

# **The future of telecommunications: Is there a revenue for Quality?**

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TILAB*

## **Introduction**

Quality of Service has always been a top priority for engineers. It just changed the meaning over time. In the beginning QoS meant being able to transmit an intelligible signal, than it shifted to the “fidelity” of the signal being transmitted, than to the “quantity” of signals that could be transmitted (taking the “fidelity” part as granted)... Quality of Service has always been a top priority for marketers, those guys in an Operating Company who are in touch with the customers. It always meant effective delivery to the customer, just the meaning of “effective” changed over time. First it was being able to provide a service (a line actually) within a six month period, then it progressively squeezed down to a few days (or less). Flexibility in promptly accommodating customer's request is a more recent (last 20 years or less) meaning of QoS for marketers.

Quality of Service for customers basically never existed. Customers started by marvelling that communications was possible at all; once they got used to it they only perceived negative quality of service: a delusion on what they have been accustomed to have.

The engineers have consistently moved forward in providing more and more of their QoS from the network point of view. See the special issue of the Communications Magazine, January 2003.

This has increased the threshold of what customers consider to be a normal service (not an exceptional service, something for what they are willing to pay a premium).

The marketers (in conjunction with processing evolution in delivery, operation and maintenance) have not significantly improved the perceived quality. Customers are complaining today at the same level they complained 10-50 years ago. They are just complaining for different things...

The customers are basically associating QoS to Value for Money: and this is very close to just Money. The less they spend the happier they are. Forget QoS. Most of the work on QoS has focused, and it is still focusing, on the network and processing side. The claim is that this would increase the customers' perception of QoS. I don't think this is true. People are not going to fancy restaurants to get better food quality than the one they get at home... They go there for different reasons.

In this paper I try to take a look at the evolution of telecommunications, as it can be envisaged today by considering the overall environment, including technology, communications paradigms, classes of services with the objective of stimulating thoughts on QoS, where it lies, where it matters.

The first part is about today's situation. After some years of neglect telecommunications industry became the darling of the stock market but that changed 3 years ago; now Cinderella is back to its smoky den. Why?

The second part is looking at the technological and service environment trying to single out some trends that may well disrupt our view of telecommunications in the coming years.

Can we look into the future? Yes because the future is already happening it is just not evenly distributed.

Disruptions are not necessarily bad; actually, in a sluggish situation like the one we are in today some of these disruptions may just be the right medicine to rejuvenate our business. But disruptions are such if they change the rules of the game and by doing that they also change the perception of people about telecommunications, what they can expect from it and therefore their perception of “bad quality”. As I mention I believe there is no perception for “good quality”.

Based on those disruptions what could be the evolution of telecommunications in very general terms? That is the objective of the third part.

The concluding part is on QoS. Where it is going to be, what are the perspectives for QoS? Are there revenues out of quality? I am not answering to these questions now, keep reading and although I cannot promise satisfactory answers I do promise to provide something to think about.

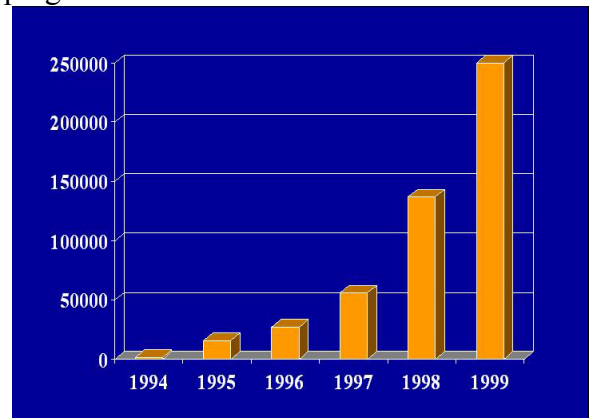
### *Something is wrong*

Operators, being they mobile or fixed lines, ISPs, manufacturers: each of them has its own agenda. Each needs to differentiate from competition to convince their clients they (their products and services) are the right choice for them. They have high quality, they deliver high value...

They surely have something in common: a slumping stock.

And this is in spite of the high quality services and products being delivered...What's wrong?Take a look at these figures on the chart.

