

# **WiMAX**

## **AN EFFICIENT TOOL TO BRIDGE THE DIGITAL DIVIDE**

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## 1. Abstract

This paper is intended at first to explain the various aspects of what we use to designate as the « Digital Divide » especially between and within countries. It stresses the importance of this new challenge, the “Information Society for all”, as stated in December 2003 by the United Nations and the ITU in the Declaration of Principles of the World Summit on the Information Society.

In the second part, it describes why and how, WiMAX will be a key element in this new important worldwide objective to provide a « universal ubiquitous and equitable and affordable access to ICTs infrastructure and services ».

## 2. What is the Digital Divide?

### *How to define the Digital Divide?*

The idea that “access to information” opens doors to wider economic and social development opportunities is not new. In 1984, the “Missing Link Report” pointed the fact that the lack of telecommunication infrastructure in developing countries impedes economic growth, but with a scope limited to access to telephones rather than today’s wider concept of Information and Communications Technologies (ICTs) access and usage. In 1996, the ITU initiated a United Nations project for the “Right to Communicate” aimed at providing access to basic ICTs for all, with motivation to reduce information poverty for developing countries. This goal is now at the heart of plans of the World Summit on the Information Society (WSIS).

Thus, during the first WSIS held in Geneva in December 2003, the “Digital Divide” was defined as the unequal access to Information and Communication Technologies (ICTs).

Although this unequal access usually apply to differences between countries (the international digital divide) e.g. comparing developed and developing countries or regions, some analysts also describe unequal access as applying within countries (the domestic digital divide) and most importantly the divide between rural and urban, well educated or poorly educated populations or poor and rich citizens.

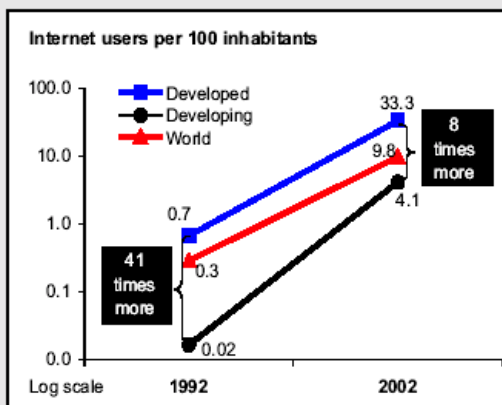
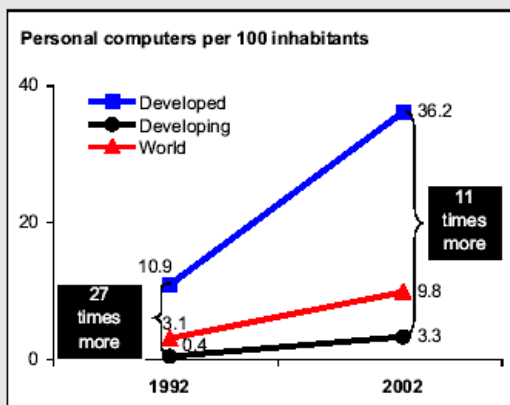
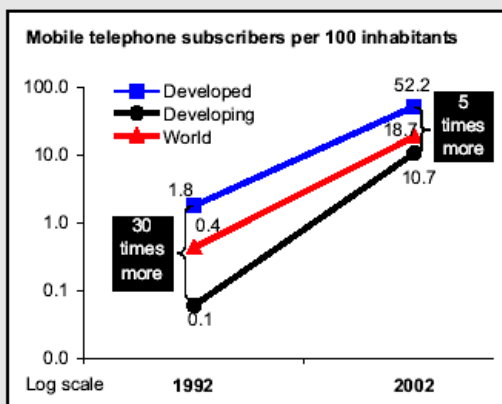
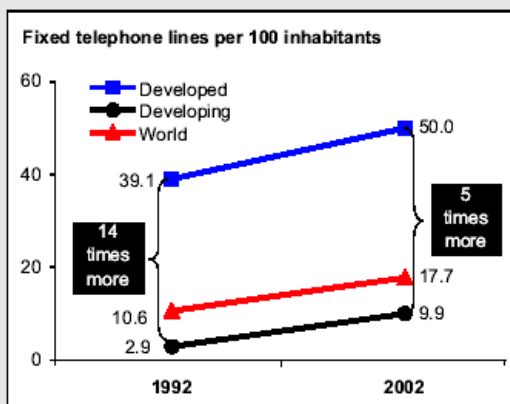
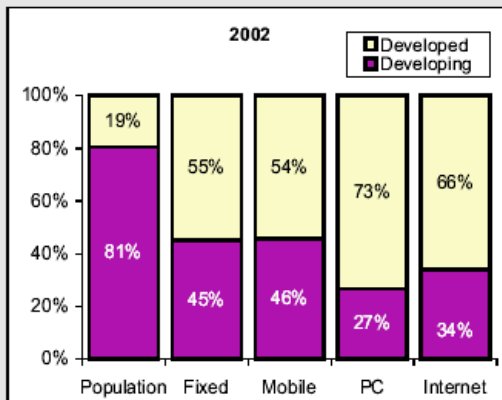
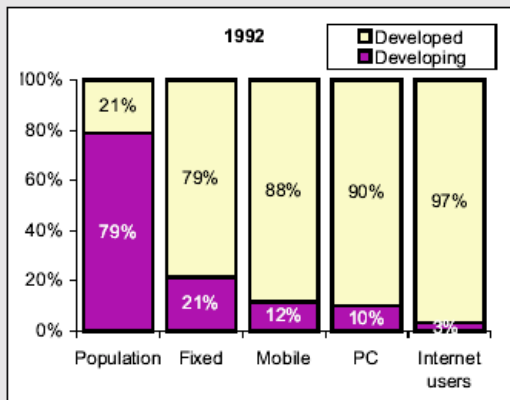
### *How wide is the gap and what is the trend: growing or closing?*

