Session 3

Regional Seminar on Costs and Tariffs for Member Countries of the Regional Group for Africa (SG3RG-AFR)

Development of broadband in Africa

A presentation by David Bernal

May 17th-18th, 2011

Gaborone, Botswana

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What is Broadband?

As it is described in the American Broadband Plan by FCC, Broadband is the **great infrastructure challenge** of the early 21st century. Its is difficult to **separate broadband services from next generation networks (NGN). According to the FCC:**

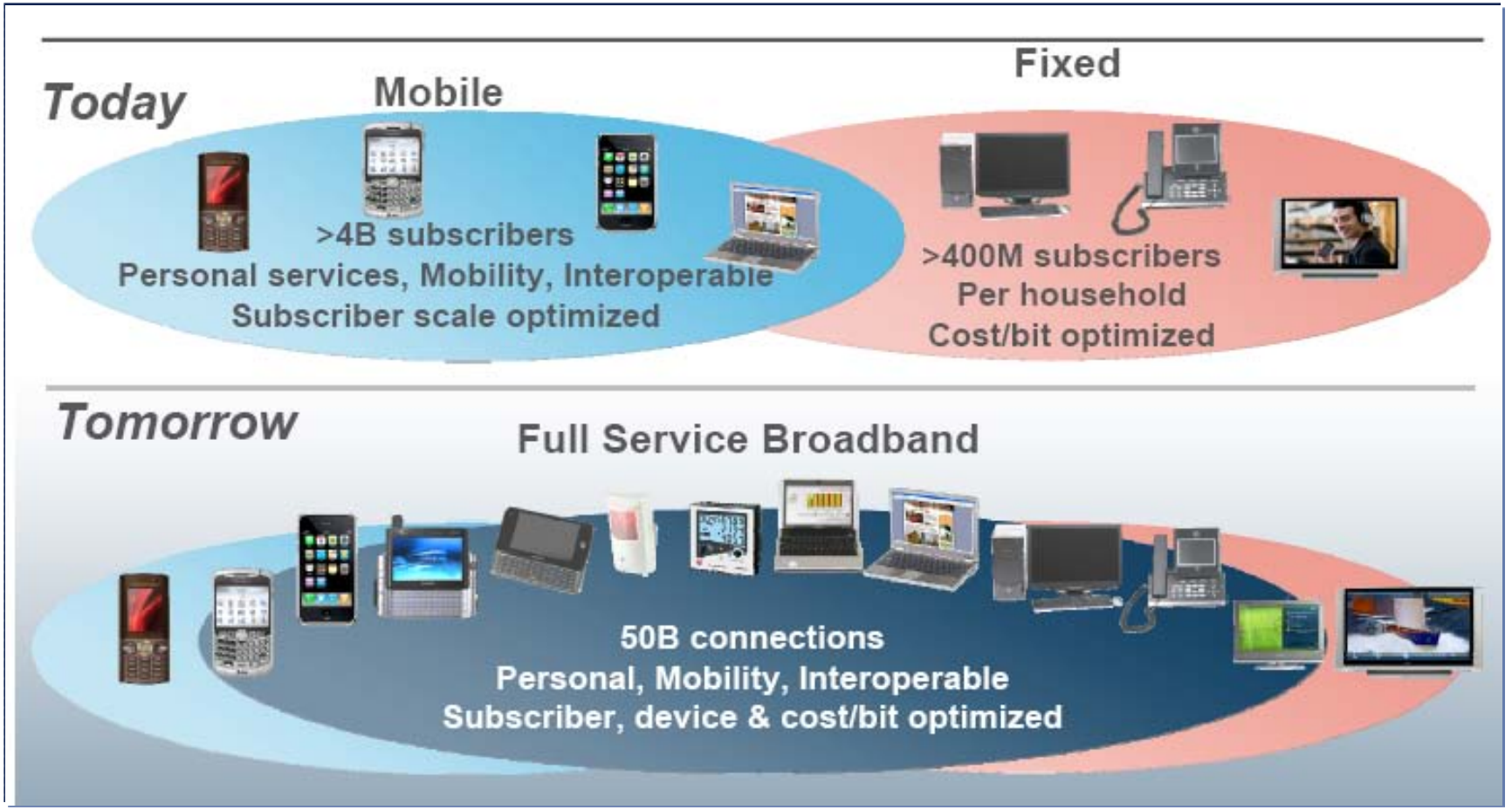
"broadband" refers to advanced communications systems capable of providing high speed transmission of services such as data, voice, and video over the Internet and other networks. Transmission is provided by a wide range of technologies, including digital subscriber line and fiber optic cable, coaxial cable, wireless technology, and satellite. Broadband platforms make possible the convergence of voice, video, and data services onto a single network.

and according to the ***Recommendation I.113 of the ITU Standardization Sector*:**

Transmission capacity that is faster than primary rate Integrated Services Digital Network (ISDN) at 1.5 or 2.0 Megabits per second (Mbits)

So, it is possible to separate Broadband from NGN ?

Evolving to full services broadband



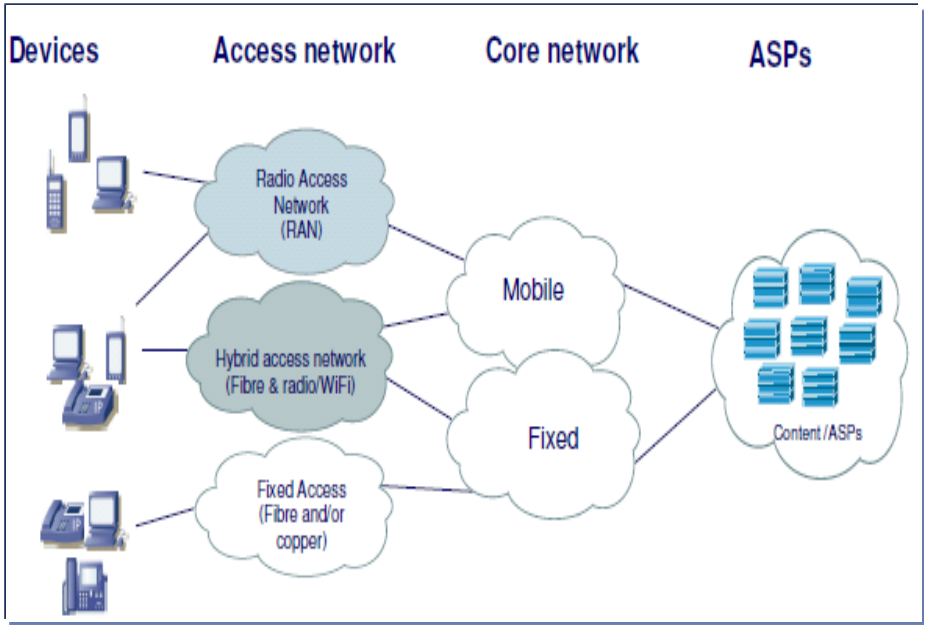
Source: Ericsson

What is NGN?

The NGN architecture **as defined by the ITU and ETSI borrows heavily from the work done by 3GPP**. According to Y.2012, the NGN architecture supports the delivery of multimedia services and content delivery services, including video streaming and broadcasting. An aim of the NGN is to serve as an PSTN and ISDN replacement.

Next Generation Networks (NGN) can be developed **using a number of technologies, including fiber, cable, fixed, mobile wireless**, or further technology **upgrades to the existing copper based networks.**

- From traditional "one network-one service" approach to a "one network-many services".
- Services and content maybe **delivered over a variety of devices**
- Provide **higher speed using different technologies**



Towards the convergence of networks, services and devices:

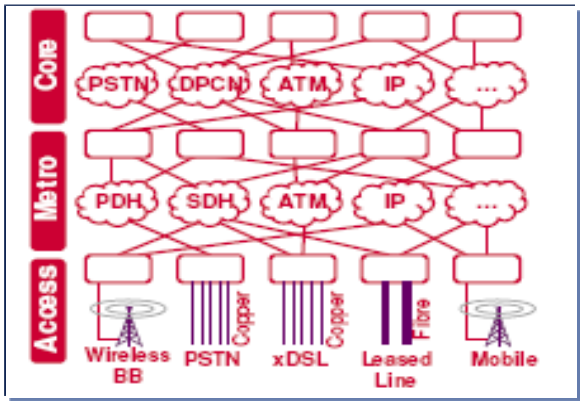
One of the most fundamental aspects that characterize **NGN is the convergence mobile/fixed networks.**

The term "**convergence"** is being used to refer to offer **voice, data, video, and other increasingly intermingled multimedia services** seamlessly over single or multiple infrastructures and platforms.

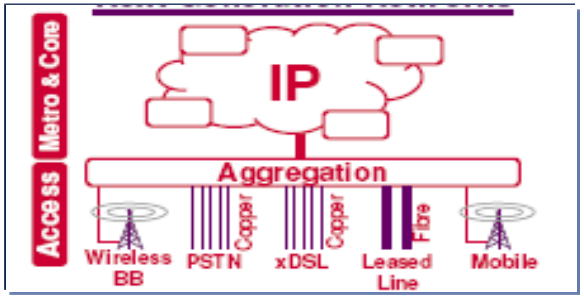
Converging NGNs, and the overall global NGN, are being driven by **digitization, packetization, high-speed transfer,** and **Internet Protocol (IP).**

From traditional networks to NGN

TRADITIONAL NETWORKS



NEXT GENERATION NETWORKS



Source: OFCOM,

NGN's are distinguished **from traditional circuit switched networks in that all information is transmitted via packets**, which are then labeled according to their type (data, voice, etc) and handled differently by traffic management equipment.

So,

- NGNs will allow carriers' networks **to cost effectively support a new suite of sophisticated services** by building on core competencies related to traditional transport services
- **It will help reduce costs by eliminating the inefficiencies** of current service-specific, proprietary, and non-reusable solutions
- NGN approaches will **reduce the time to market and life-cycle costs** of offering new services.
- It will enable carriers **to deploy advanced services,** allowing them to remain competitive as well as expand their capabilities to enter new markets

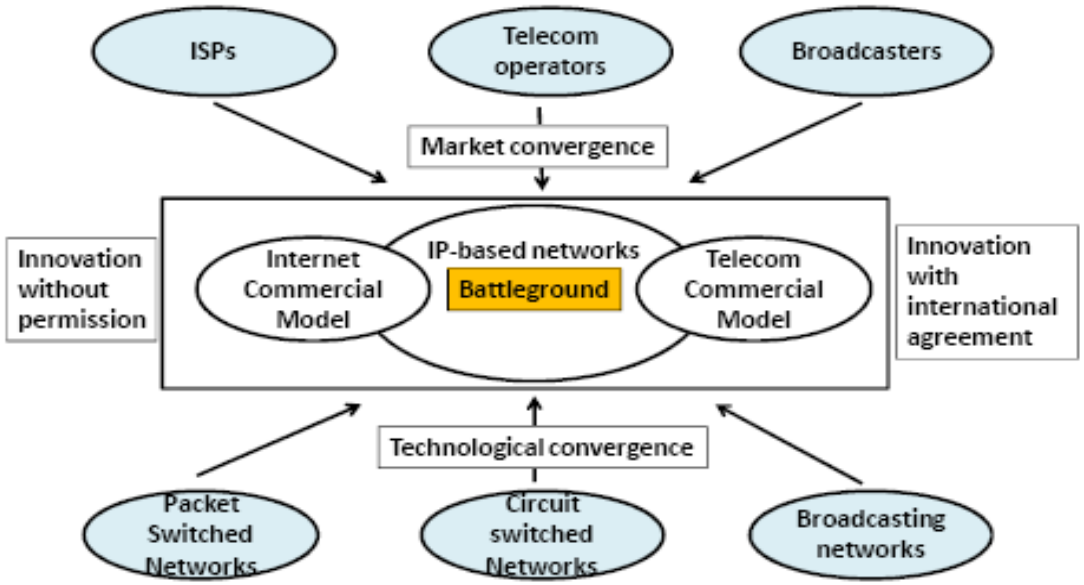
Main architectural changes to be made:

- In core network, **migration of voice from a circuit-switched architecture to packets**
- In the wired access network, new mechanism **to process voice and data (xDSL).**
- In the cable access network, **upgrade of DOCSIS (towards DOCSIS 3.0) -> FTTH**

Introduction.

Towards the convergence model

Figure 2. The convergence model



Source: J. Horrocks, "NGN and Convergence Models, Myths, and Muddle"

- **Demand is increasing very quickly** in most Member States – and it has produced an increase of required capacity and an upgraded network.

- **Rankings of broadband penetration** among Member States are very volatile, suggesting major disparities according to market conditions;

- **Price per unit of bandwidth is falling** very quickly, largely because an active competition based on infrastructure in some areas.

- **Operators offer a range of services**, presumably in the hope of encouraging upgrading;

Introduction.

A new market structure implies innovative regulatory measures

DEMAND

- **High growth** not only of **fixed but also mobile services**…..
- **Packet services**
- **Customer segmentation** (heavy internet users vs soft internet users) and fixed-mobile substitution effect.

OFFER

- **Alternative technologies** like cable, fiber , ULL or mobile that are focused on most highly populated areas and better economic conditions
- Geographical regions characterized by **infrastructure competence** has more price competition
- Governments in Europe are convinced to **extend broadband services to urban and rural areas** –> Complementation by private initiatives
- **Network neutrality could change some business models** (service providers, content providers, network operators, end users)

Geographical difference becomes a key issue to be analyzed.

