Report No. 27
Report from the UMTS Forum

Strategic Considerations for IMS – the 3G Evolution

UMTS Forum, January 2003

2.3.1 Service Capabilities for the Five Scenarios

The five scenarios have differing network deployment strategies, cost structures and service capabilities. These are described in detail in Section 5. These differing service capabilities support the overall market strategy, value proposition and revenue potential described for each scenario. The service capabilities for each scenario are discussed in more depth in the remainder of the report, but are briefly introduced here to aid in reader understanding.

No IMS – Keep it Simple

This is the situation whereby the operator makes a clear decision not to deploy IMS for some reason. However, in the model, it is assumed that a full 3G network is required and that it is implemented in a way that enables full interworking with other fixed and mobile networks, i.e. according to 3GPP Release '99.

In this and all the scenarios, a two year gap has been assumed between the start of network deployment and the launch of revenue generating services. This time, which in practice will vary between different operators and suppliers, is to allow for the process of implementation, deployment, tuning, optimisation and marketing. Thus, if the 3G network was deployed in 2003, then revenue-generating services would start in 2005.

The 3G/UMTS network provides conventional circuit-switched voice plus broadband packet data services. Furthermore, the incumbent operator in this scenario has a 2G network that can also deliver voice and data (2.5G). IMS services such as Rich Voice are not available.

As was pointed out in Report #20 and the Technology Enablers Annex, the long-term direction of fixed, mobile and corporate networks is to move away from ISDN based technology to all-IP implementation. This will ensure the integration of voice communications with data and information services, so enabling advanced services to be provided together with improved efficiency obtained by having only one integrated network to manage rather than two networks employing different technology. However, the No IMS example has particular value in this report, because it is the baseline against which the other scenarios are compared with regard to costs and revenues, and because it is an option that could be considered by some operators.

Full IMS – Technology Follower

In this scenario, the operator deploys both 3G and IMS. Both are implemented in a way that enables full interworking with other fixed, mobile and IP networks. Because this operator finds it most valuable to use standards-based technology IMS is deployed as soon as commercially available. The assumption has been made that the deployment is fully according to 3GPP specifications (Release 5 and 6), including IP based Radio Access Network (RAN) and that the capacity and quality of the IMS network is that it can carry a significant proportion of the voice traffic of the mobile network. From the IMS service date, the scenario allows IMS services such as Rich Voice to commence.

Closed IMS – Wildcard

In this scenario, the operator deploys both 3G and IMS. However, both are implemented in a way that discourages or even prevents full interworking with other fixed, mobile and IP networks. The operator believes that by deploying a network ahead of available standards or with features that are not included in any standard, he will be able to deliver unique services ahead of the competition that more exactly meet his target market's needs. A particular example might be an operator who would deploy a Microsoft NetMeeting server together with some of the IMS capability and other proprietary technology in order to provide a popular service to his users. Thus the Closed IMS scenario could be regarded as a competitive threat to less adventurous providers. There is no deliberate intention to prevent interworking, but the likelihood is that technological incompatibilities due to the early non-standard deployment would act to make interworking difficult.

Therefore, 3G network is deployed in a way that restricts interworking for data services as well as for IMS Services (Rich Voice). However, it is assumed that voice phone calls would interwork with other

networks (particularly fixed networks) and that if a 2G network is available, then it would not be restricted in any way. While the scale and complexity of this network is projected to be similar to standard IMS deployed according to 3GPP specifications, it might use some proprietary technology or it might not include some 3GPP technology such as IP based RAN, enabling it to be deployed somewhat earlier.

Only IMS – Market Follower

In this scenario, the operator deploys both 3G and IMS, but only when IMS is commercially available. Because IMS then provides for voice as well as the more advanced data services, there is no need to deploy the Circuit Switched domain of the 3G network. However the network is implemented in a way that enables full interworking with other fixed, mobile and IP networks.

The IMS network in this scenario will be deployed exactly to 3GPP specifications (including IP RAN), which have not yet been completed, which means that deployment cannot commence until 2007, with both 3G and IMS services starting later. In the scenario we have assumed an incumbent operator and so voice and some data services will be available from the existing 2G/2.5G network in the interim period before IMS and 3G are available. This scenario provides for full quality and capacity for a substantial part of the voice traffic on IMS and interworking with other networks when available.

Early IMS – Market Leader

In this scenario, the operator fully deploys both 3G and IMS with full interworking with other fixed, mobile and IP networks. However, prior to the availability of the fully specified IMS system, the operator also deploys a small subset of the SIP/IMS network without the full features of 3GPP IMS, but with sufficient capability to allow the start of a few early innovative but limited IMS services such as the dispatch service (Push-to-Talk) described in more detail in Section 3.1.3. This network strategy is consistent with the operator's "First to Market" and intention to create competitive advantage. We have assumed that an effective SIP/IMS subset could be deployed as early as 2004, either onto an existing GPRS network. EDGE or the Release '99 3G network deployed in 2003.

