ITU Regional Seminar on
Fixed Mobile Convergence and new
Network Architecture for Arab Region
(Tunis, 21-24 Nov. 2005)

WIRELESS ACCESS:
the CONVERGENCE DIGITAL BRIDGE:
A REGIONAL PERSPECTIVE

هيئة الإتصالات وتقنية المعلومات
Communications and Information Technology Commission
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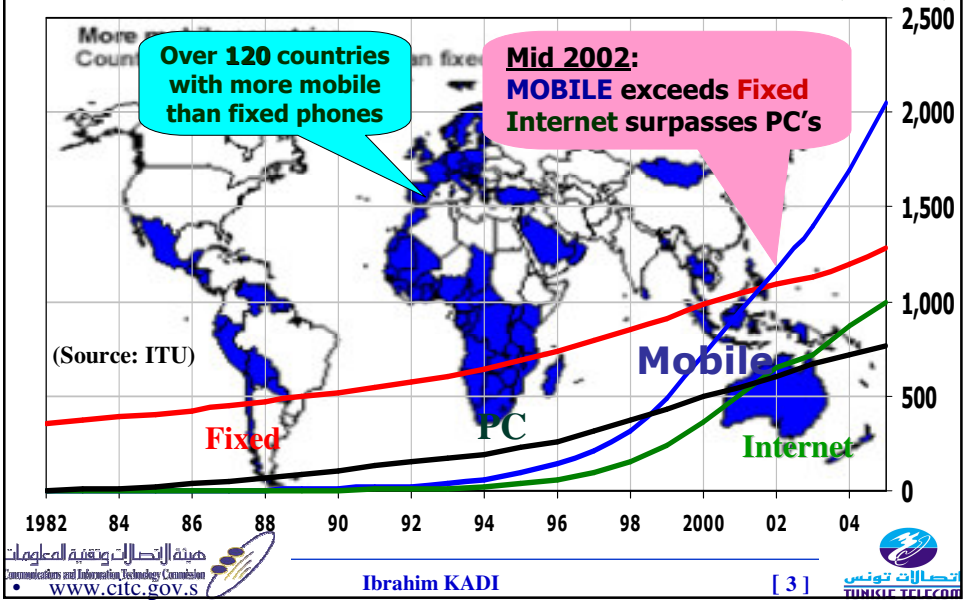
TOPICS

- Introduction: ICT Growth
- Digital Divide
- Universal Access / Universal Service
- Convergence & Broadband
- Wireless Access Solutions
- Conclusions

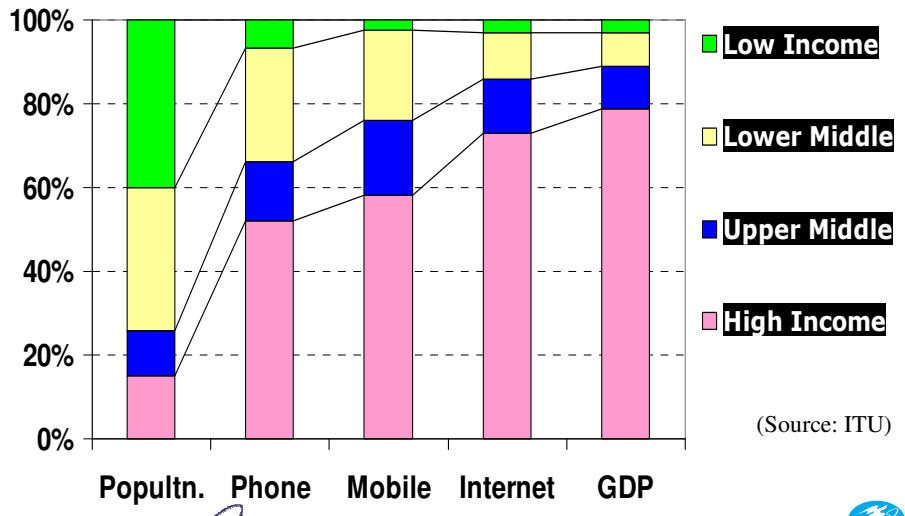
ICT Users keep Growing



But is Information Equally Available to ALL?

The Digital Divide .....

ICT Gap (Digital Divide) = Economic Gap



(Source: ITU)

Monitoring the Digital Divide

- WSIS 1st Phase (Geneva, 2003) called for "Composite ICT Development Index".
- Joint Orbicom-ITU project 2003-2005
- Report Published in October 2005:
  "From the Digital Divide to DIGITAL OPPORTUNITIES – Measuring Infostates for Development"
- Based on the *Infostate conceptual framework*,

Infodensity = *sum of all ICT stocks (capital and labor)*

Info-use = consumption flows of ICTs/period

INFOSTATE

Infostate Index / Indicator

INFOSTATE

INFODENSITY

Networks (Infrastructure)

- Main fixed lines per 100 inhabitants
- Waiting lines/mainlines
- Digital lines/mainlines
- Cell phones per 100 inhabitants
- Cable TV subs. per 100 households
- Internet hosts per 1,000 inhabitants
- Secure servers/Internet hosts
- International bandwidth (Kbs / inhab.)

