

## **Balancing Innovation and Preservation in Telephony**

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## **ABSTRACT**

Telephony might become just another application on the Internet. To examine if this is a likely or even desirable future, is the topic of this article. Everyone used to know what telephony is but with the appearance of software applications like Skype it isn't that easy anymore. Telephony in the traditional sense is interactive voice conversation between two people connected to a global network. When we talk about connectivity to a global network today, we envisage the Internet and when we talk about telephony, it is mobile telephony. The technological platform for telecommunications seems to evolve towards a common data network for all applications. The service specific silo-like networks convert towards a layered network architecture. When the underlying technology changes it remains critical to entangle the telephony application from technology. This article tries to find a clear separation between application and technology and explores innovations of the telephony application in the light of convergence of computers, media and telecommunications. Innovations should be balanced against society's needs to preserve a world wide network for voice communications.

**Keywords:** Telephony, VoIP, Skype, Telecommunications, Innovation

## **VoIP als Universaldienst – ein Widerspruch?**

Telefonie könnte zu einer von vielen Internetapplikationen werden. Telefonie ist interaktive Sprachkommunikation zwischen Personen, die Anschluss an ein weltweites Netz haben. Mit Internetapplikationen wie Skype wird Telefonie neu zu definieren sein. Die technologische Plattform für Kommunikationsnetze verändert sich zu einer einheitlichen paketorientierten Infrastruktur als Grundlage für viele Anwendungen. Damit einher geht die Veränderung der Industrie in technischer und kommerzieller Sicht von vertikal integrierten Netzen zu horizontalen Schichten. Diese Veränderung macht es notwendig, die Abgrenzung zwischen Technologie und Service zu definieren. In diesem Artikel wird versucht, diese Grenze am Beispiel der Sprachtelefonie zu finden und Innovationen in der Telefonie darzustellen. Trotz der vielfältigen Möglichkeiten durch die Konvergenz von Sprache, Daten und Medien sollen die Anforderungen der Gesellschaft an die Sprachtelefonie weiterhin Beachtung finden.

**Keywords:** Telefonie, VoIP, Skype, Innovation, Telekommunikation

## 1 Don't throw the baby out with the bath water

It used to be easy to define telephony. In the Universal Service Directive of the European Union (*Directive 2002/22/EC*) publicly available telephony service (PATS) is defined as "a service available to the public for originating and receiving national and international calls and access to emergency services ...". This rather simple definition can be regarded as an indication of the fundamental changes telephony is undergoing. Even a few years ago, everyone knew what telephony was. No elaborate definition was necessary. Telephony in the public perception extends our senses of speech and listening and helps us to converse with distant relatives as if they were next-door neighbours. From candlestick phones to rotary dial and touch-tone telephones apart from unprecedented growth nothing much has changed. Henry Ford's immortal phrase: "you can have it any colour - so long as it's black" can also be applied to the stable (i.e. monopoly) part of the history of the telephone<sup>1</sup>. Now the convergence of computing, media and communications, advances in microelectronics, commodity bandwidth and the opening of the telecommunications markets to competition have released 130 years of pent-up telephone innovation.

Digitization changed the technical foundation - at first in transmission, next in switching and lastly in the terminals. "Voice could end up embedded everywhere," said James Enck during VON Europe 2004 (*Enck, 2004*) and he added during VON Europe 2006 (*Enck, 2006*) "it's not even really about voice as a service, it's about voice as a feature and share of the consumer's attention". Voice will be part of any computer application and computers will seamlessly blend in our environment. Skype is just the first step.

Competition changed the economic environment - at first in the U.S. with the break-up of Ma' Bell, next in U.K. by introducing the duopoly between Cable&Wireless and BT, lastly with the abolition of any special rights concerning speech telephony in the European Union on January 1st of 1998. Anyone can offer telephony services today.<sup>2</sup>

The design of today's worldwide telephone network does not reflect the revolutionary changes in applications, computing and the market place. We still have switches -

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<sup>1</sup> The main innovation of Henry Ford was the assembly line and with that the possibility of mass production of a uniform car - the Ford Model T. Telephony can be compared to this kind of mass production of a service. Both lacked diversification but for different reasons. With the assembly line it was technologically too early, with telephony the incentives were missing and standardisation was the ultimate goal. The introduction of colored phones was a significant step forward for AT&T.

<sup>2</sup> The Authorisation Directive (*Directive 2002/20/EC*) ensures the freedom to provide electronic communications networks and services through general authorisation. Possible conditions are laid out in the respective annexes of the authorisation directive.

albeit smaller and more efficient, trunks, analogue lines and dumb phones. The inertia of large technological systems has carried the mainframe architecture of traditional digital telephony into the 21st century where it stands amongst Internet applications, pervasive computing and downloadable PBXs as a derelict from bygone times. It is tempting to just do away with digital switching, stop investment and build new architectures from scratch.

