Shifting towards city-wide Wireless Jordanian Cities

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Abstract
As future becomes more and more knowledge-driven, Information and Communication Technology (ICT), backed by modern wireless technologies, plays a critical important role in developing countries. Jordanian government is focusing on Internet access to connect cities and to make Jordan as a leading knowledge society. In remote areas with no infrastructure, connecting using wireless technology is almost the solution for ease of access and cost savings which will take any developing country to a new level of information economy and wealth creation. Well educated and skilled staff and as a result intellectual capital is becoming the keystone for organizations to get and stay competitive in dynamic markets.

Categories and Subject Descriptors

General Terms
Management, Performance, Design, Economics, Reliability.

Keywords
Worldwide Interoperability for Microwave Access (WiMAX), Wireless Fidelity (WiFi), Broadband, Information and Communication Technology (ICT).

1. Introduction
Internet changed the traditional ways of life, and the ways of transferring and exchanging information among people. It has a huge impact on the social and economic development strategies as well as plays a key role in way of how the people think.

The traditional Wireline Internet access becomes difficult or expensive in poor countries to build public network communication infrastructure.

As Internet access anywhere is the future, wireless network technologies allow the low-cost access to remotely located areas with. It crosses Internet boundaries and provides public Internet access wherever we go, in libraries, parks, homes, hotels, markets, cafes, restaurants, and even the beach. In fact, wireless Internet access is becoming a fundamental customer requirement for any commercial investor.

The rest of the paper is organized as follows. Section 2 gives an overview of the digital inclusion initiatives in Jordan. In Section 3, wireless deployments are discusses along with a technical background for the WiFi and WiMAX technologies are introduced and compared.

2. Digital Inclusion Initiatives in Jordan
Wireless network infrastructure arises in Jordan as a strong alternative to the dedicated Wireline. Through broadband access, the wireless networks can open a lot of opportunities for digital inclusion. Related on their applicability, there are many challenges: Mobility, signal interference, laws that regulate the use of wireless networks, Security issues as it allows information to travel over the air. There are several components of the digital divide: limited access to reliable and affordable broadband services, unable to afford hardware equipment or software programs’ licenses, limited knowledge regarding educational and economic value of Internet access, and the shortage of expertise needed to pioneer new technologies and leverage the use of broadband services through training.

There is still a huge divide between communities in terms of connectivity. Therefore, deployment and implementation of an alternative, affordable communication infrastructure that utilizes emerging wireless technologies could be the first step toward narrowing the digital divide.

Despite hoping our cities to be fascinated by wireless technology, many municipal wireless initiatives are stalled, changed direction midstream, disappointed or simply not gained our hopes and tractions. There are many reasons for this: Inconsistent connectivity, consistent ubiquitous Internet coverage is not available as the social goal of ubiquitous connectivity is to provide increased access to information for all members of the community. Ubiquitous broadband is a daily necessity for every citizen and business.

Annual expenses are expensive: the prices remain high for broadband access. In some situations, for every extra megabyte downloaded, the customer is charged extra to their existing monthly bill, lack of well-adapted, step-by-step approaches.

Inadequate speed: Giving connectivity alone does not solve all the problems; speed is an important issue, limits its use and expansion, limited scalability.

There are many different categories of Internet users. They range from professional users to non-users. [14, 13]

- Non-access users. This group does not have any Internet connectivity and some members of this group may feel threatened by the technology.
In order to bridge the digital divide, three main issues must be considered:

1. Accessibility: For most developing countries, lack of access to advanced voice and data services is a barrier to network readiness. Within the next few years those who do not have access to the next generation of broadband-driven communication technologies, such as Voice-over Internet Protocol (VoIP), video telephony, and Internet protocol television (IPTV), will be at a great disadvantage [7]. The developing countries need to build a broadband communication infrastructure that is accessible to all, in order to encourage social service and e-government applications. Wi-Fi wireless access technology is undoubtedly an attractive option for data, voice (e.g., VoWiFi), and video, compared to other traditional communication infrastructures in the developing world.

