Nederlandse Organisatie voor
toegepast-natuurwetenschappelijk
onderzoek / Netherlands Organisation
for Applied Scientific Research

Delft
Brassersplein 2
P.O. Box 5050
2600 GB Delft
Nederland

www.tno.nl

T +31 15 285 70 00
F +31 15 285 70 75

TNO report

Quick scan IMS vendors

Date	November 2007
Author(s)	Toon Norp, Herman Pals, Fabian Walraven
Reviewer	Jurjen Veldhuizen
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Management Summary

IMS is gaining momentum in the market. First operators are deploying IMS, while other operators are considering buying IMS. Operators have two approaches for introducing IMS and building an IMS eco-system:

- Buying IMS from a large vendor or system integrator. Vendors like Alcatel-Lucent, Ericsson and Nokia-Siemens offer full IMS solutions integrating their own products with products from 3rd parties.
- Buying IMS elements from various (smaller) vendors and integrating these elements themselves.

For the latter method, standards and open interfaces are key to easily integrate the various IMS elements.

By interviewing about twenty (smaller) IMS vendors we got insight in the maturity of achieving an IMS eco system based on various (small) vendors.

Vendors see PSTN replacement, Fixed-Mobile Convergence and enriched voice services as main drivers for operators to introduce IMS. Vendors experience that still many operators need to be convinced about the need for IMS and are wrestling to achieve a positive business case for IMS. There is no clear common view among vendors on market expectations for IMS services and IMS based handsets.

An IMS eco system can be built based on products from (smaller) vendors, although interoperability still has to be tested. Interoperability at control level seems quite well achieved. End-to-end interoperability between various IMS Clients and IMS application servers is seen as the big challenge. The whole end-to-end chain consisting of originating IMS client, originating IMS server, terminating IMS server, and terminating IMS client should work together, a problem that is still difficult to solve today.
With the lack of interoperability at the IMS application layer, it is difficult to create IMS services by combining and orchestrating different enablers at the IMS application layer. Vendors believe that predominantly Web Services will facilitate flexible service creation. This is seen by the parties as a solution to flexibly create new services, but lower-level protocol interactions for high performance applications are still missing.

Vendors have different means of storing profile data (e.g., in the HSS, internally), resulting in complex inter-relationships between and redundant storage of information. Standardisation offers integrated solutions but not a good solution that scales well for high volume IMS services. This only works if vendors adopt it.
Vendors are still learning and, depending on their focus and standard consolidation, reached different levels of maturity. A common vision and consensus on service creation and profile storage is pivotal for a multi-vendor strategy to succeed.

Contents

1 Introduction

1.1 Background

IMS is gaining momentum in the market. The first operators are deploying IMS, while other operators are considering buying IMS. Operators have two approaches for introducing IMS and building an IMS eco-system:

- Buying IMS from a large vendor or system integrator. Vendors as Alcatel-Lucent, Ericsson and Nokia-Siemens offer full IMS solutions integrating their own products with products from 3rd parties.
- Buying IMS elements from various (smaller) vendors and integrating these elements themselves.

For the latter method, standards and open interfaces are key to easily integrate the various IMS elements. Key question is if the latter method is possible nowadays as many problems related to interoperability and service creation may be expected

1.2 Method

The goal of this survey is to get insight in the maturity of achieving an IMS eco system based on various (small) vendors. The focus of the survey is therefore on interoperability and service creation. We interviewed about twenty IMS vendors. We excluded the large vendors as Alcatel-Lucent, Ericsson, Nokia-Siemens and ZTE as these vendors can deliver a full IMS solution themselves. It is our believe that smaller vendors have more incentive to make interoperable products as their products are part of a larger IMS solution, based on products from other companies as well. The list of participating vendors is displayed below:

Accuris Networks	Colibria	Nominum
Acision	Comneon	Opencloud
Aepona	Ecrio	Oracle
AppTrigger	GinTel	Pactolus
Bea	ICT solutions	Reefpoint:
Cantata/Dialogic	Nextone	Ubiquity

Most parties were interviewed in a phone conference, some in a physical meeting.

1.3 Outline of the report

Chapter 2 gives an overview of the key elements of the IMS ecosystem and a mapping of vendors on the different elements.

We asked the vendors about their vision and market expectations regarding IMS. The results are summarized in Chapter 3.

The subsequent chapters cover the more technical aspects of an IMS eco-system. Chapter 4 deals with interoperability and Chapter 5 with service creation.

2 IMS eco system

This chapter gives an overview of the key elements of an IMS ecosystem. The overview of the IMS ecosystem is given in Section 2.1. In section 2.2 the various elements of the IMS Eco system are clarified and the products of the interviewed vendors are plotted on those elements.

2.1 Overview IMS eco system

IMS is a complex architecture; it consists of many elements with different functions. Together they enable real-time communication services over multiple access networks.

The overview picture (Figure 1) shows elements from various standardisation bodies, in an attempt to capture a common view of the IMS ecosystem. The description of the individual elements can be found in Table 1 of Section 2.2. The IMS eco system includes most of the elements from IMS core specifications (3GPP), but also OMA's Service Enablers, border elements not specific to an access network, and the devices that connect to the IMS. Although many elements are plotted in this picture, it is still a simplified view, e.g. billing and provisioning elements are excluded. Furthermore, the user equipment is plotted as a single box, while it includes a framework of different IMS client components.

