. ▪ Rapid, cost effective, scalable across multiple mobile operator networks. ▪ Ability to leverage large existing development communities with IP expertise means more innovation. ▪ Timesaving, useful new features. ▪ IP-based approach allows wireline Internet service innovations to be more quickly deployed in the mobile environment. ▪ Cost effective, leading to more customisation opportunities and more opportunities for innovation.
Competitive Advantage ▪ Ability to create more customised services in a shorter time frame can create real service differentiation resulting in increased competitive advantage for mobile operators. ▪ Incumbent mobile network operators will be more able to compete with mobile operators entering mobile markets with IP-based services.

Source: UMTS Forum and Telecompetition, Inc., March 2002.

2.1.1 Voice over IP and the Fixed Internet

As mentioned earlier, IMS brings the ability to offer real-time person-to-person voice services into the IP-based packet switched domain and the ability to integrate those voice services with other real-time and non-real-time media. The IMS is expected to provide a major source of service innovation capability to mobile operators. To validate this expectation, this section reviews a similar technology and service development phenomenon that is already occurring in the fixed Internet in voice over IP (VoIP) services.

Over the last few years, voice over IP (VoIP) in the fixed Internet has matured to the point where the quality is acceptable, and many large enterprises are using the service or are in the process of evaluation. Convergence of voice and data networks has strong appeal to enterprises as a means to decrease costs, increase productivity, and enhance functionality. For example, in the US alone, enterprise spending on VoIP equipment doubled in 2001, exceeding $850 million.[11] VoIP companies that offer IP-based replacements for traditional enterprise PBX and managed VoIP systems have become more main stream. These IP-PBXs and VoIP-managed systems integrate voice and data functionality at both the user level and at the network infrastructure level.[12] Some of the benefits claimed by these companies include:[13]

- *Improved service creation capability with shorter development time*

  In the Internet marketplace, both the physical network and the network mobile operators are separate from the applications and application developers. Consequently, VoIP companies can easily and quickly create new service applications in weeks or months for very small market segments. In contrast, fixed telephony is characterised by large complex networks with application software embedded in the core network switches. In current wireline telephony, most service application development work affects the core software of the switch and can take months or years to complete.

- *Infrastructure and administrative cost savings*

[11] Source: eMarketer from Telecommunications Industry Association, May 2001.

[12] VoIP service providers researched include GoBeam, TalkingNets, Inc., VocalData, Shoreline, and other IP-PBX and hosted IP-Centrex service providers.

[13] Extracted from several company presentations at SuperNet 2002, January 2002.

Enterprise cost savings from implementing VoIP include toll arbitrage, leased line consolidation, reduction in administrative costs of additions, moves, and changes (due to user friendly Web interface that allows user "self registration" when changing desks). One vendor estimates that the self-registration process alone can save a 500-person business $50,000 per year.[14]

- *Timesaving, useful new features*

VoIP service providers typically provide a Web-based interface for managing voice and data communications. With this interface, voice becomes yet another media element to be manipulated like all other data elements. Examples of some of the more popular features include the following:

- Visual Voice Mail: Voice mail messages are listed with e-mail messages, and users can more easily choose which ones to listen to. Users can receive voice message notification via e-mail.
- Point and Click Addressing: Voice calls can be initiated by clicking on a contact rather than looking it up, then dialling the number. This includes group conference calls where a number of parties can be called and bridged together.
- Presence and Unified Messaging: Provide better capability to manage and screen calls. For example, when combined with instant messaging, can set up an immediate short conference call as soon as all parties are available.
- Integrated Address Book: VoIP service providers are working with e-mail messaging software providers (such as Microsoft Outlook) to enable integrated voice and e-mail contact lists.
- Web-based Interface for Network Management: Network managers can easily change features, privileges, and other attributes of individual users through a single, Web interface.
- Application Sharing: Users have the ability to share applications, jointly collaborate on whiteboard graphics, and perform simultaneous Web browsing.

The enterprise will invest in VoIP, as it becomes confident that the technology will in fact produce real savings or produce revenue. End users will likely view timesaving convenience features as important benefits that will encourage them to continue to use IP services. The mobile industry can expect subscribers to demand equally useful IP capabilities in mobile data services.

The implementation of VoIP in the fixed Internet provides an excellent illustration of the types of services, service providers and end-user benefits that might be possible in a mobile IMS-based environment. The interaction and integration of VoIP with other multimedia services is now providing real value to enterprises, and is a source of competitive differentiation for service providers. New service features are being introduced that were not available without VoIP. The innovative service offerings and other end-user benefits claimed by these companies provide insight into the possible benefits that can be obtained by the mobile industry through implementing IMS-based mobile networks.

2.2 The End-user Experience

The end-user experience is the totality of elements that contribute to the end-user perception and satisfaction of a service and of the mobile operator. If positive, the end-user experience will have a major influence in determining the customer's willingness to pay for the service and to continue using the same mobile operator. For voice service,

[14] From VocalData presentation at SuperNet 2002, January 22, 2002.

mobility alone has proven a powerful value to users and compensated for less-than-optimal coverage and voice transmission quality. As a minimum, mobile users will expect as least an equal level of service from any mobile data service they may use.

So far, the experience of many users with mobile data services has been less than satisfactory. Handset usability research conducted by the Usable Products Company identifies many of the key problem areas:[15]

- ***Handset Browser****: Most respondents would have made a voice call to complete the tasks and felt they would have completed the tasks more easily if they could have personalised the handset.*
- ***Handset Feature****s: Some respondents had difficulty finding certain features of the phone.*
- ***Text Entry****: All respondents expressed difficulty in entering text.*
- ***Nomenclature****: Different services used different names of menu items, which confused most respondents as they moved from one service to another.*

Consumer research also shows that current mobile data users continue to express dissatisfaction with the existing level of data service (especially for Web browsing), with speed of data transfer being the single lowest-rated quality.[16] In another example, according to a J.D. Powers survey,[17] mobile users are generally experiencing more problems with their service, particularly in areas of terminal equipment operation. Clearly, if mobile data services are to be a commercial success gaining widespread market adoption, this user experience must be improved.

The negative revenue implications for a mobile operator that does not improve the user experience are significant. Not only does customer dissatisfaction diminish the possibility of users adopting new services, it also diminishes individual operator competitive advantages. In the developed world, average churn time is typically growing shorter and average revenue per user declining. With customer acquisition costs as much as $475, increased churn due to an unhappy customer is an occurrence most operators in this new competitive environment can ill afford.

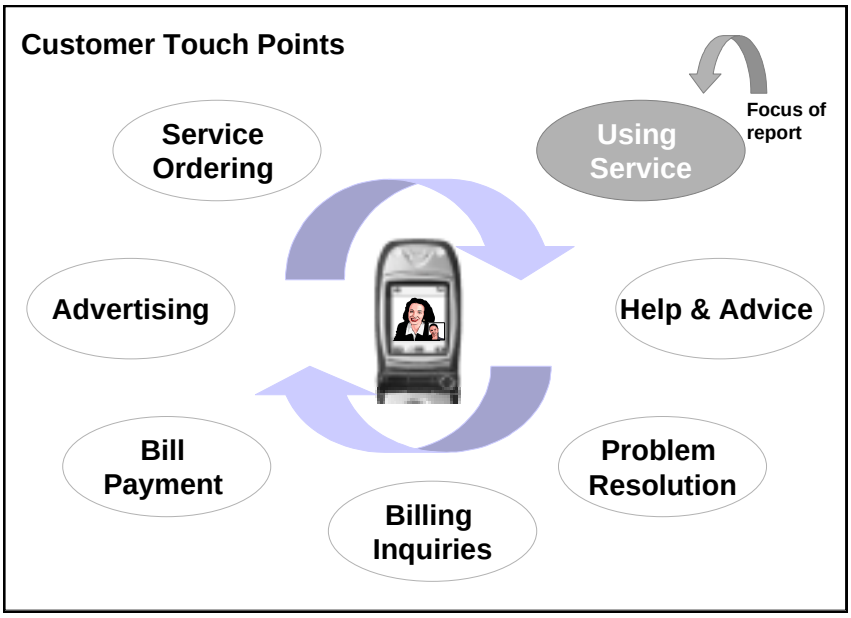
This report focuses primarily on the experience of the end user when using the service. However, it is recognised that the elements contributing to an end-user experience include all opportunities for the service and the mobile operator to communicate with or “touch” the customer. In addition to the use of the service, other elements include ordering, advertising, handling of any inquiries or service problems, and bill rendering and payment. Successful customer relationship management will create a consistent customer experience in all elements. Figure 2.5 illustrates this concept.

[15] Source: Usable Products Company, “Wireless Phone Usability Research”, January 2001. This study was commissioned by Sprint.

[16] Telephia, “Wireless Data Users Survey: National Results Q2 2001. “

[17] Source: J.D. Power and Associates “2001 US Wireless Industry Services Study”

Figure 2.5. End-user "Touch Points" potentially impacted by IMS.



Source: UMTS Forum and Telecompetition, Inc., March 2002.

Seemingly trivial details can make a tremendous difference in end-user satisfaction and speed of adoption for new services. For example, the rapid growth of Short Messaging Service (SMS) over the last few years is due in part to the use of text-input technology that allows users to quickly and easily type in messages.[18] Reluctance to use supplemental network services in wireline telephony such as call forwarding, speed dial, and last-number-dialled can be partly attributed to the requirement for users to remember a "simple" two- or three-digit code to access the service. Although readily available, NetMeeting's complexity in set-up and use has slowed widespread adoption by business.

Since users currently perceive computer response delays greater than two seconds as negative,[19] mobile operators should expect users to be equally demanding in their adoption of complex mobile data services.

2.3 Technology Enablers

There are a number of technical areas relative to IMS that are currently under development by 3GPP and in other industry initiatives, and a few that are not yet being addressed. While this report does not discuss these in any depth, it is useful to identify them here.[20]

Services that take advantage of the features of IMS will be enabled by a variety of technologies that are liable to be implemented to different degrees and with different time scales. The availability of such technology enablers depends critically on priorities in the standardisation process, the scale and cost of introducing new technology, and on the deployment strategies adopted by operators.

IMS was introduced initially as a core network concept in 3GPP but it is now clear that there is significantly more to implementing the full capability for IMS services than first

[18] The T9® Text Input software, from Tegic Communications, has been licensed by equipment manufacturers representing over 90 per cent of mobile phones worldwide and is considered by many to be a global standard. Tegic Communications is a wholly owned subsidiary of America Online, Inc. and is considered a strategic asset for AOL instant messaging.

[19] Source: IBM, from Morgan Stanley Dean Witter, "Uncorking the Internet Bottleneck," June 5, 2000.

[20] These areas are discussed in the Technology Enablers Annex to this report.

appeared. Almost every aspect of the 3G system is affected and whereas 3G was intended to be an evolution of GSM and GPRS, IMS is more revolutionary.

Three major technology components necessary to enable or support IMS are currently the subject of standardisation work within 3GPP and IETF. These are:

- The "all-IP" core network
- Multimedia call control (3GPP has chosen SIP)
- The "IP-based" radio access network.

Certain other technology components will also be required but are not necessarily candidates for standardisation.

The introduction of IMS services requiring new technology must fit in with business plans and pay due regard to the deployment of similar services in the fixed network and Internet sectors. Alternatives to IMS are becoming available that do not involve the implementation of the full set of IMS technology enablers. These alternatives can provide partial or limited solutions in certain circumstances. But the implications of not deploying or partially deploying one or more of the technology components involved in IMS should be considered carefully as this might have a negative impact on the functionality and availability of many potential IMS services.

Implementation of the full set of IMS technology enablers depends on the resolution of a number of outstanding items within the standardisation organisations. Deployment of the full set of IMS technology enablers raises a number of issues that need to be addressed by the operator community.[21]

The Annex to this report identifies the IMS technology enablers and correlates them with the 3GPP work-plan. A high level strategic discussion of the issues involved in the implementation and deployment of these technology enablers is presented in the Annex.