2. Availability: In most countries, 2.4 GHz bandwidth is license-exempt, although some may require registration of use. Wi-Fi has become the most common use of unlicensed bandwidth for so-called ‘hotspot’ or ‘hotzone’ or ‘hotcity’ type of coverage. This is because of the widespread availability of Wi-Fi radios that comply with IEEE 802.11b and the upcoming 802.11g/standards. Wi-Fi has 100% global recognition and has become the single networking standard for all developers, equipment manufacturers, service providers, and end users. The main advantage with Wi-Fi is that large-scale, service-level roaming between different Wi-Fi providers is possible, as Wi-Fi certification has become a de facto standard for IEEE 802.11-based products.

3. Affordability of services and applications: The benefit of using Wi-Fi in the last mile is that the client device is extremely inexpensive due to the large volume of production. Capital investment is also cost effective, providing greater flexibility than traditional wired communications, which in turn results in lower prices for Wi-Fi broadband services [8]. Standardization and interoperability between different vendor products have lowered Wi-Fi prices and facilitated its rapid penetration from a niche to a mass market worldwide. For the next few years at least, Wi-Fi will proliferate rapidly as a last-mile option and deliver wireless broadband access at prices dramatically lower than WiMAX.

However, Wi-Fi has the potential to address all the above issues.

3.1 WiFi Technology

Municipal, sometimes called city-wide, WiFi network is a concept of providing wireless WiFi connectivity for the residents in the area of a certain municipality. WiFi Internet is an alternative to the dial-up connections which is the poor man’s internet. This service can provide high bandwidth at very low cost. Installing of copper or fiber cables is not required. The cost of civil engineering and site acquisition is much lower in case of wireless networks. Wireless networks are easy to deploy. Wireless networks offer greater flexibility in terms of bandwidth adapting.

3.2 WiMAX Technology

The wireless WiMAX is the best alternate solution for Wireline-equivalent broadband service. Fig. 1 depicts WiMAX subscribers forecast worldwide. The forecast expects the WiMAX subscribers to be over 50 millions in the year 2012. WiMAX can support two forms of wireless service: Non-Line-of-Sight (Non-LOS) and Line Of Sight (LOS). Non-LOS works in the same manner as WiFi systems where an antenna on a computer connects to the WiMAX tower. It uses a lower frequency range (2 to 11 GHz).

LOS uses a fixed, high antenna that must point straight at the WiMAX tower and align with its antenna. LOS has a better and robust performance. It uses higher frequencies - up to 66 GHz with coverage area of up to 30 miles in ideal conditions.

3.2.1 WiMAX's business models:

WiMAX works in two business models:
3.2.1.1 Cable replacement
In this model, WiMAX equipment is used as a radio-WAN cloud with routers at the border. This model is reflected in IEEE 802.16-2004.

3.2.1.2 Cell Phone replacement
This model needs handoff technique as seen in the 802.16-2005 standard labeled (mobility enhancements).

The five WiMAX Internet Service Providers (WISPs) in Jordan should be addressed by TRC and NCSCM to create synergy policies to allow FRCs to use the available WiMAX network in the area seamlessly and without commercial, technical, and any other obstacles.

This gives the FRCs the ability to use the coverage and connect back to their organization in case of disasters where it is mostly needed.

WiMAX is considered on of the main players into the future 4G technologies. The main strength of WiMAX is that it is already in the market which makes it more feasible to adapt. In this context, WiMAX may be the convergent technology for other technologies such as cellular (GSM, CDMA...etc). This concept is very important for FRCs as convergence means interoperability which is the essence in the communications in case of disasters. There are several ways in which WiMAX can be deployed:

- Backhaul: This deployment is most popular one. As it works as a backhaul between Wi-Fi access points, it also serves as a backhaul as between the cellular towers.
- “Last mile”: This deployment serves residential and enterprise users as an alternative to Cable and Digital Subscriber Line (DSL).
- Metro: it is similar to metro Ethernet provided on point-to-multipoint sources that compete directly with fiber.
- The fourth type is the mobile version of WiMAX based on the 802.16e standard. It should be noted that while it was ratified recently, it is not expected to be quickly adopted by operators.