The laws, the policies and the regulatory regime do not reflect the changes either. Regulation claims to be technology neutral but isn't with the definition of PATS as the most notable proof.<sup>3</sup> Again it might be tempting to start with a clean slate regulation-free environment based on competition law and discard sector-specific regulation entirely.<sup>4</sup>

Even if this course of action is tempting, we shouldn't throw the baby out with the bath water (i.e. the application with the technology and the benefits of a world wide telephone network with the monopoly). This essay tries to make clear what is the baby and what is the bath water.<sup>5</sup>

## 2 The medium is the message

Let us now explore the medium telephony. What makes telephony? Is it technology or is it user experience? Will innovation lead to improved telephony or to new media, society has not yet learned to deal with? Marshall McLuhan's classic work "Understanding Media" (*McLuhan, 1964*) begins:

*"In a culture like ours, long accustomed to splitting and dividing all things as a means of control, it is sometimes a bit of a shock to be reminded that, in operational and practical fact, **the medium is the message**. This is merely to say that the personal and social consequences of any medium - that is, of any extension of ourselves - result from the new scale that is introduced into our affairs by each extension of ourselves, or by any new technology."*

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<sup>3</sup> The definition of PATS is tied to the current understanding of telephony. This leads to the absurd situation, that offering access to emergency service might constitute a proof of offering PATS. It is also being argued that Voice over IP is not a communications service, because it consists only of signalling. The transfer of bits happens directly between the endpoints in an IP network and is covered with the provision of IP connectivity.

<sup>4</sup> This idea is being circulated as "regulatory holidays" or "regulatory moratoria".

<sup>5</sup> Baby and bath water are different things to different people. The author tries to find a distinction but concedes that this is an input for discussion not a universal truth.

Telephony is a medium which eliminates distance as a limiting factor for speech and listening. The "message" is "the change of scale or pace or pattern" that a new invention or innovation "introduces into human affairs." Note that it is not the content or use of the innovation, but the change in inter-personal dynamics that the innovation brings with it (*Federman, 2004*). Telephony has undisputably brought a tremendous change to the pattern of human interaction. Telephony allows us to keep in touch anytime and anywhere and form communities no longer restricted by space.

What is the essence of the medium telephony? Is a soft client a different medium than the common black phone? Does the technology define the medium or is it the user experience? A telephone has many features and some are more important than others. Which ones can you take away and still have a phone? Which features are essential to telephony?

The first and basic feature of a phone is connectivity. Being connected is literally true for the fixed network. When the phone company installs a phone, two copper wires are strung to your house. These wires connect your home to the network. The network at first was "central", the operator. The operator was the gateway to the world and had the power to connect and to disconnect, to plug and unplug the wires. Although connectivity can be restricted, the default feature of telephones is universal connectivity to every other phone on the network.<sup>6</sup>

The second basic feature is the means of communication - voice, i.e. the ability to talk with whoever you want over any distance - provided he or she has got access to a phone too. Voice means real-time interactive conversation with minimal delay and sufficient quality.

The third feature of telephony is the phone itself. The main parts used to be the receiver with earpiece and mouthpiece, the touchpad, the hook and the bell. In order to call you lift the receiver and dial the number. Then you get a busy or free signal and someone might answer the call. The telephone bell signals incoming calls. You can take the call by lifting the receiver. The social roles of caller and callee are fundamentally different. For the calling party the phone is a means to potentially reach 3.5 billion other phones - a tremendous source of power. For the called party it can be a nuisance, which intrudes in our life anytime and any place. The called party is

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<sup>6</sup> Which is the original meaning of the term "universal service". Eli Noam: "As various discrete networks grow they must interoperate in terms of technical standards, protocols, and boundaries. Yet interconnectivity does not happen by itself; that is the lesson of decades of American experience. As part of the 1913 Kingsbury Commitment, AT&T agreed to interconnect local independent telephone companies with the Bell System long-distance network." (*Noam, 1991*)

always alert and awaits the call of lady luck, which rarely calls. The revenge of the callee is the mailbox.<sup>7</sup>

The phone, the connectivity to a global network and interactive voice conversation define the telephony experience. Let us explore these three features.

## **2.1 CONNECTIVITY (i.e. network size and addressing scheme)**

It is worth considering that we talk about connectivity to ONE worldwide telephony network, although there are thousands of operators. The amazing thing about this great machine is that it works albeit of these many involved parties.