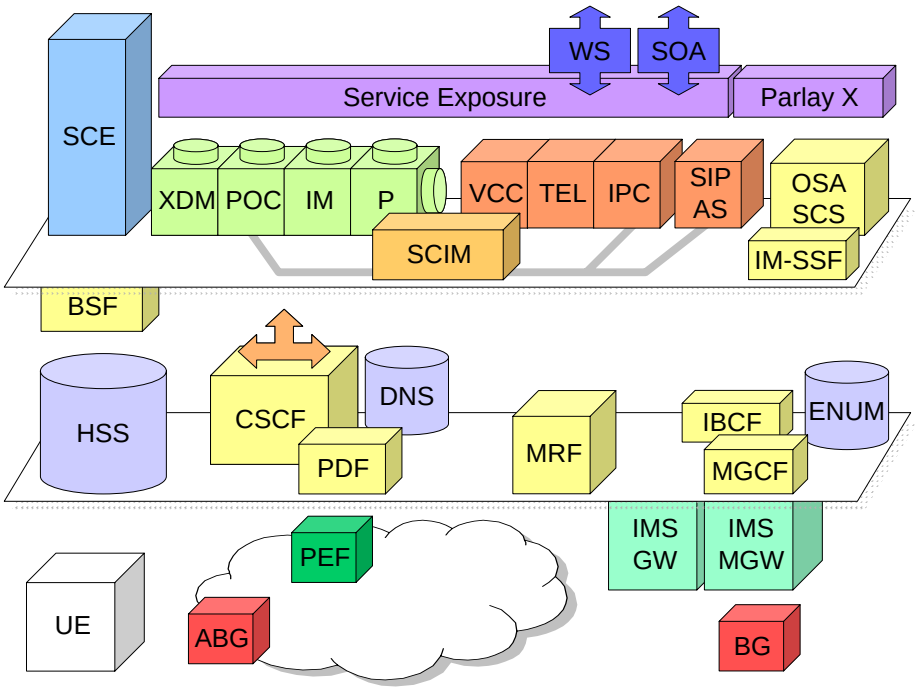

Figure 1: Overview of the elements in IMS Ecosystem (Explanation of abbreviation can be found in Table 1)

2.2 Vendors and the IMS Ecosystem

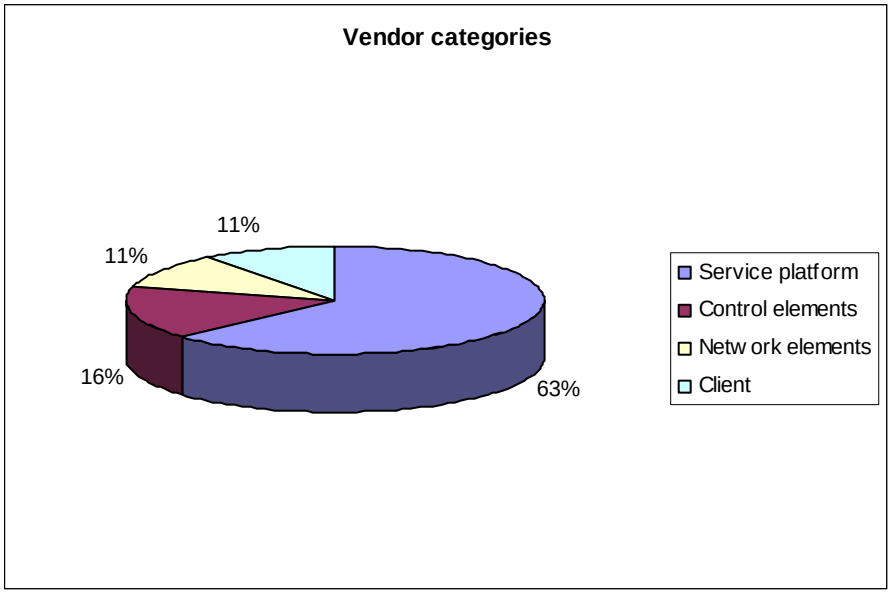

Figure 2: Product focus of the interviewed vendors

The interviewed vendors each focus on a part of the IMS ecosystem (see Figure 2):

- 63% of the interviewed vendors offer service platform solutions. This includes generic application servers, service enablers, services, service creation environments, and components for service exposure.
- 16% provide control elements like MGCF, ENUM and MRF
- 11 % deliver network infrastructure elements like Media Gateways and Border Gateways.
- 11% provide IMS client software; software development kits and services for mobile devices and set-top boxes.

Not all vendors fit in a single category. These vendors are included in the category of their core focus. The percentages reveal that the primary focus of the survey is on the service layer, specifically interoperability and service creation at this level. These subjects are of special interest in a multi-vendor IMS environment.

See Table 1 for an overview of the components, their function and the vendors. Note that the vendor list is not exhaustive! We restricted the list to the vendors we interviewed. The focus was on the (smaller) vendors delivering only some components in the IMS Eco-system. So the large vendors like Ericsson. Alcatel-Lucent, Nokia Siemens, Huawei and ZTE are not found in this list.

Abbr	Name	Explanation	Vendor
UE	User Equipment	End-user devices, like mobile phones, PC's etc.	Comneon, Ecrio
ABG	Access Border Gateway	Provides protection between subscriber and service provider network	BEA, Reefpoint
PEF	Policy Enforcement Function	Polices packet flow into the IP network	BEA, Reefpoint
IMS GW	IMS Gateway	Provides IP v4, IPv6 interworking	

Abbr	Name	Explanation	Vendor
IMS MGW	Media Gateway	Provides bearer interworking (e.g., with CS networks)	Cantata, AppTrigger
BG	Border Gateway	Provides protection between service provider networks	Nextone, Reefpoint
HSS	Home Subscriber Server	Database containing subscription-related information	
CSCF	Call Session Control Function	IMS session control function	Reefpoint (Proxy)
DNS	Domain Name Service	Resolution of domain names into server names and IP addresses	Nominum
PDF	Policy Decision Function	Authorizes media plane resources	BEA
MRF	Media Resource Function	Provides media related functions (e.g., play announcements)	Cantata, AppTrigger
IBCF	Interconnection Border Control Function	Topology hiding gateway to external networks	Nextone
MGCF	Media Gateway Control Function	Call control protocol conversion with SS7 networks	Cantata, AppTrigger
ENUM	IP-application Routing Directory	Repository, translation, and route resolution of E.164 telephone numbering and Uniform Resource Identifiers	BEA, Nominum
BSF	Bootstrap Server Function	Provides mutual authentication between UE and server (e.g., for XDM access)	
SCE	Service Creation Environment	Environment for developer to create new services	BEA, Colibria, OpenCloud, Pactolus, Accuris, Oracle, ICT Solutions
XDM	XML Document Management	Service enabler : Provide storage and access of user-specific service-related information	BEA, Colibria, Oracle
POC	Push-to-Talk over Cellular	Service enabler providing push-to-talk	
IM	Instant Messaging Server	Service enabler providing instant messaging	Acision, Colibria
P	Presence server	Service enabler providing presence	BEA, Colibria, Oracle
SCIM	Service Capability Interaction Manager	Manages interaction between different IMS applications.	BEA, Aepona, AppTrigger, OpenCloud
VCC	Voice Call Continuity	Provide call continuity between packet and circuit switched networks	Accuris, Aepona, BEA
TEL	Telephony Server	Provide basic telephony	

