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WHITE PAPER

Mobile Multimedia

The next step in richer communication

ERICSSON

Preface

This white paper is primarily intended for mobile operators, telecom journalists and analysts. On an advanced level, the paper describes Ericsson's perspective on Mobile Multimedia, including consumer trends, service diffusion and Ericsson's network vision.

The document will not describe the technical details of how different Mobile Multimedia services are enabled. If certain parts of the paper raise additional questions or thoughts, please contact your local Ericsson office for further discussion.

Contents

1 Introduction

Telecommunications is expanding “beyond voice” to new services that allow people to do more than just speak to each other. Users can utilize sound, text, and video in their interactions; they can access information systems and services from any place and at any time; they have greater control over how they interact with their communications providers; and they can influence how their chosen communication services interact with the outside world

1.1 Today’s trends

During the last 20 years, the number of mobile subscriptions, worldwide, has increased to more than 1280 million. In 2003 alone, global mobile phone sales amounted to 533 million. Subscriber behavior and demands have largely been driven by the main service available—telephony, amounting to 6.3 billion voice minutes per day. However, the users of tomorrow will have access to a large number of new mobile services; they will behave differently and have different expectations in regards to handsets and services. The best way to prepare and foresee the demands of tomorrow and the requirements of the future is to understand the trends already occurring today.

1.1.1 Youths are setting the scene

Young people all over the world are showing again and again how willing they are to experiment with new services and to define new uses for mobile devices and services. Teenagers seem to have formed their own independent world and social reality through mobile devices and the Internet. Mobile device enable ad-hoc socializing and instant life style. For young people, the phone is an important device in maintaining their social circles and they want to be accessible 24-7, out of fear of missing something. For most teenagers, the mobile phone is much more than a phone. It is a very personal device and part of their personalities and identities, and it can also be a measure of popularity.

1.1.2 Increasing demand for speed and performance

The context of increasing stress and complexity in society gives rise to increasing impatience among people. In addition, mobility as such makes people more impatient per se. People rate mobile connections as slower even if they have the same response times as fixed connections.

The increasing feeling of “lack of time” in today’s society mainly comes from feeling overwhelmed by the ***context switching between different activities and contexts*** (e.g. work/leisure, voice/data, public/private and various communication channels), rather than the information load itself.

Another interesting observation regarding product and service development is that product life cycles are becoming shorter and shorter. Managing the increasing pace of perceived change and novelty will be a key in development of future value propositions to the market.

1.1.3 Transformation of communication culture

The use of infocom technology has led to shifts in communication patterns. Telecommunication today very is much about ***sharing everyday experiences*** and ***micro coordination***.

Furthermore, the mobile device has created a feeling of need, a need to ***continuously be available***. But just as a mobile device can generate feelings of loneliness and isolation if it never rings, it can also legitimize solitude; checking and tapping on the phone says "I'm busy and want to be left alone!"

The rise of the experience economy where consumers go from consuming out of needs to consumption out of wants and desires. There is also a shift in how consumers define value—from products to experiences.

1.2 Consumers of tomorrow

Operators and service providers of tomorrow will face an increasingly demanding and empowered consumer, who will be ***individualistic, independent, informed and involved***. This expansion of individuality occurs at a time of booming supply of products, services and information giving the consumer a multitude of communication channels to choose among.

This individualization trend is complemented by an increasing ***tribalism,*** or an individual collectivism. People are self-organizing into communities and tribes of shared values and interests, often crossing national or social borders. To join a community is not a long-term commitment, on the contrary, joining and leaving is speedily done without planning.

"I'm always connected, therefore I am." The technology and connection are being taken for granted. One should be reachable at all times, 24-7. Alone no longer means just physically alone; it means "not connected". Social connectivity has become totally personalized and the meaning of your number or mail address has decreased, while the meaning of the individual behind it has grown. In this context, handsets or the Internet is merely a meeting place, a "private sphere" where people meet.

Communication will in the long run become even ***more integrated into everyday objects***, such as toys, cars and clothing. Communication will occur more and more without human intervention and be increasingly invisible at the point of use.

Advances in technology will continue to amplify the ***role of social networks in daily life***. Previously scheduled social interactions are increasingly rare among young people and there is a growing expectation and preference for ad-hoc social interactions. Communication has already moved from making announcements to sharing everyday experiences.

A well-functioning product or service is not enough; "connected consumers" are becoming increasingly informed and powerful, and are networking around common skills, interests and experiences. There is also a shift in how consumers define value—from products to experiences. Consumers expect ***rich user experiences appealing to their emotions.***

From the consumer's perspective, it is how a ***service looks and works in my phone*** that is the most important. Furthermore, it is about moving the mobile phone from the ear to the eye. However, it is important to bear in mind that for all users, the key functionality of this device will still be communication.