It is predicted that the capability of these early limited IMS services would be progressively improved. So for example, at the start of the early deployment, the SIP/IMS Push-to-Talk service would likely be more suitable for consumer users. However at the time that a fully specified IMS is available (2007 for Rel.5/6 and IP RAN), the SIP/IMS Dispatch service should be suitable for professional users such as the emergency services etc and the IMS network would then also have the quality and capacity to carry a substantial part of the conventional voice telephony services also.

The network deployment decisions and service capabilities of each scenario are further discussed in Section 5.

4 Network Considerations to Add IMS

This section looks at the changes that are necessary in order to add IMS to a UMTS network. The intention is to provide an indication to the industry of the cost needed for such an investment, which can then be balanced against the increased revenues from new IMS services. In this report, five different deployment scenarios for IMS are presented. The intention is to analyse the five scenarios in terms of a simplified, comparative cost and revenue profile.

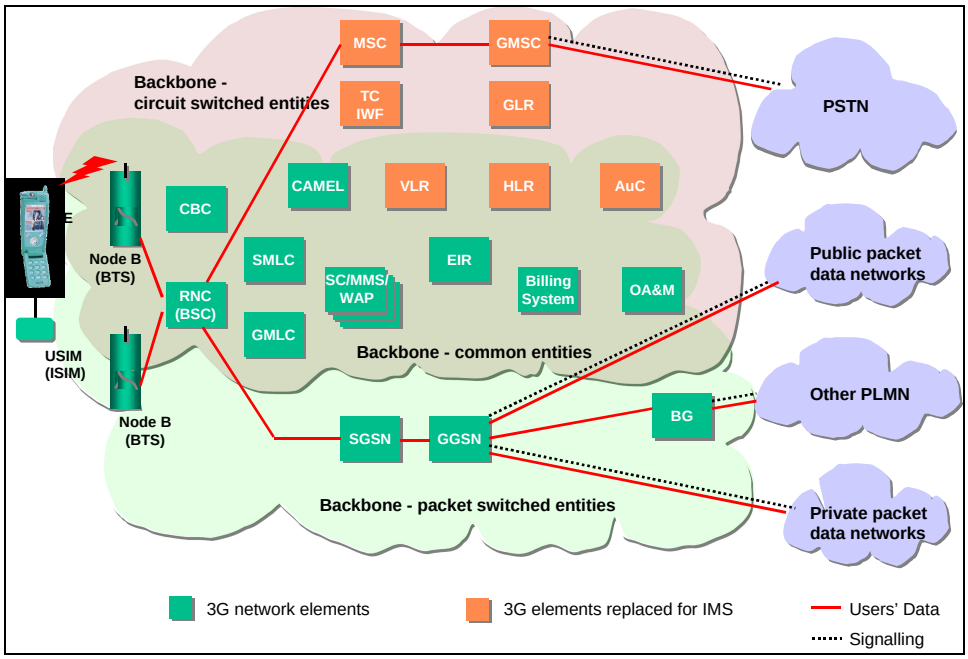
In order to estimate the investment profile for each of the five scenarios, we have first examined the two known and standardised network architectures, UMTS with and without IMS. A methodology for estimating the cost of IMS networks is then described. From the two basic networks illustrated, we have then looked at the variations in order to arrive at the profiles for the five different deployment scenarios.

The challenge has been to produce cost information for IMS at a time when the industry probably does not yet have prices and in a situation where prices for network equipment are not made public. However, the cost of deploying a UMTS network will now be familiar to operators and to an extent, the figures are approximately known to the technical press and have been published. In brief, then, the methodology is to compare the IMS platforms with the UMTS platforms on the basis of roughly equivalent complexity and then to apply this to each of the network architecture variations that result from the different deployment scenarios. One of the key differences between the five deployment scenarios is that the TIMING of the investment in both 3G and IMS platforms differs. The subsequent presentation for each deployment scenario model shows a relative cost and the timing of each tranche of investment.

4.1 UMTS Baseline Network Architecture (without IMS)

UMTS (3G) is the baseline against which IMS deployments will be compared. It happens also to correspond to one of the deployment scenarios – “No IMS”. A generic network architecture is shown in Figure 4.1. It is based on Release 1999 (Rel-99) of the UMTS standard published by 3GPP and the acronyms are explained in the appendix (Section 9.4). No attempt has been made to model a real physical deployment or to scale the relative numbers of the different network elements required. The platforms needed to provide services and content are also shown as well as the end-users’ traffic flow. However, the complex signalling data flow is only shown by the network “clouds”, apart from an initial connection between the mobile network (PLMN) and each of the external networks. It shows a fundamental feature of pre-IMS networks, namely that the signalling data follows the same path as the traffic. The call control and the service provisioning software are both integrated in the same platforms, making the development of new telephony services costly and time consuming.

Figure 4.1. 3G/UMTS Reference network architecture (Rel-99).



Source: 3GPP and Telecompetition, Inc., September 2002.

