Broadband for Development in the **ESCWA Region**

Enhancing Access to ICT Services in a Global Knowledge Society

Alcatel·Lucent

UN-ESCWA

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Foreword

Broadband is used today by almost 250 million people worldwide. It is revolutionizing the way people communicate, seek knowledge, access public services, entertain, and do business. The new broadband revolution – wireline or wireless – is making changes to the telecommunications landscape which could be as important as those made by the advent of the Internet and mobile telephony, yet with an even greater impact on content development and dissemination, thus leading to accelerated socioeconomic development.

Broadband access is also drastically changing the economic model for operators. Boundaries are becoming blurred between categories of service providers that until now were separate, namely telephony operators, Internet service providers, and television content providers. Broadband will trigger the creation of multi–service providers who will offer their services to subscribers any place, any time and through a variety of devices.

This report highlights the vast development potential in the ESCWA region as it moves towards the broadband revolution, with examples of concrete business cases focused on selected countries. It also provides an assessment of factors that hinder the deployment and spread of broadband, while proposing concrete actions to guide ESCWA member countries in their quest for enhanced infrastructure to build the knowledge society. It is meant to help stakeholders in the development of broadband in the ESCWA region, including governments, regulators, operators, service providers and civil society at large.

We are pleased to present this publication, produced by ESCWA's Information and Communication Technology Division and the Alcatel–Lucent Digital Bridge Initiative Program, as a joint contribution to the development of broadband in the ESCWA region for the benefit of socioeconomic development. It is the result of collaborative efforts between a worldwide leader in telecommunications, particularly in broadband equipment manufacturing, and a United Nations organization in charge of regional economic and social development. It capitalizes on the two organizations' complementary expertise and objectives, and is aimed at allowing stakeholders to benefit from the development of broadband in the ESCWA region. In this regard, we wish to pay tribute to Ms. Mervat Tallawy, Executive Secretary of ESCWA, for her commitment and encouragement.

Finally, this collaboration is an illustration of the multi–stakeholder approach advocated by the outcome of the World Summit on the Information Society. Our respective organizations are committed to contributing to the implementation of the Geneva Plan of Action and the Tunis Agenda, in order to reduce the digital divide and bring the benefits of information and communication technologies to all.

Yousef Nusseir
Chief, ICT Division
UN–ESCWA

Thierry Albrand
Vice–President, Digital Bridge
Alcatel–Lucent

Executive Summary

This report is a joint endeavor by Alcatel–Lucent and ESCWA.[1] It is intended to build a regional framework for broadband deployment in the ESCWA region, as a contribution to the outcome of the World Summit on the Information Society (WSIS), and as part of ESCWA's regional Plan of Action (RPoA) for building the information society in Western Asia. This report also contributes to Alcatel–Lucent's commitment to ESCWA's regional plan of action, and to Alcatel–Lucent's overall Digital Bridge Initiative program.[2]

Furthermore, it provides guidelines for ICT policymakers with respect to infrastructure development at the national and regional levels, as requested by the "Workshop on information and communication technology policymaking in ESCWA member countries",[3] held in Beirut from 2 to 4 May 2006, within the framework of the United Nations Development Account project on "Capacity building for ICT Policymaking".

The approach adopted in this report is three–dimensional. The first dimension is an analysis of the status of broadband deployment in the ESCWA region, substantiated by specific country case studies. The second is an assessment of lessons learnt from international experience, focusing on what has made broadband a success in other countries. The third dimension consists of an evaluation of technologies and business cases that may support *broadband for socioeconomic development* in the region.

Although the definition of broadband might vary from one country to another, it is commonly accepted that it is a *high-speed, always-on* (as opposed to dial-up) connection to the Internet. Broadband availability is widely perceived as a powerful catalyst for socioeconomic development. It enables the delivery of content, promotes the development of new services, and boosts useful applications such as e–education, e–health, e–government and e–business, which offer significant benefits to individuals and communities, government institutions and businesses.

Since the late 1990s, broadband has witnessed remarkable growth around the world. The global number of broadband subscribers in the world was estimated at about 200 million in 2005, and 250 million in 2006, representing 35–40% of all Internet accounts. The regional distribution of broadband connectivity is very unbalanced. While Europe, North America and Asia Pacific represented 30%, 24% and 40% respectively of the total broadband share in the second quarter of 2006, the Middle East and Africa region scored only 1%, with a total number of broadband subscribers not exceeding 2.5 million.

It is shown that there is a strong correlation between GDP per capita and broadband penetration, as well as between GDP per capita and the Digital Opportunity Index (DOI).[4] Three representative countries from the ESCWA region are highlighted; showing that broadband deployment in the region is below its expected level. The significant growth of mobile penetration has actually weakened the need for further developing the fixed infrastructure, and the investment in deploying copper has slowed down. A fixed line, however, is still necessary for DSL access.[5]

The report provides an exhaustive analysis of broadband indicators in the ESCWA countries. It also discusses the market structure and existence of any national broadband policy or initiative in the different countries, and the very important issue of international connectivity. As an overall assessment, broadband penetration in the ESCWA countries is still low, despite the existence of many national broadband initiatives and a favorable geographical situation with respect to principal submarine cables that provide main links to the Internet backbone. This could be due to reasons such as immature markets and services, low GDP per capita (in

[1] For a profile of ESCWA and its ICT–related activities, please refer to Annex 1.

[2] For a profile of Alcatel–Lucent and its Digital Bridge Initiative program, please refer to Annex 2.

[3] ESCWA, 2006, Workshop on Capacity building for ICT Policymaking, Report, 12 June 2006, (E/ESCWA/ICTD/2006/2).

[4] The Digital Opportunity Index is a modular, development–orientated, e-index based on internationally agreed ICT indicators, a tool for benchmarking the most important indicators for measuring the Information Society, compiled for 180 economies for 2004/ 2005. It is based on 11 core ICT indicators, grouped in 3 clusters: opportunity, infrastructure and utilization.

[5] A brief overview of the main technologies that are available today for broadband access is presented in Chapter 1. Interested readers can usefully refer to Annex 3 for more details about technologies.

countries other than the Gulf Cooperation Council countries), lack of awareness, inadequate government involvement, and a deficiency of relevant applications and content.

Demand patterns differ significantly amongst the three main categories of users (households, businesses and public institutions), and accordingly among the various kinds of service that are offered today to such market segments. In terms of Internet services that can leverage broadband access, despite encouraging experiences and initiatives in terms of offering broadband content (as in the case of e-education in Jordan, and e–government in Qatar and UAE), no broadband mass market has emerged in the region.

It is obvious that the banning of Voice over IP services in many countries (even when the economic terms are favorable, as is the case of Jordan), in conjunction with the absence of competitive pricing and bundling of other services (voice and television) with Internet access, are likely amongst the main reasons for broadband under–development.

Furthermore, the analysis of a number of case studies in the region[6] shows that, even with broadband demand that does not lead to true mass market and restrictions on bundled services, operators can still expect a reasonable return on investment for their broadband access projects.

An analysis of the main factors affecting broadband demand in the ESCWA region, including service, regulatory, pricing and business issues, leads to sound recommendations for making "broadband-for-all" a reality in the region for the service of economic and social development. The main findings with respect to challenges hindering broadband deployment in the ESCWA region, and suggested recommendations to overcome them, are:

1. High prices and low market maturity slow down broadband penetration in the ESCWA countries. **Bundled services**, whereby broadband is provided with other services like telephony and TV content, constitute a key enabler for price reduction and economies of scale for service providers.

2. Regional and international connectivity to the Internet is both complex (no regional backbones) and costly in many ESCWA countries. The **improvement of regional connectivity and peering**, as well as the **emergence of powerful regional service providers** capable of negotiating better interconnection prices with the main Internet backbones, would drastically reduce underlying costs.

3. Lack of a service culture and insufficient quality of telephony copper (especially for DSL deployment) are factors hindering the mass deployment of broadband. The **promotion of a service culture** and **transparency as regards copper quality** are needed. **Wireless local loop technologies** constitute an alternative to copper lines, provided that the **availability of the frequency spectrum** required is ensured by governments and regulatory bodies.

4. Mass broadband adoption is the result of the **availability of content and applications** that are relevant to users in their native language, and contributes in turn to the promotion of improved productivity in the economy as a result of this mass adoption. Both factors are lacking in the ESCWA region. The development of **digital Arabic content** and the **lifting of restrictions on Internet access** allow the Internet to become the main medium for the exchange of knowledge between people in the envisaged knowledge society.

5. The ESCWA region is characterized by a "relatively–low" to "fair" penetration of PCs. **Low–cost PCs and community centers** – for collective access when individual purchase of PCs is not economically feasible – would substantially increase access to the benefits of broadband.

6. In the ESCWA region, the scope of Universal Access is confined to basic, conventional ICT services, and Universal Access to broadband remains an unstated priority in national policies. **An extended scope for Universal Access, which includes broadband, should be clearly articulated in national ICT policies,** with an increase in investments for upgrading operators' access networks. Associated regulatory mechanisms are needed to ensure effective competition while bridging the digital divide between urban and rural areas.

7. The development of a competitive and dynamic broadband market is definitely lagging in the ESCWA region. World-

[6] Selected broadband deployment case studies are studied in Chapter 4, which discusses two business cases based on respectively wireless (WiMAX) and wireline (DSL) broadband access technologies, and gives a description of an ongoing project for mixed WiMAX/DSL deployment. These examples concern three different countries of the region (Kingdom of Saudi Arabia, Lebanon and Palestine) that have different social and economic situations.

wide, **local loop unbundling** of the fixed telephony infrastructure is becoming an essential pre–requisite for such a market; hence regulators should enforce it and avoid restrictions on the provision of other services. In the long term, incumbent operators will benefit from such competitive markets by becoming multi–service operators themselves.

The above recommendations are closely inter–related, and must be considered as guidelines for coherent action rather than a "*one–size–fits–all*" recipe. Implementation must be adapted to the specific circumstances of each country. However, they all depend on one overarching observation, namely that **broadband access cannot be considered as "a separate market" from other information and communication technology (ICT) markets like telephony and TV distribution.** Ultimately, it is the **convergence of these markets** – through the bundled service offers made possible by broadband access and core network convergence to a single IP–based platform – **that will trigger the mass–market adoption of broadband.**

Finally, it is foreseen that broadband access will not only trigger only a change in the network operator economic model as stated above (both for newcomers and incumbents alike), but also a major overhaul in the technical organization of their core networks. Network operators in the ESCWA region need to anticipate the convergence of their networks towards a next–generation network model, where a single network based on the IP protocol will be able to provide any kind of service (Internet, voice, video content, etc.)

Concurrently, policymakers in Government institutions should formulate policies that harness broadband to achieve the Millennium Development Goals and sustainable socioeconomic development, and to empower citizens of a people–centered knowledge society in the region.

Introduction

Broadband technologies bring rich content to homes and small businesses over ordinary copper telephone lines, wireless, or fiber–optic connections. A user–centric broadband vision is important to enhance and develop the information society in the ESCWA region. This vision focuses on connecting communities as a modality for creating new business opportunities in both urban and rural areas, thereby helping to eradicate poverty in these communities. It also acknowledges that the introduction of broadband technologies leads to major transformations in two well established market businesses, namely voice communications and television/media broadcasting, both of which directly involve the largest possible user base.

Within this context, improved telecommunications can be a force for change and transformation towards socioeconomic development and integration into the global economy, as well as the development of the knowledge society. Specifically, broadband can lead to improvements in healthcare and education, particularly for rural communities. Moreover, it can lead to enhancements in public services such as e–government, public safety and public security. The vision stresses the important role of broadband in facilitating the development of corporate and residential usage on the same network.

The role of the government in fostering the development of broadband technologies for economic and social development has been recognized as crucial, in terms of both strategy and regulation. In particular, the issue of deregulation of telecommunications has gone through a long learning curve in several regions of the world.

In France for example, issues such as broadband regulation were given great attention, and several steps were taken to encourage competition and market forces. A review of these steps underscores the role of the regulator in terms of developing both the market and competition at all levels of the value chain. For example, the concept of Local Loop Unbundling (LLU) and its impact on the retail market is an important dimension, as indicated in Chapter 5. In the French model, unbundling services was critical for fostering competition in broadband (and telephone communications markets), and resulted in a major transformation of the connectivity market in that country, which in turn paved the way for extensive adoption of broadband connectivity.

In the Arab region, based on research performed by the Arab Advisors Group in 2004, reviewing broadband and xDSL technologies, only 13 Arab countries out of a total of 22 offered broadband services in the form of xDSL. While residential 256 kbit/s ADSL services were provided in all these countries, only four of them (Jordan, Kuwait, Morocco, and Qatar) provided 128 kbit/s, 256 kbit/s, 512 kbit/s and 1,024 kbit/s services. By 2006, as indicated in Chapter 2, the situation had changed drastically: most of the Arab countries do now offer ADSL services, but with different levels of dissemination. While broadband via xDSL is still not available in Lebanon and Iraq, there are plans for its introduction in those countries. The total annual cost of ADSL varies greatly between countries, as shown by cost comparisons based on monthly rates as a function of gross domestic product (GDP) per capita.

For the ESCWA region, the role of Government in fostering market growth is crucial, especially since the deployment of fixed telephone lines (copper) is still largely underdeveloped. Stakeholders agree that deregulation is a catalyst for market development. Furthermore, deregulation can only succeed when backed by strong political will. The liberalization of the telecom market in the Arab region is a facilitator of broadband deployment that can lead to competition in the sector, as demonstrated by other markets that now benefit from competitive forces, service improvements and decreased costs.

Additionally, with reference to the findings of the World Summit on the Information Society (WSIS), particularly the Tunis Agenda (paragraph 23), it is recognized that there are a number of areas in need of greater financial resources, where current approaches to financing ICT for development have devoted insufficient attention to date. These include broadband capacity to facilitate the delivery of a wide range of services and applications, promote investment, and provide Internet access at affordable prices to both existing and new users.

This publication is the result of a collaboration that started in 2004 when three regional projects were proposed by Alcatel-Lucent during the Partners Forum (Damascus, 21 November 2004), which was held in conjunction with the Second Regional Preparatory Conference for the World Summit on the Information Society (Damascus, 22–23 November 2004) organized by ESCWA. One of the projects proposed by Alcatel-Lucent was devoted to the issue of "the formulation of a regional framework for broadband deployment in the ESCWA region", whose development was recommended by the ESCWA– Alcatel-Lucent joint workshop on "Novel telecom technologies for socio–economic development", Beirut, 11–13 July 2005.

The overriding principle is to establish a regional task force representing different stakeholders in order to develop and adopt collectively a regional regulatory and business framework. This framework, which includes practical modalities based on facts and best practice, could be envisaged as a reference template for the region, thereby playing a similar role to that of the European Commission's broadband frameworks for European regulators. Once established, this task force could encourage, in close cooperation with the League of Arab States (LAS), governments and policy–makers to subscribe to the regional framework, and could lead field trials and pilots, thereby accelerating deployment. To help the creation of this task force, it was agreed that a fact book describing guidelines for broadband deployment is essential. This report is the materialization of that fact book.

Additionally, this report has a direct relationship with ESCWA's study on "Enhancing telecom infrastructure, services and policies",[1] particularly the implementation of recommendations (5),[2] and (7).[3] Furthermore, the "Workshop on information and communication technology policymaking in ESCWA member countries",[4] held in Beirut from 2 to 4 May 2006, within the framework of the United Nations Development Account project on "Capacity building for ICT Policymaking", stressed the importance of carrying out a study on broadband access in the ESCWA region, recommending a "broadband–for–all" approach for socioeconomic development.

In order to fulfill the above recommendations, this report starts by presenting in **Chapter 1** an overview of the broadband technologies and services available worldwide. Generic questions on the social and economic impact of using broadband services, and the affordability of those services, are also discussed. Focusing on the ESCWA region, **Chapter 2** explains market take–up and structure, and discusses the main policies and initiatives in place. In **Chapter 3**, an analysis of the demand and supply patterns in the region is provided, with the aim of understanding customer needs in the different segments of society. It also shows how those needs are or could be addressed in terms of services provided, through a number of case studies of outstanding applications from the region. **Chapter 4** gives three business models from three different ESCWA countries to illustrate the economic aspects of broadband deployment, while **Chapter 5** highlights some of the key factors affecting broadband demand and supply. Finally, in **Chapter 6**, proposals for action are given, which are aimed at facilitating progress in the region.

[1] ESCWA, 2005, Enhancing telecom infrastructure, services and policies, (E/ESCWA/ICTD/2005/5).

[2] Stating the need for governments to endorse clear commitment to disseminate broadband services as part of an integrated socio-economic developmental agenda.

[3] Stating the need to coordinate between telecom regulatory bodies in the region to create an enabling business and regulatory environment for the wide-scale deployment of broadband services, VoIP and Next–Generation Networks (NGN).

[4] ESCWA, 2006, Workshop on Capacity building for ICT Policymaking, Report, 12 June 2006, (E/ESCWA/ICTD/2006/2).

Chapter 1

Overview

What is broadband? And why is it important? Although the definition of broadband might vary from one country to another, it is commonly accepted that it is a *high–speed, always–on* (as opposed to dial–up) connection to the Internet. High–speed usually refers to a connection which is suitable for running (most of) the available networked applications adequately. There is currently a trend to define broadband based on "capability", not merely on speed. According to a "Triple Play" vocabulary for instance, a broadband connection should have "*enough* two–way transmission capacity and speed to allow interactive, high–quality, full–motion video, data and voice applications simultaneously via one pipe."[1] For practical reasons, however, a broadband connection in this report is considered to have a download data rate of not less than 256 kbit/s.[2]

More than with traditional telephony penetration, broadband availability in a country is widely perceived as a powerful catalyst for social and economic development. It enables the delivery of new, advanced, interactive content, promotes the development of new services (and on–line entertainment facilities), and boosts useful applications such as e–education, e–health, e–government and e–business, bringing significant benefits to individual consumers, administrations and businesses. Broadband enables users to access and exchange high–quality, bandwidth–intensive content (e.g., multimedia) that is either impossible or difficult to use effectively over slower connections. Various studies and statistics in EU countries show that there is a strong correlation between penetration of broadband lines and growth. There are claims that "*25% of recent GDP growth and 40% of EU productivity growth (60% in the United States) can be attributed to ICT*."[3] Broadband networks can also help attract direct foreign investment. This brings new money into the economy, and serves as a conduit for transferring technological know–how.

Impact of using broadband networks

It is foreshadowed that the development and use of a true broadband network would involve four broad direct impacts:

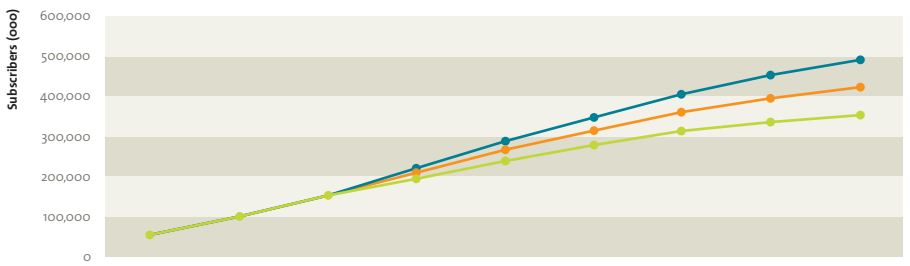
- an expansion of the communications activity in the region as the new business is developed and provides services (buying and selling inputs, employing staff etc);
- enhancing competition in telecommunications — in a range of areas, but especially in Internet Service Provision;
- opening up scope for productivity gains that are apparent from the use of broadband technologies in business; and
- competitive gains for key industries that are particularly dependent upon affordable broadband Internet access.

Source: "True Broadband: Exploring the Economic Impacts," Allen Consulting Group, 2003

Broadband evolution worldwide

Broadband has witnessed remarkable growth since the late 1990s (figure 1). The number of broadband subscribers in the world was estimated at about 200 million in 2005, and 250 million in 2006, representing 35–40% of all

Figure 1: Global broadband subscribers anticipated growth, 2002–2010



	2002	2003	2004	2005	2006	2007	2008	2009	2010
Global - High	60,956	98,559	151,534	217,827	284,433	345,230	404,537	453,712	491,243
Global - Likely	60,956	98,559	151,534	206,865	262,466	312,929	358,084	395,101	421,970
Global - Low	60,956	98,559	151,534	197,153	243,331	280,868	312,910	337,068	354,904

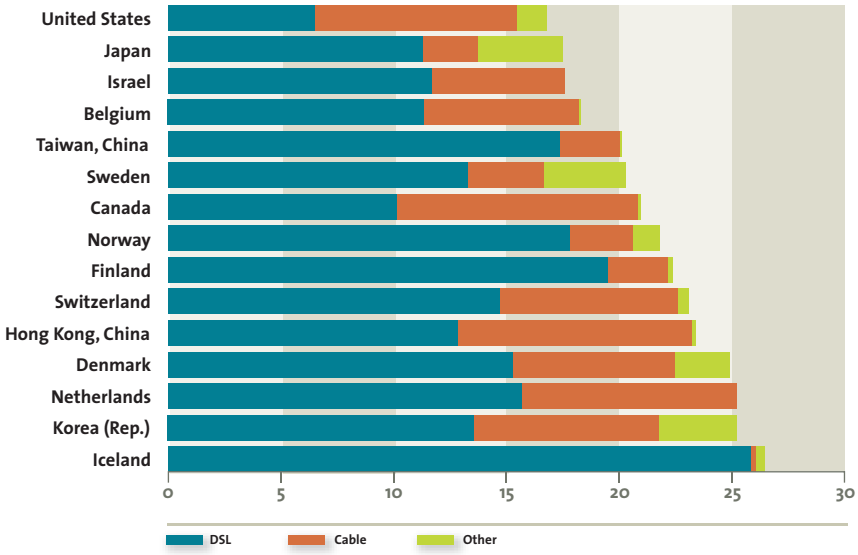
Source: broadbandtrends.com

[1] Meredith Singer, "Economic and Social Benefits of Broadband," ITU SPU Broadband Workshop, April 2003.

[2] In some countries, 128 kbit/s is also considered as a broadband offering. This allows the inclusion of Basic Rate ISDN (although it is not an always–on connection) in the broadband arena.

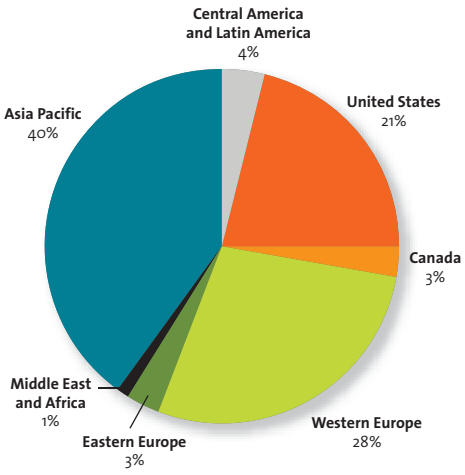
[3] Edvins Karnitis, "Broadband Internet as a Powerful Catalyst for Growth," Public Utilities Commission, Latvia, 2005.

Figure 2: Top 15 broadband economies 2005. Total penetration (per 100 inhabitants), by type of access



Source: World Information Society Report, ITU, 2006

Figure 3: Global broadband subscribers by region, 2Q 2006 (Total: 242 million)



Source: broadbandtrends.com

Internet "accounts".[4] This number is likely to reach half a billion by the beginning of the next decade.[5] In 2Q 2005, the USA was the country with the largest total number of broadband subscribers (38.2 million), followed by China (30.8 million), Japan (20.6 million), and South Korea (12.3 million). China, however, was the leading country in the number of DSL subscribers (21.2 million).[6] According to the ITU, the number of countries with commercially available broadband has doubled during the past four years to reach 166 countries in 1Q 2006.[7] Figure 2 gives total broadband penetration for the top 15 broadband economies in the world in 2005.

The regional distribution of global broadband connectivity is unbalanced (figure 3). While Europe, North America, and Asia Pacific score respectively 30%, 24%, and 40% of the total broadband regional share in 2Q 2006, the Middle East & Africa region scored only 1%, with a total number of broadband subscribers not exceeding 2.5 million.[8] This modest score, however, implies a huge opportunity for growth in the region. Indeed, the "*Middle East and Africa were identified as the fastest–growing region with a 16.5% gain in 3Q 2005. Turkey, Morocco, and South Africa each gained 30% during the quarter. Bahrain, Qatar, the United Arab Emirates, and Kuwait are the leaders in the Arab World.*"[9]

Broadband can be brought to the end user using a range of technologies. DSL is currently the lead broadband technology worldwide, followed by cable modems (figure 4). Other technologies include fixed wireless access, wireless LAN, 3G mobile, and satellite. Recent technologies with larger capacity such as FTTx are showing increasing deployment in many countries, including Japan and the USA.

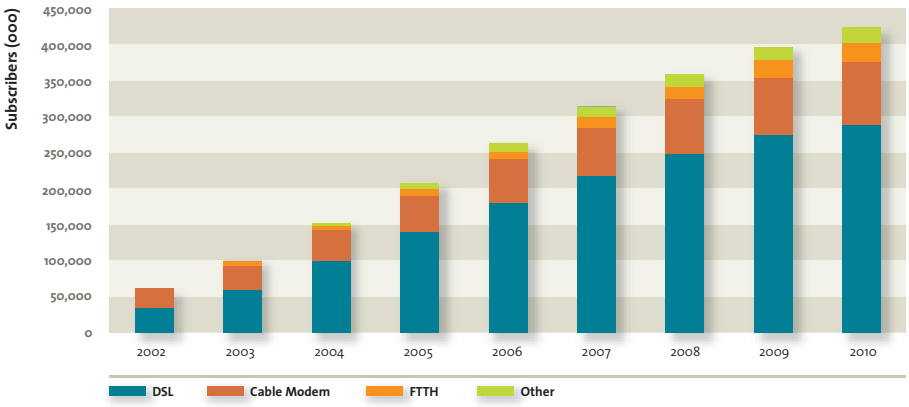
Figure 5 shows the distribution of broadband technologies by region worldwide. It also shows that broadband wireless access (e.g., with WiMAX technology) is gaining importance, especially in Africa, the Middle East, India and Latin America, partly due to the lack of an appropriate fixed infrastructure.

Affordability of broadband

This section examines how different economies are doing in broadband penetration relative to their income levels. Three countries from the

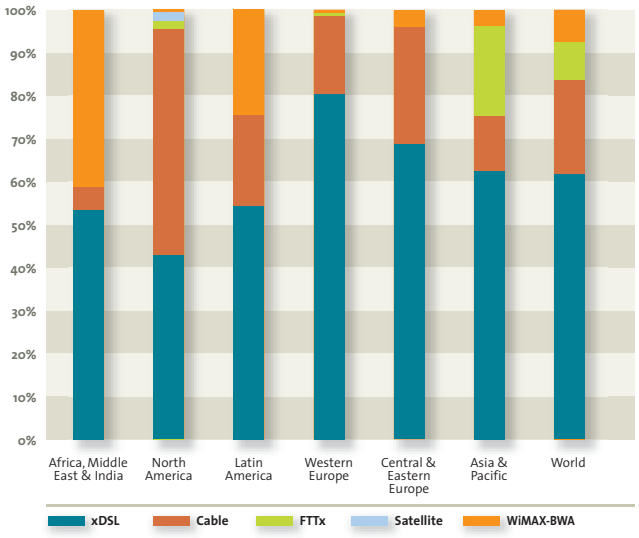
[4] The number of Internet users is commonly estimated at more than 1 billion in 2006.
[5] Source: broadbandtrends.com
[6] Source: Broadband and DSL Subscriber Numbers to 30 June 2005, 2Q 2005. dslforum.org
[7] Source: World Information Society Report, ITU, 2006
[8] Source: broadbandtrends.com.
[9] Source: The European Travel Commission, New Media Review.

Figure 4: Estimation of global broadband subscriber growth by technology, 2002–2010



Source: broadbandtrends.com

Figure 5: Regional distribution of broadband technologies, 2006



Source: Pyramid Research

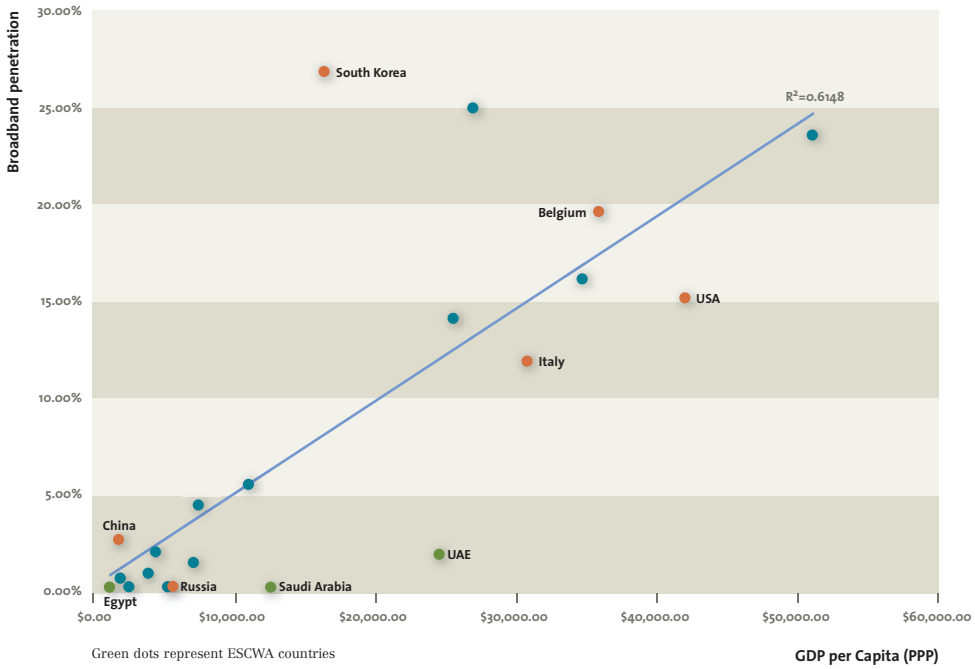
ESCWA region (Egypt, Saudi Arabia and the United Arab Emirates) are compared to a basket of 20 countries from other regions in the world.[10]

Broadband penetration vs. GDP per capita

Figure 6 shows a sound correlation between GDP per capita and broadband penetration, even if a higher dispersion can be observed in the high–income segment. Broadband penetration, however, varies slightly even in the same income segment. South Korea is an interesting special case, as it is the country with the highest broadband penetration, but with only a medium GDP per capita. This can be explained mainly by the commitment of the government to provide broadband to all.

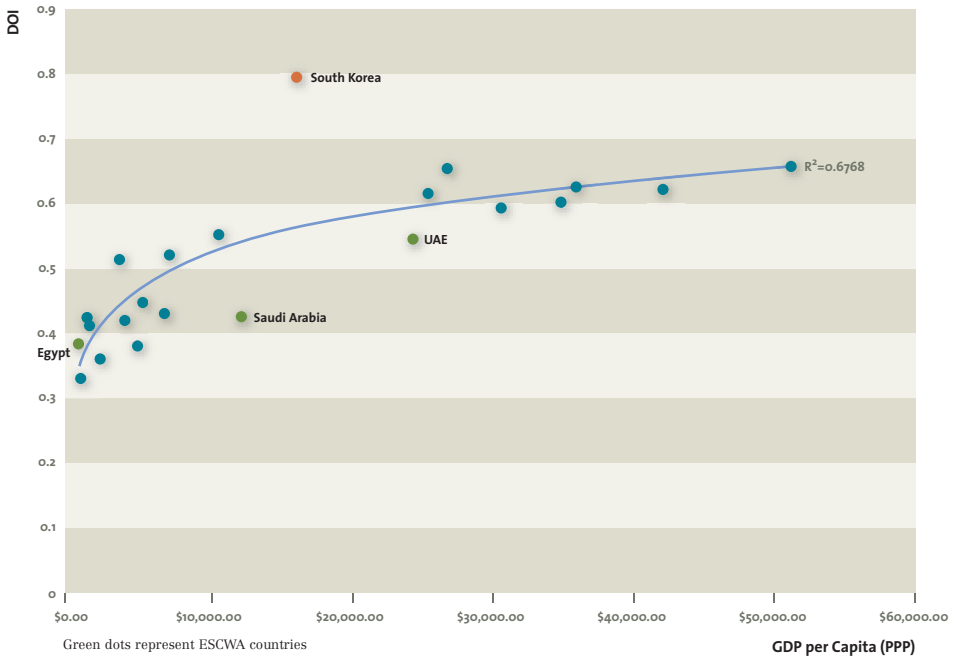
[10] The analysis is based on 2005 figures provided by Pyramid Research.

Figure 6: Broadband penetration vs. GDP per capita



Green dots represent ESCWA countries

Figure 7: Digital Opportunity Index (DOI) vs. GDP per capita

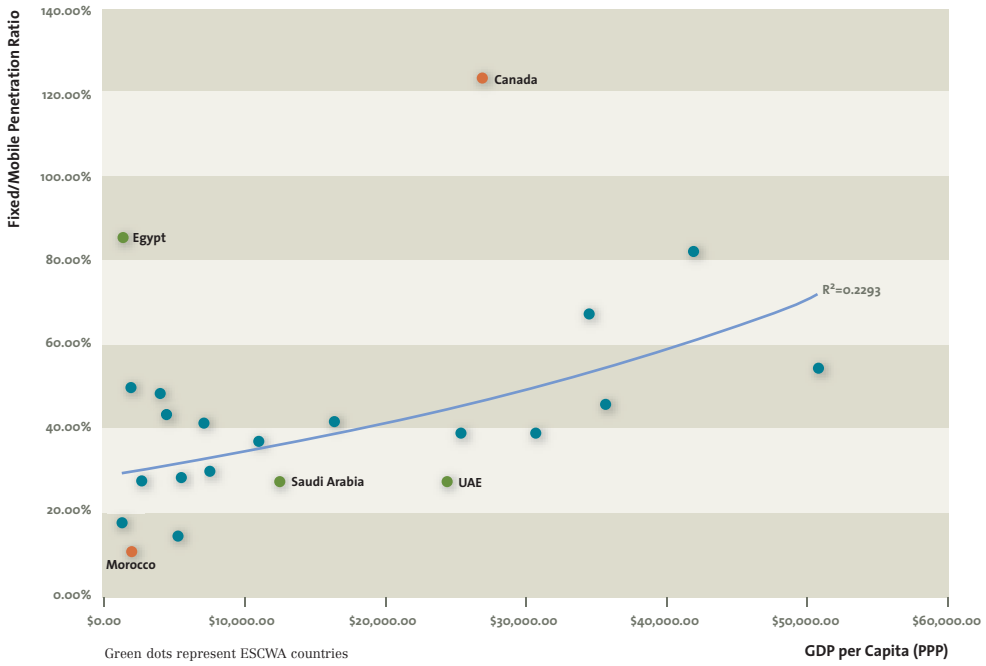


The three countries of the ESCWA region are characterized by low broadband penetration despite their relatively big difference in GDP per capita. For Saudi Arabia and the United Arab Emirates in particular, broadband penetration is less than most of the medium– and high–income countries. This is primarily due to market immaturity, and implies a big, unexploited potential, especially given that fixed–line penetration, which is a major enabler for deploying wireline broadband services, is considered acceptable.

Digital Opportunity Index (DOI) vs. GDP per capita

The ITU Digital Opportunity Index (DOI) is based on 11 core ICT indicators agreed by the Partnership on Measuring ICT for Development.[11] The indicators are grouped in three clusters: Opportunity, Infrastructure and Utilization. The major advantages of the DOI reside

Figure 8: Fixed/mobile penetration ratio vs. GDP per capita



[11] See http://www.itu.int/osg/spu/statistics/DOI/partnership.html for details.

in its modular design, its development orientation, and its ability to combine fixed and mobile components.

Figure 7 shows a direct correlation between GDP per capita and DOI. South Korea is still a special case. The three countries representative of the ESCWA region are almost situated beneath the trend line, indicating mainly a utilization gap, and implying, once again, a significant potential in the field of ICTs.

Impact of mobile telephony

Generally speaking, the number of mobile phone lines in emerging economies is comparatively high with respect to the number of fixed lines. The significant growth of mobile penetration has actually weakened the need for developing the fixed infrastructure further; investment in deploying copper has slowed down. Fixed lines, however, are still necessary for DSL access. This issue will be examined in the following section.

Fixed/mobile penetration ratio vs. GDP per capita

Figure 8 shows that the numbers of fixed and mobile lines tend to reach equilibrium in high–income countries. Saudi Arabia and the United Arab Emirates seem to have a lower fixed/mobile penetration ratio than the mean value represented by the trend line. Egypt appears to be a special case. The penetration of fixed lines is very high compared to other low– and medium–income countries, thus, a clear opportunity exists for operators to provide DSL services.

Fixed/mobile penetration ratio vs. broadband penetration

As DSL is currently the dominant broadband technology for Internet access, it would be appropriate to compare the fixed/mobile penetration ratio to DSL broadband penetration. Figure 9 shows for example Egypt's great DSL potential, since it exhibits one of the highest fixed/mobile penetration ratios and one of the lowest broadband penetration figures in the region. In the United Arab Emirates and Saudi Arabia, figure 9 shows that development of the fixed infrastructure would lead to a growth in broadband penetration.

Broadband technologies

Below is a summary of the most commonly deployed broadband technologies.