Ease of use, intuitive interfaces and lack of passwords should be considered as given factors when designing future mobile services. Integrated cameras will become commodities for mobile devices in order to serve the main purpose of imaging for person-to-person communication. In addition, consumers are coming to rely on mobile phones functioning **anywhere** and **anytime**. This places high demands on phone features, including long battery life, large memory capabilities and color screens.

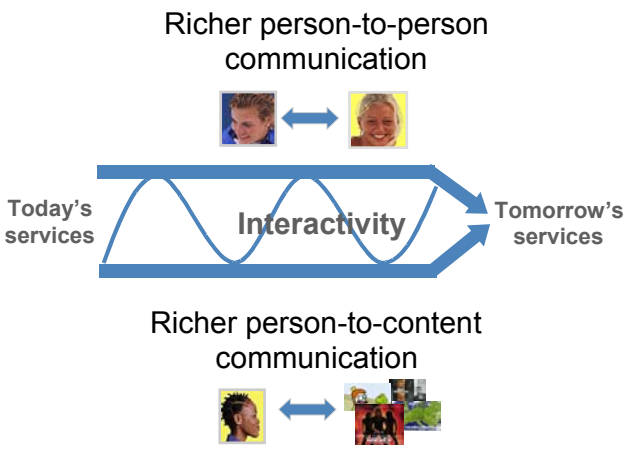
While the younger generation will set the scene and increase their influence on the rest of the market, it is also imperative to understand the **increasingly gray demographics**. Europe, North America and Japan in particular will enter a mature phase characterized by ageing.

Society is ageing in the OECD countries; the number of people over 65 in 1960 was 15% and in 2030, it will be 35%. The increasing population of elderly is likely to be more active, healthy, educated and affluent—as well as older purely chronologically—than before. This puts additional requirements on future applications and devices.

2 This is Mobile Multimedia

The consumers of the future will put new requirements and demands on services. However, the fact is that today we already use different kinds of multimedia services, i.e. services that to some extent combine pictures, motion and audio. These include TV, video and the Internet. Many of these applications have become fundamental elements of our lives because they fulfill basic needs, for example, communication with friends, escape from reality and last but not least simply enjoying ourselves.

As technology develops, we can satisfy these needs by using new tools, new applications and new personal devices. When utilizing these new personal tools and services to enrich our lives, while being mobile, we are using **Mobile Multimedia** applications.



As new handsets, new technologies and new business models are introduced on the marketplace, new attractive multimedia services can and will be launched, fulfilling the demands outlined in the previous chapter. Because the number of multimedia services—and even more so, the context in which the services are used—is numerous, the following model is introduced in order to simplify and clarify how different services will evolve, enrich our lives and fulfill our desires.

As indicated by the figure, richer communication via Mobile Multimedia will be enabled via enriched **person-to-person communication** and **person-to-content communication.** The boundaries between these two typical use cases are of course vague and will become more so as new applications and services are introduced—not fitting into just one of the use cases. In order to achieve fast uptake of services, we must understand the needs they fulfill, and how to combine them. These new services can then build on what the user is already familiar with and add a new flavor to stimulate interest.

In order to clarify how different Mobile Multimedia services relate to our daily life already and how they can be used tomorrow, please follow John, Sara and Anne during a day in their lives.

2.1 John, an entrepreneur…

.. is 34 years old, and generally lives life in the "fast lane". He is married and has two children. John always has many projects underway, both at work and at home,

and has little time for himself. He therefore desires efficiency so as not to miss out on staying connected with his family, friends and colleagues.

John's days hardly ever follow a routine, this morning he woke up very early to go to the airport for a two-day business trip. Just after leaving home, he receives **a notification on his phone** that his flight will be 30 minutes late. As he is a frequent traveler, he is sent **a digital voucher** as compensation. He can receive 2000 extra bonus points if he shows the voucher at check-in. Before take-off, he makes sure to **update his phone's calendar and mail inbox** so he can work during the flight.

While in the taxi from the airport, John's associate Jeff calls needing to show and discuss a few construction details of their new future office. Jeff activates the phone's **one-way video mode** to show John directly what he is talking about. John watches on his phone while discussing how to best move forward.

Then John switches the **presence mode** of his phone to show callers that he is "in meetings" most of the day and will only be viewing **text and picture/video messages**.

Upon arriving at his hotel room, he turns on the TV and takes out his phone to **view today's news**. His personalized subscription service shows text and video clips with the latest **business news**, **local sports** aw well as the **weather** report from home.