Skills (Human Resources)

- Adult Literacy Rates
- Gross Enrolment Ratios - Primary Ed.
- Secondary Education - Tertiary Ed.

INFO-USE

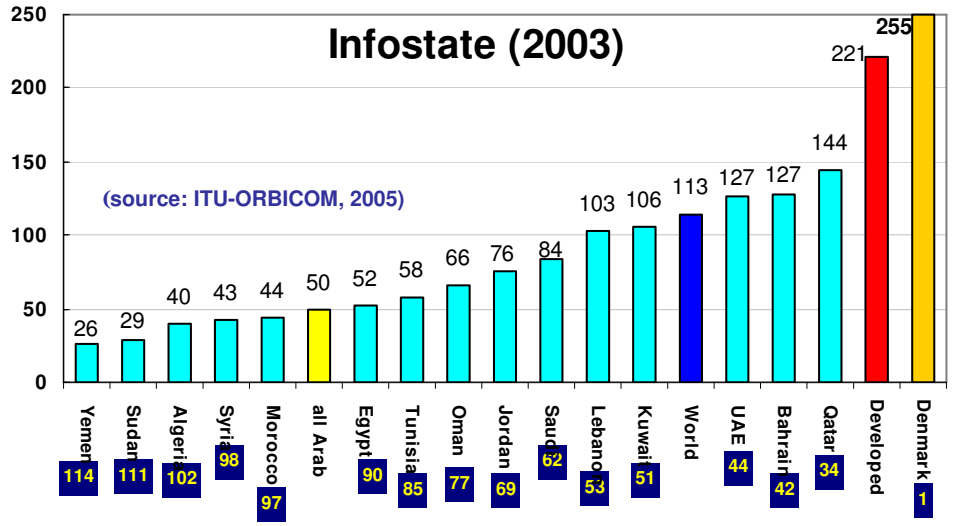
Uptake

- TV equipped households per 100 households (HH)
- Resid. phone lines per 100 HH
- PCs per 100 inhabitants
- Internet users per 100 inhabitants

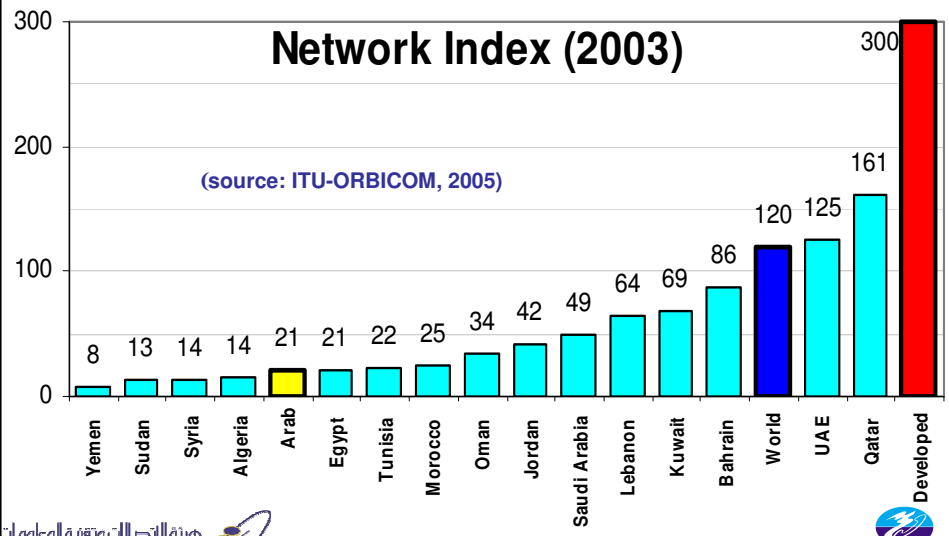
Intensity

- Broadband users/Internet users
- International outgoing telephone traffic minutes per capita
- International incoming telephone traffic minutes per capita