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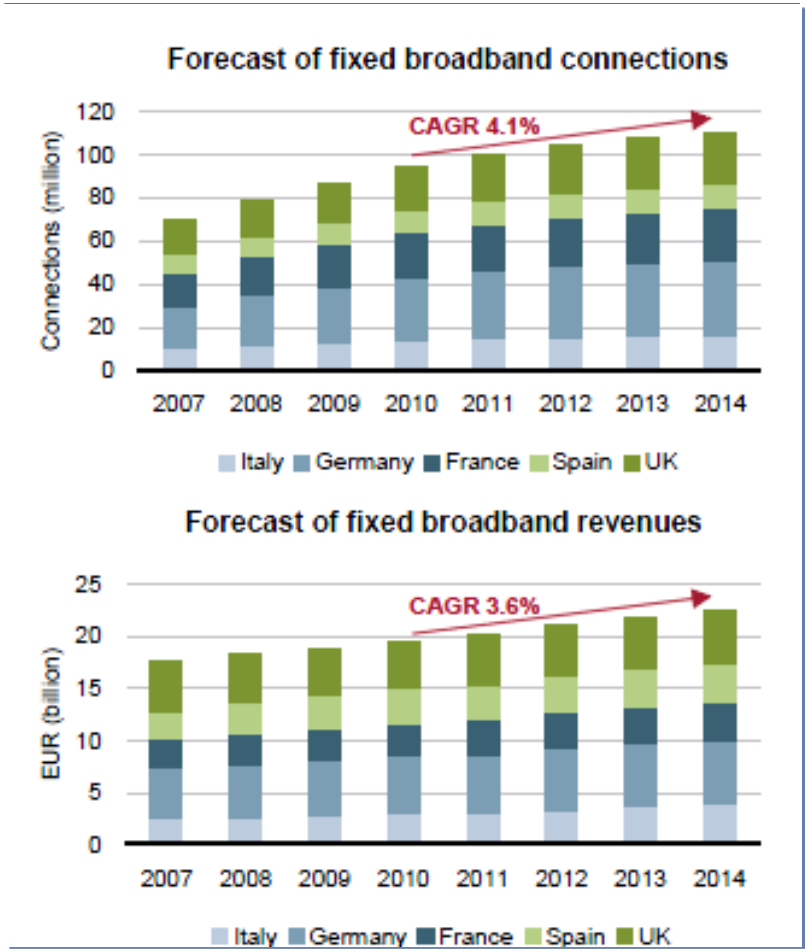
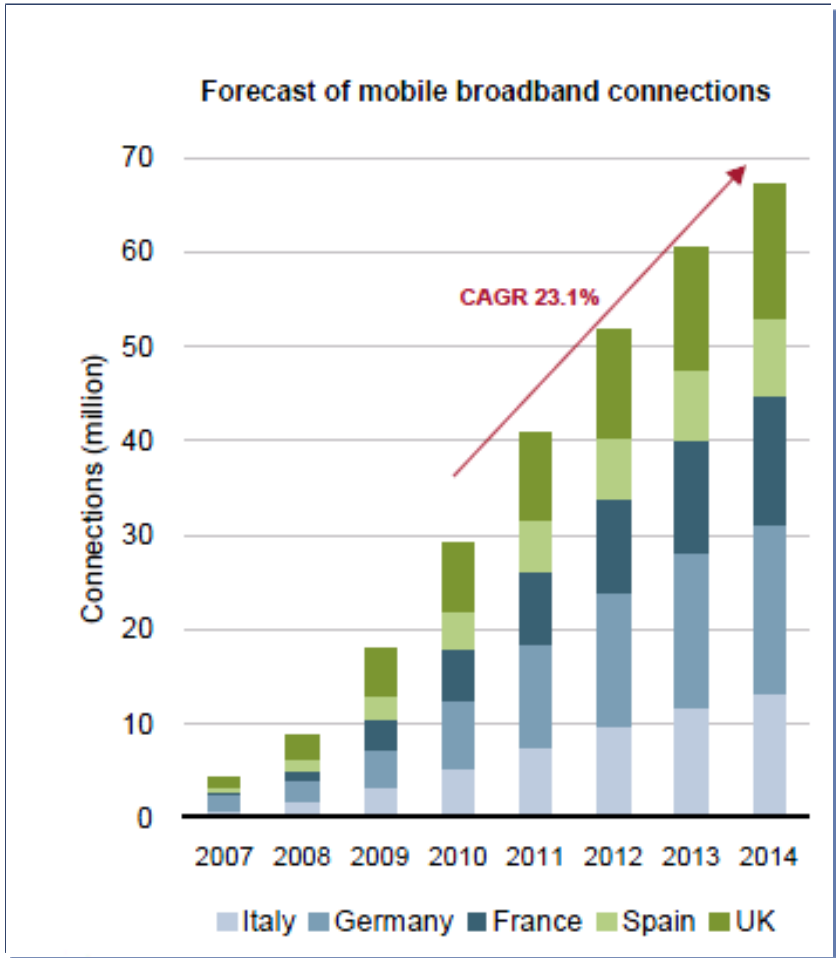
2. Main trends and challenges

Europe: Strong uptake of mobile broadband services



Source: Analysis Mason

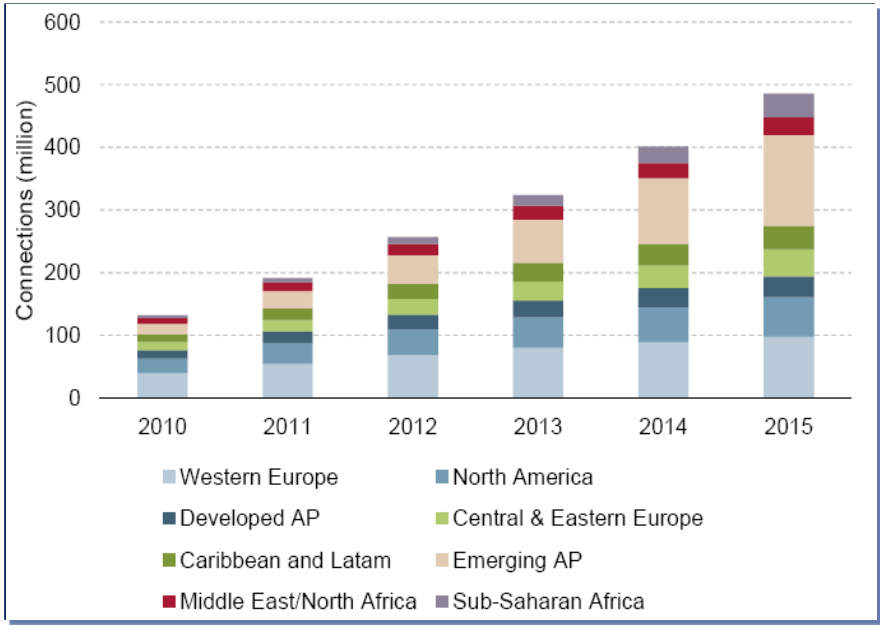


Source: Analysis Mason

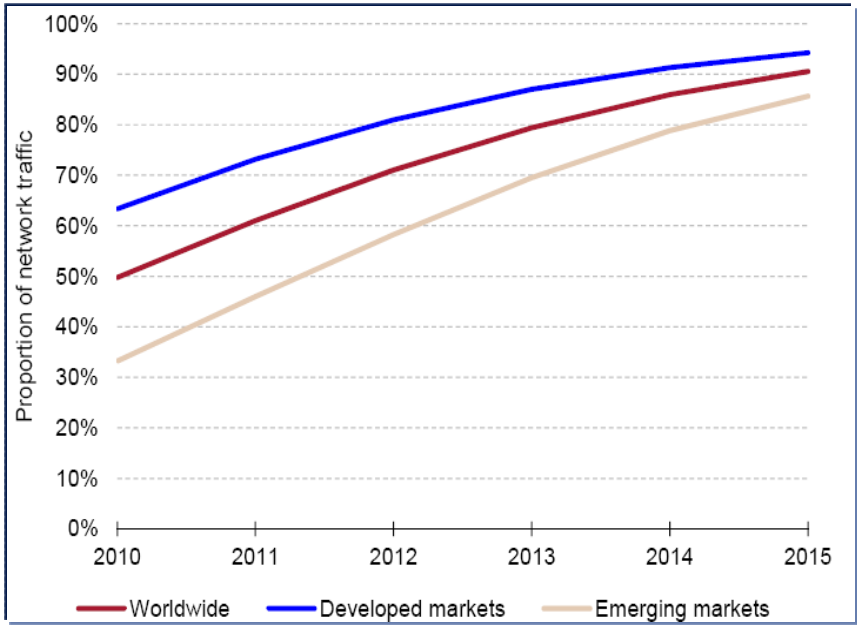
2. Main trends and challenges

Africa shows a future increase in mobile broadband connections

Mobile broadband connections by regions



Data services as a proportion of wireless network traffic, worldwide



With the prevalence of smartphones forecast to spread globally and the **consequent increase in the number of MBB data connections** (referring to all connections using 3G, HSPA, LTE or similar to connect a PC)

Voice traffic will increase between 2010 and 2015, but **data traffic is expected to increase much faster and will dominate the service mix** in developed and emerging markets by 2015.

Source: Analysis Mason

2. Main trends and challenges

Main trends

- Growing **popularity of smartphones** with a **significant impact on the traffic**
- **Mobile broadband substitution** for several clients and geographical areas.
- **Economical crisis impacts on demand evolution** and decision taken about network rollout or sharing networks
- **Impact of network neutrality** on strategy of different operators (value chain)
- **Price strategy must be changed**
- **Spectrum regulation**
- **Promoting broadband in rural areas**

Challenges

- **Definition of spectrum policy** implying more efficient spectrum use as well as a higher telecom services penetration. (refarming, digital dividend,…)
- **Definition of regulatory policy** that incentive investments and shareholders return (risk remuneration depending on the risk assumed)
- **Access network transformation** substituting traditional networks for broadband networks.
- **Geographical segmentation consideration** in the market analysis, network deployment and SMP operators.
- New **commercial and pricing policies,** based on capacity and different kinds of user devices

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3. Broadband Plans: USA

In early 2009, Congress directed the Federal Communications Commission (FCC) to develop **a National Broadband Plan to ensure every American has "access to broadband capability."**

Long Term Goals

Goal No. 1: At least 100 million U.S. homes should have affordable access to actual download speeds of at least 100 megabits per second and actual upload speeds of at least 50 megabits per second.

Goal No. 2: The United States should lead the world in mobile innovation, with the fastest and most extensive wireless networks of any nation.

Goal No. 3: Every American should have affordable access to robust broadband service, and the means and skills to subscribe if they so choose.

Goal No. 4: Every American community should have affordable access to at least 1 gigabit per second broadband service to anchor institutions such as schools, hospitals and government buildings.

Goal No. 5: To ensure the safety of the American people, every first responder should have access to a nationwide, wireless, interoperable broadband public safety network.

Goal No. 6: To ensure that America leads in the clean energy economy, every American should be able to use broadband to track and manage their real-time energy consumption**.**

100Mb download in 2020

Mobile Broadband is a key item

To achieve 500Mhz for 4G providers from current 50Mhz

Each community having access to 1Gbps to connect schools,….

But is it the solution to real lack of competence?

Fundings

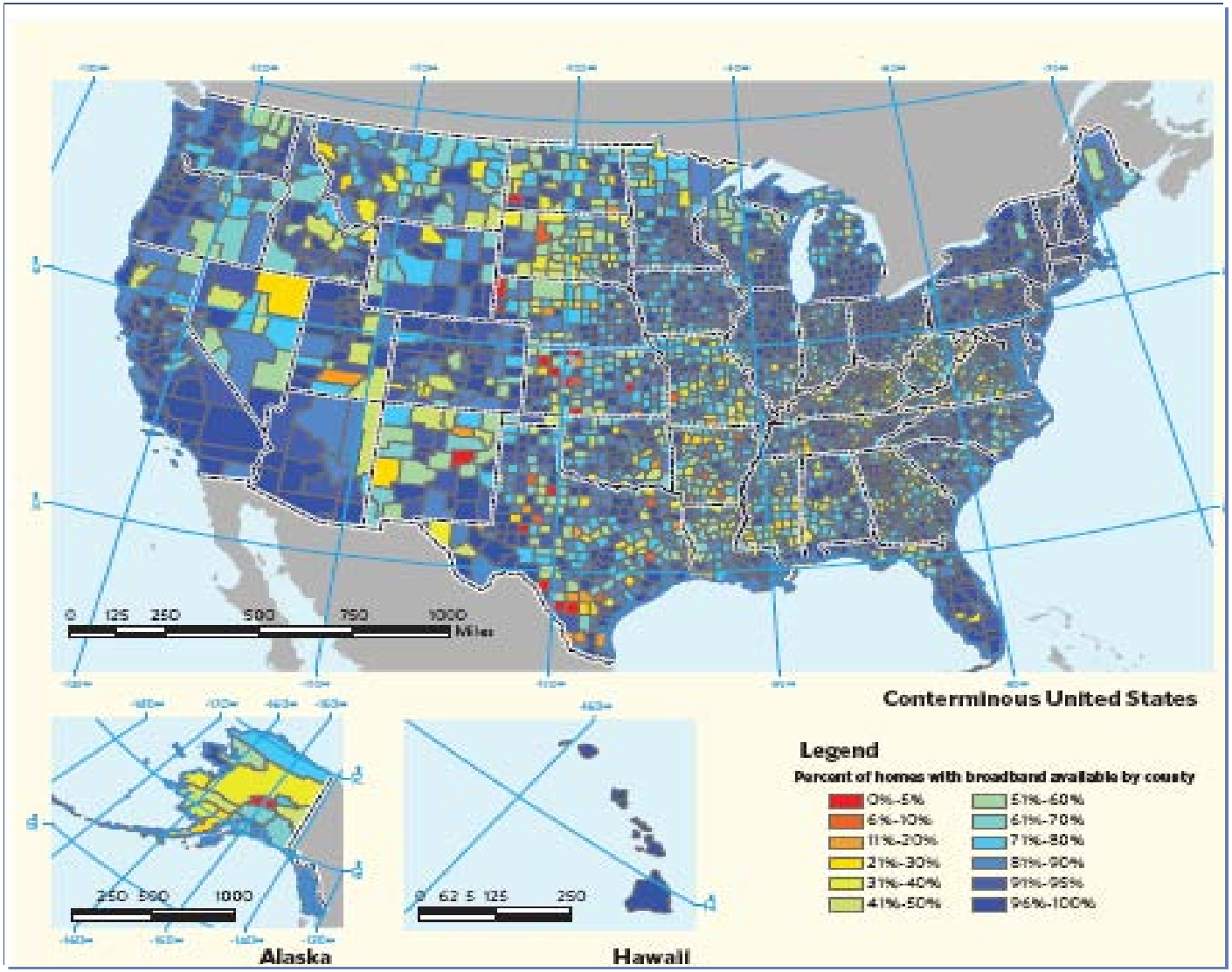
In 2010, the federal USF (Universal Service Fund) was projected to make **total outlays of $8.7 billion** through several programs

The High-Cost program, which subsidizes telecommunications services in areas where costs would otherwise be prohibitively high, will spend $4.6 billion. Additionally to USF**, FCC wants Government to approve US$9bn in 3 years to deploy broadband**

Total cost of the **Broadband Plan is estimated around €US$15bn-US$ 35bn**

3. Broadband Plans: USA

Availability of 4Mbps-Capable Broadband Networks in USA by country



3. Broadband Plans: Europe - Digital Agenda

Key Performance Targets from the Benchmarking framework 2011-2015 endorsed by the EU Member States in November 2009.

Broadband targets

• **Basic broadband** for all by 2013: basic broadband coverage for 100% of EU citizens. (Baseline: Total DSL coverage (as % of the total EU population) was at 93% in December 2008.)

• **Fast broadband by 2020**: broadband coverage at 30 Mbps or more for 100% of EU citizens. (Baseline: 23% of broadband subscriptions were with at least 10 Mbps in January 2010.)

• **Ultra-fast broadband by 2020:** 50% of European households should have subscriptions above 100Mbps.

Digital single market

• **Promoting eCommerce**: 50% of the population should be buying online by 2015. (Baseline: In 2009, 37 % of the individuals aged 16-74 ordered goods or services for private use in the last 12 months.)

• **Cross-border eCommerce:** 20% of the population should buy cross border online by 2015. (Baseline: In 2009, 8 % of the individuals aged 16-74 ordered goods or services from sellers from other EU countries in the last 12 months.)

• **eCommerce for business:** 33% of SMEs should conduct online purchases/sales by 2015. (Baseline: During 2008, 24% and 12% of enterprises was, respectively, purchasing/selling electronically, for an amount equal to or greater than 1% of the turnover/total purchases.

• **Single market for telecoms services:** the difference between roaming and national tariffs should approach zero by 2015. (Baseline: In 2009, the roaming average price per minute was 0.38 cents (call made) and the average price per minute for all calls in the EU was 0.13 cents (roaming included).

3. Broadband Plans: Spain – Plan Avanza

The objective of "**Avanza Infraestructures“ (2008-2011) funding program** is to facilitate investments to extend telecommunication services" coverage to isolated and rural areas.

•The objective is to continue PEBA program successes by increasing broadband coverage in very small population centers and not only to improve bandwidth and network capacity provided by telecommunication operators at rural areas but also to improve the service quality.

Main goals of phase I. Projects intended to:

- **Develop access infrastructures** in order to satisfy the **demand for broadband connection from population in isolated and rural areas.**
- Develop rural backbone networks (**High-capacity rural networks)**
- **Test in rural areas those innovative broadband technologies** that are being spreaded in urban areas.
- **Develop public networks** so that citizens can access to Public Administration services.
- **Disseminate broadband advantages and opportunities** so that digital divide can be narrowed.

