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Evolution towards converged services and networks

White Paper

Convergence, long talked about in the telecommunications industry is re-emerging with renewed vigor. This white paper examines the drivers and technologies that enable true convergence, and what operators need to consider in order to fully capitalize on this opportunity.

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1 Executive summary

Research has shown that end-user behavior is rapidly changing due to globalization, the increased value placed on individuality, emerging tribalism, new patterns of social networking and an increasingly nomadic lifestyle. From a service perspective, the consumer and enterprise business user expect convenience, ease of use, reliability, security and support to be always best connected.

The communication market is evolving rapidly. New players emerge and competition increases. As a result new partnerships are being formed and old boundaries for conducting business fade away. In this changing business environment, operators explore different ways to find new revenue streams, reduce operating costs, and provide solutions that create stickiness and reduce churn. The successful operator will provide a multitude of new services. Many of the services will be available by both mobile and fixed access. Others will represent a combination of TV, Internet and telephony – all of them being converged services.

Technologies that enable converged services exist. The Internet Protocol (IP) and the Internet paradigm are being introduced in all areas of communication. Rapid development of radio technology leading to increased bit rates and support for mobility enables true converged services – the same end-user service can be reached by both mobile and fixed access via the same user interface.

Operators that adapt their strategic business plan, considering the changing environment, with an early introduction of converged services will gain a competitive edge. Furthermore, the introduction of layered architecture will improve efficiency, flexibility and enable a smooth introduction of IP Multimedia Subsystem (IMS), a cornerstone for efficient converged service offerings.

2 Definition of convergence

Traditionally, the term fixed-mobile convergence (FMC) has been used by the telecom industry when discussing the integration of wireline and wireless technologies. But it is not just about this particular kind of convergence, it is also about convergence between media, datacom and telecommunication industries, as shown in Figure 1.

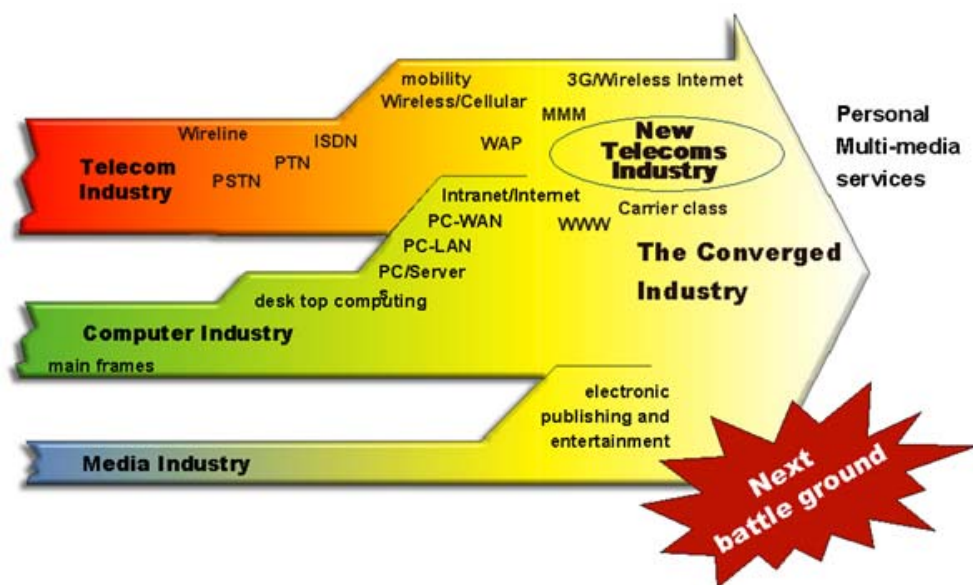


Figure 1. Industry transformation and convergence

In this paper, convergence is considered from three viewpoints: user services convergence, device convergence and network convergence.

User service convergence; where there are common user service delivery capabilities with access and device awareness. This means that a multitude of services (person to person, person to content and content to person) can be provided to the same user over different access networks and to different devices.

Device convergence; common devices supporting several access types, such as CDMA2000, WCDMA, GSM, fixed broadband and WLAN. Device convergence allows multiple applications to be run, reusing the same functions for identification and authentication. Furthermore, the mobile device supports more and more functions in addition to telephony, e.g. Camera, TV/Video and email.