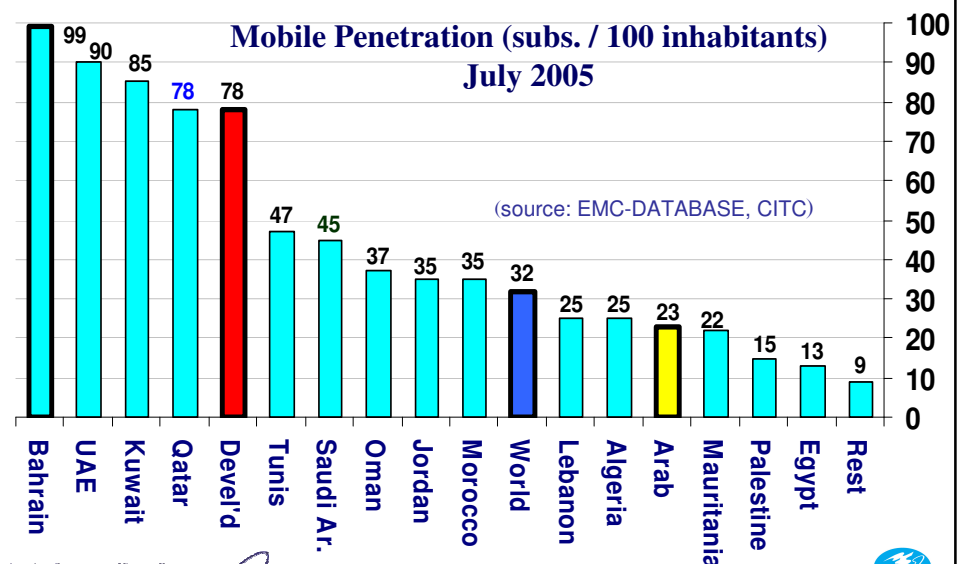
Information Divide: INFOSTATE



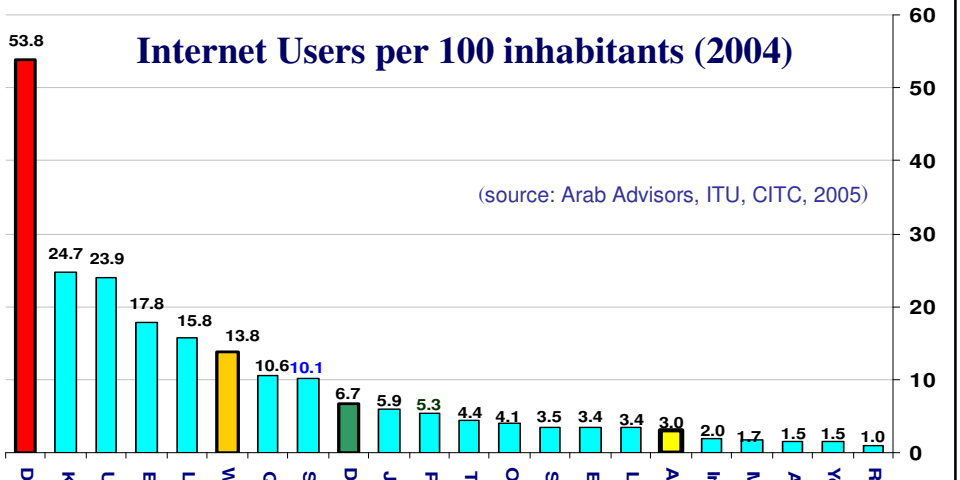
Digital Divide: ICT Networks Gap



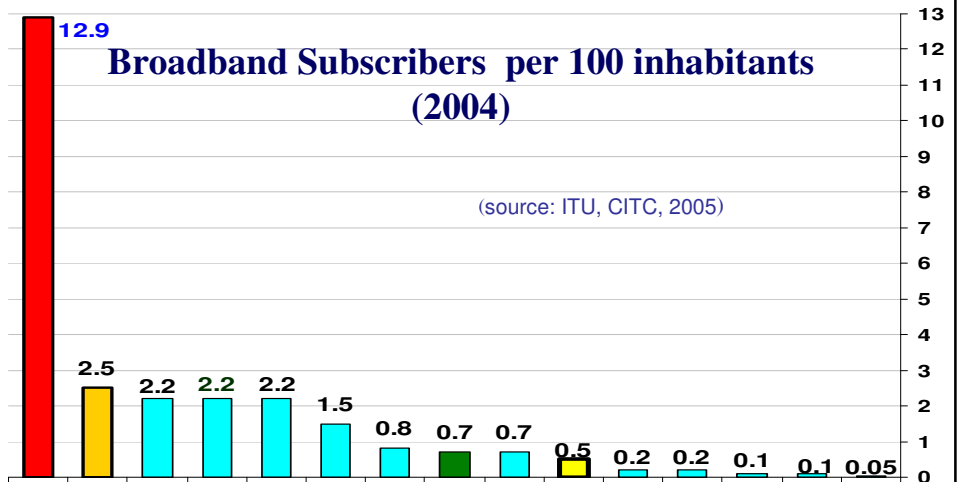
Arab Mobile Density (gap within)