From an operator perspective, the overview of IMS technology enablers presented in the Annex poses a number of challenges. These include:

- An IP-based radio access network reduces spectrum efficiency. Should an IP-based RAN be deployed from the start, should it be deployed later or should it remain an option?
- IMS makes access independence much easier to achieve. IMS calls can be delivered to suit the situation of the terminal via alternative access networks such as alternative IMT-2000 RAN technologies, wireless LAN, fixed or private networks. Enabling access to be provided easily via privately owned or competitor owned LANs might not be in the operators' business interests.
- Powerful browsers might not be available for small handheld devices for a few years. It may be advisable to specify certain minimum terminal capabilities for IMS to ensure full enjoyment of services by users.
- The availability of IMS person-to-person services depends on the capabilities of all the networks involved. For the full IMS experience, all involved networks must support IMS otherwise the potential richness of IMS services will be lost.[22] There is a need for a concerted roll out of IMS core networks by the industry, otherwise IMS subscribers will not get the improved services even if their own network provider has invested in the technology.

[21] For example, in-call handover between IMS and circuit switched domains is problematic. Operators may need to plan to deploy IMS-capable access throughout their whole network coverage so that inter-domain handover is not necessary.

[22] This includes the deployment of VoIP services in fixed, private and IT networks, because by being compatible with VoIP, the growth potential of IMS will be enhanced.

A fuller discussion of these issues and other aspects relating to technology enablers is contained within the Annex to this report.

3 IMS Services and Applications

This section provides an overview of IMS service and application examples and relates them to 3G service categories discussed in the UMTS Forum Reports 9 and 13.

The terms “services” and “applications” are used loosely in the mobile industry to apply to a large number of market and technical capabilities and functions that collectively encompass a new type of user experience.[23] While the UMTS Forum Reports 9 and 13 have very specific definitions for these terms, the distinction is less important in this document, because it focuses on the end-user experience, regardless of whether that experience is enabled by a billable service or an application.

The UMTS Forum has forecast 3G service categories in previously published reports,[24] adopting a services framework of six very distinct service categories. The service categories are simply a modelling convention adopted to ease understanding, provide clarity and avoid double counting of revenue. These distinct service categories do not mean to suggest that services cannot be combined in any number of ways in end-user offerings, nor do they preclude the possibility of interaction and integration between services. For example, Rich Voice could be integrated with Multimedia Messaging Services to provide both real-time and non-real-time media exchange between persons.

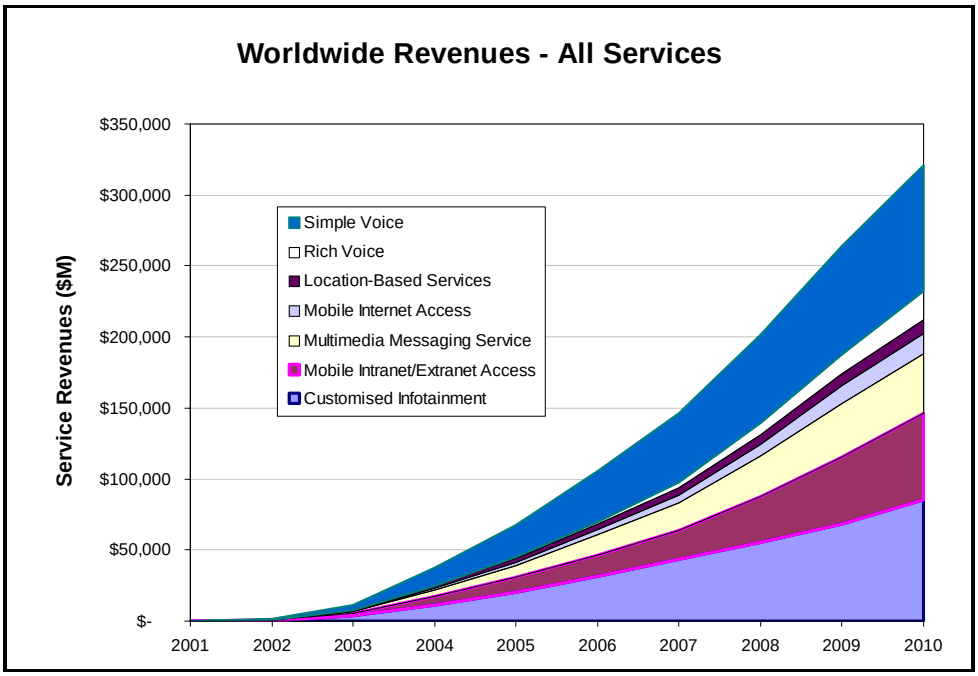
Figure 3.1 shows the magnitude of the 3G revenue opportunity to be impacted by IMS. Worldwide 3G annual revenues are expected to reach $322 billion in 2010. The 3G services in the forecasts are presumed to carry the robust end-user experience that can be provided in an IMS-based network. Some forecasted services, in the Rich Voice category in particular, may not be possible at all without IMS.[25] What these revenue numbers do not include are any new, revolutionary services that might be made possible through an IMS-based network.

[23] The UMTS Forum has defined “services” to be those capabilities that are billable by the operator, more visible to the end-user, and typically presented as discrete options for the user. Applications, on the other hand, are typically not billed separately, are often not visible to the end user, but are necessary to provide the billable service. See UMTS Forum Reports 9 and 13 for a more detailed discussion of services and applications, including the six service categories identified as the major source of 3G-market opportunity.

[24] See UMTS Forum Reports 9 and 13, which can be downloaded from the UMTS Forum Web site: www.umts-forum.org.

[25] Rich Voice included real-time voice, integrated with real-time video or graphics.

Figure 3.1. Worldwide 3G revenues – by service category (2002-2010).



Source: UMTS Forum Report 17 and Telecompetition, Inc., August 2001.

Table 3.2 lists example IMS services and applications and shows where they are included in the UMTS service category revenue forecasts. The lighter-shaded areas of the chart indicate applications and services that are not expected to generate direct revenue, but will drive indirect revenue through increased, billable traffic on the network.

Table 3.2. Example IMS services and the UMTS Forum service framework.

Service Concepts and Applications		UMTS Forum Service Categories					
		Access Focus		Portal Focus	Specialised Service		
		Mobile Internet Access	Mobile Intranet/ Extranet Access	Customised Infotainment	Multimedia Messaging Service (MMS)[26]	Location-based Service	Rich Voice and Simple Voice
Voice/ Conference	Videophone						■
	Basic Voice (IP-based)						■
	Local Services						■
	Multimedia Group Call						■
	Mixed Media Interactive Communication						■
Web Access/ Messaging	Instant Messaging	▒	▒	▒	■		
	Multimedia Messaging	▒	▒	▒	■	▒	
	Peer-to-peer Gaming Service	■		■	▒		▒
	Server-based Gaming	■		■	▒		▒
	Mobile VPN		■				
General Applications/ Enablers	Presence	▒	▒	▒	▒	▒	▒
	Interactive Customer Care	▒	▒	▒	▒	▒	▒
	Basic Multimedia Service	▒	▒	▒	▒	▒	▒
	Prepaid Services	▒	▒	▒	▒	▒	▒
	Distributed Speech Recognition Voice Portal	▒	▒	▒	▒	▒	▒
	Downloading Multimedia Objects	▒	▒	▒	▒	▒	▒
	Mobile Number Portability	▒	▒	▒	▒	▒	▒
	Global Text and Total Conversation	▒	▒	▒	▒	▒	▒
	Multimedia-based Voice Response	▒	▒	▒	▒	▒	▒
Regulatory	Lawful Intercept						▒
	Emergency Call						▒
	Priority Service						▒
	Malicious Call Trace						▒

Legend	Driver of Traffic (airtime or messages)	▒
	Revenue source in UMTS Forum Forecast	■

Source: UMTS Forum and Telecompetition, Inc., March 2002.

3.1 Example IMS Services and Applications Description

Users expect many new and interesting multimedia services and applications to be enabled by 3G technology and the IMS platform. In addition, they expect to maintain the quality and functionality available with current mobile voice services and a seamless migration of services as networks are upgraded. Standards development is currently focused on four major areas that are necessary to provide these new services as well as a smooth transition of existing ones.

- *Revenue generating **voice services** that include basic voice capabilities and new voice services enhanced with multimedia functions.*
- *Revenue generating data services that include **Web access and messaging** functions.*

[26] In this service framework, Multimedia Messaging Service is defined as a non-real-time multimedia enhanced messaging. Rich Voice is real-time, person-to-person voice plus real-time multimedia.

- ***General enablers*** *that provide mobile multimedia building-block functionality that will be used in a wide range of new services.*

- ***Regulatory mandates or government*** *requested elements to provide security and ensure industry health.*

Table 3.3 describes examples of IMS services and applications that have been identified for possible development. Some of these items can, in fact, be provided in some fashion without IMS, although IMS will enhance multimedia functionality, simplify implementation, and enable service delivery across multiple networks as described earlier.

Table 3.3. Example IMS services and applications description.

	Service Concepts and Applications	Description
Voice/Conference	Videophone	Consumer, person-to-person or person-to-multiparty, real-time video plus voice
	Basic Voice (IP-based)	Conversational voice service, comparable to existing mobile voice, which can transmit to and from all types of networks
	Local Services	Services provided by the local network, home or roaming
	Multimedia Group Call	Voice plus data, images, and/or video broadcast from a single user to multiple users
	Mixed Media Interactive Communication	Service where the sender and receiver in a multimedia session can be communicating with different types of media (e.g., voice for sender and text message for receiver)
Web Access/Messaging	Instant Messaging	Exchange of content, usually text, between a set of participants in real-time
	Peer-to-peer Gaming Service	Service where users play mobile interactive games amongst themselves while still communicating with each other using voice or text without suspending the game
	Server-based Gaming	Service where a number of individuals play an interactive mobile game that is managed by a server
	Mobile Virtual Private Network	Business service that provides secure, single sign-on access to the company's information management systems
General Enablers	Presence	Provides access of availability status to other users or services
	Interactive Customer Care	Ability for customer service to scan the current user settings and reset terminal settings
	Basic Multimedia Service	Ability for user terminals to address, access, and present different types of multimedia objects
	Prepaid Services	Payment option where users pay a predefined amount of money for the mobile service in advance
	Distributed Speech Recognition Voice Portal	Ability to access information and conduct transactions with voice commands
	Downloading Multimedia Objects	Ability to download and store multimedia objects (e.g., music clips) from mobile Web sites to the local terminal
	Mobile Number Portability	Ability for the user to move from one network operator to another without changing his phone number.
	Global Text and Total Conversation	Real-time character-by-character text conversion in a multimedia conversational service
	Multimedia-based Voice Response	Ability for users to change which type of media they are using in the middle of a call without terminating the call (e.g., switch from voice to interactive data)
Regulatory	Lawful Intercept	Ability for law enforcement agencies to legally intercept any type of media in a call
	Emergency Call	A "911" or "112" type service that will route calls to emergency facilities and provide location information to the emergency agency
	Priority Service	Ability to give priority call completion to designated agencies or individuals in the event of an emergency
	Malicious Call Trace	The ability for the network to track the events and services involved by a calling party when the user deems the call to be threatening, malicious, or life threatening

Source: The 3rd Generation Partnership Project (3GPP)[27] TR22.941, V6.0, September 2001.

The inclusion of comparable basic voice services is critical to developing multimedia services that include a voice component.

[27] The 3rd Generation Partnership Project (3GPP) is a collaboration agreement established in December 1998 to bring together a number of telecommunications standards bodies, which today include ARIB, CWTS, ETSI, T1, TTA, and TTC.

3.2 IMS Service Benefits and Market Significance

The IMS services listed in Table 3.3 were evaluated in terms of the market significance and impact of IMS. Table 3.4 summarises that evaluation.