Wireline technologies

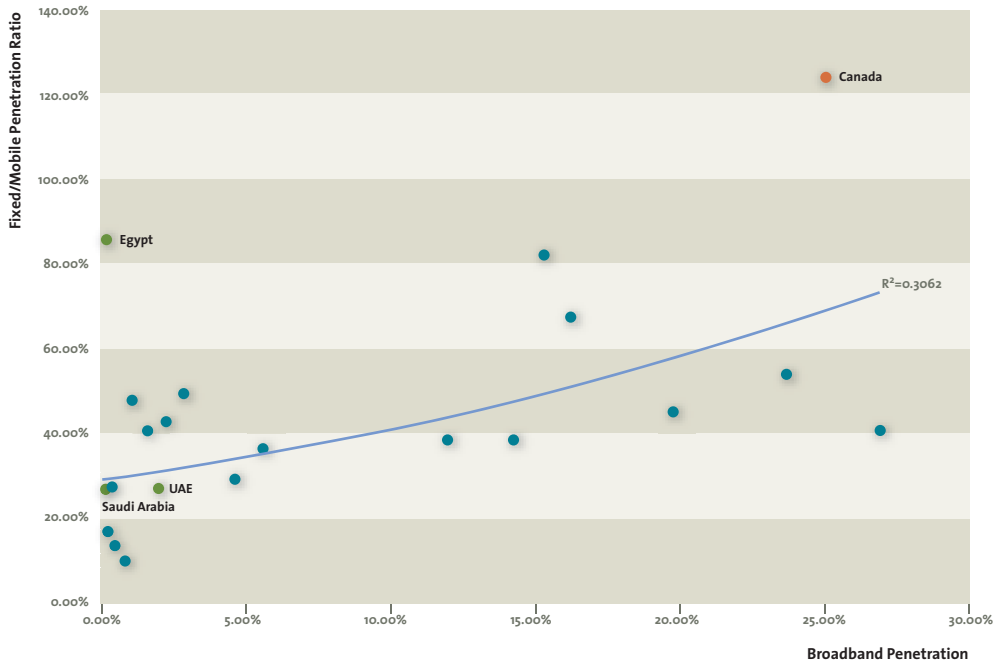
Approximately one billion phone lines worldwide provide a robust, global core infrastructure capable of delivering broadband to homes,

Table 1: DSL standards and performances

	Standards	Speed		Distance	Type of Services supported
		Upstream	Downstream		
ADSL	NOW (ITU)	0.3 Mbit/s	1.5 Mbit/s	4.5 km	Voice, data
		0.3 Mbit/s	8 Mbit/s	700 m	Voice, data, SD video
ADSL+	ITU	0.3 Mbit/s	7 Mbit/s	2 km	Voice, data, SD video
SHDSL		2.3 Mbit/s	2.3 Mbit/s	4 km	Voice, data
VDSL	ATM NOW (ITU)	4 Mbit/s	15 Mbit/s	1 km	Voice, data, HD video
	Ethernet (IEEE)	12 Mbit/s	22 Mbit/s	500 m	Voice, data, HD video

Source: Alcatel-Lucent

Figure 9: Fixed/mobile penetration ratio vs. broadband penetration



offices, schools and government bodies. With copper infrastructure already in place, DSL is the most effective and economical technology for global broadband deployment.

DSL technology leverages the existing pair of copper wires in the phone network to provide a high–data–rate connection between the household and the central office (CO). Typically, the download speed of DSL ranges from 128 kbit/s to 24,000 kbit/s; but the speed is limited by the distance between the CO and the customer equipment (see table 1). Typically, it is impossible to get a broadband connection if the household is more than 5 km from the CO.

Some high–value–added services can measurably increase the average revenue per user (ARPU) for users who are ready to pay for these services. The high margin for these products can justify the deployment of fiber to the user (FTTU).

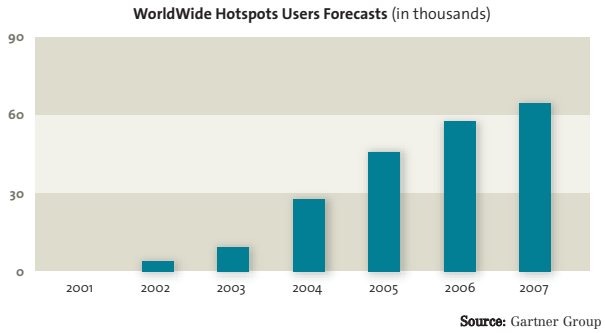
The installation of fiber feeder loop technologies is hampered by the absence of an installed base, and the civil works required for deployment. Thus fiber access is limited to use in greenfield situations (where there is a lower incremental cost compared with a copper infrastructure), in the feeder network (where its high cost is shared by multiple users), or where the almost unlimited bandwidth and the services that it can support justify the high initial investment (figure 10).

Cable television networks can provide broadband access to the Internet. However, this infrastructure is not very common in the ESCWA region. The powerline grid can also be a means of Internet access, despite its many disadvantages.

Wireless technologies

Wireless technologies are different in scope and usage. Subject to frequency spectrum availability, wireless deployment could take place less expensively and more rapidly than wireline deployment, and offers new potential for broadband extension.

Figure 11: Market forecasts for hotspots usage



Source: Gartner Group

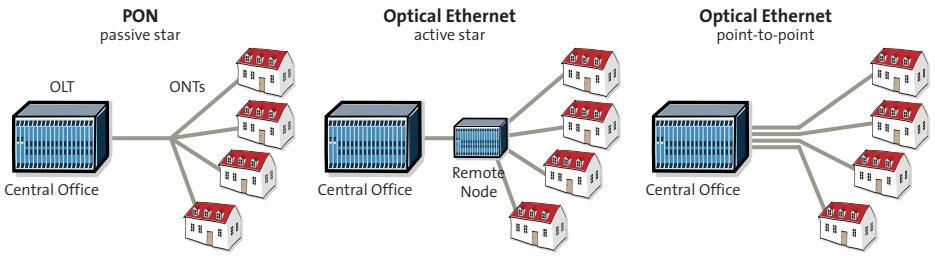
WiFi hotspots are common in highly frequented public places (such as stations, airports, congress centers, exhibition grounds, hotels, etc.), where they provide access to the Internet.

Users might have to pay for broadband access at hotspots, but free hotspots continue to grow. Wireless networks that cover entire cities, such as municipal broadband, have also mushroomed (figure 11). MuniWireless,[12] a portal dealing with municipal wireless broadband projects, reports that over 300 metropolitan projects have been started.

Hotspots usually belong to venue owners such as airport authorities or hotel chains, who deploy a WLAN (wireless local area network) infrastructure. Public WLANs are mainly aimed at "nomadic" usage (e.g. during a break in travel). Users sit in a hotspot, open their laptops, and get easy access to the Internet or their corporate Intranet. They can also access local information (flight departures in an airport, restaurant menus in a hotel, conference schedules in a conference centre, etc.).

A second phase will probably see the seamless availability of applications from both mobile and WLAN networks. Local services linked to the hotspot locations will also be implemented to offer end users specific applications such as video streaming, infotainment, etc. In addition, services specifically aimed at WLAN users could be deployed via mobile networks – for example, the communication of WLAN service availability in the area.

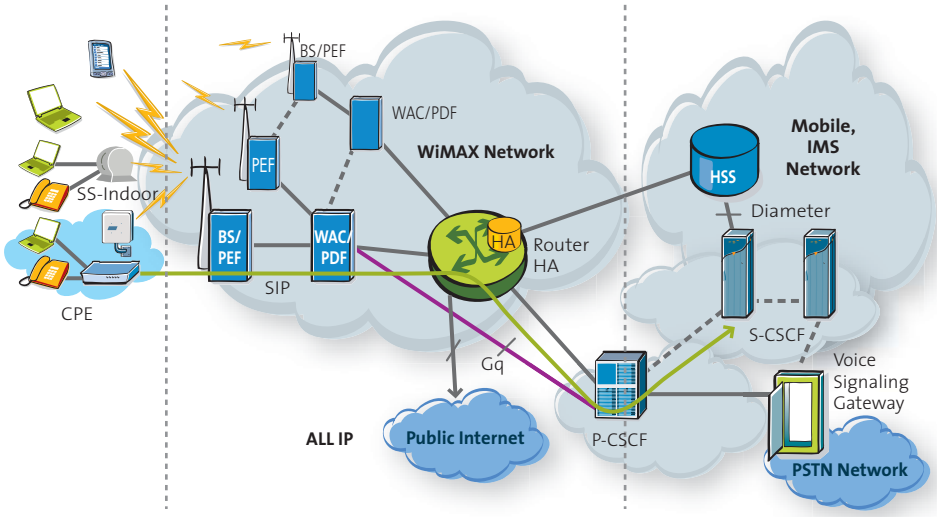
Figure 10: The different fiber technological options



Source: Alcatel-Lucent

[12] Website URL: www.muniwireless.com

Figure 12: WiMAX network architecture



Source: Alcatel-Lucent

WiMAX (Worldwide Interoperability for Microwave Access) is a wireless broadband technology that extends the Internet broadband revolution by bringing two new dimensions: mobility, and extended reach with no wires (figure 12). The main characteristics of WiMAX are:

- Broadband with global cell throughput, typically at 25 Mbit/s/cell;
- IP native;
- Point–to–multipoint microwave, with a cell radius up to 15km;
- Non line–of–sight;
- Cellular–like coverage design;
- Standards–based: IEEE 802.16e;
- Cost–effective: Customer premises equipment (CPE) at $300 (indoor gateway);
- Supported by more than 350 industry players, which makes it interoperable.

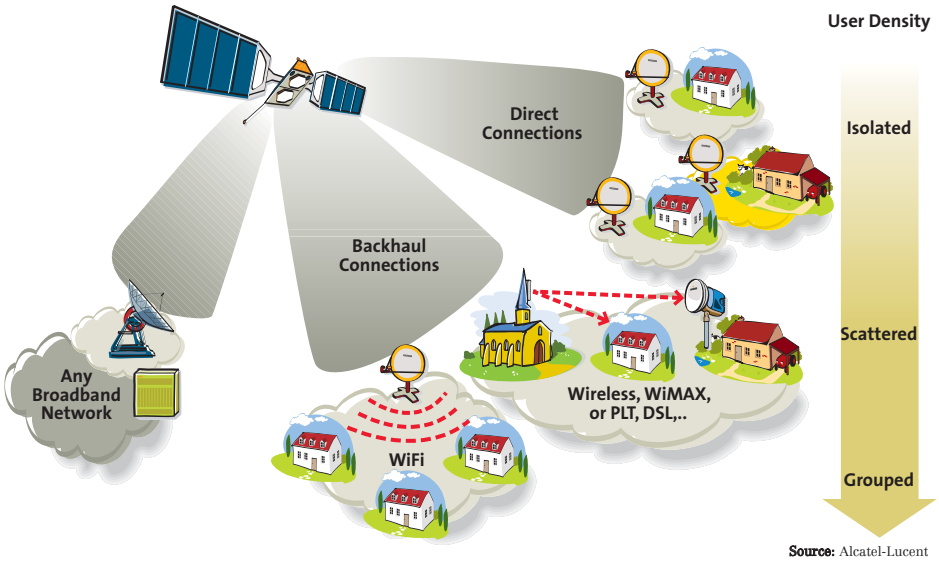
It is useful to highlight this last feature. Interoperability will dramatically drive down the cost of end users' CPE, similar to what happened with WiFi technology. This will allow WiMAX to become the main technology driver for broadband within emerging countries. Another essential feature is the cellular coverage design. This will open the possibility – especially in areas that are covered by mobile telephony antennas – to share infrastructure (mainly masts, power, and security) with the legacy mobile cellular infrastructure, avoiding the deployment of a WiMAX infrastructure "from scratch".

Satellite

In isolated areas where no infrastructure can be easily deployed, satellite is the only possible means of broadband access (figure 13). Recent progress in both satellite and ground technologies has led to the introduction of attractive, two–way satellite access solutions, which offer far better performance than traditional VSAT in terms of bit rates and price. The cost of satellite capacity per Mbit/s will decrease significantly in the next few years, as a result of expected improvements in signal processing (doubling the useful throughput compared with existing transponders) and satellite technology (multiplying the capacity and cost efficiency of onboard satellites).

However, satellite access has major issues. Its high latency (more than a second), due to the very long radio transmission path, is a problem for various services, including IP telephony. Moreover, controlling a satellite connection is quite difficult, therefore use of this technology can be highly restricted by law in some countries.

Figure 13: Different types of satellite connection usage



Source: Alcatel-Lucent

Chapter 2

Broadband Market Take–Up in the ESCWA Region

Broadband is strategically important to the ESCWA region because it can potentially accelerate the contribution of ICT to economic growth and productivity improvement. This chapter is intended to give a brief description of the broadband market in the ESCWA region, focusing on broadband take–up by end users, market structure, and regional and international connectivity.

Assessment of broadband penetration and number of subscribers

As an overall assessment, broadband penetration in the ESCWA countries is still low (see table 1). This could be due to reasons such as immature markets and services; low GDP per capita (in countries other than the GCC); and lack of awareness, government involvement, and relevant applications and content.

Table 1 shows that the total number of broadband subscribers in the whole ESCWA region hardly exceeds half a million subscribers, whereas the total population in the region in 2005 was estimated at more than 160 million inhabitants. This gives an aggregate penetration of about 0.3%, which is very low compared to other regions in the world (see Chapter 1). The vast majority of current broadband subscriptions are DSL–based. However, this aggregate value is far from being uniform across the region. Penetration in the higher–income GCC countries, with the exception of Saudi Arabia, is comparatively high. In the upper–middle–income countries, Oman has a penetration value similar to Saudi Arabia. Lebanon is characterized by a clearly high penetration of broadband within total Internet accounts, mostly delivered using wireless technologies. This is a good example of how wireless technologies are used to efficiently promote broadband access.

Within the lower–middle–income countries (Egypt, Jordan, Palestine, Syria),[1] in addition to Yemen (a low–income country), Jordan seems to have a comparatively high broadband penetration rate relatively to the number of Internet accounts and fixed lines. This is due to the low penetration of fixed telephony, a fact that limits DSL deployment. Conversely, the relatively high penetration of fixed telephony in Egypt and Syria represents an opportunity for future

[1] No significant data is available for Iraq, which is one of the ESCWA lower–middle–income countries.

Table 1: Internet and broadband subscribers in the ESCWA Region, 4Q 2005

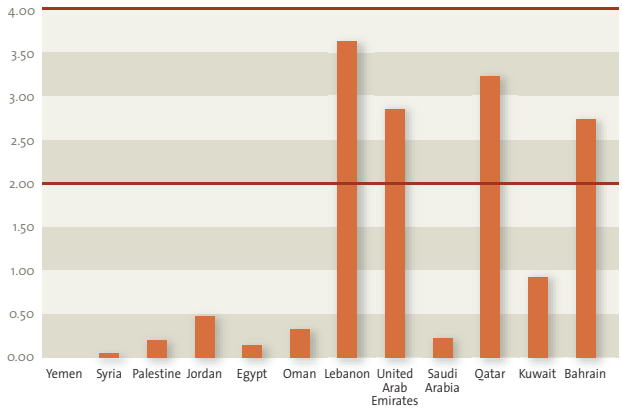
	Bahrain	Kuwait	Qatar	Saudi Arabia	United Arab Emirates	Lebanon	Oman	Egypt	Jordan	Palestine	Syria	Yemen
Population	726,617	2,687,000	777,800	24,573,000	4,496,000	3,577,000	2,567,000	74,033,000	5,703,000	3,702,000	19,044,000	20,975,000
Main fixed lines in operation	196,515	510,295	205,386	3,800,000	1,236,860	990,000	265,237	10,396,150	650,000	348,968	2,903,139	850,000
Main fixed lines in operation per 100 inhabitants	27.05	18.99	26.41	15.46	27.51	27.68	10.33	14.04	11.40	9.43	15.24	4.05
Total Internet accounts	60,000	283,200	53,146	1,000,000	526,978	230,000	57,022	4,886,474	130,000	81,000	216,000	110,000
Total Internet accounts per 100 inhabitants	8.26	10.54	6.83	4.07	11.72	6.43	2.22	6.60	2.28	2.19	1.13	0.52
Total Internet users (estimated)	155,000	700,000	219,000	4,000,000	1,397,207	700,000	285,000	5,000,000	450,000	243,000	1,100,000	600,000
Total Internet users per 100 inhabitants (estimated)	21.33	26.05	28.16	16.28	31.08	19.57	11.10	6.75	7.89	6.56	5.78	2.86
Broadband Internet subscribers	20,000	25,000	25,168	55,000	128,493	130,000	8,378	113,526	28,000	7,665	7,000	1,400
Broadband Internet subscribers per 100 population	2.75	0.93	3.24	0.22	2.86	3.63	0.33	0.15	0.49	0.21	0.04	0.01
Broadband Internet subscribers per 100 main fixed lines	10.18	4.90	12.25	1.45	10.39	13.13	3.16	1.09	4.31	2.20	0.24	0.16
Broadband Internet subscribers per 100 Internet accounts	33.33	8.83	47.36	5.50	24.38	56.52	14.69	2.32	21.54	9.46	3.24	1.27

Source: ITU World Telecommunication Indicators; Arab Advisors Group (with extrapolated figures for Bahrain, Jordan, Kuwait, Saudi Arabia and Yemen)

DSL deployment in these countries. The relatively low penetration of broadband within all Internet accounts in Egypt is a side–effect of the free Internet scheme, which tends to increase the number of "account–less users" accessing the Internet.

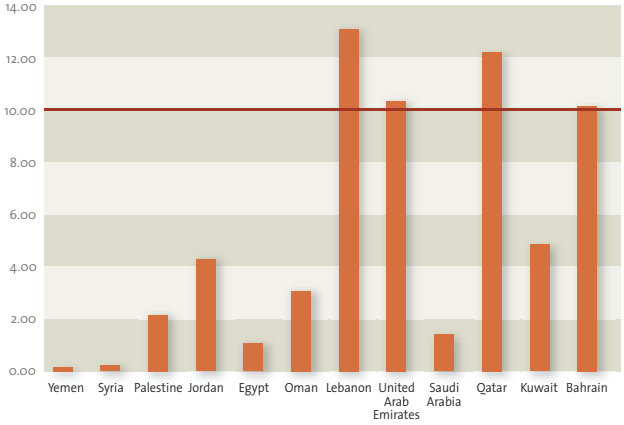
The present status of broadband in ESCWA countries could be considered as an attractive development opportunity. Figures 1a, 1b, and 1c represent broadband penetration in ESCWA countries among the overall population; the total of main fixed lines in operation; and the total of Internet accounts, respectively. Penetration thresholds are also plotted in red. With the exception of Lebanon and three of the GCC countries, all other ESCWA countries are well below the threshold of 2% (figure 1a). Egypt, for example, has set this as a target to be reached in 2007; but this is still very far behind the top world figures of about 25% or the OECD regional average of about 13.5%.[2] For a typical fixed telephony penetration of 20%, a threshold of 10% could be considered acceptable; the results show a similar gap (figure 1b). Limited fixed telephony penetration could constitute a considerable obstacle to deploying DSL technology in the future, as in Jordan; thus alternative, wireless technologies should be considered. Finally, there is a clear opportunity for subscribers to upgrade their traditional dial–up Internet connections to broadband (figure 1c), if appropriate marketing highlighting the added value of broadband services is employed.

Figure 1a: Broadband subscribers per 100 residents in the ESCWA region, 4Q 2005



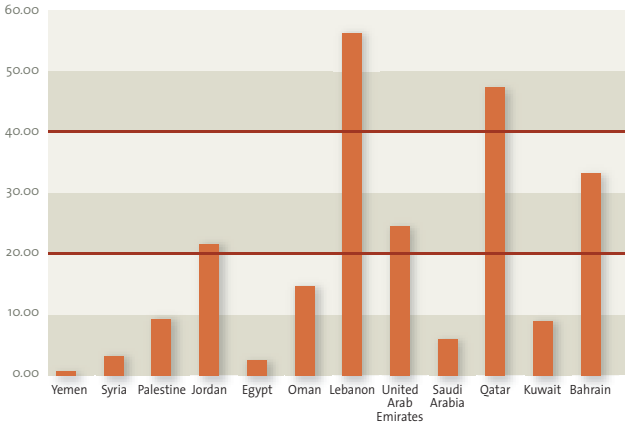
Source: ITU World Telecommunication Indicators; Arab Advisors Group (with extrapolated figures for Bahrain, Jordan, Kuwait, Saudi Arabia, and Yemen)

Figure 1b: Broadband subscribers per 100 fixed lines in the ESCWA region, 4Q 2005



Source: ITU World Telecommunication Indicators; Arab Advisors Group (with extrapolated figures for Bahrain, Jordan, Kuwait, Saudi Arabia, and Yemen)

Figure 1c: Broadband subscribers per 100 Internet accounts in the ESCWA region, 4Q 2005



Source: ITU World Telecommunication Indicators; Arab Advisors Group (with extrapolated figures for Bahrain, Jordan, Kuwait, Saudi Arabia, and Yemen)

Market structure

Unlike fixed telecom services, data services in most ESCWA countries are open to competition – at least theoretically (see table 2). In many cases, ISPs act as resellers of the incumbent's infrastructure. This is clearly the case in Syria, where the local loop is still fully under the control of the government–owned incumbent, Syrian Telecom, which offers new–entrant ISPs (five in 2006) limited "bit–stream" access to its digital subscriber line access multiplexer (DSLAM) equipment. In Egypt, the regulatory authority formally enforced local loop unbundling in 2Q 2002, enabling licensed network service providers to share the local loop with the incumbent, Telecom Egypt. There are currently eight licensed data service providers, and more than 200 ISPs in Egypt.[3] In Oman, after the adoption of its national ICT strategy, e–Oman, in 2003, the telecom sector was opened to competition. However, the incumbent, Omantel, is still the sole active ISP in the country.[4] As in Egypt, the liberalization of data services in Jordan was successful. There are currently 10 licensed ISPs; most of them are backed by regional and international operators. The exclusivity of the incumbent, Jordan Telecom, expired in 2005, but it is still the sole provider for Internet connectivity infrastructure. However, in 2006, Jordan Telecom was supposed to start

[2] Source: Paul Budde Communication.
[3] Source: Egypt Case Study, ESCWA, 2006.
[4] Source: Oman Case Study, ESCWA, 2006.

Connectivity and Infrastructure in Jordan

Jordan's ICT industry has been attracting international and local investors and many public/private partnerships have been formed, carrying Jordan further down the road to becoming a hub in the region. Jordan's appeal to foreign investors is buried within many positive factors that materialized in Jordan recently. King Abdullah II's strong support, leadership and visionary perspective regarding the key role of ICT in the economic prosperity of Jordan has set the basis for all advancements in this area. The improvements that followed The king's nationwide prioritization of ICT include world–class infrastructural developments, a liberalized telecommunications market and an independent regulatory framework. Consequently, Jordan has expanded beyond many of its regional counterparts and advanced greatly in connectivity and access.

Recent trends of change related to connectivity and infrastructure include stagnation of fixed line growth, increased competition and further advancements in the mobile market and the slow but firm uptake of competition in the ISP market. More specifically:

- Mobile–fixed substitution has caused fixed line penetration to stop at a lower level than comparables in the Middle East and stag nated fixed line growth at 11%, which forms a barrier for broadband penetration in the future.
- Mobile penetration is growing rapidly and reached 64%, mainly due to significant drops in mobile charges.
- The share of business customers stayed constant in fixed line. The billing structure in fixed line is changing with rising subscription fees and decreasing usage charges although overall costs are decreasing. This trend is visible in the billing structures of businesses in developed countries and is expected to be the case for Jordan in the future.
- PC penetration is growing annually at 27% but it is still behind desired levels due to affordability issues. In countries with GDP per capita below $7,500, PC penetration is a matter of affordability and Jordan experiences difficulties in strengthening its PC penetration and Internet access due to the lower level of average GDP per capita. 89% of the stakeholders of the Jordan e–Readiness assessment perception survey have also identified the high PC costs and Internet prices as the most important obstacle against the increase of PC and Internet penetration in Jordan.
- Although competition in the ISP sector is at a satisfactory level with respect to comparable countries, the market is dominated by two players, Wanadoo and Batelco. This structure is not expected to change unless the use of the infrastructure is regulated more effectively.
- Broadband penetration is still at low levels with 0.5% and is very immature.
- Telecommunications sector is a key industry for the Jordanian economy with 10% contribution to GDP.
- The mobile market in Jordan is the most liberalized in the Middle East. Still, the market share of largest mobile operator is the largest when compared to any OECD country, which indicates additional regulation to foster competition in the mobile market.
- The quality and reliability of the telecommunications infrastructure is above global standards.

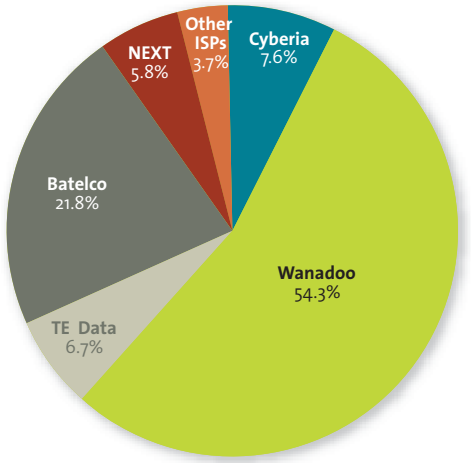
Source: "The e-Readiness Assessment of the Hashemite Kingdom of Jordan," Ministry of Information and Communications Technology, 2006

Table 2: PSTN and data market structure in ESCWA countries, 2006

Country	PSTN	Data and Internet
Bahrain	Competitive, *Single operator to date*	Competition, *Single operator to date*
Egypt	Monopoly, *Market liberalization initiated during 2006*	Competitive
Iraq	Monopoly	Competitive
Jordan	Competitive	Competitive
Kuwait	Monopoly	Competitive
Lebanon	Monopoly	Competitive
Oman	Monopoly	Competitive, *Single operator to date*
Palestine	Monopoly	Competitive
Qatar	Monopoly	Monopoly
Saudi Arabia	Monopoly, *Market liberalization initiated during 2006*	Competitive
Syria	Monopoly	Competitive
UAE	Competitive, *Market liberalization initiated during 2006*	Competitive , *Market liberalization initiated during 2006*
Yemen	Monopoly	Competitive, *Duopoly*

Source: Arab Advisors Group; ESCWA

Figure 2: ISPs' ADSL market shares in Jordan, 2005



Source: Arab Advisors Group

leasing its infrastructure to competitors.[5]

The encouraging trend toward market liberalization in the ESCWA countries still suffers from significant concerns as to the true extent of genuine competition. Table 2 shows that, although 12 countries out of 13 have allowed competition in their data markets, some of them still have a single service provider. In other cases, competition is only open to Internet services, but not to data services and carrier provision. Furthermore, incumbents still directly or indirectly dominate the markets. In Jordan (figure 2), Wanadoo Jordan (a subsidiary of Jordan Telecom) had about 55% market share in 2005 despite strong competition from other providers, especially Batelco Jordan. In Saudi Arabia, more than 15 ISPs provide ADSL services, but the incumbent, Saudi Telecom, charges an activation fee for the service in addition to a fixed monthly fee for using the phone line.[6]

The situation of limited competition may reflect commercial realities such as limited market maturity or high risk, but it is also the outcome of government policies and strategies regarding liberalization. The major characteristics that still

[5] Source: Arab Advisors Group.
[6] Ibid

Table 3: National information society policies and strategies in the ESCWA region

	Detailed ICT Strategy	Explicit Implementation Plan
Bahrain	YES	YES
Egypt	YES	YES
Iraq	NO	NO
Jordan	YES	YES
Kuwait	YES	NO
Lebanon	YES	YES
Oman	YES	YES
Palestine	YES	NO
Qatar	YES	NO
Saudi Arabia	YES	YES
Syria	YES	NO
United Arab Emirates	NO (*)	NO (*)
Yemen	YES	NO

* Despite the lack of a formal document for national ICT strategy, there are action plans with excellent pace of implementation, particularly in Dubai

Source: ESCWA

favor continued concentration of market power in the hands of incumbents include the benefits from established networks and wide subscriber base; the significant costs involved in the deployment of network elements; and market experience. In this context, the role of regulatory authorities and the transparent implementation of ICT strategies are of prime importance.

Given the market imperfections, governments may take the decision to intervene directly in order to guarantee access to essential facilities and networks controlled by the incumbent (e.g., Egypt). For example, tariffs could be directly "imposed" by governments to facilitate the adoption of broadband services. This was the case in Egypt and Syria. The counter–example can be taken from Lebanon, where there is no government intervention, and prices are set by market forces.

Broadband policies and initiatives

Most ESCWA members have elaborated some form of national ICT policy and strategy, though with varying degrees of explicit implementation plans (see table 3). The existence of a specific broadband policy/initiative in these countries is however less clear. A notable exception is Egypt, which adopted a formal three–year broadband strategy [7] that was officially launched in May 2004, with the aim of boosting broadband deployment based on different technologies (ADSL, WiFi and WiMAX in

[7] Source: Egypt Case Study, ESCWA, 2006.

Egypt's Broadband Initiative

The three–year broadband initiative (2004–2007) was officially launched in May 2004. The initiative aims in the short term at boosting ADSL penetration, introducing WiFi and WiMAX hotspots in public areas and promoting wireless LANs in the residential sector. In the medium term, the initiative includes a plan to introduce cable modems for the delivery of advanced integrated services to households. The initiative also considers the expansion of a WLL network (based on CDMA2000–1x), currently targeting rural areas, to cover urban areas for voice and broadband services. The long–term agenda includes other broadband technologies and services such as VDSL, ETTH, and 3G broadband services. The ultimate goal is to increase broadband subscribers to 1.5 million, reaching a penetration of 2% by the end of 2007.

Broadband penetration has started to improve over the last two years. The government has realized the need to build an e–society as part of the global information society, and is leading an ambitious broadband initiative, with the objective of increasing broadband penetration.

Egypt has come a long way since then, as the "broadband initiative" was the latest phase of a national "e–readiness" plan to provide citizens with Internet access and close the much–touted digital divide. According to a press release from MCIT (Ministry of Communications and Information Technology), under whose auspices the scheme was hatched, the initiative is "*unique in the Middle East and Africa, and will lead to huge progress in Internet services.*"

The initiative's primary goal is to double the country's current number of ADSL lines with a 20–fold increase over the next three years. The initiative's second goal is to set up WiFi hotspots to offer high–speed, wireless Internet access from certain public areas. One reason for low broadband penetration thus far has been the prohibitive cost of ADSL subscriptions. While prices are comparable to international standards, they are high within the context of the Egyptian economy.

The government's new–found ability to charge so much less for the service can be attributed largely to a decision to boost the national bandwidth supply (which has reached 5.3 Gbit/s), essentially allowing it to negotiate volume discounts from international bandwidth suppliers, such as FLAG telecom and SEA–WE–ME. Although state–owned fixed line provider Telecom Egypt (TE) enjoyed a monopoly on international connectivity, the government struck a deal to reduce the leasing rate of these lines to several local ISPs. Another obstacle which has traditionally hampered ADSL penetration is the difficulties associated with installation, with the process often taking far longer than advertised. So, "*a straight–forward deployment process of DSL lines*" was announced by MCIT to ensure a reduction of installation time to a matter of days.

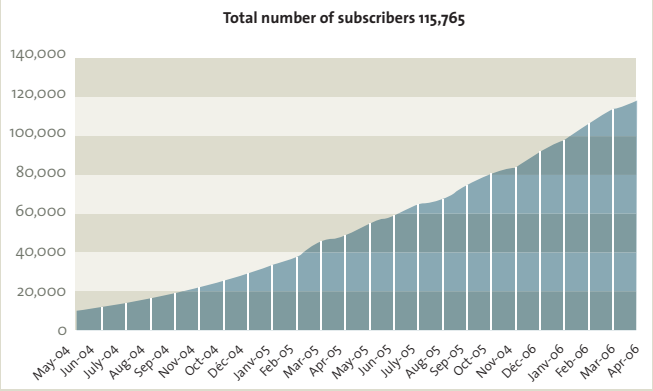
During 2002, the focus was to set a suitable regulatory environment to encourage the spread of broadband technologies across the nation. By April 2002, local loop unbundling took place. In the following month, ADSL services started being offered to the public.

Egypt's "Broadband Initiative Preparation", including a market study, problem identification, and the design of the broadband initiative action plan, took place from October 2003 to April 2004. The official launch of the initiative was in May 2004. The action plan can be summarized as follows:

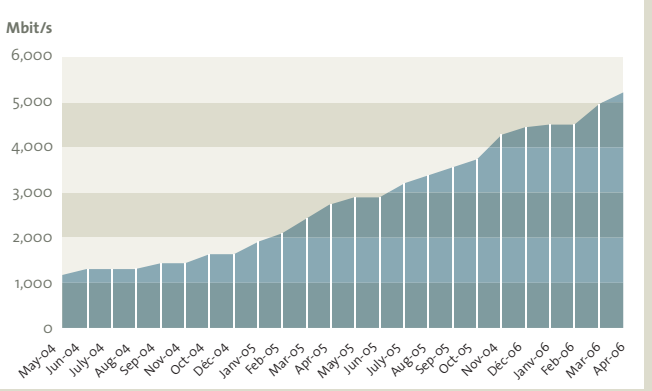
1– Increasing ADSL penetration comes first in the broadband initiative action plan. The initial target was to increase ADSL subscribers by 50,000 during the first year. Starting in the first quarter of 2004, the plan was to focus on three main objectives:
   - Reducing the minimum monthly fees for ADSL services via a number of reductions in unbundling fees and costs of local capacities through volume discounts.
   - Stimulating demand by empowering content providers to deliver more attractive e–applications.
   - Launching a wide, government–supported marketing campaign to increase public awareness while decreasing market overheads.

Egypt's Broadband Initiative (Continued)

Development of ADSL lines (May 04-April 06)



Evolution of international capacity (May 04–April 06)



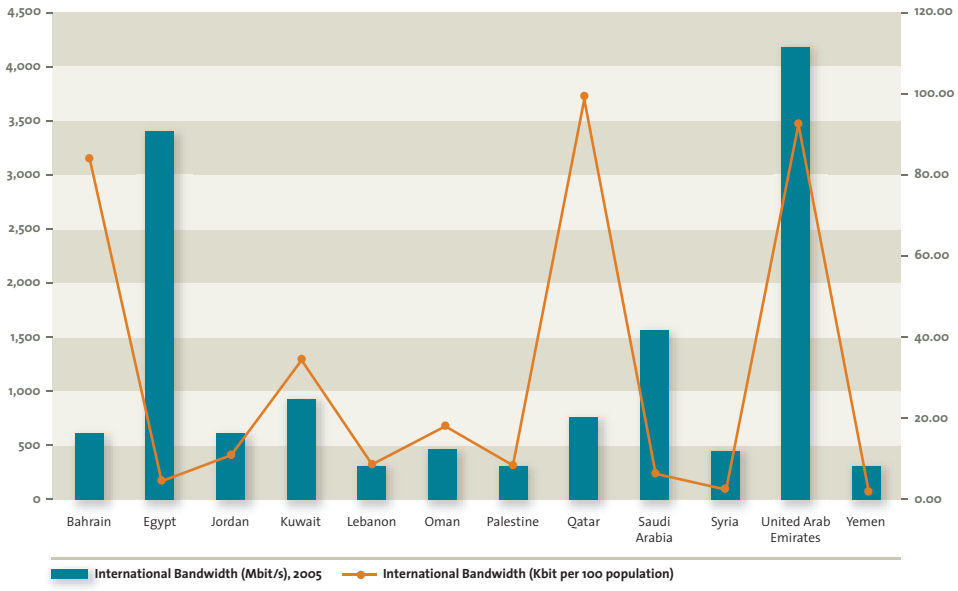
Also during 2004, the action plan focused on spreading the use of WiFi technology by encouraging the establishment of hotspots in public areas such as Cairo International Conference Center, Cairo airport, plus universities, hotels, cafés and other public places. Collaborative efforts took place aimed at setting the regulatory environment and defining the licensing framework for providing public WiFi services. This was accompanied by a "Laptop for Every Professional" initiative.

2– The second phase of the initiative's action plan, which started during the third quarter of 2004, focused on exploring the newer WiMAX 802.16 technology. As 802.16 products have become more available, the government led another pilot project to test the deployment of the technology in last–mile broadband access. The successful result of this pilot is expected to drive, at a later phase, the widespread deployment of WiMAX technology for expanding broadband access to residential customers and businesses.

3– Cable modem, the third component on Egypt's broadband agenda, was planned to be introduced during a later phase of the initiative. MCIT is still working on setting the regulatory environment for cable services in collaboration with NTRA and the Egyptian Radio and Television Union (ERTU). This will clearly define the licensing framework, as well as the roles of the different service providers, in offering broadband data access and broadcasting services. After this phase, two districts will be selected to implement pilot projects, which are necessary for early market testing. The pilot project will explore the different alternatives for laying down fiber infrastructure in highly populated areas, such as new excavation techniques and fiber–in–gas technologies. TE, in cooperation with different vendors, is expected to play a key role during this phase. The definition of a successful business model for providing wide–scale cable services will greatly depend on the outcome of the pilot projects, and will follow at a later stage.

4– In the long term, Egypt's broadband agenda will introduce newer technologies such as VDSL and ETTH (Ethernet to the Home), and increase the deployment of broadband wireless services as new technologies become available.

Figure 3: International Internet bandwidth in the ESCWA region, 2005



Source: ITU World Telecommunication Indicators

the short term; cable modem in the medium term; and other technologies like FTTH in the long term). The ultimate goal, as stated, is to reach a total broadband penetration of 2% (1.5 million subscribers) by 2007.