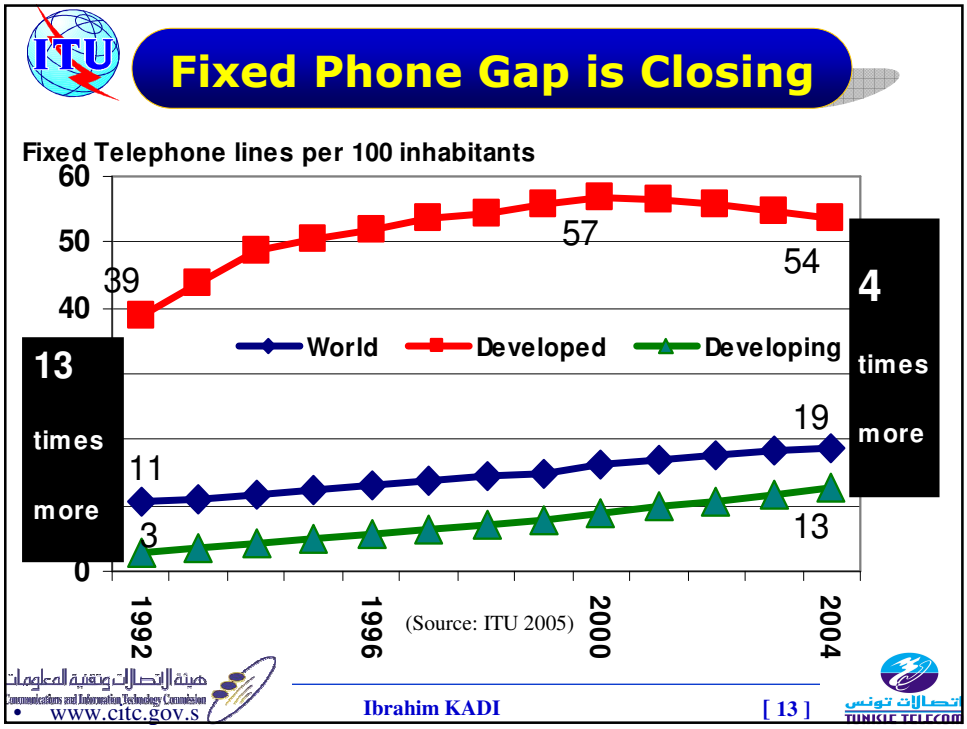


Arab Internet Digital Divide



Broadband Gap is much larger




Fixed Phone Gap is Closing
Fixed Telephone lines per 100 inhabitants
60
50
40
0
39
57
54
11
19
3
13
World
Developed
Developing
13 times more
4 times more
1992
1996
2000
2004
(Source: ITU 2005)
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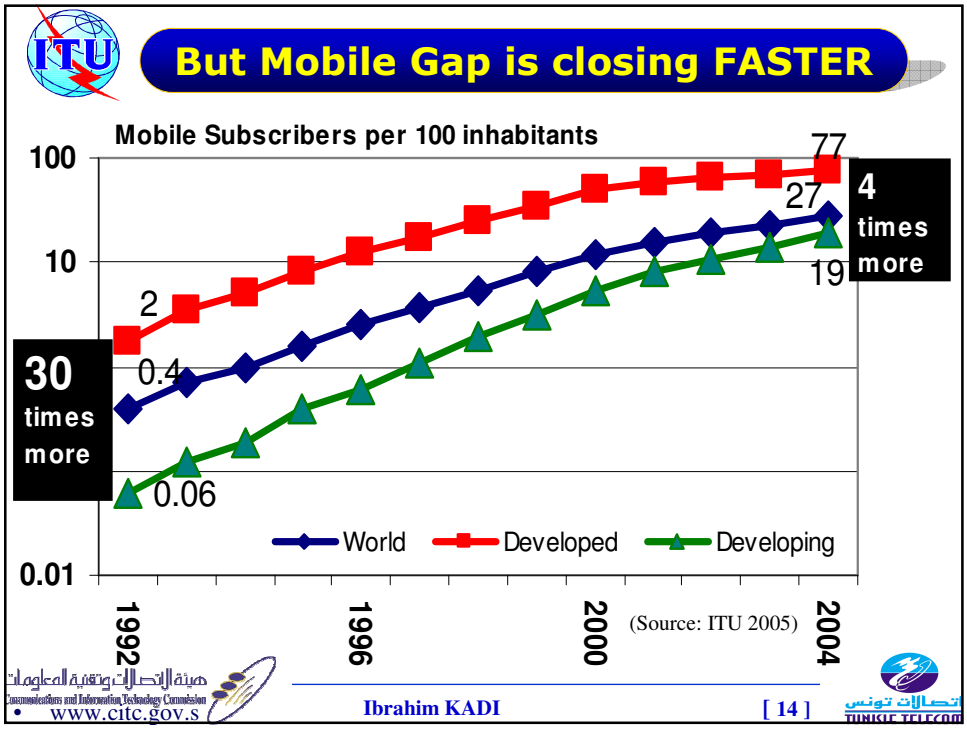
[13]


But Mobile Gap is closing FASTER
Mobile Subscribers per 100 inhabitants
100
10
0.01
77
27
19
2
0.4
0.06
World
Developed
Developing
30 times more
4 times more
1992
1996
2000
2004
(Source: ITU 2005)
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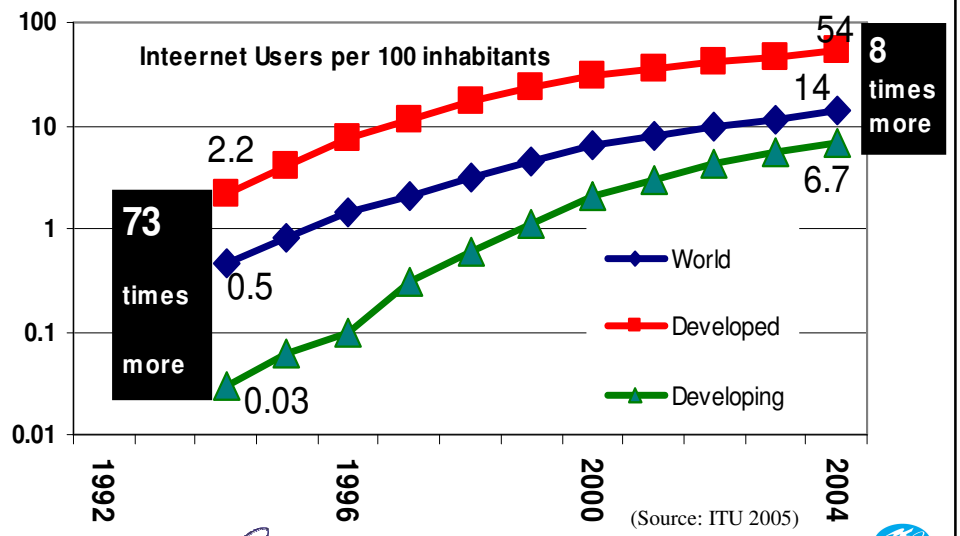
Internet Gap: larger & Closing slower