3.3 WiFi vs. WiMax
While Wi-Fi is a LAN technology based on the 802.11 standard, WiMAX is a WAN technology based on the IEEE 802.16 standard. They are complementary technologies for extending wireless reach where both are incorporated together to form cost-effective solutions, note the followings:

- The gaps between Wi-Fi hotspots are filled in by WiMAX.
- The mobility of cellular phones, that deliver a movable personal mobile broadband, with the familiarity of Wi-Fi are both combined together with WiMAX. Though, mobility at higher broadband levels over significantly greater distances is provided through WiMAX.
- Coverage: While WiFi’s range is about 100 feet (30 m), WiMAX coverage will blanket a 30-mile (50 km) radius. The increased range is due to the frequencies used and the power of the transmitter. Of course, at that distance, terrain, weather and large buildings will act to reduce the maximum range in some circumstances, but the potential is there to cover huge tracts of land. A single WiMAX tower can provide coverage to a very large area -- as big as 3,000 square miles (~8,000 square km).
- Speeds: WiMAX operates at higher speeds than WiFi, over greater distances. The fastest WiFi connection can transmit up to 54 megabits per second under optimal conditions. WiMAX should be able to handle up to 70 megabits per second. Even once those 70 megabits is split up between several dozen businesses or a few hundred home users, it will provide at least the equivalent of cable-modem transfer rates to each user.
- WiMAX wireless systems serve more users number than WiFi.
- Frequency bands - 2 to 11 GHz and 10 to 66 GHz (licensed and unlicensed bands).
- Line-of-sight not needed between user and base station

In short, the promised future of more powerful and more accessible wireless Internet access is provided through WiMAX technology. [1, 2, 3, 4]

4. Wireless Applications in Jordan
4.1 Wireless Applications in Education and Health in Jordan
As the name suggests, Information and Communication Technology (ICT) encompasses all the technology that facilitates the processing, transfer and exchange of information and communication services.

Benefits include anything from public safety and communications systems to basic revenue issues like instant credit and ATM charges for parking meters. Other applications include public safety and surveillance, asset tracking, inspection and code compliance and crisis management.

There is a movement in the educational arena to utilize Internet to enhance learning. Internet plays an essential basic critical role in the followings:

- permitting the information distribution to remotely located areas in an instant time.
- Provide access to educational and training materials online such as: electronic libraries, training material, research papers, news articles, electronic labs and trials for students and teachers, online courses and examinations in relevant subjects.
- also helps delivering education more efficiently
- By utilizing knowledge opportunities, Internet is a critical component of the education…….
- There is a movement in the educational arena to open new doors for teaching. For one, remote online learning crosses school boundaries and brings learning into homes. As a mean of supporting life long learning, it expands the school day into the at home hours. Since the life classroom based training is becoming too costly, E-learning makes training and education available to people 24 hours a day. Thus, people can access learning when it is convenient.
The opportunities for students and their parents are to access to school databases, software programs. Also permits parents to become more involved in their children’s instruction.

Bringing connectivity to schools, and building digital capacity among teachers.

By connecting rural schools and colleges to urban institutes, it enables the ways of teaching and learning among the rural population. Thereby, spreading education in a more pervasive manner. Moreover, by reducing the scarcity of teachers in rural areas, this facilitates improvement of the education system.

Therefore, learning anywhere at any time, without using wires, is the future. But, the reluctance to fully embrace remote technology comes down to an equity issue: Not all students have computers, not all students have access to the Internet.

In the context of health, the following are benefits of using wireless to the health sector:

- Enhance the quality of healthcare
- Linking a rural clinic to a larger hospital: thus enabling data, voice, and video transmissions between a rural patient and the city-based doctor.

4.2 Wireless & Government Security

In an emergency, communication is crucial for government officials as they try to determine the cause of the problem, find out who may be injured and coordinate rescue efforts or cleanup operations.

A gas-line explosion or terrorist attack could sever the cables that connect leaders and officials with their vital information networks.