As a result of recent measurement indicators, depending on the selected criteria e.g. Internet host and/or users, fixed and/or fixed and mobile telephones and looking at their evolution across the past years, e.g. in developed and developing countries, different views are expressed stating either an overall trend of growing ICTs disparities between and within countries or demonstrating that, in relative terms, the gap between rich and poor countries is closing.

Despite the various parameters that can be considered, the availability and the quality of the access, i.e. the physical telecommunication infrastructure, is the key to a quick and reliable development of ICTs in the countries. Looking closer to the statistics as published by the different official bodies such as ITU or the World Bank, it is clear that the gap in ICTs access between developed and developing countries does exist and is still quite important.

**Figure 4.3: How wide the divide?**

*Distribution of population, fixed and mobile telephone subscribers, personal computers and Internet users and fixed and mobile telephone subscribers, personal computers and Internet users per 100 inhabitants, by economic grouping, 1992 and 2002*



Note: Developed includes Western Europe, Australia, Canada, Japan, New Zealand and the United States. Developing refers to all other countries. Source: ITU World Telecommunication Indicators database.

### 3. The new Development challenge: to bridge the Digital Divide.

Very recently, on June 16th 2005, ITU published a press release announcement favoring “partnership as the key to connecting communities”. The initiative, called “connect the world” is a global multi-stakeholder effort established within the context of the WSIS to encourage partnerships to bridge the digital divide.

The objective is to “bring access ICTs to the people worldwide whom making a simple telephone call remains out of reach”, keeping in mind that “at present ITU estimates that around 800’000 villages, or 30% of all villages worldwide, are still without any kind of connection”.

The article also makes the following statement:

“At present the 942 million people living in the world’s developed economies enjoy five time better access to fixed and mobile services, nine times better access to Internet services and own 13 times more PCs than the 85% of the world’s population living in low and lower-middle income countries. But while figures do show a clear improvement over the last ten years in bridging the gap between information “haves” and “have-nots”, they nonetheless fail to paint a true picture for many rural dwellers, whose communities are still often un-served by any form of ICT.”

As industry player, the WiMAX forum is fully committed in providing in the very near future a new suitable wireless technology standard to cope with the new Millennium Development Goals aiming at “a global partnership for development” (Goal 8) and more specifically through Target 18 “in cooperation with the private sector, make available the benefits of new technologies, especially Information and Communications” and the objective that: “every one can create, access, utilize and share the information and knowledge, enabling individuals, communities and people to achieve their full potential and improve their quality of life in a sustainable manner.”

Further more, the new WiMAX wireless technology will perfectly cope with 2 of the WSIS goals for 2015:

- Target 1: to connect villages with ICT’s and establish Community Access Point, knowing that it is estimated that 1.5 million villages in developing nations remain unconnected to telephone networks.
- Target 10: To ensure that more than half the world’s inhabitants have access to ICT’s within their reach, knowing that the total number of estimated Internet users in 2002 was around 600 million, or just under ten per cent of the world’s population.