(Source: ITU 2005)

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- Introduction: ICT Growth
- Digital Divide
- **Universal Access / Universal Service**
- Convergence & Broadband
- Wireless Access Solutions
- Conclusions

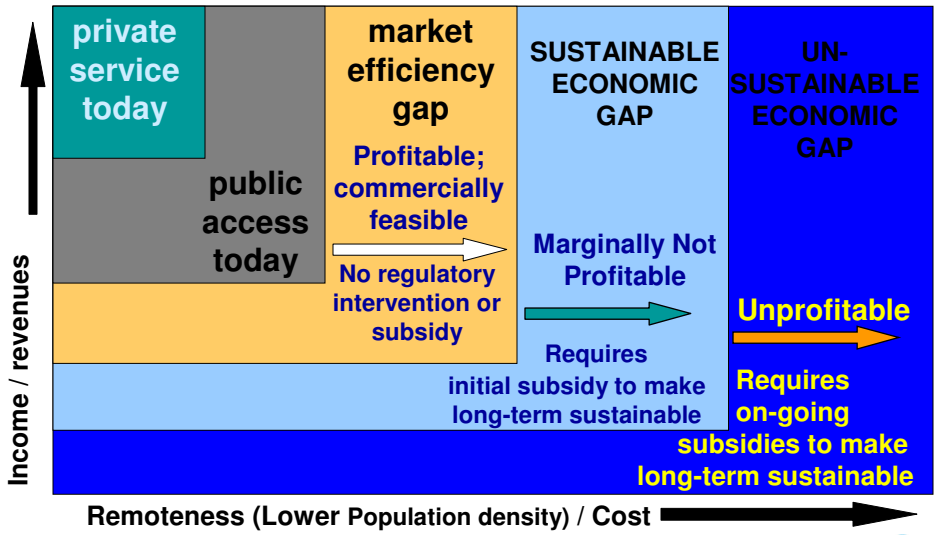
What is Universal Service

- Universal Service (US): implies, literally, 100% of the target population (e.g., every household in the entire country) subscribes to/uses a particular service (e.g., telephone, Data, Broadband)
- Universal Access (UA): a service is "accessible" to 100% of the population, i.e., they have the opportunity to utilize it.
- UA is a goal for providing reasonable access to basic services
- In the Developed World: US = Anytime, Anywhere Access
- In many Developing Countries the scope of UA now includes access to Internet and not only basic phone services
- Universal Access should also address Telecom services at public facilities (e.g.; Schools, Hospitals)

Need for Universal Service in ME/Africa

- A geographically diverse population, with a significant percentage still living in rural or remote areas
- Low literacy rates compared to other regions of the world
- Low per capita GDP and disposable income
- Computer literacy is generally low
- Fixed teledensity is low, but internet usage is much lower. Mobile services have made some progress
- Internet usage is growing in large urban MEA cities, But there is still a large disparity between Urban and Rural areas.
- Other (more serious) forms of Digital Divide:
  - Rural ⇔ Urban - Poor ⇔ Wealthy
  - Gender (Female ⇔ Male) - illiterate ⇔ Educated

US / UA : Market & Economic Gaps



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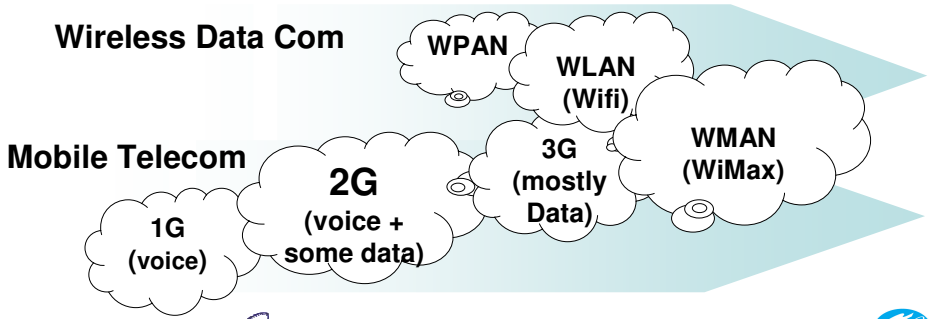
Convergence of Networks

- Convergence is multi-dimensional:
  - Industry: telecom, IT, Media
  - Service: fixed, mobile, data, internet
  - Technology: wireless /wireline, IP-based NGN
  - Device: Telephone, computer, TV / Radio



Impact of Convergence

Developed Countries

- Need to move towards Next Generation Networks (NGN)
- But, legacy investments must be protected….
- Large installed PSTN customer base need to be migrated to broadband access, using either fixed or mobile, or both.
- Mature mobile population will evolve to high speed (3G / HSDPA) technology for broadband access to NGN platforms

Developing Countries

- Clearly identified need to move towards NGN
- Legacy investments are much less of an issue
- Can “leap frog” from outdated technology to NGN and benefit from the experienced gained by early adopters

What is broadband?