Even without a formal broadband policy, the importance of promoting broadband applications and services is generally well perceived in the ESCWA region. Most of the countries in the region consider broadband as an increasingly important developmental building block of the Information Society. Many of them have launched applications running over high–speed, broadband telecom networks. In Jordan for instance, a "Broadband Learning Network" is currently under construction, which aims to interconnect all public schools and universities.[8] Similarly, the "Education Net Initiative" in Kuwait aims to connect all schools and libraries over one network

[8] Source: "Jordan Internet & Datacomm Landscape Report," Arab Advisors Group, 2006.

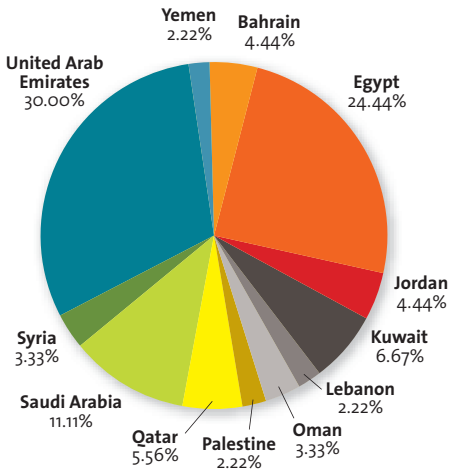
by 2006. A DSL network is set to connect public schools to the Internet.[9]

International connectivity

International connectivity is a major issue affecting Internet development in the ESCWA region, as it constitutes the gateway to the international Internet. Broadband is, by definition, a bandwidth–consuming service, so the volume of international connectivity required is directly proportional to the number of broadband subscribers. The ESCWA region has recently shown a notable increase in its international bandwidth (see figure 3). However, if we consider the region's population, we can observe that both an internal and an external divide remains.

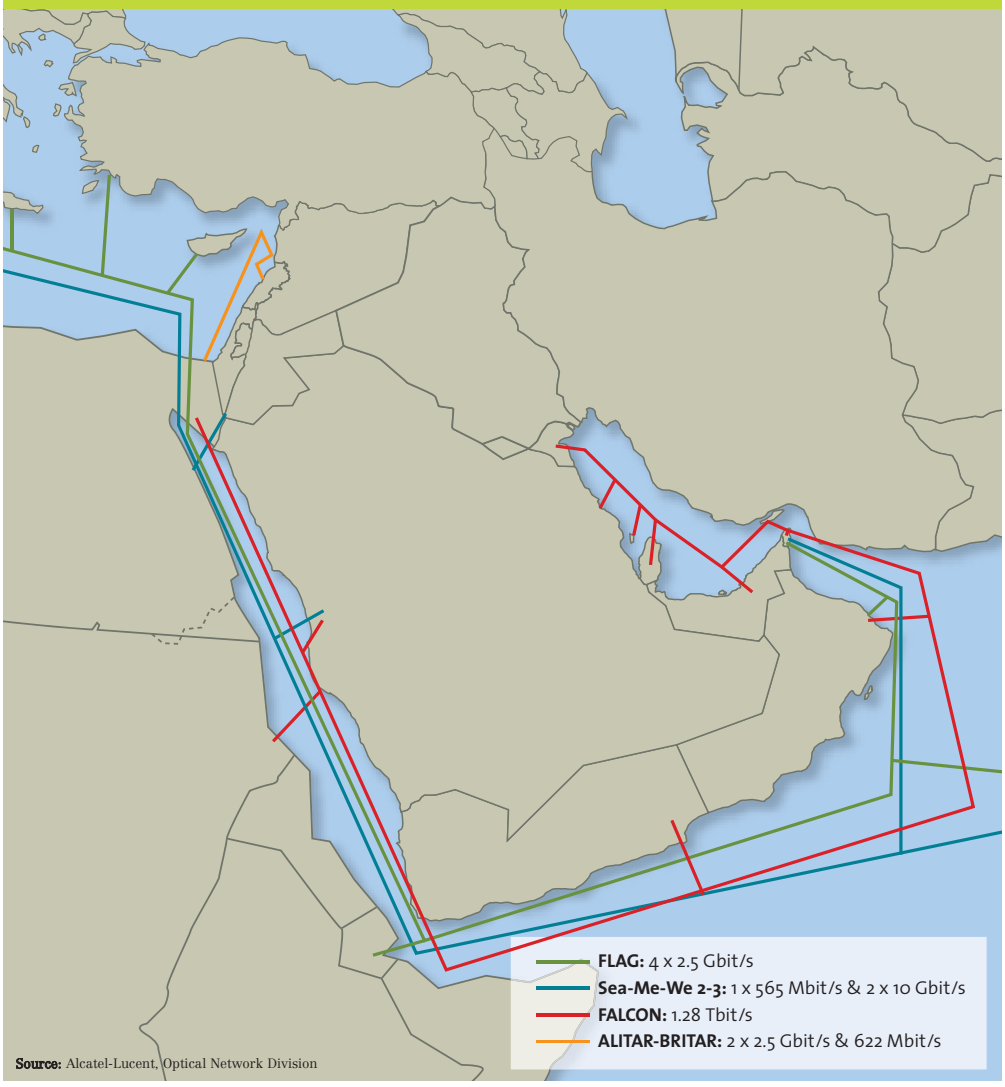
Internally (within the region), the international connectivity per 100 people in the region varies from a maximum of about 100 kbit/s, as in Qatar and the UAE, to a minimum of less than 2 kbit/s, as in Yemen; the average for the region is slightly over 8.5 kbit/s, compared with the world average of more than 80 kbit/s. This last figure shows the wide external divide; the highest connectivity in the region was found to

Figure 4: Distribution of international Internet bandwidth in the ESCWA region, 2005



Source: ITU World Telecommunication Indicators; Arab Advisors Group

Figure 5: Submarine optical cables in the Middle East



Source: Alcatel-Lucent, Optical Network Division

[9] Source: "Regional Profile of the Information Society in Western Asia," ESCWA, 2005.

Fiber–optic and satellite operators in the MENA region

The Arab countries examined get most of their international bandwidth via either fiber–optic cables or satellite connections. Fiber–optic cables connect countries regionally such as the Fiber–Optic Gulf (FOG), or globally such as FLAG (Fiber optic Link Around the Globe) and the SEA–ME–WE systems.
Usually, fiber–optic cables supply the international bandwidth, the bandwidth capacity utilized for voice, data, and Internet connectivity. As for redundancy plans, the telecom operators usually rely on satellite connections as a backup for securing and maintaining international connectivity.
Most Arab countries still have state–owned or partially private monopoly telecom operators that exclusively provide international bandwidth and connectivity through their premises. For example, if an ISP obtains Internet bandwidth via satellites or fiber–optics, it has to pass through the monopoly telecom operator.
The majority of the Arab countries examined obtain their international bandwidth via FLAG (which provides connectivity to 10 of the 13 countries listed in the exhibit below,), the SEA–ME–WE systems (10/13), Arabsat (12/13), Intelsat (12/13), amongst other operators.

Source: "International Connectivity in the Arab World," Arab Advisors Group, 2005

be one order of magnitude less than the average in the high–income OECD countries.

Figure 4 shows the distribution of international Internet bandwidth within the ESCWA region. The UAE has the largest share, at around 30% of overall regional connectivity, followed by Egypt, then Saudi Arabia (both of which have a much larger population than the UAE). Lebanon's low share is not significant, since ISPs make heavy use of "private" satellite downlinks.[10] "The UAE's large share stems from its advanced Internet market, the high adoption of broadband by the large cosmopolitan communities that reside in the country and the supply of Internet services to neighboring countries through its EMIX."[11]

The ESCWA region is connected to the rest of the world through several fiber–optic cables, which give the region relatively high potential connectivity (figure 5). It is expected that increasing demand for bandwidth, due to broadband deployment and the emergence of new services with high data–rate requirements, will drive new investments in international bandwidth for the various countries in the region.
Most of the ESCWA countries are still under monopoly for international gateways, although competition has started to emerge, mainly in Bahrain, Saudi Arabia, Jordan, and Egypt. "In Qatar, Qtel's monopoly over international services is expected to live out the license's lifetime until 2013."[12] The potential adoption of IP telephony might accelerate the liberalization process of this market.

[10] Source: "International Connectivity in the Arab World," Arab Advisors Group, 2005.
[11] Ibid.
[12] Ibid.

Chapter 3

Broadband Demand & Supply Patterns in the ESCWA Region

This chapter will examine the demand and supply patterns for broadband services in the ESCWA region, from the perspective of both customer needs, and the services and products that are used to fulfill them. Different case studies from the region are also presented as illustrations.

Understanding customer demands and needs

As the overall demand for broadband services and applications increases, it is essential to understand and assess user requirements in order to deliver appropriate products. Service providers typically use market segmentation to identify customers' needs. The market is commonly divided into business, government, household, and local community segments, each of which has its own characteristics in terms of required applications, tariffs, and expected growth. Customers in the business and government segments can be qualified as "heavy users", and were naturally targeted first when broadband was initially introduced, especially since they were supposed to be less "price–sensitive" than residential (household) users.

In Chapter 2, broadband market take–up in the ESCWA countries was examined and shown to be still immature. Services in such markets are supply–driven rather than demand–driven. Demand is usually stimulated by introducing new products and applications. The products are then adapted and expanded to better meet the expectations and needs of the growing customer base in the specific market segment.

Household and local community broadband market segment

Residential users tend to use the Internet for a variety of activities, including sending and receiving e–mails; finding information about goods and services (and eventually buying them on–line); obtaining information from (and sending forms to) public authorities; making on–line payments and Internet banking; accessing entertainment facilities, etc. Most of these activities can be achieved using a dial–up connection. Broadband, on the other hand, is an increasingly convenient option because, being an always–on facility, it allows the telephone line to be freed up during Internet access. It also allows for multiple connections to take place at the same time when coupled with home networking, especially wireless (home WLAN). Broadband connections also become a necessity for activities such as streaming and downloading music and videos, on–line interactive gaming and entertainment, audio–and video-

Survey on Egypt's demand pattern for broadband access and services

In 2006, Alcatel-Lucent conducted a survey in Egypt on cybercafé customers and broadband early adopters in order to better assess potential broadband usage patterns in the country.

The objectives of the study were to identify target profiles in term of demography, education and income; to identify current Internet usage in professional and personal life; and to evaluate the demand for broadband access. The study was conducted in the cities of Mansoura, Tanta, Mahala and Assout.

63% of early adopters (people who are already broadband–equipped) have been using the service for less than one year; and 32% for less than 6 months. The general availability of broadband access is quite recent.

As for the perceived advantages of broadband access, there is an important difference between cybercafé customers and the early adopters. The key points for cybercafé customers were to have a fast connection to download pictures and videos; to have a stable connection; and to be able to make phone calls over the Internet. For the early adopters, the main advantage was to have an easy and stable connection.

The early adopters use the Internet more for professional reasons than the cybercafé customers: 25% versus 15%. As far as applications are concerned, a large proportion of both cybercafé and early adopters go on–line to send and read e–mails, chat, and listen to music. However, broadband–equipped people use certain services more than cybercafé customers: watching on–line video; searching for information; reading news; downloading; and making phone calls. Although it does not concern the majority of users, the early adopters are slightly more interested in on–line buying and e–government services.

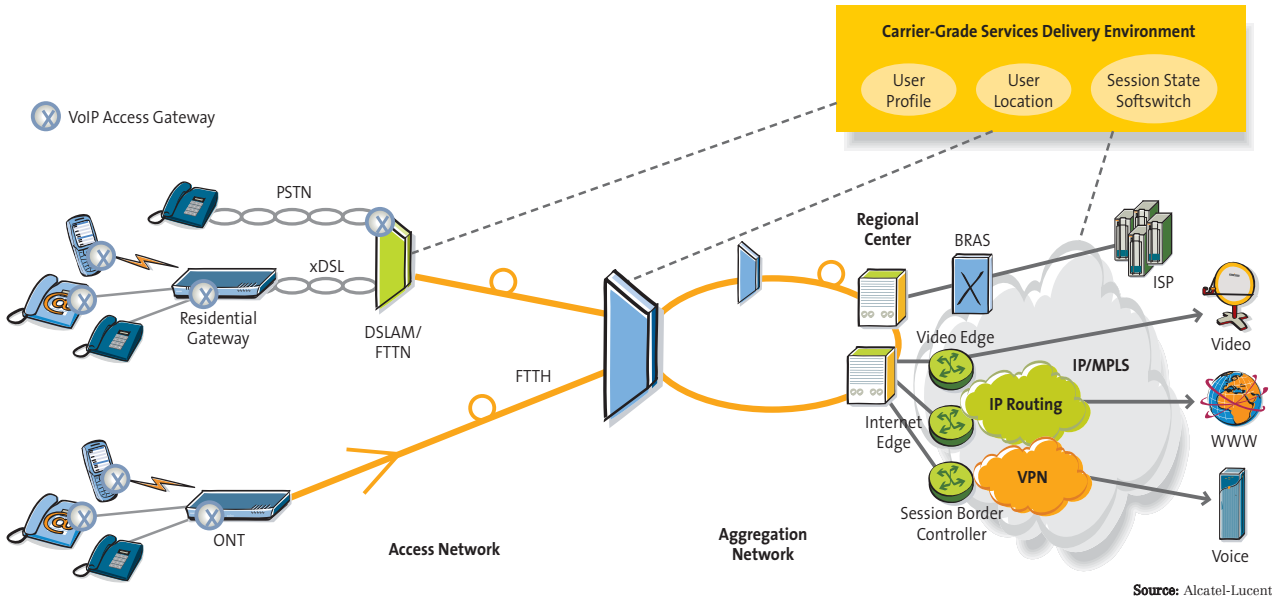
According to the survey, 71% of cybercafé users are either quite interested or very interested in having a broadband connection at home. However, broadband is available for only 27% of the respondents, and 19% do not know if they can subscribe to a broadband connection. The people who are interested are quite enthusiastic, as 52% intend to subscribe a broadband connection within six months! This proportion grows to 78% within 12 months.

As far as payment methods are concerned, respondents are split fairly equally between the 46% who want to have a monthly price plan without commitment, and the 42% who want a subscription method with a contractual commitment. Only 7% are interested in pre–paid cards.

The survey showed that the need for home broadband among cybercafé users is very high. It is also interesting to note that broadband–equipped people use more services than cybercafé users, and 74% of them would score their broadband connection at 8/10 or higher. This indicates the satisfaction level of broadband users in Egypt.

Source: Alcatel-Lucent

Figure 1: VoIP service delivery options



Source: Alcatel-Lucent

communication over the Internet, etc. These applications are very popular with younger people. Considering that, according to 2006 statistics, over 50% of the average ESCWA population is under 25,[1] and the fact that older generations suffer from computer illiteracy, one can see that the younger generation represents the primary target in the household segment.

With the exception of the GCC countries, the ESCWA region is also characterized by low– to medium–income households with an average of 4–5 children per family. Low income is a considerable obstacle to accelerating broadband uptake. The overall result is that residential broadband users are quite price–sensitive, and tend to sacrifice quality for affordability. Therefore, basic broadband connections (e.g., ADSL) are in most cases enough to fulfill the needs of residential customers in the region.

Local communities (especially in rural areas), public institutions and the civil society have specific demands for broadband connectivity. "IT Clubs," Internet cafés and community tele–centers offer Internet access to the public. In rural areas where it is not possible to use DSL technology, wireless backhauling (e.g., by using WiMAX) represents an interesting alternative. Broadband connectivity in these centers is shared among users who access the Internet to send and receive e–mails, surf the Web, or use available electronic services and on–line entertainment facilities. Coupling tele–centers with the development of community portals, which carry community–relevant content, can considerably increase interest in accessing the Internet among the community's population, leading to more demand for bandwidth.

IP Telephony

While IP telephony services have been available for many years, the increased use of broadband worldwide has resulted in many operators and service providers embracing this technology as a way to safeguard their position in the market. IP telephony can provide an affordable substitute for the traditional public switched telephone network (PSTN) through a broadband connection (figure 1). Users can make and receive phone calls via an "IP phone", without even the need for a standard telephone line; these calls can either be routed to other broadband subscribers, or to the public switched telephone network (PSTN). When VoIP and IP telephony[2] are widely deployed, they are also justified for tele-workers, videotelephony and unified messaging.

Several needs can lead to the implementation of IP–based telephony:

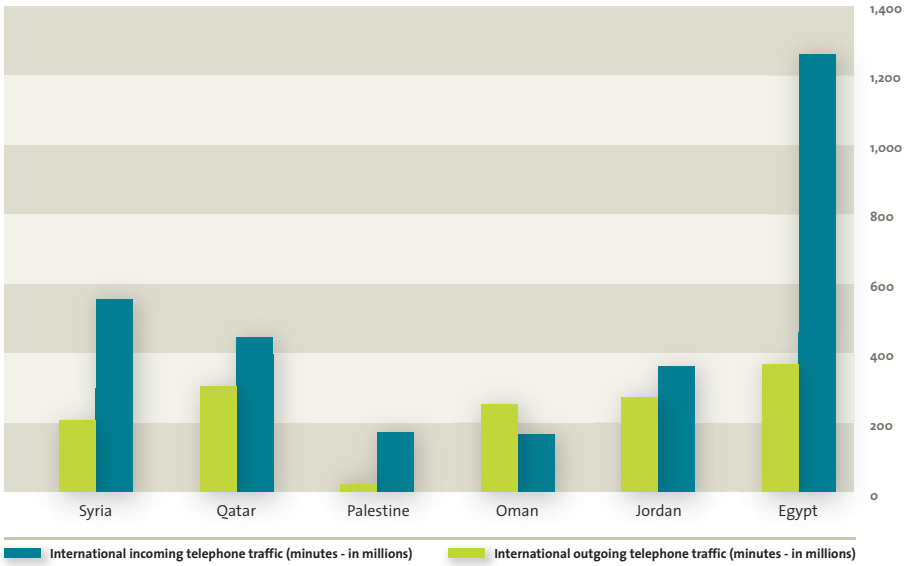
- *Differentiation:* To provide a service that is different from the competitors'.
- *Packaging:* To offer data and voice (and multimedia) services together, as a way to lock in customers.
- *New services:* Voice VPN, IP Centrex and videotelephony are examples of services that address particular market needs (especially in the SOHO and small corporate markets), and require IP–based telephony.
- *Optimization:* A VoIP solution for several terminals using one broadband data link can reduce deployment and maintenance costs in areas where copper is scarce, on green–field sites and in large companies.

VoIP/IP telephony is one of the most requested applications in the region because it allows

[1] Source: World Population Prospects, the 2004 Revision.

[2] Technically speaking, there are some differences between IP telephony and Voice over IP (VoIP); but for the sake of simplicity, we will use these two terms interchangeably in this report.

Figure 2: International telephone traffic in selected ESCWA countries, 2004



Source: ITU World Telecommunication Indicators

international phone calls to be made at affordable rates, sometimes even for free. When using computer–to–computer communications, people tend also to use Webcams to make video calls. VoIP works better on broadband connections, leading to the "double–play" service which enables customers to use their connection for both Internet access (data) and voice calls.

The imbalance between international incoming and outgoing telephone traffic in many developing countries (figure 2) can be seen as an opportunity for IP telephony. Operators can take advantage of a more balanced traffic distribution through the increase in outgoing traffic due to reduced–cost IP communications. Unfortunately, this approach is not accepted in many of the ESCWA countries, especially in low– to middle–income countries, as governments and operators still depend on the difference between the incoming and outgoing traffic to secure revenues in hard currency. In Yemen, Syria, and Lebanon, licenses delivered to data and Internet service providers explicitly prohibit the use of VoIP. In Jordan, on the other hand, the "new integrated licensing regime gives ISPs the right to offer voice services for national and international calls."[3] Several ISPs, such as Batelco Jordan and NEXT, have started investing in international VoIP calling cards; and "Jordan Telecom also launched its "double–play" service under the name LiveBox through its subsidiary ISP, Wanadoo."[4] Finally, in Syria, the government has awarded contacts for VoIP traffic termination with the aim of reducing the amount of illegal international traffic.

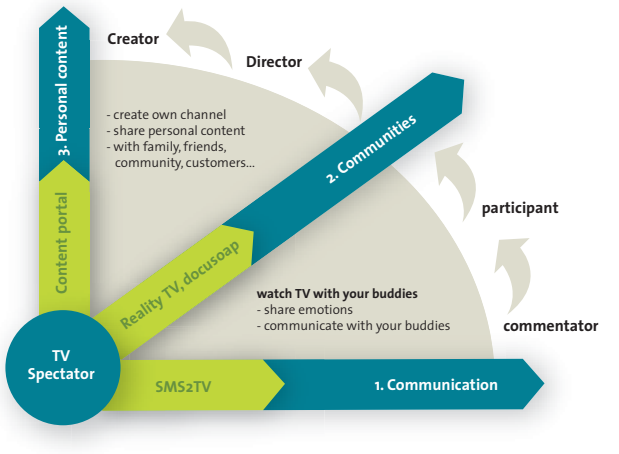
Television over the Internet

Television over the Internet, or IP TV (figure 3), has several advantages for end users. It provides two–way, interactive capabilities not offered by traditional TV broadcasting. Interactive television allows data to be sent back to the TV service provider, which can be used in many ways – such as altering what one is watching (e.g., switching camera angles or changing commentators on a sporting event), requesting more information (e.g., interactive news or advertising), or providing statistics and feedback.

IP TV supports point–to–point distribution, allowing each viewer to watch individual broadcast streams (Video on Demand). This enables stream control (pause, wind/rewind, etc.) and a broad selection of programming, much like the Web. Video on Demand can also emulate digital video recorders, and may also allow the down-

[3] Source: "Jordan Internet & Datacomm Landscape Report," Arab Advisors Group, 2006.
[4] Ibid.

Figure 3: The different stages of the IP television consumer



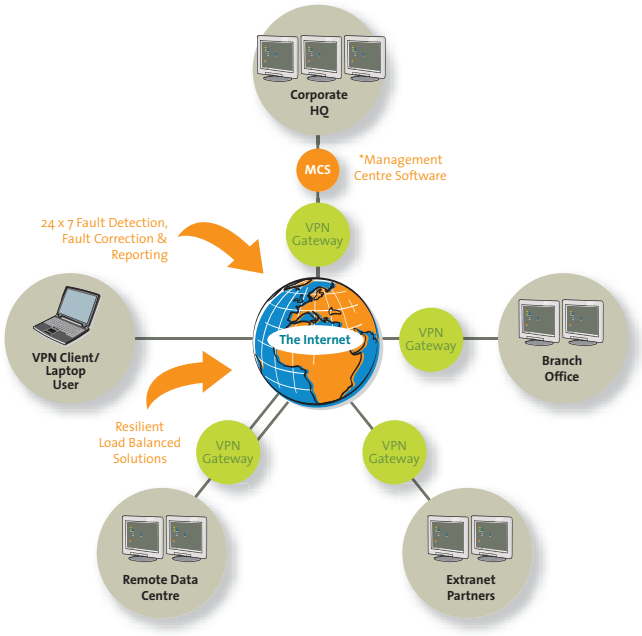
Source: Alcatel-Lucent

load of programs to a hard disk for local control. Traditionally, TV has been delivered via a cable or antenna (or via satellite). Telephony uses another cable, and the Internet has been available on either of them. Now both cable operators and telecommunications operators are offering all three services on a single cable, which is more cost–effective. Triple Play is the expression used by operators to describe a package of telephony, data and TV/video over a single connection.

Broadband access is an opportunity for a community, like a municipality, or a group of people sharing the same interest, to set up its own channel. The digital nature of multimedia content, and the availability of computing equipment and video manipulation software make the broadcast of special–interest programs easy to achieve. The broadband subscriber can take advantage of the connection to access not only national channels, but also local, relevant content. As the cost is significantly lowered, Internet can then offer new services that traditional television is not able to offer.

Unlike double play, the market in the ESCWA countries is not mature enough for the introduction of Triple Play services, which are being marketed now in many developed countries as the converged telecommunication broadband service of the future. "Official" TV broadcasting is still subject to strict regulation in several countries in the region. Nevertheless, households can access many satellite TV programs by installing individual receivers.

Figure 4: Virtual private network infrastructure



Source: Community Internet UK

Business broadband market segment

The business segment includes SMEs and large corporations. SMEs have needs and demand patterns more or less similar to residential users. Services include corporate e–mail systems, VPN, Internet telephony and, to a lesser extent, videoconferencing. DSL is likely to be the most attractive option for SME customers.

Large corporations have different needs, as their requirements also include large enterprise networks, videoconferencing, and on–line administrative and financial transactions. These services usually require larger bandwidths. Besides DSL, other broadband technologies can be used, including leased lines and satellite links.

Virtual private networks

A virtual private network (VPN) is a private data network that makes use of the public telecommunication infrastructure, maintaining privacy through the use of a tunneling protocol and security procedures (figure 4). A VPN can be contrasted with a system of owned or leased lines that can only be used by one company. The main purpose of a VPN is to give the company the same capabilities as private leased lines at a much lower cost, by using the shared public infrastructure (which should have enough capacity). Phone companies have provided private shared resources for voice messages for over a decade. A virtual private network makes it possible to have the same protected sharing of public resources for data. Companies today often use VPNs for both extranets and wide–area intranets.

A well–designed VPN can provide immense benefits to an organization. It can:

- extend geographic connectivity;
- improve security where data lines have not been encrypted;
- reduce operational costs versus traditional WAN;
- reduce transit time and transportation costs for remote users;
- simplify network topology in certain scenarios;
- provide global networking opportunities;
- provide telecommuter support;
- provide broadband networking compatibility;
- provide faster return on investment than traditional carrier leased/owned WAN lines;
- deliver a good economy of scale.

VPN services over IP or indeed MPLS (Multi–Protocol Label Switching) networks that include dedicated and shared leased lines are offered by data service providers in most of the ESCWA countries. This was the result of the

major investment in core IP/MPLS public data networks that replaced legacy X.25 and Frame Relay networks.

E–business and e–commerce

Electronic business methods enable companies to link their internal and external data processing systems more efficiently and flexibly, to work more closely with suppliers and partners, and to better satisfy the needs and expectations of their customers.

E–business (especially B2B) is much more than just e–commerce. It involves business processes spanning the entire value chain: electronic purchasing and supply chain management; processing orders electronically; handling customer service; and cooperating with business partners. Special technical standards for e–business facilitate the exchange of data between companies. E–business software solutions allow the integration of intra– and inter–firm business processes. E–business can be conducted using the Internet, intranets, extranets, or any combination thereof. Broadband connections are often used to allow enough transaction bandwidth.

An e–commerce company usually survives not just by its products, but also by having a well–organized business structure and a secure, well–designed Website. Important success factors include:

1. Providing an easy and secure way for customers to order. Credit cards are the most popular means of sending payments on the Internet, accounting for 90% of on–line purchases. Card numbers are transferred securely between the customer and merchant through independent payment gateways.
2. Providing reliability and security. Parallel servers, hardware redundancy, fail–safe technology, information encryption, and firewalls can enhance this requirement.
3. Providing a 360–degree view of the customer relationship, i.e. ensuring that all employees, suppliers, and partners have a complete view, and the same view, of the customer. However, customers may not appreciate the "Big Brother" experience.
4. Constructing a commercially sound business model. If this key success factor had appeared in textbooks in 2000, many of the dot–coms might not have gone into bankruptcy.
5. Engineering an electronic value chain which focuses on a "limited" number of core competencies — the opposite of a one–stop shop. (Electronic stores can appear either specialist or generalist if properly programmed.)
6. Operating on or near the cutting edge of technology, and staying there as technology changes (but remembering that the fundamentals of commerce remain indifferent to technology).
7. Setting up an organization of sufficient alertness and agility to respond quickly to any changes in the economic, social and physical environment.
8. Providing an attractive Website. The tasteful use of color, graphics, animation, photographs, fonts, and white–space percentage may aid success in this respect.
9. Streamlining business processes, possibly through re–engineering and information technologies.

Naturally, the e–commerce vendor must also perform such mundane tasks as being truthful about its product and its availability; shipping reliably; and handling complaints promptly and effectively. A unique property of the Internet environment is that individual customers have access to far more information about the seller than they would find in a "bricks–and–mortar" situation.

E–commerce is developing fairly well in several ESCWA countries (e.g., the GCC countries, Jordan and Lebanon), while other countries are just starting. Many companies provide e–commerce selling facilities through their Websites to on–line customers. However some companies "*are still not motivated to launch a fully integrated Web site for e–commerce transactions due to Internet security issues in addition to the current deteriorating economic situation.*"[5] Moreover, e–payment still faces the challenge of public lack of awareness in a cash–based society.

Public broadband market segment

The public market segment is mainly concerned with services that are delivered to the public. Most of those services, in developing countries, are initiated or directly provided by governments, which are considered both the major promoters and the biggest clients of ICT applications.

As a client, a government has similar demand patterns to the business segment. In particular, office automation is considered one of the important drivers for high traffic between multiple locations, contributing to the increase in broadband usage.

As a promoter, government has a very important role to play, building "government networks", and encouraging ICT applications such as e–education, e–health, e–government, and e–payment, which are key factors in creating new demand for on–line public services and expanding broadband usage.

[5] Source: "Lebanon Internet & Datacomm Landscape Report," Arab Advisors Group, 2005.

E–government

The major objective of any e–government project is to increase the efficiency of public services delivered to citizens. Typically, this is done by converting as much information as possible into electronic format so that it can be retrieved by anyone using the Internet. Such projects target three audiences: citizens surfing public Internet sites; enterprises using the administration's extranet services; and employees connected to the administration's intranet.

From the citizen's viewpoint, e–government provides free on–line information and administrative form processing services, such as income tax returns, local authority services, news, and social security information. For example, citizens would like to be able to renew their drivers' licenses without lining up at the licensing authority's office. Similarly, it would be very convenient if people could obtain visas or health–related information when planning a vacation. Enterprises, on the other hand, are interested in on–line administrative procedures, such as legal status, VAT filing, accounting, new worker declarations, customs declarations and nationwide statistics. They are also interested in Web–based commerce with public administrations, i.e. Public Private Partnerships (PPP). The key gains here are the automation of administrative procedures, and the consequent savings on administration and accounting costs. Savings can be achieved not only by the enterprise, but also by the administration in terms of enhanced staff productivity, and by cutting the cost of tax collection. Both benefit enterprise competitiveness.

The key attraction from an administration's perspective is obtaining access to unified intranet collaborative services. Unified procedures and workflows (human resources, purchasing, public service support, etc.) throughout a distributed virtual organization enable civil servants to respond more efficiently to people's requests, without the need to have a server on every site. Administrations differ from enterprises in the numbers of users who need to be connected. Large administrations often have hundreds of thousands of employees, and are connected to tens of millions of potential users. Also, they are distributed nationwide, and even abroad through their embassies. All the citizens in a country want access to their services. Consequently, it is necessary to deploy multiple access solutions as well as measures to narrow the digital divide. Administrations, but also citizens, are also sensitive about the security of private and public information databases, such as electronic medical records. They are therefore keen to respect privacy legislation, and protect public services against hacker attacks in an environment that is open to the public.

In brief, e–government supporting collaborative communication tools should meet three main criteria: scalability, while preserving the multiplicity of services; flexibility with respect to the method of access and geographical location; and a high level of security for communication services, information databases and transactions.

Most of the ESCWA countries have already launched some sort of e–government initiatives or projects, even if some of them are still in the initial stages. These projects are fairly advanced in the GCC countries as well as in Jordan. The Dubai government was an e–government pioneer. A recent study placed Dubai's availability of basic public services on–line at 76.4%. Only three European countries had better availability in late 2003.[6]

E–education

Educational institutions, companies and governments are faced with growing challenges to provide improved access to education, enable lifelong learning, and deliver educational services in new ways.

As we move towards a knowledge–based society, educators worldwide face a mounting series of challenges. The first of these is to provide access to knowledge to every member of society, children and adults alike.

Delivering educational services is yet another challenge. With larger classroom sizes, teachers are finding it increasingly difficult to offer the individualized attention that students need. Moreover, student populations are often located in areas that are far from teaching facilities. Broadband technologies can help educators meet these challenges, by providing innovative, cost–effective systems for delivering educational services. With shrinking budgets, a common problem for many school districts and universities, these solutions can help teachers and administrators do more with less.

Broadband technology enhances educational service delivery by offering increased flexibility, easy communications, and immediate access to global resources. Broadband is a key driver for the evolution to a multimedia world, which integrates voice, images, data and TV in a single connection; it can therefore reduce the disparity in access to knowledge. This gap, often called the digital divide, can deepen a nation's economic and social rifts, and lead to the virtual exclusion of certain segments of society. By contrast, providing universal access to education is a way of creating a cohesive, inclusive society that is focused on development.

[6] Source: Madar Research, 2003. The study was based on a methodology adopted by the European Commission for evaluating the level of on–line availability of EU basic public services.

Networks provide an ideal medium for sharing information. The notion of networking, however, is much broader than telecoms alone, and includes human interactions. In this broader sense, networks have a tremendous value for education. Broadband Internet provides instantaneous, global access to educational resources. Inter–campus networks provide course– and discipline–specific links and information to an international user base for research and teaching. Virtual universities and classrooms create opportunities for collaborative learning. The availability of e–mail and discussion groups increases student/teacher interactions.

E–education takes advantage of broadband to improve ways of educating children and others. With distance learning, educators can address different audiences and diversify their teaching styles to include interactive lessons, face–to–face teaching, on–line tutorials, etc. Leading professors can have vastly greater impact by reaching a much broader audience. Computers and networks make it easier to design and run courses that emphasize "learning by doing," which is more difficult in traditional classroom environments. Teachers can free up classroom time by using the network to collect homework and perform other routine functions. E–education is also an excellent means of delivering individualized instruction on demand for lifelong learners, although this market is rather limited.

E–health

E–health refers to all forms of electronic healthcare delivered over the Internet, ranging from hospital information systems, to informational, educational and commercial products, to direct services offered by professionals, non–professionals, businesses or consumers themselves (figure 5). E–health includes a wide variety of the clinical activities that have traditionally characterized tele–health, but delivered through the Internet.

Broadband enables new ways of working and helps improve the quality of care in connected areas. Experience and knowledge can be more easily shared, and collaboration is enhanced. Remote populations can access medical expertise from anywhere with tele–expertise and tele–diagnostics. In emergency or disaster situations, a broadband network can speed up the deployment of medical teams and enable better coordination.

Supply of services and products

Broadband services and products delivered to the customer are based on several access technologies, which can be broadly classified into wireline and wireless. Wireline services include mainly xDSL–based access, traditional leased lines offerings, access by fiber optics to the building (FTTB) or to the home (FTTH), and access via cable modem technology. Wireless services include the use of the wireless local loop (WLL) for data, WiFi and WiMAX technologies,third–generation (3G) mobile, and satellites. The selection of the best access technology depends on several factors, like demand assessment, cost–effectiveness, availability of resources (especially the frequency spectrum for wireless technologies), and geography.

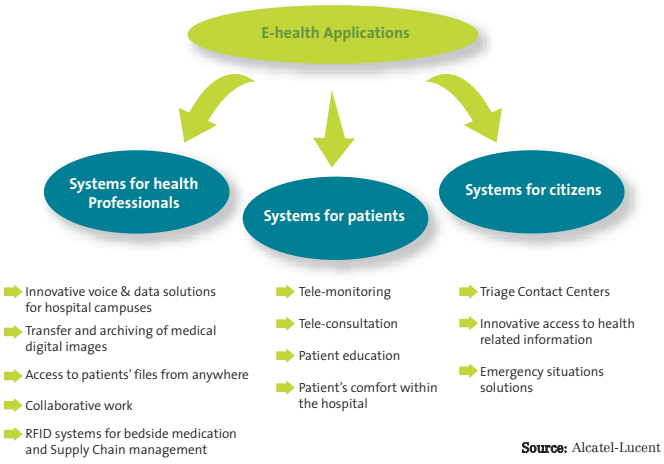
In this chapter, we will analyze some of the access–technology supply patterns in the ESCWA region.

Wireline services

DSL is by far the most common technology in use in almost all of the ESCWA countries; the exception is in Lebanon, where the major offering is wireless–based, although plans were set to introduce DSL during 2006 (See next chapter). DSL is characterized by its relative affordability and ease of deployment, especially when "copper" is sufficiently available in the access network. Operators and service providers in the region have made use of the already–deployed copper plant of the public switched telephone network (PSTN). While the PSTN provides relatively good coverage of urban (and to some extent suburban) areas, DSL is sometimes not available in rural areas (e.g., in Syria and Yemen.) The quality of the copper plant in terms of loop length (in the range of 3–5 km) and cable characteristics (cable diameter, buried vs. suspended cables, etc.) is crucial, as it affects the decision to use DSL technology in a particular area.

ADSL is the most common "flavor" of the xDSL family in the region, with available download speeds ranging from 256 kbit/s (128 kbit/s is some-

Figure 5: E–health applications



Source: Alcatel-Lucent

ADSL supply patterns in Oman

The total ADSL subscriber base in Oman is 11,500, with an additional 231 leased line subscribers. With 2.34 million residents in the country, the potential for growth of services is enormous.

Residential Sector
With around 169,400 students in Oman beyond the secondary school education stage, and an average of five children per family, the residential market is characterized by low–income–bracket households with children. The market in Oman is relatively immature compared with other GCC countries, and much of the development of Internet access has been characterized by Omantel's low–cost post– and pre–paid dial–up Internet access services. The advent of ADSL broadband in 2004 has however transformed the market, and Omantel has now sold its entire installed base of 11,500 ADSL connections, mainly to residential customers.

