White Paper

Nokia Multi-Access to IP Multimedia

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CONNECTING PEOPLE

Contents

Executive Summary

The services and business models of mobile and fixed broadband domains are converging. The IP Multimedia Subsystem will unify the IP multimedia services of fixed and mobile domains, enabling Multiple Access to those common services via a variety of different access networks and terminal types, the critical component is Session Initiation Protocol (SIP). The increased number of end points, or connected end-users, in the unified fixed/mobile environment will drive increased usage.

Common service delivery machinery for both fixed and mobile domains will provide the same authentication, end-to-end-security, applications, service provider and a single bill to multi-access end-users.

The open converged broadband/mobile service environment offers new opportunities for network operators, enabling them to also become service providers for end-users who do not use their network for access.

Convergence

Convergence between fixed broadband and mobile domains can be viewed from several angles:

- Convergence of services – The same services and content can be delivered via any network to any terminal. For example, using an Instant Messaging service from both a fixed and mobile terminal.
- Convergence of networks – The same access, backbone and service core is used for mobile and fixed services.
- Convergence of terminals – Support for multiple accesses in the same terminal (for example, DSL, USB, Bluetooth, WLAN, Cellular).

The main focus of this paper is the convergence of services, using **multi-access** networks and terminals to utilize the very same IP multimedia services. The converged services themselves are fully network and terminal independent – able to exist across the boundaries of different networks.

Convergence of Services and Business Models

Service Convergence

The services currently carried by fixed broadband networks and mobile networks are considerably different. Broadband networks are dominated by non-real-time data traffic, whilst mobile networks carry a rapidly evolving mixture of voice, messaging and data services. The near future will see a growth in voice, video, Multimedia Messaging and Instant Messaging services over broadband networks; whilst mobile networks will carry increasing amounts of video and non-real-time data traffic. Hence, the services carried by broadband and mobile networks will converge. This is depicted in Figure 1.

Business Model Convergence

As services converge, so too will the business models.

The role of the subscription provider, i.e. the owner of the business relationship with the end-user, will become more clearly detached from the role of the network operator. This could be accompanied by an increase in the number of virtual network operators (MVNO) entering the mobile domain, as well as content providers entering as subscription providers in both the broadband and mobile domains. For end-users, this will enable a single subscription, covering both broadband and mobile services.

The new services supported by broadband networks will require the introduction of new usage and transaction-based charging, in addition to the current flat fee or dial-up pricing schemes. Thus, broadband operators need to be able to apply the business models already established in the mobile domain.

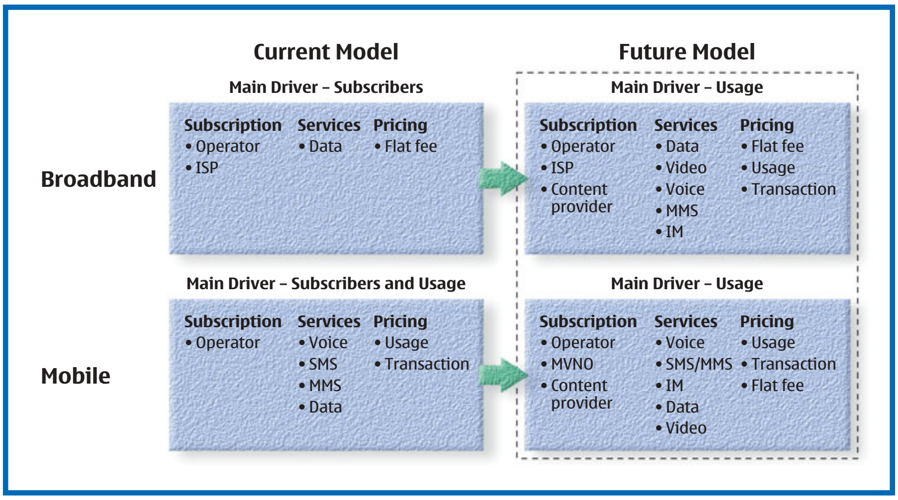

Figure 1. Service and Business Model Convergence

Several ISPs already support transaction-based charging, enabling an SMS to be sent from the Internet to mobiles, with the charge being added to the end-users' ISP bill. Flat fee pricing is also entering the mobile domain, with many operators now offering GPRS services for a single monthly fee, regardless of usage.

