Towards more intelligent and efficient networks

Juan Carlos García López, Telefónica

Networks 2008

Budapest, September 30th 2008

We live in an environment characterized by the acceleration of change and transformation

Trend to **globalization** in all sectors

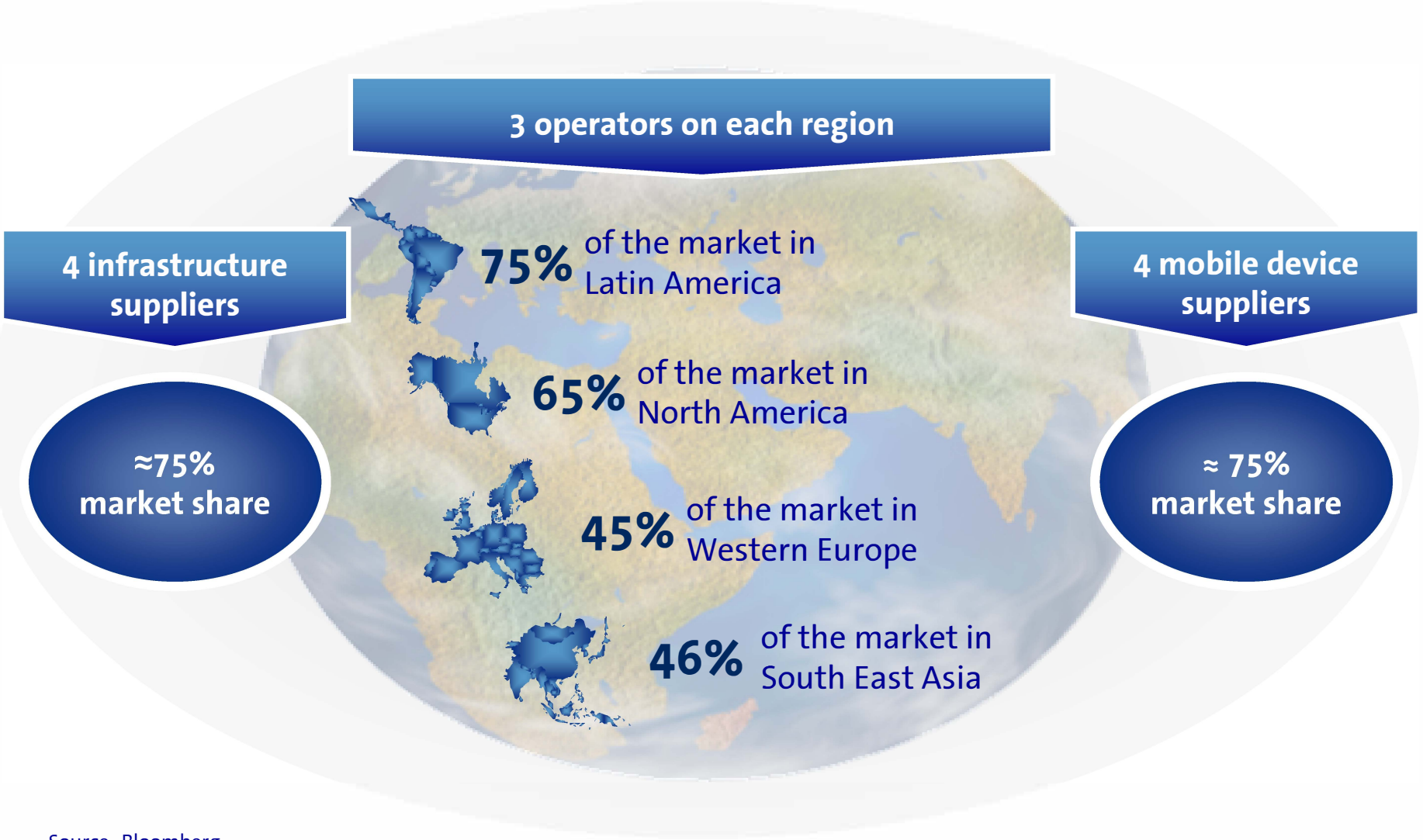
Convergence between adjacent sectors

The "radical" **innovation** stresses the dynamism of the sector

The **consumer** is more and more "The King"

All the operators have to respond and anticipate to the new trends

Global competence among big players is consolidating



Source: Bloomberg

The consumer is always surprising us, being more and more the leading actor

The past years we said the consumer likes...

... being always connected

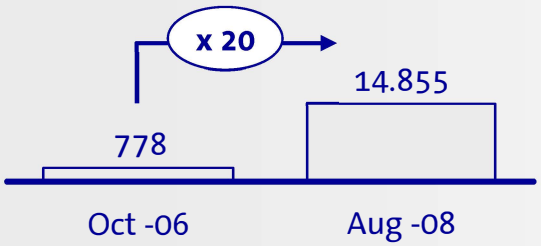
... using new on-line formats to communicate

... creating social relationships through virtual communities

And last year he has again surprised us...

... showing us he likes to live new experiences in the digital environment, as Second Life ...

Number of worldwide "residents". Thousands



Virtual assets buying:

- Clothes
- Cars
- Houses

... or creating new contents to share in the new social networks

62 MM Visits per day (users)

930 MM Visits per day (videos)

100.000 New videos per day

New uses

Political debates

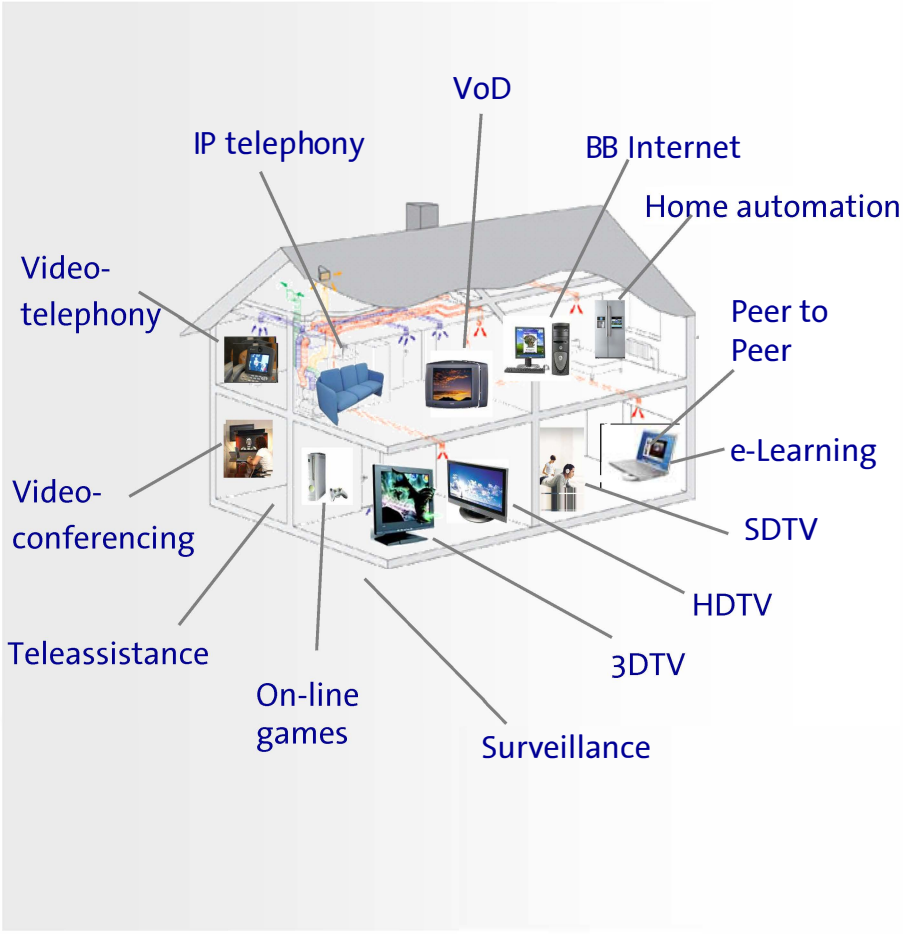
Advertisements

TV programs

Users will demand more and more new services

Individuals use more and more services of the mobile terminal...

... and the households require more sophisticated services



Convergence continues being a growing trend

All the services in a single mobile device

All the home entertainment services managed from a single device

On-line communications from PC and mobile

Personal TV at home, in the PC and in the mobile device

Communications and fixed and mobile broadband at home

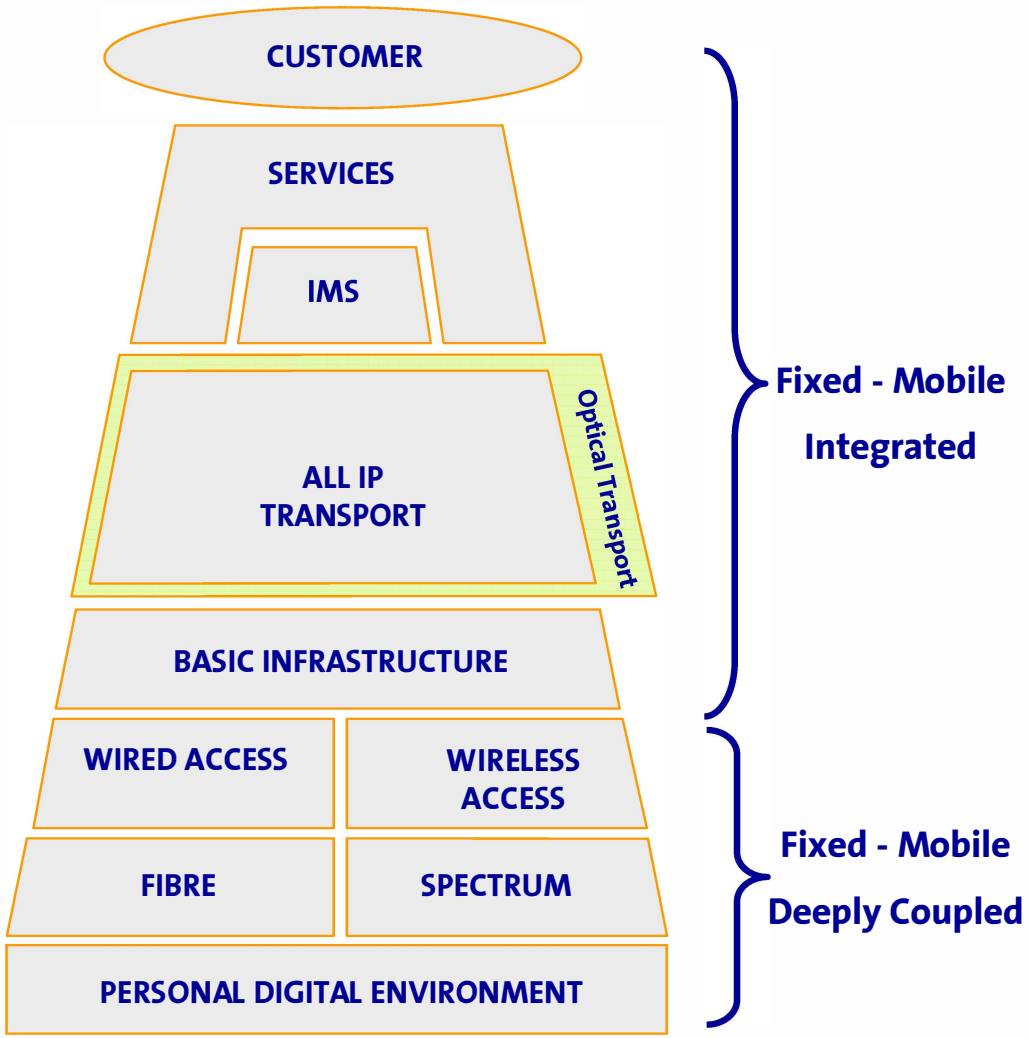
Entertainment, information and communication services through a single TV platform