Network convergence; this implies consolidation of the network to provide different user services, with telecom-grade quality of service, to several access types with an emphasis on operator cost efficiency.

3 Convergence is back

A decade ago, the telecommunications industry started to discuss fixed-mobile convergence. Even though the theory was right, the relatively immature technology meant providing convergent services in an efficient way to end users was very complex. Furthermore it was obvious that users were not ready for converged services.

Network operators now re-evaluate convergence and see it as an opportunity to create stickiness and provide more value for their subscribers. Examples of convergence-related services and implementations available today are:

- **User services**
 - Bundling of fixed, mobile and broadband subscriptions
 - Triple play (telephony, internet and IP TV via broadband)
 - Single phone number
 - Single mailbox
- **Devices**
 - Seamless WLAN/2G/3G connection
 - Multi access mobile phone with both licensed and unlicensed mobile access
 - Media and PC functionality in mobile devices
- **Networks**
 - Layered architecture with IMS

4 Putting the end user in focus

In this section, the term 'end user' refers to both consumer and enterprise business users. The different end user behaviors are described to get an understanding on what drives the users now and in the future. This is an input to which services the operator should offer. The relation to convergence is described in chapter 4.2.

4.1 Changing end-user behavior

The communication landscape is richer now than it has ever been. This has far-reaching implications on how the end user will be perceived in the future.

Research has shown that the following trends are relevant from a user-service perspective:

Globalization results in trends becoming very similar globally, for example among young people. Globalization and the impact of mass media make trends diffuse and spread much faster on a global scale.

The user places increased value on individuality at the same time as we have a boom in the supply of products, services and information. This leads to new choices that were not previously available. Customers demand more customized and tailored offerings. With this comes the requirement for personal control of services and information. This increased individualism is also true for former collective environments, such as the home.

Tribalism emerges as a counterforce to the individualization trend. People are self-organizing into communities and "tribes" of shared values and interests. A tribe can be local or spread across the world. So what we see is a collective individualism. The tribe plays a major role in the individualization process.

New patterns in social networking are both enabled and amplified by technology. Already, scheduled social interactions are increasingly rare among young people and there is a growing expectation and preference for ad-hoc social interactions.

A nomadic lifestyle, where the borders between private and business use are fading and the user expects (or is expected) to have access to the services anywhere and at anytime, is also evolving. Communication capabilities that support context switching and multi-tasking in all aspects of life will be critical.

4.2 End-user expectations

The user needs based on the changing end-user behaviors described, and today's basic user expectations, lead to three areas for further consideration, all of them closely related to convergence:

Convenience and ease of use

Users expect similar user interfaces for most services without having to consider which network is used. Services shall be adapted to the device and access characteristics being used, including simplified processes for identification and payments, as well as the ability to control cost.

Always best connected

Users expect to be able to connect anytime, anywhere - also when on the move - by their device of choice. Users also expect to be able to specify in each situation whether "best" is defined by price or capability.

Reliability and security

Users expect reliability in all transactions, independent of access, and guaranteed connection quality. From a security point of view the user expects no viruses, no worms, no fraud, nobody listening in and the ability to know who requests a communication session.

Thus, one of the most profound changes in the way we look at convergence today, as compared to a decade ago, is the increased end-user focus as a driver of convergence. Earlier, the focus was far more on operator and network efficiencies. These advantages, however, still remain and have gained increased importance because of the new user and service behavior together with maturing technology.

5 Opportunities and challenges for operators

There are different approaches to the changing business environment for different operator categories. It is, however, clear that convergence will play an important role for all categories independent of selected business direction.

5.1 Existing operator categories and new players

In most markets competition for telephony is intensifying, both for fixed and mobile network operators. New players, such as cable-TV companies and dedicated Voice over Internet Protocol (VoIP) application vendors, are also entering the telephony segment. To grow, most network operators and other players on the market start to address areas outside their traditional offering, which means that new offerings are created by combining previously disparate offerings – traditional operating boundaries are fading.

Mobile-only network operators are striving to offer more advanced services to mobile customers to provide a competitive alternative to fixed network services and in that way increase market share. Others focus on offering convergent services to the enterprise segment, including mobility.