Abbr	Name	Explanation	Vendor
		services	
IPC	IP Centrex server	PBX-like service hosted by service provider	Pactolus
SIP AS	SIP Application Server	Generic application server providing SIP services	Accuris, BEA, Oracle, Ubiquity, OpenCloud, Acision
IM-SSF	IP Multimedia Services Switching Function	Provide interworking between SIP and CAMEL	Aepona, BEA, AppTrigger, OpenCloud
	Service Exposure	Provide service access through API	Aepona, BEA, Oracle, AppTrigger,
OSA SCS	Open Services Architecture Service Capability Server	Provide access to network through Parlay API	Aepona, AppTrigger, Ubiquity
SOA	Service Oriented Architecture	Architectural style based on loosely coupled services	BEA, Ubiquity
	Parlay-X	Provide a set of telecommunications webservices	Aepona. BEA, Oracle, AppTrigger
	Application developer	Making new applications.	Gintel, ICT Solutions, BEA

Table 1: Overview of the IMS elements and the vendors delivering these products.

Based on this table we conclude that in principal an IMS ecosystem can be built based on products from individual ‘smaller’ vendors. Although we did not interview vendors delivering a full CSCF or a POC, we do know there are ‘smaller’ vendors that are delivering these products (e.g. Tekelec has a CSCF product and Celtius is providing a POC solution). Of course this is still largely depending on interoperability, but for each IMS element a ‘smaller’ vendor can be found. The status of interoperability is discussed in Chapter 4.

3 Vision of vendors on IMS ecosystem

In this Chapter we discuss the vision and market expectations of the vendors regarding IMS. In section 3.1 the IMS services which the vendors are expecting are elaborated. Section 3.2 covers the IMS market expectations. This Chapter ends with the conclusions in Section 3.3.

3.1 IMS services

The vendors expect that operators will introduce IMS in one of the following key area's (See Figure 3):

- Enriched voice: e.g. integration of voice and information, like directory services, customer care, presence based voice routing, push to talk
- Fixed Mobile Convergence: IMS will be the enabler for fixed mobile convergent services, as it will be a single control and service development platform independent of the (fixed or mobile) access technology.
- Replacement of current services: For fixed operators one of the main reasons to introduce IMS is to replace the current PSTN network services by voice services based on IP and IMS.
- Other services like advertisement, convergence with TV, multimedia services and QoS enabled services.

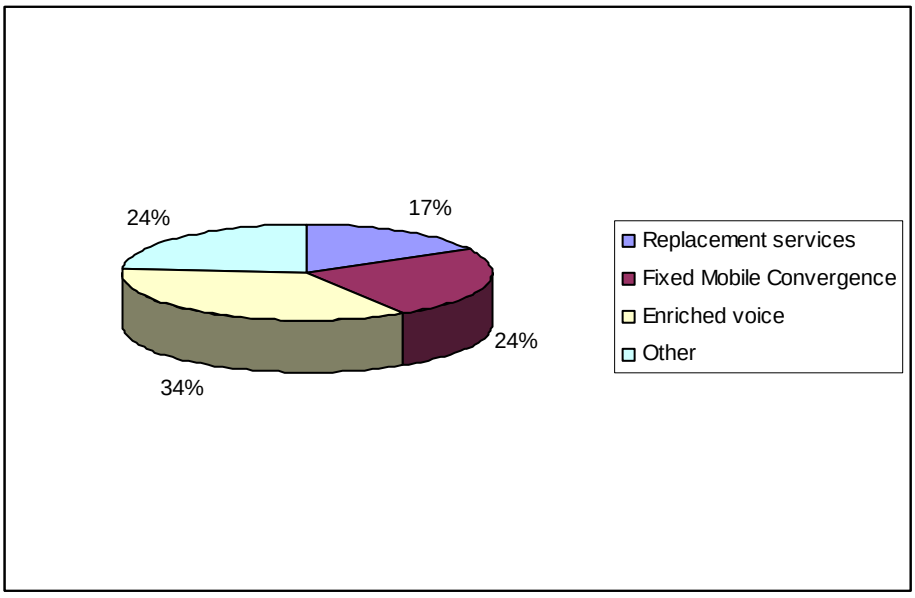

Figure 3: Services which operators will provide using IMS, as expected by vendors.

It is not a surprise that IMS introduction starts in the 'voice' environment. Voice is still one of the largest revenue drivers for operators. The enriched voice services like IP centrex, or value added services based on IMS can be offered to all voice customers, as generally no new handsets are needed. In this way the introduction of IMS is not depending on the availability of IMS based handsets.

Vendors experience that still some operators need to be convinced about the need for IMS and are wrestling to achieve a positive business case for IMS. Introducing IMS as replacement for current voice services is based on a cost-reduction business case. This

can often be more easily achieved than convincing the management about potential additional revenues based on new services. One new service generally does not generate sufficient revenues to support a positive business case for IMS.

One of the selling points of IMS is that new services can be easily introduced. We asked vendors in which way operators will typically deliver on the IMS platform in 2010 and 2013. The results are depicted in Figure 4.