To his surprise, he has received a **video message** from his 6-year old son proudly showing daddy a happy toothless smile—he lost his first tooth today! John then places a **two-way video call** home before the children's bedtime to check out the tooth gap and say goodnight. Afterwards he chats with his wife about today's happenings. Right before going to sleep, he can't keep himself from playing a few rounds of **on-line black jack** on his phone, just for fun, no big bets, but John enjoys the challenge of trying to win a little money.

2.2 Sarah, a student...

...is 20 years old and is studying media arts and communication at the local university. She has an open personality and is curious about lots of things. She is ambitious regarding her studies, likes to spend time with her friends. Sarah has lots of friends and a huge need to maintain her social network, share emotions, express herself and to simply have fun.

A day in Sarah's life starts with a harsh melody from her mobile phone as a wake-up call; a few seconds later, morning music and news from her favorite Internet radio station begins playing on her iBook. While getting dressed and sipping her morning coffee, she uses her phone to **receive and listen to some new music** her boyfriend sent her last night.

On her way to school, she listens to the local FM radio station on her phone, when they suddenly play a cool new song. She quickly checks the screen to **view the play list**. She likes it so much that she decides to **buy the song and download it** to her mobile phone straightaway.

During a morning lecture, she sends a **picture message** to her friends including the song and text saying "Cool song, eh?" and "Want sushi lunch, meet 12 at

Kikos!" Neither Sarah nor her friends ever turn their phones off. She notes that their mood **emoticons in her address book** show that they all are busy – but they'll certainly get Sarah's message nonetheless.

After school, she goes home to prepare for a night out with two girlfriends. Sarah wants their advice on which clothes to wear, so she quickly snaps a couple of photos of herself in the mirror with different outfits. She then makes **a group call** to both her friends, and while chatting she **sends the photos** to them and asks for their opinions.

Later in the bar, they **check out the Big Brother web cams** on the phone together—one of the guys on the show is from their school. Giggling, they **place their votes** for him to stay him on the show a while longer, also, they record and send him a **video greeting** from the bar…

2.3 Anne, a financial controller...

...is 43 years old and has a 10-year-old son, Peter. She uses her mobile phone and PC a lot, but is not really interested in technology nor special features. Anne wants useful services that can save time and make her life easier. Anne has strong values and beliefs; she cares a lot for her family and close friends, and also tries to do what's right for society and for people who are less well off.

A day in Anne's life starts early; first breakfast with Peter and then he's off to school. As Anne is getting ready to leave for the commuter train, she receives **notification on her mobile phone** that her train is running 20 minutes late. The service also sent her an **alternative route suggestion,** but today she had no morning meetings so she was quite happy to use the extra 20 minutes at home to get some chores out of the way. On the train, Anne also tries to use time efficiently, most often to **read e-mail**. When replying to messages with her phone, Anne usually records and sends a **voice message, with or without attachments.** She has found this to be quicker for her than typing on the phone. Today she remembers she has promised to take her mother and son to the theater next week. She calls tickets.com to see if there are any good seats left. While talking, the salesperson opens a **web link** to show Anne available seating suggestions. Anne looks at her screen and they discuss where one sees and hears the show best. Finally, Anne **buys the tickets and charges** them to her phone account. She **sends details on the booking with her greetings and a promotion video** to her son and mother.

Anne has volunteered to buy a present for a colleague who is changing jobs, so she goes out on her lunch break for a look in the nearby shops. She looks around, but the problem is not finding a nice present, but selecting one. Before making the final decision, she calls June, a colleague. While talking, Anne activates her **one-way video** to show June what she has to choose among. It's always nice to have a second opinion.

That evening at home, Peter shows her his latest combat **game** he **downloaded** to his phone, which is actually a cool gaming device. He also sometimes **plays games on-line** with his friends. Anne chats with Peter and watches him download a free demo version of a new game and she looks forward to testing it with him.

2.4 Person-to-person communication

Person to Person communication

We will use Mobile Multimedia services every day, and will be able to do so even more as technology evolves. Even though different services are used in different contexts, they all satisfy basic human needs and desires.

When it comes to communication between people, it is mainly about enhanced communication between parties through any combination of voice, text, pictures, animations and sounds. From a consumer perspective, the switching between these modes should work seamlessly. Communication in this situation is appealing to human senses and to spontaneity; it is about interactivity, keeping in touch and being better informed.

In person-to-person communication, all of the trends previously described illustrate a desire for a richer communication experience through a mobile device perceived as a tool with a wide variety of capabilities rather than something that provides just “voice and simple text”. Not only does the user want to be able to communicate in different ways, he or she also wants to feel in control of the communication situation. With new technologies and services, the desired control, flexibility, and multiple ways of communicating will be made possible.