Voice communication through mobile (GSM) and fixed (WiFi) networks in a single device

… to provide these new services networks have to evolve

FROM	→ TO
▪ Vertical service platforms: ▪ By business (F/M) ▪ By service	▪ Multiservice platforms, F/M integrated
▪ Differentiated Control, IP and aggregation networks: ▪ By business (F/M) ▪ By segment (Residential-Business)	▪ Integrated Control, IP and aggregation network, for all the segments and services
▪ Relationship with third parties based on bit exchange	▪ Relationship with third parties also based in services and contents exchange (IPTV like)
▪ Transmission with different levels of F/M sharing ▪ Basic Infrastructure with different levels of F/M sharing	▪ Highly shared transmission ▪ Highly shared basic infrastructure,even with third parties
▪ Broadband fixed access (Internet, IPTV) and narrowband (voice) mainly over copper	▪ One multiservice broadband fixed access progressively over fiber
▪ Mobile access with growing deployment and capacity difficulties	▪ Mobile access complemented by fixed BB access and closer to the customer (Domestic Node)
▪ Limitations to bring broadband services to every corner in the home and with incipient presence of Telefónica-controlled devices	▪ Broadband anywhere in the home and with a higher presence of devices controlled by Telefónica

Telefónica target network evolution



- **Efficient**
  - Evolving/switching off obsolete networks
  - Scalable to fulfill traffic requirements
  - Providing coverage in a profitable way
- **Relation with 3rd parties**
  - Allowing new relationships model with other agents like **ASPs** (Google, Yahoo,...) and other **operators**
- **Powerful.**
  - Supporting new range of services and business models making Telefónica more **competitive**.
- **Flexible** and less complex
  - Capacity for adapting to new requirements and shorter TTM
- **Intelligence**
  - Intelligence has to be added to the network to increase network value
- **Open**
  - Networks will be open to external innovation to provide a broader range of services
- **Reliable and Secure** to manage all the services

Access

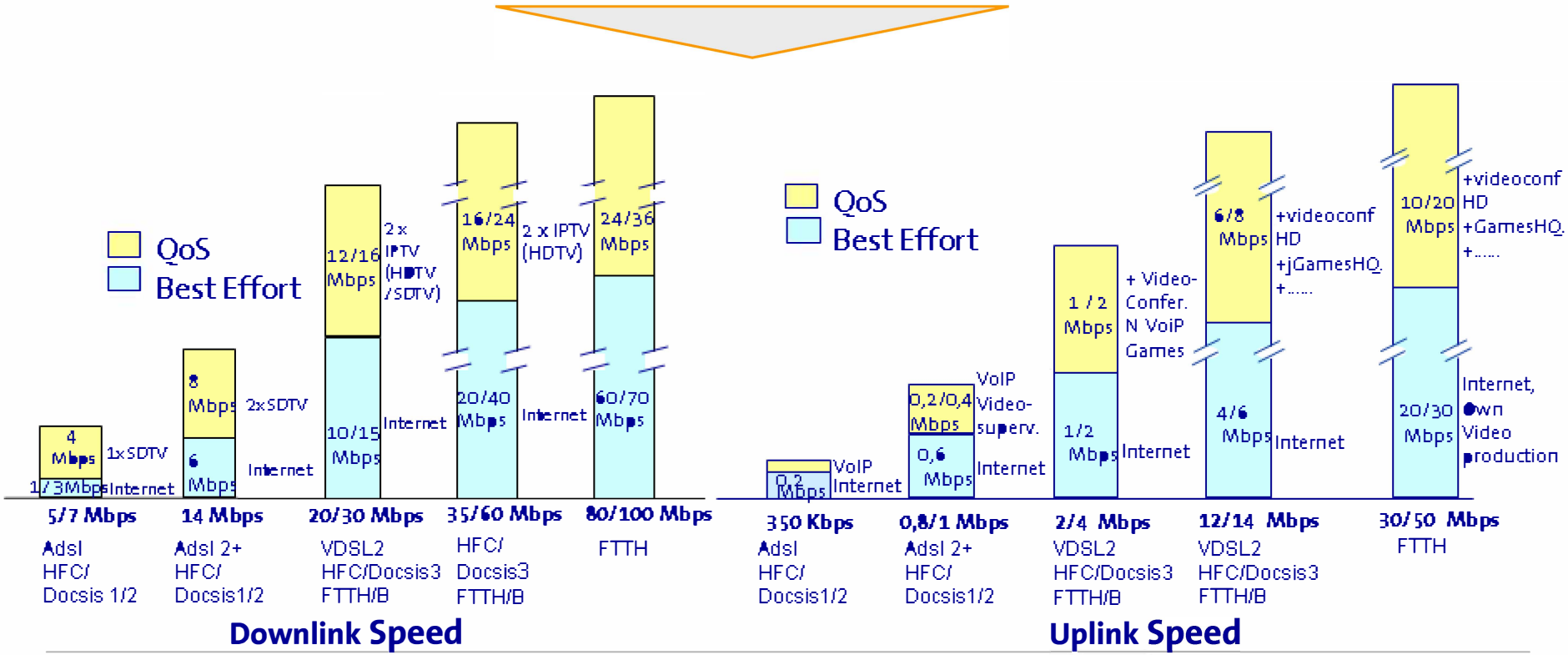
Fixed access: Internet and 3P offers will require to provide more bandwidth

Trends in Downlink

- Video is representing a higher and higher percentage of traffic on the internet
- HD Television is becoming a reality (8/12 Mbps with MPEG 4...)

Trends in uplink

- The video produced by our own customers to be distributed in internet is experiencing an exponential growth
- The interactive applications that require a high bandwidth (videoconference, videosurveillance, videogames, telepresence...) will be a differential element against competition.