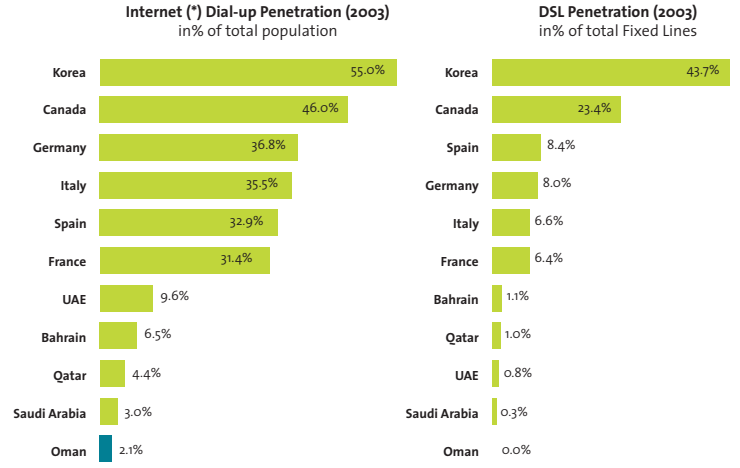
The current residential ADSL broadband package costs OMR 12,000 per month (US$ 32.00), with very low–cost download charges at OMR 1,000 per GB (US$ 2.60). Indeed, take–up would have been much higher if capacity had been available away from the main urban population centers in the capital and major city areas. Omantel is currently procuring a large base of ADSL infrastructure, and is confident of selling all new capacity as it becomes available.

Corporate Sector
With around 20,000 active corporate entities registered in Oman as businesses, the growth potential for high–speed (broadband) Internet access is very high. Traditional Internet access in Oman's SME community was characterized by a narrowband link and one company e–mail ID. ADSL is now changing this, with a focus on the imperative for corporate domain names and multiple e–mail IDs, one for each company employee. Following the requirement to stay connected to the world as a global village, there is an acute drive towards the latest ICT trends and use of the most up–to–date technology.
In addition to ADSL connectivity, there is a demand for additional business application suites and connectivity types, which will continue to drive ADSL penetration. Examples include on–line storage/disaster recovery; on–line collaboration/portals; application hosting; remote LAN connectivity and management; etc.

Government Sector
The government initiative to promote electronic services to all people in Oman encouraged Omantel to provide, implement and deploy broadband services in most areas. The Omani Government employs 100,000 staff spread over 43 ministries and other public organizations, although almost 70% of these employees are involved in healthcare and education. The Government Convergent Network will connect all government organizations including schools and hospitals, and serve its stakeholders' needs. The network is based on IP/MPLS technology that caters for bandwidth on demand, and creates a virtual private network for government organizations. Omantel's MPLS network is positioned as the enterprise/government solution to complement its SME–oriented ADSL offerings.

Local communities and special needs organizations

In a move towards promoting the advancement of Digital Oman and with a view to serving the needy, Omantel has strived to offer technology access in a timely manner and under special rating/charging plans to local communities and special/voluntary organizations.



(*) The figures reflect the number of Internet dial-up users (rather than the number of accounts)
Source: Informa Fixed Line Database; ITU Database; Arab Advisors Group; Booz Allen analysis

times available) to 2 Mbit/s. Higher speeds (up to 8 Mbit/s or even more) can be also available in some cases, especially in the GCC countries.
DSL coverage in the ESCWA region has reached an acceptable level in many countries, especially GCC countries. Jordan Telecom's ADSL coverage for example is estimated at 99% of the operator's network, and about 92% of the population.[7]

Internet leased lines are high–end offerings aimed at major enterprises that have high–capacity synchronous Internet data transfer requirements, or wish to host their own Website with a fixed IP address. Leased lines in the region are characterized by very high (sometimes prohibitive) prices; but tariff reductions have been applied in many countries over the past few years. It is interesting to note that tariff reduction has not stimulated more demand, nor has the introduction of ADSL slowed down demand. Clearly, Internet leased lines are a niche offering for major corporate customers.

Cable modem infrastructure is not common in the ESCWA countries, and the supply of Internet access facilities via cable modem is insignificant or even nonexistent, as cable operators are still focusing on building coverage for their core business of satellite TV distribution. There are, however, plans to introduce data and Internet services via cable in the future. For example, in Egypt's Broadband

[7] Source: "Jordan Internet & Datacomm Landscape Report," Arab Advisors Group, 2006.

WiFi in the Middle East

Bahrain
Batelco launched WiFi services in April 2004 with initial installations at Bahrain International Airport, Costa Coffee shops in Seef and Adliya, and the Crown Plaza and Gulf Hotel lounges. In February 2005 Batelco launched WiFi at McDonalds branches in Saar, Sakir and Bab–El–Bahrain. Further WiFi services are planned countrywide as part of Batelco's "Broadband Bahrain" program. Services are accessible via pre–paid cards.

Jordan
The TRC relaxed regulations on WiFi in October 2003, removing fees for internal corporate use. However, operators offering service to the public need to be registered with the TRC, and are required to pay an annual fee of US$ 22 per access point. In February 2005 JT launched national and international WiFi services in conjunction with Wanadoo from France Telecom. Other sites are planned.

Kuwait
MTC–Vodafone provides post–paid access to a number of WiFi hotspots powered by Zajil Telecom throughout Kuwait. Zajil had over 50 hotspots in early 2005.

Lebanon
In late 2002 Globalcom Data Services, a data company, contracted Alcatel-Lucent to supply a nationwide LMDS access solution for its data backbone network. The access network operates in the 26 GHz frequency band. Three ISPs, Cyberia, IDM and Terranet, provide broadband services in partnership with Globalcom Data Services.
Another data company, Cedarcom, provides data services to Internet Service Providers (ISP)s, Application Service Providers (ASP)s, banks, universities, large organizations and small–to–medium enterprises. It received its license in April 1997, which was renewed in September 2003. However, it did not commence wireless services until mid–2004. Its core MPLS network was built using Cisco equipment, and the access network consists of point–to–multipoint links built using World Interoperability for Microwave Access (WiMAX) equipment from Aperto Networks. The network operates in the licensed 2.6 GHz, 3.5 GHz and 7.5 GHz spectrum bands.
Fiberlink Networks, an ISP, provides wireless services using Cedarcom's network. As of October 2004 IDM offered WiFi access with 75 hotspot locations. Hotspots have also been installed in the Intercontinental, Phoenicia and Le Vendome
Hotels, coffee houses such as Starbucks and Tribeca, Beirut International airport, and in the Virgin Megastore in Beirut. IDM plans to establish additional hotspots.

Oman
In December 2004 the Ministry of Education announced that it had deployed a Cisco wireless solution in over 200 schools that is accessible by 100,000 students.
Publicly accessible WiFi hotspots are limited to a small number of hotels.

United Arab Emirates
ECompany provides wireless broadband access in select areas utilizing Multimedia Wireless System technology in the 3.4 GHz range.
ECompany introduced WiFi, branded iZone, in October 2003 with hotspots in selected public locations. By early 2004 there were around 40 access points, and the company planned to have 100 hotspots by the end of 2004.
In July 2004 WiFi was introduced on the Emirates airline

Source: "Telecoms & Broadband – Africa & Middle East," Paul Budde Communication, Telecommunications and Information Highways, e-newsletter, 6 June 2005

Strategy, a plan to introduce cable modems for the delivery of advanced integrated services to households as a pilot project is in place for the medium term.[8]

Fiber to the building/house/area (FTTx) is also a mostly nonexistent service in the ESCWA region, whereas it is witnessing an increasing interest in the developed world (e.g., Japan).[9] This service, however, is interesting when deployed to serve special zones (like high–tech parks), huge corporate buildings and sometimes greenfield sites where copper is not available. Trials of FTTx are planned in some countries in the region, including the UAE, Egypt and Syria.

Wireless services

Wireless local loops (WLL) are mainly used in low–density rural and remote areas. Beside its primary use for last–mile voice delivery, WLL can also be used for providing data services. CDMA 2000 WLL technology has been deployed for this purpose in almost all ESCWA countries, but due to its limited bit rate (typically 153 kbit/s), it can hardly be considered as a broadband offering.

Table 1: WiMAX trials in the ESCWA countries

Country	Requirement for WiMAX provision	Entity that conducted WiMAX trials
Bahrain	Spectrum plan under study	No testing conducted
Egypt	Regulations under study	MCIT
Iraq	Local services license	To be awarded
	Sub-contracted by IPTC	Wireless Telecommunications Services
Jordan	Individual License	Batelco Jordan
		Fastlink
		Jordan Telecom (Pre-WiMAX)
Kuwait	Ministry needs to retrieve the 3.5 GHz band	No testing
Lebanon	No regulations	GlobalComm (Pre-WiMAX)
Oman	Regulations under study	OmanTel provided WAS network in 2.4 GHz and 5.8 Ghz
Palestine	No detailed regulations	No testing
Qatar	No detailed regulations	Qtel has WLL product that is WiMAX ready
Saudi Arabia	Licensed datacomm operators	STC, ITC, Bayanat
	Licensed mobile operators	Etihad Etisalat (to connect its network)
Syria	Regulations under study	N/A
UAE	No set policy for WiMAX	Demonstration at Gitex
Yemen	Regulations under study	Public Telecommunication Corporation to be in charge of operating WiMAX

Source: "WiMAX in the Arab World: Current status and regulations," Arab Advisors Group, 2006

[8] Source: Egypt Case Study, ESCWA, 2006.
[9] Japan has recently announced its objective to connect 30 million FTTx subscribers by 2010.

Attribution of WiMAX licenses in France

At the beginning of the 21st century, the development of wireless technologies for data networks pushed the French government to back the emergence of the wireless local loop (WLL) in metropolitan areas. However, even if several licenses have been issued at the national level for fixed wireless access, almost every operator declined to propose the service because the technology was not mature and standardized, and because the market was not significant at that time. Only one company – IFW, part of the Illiad group – owns a national WLL license from this first attempt.

The emergence of WiMAX – a wireless broadband technology – and the interest of individuals and businesses in mobile communications have led to a new start for WLL. These arguments pushed the French Government to start a new attribution process for WiMAX licenses in 2005. The previous experience and the attribution of UMTS/3G (Universal Mobile Telecommunications System) licenses enabled the building of a new strategy in order to comply with the government's objective. The following explains the legal framework linked to radio frequency attribution, definition of the licenses, and the attribution process.

Legal framework

In France, the telecommunication sector is governed by the Post and Electronic Communication Act, which is mainly a transposition of European Union directives. The Post and Electronic Communication Regulation Authority (ARCEP) is responsible for law enforcement in this area.

The main objectives of the law are to increase the coverage of different communication systems, and to encourage competition at different stages of the telecommunication value chain – core network, aggregation network, and access methods. This policy has delivered good results in terms of the affordability of offers, and increased network coverage via e.g. DSL, through local loop unbundling.

The parliament has also approved a bill which enables administrative organizations – regions, departments and municipalities – to hold a telecommunications license. This is a tool that helps define telecommunication policy for local government – for instance, a rural municipality can deploy a broadband network if no company has done so. However, local government cannot derive a competitive advantage over public or private companies under fair competition rules.

License definition

The regulatory authority decided in 2005 to issue new WLL licenses. It has identified the 3.4/3.6 GHz band, which is the norm for nomadic WiMAX across Europe, with 15 MHz bandwidth per license. It enables only nomadic usage and not mobility, meaning that no handover between cells will be allowed.

To comply with the rules previously defined, the regulation authority will analyze applications on a regional basis to increase the number of operators and local governments involved. Two licenses will be issued for each region. The operators are allowed to resell their license to a third–party company or organization for a part or all of the territory covered by the license.

Attribution process

After the call for tender in August 2005, the regulation authority received 175 letters of intent by 14 October 2005. This step allowed players seeking Wireless Local Loop authorization the time to examine options for sharing their frequency use with other parties.

In early January, at the end of this phase, the authority examined the applications to evaluate the potential scarcity of frequencies region by region. On 10 January 2006, a review of the 45 applications received showed that there was a scarcity of frequencies in the 22 metropolitan regions, and Guyana and Mayotte, where formal procedures had been launched.

The regulatory framework, as seen previously, is focused on service coverage and fair competition. Therefore a simple auction system was not appropriate for choosing successful applicants. The authority identified three criteria for assessing the quality of the applications:

- Broadband coverage of the territory;
- Ability to encourage broadband competition;
- Fees payable to the government.

The selected candidates committed to extensive deployments, which became obligatory in the authorizations. The obligations will involve deployments, starting in June 2008, at more than 3,500 sites. The deployment commitment particularly targets zones not covered by DSL – referred to as broadband white spots. Moreover, some of the successful candidates intend to provide wholesale frequency access offers on their network. Some have no retail plans, and may only provide wholesale offers.

In 2006, the French government will collect a total of 125 million Euros from candidates for the frequency authorizations. In addition, the government will collect about 1.6 million Euros annually in fees from operators for the use of WLL frequencies. However, there is a marked difference in the fees proposed for different regions such as Paris and Champagne.

Following the industry trend, 14 regional councils entered the WLL frequency allocation procedure, and six were selected. The selected regional council projects involve large deployments – to counter–balance their symbolic fee payment of 1 Euro – which are well coordinated with those of local authorities within their regions. It will now be up to the regional councils either to provide frequencies to the local authorities designated in their frequency applications, or to operators for the provision of services in those local authority areas.

Future

The frequency allocation process for nomadic WiMAX has been a success. The authority has announced that another process will be started for mobile WiMAX (802.16e), at a lower frequency such as 2.5 GHz or 700 MHz. The government has recently announced the end of analog television broadcast in 2012, and the freed–up frequencies – 50 to 300 MHz – could be used for mobile broadband wireless access.

Source: ARCEP; http://www.arcep.fr/index.php?id=8650&L=0

WiFi is mainly intended to connect mobile devices (laptops, PDAs, etc.) to the Internet. A distinction should be made, however, between indoor WiFi (for private use) and operator–deployed public WiFi hotspots.

In most ESCWA countries, outdoor WiFi hotspots are now being promoted. The number of WiFi hotspots now exceeds 100 in Egypt,[10] and 12 in Oman.[11] WiFi is also commercially available in Bahrain, Kuwait, UAE and other GCC countries.[12]

WiMAX is a relatively new technology for broadband access. It can be deployed in urban and suburban areas to provide fixed, nomadic (i.e., on the pause) and/or mobile broadband access to the Internet. There is greater potential for WiMAX deployment in areas where copper is of limited availability or poor quality.

Deployment of WiMAX should be associated with an appropriate legal framework, focusing not only on frequency allocation, but also on coverage (including universal access) and competition regulation. These considerations are mostly still under study in the ESCWA countries. Experiences from the developing world (e.g., France) could be studied to achieve the best results.

Trials of WiMAX have taken place in several ESCWA countries (see table 1). In Egypt, several pilot schemes are under way, especially at the Smart Village. A successful result for this pilot is expected to drive, in a later phase, a wider deployment of this technology to residen-

[10] Source: Egypt Case Study, ESCWA, 2006.
[11] Source: Oman Case Study, ESCWA, 2006.
[12] Ibid.

tial users and businesses.[13] Another WiMAX pilot project is now under negotiation to be deployed in Greater Damascus, Syria.[14]

Internet by satellite, although still rather expensive, provides an interesting alternative to DSL especially when combined with satellite TV receivers, which are abundant in the ESCWA region. Residential Internet by satellite is mainly used in the downlink, while the uplink (less bandwidth–demanding) is provided by a classic dial–up (or even DSL) connection.
VSATs (Very Small Aperture Terminals) are more commonly used in business–to–business transactions (but also in remote regions), providing high–speed, two–way data transfer. Many ISPs in the region also use satellite connectivity as a backup (or sometimes an alternative) to traditional international cable systems.

Mobile communication networks can also be used to provide data services. All ESCWA countries already have second–generation (2G) mobile networks installed. Customer needs for higher bandwidth have resulted in most operators upgrading their 2G networks by deploying services like GPRS and EDGE. Certain operators, however, have chosen to deploy third–generation (3G) networks based on UMTS standards, which provide much greater bandwidth. Figure 6 shows how different mixes of broadband access technologies can be utilized to best deliver services to the end user, based on geographical location and the bandwidth required. Part (a) shows how passive optical networks (PON), DSL, WiMAX, 2G mobile networks, and satellite access are positioned in relation to each other. WiMAX is distinguished by its ability to serve rural areas, while PON is mainly reserved for high–bandwidth applications. Part (b) shows how 3G mobile networks could be positioned relative to WiMAX: 3G services are mainly used in urban (and some suburban) areas. There is therefore a certain complementarity between WiMAX and 3G, even though licenses for 3G operation anywhere in the world tend to be much more expensive.

Broadband Internet via satellite in Oman

Omantel has taken the decision to introduce broadband Internet via satellite by expanding the existing VSAT infrastructure at Al–Amerat Satellite Telecommunications Complex. The service will provide Internet facilities for remote areas where there is no terrestrial network infrastructure, and also those areas where ADSL cannot be provided due to its technical limitations (i.e. a maximum distance to the serving exchange of about 4 km).

Omantel, in partnership with MCA, has launched its IP VSAT service, to provide all–digital global connectivity for overseas customers. The partnership with MCA for this particular IP–based VSAT service is intended to ensure customer access to reliable and cost–effective service, combined with a high–speed digital network with regional coverage throughout the Middle East and Africa. The system uses MCA's proprietary IP solution, and is designed to offer affordable service to small to large enterprise users covering the Middle East and Africa. The system supports a range of communications solutions, including VoIP, video, database, Internet, business services data, Internet access and e–mail.

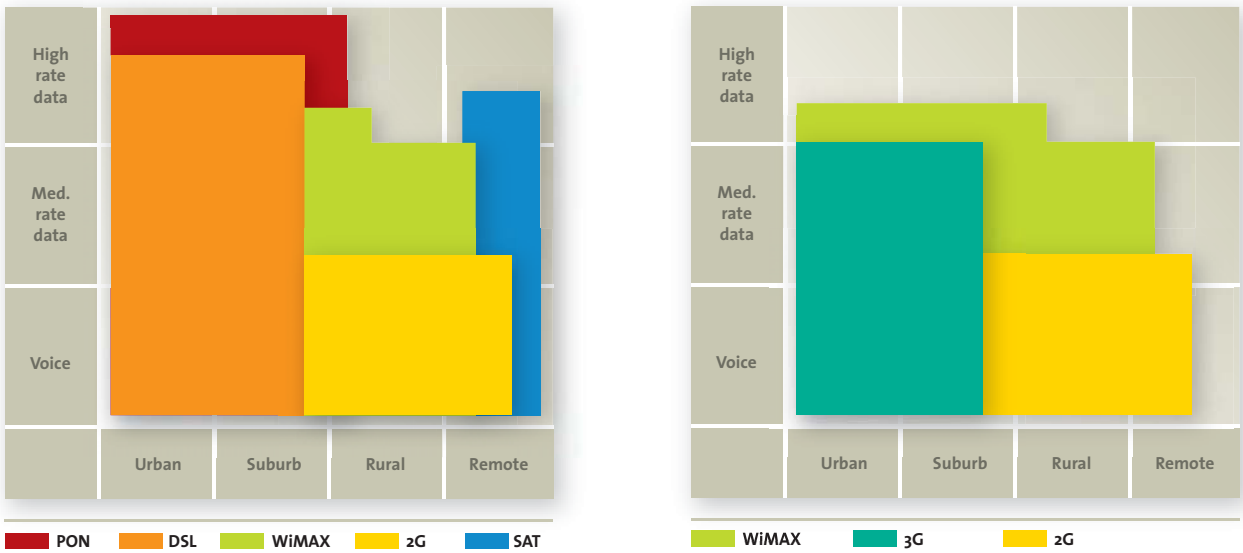
The IP VSAT terminals provide transmission speeds of up to 360 Mbit/s, making it an attractive solution for a wide range of customers that specialize in providing enterprise customers operating in remote locations with a variety of superior, satellite–based IP, data, and voice solutions.

Case studies: examples of significant broadband applications in the ESCWA region

In this section, several case studies illustrating applications requiring broadband connectivity

[13] Source: Egypt Case Study, ESCWA, 2006.
[14] Source: Syrian Telecom.

Figure 6: Recommended mix of broadband access technologies

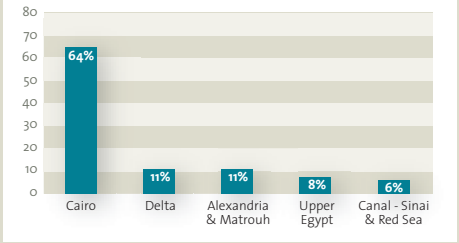


Source: Alcatel Telecommunications Review, 3rd Quarter 2006

Broadband coverage in Egypt

Although the government is encouraging the spread of ADSL, ISPs are mainly expanding in Cairo and Alexandria, which already have the highest concentration of Egypt's access ports. ISPs are always reluctant to introduce a loss–making business in areas that consume more resources for less revenue. Since the cost of a connection is the same all over Egypt, high demand in the cities and the fact that rural connections are often shared among many low–revenue users discourage ISPs from expanding beyond the suburbs.

Distribution of Ports across Egypt



The Egyptian government is encouraging service providers to aggressively introduce WiFi technology, allowing users to connect wirelessly to the Internet via laptops, PDAs (Personal Digital Assistants) or mobiles. It hopes that WiFi will one day replace "free" dial–up Internet service. The technology is relatively new to Egypt, but the number of hotspots is increasing every day in popular locations such as bookstores, hotels, airports and cafés.

A WiMAX field trial was deployed at the Smart Village to investigate the technology, its application, and the viability of the WiMAX business model. It provided valuable information on how to structure a regulatory framework to encourage widespread deployment of the technology, especially as an optimum solution for introducing broadband services in rural areas and new satellite cities, where the infrastructure is less developed than in urban areas.

Traditionally used in business–to–business transactions, VSAT provides high–speed, two–way satellite–based data transfer for medium to large companies, banks, commercial institutions and government agencies, as well as ISPs looking for a fast, economic and reliable alternative to traditional land–based systems. SAT technology, meanwhile, is already deployed in Egypt by some petroleum companies, the Ministry of Education, and others.

are given. These case studies span the entire ESCWA region, and cover the most significant services discussed in the previous sections.

The IT Clubs model in Egypt [15]

The IT Clubs model offers a communal solution to problems of affordability, accessibility, and awareness. IT Clubs – currently 550 – are an essential component of the country's national plan to familiarize people with computers, and promote ICT awareness regardless of skills, gender, or income level. The IT Clubs model is a public/private sector initiative to deliver affordable Internet access throughout the country to those who cannot afford PCs. For nominal fees of around LE 1 (about US$ 0.15) per hour, and by providing hardware, software, and Internet connections, the government has made IT a daily reality for many who previously had little experience of high technology. As an added benefit, local businesses are also welcome to use the IT Clubs.

With many centers based in deprived and rural areas, IT Clubs provide opportunities for those with the greatest need. Users receive guidance from instructors in each club, as well as training in basic skills such as typing, software applications, and Web design. The government provides all the infrastructure necessary for each club, including computers, printers, peripherals, Internet access, a network (LAN), and a server. The government is partnering with Egyptian and international entrepreneurs to accelerate the rate of expansion of these clubs throughout the country.

IT Clubs also create job opportunities for university graduates who can join the "Training of Trainers" program. Graduates who complete the program become IT Club trainers, responsible for providing courses at a particular IT Club. To reinforce the concept of community at each club, trainers must live in the same district as the club they work in, capitalizing on their familiarity with the needs and interests of the local community.

Through its continuing commitment to IT Clubs, MCIT is taking the latest technology to the grass roots of society and, by making IT a part of local communities, is increasing opportunities for all citizens.

Offer from OmanTel to open cybercafés in the country

To develop a network of cybercafés across the country, OmanTel, the incumbent telecommunication operator in Oman, launched a special offer for entrepreneurs wanting to set up their own cybercafé. This is a concrete result of OmanTel's commitment to provide broadband access to all, irrespective of income.

To achieve maximum coverage and efficiency, OmanTel's offer combined a significant rebate with rules to improve the community aspects of the project.

OmanTel provides advice for future cybercafé owners, such as choosing an appropriate location (on a busy street on the ground floor if possible, or in a mall). The authorization to open a cybercafé is subject to a number of conditions: the entrepreneur must provide an exhaustive description of the cybercafé, including a layout plan, the number of computers and equipment, as well as financial information in order to check the sustainability of the business. Each cybercafé has to be sufficiently far from the next to avoid concentration, and to encourage coverage of unserved areas.

[15] Source: "Building Digital Bridges: Egypt's Vision of the Information Society," Ministry of Communications and Information Technology (MCIT), Egypt, 2006.

The Internet connection can be provided via dial–up, ADSL, or leased line. Table 2 shows the rebate available to cybercafés compared with standard businesses.

Table 2: Prices of ADSL connection in Oman

Type	Monthly Rental	Usage charges / GB RO	Speed in kbit/s Upload/ Download
Residential	12	1	128/384
Business	120	1	128/1024
Cybercafé	75	1	128/1024

(1 RO = 2.60 US$)

Batelco's offer for corporate VPN connections

The rapid economic development of Bahrain's commercial sector has led to the creation of subsidiary companies across the country and internationally. As most of these enterprises want to take advantage of a single, integrated information system, the need for secure and seamless remote connections has increased. To address this new market, Batelco proposes a complete VPN offer for businesses.

The companies have a choice between a national offer based on Batelco's national backbone network, and an international offer across the Middle East and GCC countries in partnership with the Cable & Wireless company.

Batelco's IP Virtual Private Network (VPN) allows the creation of a network that acts like an extension to a private corporate network, but runs on Batelco's shared network infrastructure. The result is a fast and efficient means of making scattered locations seem like local sites, from workers' homes to branch offices.

Batelco's IP VPN interconnects sites and remote workers to create a single, company–wide communications network for voice, data and multimedia applications. Network traffic can be classified into different Quality of Service (QoS) levels, each with its own level of priority. This allows the network to distinguish between delay–sensitive traffic such as voice, video and Voice over IP, and non–delay sensitive data, such as e–mail and Web browsing. Tariffs are listed in table 3.

Table 3: Prices for national multipoint VPN

Speeds	Tariff (BD)
4 Mbit/s	1,350
8 Mbit/s	1,450
10 Mbit/s	1,500
25 Mbit/s	1,980
50 Mbit/s	2,300
100 Mbit/s	2,700
200 Mbit/s	3,200
500 Mbit/s	4,200
1 Gbit/s	5,000

(1 BD = US$ 2.65)

Source: Batelco; http://www.batelco.com/Bus_Data_National_MPLS.asp

E–commerce players in Lebanon [16]

E–commerce–enabled Web pages are widely used by Lebanese companies and institutions. In fact, e–commerce users in Lebanon include many businesses in a wide range of retail (B2C) and business–to–business categories.

E–commerce solutions and applications are offered to most of the B2C companies through NetCommerce S.A.L (www.netcommerce.com.lb), which is managed by Inconet Data Management (IDM), Credit Libanais Bank, and Fransabank.

NetCommerce offers companies e–commerce solutions to help them expand their businesses on–line. The products and services traded through the Internet are managed in real time using a secure payment gateway. Purchases are settled by Visa and Mastercard. Transactions are authenticated and authorized using 128–bit SSL (Secure Socket Layer) encryption technology from VeriSign. NetCommerce also provides detailed and summary transaction reports, as well as financial follow–up. Furthermore, NetCommerce has strategic alliances with leading logistics firms to ensure the delivery of ordered products. NetCommerce also registers the company's site with search engines and shopping directories like Yahoo! Shopping. It also links the company's site to related local, regional and international sites.

B2B e–business with Internet: tejari.com

Tejari (www.tejari.com) is a B2B marketplace that allows companies to buy and sell goods and services on–line. Through Tejari, buyers can find, compare and procure products and services from the familiarity and convenience of their desktop Internet browser. Suppliers can list their products and services and sell them through on–line catalogs or auctions.

Operational since June 2000, Tejari has created, and maintains, the highest standard of B2B customer service and trading facilities in the Middle East region.

Not only is Tejari now the Middle East's leading business–to–business on–line marketplace, it remains the sole on–line procurement service provider with a demonstrated knowledge of the unique challenges and traditions of the region's business community.

Here is a list of the services offered by Tejari:

- Tejari Transact: member companies and organizations in Tejari Transact can buy and sell goods and services efficiently on–line and in real time. Through Tejari, buyers can find,

[16] Source: "Lebanon Internet & Datacomm Landscape Report," Arab Advisors Group, 2005.

compare, and procure products & services. Buyers can conduct reverse auctions in which sellers bid to supply products and services at the most competitive prices. Suppliers can also list their products and services, to sell them through on–line catalogs or auctions.

- Tejari Link: an innovative on–line service from Tejari. It facilitates trade between Middle East companies by providing a convenient, cost–effective and extensive on–line marketplace where they can buy and sell a wide range of products and services.
- Tejari Mobile: Offers access to the Tejari Website from mobile devices.

Qatar e–government portal

The government of Qatar initiated an E–government Committee to design, guide and help to implement a government–wide initiative providing e–government services to citizens and businesses in an effort to achieve the highest performance in executing governmental transactions electronically, through streamlined business processes and integrated information technology solutions.

To achieve this mission, in April 2001 the State of Qatar partnered with an international consulting firm to draw upon international best practice and thought leadership to craft a strategic vision for transforming Qatar into a leader in e–government. The project team, comprised of the Qatar e–government Committee and the consulting team, developed the Qatar e–government strategic vision by defining key objectives and identifying the key enablers of and barriers to success. The strategic vision developed for the e–government initiative includes:

1. Qatar online services;
2. Anytime, anywhere access;
3. Providing government transactions, information, and knowledge.

The scope of the e–government framework involves setting up a:

- Single government–wide portal;
- Single electronic payment gateway;
- Single public key inscription security.

Ministries will be able to link their legacy systems and existing processes to the e–government framework, and e–enable their services. Through parallel efforts, ministries will be responsible for re–engineering their business processes and undertaking projects to upgrade and replace their back–office legacy systems.

Among the services currently available on the portal, it is possible to apply for a visitor's visa, health card or residence permit; pay water, electricity and phone bills; settle fines for traffic violations; and even donate to the Red Crescent or the Zakah Fund.

In the near future, the Website will allow applications for building permits and new or replacement passports; facilitate imports and the payment of import fees and customs duties; issue various certificates on–line; and accept new car registrations.

With a 40% Internet user growth rate,[17] the Qatari government has succeeded in leveraging the opportunity to interact efficiently with many citizens, residents and businesses, allowing significant savings on public services through reducing paper–based processing and payment offices.

E–Palestine[18]

On 10 May 2005, the Board of Ministries gave its approval of the e–Palestine initiative and all its components. The e–Palestine project covers e–government, electronic education, a smart card project, the National Institute for Telecommunication and Information Technology, the role of women in the telecom and information technology sector, the Palestinian Euro/Mediterranean partnership, and a project to create a database of the Palestinian culture and ideologies.

The establishment and execution of e–Palestine is the responsibility of the Ministries' committees as determined by the Minister of Telecommunication and Information Technology. The committees' roles are:

- Drawing up the regulatory framework, regulations and structure for the e–Palestine project, and undertaking the necessary research.
- Providing the funds required by the project from the sponsoring countries.
- Executing the projects in cooperation with the ministries and institutions concerned, and the specified parties from the private sector.

E–government

The law establishing the e–government initiative was signed on 3 May 2005. It decrees:

- Forming a technical committee (emanating from the ministerial committee) to initiate the e–government project.
- Establishing a management department in the MTIT for the project.
- Setting a strategy to convert to electronic government and submitting this strategy to the Board of Ministers.
- Informing the project's sponsors of the financial resource requirements to obtain the budgets required.

[17] Source: "Regional Profile of the Information Society in Western Asia," ESCWA, 2005.

[18] Source: "Palestine Internet & Datacomm Landscape Report," Arab Advisors Group, 2006.

- Decreasing Internet datacom network tariffs in cooperation with Paltel and concerned parties in the private sector.

The Jordanian e–learning success story

At the start of 2002, the King of Jordan tasked the minister of education with providing all schools with Internet access and e–learning services. This school project was considered as a national project, and a budget was assigned to it by the government.

The Jordanian Telecommunications Company (JTC) submitted a tender to the Ministry of Education for the project at just above the deployment cost, which fell within the available budget. An agreement framework was signed between the two entities for the connection of 3,000 schools.

The challenge

Delivering broadband access to 3,000 schools, half in Amman and the central area, half in the northern and southern areas.

The solution

- Collaboration between Jordan Telecom and Alcatel-Lucent.
- Support from France Telecom, JT's mother company.
- Start building the broadband access network nationwide.
- Choice of technology: ADSL, the most reliable and most economic option, as it re–uses the existing telephone infrastructure already deployed in the country.

The Jordanian experience today

The most important result of the Jordanian e–learning experience is that the country has now engaged in an upward spiral for economic growth.

With the introduction of broadband access in schools, students are becoming familiar with using high–speed Internet services and state–of–the–art network access, thereby creating:

- Demand for local e–learning media and content, thereby creating opportunities for the local economy to grow in these fields.
- Demand for highly skilled technology professionals to support and implement this growth in infrastructure.
- Supply of a better educated, better skilled future workforce for the country.

Statistics

- Eight public universities connected to the Web via broadband;
- 2,100 schools connected to the Web via broadband;
- 1.5 million students and teachers with access to reliable e–learning;
- 90% of the Jordanian population covered by broadband;
- More than 100 DSL hubs nationwide;
- A broadband penetration rate in the Internet access market of 6%.

Chapter 4

Selected Broadband Deployment Case Studies

This chapter presents three case studies of broadband deployment in three different countries of the ESCWA region. The first is a business case established for wireless broadband deployment (based on WiMAX technology) in the Kingdom of Saudi Arabia. The second is a description of a mixed wireline/wireless broadband deployment project in Lebanon, based on DSL and WiMAX. The third is a DSL deployment business case in the Palestinian Territories.[1]

WiMAX business model in the Kingdom of Saudi Arabia

As a major country of the ESCWA region, the Kingdom of Saudi Arabia is a good choice to illustrate a business case for WiMAX deployment. This is particularly because of the special geographical nature of the country, where wireline DSL deployment could be limited by distance. The rate of technology adoption in recent years demonstrates that mobile and Internet technologies are of great interest to the Saudi population.

Table 1 : Profile of the Kingdom of Saudi Arabia

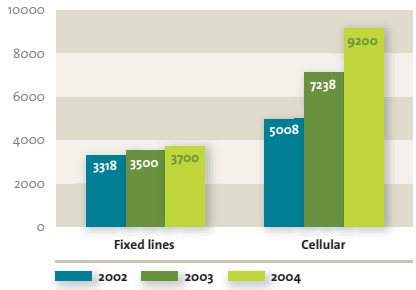
Population	25,192,720
GDP per capita	$ 15,338
Density	11/km²
HDI	0.772
Fixed line	3,821,000*
Mobile Subscribers	14,140,000*
Internet users	3,400,000**
Computer equipment	2,250,000**
Int'l bandwidth	750 Mbit/s**

Source: * Pyramid, ** ITU world database indicators 2005

WiMAX technology has the capacity to offer broadband Internet service with coverage of 1 km in dense urban areas to about 20 km in rural areas. The deployment of a WiMAX network is appropriate to address two important markets in Saudi Arabia:

Fixed Wireless DSL, for areas where deploying a conventional DSL solution is not economical; where no or poor copper is available; or for offering nomadic services linked to premium indoor services.

Figure 1: Evolution of fixed and cellular lines (in thousands) in the Kingdom of Saudi Arabia



Source: Arab Advisors Group Strategic Research Service, "On the threshold of competition: an analytical look at the Saudi Telecom market," 30 March 2005

Nomadic/Mobile Broadband, for broadband wireless applications where service continuity needs to be preserved while the end user is moving across the coverage of different base stations (BS) in the service area.

Network design

The network design consists of dimensioning the network in order to comply with the requirements of coverage, bandwidth, and user capacity. This will give useful information about the number of sites needed, and the cost of a WiMAX development for this business case.

Following analysis, the objective will be to dimension the WiMAX network for full coverage of the urban, suburban and rural parts of three cities: Riyadh, Jeddah and Dammam. It will

Figure 2: Map of the Kingdom of Saudi Arabia

[1] The two business cases were developed by Alcatel-Lucent based on assumptions explained in the text. The Lebanon case is provided by Globalcom Data Services and describes an ongoing project by that operator.

exploit the technological and market expertise of the Alcatel-Lucent business consulting team.

Geographical and population assumptions

Table 2: Population categories assumptions

	Percentage Split				
District (City)	Dense Urban	Urban	Suburban	Rural	Total Surfaces (Sq. Km)
Riyadh	8%	18%	57%	17%	1,359
Jeddah	13%	15%	69%	3%	571
Dammam	4%	20%	47%	29%	619

The main advantage of WiMAX in this case, compared to wireline solutions, is to facilitate the coverage of suburban and rural areas, which constitute the majority of the total surface area.
Table 3 shows the assumptions about the number of customers in each district who would potentially subscribe to a WiMAX service.

Table 3: Number of customers assumptions

District	Total population	Number of WIMAX users
Riyadh	4,619,495	110,000
Dammam	1,120,000	50,000
Jeddah	3,066,297	90,000
Total	8,805,792	250,000

Capacity/traffic mix & traffic profile assumptions
Two different segments of the market are considered in the analysis: the residential market, and the small and medium enterprise market. For each market, a different level of service – especially in terms of data rate – is envisaged (see table 4a). The relative weighting of these profiles at each base station (see table 4b) is a key determining factor of the capacity needed by the future system.