- **Broadband (BB) is a connection whose combined capacity, both up and down, sums to 256 Kbp/s or higher** (ITU Definition)
- **The definition of Broadband is a moving target / debatable:**
  - Different meaning/rates to different countries: USA (200 kb/s) OECD (256Kb/s), Sweden (0.5-5 Mb/s)
  - Data rates evolve with time / technology / market demand
- **Driving forces behind its materialization**
  - Market demands: internet / powerful computers / info. Age
  - dramatic progress in data coding and compression techniques and capabilities of microprocessor
- **160 Mill. BB subs (2004): Africa (0.04%), Arab (0.8%)**
- **The poor (Africa/Arab) pay more for less broadband**

Wireless Access: ITU Definitions

Wireless Access systems : are broadband [> 256 Kb/s] radio systems that may be deployed either indoors or outdoors. They include:

- **Fixed wireless access (FWA)**: Wireless access application in which the location of the **end-user termination** and the network access point to be connected to the end-user are **fixed**.
- **Mobile wireless access (MWA)**: *Wireless access* application in which the location of the **end-user** termination is **mobile**.
- **Nomadic wireless access (NWA)**: Wireless access application in which the location of the **end-user termination** may be in different places but it must be **stationary while in use**.

BB: a Dilemma of developing countries

- Debate among developing countries about broadband:
  - BB still a luxury affordable only in rich countries
  - Concentrate on rolling out of basic services
  - Leapfrogging directly to BB neither realistic nor make sense
- Digital Divide / Present state of telecom: not encouraging
- But realities dictate:
  - basic service to deal with Universal Service Obligations (USO) and digital divide, and
  - BB necessary to maintain competitiveness in global economy
- Mission impossible!

Opportunities to ease the dilemma

- Mission seems not so impossible
  - Deploy leading edge but obtainable standard technology, (WiMax, IMT-2000 etc)
  - Take advantage of Fixed Wireless Convergence (FMC)
- Low Teledensity in developing countries
  - roll out of wired access network needs huge investment
  - installation cumbersome / awfully slow
- Broadband Wireless Access – a promising option:
  - Fast to install / cost-effective in investment / operation
  - Coverage faster to extend to bridge digital divide
  - high speed capability / multi services broadband services

Broadband Access Technologies

- **WIRE LINE:**
  - DSL - Cable modems - Fiber
- **WIRELESS:**
  - Mobile wireless networks (3G)
  - Fixed wireless (Wi-Fi, WiMAX)
- **SATELLITE: VSAT & Mobile Satellite (e.g. Thuraya)**
- **FUTURE TECHNOLOGIES :**
  - e.g.; Broadband Over Power Line (BPL), PLC, ……

New Wireless technologies cheaper to deploy than legacy wire line networks

Wire Line Broadband Access

- **Digital Subscriber Line (DSL):**
  - Dominant BB Access Tech. Today (60%), mostly in developed countries,
  - Issues for developing countries:
    - Unavailability or poor quality of copper wire local loops
    - Attainable speeds decrease with distance from exchange: good for condensed areas (Cairo, Bahrain)
    - Poor performance: high ambient temperature, and longer typical distances of local loops in rural & suburban areas (Riyadh, Khartoom)
- **Cable (CATV) modems**:
  - Existing TV cable infrastructure, mostly in N. America, and Europe,
  - Huge investment – not cost effective for developing countries
- **Fiber**: to the home/premises (FTTH / FTTP), Fiber to the Zone
  - Best technology: highest rate, best performance, … , But
  - Expensive, not cost effective, not an option for rural access
  - Ideal solution for backbone (e.g., electric grids fiber)

Broadband Over Power Line (BPL)

- Access BPL provides high speed data connection/services to users over existing power lines
- "In House" BPL allows for networking of electronic devices over existing wiring in the home
- Developed Countries: Still emerging -- some utilities, hotel operators and others are deploying experimental and operational BPL systems.
- Developing Countries: Promising Option for BB in Urban Rural communities (if connected to electric power grids)
- Electric Power Grids offer other US/UA communication opportunities (yet another type of convergence): Optical fiber over Transmission towers, Right of Way (RoW)