Session Initiation Protocol (SIP)

Session Initiation Protocol is the key enabler for converged multimedia services.

SIP Unifies Messaging Across Fixed and Mobile Domains

The messaging world currently consists of incompatible 'messaging islands', such as SMS, AOL IM and Windows Messenger. For example, you can only send an AOL Instant Message to someone with an AOL account. SIP convergence will bring a huge increase in the number of compatible messaging end-points, resulting in an exponential increase in messaging traffic (Metcalfe's Law) in both fixed and mobile domains.

But with SIP this unification is not just about messaging...

Multimedia Person-to-person(s) Communication

SIP brings the concept of a 'call' to the Internet with the capability of charging based on usage. SIP is the only open protocol that enables the calling party to 'ring' a PC (Microsoft NetMeeting is proprietary, however, Windows XP NetMeeting is based on SIP).

SIP communication is built around the concept of a session. A communication session between end-users is first established. Then, different multimedia components, such as video, browsing and so on, can be seamlessly added to this session and taken away without restarting the ongoing session. SIP turns the Internet from 'click-to-browse' and 'send-and-pray' into to real-time multimedia communication.

SIP-enabled Multiple Access

With SIP, you do not need to know if the receiver has a PC, PDA or mobile. You also do not need any specific terminal or service to be able to communicate with your friends. This is the real power of multiple access.

More than two decades ago, it was taken for granted that the original voice-only mobile networks must be able to communicate with fixed telephones. Today, when making a voice call, you do not actually know if you are calling a fixed or mobile telephone (unless you happen to know the network codes of the country you are calling, and even then you cannot be sure if the call is diverted to a different terminal). However, where non-voice services are concerned, the mobile industry has been somewhat inward looking – focussing only on services that can be used within mobile networks.

Now, with SIP, the same compatibility becomes a reality for the whole range of fixed and mobile person-to-person services. Mobile-to-mobile is certainly a huge market, but it is only half of the story.

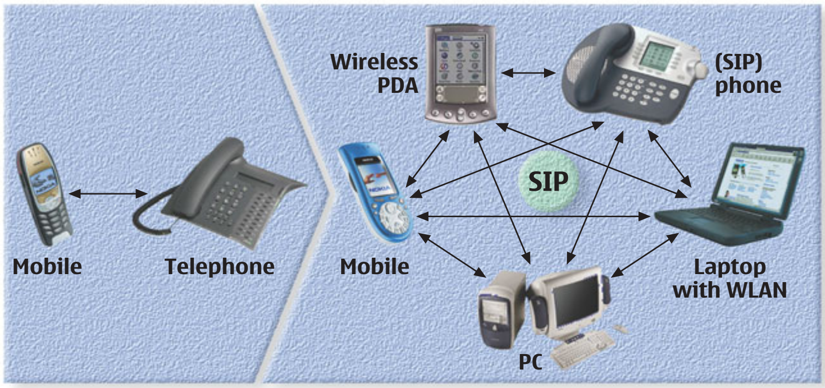

Figure 2. Example of SIP-enabled Service Mobility

	IETF SIP	3GPP SIP
Authentication	Username/Password	Secure authentication via USIM/ISIM. Enabling security and charging solutions.
Charging	Mobile users also charged for terminated voice, video, messaging etc.	Supports 'calling party pays'
Regulatory support	No support for emergency call, lawful interception or number portability	Supports mobile network regulatory requirements.
Quality of Service	For real-time services (voice, video), guaranteeing QoS is difficult	Bearer QoS for conversational services can be managed mobile-to-mobile, even when roaming

Table 1. Drivers for 3GPP SIP Extensions

Flexible and Extensible

Compared to the alternative real-time communication protocol H.323, SIP is simpler, more flexible and extensible For example, SIP will allow a ring tone, picture or message to be sent as part of the session set-up signalling. The Windows Messenger that is included in Windows XP is based on SIP.