Table 4a: Throughput per customer profile

	Profile	Throughput
Profile 1	Residential_light	256 kbit/s
Profile 2	Residential	512 kbit/s
Profile 3	Residential high end	1024 kbit/s
Profile 4	SME Light	512 kbit/s
Profile 5	SME High	1024 kbit/s

Table 4b: Customer profile distribution per BS

	Distribution per BS (%)
Profile 1	55
Profile 2	22
Profile 3	9
Profile 4	11
Profile 5	3

Deployment scenario
The business case is based on a deployment using 5MHz of bandwidth in the 2.3 GHz frequency band. This frequency band is authorized by the regulator in the Kingdom of Saudi Arabia for broadband wireless access systems.
A mix of customer premises equipment (CPE) types is assumed as shown in table 5.

Table 5: CPE type distribution per customer

CPE type	Dense urban/urban	Suburban	Rural
Outdoor	0%	0%	40%
PCMCIA card	30%	100%	60%
Residential Gateway	70%	0%	0%

This split accurately follows the distribution of profiles, with Residential being the dominant profile (using Residential Gateways or Outdoor), and SME (both Light and High profiles) having a smaller penetration (using PCMCIA cards). For ease of calculation, it is assumed that there is no overlap between CPE types and that the scenario is designed to be as realistic as possible.

Results
With these different assumptions, it is possible to assess the number of sites (base stations) needed for the WiMAX coverage of Riyadh, Jeddah and Dammam.

Table 6: Number of sites needed per region and per type of district

Number of sites (scenario 1.a)	Dense Urban	Urban	Suburban	Rural	Total
District					
Riyadh	126	189	300	14	629
Jeddah	89	67	152	1	309
Dammam	30	99	110	12	251
Total	245	355	562	27	1189

Most of the base stations will be used to cover the suburbs of each city, since these areas are the most extensive. However, in rural areas, the number of cells needed is very low compared to the surface area covered. This is due to the improved range of a base station in a line–of–sight situation (few obstacles and outdoor CPE).
In urban areas, the requirement is to provide a good service level for many users at the same time, which requires the large number of base stations shown for this profile.

Business case

Revenue assumptions
Average Revenue Per User (ARPU) is a key profitability driver. It is affected by competitive technology cannibalization; loss–leading service

offers (especially mobile); high–end corporate use; and the prevalence of entry–level, mass–market services. As these assumptions have a strong impact on the profitability of the project, a sensitivity analysis will complete the business case.
Table 7 shows the monthly ARPU (in Euros) for each profile and the connection fees paid by the customer at the time of subscription.

Table 7: Monthly ARPU and connection fee assumptions per profile category

	Profile	Throughput	ARPU	Connection fee
Profile 1	Residential light	256 kbit/s	30	60
Profile 2	Residential	512 kbit/s	40	65
Profile 3	Residential high end	1024 kbit/s	50	70
Profile 4	SME light	512 kbit/s	150	120
Profile 5	SME high	1024 kbit/s	200	140

CAPEX (Capital Expenditure) assumptions

- Radio site acquisition cost: € 20,000 (20 k€) per site;
- Leverage existing infrastructure:
  - Core network;
  - Soft switches;
  - AAA, billing platform, etc.;
  - Call center;
- Backhauling: 15 k€;
- Frequency license.

OPEX (Operating Expenditure) assumptions

- CPE subsidies: 50%;
- Workforce:
  - Customer care staff (call center): 20 people x 8 k€;
  - Sales and marketing staff: 4 people x 10 k€;
  - Network operation engineers: 214 people x 12 k€;
  - General and administrative staff: 4 people x 10 k€;
- Marketing expenses: 1% of income.

Financial results

The main financial indicators for the WiMAX deployment in Riyadh, Jeddah and Dammam are summarized in table 8.
Even if the operator only achieves positive free cashflow after two years, financial break–even will occur three and a half years after the beginning of the project, which is reasonable. The Net Present Value (NPV) after 10 years will reach 205.6 million Euros, confirming the project's profitability.
Figure 3 and figure 4 show respectively the breakdown of the free cashflow, and the evolution of cumulated free cashflow.

Figure 3: Breakdown and evolution of free cashflow

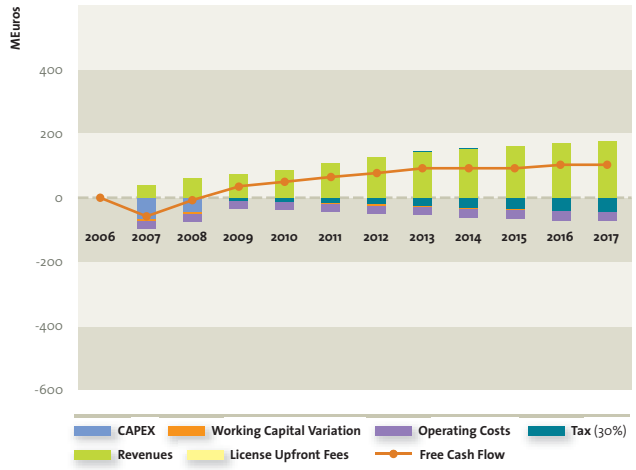
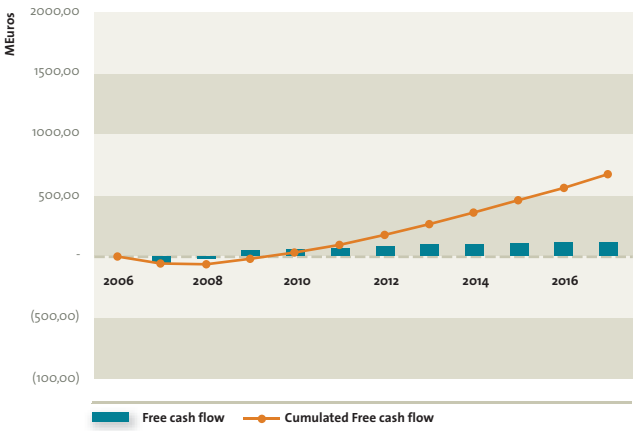


Figure 4: Evolution of cumulated free cashflow



Sensitivity analysis

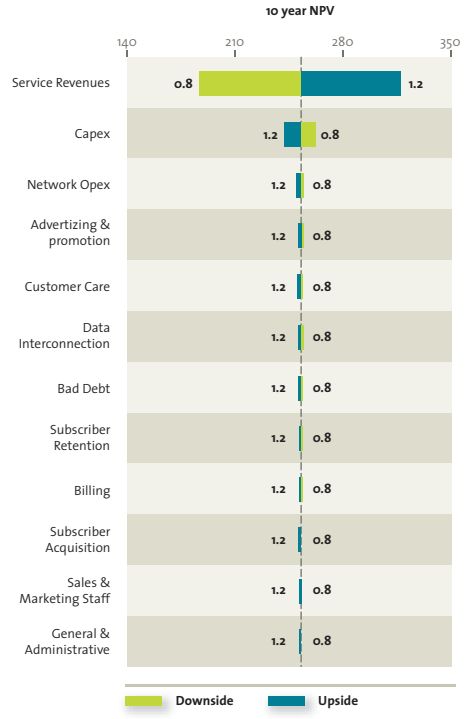
These financial results are based on assumptions about many parameters, especially service revenue, OPEX and CAPEX. However, it is

Table 8: Main financial indicators of the KSA WiMAX project

Financial Dashboard							
NPV (12% WACC)	MEuro	IRR	Percentage	Time to :	Years	Funding	M Euro
5 Year	36,3	5 Year	34,5	FCF Positive	2,2	Year zero	0,5
10 Year	205,6	10 Year	56,4	Breakeven (Payback Period)		Peak Av / year	64,7
14 Year	310,1	15 Year	59,1		3,5	until FCF Positive	7,9

important to appreciate the impact of a change in these parameters on the profitability of the deployment.
The following graph shows the impact of a +/– 20% change in the value of the different parameters on the 10–year Net Present Value.

Figure 5: Sensitivity analysis



In fact, only the service revenue has a strong impact on profitability, therefore the assessment of the ARPU and market penetration has to be carefully prepared. However, 20% less revenue still enables a significant profit. The other parameters have much less impact.

DSL and WiMAX deployment in Lebanon, by Globalcom Data Services

Lebanon was once a pioneer in the development of telecommunications infrastructure and services in the Middle East.
Deregulation and the introduction of new services were pushed aggressively, starting with the award of two GSM BOT (Build, Operate and Transfer) licenses in 1994; the introduction of Internet Service Provider (ISP) authorizations in 1995; and the award of data carrier licenses in 1996. In 1997, the Ministry of Telecommunications (MoT) started to discuss license extensions with the data carriers that would allow the introduction of DSL–based broadband access.
This rapid advance came to an abrupt halt in 1998 following changes in policies. The momentum restarted towards the end of 2005, and culminated in the signature, early in January 2006, of a Memorandum of Understanding between the private sector and the MoT, which identified the guiding principles for the introduction of DSL–based broadband services, and restarted the process for their introduction.
In parallel, a standard for WiMAX has been agreed. A WiMAX pilot project will therefore be launched in December, with nationwide deployment planned for 2Q 2007.

DSL deployment: the current status

The successful deployment of DSL is a joint endeavor of the MoT and the licensed data carriers. The MoT needs to complete six major initiatives before the carriers can intervene:

- Issuing the necessary decrees to formalize the MOU (completed);
- Preparation of co–location rooms in the PSTN exchange sites, where data carriers will install their equipment (work in progress, with an expected completion date of 30 December 2006);
- Upgrading power supplies in the co–location sites (tender in progress, with an expected completion date of 15 January 2007);
- Upgrading the transmission backbone to handle the significant data traffic expected (upgrade completed outside Beirut, and work in progress inside Beirut, with an expected completion date of 30 December 2006);
- Equipping the Main Distribution Frame (MDF) with voice/data splitters (tender in progress, with an expected completion date of 15 January 2007);
- Upgrading the country's main Internet feed (work in progress, with an expected completion date of March 2007).

From their side, the data carriers must complete five major projects:

- Acquisition and installation of DSLAMs in the co–location rooms (most carriers have already acquired their DSLAMs, and are waiting for authorization to install in the co–location rooms);
- Acquisition of the end–user splitters and modems (under way);
- Acquisition and installation of the NGN switches (most carriers have already acquired their switches);
- Interconnection with Internet Service Providers (under study jointly with MoT; it is expected that MoT will install fibers connecting the carriers to the ISPs);

- Agreement with MoT and the ISPs on commercial packages (discussions under way in a joint commercial committee, with the goal of reaching a final agreement before the end of December 2006).

As can be seen, the execution of all the above projects is well under way. It is expected that:

- Carriers will be able to start installing the DSLAMs and the switches in early January 2007;
- The first service tests are likely to take place during February 2007;
- The first commercial service is expected at the end of March.

The international upgrade element is a critical requirement, because it involves three national parties: Lebanon's MoT, Syria's STE and Cyprus' CYTA.

DSL project economics

Lebanon's PSTN has about 350 main and remote switches with a total installed capacity of 1.2 million lines, but only around 650,000 subscribers in total. This low ratio of subscribers to installed capacity is mainly due to the rapid development of GSM networks and services during the mid 1990s, at a time when the PSTN was still being rehabilitated following years of neglect and damage sustained during the 1975–1990 Lebanese civil war. All the parties to the DSL project have high expectations that the successful launch and development of DSL–based services will rekindle interest in the PSTN and will increase its penetration ratio.

The first phase of the DSL project will see the infrastructure deployed in the 36 most important exchange sites, covering 70% of PSTN subscribers across all of Lebanon's main towns and cities.

As indicated above, it is expected that the installation of the first DSLAMs will start mid–January, and will be completed in the 36 sites around September 2007. Other sites will be deployed according to commercial demand, but it is expected that 35 additional sites will be deployed in 2008, and 70 additional sites in 2009. The remaining small towns and villages will be covered through WiMAX.

From the administrative point of view, the customer's only relationship is with the ISP. The ISP in turn will contract for the DSL port with the Data Carrier. The carrier in turn will deal with the MoT. Five customer profiles are expected (see table 9).

It is reasonable to assume that each carrier can target a deployment of 50,000 ports within two years. The CAPEX per port for such a deployment, given all the related equipment and services (NGN switches, OSS/BSS, etc.), could be assumed to be in the range of $120 – 150 per port.

The main operating costs for the data carriers are:

1. 20% revenue sharing imposed on the carrier by the MoT;
2. A charge by MoT per line and per month for the services provided to the carrier. This is still under discussion, but could be in the region of $5 per line per month;
3. Salaries and related charges;
4. Other administrative charges;
5. Financing charges.

On the financing charge aspect, a carrier can benefit from loans with interest rates subsidized by the Lebanese Central Bank, under a law encouraging private sector investment in technology fields. The interest rate can be as low as 1.5% p.a. Under the above assumptions, it is expected that financial break–even will be reached at the end of the second year.

High–speed Internet will be the first service offered on the DSL infrastructure. As for additional services, in particular VoIP (Voice over Internet Protocol) and IP TV, these are not expected for a couple of years. By law, VoIP will only be deregulated after five years.[2] IP TV will not be viable for deployment until a large number of subscribers are connected to the DSL internet service.

WiMAX project: the current status

WiMAX will be deployed all over Lebanon. In cities where DSL will have extensive penetration, WiMAX will be deployed to target mobile data users as a complementary service to DSL. It will also be used to cover those few DSL dark spots. There, planning is under way to achieve indoor coverage "behind the second wall". Where DSL will not be deployed, WiMAX will be deployed as the main broadband access method,

[2] Note from the report editors: this illustrates how banning VoIP reduces revenue opportunities for operators rolling out broadband infrastructure. It must be noted that such VoIP bans have, in practice, only harmful effects, since unregulated VoIP is fairly well established in the country.

Table 9: Customer profiles for DSL deployment

Profile		Downlink kbit/s	Overbooking	ARPU ISP ($)	ARPU Carrier ($)
Residential	Bronze	256	25	35	18
Residential	Silver	512	25	50	20
Residential	Gold	1024	25	70	25
SME/SOHO	Light	1024	10	N/A	N/A
SME/SOHO	High	2048	10	N/A	N/A

with indoor coverage in small cities, and outdoor coverage in sparsely populated areas.

Deployment will feature the IEEE 802.16e version of the WiMAX standard, due to its superior features over the earlier, intermediate versions. 802.16e will be used for fixed (on–the–roof antenna), nomadic and mobile applications.

Given the delays in finalizing the 802.16e version, and the delay in getting equipment certified, the first pilot is scheduled to be deployed in December 2006. Globalcom Data Services has signed a framework agreement with Alcatel-Lucent covering this pilot and, if successful, the nationwide deployment of the service. Nationwide deployment is scheduled to begin in April 2007. Practically, DSL and WiMAX will be launched simultaneously.

WiMAX project economics

Globalcom Data Services is planning to deploy, by the end of 2007, a WiMAX network with a capacity of about 20,000 subscribers. The main constraint is the geographical coverage requirement, rather than the capacity requirement.

Subscriber uptake remains uncertain today, since firm commitments to produce 802.16e CPEs have not yet materialized in the market. However, given some reasonable CPE delivery assumptions, and a service tariff about 20% higher than that of DSL, it is expected that financial break–even would be achieved in about 30 months.

Conclusion

Due to the delay in launching the DSL project, Lebanon finds itself in a situation unique in the world, where DSL and WiMAX will be launched in parallel. Both infrastructures will complement one another. DSL will be deployed in large cities; WiMAX will be deployed in large cities as a mobile complement to DSL, and as a main broadband access method elsewhere. The WiMAX strategy also benefits from the lack of 3G services in Lebanon. For an overall initial deployment of about 70,000 users, it is expected to reach break–even in a 24–30 month timeframe.

DSL business model in the Palestinian Territories

The Palestinian Territories contain significant urban centers, which is why they present a good business case for DSL deployment.

Assumptions

In spite of difficulties in finding accurate statistics for Palestine, it is possible to estimate the main parameters to assess the profitability of the project, especially by extrapolating data available for Jordan. The assumptions taken for the business case are as follows:

Table 10: Basic assumptions for Palestinian territories DSL business case

Population	~3,500,000
Number of Households	~550,000
PC penetration	58,600 - 26% of the households
Internet subscriptions	~50,000 - 10,2% of the households (Jordan: 13%)
GDP per Household	$ 5,600 (Jordan: ~25,000$)
GDP growth rate	0%
Social classes	Jordan statistics

Cost factor assumptions

The business case assumes a 15% Weighted Average Cost of Capital (WACC), due to the relative uncertainty of a project in the Palestinian Territories, and a 10% tax rate. The different cost factors for the business case are:

CAPEX

- Infrastructure and installation (central office and CPE);
- Services and applications (mail, Web hosting, FTP, gaming, etc.).

OPEX

- National transmission cost (Central Office – Point of Presence);
- International transmission cost (Point of Presence – Internet backbone);
- Helpdesk/support cost;
- Billing and invoicing cost;
- Utilities and services (security, maintenance, power supply, etc.).

Table 11: Service take-up assumptions for the Palestinian territories DSL business case

	2004	2005	2006	2007	2008	2009	2010	2011
DSL residential	0	24,879	65,057	95,151	102,824	109,419	106,924	111,949
DSL business	0	2,454	9,174	17,378	24,347	27,825	27,825	27,825
Total Number of DSL subscribers	0	27,332	74,231	112,529	127,170	137,243	134,749	139,774
Net adds	0	27,332	46,899	38,298	14,641	10,073	-2,495	5,025
PSTN lines	249,903	249,903	249,903	249,903	249,903	249,903	249,903	249,903
DSL penetration Wrt PSTN lines	0.00%	10.94%	29.70%	45.03%	50.89%	54.92%	53.92%	55.93%

Service take–up

This is summarized in the table below, taking into account residential and business subscribers, and keeping the pessimistic assumption that the number of fixed lines will remain constant (no expansion of the PSTN installed base).

Revenue assumptions

Table 12 below summarizes the definition of the different kinds of service (both residential and business), and the assumptions related to retail price and resulting ISP net revenue. Table 13 summarizes the assumptions of the split over time for each category of services (for residential services) and, finally, table 14 summarizes the total revenues and average revenue per subscriber/year over the considered period.

Figure 6: Financial results for DSL deployment in the Palestinian territories (million Euros)

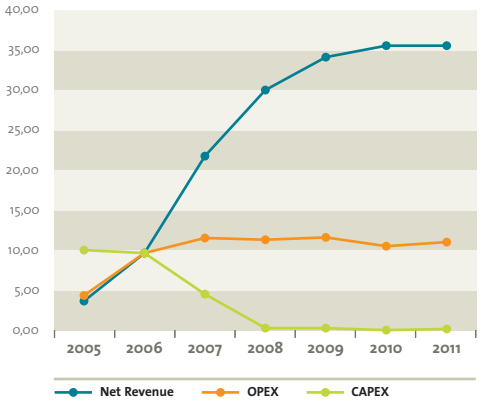


Table 12: Service definition for residential and business subscriber categories

	Definition of service packages					
	Downstream (kbit/s)	Upstream (kbit/s)	Cap (Gb/hour)	Overbooking	Retail fee $	Total ISP revenu $
Service Residential						
Service 1	256	64	30H	32	22,1	9,0
Service 2	512	128	5Gb	32	33,3	13,4
Services (SE/LE)						
Basic (Asymmetric)	512	128	10Gb	15	89,5	35,9
Pro (Asymmetric)	1024	128	Unlimited	15	134,2	53,7

Table 13: Split of residential subscriber profile over time

Service Penetration	2005	2006	2007	2008	2009	2010	2011
Service Residential							
Service 1	70%	70%	60%	60%	60%	55%	55%
Service 2	30%	30%	40%	40%	40%	45%	45%

Table 14: Revenue and average revenue/subscriber over the period

Total Revenues (m$)	4	11	24	33	38	40	39
Revenue per subscriber per year	135	142	214	261	274	293	282

Results

The financial results, taking into account the market and cost assumptions, are summarized in figure 6 and table 15.

The payback period is five years, which is quite slow for a telecommunication project in the Middle East. However, the business case shows good profitability, with a Net Present Value (NPV) of 16 million Euros, and an Internal Rate of Return (IRR) of 37% after seven years.

Investment in DSL in the Palestinian Territories is therefore interesting, especially for institutional players like the incumbent operator, which can appreciate a long–term return on investment.

Table 15: Palestinian territories DSL business case financial results

Payback Period (Cumulative Cash Flow)	4,26 years
Payback Period (Discounted Cumulative Cash Flow)	4,89 years
Horizon	7 years
Net Present Value (million Euro)	16
Net Present Value per subscriber (Euro)	117
Internal Rate of Return	37%
Horizon	5 years
Net Present Value (million Euro)	1
Net Present Value per subscriber (Euro)	7
Internal rate of Return	-9%

Conclusion

The above business cases reflect the variety of social and economic conditions in the ESCWA region, and the variety of technologies that could be used to deploy broadband infrastructure. They are also based on restrictions related to revenues that can be inferred from other voice telephony and TV distribution services (especially for the DSL cases). Reasonable periods of return on investment are achievable, and these could be improved dramatically, were restrictions on bundled services to be reduced, since this would affect both the average revenue per user and the percentage of users signing up to the service .

Chapter 5

Factors Affecting Broadband Demand in the ESCWA Region

In this chapter, we will identify some of the factors and marketing issues related to broadband services that could have a substantial impact on both demand and supply. This should enable governments and service providers interested in the promotion of broadband to identify how those factors can apply to their economies, and to address some of the problems encountered.

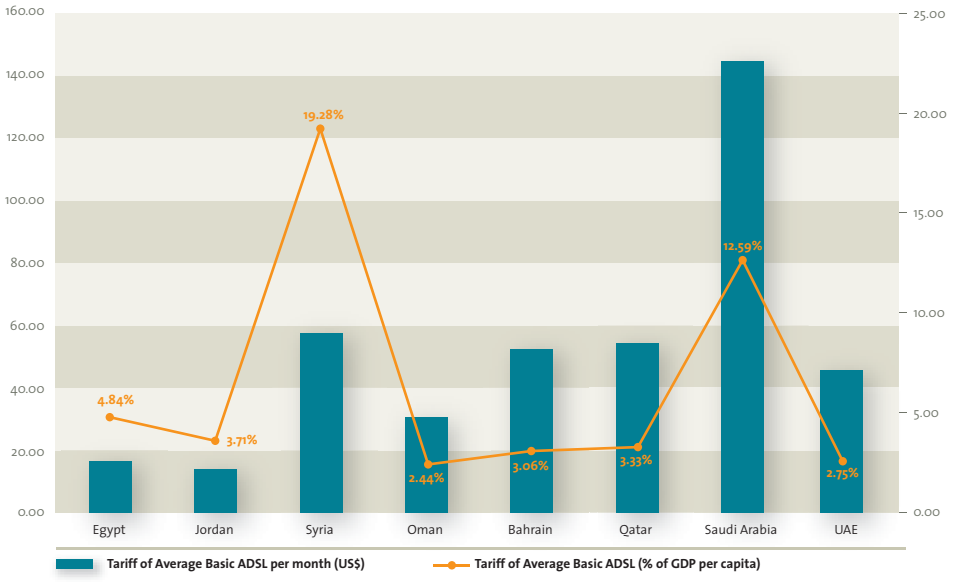
Service pricing

High prices and low market maturity are among the major factors slowing down broadband penetration (especially ADSL) in the ESCWA countries. Suitable pricing schemes are hence vital to increase broadband adoption, as consumers will only adopt broadband when its cost is justified in terms of the added value it offers, taking into account the level of income.

Figure 1 shows a comparison of basic ADSL tariffs in selected ESCWA countries, compared to the GDP per capita. The figure shows that ADSL prices are generally higher than a "typical" 2–3% of the GDP per capita and, in some case (e.g., Syria and Saudi Arabia), much higher. High prices are sometimes used as a means to filter demand (e.g., in Syria) due to the lack of service availability, and service providers would lower their tariffs considerably once network expansion is achieved. In other cases, however, high prices are merely the result of a lack of competition.

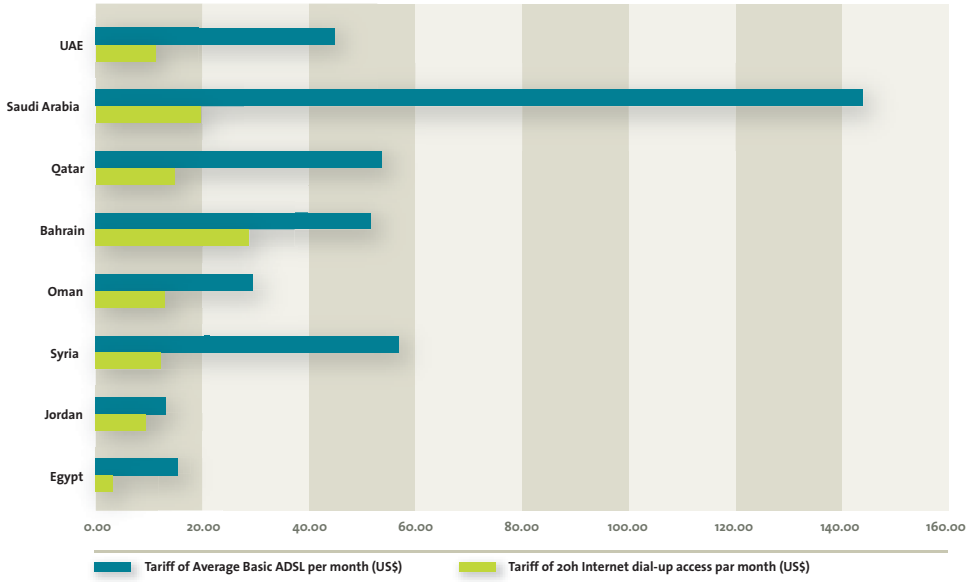
It is also interesting to compare ADSL tariffs to traditional dial–up Internet access, taking a typical basket of 20 hours per month of dial–up access as a reference point (figure 2). Generally speaking, the total cost of broadband is usually more expensive than narrowband below a certain threshold of usage. The price of a dial–up Internet connection is composed of the access charge plus the cost of the local telephone calls to connect to the ISP. By contrast, broadband eliminates the cost of the telephone calls. For heavy users, this pricing scheme leads to broadband working out cheaper than narrowband. In Jordan, for instance, DSL will rapidly become an attractive option once the 20 hours per month are exceeded; while in Egypt, with the Free Internet Initiative, the cost of dial–up access is as low as EGP 1.2 (US$ 0.2) per hour. The cost of the (already

Figure 1: Comparison of average basic monthly ADSL tariffs in selected ESCWA countries, 2Q 2006



sources: ITU World Telecommunication Indicators, operators' websites

Figure 2: Comparison of basic ADSL and dial–up tariffs in selected ESCWA countries, 2Q 2006



sources: ITU World Telecommunication Indicators, operators' websites

low–priced) basic ADSL access (256 kbit/s) is EGP 95 (US$16.5) per month; this is still nearly four times the cost of the basket of 20 hours per month of dial–up access. "Light" dial–up users have no incentive to switch to ADSL, especially when no major value–added services are available.

Market immaturity, characterized by the absence of added value to the new broadband services, is another reason why service penetration is slow, irrespective of price. In Jordan for example, the ADSL service is among the less expensive in the region. A 256 kbit/s ADSL connection costs only JD 9.9 (US$ 14) per month, compared to JD 6.7 (US$ 9.5) for a basket of 20 hours per month of dial–up access. But even with this remarkable price scheme, the total number of ADSL subscribers was still around 45,000 in 1Q 2006.[1] In contrast, ADSL charges in Saudi Arabia are still high. The user is charged more than SAR 400 (US$ 106) per month for a 256 kbit/s ADSL connection.[2] The total number of ADSL subscribers in 1Q 2006 was estimated at 64,000. Even with the big difference in price, the Jordanian ADSL market is still comparable to that of Saudi Arabia.

The cost of broadband can become acceptable to end users when other services are delivered over the same connection. For example, a DSL connection can also be used to provide voice telephony and a variety of TV programs, converging to offer what is known as Triple Play. This could result in considerable savings for both providers and consumers, and accelerate the adoption of broadband (as happened in Europe). For service providers, economies of scale will make international connectivity cheaper. Attractive prices could in this case be proposed for large bandwidths (tens of Mbit/s). When suitable prices are reached, a DSL provider might become a more serious competitor to the incumbent operator, as subscribers might consider cancelling their ordinary subscriptions and replacing them with voice over DSL; the environment becomes even more competitive with cable operators, who also aim to provide broadband Internet access and IP telephony along with their original cable TV service.

[1] "Jordan Internet & Datacomm Landscape Report," Arab Advisors Group, 2006.
[2] Source: Arab Advisors Group.
[3] Source: Egypt Case Study, ESCWA, 2006.

Problem of DSL line sharing in Egypt

In Egypt, the cost of basic ADSL access (256 kbit/s) is still nearly four times the cost of a basket of 20 hours' dial–up access per month. One of the problems engendered by this situation is the "sharing problem." One residential subscriber to the ADSL service may share his connection with one or more neighbors. It is estimated that of all ADSL connections in Egypt, nearly 20% in urban areas and 80% in rural areas are shared, resulting in an over–consumption of bandwidth and loss of revenue.[3] The service providers are faced with a huge problem because their business model is not designed to deal with this phenomenon, hence they are becoming reluctant to introduce the service in areas where sharing is common. One way of addressing the sharing problem is by "bundling" routers (especially wireless routers) with their hardware. This would provide connectivity at the "local community" level, and allow service providers to suggest the suitable access rate to their grouped customers.

Pricing schemes

Several broadband pricing schemes can be found worldwide. Here we consider some of those schemes and their implications in the ESCWA region.

Flat–rate is the pricing scheme where subscribers are charged a flat monthly rate which does not change according to the volume of usage. This scheme has the advantages of being simple and "predictable" for both customer and service provider, and is commonly used in the ESCWA region (Egypt, Jordan, Syria, UAE, Qatar, etc.). This scheme also allows service providers to make a variety of offers to attract customers and build the subscriber base. In Jordan, for example, Wanadoo offers two free months in return for a yearly subscription. It is also common for some providers to discount the installation fee, equipment fee, or equipment charge for their customers.

Volume–based pricing can also be used. Consumers in this case are charged on the basis of volume downloaded. In Bahrain for example, a threshold of 2 GB is placed at the entry–level broadband subscription (256 kbit/s). According to Batelco, this enables the user to surf for three hours per day, send and receive 20 e–mails per day, and use instant chatting for two hours per day.[4] On exceeding the limit, the user has to pay an extra charge, usually per 1 MB. This pricing scheme is mainly used to control bandwidth usage, especially when it is scarce. However, it tends to restrict usage patterns and may discourage market uptake and experimentation with broadband services.

Prepaid is not commonly used with DSL connections, but prepaid cards can be used for wireless access to the Internet in public WiFi hotspots (e.g., in airports, hotels, cafés, etc.). The prices, however, are often prohibitive (especially in luxury hotels). This scheme might become attractive where operator–deployed wireless connectivity is used.

Operators and service providers can also use other pricing techniques, like offering reduced prices for a restricted set of services, or offering product bundles. For example, cable TV operators might offer Internet access (and telephony) to their customers at greatly reduced prices. While this scheme is becoming very popular in Europe, it is still almost nonexistent in the ESCWA region, due to market immaturity, but also to government unwillingness to "liberalize" IP telephony.

Finally, it is important to note that an adequate pricing scheme, combined with a clear set of services, is a major factor in encouraging broadband adoption in a country.

Regional and international connectivity

Regional and international connectivity is crucial for the development of broadband, in terms of both quality and price, as broadband, by definition, is a bandwidth–intensive service. An important component of the broadband total tariff is represented by the cost of international connectivity.

The Internet backbone consists of many different networks. Usually, the term is used to describe large networks that interconnect with each other and may have individual ISPs as clients. For example, a local ISP may provide service for a single town, and connect to a regional provider which has several local ISPs as clients. This regional provider connects to one of the backbone networks, which provides nationwide or worldwide connections.

These backbone providers usually provide connection facilities in many cities for their clients, and they themselves connect with other backbone providers at Internet Exchange Point (IXPs) such as EMIX in the United Arab Emirates.

Backbone networks are usually commercial, educational, or government–owned, as in the case of military networks. Some large companies that provide backbone connectivity include UUnet, British Telecom, AT&T, Sprint Nextel, France Telecom, BSNL, HE.NET, Teleglobe, Qwest, and SAVVIS.

Peering and IXP development

Peering is defined as an agreement between two ISPs to interconnect their networks in order to bypass expensive transit networks (figure 3). This connection is made through Internet exchange points, or IXPs, which are facilities where ISPs can deploy cable to interconnect with other providers, generally from the same country or region. ESCWA member countries can take advantage of only two IXPs: EMIX in the United Arab Emirates, and CRIX in Egypt.

Peering enables the achievement of three objectives:

- Lower costs, as the traffic between two providers does not require an international transit bandwidth, which is very expensive.
- Reduce latency by taking a shorter route for a connection, which is crucial for applications with a high quality of service like IP telephony.
- Decrease significantly the loss of IP packets with shorter routes. This increases the efficiency of the provider's network.

To overcome the lack of national and regional peering, several attempts have been made to build some sort of regional "Pan–Arab Back-

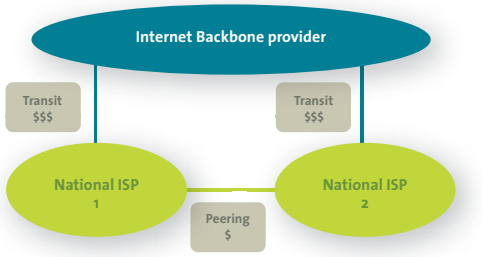
[4] Source: Operator's website.

bone Network" in the ESCWA region. To date, these attempts have not been successfully concretized. The argument here, however, is that if operators in these countries manage to build exchange points and aggregate local traffic, they can save on their international capacity requirements: local traffic will stay within the region rather than travel overseas and back, therefore the overall amount paid for international bandwidth will be reduced. More importantly, building national and regional IXPs would help operators attract content from developed countries to be mirrored and/or hosted locally, thus lessening the asymmetry in the traffic exchanged with developed countries.

International connectivity

As stated earlier, international connectivity is a major issue for Internet development in the ESCWA region. International connectivity is an expensive resource. It can represent more than 80% of the Internet connection cost for a provider. The problem is that the high cost generated by this situation impedes the growth of potential Internet users, and prevents ISPs from investing in more international bandwidth: this is the Internet vicious circle (figure 4a).

Figure 3: From transit to peering



Source: Alcatel-Lucent

The vicious circle can be broken through large investments – that could form part of a national broadband strategy – in international bandwidth capacities (figure 4b). The lower cost of this connection enables ISPs to offer broadband connection at a lower price to stimulate demand.