They are not representing the growth of Internet users, or the growth of traffic or servers. They represent the growth in the number of times the word Internet was mentioned in USA newspapers. In 1994 the Internet was mentioned 1833 times by USA newspapers. In 1995 the word Internet appeared 15,940 times, over 27,000 in 1996, over 250,000 times in 1999.



The more you talk about something the more it seems real. I feel this was part of the problem. By talking a lot we grew the expectation of the “stock market” and this in turn steered company to talk more about it to show they were riding the wave.

Many companies leveraged on this “halo” to be financed, many companies failed and are now fading away. Many of these companies seemed to be perfectly poised for a bright future, yet, most, simply vanished. The reasons were many<sup>1</sup>, I just want to point out few of them because they are structural reasons, that is they are not related to the individual company itself, to the way it chose to implement the business or the effectiveness of its implementation.

### *The myth of replacement*

In those glorious heydays of misplaced trust and unreasonable hopes the leading idea was that “technology” (internet, network, software) was so nice that it explained the expectations. However seldom, if ever, technology is the reason for market success. You need technology as an

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<sup>1</sup> For interesting analyses on specific “failures” read: [F'd Companies: Spectacular Dot-Com Flameouts](#) by Philip J. Kaplan

enabler but overestimating technology is always a big mistake in the short term. Similarly it is always a big mistake to underestimate technology in the long run. Internet companies, by large, made the first type of mistake and they managed – thanks to the press- to take on board the large public. Telecom companies made the second mistake underestimating the impact of technology on their networks<sup>2</sup>. The first mistake was both about a misconception of the time it takes to a new technology to succeed, and the belief that such a technology would quite simply move all markets to the Internet. Buyers will become e-buyers and only those companies that would e-sell would prosper<sup>3</sup>. This is what I call the myth of replacement. Examples abound: the advent of television created the expectation for the disappearance of the radio, the birth of the PC was saluted as the end of the television, the advent of the internet was taken to herald the disappearance of newspapers<sup>4</sup>. Indeed a new technology, once it establishes itself (but that takes time), introduces new opportunities and may change some rules. That goes for the new players and for the existing ones who can usually find a better way to leverage their assets with the new technology. As a result we have seen a coexistence of old business with new ones.

Often engineers get excited because they have found a new technology that delivers better QoS. Digital vs analogue, high speed vs lower speed, video vs audio, electronic agenda vs paper one. . .

Customers have a different perception of QoS and related value. They have thresholds and these thresholds are not tied to technical parameters but to their habits. And it takes a lot to change people habits, and you cannot expect to change habits to “all” people. People have been used to have voice communications: the addition of video (video telephony) simply did not appeal to them. PC is great, but statistics show that penetration does not reach 100%. A significant portion of people simply do not want it, no matter how cheap it may be.

### *The revenue ceiling*

Another “structural” reason is the limited amount of money available as a whole and more specifically for telecommunications.

Every time a new service is proposed it is going to chew on existing services or, less likely, on other market areas. As an example, in Italy youngsters have decreased their spending on “shoes” to be able to buy cell phone pre-paid cards and according to a recent poll in Scotland they have decrease smoking to have money for their cell phones calls.

Normally, however, expenses are balanced within any specific market area. That is to say a telecommunications offering is likely to succeed at the expense of another telecommunications offering. You sell ADSL and people stop using ISDN, you sell mobile phones and people stop using the fixed phones (and return the second line. . .). Look at the picture. A successful service, such as the I-mode of Docomo, is getting money from other services sold by the same company. By far we are a mature market where any new service, if successful cannibalizes existing revenues.

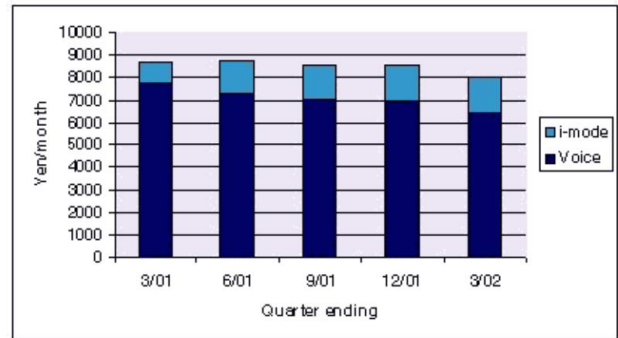
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<sup>2</sup> This “mistake” would require a bit of discussion and this paper is not the appropriate place for that.