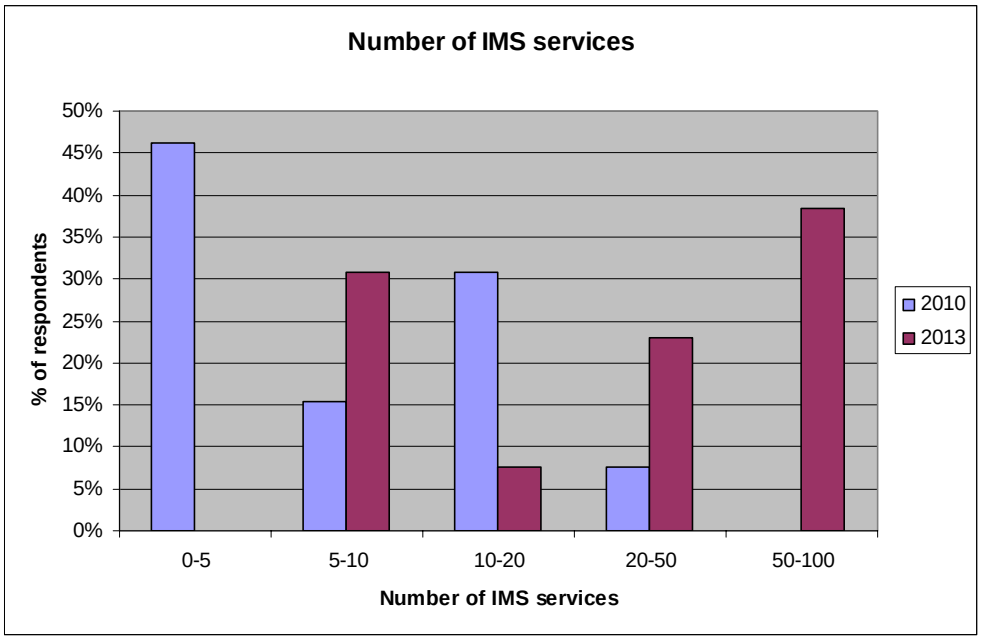

Figure 4 Number of IMS Services in 2010 and 2013 run by an operator as expected by vendors.

As we see, there is no common view among vendors on the number of IMS services. We experienced that most vendors found it a difficult question to answer. The numbers vary from 5-10 services in 2013 up to 50-100 in 2013.

In TNO's opinion, operators should focus on large scale services and services for mass markets. For operators it will be too complex to deliver many services for niche markets. These niche markets can be targeted via partners, who will build services using standard IMS building blocks from the operator like presence and location, address book and voice functionality. So operators will have about ten to twenty basic large services like voice, IP Centrex and messaging, but together with partners they will be able to offer a richer set of services for specific markets. IMS provides an enabling framework and capabilities for new services. This enabling framework can be in some way compared to 800/900 services or I-mode. Operators provide 800/900 services with basic free calling or premium calling services, and functionalities like billing. On top of these services service providers or customers can build their own menu or service structure for individual purposes. Operators provide the basic services, while service providers cover specific niche markets.

3.2 Market expectations IMS

Most vendors did not clearly express their expectations on market penetration of IMS services. IMS is still in its infancy and it is difficult to predict the take-up of the IMS services will be. The market expectations for IMS services in 2010 and 2013 are plotted

in Figure 5. We see that there is a wide variation in the expectation ranging from penetration in 2013 of about 5% up to 50 to 100%. It is remarkable that up to 50% of the respondents do not expect a penetration of more than 20% in 2013. It should be noted that in general vendors are the most optimistic parties about introducing new technologies.

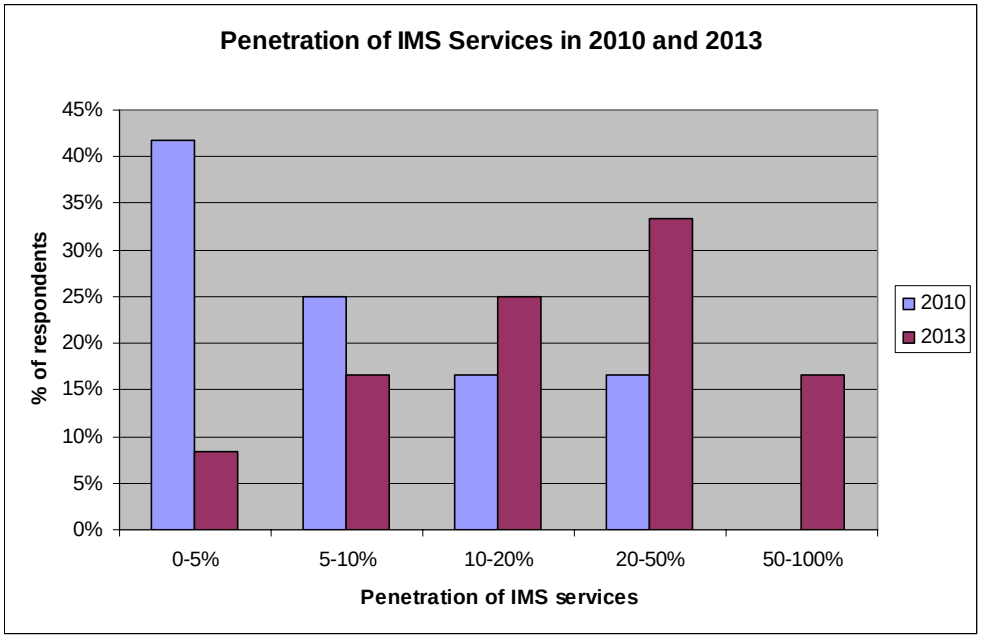

Figure 5 Market penetration of IMS services based on vendor expectations

Also for the penetration of IMS capable handsets there is a wide range of expectations, ranging from 0-5% penetration of IMS enabled handsets in 2013 up to 50-100% in 2013. We conclude that there is no clear and common view of vendors on the penetration of IMS handsets.