The downside of the high flexibility is that SIP has a relatively high signalling overhead. In narrow bandwidth applications, such as GPRS mobile, this means that header compression and stripping techniques will be used to reduce the SIP overhead.

SIP Compatibility

Internet standardisation is somewhat different from telecommunications standardisation. The IETF creates recommendations, in the form of RFCs (Request For Comments), that form the building blocks from which solutions can be built. This enables maximum flexibility and naturally results in the existence of different dialects or flavours of protocols, and the emergence of de-facto standards. Currently two main flavours of SIP exist; IETF SIP and 3GPP SIP.

The compatibility between different SIP implementations can be considered on two levels; the connectivity layer and application layer compatibility.

Connectivity Layer

At the connectivity layer, the specific requirements of the mobile environment have led 3GPP to standardise a version of SIP that is built on the IETF building blocks, but that also includes 3GPP extensions (hereafter this is referred to as '3GPP SIP'). This 3GPP flavour of SIP is tailored to meet the requirements of the mobile domain, which are detailed in Table 1.

In IETF SIP, the network itself is not aware of the SIP session and acts only as a bit-pipe for the SIP traffic. By contrast, in 3GPP SIP the network is session state aware and takes an active role in the SIP session, controlling the usage of network resources according to the demands of the service. Although developed for the mobile domain, 3GPP SIP includes exactly those features that are required to enable fixed broadband operators to evolve to a usage-based business model.

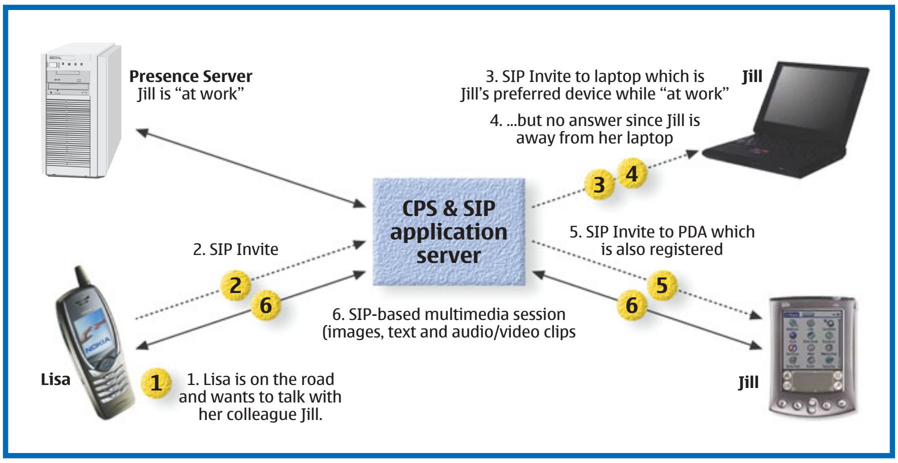

Figure 3. Example of SIP-enabled Service Mobility

A further benefit of 3GPP SIP is that it is tightly standardised, guaranteeing interworking between different vendors' implementations. An SIP implementation based only on the flexible IETF building blocks opens the possibility of interworking difficulties between implementations.

For convergence to be realised, interworking between the IETF SIP of the fixed Internet and the mobile-optimised 3GPP SIP must be enabled. Nokia target that their IP Multimedia Subsystem will understand both the IETF and 3GPP flavours of SIP. Additionally, other SIP vendors have also voiced their support of both flavours. Similar announcements from other SIP vendors are expected in the near future. It is also expected that SIP user agents ('SIP stacks') for fixed terminals (PCs) that understand both IETF and 3GPP SIP will become available.

Additionally, 3GPP is currently working towards bringing their SIP extensions into IETF, so some convergence at the specification level can also be expected within the 3GPP Release 6 timeframe.