Cellular Mobile Success

- ☑ Fastest growing service in history
- ☑ 2 Billion users mostly 2G-GSM (1.5 B. in 200+ countries)
- ☑ 2G: mainly voice, limited data rates
- ☑ 2.5G ➔ higher rates: GPRS (171 Kb/s), EDGE (384 Kb/s)
- ☑ 3G (IMT2000) delivers broadband: up to 2 Mbp/s, HSDPA: downlink rates up to 14 Mbp/s
- ☒ 2.5G / 3G coverage is still patchy, requires major investments
- ☒ Business Case for 3G deployment in developing countries:
  - UNCERTAIN in Urban areas
  - NEGATIVE for Rural

Cellular for BWA in Developing Countries

- Attractive for Rural Access and Universal Service
  - Open Standard, Unique economies of scale, Harmonized spectrum worldwide
  - Pervasive Coverage (75% of population in developing world)
  - Issue: Affordability (high prices & low disposable income)
- Proposed Solutions for Rural Areas:
  - "cost-based-pricing" instead of conventional "market pricing" used across whole service areas (Urban & Rural)
  - Reduce operator cost in Rural Areas: licenses fees, free spectrum, free access to public lands and RoW
  - Lower price differentials: pre-paid vs. post-paid, off-net vs. on-net

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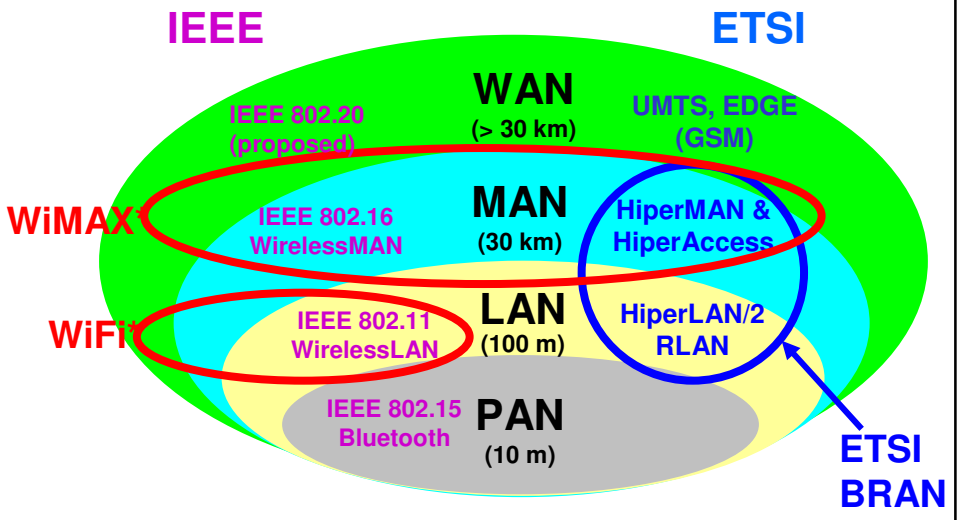
Broadband Wireless Access Standards



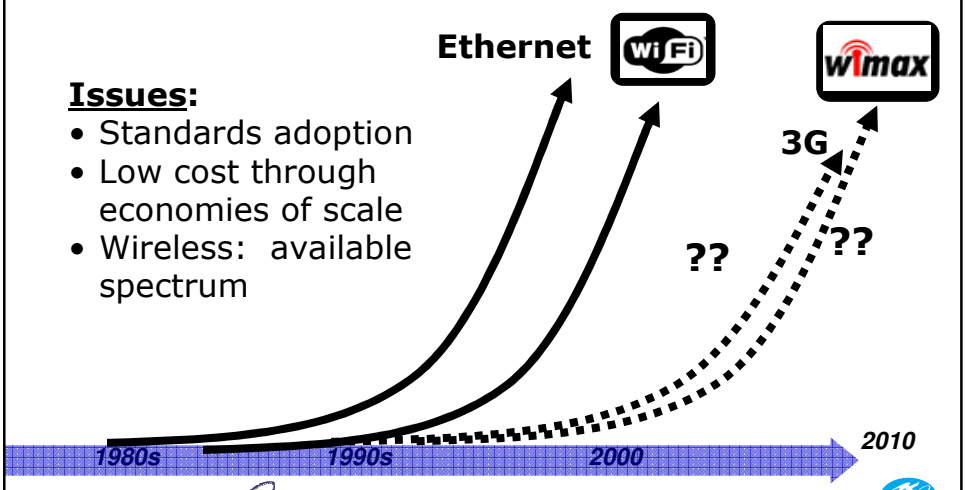
BWA Standards

Technology	Standard	Usage	Throughput	Range	Frequency
UWB	IEEE 802.15	Personal Area Net. (PAN)	110-480 Mbps	Up to 10 meter	4 to 10 GHz
WiFi and HyperLAN 2	IEEE 802.11 & ETSI Standard	Radio LAN with other FWA	Up to 54 Mbps	Up to 100 meter	900 MHz 2.4 GHz 5-5.8 GHz
WiMax	IEEE 802.11d and 802.11e	Radio MAN (fixed & mobile)	Up to 75 Mbp/s on 20 MHz and up to 30 Mb/s for mobility	7-10 km (fixed) 2-5 km (mobile)	2.1, 2.3, 2.5-2.6 & 3.5 GHz
3G Mobile (UMTS & CDMA 2000)	IMT - 2000	Cellular Wireless Wide Area Network	Up to 2 Mb/s	2-8 km	800-900 MHz, 1.7, 1.8, 1.9, 2.1, 2.3, 2.8 GHz