Action Plan

- **F1 action line projects:** 13 projects from 4 telcos are being developed in order to provide broadband access to 10.034 population centers. Both cabled and wireless broadband access technologies are being used: ADSL, 3G/HSDPA, WIMAX and Satellite. Envisaged investments amount to nearly 9 million € with a contribution by the Government of 2.1 million € non-recoverable subsidies and nearly 4.7 million € zero interest loans.

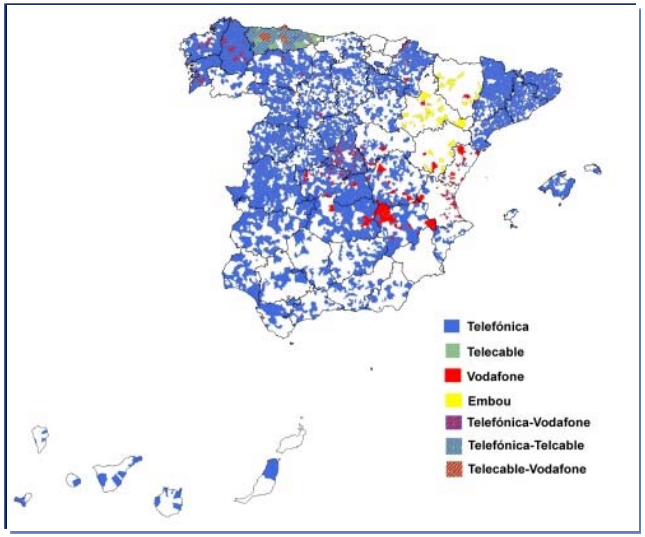
- **F2 action line projects:** 16 projects from 3 telcos are being developed in order to improve backbone networks of 721 town councils. Envisaged investments amount to nearly 46 million € with a contribution by the Government of 10.1 million € non-recoverable subsidies and nearly 21 million € zero interest loans.

- **F3 action line projects:** one pilot project is being developed within this action line by Innovamar tecnological foundation . The project objective is to develop ICTs at sea related industries in order to update the fishing sector.

- **F4 action line projects:** taken into account the importance of training and advertising in order to increase Internet usage rates and literacy at rural areas, this action line objective is to disseminate advantages of broadband and telecommunication advanced services as well as available opportunities by accessing to the information society.

3. Broadband Plans: Spain – Plan Avanza

Action F1



Comunidad Autónoma	Nº núcleos	Nº proyectos	Operadores beneficiarios
Andalucía	316	1	Telefónica
Aragón	87	2	Embou, Vodafone
Asturias	1549	3	Telefónica, Telecable, Vodafone
Baleares	83	1	Telefónica
Canarias	40	1	Telefónica
Cantabria	61	1	Telefónica
Castilla La Mancha	429	2	Telefónica, Vodafone
Castilla y León	1890	2	Telefónica, Vodafone
Cataluña	1989	1	Telefónica
Ceuta	3	1	Telefónica
Comunidad Valenciana	98	2	Telefónica, Vodafone
Extremadura	399	1	Telefónica
Galicia	1910	2	Telefónica, Vodafone
La Rioja	147	1	Telefónica
Madrid	427	2	Telefónica, Vodafone
Melilla	2	1	Telefónica
Murcia	2	1	Telefónica
Navarra	602	2	Telefónica, Vodafone
TOTAL	10034		

Action F2

Comunidad Autónoma	Nº municipios	Nº proyectos	Operadores beneficiarios
Andalucía	84	3	Red Banda Ancha de Andalucía, Nostracom, Telefónica
Aragón	123	1	Telefónica
Asturias	3	1	Telefónica
Canarias	3	1	Telefónica
Cantabria	8	1	Telefónica
Castilla La Mancha	44	1	Telefónica
Castilla y León	258	1	Telefónica
Cataluña	12	1	Telefónica
Comunidad Valenciana	6	1	Telefónica
Extremadura	34	1	Telefónica
Galicia	72	1	Telefónica
La Rioja	11	1	Telefónica
Madrid	2	1	Telefónica
Murcia	1	1	Telefónica
Navarra	47	1	Telefónica
País Vasco	13	1	Telefónica
TOTAL	721		

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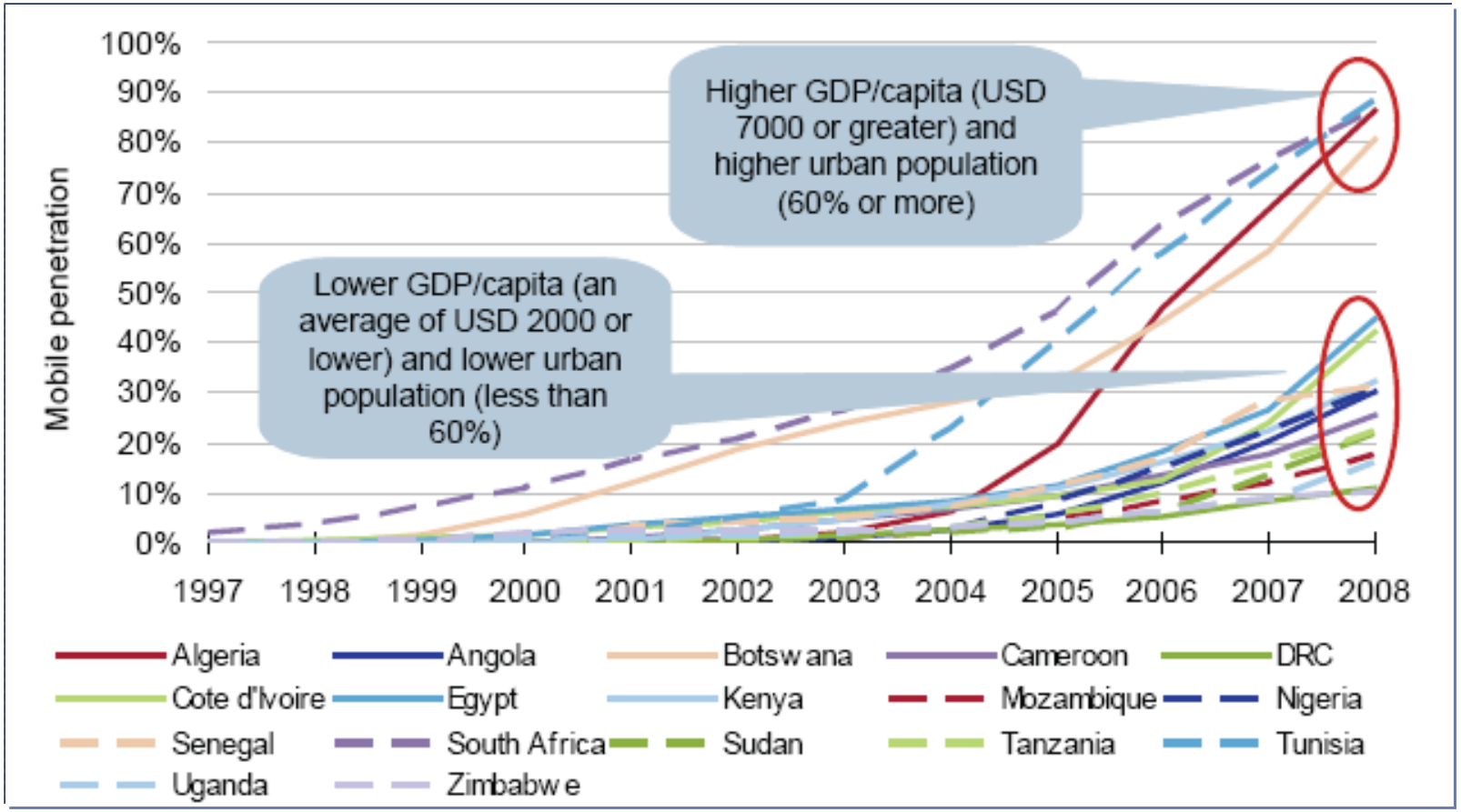
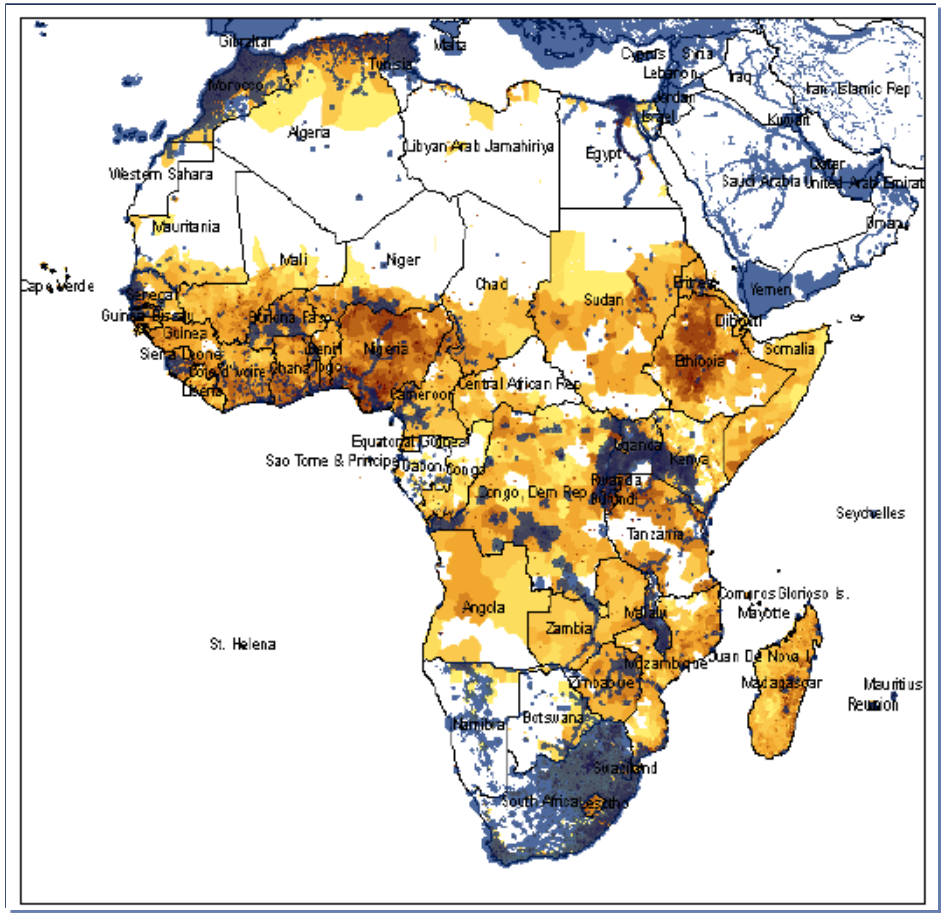
Correlation between broadband and GDP

- Positive correlation between the availability of telecom services in a country and its gross domestic product (GDP) or overall economic output.



Source: Analysis Mason

Coverage and penetration in mobile market



- Africa has **more than 900 million people living in 54 countries. It covers more than 20 percent of the total landmass on this planet** . Considering its huge size and population, opportunities to expand mobile service are just as enormous especially in remote African communities.

- Approximately **half of African countries face a great challenge to bring greater geographical and population coverage** to markets where penetration and affordability are low.

- These are generally **low income countries, mostly with large geographical areas or topographical barriers** and weak transportation and electricity supply infrastructures, which contribute to high operator costs.

- Amongst **the 43 African countries of a sample analyzed, 10 have achieved GSM coverage greater than 90% of population and a further 8 have coverage of 70%** or greater.

- All except one (Angola) of the **24 countries with less than 70% population coverage has per capita incomes less than US$ 1,000**

Source: GSMA

Coverage and penetration in mobile market

• **Although 80% of the future subscriber growth will come from developing markets**, primarily in Africa, Asia Pacific and Latam, **revenue growth will be more balanced** between developed and developing markets.

• **In developing countries mobile has eclipsed the fixed networks** and has become the means to bring communications services to everyone. Mobile has now emerged as the dominant and preferred route to Universal Access (UA) and Universal Service (US) .

• **Mobile operators have been able to meet demand for basic voice services in a much more rapid and flexible way than fixed line operators**, eliminating many of the barriers for people on low incomes to subscribe and use communication services.

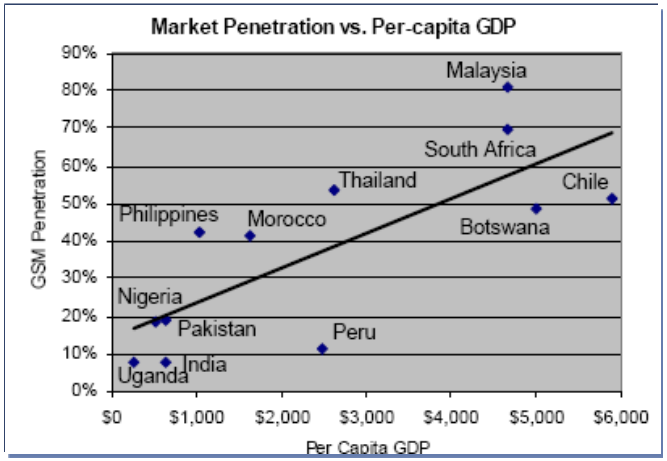
•**Marginal revenues in rural areas are lower than urban areas** and investments required to reach these rural areas are disproportionately high. **To serve rural areas, operators must pay increasing attention to the total cost of ownership (TCO) of their networks**, to minimize both capital and operating costs.

SUMMARY.

• ***Low ARPUs are not an insurmountable barrier for operators.*** Companies operating in a low ARPU environment can be profitable

• ***Competition between multiple operators results in more rapid growth.*** Almost all of the high achievement countries have three or more GSM operators.