To provide this higher bandwidth, fibre is needed

The fibre deployment will be gradual using FTTH topology and complemented by VDSL2

1 Coverage from Central Office

- VDSL2 from the central office provides a 25 Mbps service to customers close to the C.O.

2 Modernization of loops in consolidated areas

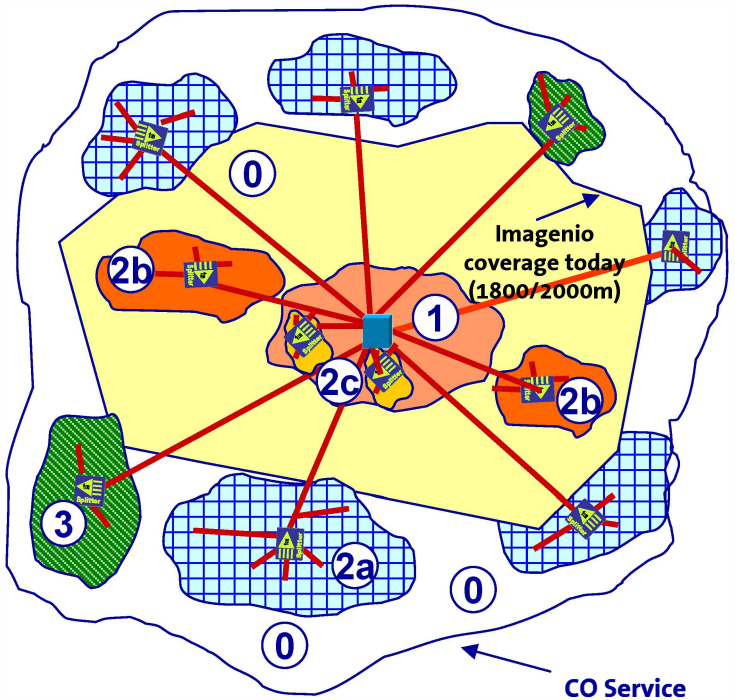
- Start selectively implementing the analysed solutions based mainly in FTTH where IPTV service cannot be provided today (2a), ensuring new incomes. Progressively enter into current IPTV coverage (2b), and in VDSL2 (2c) coverage area (1) when >25Mbps service is needed.

3 New building areas

- Deploy FTTH from the beginning, with VoIP as first line (conditioned by regulation approval).

0 Non priority areas

- With this strategy, in some areas fibre will not be deployed. Wireless access could be an option.



Sizes of areas are illustrative

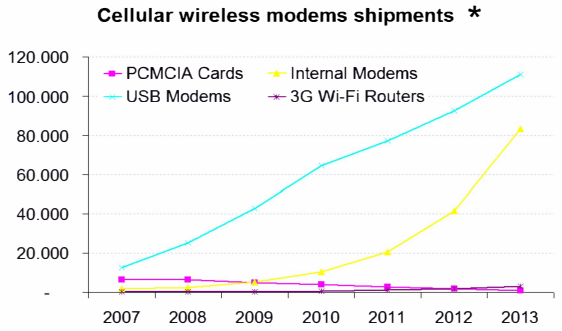
We are perceiving an explosion of mobile data traffic, caused by a cumulate of conditions

Radio Access Technology Evolution

- 2G and 2,5G networks do not allow broadband wireless access due to low datarates 3G UMTS was conceived for enhanced datarates (up to 384 kbit/s peak) but with a low throughput
- UMTS evolution towards **HSDPA** (mainly SW evolution) allows for higher datarates (up to 7.2 Mbit/s peak).
- Mobile only players with **excess of capacity** (UMTS networks are empty) are already making aggressive offers

Handset Evolution

- Higher number of available connectivity terminals (**dongles, PCMCIA, integrated**) with reduction on cost
- Disposal of new handset concepts like **IPhone** or Mobile Internet Device (MID)
- Laptops are becoming one of the main devices for broadband. As BB consumption is shifting from desktop to laptops mobile BB become more attractive to customers



Services Evolution

- **Pure connectivity** (for PC) is becoming the main mobile data service
- There are new type of uses more adapted to mobile use like community services where mobile allows an ubiquitous connection with the community
- Video component is taking more part of mobile services.

Tariffs evolution

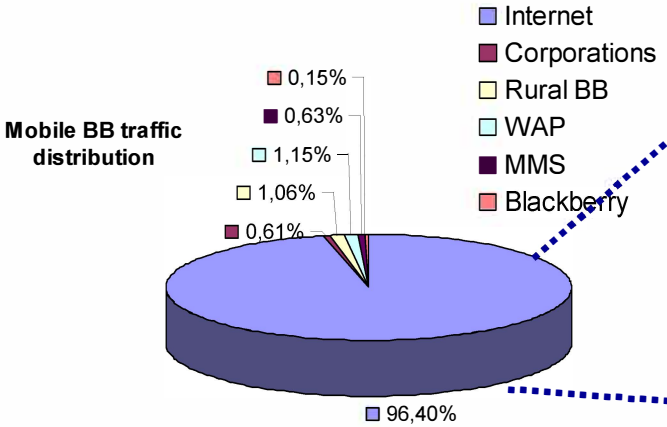
- The launching of **flat rates** for mobile data traffic has triggered the increase of data traffic on mobile networks. In Spain after flat rate the mobile data traffic growth rhythm changed from 10% - 15% monthly to more than 50% monthly

* Source:ABI Research May 2008

Until now the use that our customers do of these mobile traffic measured in the network is surprising: it is similar to fixed use

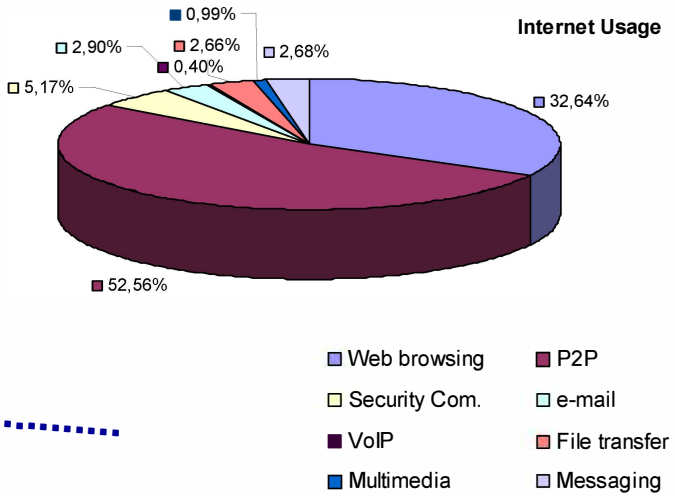
Usage of mobile data traffic

- Currently 97% of mobile broadband traffic originated in PCs. This causes that more than 96% of traffic goes to internet.