Fixed-only network operators are searching for ways to add mobility to their broadband networks, by becoming Mobile Virtual Network Operators or exploring mobile license opportunities, to create a bundled offer. They are building wireless access (WLAN) through hot spots using unlicensed spectrum. Fixed broadband operators also offer triple-play (telephony, internet and TV) services to utilize their bandwidth advantage. Furthermore, they sell carrier capacity to other operators.

Combined mobile and fixed network operators utilize their combined customer base through bundles and value-added offerings. They can

consolidate their networks in order to cut costs. They can, of course, also target the same areas as fixed-only and mobile-only operators.

Cable-TV network operators are striving to enter the broadband and telephony segments. It is anticipated they will address mobility in a similar fashion as fixed-only network operators as well as the wireless hot spot access provisioning. Cable network operators tend to focus on entertainment services where they have strong partner relations.

Voice over IP application providers are striving to dramatically increase their telephony market share in order to capitalize on their interconnect revenues. They are exploiting the rapid growth of broadband IP data access.

It is not possible to specify a single path forward for each operator category, as each operator must take into consideration much more than just the current business operation when defining its strategy. However, it is obvious that convergence will be an important aspect for all operator categories.

5.2 Challenges

Some important challenges related to the current and coming business environment and network evolution are outlined below.

In a changing business environment each operator must explore different ways to expand its business and decrease costs in the long term. This implies finding ways to attractively bundle services and subscriptions to create stickiness, hence reducing churn and therefore reducing subscriber retention/acquisition costs. Further alignment/convergence of the bundled services will enhance the offering.

There are also different regulatory aspects related to convergence that could affect an operator's business plans, for instance bundling restrictions due to perceived competition limitations.

Network operators must act fast in a dynamic market and adapt quickly to the new business environment. Operators also need strong marketing efforts to leverage the potential opportunity for growth and cost savings. A service delivery platform that enables fast deployment of new converged service offerings is a prerequisite to succeed.

5.3 Operator categories and business direction

An important part of the operators' strategy to address market opportunities is to choose in which direction to drive their business. There are three main scenarios, all plausible, for how operator business can be developed: walled garden, bit-pipe provider and channel provider, illustrated in Figure 2.

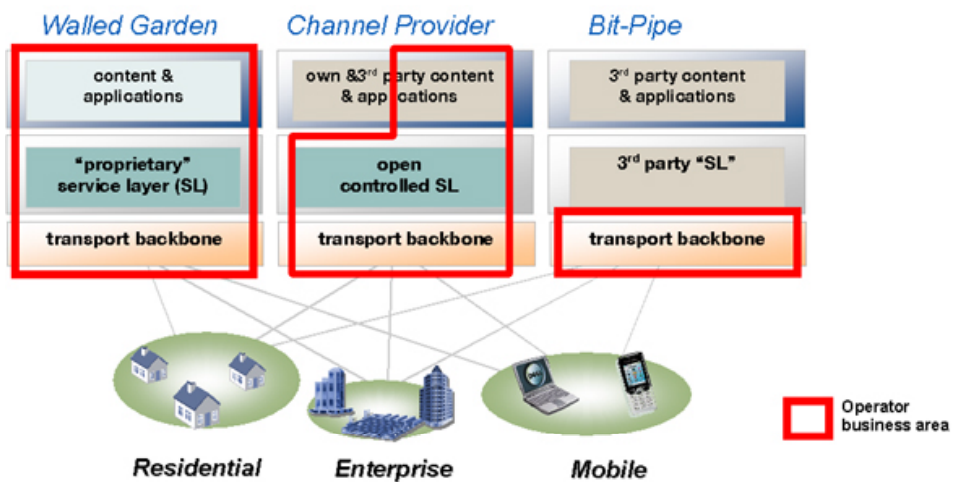


Figure 2. Operator category options

The walled garden approach means that the operator strives to have an exclusive relationship with the end user, from the device to the service.

For bit-pipe operators, the main objective is to focus on operational excellence and maximum efficiency in the network. There is little focus on service provision.

The channel provider operator could be seen as a combination of the walled garden and bit-pipe scenarios, where the operator supports content and application providers with key network characteristics and services. Examples of characteristics are: identification, authentication, roaming and presence management. This channel provider option drives convergence in all layers.

6 Enabling technologies

While technology was a limiting factor a decade ago, it has today reached a level of maturity that enables convergent services. One advantage that now makes convergence a reality is the evolution towards one common network, which is IP based. Furthermore, high-speed broadband connections, both fixed and wireless, make it possible to offer converged multi media services, independent of access type.

