1 A New Wireless World

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Mobile Telephony – A Straightforward Development

Mobile Telephony is arguably the most well known example of wireless services. It can rightfully be considered a worldwide success by any standard. The number of users is already approaching 3 billion. This outnumbers by far the accesses to traditional landline networks. In light of this, researchers like Bar & Galperin (2004) have suggested an eventual switch to wireless communications only. They have a point insofar that mobile telephony already has a share of more than 40 % of all voice minutes in many European countries. Furthermore, mobile telephony is now also under deployment in parts of the world with no previous access to any kind of telecommunications whatsoever. The number of users could well increase by yet another billion by 2010, given further cost decreases.

However, it will not simply be a matter of " more of the same" as the use of mobiles has now extended to new services over and above traditional voice telephony. There is reason to talk about a new phase, which looks bound to encompass a far more complex set of market situations.[1]

1 For more on the different development stages see e.g. Thorngren (1994), Möller yd (1997), Lindmark (2002), Karlson et al (2003) and Thorngren (2003a)

The Next Phase: A Complex Web of Wireless Offerings

The world of wireless already contains a plethora of options besides the well-known case of mobile telephony. They are designed to meet a variety of specific needs and requirements. Wireless is sometimes a matter of a unique offering. A case in point is satellite communications used to distribute TV-signals to cover whole continents. There is no viable alterna-tive. But more often than not a wireless solution is actually a substitute, which must prove its value over and above traditional solutions. A case in point is wireless transmission used inside a home to move signals between e.g. a computer and a TV or a printer, which saves the costs and inconvenience of in-house wiring. An example of even more short-range usage is RFID-tags enabling automatic tracing of things on the move. This is a solution with the potential to eventually replace the use of manually read bar codes. The three examples differ not only with respect to distance and range, from thousands of kilometres to less of a meter. It is also a matter of radically different capacity requirements, and of solutions tailored to meet specific needs.

By contrast, Mobile Telephony has been designed on the formula "One Size Fits All", successfully providing a highly uniformed service. Can the same approach be as successful in meeting the more diverse requirements of users of "data-com", with purposes as different as downloads of music and secure access to corporate intranets? Just a matter of increased speeds and capacity? Perhaps not, as there are some fundamental differences between voice telephony vs. any kind of " datacom-based" service.

A telephone conversation is by definition a matter of" real-time" communication, and has to be handled on a " split-second" basis. Even a delay of half a second can spoil it. By contrast, a transmission delay of some seconds is normally not considered a disaster by those trying to access the Internet, to receive or send e-mail etc. Especially as any transmission delay often is masked by other delays, due to busy servers etc. Transmission of TV and video fall into two quite separate categories. Video content can sometimes be downloaded and stored like any other kind of data. There are how-

ever also situations when split-second transmission quality is crucial, like in a live videoconference or while viewing a major sports event.

This basic difference between services initiated the lively debate in the US on "Network Neutrality". Should voice and live video services be given priority on the Internet because they are vulnerable to even the slightest delay? For more on this see Thorngren (2006 b). Data communications are not that time-sensitive, as there are methods for error corrections. Even whole messages can be resent. A number of days (rather than seconds) might well lapse between the download and actual viewing and "consumption". In the latter case there is room for important cost savings as low-traffic hours can be utilized.

Datacom-based services also differ from voice as there is a great potential to provide more customized offerings and service levels. The use of Internet or the reception of a video can be adapted to the properties of each and every kind of a digital device and its screen-size etc. Along the same lines, many business users might not consider the usual "best effort" of the Internet good enough. They often ask for (and are willing to pay for) more secure levels of Quality of Service (QoS) through VPN-tunnelling etc. There is a wide range of other value-adding options.

In brief: The New Wireless World looks bound to provide an ever increasing number of different options, rather than any single and uniformed service carried by any single kind of network. This is a situation similar to the pattern for physical transportation where the use of cars, buses, trains and airplanes often are combined. For more on this see Thorngren (2001) and (2004 c).

Convergence on the Move?

On the face of it, this complexity contradicts the much-touted developments towards convergence. Once converted to digital bits (Zeros and Ones) any kind of content can be freely mixed and move together along the same digital pipe. This saves capacity and costs,

like the use of containers in the physical world. At the end-points it is however still a matter of separation, of packing and unpacking. The nearer the endpoint a user is, the greater the tendency towards fragmentation and divergence in order to match specialized needs and requirements. That said, there are also efforts within the industry to carry convergence effects closer to the end user. In the case of Apple, the convergence is literally in the hands of the user in the form of a handset (I-phone), which combines what otherwise would have required three or four different gadgets. Telecom companies, like Ericsson, present the third generation (3G) mobile networks as a converged platform, able to carry not only voice but also text, data and video. Others, like cable TV- operators are offering voice and broadband as parts of a package deal they label Triple Play. There is reason to talk about " the battle of the living room", as many players are competing for the role of sole supplier. In consequence, wireless solutions are also in complex competition with landline offerings. With the latter trying to increase their footprint by offering more or less free access to Hot Spots (wireless LANs) in public places. Four previously separate services are bundled into one package deal.