2.5 Person-to-content communication

Person to Content communication

The increasing mobility of people, new communication channels and the proven desire to be connected even when mobile are pushing for a market of using the mobile device as a media and information channel.

Person-to-content communication is about providing contextually relevant services “on the go”. Escapism/entertainment and information/utility are the two main areas.

The need for escaping reality with a bit of entertainment and relaxation in daily life is universal and eternal. This is about finding a minute of time “on the go” for myself to play around, relieve boredom or to search for stimulation and excitement. Relevant content in the areas of music, sports and games will be among the most popular services. The mobile phone also offers great opportunities of direct interactivity, to be part of and influence the media content, for example, via text or image communication.

The need for always being connected, always on and always having access to real live information is the opposite of escapism. This is about being “on the go” but still staying in touch with the world and being up-to-date on the world around you. The content here is often time critical information that needs to be constantly updated and fresh in order to be relevant, such as news and sports updates. The mobile phone also has the unique opportunity to offer location-relevant information on the move.

It must again be stressed that ease of use, intuitiveness and immediacy are extremely important attributes. This applies to both person-to-person and person-to-content communications, and becomes even more important as handsets become more capable.

3 Opportunities and Challenges of Mobile Multimedia

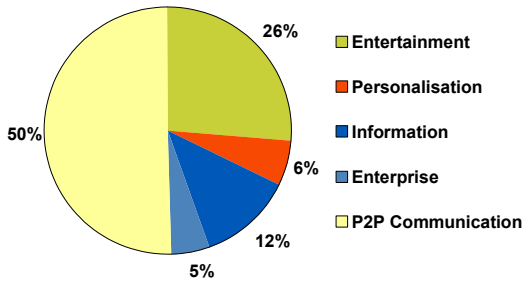
The potential of Mobile Multimedia services is enormous! However, there are certain challenges on the road ahead that need to be considered. This chapter will discuss the opportunities and challenges of delivering Mobile Multimedia services.

3.1 The market outlook is positive

Mobile Multimedia and 3G have largely been bracketed together, with the result that until recently, most operators thought of Mobile Multimedia in the context of future strategy. Successful launches of data services, such as i-Mode in Japan and Vodafone Live mainly in Europe show that the interest for Mobile Multimedia services is here already now, and what is more, it is here to stay.

The number of operators offering their subscribers Mobile Multimedia services has grown substantially in 2003, and appears set to grow even more during the years to come. According to strategy analytics research, shown in the figure below, the total market value for mobile data-driven applications will reach $114 billion in 2008.

Global Mobile Data Revenues
breakdown by applications



It is interesting to note that person-to-person communication represents 50% of revenues, which clearly indicates the potential for richer person-to-person communication. However, one should not forget that a lot of person-to-person communication is driven by the need to communicate about content generated by person-to-content services. The boundaries of the two areas are thus very vague and the enrichment of both areas is crucial for success.

3.2 Meeting the needs

The success of Mobile Multimedia will depend on both a pull from—and a push to—the market. The users will gradually learn to appreciate more advanced services, fuelled by the possibilities being introduced both in the mobile handsets and on other channels such as the Internet—thereby creating a pull from the market.

Operators can also stimulate uptake of new services through targeted push activities, where uptake is stimulated through step-wise introduction, building on—but extending—existing behaviors and desires.

The largest benefit the mobile channel commercially provides the operator—compared to the Internet—is that payment acceptance is already in place. Users expect mobile services to carry a cost comparable to, for example, the Internet where everything is expected to be free of charge (although this is gradually changing). Applications and services therefore need to be tailored to the mobile channel, to enable users to identify and agree on the differences therein, while also accepting the inherited charging associated with use. Furthermore, anecdotal evidence from, e.g., the way mail was used to subsidize American newspaper distribution in the 19th century indicates that we as users seem to be more willing to pay for person-to-person communication than for what is essentially broadcast. The successful operator must therefore have the means to create attractive service bundles that can efficiently and profitably deliver all kinds of services at a cost that the end user is willing to accept.

The history of mobile telephony has shown very clearly that in order to create and expand a true mass market, the solutions have to be firmly based on standards allowing interoperability in many dimensions: *terminal-to-network* to create a thriving end-user equipment market; *intra-network* to create multivendor competition; and *inter-operator* to create a user base that is not limited by the coverage of a given operator or technology.