4.1.1 Network and Deployment Description

The network architecture and the following descriptions are based on the latest 3GPP specification to describe the Rel-99 implementation[4]: The pre-IMS UMTS network incorporates two domains: the Circuit Switched (CS) domain based on 2G GSM technology and the Packet Switched (PS) domain based on GPRS (2.5G). The 3G Radio Access Network (RAN) is newly introduced in UMTS. The elements, shown in Figure 4.1, which make up the cost of deploying a 3G/UMTS network, are identified in Table 4.2.

[4] TS 23.002 version 3.5.0 and to a lesser extent on the GPRS Service Description Stage 2 in TS 23.060 version 4.5.0 (actually a Rel-4 document).

Table 4.2. Key components of a UMTS network.

Domain / Location / Function	Name	Type	Comment
Circuit Switch (CS)	MSC – Mobile Switching Centre	Large network element	
	GMSC – Gateway MSC	Large network element	
	GLR – Gateway Location Register	Network element with database	
	TC/IWF The Transcoder and Interworking Function	Plug-in cards/module	
Circuit Switched (CS) and Packet Switched (PS)	HLR – Home Location Register	Network element with database	
	VLR – Visitor Location Register	Network element with database	
	AuC – Authentification Centre	Network element with database	
	EIR – Equipment Identity Register	Network element with database	
Packet Switched (PS)	SGSN – Serving GPRS Support Node	Network element	
	GGSN – Gateway GPRS Support Node	Network element	
	BG – Border Gateway	Network element	
Radio Access Network (RAN)	BSC – Base Station Controller or RNC – Radio Network Controller	Large network element	
	BTS – Base Transceiver Station or Node B	Network element	
Mobile Station	ME – Mobile Equipment	Subscriber terminal (“handset”)	Not included in cost analysis
	USIM – UMTS Subscriber Identity Module	Card in terminal	Not included in cost analysis
Messaging Services	SC/MMS/WAP – Centres and gateways for messages	Network elements	
	CBC – Cell Broadcast Centre	Network elements	
Location Data	SMLC – Serving Mobile Location Centre	Network element with database	
	GMLC – Gateway Mobile Location Centre	Network element with database	
CAMEL	CAMEL – Customized Applications for Mobile Enhanced Logic	Software	
Management Functions	OAM&P – Operations, administration, maintenance and provisioning systems / platforms	Software	Not included in cost analysis
	Billing system	Software	Not included in cost analysis
Transport	Backbone and backhaul circuits	Transport facilities – often leased from wireline operators	Not included in cost analysis
Other	GCR – Group Call Register for number portability, OSA servers, buildings, planning, network, optimisation, service development toolkits, etc.	Varies	Not included in cost analysis

Source: UMTS Forum and Telecompetition, Inc., January 2003.

4.2 UMTS Architecture (With IMS)

The architecture presented here for the main comparison with 3G assumes that the existing 3G/UMTS network is upgraded to include IMS, including multimedia call control based on the Session Initiation Protocol (SIP) from IETF and that legacy mobiles supporting circuit-switched voice are still required. It also happens to correspond to one of the five deployment scenarios “Full IMS”.

A complete generic network architecture is shown in Figure 4.3. It is based on Release 5 (Rel-5) of the UMTS standard published by 3GPP and the acronyms are explained in the appendix (Section 9.4). It shows the platforms that have been added in order to implement the IMS core network as well as the 3G platforms that require substantial upgrade in order to support it. These are mainly platforms within the Packet Switched domain.

IMS does not necessarily put additional requirements on the components of the infrastructure that transport the IP packets. An installed base using ATM transport (“IP over ATM”) is capable of supporting IMS as an alternative to one based on all-IP transport. A feasible path for an operator is to introduce all-IP transport when it is justified for other reasons in addition to IMS. For example, network expansion can be done with IP transport whilst keeping the installed ATM transport. Thus the overall business plan can decide when the ATM transport network should be replaced by all-IP. However provided, the backbone packet transport network must support the Quality of Service (QoS) requirements for IMS and upgrades may be necessary in some cases.

Also shown is a fundamental change to the circuit-switched core network that was introduced in the 3GPP Rel-4 specifications. Because IMS is concerned with moving real-time person-to-person services such as speech away from the CS domain and into the PS domain, it might be thought that upgrades to the CS domain are irrelevant. However, given that legacy mobiles still have to be supported, the Rel-4 changes are highly synergistic with one of the main principles behind the IMS architecture, namely the separation of user data and signalling. Thus an operator moving to IMS may well implement these options (and probably in his 2G network as well). In Figure 4.3, the separation of the signalling and the user data (traffic) can clearly be seen (but shown only at the interfaces to the external networks for clarity), especially when compared to Figure 4.1.

Our cost analysis methodology, presented in Section 4.4, enables other scenarios to be evaluated, such as moving from a Rel-4 network to IMS (Rel-5), or from Rel-99 to Rel-5 without implementing the Rel-4 changes to the CS domain (if that is possible without undue risk).