• ***Competition between multiple operators results in more rapid growth*** Almost all of the high achievement countries have three or more GSM operators

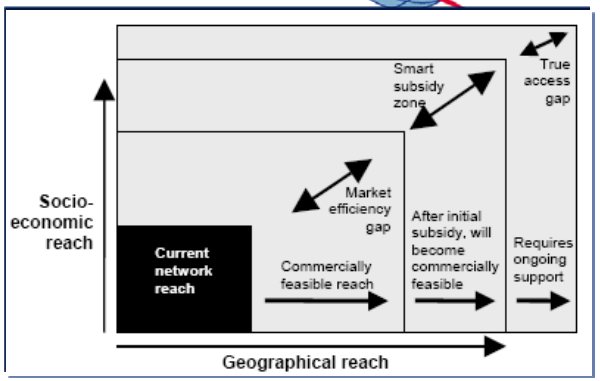


Source: GSMA

Mobile market in rural areas

- **Total marginal revenue can be improved through de**eper coverage, but **the cost of network expansion and operation in rural and low population density areas rises exponentially.**

- **Many rural areas combine low ARPU with higher costs due to high backhaul expenditures**



To maintain EBITDA levels with reduced ARPU**, operators have to focus on reduce their operation costs by several measures:**

Business management costs

- Marketing & sales
  - Branding
  - Advertising
  - Segmentation
  - Subscriber acquisition
- Subscriber management
  - Subscriber retention
  - Billing & charging
- General & administration
  - Corporate overhead & offices
- Interconnect/Roaming
  - Payment to other operators

Network costs

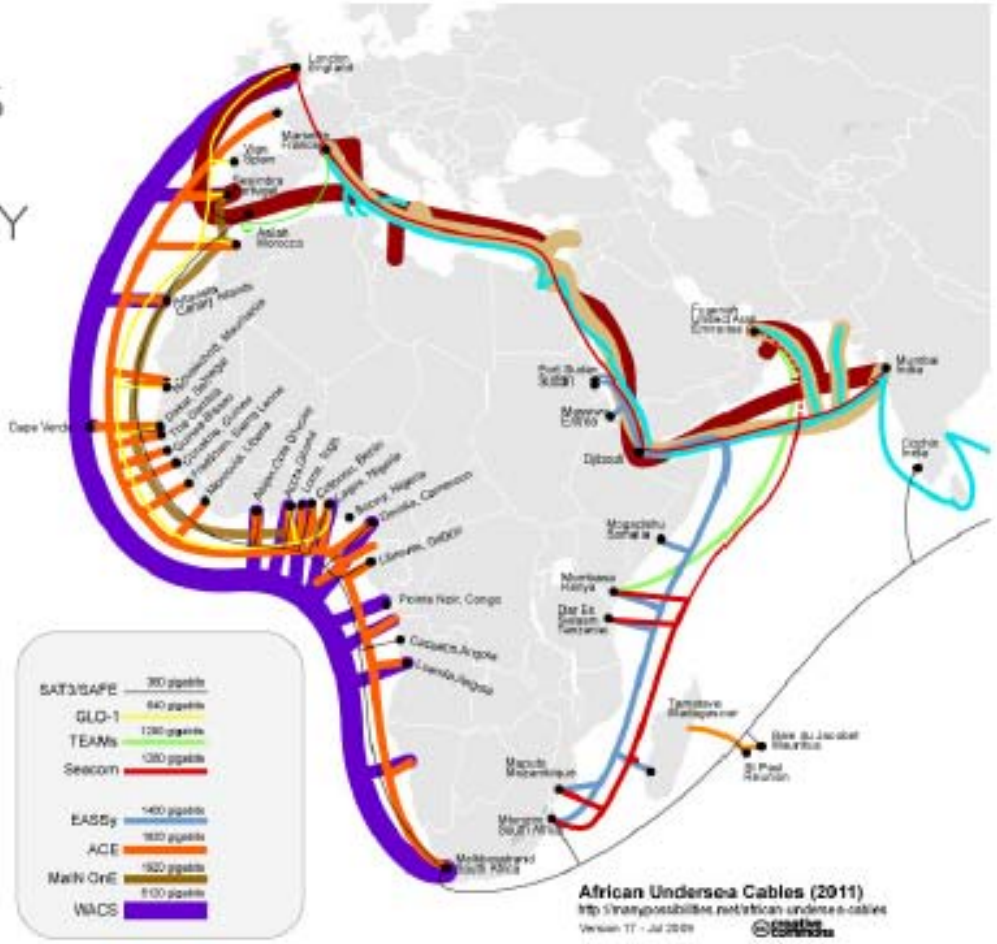
- Network operations
  - Operation & Maintenance
  - Spares
  - Power supply (incl. fuel)
  - Transmission backhaul Opex
  - Site rental
  - Support & training
  - Network performance efficiency technology (AMR, SAIC, etc.)
- Capex / Depreciation
  - base station Equipment
  - Transmission Equipment
  - Other site Equipment – Power Gen
  - Civil Works – Towers, Shelters, A/C

Measure	Impact	Benefit	Capex	Opex
Improved ventilation, cooling and/or heat tolerance of base station electronics	Eliminate or reduce air conditioning requirement, with consequent lower power requirement	Reduce external electric power supply, or		✓
		Eliminate or reduce requirement for diesel generator and fuel supply, or	✓	✓
		Enable more economic use of solar panels	✓	
Improved ventilation, cooling and/or heat tolerance of base station electronics, *as well as* smaller size for outside installation	As above	As above	✓	✓
Enhanced radio transmission performance	Improved and balanced "link budget" and longer signal range for "strong" signal coverage	Fewer base station sites, resulting in lower Capex and Opex costs	✓	✓
Enhanced network voice and data carrying technology (e.g. AMR[25])	Improved quality and capacity on existing networks and maximum growth efficiency	Fewer base station sites, and improved revenue versus cost relationship on existing and expansion networks	✓	✓
Enhanced radio & antenna technology to achieve extended range	Larger cell size applicable to and tailored to low density areas	Fewer base station sites in very high cost and low density areas	✓	✓
Enhanced transmission technology to achieve lower interference (e.g. SAIC[25])	Optimum signal processing performance & user capacity with lower transmitter output power	Lower power consumption for equivalent network performance		✓
Smaller base station equipment cabinet size	More portable and easier to install, easier site acquisition	Smaller shelters, more rapid deployment	✓	

Source: GSMA

International bandwidth in Africa

BY 2011 WEST AFRICA WILL HAVE X50 TIMES THE INTERNATIONAL BANDWIDTH OF TODAY



Source: Ericsson

International bandwidth in Africa

❑ **Out of the 49 Sub-Saharan African countries and territories**, **32 now have their capital cities connected to international fibre** and many of these have either completed a backbone to connect their major cities or have plans to do so **by 2012.**

❑ **In a number of instances, Governments** like those of Kenya, Rwanda, Tanzania and Uganda **have taken on loans or deployed universal access funds** to get national backbones built. In each instance, these have been given to the former incumbents to manage but only in the case of Tanzania is this still a Government-owned entity

❑ **Others like Angola and Ethiopia have left the responsibility of building the national fibre backbone with the incumbent**, although in the case of the latter, the **Government has signed a contract with France Telecom to provide strategic management**

❑ In the case of **South Africa, the Government created a separate agency (Infraco)** to operate existing assets and build out more

❑ **Of the 19 countries that remain unconnected, 14 of them have concrete plans that will see their capital cities connected by 2012** and backbone plans to connect major cities.

❑ **The driver for the connection of most African capitals has been the arrival of eight international fibre cables** : many African capitals are either on the coast or near to the coast.

Cable	Timing
East coast	
Seacom	Implemented
TEAMS	Implemented
EASSy	Implemented
LION	1 and 2 implemented
West coast	
Glo One	2/Q3 2010
Main One	Implemented
WACS	Q2, 2011
ACE	Q2, 2012

1) The maximum capacity of all the cables being built is **15.71 Tbps (demand was measured in Gigabits)**

2) The arrival of this large amount of **international bandwidth provides the spread of networks to both major cities and the roll-out of fibre and wireless local** delivery networks in the cities themselves.

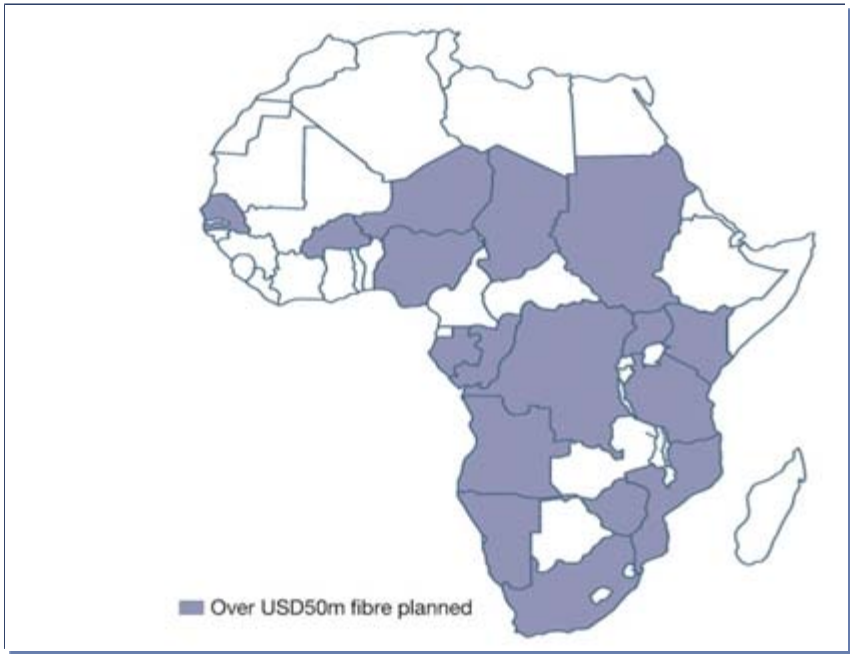
3)Lower prices of international bandwidth help operators to make money with services provided to end users instead of bandwidth.

Source: ITU

International bandwidth in Africa

Fibre is now laid in the ground of most sub-Saharan countries in order **to cover the high demand for high-capacity telecoms networks in emerging markets**, driven by: mobile operator cost reduction, mobile broadband, economic growth, broadband access for businesses and transit connectivity

Sub-Saharan countries with large fibre roll-out plans



Governments and operators in sub-Saharan Africa have announced their plans to deploy fibre-optic networks worth between **USD50 million to USD1 billion over the next few years.**

Fibre networks are being **built by incumbent fixed network operators**, **mobile network operators, utility companies** (electricity and rail) or **specialized international connectivity** companies.

Source: Analysis Mason

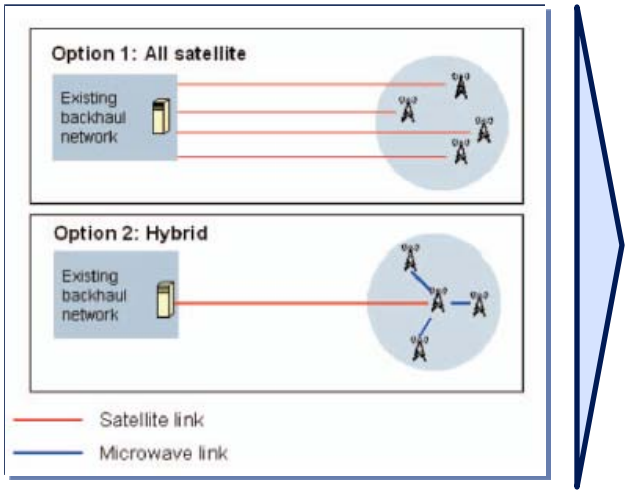
An alternative to expand broadband to rural areas

• **To connect rural African communities**, local base stations must be connected to fixed wireline or fiber cables, microwave links or satellite backhaul connections:

- **Fixed wireline is almost non-existent in many parts of Africa**. In most circumstances, microwave links are used because equipment is readily available and spectrum licenses are easy to obtain. Microwave links are most cost-effective when servicing large populations over small distances

- **Costs dramatically escalate when connecting communities that are more than 30km** away from the core network, requiring multiple hops.

- **Satellite technology is not impacted by distance**. It's much more efficient and economical to use than microwave links when servicing small populations over large distances, such as those in rural or remote areas.



Many African communities **with large populations are isolated, far away from their closest neighbor**. So, mobile network operators have two options:

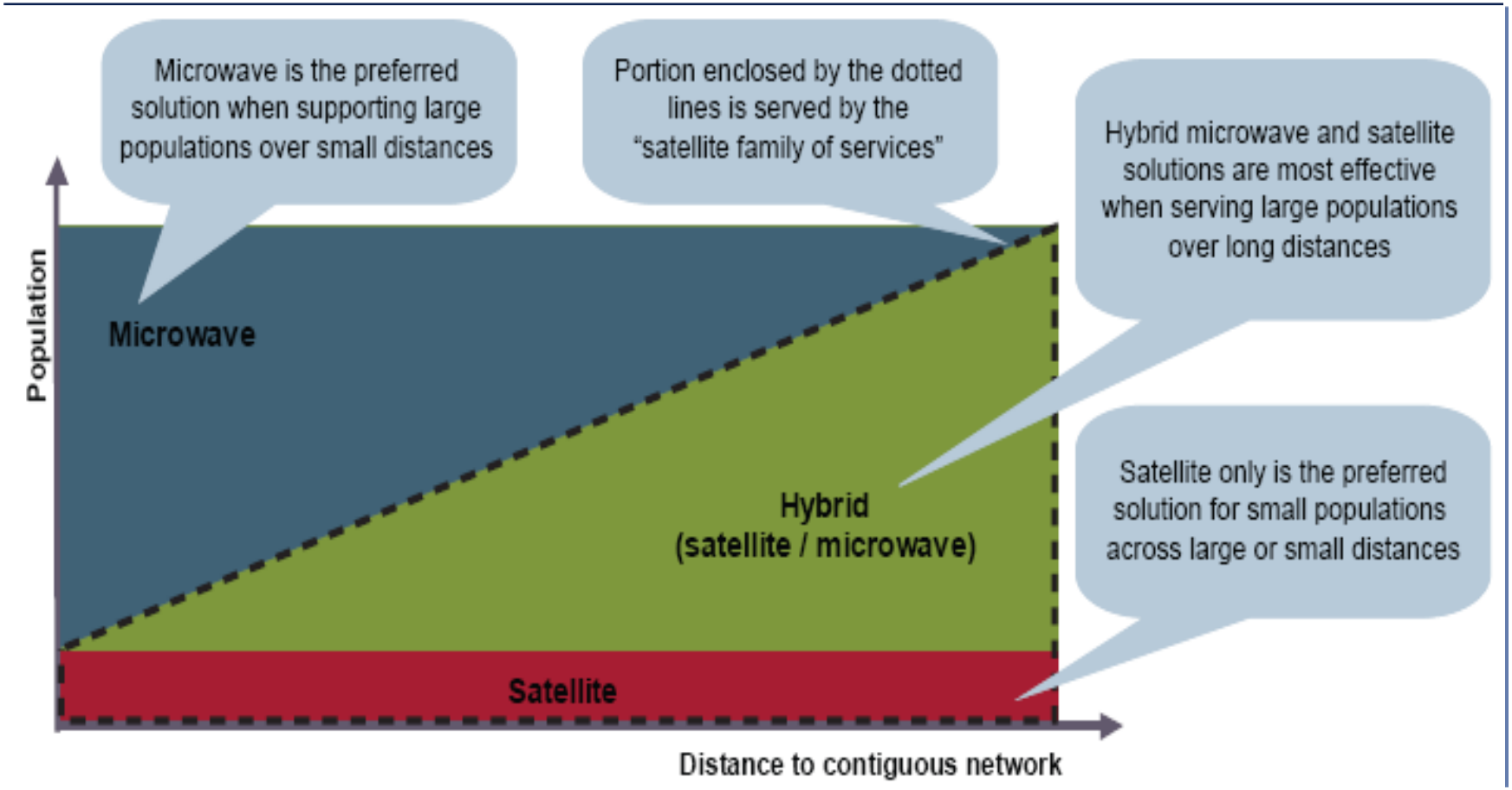
1)Connect each base station to **a single aggregation node**

2)Use a hybrid approach that includes both microwave and satellite technologies. Several base stations serving a community are connected locally with microwave, then the cluster is backhauled via satellite to the operator's core network.

Source: Intelsat and Analysis Mason

An alternative to expand broadband to rural areas

Hybrid backhaul combines the distance advantage of satellite with the bandwidth advantage of microwave.



Source: Intelsat and Analysis Mason

The Uganda UA Program: trend to internet

❑ **The UA policy and funding (RCDF) program was designed to cover both rural telephony and Internet** and designed to leverage the digital backbones constructed by the two leading operators, Uganda Telecom Limited (UTL) and MTN Uganda.

❑ A techno-economic analysis determined that **the use of commonly available broadband wireless options**, with a coverage radius of 10-15 km**, would ensure that Internet services could be provided as an overlay network** in virtually all of the district centres using base station towers in a very economical manner.

❑ **One-time "smart subsidies"** were therefore offered for the installation of Internet POPs and broadband access systems at 32 of the country's 56 district centers **The Internet POPs would ensure that all institutions, schools and businesses within line-of-sight of the district centres' central radio towers would be able to secure high quality Internet access** at the same price as if they were located in the capital, Kampala.

❑ **The regulator, UCC, also decided** that along with or following immediately behind each Internet POP, **one public Internet café per district and at least one "vanguard institution**" (e.g. a leading Internetready school or college) **could be incentivized with "smart subsidies**."

❑ **As well, local training initiatives and regional content development could be supported from the RCDF**. These would combine to promote the start-up of the local Internet market on a commercially sustainable basis.

