Global Communications Newsletter

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Leveraging Technology and the Market to Bring Telecommunications Business into the Next Decade

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This article summarizes the keynote address given at the ISSC '04 in Alexandria in June 2004. The main points made are: we are in a transition time from the established world of telecommunications services where value is in the network, to a new world of distributed actors; at the same time users and providers are using the network in a much more transparent way. The value shifts mostly to applications and the periphery of the network. The definition of network boundaries itself is becoming difficult. In the fixed network most of the investment was in the network, and it was up to the operator to invest the money. Assuming 10 as the overall investment in world wireless business, it results that 7 is in the terminals, and of course this investment has been sustained (mostly) by users.

These changes, and those to come, are being enabled by technological evolution. In turn, this evolution and its effect on the market are leading to significant changes in the value chains, which I call disruptions. Technology evolution, market disruptions, and new value chains are intertwined; this is reflected in this article, where I consider some of them.

A Crumbling World

It used to be clear.: the farther away you called, the more you had to pay. This is rapidly changing. In many countries flat rate tariff schemes get rid of the concept of time, and the same goes for distance. In Norway all domestic calls are local calls. Calling from Italy to the United States costs the same as calling to France, just across the border. Telecom Italia has seen a progressive decrease in revenue from traffic and an increase in revenue from subscriptions. The trend is generalized in many countries, and within 10 years we will probably all be local from the tariff point of view.

Today, operators are still pricing data connectivity based on bandwidth. Give it 10 years and you might have hundreds of megabits per second in the local loop. At that point it will be very difficult to charge for bandwidth.

Service level agreements (SLAs) are obviously another way to differentiate charges: the better the service, the higher the charge. The progress of technology, however, is going to lead to quality exceeding demand; this, in a way, has already happened in the area of service delivery while we are still at bay in the area of service provisioning and maintenance.

Forecasting existing technology evolution is viable, but it is much more difficult (pretty close to impossible) to forecast the advent of brand new technology, like foreseeing the advent of plastic in the early 1900s.

Distance-time, bandwidth, and SLAs have been the pillars for differentiating charges in the 100 years of telecommunications service. These pillars are crumbling; we should be prepared and start look for others.

Changes Looming Ahead

Technology evolution will obviously continue in the next decade, and we can easily predict a certain amount of performance evolution for any given technology (e.g., increasing optical fiber capacity, increased display resolution).

However, all these areas of evolution are to a certain extent, indirectly related to one another via the market. Evolving a technology requires investment in research, the production process, and manufacturing plants. This investment is unlikely to happen unless there is some consensus that such an evolution has a market willing to pay for it. This generates a self-fulfilling loop: if there is a market expectation, investment takes place and technology is likely to evolve; if no market is foreseen, investment sources are difficult to find and technology evolution slows down.

Forecasting existing technology evolution is viable, but it is much more difficult (pretty close to impossible) to forecast the advent of brand new technology, like foreseeing the advent of plastic in the early 1900s. It is a pity because this is what may really change the overall scenario. There is a way around this contradiction in terms: trying to understand what kind of disruption may lead to a radical displacement of current value chains. We might not be able to pinpoint a (nonexistent) technology that would make it happen, but we might evaluate what the result might be. This exercise basically requires pushing (as a thought exercise) current technology beyond its current limitations, like saying in 1900 "Let us assume that we can evolve steel to a point where it is cheap to produce, light, and as thin as a sheet of paper. What would happen?" Actually plastic was invented instead and provided those features.

Disruptions may also occur by stretching current technologies up to a point where the business proposition changes radically, leading to reshaping of value chains. This can be a good starting point, since a new technology can accelerate at such a stretch, anticipating disruption. In the following I consider some of these macro changes enabled by evolutionary trends.

Bringing Telecommunications Business into the Next Decade/cont'd

Table 1 summarizes the disruptions considered in the European Union project Fistera, http://fistera.telecomitalialab.com.