Application Layer

Interworking at the application layer is also required if a particular SIP application is to be used across different terminals and access media. For example, messages sent by one SIP messaging application should be understood by other SIP messaging applications. In IETF SIP, messaging is loosely specified by the IETF SIMPLE Working Group. This will also form the basis of 3GPP SIP messaging made in release 6.

At the application layer, the emergence of de-facto standards will play a key role in creating compatibility. Additionally, application gateways within the network will be used to provide compatibility between different applications for example, how MMS to email gateways are used today.

Mobility of Services and Devices

Today end-users already have multiple terminals – a fixed PC and a mobile phone. Furthermore, there are a growing number of end-users with additional terminals, such as PDAs and second mobile phones. Generally, these terminals will be used simultaneously; at any one time they will all be active and connected to the network.

Service Mobility

In the future, presence information will allow the used terminal to be automatically selected, depending on the service, the device capability, the device availability and the end-user preferences. This is shown in the Figure 3 above.

For multimode terminals, such as a possible future cellular/WLAN terminal, the mode of operation will be selected based on the quality of service and bandwidth requirements of the service. For example, WLAN will be used for non-real-time services, whilst cellular will be used for real-time services.

Device Mobility

Device mobility, for instance, when a multimode cellular/WLAN mobile terminal moves from WLAN coverage to cellular coverage, is achieved via Mobile IP based handovers. This enables the communication session to continue seamlessly across such borders and means that the end-user does not have to re-authenticate with the IP Multimedia Subsystem.

Authentication

The critical requirement in enabling convergence is the secure authentication of the end-user, as without this no revenue can be collected. The subscription provider has the responsibility of providing the authentication and billing services to the other parties in the business model, for example, network operators and content providers.

In the fixed broadband domain, operators are faced with the challenge that the 'username/password' authentication mechanisms currently utilised in the Internet domain are relatively weak and insufficient to ensure that the consumer of the services can be correctly charged. On the other hand, it would be unreasonable to expect that all PCs are equipped with the physical ISIM card-based authentication of the mobile domain.

The converged authentication solution is still being discussed in various forums. The final solution probably lies somewhere between the two extremes, for example, in the utilisation of Public Key Infrastructure (PKI) certificates that are dynamically generated using the SIM and stored to the PC.

Quality of Service

In the 3GPP mobile domain, the end-to-end QoS can be fully controlled to meet the requirements of different types of services and usages. However, in the fixed broadband domain, no such standard QoS control mechanisms currently exist. To enable usage based charging i.e. 'charging per bandwidth', Quality of Service (QoS) control mechanisms must also be brought to the broadband domain. Bringing in QoS mechanisms at the same time enables significant statistical multiplexing gains to be achieved – ensuring that optimum usage is made of the network operator's transport capacity.

In the mobile domain there are also Quality of Service choices. For example, a GPRS mobile could use the mobile operator as a best-effort connection to connect directly to the SIP proxy of an Internet-based service provider. In this case there is no guarantee of satisfactory service quality. By choosing to use the mobile operator's SIP proxy (CSCF in 3GPP terminology) instead, the end-user will be delivered services of a controlled quality. This is of course vital for real-time voice and video based services.

It should also be noted that using an Internet based SIP proxy, rather than the mobile network IMS, may have several other disadvantages for the mobile user, such as:

- Reduced security
- No support for emergency calls
- Charging for receiving incoming calls (GPRS bandwidth)
- Reduced presence information (i.e. without location information)

