

A ROLE OF INFORMATION AND COMMUNICATION TECHNOLOGY (ICT) FOR ACEH DEVELOPMENT

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Abstract

The Information Age has transformed industrialized nations in the latter part of the 20th century, and now is poised to have an equally dramatic effect on developing nations. In this era, the government paradigm has changed and concerned to give a better and efficient service to their community. Therefore, Information and Communication Technology (ICT) has chosen as a system to implement. Through ICT implementation, administration activities and public service will improve and also give a positive impact to other sector like education and community. By using this technology, community has an opportunity to access and use on-line services in obtaining information. The key success factor of this implementation is mainly of the availability and the good quality of grade of service communication infrastructure. Fiber optics technology has considered in many countries as a main or backbone connection for hub of services to provide a broadband services and high speed access. To boost up this service, the combination of wireless technology is a good approach to broaden the coverage and practical in terms of time.

Keywords: ICT, internet, public service, wireless

1. Introduction

The trends in the world market economy have brought every country to challenge the impact of the liberalization, privatization and globalization wave. Global and regional market agreement has tied every country like WTO, APEC, and AFTA to empower economic activities. In the globalization context, the Information and Communication Technology (ICT) influx has been the most conspicuous development. The Internet as key of ICT technology in terms of content delivering mechanism and applications is fundamentally altering the process of information exchange and economy activities. In spite of this trends has become a new life style in information era, lack of communication infrastructure and connection are barriers to pursue a good quality of service, mostly in developing country like Indonesia.

Previously, ICT concept has not well understand by government body and was generally considered a luxury and was not considered a viable option for development policy where other needs, such basic development as building roads, schools, hospitals and public welfare, etc. were considered more urgent. Lack of knowledge and budget availability make ICT is not a prominent concern of government policy in most developing countries. But time has changed the development policy shortly as the developed nations have shown the impact of the ICT system in their countries as well as the technology cost decrease significantly such as computer and communication connection price.

By definition, ICT is the set of activities that facilitate by electronic means the processing, transmission, and display of information. The convergence of computer and telecommunication technology in delivering information for users through computer network soon are expanded from local network access to worldwide using internet connection. This capability has enhanced the current service delivery strategies to be very efficient for influencing the process of governance in various ways. The Asian Development Bank (ADB) recognizes that ICT is a powerful force in shaping the social and economic development of the Asia and Pacific region. ICT promotes the acquisition and absorption of knowledge, offering the government and other non-government agencies unprecedented opportunities to improve policy formulation and its implementation, enhance educational systems, empower the downtrodden, create new economic institutions, widen job opportunities, reduce poverty, re-engineer organizations and institutionalize innovations.

There are pessimists who believe that the use of ICT in governance may worsen the situation of unequal access to government services. This could be due to lack of adequate infrastructure, unequal ownership of computers, language barriers, rigid mindset of government officials, lack of capacity building exercises, absence of effective grievance mechanisms, non-availability of right to information; and differences in utilization of information. On the other hand, the optimists believe that as the myriad socioeconomic problems hindering the country's development require systematic technological solutions. ICT is almost projected as a panacea for catapulting the country into a developed and stable economy. The process of ICT implementation like e-governance will lead to more effective governance only when its key resource of information is shared, amongst all the stakeholders.

2. ICT and Society

a. ICT value

The major change brought by the ICT is the transformation of the industrial economy into knowledge and network economy. This concept of the "new" economy has been adopted by the government, the corporate and the citizens and ICT brings about:

- openness
- democratization
- connectivity
- accountability
- accessibility
- decentralization

The impact of ICT on the society can be felt at different level. Some examples of the ICT applications at the local level include: local government support and social services, smart communities/schools, market information/opportunities, employment opportunities, and local content creation. At the national level, ICT helps the society by helping provide: e-governance, regulatory framework and cyber-laws, sustainable human development (e.g., e-learning, telemedicine/e-health, etc.), and e-commerce. At the regional and the global levels, ICT facilitates cooperation and growth by easing the government-to-government, people-to-people contacts and sharing of education, best practices, etc.

With all the above beneficial impacts of ICT on the society also come some issues. The biggest of these issues is the "digital divide" – the gap between those who have access to technology (telephones, computers and, increasingly, the Internet) and related services and those who do not have access to these resources. This digital divide exists at all the levels of society, e.g., the ethnic minorities vs. the majority; the rural poor vs. the urban educated; least developed countries vs. most developed countries.