6.1 Evolution towards all-IP

The trend is clear, IP paradigm is, or will be, used in almost all areas of communication.

A common IP-based network enables a multitude of common functions and therefore reduces costs in the form of planning and operation. The potential

savings for operators are substantial and one of the most important drivers of network convergence.

And to save the best for last; when the underlying structure is more structured and standardized, other areas have more room for variation. This means that customized services, which of course still can be convergent according to the definition, can be provided efficiently.

6.2 Access technology development

The fixed broadband penetration is increasing with double digits every second year. Home networks are becoming the norm. The PC penetration is still rising. Communication standards within the home have evolved around Ethernet and IP, enabling high capacity connectivity between the home gateway and the service provider. Already today the technology exists to build high capacity and low cost Ethernet solutions for the mass market, which enable triple play and other innovative services.

The development of wireless access technologies has reached an important breakpoint. Today, it is possible to transfer packet data with high bit rates also over a mobile radio interface. This will lead to a new generation of services such as broadband Internet access, Video over IP and IP telephony.

This rapid development of radio technology is an enabler for true converged services, meaning that the same end-user service can be reached via both fixed and mobile access via the same user interface. Figure 3 shows the capabilities of some existing and emerging radio technologies.

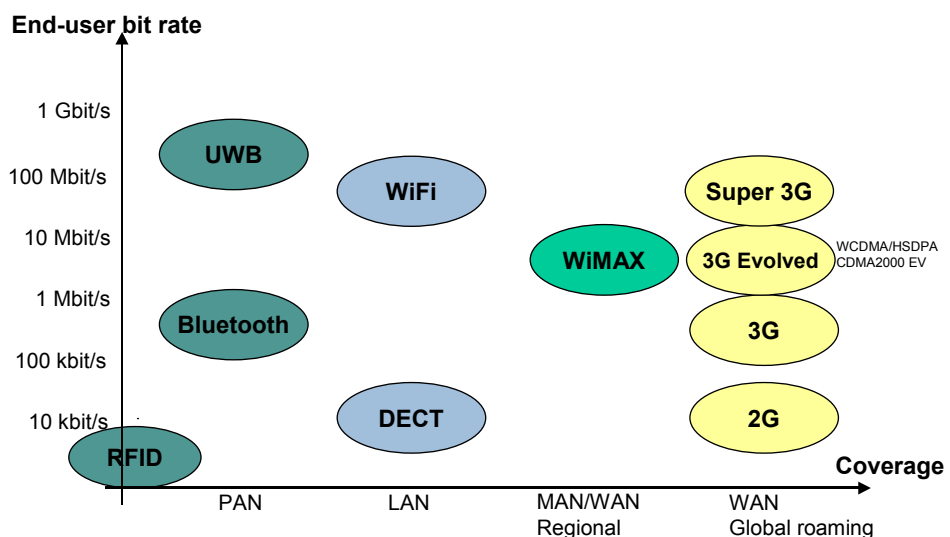


Figure 3. Bit rates and coverage for wireless technologies

There is already support in the radio access standards (for instance WCDMA and CDMA2000) for VoIP, including support for mobility.

The appropriate standardization bodies are addressing updates in radio access standards so that optimized transport of telecom-grade IP telephony services includes full support for mobility.

7 From theory to practice

7.1 Short term convergence implementation

Network operators already offer convergent services. In general, user services can be offered relatively independent of the evolution of networks and devices. Services such as "one number" and "follow-me" are available. These services, together with bundling of subscriptions (fixed, mobile, broadband), can be an opportunity to gain new revenue streams and decrease churn.

Enterprise solutions giving fixed and mobile users a single numbering plan with access to the same PBX services are also offered. Video telephony can today be offered from both PC's and mobiles. Services such as Push To Talk and combinational services (such as combining telephony and multimedia sessions) are offered now.

It is important to ensure that new services are introduced in a future-proof fashion. Standards must be followed to allow interoperability and to ensure that the solution can be upgraded. IMS is a cornerstone for converged service offerings for fixed, mobile and the enterprise segments.

As described earlier (see section 3) there are also other important new converged services available, such as triple play and WLAN plus 2G/3G bundled subscriptions.