The degree of connectivity of a given country depends partly on technical factors, but it also depends on the regulatory environment. Liberalization can totally transform the

Connection route between the Emirates and Bulgaria, going through New York, Los Angeles and Singapore

1 192.168.222.1 (192.168.222.1) 0.365 ms 0.167 ms 0.198 ms
2 rtr–zonab5.powernet.bg (193.24.241.161) 1.869 ms 0.920 ms 0.870 ms Bulgaria
3 193.24.240.3 (193.24.240.3) 3.093 ms 4.127 ms 3.402 ms
4 ffm–b1–geth2–3–107.telia.net (213.248.79.121) 45.943 ms 45.371 ms 47.880 ms
5 ffm–bb2–link.telia.net (213.248.64.141) 46.223 ms 45.714 ms 46.669 ms
6 ldn–bb2–link.telia.net (80.91.249.12) 63.446 ms 62.802 ms 67.558 ms
7 nyk–bb2–link.telia.net (80.91.249.251) 133.402 ms 130.599 ms 130.395 ms
8 nyk–b1–link.telia.net (213.248.83.66) 131.303 ms 129.894 ms 132.947 ms
9 dcr3–so–6–0–0.newyork.savvis.net (208.173.129.13) 133.011 ms 131.795 ms
133.282 ms New York
10 bcs1–so–1–1–0.NewYork.savvis.net (204.70.192.186) 131.147 ms * bcs2–so–3–0–0.NewYork.savvis.net (204.70.192.202) 132.222 ms
11 bcs1–so–6–2–0.Washington.savvis.net (204.70.192.13) 132.410 ms 129.920 ms bcs2–so–4–0–0.Washington.savvis.net (204.70.192.1) 136.734 ms
12 dcr1–so–3–0–0.Atlanta.savvis.net (204.70.192.53) 147.285 ms bcs1–so–7–0–0.Washington.savvis.net (204.70.192.33) 131.450 ms 129.547 ms
13 dcr1–so–1–3–0.dallas.savvis.net (204.70.192.78) 165.065 ms 164.075 ms dcr1–so–3–0–0.Atlanta.savvis.net (204.70.192.53) 166.993 ms
14 dcr2–aso–0.Atlanta.savvis.net (204.70.192.42) 147.201 ms dcr2–so–2–0–0.LosAngeles.savvis.net (204.70.192.86) 196.377 ms
dcr2–aso–0.Atlanta.savvis.net (204.70.192.42) 147.341 ms Los Angeles
15 dcr1–aso–0.LosAngeles.savvis.net (204.70.192.117) 195.490 ms 195.978 ms dcr2–so–2–0–0.dallas.savvis.net (204.70.192.70) 165.307 ms
16 208.172.44.26 (208.172.44.26) 200.410 ms 208.172.44.22 (208.172.44.22) 199.871 ms dcr1.lay–so–3–2–0.losangeles.savvis.net (204.70.194.53) 195.630 ms
17 208.172.44.26 (208.172.44.26) 200.761 ms 203.208.171.65 (203.208.171.65) 201.322 ms 201.218 ms
18 203.208.171.65 (203.208.171.65) 200.072 ms 199.652 ms 197.150 ms
19 203.208.171.1 (203.208.171.1) 198.768 ms 203.208.171.122 (203.208.171.122) 199.415 ms 205.065 ms
20 203.208.171.122 (203.208.171.122) 199.402 ms 203.208.173.133 (203.208.173.133) 200.281 ms 203.208.182.73 (203.208.182.73) 396.014 ms
21 p4–0.sngtp–cr3.ix.singtel.com (203.208.172.125) 419.134 ms 421.144 ms 203.208.182.73 (203.208.182.73) 390.255 ms
22 so–1–0–0.sngc3–cr1.ix.singtel.com (203.208.172.149) 390.323 ms p4–0.sngtp–cr3.ix.singtel.com (203.208.172.125) 428.163 ms
so–1–0–0.sngc3–cr1.ix.singtel.com (203.208.172.149) 406.948 ms
23 p4–1.sngtp–cr1.ix.singtel.com (203.208.182.125) 405.590 ms 203.208.143.154 (203.208.143.154) 337.672 ms p4–1.sngtp–cr1.ix.singtel.com
(203.208.182.125) 396.475 ms Singapore
24 195.229.0.90 (195.229.0.90) 339.959 ms 203.208.143.154 (203.208.143.154) 347.874 ms p4–1.sngtp–cr1.ix.singtel.com (203.208.182.125) 423.461 ms
25 dxb–emix–ra.so611.emix.ae (195.229.0.242) 366.919 ms 203.208.143.154 (203.208.143.154) 370.038 ms 195.229.0.90 (195.229.0.90) 340.555
26 213.42.21.36 (213.42.21.36) 366.150 ms 195.229.0.246 (195.229.0.246) 350.179 ms 195.229.0.90 (195.229.0.90) 357.193 ms
United Arab Emirates

Source: Alcatel-Lucent

Figure 4a: Internet vicious circle

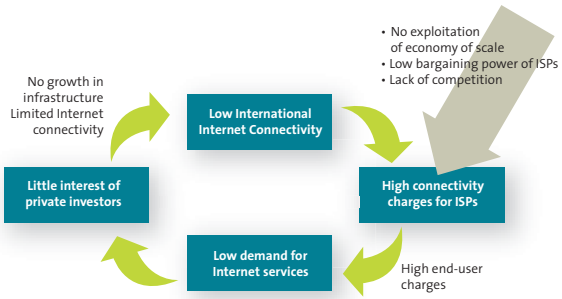
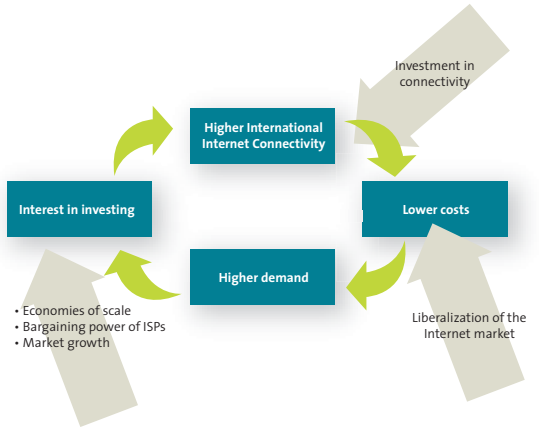


Figure 4b: Internet virtuous circle



Source: Claudia Sarocco, "Improving IP Connection in the LDCs – Background paper," Workshop on Improving IP Connectivity in the Least Developed Countries, Geneva, 11 and 12 April 2003

Egypt's international telecommunications

International connections are the raw material of an Internet service provider, as most of the transmissions in the Internet network cross borders. Therefore their price is an important issue for ISP profitability. However in developing countries, the small number of international connections available makes prices very high, as shown by the situation in Egypt.

In July 2000, Telecom Egypt signed an agreement with FLAG to build a local Point of Presence (PoP) in Cairo to provide licensed ISPs with managed bandwidth services, as well as IP transit. As demand for bandwidth has increased over time, this agreement has resulted in further reductions in price, since FLAG is, so far, the only international carrier in Egypt that offers one–stop–shop services (both transmission and IP connectivity), which gives it a competitive edge.

International Internet connectivity (IIC)

The cost of IIC comprises two elements: the transmission link from Egypt to the United States and the IP port. Although it is quite common for an ISP to purchase transmission from one carrier and the IP port from another, most Internet connections in Egypt, as well as their IP peering ports, are offered via FLAG.

By early 2003, FLAG and TE reached an agreement with the local ISPs allowing the latter to own the bandwidth instead of leasing it. This model is known everywhere as Indefeasible Right of Use (IRU), which is a long–term lease for a certain bandwidth capacity of an international cable. The IRU contract between the local ISPs, TE and FLAG allows the ISPs to lease the capacity for 15 years. Under this model, the ISP was able to acquire 155 Mbit/s of bandwidth for US$ 3.675 million. With continuous support from the government as well as the roll–out of nationwide broadband services, demand for international bandwidth has increased steadily. Therefore, this price has decreased rapidly over the past couple of years, to US$ 1.25 million, which is the present IRU price for a 155 Mbit/s link. By depreciating the IRU numbers over a fifteen–year contract period, it turns out that the monthly charge for a 155 Mbit/s link is around US$ 7,000.

To calculate the total value paid in US$ by Egyptian ISPs for international Internet bandwidth, the following assumptions are taken into account:

1. The current IRU price for 155 Mbit/s bandwidth, which is US$1.25 million (the average price for a 155 Mbit/s IP port), i.e. US$ 8,000 per month;
2. Depreciating the IRU number over four years.

The results are as follows:
– The IRU price per Mbit/s per month is US$ 168;
– The IP port price per Mbit/s per month is US$ 52;
– This gives a total of US$ 220 paid per Mbit/s per month.

Since the international capacity is currently 3.345 Gbit/s, and the previous calculation shows that 1 Mbit/s per month costs US$ 220, it turns out that the total amount paid for international bandwidth is US $735,900 per month. This figure is based on a best–case scenario which uses today's minimum prices, although most of the capacity was acquired in the past at much higher prices.

Actually, Egyptian ISPs pay this high price, like other non–Tier 1 carriers, because they have no choice but to pay the full amount for transmission as well as for peering (i.e. transit). This is because they cannot fulfill any of the Tier 1 carriers' policies for settlement–free interconnection. Such policies are well–nigh impossible for any of the ISPs to achieve, since the connectivity level demanded by these companies reflects global levels.

One possible mean of mitigation is to push for peering agreements with regional ISPs in order to bypass Tier 1 carriers. It is also possible to attract new Tier 1 carriers into the region in order to increase ISP bargaining power.

Source: Baher Esmat and Juan Fernández, "International Internet Connection Costs," ITU/WGIG http://www.wgig.org/docs/book/EB_JF.html

telecommunication market. In Nepal, for example, the decision of the Government to allow ISPs to have their own international connectivity using VSAT technology prompted an increase in the available international Internet bandwidth from 320 kbit/s in May 1999 to over 1 Mbit/s by the end of 1999, and to 10 Mbit/s (downlink) in 2001. Similar regulatory measures are being considered in several countries in the ESCWA region, such as Egypt and Jordan.

Quality of Service

One of the key factors affecting the spread of broadband services in a country relates to operations and quality of service. Lack of a "customer service culture" and lengthy provisioning logistics are one of the main challenges of today's ADSL installation process. In Egypt, for example, installation takes from five days to three weeks, and varies from one exchange to another. The procedure delay is mainly caused by lack of technical skills, limited numbers of technical staff, or bureaucracy. Standardization would result in a quicker and enhanced installation process, which could be achieved by a smaller number of technical personnel. To minimize bureaucracy and paperwork, the introduction of operational automation is essential.

Another aspect relates to the existing copper plant. In many countries, operators are experiencing difficulties in providing DSL services over their copper cables, either due to the long distance separating the customer from the central office, or due to the poor quality of the copper cables themselves (small diameter, bad installation, etc.). These problems are usually more often encountered in rural areas (but sometimes even in suburban areas), and tend to discourage customers from upgrading their Internet connection to DSL. To deal with this problem, wireless local loop technologies can be employed if enough frequency spectrum is available.

Existence of relevant content and applications

One of the key factors why people adopt broadband is the availability of applications and content which are relevant and have a perceived value. On–line Arabic content is typically estimated at approximately 1% of the total content on the "visible" Web. This "content divide" can be best shown by comparing the figures for English and Arabic languages on–line (figure 5). Clearly, governments have a key role to play in bridging this digital divide.

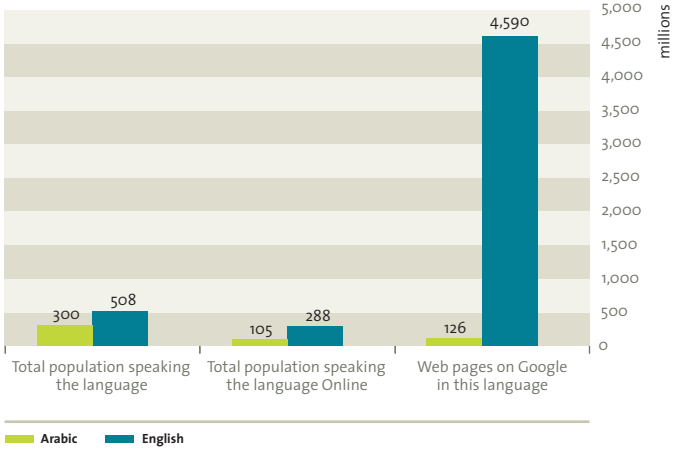
It can be observed that in countries where broadband penetration is high, the amount of content in local languages is relevant. More content in local languages should increase overall Internet usage, and broadband adoption in particular will benefit. This is because local–language content gives users more reasons to stay on–line, and those users often go for faster connections. Interactive multimedia content in particular is expected to stimulate demand for higher bandwidth.

In some ESCWA countries like Egypt, content is sometimes "bundled" with the access method to guarantee revenues. Access providers might restrict access to certain content by making it only accessible via certain dial–up numbers. This also applies to ADSL users[5]. It is recommended, however, that content providers and access providers maintain separate operations to ensure maximum flexibility in the market.

Successful broadband economies usually make effective use of relevant applications over broadband. The business community is constantly seeking to minimize costs and increase productivity; this is why the availability of business applications is a major factor to drive broadband adoption. Many governments in the ESCWA region have drawn up policies aimed at encouraging the use of e–commerce. For instance, the volume of trade and transactions conducted electronically in the Gulf Cooperation Council (GCC) states was estimated at US$ 11 billion in 2003.[6] For residential users, IP telephony is probably one of the "killer" applications for broadband, especially in countries with metered local and long–distance calls (which is mainly the case in the ESCWA region). Many countries have chosen to ban, or severely regulate, IP telephony. This measure

[5] Source: Egypt Case Study, ESCWA, 2006.
[6] Source: Ernst & Young survey on E-Commerce in the Gulf States, 2003.

Figure 5: Comparison between English and Arabic on-line



Source: "E-government development," working paper, ESCWA policy making network, 2006

might help protect the incumbent operator in the short term, but it constitutes a considerable barrier against the proliferation of the Internet in general, and broadband in particular. Other important applications for promoting broadband include audio streaming, video on demand, tele–working, etc.

It is worth mentioning here that in 2003 ESCWA launched an initiative for Arabic digital content, with the aim of identifying the economic priorities and opportunities for the development of an Arabic content industry.[7]

PC penetration and means of access

The availability of personal computers in households and workplaces is essential to access the Internet. The ESCWA region is characterized by a "relatively–low" to "fair" penetration of PCs (figure 6), with an average of about eight PCs per 100 population, which is lower than the world average of about 13. The percentage of PCs effectively connected to the Internet is very difficult to assess.

Several ESCWA countries (e.g., Egypt, Jordan, and Syria) have launched "popular PC" ini-

[7] "Digital Arabic Content: Opportunities, Priorities, and Strategies," ESCWA, 2005 (in Arabic).

Egypt at the forefront of e–content arabization

Many Arabic speakers lament the lack of Arabic–language material on the World Wide Web. With statistics showing that Arabic–language e–content accounts for only 0.3 percent of the global total – in sharp contrast to the massive contribution of Arab culture and civilization to human history – the Ministry of Communications and Information Technology (MCIT) has made it a national priority to rectify this situation and develop a strong Arabic–language presence on the Web. To this end, MCIT has already taken a number of steps.

In May 2005, MCIT launched the e–Content Initiative following the signing of a cooperation protocol with the Federation of Egyptian Publishers and the e–Learning and Business Solutions Union. The underlying strategy is based on the creation and promotion of an Arabic e–content portal, which aims to bring into existence 2,000 addresses and 300 software programs over a four–year period. The e–Content Initiative has a fund of LE 70 million to cover its first three years, and it is expected that there will be up to 300,000 titles available on the portal by June 2007.

"*The target of the Digital Arabic Content portal is to promote the use of digital technology to present Arabic content in the fields of literature, culture, history, social sciences, art and music,*" explained Dr. Hoda Baraka, first deputy to the CIT Minister and director of MCIT's information infrastructure. Already, digitized content covers a broad spectrum of categories and topics in the form of books, magazines, directories, news, business resources, movies, music, sports, arts and entertainment resources.

The first operational phase, the digitization of Arabic content, is to be followed by the establishment of Arabic databases and electronic indexes to facilitate content searches and retrieval. This will make the growing body of material more readily available and reduce the cost of posting and accessing it.

Additionally, in July 2006, Dr. Tarek Kamel, Minister of CIT, and Mr. Farouk Hosni, Minister of Culture, signed two related cooperation protocols: one to digitize selected cultural heritage works from the National Library and Archives of Egypt (Dar Al Kutub) in an LE 12 million project, and the other to digitize the cultural property of the Egyptian Theater Organization in a project expected to cost LE 2 million.

These projects, which will take three years to complete, fall within the context of a national plan whose goal, according to Dr. Baraka, is "*to enhance the presence and awareness of information technology and the value–added benefits of cultural and intellectual property in order to create a more knowledgeable society and activate the Digital Arabic Content Initiative.*" The first output is expected in the second quarter of 2007.

Also in July, the Information Technology Industry Development Agency (ITIDA), a branch of MCIT, announced its second national contest for Arabic e–content as part of the e–Content Initiative.

"*The competition aims at pushing forward and enriching the Arabic e–content industry in Egypt. The idea came as a means of encouraging the efforts that individuals, private institutions and civil society entities exert to develop e–content production,*" said Effat El–Shooky, senior adviser at ITIDA and vice president of the Regional Information Technology and Software Engineering Center (RITSEC).

"*The competition acts as a mechanism that helps to build an edge for youth and SMEs, as well as setting the groundwork for a niche to export e–content to Arab countries,*" El–Shooky noted.

While implementation of the portal has been assigned to Microsoft, the ministry itself, Dr. Baraka explains, has provided all the technical requirements for the project, such as converting content into digital format, portal improvement, content protection tools, e–payment applications and tools for settling accounts with the various parties involved. "*MCIT also pays for the copyrights and intellectual property rights of the content providers and software programs,*" she notes.

Other related efforts include MCIT's recent agreement with Dar Al Maaref Printing and Publishing House to digitize selected works published by the company over a period of three years, with the first output expected to be delivered in the second quarter of 2007. Various other parties are also working to achieve similar targets. The Center for Documentation of Cultural and Natural Heritage (CULTNAT) now has a comprehensive information system designed to document Egyptian heritage, increasing its local and international exposure via hard–copy printing, on–line publishing and a state–of–the–art Website. The digital documentation at CULTNAT encompasses approximately 90 million documents covering all branches of Egyptian historical and cultural heritage.

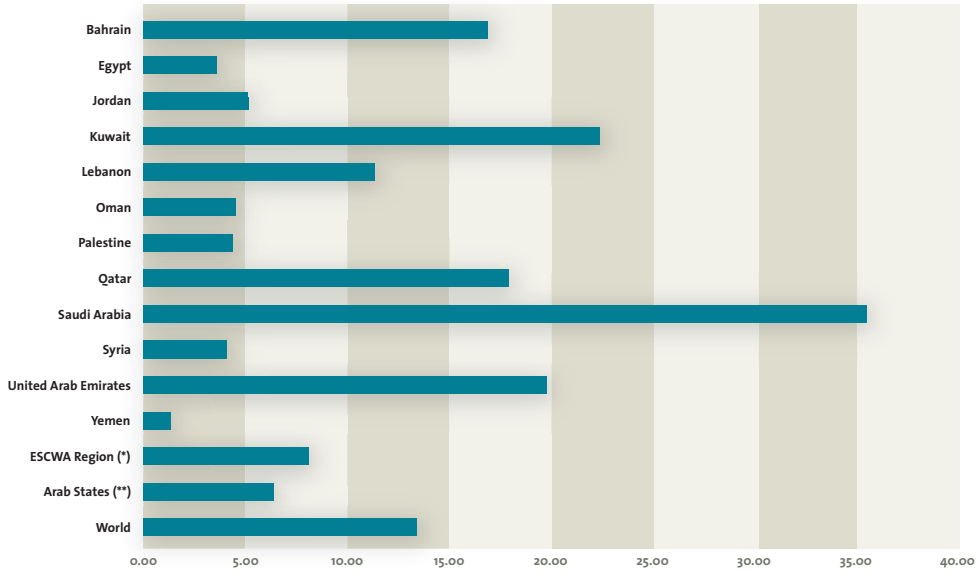
Another contributor to the MCIT initiative is Google, whose launch of a news service in Arabic allows users to search more than 500 Arabic–language sources. Meanwhile, Arabic content provider Maktoob.com, in cooperation with the BBC, has added a news service to its site.

Egypt has set an example as a purveyor of quality Arabic content for various media and MCIT's e–Content Initiative, Dr. Baraka asserts, "*will promote the development of materials in a wide range of categories including arts, education, sports and entertainment.*"

With a 32 per cent increase in the market for digital documentation and content management in the countries of the Arab Gulf being just one of the dramatic developments in the Arabic e–content field noted by various studies and reports over recent years, the success of the efforts of MCIT and others is clearly set to change the global digital landscape, while at the same time opening the doors of the on-line community to millions of Arabic speakers in the Middle East and around the world.

Source: Ministry of Communications and Information Technology, Egypt
http://www.mcit.gov.eg/FeatureDetailes.aspx?id=eO7DPO7EznY=

Figure 6: PC penetration per 100 population in the ESCWA countries, 2005



(*)excluding Iraq (**)excluding Iraq and Libya

Source: ITU World Telecommunication Indicators; ESCWA Statistical Information System

tiatives offering PCs to the public at affordable prices with easy installments. In most cases, those PCs were bundled with Internet accounts or telephone bills – sometimes with broadband access.

For low–income users, collective Internet access is an appropriate solution. Some operators have successfully experimented with subcontracting collective access locations to single or small groups of entrepreneurs. This ensures that the facility is kept up to date, and it minimizes the risk taken by the operator. It also offers a service that is better suited to the local culture.

Developing countries have also experimented with "multi–purpose community tele–center" models, whereby a public access facility provides a variety of ICT–related services, such as telephony, Internet access, office automation workstation, photocopying, etc. Although the idea appears attractive, it has turned out to be disappointing. The causes of the failure of such projects are generally the same: bureaucracy (especially in government agencies); financing by donations, with insufficient commitment from the local private players involved; and/or the absence of an appropriate business model with clear targets.

These few failures should be seen as lessons learnt in how to make such collective access sustainable. There are no miracle recipes, just a few common–sense elements: ensure that local players are involved, ensure that the pilot phase (during which aid money is available) is used to lay the foundations for a viable business plan and, more importantly, the innovative use of ICT to provide useful, indeed essential, services to local people.

Development–oriented policies

Universal service

Governments can encourage the investments needed to deploy broadband in high–cost areas (e.g., rural and remote regions) by including broadband service in the definition of universal service or universal access.

Provisions relating to a "universal service obligation" (USO) for basic telecommunications are commonly adopted in various countries. In essence, USO constitutes a requirement that telecommunications operators provide basic voice and Internet services to all who request it, at a uniform and affordable price, even though there might be significant differences in the costs of supply. Applying such a traditional USO approach to broadband services would mean giving all consumers (including those in regional, rural and remote areas) the right to a broadband connection on reasonable demand at affordable prices. By comparison, a policy of "universal access" generally refers to a situation where every inhabitant has a reasonable means of access to a publicly available broadband service. Universal access may be provided through community telecommunications centers, tele–boutiques, community broadband Internet access terminals, and similar facilities. While universal service and universal access policies can be quite different, the concepts

More for less

The evolution of the PC for Community initiative promises to increase the penetration of PCs and Internet users within Egyptian society.

Adel Radwan had wanted to buy his eighteen–year–old daughter a computer for some time, but he could not afford it. Although it was possible for him to pay for it in installments charged to his phone bill, he still could not afford the monthly costs, and could only afford to spend around 50 LE per month. It is Adel, and others like him, for whom the latest development in the PC for Community initiative was designed. The new initiative, dubbed "the Family Computer", provides PCs at a cost ranging from 1,500 to 1,800 LE. All computers previously provided under the "PC for Every Home initiative" (part of the PC for Community scheme) had been high–specification units, with prices ranging from 2,800 to 4,650 LE. However, MCIT found out that a large proportion of prospective users needed more basic specifications fit for beginners, students, or simple office use.

To this end, Dr. Tarek Kamel, Minister of Communications and Information Technology, announced with Jean–Philippe Courtois, President of Microsoft International, the launch of a new, low–cost, easy–to–use personal computer. The new computer is available to Egyptian families for a monthly installment in the range of 50 LE, paid back normally over a period of 40 months. The amount of the installment was identified by polls taken in several provinces.

The PCs will feature an Arabic version of Microsoft Windows XP Starter Edition, and will be totally compatible with beginners' needs. Windows XP Starter Edition was developed especially for Arab users by a group of the corporation's experts abroad. It was achieved with the assistance of a development team in the company's innovation center in Egypt's Smart Village. The new operating system is specially designed with detailed audio (Egyptian voiceover), video, and written descriptions of all functions to assist first–time users. The specifications and hardware were identified to meet the basic needs of the largest sector of users, with processors ranging from 1.0 to 2.13 GHz, memory of 128 to 256 MB, and a hard disk of 40 GB.

In addition, the system features a highly detailed user manual to solve any operating problems the user might face. International hardware companies like Intel and Via are partners in the development of this new PC, and the computer is easily upgradeable by replacing the operating system with Windows XP Home Edition, or Windows XP Professional. Replacing the motherboard and the processor is also possible to improve performance.

With this latest low–cost PC initiative, MCIT hopes to reach 40–50 per cent of Egyptian families in all provinces within five to seven years. The PC for Every Home initiative has so far succeeded in distributing more than 250,000 PCs to low–income Egyptian families.

The new PC will also be offered through the installment programs sponsored by Banque Misr and the National Bank of Egypt.

With the framework for the new PC now in place, MCIT is now working on providing all provinces with quality marketing, post–sales, and maintenance services that will build confidence in the initiative and help reach targets.

Launching low–cost, easy–to–use computers is a big step towards developing an Egyptian Information Society and narrowing the digital gap. Such initiatives are implemented in cooperation with multinational software and hardware corporations, as well as local computer assembly companies, within the framework of a public/private partnership model. The objective of these partnerships is to extend the computer and Internet usage across all different segments of the community, and to help improve the educational and professional levels of the users.

This initiative will also support building a strong, local IT industry that fulfills the needs of both local and regional markets for products. Already, offers have been tendered by more than 12 companies participating in the Computer for Every Home initiative to assemble the new computer.

Additionally, Intel is expected to launch a new product designed at the Intel Design Center in Egypt, which will be released to the local market in May 2007. According to distribution levels, it will be produced by Egyptian hardware manufacturing companies. There will also be continued cooperation with VIA Technology to develop products that are compatible with the Egyptian market, and encourage it to invest in the Egyptian market.

Source: Ministry of Communications and Information http://www.mcit.gov.eg/FeatureDetailes.aspx?id=QOLSBRAtAF8=

are closely related, and the terms are sometimes used interchangeably. Universal access may also be interpreted as not addressing the issue of "affordable price." In the case of ISDN for example, many regulators in Europe required that ISDN be available throughout the country on demand, but prices for ISDN access were left to the market.

Incorporating broadband into the USO is likely to require a significant investment in upgrading the operator's access network. This can adversely impact the development of competition in the industry, both by the imposition of higher USO levies on an incumbent's competitors, and by further entrenching subsidization of the incumbent's services in USO net cost areas. Such a development may well have the effect of dissuading innovative alternative providers from entering regional markets (since high–speed data services can be delivered through a number of different platforms, many of which are offered by new competitors).

To conclude, the policy makers have to make a trade–off between the introduction of competition in the telecommunication area, and the willingness to narrow the digital gap between urban and rural regions, and between high and low income populations. The regulatory authorities, according to their priorities, can establish a policy that takes into account the implications of these two aspects.

Local loop unbundling

Local loop unbundling is the process of allowing telecommunications operators to use the twisted–pair telephone connections from the telephone exchange central office to the customer's premises. The local loop is owned by the incumbent local exchange carrier.

The emergence of Internet services highlight-

Current universal service regime in Jordan

Jordan Telecom's license imposes certain universal service requirements:

- JT must provide basic telephone service to any person wishing to obtain it, willing to pay the published prices, and abide by its generally–applicable terms and conditions;
- JT must provide service to any household in a municipality with over 300 residents, and to residents outside such areas, except that JT may recover its costs of connection over and above a certain threshold.

Following liberalization of the market, the TRC is required to create a competitively neutral Universal Service framework:

- Mechanism to be developed to allow other competing operators to share the cost of providing universal service upon the licensing of such operators;
- TRC may require JT to allow other operators to meet the Universal Service Obligation through a transfer of subsidies;
- Universal Service Obligations must be administered in a transparent, non–discriminatory and competitively neutral manner.

Source: Muna Nijem, Telecommunications Regulatory Commission (TRC), Jordan, "Future Challenges for the TRC," 1st Regulatory Meeting for the ITU Arab Region, Algeria, 2003

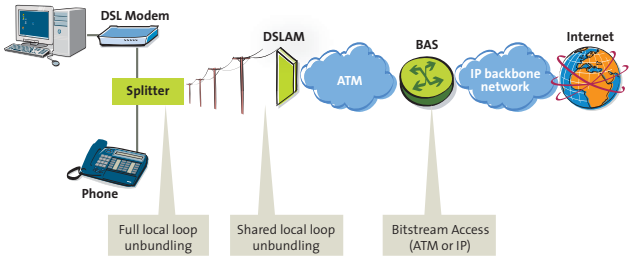
ed the importance of access to the local loop, since Internet service providers (ISPs) have to depend on local network providers to access customers. With the emergence of high–speed Internet access based on the public switched telecommunications network – mainly asymmetric digital subscriber line technology (ADSL) – the question of access to local network infrastructures has moved to the forefront of policy agendas.

Local loop unbundling can be classified into three main types (figure 7):

1. Full unbundling (or access to "raw copper.");
2. Line sharing or shared access;
3. Bit–stream access.

Full unbundling (sometimes referred to as access to raw copper) occurs when the copper pairs connecting a subscriber to the MDF are leased by a new entrant from the incumbent. The new entrant takes total control of the copper pairs and can provide subscribers with all services including voice. The new entrant can also enhance the copper pairs by adding ADSL technology. The incumbent still maintains ownership of the unbundled loop and is responsible for maintaining it.

Figure 7: Types of local loop unbundling



Source: Anne Lenfant, "Broadband Regulation in France," Workshop on Novel Communication Technologies for Socio-economic Development, Beirut, 11-13 July 2005

Line sharing allows the incumbent to maintain control of the copper pair and continue providing some services to a subscriber while allowing an access seeker to lease part of the copper pair spectrum and provide services to the same subscriber. Line sharing allows the incumbent to continue to provide telephone service while the competitor provides broadband (xDSL) services on the same copper pair. With line sharing, the competing supplier uses the non–voice frequency of the loop. Consumers can obtain broadband service from the most competitive provider without installing a second line.

A primary difficulty of line sharing has to do with technical interface problems. For example, implementation of ADSL with telephony and with ISDN uses different spectrum allocation, such that different equipment may be necessary both for the splitter and for ADSL. In addition, line sharing may slow down the speed for digital access in general due to "frequency unbundling". When high–speed data runs along adjacent telephone lines, the signal on one wire can bring noise into the next wire, interfering with the signal and resulting in slower data rates. This problem is known as "crosstalk", which has to be technically overcome in order to expand ADSL access via line sharing.

Bit–stream access provides ISPs with a wholesale xDSL product from the incumbent. With bit–stream access, the incumbent maintains control over the subscriber's line but allocates spectrum to an access seeker. The incumbent provides the ADSL technology and modems so that new entrants have no management control over the physical line and are not allowed to add other equipment. Unlike full unbundling and line sharing, the access seekers can only supply the services that the incumbent designates. Accordingly, bit– stream access reduces the level of competition compared with full unbundling and line sharing, as there is no competition at the physical layer, and no incentive for the incumbent to deploy new technology. For new entrants, a low level of service–based competition can be expected due to the fact that they can only obtain access to the system that the incumbent chooses to implement.

With bit–stream access, spectrum management between operators is unnecessary because it is handled completely by the incumbent. It is partly for this reason that new

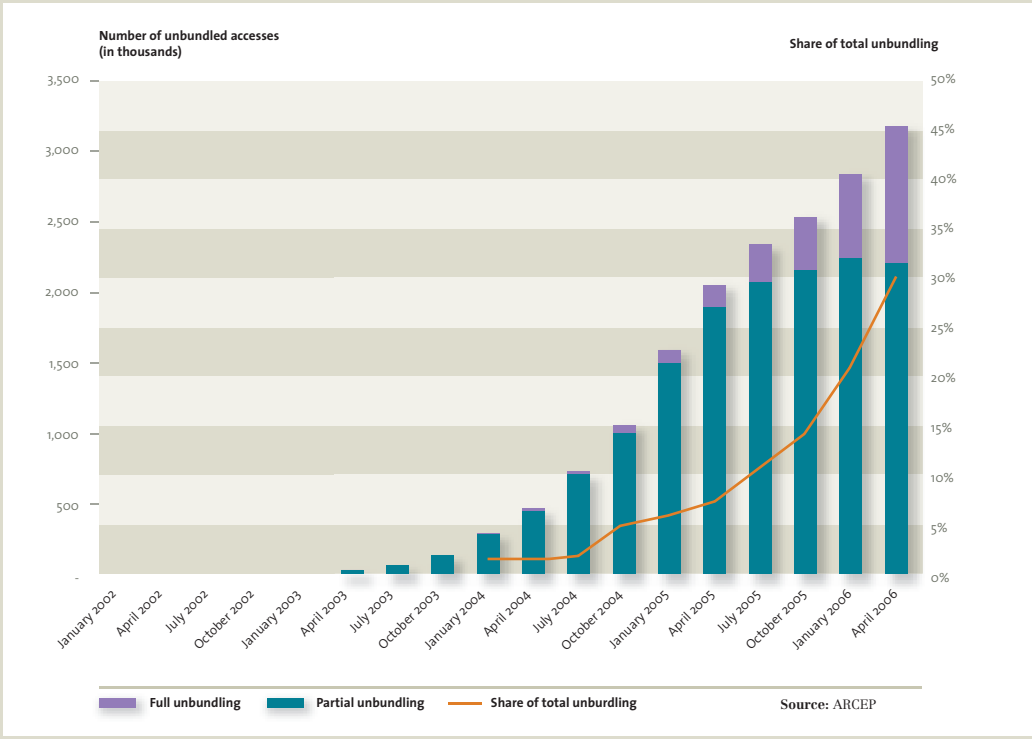
Local loop unbundling in France

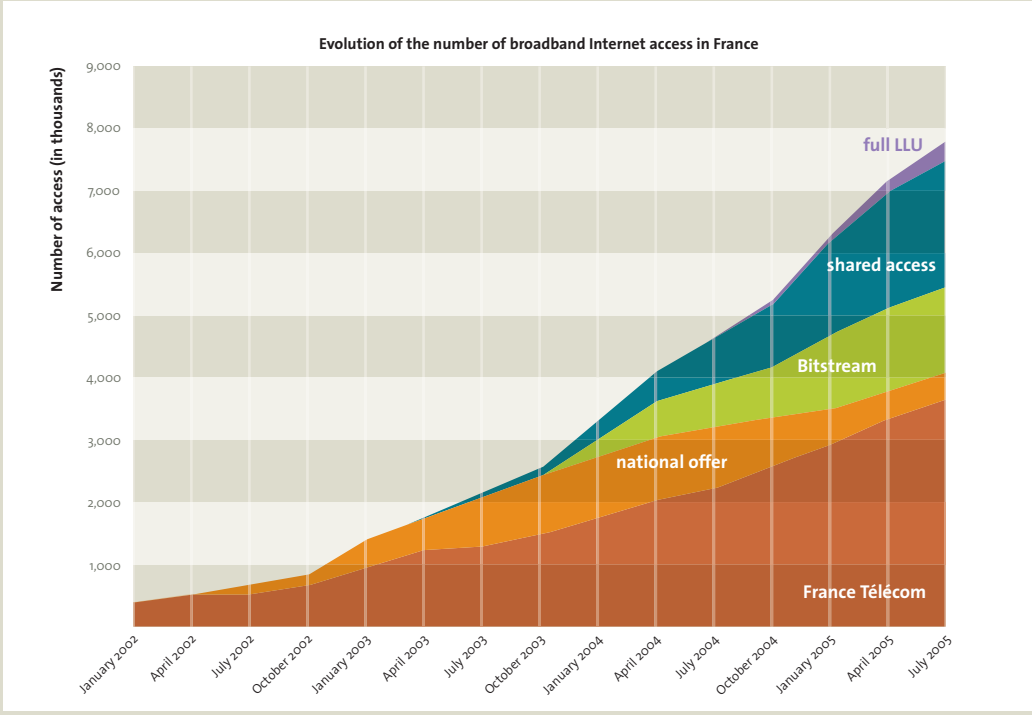
Broadband competition, notably in ADSL, took off sharply in 2003, with diversified service and tariff offers. At the end of 2006, France is among the European leaders in ADSL and, notably, unbundling, with over 10 million subscribers. The rivals of Orange, France Telecom's Internet service provider, have 55% of the retail market.

The fall in wholesale prices at the end of 2003, as well as tariffs being differentiated as a function of production costs, allowed the substantial productivity gains in the sector to be passed on to the end user, while still encouraging alternative operators and France Telecom to persist with the geographical rollout of ADSL.

The success of the LLU process in France has enabled significant progress in the broadband penetration in French households. The different offers are well diversified, from simple Internet access to Triple Play services, therefore cost oriented and customer focused. The dynamic generated by this process has been profitable for the incumbent telecom operator France Telecom, although initially it feared losing telephony business. The graph shows that, despite the entry of new competitors into the market, the number of connections fully managed by France Telecom has increased. Moreover, the loss of market share is compensated for by the revenue from competitors for unbundling, copper wire line rental and maintenance services, whilst noting that copper broadband has reduced the deployment of fiber–optics to the home.

Source: ARCEP; Unbundling in France at 31 March 2006





entrants generally do not favor this method. This variant of LLU can be a good option, especially for ISPs. While bit–stream access has been considered as a form of unbundling, there are some countries that do not view bit–stream access as coming within the scope of unbundling policy.

There are very few example of local loop unbundling in the ESCWA region; none of them have yet reached the stage of full unbundling. Jordan announced an "unbundling policy" in 2005 focusing mainly on bit–stream access. Partial unbundling took place in Egypt, while in Syria, only resale services are allowed for competitive DSL providers, and the incumbent, Syrian Telecom, keeps full ownership of the local loop and the associated broadband equipment (DSLAM).

Impact of LLU on prices

The issue of unbundling has brought to the forefront the requirement to rebalance subscriber prices and, in particular, fixed subscriber line charges. The objective is that they should reflect costs. In the past, when countries decided to open their telecommunication markets to competition, most regulators began a deliberate policy of rebalancing charges toward cost. In some countries a target date was set for price rebalancing. In many countries however, regulators have been reluctant to raise subscriber prices for monthly charges, given that these rates are politically sensitive. The result is that, in some countries, rebalancing of subscriber fixed charges has not yet been achieved. Rebalanced prices are important for new entrants wanting to take advantage of unbundling. Without rebalanced prices, new entrants with a business model focusing on low–value services can be caught in a price squeeze and may be unable to offer service at competitive prices. This is because regulators try to price unbundled local loops at cost. If subscriber line charges are set below cost, then unbundled loop prices for new entrants will be higher than the retail price charged for residential subscriber lines. This means that new entrants will not be able to use fully unbundled local loops to offer similar subscriber lines (figure 8). For line sharing, this poses less of a problem as long as there is non–discriminatory pricing between the incumbent and its ISP, or the incumbent and new entrants, for access to spectrum on copper loops.

Another price implication of local loop unbundling has to do with the geographic averaging of subscriber line charges. For instance, residential subscribers pay the same for a line irrespective of where they live in the country, even though the cost of providing these lines may differ, especially between

Conclusions on network unbundling in Jordan

Unbundling involves the incumbent telecommunications operator allowing the use of various components of its network and their functionality to its competitors. Such a process would involve the physical connection of the incumbent's facilities with those of the other licensed operator. This configuration enables competing providers partly or wholly to use the incumbent's network and to provide voice and/or data services to end users using a combination of the incumbent's network and their own facilities.

Given the widespread difficulties that have been experienced in many countries to date with respect to full local loop unbundling ("LLU"), the TRC has decided to implement only bit–stream unbundling for LLU and will require that Jordan Telecom provide this facility to other operators at cost based rates. The TRC believes that bit–stream unbundling is consistent with the desire to "ensure the availability of advanced and high quality Information and Communications Technology (ICT) services to all users at just, reasonable, and affordable prices".