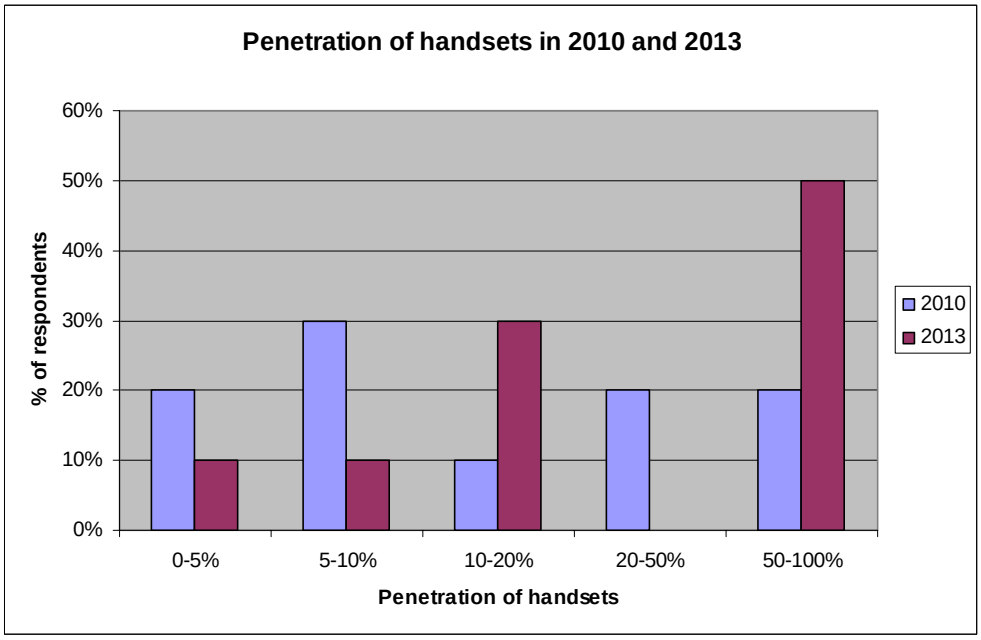

Figure 6 Market penetration of IMS enabled handsets based on vendors expectations.

The penetration of IMS services is not fully depending on the availability of IMS handsets and terminals. Services like PSTN emulation or premium voice services

(0800/0900) and IP Centrex can be based on IMS, while the terminals do not need to support IMS. IMS services without the need for IMS handsets are already offered by some operators, e.g. TDC offers IP Centrex based on IMS. At this moment the first IMS based handsets are available on the market, and IMS client software can be installed on handsets.

3.3 Conclusions

Vendors expect that operators will mainly introduce IMS for voice related services in three main areas:

1. replacement strategy for the current voice services
2. to enable fixed mobile convergence
3. to deliver enriched voice services.

There is no clear common view between vendors on market expectations for IMS services and IMS based handsets (From less than 10% up to more than 50% in 2013).

4 Interoperability

In this chapter we discuss the view of the vendors on interoperability (Section 4.1), standards and testing (Section 4.2). This Chapter ends with the conclusions in Section 4.3.

4.1 Multi-vendor interoperability of IMS implementations

A majority of the vendors is not satisfied that multi-vendor interoperability is achieved with IMS implementations. Only 17 percent of the vendors consider multi-vendor operability achieved. A number of vendors indicated that interoperability depends on the layer, e.g. interoperability is achieved at IMS session control layer but not at IMS application layer

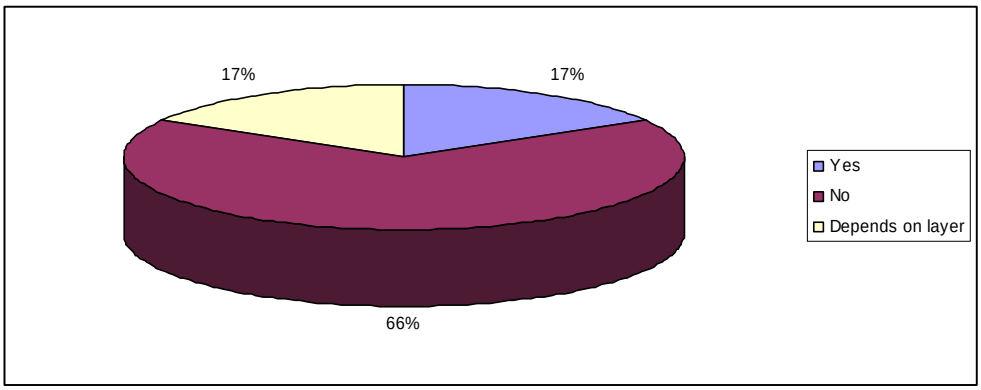

Figure 7 Responses from vendors on whether multi-vendor interoperability has been achieved

Various reasons were mentioned for the lack of interoperability. The most commonly mentioned problems with interoperability are mentioned below.

- 39 % of vendors mentioned that they needed to do adaptations each time they integrated their product with a different vendor. In general, the adaptations needed were not major (e.g. modifications of parameters).
- 22 % of vendors consider the IMS standards lacking, mainly because there are too many options within the standards.
- 17 % of vendors mentioned that the technology is not mature enough. Standards should enable multi-vendor interoperability, but they are not fully implemented yet.
- Another 17 % of vendors complain that the big vendors use vendor specific additions to the standards. Though these additions may provide additional functionality, they hamper multi-vendor interoperability.