Internet Usage

- 53% of mobile data traffic is P2P
- 33% navigation
- 3% email
- 3% VoIP



- This traffic is caused mainly by 3 traffic profiles:
  - Pure mobile traffic (handsets originated) that is less than 3% of total traffic
  - DSL like traffic that represents 84% of traffic (5% of customers)
  - DSL light traffic (navigation and email mainly) that represents 13% of mobile data traffic

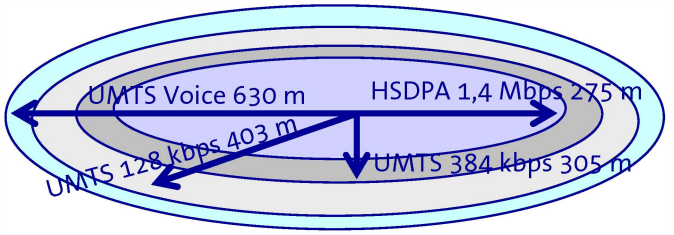
Source: Spanish network management report December 2007

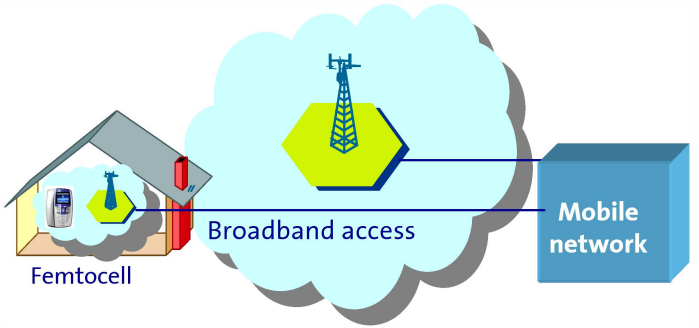
Mobile data explosion and the needs of ubiquity for data push for coupling fixed and mobile access

Femtocells

- The increase in traffic and bandwidth will reduce the cell coverage: significant number of additional base stations will be needed. Technology evolution (because of higher frequencies used) will mean as well an increase in the site number.
- Traditional deployments present increasing limitations and difficulties.
- More than 60% of the mobile traffic (currently mainly voice) is generated from indoor environment (home & office)
- A new concept appears: the femtocells deployment implies that the Base Station is moved into the customer's home, connected to a broadband access.
- A part of the traditional deployment could be progressively complemented by Domestic Nodes

Cell Radius depends on the bandwidth used by the customer





Mobile data explosion and the needs of ubiquity for data push for coupling fixed and mobile access

Wireless extension of fixed coverage

	Maximum Throughput (technological limit)	Average Throughput (reasonable offer)	Available services	Comments on feasibility
ADSL	20 Mbps down 1 Mbps up	10 Mbps down 512Kbps up	HSI IPTV (with SD)	
VDSL	100 Mbps down 100 Mbps up	25 Mbps down 25 Mbps up	HSI IPTV (with HD)	Limited loop length for 25 Mbps (600m)
FTTH	2,4 Gbps down 1,2 Gbps up	50 Mbps down 50 Mbps up	HSI IPTV /Broadcast TV, with HD	Less Opex than the other solutions
Cable (with docsis3)	140 Mbps down 40 Mbps up	20 Mbps down 5 Mbps up	HSI IPTV/ Broadcast TV, with HD	Higher Opex and less quality than FTTH
WiMAXe 3,5 GHz	34 Mbps (shared up&down)	1 Mbps (shared up&down)	Voice, mobile TV HSI	Capacity limited Available Q42008
HSPA 2,1 GHz/ LTE 2,6 GHz	14 Mbps down 5,6 Mbps up / 170 Mbps down 50 Mbps up	1 Mbps down 0,5 Mbps up/ 5 Mbps down 2,5 Mbps up	Voice, mobile TV HSI	Capacity limited LTE available in 2011

Wireless technologies can provide competitive cost for specific broadband services (1 Mbps) but no massive IPTV service. HSPA can be used already for these uses, however LTE will be slightly more efficient. Cost of wireless options can be decreased with lower frequencies (850, 900 MHz)

Transport

A common fixed-mobile transport for all services and segments is a key element of the evolved network

This layer supports all our businesses (wireline and mobile), for all the segments (residential, business) and all the services

Services

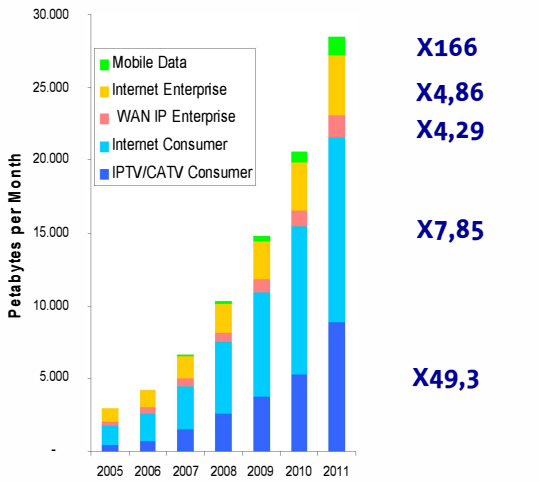
- The access evolution, the coverage targets and future applications condition the transport project in terms of capacity
- The evolution of the traditional services to the new networks and the new services (for instance video) condition as well the level of security (availability).