This achievement was only possible through collaboration in form of international standards organisations. While introducing new technology the topics of interoperability and interconnection have again to be addressed in a form which is acceptable by all parties.

The value of connectivity depends on the size of the network<sup>8</sup>. The telephone network has grown tremendously in the last 130 years. With respect to the network there are at the end of 2005 about 2.3 billion mobile phones and 1.2 billion fixed telephones<sup>9</sup> associated with an E.164 telephone number. Considering a population of 6.5 billion at least every other person has access to a telephone.<sup>10</sup> Everyone with a phone is connected to half of the people of the earth by just picking up the receiver and dialling ten odd numbers.

Size is not a benefit in itself. The value is in the appropriate size. There was a time when the growth of the network was most important. Does the size of the network still matter? Would we consider it a great improvement if three quarters or 90 % of the whole population are reachable via telephone? It would of course be a great step forward for society to narrow the "digital divide" in developing countries, but in developed countries the telephone saturation has been reached.

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<sup>7</sup> Interesting communications (i.e. none) happens if both parties forward their incoming calls to the mailbox.

<sup>8</sup> This is the message of Metcalfe's law. It says: "the value of the network is equal to the square of the number of connected nodes". Andrew Odlycko and Benjamin Tilly criticise the formula in their essay "A refutation of Metcalfe's Law and a better estimate for the value of networks and network interconnections" (*Odlycko, Tilly, 2005*).

<sup>9</sup> TeleGeography presented these figures at the Global Telecommunications Meeting in Washington DC, May 2006 (cited in the Austrian newspaper KURIER 12. Mai 2006)

<sup>10</sup> One can of course turn that argument around and state, "more than half of the population has never made a phone call". A glass can be half full or half empty – it depends how you look at it.

In order to establish communication within this worldwide network addresses are needed. If you write a letter a civic address (number, street and city) will do. It would have been preferable to stick to traditional means of addressing the called party by name as in the early days of the phone with the help of a human operator. With automation of switching equipment dialled numbers were converted in pulses, which controlled the switching equipment. Every phone was assigned a specific number. These numbers had an elaborate structure which resembled the structure of the network. This scheme has the advantage of being universally standardised and accepted (*ITU-T Rec. E.164*).<sup>11</sup> Numbers have been complemented by "names" (e.g. freephone, premium rate and mobile numbers), which cannot be used for routing in the network and have to be translated into addresses. The universal reachability today is restricted to geographical and mobile numbers.<sup>12</sup>

Connectivity is a basic feature of telephony while the means of addressing are entangled with technology and about to change - however tedious this change may be. Size is not a benefit in itself. The main feature of telephony is to be able to reach whomever I need or want to reach. This means there needs to be - in terms of user experience, not necessarily in technology - ONE common network and ONE common addressing scheme.

## **2.2 INTERACTIVE VOICE CONVERSATION (transmission)**

Communication is between people. The source is voice and the sink is the ear. The main underlying requirement is that the communication path between the two people shall be as transparent as possible. Transparency of the transmission path means small delay and a broad frequency band.

The delay should ideally be nearly zero. Technically speaking the ITU-T defines the threshold for delay with 150 ms one-way delay (*ITU-T Rec. G.114*). A round trip delay over 300 ms makes conversation in western culture difficult. We assume after a pause of 300 ms that we can start to talk. With such a high round trip delay we do not know if the other party has started to talk as well and both people are speaking at the same time and conversation becomes troublesome.

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<sup>11</sup> The addressing scheme according to E.164 can also be used in an IP-based network (*Stastny, 2002*).

<sup>12</sup> Premium rate numbers are usually not reachable from abroad, because of the impossibility to determine the correct charging information for the calling party. Freephone numbers might be reachable from abroad but are usually not free.

The range of sound is rather limited therefore sound has to be converted into signals the network can carry. The simplest<sup>13</sup> means is a messenger who stores the information in his memory. Traditional mail carries voice transformed into letters. In telephony the sound was converted into modulation of electrical current. The sound waves meet a membrane, which mechanically changes the resistance of the circuit. This is technology and there is no reason, that the sound should not be converted into a different signal. Networks used to carry the analogue signals directly.

With the event of digitization transmission changed profoundly. It became possible to regenerate a signal exactly in the same form as it was recorded. The technological restrictions of the path between sender and receiver in early analogue networks are still with us today. In an IP network G.711 (*ITU-T Rec. G.711*) is commonly used as a codec, which restricts the transmission to a frequency band of 4 kHz. Going back to the underlying requirement of transparency between sender and receiver, a frequency spectrum of about 20 kHz should be delivered through the network. There is every reason why a traditional telecommunications network is not able to do this and there is no reason at all, why an IP-based stupid network should stick to the old rules and provide horseless carriages for transmission of sound.