WiMAX could be used to set up a back-up (or even primary) communications system that would be difficult to destroy with a single, pinpoint attack. A cluster of WiMAX transmitters would be set up in range of a key command center but as far from each other as possible. Each transmitter would be in a bunker hardened against bombs and other attacks.

No single attack could destroy all of the transmitters, so the officials in the command center would remain in communication at all times.

Strong ICT capability is the primary tool for facilitating Jordan’s emergence as a leading knowledge society. In order to build a strong civil society with a knowledge-based economy, however, a free flow of information to all tiers of the economy is needed.

5. Proposed infrastructure model for Jordan

This section proposed communication infrastructure model for developing Jordan.

Mesh infrastructure has many advantages over client mesh as it is more secure, more predictable, easier to manage, and does not suffer from initial seeding issues.

WiMAX main base stations that have wired backhaul are placed at the center of a cluster, and WiFi mesh access points are embedded in both WiMAX main and mesh cells. This is done to reduce the operating cost, because rental of wired backhaul networks accounts for a major cash outflow [20].

All the commercial/public Internet services must be enhanced under the umbrella of a new proposed committee. This committee is responsible for the followings:

- Study the ICT in Jordan. Then, define, explore, and test the tactical and strategic vision. It is also critical to identify wireless plans that can be offered in the near future, as well as long-term plans that can offer the new wireless technologies that can be expected to evolve. However, all plans should be secure, predictable, and easy to manage.
- Collecting, studying and analyzing data and information related to all wireless entities in Jordan. Then, creating and adapting the right procurement strategies for all wireless entities in Jordan. Finally, preparing the progress reports and setting up monitoring and evaluation plans for all the Jordanian projects.
- Put the standardization that will reduce “equipment and component costs”, enable mass production, and allow interoperability between the equipment of different vendors.
- Since the needs and requirements are different, the appropriate communication architectures and infrastructures vary not just from city to city but also within different parts of the same city. Despite a uniform infrastructure is not necessary, it is essential, however, to understand each wireless technology’s capabilities and limitations.
- Setting the appropriate performance measures needed for monitoring and evaluation for the speed of internet. Then, deliver monitoring and evaluation products and services that generate reports about providing a platform of consistent connectivity and ubiquitous coverage.

Finally, the committee itself should always be sure that it is on the track of achieving its objectives. It should review progress against objectives and keep adjusting planning assumptions, priorities and strategies as needed.

6. Conclusions and Recommendations

In order to deliver better services in health and education, benefit from the large pool of skilled manpower, explore new business opportunities, social development, and to create better living conditions, the Jordanian government should provide free WiFi/WiMAX Internet access to all residents and visitors.

Jordanian policymakers have to explore options such as publicly owned or public–private partnerships to build its wireless infrastructure to reach every village, town, and city in Jordan. To provide the best connectivity in a short period of time, they should take certain points into their consideration:

- They should seek suitable strategies to promote economically vital broadband technologies such as Wi-Fi and WiMAX.
- The Jordanian government should steadily shift towards wireless networks for ease of access and cost savings. It should invest in large-scale wireless networks that will potentially blanket the entire Jordan. Free wireless hotspots should be popped up all over as free of charge.
• Intranet pilot projects such as the Jordanian e-government, e-army, e-health, and e-education must be implemented.

• Accelerate and facilitate a process of digital inclusion and to disseminate broadband to all Jordanian citizens with low cost and in a short time.

• Digital inclusion initiatives in Jordan must take into consideration bridging the digital gap through implementing programs that provide computers and software and include basic computer training to the scientists, engineers, technicians, business managers, and to the ordinary public residents. It is essential to make every resident, even low-income’s, accesses to computers and the Internet. This bridging of the digital divide may be done through public-private partnership.

• MoE requires that all teachers take the International Computer Driving License (ICDL) Course. ICDL is an intensive course to train people in a wide range of software products.

• Those without the necessary equipment - computer, wireless network card, etc. - or skill base) can effectively access the Internet or use broadband applications?

As depicted in this paper, all of the projects, from different public and private organizations, make Jordan’s ICT environment well defined and relatively sophisticated.

7. Acknowledgment

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8. References