New requirements

- Absorption of traffic growth derived from aggressive commercial offers and policies
- Higher availability and resilience for critical traffics (signalling, VoIP, network managements) and against multiple points of failure (five nines availability)
- QoS differentiated per service and user
- Flexible and quick demand provisioning end to end with efficient offer capability

Efficiency Requirement

Worldwide IP traffic forecast



Transport investment for increasing bandwidth

Bandwidth Per customer	Cumulative Capex per customer
10 Mbps	X 1
25 Mbps	X 2
100 Mbs	X 3.5

These requirements force the evolution of the transport layer

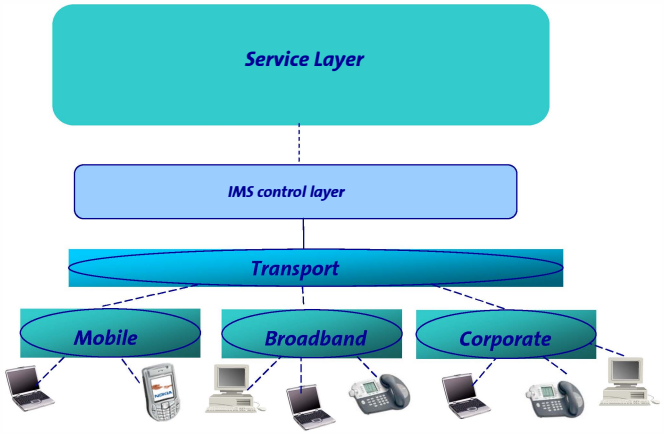
- IP backbone must be common for fixed and mobile operations.
- Operators (even non incumbent) force to build their own transport media for backbone (dark fiber, own fiber, ...)
- For transmission, photonic restoration (photonic mesh) is the technology to be deployed.
- High capacity transmission technology (40 G, 100 G) will be used and preferable with Ethernet interfaces.
- Transport architecture
  - Fixed-mobile (BRAS – GGSN) aggregation consolidation
  - Distributed fixed aggregation functions (BRAS)
  - Consolidation of aggregation and IP layers
  - Use of transmission equipment in the IP routers (GMPLS)
- Security criteria for transport network (redundancy) and its balance with efficiency requirements to be set up
- Prioritization of traffic when transport or access (specially mobile access) resources are limited.
- New routing and topology for specific traffic types (specially P2P like P4P) should be studied

Control

IMS will be the convergent control of Telefónica Networks

Why IMS should be implemented?

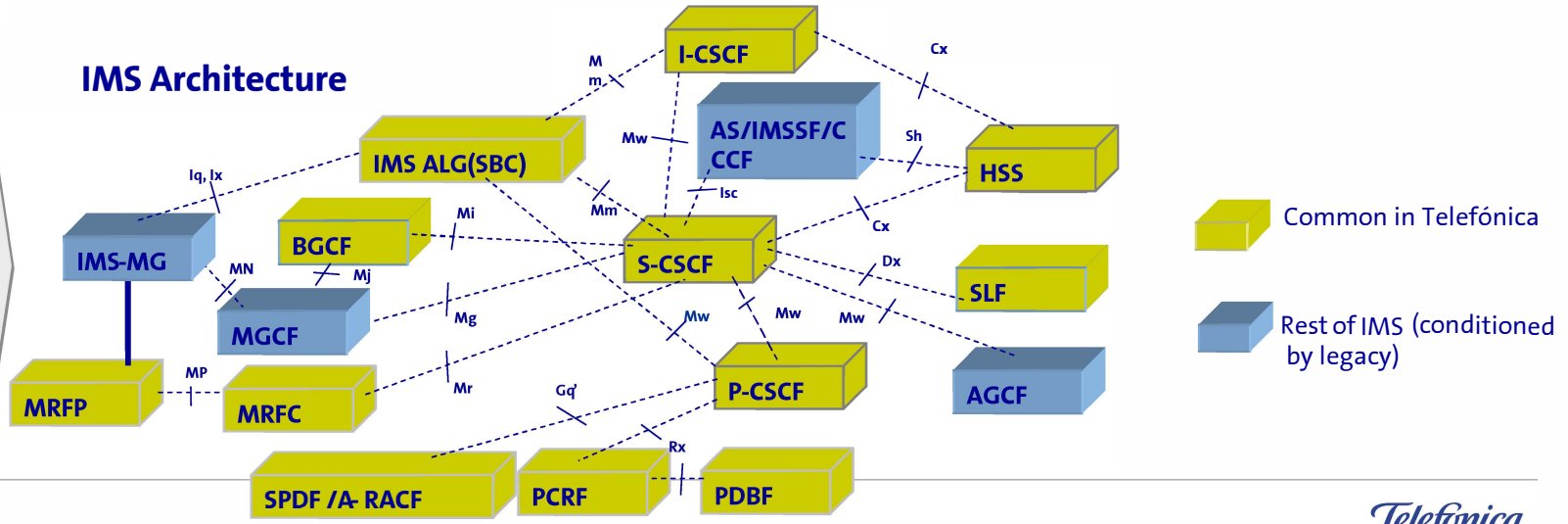
- IMS offers a common converged standard control layer for fixed and mobile accesses, being a key component to achieve a horizontal architecture and reduce TTM for new applications
- IMS will guarantee IP interoperability between operators to ensure large communities for person to person IP-based communication services