3G-operators response to these "Quadro Play" offerings have been to increase and improve their indoor coverage by installing additional and small (pento) base stations inside offices and homes. Somewhat surprisingly "mobile" phones are actually mostly used indoors, at the office or in the home. 60–70 % of the traffic minutes occur indoors, even in Mediterranean countries. Calls literally made " on the move" are rather an exception, in spite of the many conversations to overhear on streets and buses. When it comes to "datacom" e.g. downloads and uploads of data, music and video, the proportion of indoor usage (by people sitting still) can be expected to be even higher. The high proportion of indoor usage is bound to have an effect on "datacom" pricing. The download of less time-critical content can wait until it can be accessed for "free" (at flat rates) at office or home. Even those actually on the move can use Wireless LANs at most airports and an increasing number of railway stations, hotels and restaurants. This "nomadic" usage is already a factor on the market. For more see Thorngren (2005) and (2006 a).

Pricing Wireless – A Triangle Drama

In the early days of 3 G, the operators (inspired by the success of I-mode in Japan) expected to earn crucial extra revenues by acting as inter-mediators between content providers and end-users.(Providing portals, taking care of the billing etc.).This concept of revenue-sharing is not dead , but attractive content is often delivered for more or less "free" as part of the strategic positioning of a network, competing with other kinds of converged platforms. It is not always self-evident who is to pay whom for what. Seen from the perspective of the network operators: Content providers are to pay wireless operators, as they provide new channels to reach additional audiences and revenues. Why should not those creating heavy traffic loads contribute to the costs for the necessary capacity increases? The counter-argument is that wireless operators sometimes rather have a reason to pay in the other direction for attractive content (like major sports events) in order to defend or expand their positions on the telecom market. Thus, payments can well move in both directions, like in the cable-TV industry. There are unresolved channel conflicts. Issues to be discussed at some depth in later chapters of this book.

In any case, the issue of charging for the traffic per se has already proved to be a major problem for the operators. Voice traffic has often been charged per minute of use, but the same simple measure is not applicable for data traffic. A download carried out in e.g. 30 seconds, can well use as much capacity as 30 minutes of voice telephony. It seems to be necessary to apply a more relevant unit of charging, based on the actual volume of data transferred at a download or upload, irrespective of time used for transmission. Otherwise there will be a negative incentive for operators to invest in upgrades: The faster the network, the less they can charge per volume transmitted Customers "expect more for less" like in other IT-markets (e.g. for PCs and flat-screens) Operators of conventional 2/3G networks might find it hard to deliver without applying some kind of (data) volume charging. Data volumes are measured in Mbytes. An example: A download of an MP3-song bought for 10 SEK is a matter of 3 Megabytes (which corresponds to around 30 minutes of voice conversation, and could well cost more than 30

SEK in traffic charges). The problem: Very few users have any clue about the size of a Mbyte. Even among those willing to accept a 30 SEK price tag there is understandable hesitation, as soon there is a matter of less standardized applications. How many Mbytes will they require ?

In order to overcome this problem some 3G operators have introduced ceilings, like maximum X SEK per day or month, whereas others have bitten the bullet by simply introducing flat rates. This looks inevitable given the de facto competition with cable-TV, other landline operators and the rapidly increasing number of hot spots providing WLAN-access. However there is only so much capacity, and only limited economies of scale to be derived from building ever more dense "forests" of physical antenna masts. Moore´s Law doesn't apply.

A consequence of flat rates is that it is increasingly difficult to discuss revenues and profits for individual services in isolation. They are rather elements within the set of competing converged platforms. Conventional wireless 3G-operators aim to get indoors where the bulk of traffic is. Cable TV-operators aim to use Triple Play in order to replace the need for conventional telecom wiring. Some of them also have a presence in public areas. By offering an option to use (more or less) "free" Internet access in major cities, they hope to attract more customers to their indoor business while also weakening the case for 3 G indoors. Traditional landline operators are not idle either. By upgrading their networks using e.g. optical fibre they claim to out compete cable TV with a more flexible offering. Voice telephony (IP-based or not) could well be the first pawn to be sacrificed in this strategic battle as low volume services can be given away, like peanuts. On the other end of the scale, TV in the mobile handset could also be used as a tool for overall positioning on the market. (Rather than as an individual service with a bottom-line of its own).

Access Anywhere, Anytime on any Device for any Purpose?

Any, any, any is not a modest ambition, yet it is part of the political agenda in many countries. In the case of Japan launched under the umbrella concept of " the ubiquitous network society", within the EU labelled "Ambient Networks". Among the common denominators are a plethora of different wireless networks in competition, yet also working with the fixed networks. At the local level many cities are offering "Muni-networks" providing more or less free access to wireless broadband in parts of a city in order to promote tourism etc.