Table 3.4. Service prioritisation summary.

	Service Concepts and Applications	Market Significance	Benefit of IMS
Voice/Conference	Videophone[28]	Revenue Enables other video services	Enhanced integration with other data elements
	Basic Voice (IP-based)	Revenue – Critical service in most service bundles Available in fixed/wireline	Will enable inclusion of VoIP in 3G services Enhanced integration with other data elements
	Local Services	Revenue	Will allow local content and services to be accessible
	Multimedia Group Call	Revenue Wireline audio and Web conferencing available Not currently available in mobile environment	Enhanced integration with other data elements May not be technically feasible without IMS
	Mixed Media Interactive Communication	Revenue Not currently available in fixed or mobile environments	Enhanced integration with other data elements May not be technically feasible without IMS
Web Access/Messaging	Instant Messaging	Revenue Very popular service which drives traffic Available in fixed Internet and in mobile environment through SMS	Will enable inclusion of instant messaging
	Multimedia Messaging	Revenue Enhancement of SMS, which will drive much traffic Analogue in fixed Internet is e-mail with attachments	Enhanced integration with other data elements
	Peer-to-peer Gaming Service Server-based Gaming	Revenue Very popular service which drives much traffic Available in fixed Internet and in mobile environment through SMS	Enhanced integration with other data elements Some games may not be technically feasible without IMS
Web Access/Messaging	Mobile Virtual Private Network (VPN)	Revenue Critical to serving enterprise market	Will allow enterprises to include mobile services as part of IP network convergence plans

[28] NTT DoCoMo and Manx Telecom trials are using circuit-switched networks for the voice and video portions of the service.

	Service Concepts and Applications	Market Significance	Benefit of IMS
General Enablers	Presence Interactive Customer Care Basic Multimedia Service Prepaid Services Distributed Speech Recognition Voice Portal Downloading Multimedia Objects Mobile Number Portability Global Text and Total Conversation Multimedia-based Voice Response	Important functions for enabling many IMS services Available in fixed Internet and to some extent in mobile environment	Enhanced integration with other data elements Enables packet-based services to have same functionality as existing circuit-switched voice
Regulatory	Lawful Intercept Emergency Call Priority Service Malicious Call Trace	Mandated	Enables packet-based voice to have same functionality as circuit-switched voice

Source: UMTS Forum and Telecompetition, Inc., March 2002.

4 Detailed Analysis of Three Representative IMS Services

This section contains detailed analyses of three representative IMS services. The three services are all revenue-producing services and were chosen to illustrate the impact of IMS in person-to-person, person-to-machine-to–person, and person-to-multiparty situations and combinations of all multimedia elements. Services are analysed in terms of existing analogues in the fixed and mobile environments. In addition, the end-user experience impact of IMS and the potential market value of each service are discussed.

4.1 IMS Advanced Mobile Videophone Service (Consumer)

This section discusses the history of videophone service, the reasons for its appeal and its historic commercial failure. Also, this section describes how the addition of mobility and IMS capabilities will enhance the end-user experience and create a more commercially viable service offering.

4.1.1 Consumer Videophone Services – Lessons from the Past

Since the early days of AT&S's prototype Picturephone, the communications industry has been fascinated with the concept of combining video with voice communications. While it was hailed as a landmark scientific achievement, the Picturephone failed commercially despite several different market campaigns. Table 4.1 summarises the historic problems that led to the poor market adoption for fixed videophone service in the consumer market.

Table 4.1. Historic problems with fixed videophone services.

Problem	Description
Lack of terminal ubiquity	Without some critical mass penetration of the videophone terminals, there are limited people one can call.
Limited field of vision	Videophone cameras can only capture a narrow range, hence the term "talking heads."
Poor picture and/or sound quality	With Picturephone, the sound quality was there, but the picture was poor.
Limited terminal interoperability	Videophone terminals are usually designed to only operate with other same brand terminals.
Limited use in time and place	Videophones associated with fixed telephony cannot be easily moved. Thus grandparents can get a live look at the baby sleeping in the crib, but not at the toddler at the playground or the birthday party in the garden.
Lack of privacy	Despite the ability to control what the camera shows, there is a perception that videophone is invasive and might cause personal embarrassment.

Source: UMTS Forum and Telecompetition, Inc., March 2002.

4.1.2 Current Consumer Use of Video Services

Despite this lack of market success, the consumer is apparently still fascinated with the concept and willing to keep trying. Encouraged by the success of video technology in other consumer markets, the communications industry has continued to pursue the videophone concept. For example, over 75 per cent of the European populace have access to video camcorders,[29] and in the US; total streaming video hours has increased by over tenfold since 1999.[30] Table 4.2 summarises the main characteristics that consumers find attractive in the videophone concept.

[29] eMarketer, from Eurobarometer, 1999.

[30] eMarketer, from Deutsche Banc Alex Brown, 2000.

Table 4.2. The attraction of videophone service.

Benefit	Description
Emulates "in Person" Experience without Travel	Videophones allow one to see the person you are talking to and capture nuances of expression and body language that are missed in text or audio-only communication
Increased interpersonal connection	Videophone allows people separated by distance to share experiences more fully with each other
Improved privacy control	Users of videophone services can turn off the video at will, affording a greater degree of privacy and control

Source: UMTS Forum and Telecompetition, Inc., March 2002.

As another example of consumer interest in videophone service, in the last few years, smaller, inexpensive and easy-to-install Web cameras have taken hold, propelled by the availability of instant messaging "video chat" services often available at no charge on the Internet.

Despite the poor quality of both the voice and the video, video chat services on the Internet are popular because of the following characteristics:

- ***Low-cost and easy-to-use.*** Inexpensive video equipment (Web cameras and microphones) that can be installed on almost any existing multimedia PC. The service is nearly free.
- ***Terminal-independent user interface.*** The software can be downloaded free of charge for use on any PC.
- ***Ubiquitous network access.*** Can be used for any URL on the Internet.
- ***Ready availability of interactive content*** (e.g., "chat rooms," including adult content).
- ***Easy-to-use addressing and numbering scheme for "calling" people.***
- ***Non-disruptive to other activities.*** One can continue with other PC and telephone-related activities (e.g., e-mail, other voice phone calls) while making a video call.

With Web cams/video chat and other video technology, consumers have clearly demonstrated their willingness to purchase products that have a video component, and consequently the industry continues to develop applications to try to meet that need.

The addition of mobility to the videophone concept has renewed market hopes for a commercially viable consumer service. Mobility brings relevance to video. In mobile videophone, the other party can "see what I'm talking about – not simply see me." Also, the addition of Presence allows the called party to better control when and how they will accept a video call. Mobility allows video to be used in more and different ways not possible with fixed videophone services.

More recently, several mobile operators and handset manufacturers have introduced handsets and service trials for mobile videophones for both real-time and streaming video.[31] For example, real-time, interactive video is currently available as part of the NTT

[31] The terms "mobile video" and "mobile videophone" are often used to describe streaming media video clips that are captured or downloaded and played back on a mobile device. While these are important services that might be accessed with the same or similar video-capable terminal, they are not real-time, person-to-person, or interactive. This type of service is also available today in limited areas. For example, the FOMA service, recently introduced by NTT DoCoMo in Japan includes options on the P2101V handset to capture up to two minutes of normal video and 70 still images. Another FOMA service, I-motion, provides video and audio clips as well as stills for downloading and viewing. It uses the N2002 FOMA terminal.

DoCoMo FOMA service in Japan (using Panasonic handsets) and by Manx Telecom on the Isle of Man in the UK.[32] Mobility resolves some of the historic complaints, and so many in the industry believe that this enhanced functionality will produce a commercial success.

Table 4.3 summarises the added advantages that mobility brings to the videophone concept.

Table 4.3. The added promise of mobility to videophone.

Additional Benefits of Mobility	Description
Expanded field of vision	Since the camera is mobile, it can be pointed wherever the user desires.
Expanded use in time and place	Mobile videophone would be accessible from any place within the mobile operator service area.
Increased privacy control	The video portion can be added or deleted at will. Video portion can be dropped at any time without terminating the call.

Source: UMTS Forum and Telecompetition, Inc., March 2002.

4.1.3 IMS Advanced Mobile Videophone Service Description

In both the FOMA and Manx Telecom market trials, real-time videophone services are provisioned in a circuit-switched domain rather than the packet-switched domain in the core network. These are not IMS-based networks, and so do not have the additional interactivity that will be available through IMS.

The future IMS Advanced Mobile Videophone Service will be a two-way, real-time, conversational video, with the same feature capabilities as voice service. As with the existing early stage mobile videophone service, IMS Advanced Mobile Videophone Service will be a person-to-person transmission, but will extend this to person-to-multi-party transmissions and enables additional functional capabilities, which include:

- *Flexibility to initiate the video component at call set-up or at anytime during the voice call. The video component can be removed, as the user requires.*
- *Ability to set up calls to multiple destinations with the option to display each party simultaneously or in turn, depending upon terminal capabilities.*
- *Ability to receive other video or data information during a video call.*
- *Ability for the call to default to voice only, if the called party is on a network or terminal that does not support video.*

The technical components required to enable the IMS Mobile Videophone Service include

- *A 3G, IMS-capable packet network*
- *Video-capable mobile terminal including a camera, microphone, and codecs*
- *Integration of the call control processes through an easy-to-use, browser-like man-machine interface, which can be customised to suit particular service scenarios*

Table 4.4 summarises the additional benefits IMS brings to the mobile videophone.

[32] Orange in the UK offers a commercial videophone service over its GSM network. This requires both parties to have the same terminal type and is a circuit-switched service using HSCSD. It is therefore more similar to a conventional fixed network videophone service than a mobile videophone service as defined in this report.

Table 4.4. Benefits of IMS to mobile videophones.

Additional Benefits of IMS	Description
Further expanded use in time and place	IMS Advanced Mobile Videophone Service would be accessible from any place within the mobile operator service area, and between other networks. In addition, the possibility exists for exchanging media elements between mobile and fixed Internet environments.
Increased interpersonal connection through terminal interoperability and integration of services	The use of SIP and other existing Internet and video standards will enable increased interoperability between different terminal types. Greater integration of services creates a more natural personal experience.
Guaranteed call completion	Call completion does not depend on the called party having a compatible terminal. Calls can be accepted without the video component, or the video component can be routed to a different destination.

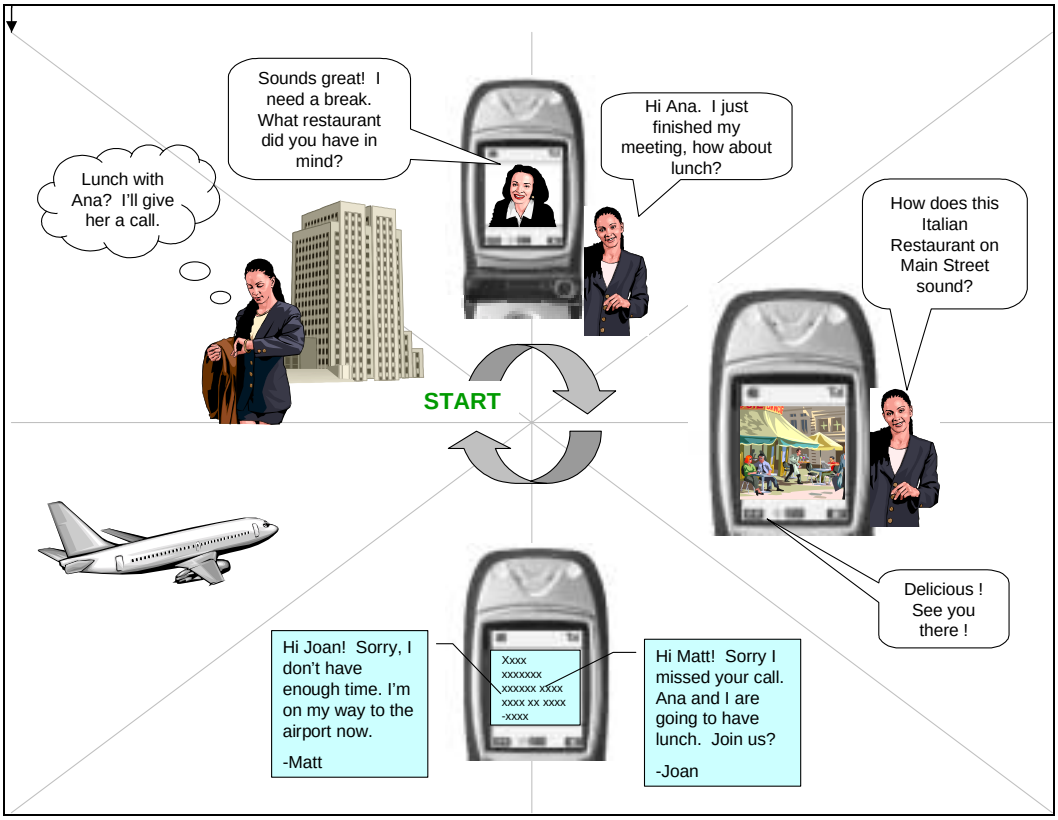
Source: UMTS Forum and Telecompetition, Inc., March 2002.