Information Technology (IT) is a vital feature of the move to knowledge society. Now ICT technology becomes a new tool for administration purposes and delivering better services to community to achieve good governance, but its implementation in Indonesia administration and education system especially in Aceh is far behind compared to other fields. So far, people awareness of the important of ICT in Aceh province is not well-known. Some reasons behind this problem can be understood as low computer literacy, lack of computer resources for office workload, as well as the internet access is limited only in prime cities and slow connections while the need for internet also low. In fact internet is not considered as a public service site, only 11 government website have published in cyber zone which two websites are uploaded to unofficially site, not using *go.id* domain as official address site for government bodies. Currently, most of the entire Aceh government's website is not maintaining well.

b. Target society

Generally, Aceh is the well-known name as one of Indonesia's province which now has a new abbreviation NAD for short Nanggroe Aceh Darussalam province. NAD is placed in the northern of Sumatra island, which cover 57,366 square km including some small island. There are 17 *kabupaten (regencies/districts)*, 4 *kotamadya (cities)*, 241 *kecamatan (sub districts)*, 112 *kelurahan* and 5,853 *desa (villages)*, all territories administrative name's in Indonesia government institution to serve about four million Aceh populations. The population was decreased after tsunami and giant earthquake came in December 26, 2004, people were dead and most essential services were affected and now needed to rebuild again. A good story is Aceh becomes more famous all over the world especially on the internet. Using Google search engine to look how to find any information about Aceh, by putting the key word like "tsunami" and "Aceh", the result will be shown about 1.4 million hits while 6.5 million hits for single "Aceh" word. Statistics calculation in the Fig.1 to Fig. 3 below might help to give a common understanding the role of ICT and internet usage are used by people in Aceh or how people could get any information about Aceh.