<sup>3</sup> Intel’s CEO declared in 1999 that by 2005 we would no longer be talking about e-companies vs. normal companies because only e-companies will be the only ones on the market.

<sup>4</sup> There is plenty of data, from the booming in numbers of radios to the multiplication of newspapers and magazines. Possibly one single data may be significant: the increase in sale of office printing paper. In spite of all the talk on the paperless office there is a great business in selling paper to offices. <http://www.nytimes.com/2001/04/21/technology/21PAPE.html>

Creating a new service requires money. And if successful it will not bring in any fresh money, just swap money flow from something else. On the other hand telecom operators are forced to provide new services to contrast those offered by competitors. New services are not to increase revenue; they are essential for not losing revenues to competitors.

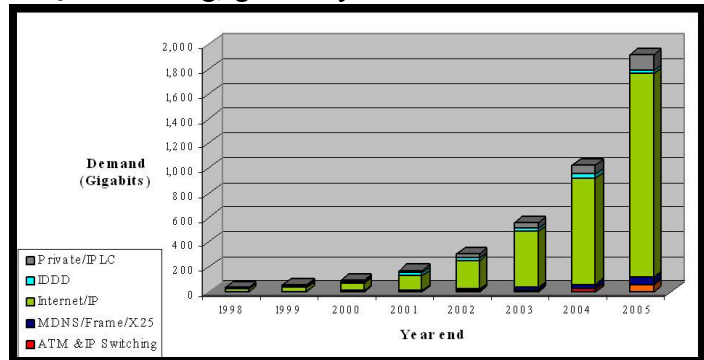


This elemental, structural, aspect was overlooked and people (and the stock market) felt that any bright idea will generate money. It might, but if it does someone else is going to lose money. Providing higher QoS simply kills lower QoS offering, generally it does not increase revenue.

*The excess of capacity*

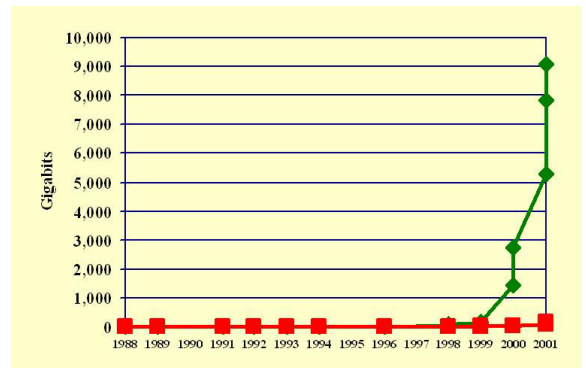
The last structural reason I wish to highlight is the blow-out of the ratio

between communication capacity offer and market demand.

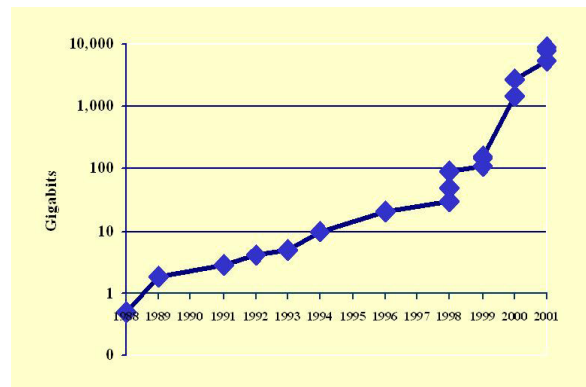


As shown in the graph, plotting the growth of traffic demand on telecommunications infrastructure, we have seen in the last decade a significant consistent growth.

Because of this growth (whose perception was further distorted by the relative, percentage, growth of internet traffic in the order of 3 digits per year) the feeling was of a tremendous business opportunity for telecommunications. Out of that feeling, and a readily accessible capital market, we had the landslide of infrastructures deployment in the late nineties.