4.1.4 The End-user Experience

This section uses a consumer scenario to illustrate the difference in the customer experience from using mobile videophone with and without IMS.

Figure 4.5 shows a hypothetical situation in which two friends (Joan and Ana) are making arrangements to have lunch. Their communication is enhanced with a mobile videophone service, because the two friends can see each other as they talk. In fact, Joan can even point her camera at the restaurant under discussion so that Ana could “see” where it was located and whether it was the kind of place she wanted to go. As the phone also has e-mail capability, Joan can also get text messages from other friends. However, since this early version mobile videophone does not provide interaction of video, voice, and text elements, she is not able to respond to Matt’s message immediately or add him onto the call. As a result, she missed the opportunity to have Matt join them for lunch on his way to the airport.

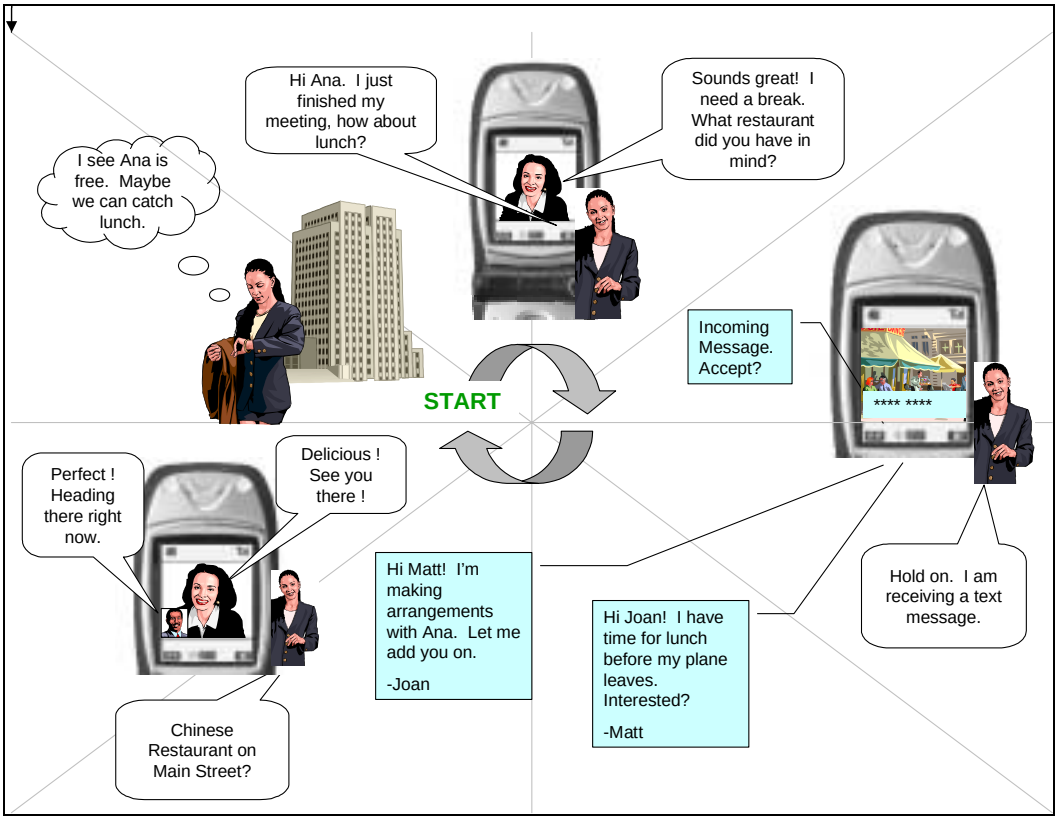
Figure 4.5. Consumer mobile videophone without IMS – the end-user experience.



Source: Telecompetition, Inc., March 2002.

Figure 4.6 shows how that customer experience could be further enhanced with the high level of service integration and interaction of IMS to more closely emulate a true "in person" interaction. Because Joan is using an IMS service including Presence, she knows that Ana is available to receive her call. She is able to respond to Matt's text message while still conversing with Ana. Joan is able to add Matt as a third person into the existing videoconference conversation. As a result, the three friends are able to negotiate a mutually acceptable time and place to have lunch together.

Figure 4.6. Consumer advanced mobile videophone with IMS – the end-user experience.



Source: Telecompetition, Inc., March 2002.

The addition of IMS to the mobile videophone will create a customer experience with many of the advantages of fixed Internet "video chat" services, but in a mobile environment.

4.1.5 The Value of Consumer IMS Advanced Mobile Videophone Service

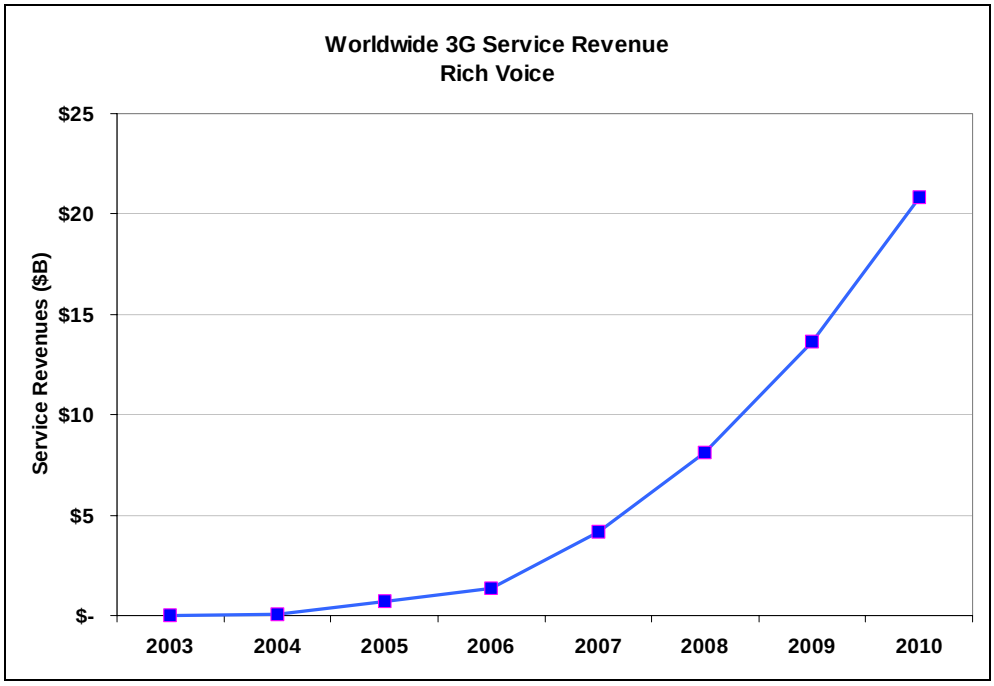
The terminal and network technology required for early mobile videophone service will create a type of market test bed for early adopters. There will likely be many new applications and variations of mobile voice + video services that are now unknown. Therefore, the value of mobile videophone can only be estimated using very limited information on its potential uses.

The UMTS Forum has forecast worldwide multimedia Rich Voice Service revenue for business and consumer provided via 3G networks at $20.8 billion by 2010. This is a relatively small number considering the total 3G revenue opportunity of $322 billion, but it takes into consideration the market and technical challenges associated with delivering real-time mobile videophone service.[33] Some of the revenue that could be attributed to Consumer IMS Advanced Mobile Videophone Service would be included within this Rich Voice category.

Figure 4.7 shows the UMTS Forum worldwide forecast for Rich Voice Service, which would include IMS Advanced Mobile Videophone Service.

[33] The forecast is based upon a very modest penetration of 3G subscribers by 2010, with the greater growth expected after the forecast period.

Figure 4.7. Worldwide 3G Rich Voice service revenue: 2003-2010.



Source: UMTS Forum Report 17 and Telecompetition, Inc. August 2001.

What this forecast does not reflect is the possibility for end users and mobile operators to create entirely new services and uses for combining voice with video content in a mobile environment. An IP network with IMS effectively separates the service application from the underlying network technology, making service development more cost effective for smaller niche applications. In the fixed communications space, as was discussed in Section 2.1, wireline VoIP service providers have introduced a number of new features. A similar growth of new service ideas can be expected in the mobile environment as well.

4.1.6 Summary

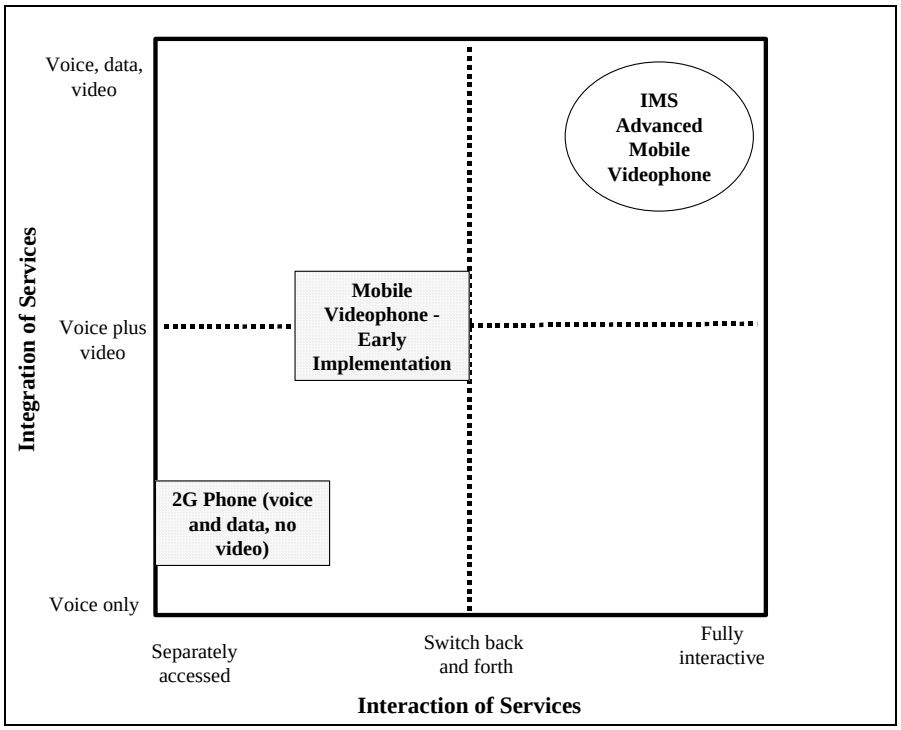
Mobile personal videophone service has been a popular service concept, discussed frequently within the mobile industry and portrayed often in the media. The ability to experience real-time video and audio communications has much public appeal, being depicted often in futuristic motion pictures, for example. However, the commercial attempts for such a service have historically been frustrating, fraught with lack of market acceptance and technical limitations. Nonetheless, the more recent modest success of Internet video chat services and the expectation of increased technical capabilities enabled by 3G technology have renewed hopes that the personal videophone concept when combined with mobility can be made into a commercially viable service.