Interactive voice conversations over long distances require transparency of the frequency band (up to 20 kHz) and ideally zero delay.<sup>14</sup> How this might be achieved, is a matter of technology.

### **2.3 The PHONE**

The phone is a mixture of technology and application. The receiver is perfectly adapted to a conversation between two people - the telephony application. The touchpad reflects the technological means of addressing according to ITU-T Rec. E.164. Other means of addressing (e.g. calling with the help of a Customer Premises Equipment based directory or voice based calling) are being explored today, but the inertia of E.164 is quite substantial. Speech quality is also technology. There is no reason why quality shouldn't be much better. Little consumer demand for high quality speech is often mentioned. This is rather a proof for the inertia of the customer than

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<sup>13</sup> It can certainly be argued, if this is "simple".

<sup>14</sup> During the history of communications the means and the speed of carrying messages changed. The means were the written word, memory of a messenger or electrical current. There can be packets (i.e. letters) or circuits (digital telephony). The speed has increased tremendously from weeks in the early 19th century to seconds in the global PSTN/ISDN or the Internet.

for the missing demand. The 4 kHz restriction of the speech band is as useful and as arbitrary as the keypad layout of a common typewriter<sup>15</sup>.

## **2.4 It's about user experience, not technology**

As we have seen, the medium telephony is defined by user experience, not by technology. Telephony in the traditional sense is private, interactive voice conversation between two people connected to ONE global network. Let us now explore recent and possible future innovations of the medium telephony.

## **3 Innovations in telephony**

Many evolutionary paths have been pursued to change the telephony application and many more are being explored today. This cannot be an exhaustive description, however it is the intention to discuss the main trends.

### **3.1 The application - technology matrix**

It is useful to distinguish between application and technology. One can observe that they follow different time schedules. For instance applications like photography remain while the underlying technology changes from analogue film material to digital storage of pictures. On the other hand technological changes provide the foundation for new applications.

The main technological changes in telephony were automation, electronic and programmable systems. The telephony application has remained largely unchanged.

Figure 1 shows the possible evolution paths from old to new. There is no direct way from the upper left to the lower right corner. Concerning telephony this means that applications on new technology will resemble the old applications before new applications will be explored. This inertia is a good thing and has to do with society's basic need for stability.

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<sup>15</sup> The QWERTY layout was designed that the type bars of mechanical typewriters do not entangle. The Dvorak keymap is carefully adapted to the English language.

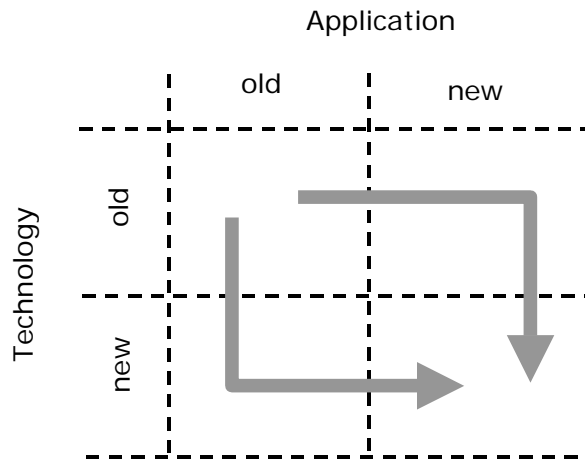


Figure 1: Evolution paths from old to new

In telephony a very significant technological change from circuit switched to packet switched technology is happening right now. The author's prediction is that the application will remain largely unchanged and will be reinvented with IP-based technology before new enhanced applications will gain significant market share.

Ten years ago mobility was a perfect example of a changing application while keeping the same technology. It is no coincidence that these two major shifts are approximately 10 years apart. It would not have been possible for them to happen at the same time.

### 3.2 Person or place - the mobility revolution

Phones used to be stationary. The phone company provided the outlet and the length of the phone cord limited the range of the phone. Cellular phones are mobile and resemble more and more a personal accessory like a wristwatch or a wallet. Although both applications - the mobile phone and the fixed phone - comply to the general description of telephony as *a service available to the public for originating and receiving national and international calls and access to emergency services*, they differ fundamentally in the user experience and should be regarded as different media. Fixed phones define a network of places, mobile phones lead to a network of people.

Mobility has been the killer application in telephony of the last 15 years. The growth in mobile telephony has exceeded every prediction. In a little more than 10 years the number of mobile phones has passed the number of fixed phones, which took more than 100 years to emerge.