However in spite of the huge quantity of buildings being constructed around the world, and hence the huge need for sand to make concrete...the price of sand did not go up. Quite simply, there is so much sand around that no matter what the demand is, the offer is way greater. This is the situation in telecommunication infrastructure capacity.



Looking at the graph we see that over the last decade we have had a tremendous growth in capacity. Actually the graph is misleading since its Y axis is using a logarithmic scale.

Let's put together demand and offer and see what happens. Whilst network capacity has always been very close to the market demand

for transport since the beginning of telecommunications, thus basically stabilizing prices, at the end of the 1990s offered capacity blew out of proportion.

It does not take an economic genius to appreciate the result on the price dynamics. Prices fell, as well as the asset value of infrastructures. And the situation is not going

to improve in the coming years (in this area). Advances in optical fiber will keep increasing the network capacity. On the very latest fibers available in research labs capacity has further multiplied. If we imagine carrying all world traffic on a single fiber we would still have plenty of capacity to spare. In fact we would be using only 0.0006 Erlangs of the fiber theoretical capacity. In other words we could transport the current world traffic of a year in 5 seconds.

Even if we assume a 100% increase in traffic and a stable network capacity it would take the next 14 years before filling in that single fiber.

The good news is that demand will grow more than 100%, starting 2005; the bad news is that network capacity will continue to grow.

### *Disruptions ahead*

Let's now consider some of the disruptions that are lying ahead. I feel they are important when discussing QoS because a disruption changes the rules of the game, it changes the perception of the customers and the way they use the network: hence they alter current view of what is relevant for the QoS.

#### *Storage*

First let's consider the storage evolution. Storage used to be a scarce resource and good programmers knew how to use it sparingly. Digital photography was beyond reach also because it would cost too much to store the digital pixel. Thinking about it: if you wanted to store a picture taken with a today's 3 Mpixel digital camera on a memory available 30 years ago that would have cost you about 10,000 \$. Now you can store such a picture on a dynamic memory for less than 30 cents (and on a DVD for 2 tenths of a cent).

Customers used to value the possibility to store their messages in the network (that was in the late 70ies, one of the perks provided by the electronic exchanges) then they found it more convenient to store it locally in an answering machine. Today, messages are stored in the network and customers no longer value it, it is taken for granted, the same way you take for granted that a highway is paved. The idea of a gravel highway is just "absurd".

The storage of messages shows how the evolution of memory changed the service delivery architecture (and the associated pricing structure).

In the coming years we can expect dynamic memory to keep increasing size and lower cost and power consumption. The result is a bunch of handheld terminals packed with new functionalities, part of these stolen from the network, taken for granted, basically free (you may pay a few extra dollars for them when buying the terminal but you are not perceiving their cost).

Hard disks have reached 160 GB and within three years we can expect to have 1TB disk for less than 300\$. What can you fit on such a disk?

About 1 million pages of text or 3,500 pictures a day for a year, or 26 hours of sound every day for a year. Only 4 hours of television a day for a year.

Back in 1945 Vannevar Bush articulated for the first time a vision, he called it Memex, of storing a whole life, images, information, sounds. At that time it was a complete nonsense, or a pure thought experiment. Now Microsoft is working on that vision, storage technology is about ripe to do that. What we miss is appropriate retrieval technology. This is the objective of the MyLifeBits project.

What is the impact of this growing storage capacity on QoS?

If you can duplicate information in the network you no longer need to provide QoS transport up to the content provider. It is enough to go to the nearest mirror. Think about ADSL. It provides high-speed connectivity...for about a mile. From there on you are as any one else with a dial up connection in the big Internet. But if your

service provider is mirroring at the POP, based on your profile, the information you are most likely to require then you get high speed all the way to the information. Mirroring is already a reality with Akamai; it will become more and more widespread. Lufthansa is working to mirror Internet information on its Jumbo Jets so that people can access it during the flight...

Mirroring can, and likely will, become a customer behavior. Unfortunately, for the network operator, customers do not mirror, they cash information. Since there is plenty of local storage and tariff is moving toward always-on flat rate we can easily imagine customers to activate little applets that for any Internet page being downloaded automatically download all pages linked from that one. Once he clicks on a link the page will be immediately available since it has been cashed and the applets start their cashing job again.