Mobile videophone service is currently in the early stages of commercial introduction, most notably with the FOMA videophone service in Japan offered by NTT DoCoMo and by Manx Telecom in the Isle of Man. Currently, these early service introductions are limited in functional capability and video quality. The NTT DoCoMo videophone service, for example, does not include other data capability, and the NEC videophone for the Isle of Man has a separate device for the video and telephony portions of the service. However, it is hoped that these early service introductions will serve as technical and market beachheads into more robust services in the future.

The completion of packet-based IP mobile networks, including IMS will more tightly integrate the voice with the video and data components. This will create a consumer experience that is closer to the ideal – being there in person, communicating at will with multiple people without interrupting the natural flow of communications. Users will not have to switch back and forth from one type of media “call” to another; or “hang up” in order to

respond to second messages or calls. IMS Advanced Mobile Videophone Service will provide many of the popular features of fixed Internet "video chat" services into a mobile environment. Figure 4.8 compares significant attributes that define this enhanced, more tightly integrated customer experience achieved with IMS Advanced Mobile Videophone Service with other types of videophone services.

Figure 4.8. Comparison of multimedia functionality.



Source: Telecompetition, Inc., March 2002.

As most mobile operators are planning or building more robust, bandwidth producing 2.5G/3G networks, and the major handset manufacturers have all announced or are planning some type of mobile video handset, technical limitations in these early introduction models should be largely overcome in the next few years. Given the consumer appetite for video products of all types, the industry should expect to achieve at least moderate revenue levels for this service.

4.2 IMS Multimedia Group Broadcast (Business)

Different from the consumer segment, conferencing services of all types have flourished in the business segment, especially in the US that currently has about 75 per cent share of the worldwide conferencing service market of $3.5 billion.[34] IMS Multimedia Group Broadcast is a mobile variation that provides functions similar to Web and video conferencing services for businesses. This section describes the group conferencing industry and how IMS Multimedia Group Broadcast can improve the end-user experience and provide tangible benefits to the enterprise.

4.2.1 Current Business Use of Group Conferencing Services

In the fixed telecommunications industry, there are a number of group communication options available to businesses today. These include the following:

[34] Wainhouse Research, "Teleconferencing Markets and Strategies," 2001.

- *One-way conferencing of audio, video and/or data for presentations and events (e.g., radio and business television).*
- *Interactive, two-way conferencing for meetings and conferences.*
- *Interactive, two-way Web conferencing, which can include audio, video, and/or data/graphics.*
- *One-way Web casting using streaming audio, video, and/or visuals.*
- *Simple person-to-person audio conferencing accomplished with handsets and/or desktop conferencing phones.*
- *Peer-to-peer PC conferencing using Microsoft NetMeeting[35] or similar software.*

Of these options, Web conferencing is the fastest growing segment of the market.[36] Web conferencing is an interactive communications medium where knowledge can be exchanged with anyone that has a phone and a Web browser. Web conferencing enables collaboration by providing visual enhancements to simple audio conferencing. Video (using Web cam) is a user-enabled option. Typical capabilities found in Web conferencing services include the following:

- *Synchronised audio with graphics.* The conference host can control the display of graphics (e.g., PowerPoint slides) to synchronise with what is being said.
- *Full Interactivity.* Audience members can ask questions and receive answers at any time.
- *Audience Polling.* The conference host can pose group questions with the audience responding via text messages back to the server.
- *Participant exchange of messages or data.*
- *For the conference host, an easy-to-use Web interface for establishing and managing the conference.*

In addition, the ability to have near-ubiquitous access and the ability to scale up to very large broadcasts have given enormous appeal to Web conferencing services.

4.2.2 IMS Multimedia Group Broadcast Service Description

Multimedia Group Broadcast is a voice call, enhanced with multimedia elements, which can be either two-way or one-way, 1:n or n:n communications. Other than individual, three-way call, and group broadcasts of SMS messages, similar services are not generally available in a mobile environment. With this service, multimedia content would be broadcast from a central point (server or live conference) to a work group.

IMS Multimedia Group Broadcast adds the mobile environment to currently available conferencing options and provides a new mechanism for communication with employees that have no access to Internet and/or fixed wireline telephony. When used as an extension of fixed group conferencing services, IMS Multimedia Group Broadcast would allow users with mobile devices to participate more fully in a Web conference or Web cast.

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[35] Microsoft NetMeeting is peer-to-peer software that requires a pre-installed PC client, an MCU for multipoint conferences and fairly knowledgeable PC users to set up and use the service.

[36] Wainhouse Research, "Teleconferencing Markets & Strategies," Volume 3, September 2000 predicts Web conferencing to grow at 89 per cent compound annual growth rate (CAGR) through 2005.

The addition of mobility and personalisation to group calling in an IP environment could also create new uses. Two anecdotal examples follow:

- *Enable a school district to notify parents of unanticipated school closures (e.g., extreme weather conditions) or other events through multimedia messages sent via telephone, e-mail, fax, or mobile phone.*

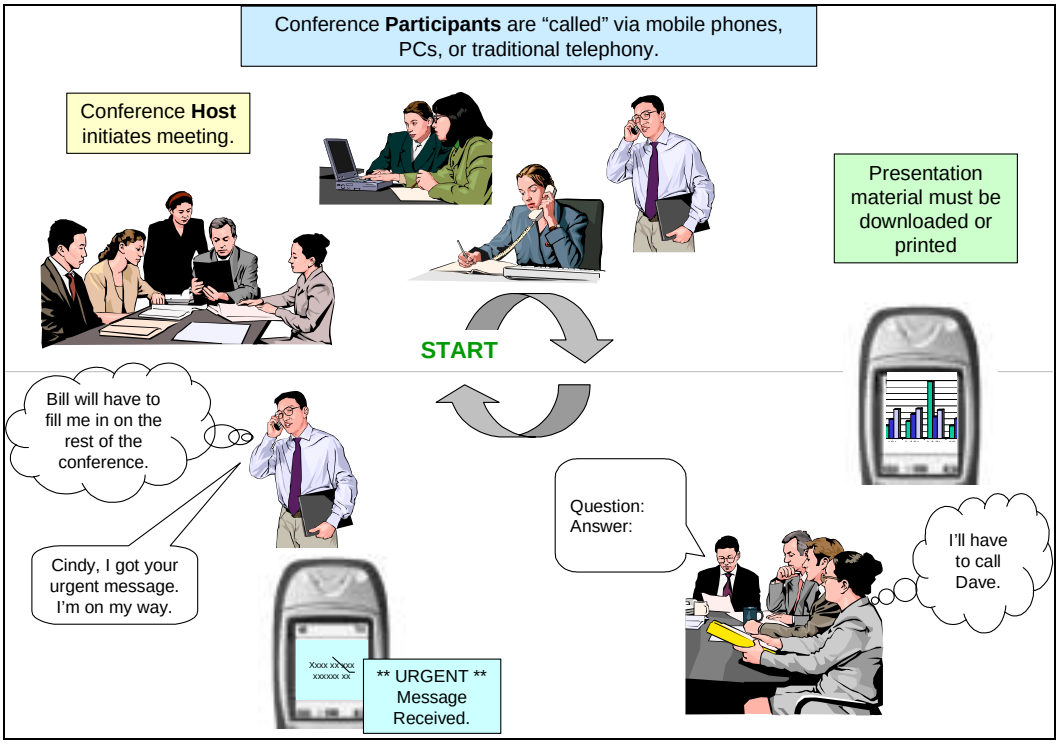
- *Broadcast information to mobile emergency service personnel of an emergency situation including pictures of the area and real-time video instructions.*

4.2.3 The End-user Experience

Figures 4.9 and 4.10 illustrate how IMS enhances the end-user experience in IMS Multimedia Group Broadcast. In this scenario, the company needs to communicate last-minute information about a planned merger to a number of stakeholders including financial analysts, major shareholders, company officers and internal analysts. Many of these individuals are in remote locations without access to a PC. It has been decided to use a Web conferencing service and include participants located in a number of locations with access to different types of fixed (PC) and mobile terminals. The conference is essentially a one-way broadcast from the host (audio and visuals/graphics) to the participants, with controlled ability for participants to ask questions and be queried by the host.

As shown in Figure 4.9, without IMS, participants are notified through e-mail and/or phone calls. The presentation is e-mailed and/or faxed out in advance so that mobile users that have access to a printer can print the document and view it while on the audio conference. Those individuals with access to a PC can view it during the call, seeing the presentation pages as the host scrolls through his presentation. Because the mobile device is not IMS-capable, it does not allow users to participate in the conference while simultaneously attending to other messages or communications. Consequently, one participant must leave the call to attend to other urgent business. Another participant becomes aware that based upon the content of the presentation, she needs to change work plans and to contact “Dave” to discuss the revisions. However, she is not able to make that call while the information is fresh in her mind, but must wait until after the broadcast is finished.

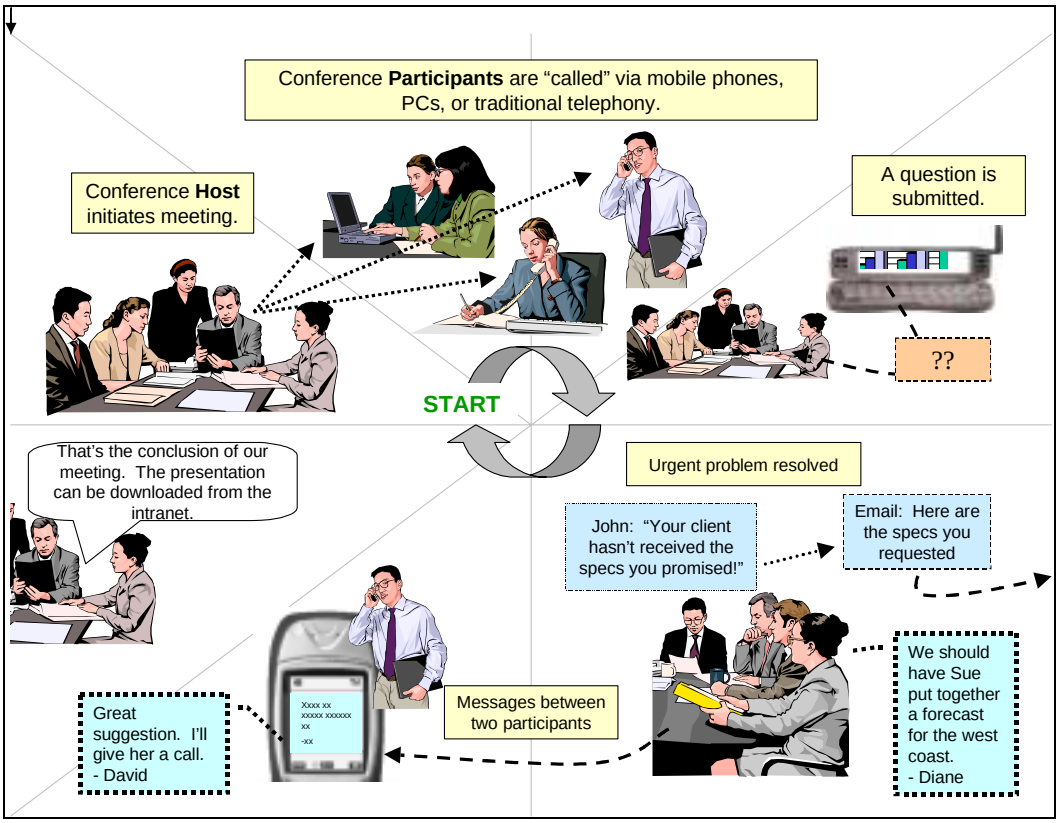
Figure 4.9. Multimedia group broadcast without IMS – the end-user experience.