7.2 Service convergence

Convergence of services and applications implies that the same service can be accessed from different types of terminals, for example sending messages from a mobile user to a PC, or browsing the internet from a handheld mobile phone, and different types of networks – cable TV, mobile or fixed line.

IMS, which is a standardized solution for Session Initiation Protocol (SIP) based applications for multiple accesses, is a key component for delivering converged services with telecom-grade quality of service. IMS makes it possible to increase network efficiency and makes the introduction of new services faster and easier. The common service execution environment of IMS

supports user applications that are available over multiple accesses (access-aware service platforms). There will be one common user and services management function, a common charging system, and a common (SIM-card based) identification and authorization system.

Flexible authentication and identity mechanisms are crucial in a converged environment. The nomadic lifestyle of the end user will require a convenient solution. The use of SIM-card based authentication will be expanded into new domains. One solution is wireless communication between a personal SIM-card holder and the device being used. The SIM-card could be carried as a personal item, always being with you, as exemplified in Figure 4.



Figure 4. A personal SIM-card for universal authentication.

The presence information is a key component for many IMS-based services. Presence-aware communication allows a user to see recipient information before connecting (e.g. availability, geographical position). Presence enables the user to see possible communication alternatives based on device and network capabilities. The presence information will be available from any device (mobile and PC). Presence enables a paradigm shift in person-to-person communication.

The majority of communication sessions using converged services, such as voice calls, video calls, chat sessions, file transfer, on-line games and white board sessions, are typically initiated via the active phonebook. The active phone book is one application that uses the presence information from IMS. An example of active phone book is shown in Figure 5.

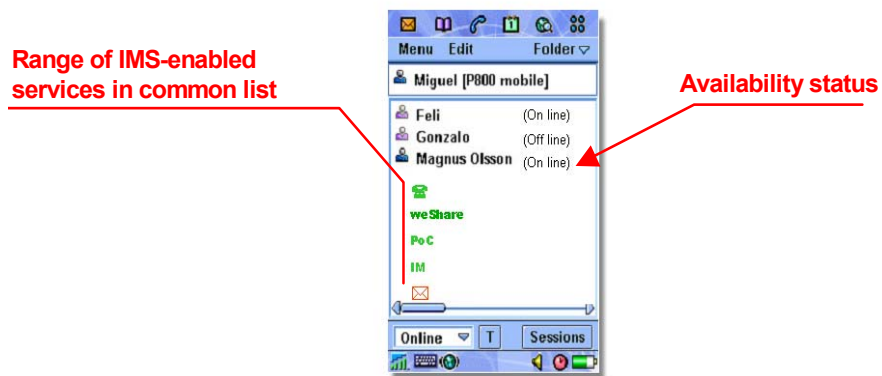


Figure 5. Converged active phone book

7.3 Device convergence

Device evolution can be seen as a mirror of the network and access evolution. It is in the device that the new applications will be available and the identification and security mechanisms are implemented - therefore it is also where access capabilities need to exist. Another possible functionality for mobile device convergence, in the short/medium term, is adding support for Unlicensed Mobile Access (UMA). This allows a mobile phone to use WLAN/Bluetooth to access the local fixed broadband to connect to the GSM core network. Furthermore, in the future, IP telephony needs to be implemented in the communications protocol of the device so that future convergence opportunities can be fully utilized.

The pace of evolution in this device convergence area will increase in coming years, as new access technologies are introduced. It can be expected that additional access technologies will lead to extra cost for the device. Overall device and network economy must therefore be considered when introducing new accesses. Storage requirements and capabilities will dramatically increase in both devices and networks. Figure 6 shows the evolution of the capabilities of the mobile phone.