From Products to Services

There is a general trend to use products to offer services; this may go to the point of providing products "free of charge" to be able to offer and push services. Subsidies on cell phones is an example. Take the medical area. Drug companies are starting to investigate how to offer personalized cures, selling a box of pills and the service of being monitored as the drug is used. Body area networks, Bluetooth-enabled cell phones, sensors, and radio markers are providing the technological enabling platform.

Cars can be sold with a given horsepower, but when the driver requires a bit more she can press a button on the dashboard and send a message to the manufacturer. The driver will be paying according to the time she uses the extra power.

Digital camera manufacturers may embed cell phones and let people upload photos to a service center to have them edited and printed, and also get advice on how to take a shot.

The Disappearance of the Computer

Many computers have already disappeared from our perception. In 10 years many more will probably do so. We have computers hidden in the television remote control, the watch on our wrist, the digital camera, the cell phone, a key card given to us at hotel checkin. The list is endless. There have been many more 25-yea-old 8080 microchips sold in 2003 than Pentium, AMD, and the like all together.

The key point here is that as computer (microchip) prices fall below a certain threshold, it can be embedded in other objects and become an integral part of those objects, disappearing from our perception.

This is interesting from the point of view of telecommunications, particularly since 2003. At that time a new production technology invented the previous year made it possible to put on a single chip both the processing and radio communication parts, thus enabling the construction of cheap single-chip communicating computers. In perspective, any object can embed a communicating computer, thus multiplying the number of telecommunication users.

The pervasiveness of computers in objects creates opportunities for telecom operators and service providers. It also creates challenges for many companies that will need to expand their skills to be able to make use of microprocessors in their products.

Ubiquitous Seamless Connectivity

The variety of technologies, particularly those supporting wireless access, is making ubiquitous connectivity a reality. In a few years, it will not just become more pervasive, it will become seamless. This is going to change the perception of connectivity service and user-operator relations. Seamlessness will become possible because of smarter terminals, able to automatically switch between access networks, because of networks able to communicate with one another and maintain virtual connectivity across their boundaries, and advanced transparent identification procedures (identification will be done backstage with all the required safeguards).

The loss of perception the user will have of the network and possibly service provider clearly creates a significant issue in the relationship with the customer and is likely to lead to a reshaping of several value chains. A key position in the value chain will be held by those who are recognized by the end client, independent of the fact that they will actually be the ones to deliver a specific service. These companies will form a new breed of business intermediates. Security, ease, flexibility, and capability to provide profile-based services will be the key requirements.

Changing Traffic Patterns

Email, Web surfing, video clips on mobile: these are all examples of services generating significantly different traffic patterns than those of voice communications. However, in coming years the impact of local storage will lead to even more significant changes in traffic patterns over telecommunications networks.

Local storage, in the living room, mobile devices, the office, will dramatically change the behavior of users and the balance between local and accessed information. The likely availability of high-density low-cost polymer memory will make it possible to store 2000 movies on a credit-card-sized memory. The card can be provided for free to everyone going to see a movie, thus allowing a person, once back home, to plug it into his/her television and watch movies, let's say three minutes each. Finding something he/she wishes to watch will be a matter of just clicking a button to request the decryption key (and paying the requested price) being able to watch the movie with no need to download it. In an opposite direction, the availability of huge hard drives (we have already reached 1 Tbyte, $900) makes it feasible to "duplicate" the Web in one's PC (at least the part one is interested in). Traffic will be limited to updating, and most of it can be done backstage.

As I observed at the beginning, this is outside the normal way of doing business today, and in part it also contrasts with the investment in broadband targeting movie spectators.

Unlimited Bandwidth

In some areas served by fixed lines, we already have unlimited bandwidth (on the loop), since once you have 100 Mb/s you generally have more than you can chew. In 10 years we might assume this will be the "normal" situation.

On wireless there might be a breakthrough in the next decade. Some studies have already proved that terminals with sufficient power (in terms of both processing and energy), by working together in analyzing the incoming signal, can differentiate various sources and get rid of the interference problem. This could result in practically unlimited bandwidth.

The crucial bottleneck is in the battery. This bottleneck can be expected to find a solution in the next decade (micro fuel cells, nanotubes, etc.).

The availability of unlimited bandwidth clearly changes perceived value and regulation needs.