Source: Telecompetition, Inc., March 2002.

In Figure 4.10, IMS simplifies the invitation process for the host by notifying all participants through one interface using e-mail and visual voicemail. In addition, through the Presence capability, participants busy in other activities can be automatically added into the conference when they are available. Because graphics and audio are integrated, mobile participants can view the presentation in real-time as the host pages through each slide. The interactivity of audio and graphics capability allows one participant to easily attend to other urgent business without leaving the meeting, and for other participants to discuss the contents of the broadcast without leaving the call or disturbing other participants.

Figure 4.10. Multimedia group broadcast with IMS – the end-user experience.



Source: Telecompetition, Inc., March 2002.

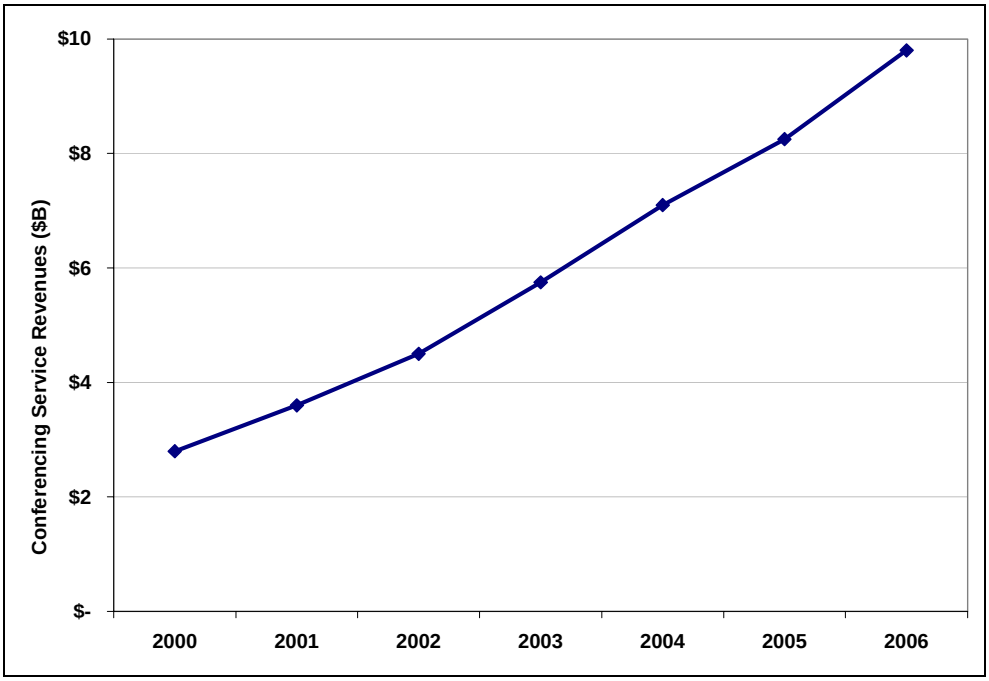
Because IMS tightly integrates voice and multimedia functionality, it allows a more natural flow of communication–one that doesn't require disruption of one activity to conduct another. In addition, IMS allows the mobile environment to be more fully integrated with the fixed Internet networks.

4.2.4 The Value of Multimedia Group Broadcast

The conferencing service market is estimated at $3.6 billion worldwide and expected to grow at a compound annual growth rate (CAGR) of 22 per cent through 2006.[37] By implementing an IP-based network with IMS, the mobile industry is following a parallel path compatible with the technology direction of the fast-growing Web conferencing service providers. Consequently, IMS will help the industry to be positioned for growth opportunities in IP-based conferencing services as well as generate access revenues from usage by the mobile participants. Figure 4.11 shows that the worldwide conferencing service provider revenues from all forms of group conferencing are expected to approach $10 billion by 2006.

[37] Wainhouse Research, "Teleconferencing Markets and Strategies 2001," Volume 3, Executive Summary,

Figure 4.11. Worldwide group conferencing service market: 2000-2005.



Source: Wainhouse Research, LLC, December 2001.

For business users, the economic advantages in using conferencing services include reduced travel, greater intra-company efficiency with geographically dispersed work groups, and communications cost reduction through use of Internet-based services. According to one Web-conferencing vendor, use of a Web conference can reduce attendee costs by 80 per cent while increasing attendance and sales leads.[38] With IMS, the mobile industry can extend these benefits to mobile business users as well.

4.2.5 Summary

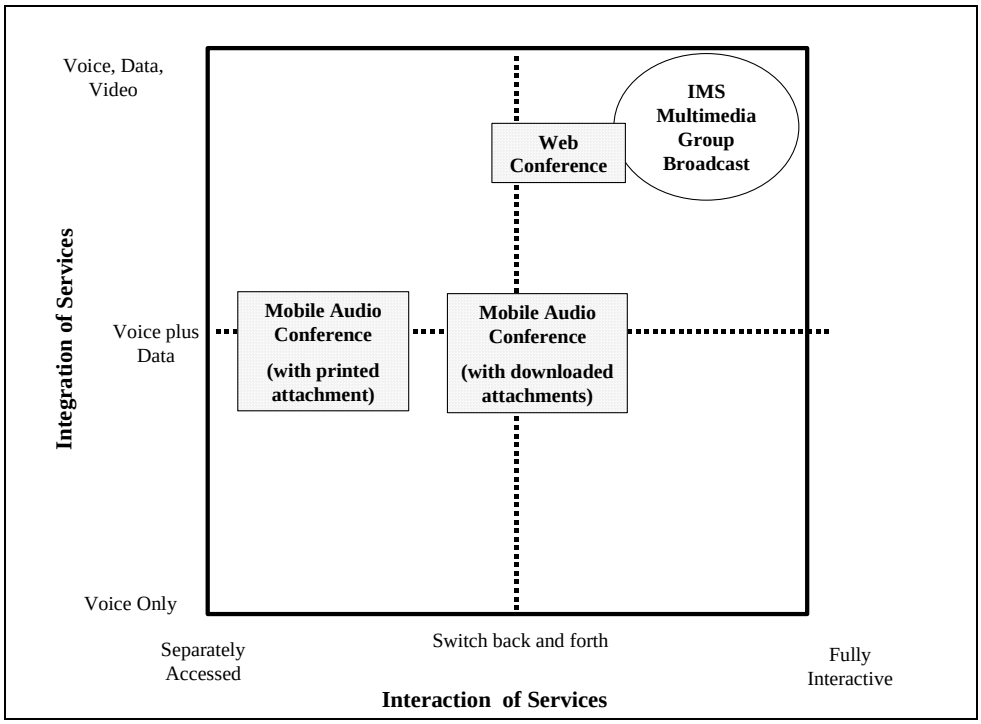
Conferencing services are traditionally offered via fixed communications networks, with participants having the option to call in for the audio only, on either a fixed line or a mobile phone. The introduction of IP networks in the fixed environment has created new opportunities for conferencing service providers who can offer integrated voice, data, and video conferences on-demand, using a commonly available user interface (the Web). While audio-only voice conferencing will still command a significant portion of the revenue, the faster growing areas are Web-based services and streaming media that are increasingly including video.

With IMS Multimedia Group Broadcast, the advantages of fixed conferencing services can be easily extended to include the mobile/remote worker as well. For the individual mobile worker, IMS Multimedia Group Broadcast allows him to participate more fully in the communications process and/or have access to information previously unavailable while mobile. In addition, IMS creates a more user-friendly experience that more closely emulates “being there.” IMS-capable mobile users can conduct multiple tasks while participating in the same conference, in much the same way as their co-workers accessing the conference via a PC. For the enterprise, IMS Multimedia Group Broadcast simplifies communications processes when participants are in different locations with access to different types of terminals and networks.

Figure 4.12 illustrates how with IMS Multimedia Group Broadcast, the user experience is much like that of a PC-based Web-conferencing user.

[38] Presentation by Placeware at Supernet 2002, January 22, 2002.

Figure 4.12. Comparison of multimedia functionality.



Source: Telecompetition, Inc., March 2002.

4.3 Mobile Gaming

By most industry projections, mobile entertainment, particularly mobile gaming, represents the 3G-service area with the highest user interest. A number of concurrent factors contribute to the strategic importance of mobile gaming for mobile operators:

- Mobile entertainment is an additional revenue-generating service, totally separate in end users' minds from their voice communications usage.
- The availability of smarter mobile handsets allows for the development of mobile games having a richer user experience, more closely comparable to off-line and wired Internet gaming.
- Non-wireless gaming (via handhelds, video game consoles, and PCs) amongst mobile users has increased dramatically over the last few years. According to a recent US survey, nearly 40 per cent of mobile users play games on electronic devices for at least one hour per week.[39]
- Mobility brings a unique game-play element which end users find appealing and has yet to be fully leveraged by game developers (though considerable development and experimentation is underway)

Mobile games fall into three broad categories as seen in Table 4.13.

Table 4.13. Mobile games categories.

Number of Players	Description	Gaming Approach
Single player	A single user plays the game alone	Embedded or downloaded to handset

[39] Telephia, "Wireless Data Users Survey: National Results Q2 2001. "

Number of Players	Description	Gaming Approach
Two player	Two mobile users play against each other simultaneously	Peer-to-peer or server-based, requiring a communications link between players
Multi-player	Three or more mobile users engage in simultaneous game play	Peer-to-peer or server-based, requiring a communications link between players

Source: UMTS Forum and Telecompetition, Inc., March 2002.

Both embedded and peer-to-peer games are limited by the memory and processing power of the handsets. In contrast, because most of the game logic resides on a game server in the network, server-based games allow for a richer gaming experience. Most of the successful wired-Internet multi-player games (i.e., Ultima Online® and Quake®) are server-based games.

To date, the majority of existing mobile games are single-player embedded (or downloaded) games, allowing the mobile user to only play alone. The current peer-to-peer games primarily rely on text messaging, because this capability is the most widely supported by both the handsets and mobile networks. Though games of this type are not particularly complex, they illustrate the tremendous desire of gaming content developers and mobile service providers to quickly exploit the deployment of new capabilities in the mobile network.

Multi-player gaming is thought by most to be the “killer” mobile-gaming application. Like multi-player gaming on the wired-Internet, multiple players in multiple locations are able to engage in game play. But unlike the wired Internet, the players are mobile, which allows users to play wherever, and whenever they desire.

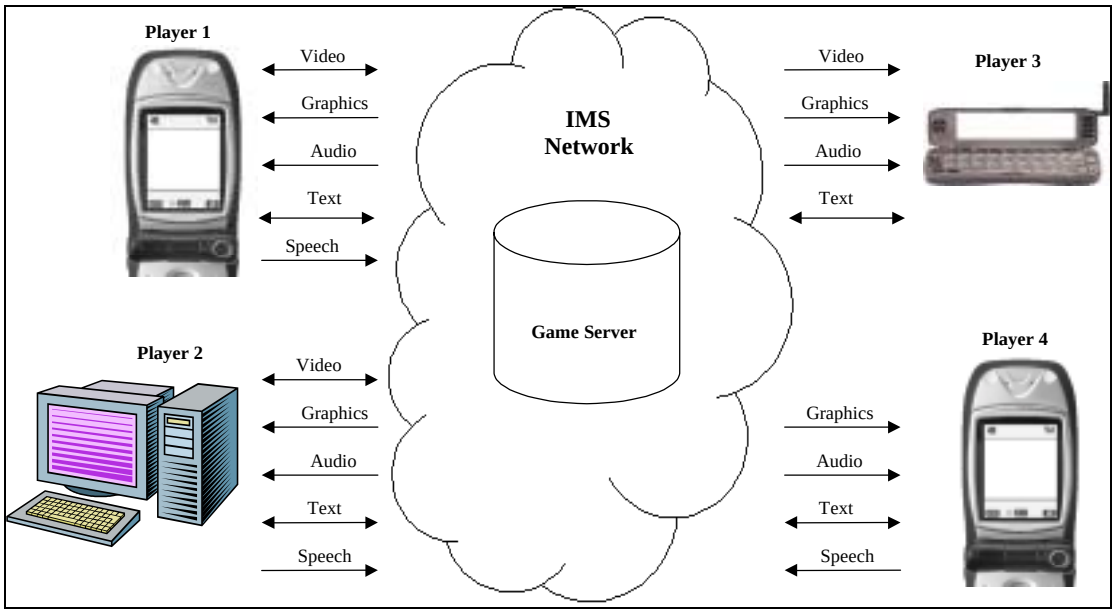
4.3.1 IMS Mobile Gaming Service Description

Multi-player server-based games typically use far greater network capacity than peer-to-peer games because of the large, continuous information flow between the server and clients. However, it is still likely to be popular because of the near infinite variety of games that can be offered from servers.

