

Digital inclusion in Brazil Using Wireless Networks

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1. Introduction

In remote and isolated regions that have poor network communication infrastructure public, the broadband internet access becomes difficult or expensive. Wireless network technologies allows the access to remotely located areas with a low cost. In Brazil, this kind of network infrastructure also arises as a strong alternative to the dedicated lines and the commutation packages networks in order to facilitate the digital inclusion. This paper shows how the wireless networks can be used as an alternative to regions that have difficult wireless networks facility.

2. Wireless Connection

Wireless means any type of connection for transmission of information without the use of wires or cables. Among this communication model one can mention some technologies: Wi-Fi, Bluetooth, Wi-Max and Wi-Mesh.

Wi-Fi is a set of specifications for local wireless networks (WLAN). WLANs are based on IEEE 802.11 [1] and they are used in indoor applications, e.g. in a corporative building, a campus, or a public space such as airports. This standard defines the frequency, speed, reach and other characteristics. Wireless connection works with radio frequencies in a band of 2.4GHz that it does not need license for installation and operation resulting in an attractive option. However, for its commercial use in Brazil it is necessary to have an license of the National Telecommunications Agency (ANATEL). The speed and nominal reach in the Wi-Fi are 11Mbps and 100m respectively. The reach and speed always will be influenced by the environment, since the signal is transmitted through the air. To establish an internet connection by means of a Wi-Fi it is necessary to be in the radius of action of an access point (generally known as a hotspot) or an public place where it operates wireless network and which uses an mobile device with wireless capacity.

Bluetooth is a global standard of wireless communication with low consumption of energy that allows the data transmission among compatible devices with this technology. Therefore, a combination of hardware and software is employed to establish this communication with different types of devices. The data transmission is made through radio frequency allowing a device to detect another without taking into account their positions, as long as they are inside the proximity limit. The maximum reach of the Bluetooth is 100 meters with a maximum power of 100 mW. The speed data communication is low, around 3 Mbps. Although the rate transmission is short, it is enough for a satisfactory connection among the most of devices.

The standard IEEE 802.16 [2] also know as Wi-Max is a metropolitan wireless network technology, which has the largest covering area as well the highest transmission rate (up to 74 Mbps), a quality service (QoS), Ethernet and networks interfaces for IP, ATM, E1/T1. With Wi-Max data transmissions can achieve 1Gbps and a radio of 50km (Line of Sight) [3]. The licensed bands are 3.5 and 2.5 GHz. It supports BWA technology (Broadband Wireless Access) including,

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fixes, mobile and voice, video and data transmission. Nowadays, the Wi-Max has two standards, IEEE 802.16d (or IEEE 802.16-2004) known as Nomadic and the Mobile IEEE 802.16e (or IEEE 802.16-2005) [3]. The main difference between the fixed and mobile Wi-Max is that the first does not commute (without handoff between ERBs in high speed), while the second one commutes (with handoff between ERBs in speeds of up to 100 km/h).

In principle, the Wi-Max will be a bridge for the digital inclusion which will permit the broadband internet access in remotely located areas with low availability of phone services or unreliable wired networks facilities.

One of the new applications of wireless networks where the Ad Hoc is utilized consists in wireless mesh networks, or just, Wi-Mesh, aka community wireless access network [4]. This new kind of networks avoids the use of fixed networks between the access points by dynamically routing the traffic of their nodes. The Wi-Mesh are quite similar to Ad Hoc networks since both utilize wireless transmission and have dynamic and growth organic topology. The nodes of the Wi-Mesh are fixed, although their localizations are not pre-defined. The main characteristics of the Wi-Mesh is to promote a broadband community networks with wireless infrastructure offering a low cost internet access [5].

Wi-Mesh uses the same standard employed by the Wi-Fi which makes both completely comparable, and assuring up to 54 Mbps and extends their reach from 100m to 500m. The Wi-Mesh area a great support for the digital inclusion since the cost involved are lower.

The specialists have been argued that the wireless networks can open a lot of opportunities for digital inclusion through broadband access. However, there are many challenges related to their applicability, such as, mobility, signal interference, laws that regulates the use of wireless networks and so on.

These challenges generate new sources of research that can be explored by researchers, the industry and the academy.

3. Research Chances

A great challenge for the future is to understand how to build the next generation internet in such way to accomplished its complete potencial allowing new applications [6]. The network field play a fundamental role permitting the information distribution to remotely located areas in real-time. From the broadband internet implementation, users would have instant access to multimedia information by means of, teleconference and/or videoconference applications.

To study of improvement techniques of these applications is a promising research line, since they will play an essential role in education dissemination.

New communications protocols should be model for this wireless environment considering the user mobility, the signal interference and intensity, packages collisions, which can increased drastically the number of packages retransmissions, saving energy of mobile devices, failure tolerance, routing, connectivity, besides the new discovery and selection services protocols available over the wireless networks.

The last one is my PhD research focus, where we aim to maximize the wireless network performance by using a selection service protocol to reduce the number of unnecessary messages.

4. Conclusion

Wireless network technology is encouraging but it still faces limitations. The Wi-Max and the mobile phone networks are cheaper technologies only when there are lots of users and there are not open source drivers for the Wi-Max. Wi-Mesh suffers of constant interference with the growth of omnidirectional antenna.

These issues brings new opportunities for R&D in this subject. However, to disseminate broadband to all Brazilian citizens with low cost and in a short time, the Brazilian government

needs to increase the investment in research and establish public politics with a view to accelerate a process of digital inclusion.

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