IMS Services

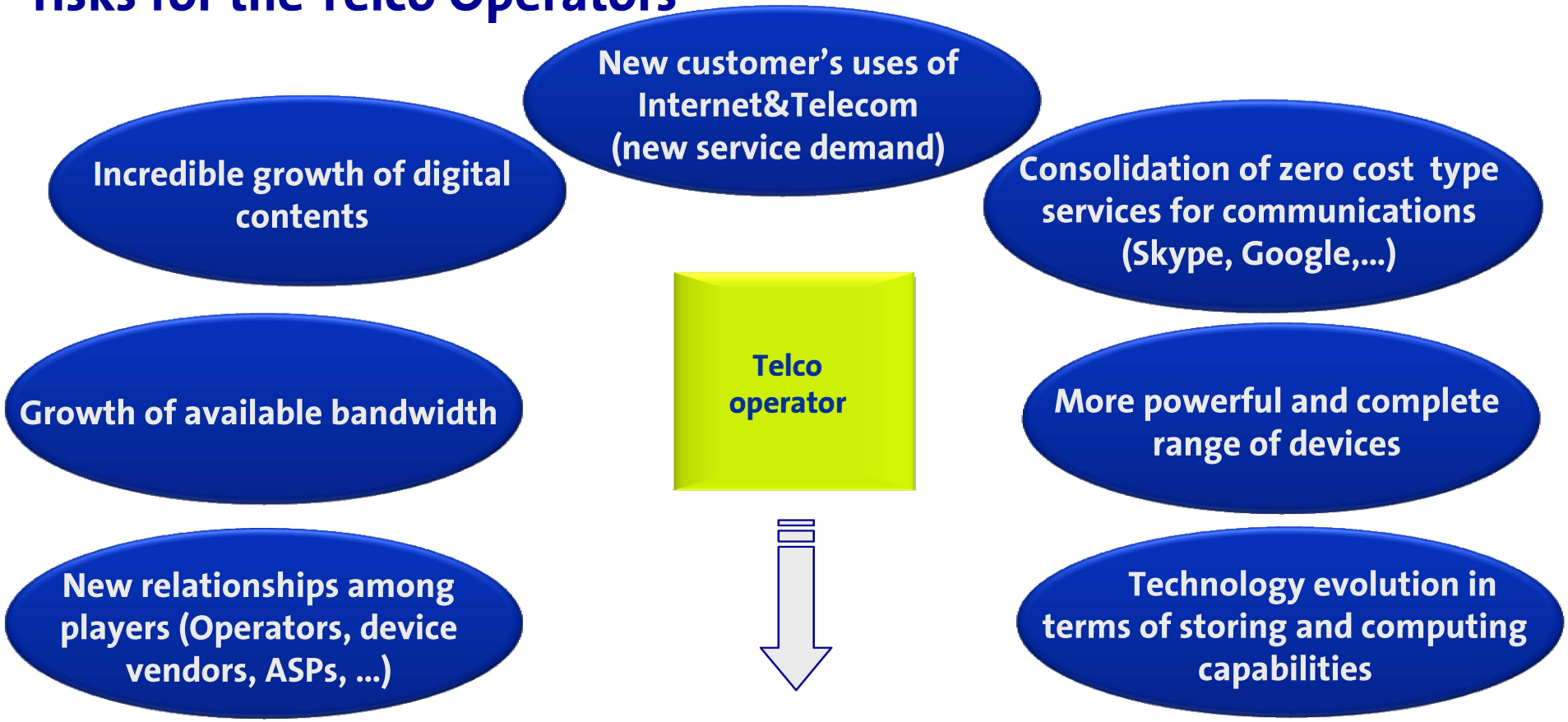
- Telefónica is providing services based on IMS:
  - We started with corporate fixed services (IP Centrex, VoIP).
  - We added convergent corporate services (corporate IP)
  - We are now delivering mobile residential services
- Although main driver for IMS is not savings, IMS brings CAPEX&OPEX savings when the number of IP services grows (>3)

Common Telefónica specifications



Service Layer

Technological environment is bringing both opportunities and risks for the Telco Operators

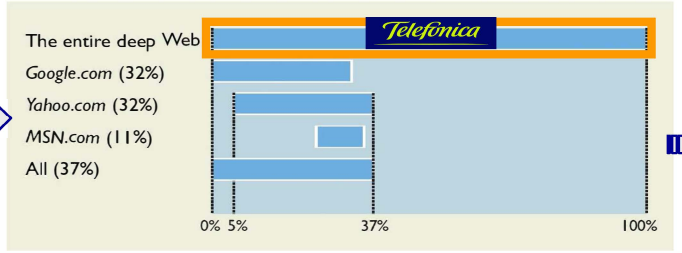


One of the key assets of operators for playing in this new battleground is Network. Adding intelligence to the networks will open new opportunities for revenues (new services, new business models) and efficiency.

Examples of what can be done adding intelligence to the network

To know the use of the IP Traffic carried by Operators

- Compared with internet players, Telefónica's knowledge of IP traffic is much more complete



- New opportunities for advertising, charging depending on the content, piracy control, parental control, ...

To locate our customers both in a massive way or individually

- Some operations already locate the customer (cell location, cell+distance to the site)
- New possibilities arise: A-GPS (high definition at higher cost), massive location

- Location makes a lot of services possible. Some of them could be:
  - Instant Advertising (to send an ad to the spectators in a football match)
  - Historical location: to recommend a trip to a user that travels every weekend
  - Massive location: to know vehicles' speed by the speed of Telefónica devices

Network Centric services

- Evolution on processing and storing capacity will allow to move some functionalities to the network side

- Manage the communications from the network (IP Centrex).
- Store in the network the user contents (multimedia, documents, directory, ..).
- Use software remotely (typical example of Google docs vs MS Word)

Adding intelligence to the network to be analysed as a possible source of new revenues

To be ready for taking advantage of these opportunities Operators should have a horizontal service architecture

Common service architecture

- Adoption of a common target service architecture in Telefónica will result in:
  - Ability to offer same products across Telefónica footprint
  - Faster deployment of products developed in one OB into other OBs
  - Lower cost of deployment through the use of common vendors and less local development
- New architecture will be a Standardised Horizontal service structure (enablers&applications) and will allow to develop services in a more efficient way
- There is an opportunity to share SOA architecture being implemented in BSS/OSS layer in the 'Telco' service architecture layer
  - Simplify new service integration into service architecture
  - Simplify integration with BSS/OSS layer