The TRC has also concluded that "transmission link services" as defined in the original Guidelines ("services where a Designated Licensee provides fixed capacity between two fixed points over its network to other Licensees") are adequate to respond to the needs of competing operators for unbundled transport services. However, for additional clarity, the TRC will classify "transmission link services" and "interconnection link services" as "transport services" (as defined above). In accordance with the current definition in the "Guidelines", such transport services do not include the provision of service directly to the subscriber's premises.

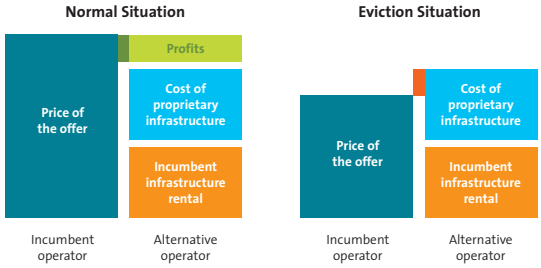
Rather than develop a new procedural framework to govern its decision regarding bit–stream unbundling, the TRC will utilize the processes and procedures that currently exist in the "Guidelines" and will make the necessary modifications to accommodate bit–stream unbundling including the insertion of new processes on Bit–stream Unbundling. However, for the sake of clarity, in order to ensure that bit–stream unbundling is provided to other operators in a timely and orderly fashion, the TRC is outlining the procedures and provisioning intervals that incumbents (primarily JT) will be expected to adhere to. In formulating its decision on provisioning intervals, the TRC took into consideration the scope and size of the existing fixed line network (i.e., JT) in Jordan and determined that:

- Upon receipt of another operator's provisioning request, JT will provide an initial response within ten (10) working days;
- If the operator (one party) receives a positive response from JT (the other party), the two parties will have a maximum of 15 working days in which to reach agreement on the manner and the time frame in which the bit–stream unbundling will be provisioned;
- Provided that the two parties reach agreement within the time frame specified above, the TRC will have five (5) working days in which to issue its approval or to require changes by one or both parties;
- If JT's initial response is negative or if the parties fail to reach agreement, the Commission will investigate and render its decision within 30 working days.

Source: "Explanatory memorandum on interconnection, network unbundling, infrastructure sharing and collocation requirements," Telecommunications Regulatory Commission (TRC), Jordan, 2005

urban and rural areas. However, if unbundled loops are charged at cost, rather than at some average cost, the policy of geographic averaging of prices breaks down. Whether this occurs may be a policy or regulator decision. If geographic averaging is maintained in the pricing of unbundled local loops, new entrants may be faced with a price squeeze if they want to use full unbundled local loops to offer voice services, unless subscriber line prices are also geographically averaged. As noted earlier, for line sharing, the geographic averaging of prices may not raise a problem for new entrants, so long as there is non–discriminatory pricing by the incumbent for the prices of DSL–enabled lines. Incumbents may also raise other problems. For example, if they have to charge average prices for DSL, they may suggest that new entrants are skimming by using LLU to supply services to the most profitable customers.

Figure 8: Avoiding eviction prices



Source: ARCEP

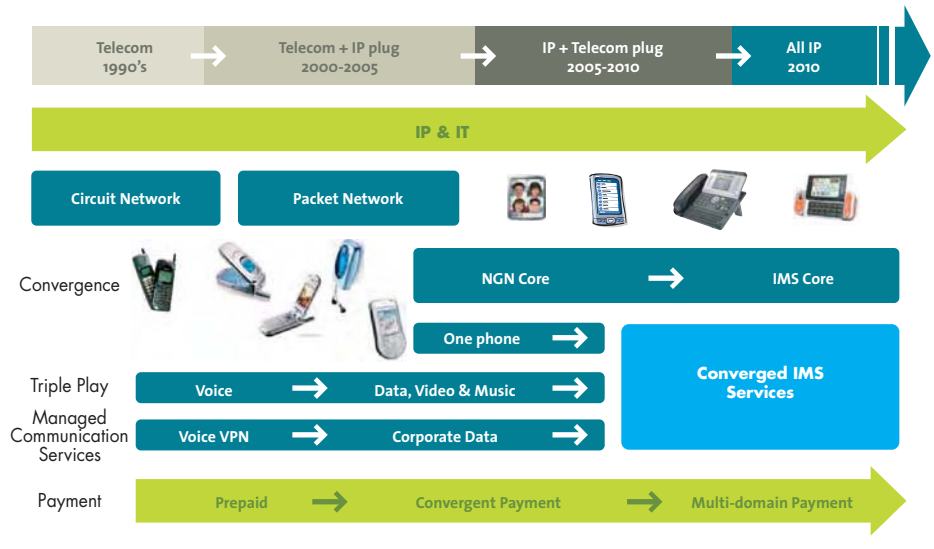
Convergence

Convergence can be defined as the integration of computers and information technology, communication networks, and broadcasting and television. A more formal and comprehensive definition of convergence is "the progressive integration of the value chain of the information and content industries –telecommunications, posts, multimedia, electronic commerce, broadcasting, information technology, and publishing industries– into a single value chain based on the common use and distribution of digital technology".[8] This definition shows the tight relationship between convergence and broadband access, as the delivery of services in a converged environment requires an adequate high–speed, always–on connection. One can distinguish between two types of convergence:

1. Convergence of technologies and networks to build a common platform to deliver voice, data and video services.
2. Convergence of services, enabling the delivery of multiple services to end users over the same medium.

Traditional circuit–switching core networks (fixed or mobile) have long been deployed for voice transport. With the introduction of IP, a new requirement to transport data and services emerged – for which packet core networks, fixed or mobile, have been deployed. With the availability of IP in the network, there is now a new possibility: the delivery and transport of voice services over IP. Indeed, this is the basis of the Next–Generation Network (NGN) core, fixed or mobile. First, there is the transport of Voice over IP, then the evolution toward IMS, or the transport of any kind of multimedia/conversational services. This is usually referred to as service convergence (figure 9). Many analysts and market leaders now

Figure 9: Evolution toward converged services



Source: Alcatel-Lucent

[8] Cited in: Edwin S. Soriano, "Nets, Webs, and the Information Infrastructure," UNDP-APDIP, 2003.

agree that IT innovation should be brought to the telecom market, including its core functions, as soon as possible. Service providers should be able to leverage the advantages of IT in their existing networks immediately. They need to complete and transform their networks at several levels, including the network control level, for traditional circuit networks with traditional terminals.

The first objective of the operators is to increase their revenues by offering new services (including VoIP and IP TV), which can be introduced in two ways through network expansion.

The first approach is to implement the service offered by one network through another network, thus creating a new service on the second network. A universal service can be provided after extracting the common features of both networks. Examples of traditional services provided through different networks are shown in figure 10, where the bold type shows the new services generated from the traditional services.

The second way is to combine existing services to generate a new one. For example, multimedia services combine voice and data services, and location–based services combine mobile information and data services. Other examples are browse & talk, and unified messaging.

Technical and economic considerations must be taken into account when deploying network convergence. Indeed, network convergence at the service layer may be used to expand services. When a softswitch is used to control the Voice over Internet Protocol (VoIP) service, the service layer logic, such as the intelligent network, can be re–used. In the case of the Wireless Application Protocol (WAP) or Voice eXtensible Markup Language (VXML), the interface to the shared WWW browser component can be re–used because it has been defined between the core logic and different network services even at the service layer. Network–level integration has two components: a data plane (integrated with IP) and a control plane (integrated with unified control equipment such as a softswitch). Convergence at the lower layers will, of course, facilitate convergence at the higher layers. However, the cost of implementing convergence at the lower layers may be high, as these layers represent a large percentage of the total network CAPEX. For example, the access layer represents about 30-50% of the investment in the whole network.

The second objective of the operators is to reduce their investment and operations costs. This can again be achieved through network convergence. In order to expand and introduce new services, network operators can continue to develop specific overlay networks or attempt to develop converged ones (figure 11).

Figure 10: Example of traditional services and their mapping to other service networks

Fixed voice services	Data Services	Mobile Services
Voice message	**VoIP**	Voice
VXML	WWW browse	**WAP**
Voice Mail	Email	**Unified message**

Source: Alcatel-Lucent

Figure 11: Comparison between converged and overlay networks

Converged network	Overlay network
Simplifies the network architecture	Dimensioning according to the deployment
Shares the common equipment to reduce Capex	Less dependency on one supplier
Reduces Opex(fewer network elements, less, room, spare parts, management, training)	Optimized according to service requirement
Reuses resources statistically	Faster deployment
Low cost to change service or introduce new ones	Proven large scale deployment

Source: Alcatel-Lucent

Chapter 6

Going Forward

In this chapter, we will revisit the factors discussed in previous chapters, and try to suggest recommendations for action in order to solve some of the problems encountered, and to address those factors that have a substantial impact from both the demand and supply perspective, with the aim of improving broadband deployment in the ESCWA region.

It will be evident that these recommendations are closely inter–related, and depend overall on one overarching principle: the economic case for broadband access cannot be made separately from voice telephony and TV distribution, with their associated advertising-based or subscription–based paradigms.

The dramatic take–up of broadband access in France, which was highlighted in the previous chapter of this report, was "technically" related to a regulatory framework that favored local loop unbundling. Yet the main driver behind customers signing up massively to broadband access was the introduction of competitive offers for bundled broadband access, telephony and TV services (so–called Triple Play).

The list of ideas below must be considered as recommendations for coherent action, rather than a "*one–size–fits–all*" recipe. The ESCWA region consists of 13 countries that share many sociological, political and cultural aspects, but also demonstrate profound disparities in economic, social, and human terms. Hence, what is proposed below is a general framework for action. Implementation must be adapted to each country–specific situation.

Bring down broadband prices with bundled service offers, and create a virtuous adoption circle

Consumers will only adopt broadband when its cost is justified and affordable; suitable pricing schemes are thus vital to increase broadband adoption. High prices for broadband access services in the ESCWA region cannot be brought down in a sustainable manner unless market dynamics and the interest of the players involved reinforce such a target.

From the strict point of pricing, the key factor seems to be the availability of **bundled offers**, where broadband access is offered with other services like telephony – fixed and even mobile (see convergence issues below) – and access to video content. Customers will be more willing to pay a single one–stop shop operator, especially if the bundle cost is cheaper than the sum of its individual elements, resulting in considerable savings for both providers and consumers, and thus accelerating the adoption of broadband.

With bundled services, even "light" dial–up users might have an incentive to switch to broadband, since the cost of broadband is combined with other services that they use, like telephony or TV.

For service providers, the economy of scale will make international connectivity cheaper. Attractive prices could in this case be proposed for huge bandwidths (tens of Mbit/s).

Improve regional connectivity and peering, and allow the emergence of powerful regional service providers

The ESCWA region should further take advantage of the two existing IXPs: EMIX in the United Arab Emirates, and CRIX in Egypt. Previous attempts to build a regional "Pan–Arab Backbone Network" covering the ESCWA region should be completed, and given the undivided attention of policy–makers. Accordingly, operators in these countries will be able to build exchange points and aggregate local traffic, thus saving on international capacity requirements, reducing the overall amount paid in international bandwidth, and enabling operators to attract content from developed countries to be mirrored and/or hosted locally. This would eventually reduce the asymmetry in the traffic exchanged with emerging countries.

International connectivity is very expensive, hindering the growth of potential Internet usage, and preventing ISPs from investing in more international bandwidth. The vicious circle can be broken through a major investment – as part of a national broadband strategy, for instance – in international bandwidth capacities. The resulting lower connection costs would enable ISPs to offer broadband connectivity at a lower price to stimulate demand.

Promoting peering agreements with regional ISPs in order to bypass Tier 1 carriers would also relieve the pressure on ISPs to pay high prices. Since ISPs cannot fulfill any of the Tier 1 carriers' policies for settlement–free interconnection, they have no choice but to pay the full transmission cost, as well as peering and/or transit costs. It is also possible to attract new Tier 1 carriers to the region in order to increase ISPs' bargaining power.

Finally, allowing the emergence of at least one powerful regional service provider operating in many countries of the ESCWA region, and capable, due to the volume of traffic it handles, of negotiating peering agreements with major Internet backbone providers, could be a welcome move.

Improve technical and human factors related to Quality of Service as a key enabler for mass broadband adoption

Quality of Service is one of the most difficult issues to solve, and depends on both technical and human factors.

Promoting a "customer service culture" and simplifying provisioning logistics are two main recommendations to enhance today's broadband installation process. The process delay can be reduced through standardization of technical experience, raising the skills of technical staff, and alleviating bureaucracy through the introduction of automation, which would result in a quicker and better installation process being achieved by a smaller number of technical personnel.

Lack of quality installation and maintenance, especially at the end–user side of the network, is an issue in the region. For instance, the quality of copper for DSL access in the region is generally perceived as "bad", but this is based only on anecdotal evidence. A reliable and independent source of information – published for instance by a regulatory authority – on copper quality would allow independent service providers to build a reliable business plan for DSL deployment based on sound assumptions.

Encouraging the adoption of wireless local loop technologies, and ensuring the availability of the necessary frequency spectrum, are initiatives that must be taken by governments and policy–makers. This allows circumvention of the difficulties in providing DSL services over copper cables, especially in rural areas.

Another issue is the lack of a "service culture". It is fairly well established that broadband access installation requires a minimum level of technical skills from the end user, and quality "hot line" support from the service provider. Service providers in the region must pay special attention to this problem, and learn from the experience of developed countries.

Provide relevant content and applications, and use broadband access as a lever to improve human development deficiencies in the region

As has been demonstrated in several parts of the world, the availability of applications and local content boost the adoption of broadband technologies and services. The more relevant content available in the Arabic language, the greater the increase in overall Internet usage, and the wider broadband will be deployed. For further information on the issue of Arabic content, refer to the ESCWA Initiative on "Promoting Digital Arabic Content",[1] and ESCWA's study on "Digital Arabic Content: Opportunities, Priorities, and Strategies".[2] Spam is also a problem that must be tackled within the framework of international collaboration agreed upon by the World Summit on the Information Society, and as recommended by the Internet Governance Forum (IGF).

Interactive multimedia content is expected to stimulate demand for higher bandwidth. It is recommended that a regulatory framework that allows content providers to provide their output through any access platform (including broadband access) should be encouraged, since many of the countries in the region face serious problems in terms of content piracy.[3] Willingness (or lack thereof) to give access to information and education to the general public is another key issue. The 2003 UNDP Arab Human Development Report devoted to the subject of "Building a Knowledge Society" calls for "the establish-

[1] ESCWA, 2003, "Promoting Digital Arabic Content" (E/ESCWA/ICTD/2003/10)
[2] ESCWA, 2005, "Digital Arabic Content: Opportunities, Priorities, and Strategies" (E/ESCWA/ICTD/2005/4)
[3] Through satellite because of advances in scrambling technologies, as exemplified by the last soccer World Cup.

ment of an independent knowledge sphere that produces and promotes knowledge", and highlights "the legal constraints on publications…and electronic media" in many countries in the region.

Furthermore, the new, so–called "Web 2.0" paradigm, where the Internet is becoming more of an exchange platform where every "user" can become a "publisher" and "content producer", is an important development. The creation of local and regional portals allowing this kind of platform will contribute to the use of the Internet by everyone – especially young people – and to the creation of a virtual public space for freedom of speech, the absence of which was also pointed out by the last 2004 UNDP Arab Human Development Report.

Develop collective means of access to the Internet and affordable PCs

Since the ESCWA region is characterized by a "relatively low" to "fair" penetration of PCs, it is evident that the limited availability of PCs is still a major obstacle to the widespread adoption of broadband.

For users with low incomes, especially those living in remote rural areas, collective access to the Internet through cafés or community centers may provide an appropriate solution. For such an approach to work and be sustainable, local players must be involved in the definition and launching of innovative applications and services that relate to the local communities in these areas. The connectivity of such community centers with broadband can leverage new broadband wireless technologies like WiMAX.

On the other hand, launching low–cost, easy–to–use PCs is an essential step towards developing the Information Society. Such affordable PCs need to be offered in cooperation with multinational software and hardware corporations, as well as local computer assembly companies, within the framework of a public/private partnership model. Proper pay–by–installment programs sponsored by local banks, coupled with quality marketing, post–sales and maintenance services, will help build confidence in such schemes.

Include broadband access as a Universal Service Obligation

Governments should support investment to deploy broadband services in high–cost areas by including broadband services in the definition of universal service or universal access. Applying a traditional Universal Service Obligation (USO) approach to broadband services would mean giving all consumers the right to a broadband connection on reasonable demand at affordable prices.

Accordingly, a policy of "universal access" generally refers to a situation where every inhabitant has a reasonable means of access to a publicly available broadband service. Incorporating broadband services into the USO is likely to require a significant investment in upgrading the operator's access network. In this regard, policy makers have to make a trade–off between the introduction of competition in the telecommunications arena, and their willingness to bridge the digital gap between urban and rural regions, and between high– and low–income populations. The regulatory authorities, depending on their priorities, can set up a policy that takes into account the implications of these two aspects.

Develop and generalize local loop unbundling and the emergence of multiple–service offers by newcomers and incumbents

Many of the ESCWA countries have established an independent telecom regulatory authority and introduced effective competition in the telecom sector. However, effective competition – in terms of service and price – in the domain of Internet access in general, and broadband access in particular, is still lacking. This is due to the absence of effective unbundling of the local loop due to the fear of many regulators, governments and incumbent operators that unbundling the local loop will open a Pandora's box of unregulated Voice over IP (VoIP).

This fear of unregulated VoIP is at best shortsighted, and will cause unnecessary delay in the evolution of service operators in terms of business and technology.

The experience of developed countries points to an initial post–unbundling period where incumbents could see their revenues attacked by multiple–play newcomers. In such situations, they will typically fight back, retaining customers with their own multiple–play offers that leverage their mastery of their own networks. In short, they evolve from being basically a single–play (voice service) operator to a multiple–play service provider. This evolution is also based on technical considerations

related to convergence, which will be discussed in the section below.

Furthermore, policy–makers should try to rebalance subscriber prices, in particular fixed subscriber–line charges, with the objective of reflecting costs. A clear target date should also be set for price rebalancing. Rebalanced prices are important for new entrants wanting to take advantage of unbundling. Without rebalanced prices, new entrants with a business model focusing on low–value services can be caught in a price squeeze, and may be unable to offer service at competitive prices. As explained previously, if subscriber line charges are set below cost, then unbundled loop prices for new entrants will be higher than the retail price charged for residential subscriber lines. Whether this is a policy or regulatory decision, one more benefit of unbundled loops being charged at cost is that the policy of geographic averaging of prices will automatically break down.

Develop core network convergence into a next–generation network paradigm

Network convergence is the paradigm that allows service providers to evolve from network silos (one network per service – fixed voice, mobile voice, Internet access, video distribution, etc.) to a single network capable of offering any service and, most importantly, offering it to the customer anytime, anywhere and through any access network, fixed or mobile.

Convergence can be seen as the transposition of this blurring of the frontiers from the access part of the network (which, due to broadband, is now capable of handling any kind of service) toward its core. Such an evolution is inevitable not only from the economic standpoint, as stated above, but also from the technical standpoint: in the long term, there is an inherent "impedance mismatch" between the development of broadband access networks on the edge that are essentially multi–service in their capabilities, and maintaining legacy "silos" of single–service networks within the core.

Governments and regulators must therefore encourage efforts by operators towards convergence. This is the only sustainable way for operators to stay in business, and for policy makers to ensure the delivery of any kind of telecom service in an open, competitive and regulated environment.

Annex 1

The ESCWA Region

The Economic and Social Commission for Western Asia (ESCWA) is part of the Secretariat of the United Nations, and is one of the five regional commissions, which report to the UN Economic and Social Council (ECOSOC), the principal organ responsible for coordinating economic and social activities in the United Nations system. The other regional commissions are: the Economic Commission for Europe (ECE); the Economic and Social Commission for Asia and the Pacific (ESCAP); the Economic Commission for Latin America and the Caribbean (ECLAC); and the Economic Commission for Africa (ECA). ESCWA carries out its work at the Western Asia regional level.

The history of ESCWA starts in 1973, when an Economic Commission for Western Asia (ECWA) was established by the ECOSOC resolution 1818 (LV) of 9 August 1973 as the successor to the United Nations Economic and Social Office in Beirut (UNESOB). In 1985, the social dimension was emphasized and the Economic Commission was renamed as the Economic and Social Commission for Western Asia (ESCWA), in accordance with ECOSOC's resolution 1985/69 of 26 July 1985, in order to acknowledge more fully the social aspect of the Commission's activities.

ESCWA region

The ESCWA region covers 1.8 million square miles, the equivalent of 3.5 per cent of the world's surface, and its total population in 2004 was some 179 million, representing 2.8 per cent of the world population. It generates a GDP of US$649 billion; a mere 1.6 per cent of global GDP; 2.7 per cent of global foreign trade; and 2.7 per cent of global foreign currency reserves.[1] Member countries of the ESCWA region are: Bahrain, Egypt, Iraq, Jordan, Kuwait, Lebanon, Oman, Palestine, Qatar, Kingdom of Saudi Arabia, Syrian Arab Republic, United Arab Emirates and Yemen.[2]

While the economies of the ESCWA region have become further integrated into the world economy over the past years, the region's share of the world economy is not commensurate with its share of the world's surface and population. Key factors in the limited growth of GDP in the Arab world are the inability to effectively mobilize sufficient local financial resources and to attract foreign sources of finance, including the large volume of Arab investments abroad, which are valued at over US$1 trillion. The financial markets and the banking sector are insufficiently developed, and the region needs more effective mechanisms to mobilize local financial resources. Local rates of growth, trade systems, laws and institutions similarly hinder FDI flows.[3] A large proportion of the labor force is not specialized, and economies are not diversified. The raging conflicts suffered by the region also have a substantial negative impact on trade and production. While determined efforts have been made to diversify sources of funding in the region, oil exports remain the dominant factor in foreign trade. The only two sectors that showed growth in 2004 and contributed to facilitating the Arab world's integration into the global economy are the ICT and oil and gas sectors.[4]

Key challenges and issues for the ESCWA region

The region has demonstrated progress in many Millennium Development Goals (MDGs) related fields. However, progress varies across sub–regions and at the country level, where urban/rural disparities persist. Despite concerted efforts to rectify the situation, there have also been setbacks that are attributable

[1] The situation in the Arab world as a whole does not differ greatly from that in the ESCWA region. The Arab world covers an area of 5.3 million square miles and contains 306 million people, the equivalent of 10.2 per cent of the world's surface, and 4.8 per cent of its population. In 2004 it produced a total GDP of $865 billion, the equivalent of only 2.1 per cent of global GDP, and generated only 3.5 per cent of global foreign trade.

[2] ESCWA, 2005, "The annual review of developments in globalization and regional integration in the countries of the ESCWA region".

[3] Ratios of regional FDI to world FDI flows were less than 1.2 per cent for the ESCWA region

[4] Ibid

to several factors, including poor economic performance, inadequate financing, and political tensions and conflicts. That poor growth record has been reflected in slow progress in human development in comparison with the average for developing countries. The region faces a number of challenges to achieving the MDGs, including unemployment, the gender gap, illiteracy, regional disparities, war and conflict, and the digital divide.[5]

Digital divide

The region suffers from a significant digital divide. This divide is manifested in low penetration rates and per–capita indicators for basic ICT services, including fixed and mobile telephony as well as the number of PCs, Internet users and Internet hosts. This disparity exists not only between the region and the rest of the world, as shown by values below world averages, but is also present between the countries of the region, and even between the rural and urban communities of individual countries. Political, economic, social and cultural factors are major obstacles to the wide–scale dissemination of ICT services, in addition to the language barrier and the non–availability of adequate local content in the Arabic language. Lack of financing is also an obstacle in the non–GCC countries. Despite the multi–dimensional efforts and the major policy initiatives in the region, closing the digital divide remains one of the main challenges to the process of establishing sustainable socio–economic development. There follow some of the ICT indicators for the ESCWA region for the year 2005 (see table next page).

ESCWA's activities

ESCWA promotes economic and social development through regional and sub–regional cooperation and integration, and serves as the main general economic and social development forum within the United Nations system for the ESCWA region. It formulates and promotes development assistance activities and projects commensurate with the needs and priorities of the region, and acts as an executing agency for relevant operational projects. ESCWA coordinates its activities with those of the major departments/offices of the United Nations at Headquarters, and with specialized agencies and intergovernmental organizations, such as the League of Arab States, the Gulf Cooperation Council and the Organization of the Islamic Conference, with a view to avoiding duplication and ensuring complementarity, synergy and exchange of information. The majority of activities under the regular program of work are regional in dimension. There are, however, a limited number of activities that are country–specific, but which have regional implications.[6] The main themes of work in ESCWA are:

- Sustainable development and productivity;
- Social development;
- Economic analysis;
- Globalization and regional integration;

[5] "The Millennium Development Goals in the Arab region", United Nations, New York, 2005

[6] For more information, visit the ESCWA Website: www.escwa.org.lb

	Number of fixed telephone lines in operation per 100 individuals	Number of cellular mobile subscribers per 100 individuals	Number of personal computers per 100 individuals	Number of Internet hosts per 10,000 individuals	Number of Internet users per 100 individuals	Digital Opportunity Index (DOI)
Bahrain	27.05	103.04	16.9	25.84	21.34	0.56
Egypt	14.04	18.41	3.78	0.5	6.75	0.38
Iraq	4	2.22	...	–	0.14	...
Jordan	11.36	28.93	5.34	5.28	11.22	0.41
Kuwait	18.99	88.57	22.33	10.93	26.05	0.49
Lebanon	27.68	27.68	11.45	19.37	19.57	0.4
Oman	10.33	51.94	4.66	5.94	11.1	0.4
Palestine	9.43	29.57	4.59	...	6.56	...
Qatar	26.41	92.15	17.88	4.23	28.16	0.51
Saudi Arabia	15.46	54.12	135.39	6.96	6.62	0.42
Syrian Arab Republic	15.24	15.49	4.2	–	5.78	0.36
United Arab Emirates	27.51	100.86	19.84	62.02	31.08	0.54
Yemen	3.85	9.54	1.45	0.08	0.87	0.28
ESCWA	12.36	24.3	8.13[1]	3.54[2]	6.5	0.38[3]
World	19.78	33.95	13.38	421.63	15.17	0.37

Notes: [1]: Excluding Iraq [2]: Excluding Palestine [3]: Excluding Iraq and Palestine
(...) data is not available (–) data is negligible

Source: International Telecommunication Union, 2006

- Information and communication technology;
- Emerging and conflict–related issues;
- Women–related issues;
- Statistics coordination.

Information and Communication Technology Division (ICTD)

The Information and Communication Technology Division (ICTD) aspires to play a significant role alongside ESCWA member countries in their transformation toward the knowledge–based society and global competitiveness in the market, through advocating policies to increase employment, reduce poverty, and enhance quality of life through state–of–the–art ICTs and their applications. On the national level, the ICTD aims to increase the capabilities of member states to harness information and communication technology for their development. In this respect, it provides support for the development of ICT policies, infrastructure, and applications, and raises awareness of the potential of ICT in promoting sustainable development and enabling ESCWA countries to integrate into the global economy. On the regional level, ICTD endeavors to establish cooperation and coordination mechanisms between regional players engaged in ICT development activities. It promotes ICT applications for development, and strives towards the establishment of a sustainable ICT sector in the region.

ESCWA member countries are working to enhance their human and institutional capacities, improve policies, and promote investment. This will require sustained actions at the local, national and regional levels, and reform aimed at good governance, partnership, gender equality, environmental sustainability, pro–poor economic policies, and closing the digital divide.

Closing the digital divide will be achieved through a multi–dimensional strategy, one which can induce a tangible and leapfrogging impact on the ground. New technologies such as broadband and wireless, coupled with innovative tools for Arabic software and content creation, should be creatively blended so as to directly target the core socioeconomic problems at the grass–root level. Opportunities need to be seized for the benefit of the young and for marginalized communities. Policy–makers and business leaders need to work more collaboratively to create the regional information society and knowledge economy, the future landscape for the younger generation in the ESCWA region. The role of ESCWA member countries in the ongoing global debate on Internet governance, and in enhancing access to ICT services, is essential to combating the threat of further marginalization, and to maximizing opportunities for the region's participation in shaping the future of the Internet.

Annex 2

Alcatel–Lucent

Alcatel–Lucent provides solutions that enable service providers, enterprises and governments worldwide to deliver voice, data and video communication services to end users. As a leader in fixed, mobile and converged broadband networking, IP technologies, applications, and services, Alcatel–Lucent offers the end–to–end solutions that enable compelling communications services for people at home, at work and on the move.

With 79,000 employees and operations in more than 130 countries, Alcatel–Lucent is a local partner with global reach. The company has the most experienced global services team in the industry, and one of the largest research, technology and innovation organizations in the telecommunications industry.

Alcatel–Lucent achieved pro–forma combined revenues of 18.6 billion Euros in 2005, and is incorporated in France, with executive offices located in Paris.

For more information, visit Alcatel–Lucent on the Internet: http://www.alcatel–lucent.com

Alcatel–Lucent Digital Bridge Initiative [1]

Alcatel–Lucent strongly believes that information and communication technologies (ICT) are a necessity for economic and social development, and that **multi–stakeholder** initiatives involving service providers, equipment manufacturers, national and local authorities, and international organizations are key levers to bridging the digital divide.

Convinced of the benefits of innovation in new technologies and new business models, we believe that making "broadband-for-all" a reality, especially to populations of high–growth economies, is an achievable task in the next few years.

Alcatel–Lucent's Digital Bridge Initiative contributes to the materialization of the "broadband-for-all" vision through a set of concrete actions aimed at providing win-win solutions for all involved stakeholders, namely:

The implementation of **pilot projects** for the development of local added–value services in rural and under–served areas. The aim is to deliver the proof that the deployment of telecom infrastructure in rural areas can be profitable to all stakeholders – not just the local populations, but also telecom operators. In all projects, Alcatel–Lucent is teaming up with public and/or private partners in a true multi–stakeholder public–private partnership, in which each entity stays within its role and stated objectives. For this purpose, Alcatel–Lucent is leveraging mobile 2G infrastructure as well as broadband access solutions such as WiMAX, to connect rural communities to the Internet for useful applications in the domains of health, education, governance, and so on.

Alcatel–Lucent is currently conducting several pilot WiMAX deployments in under–covered areas of the African continent to illustrate how this infrastructure can be used to concretely improve the living conditions of rural populations, and stimulate larger deployment projects by operators.

These pilot schemes will allow, inter alia, hospitals in rural areas to offer improved healthcare thanks to the transmission of medical images; local authorities of rural communities to offer improved public services (land registration, civil services, etc.); and the establishment of IT discovery and training programs for young people (16–25 years old) in deprived areas.

Support for local partners through partnership centers designed to incubate innovative ideas for local ICT–based services. The aim is to develop local ecosystems, which will develop services tailored to local needs and generate more traffic for the network operators.

Two Alcatel–Lucent "**partnership centers**" were inaugurated at Alcatel–Lucent premises

[1] For further details see http://www.alcatel-lucent.com/digitalbridge

in Tunis, Tunisia, in December 2003 and in Cairo, Egypt, in September 2005. They are open to anyone with an idea for developing a service, but this must respond to local needs and the constraints of the local environment. Alcatel–Lucent has set as an objective the creation of three more partnership centers by 2008 within its premises located in emerging countries.

Finally, Alcatel–Lucent conduct joint studies with international organizations, such as the current report with ESCWA. An earlier report was prepared jointly with infoDev (World Bank Group) and was entitled: "Promoting Private Sector Investment and Innovation to Address the Information and Communication Needs of the Poor in Sub–Saharan Africa".[2]

The latter report was issued as a joint contribution to the second World Summit on the Information Society held in Tunis in November 2005.

[2] Available at http://www.alcatel-lucent.com/digitalbridge

Annex 3

Broadband Technologies

To date, the ESCWA countries have mainly used the Internet for basic e–mail and Web browsing services. To provide broadband access to the end user, ISPs need to widen the bottleneck between their network and the user. Today, the challenge of telecommunication technologies is to enable fast Internet access all along the telecommunication chain. The existing phone network has reached its limits with a 56 kbit/s data rate, which is not enough to provide value–added services like VoIP (Voice over Internet Protocol) or IP TV.

The network model (figure 1) depicts the architecture needed to connect remote subscribers to the regional fiber ring. There are three levels to be considered.

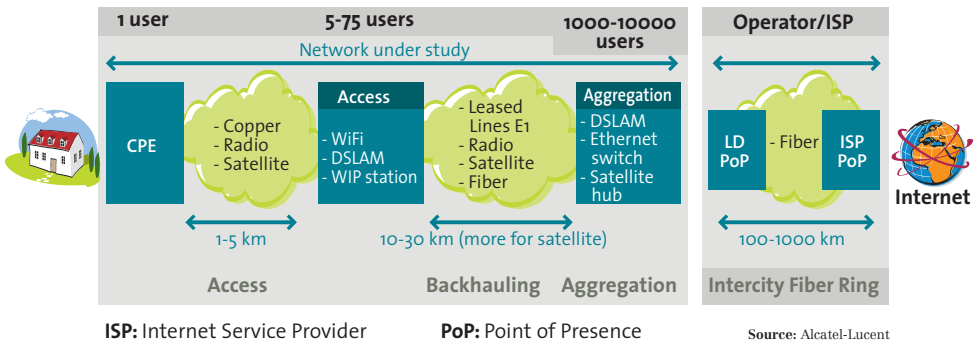
Customer Premises Equipment (CPE) level: This encompasses all the equipment installed at the customer's premises, ranging from a simple modem for Digital Subscriber Line (DSL) access, to a satellite dish and associated terminal for satellite access. Installation costs naturally depend on the access technology, ranging from nothing for DSL access, to quite a high price for a two–way satellite solution.

Access level: This corresponds to all elements in the access node that is installed close to the users. The reach and modularity of these nodes depends on the technology. A DSL access node (DSL Access Multiplexer, or DSLAM) has a reach of up to 5 km, while WiMAX (Worldwide Interoperability for Microwave Access) systems can reach up to 15 km. Note that no access node is deployed in the case of an end–to–end, two–way satellite solution. The focus has been on access nodes connecting fewer than a hundred users, which corresponds to a village of 250 households on average, and a varying broadband access penetration rate from a few percent in 2003 up to 30% in 2006.

Aggregation level: The aggregation node is at one end of the fiber connected to the regional ring, while the other end terminates all the backhauling links to the access nodes. It aggregates a large number of users (between 1,000 and 10,000). Depending on the type of access, various aggregation technologies have been considered, for example Asynchronous Transfer Mode (ATM); Ethernet; and satellite–specific ground stations. The backhauling distance will depend on the local geography, but is generally limited to a few tens of kilometers in Europe. As an example, preliminary studies set this distance at an average of 12 to 15 km in France.

The main technological challenge is to provide broadband access with the same quality of service in different areas under different conditions. It is not possible to address high–density population zones with the same solutions used for isolated villages. The technological answers to this issue have to take into account the population density of the area, the way of life of the potential users, and the existing telecommunications infrastruc-

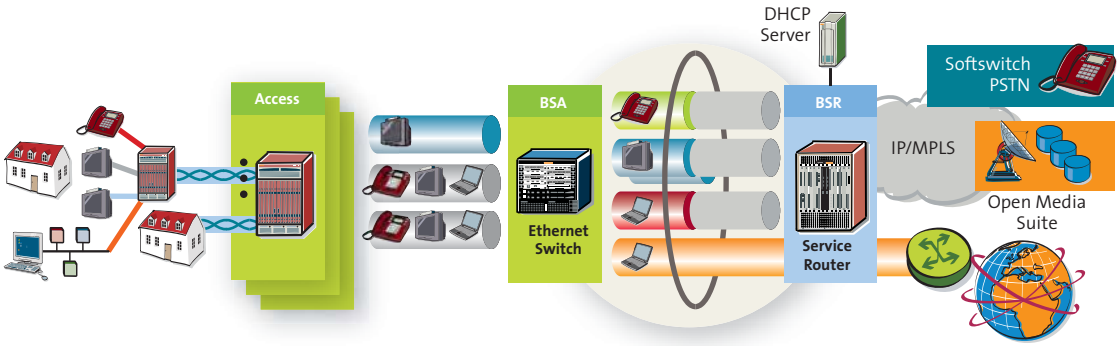
Figure 1: Network model



ISP: Internet Service Provider **PoP:** Point of Presence

Source: Alcatel-Lucent

Figure 2: DSL network architecture



Source: Alcatel-Lucent

ture. Therefore, the appropriate technology will help to achieve the goals of regional ICT policies: extending coverage and increasing bandwidth.

Wireline solutions

The main characteristic of urban areas is a high density of population and, therefore, of potential broadband subscribers. Moreover, the fixed–line phone network (Public Switched Telephone Network, or PSTN) is mostly well developed due to customer demand, and there are no installation waiting lists in the ESCWA region.

The PSTN can offer cost–effective broadband connectivity to local populations using DSL technology. However, where demand for high levels of service exists, alternative technologies would need to be deployed to provide the requested data rate.

DSL

Approximately one billion phone lines worldwide provide a robust, core global infrastructure capable of delivering broadband to homes, offices, schools and governments. With the copper infrastructure already in place, DSL is the most effective and economic technology for global broadband deployment (figure 2).

DSL avoids the bottleneck problem associated with delivering network services over phone lines. When accessing the Internet via a dial–up modem, the digital data is converted by the network into analog signals that can be transmitted over the telephone line. The receiving computer's modem must change the data back into digital form. A DSL transmission is digital and does not need this conversion. This allows phone lines to carry more bandwidth for transmitting data.