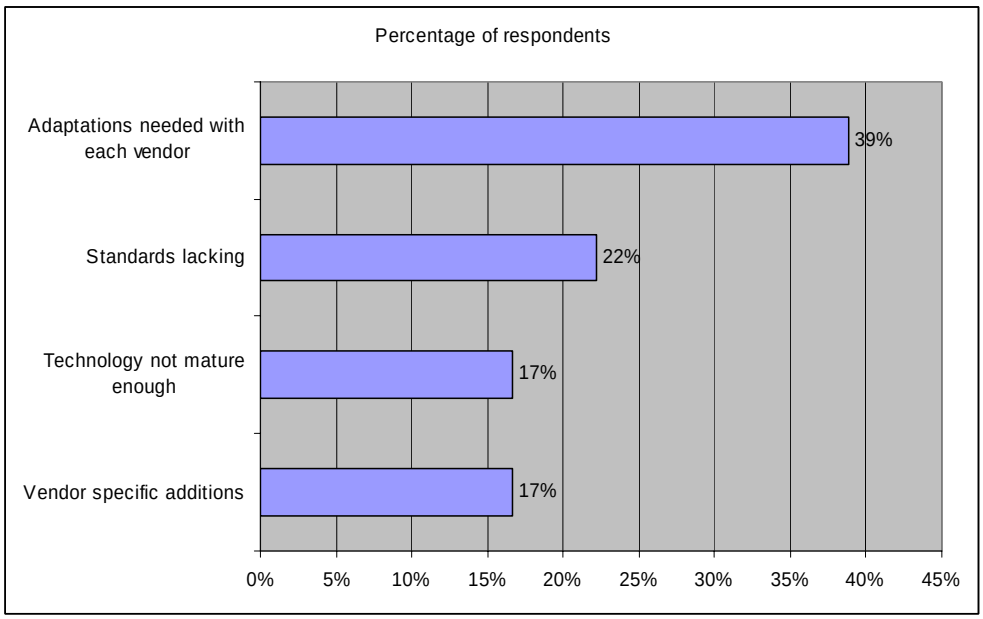

Figure 8 Commonly mentioned causes for a lack of interoperability.

Also when analysing the responses from the vendors in more detail, we see that the interoperability depends on the layer. Vendors with products that rely on the IMS session control layer are generally more positive about interoperability than vendors with products that rely on functionality in the IMS application layer.

- At the IMS session control layer, the interfaces between CSCFs, IBCF, and MGCF are well standardised. Though our study did not focus on the IMS core itself, it is felt by many of the vendors that interoperability at the IMS session layer is well established.
- The ISC interface between the Application Servers and the CSCF is also well standardised. However, here the major core vendors often have made vendor specific additions.
- Entities and interfaces between them in the IMS application layer are less well specified. Some functionality like the Service Capability Interaction Manager (SCIM) is still largely unclear. Where standards are provided at the IMS application layer, often options exist on how to use them.
- The interfaces between clients and IMS applications provide a particular challenge. At the moment, IMS clients and servers have to be adapted to work together. But this implies that an additional IMS client will not work with the same server and vice versa. The whole end to end chain of originating IMS client, originating IMS server, terminating IMS server, and terminating IMS client should work together, a problem that is still difficult to achieve today.

Some vendors provide equipment that alleviates some of the interoperability problems, like for instance Session Border Controllers. Session Border Controllers (SBC) hide the architecture behind the SBC and can make adaptations to the different protocol variations that may be used by the different application servers. Also the Service Exposure function (webservice) can abstract from the vendor specifics of a particular IMS service architecture.

4.2 Standardisation and testing

Standards bodies that are relevant for IMS vendors are 3GPP, ETSI TISPAN, OMA, and IETF. But also open source developments (e.g. the Java Community Process) are important for many of the IMS application vendors.

Most vendors follow the progress in related standardisation bodies (e.g. 3GPP or OMA). Some 2/3 of the vendors also directly influence the standardisation of specifications that a relevant for their products.

Standardisation of billing, provisioning and management interfaces is usually less well developed. Vendors mentioned various interface technologies for these interfaces:

- The Diameter based 3GPP interfaces for online and offline billing (Ro and Rf) seem to become more and more common. Also CDR file based billing interfaces are still quite common.
- Provisioning interfaces are mostly proprietary. Web-based interfaces are used for setting of user profiles. XML-based interfaces seem to be getting some traction.
- Few vendor interviewees were able to mention interface technology on which the management interfaces on their products were based. Vendors that mentioned a management interface technology all mentioned SNMP (Simple Network Management Protocol).

Almost all vendors have experience with bilateral interoperability testing between vendors. Approximately 1/3 of the vendors also had participated in testing events as organised by e.g. OMA, GSMA, ETSI and the IMS Forum.

4.3 Conclusions

Multi-vendor operability depends on the layer; at the IMS session layer it is well developed, but at the IMS application layer many interoperability issues still exist.

With the lack of interoperability at IMS application layer, it is not yet possible to easily create IMS services by combining different enablers at the IMS application layer. Creating services by combining different enablers is only possible at webservices level; a solution to flexibly create new services, but not a good solution that scales well for very large scale services.

5 Service creation

In this survey, service creation consists of the definition, configuration, and deployment of a service. This chapter discusses the current vendor approach to service creation and its status regarding a multi-vendor strategy. As working assumption for this survey, a service consists of components of multiple vendors such as service-specific application servers (e.g., VCC, IP Centrex), generic application servers (e.g., SIP Servlets, JAIN SLEE), service enablers (e.g., presence, instant messaging, group and list management), and client software.

5.1 Introduction

The common vendor driver in the product offerings is to shorten the time needed to develop telecommunication services, and vendors see this as a multi-vendor opportunity:

- 86% of vendors think IMS services will consist of components of different vendors.
- 14% of vendors think operators will buy stovepipe services because of short term focus.

However, vendors point out that several challenges remain. From Section 4.1 follows that service platform vendors are more pessimistic about interoperability than infrastructure vendors based on less mature or missing standards. These grey areas stimulate proprietary solutions, allow multiple interpretations, and hamper integration between vendors. From practical experiences vendors see that it is often costly and time-consuming to successfully integrate products of different vendors.

Service creation, innovation and quickly adapting to continuous changing demand are traditionally troublesome in telecommunications. As a contrast, the vendors find inspiration from ‘Web 2.0’, specifically the so called mashups. Mashups are web applications that combine multiple services and data sources into new services using ubiquitous HTTP and XML technology. Mashups show that a common set of service capabilities makes a sheer unlimited number of services possible. Not only because common technology is used, but also by making it available to a large number of developers.