Although the media mobile and fixed telephony are different, the technologies show apart from the access network little differences. With the event of other wireless access technologies (unlicensed like WiFi or licensed like WiMAX) the fixed network

can also be extended with a wireless part. There is also the concept of a combined dual-mode phone, which can serve as a WiFi phone and a cell phone dependent of coverage, charges and user-choice. The distinction between mobile and fixed telephony from a technological point of view is therefore disappearing.<sup>16</sup>

From an application (i.e. a product) point of view the distinction between mobile and fixed telephony makes sense. These are different products and customers are willing to pay a lot more for mobility than for tethered telephony. Mobility in this sense has to be distinguished from roaming. Mobility means mainly coverage of the area of personal daily movement within the area of the same network. This is a basic feature for the residential market and there is a significant price war going on (with on-net tariffs approaching zero in some countries). Roaming in other networks is regarded as value added service and being exploited widely.

Phones will become untethered personal items. This however does not mean that the future will belong solely to today's mobile operators. It just means that the distinction between wireline and wireless operators is a technologically outdated model and some sort of re-integration becomes necessary. Today's wireless operators are however not easily convinced that this is a good idea because they are usually more successful than their wireline counterpart.

### **3.3 What are you going to pay?**

The second main area of innovations in telephony is charging. Telephone calls used to be priced according to distance. Customers can easily be convinced that a call to the other side of the earth costs more than a call to the next door neighbour. Technological advances and competition in long distance calls have brought down the costs for long distance calls. Today the wholesale minute from Europe to the US costs less than one Euro cent per minute. Competition leads to lower prices for end-users and to the necessity for telecom operators to rebalance tariffs because revenues from long distance calls have been used in the past to subsidise local calls. This leads to uniform prices independent of distance, as Francis Cairncross described in her landmark work "The Death of Distance" (*Cairncross, 2001*).

Internet has emphasised the model of "all you can eat". Both customers and operators love "all you can eat". Customers do not need to check the usage and operators can easily calculate their income. Customers usually overestimate their communications demand and are likely to consume less than they pay for. These flat rate models are

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<sup>16</sup> The distortion of the market power becomes visible with the emergence of "fixed" phones with SIM cards. Here mobile operators venture into the fixed market. Fixed network operators are sometimes restrained by their mobile departments to do the same in the other direction.

being introduced for telephony as well. There are offers for unlimited calls within the US and there might be offers for unlimited calls within the European Community soon.

Although dependency on distance is disappearing, diversification in telephony prices emerges in premium rate charging - i.e. charging for content. Duration based charges for a value added call can reach up to 10 € per minute.

Inter Carrier Billing in telephony is mainly based on duration and type of call. In the Internet area peering is widely used. Peering (or "bill and keep") means that the amount of traffic is deemed to be equal in both directions and therefore no accounting is being conducted. With the possibility of speech communications on packet based networks these two principles clash and the future of interconnection pricing is uncertain.

Considering this evolution in the future we will have two cost elements in telephony: a monthly fee for the access as in the Internet access and a termination fee per minute of roughly two Cents a minute in a fixed network and more than ten Cents in a mobile network, regardless of the geographical destination. These two values will converge towards a common, distance independent destination fee.

Tariff transparency is on the verge of disappearing. It is clearly not in the interest of any competitor on the market, that his prices can be easily compared to other competitors' prices. This leads to a vast increase of complaints and a loss of trust in the medium itself. This is being made more severe by charging for content instead for the use of the medium itself. It is however in the interest of society to explore the advantages of competition while keeping the transparency of the price to pay.

Although distance is deemed to be dead we observe a broad spectrum of prices, ranging from flat rate to excessive pricing for premium rate services. The mobile phone might in the end even become a universal means of payment.

### **3.4 The disappearance of the phone book**

A phone book is a directory of people with a phone connected to the global telephony network. The value of a phone book is to look up a name and to find the phone number. The underlying assumptions are the validity and the completeness of the entries. Traditionally the phone company validated name and address so you could trust the entry in the phone book. Unlisted numbers used to be the exception. With the event of mobile phones and prepaid accounts unlisted numbers became the rule rather than the exception. Phone books seem to be on a diet and lose weight and value. The argument therefore is that the telephone book is "technology" and bound to change.

Directories however will not disappear. They will just be managed differently. A typical user does not have more than 150 contact addresses. These can easily be managed in a database of a smart computer based telephone. Directories might also reside in the network. During registration every Skype user provides his or her name and details. This data is included in a searchable directory. This is certainly easier than maintaining a telephone book in the traditional sense. It is however a vertically integrated solution, because it only holds the Skype users and not other VoIP subscribers. Furthermore there is no validation of the entries.

The phone book, as we know it, loses its significance and will disappear and give way to directory services. In order to be of any value, the directory entries need to be somehow validated and at least mostly complete. In Skype everyone can enter his or her details without the necessity to provide proof of any sort. This is not a useful application for business telephony. You need to know who you are talking to.