❑ While the RCDF's strategy did not immediately guarantee that Internet service would be implemented ubiquitously, the strategy **serves to stimulate the market and also greatly reduces every rural person's distance to the nearest Internet access by the placement of the POPs in each district centre.**

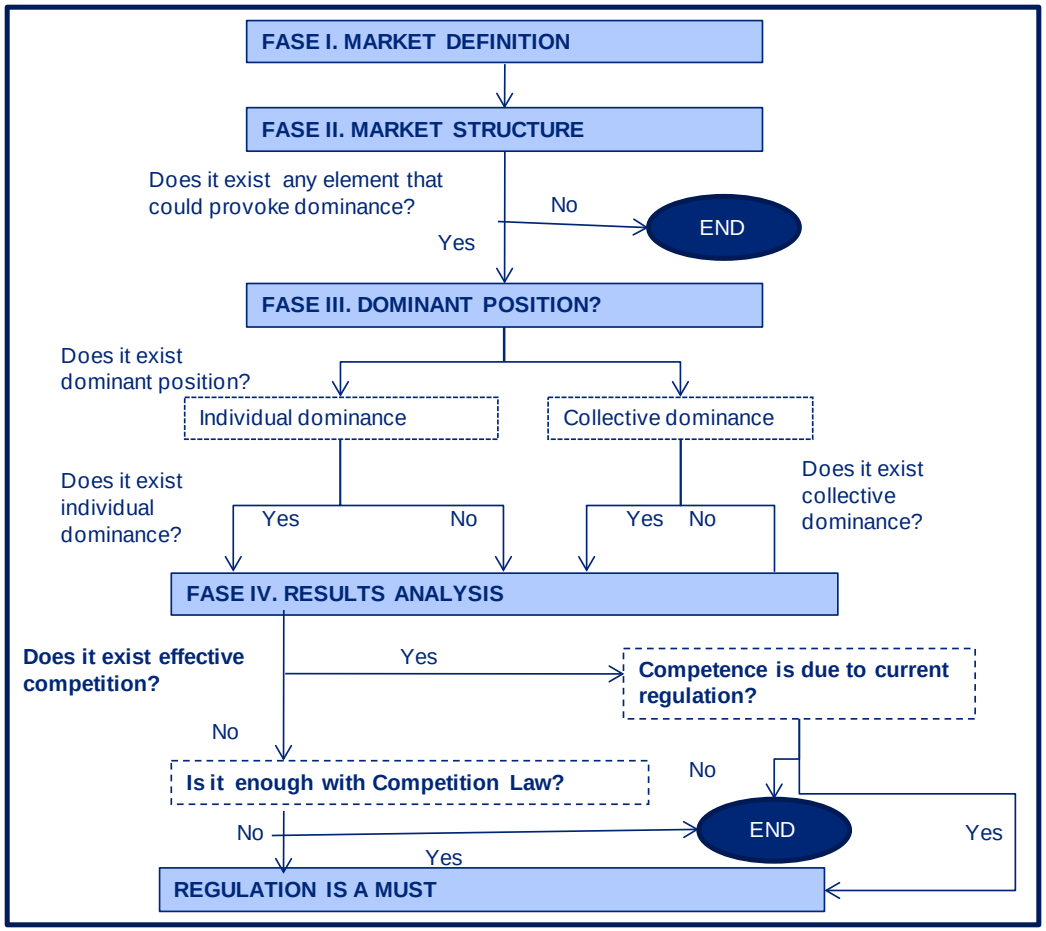
❑ **Rural users are now on the way to being able to access the Internet**, at least through public Internet cafés or institutions that are close to them.

Source: GSMA

Contents

When to regulate?

In order to justify the imposition of regulatory obligations on a given market, **the three criteria test** is applied.



The three Criteria test

1. Presence of high and non-transitory entry barriers whether of structural, legal or regulatory nature
2. It admits only those markets, the structure of which does not tend towards effective competition within the relevant time horizon
3. Application of competition law alone would not adequately address the market failure(s) concerned

Obligations/Remedies:

- **Price control**: cost oriented/ reasonable "prices"
- **Separated accounting**
- **Access obligation**
- **Non discrimination and transparency**
- **Functional separation**

Regulation based on geographical situation

• In reality, **competition is focusing on some areas** in every country !!

• Geographic markets should not be considered exceptions in fixed and mobile telecommunications:

  • **narrowband access** markets as well as **broadband access markets** are likely to show very often the features of geographic markets.

Regarding NGA (Next Generation Access), **geography does matter:**

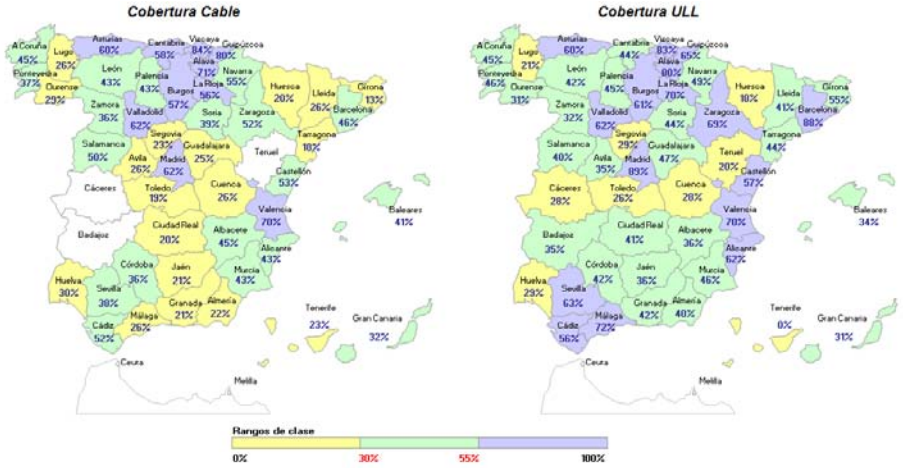
• state and age of existing network infrastructure**,**

• length of local loop,

• population density and structure of the housing market,

• Others (distribution of users,…)

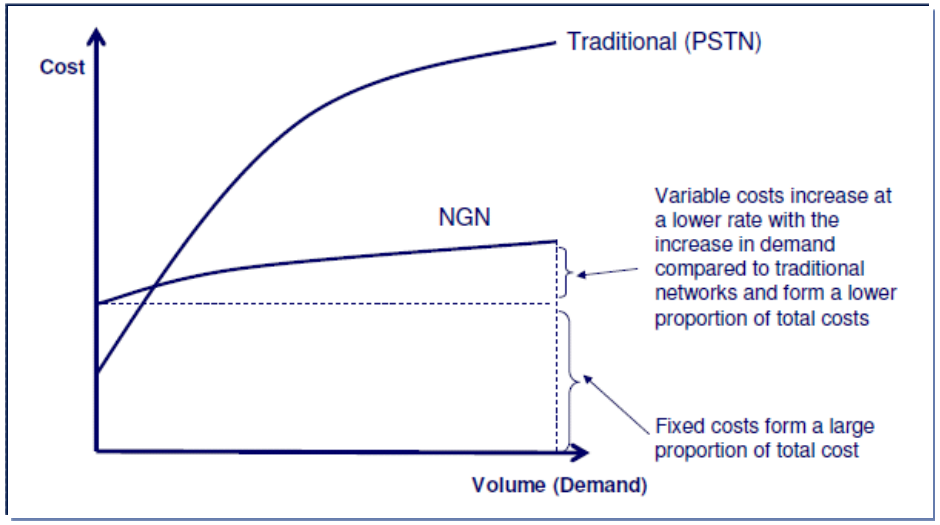
Example: Spain

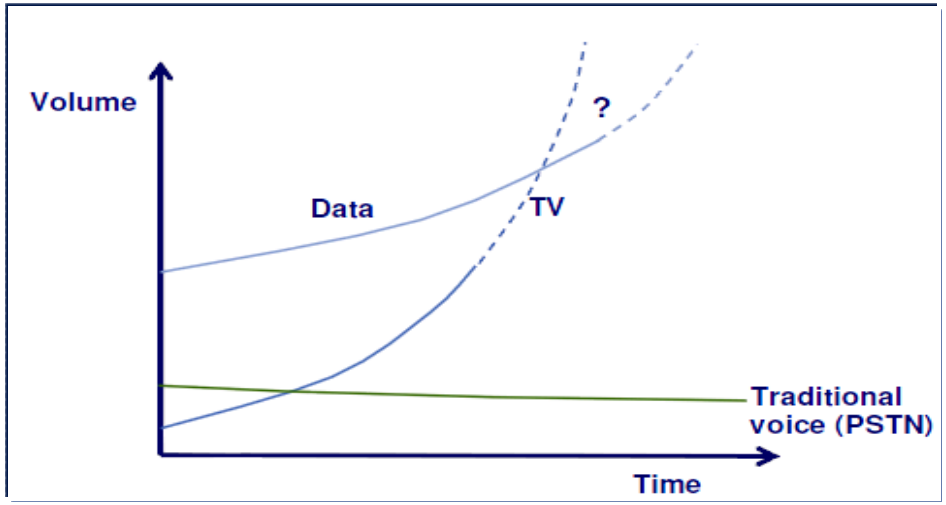


In Spain, broadband market shows very heterogeneous competitive conditions, existing higher competition in areas where several types of infrastructures provide several broadband services: socio-demographic and economic conditions in different regions.

Source: CMT

NGN will change the operators costs structure





- **NGN costs should be lower** and less dependent on traffic volumes.

- NGN features create fundamental problems if we wish to cost an **individual service for "cost-based wholesale price" remedies**

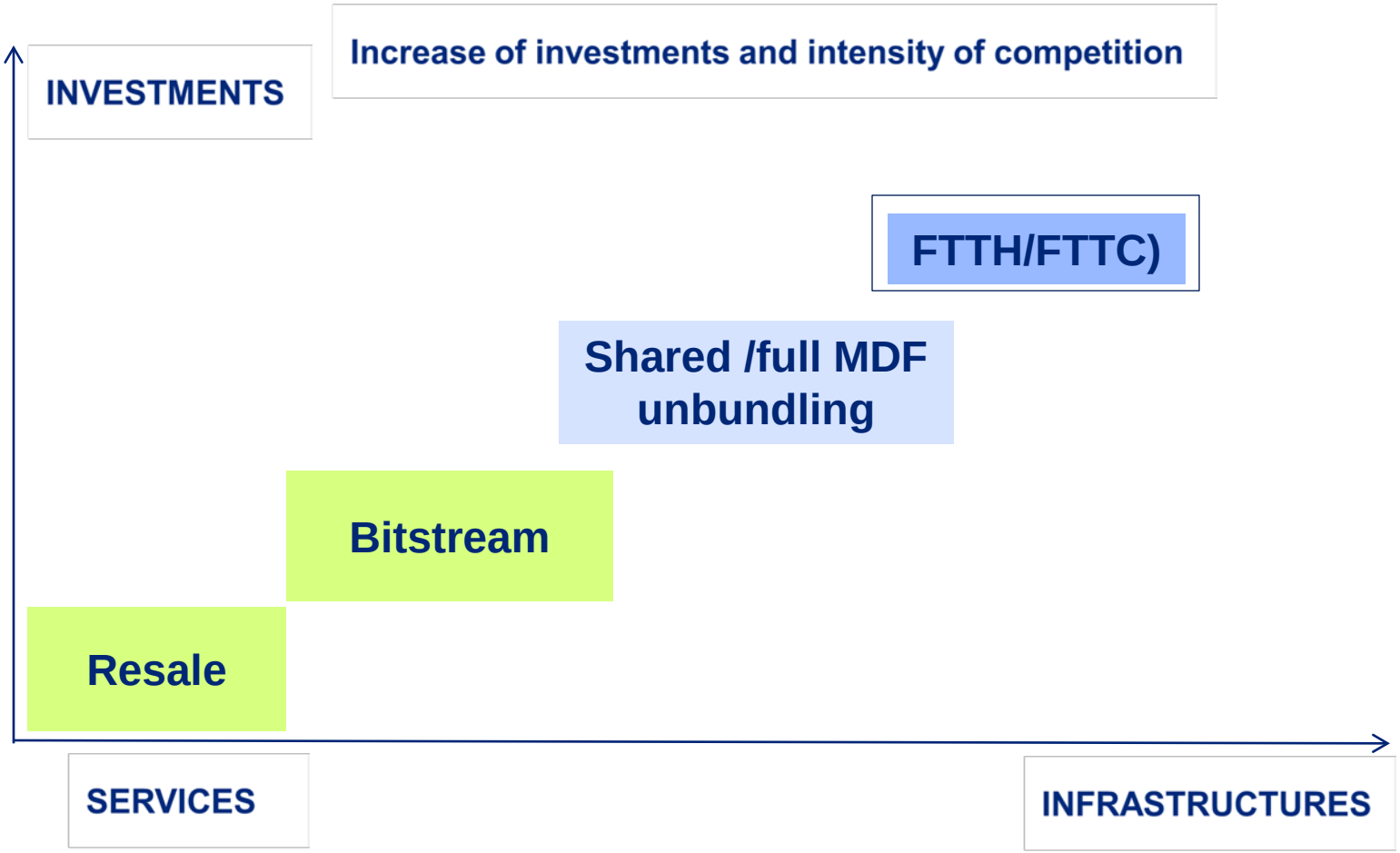
- There is a **great deal of uncertainty** about the applications that will need to be supported and hence the optimum design and deployment of **Next Generation Access Networks (NGAs)**

- **Data services dominate voice traffic** volumes contributing to an increase of data revenues in the operators accountings.

- Different types and speeds of NGA roll-out lead in turn to uncertainties for the design and dimensioning of the aggregation and core IP transport and optical networks, and thus for cost allocation

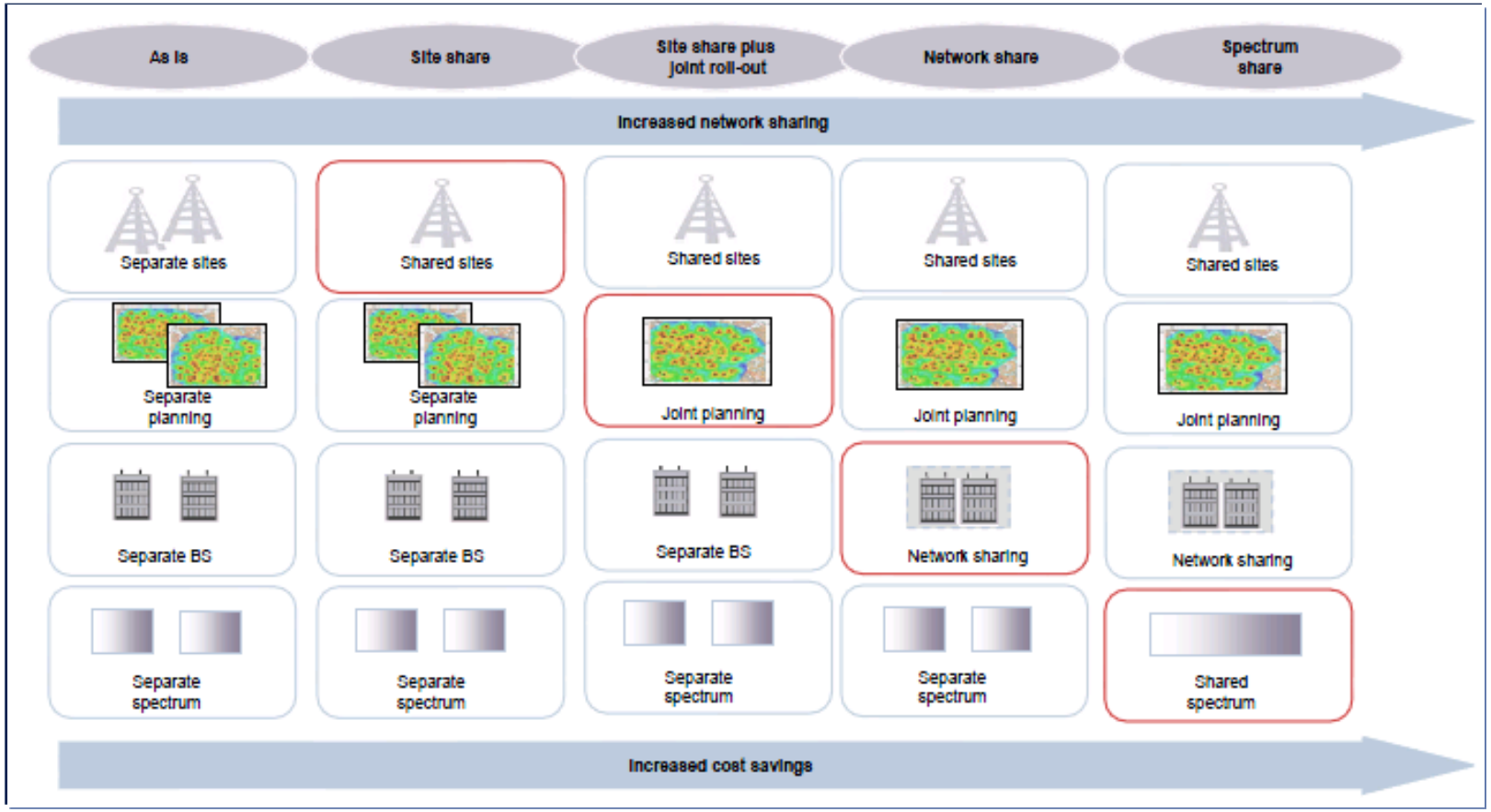
Investments related to the kind of competition

- The **main barriers of FTTC /FTTB and FTTH** are civil engineering cost (horizontal barrier), in-house wiring (vertical barrier), co-location at the street cabinet, and backhaul between the Street Cabinet and the operators' networks.