The Emergence of "Always On"

Flat rate tariff (along with the host of technologies that make it economically viable) is leading to a major change in the perception of communication: no longer something one has to set up, rather an always on channel, a window on the world.

Big screens, very-high-definition (8 Mpixel and up) display technology making screens indistinguishable from windows, pagers like devices ... they all lead to a different way of communicating that adds up o existing communications.

Our children's room may have a screen as big as the wall that extends their room into the living room of their grandparents. When they happen to be in their room and Grandpa is in his living room, one block or 100 miles away, they can act as if they are together. That same "window on the world" might be opened on a friend's room or a safari lodge in Kenya overlooking a watering hole so that I can see animals coming and going.

Clearly this is a great potential traffic generator (which

Disruption	Technology enabling factors	Market pull factors	Impact on the industry
Transformation of products into services.	Embedding of communications capabilities into any product; competitive advantage derives from profiling, cheaper manufacturing.	Products are becoming commodities; loss of differentiation capabilities, increased copycat possibilities.	Enterprises become service companies; shortening of product's life cycle, strong increase of call centers; more global market, restructuring of the value chain.
Disappearance of the computer.	Diminished processing cost; system on chip; wearable computers; increased connectivity and ubiquitous access.	Need to increase volume; need to increase flexibility; need to provide easier access to functions.	Skill to exploit increased processing capabilities in any object; new level of competence required; new actors and competitors in the value chain.
Ubiquitous seamless connectivity.	Increased connection capabilities for any object as result of object capabilities and access point availability; variety of infrastructures; WPAN; software radio.	Mature market drifting toward flat rate; demand for transparency; drive to decrease cost; bundling communications into services and goods.	Shift from connectivity to service; bundling of services; seamless service hopping; crucial importance of profiling; embedded connectivity demand; increasing opportunity to offer new services.
Changing traffic pattern.	Huge amount of local storage; sensors, tags; digital camera, camcorder; agent communications.	Growth of peer-to-peer as content production is more and more dispersed and shared; flat rate and always-on tariffs.	Push toward the transition from ADSL to VDSL; push toward optical access; always on, ubiquitous wireless access and seamless connectivity across access points.
Unlimited bandwidth.	Advances in propagation studies; terminals as network nodes; cognitive radio; software radio; mesh networks.	Need for ubiquitous connectivity; variety of local access operators; great variety in traffic demand.	Incumbent mobile operators; new mobile operators; service and product industry; regulatory framework.
Disposable products.	Diminishing cost of production "per item"; increased flexibility and customization; long lasting batteries; on-site production; short-range embedded connectivity.	Faster pace of evolution for fashion and design; shift from products to services; function-oriented interface.	Evolution in the value chain; faster evolution life cycle; evolution in customer care; recycling as a problem: as part of production and as a service.
Autonomous systems.	Increased processing power in objects; increased flexibility in terminals; agent technologies; ad hoc networks; local world mirroring.	Sensors and sensor networks; overall increased complexity; heterogeneous systems; fast asynchronous evolution.	Network operator dilemma: A.S. as network users or as part of their offering; virtual network providers; service providers; engineering challenges.
From content to packaging.	Diminished cost of content production; consumer-based content production; information as a "by product"; multimedia and multimode; profiling.	Abundance of information; need to get rid of information; difficulty in controlling ownership of content.	Reshaping of the content industry shifting toward content bundled into services; rise of the packaging industry; ambiguity in the telecommunications industry business to be resolved.
The emergence of virtual infrastructures.	Ubiquitous, seamless communications infrastructures leveraging on WiFi, UWB, multimode terminals, WPAN; wireless broadband; increased local storage; agent technology; intelligent ambient; mixed virtual reality.	Globalization of business; increased circulation of people; leveraging global investment.	Telecom operators see a growth of competition with growing loss of the network ownership advantage; emergence of virtual telecom operators; consumer electronics opportunity; computer industry used as underlying platform.

basically does not bring in any money) and a great service platform (this is the money generator).

Disposable Products

The progressive lowering of production cost and interest in having people upgrading their products as frequently as possible are leading to a growing number of disposable products. Cell phones and digital cameras are already available in "disposable format" and so will low-end computers in three to four years.