Typically, individual DSL connections provide from 28 Megabits per second (Mbit/s) to 512 kilobits per second (kbit/s) downstream (from the network to the end user), and about 128 kbit/s upstream. A DSL line can carry both data and voice signals, and the data signal is continuously connected.

The different flavors of DSL

Various DSL variants can be considered for the future evolution of the access network. They differ primarily in their spectrum masks and the number of tones used for transmission in each direction. The different reach, bandwidth and spectral compatibility characteristics can be leveraged for different deployment approaches.

- ADSL
  ADSL, recently updated with the ADSL2 standard, is the most widely deployed technology in the CO (Central Office, i.e. local telephone exchange) today. With a reach of 5 km at 1 Mbit/s, it is excellent for mass deployment. ADSL can be deployed in dense urban zones because there are no adjacent ADSL pairs feeding from the CO. However, there is a spectral problem if ADSL is injected at two locations (the CO and a remote site) on the same cable. For this reason, ADSL is not suitable for the suburban or rural zones unless all ADSL lines beyond that point can be provided from the remote node. However, if this condition is met, it can be an economic solution.
- Reach Extended ADSL2 (READSL2)
  This recent standard aims to extend serv ice to 5.5 km (on 26–gauge loops) with a minimum downstream/upstream bit rate of 192/96 kbit/s in addition to the standard telephone service. The extra reach is achieved by boosting the power spectral density in the lower end of the spectrum (both upstream and downstream) and

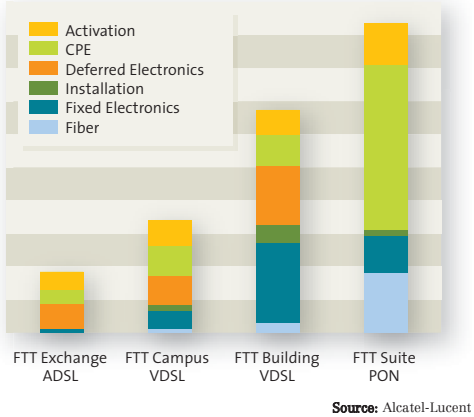
using a narrower frequency band, while maintaining the same total power as ADSL2. Deployed in the CO, it is possible to slightly increase reach using this variant of ADSL2.

- ADSL2+
  This important variation on the ADSL2 standard substantially increases bandwidth by doubling the spectrum to 2.2 MHz, resulting in a throughput of 5.5 to 15 Mbit/s over 1.5 to 3.2 km. The performance over longer distances is equivalent to ADSL2.
  Interestingly, it is possible to achieve spectral compatibility between remote ADSL2+ and CO–based ADSL by using a flexible start frequency. The extended start frequency for remote ADSL2+ results in a slightly lower throughput than CO–based ADSL2+, but provides an effective means of increasing the bandwidth and coverage in all areas at a moderate cost because of the relatively long reach. Further, the bandwidth provided by ADSL2+ corresponds quite closely with the targeted bandwidth tiers for future service requirements, as mentioned earlier.
- Very high bit rate DSL (VDSL)
  The VDSL standard has been under consideration for several years. It provides an asymmetric downstream bandwidth of 5 to 25 Mbit/s over 1 to 1.5 km (or a symmetric bandwidth of 2–10 Mbit/s). VDSL is spectrally compatible with CO–based ADSL, and can therefore be deployed in gray zones. However, because of its shorter reach, nodes must be deployed closer to the customer (typically at the distribution area cabinet, referred to as FTTCab), thereby increasing deployment costs.

Cost Analysis

The relative costs for the various scenarios are shown in figure 3. In analyzing these results, it is immediately apparent that the closer the fiber deployment to the user, the higher the cost. This is not so much because of the cost of fiber, but due to the cost of the electronics, civil engineering, and associated power supply equipment required in multiple locations.

Figure 3: Cost analysis for fiber backhauling



Source: Alcatel-Lucent

It is important to note that the initial first cost, that is, the cost of realizing a presence before any customers are added, is low for central office–based deployment, and increases as fiber is deployed closer to the user. The initial first cost is related to the risk of deploying the technology. If there is uncertainty about whether, where and when customers will use a service, then central office deployment offers the broadest coverage with the least risk. Of course, deployment costs can vary significantly according to local conditions. It is possible that fiber is already present and is therefore considered as a sunk cost. It is also possible that power is provided by the building owners, thus reducing capital costs. Furthermore, installation and manpower rates vary from place to place, in some situations reducing the cost of deep fiber deployment. Finally, it is worth noting that Passive Optical Network (PON) based solutions are not significantly more expensive than VDSL solutions. The initial first cost is identical, but the Customer Premises Equipment (CPE) is currently quite expensive for PON solutions. If large numbers of simple CPEs are introduced offering low cost/functionality, PON might well become a reasonable alternative.

Fiber–to–the–User (FTTU)

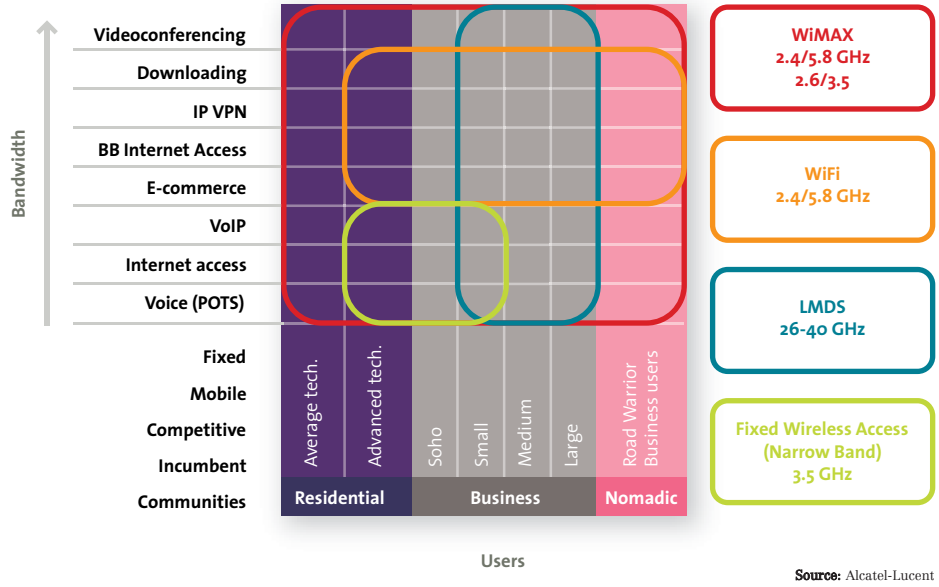
The access network, also known as the last mile, can be a bottleneck that limits the deployment of new services. Optical technology can be used in the last mile to meet today's broadband requirements. At the same time, FTTU provides the assurance that the network will be able to support demands that emerge in years to come.

In certain cases, for large companies or for individuals who want a very high level of service, a DSL connection cannot provide a sufficiently high data rate. For example, a solution combining several high–definition television streams, VoIP (Voice over Internet Protocol) lines, and very–high–speed Internet access will require a data rate of over 20 Mbit/s.

Passive Optical Network

With this technology, each fiber from the central office can deliver very–high–speed broadband services to up to 64 users. The

Figure 4: Matrix of different wireless broadband technologies



Source: Alcatel-Lucent

split between the different users is made by passive splitters which do not need a power supply. This solution is the most economical, but the data rate is limited by the multiplexing and splitter equipment. PON technology is the most widely used technology worldwide in 2006.

Active Optical Network

Contrary to PON, active networks use active splitters, which need a power supply. Although active splitters enable an efficiency increase, the relatively high cost of the equipment and its power supply needs, compared to the potential gains, mean that this technology is not widely used.

Ethernet point–to–point

With this technology, each fiber from the central office is exclusively dedicated to one end user. This enables virtually unlimited data rates, depending on the equipment at the termination point of each fiber. Compared to PON, this increases dramatically the number of central offices needed – by a factor of eight – but this is the only solution to deliver symmetrical Gigabit services to customers if the demand for more speed continues to grow.

Wireless solutions

WiMAX

In suburban and rural areas, alternative technologies may have to be deployed to compensate for poor DSL penetration and poor copper quality, and to offer VoIP. In these areas, WiMAX will provide data/Internet access, fixed voice access, as well as enterprise services such as corporate VPN, and home office and business broadband connections. The same network will also provide mobile broadband services in urban and suburban areas. WiMAX enables the rapid and cost–effective deployment of the access loop for voice and data, plus wireless DSL and mobile broadband services, to areas with either poor or non–existent copper infrastructure, or high unbundling costs. Time to market is greatly reduced compared to a wired infrastructure, and the mobility aspect offers the possibility to explore new usages of broadband communications. These opportunities will open a new era of broadband wireless access.

WiMAX cost efficiency

WiMAX's advanced antenna technologies with beamforming and Multiple Input Multiple Output (MIMO) are beneficial for coverage extension, signal quality interference mitigation, and throughput enhancement.

Figure 5: Ratio of cell use to the number of antennas with advanced antenna technologies

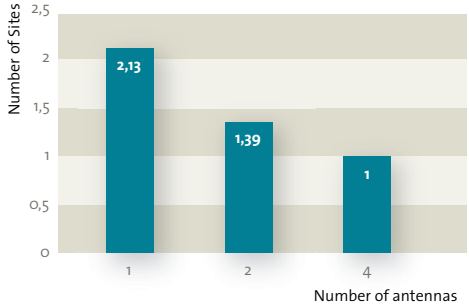
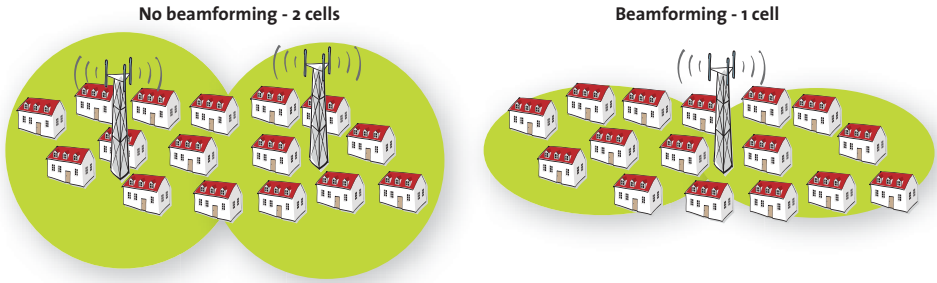


Figure 6: Example of the benefits of beamforming

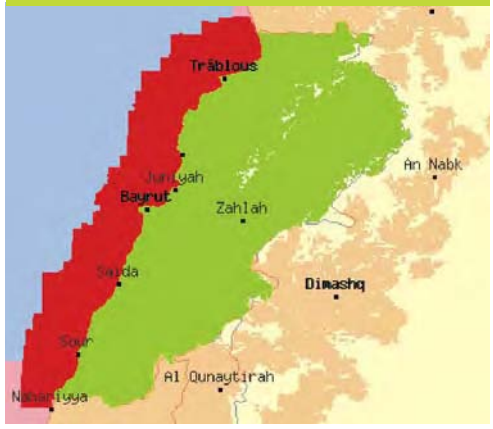


The above technologies halve CAPEX requirements due to enhanced coverage, and provide a 40% throughput increase in the cell.

Beamforming is a mandatory feature for WiMAX terminals, and WiMAX 16e profiles feature sufficient "hooks" to be able to support advanced algorithms for the antenna processing required. In addition, beamforming is a mature and field–proven technology. Because of the ability of beamforming technology to enhance coverage (a key operator issue when deploying a new system) and mitigate interference (with the effect of higher throughput), and also because the impact on the terminal is minor (all the complexity is inside the BS), the operator gains a competitive advantage by deploying WiMAX systems with this technology.

The deployment of a large GSM network across the Middle East has extended coverage to several hundred thousand people. An important investment effort has been made by different mobile phone operator, especially in terms of base station infrastructure.

Figure 7: GSM coverage in Lebanon – an opportunity for WiMAX

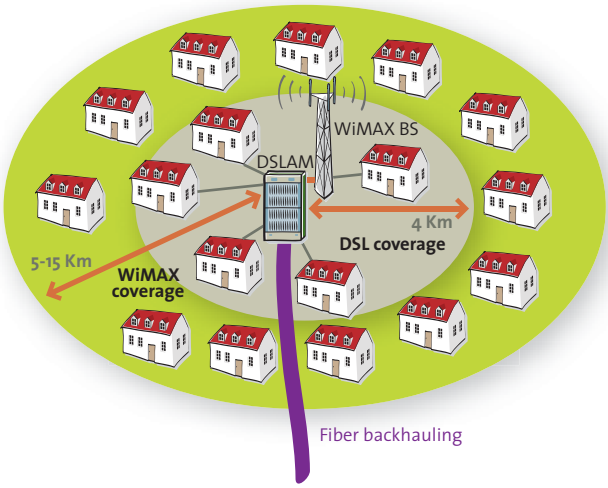


Source: GSM Association

These base stations can be used as WiMAX base stations as well. A classic GSM tower can host a WiMAX system with dedicated antennas. The capital expenditure for mass–market wireless broadband is therefore significantly lowered, since the civil engineering cost disappears, and the fact that one tower hosts two systems creates economies of scale at the operating level.

An Internet service provider can take advantage of the synergy between DSL and WiMAX. The base station can be installed close to the central office, to take advantage of the backhaul infrastructure deployed for the DSLAM. Since DSL only connects users within 4 kilometers or so of the central office, this system enables the broadband coverage area to be extended. Moreover, significant capital and operating savings are achieved through the re–use of operational and maintenance methods, and network infrastructure.

Figure 8: Use of DSL/WiMAX synergies



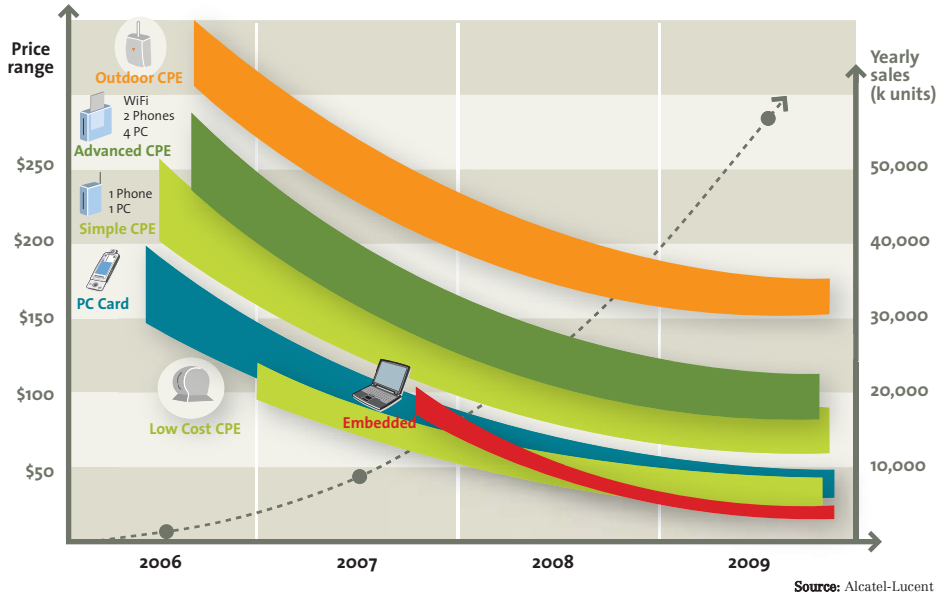
The terminal challenge

The major obstacle to WiMAX becoming a global mass–market technology for broadband wireless access (BWA) is the availability of low–cost terminals, and terminals adapted to targeted markets (W–DSL, Nomadic or Mobile).

While today's available BWA technologies are only compatible with high–cost outdoor terminals, WiMAX and 802.16 evolutions offer some valuable radio features that make WiMAX systems compatible with indoor Self–Install CPE and even smart devices, from PCMCIA cards to chips embedded in Smartphones or PDAs.

Such compact, indoor, low–cost terminals have limited performance (in terms of output power and antenna gain) that need to be compensated by rich radio features embedded in the base station, otherwise the link budget, and therefore coverage and operator CAPEX, would be drastically affected.

Figure 9: Evolution of WIMAX CPE prices



Source: Alcatel-Lucent

Frequency band

Broadly speaking, the resources available today for first WiMAX deployments fall into two main bands:

- 3.5GHz (3.4–3.6) in Europe, Africa, the Middle East, Asia–Pacific and some Latin America countries;
- 2.5GHz (2.5–2.7) in North America, Brazil, Mexico, and some South–East Asian countries.

There are also some resources available in the 2.3GHz band in the USA and some APAC countries, particularly South Korea, whose emerging WiBro system has now converged with WiMAX based on 802.16e; and in the 3.3GHz band (India for instance). All these bands are quite suitable for an optimized network deployment in urban/suburban environments, but the deployment of broadband wireless systems in rural conditions requires some frequency to be allocated in the sub–1GHz band, for instance 700MHz, which has already been allocated in some parts of the USA and in some APAC countries.

Third–generation mobile (3G)

These technologies are already available and can provide a data rate of up to few hundreds kbit/s, which is enough for most usages. However, a 3G deployment requires three times more CAPEX than WiMAX, with licenses representing a large part of the investment. The fact that the network is not fully IP (Internet Protocol) based limits the economies of scale and scope available from convergence, and the handsets remain expensive, even if 3G is nowadays widely deployed.

HSDPA

HSDPA (High Speed Downlink Packet Access) is a standardized Universal Mobile Telecommunications System (UMTS) feature, part of 3GPP release 5, which enhances radio–access bit rates and improves cell capacity. By re–using the existing UTRAN (UMTS Terrestrial Radio Access Network) infrastructure, with an improved radio modulation and smarter radio access management, HSDPA provides UMTS networks with a smooth evolutionary path to access speeds up to five times faster than standard UMTS. In commercial usage, end users will benefit from throughput of around 2 Mbit/s with peaks up to 10 Mbit/s; current UMTS networks can only offer throughputs up to 384 kbit/s per cell. Corporate users will be able to retrieve e–mails with

bulky attachments much faster than with UMTS, and will enjoy quicker and easier access to corporate networks and intranets. In addition, HSDPA will also provide up to 100 per cent increased cell capacity.

HSDPA is a good solution to providing first–class mobile broadband if a UMTS network already exists, because costs are greatly reduced by virtue of it being a simple evolution. However, if we consider a complete greenfield network deployment, HSDPA and UMTS require two to three times more CAPEX than WiMAX.

Satellite solutions

Recent progress in both satellite and ground technologies has led to the introduction of attractive two–way satellite access solutions, which offer far better performance than traditional VSAT in terms of bit rate and price. The cost of satellite capacity per Mbit/s will significantly decrease in the future, as a result of expected improvements in signal processing (doubling the useful throughput compared with existing transponders) and satellite technology (multiplying the capacity and cost–efficiency on board satellites).

A new standard, known as the Digital Video Broadcast Return Channel System (DVB–RCS), is emerging for two–way access by satellite. Based on this standard, end–to–end solutions exist that are compatible with existing geostationary satellite technologies, providing what we describe as "ADSL–in–the–sky", with a performance comparable to terrestrial solutions.

Satellite access is useful to deliver telecommunication services directly to users distributed over a wide area, such as a continent. Potential users can be classified into three types: residential/SOHO (Small Office/Home Office) users with a single PC; Small and Medium–size Enterprises (SME), with several PCs usually connected through a small router; and Large Enterprises (LE) with numerous, widely dispersed sites (some possibly in remote areas), which might own some local data storage facilities (e.g. a cache).

Dedicated equipment at the user's premises handles reception from the satellite (forward DVB–S, in this example) and transmission to the satellite (return TDMA, in this case), adapting packet transmission/reception to and from the antenna across standard interfaces (Ethernet or Universal Serial Bus).

The actual service to the user will be delivered via a connection to an ISP (which will give access to the Internet), or to a corporate site and servers. The hub (or gateway) is the central point controlling all customer terminals. It manages user connections, hosts all the packet–to–radio adaptation functions for both transmission directions, shares radio capacity between all the satellite terminal traffic, and finally adapts packet handling to terrestrial networks.

The cost of the satellite terminal is a key factor determining the success of Internet services via satellite, because the user terminal represents nearly two–thirds of the total investment in a satellite–based Internet system. As the established DVB–S standard is used downstream, DVB–RCS terminals benefit from the millions of DTH receivers produced every year. Upstream signal processing and transmission require dedicated hardware, which has not yet achieved the same level of integration and the same production quantities as DVB–S.

Glossary

3G Third Generation (3G) is a term given to the next generation of mobile communication systems that offer enhanced services, such as multimedia and video. The main 3G technologies include UMTS and CDMA2000.

Access Part of a telecommunication network close to the subscribers. It is the link between the subscriber's terminal and the local, national and international core networks.

ADSL–in–the–sky Two–way satellite network providing broadband access to end users at layer 2, and with an ADSL–like interface from the perspective of the telecom operator.

Aggregation In telecommunications, aggregation is the process by which information is gathered from different sources and combined into a single information stream. The purpose is to optimize the resource required in the network, by grouping together fine granularity flows into coarser granularity flows, for example when moving from access to core networks. Aggregation is typically implemented in metro networks.

ADSL Asymmetric Digital Subscriber Line transforms an operator's existing copper twisted pair investment into a multimedia broadband distribution system. Working on an existing copper telephone line, ADSL's transmission speed is up to 200 times faster than today's analog modems. ADSL's speeds range from 128 kilobits per second up to 12 Megabits per second. ADSL supports high–speed data communications on top of traditional telephone service, on a single telephone access line.

ARPU The Average Revenue Per User (ARPU) measures the average amount of money spent by a customer per month for a given service such as a cellular phone, pager, etc.

ATM Asynchronous Transfer Mode (ATM) is a data transfer technology in which information is organized into fixed–size, labeled cells that flow via end–to–end virtual connections. It is asynchronous in the sense that the recurrence of cells containing information from a connection is not necessarily periodic, but depends on the required instantaneous bit rate.

AAA Authentication, Authorization and Accounting (AAA) is a way of checking user access to a network. It is a very important function, particularly when the service provider is not providing the network access. Authentication verifies the user's identity, e.g. with a password or other mechanism. Authorization checks what the user is allowed to do, i.e. to which services or levels of quality of service he has access. Accounting bills for all the above according to different principles such as time, data volume, application used, etc.

Backbone network A network that uses high–speed transmission paths and provides connectivity for regional networks and other sub–networks. The two terms "backbone network" and "core network" are often used as synonyms. They both refer to the actual heart (or core) of the telecom network. This network should be able to transmit and handle a huge amount of information. Normally when using the term "core network", the operators refer to both routing and transmission. The term "backbone network" refers only to the transmission resources needed to support the network. In order to offer efficient communications, operators need a huge transmission capacity at the core of the network. Backbone networks are used to interconnect cities, regions, countries or even continents. The Internet was initially based on the interconnection established in the late 1960s between universities and research centers in the United States. Lack of appropriate interconnection is, at the same level as lack of universal access, at the root of the Digital Divide. Some African countries have an interconnection capacity to the Internet that is equivalent to that available to an individual broadband user in a developed country.

Backhaul (1) In wireless network technology, to transmit voice and data traffic from a cell site to a switch, i.e. from a remote site to a central site. (2) In satellite technology, to transmit data to a point from which it can be uplinked to a satellite. (3) To transmit data to a network backbone.

BWA Broadband Wireless Access. Any technology that offers broadband access via wireless. A generic term that encompasses both new BWA technologies like WIMAX and older technologies.

Bandwidth The maximum amount of data, measured in bits per second or bit/s, which can travel a communications path in a given time, usually measured in seconds. Usually prefixed with a k for 1000, M for 1 million and G for 1 billion bit/s.

BS Base Station: a transceiver station in a terrestrial mobile network.

CAPEX Capital Expenditure: expenditure used by a company to acquire or upgrade physical assets such as equipment, property, or industrial buildings. In accounting, a capital expenditure is added to an asset account (i.e. capitalized), thus increasing the asset base.

CATV Community Antenna Television: a television distribution method in which signals from distant stations are received, amplified, and then transmitted by coaxial or optical fiber cable or microwave links to users. CATV was originally used in areas where good reception of direct broadcast TV was not possible. CATV now also consists of a cable distribution system to large areas in competition with direct broadcasting. CATV is now usually understood to mean cable TV.

CDMA2000 CDMA2000 1X technology supports both voice and data services on a standard 1x CDMA channel, with a capacity twice that of the previous IS–95 CDMA system, to better adapt to the growing demands of voice and wireless Internet services. Its upload rate is 153 kbit/s now, and will attain 2.4 Mbit/s in the future, without losing voice services due to data requirements. CDMA2000 1x is compatible with previous CDMA technology, and can be easily upgraded in a secure and economical way for operators.

CO Central Office, the local telephone company office to which all local loops from customers in a given area connect, and in which circuit switching of subscriber lines occurs. An end office (also known as a central office, serving wire center, wire center, local serving office) in the message network that establishes line–to–line/trunk, and trunk–to–line connections, and provides the first line of switching (dial tone to end users).

Core network A network that uses high–speed transmission paths and provides connectivity for regional networks and other sub–networks. The two English terms "backbone network" and "core network" are often used as synonyms. They both refer to the actual heart of the telecom network. This network should be able to transmit and handle a huge amount of information. Normally when using the term "core network", the operators refer to both routing and transmission. The term "backbone network" refers only to the transmission resources needed to support the network. In order to offer efficient communications, operators need a huge transmission capacity at the core of the network.

Churn The churn rate describes the percentage of subscribers that change operator to buy the same service from another operator.

CPE Customer Premises Equipment (CPE) is a generic term used to describe all customer devices, including modems, Integrated Access Devices (IAD), Residential Gateways (RGW) and terminals.

DSL Digital Subscriber Line (DSL) technology works on the existing copper telephone line already in a house, also known as a "twisted pair". It uses sophisticated digital coding to utilize more of the existing space on the wire, without interfering with normal phone conversations. It is extremely fast. With Asymmetric Digital Subscriber Line (ADSL) download speeds of up to 8 Mbit/s, it is 200 times faster than traditional analog modems. DSL technology comes in different flavors, with ADSL and Very high speed Digital Subscriber Line (VDSL) the best known.

DSLAM A Digital Subscriber Line Access Multiplexer (DSLAM) is a piece of equipment used by a telecom operator to provide DSL services to end users.

DVB–RCS The Digital Video Broadcast Return Channel by Satellite (DVB–RCS) standard was approved in 2000 by the European Telecommunications Standards Institute (ETSI). DVB–RCS is the international standard for two–way broadband IP communication by satellite.

EFM Ethernet in the First Mile refers to a set of fiber–based access technologies based entirely on Ethernet packet transport. Refers to the collection of technologies being standardized by the IEEE to deliver Ethernet to the end user.

EPON The Ethernet Passive Optical Network is an optical access technology currently being standardized by the IEEE 802.3ah Ethernet in the First Mile (EFM) initiative. It offers a shared, bi–directional bandwidth of 1 Gbit/s for a typical number of 16 users. It builds further on the Gigabit Ethernet (GbE) protocol, but with some modifications to allow for the bi–directional delivery and processing of 802.3 Media Access Control (MAC) frames on emulated point–to–point links. With respect to the optical components, two system versions are defined, long–reach (max. 20 km) and short–reach (max. 10 km), corresponding to different optical budgets.

FTTCab Fiber To The Cabinet involves laying fiber, and the associated fiber management equipment, down the entire feeder route to each and every FDI. At each FDI, an active VDSL node is deployed. Powering can be provided locally with individual power hookups and battery packs, or from a centralized location either in the central office or from a central outside cabinet via heavy–gauge copper pairs that can be laid for this purpose.

FTTB Fiber To The Building: a technique of subscriber distribution using optical fibers, in which the optical network terminations are located at the cable entrance into the building, usually in the basement.

FTTP Fiber To The Premises technology enables homes and businesses to have several telephone lines, digital trunking, hundreds of analog and digital TV channels, interactive video services, and multiple very–high–speed Ethernet connections.

FMC Fixed/Mobile Convergence is the transition from distinct and separate fixed and mobile telecommunication services to converged, seamless services using a combination of fixed and mobile networks to offer a user–centric service. Fixed/Mobile Convergence has three main aspects: infrastructure, services and devices.

G.SHDSL A DSL technology from the ITU (G.991.2) that provides symmetric transmission from 192 kbit/s to 2.3 Mbit/s using a single copper pair, depending on distance from the central office (from 20,000 ft. to 6,500 ft.). With two wire pairs, 384 kbit/s to 4.6 Mbit/s can be achieved.

GPON The Gigabit–per–second Passive Optical Network is an optical access technology currently being standardized by the ITU–T as G.984.x (as a follow–up to G.983 B–PON), on the recommendation of the Full Service Access Networks (FSAN) workgroup. G–PON offers a bandwidth of 155 Mbit/s, 622 Mbit/s, 1.244 Gbit/s or 2.488 Gbit/s to a maximum of 128 users per system upstream (from the users towards the network), and 1.244 Gbit/s or 2.488 Gbit/s downstream (towards the user).

Greenfield situation A scenario in which an access network must be deployed to serve a brand new sub–development with new streets, and new buildings.

Handover The action of switching a call in progress from one radio resource to another radio resource without disrupting the communication.

HSDPA High–Speed Downlink Packet Access (HSDPA) makes life easy for 3G customers, with data delivered at speeds comparable to, or better than, fixed–line broadband access systems. Mobile operators can also significantly boost network speed at relatively little cost. HSDPA is a packet–base data service with data transmission up to 14 Mbit/s over a 5 MHz bandwidth in WCDMA downlink. It was designed to increase packet data throughput and traffic by means of "smarter radio management" (new radio modulation, fast physical layer retransmission and transmission, etc.) and the introduction of shared channels for different users.

HSI High–Speed Internet (HSI) is a service that telecom operators offer to residential users. The service allows the residential user to access the Internet using a high–bandwidth connection (e.g. Digital Subscriber Line (DSL) or Cable). This high–bandwidth connection enables immediate and fast access to large amounts of data.

Hotspot Refers to WLAN/WiMAX access points made publicly available by a service provider. Refers to a single cell environment.

IMS IP Multimedia Subsystem (IMS) is a voice/video over IP architecture based on Internet standard protocols (RTP, SIP), and which introduces the notion of domain. Domains are managed by the operators. IMS enables interoperability between IMS domains and with legacy telephony (through border nodes), whereas the proprietary VoIP tendency was to design systems for a single operator.

IP Internet Protocol (IP) specifies the format of packets (or datagrams) and the addressing scheme for sending information over the Internet or some other network.
Most networks combine IP with a higher–level Transmission Control Protocol (TCP). TCP/IP establishes a virtual connection between a destination and a source. On its own, IP allows information to be addressed and dropped into the system, but there is no direct link between the sender and the recipient.

IP–Transit Direct access to the IP backbone network without peering.

IP TV Internet Protocol Television (IP TV) is a term used to describe a number of service offerings for the delivery of packetized video services over a broadband network. These video services can range from a multi–channel video service (switched digital video) that mimics traditional broadcast TV, to true video on demand (VoD), and fully interactive and/or enhanced video services. Typical service enhancements include robust program information, selection and navigation, as well as multiple camera angles, integrated digital video recording functionality, and the integration of data and telephony services into the video experience.

IRR Internal Rate of Return, often used in capital budgeting, is the interest rate that makes the net present value of all cashflow equal zero.

ISP An Internet Service Provider is a company or organization that provides Internet access to the public or to other organizations, usually for a fee. Most offer a full set of Internet services (access to e–mail, newsgroups, File Transfer Protocol (FTP), and Telnet, at a minimum) for either an hourly rate or for a flat fee for a fixed number of hours of access.

IXP An Internet Exchange Point is a physical infrastructure that allows different Internet Service Providers (ISP) to exchange Internet traffic between their autonomous systems by means of mutual peering agreements. IXPs are typically used by ISPs to reduce dependency on their respective upstream providers; furthermore, they are used to increase efficiency and fault–tolerance.

LAN A Local Area Network is a group of computers and associated devices that share a common communications line, and typically share the resources of a single processor or server within a small geographic area (for example, within an office building or a group of buildings). Usually, the server has applications and data storage that are shared in common by multiple computer users.

LLU Local loop Unbundling describes the access provided by local exchange carriers so that other service providers may buy or lease portions of its network elements, such as interconnection loops to serve subscribers.

MDF Main Distribution Frame. A distribution frame on one part of which the external trunk cables entering a facility terminate, and on another part of which the internal user subscriber lines and trunk cabling to any intermediate distribution frames terminate.

NPV Net Present Value: a financial approach where the present value of cash outflows is subtracted from the present value of cash inflows.

OPEX Operating Expenses (OPEX) before depreciation and amortization of tangible and intangible assets, and before amortization of actuarial adjustments in the early retirement plan.

Payback period The payback period represents the amount of time that it takes for a capital project to recover its initial cost.

Peering Peering is the arrangement of traffic exchange between Internet Service Providers (ISP). Larger ISPs with their own backbone networks agree to allow traffic from other large ISPs in exchange for traffic on their backbones. They also exchange traffic with smaller ISPs so that they can reach regional end points. Essentially, this is how a number of individual network owners put the Internet together.

PoP Point of Presence: the node at which an Internet Service Provider (ISP) connects a subscriber to the Internet.

PSTN Public Switched Telephone Network. A telecommunication network established and operated by an administration or a recognized private operating agency, in order to offer telephone services to the general public. The term "switched" is commonly used although not essential since, in practice, all public telephone networks include switching exchanges.

READSL Reach Extended ADSL (READSL) is a variant of ADSL that uses the same modulation standards as its cousin Discrete Multi Tone (DMT). The idea behind READSL is to boost the lowest part of the spectrum by sending more energy between 25 and 200 kHz. This technology enables a 5–10% increase in the range of lines for throughputs of 128 and 512 kbit/s. Subscribers located in an ADSL zone, but until now too far away from the exchange, will thus be able to take better advantage of the offered services.

STB A Set–Top Box (STB) is a consumer electronics device installed in the home that decodes digital video and audio signals into a format playable on a television.

Triple Play Triple Play refers to offering voice, video and data across the same connection. Thanks to major advances in video compression, Triple Play services are now offered across a range of smaller pipes using technologies ranging from DSL to broadband wireless.

UMTS Universal Mobile Telecommunications System is a technology for 3G mobile services, the next generation of GSM (Global System for Mobile communications). In addition to voice and video telephony services, UMTS supports data transfer rates up to 144 kbit/s in rural environments, and 2 Mbit/s in indoor environments.

Universal access Describes a situation where, within a specified geographical zone, access to Information and Communication Technologies (ICT) has become ubiquitous. Historically, universal access meant the ubiquity of access to a wireline telephony network. The term has evolved, and now means any – possibly combined – access to a wireline or wireless telephony network and (broadband) access to the Internet.

VDSL A Very–high–speed Digital Subscriber Line (ITU–T G.993.2) supports the transmission of symmetric or asymmetric data rate services over the twisted pair access network (existing copper telephone lines) at maximum aggregate data rates up to 200 Mbit/s (sum of downstream and upstream) by using a maximum frequency range of up to 30 MHz. VDSL can be used inside buildings to deliver 100 Mbit/s symmetrical services. It can also deliver lower bit rates over longer lines from a remote cabinet or a central office, with typical asymmetric service offerings of 25 + 5 Mbit/s and 50 + 10 Mbit/s over distances in the range of 500 m to 1.5 km. Over longer lines, VDSL can deliver similar bit rates to ADSL2+.

VoD Video on Demand: a service offered by a network operator which allows the end user to browse, select and purchase from a variety of video assets such as movies for playback on their television or PC, depending on the service. VoD services generally allow Digital Video Disc (DVD) like control such as pause, fast forward, rewind and stop.

VoIP Voice over IP, i.e. voice delivered using the Internet Protocol, describes a set of facilities for managing the delivery of voice information using the Internet Protocol (IP). It means sending voice information in packet mode rather than the circuit–switched mode used by the PSTN.

VPN Virtual Private Network: a network exhibiting at least some of the characteristics of a private network, even though it uses the resources of a public switched network.

VSAT Very Small Aperture Terminal: an earth–bound station used for the communication by satellite of data, voice and video signals, excluding broadcast television. A VSAT consists of two parts: a transceiver that is placed outdoors in direct line of sight to the satellite; and a device that is placed indoors to interface the transceiver with the end user's communications device, such as a PC. The transceiver receives or sends a signal to a transponder on a satellite. The satellite sends and receives signals from a ground station computer that acts as a hub for the system.

WACC Weighted Average Cost of Capital. A calculation of a firm's cost of capital in which each category of capital is proportionately weighted. All capital sources – common stock, preferred stock, bonds and any other long–term debt – are included in a WACC calculation.

WiFi Wireless Fidelity is the common name for the Wireless Local Area Network (WLAN) technology based on the IEEE 802.11 standard.

WiMAX Worldwide Interoperability for Microwave Access is a wireless industry coalition whose members organized to promote IEEE 802.16 standards for Broadband Wireless Access (BWA) networks. WiMAX 802.16 technology is expected to enable multimedia applications via wireless connection, and enable networks to have a wireless last–mile solution.

WLL Wireless Local Loop is a way of provisioning local loops without wires. Local loops are the lines between a customer and a telephone company. Such systems are being deployed in Asia and developing countries to avoid the costs of wires and cables.

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Alcatel-Lucent
54 rue La Boétie
75008 Paris, France
www.alcatel-lucent.com

ESCWA
Riad El-Solh Square
PO Box 11-8575, Beirut, Lebanon
www.escwa.org.lb

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