Sharing passive and active infrastructures

Some operators have decided to **share their networks under several options in order to reduce their opex and capex**: site sharing, RAN sharing and backhaul sharing

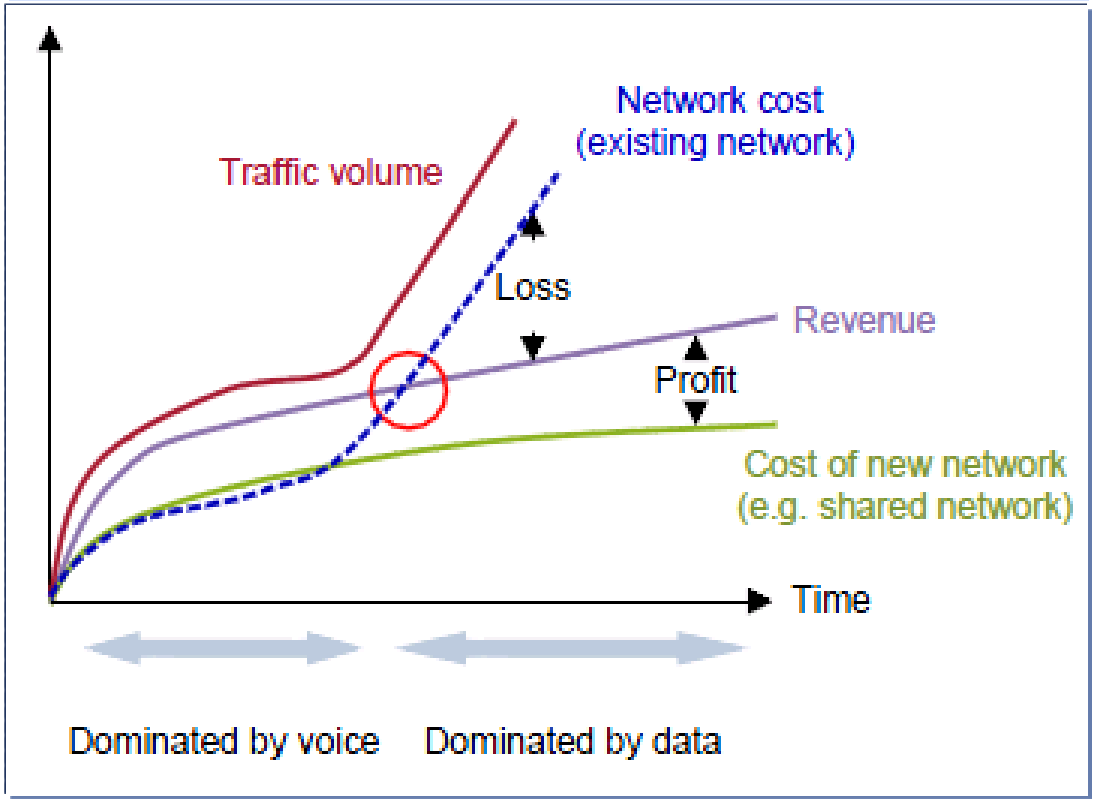


Source: Analysis Mason

Mobile networks: cost reduction by sharing infrastructures

The main driver to share networks is reducing network costs that represents o**ne-third of total expenditure.**

Comparison of the network economics of legacy and LTE networks



Expenditures breakdown:

Capex:

37% buildings and materials,
31% power,
15% BTS or Node B,
6% backhaul,
11% other

Opex:
20% electricity,
20% hw and sw,
15% land rent,
14% backhaul,
31% other

Another driver could be to **extent coverage into rural areas**,

Source: Analysis Mason

Regulatory Requirements for NGNs: a new approach

NGN are facing different assessments to traditional remedies or regulatory strategies, taking into account the relationship between services and networks.

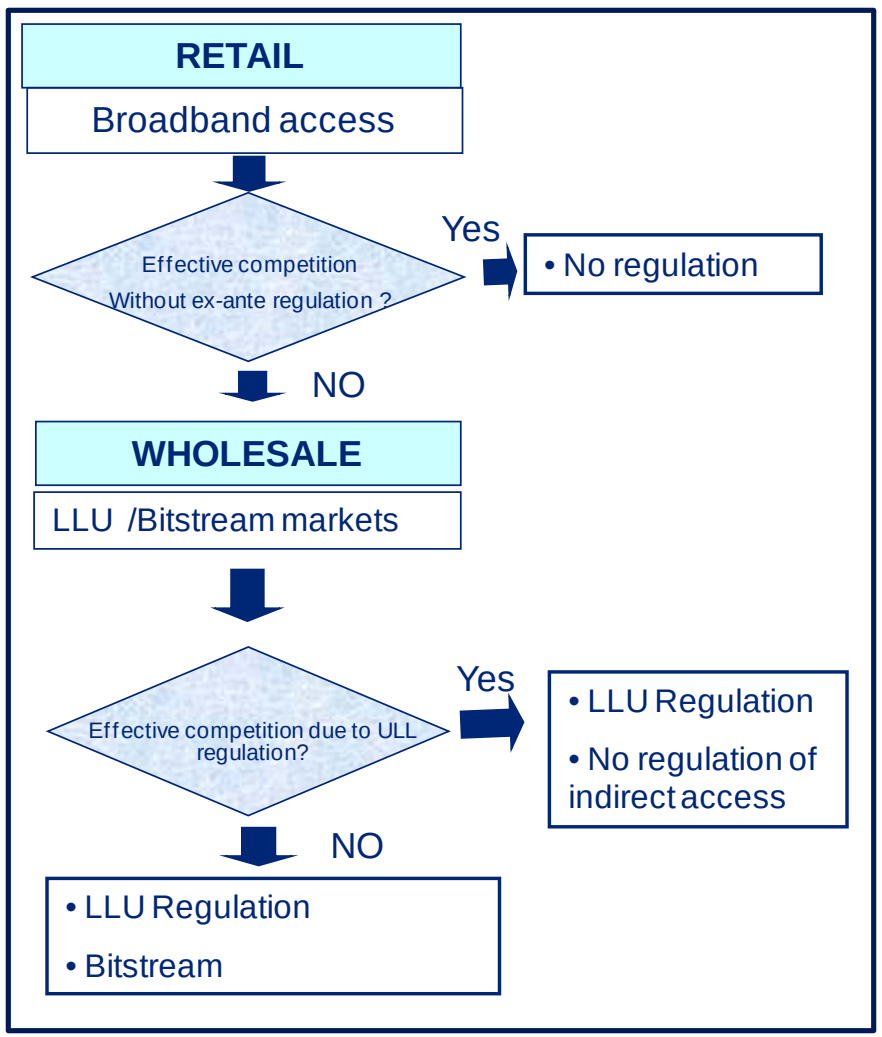
ACCESS NETWORK

- Already shared **access costs cannot be sensibly/easily split into services**
- **"Customer dependent costs" are mixed with traffic dependent costs** and co-exist in the access network or even at customer premises
- **Copper local loop is no longer a clear demarcation:**
  - Even in traditional networks, the definitions have been a problem with some "arbitrary" allocations of nodes from access to core
- **Traditional definitions** (often in directives or law) **cannot be easily applied**
- NGN access seems to be the **enduring bottleneck**

CORE NETWORK

- **Services share the same network** – in the past each had their own dedicated network (and costs). A large amount of costs are fixed/common to many services
- In the past **shared systems' cost could be split based on technical and economic factors** that were generally agreed on and based on good cost driver logic
- **NGN services are delivered by application severs** - more separate from the networks
- **Service providers should be able to configure the network** (say QoS – speed, priority) to suit the service

Regulation at wholesale or retail level?



- A **Minimal intervention** principle
- **Wholesale regulation**
- To incentive **investment** and **innovation**
- Regulation applied to **emerging markets**
- Regulation must **no disturb competition**
- **Ex-ante policies** proportional to the market situation

Functional separation as an alternative option to open market

• Functional separation **requires dominant operators to separate** , but not sell, their network **infrastructure from their retail service division**

• The separated network business provides **the same services to the rest of incumbents' retail business as to the alternative operators**.

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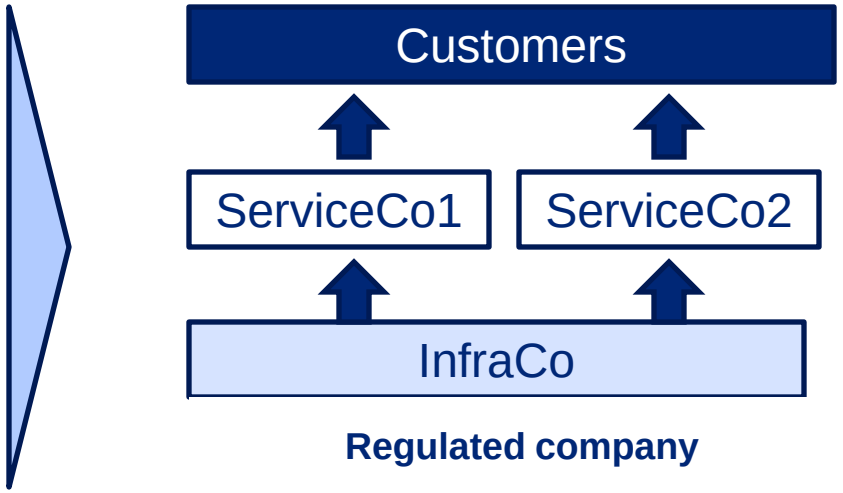
Functional separation – some examples:

- **Great Britain - Open Reach**
- **New Zeland - Chorus**
- **Sweeden - Skanova Access**
- **Italy – Open access**



Reasons that have affected access to affordable broadband in Africa

	SITUATION	SOLUTION
1	**Low overall levels of competition:** Countries that have a low overall level of competition at both the retail and wholesale level do not incentivise national infrastructure roll-out	**Creating a market dynamic is essential for speeding up market development** starting by encouraging competitive access at the local loop level
2	**Lack of access to investment:** National incumbent may want to build a national fibre network but its main shareholder (the Government) may not have the resources to fund it.	**Privatisation** will create these resources
3	**Restricting network use and opportunities to aggregate.** Some countries allow mobile operators to build their own networks but do not allow them to sell this capacity to third parties like other operators	**Control the limits on the number of operators** allowed to build their own networks and **the license**s for the wholesale carriage of traffic.
4	**Alternative infrastructure carriers not allowed or restricted** Almost every African country has potential fibre networks that are operated by national utility companies	**Government must allow to use part of the fiber** capacity not only by the incumbet but also third parties
5	**Lack of clear ground rules for third party access .** Once national infrastructure is open to competition, there can still be difficulties about access to that capacity by competing providers	**Clear guidelines for things like access and co-location** to allow competitors to access to incumbent facilities.
6	**Absence of policies on sharing and passive infrastructure**: In undeveloped markets where there is still plenty of new growth, there is little incentive to share infrastructure.	**Clear guidelines by Government for sharing infrastructure** (like ducts….) to make it cheaper for all operators to operate.

Policy and market interventions in Africa

COMMERCIAL INFRASTRUCTURE SHARING

Sharing passive infrastructure through building ducts: South Africa MTN, Neotel and Vodacom came together in March 2009 to build a 5,000 kms network costing between R1.7 – 2 billion to compete with the existing one provided by the incumbent Telkom

Sharing passive and active infrastructure: In Uganda, Orange is sharing both active and passive parts of the Warid network (now taken over by Essar) and in Kenya Yu (the Essar brand) is sharing network with the second largest operator in the country Zain (now taken over by Bharti Airtel)

With ARPUs declining, similar pressures are forcing operators to look at ways of sharing other parts of infrastructure through third party providers. Independent companies either purchase or build towers for mobile operators that they then lease to them.

ENCOURAGING THIRD PARTY PROVIDERS

Three categories of third party providers are worth highlighting as all encourage both the spread of national telecom networks and act to provide effective price competition. These are:

1) **carriers' carriers,** provide wholesale capacity for other operators. Ex: Phase3 Telecom and Suburban Telecom in West Africa; Kenya Data Networks in East Africa; and Liquid Africa (owned by Econet) in Southern Africa

2) **alternative infrastructure operators,** usually utilities or parastatals. Ex: electricity, gas and water companies, railways and oil companies.

3) **dark fibre operators.** Ex**:** In South Africa, there is a company called Dark Fibre Africa that does exactly that.

Contents

Issues to be considered for NGN cost modeling

1 **Costing methods** for traditional networks show some difficulties:

NGN services share the same network components. **The cost driver to each service is not as clear as PSTN** (Service routing table more difficult)

The problem is not how to make an NGN cost model but also **how to get a service-costing allocation scheme** with a rationale economic and following technical and commercial reality

Models based **on traditional "cost drivers" are difficult** because costs for some services will be too low and others too high and not aligned with current market revenue trends

2 However, there are **some basic obstacles to doing cost modeling based on operator accounts** ("top-down"). Suitable historic accounts for a top-down modeling approach **will almost certainly not exist for services** such as IPTV.

3 Considering **modeling future years**, a number of issues arise:

Traffic volumes are uncertain across the range of traffic types, and likely to grow much more rapidly than in the past PSTN environment :

The rate and dimensioning of future investments, perhaps to cope with rapid traffic mix changes **can only be estimated**

Key financial parameters to be considered using cost models

Bottom up models - LRIC	Top down models

Assets, working capital and operational costs

- A functioning network incurs operational costs. Both capital and operational costs must be recovered. In addition to the fixed assets, some working capital is required – net assets less net liabilities. This requires an additional investment that should be allowed for.

Annualisation methodologies

- Annualisation charges are calculated on capital investment as the sum of the cost of capital, and depreciation. The effective annual cost of the investment is required to define the revenue needed to provide for the replacement of the investment (asset) and to allow a fair return on the investment (profit).