## 4. What are the barriers to the broadband ICTs access deployment?

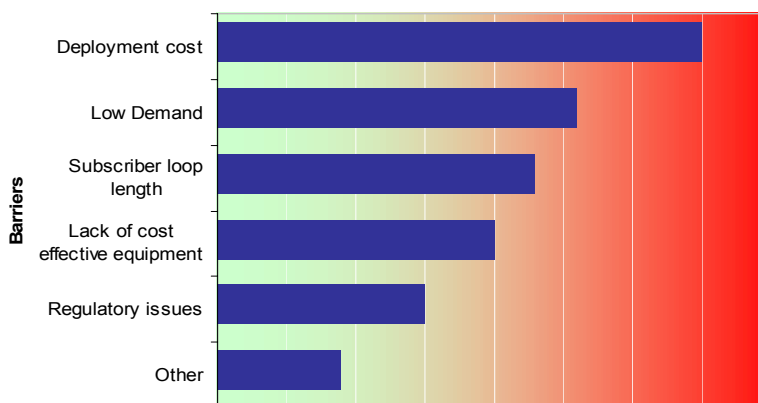
There are many reasons why, until now, broadband ICT access was mainly deployed in developed countries and more precisely in urban areas. However it can easily be explained that economics and existing technologies are the main drivers (and barriers in developing countries) to ICTs.

Economics at first because, as any early entrepreneur in this new business, operators and service providers are naturally inclined to first serve the most populated areas, i.e. dense, rich cities and suburbs where most of the potential customers are located instead of less populated areas such as remote and rural areas. In the same way, while developed countries and urban areas are requiring higher and higher bit rates for multimedia applications, rural areas in developing countries are still at first favoring voice communication with a slow evolution towards ICTs. Moreover, while developed countries already have existing telecommunication infrastructure ready to evolve and the financial resources to invest and pay for new services, developing countries still suffer from the lack of basic infrastructures ( not only telecommunication infrastructures, but also electricity supply, roads...etc.) and more crucial have great difficulty to mobilize the necessary financial resources. This is what we will call as the “demand factor”.

Technologies as well because, until now, existing wired or wireless technologies have inherent limitations either in performances or in capacity (e.g. the 6 Km maximum distance from the exchange for ADSL) or the Line Of Site (LOS) Customer Premise Equipment (CPE) location from the base station for wireless access. And even if such limitations can be overcome using other complementary backbones or equipments (optical fibers or microwaves links, remote switching units...etc), the extra cost of these new equipments, of their deployment and their operation directly impacts the business model. This is what we call the “cost factor”.

Both the “Demand” and “Cost” factors are the major barriers to the broadband access as identified by ITU in the following chart.

**Major barriers to broadband access deployment**



Source ITU 2003

## 5. WiMAX a new powerful technical innovation to bridge the digital divide.

### *What is WiMAX?*

WiMAX is a broadband wireless technology that is largely supported by the computer and the telecom industry, cost-effective and standard base. It is engineered to deliver the latest type of ubiquitous fixed and mobile services such as VoIP, Information Technology and Video at very low cost. WiMAX systems are able to cover a large geographical area, up to 50 km and to deliver significant bandwidth to end-users up to 72 Mbps

This paper intends to highlight some points that make WiMAX the most appropriate technology to reduce digital divide.

For more details on the WiMAX standard-based technology, the reader will refer to other published white papers on WiMAX, however in very short WiMAX can be summarized as follows:

- WiMAX stands for “World Interoperability for Microwave Access”.
- WiMAX/IEEE 802.16 is a global standard-based technology for Broadband Wireless Access Equivalent to Wi-Fi Alliance for IEEE 802.11
- WiMAX forum will certify Interoperability of IEEE 802.16 and ETSI HiperMAN

### *Why WiMAX?*

Compared with other wired solution such as ADSL, or any other wireless or satellite system, WiMAX based access networks will enable operators and service providers to cost-effectively reach million of new potential customers providing them with broadband ICTs access. This is even truer for developing countries and rural areas for which the cost/profitability and the demand factors are essential. This obviously includes adequate coverage, reliability, performances (throughput), capacity and applications.