Mirroring does not create useless traffic since statistically information will be downloaded by at least one of the surfers. The better the profiling program does its job the better the transport optimization. With caching it is the other way round. For every page you waste an average of ten times the traffic.

It may get worse.

Given TB+ disks plus flat rate customers may decide to recreate the Internet on their local disk, updating it every day (let's use this always-on connection...).

Now this would smash the QoS! The local network does not have that kind of bandwidth to support this kind of traffic and its upgrade would be extremely costly (without generating additional returns). An ADSL connection is usually calculated to deliver the speed claimed on the connection to a POP assuming only few customers are actually using it. Were all of them downloading at the same time the speed is likely to go down to 50kbps or less.

The evolution of read only memory is also going to change the rules of the game. A Swedish company, Thin Film, has demonstrated a polymer-based memory that on a credit card size can fit the equivalent of 400,000 CDs. You can imagine going to a movie and receiving, for free, a card containing the best 2,000 movies of the last three years. Once home you plug in the card in a card reader and have a preview of what you want. If you like it a click will get you on the Internet to buy the password to access the film. No more download from the network, no need for broadband, or streaming.

One of the characteristics of the QoS for a network is gone; QoS is now local.

### *Display*

Displays are the weak link in the delivery chain. We are used to wide screens in Movie Theater and anything else is quite different. Recent progress has produced better home screens but they are very costly and still do not compare.

It is likely to remain that way for a while. The movie theater experience is difficult to duplicate, because of cost and especially because of space availability. The average living room cannot compete with a theater.

However in many areas the evolution of displays is going to make the visual experience (and visual communication) so common that in just a few years we may be wondering how we could have lived without it.

### *Offer exceeds Demand*

I mentioned the overwhelming capacity offered by the network. But it is not the only area where we have a situation of offer exceeding demand. This happens in the content area. There is so much content on the web that people are not willing to pay for it. Companies like the Encyclopedia Britannica had found out the hard way that proposing high quality content is not sufficient to win the market.

Carriers have experienced that selling quality does not work (think of the Sprint all digital network...); customers are seeking for lower prices. Price seems to be the only Quality parameter that really matters.

The same goes for applications. Quality tends to be considered more important in the process, rather than in the product (or service).

**Pin-Pointing** Another area of significant disruption is the one of pinpointing. We already have many technologies to deliver new types of services related to a geographical location.

Wherify is a US company that lets you know where your kid is by putting a special wrist watch that communicate the position to a supervising system. You can call a call center or go on the Internet and get the information. You can also subscribe to an alert system so that if your kid steps out of a certain area you are immediately notified.

Same service is provided to localize pets.

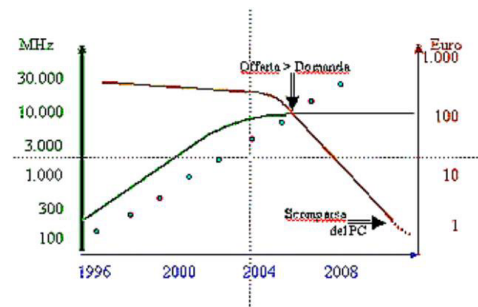
Tagging is going to be a tremendous factor in the creation of new services. Within 5 years, at most, we will be surrounded by tagged objects, and equipment like cell phones may be able to capture the tags and retrieve information from databases in the network.

Gillette has announced early January 2003 an order to Alien for 500 million tags with the idea of experimenting to monitor the delivery chain.

The environment will be progressively more and more intelligent. Sensors are becoming common and they can make the environment aware of what is going on and we could better interact with it.

**Moore's Law reversed** The Moore's law has given us more and more powerful chip. It will continue to do so in the coming years but what is mostly interesting is the fact that also here we see an offer that is exceeding demand. The result is a rapid decrease in price and the dissemination of computers everywhere.

In turn this is likely to generate completely different architectures where the local management takes the upper hand on the centralized management. It will be very difficult to associate quality to a central entity...