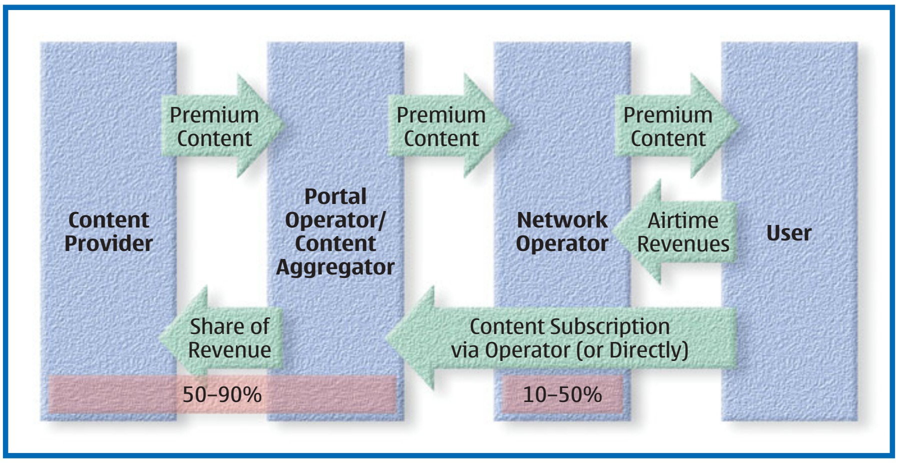

Figure 4. Revenue Sharing (percentage figures shown indicate the range of revenue distribution in mobile networks today)

Revenue Sharing Models

A key requirement of the evolving converged broadband/mobile business model is the need to share revenues between content providers, portal operators/content aggregators and network operators.

In the revenue sharing models currently active in mobile networks, the revenue share taken by the content provider ranges from the 50% typical of SMS-based services to the 90% of DoCoMo i-mode. A generic revenue sharing model is shown in Figure 4. Importantly, in all cases the network operator retains 100% of the access revenue. It is expected that revenue sharing levels in the converged broadband/mobile domain are rather similar to those of i-mode.

Work is ongoing in various forums to create standardised web services interfaces that will enable the easy provisioning of services and appropriate revenue distribution between network operators, portal operators and content providers.

Control Points and Challenges

One aspect clearly shaping the industry today is the fight to maintain control over end-users and content. For example, the widely publicised 'Instant Messaging wars' of recent years has seen IM service providers using incompatibility as a way of maintaining control over end-users. Clearly, there may also be resistance in moving to an SIP based, globally unified messaging technology.

Nokia believes that 'control point' oriented thinking ultimately risks limiting what can be achieved. Openness in all aspects is the only way the full business potential of the converged fixed mobile world be realised. In fact, convergence will open many new business opportunities to existing operators and service providers.

New Business Opportunities

The open converged broadband/mobile service environment offers new opportunities for network operators, enabling them to become service providers for end-users who do not use their network for access. For example:

- A mobile network operator can offer Instant Messaging and IP multimedia services to broadband access subscribers.
- A broadband network operator can offer Instant Messaging and IP multimedia services to mobile subscribers.
- A service provider can offer Instant Messaging and IP multimedia services to broadband and mobile subscribers (whilst this is technically possible, the complex financial agreements required may make this impractical).

Instant Messaging and person-to-person communication across different networks does not currently exist, providing an untapped opportunity. Any operator with SIP messaging capability can provide messaging to any SIP-enabled device based on subscription.

Existing mobile and fixed network operators are strategically placed to exploit these emerging business opportunities.

Conclusions

The telecommunications and service provider industry is undergoing a change from telephony, mobile text messaging and fixed Internet services to richer person-to-person(s) and content-to-person services.

The IP Multimedia Subsystem, providing services based on Session Initiation Protocol (SIP), will be the key enabler for converged multimedia services.

The business models of mobile and fixed broadband domains are converging, from voice/SMS and monthly fee to transaction-based multimedia. In order to ensure profitable operations for convergence services, the following service and business model enablers need to be in place:

- Service provisioning capabilities
- Reliable authentication
- Billing and charging solutions
- Business-to-business interfaces
- Quality of Service control mechanisms

Glossary

SIP	Session Initiation Protocol
SMS	Short Message Service
QoS	Quality of service
IP	Internet Protocol
GPRS	General Packet Radio Service
IM	Instant Messaging
IMS	IP Multimedia Subsystem
CSCF	Call State Control Function
3GPP	3rd Generation Partnership Project
WLAN	Wireless Local Area Network
IETF	Internet Engineering Task Force
PDA	Personal Digital Assistant
MVNO	Mobile Virtual Network Operator
ISIM	IP Multimedia Services Identity Module

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