Ericsson thus believes strongly that future networks as well, must have a solid foundation in international standards as well as industry consensus on deployment. Of course, the architectural design choices made must in equal measure provide for operator differentiation in personalization, service bundling, co-branding, business-to-business relations, tariffing, quality-of-service aspects, etc.

It is also clear that in the harsher business climate of today, technology enablers will not be introduced just on technical merits. Instead, technology is—and indeed should be—motivated by the commercial interest of the applications that can be launched. Again, it becomes a question of balance, as a pure application-driven architecture easily results in a large number of parallel vertical “stovepipe” implementations, with overlapping functionality and an explosion in operations and management costs. Therefore, even though the launching applications will be the drivers for technology e.g. IP Multimedia Sub System (IMS), the choice of implementation strategy must take into account the future viability of the solution chosen when a large number of applications have to be supported. Note that this is not just an issue of keeping things simple for the operator. As an example, we should not present a different user interface for each application that is based on group communications. The people in a person’s circle of friends do not change depending on the applications they use![1]

Accordingly, the solutions Ericsson proposes are designed to fit current business, the revenue- and perception-driving applications around the corner, as well as the

[1] With the possible exception of schoolyard fashion-sensitive communities…

long-term architectural principles. An important consideration that Ericsson gives careful attention is how the new principles and delivery mechanisms can be introduced into existing, business-critical, revenue-generating networks without disrupting existing business.

One fundamental assumption is that the business landscape in coming years will contain a wide variety of person-to-person and person-to-content applications, sometimes handled and managed individually by the end user, but probably normally bundled and provided by the operator or operator federations. Obviously, the end users expect convenience and ease of use; one major element here is the ability to provide Single Sign On functionality

In particular, Ericsson would like to point to the fundamental importance of attribute-sharing mechanisms in the networks of the future. The capabilities of handsets vary over a very wide range even today; they will be even more diverse in the future. Additionally, varying conditions—such as end-user ability and willingness to communicate, location, roaming status, downloaded applications, bearer allocation, etc.—should be made available to applications in order to make the best possible use of the available resources. Basic mechanisms, such as that defined in the 3GPP Presence architecture, provide a useful basis for collecting and disseminating this kind of information in a standardized, extendable and interoperable fashion. Interestingly, this can also be seen as one of the core features of emerging attribute-sharing standards within the Liberty Alliance, the GUP (Generic User Profile) work in 3GPP, as well as other initiatives.

Ericsson therefore sees it as obvious that IMS will become a mainstay of mobile multimedia business. It fits the requirements quite well: it is an international, recognized standard; it specifies interoperability and roaming; and it provides bearer control, charging and security. Additionally, it is both well integrated with the existing mobile voice and data networks, as well as taking its main characteristics from the IT domain, mainly by embracing SIP, RTP and other IETF protocols as the technology base.

3.2.1 Handsets

Richer person-to-person communication implies that at least two users are involved. In all such communication the diffusion of necessary handsets are important. If you are the only one with a fax—who can you fax to? Similarly, content distributed in a person-to-content service session requires appropriate handset players. Therefore, it is important that both the handset industry as well as the media industry support each other in launching appropriate handsets and coded content.

Operators have a clear opportunity to take the initiative in this process by working for interoperability and standards. Introducing new handsets can be managed together with the introduction of new and compelling services, creating a positive market pull spiral. Downloadable clients will be an interesting deployment option, allowing very rapid market uptake.

3.2.2 Service continuity

As indicated previously there are two different ways in which new services are introduced. Either they leverage on existing behaviors and desires, just fulfilled in

a different format, e.g. adding pictures to an ongoing voice call; or they are revolutionary—as was SMS—in the sense that totally new user behaviors are introduced. Regardless of how a new service is introduced, consumers expect at least basic services to work. If a mobile phone belonging to a multimedia enabled network roams into a conventional network, the owner of the mobile still expects home network based person-to-content services to work. Note that this is essentially not an issue, as the conventional services represent a reliable source of cash flow for the foreseeable future.

Quality of service should be stressed as a major requirement for successful service diffusion. As consumers of today have mostly experienced mobile service enabled via circuit-switched networks, it is imperative to introduce new services with a similar kind of quality.

3.2.3 Service enablers

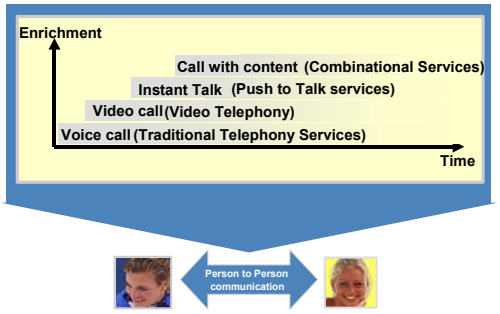
As technologies and solutions evolve, the number of different applications available for consumers will increase rapidly. It will thus be hard to predict which applications that will be embraced by the general public and which services that will drive demand for new handsets and support enablers such as presence, group management, etc. This implies that operators have many opportunities to expand the market.