Although the right to remain anonymous is acknowledged, it has to be balanced against the need for identification and authentication<sup>17</sup>. In today's telephony environment the following means exist:

- The calling line identification, which is provided and authenticated by the originating network. There are also rules how to deal with the user identification between networks. The relation of the calling line to the subscriber name is maintained by the operator, with the exception of prepaid accounts.
- The right of the user to suppress the identification (CLIR)
- The right of the emergency service provider to override CLIR
- Malicious call identification
- The right not to be listed in the directory

These features are deemed by society to be important for public telephony. Are they still useful for prepaid mobile phones, Skype or any other VoIP services?

Skype has a feature called "manage blocked users". It is quite easy to place a user on this list so you won't be bothered anymore. It is also possible to restrict incoming calls to people from the contact list. These features allow protection against malicious calls.

Identification is restricted to the number in case a prepaid account is used or to the unvalidated entry in case of Skype. The relation to the name of the caller cannot be established.

The discussion of the phone book has led us to the underlying problems of identification and authentication. Even if phone books are disappearing and making

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<sup>17</sup> Identification answers the question „Who are you?“ and authentication the question „can you prove it?“.

place for directories, in an evolved telephony network means for identification and authentication need to be retained. The user's right to remain anonymous and to protect one's privacy have to be balanced. Today's calling line identification is an authenticated identity. The proof is given by the subscriber's operator (the number is "network provided"). The relation to the subscriber's name can be retrieved from the operator. The value of these features is decreasing because of the high number of prepaid accounts. In an evolved telephony network identification of the user and authentication need to be addressed.

The future might bring us two different networks. One network with reliable communication and authenticated access, where you can conduct secure business transactions without fear of repudiation. The other one with open and anonymous communication, but with the option to authenticate if needed.

### **3.5 Always on**

Telephones used to be always on. Even if the power supply failed, the phone would work because telephone companies provided current over the copper line. This feature is slowly disappearing, because it has no commercial value anymore. People are used to the uninterrupted availability of power supply and the technological advances of batteries allow the economical storage of power. We depend on power supply in many other ways, for instance for light, refrigerator and the freezer. Our concern about the frozen food is probably greater than over the fixed telephone. Mobile telephones do work as long as the battery lasts provided the base stations have emergency power supplies.

The age of "always on" seems to be over. Power supply over Ethernet or twisted pair seems to be no longer necessary and is being replaced by mobile phones with long lasting batteries and docking stations.

"Always on" has another aspect too. Fixed telephones used to have no power-off switch. Society wanted you to be reachable any time of the day. With the abundance of telephones the value of this feature also has diminished. The fixed telephone got the features "do not disturb", the answering machine and call forwarding. Mobile phones have a power-off switch. The value of "always on" is also disappearing in this respect.

### **3.6 Presence**

Presence is not a new feature. Telephones always dealt with presence information. The call-forwarding feature allows to be reached even if away from the access line; voice mail allows you to leave messages. The mobile phone needs additional presence information (e.g. in case of loss of coverage). PC-based telephony like Skype leads to

new presence information like "on-line" or "off-line", which means the PC is turned on or turned off. If the PC is turned on and you are not using it, the presence information turns into "away" and later into "not available". The value of this information can be disputed, because the user might be in the same room just doing something else.

The telephone did always provide presence information. If it kept ringing and nobody answered you concluded that either nobody was at home or not in the position or not willing to take a phone call. The simple "no answer" and "busy" signals were sufficient for a long time and society has not changed that much. Table 1 compares presence information for fixed and mobile networks and for Skype and sheds light on the evolution of presence information.

	<b>A-party gets "presence information" in case of a call attempt</b>		
<b>B-party</b>	<b>fixed network</b>	<b>mobile network</b>	<b>Skype</b>
on-line	alerting signal	alerting signal	alerting signal
is talking	busy tone	busy tone	busy tone
does not want to be disturbed	Call forwarding to an announcement	silent/buzzer on	"do not disturb" icon on the buddy list
away/not near his phone	alerting signal	alerting signal	"away" or "not available" icon
off-line	n/a	announcement	"off-line" icon
no coverage	n/a	announcement	n/a; might become an issue with WiFi
wants to record messages	voice mail/answering machine	call forwarding to voice mail	voice mail

Table 1: Evolution of presence information

Fixed and mobile networks provide presence information only in case a call attempt is made. You won't know in advance what presence information you will receive. Computer-based applications like Skype are different. The presence information can be decoupled from making a phone call.<sup>18</sup> The fixed and the mobile network miss this "buddy list" feature. Realizing this feature in the network would be very complicated and cumbersome to use.