A key requirement provided by IMS for all gaming scenarios is the possibility for players to communicate in parallel with the game play by voice, text, or video and to do so by choice as a whole group, as a team or individually. Thus IMS has the capability to set up the calls as groups or "private chat," as well as the game session.

As shown in Figure 4.14, multiple devices and media types are supported by the IMS multi-player gaming service. Upon login to the gaming service, player device characteristics are identified, allowing the gaming server to optimise each player’s game experience for that player’s respective device.

Figure 4.14. Multi-device mobile gaming with IMS.



Source: Telecompetition, Inc., March 2002.

For server-based gaming, depending on the media richness and the latency demands of the game, there could also be the requirement to deliver QoS levels approaching that for real-time speech itself (i.e., for the game itself and irrespective of the communications channel described above). The IMS-based network could provide for these requirements. Presence and location information could also be integrated through the use of IMS, giving game developers a unique set of capabilities to incorporate into future games.

The future IMS multi-player games service will not only incorporate the advanced capabilities described for both Advanced Mobile Videophone and IMS Multimedia Group Broadcast, but must also seamlessly integrate sophisticated application (e.g., gaming) servers and clients. Critical IMS enabling capabilities include:

- *Flexibility to initiate the video component at call set-up or at anytime during the voice call. The video component can be removed, as the user requires.*
- *Ability to set up calls to multiple destinations with the option to display each party simultaneously or in turn, depending upon terminal capabilities.*
- *Ability to receive other video or data information during a game session.*
- *Ability to set up calls to non-game-playing users and share any of the media streams currently active in the game.*

The technical components required to enable the IMS mobile multi-player gaming service include:

- *A 3G, IMS-capable packet network.*
- *Ability for the game server to set up separate QoS requirements for each player's device.*
- *Mobile terminal with high-resolution display and high-processing power.*
- *Integration of the call-control processes through an easy-to-use, browser-like man-machine interface, which can be customised by the gaming service provider to suit particular game-play scenarios.*

4.3.2 End-user Experience

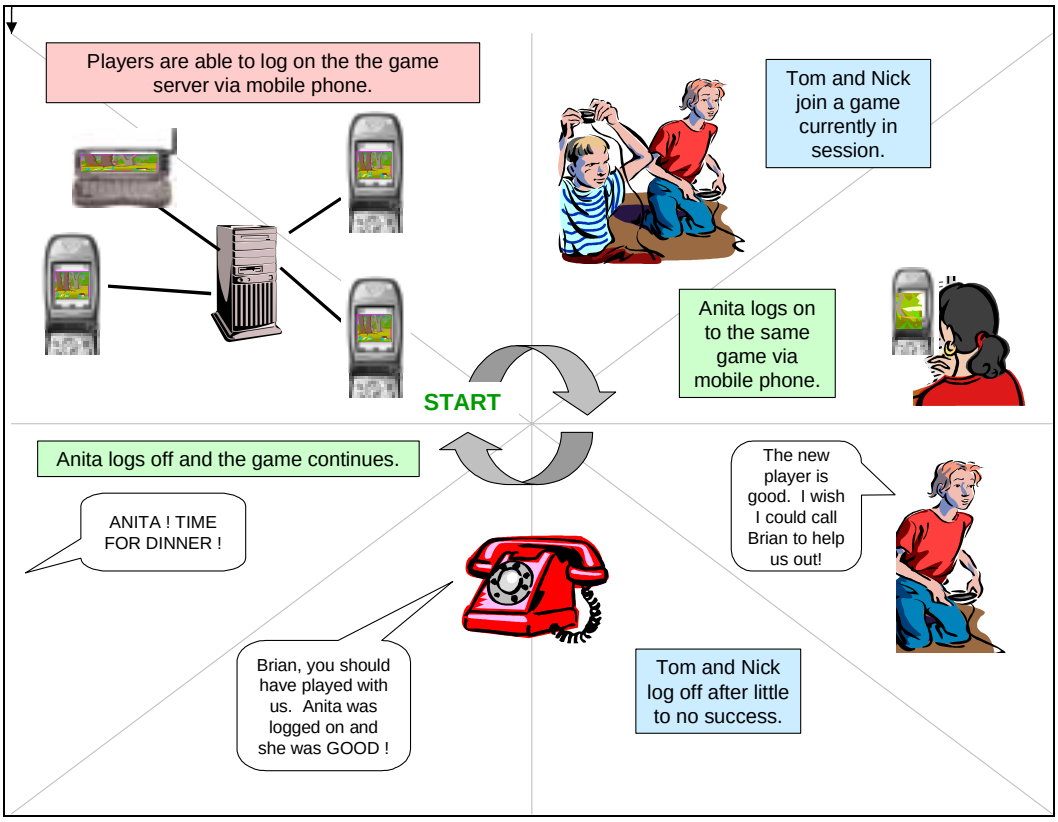
In this scenario, we define a server-based, multi-player, multi-platform game called "Treasure Tag." Users play in teams of four against other teams. The game service supports players on a wide variety of devices: handsets, PDAs, and PCs. The object of the game is to collect the most treasure objects hidden in a forest within 10 minutes. A player can "tag" an opposing team player to remove them from the game and capture any treasure that player is carrying.

The game is designed to provide a significant competitive edge to those players who operate effectively as "teams" through team communications and developing joint tactics. The visual display seen by each player is limited to that seen by that player's character in the game. As a result, players must communicate with other teammates to share information while navigating the game space (e.g., "Hey Bill, there's someone hiding behind that tree on your left!").

There are always a lot of active game sessions on the Treasure Tag game server. At a Web service operated by the game application provider, interested potential players can choose a game session and also find other gamers with whom to form a team. There is a text and voice chat service where potential teammates can learn to know each other.

Without IMS, the complexity of the multi-platform, multi-player game is limited (Figure 4.15). Game play would rely on text messages and graphics since only these media types would be supported by the various devices and their network connections. In order to call or conference in another person to get advice or to "show off," a player would have to use a separate device. Sharing of the video and graphic images with another person would be even more difficult.

Figure 4.15. Mobile gaming without IMS – the end-user experience.



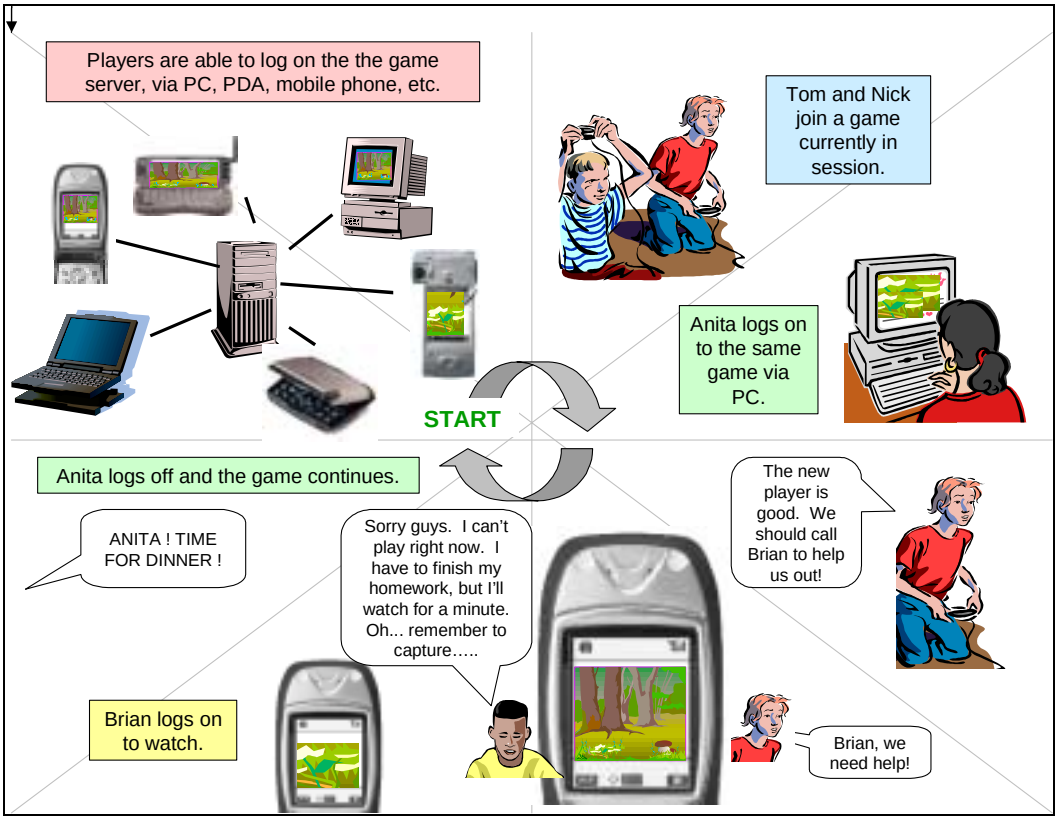
Source: Telecompetition, Inc., March 2002.

However, in an IMS environment, the Treasure Tag game would fully utilise the advanced features of IMS in a number of ways:

- Device-specific characteristics, user preferences, and network QoS characteristics are registered with the game server when a user logs into the service, allowing the game server to tailor the media types and quality delivered to that user
- Users can play the game using a variety of IMS-capable devices (handsets, PDAs, and PCs), allowing wired Internet and mobile users to play together
- Teammates are able to communicate with each other one-on-one or one-to-many (the team) through voice, text, or video, while playing the game and without that communication being "heard" by other players (e.g., private group call)
- A player can choose to broadcast a message to all opposing team players (i.e., "We are the champions!")
- During the game play, a player can add additional users to the session, allowing them to view their video/graphics view of the game space

As shown in Figure 4.16, multiple devices are supported by the IMS multi-player gaming service. Upon login to the gaming service, player device characteristics are identified, allowing the gaming server to optimise each player's game experience for that player's respective device

Figure 4.16. IMS-based mobile gaming – the end-user experience.



Source: Telecompetition, Inc., March 2002.