In order to be successful, operators need to have clear strategies regarding service introduction and service diffusion, coupled with efficient tools and business processes. From a consumer perspective, users learn from and educate each other as new services are successively introduced. From an operator perspective, both capital and operational expenditures can be kept to a minimum by reusing common enablers. The best way to achieve this is to deliver future Mobile Multimedia services on a platform/system that facilitates several services to use common enablers, such as presence and group management. As successful applications build on specific enablers, these enablers will become “global enablers” that are automatically included in new services and supported by handsets.

4 Service Evolution

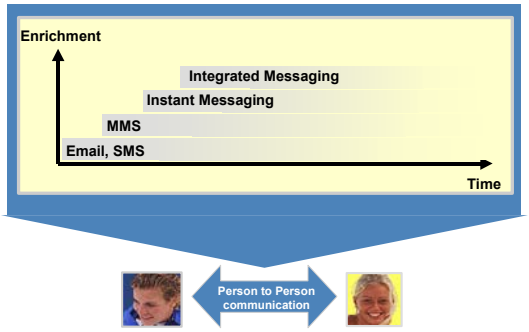
The service evolution occurs in both the area of conversational and messaging services, and addresses future needs as described in the previous sections of the document, such as being able to instantly share experiences, always being available and belonging to a community

Person to Person- Conversation



In the area of conversational services, the evolution involves enrichment and interaction where content is added to calls. This builds very clearly on existing behavior because the well-known telephony paradigm is at the heart of the matter. Incorporating images, video, web sharing, etc. adds value and quality—and most likely minutes—to the calls. Push to talk adds the capability of being instantly in contact with a workgroup or a circle of friends, bringing yet another element of supporting basic social interaction into play.

Person to Person- Messaging



For messaging services, the evolution follows the same pattern. Well-established behavior such as email and SMS (or two-way paging) is extended by adding media—MMS—as well as adopting group communications from the Internet chat paradigm in the form of instant messaging. Going beyond that stage, we will also see a convergence of messaging with online conversations. For instance, MMS is an excellent fallback when an intended multimedia call cannot be set up.

In the area of richer person-to-content communication, the evolution addresses the need of staying updated and informed, as well as having fun and escaping reality.

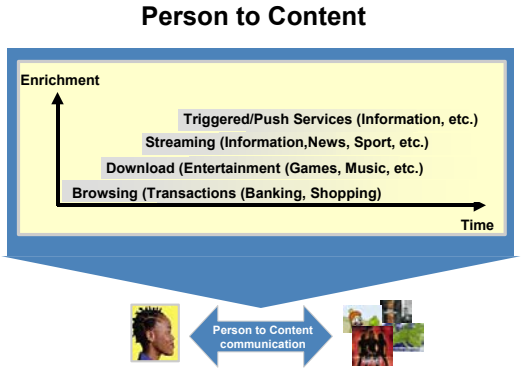
As mentioned earlier, the boundaries between person-to-content and person-to-person communication is becoming more and more vague as future services will be tightly integrated. The development of new person-to-content services is described in the figure below.

Yet again, the importance of a well-defined service strategy and corresponding network functionality is of importance. As an example, let's look at the question of delivering content via streaming or downloading.

Streaming—typically via a streaming server in the mobile network—has a number of attractive features, such as superior bandwidth utilization, fast playback start and the capability to receive live feeds.

Downloading, on the other hand, introduces more delays and requires handset storage capacity, but is typically more robust and requires less network support.

Downloading carries the risk of unauthorized redistribution of copyrighted media material. In order to protect the business model of providing mobile media content, proper Digital Right Management (DRM) mechanisms are needed, from simple forward-lock to more advanced DRM solutions as proposed by the Open Mobile Alliance (OMA).



A similar development can be noted regarding how communication partners are identified. From the basic list of phone numbers on a SIM card, more capable address books have evolved. Presence-enabled phonebooks are being introduced, and on the longer term, we will see network-based active phonebooks. Besides the strategy of how to distribute new services, operators need to decide on how the content should be created and managed, i.e. where the content should be created, via partners or in-house, how the content should be authored, and finally but not least important, how it should be encoded. All of the above need to be handled and managed for the business model for person-to-content services to be successful.