**Wireless Access** A similar impact is going to result from the Wireless Always-on (started in 2002).

Wireless manufacturers are shaking hands with PDA manufacturers to make Internet access seamless and with bandwidth in the range of several hundreds of kbit per second. PDAs have the advantage over the cellular phone of a bigger screen that better accommodate web pages. Today's drawback of PDA, the lack of a keyboard to input text, should be overcome in the coming years through voice recognition. At the same time the integration of entertainment (music players and e-books) with PDA is likely to further increase their use.

It is difficult to say if the PDA will overtake the function of the cellular phone, although it is easy to foresee that most PDA will be Internet enabled and connected wireless. Probably we will still continue to have a cellular phone (that in turn will be always on in terms of SMS reception but that cannot qualify as internet connection).

DSP technologies (Digital Signal Processing) keep evolving rapidly and will enable wireless information appliances (since cost will keep decreasing and performance increasing). The car market seems to be one of the first to be connected always-on, of course using wireless.

## *The Future of Telecommunications*

There may be, of course, several other disruptive technologies affecting the evolution of telecommunications in the next 10 years, several of those have not been invented yet. But those that we have considered are sufficient to imagine a very different telecommunications in the near future.

In a nutshell, telecommunications is in the process of disappearing, not because of market depression, of new competitors but as a result of its own success.

In the coming years we will see more and more telecommunications services embedded in other services or products. Telecommunications may become a use and throw away paper cell phone that is packaged with the new toaster and is used as a way to contact a call center if you have problem. It has become part of the warranty... Examples are many and all points in that direction.

Look at roads. They are everywhere and because of that you never notice them. You perceive a road when something is wrong, e.g. the road is congested, or when you have to pay for it. That is happening in telecommunication as well. Cell phones give us a seamless way to access the network. You no longer need to look for a phone, picking it up from your purse or pocket has become an automatic behavior. The advent of flat rate will make the cost of a call irrelevant and we no longer will perceive it as we make a call.

Furthermore the ubiquitous presence of telecommunications services in mostly any product around us will further contribute to the disappearance of telecommunications from our perception.

***The death of distance***      Calls tend to be charged independently of distance. In Norway any domestic call is a local call; within a few years calling your neighbor or calling a friend across the ocean will not make any difference.

Flat rate is happening and we are already seeing its effect. In the graph you see the trend in revenue for Telecom Italia. Revenues from traffic are declining; the ones from subscription are (slowly) on the rise. ADSL will contribute to this trend.

What does it mean when we plot for the next years? Are we going to pay user for using our network?

***The death of bandwidth***      Differentiating price according to the speed provided in the last mile is working today but as speed goes up it will be more and more difficult to apply. Already in some area where customers are connected to a fiber the differentiation of pricing on 10 or 100 Mbps is failing. People are satisfied with the 10Mbps and are not willing to pay for more. The Operating company in the end provides everybody with the higher speed connectivity since that is what the network support and it would cost more to them to differentiate.

In a few years we may reach 1 Gbps on the local loop, technology for that already exists in the labs, like the one shown in the picture, a MEMS used as an add/drop multiplexer.

***The death of SLA***      Differentiating price on Service Level agreements is similarly getting more and more difficult given the high quality of our network. When we started GSM the idea was that a digital system would provide a better voice quality (it actually didn't, but that's not the point) and therefore we could charge a premium on analogue. It never happened. SLAs are still important when dealing with business customer but not as much in the quality of the service; they pertain to the quality of the management of the service, delivery, flexibility, availability...

Customer ignorance is a profit center but Internet is changing that. For the time being Operators are substituting ignorance with confusion as a revenue generator. There are so many tariffs that it is almost impossible for a customer to decide for the best one. But this is also going to change. Flat rate, again, is going to clear the confusion and some customers are already opting for a potentially higher expense by choosing flat rate just to have a certainty on the expense.

### The Future of Quality

Think of wristwatches. Twenty years ago advertisement pointed out the different quality of the watches in terms of accuracy. One was accurate up to 1

*When much is too much* second a day, another up to a second a month...Today you don't see this type of advertisement. Who cares if a watch is accurate up to 1

hundredth of a second a month or a year. It is anyhow well beyond the perception of accuracy. The same thing happens for the network. We have, or are in the process of providing, high bandwidth, we are always connected (see ADSL and GPRS), flat rate relieves you from any worry on the price. The network can let you send voice as well as music, pictures, text, video...and out there you have plenty of free content, 1.5 billion GB of new content produced every year.