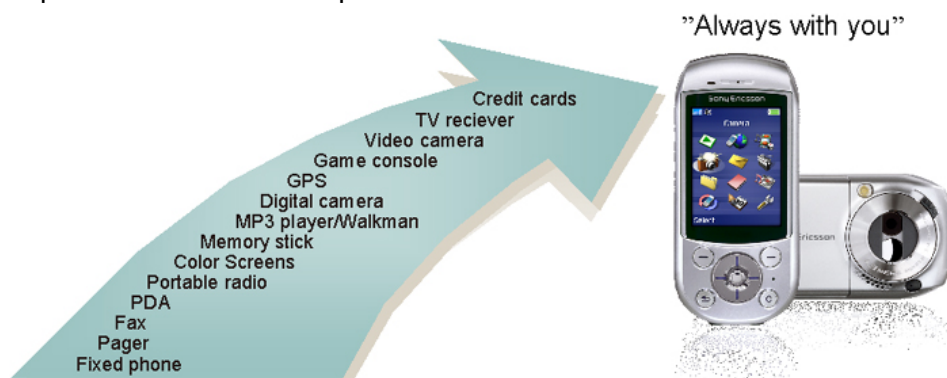


Figure 6. More and more functions are being included on, or connected by, the mobile

Some key network characteristics must also be available to devices connected to the fixed network. The evolution of connected home networks with a multitude of applications, such as interactive TV, games, music downloads, shopping and home security, to name a few, will require some of the characteristics that are delivered by IMS (e.g. quality of service, user management, charging and security) also in the fixed network and to stationary devices. Figure 7 shows some examples of devices connected to the home via a broadband connection that could benefit from network information, just like the mobile devices.



Figure 7. Digital infrastructure at home.

A highly important opportunity for telecommunication players is to address this home networking need with business model solutions originating from the mobile market, e.g. the authentication and security related to the SIM-card. Extended use of the SIM related functionality will increase the operator's value to the Content Providers as well as to the users.

7.4 Network convergence

Until recently networks for wireless, wireline, data and cable-TV services have existed in isolation. The next-generation solutions represent a more efficient way to build networks using a common multi-service layered architecture. The networks will have a layered structure with a service layer, a control layer, a backbone layer and access networks.

Having one converged network for all access types is a significant benefit of layered architecture. This can improve service quality and allows the efficient introduction of new multimedia services based on IMS.

Operators can increase network efficiency using optimized transport and coding solutions and will not need the over-capacity required when the networks are separated. Significant cost savings can arise from having one network with fewer nodes and lower operating costs. From an investment perspective, it is possible to optimize the use of control and media processing resources, hence reducing the need to replace technologies and the cost of network updates.

IMS is a key component of multi-service layered architecture. IMS is a subsystem supporting multimedia sessions, standardized by 3GPP and using the Session Initiation Protocol (SIP) from IETF. IMS is a common foundation for fixed, mobile and enterprise services, delivering services over multiple accesses such as CDMA2000, WCDMA, GSM, fixed broadband and WLAN. Thus being a cornerstone in a converged solution. Figure 8 shows a target network architecture based on IMS.

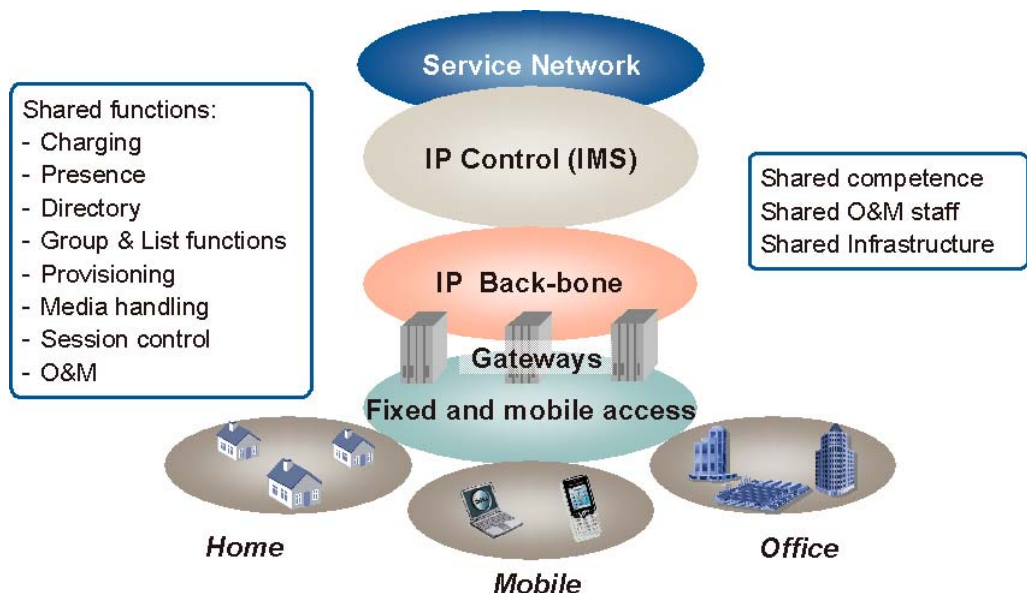


Figure 8. Target architecture

A converged network using IMS allows the following resources to be shared, regardless of service or access type.