4.1 The network vision

In the previous sections, we have discussed the end-user experience and the business aspects of multimedia. In terms of network realization, it is quite clear that Mobile Multimedia services of the future will be fully enabled via an end-to-end IP network. However, in order to reach this environment, both from a technological and business point of view, there are certain aspects to consider.

Simplicity, intuitiveness and ease of use for the end user should always be the primary goals. These properties collaborate to create an environment where the end user—private user, corporate employee or both at the same time—finds it easy and straightforward to contact the desired person or retrieve the desired content using the means available.

Essentially, this says that a key property for the communications network is to hide the technological details from the end user as much as possible. This is what Ericsson means by Always Best Connected**:** the notion of a network that is aware of the resources available, selecting the best bearer or combination of bearers for each task at hand.

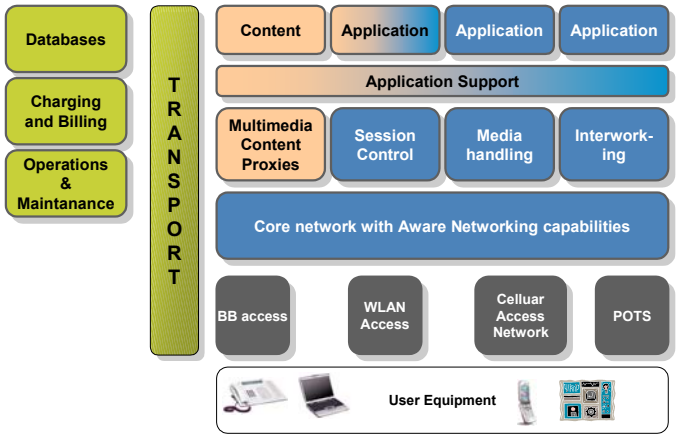


Figure: The target network: logical architecture. Same services, multiple accesses. Black: access, blue: person-to-person, pink: person-to-content, green: support.

Ericsson believes that the network of the future must encompass the following features:

Service convergence:

A service layer that combines the resources of a conventional, content-oriented service network with those of a person-to-person oriented IP multimedia network. In the target network, Ericsson envisions a component-based architecture, consisting of.

- A unified, logical way of accessing the system databases containing commonly used static, semi-static and dynamic data such as subscription information, session state and bearer state. This is essentially a logical extension of the Single Sign-On database already in place, joined with 3GPP and 3GPP2-style presence information.
- Performance and resilience considerations necessitate that this logical database is implemented in a set of layered, replicated and intelligently cached physical databases. Efficient distribution mechanisms are essential, as well as carefully engineered latency/bandwidth tradeoffs based on predicted usage patterns.
- Scalability and availability further dictate that the access mechanisms exposed to applications and peering networks include serving node assignment and discovery. Properly designed, such mechanisms also facilitate recovery backup.
- Service-specific data may still be stored locally with the service execution environment, for time-to-market and performance reasons.

Access convergence*:*

Being able to deliver services on any access form available is fundamental to the notion of Always Best Connected. As discussed above, it should be of no concern to the end user what path the bits are sent between the end-user device and the communicating peer, as long as it is selected in a way consistent with what the

user perceives as “best”. Note that the criteria involved can be complex, involving bandwidth, loss rate, security, privacy, cost, etc.

This means that the common service set must be possible to deliver over a wide range of bearers, with dramatically different characteristics: bit rate, error rate, delay, delay variation, device image size, compute power, etc. Achieving similar characteristics by selecting the least common denominator is obviously not an option, so in the target network, methods and protocols for indicating bearer and device capabilities to the application must be introduced in order to optimize application behavior.

Conversely, the creation of APIs that allow applications to express needs and expectations on bearer behavior in a standardized and scalable fashion is a key element of the vision.

Access methods in the target network will involve a full range of legacy technology—such as PSTN, Circuit Switched mobile telephony, many variants of messaging protocols, H.323-based multimedia, broadband access, 802.11 WLAN, etc.—extended by emerging technologies such as mobile@home (using the handset at home over Bluetooth and eventually WiFi), WiMax, full IP-based conversational real-time mobile telephony, HSDPA, CDMA2000 1xEV and other high-performance cellular technologies, DVB, as well as others that are yet to be developed.

A very important special case is interworking with IP (or more accurately multimedia) PBXs in the enterprise domain. It is imperative that the cellular access remains as an easily integratable component in enterprise solutions, as this is and will remain a substantial revenue source.