SDP

- Key drivers for common definition of SDP :
  - Shorten time to market for new service development
  - Increased importance of exposing network capabilities to large number of third party applications. Make Telefonica attractive partner to third parties
  - Easier interaction/integration with BSS and OSS
  - Builds 'smart pipe' capability

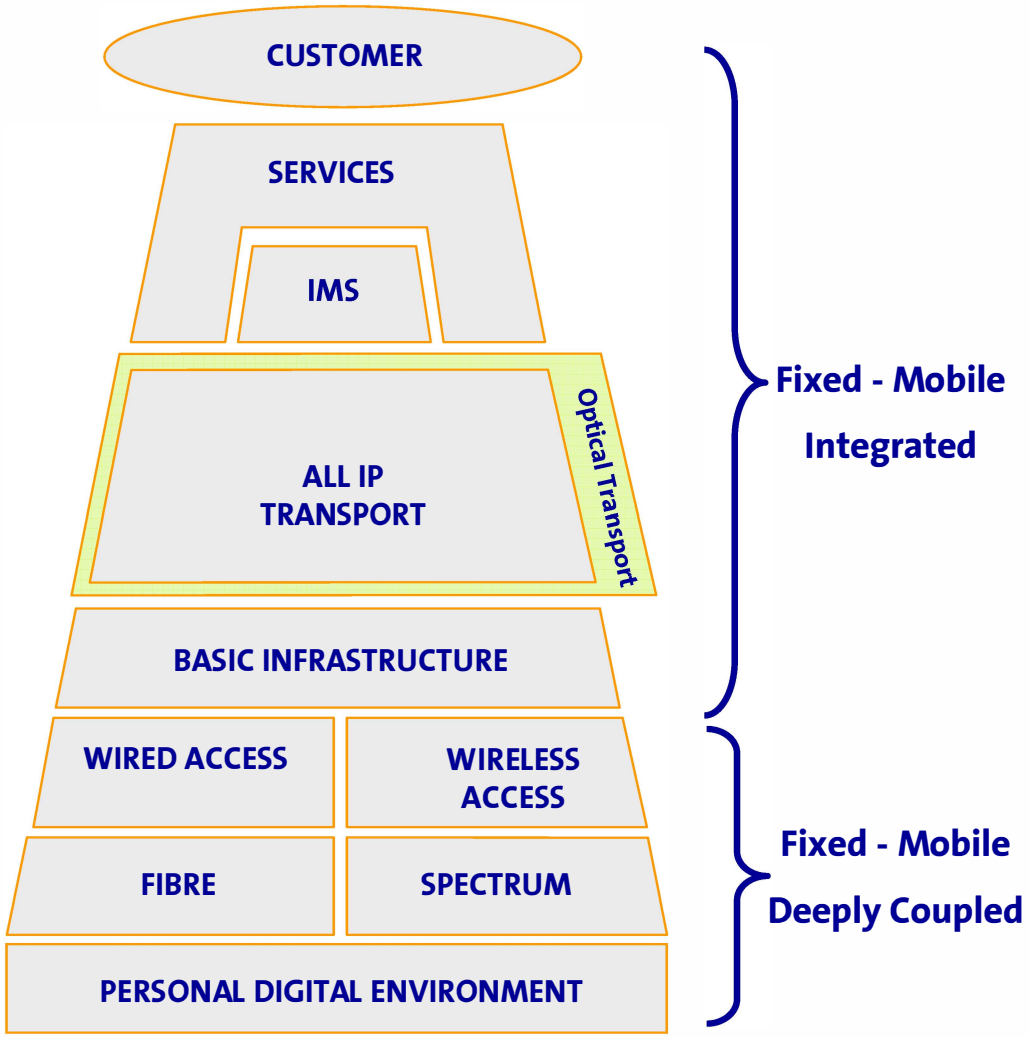
Conclusion

Conclusion

- Networks should be designed to follow the **broadband speed race** increasing bandwidth year over year . Fixed broadband speed should be considerable higher (e.g. x10?) than mobile one
- The **collaboration between fixed and mobile** accesses should be increased
  - Mobile access can provide broadband fixed service for certain uses and environments
  - Femtocells will increase speed & coverage of mobile networks. They may reduce costs by offloading traffic in the home. With femtocells the reference speed of mobile can tend to the fixed one.
- **The transport and the distribution of contents**, specially video, is more and more important. The transport architecture should be reviewed in order to fulfil the challenges the networks are facing
- Network infrastructure must be **convergent**. Those operators with fixed and mobile operations must maximize the reuse of assets between fixed and mobile
- The infrastructure must be ready for the integration of more **intelligence and openness in the network** to put in value the networks providing more services to the end users. Different levers will be included (customers profiling, storage, IP traffic knowledge, location, presence, ...).
- Convergence should be pursued not only as fixed and mobile but also network and IT. In order to improve **time to market** for new services, network and IT must be much more coupled and a multiservice solution (SDP/IMS) implemented in advance.
- The home is the place where majority of Telecom services are used so the role of Telefónica in the **digital home** is very important. Infrastructure must allow Telefónica to play a key role at home.

Conclusion

Towards more intelligent and efficient networks



- **Efficient**
  - Evolving/switching off obsolete networks
  - Scalable to fulfill traffic requirements
  - Providing coverage in a profitable way
- **Relation with 3rd parties**
  - Allowing new relationships model with other agents like **ASPs** (Google, Yahoo,…) and other **operators**
- **Powerful.**
  - Supporting new range of services and business models making Telefónica more **competitive**.
- **Flexible** and less complex
  - Capacity for adapting to new requirements and shorter TTM
- **Intelligence**
  - Intelligence has to be added to the network to increase network value
- **Open**
  - Networks will be open to external innovation to provide a broader range of services
- **Reliable and Secure** to manage all the services


Telefonica