- Charging
- Presence
- Directory
- Group and list functions
- Provisioning
- Media handling
- Session control
- Operation and management

In addition to making converged user services faster and easier to introduce, as described in chapter 7.2, the common shared resources also increase operational efficiency in the network.

The network evolution path is unique for each operator and depends on many factors including the business environment, cultural heritage, regulations, end-

user behavior and PC and mobile penetration rates. The transformation is usually done step by step towards the target network with an all-IP-solution based on IMS.

8 Key operator aspects

There are a number of decisions and actions to be taken when defining the strategy and way forward. Both the business and network convergence aspects must be considered.

Successful operators will:

- Through market research, considering global user trends and local market situations, create winning propositions towards end-user segments, bearing in mind the users expectations of converged services.
- Select solutions that follow standards in order to ensure service, network and device interoperability, and partner with vendors who are driving and adapting the agreed standards. Full interoperability is a foundation for converged services.
- Select vendors and partners that can provide a product portfolio covering all solutions within the areas of fixed, mobile and enterprise. This is needed to secure a homogenous end-to-end solution covering the services, device and network domains, and to consider convergence from all aspects.
- Consider short and medium range radio technologies (WLAN, WiMAX) and how they can be integrated as an extension to fixed broadband access and how this would affect the possibilities to offer converged services.

9 Conclusion

For years the telecommunications industry discussed convergence in its many forms. Even though the theory was right it did not become a reality. However, today's trend is clear, convergence has returned - and this time with a solid user, technological and service motivation. Examples of convergence-related services and implementations available already today are; bundling, triple play, seamless WLAN/2G/3G connection, multi-access mobile devices, layered architecture and IMS.

The communication market is evolving rapidly. New dynamic players are emerging and competition is increasing. New partnerships are formed and old boundaries for conducting business are fading. In this changing business environment operators are exploring different ways to find new revenue streams, reduce operating costs and provide solutions that create stickiness and reduce churn. To offer convergent services is one way to achieve this.

Operators have network assets that they want to continue to leverage during the evolution towards next-generation networks. This requires substantial planning and typically a staged approach. It is not possible to specify a single path forward for each network operator category, as each operator is unique. However, it is obvious that convergence will be an important aspect for all network operator categories.

Technology that enables converged services exists. IP and the Internet paradigm are being introduced in all areas of communication. Rapid development of radio technology leading to increased bit rates and support for mobility enables true converged services – the same end-user service can be reached by both mobile and fixed access via the same user interface.

The successful operator will provide a multitude of new services. Many of them will be available by both mobile and fixed access. Others will represent a combination of TV, Internet and telephony – all of them being converged services. Operators that act now and adapt their strategic business plan considering the changing environment, with an early introduction of converged services, will gain a competitive edge.

IMS is a cornerstone for efficient converged service offerings. It is a key to deliver multimedia services with telecom-grade quality of service. IMS makes it possible to increase network efficiency and makes the introduction of new converged services faster and easier.

10 Glossary

3GPP Third Generation Partnership Project

CDMA Code Division Multiple Access

DECT Digital Enhanced Cordless Telecommunications

FMC Fixed-Mobile Convergence

GSM Global System for Mobile Communications

IETF Internet Engineering Task Force

IMS IP Multimedia Subsystem

IP Internet Protocol

ISDN Integrated Service Digital Network

LAN Local Area Network

PBX Private Branch Exchange

PSTN Public Switched Telecom Network

SIM Subscriber Identity Module

SIP Session Initiation Protocol

UMA Unlicensed Mobile Access

WAN Wide Area Network

WAP Wireless Application Protocol

WCDMA Wideband Code Division Multiple Access

WiFi Wireless Fidelity

WiMAX a wireless industry coalition for broadband wireless access networks.

WLAN Wireless-Local Area Network

VoIP Voice over the Internet Protocol

11 References

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http://www.ericsson.com/products/white_papers_pdf/service_wp_layer.pdf
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