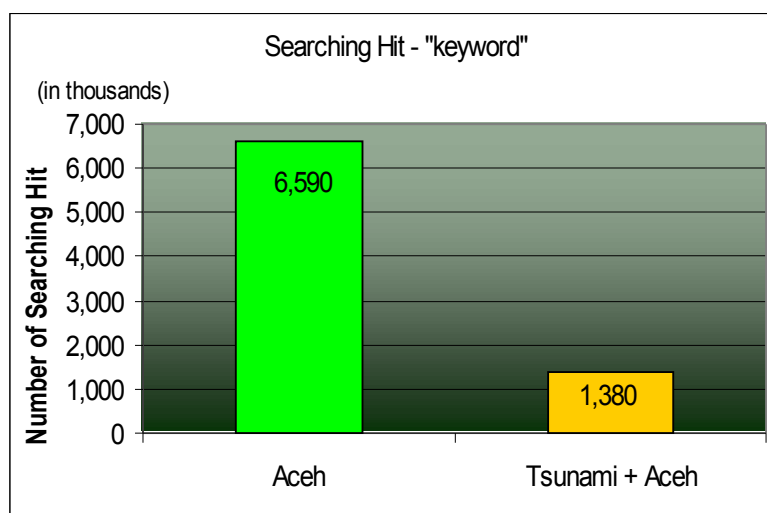


Fig. 1 Searching hit using "Aceh" keyword

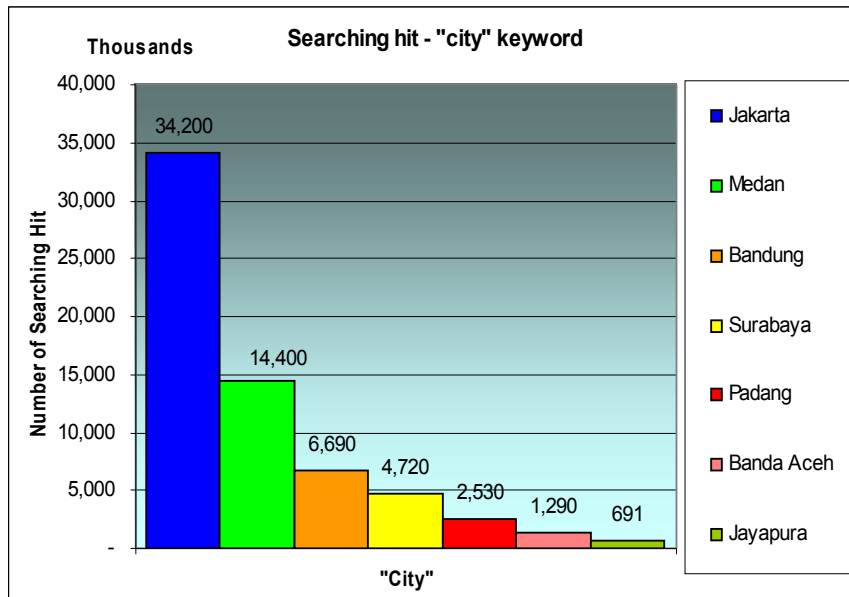


Fig. 2 Searching hit using “city” keyword in Indonesia cities

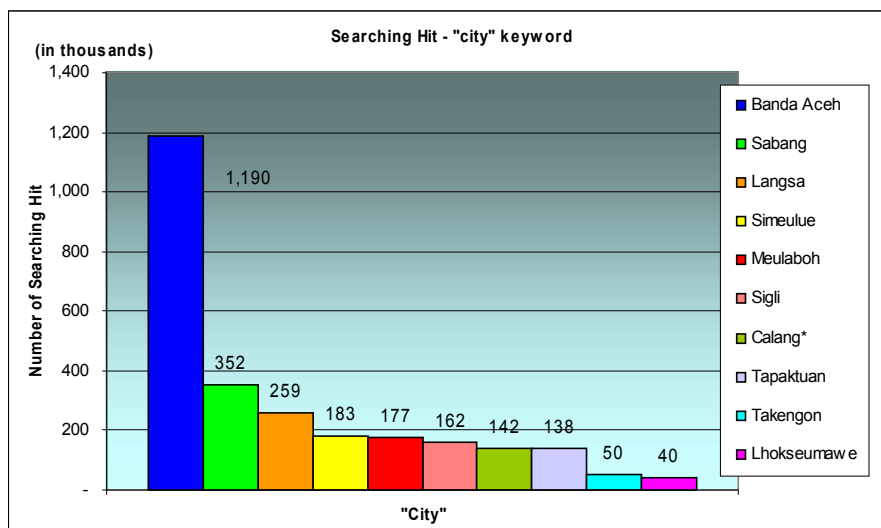


Fig. 3 Searching hit using “city” keyword in NAD province

3. ICT Technology

Computer and communication technologies offer up a potentially vast set of questions and issues, for the very reason that they involve two very different modes of production: the social and the technical. At the present time, the convergence of computer and communication technology has brought people all over the world change their social life in obtaining and

exchanging the information daily. In the market, we find Intel and AMD, the two most intensive processor firms explore processing speed with their own brand name for processor technology and on software issue, the operating system also show a highly competition with Microsoft dominantly installed for any computer shipment. As the price is going down, computer and cellular phone as a communication device are two kinds of thing that highly usage in daily life in modern society. IDC, one of US research firm, in its news release shows that an estimation of computer growth will be increased. IDC reported that in 2006, PC has been shipped 230 millions unit, and be projected 257.1 millions in 2007 and 284.5 millions in 2008 [1]. In communication technology perspective, a number of users using wireless telephone has beaten the wire line connection, fixed telephone. GSM as the second generation of cellular technology has been the very popular choices worldwide, about 210 million subscribers. Now, 3G cellular technology is introduced in every country, to overcome the limitation of GSM data speed, 14.4 kbps to a higher data speed up to 2 Mbps, while 4G is being explore and will be available soon to challenge 3G technology.

Stand alone, workstation, client and server are some network terminology and become a buzz word in earlier stage of networking era. Sharing tasks and information to reduce workload have shifted the computer usage from stand alone perspective to network integration at least two computers in a system. In brief, Local Area Network (LAN), Metropolitan Area Network (MAN), Wide Area Network (WAN) has become a choice for that purpose. In terms of distance, LAN is suitable for short range and commonly install in one building. MAN has ranged 10 to 50 km inter-building in the same city while WAN is the longest and widest coverage, more than 50 km. A WAN spans a large geographic area, such as a state, province or country. WANs often connect multiple smaller networks, such as LANs or MANs. The world's most popular WAN is the Internet. WANs generally utilize different and much more expensive networking equipment than do LANs. Key technologies often found in WANs include SONET, Frame Relay, and ATM.

From networking and communication view, computer network technology can be classified into wire and wireless connection. As its name, wire technology relies on cable connection which the information signal converts to electric or light signal. Normally, coaxial cable and Unshielded Twisted Pair (UTP) are installed to the existing network inside the building while fiber optics used as a main connection between buildings or to internet backbone. There are two kinds coaxial cable, thin and thick coaxial cable using bus topology. Thin coaxial range is 185 meters and thick coaxial range is longer, up to 500 meter for one segment to ensure the signal not to degrade. Compared to coaxial cable, for LAN purpose, UTP category 6 is highly selected in terms of the ease installation, performance and network maintenance. UTP network is built using star topology with hub as a central connection. These topologies are shown in Fig. 4 and Fig. 5 below.