*Odyssey: the story of ADSL*

Remember Homer and his masterpiece, Odyssey? It is a story of people who having seen the light (the flames of Trojan) wanted

to bring information home and to do that they embarked in what was supposed to be a straightforward voyage. That voyage turned out to be a nightmare. Transport kept failing, Service Providers proved unreliable, the equipment maintenance was extremely difficult and time consuming. Eventually they resorted to ask the favors of the gods (who regulated the environment) and discovered someone was supportive, others were against them but in the end that did not matter since they spent most of their time arguing and fighting with each other. A bunch of skilled man, they were all sailors, with the best technology of the time, a boat, playing on their turf, the Aegean Sea.

### xDSL

- A seemingly straightforward task
- Requires many steps
- Involves many actors
- Competition is hot
- Satellite, Cable, Wireless

Homer today would have probably written the same story, the same plot. The only difference is he would have obviously not chosen Trojan but ADSL subscription.

It would seem to be a simple task, but it turns out that it requires many steps, it involves many actors, there is a lot of competition and by the time everything will be ok there may be alternative technologies available.

The fact is that managing the process of ADSL deployment and up keeping is very very difficult and the need to cut cost is leading companies to take shortcuts that eventually are not leading anywhere. In fact becoming more efficient is not generating new money; simply results

in decreasing the price to the end user (that is good for the user). The story of innovation has shown this quite clearly. Any cost saving in the production and distribution is going to the end customer.

Some of this cost cutting is affecting the quality perceived by the user. However anyone is doing that and therefore there is no differential on the perceived quality.

### Odyssey

- A seemingly straightforward task
- Required many steps
- Involved many actors
- Competition was hot
- Once they got there they discovered a different world

The mantra for Operator is “look at how much it costs to the operator”. If one is really interested in delivering quality then the focus should be on how much annoying it is to the user.

The fact is that increasing quality may be just too expensive.

With ADSL Operators are entering into the retail market, something they are not used to. And it is a very cost laden area. You need to solve a myriad of specific problems and these change from day to day and from one customer to the other.

Operators have been used to manage all from a central location. If you think about it: it is easier to get somebody coming home to fix a 300\$ washing machine than someone to set up and fix a home network valued in the tens of thousands of \$.

Operators are striving for flexible management and delivery as a way to increase the perception of quality but the truth is that I do not want a good flexible management nor provision. I don't want to see it! Sadly, I also don't want to pay for what I am not seeing!

I am told of the great quality of the network but what I want to see is quality at my end point: as someone pointed out: “your blouse is great but it would look better on the floor of my bedroom”.

### *The value of Packaging*

Where is the value? It is not in the content per se. Look at the water we drink.

In many places you can get water for free from fountains on the square or along the roads. Still all of us prefer the convenience of getting water from the tap and are willing to pay 1 Euro per cubic meter.

Once we are at dinner many of us elect to drink bottle water and pay 1000 Euro for a cubic meter. The water is the same, sometimes it is actually better the one you would get from the fountain. The package makes the difference in the perception of value.

As Einstein used to say when explaining relativity, the appreciation of time length depends on which side of the rest room door you are standing.

Look at SMS. We charge an outrageous price for them and still our customers, youngster particularly, value them very much. SMS have created a new way to communicate. 40% of girls are breaking up their engagement through SMS according to Nokia.

### *The value of Flexibility*

Bandwidth is not going to be a differential from 2006 and beyond. But bandwidth flexibility may be.

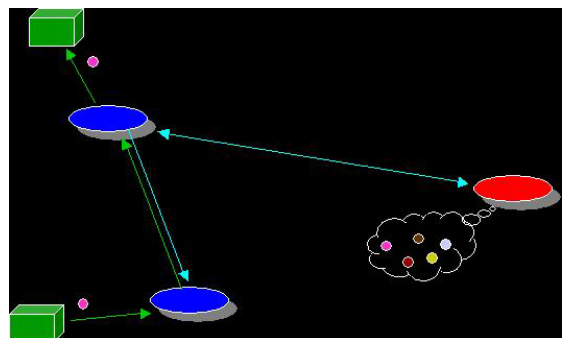
We can imagine connecting the kids' room with the grandparents' living room through a big screen that let them see each other at any time of the day. Of course you do not want to have high quality video for most of the time but just in those occasions when kids are in their room and grandpa is in his living room. This requires a minimum bandwidth for most of the time and then to increase it when communication is happening. Same goes for cellular communication. Normally you would need just voice transport capacity but if you want to send images or clip than bandwidth should be increased. I do not want to plan in advance and be stuck with a fixed bandwidth.