Cost of capital (WACC)

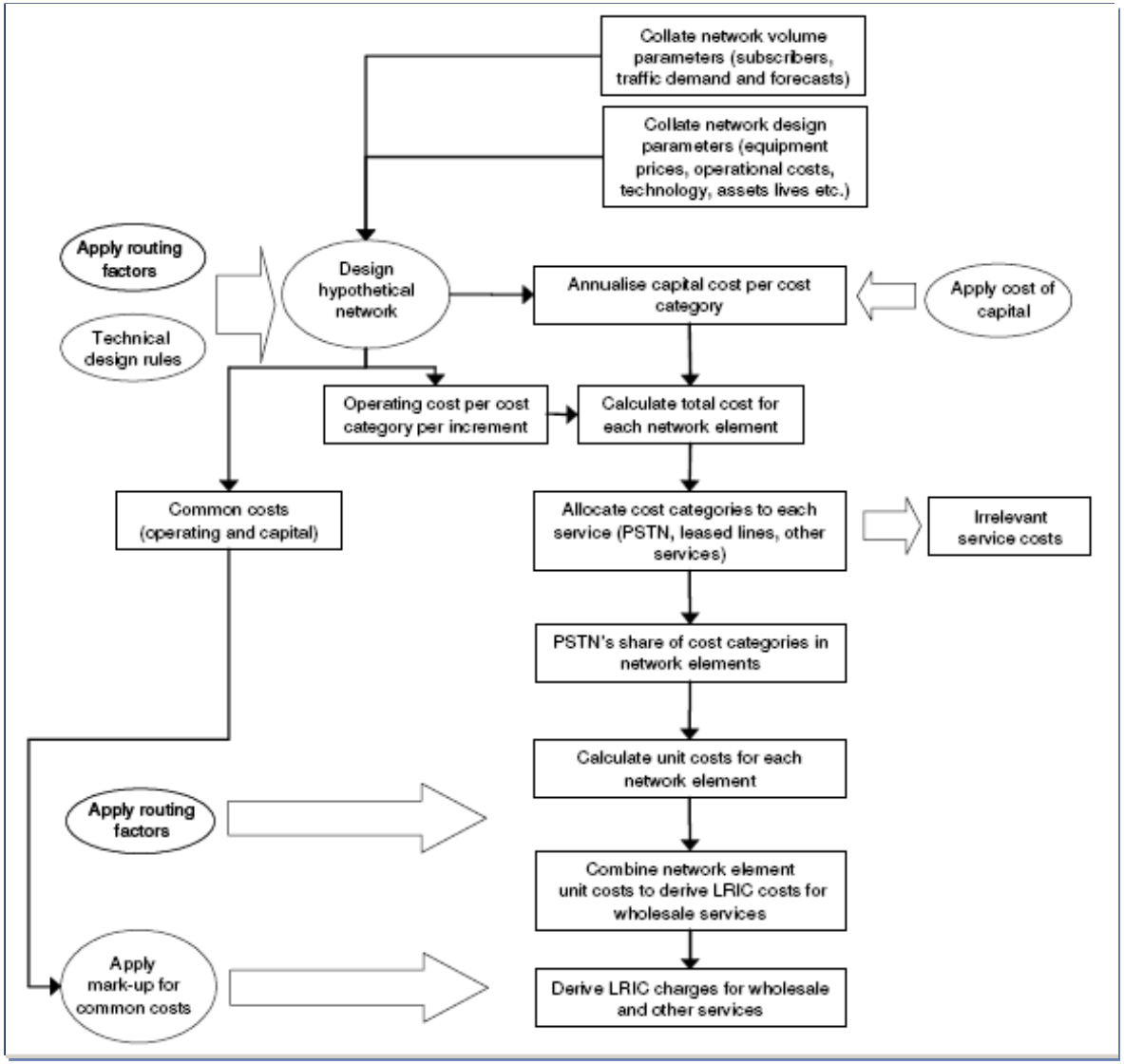
- It provides a fair return on the asset investment. If it is correctly defined, it allows sufficient return to account for the risks of the associated telecoms market

Routing factors:

- Specify, for each type of service, the average use made of each type of network element

Others

Bottom up - LRIC



The main parts of the model are:

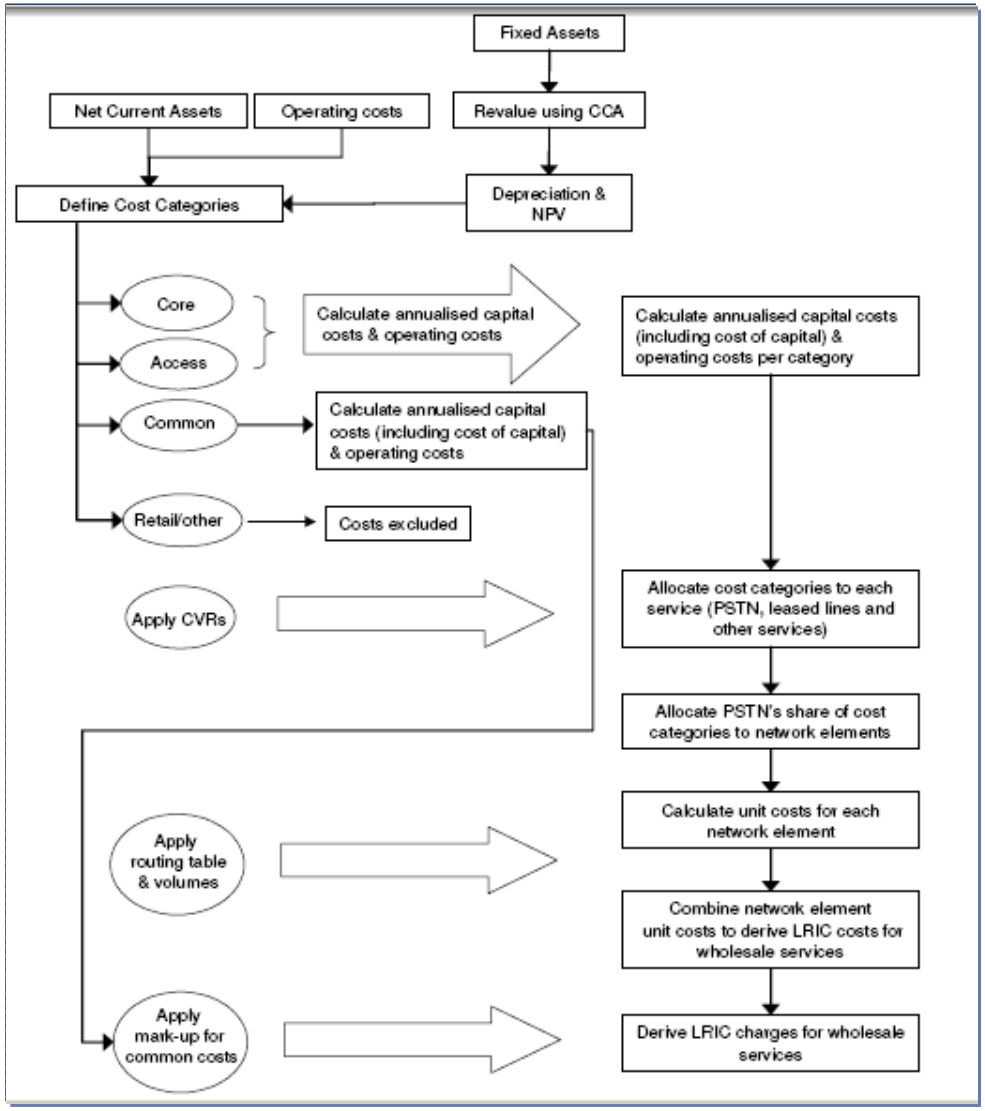
1. **Estimating demand** and determining input unit costs
2. Building an hypothetical network
3. Calculating network elements
4. Determining the **cost of network elements**
5. Calculating Cost services

- **The Bottom-Up model shall be used** as part of a process to validate and reconcile results obtained **from the Top-Down model to achieve fairly determined LRIC estimates for key wholesale services**

- **The Bottom-Up models may be updated periodica**lly and used to compare with updated versions of the Top-Down models.

6.Pricing: Cost modeling: Top down

Top down accounting



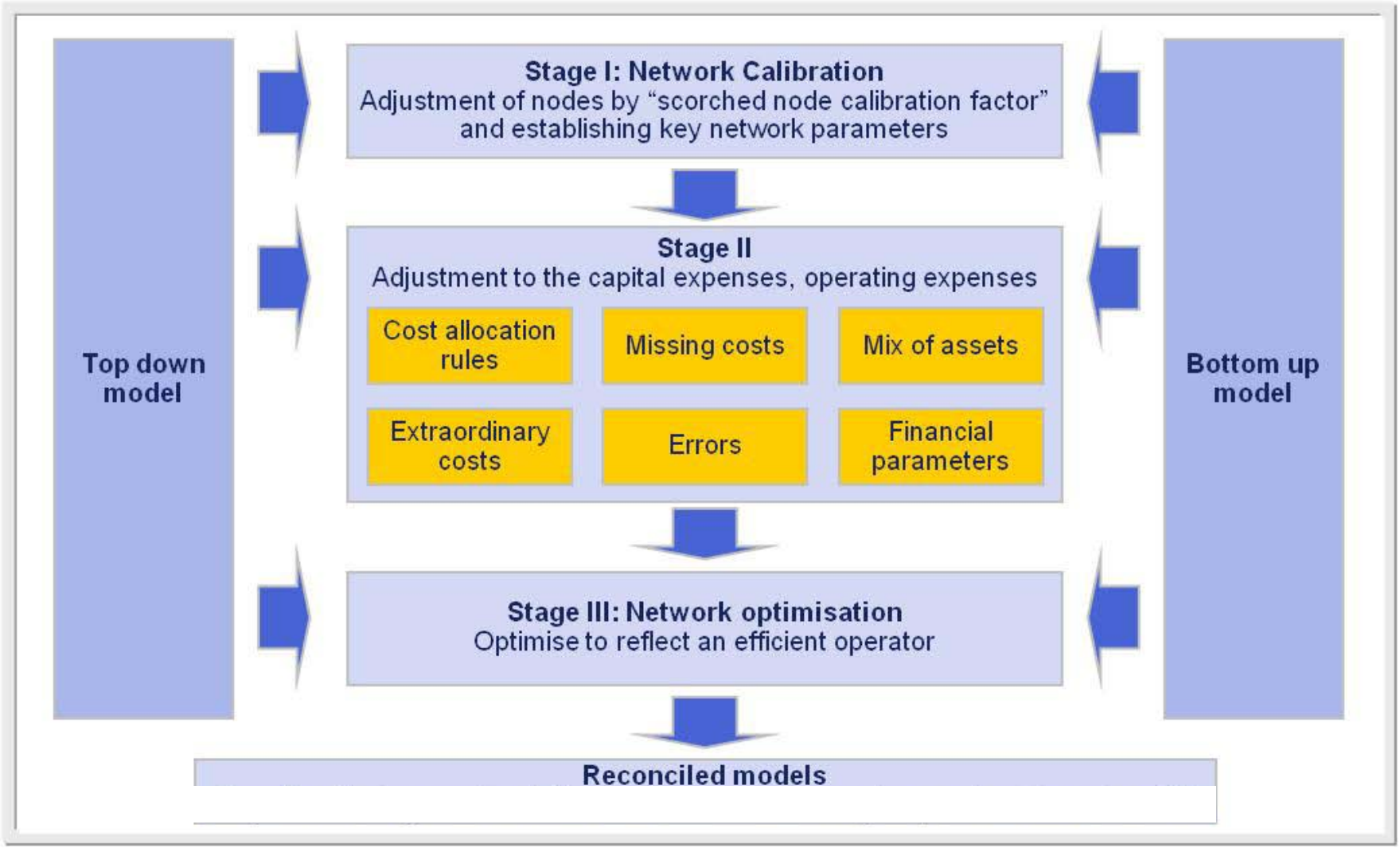
- Since **LRIC is a forward-looking concept, current cost accounting (CCA**) principles have to be used to estimate the appropriate Gross value of assets **(an annualisation method has to be defined)** . This involves re-valuing assets on the basis of the replacement cost of the modern equivalent asset (MEA).

- Under top down models and **using FDC (Full Distributed costs) you have a first draft to calculate asset revaluation** by using historical cost accounting

- **Cost-volume relationships** (CVRs) show the way in which costs change in relation to a change in the volumes of the service provided.

- **Average cost of capital** (WACC) is a key element of this model

Reconciliation process: Top down vs bottom up



6.Pricing: Cost modeling

Real options: Cost models based on **real options theory** could fit with this capital intensive markets

- **Traditional regulatory practice** evaluates investments according to the well-established **net present value theory**

- In economy, "**real option"** is the term given to the possibility to **modify a project,** and it is really **useful with** investment decisions made under **uncertainty:**

  - The investment is partially or completely irreversible.
  - There **is uncertainty over the future re**wards from investment.
  - Investors usually have some leeway about the **timing of their investments**

Traditional models based on **the net present value** rule assume that investment is **either reversible or is a "now or never proposition",** so it **does not model the value** that might be associated with the choice **of using different timing strategies**.

From a financial point of view, pricing cost oriented implies that Net Present Value (NPV) is equal to zero.

How to calculate access prices using real option theory

Value of "waiting" option

- Investment at t=0: NPV = 0 estimated access value price" p0"
- Investment at t=1: NPV(p0)>0. In this case, when sunk costs exists, there is some uncertainty regarding future cash flows and you can have the possibility to wait, and unlike rational investor that invest at t=0, the "wait price" is different from NPV =0

Distortion generated without including "waiting" value

- Competitor , that taking into account uncertainty and the access price p0 (NPV =0) wants to rent infrastructure from incumbent at t t=0,and enter into the market at t=1.
- Investment at t=1: NPV(p1)>0 and p1<p0, could fix a lower price (p1) than p0, whereas that using p1 incumbent would have NPV<0. In this case, regulation would provoke some advantage to the entrant disturbing the competence.

- The rule to fix prices should be the one that do not create "waiting value". Prices which do not disturb competence are not sensible to invest at the moment t=0 or at t=1;

Investing at t=0?