BWA Standards Position

Issues:

- Standards adoption
- Low cost through economies of scale
- Wireless: available spectrum



Spectrum Shortage

- Single Most Critical Issue in Mobile & BWA Growth/Performance
- Limited Allocations for Wireless Access and Mobile:
  - Broadcasting Allocated Most of Spectrum Below 1 GHz
  - GSM Spectrum 890-960 MHz, 1800 MHz , 1900 MHz
  - New 3G Allocations (160 + 200MHz) - WARC 2000, Istanbul
- High Spectrum License Costs
- Basic Law of Economics: Limited Supply, Growing Demand
- Basis for any Meaningful Pricing Strategy:
  - Set Tariffs / Air Time Cost as per Spectrum Used

Spectrum is critical

- Critical For Any Wireless Access System Deployment
- Availability / Flexibility
- Major Impact On Data Rates (Broadband) & Available services
- Major Impact On Cost, and Affordability
- Need to maximize Spectrum Utilization Efficiency
- Lower frequencies Better for universal service in rural areas :
  - better propagation ➔ wider coverage / lower cost
  - limited bandwidth ➔ lower data rates
  - Good Example: Russia 450 MHz deployment
- Many developing countries have 450MHz available for licensing
  - Rural BWA fits perfectly in the NMT 450 spectrum band

Spectrum Regulatory Models: Benefits and Limits

- **Command and Control Model:**
  - Strict operating parameters originally designed for the previous generation of inflexible radio system designs
  - Requires constant intervention from the regulator which could slow innovation and market development
- **Exclusive Model:**
  - Exclusive licenses based on geography and spectrum blocks
  - Provides the greatest level of investment certainty
  - Need to provide incentives to encourage network build out.
- **Unlicensed or License-exempt Model**
  - Standardized equipment and mass production on a global standard
  - could lead to overcrowding and resulting interference
  - Careful application of power limits and sharing rules should be considered

Spectrum Management Best Practices To Promote BWA (GSR 2005)

1. **Facilitate deployment of innovative broadband technologies**
2. **Transparency:**
3. **Technology and service neutrality**
4. **Flexible use measures**
5. **Ensure affordability**; Reasonable spectrum fees for US/UA BWA
6. **Optimize spectrum availability on a timely basis**
7. **Manage spectrum efficiently**
8. **Ensure a level playing field**
9. **Harmonize international and regional practices and standards**
10. **Adopt a broad approach to promoting broadband access: incl. other reg. instruments (competition, infrastructure, USO) and incentives**

(source: GSR Nov. 2005)

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Broadband: Benefits

- Broadband is an accelerator of social and economic development:
  - Making the power of communications accessible to all
  - Enhancing productivity, enabling tele-working
  - Offering new tools for public safety and homeland security
  - Improving public health through telemedicine and digital hospitals
  - Educational tools in classrooms & distance learning capabilities
- Broadband applications enable economic & social benefits:
  - Public safety and national security
  - Tele-work
  - Emergency Services
  - Distance learning/educational tools
  - Accessible communications for persons with disabilities
  - Telemedicine
  - E-Government / commerce
  - Utility applications

BB in developing countries Requires regulatory / government support

- Broadband Access Provision:
  - Little incentive to deploy broadband networks: low demand / limited competition / limited funds
  - Lack of promoting regulatory framework
- Connectivity:
  - Lack of backbone networks
  - Incumbent ownership of existing backbone networks
  - Limited international connectivity and local hosting
- Demand:
  - Limited consumer demand: high prices / voice emphasis / limited local content
  - Limited co-ordination/promotion of broadband benefits

Broadband Regulatory Priorities

- Facilitate market entry by all potential broadband providers
- Remove barriers that impede BB infrastructure investment
- Technology neutraliy and free access to spectrum
- Encourage infrastructure investment, with incentives as needed
- Coordinate with other sectors to access alternative fiber backbones connectivity (e.g.; electric grids, railways)
- Focus on wireless access technologies (BWA)
- Encourage small-scale market operation, esp. for rural areas
- Drive BB demand from government and public service and promote commercial content / application development
- Raise BB awareness among all key stakeholders
- Develop mechanisms to lower costs end-user terminals

Conclusion

- Digital Divide is multi-dimensional: between countries and within countries (Rural vs. Urban, Poor / Rich ….. etc.)
- A well developed Telecom infrastructure (and broadband) contribute positively to GDP growth
- The Arab / Africa Region needs an “economical” solution for driving Universal Coverage.
- BWA is the best option for Universal Service / Access for both urban and rural communities
- Mobile systems and BWA (particularly WiMax at sub 1 GHz band) offers good solutions for Low Cost Voice coupled with Broadband Data speeds

Acknowledgements to:

- ✓ ITU &TUNISI TELECOM
- ✓ Seminar Organizers (Staff)

☺☺ **THANK YOU** ☺☺

FOR YOUR ATTENTION

…… and QUESTIONS ……

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