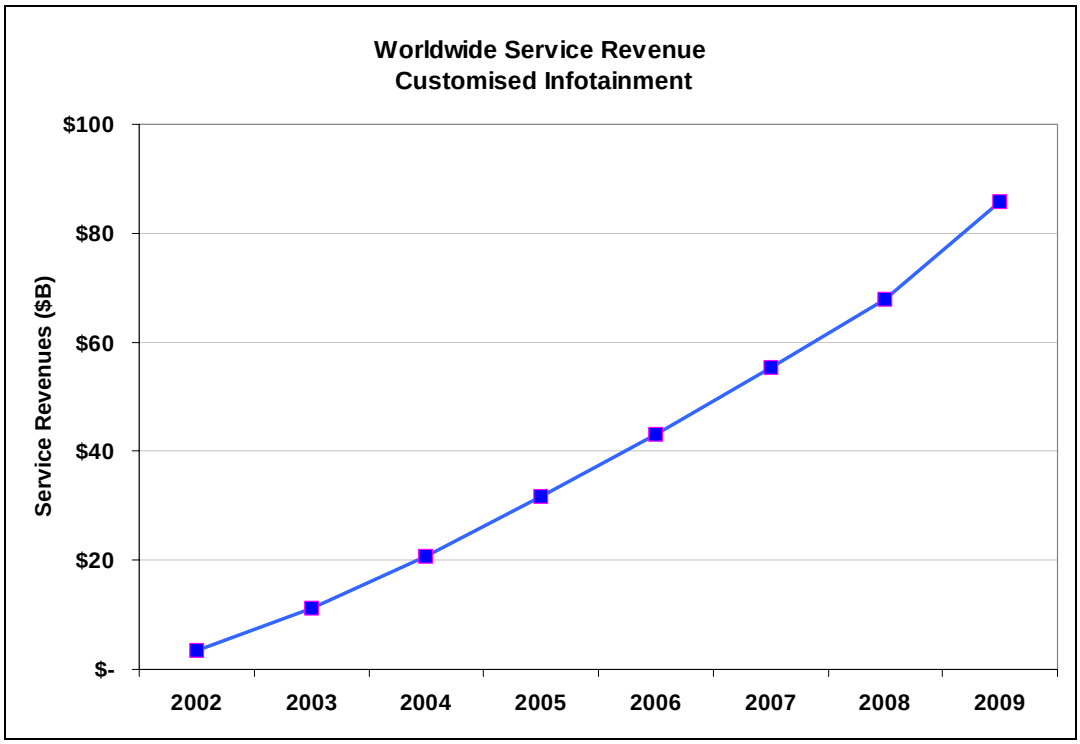
With IMS (Figure 4.16), the player's user experience is much richer, regardless of that player's device. Using video, players can see other players that have video camera capability. Voice is supported, allowing players to verbal communicate with their teammates and opponents while playing the game. Non-playing users can also be easily added to the session.

All in all, these factors contribute significantly to the entertainment value of the game experience. A richer user experience increases the perceived value (user's willingness to pay) for the game and encourages more frequent usage.

4.3.3 The Value of IMS Mobile Gaming

Gaming services will be one of the key drivers of consumer mass-market mobile data services. For example, over half of NTT DoCoMo i-mode subscribers use gaming services.[40] According to a recent US survey, nearly 40 per cent of mobile users play games on electronic devices for at least one hour per week.[41] Figure 4.17 shows the UMTS Forum forecast for consumer Customised Infotainment,[42] a 3G service with a significant gaming component. At about $85 billion in 2010, Customised Infotainment represents over 25 per cent of the $322 billion 3G revenue opportunity.

Figure 4.17. Worldwide Customised Infotainment (IMS) revenue: 2002-2010.



Source: UMTS Forum Report 17 and Telecompetition, Inc., September 2001.

While it is possible to forecast revenues for the entire group of Customised Infotainment services, identifying the contribution of specific services, like mobile games, is problematic. As in the wired-Internet world, some games will likely be included in the user's service bundle. More advanced or challenging games may be premium priced. Mobile operators will attempt to optimise their infotainment services “bundle” rather than pricing individual “basic” service offerings. In any case, mobile gaming will continue to play an integral role in accelerating user adoption of 3G services.

4.3.4 Summary

The mobile-gaming segment of mobile entertainment represents a significant revenue driver for mobile operators and content providers. As evidenced by the continued growth of the hand-held gaming market (e.g., Game Boy), users enjoy the ability to play games while mobile, for passing the time or for entertainment. Even though the mobile games available

[40] ARC Group, “Mobile Entertainment – Opportunities, Challenges, and the Path Forward.” June 2001.

[41] Telephia, “Wireless Data Users Survey: National Results Q2 2001,“ June 2001.

[42] Customised Infotainment is one of the six service categories identified by the UMTS Forum. It is a mass-market consumer service that will include a significant gaming element as well as other information services.

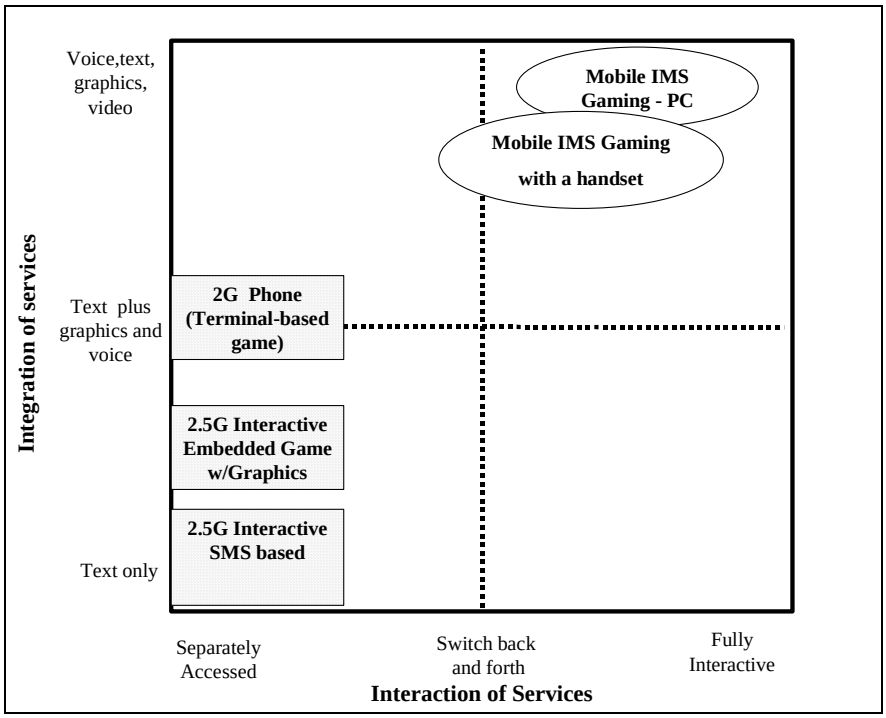
today are relatively simple, they are pushing the limits of the current mobile infrastructure and handsets. Content providers are continuing to create new games that leverage new network and handset capabilities, as they become available.

The richness of the mobile-gaming experience is limited by the existing network and handset functionality and in the ability of content developers to create and deploy the games. IMS provides the underlying functionality to transform mobile gaming to the next level. Gaming experiences comparable to those obtained off-line and in the wired world can be provided to mobile users. The IP functionality of IMS more easily facilitates the adaptation of wired Internet-based games, particularly multi-player games, for mobile users. Additionally, deployment of IP mobile networks, including IMS, will expand the creative horizon for gaming overall through several unique features:

- *Multi-device capabilities (i.e., mobile and non-mobile users can play each other)*
- *Presence (allows users to see if another teammate or favourite opponent is available to play a game)*
- *Location-based parameters (allows the creation of games that take into account the user's proximity to specific physical locations or other potential game players)*

Figure 4.18 compares the multimedia functionality of the various mobile gaming alternatives, showing IMS-based gaming to deliver higher service interaction and integration.

Figure 4.18. Comparison of multimedia functionality.



Source: Telecompetition, Inc., March 2002.

Enhancing the mobile user's gaming experience will likely increase the consumer acceptance for 3G services in general. The content development community is quick to exploit new functionality. In the non-mobile world, users are eager to acquire new gaming products, as they become available. IMS provides the foundation and catalyst for realising the significant revenue potential of mobile gaming.

4.4 Summary – End-user Benefits from IMS

As illustrated in this section, mobile services that combine voice and other multimedia elements such as video, graphics, sound, and other data can be provided in some manner without using an IMS capable network. However, the addition of IMS provides a greater degree of service integration and interaction, creating a more enhanced experience that more closely emulates the natural communication flow. For example,

- *Users are able to simultaneously conduct voice or videophone calls while responding to e-mails*
- *Corporate group conferences can extend multimedia capability more easily to remote or mobile employees*
- *Mobile entertainment and gaming are more enjoyable, because users can collaborate with each other during play*

These are personal benefits that end users will value. In addition, users also enjoy the following general advantages through an IMS capable network:

- *A more tightly integrated and consistent experience across wireline and mobile services due to the interoperability of IMS-capable networks with other IP networks*
- *Quicker service creation – availability of more and better customised services in months instead of years*
- *Web-like graphical capabilities on the handset that increase ease of navigation and usability*

5 Conclusions

The marriage of multimedia content with mobility represents revenue opportunities to the mobile operator estimated at $322 billion worldwide by 2010. However, past experience has shown that end users will resist adopting new technology services that are either too complex or too cumbersome. At a minimum, most mobile data users will demand the same quality, ease-of-use and ubiquity that they currently experience in mobile voice services. The end-user experience counts. The quality of the end-user experience will ultimately determine the end-user willingness to adopt, pay for, and continue to use a service. Seemingly subtle differences do matter in using a service at all, and can be the deciding factor for the end user in making competitive choices.

Several factors contribute significantly to the quality of the user experience and therefore significantly affect user adoption and operator revenues:

- ***Service Transparency****: the result of seamless integration and interaction of services that allows users to perform their desired tasks easily and naturally*

- ***Service Customisation****: allows users to choose the service to more closely match their individual needs and work style from a wide selection of service possibilities, and to customise that service through an easy-to-use Web-like interface*

- ***Global Roaming****: allows users to use their advanced services anywhere, across multiple operator networks*

Fundamentally, IMS is about service creation. Though the technical feasibility exists to create innovative services using a proprietary, non-IMS platform, the ability of the operator to continually satisfy user expectations, over time, in these areas is limited. IMS enables mobile operators and other industry participants to quickly and successfully address user needs in each of these areas.

- ***Service Delivery****: IMS allows mobile operators to create and deliver more services more quickly*

- ***Service Customisation****: IMS increases the operator ability to provide services to end users more quickly and with a greater degree of customisation to smaller segments*

- ***Service Ubiquity****: IMS increases the operator ability to offer a consistent experience between mobile and other IP networks*

In order for the projected $322 billion revenue opportunity to be realised, mobile operators must utilise the power of IMS to create well integrated, easy-to-use services that enhance rather than frustrate the end-user experience.

The IMS platform provides that enhanced experience and is the gateway to future 3G revenue opportunities.

5.1 Operator Challenges

IMS represents a challenge and opportunity to operators. The evolution of mobile networks to 3G/UMTS IMS-based platforms has profound implications for the mobile industry as well as the individual mobile operator. Technology and adoption issues aside, the adoption of IMS has the potential to dramatically alter the value chain of the industry as a whole. While this report has focused on the enhancements to the end-user experience, the following observations should be noted and considered for further evaluation. In addition, a technical annex, “Technology Enablers” is also available for this report.

- IMS-based voice quality must be at least comparable to 2G mobile voice and be as spectrum efficient as 2G. Some of these technical issues are still being resolved.
- The interoperability of IP networks and the rapid service creation enabled by IMS effectively reduce the market entry barriers for new or additional service providers. Incumbent mobile operators will face new competitive threats as well as find new opportunities for partnership and service innovation. The existing industry structure and value chain will change.
- Service ubiquity and global roaming may not be achieved in the short-term because operators have varying deployment strategies and timetables. The issue of how much ubiquity, by customer segment and by market, is needed to prompt market adoption requires further analysis.
- Acceptable quality of service and security are critical functions for user adoption of any IMS services.
- There are some technology enablers for which the industry has to decide upon a deployment policy, either collectively or as individual operators. These issues are addressed more fully in the Technology Enablers Annex to this report. These include:
    - *IP transport in the RAN (backhaul links).*
    - *"IP based RAN" (efficient IP over the air including techniques such as Robust Header Compression).*
    - *RAN capacity enhancing techniques such as High Speed Packet Downlink Access.*
    - *SIP Proxies in the core network.*

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