Are these "any, any, any." visions compatible with the emerging consolidation on the market with mighty operators launching their own versions of "converged platforms." marketed as bundled deals to end-users Perhaps so, and not only because value constellations (as opposed to value chains) carry a potential to give birth to new combinations, as well as new actors. Even if some customers might happily go for a package deal, others might shy away from what looks like a digital version of the Swiss Army knife. Better to have a fully-fledged screwdriver, especially if you don't want to carry around a complete toolbox all the time. As a case in point, Nokia has recently presented a mobile " phone", dedicated for datacom (only). Along the same line, there is room for new and specialized offerings catering for the specific requirements of e.g. taxi drivers and emergency services.. For more on this issue see Valiente (2007) and Craig (2006). What about a " truly mobile network", movable to provide rapid local coverage after e.g. a train crash in the woods?

Enough Capacity and Frequencies?

Will there be room (enough frequencies) to cater for the expected further growth of the Wireless World? The short answer is Yes, as long as the question is a matter of physics, rather than economics. A given frequency band can be re-used and reused again, by build-

ing smaller and smaller cells. However the costs will (at best) increase linearly. There are no economies of scale comparable to those available by using optical fibres. For more on this issue see the chapter authored by Mäkitalo, et al, later in this book. It could be cost increases, rather than physics, that ultimately limit wireless growth. A new market balance between wirelesses vs. fixed broadband seems to badly needed.

In any case, basic issues of capacities and costs for the different options are bound to have a far-reaching effect in the longer term. As discussed, present prices often reflect market ambitions rather than the need for cost recovery to enable further investments. Flat-rate pricing might be a shorter term necessity for 3G operators, as opposed to charge per Mbyte. Flat rates could attract otherwise shy users and build market share. However, there is only so much capacity available in a mobile network. A simple comparison with the present flows of datacom in the fixed network illustrates the magnitude of the capacity gap: The average European usage of mobile telephony is around 150 minutes per month. A figure, which corresponds to around 15 Mbyte. Simply the download of five MP3-songs per month would double the traffic volume. This is good news in the short term as long as there is still unused capacity to bring into play. However, the volume of data traffic in the fixed networks is already approaching 1,5 Gbyte, which translates, to a 100 times heavier traffic load. Within a not-so-distant future 3G operators therefore seem bound to introduce a ceiling. No more unlimited access. Rather usage might be restricted to X Mbytes per month. Above this level it may be necessary to reintroduce the infamous charge per Mbyte.

This is not to spell the demise of 3G-operators.They can after all expect to face a positive problem: coping with larger volumes than they can possible handle. In any case, a change of strategy is in the cards. Some have already chosen to market the heaviest content on memory cards, which can be side-loaded into a mobile handset. Others have chosen to cooperate with operators of WLAN-networks to offload any too capacity-thirsty content, but still up keeping a more " live" customer relationship. Not to be forgotten, there is also a market for machine-to-machine (M2M) communication. Even if

the speed requirements often are modest, other aspects like security, reliability and coverage can be the more crucial to end-users.

Some Preliminary Statements

- The New Wireless World looks bound to provide an ever-increasing number of different offerings, rather than any single and uniformed service carried by any single kind of network. A situation similar to the pattern for physical transportation where the use of cars, buses, trains and airplanes often are combined.
- Mobile telephony is replacing fixed voice services, due to decreased price differences and the convenience of one handset, one address-book, one voice-mail, etc. However, this feat is not easy to replicate when it comes to more advanced and " capacity-hungry" services. Migration could even be in the opposite direction, from wireless to land-based communication as discussed in Negroponte (1997), often referred to as the "Negroponte Switch":

  > *"But even with all tricks and efficiencies, the bandwidth available in the ether is scarce by comparison with what can be provided by fiber and our endless ability to manufacture and lay more and more of it. For this reason, I proposed a trading of places between the wired and wireless information of today".*
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  > Negroponte 1997 p.24[2]

- From a global perspective there is reason to talk about a new kind of Digital Divide. This time with emerging economies as the growth engine for wireless for all purposes, including high-speed datacom services. Whereas more "mature" markets already are in the second loop of the Negroponte switch. (With TV over fixed networks as a driver for capacity build-out, also enabling broadband datacom services at ever-higher speed.)

2 For a comment on the previously mentioned article by Bar & Galperin (2004) where they suggested an eventual switch to wireless communication solely, see Thorngren (2004 b).

- Pricing strategies are a critical issue in the new wireless world. Unlimited access at flat rates might not be sustainable where there is a capacity limit. Build-outs (of conventional networks) can prove increasingly costly, and investments difficult to recover on the increasingly important but low priced "indoor" market. Pricing more related to the extra ***value creation*** (in relation to other offerings) looks to be more of a sustainable strategy. A degree of convergence between wireless and fixed networks is one of the options to be discussed in later chapters of this book.
- The concept of mobility is clearly more than just a fancy new word for mobiles. Rather it is an intriguing umbrella embracing the complexities in a new wireless world. It is an issue to be discussed in some depth both in the next chapter, and in the concluding chapter. ***What is to be expected beyond Mobility?***