I want a service that seamlessly fits my changing needs and therefore the network should provide flexibility.

### *The value of Paradigms*

Telecommunications is based on peer to peer. It has been so from its invention. Computer folks

have been smarter because they invented the



name, peer to peer, but that was 140 years later.

The fact is that peer to peer is not a good paradigm in telecommunications if you want to make money in the present environment. Peer to peer is about a transparent network and it is difficult to charge for something that is transparent. Today there is a lot of competition and basically no differentiation whatsoever on the network, as perceived by the customer.

They perceive services, content delivered (not content delivering).

We need to look for other paradigms. A possible one is what I call clustering.

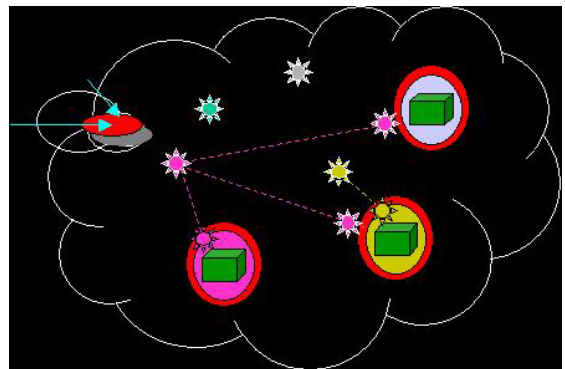
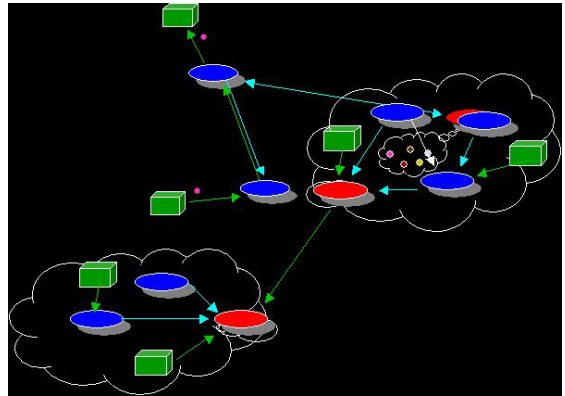
We are going to see many devices connected one another forming environment and communications will take place not from one point to another (telephone to telephone) but from one environment to another.

Information should flow seamlessly to the most convenient device in the environment. Telecom Operator can support that and it is not just a matter of standardization (although standardization is needed at the physical connectivity layer). Providing a seamless routing means to understand what the content is and what the needs, what the habits of the customer are when in that particular environment.

Profiling becomes a very important service and I am convinced that customers are willing to pay for simplifying their life, optimizing time, getting a more effective communication.

Another example is sticking. Here the concept is that information is attached to a particular place, or a particular object or person. Again profiling is crucial in delivering this type of service. Think about health care. Each of us may have his clinical data always associated to his profile (and of course privacy should be ensured as well as disclosure rules, e.g. you do not want this information to remain inaccessible to the emergency ward where you have just been taken when you fainted).

Technology is starting to be available to periodically monitor some health parameters, as an example as you brush your teeth. This information can be analyzed and stored to keep a record.



### **Closing remarks**

As I pointed out we live in a rapidly changing world where the rules of the game keep changing. We used to guard ourselves from our siblings. Those were our competitors. And we all played by the same rules.

It used to be that those who live by the sword die by the sword. It is no longer like that. Today it is: Those who live by the sword will be shot by those who don't.

I do not think that in the future there is really a revenue for "quality" as we used to qualify quality in the past, that is based on network and service delivery parameter.

But on the other end those parameters remain very important because there won't be any revenue without quality!