Vendors recognize that it is a long road for IMS services to reach the same level of flexibility, not even considering the willingness of operators to adopt such disrupting approach to service creation. The main issues they named are:

- Interoperability between vendors
- Complexity of standards
- Missing open standards and industry agreement

Interoperability is discussed in Section 4.1. Complexity of standards is a problem inherent for telecommunications networks; service creation asks for complex protocol knowledge. Additionally, vendors say that open standards and industry agreement is lacking, which is needed for a flexible multi-vendor service platform.

Also regression testing is very complicated when a new service is introduced based on a generic re-usable architecture.

5.2 Tooling in Service Creation Environments (SCE)

The challenge for vendors is the balance between complexity of standards and the need to accelerate service creation by hiding most of the complexity to developers. Vendors support the design and implementation of new services with tooling. The survey shows that vendors offer a range of tools:

- Command-line deployment tools
- Provide plug-ins for existing IDE
- Web-based management
- Custom service creation environment (SCE)

Often these tools are specific for a vendor solution. The custom SCE is most advanced in terms of simplified service creation; it often includes a graphical interface using drag-and-drop to create new services. This hides many details from the developer. At the same time it is vendor-specific because there is not a standard set of modelling artefacts available, and it is often hard, if not impossible, to integrate components of other vendors. This is one area where vendors find that open standards and industry agreement are missing. A second complicating factor is the diversity of service capabilities that have to be modelled, especially when integrating with non-IMS domains.

The use of plug-ins for existing Integrated Development Environments (IDE), notably Eclipse, has the advantage of utilizing an environment the developer is familiar with. Plug-ins can support code generation and configuration wizards to hide intricacies and are often used in combination with command-line deployment tools that are integrated with the build environment. Client vendors generally include emulators for stand-alone testing, and building blocks to simplify development of common functionality.

For client vendors it is hard to offer a consistent development experience across different handsets. All interviewed client vendors included support for JSR281 on their roadmap (starting from Q1 2008), which offers a common (Java) API for IMS service creation. Also a change from early proprietary components to their standardized counterparts (e.g., VCC) shows that client vendors are working towards a set of common building blocks.

Vendors show that a common set of tools currently does not exist and available tooling is proprietary, largely because of missing standardisation and industry agreement. Hiding complexity is achieved to a certain extent, but because there is no consensus important tools for integrated testing are missing. Consequently, integration of different vendor products is only achieved on a case-by-case basis, which currently makes it expensive.

5.3 Web Services

Not only tooling is used to simplify the service creation process. A majority of vendors look to extend the services and applications in the IMS domain to Internet/IT domains. The solutions of vendors increasingly depend on IT technology and this is seen as crucial to fully benefit from an IMS ecosystem. Traditional IT vendors extend their

product portfolio with telecommunication protocols (SIP, Diameter), and telecom vendors with IT technology (Web Services, SOA).

Vendors also see that IT drivers such as moving from monolithic to loosely coupled systems are also relevant for IMS. Figure 1 shows reusable service components, such as presence, instant messaging as specified by the Open Mobile Alliance.

Vendor support for Web Services is already large (see Figure 9):

- 73% of the vendors already include Web Services in their products
- 9% include Web Service support on their roadmap
- 18% are not planning Web Service support

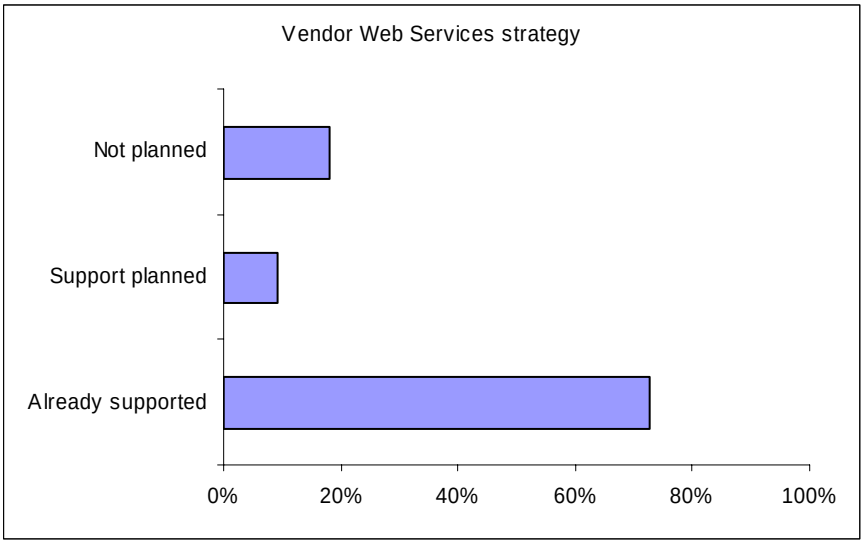

Figure 9 - Web Services for service creation

Vendors believe that most service creation will be enabled by Web Services. High-level service capabilities hide complex protocol details, which appeals to a larger group of developers. The capabilities are no longer directly accessed using telecommunication protocols such as SIP. Vendors trigger lower-level protocols by translating Web Service calls based on a specific policy, possibly involving multiple application servers. Developers no longer have to worry about low-level components and their relationship.
However, high-level APIs do have drawbacks; vendors acknowledge that Web Services are not suitable for all services, especially those that are sensitive to latency. An example is VCC, which requires specialized application servers.

As a result there are emerging two levels of service creation:

1. (lower-level) SIP services reside in application servers and do not have a direct relation with northbound interfaces such as Web Services. These services are sensitive to latency which makes them less suitable for Web Service interaction.
2. There is a high-level interface which exposes specific service capabilities. This is where vendors think most service innovation will take place, and this enables integration with non-IMS domains such as enterprise networks.

Also, Web Services are a step closer to the anticipated mashups. However, to fully benefit from the concept operators have to open up their networks, while it is expected

that an operator wants to keep service creation internal to get used to this disruptive change. This is seen as a big challenge by vendors; move beyond voice and embrace new models of service creation.