Presence always was an issue. New technologies allow new forms of presence information. They need to be reliable, easy to use and to provide useful information to the caller.

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<sup>18</sup> Some kind of decoupling was invented in the fixed and mobile network with the feature "e-mail waiting indication" or "voice mail waiting". The call completion features belong to this category as well.

### 3.7 Location

Location was not an issue in the fixed network with geographic numbers. The address was in the phone book and everyone could be certain that the phone was at this specific address. Location became an issue with the event of mobile phones<sup>19</sup>. The requirement to determine the location of a mobile phone originated from emergency services. In the United States mobile phone companies are required to implement means for location determination. Here we can also observe the pattern to keep the application while changing the technology.

Location based services were heralded as one of the future killer applications by the UMTS Forum. Dependent on your location you can get information about gas stations, weather forecasts and many more. The simplest feature probably being location presentation to the called party. Although some location based applications have been explored, the use of location based services has not fulfilled their promises. The author argues that before deployment of location based services will become wide spread, a simple user right needs to be established: "the right to not disclose your location". Critics argue that even the suppression of location information can arouse suspicion.

What will happen to location? The driver will be emergency services and this will lead to the necessary technological developments. In order to make location based services acceptable for the public there might emerge an opt-in process for location in contrast to the opt-out process for identity. This means your location will by default not be disclosed unless you specifically opt for location presentation. The e-privacy directive of the European Union already includes the necessary framework for location data by demanding that data are made anonymous or the consent of the user being obtained (*Directive 2002/58/EC*).

The next ingredient will have to be the killer application for location, which does not exist yet. Niche applications are any kind of dispatchers. Opt-in could also be application specific. A simple one being weather report or traffic report. If you apply to weather report, you get for instance three times a day an SMS with the local weather forecast dependent on your location. This service could be offered as a complimentary service to your subscription in order to whet the appetite for other location based services. It might also be prudent not to advertise these services as location based, which might cause resentment.

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<sup>19</sup> Roaming was also explored in the fixed network under the name Universal Personal Telecommunications (UPT).

### **3.8 The smart phone**

Phones used to be dumb. The intelligence was in the network. Nowadays computers are everywhere and there is no reason that phones couldn't become smart as well. And they do - albeit slowly. Touch-tone phones could remember up to ten numbers and users could recall them via short codes. Cellular phones are much smarter. They can serve as radio receivers, cameras, phone books, alarm clocks and calendars. Mobile phones have got a nice colour display and a small keyboard, where people with tiny fingers and eagle like eye-sight can find the right letters.

Intelligence is a nice thing, robustness and being fit for the purpose are as well. We have not found the balance yet. Our love for technological progress has carried us away and sometimes we forget the real usage for things.

Will phones get dumb again? I don't think so. They will stay programmable and have a processor and an operating system but they will learn to be more reliable than they are today. The trend to the multi purpose device, which can take pictures and serve as a TV as well are however over. In the future we will see more specialised items. There is a trade-off between different applications and you cannot do everything well. A PC is not a phone and a mobile phone is not the best item for watching TV. Mobility is however so valuable that people accept many shortcomings. We will see how many.

### **3.9 Are mass media and communications converging?**

There is much hype concerning convergence of mass media, communications and Internet. What does convergence mean? Will it be a happy family reunion or a war of the worlds or something in between or all of it?

Let us forget about the happy family. Communications and mass media do not have anything in common but that their content can be presented in bits and bytes. That however will not lead to convergence but to confusion and collision.

Vilem Flusser has distinguished between two forms of communication, which he called dialogue and discourse. The dialogue is aimed at creation of information (through exchange of ideas and synthesis), while a discourse is the distribution of information (in order to overcome entropy). (*Flusser, 1998*) Both forms of communication need to be present and in balance in order to form a culturally rich and stable society. If discourse prevails and sources are limited a totalitarian regime is likely to emerge. If a society is based mainly on the dialogic structure, progress will be stifled. The value of communications networks as the telephone is in the interchange of ideas. Communications networks increase the amount of information and form a network between people however far they are apart. The goal of mass media is to distribute information. Mass media is unidirectional.

From a technology point of view there might be convergence. The same technological boxes and wires can be used for communications and for distribution of video channels. A network provider may be able to deploy one network for different applications.

From the marketing point of view communications and mass media are different businesses and it remains to be seen if one company can do both well. There will be no convergence of applications, a balance between dialogue and discourse and a proliferation of sources are however desirable.