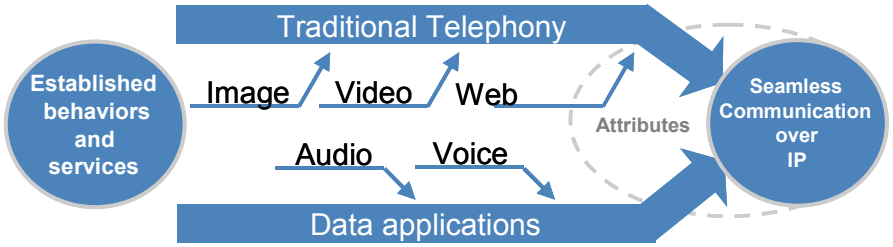
Transport convergence*:*

Essentially, this is already happening, so in terms of the vision it can be basically taken as a given. Ericsson delivers IP-based transport solutions for core networks now; and similar solutions are being studied for both 2G and 3G radio networks. Interesting special cases such as mobile@home have IP-based transport built into the concept; the increasing availability of metropolitan area networks means that it seems very natural to capitalize on this to rationalize the radio access network. Equally as natural, this backbone infrastructure is a fundamental part of bringing fixed broadband access to metropolitan customers. One backbone serving multiple purposes; convergence!

The CAPEX/OPEX reduction effects for an operator when standardizing on a single backbone are likely to be significant, as a single technology base for interconnecting network elements and commodity wide area transport creates the opportunity for rationalization. In this context, it is interesting to note that the service side and the transport side are to a very large extent decoupled in mobile networks. i.e., there is no need to force a transport-side revolution if one wants to attain the service benefits, or vice versa. Using the layered architecture (“softswitch”) approach, allows operators to consolidate and optimize the transport networks within the current standards and architectures, also reaping the major benefits of going IP for the current revenue base: the existing traffic.

4.2 The path to the vision

As we have seen in the previous sections, the evolution of new Mobile Multimedia services is dependent on new technological capabilities and builds on end users' existing consumer behaviors and needs. We still have two service evolution paths to consider: enriching traditional voice behavior with new data services and/or adding basic voice services to established data applications.



The figure above describes schematically how Ericsson sees the orderly, step-wise evolution of new Mobile Multimedia services, where existing behaviors and needs are enriched via new technologies.

The upper path describes how traditional telephony can be enriched via data services such as pictures, video, web pages, games, etc.

By enabling an approach where the end user successively embraces new Mobile Multimedia services, this evolution can start today, utilizing the possibility of two different service carriers being in a radio access network. In so doing, operators can smoothly introduce new multimedia services in existing network environments.

The lower path describes a similar evolution, but in this case existing data applications are enriched by voice services. An example could be a game that is enriched with a voice conversation while playing.

Both paths describe an evolution of combinational services, where enrichment and interaction are vital components. As the service evolution continues, applications of the future will be enabled seamlessly over a full IP network architecture and a common service layer. By then, there will be no boundaries between the two tracks; consumers will share web pages and streaming sessions while talking, interact on common whiteboards while in video conferences and add or drop media as they like. The needs of the future will be fulfilled by new technologies and services, but the basic behaviors of today will bridge to mass-market service acceptance.

Creating the envisioned networks will still require substantial effort in standardization and implementation. The end goal is the fully integrated, end-to-end IP environment that the IP Multimedia Subsystem was designed for, as this will provide the truly flexible application development and deployment environment we need. However, Ericsson firmly believes that the industry can achieve significant early progress by applying a carefully balanced phased approach. The

key to this strategy is to build on two premises: firstly, the end user does not really care which technology is being used as long as the resulting service as experienced through the handset is as expected; secondly, the trickiest delivery problem for mobile IP multimedia is conversational, low latency, full duplex voice.

However, there is naturally a solution to this dilemma: using existing, proven, efficient assets! Ericsson has designed what we call the Combinational approach, where all media flows of the multimedia experience use packet bearers, except for real-time voice flow, which is carried over the existing circuit-switched bearers. The flows are merged in the handset, supported by address translation and capability exchange functionality in the network. In addition, the network will support interoperability with the emerging flora of SIP-based multimedia clients at home and in the enterprise environment.

5 Acronyms

3GPP	3rd Generation Partnership Project
CDMA	Code Division Multiple Access
DRM	Digital Right Management
DTM	Dual Transfer Mode
GSM	Global System for Mobile Communication
IMS	IP Multimedia Sub System
IP	Internet Protocol
ITU	International Telecommunication Union
MMS	Multimedia Messaging Service
OMA	Open Mobile Alliance
QoS	Quality of Service
RAB	Radio Access Bearer
RAN	Radio Access Network
RTP	Real Time Transfer Protocol
SIP	Session Initiation Protocol
SMS	Short Message Service
TDMA	Time Division Multiple Access
WCDMA	Wideband Code Division Multiple Access
WLAN	Wireless Local Area Network

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