5.4 Service capability interaction

Before adopting a loosely coupled approach where services consist of flexibly combined or chained capabilities (reusable service components) a strategy is needed to manage application invocation (where an application implements a capability).

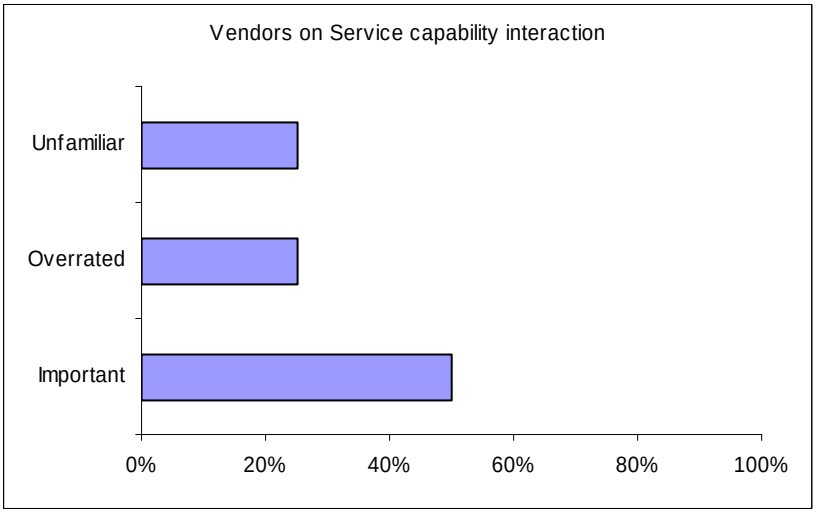

Figure 10 - Vendors on Service capability interaction

Some services may need information from various application servers in one session. Information is necessary to select the right application to invoke. While the IMS Core offers a mechanism to define the sequence of invocations based on static profiles, this mechanism is not always sufficient, and a more powerful mechanism is needed. This function is often called the SCIM. Note that there is not yet a broad consensus on the role of the SCIM, and there is discussion about it both in and outside standardization organizations. This can be seen from the responses on what view vendors have on service capability interaction:

- 50% of the vendors find service capability interaction an indispensable part for service creation
- 25% find the discussion unnecessary and overrated
- Another 25% were not familiar with the subject

In practice a SCIM is often a part of an application server, for example several vendors see the Application Router entity defined in JSR289 as possible SCIM implementation. Other vendors have defined their own proprietary implementation, mostly consisting of routing rules based on XML-based configuration.

Vendors expressed the need for further service capability interaction standardization. Currently there is a study item defined in 3GPP that tries to understand the need for further SCIM standardization. However, the vendors actively working on service capability interaction take a broader view of the problem, in different areas of which SCIM is only an option:

- Applications that act on the same session
- Component orchestration
- Client service capability interaction

The SCIM is associated with the first option, as discussed above. Component orchestration happens on top of this, where exposed service capabilities are combined to create meaningful and correctly behaving services. Exposure is done through Web Services, and BPEL engines are used for integration. As discussed before, this is where most vendors expect service creation will happen eventually.
On the client the same problem need to be solved as the SCIM tries to solve: Multiple applications are interested in session events and an entity (middleware) is needed that resolves events to the right application, in the right order.

An additional challenge that the interviewed client vendors identified is how to present a user with a user-friendly GUI when combining several service capabilities; with a small screen it is hard to inform the user about what is going on.

As vendors integrate SCIM functionality in their application servers there will be multiple SCIM implementations that are distributed in the service environment. Thus a single centralized SCIM will probably not exist. This is a good thing because a present day SCIM likely has proprietary components, and the risk of including service logic as integration solution is large, creating vendor lock-in.

5.5 User profiles and storage

User-specific service-related information is an important asset in service creation. User profile data is often distributed in the network and accessed by application servers in various ways. Storing service-specific information in external storage (e.g., HSS, XDM, LDAP) introduces a new integration point. In early versions of a service, local storage is used, to be self-contained. Because services use both private and shared data this introduces potentially redundant data:

- 87% of the vendors store profile data both internally and externally
- 13% of the vendors store profile data internally only

The majority of vendors that store data externally use the HSS, and of the 13% of the vendors that store data internally most are looking at possibilities to store data in the HSS.
In early 3GPP standardisation the HSS was the primary target to externally store application-specific information using a Diameter interface. However, it is questionable if the HSS is the right place to store this information, as it can quickly involve large amounts of data. Also, it is not clear whether operators like the idea to let applications use such a crucial network entity as generic data repository. There are currently alternatives such as OMA XDM and 3GPP's GUP. XDM is best suitable for data that should also be available from clients. This is supported by the fact that all interviewed client vendors include the XDM enabler.

The expectation is that application data comes from all kind of different sources. To provide a coherent view of this data, and make it available for applications, some vendors look beyond the HSS as primary source of data storage and explore common profile storages such as Generic User Profile (GUP). GUP uses a model where a single node provides access or redirection to requested data sources. It is for example possible to access HSS data using GUP. Applications can access information without knowing where it resides beforehand, decoupling data requests from its actual storage location. Such common access approach would help improve this situation. Even some vendors

are using a distributed environment with highly fragmented data storage solutions like GRIDs or table-like solutions.

5.6 Conclusions

With the still lack of industry agreement at the IMS application layer, it is difficult to create IMS services by combining and orchestrating different enablers at the IMS application layer. Vendors believe that predominantly Web Services will facilitate flexible service creation; however a consistent correlation with lower-level protocol interactions is still missing.

Vendors have different means of storing profile data (e.g., in the HSS, internally), resulting in complex inter-relationships between and redundant storage of information. Standardisation offers integrated solutions but this only works if vendors adopt it.
Vendors are still learning and, depending on their focus and standard consolidation, reached different levels of maturity. A common vision and consensus on service creation and profile storage is pivotal for a multi-vendor strategy to succeed.