### *WiMAX: the ease to install*

Ease of installation is one of the key issues to lower deployment costs in developing countries or rural areas.

In rural areas, the consequences of the long distances from the core network access point and the scattered location of villages, farms... in the countryside makes any deployment very costly. In developing countries, the lack of main infrastructure (electricity, roads...), and environmental condition (temperature, humidity...) adds on the difficulty.

Thanks to the NLOS/LOS coverage advantage, the operator/service provider can easily plans a 95% predictability coverage ensuring high installation success rates and controls deployment costs. A quicker

and simpler installation with a much greater rate of success means operators spend less money rolling out their networks.

WiMAX NLOS capability also allows indoors self install CPEs within several Km radius.

### *WiMAX: the wide coverage*

Even more important than the range limitation, the coverage, i.e. the capability to reach any potential customer within the base station covering area, is essential for the operator/service provider.

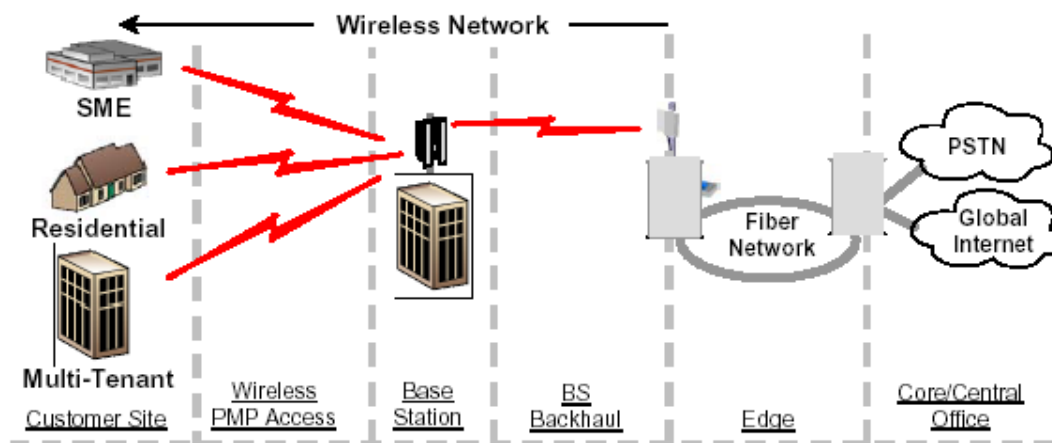
While many currently available wireless broadband solutions can only provide Line-Of-Site (LOS) coverage, WiMAX, thanks to its OFDM technology, has been optimized to provide excellent Non-Line-Of-Site (NLOS) coverage (up to 15 Km around the base station) and long range transmission up to 50Km in LOS conditions.

Combining both LOS and NLOS coverage, WiMAX is the ideal solution for getting the exact requested coverage in the most economical way.

### *WiMAX: the flexibility*

Wireless is more flexible and thus easier to deploy according to the market demand (Capex follows the needs).

Although most of the existing wireless technologies suffer from limited range and coverage (usually a few hundred meters around the base station) resulting in very costly combination of technologies (wired and/or wireless), WiMAX technology benefits of a wide coverage and can be deployed as a Point MultiPoint “last mile” connection but also as part of the backhaul to the PSTN and Internet access points. The WiMAX role in an access network is illustrated in following scheme.



With potential range of 30 to 50 kilometers in Line Of Site (LOS) conditions, WiMAX offer a huge improvement over all existing broadband wireless technology.

With the addition of the capability for the operator to adapt its network configuration to his marketing strategy (coverage, throughput, services, and grade of service) WiMAX provides a very powerful solution

to meet the operator's objective for profitability.

### ***WiMAX: a multi-application technology***

Following the normal trend of digitalization and packet transmission and switching, WiMAX uses the Internet protocol and thus supports all multimedia services from Voice over IP (VoIP) to high speed internet and video transmission. WiMAX allows service providers to offer all the latest generation of services and beyond, thanks to a throughput up to ten's of Mbps. With regard to the potential users, this means that WiMAX have the capacity to deliver services from households to SME's, SOHO's, Cybercafés, Multimedia Telecentres, Schools and Hospital...