This is creating tremendous opportunities for service offering since it will be possible to deliver a new service by packaging it into the required hardware.

The advantage of packaging hardware with a service (today it is the other way around) is that the hardware can be customized to the service, making it easier to use. Many new telecommunications services, closely embedded in objects and everyday activities, can greatly benefit from this trend.

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Autonomous Systems

The variety of evolution concurrently progressing in many parts of the world is so fast and, in a loose way, so related in terms of the interaction resulting through the newly created products/applications that the usual standard creation process is lagging behind.

The likely solution to this widening gap is the emergence of autonomous systems. These systems are able to perform their activities taking into account the local environment and adapting to it. Rather than relying on external planning and careful interaction, the approach is to make the best of what can be known locally.

Autonomous systems have, however, a strong need for communicating. Locality, in fact, is no longer a geographical concept; rather, it refers to the information and applications that are on the boundary of a system — and this boundary is, in many cases, stretching over different places; thus the need for communication capabilities.

The Emergence of Virtual Infrastructures

As infrastructures become intertwined, the access of applications and terminals is independent of the specific infrastructure owner, and users lose sight of the real infrastructure, we can expect to see many virtual infrastructures emerge. We are already talking of virtual mobile operators, meaning those that offer a service making use of other operators' infrastructures.

Imagine entering a big department store. You might receive a message on your cell phone saying "Hello, welcome to our department store. You are welcome to use our infrastructure for free. Just press number 1. For every €20 spent you get a credit for a one-minute call anywhere in the world while you are in our mall." If you press 1 via software radio a new coding scheme is downloaded to your cell phone, and from that moment on (as long as you stay within the radio coverage of the mall) you are connected to the global network via that department store's private network. The store does not need any license to operate since it is only covering its own private area. To forward your calls and direct incoming calls to you it will set up a connection through a public operator.

In 10 years hundreds of private operators will provide the access part.

Pinpointing

In the next few years radio frequency identifcation (RFID), electronic tagging systems, will become widespread, completely changing distribution and retail procedures. RFIDs are interesting for telecommunications because they open up a Pandora's box of new services. Imagine entering a supermarket. With your cell phone you can point at a package of lasagna and in a moment you will get the 128 bits of the tag on your screen. Not very useful indeed. Actually, those bits will not be shown on your cell phone screen, but sent to the manufacturer of the product (its address is part of those bits) and result in the retrieval of a bounty of information about the product. This information is not sent to you directly but goes to a trusted service provider who has your profile and knows what really matters to you. Pinpointing and electronic identification will create tremendous opportunities for new services and lead to reshaping of value chains.

From Content to Packaging

Last year research from Berkeley pointed out the tremendous growth of information on the Web and outside of it. Actually there is so much information being produced that it dwarfs that on the Web, which is the most easily accessible. We see a clear trend toward putting more and more of it there. What we have witnessed in these last two years is the shift from the shoebox to the Web. People are starting to use the Web as their closet to save and share information: pictures, movies, ideas, and so on.

The bottom line is that today and more so tomorrow, information availability largely exceeds demand. Hence, there is a generalized loss of value of information, explaining the difficulty for information providers in charging a price for it. *Encyclopedia Britannica* docet.

However, the increased amount of information creates the problem of sifting through it. Search engines like Google basically mask information rather than reveal it. This problem is actually an interesting source of potential services for future companies that will focus on the customization of information, packaging it by profiling users. This involves a lot of (not yet existing) technology and a lot of trust.

Wrapping It Up

I believe I have shown a number of significant changes that are likely to happen, possibly in various degrees, over the next 10 years.

These changes are enabled by a relentless technology evolution, although the reasons are to be sought in the market evolution. Here uncertainty is much greater. New technology, unforeseeable today, may become available and even lead to sooner changes.

These changes foresee some threats to the established value chains and the actors dominating the scene today. At the same time they offer plenty of business opportunities to all: today's dominant players, startup compaines, and not yet existing companies. Being strong today is not a guarantee of successfully exploiting those changes.

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