### **3.10 Multimedia**

Video telephony was presented at the world fair 1960 as the logical evolution of telephony. It has never really taken off. Video telephony is a completely different medium than telephony. In the words of Marshal McLuhan it is an extension of vision as well as speech. Society did not accept this new medium easily. You don't need to dress or use make-up for a telephony call - for a video call that is different. A video call intrudes much more in our privacy as a phone call.

Multimedia is defined as combination of pictures, text, video, audio and speech. Although these media for themselves are well established, a combination of different media is still subject of experiments. Although society has accepted text messaging in form of SMS and e-mail rather quickly the value of a combination of different media has yet to be proven.

### **3.11 The water company?**

Technology is evolving towards IP-technology.<sup>20</sup> Therefore the border between the network and the services needs to be defined. The eventual solution for telecommunications industry might be "the model of the water company". This means, that communications means can be provided in the same way as water or electric current. In a possible future environment there could be a horizontal split in technology and business models. One set of companies provides the physical network for transport of information. Since bandwidth is becoming abundant these bit pipes will be rather large. This network is based on the end-to-end principle above a specific layer.<sup>21</sup> Appliances for this communication network are sold as products on the market and may be:

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<sup>20</sup> The evolution of the switching network is being explored in (*Malleck, Reichl, 2004*).

<sup>21</sup> Pure IP networks are end-to-end above the IP layer. This is also called the hourglass model.

- **A phone:** There are means to register your phone in a worldwide directory and being able to place and receive phone calls. The amount of communication (bits) is charged on a meter like current, gas or water. There might be different charges for day and night bits.
- **A radio or a TV:** It tunes itself to radio stations on the network and there is no longer any dependence on terrestrial transmission and there is also no restriction to reachability. Premium rate services are possible in the same way premium TV services are offered today. Radio or TV stations can therefore be encrypted and you have to buy a special subscription. Radio or TV services can also be free and receivable from everywhere.
- **A multi purpose PC:** You can also connect a multi purpose PC with a web browser in order to surf HTML sites on the World Wide Web. A PC can also be used to provide services to other users (for instance pose as a radio station).

This model can also be used without the wires. In case of wires the charging is based on the specific outlet. In case of wireless the charging is based on your identification. UMTS shows the path to this scenario. There might however emerge more application specific UMTS user equipment using only the bitpipe. I'm still waiting for a UMTS based radio for tuning in to Internet based radio stations.

On the network side this scenario requires much cheaper equipment. The network is also not subject to change apart from capacity, because the network is service agnostic in the same way electrical current is appliance agnostic.<sup>22</sup> Products can achieve economies of scale.

Where is switching and where are protocols in this scenario? Switching is in the network and restricted to the IP layer. Routing is distributed and replaced by global directory services. These directory services are application specific. Protocols are application specific as well and are end-to-end.

It is not the Internet model we are talking about today but it might evolve from it. The difference is that today services are provided by the network. In the model of the water company there is only one service - delivery of bits. Everything else becomes a - however sophisticated that might be - computer based product and resides at the edges of the network. The technology for peer-to-peer applications is available today and it might become the rule rather than the exception tomorrow.

This scenario is not the unavoidable future, however it is plausible. On the other hand it might take some decades and many detours to get there. The author believes that

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<sup>22</sup> Not to mention 110V and 220V and the usual set of plugs and sockets ;-)

eventually this model will prevail because it is the simplest. Society is challenged to provide the right environment for competition in infrastructure and services.

#### **4 Conclusion - The changing face of telephony**

The main innovations of the medium itself have been automation (i.e. the ability to set up the connections by the user instead of the operator) and mobility (i.e. the ability to carry your phone around). These two innovations have had profound impact on society's use of telephony.

The medium telephony is evolving and new media are emerging. Mobile telephony can be considered as a new medium. VoIP has the potential to resemble traditional telephony and to provide completely new media. The border is blurred and the challenge for society is to understand the implications and to find the appropriate means to deal with negative impacts.

The traditional telephony application is a basic asset for society in order to foster the dialogic form of communications. The main ingredients, which should be preserved, are *inter alia*:

- ONE telephony network (as perceived by the customer, albeit consisting of a vertically and/or horizontally interconnected set of networks and/or applications) with a common addressing scheme allowing the possibility to connect to any other party on the network.
- network integrity, reliability and survivability
- access to emergency services
- privacy of communication (e.g. by means of encryption)
- tariff transparency (e.g. the right to know beforehand the cost of a call)
- means to identify and authenticate the partner
- the right to remain anonymous (including the right to not disclose the location of the call)
- protection of subscription data and call data
- choice of provider
- the right to protect oneself against unsolicited communications

These rules have evolved over some time, are part of the medium telephony, independent of technology and should be preserved. In a time when technological evolution is at high speed it remains critical not to throw the essence of telephony out with circuit switching technology.

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