### ***WiMAX: the Worldwide Standardization benefits***

Developed and supported by the WiMAX forum (more than 300 members), WiMAX will become the worldwide technology based standard for broadband and will guaranty interoperability (i.e. multivendor CPEs), reliability and evolving technology, but also, thanks to high volumes and integration, will ensure equipments with very low cost. With CPEs under 100 \$ as one of the first objective, business model can easily be profitable even in developing countries.

### ***WiMAX: the Spectrum flexibility***

In line with the objective to become the worldwide standard based technology for broadband, WiMAX will use a single radio covering all licensed and unlicensed frequency bands allocated by the ITU for such services i.e.:

- The two licensed bands 3.3-3.8 GHz and 2.3-2.7 GHz
- One license exempt band 5.725-5.85 GHz.

In addition to the flexibility offered to address all national spectrum situations, this single radio, thanks to the volume effect, will makes base stations and customer premises equipment costs very attractive.

### ***WiMAX: The financial solution to favor the broadband access in developing countries***

WiMAX technology flexibility allows a great variety of services, type of users and progressive deployment in any geographical locations. This means that the same network can support private and public services and thus favor financial partnerships.

### ***WiMAX: a solution that allows strong competition***

WiMAX is part of an Internet ecosystem. It is cost effective for a few or for a million subscribers, it is easy to deploy, to install, it is transparent and secured and thus allows strong healthy dynamic competition among different types of service providers. It is an adequate solution for ILEC, Wireless Internet Service Providers, Local community, Government...

Allowing competition in developing country is the fastest way to provide services in unserved areas.

### ***WiMAX: for fixed and mobile access***

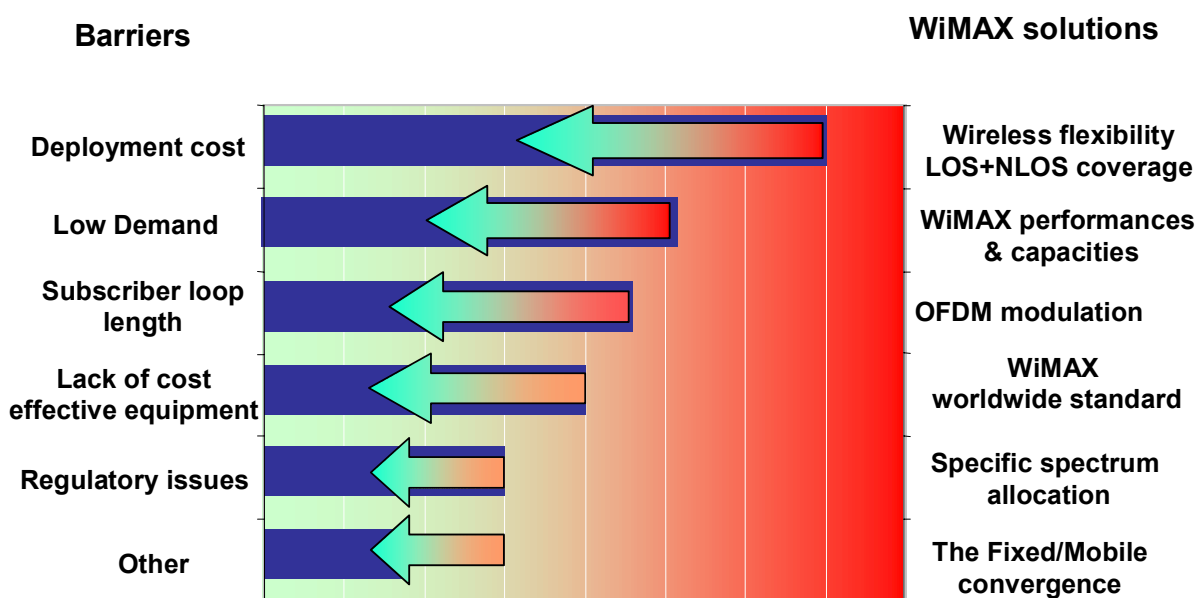
The WiMAX networks will be able to support fixed, nomadic, portable and mobile wireless broadband connectivity on the same network.



## 6. Conclusion

Looking back to the barriers as summarized by ITU, WiMAX appears clearly as the solution to favor the broadband access in developing countries.

### How WiMAX will break the barriers to broadband ICTs



To conclude, WiMAX is a new powerful broadband wireless technology aiming at providing a « universal ubiquitous and equitable and affordable access to ICTs infrastructure and services » and thus highly contributing to bridge the “Digital Divide”.

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