1. T=4: NPV(p4)=0, estimation of "p4"
1. T=3: NPV (p3)=0, estimation of "p3"
1. T=2: NPV (p2)=0, estimation of "p2"
1. T=1: NPV (p1)=0, estimation of "p1"

p4>p3>p2>p1>p0

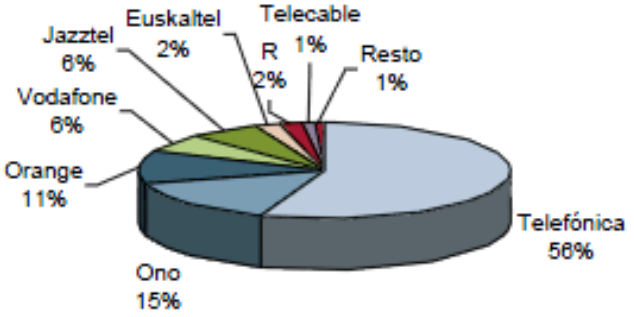
Contents

Spain

Several fixed and mobile operators (Telefónica, Vodafone, Orange, Jazztel and ONO) are leading the deployment of fiber network in Spain

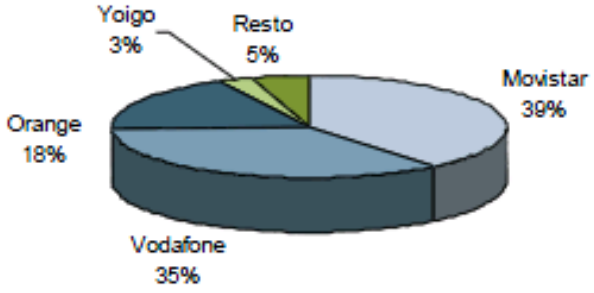
Share of the fixed broadband market (Q4 2009)

Telefonica still has a dominant position, but OLOs (including ONO) are now winning the battle for new additions



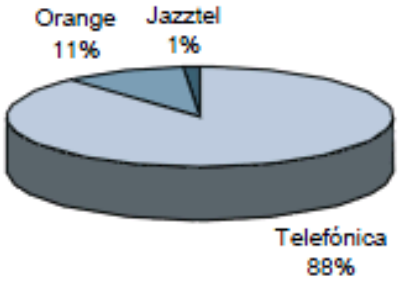
Share of the mobile broadband market (Q4 2009)

Due to their strong position in the mobile market, Vodafone and Movistar dominate the mobile broadband market



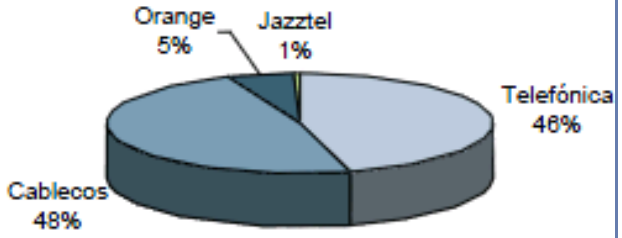
Share of the IPTV market (Q4 2009)

Telefonica's Imagenio is the most successful offer in the market; OLOs are increasingly focusing on IPTV



Share of the triple-play market (Q4 2009)

Telefonica's Trio package is the most successful. Orange and Jazztel are investing heavily to expand in this market



Source: Analysis Mason

Spain

• In general terms, **OLOS have decided to base theirs business models on Local Loop Unbundling** (LLU) as a mechanism to be different from other operators. But, growing presence of some operators in exchanges where only traditional SMP operator was, has created an **aggressive competence** and a **large variety of services .**

• Differentiation through LLU has helped **packet services** appearance

• **LLU**, like cable technology, is focused on certain areas with special social and economic conditions . SMP operators **are losing market power** in that regions

Competence based on Infrastructures

Competence based on services

Spain

Market, competition and regulatory conditions could make fibre an opportunity for new entrant with manageable risks

Growing demand	• **B2C* demand is increasing due to the growing penetration of high-bandwidth services (non-linear TV, fixed and** mobile broadband) as well as growing capacity requirements for these services • **B2B** demand is also experiencing significant growth, with increasing needs for more mobile backhaul capacity and** FTTx deployments in urban areas
Limited competition	**Backbone and aggregation – the majority is under the control of several electric companies, which provide** services directly to retail operators • **Access – Telefonica is the only operator with enough funds to deploy an FTTx network; cable operators will deploy** DOCSYS 3.0 in selected areas; whereas the high investments required would make it difficult for LLU operators toenter this market
Positive regulation	**Remedies in Market 4, including access to Telefonica's ducts, provide a workable environment. Proactive** lobbying with the CMT would improve the investment case • The European Commission and the Spanish authorities view the deployment of high-speed fibre as a **strategic objective, which could entail the allocation of public funding**
Geographic scope	• The business case is clearly **more attractive in the most densely populated areas where key potential clients are** already present through LLU • At a later stage, the potential in other areas could be examined on a case-by case basis depending on the economics
Manageable risks	• The business case is clearly **more attractive in the most densely populated areas where key potential clients are** already present through LLU • At a later stage, the potential in other areas could be examined on a case-by case basis depending on the economics

Source: Analysis Mason

Spain

A favourable regulatory environment benefits the deployment of fibre networks, potentially with public funding

Spanish regulation

The CMT has imposed useful regulation in Markets 4 and 5 with the aim to create a favourable regulatory environment for investment in FTTH by:

- mandating open access to fibre networks in buildings: the operator which first cables a building needs to provide access to competitors
- mandating access to Telefonica's ducts for the deployment of FTTH and HFC-based NGA networks, as well as for mobile backhaul

Assessment of Spanish regulation

According to the CMT approach, it makes a workable framework:

- the same Telefonica's local exchanges specified in the OBA are also open for the use by other operators of Telefonica's ducts
- the prices have been set at levels that may allow a business case to be successful
- Some lobbying could be beneficial to clarify some grey areas left in the MARCo such as actual available duct capacity, SLAs, simultaneous deployment of several fiber cables, etc.

Public funding

- The objective of state-aid control is to ensure that these measures will lead to higher broadband coverage and penetration, or in a more timely manner than would otherwise occur without the aid

- The European Commission recently announced its endorsement of almost EUR300 million of public funding to support the deployment of broadband networks from September 2010. It also announced its intention to award up to EUR1 billion to improve broadband coverage in rural areas

Assessment of regulation for public funding

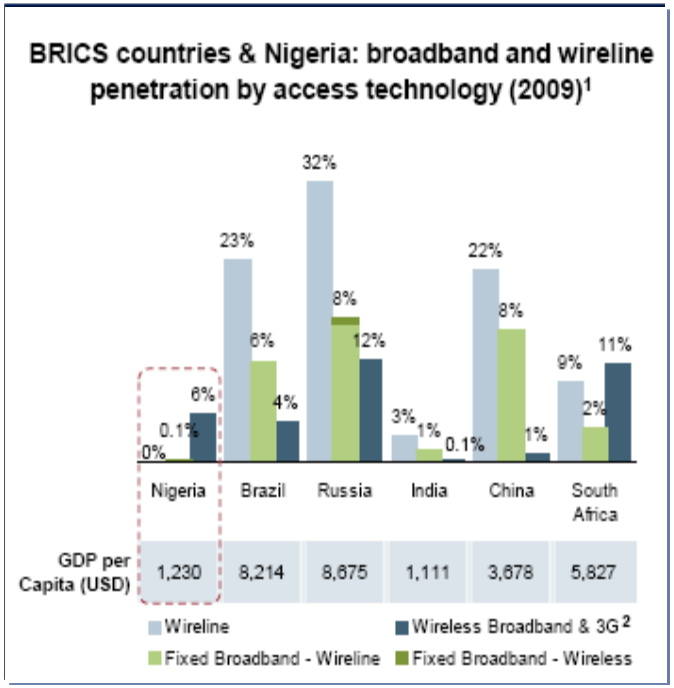
- It is key to identify the three different types of area: white (no NGA network in three years), grey (one single NGA network in three years) and black (two or more NGA networks in three years):
- currently it is difficult to envisage that more than 25% of the population will live in black areas by 2012 (limited deployment by Telefonica)
- The safest bet is to target white areas, although a new operator could try and build a case by arguing that it could build a more open NGA network, with effective wholesale products (including fibre unbundling) in grey areas

Source: Analysis Mason

Nigeria

Broadband in Nigeria is already mobile – and with positive policy action **can enhance Nigeria's GDP by over 1% in 2015**

With almost non-existent wireline services, **broadband in Nigeria is driven by wireless access technologies**

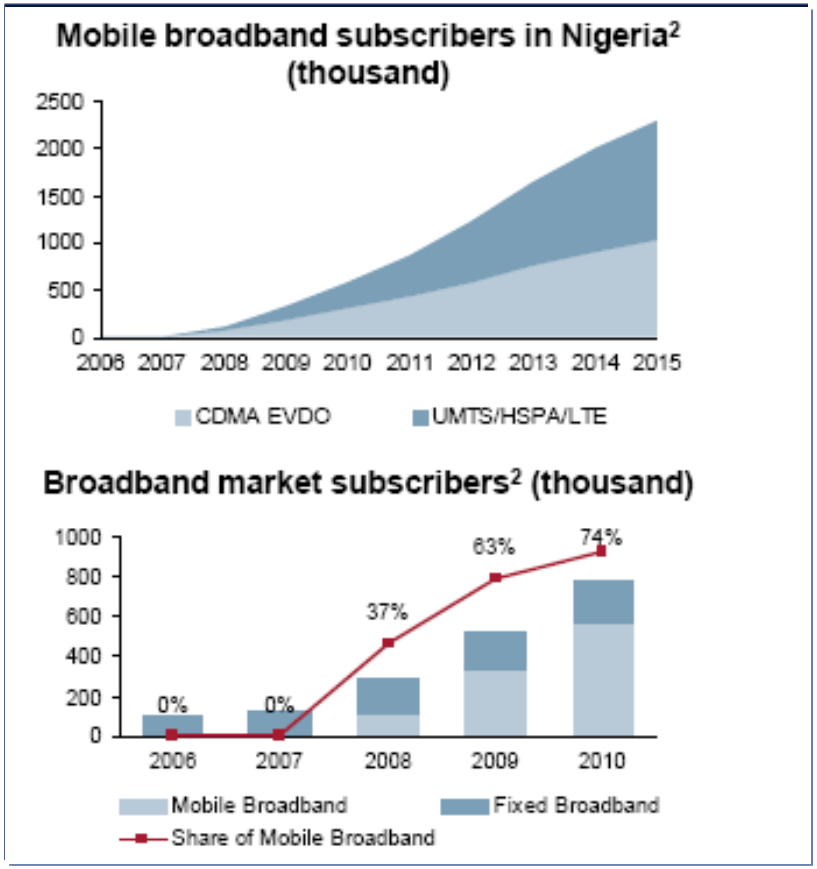


- **Fixed network infrastructure is very limited outside Lagos**
  - State-owned incumbent Nitel has undergone turbulent privatisations, nationalisations and management changes in the last ten years
  - Subscribers to its fixed service, and to mobile division M-Tel‟s mobile service, have been in decline over this period despite huge market growth
- **Wireless broadband** (currently offered using UMTS, HSPA, WiMAX and EVDO networks) **is critical to seizing the opportunity presented by Internet and data access** in Nigeria

Source: Analysis Mason

Nigeria

Mobile broadband services using HSPA and LTE are expected to continue to drive increased broadband reach



CDMA mobile broadband networks were first to launch, **while 3G (UMTS) licenses were only awarded in April 2007**

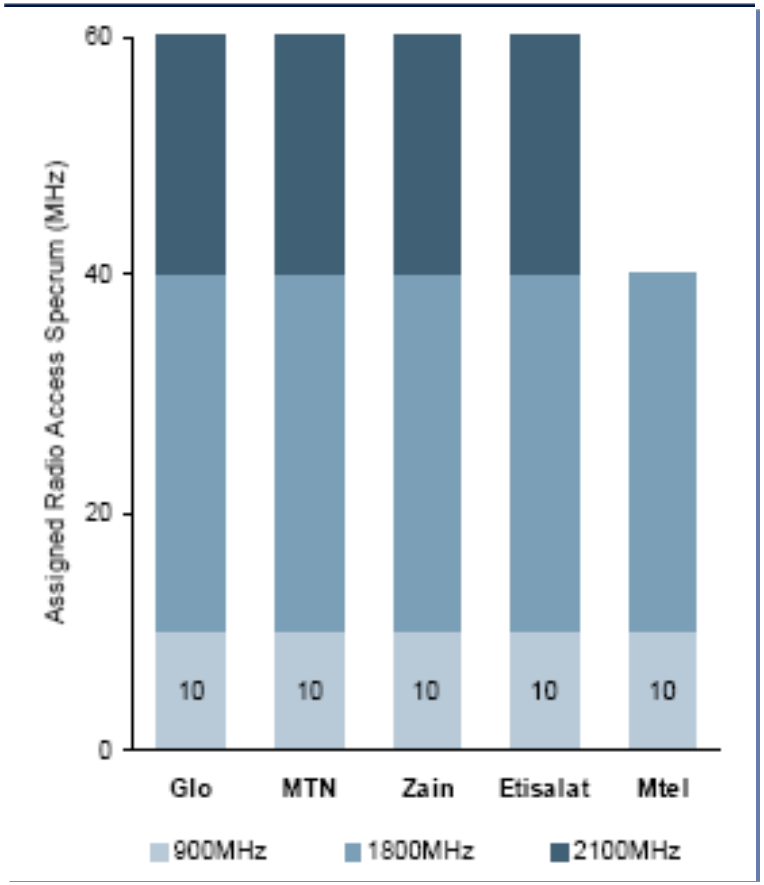
Mobile broadband has created momentum in the broadband market, despite HSPA only being launched in 2008:

- Mobile broadband subscribers now account for over half of all high speed internet service users
- By Q4 2010, it was estimated that mobile broadband connections in Nigeria numbered just under 600 thousand
- By the end of 2011, UMTS/HSPA/LTE share of subscribers is expected to be higher than CDMA, which is likely to remain confined to major towns

Source: Analysis Mason

Nigeria

The Nigerian Communications Commission (NCC) has generally used effective, proportionate regulation



- **While local loop unbundling is in place**, the poor state of incumbent Nitel‟s infrastructure means that it is not used

- NCC has recognized the importance of facilitating market provision of broadband, particularly **through access to spectrum**

- **NCC has used auctions to award GSM licenses** (2001), the second national operator license (2002), 3G licenses (2007) and CDMA and fixed wireless licenses

- However there are spectrum issues emerging that could jeopardize mobile broadband growth:

  There is a lack of clarity over when the vital Digital Dividend spectrum will be passed to the NCC for use by mobile broadband, which could dramatically increase mobile broadband coverage

Source: Analysis Mason

Nigeria

NCC administers several ICT initiatives

	Wire Nigeria (WiN) Project	*State Accelerated Broadband Initiative (SABI)*	*Universal Service Provision*	*The Digital Bridge Institute (DBI)*	*Digital Awareness Programme (DAP)*
Aim	To facilitate the **build out of fibre optic** cable infrastructure	To **stimulate demand** for internet services, and drive affordable home broadband	To provide ICT **access in unserved and underserved areas**	To increase the number of **skilled Nigerians in the telecoms** sector	To encourage the **use of ICT in primary, secondary and tertiary** institutions
Mechanism	Subsidies and incentives to encourage rapid deployment of fibre transmission cables	Subsidy to build broadband infrastructure in all 36 state capitals and urban and semi-urban centres	Subsidies to the private sector	ICT training for over 2000 local and international students. Intended to become privately-run	Computer and internet facilities, basic ICT training for teachers and students

Community Communications Center (CCC)	*Schools, Universities Access Programme (SUAP)*	*Rural Broadband Internet (RUBI) Access*	*Accelerated Mobile Phone Expansion (AMPE)*	*Backbone Transmission Infrastructures*
voice, internet and ICT services to unserved communities on shared basis	connectivity to 360 schools, universities and neighbouring communities	subsidies to private sector to provide wholesale bandwidth to CCCs, cybercafés, rural service providers	network roll out in unserved towns/villages in all 774 Local Government Areas by private sector	voice and data access points in local government area headquarters

Government should consolidate initiatives so as to make maximum use of private sector input, and should aim to ensure that competition is enhanced through those initiatives

Source: Analysis Mason

Contents

8. Summary and conclusions.

1. **No homogeneous competence conditions**. Depending on the geography and economic conditions , **competence based on infrastructures** or on **services** is applied.

2. **Different access alternatives**, like LLU or mobile broadband, must be taken into account in order to analyze markets and define ex-ante obligations.

3. **Next Generation Networks (NGN) investments** open the discussion related to the remuneration of the risk assumed by operators to deploy the networks.
   Traditional weighted average cost of capital (wacc) vs **real options**

4. **Calculating NGN pricing** face some difficulties compared with traditional networks and services: LRIC models - bottom up vs top down

5. **A new investment cycle** bring us new models to be considered: **real options**

6. **New cost reduction strategies (sharing passive or active infrastructures)** for mobile operators will become a key driver to analyze competitive markets considering incumbents and new entrants

7. **Take into consideration geographical areas** is crucial, from a regulatory point of view, in order to provide proportionate obligations.

8. **Spectrum availability (Digital Dividend) for mobile services** could bring new opportunities for rural areas

9. **Public Private Partnership** could bring us a solution for providing broadband services under capital intensive markets: fiber networks deployments,….

Regional Seminar on Costs and Tariffs for Member Countries of the Regional Group for Africa (SG3RG-AFR)

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