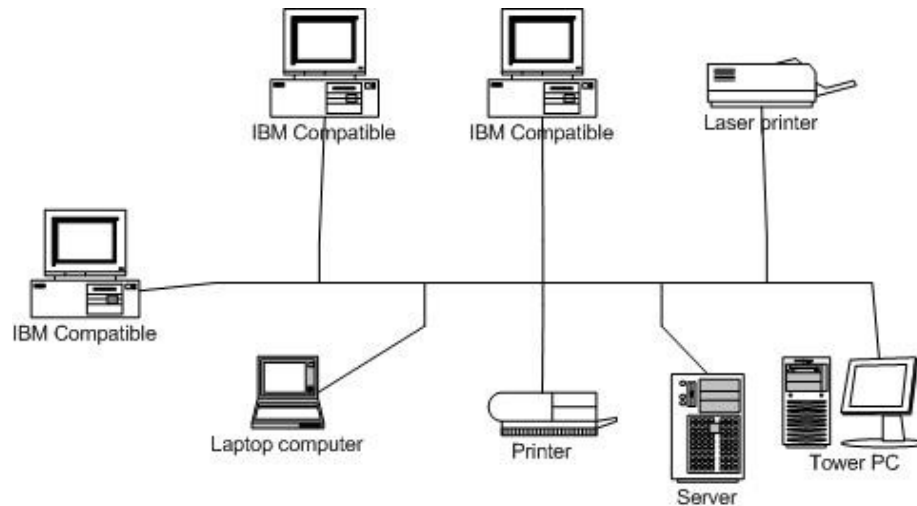


Fig. 4 Bus Topology using coaxial cable

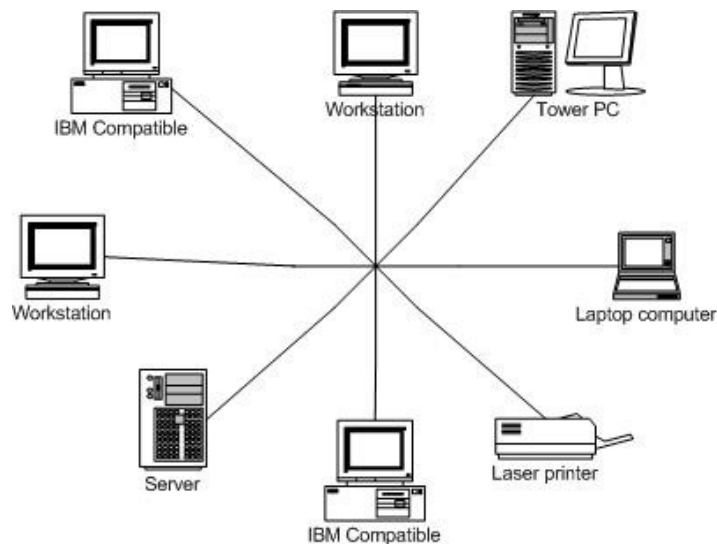


Fig. 5. Star Topology using UTP cable

A Wireless LAN or WLAN is a wireless local area network, which is the linking of two or more computers without using wires. In wireless technology, spectrum management has to be understood and interferences among stations has to consider well. In practice, WLAN utilizes spread-spectrum technology based on radio waves to enable communication between devices in a limited area, also known as the basic service set. This gives users the mobility to move around within a broad coverage area and still be connected to the network. And now, WiFi stands for Wireless Fidelity, a WLAN technology can be used for limited range service, covering a single home, restaurant, hospital or office space. A various WiFi specification is based on the 802.11 standard and can be classified as follow:

- **802.11** -- applies to wireless LANs and provides 1 or 2 Mbps transmission in the 2.4 GHz band using either frequency hopping spread spectrum (FHSS) or direct sequence spread spectrum (DSSS).

- **802.11a** -- an extension to 802.11 that applies to wireless LANs and provides up to 54 Mbps in the 5GHz band. 802.11a uses an Orthogonal Frequency Division Multiplexing (OFDM) encoding scheme rather than FHSS or DSSS.
- **802.11b** -- an extension to 802.11 that applies to wireless LANs and provides 11 Mbps transmission (with a fallback to 5.5, 2 and 1 Mbps) in the 2.4 GHz band. 802.11b uses only DSSS.
- **802.11g** -- applies to wireless LANs and provides 20+ Mbps in the 2.4 GHz band.

WLANs can operate with or without Access Points (AP), depending on the number of users in the network. Infrastructure mode uses access points as a hub or concentrator to allow wireless computers to send and receive information. The access point can also connect to a wired network or to the Internet. Multiple access points can work together to provide coverage over a wide area.



Fig. 6 WLAN access configuration using Access Point

Peer-to-Peer mode, also called Ad Hoc mode, works without access points and allows wireless computers to send information directly to other wireless computers. Peer-to-Peer mode can be used to attach computer to a network computers in a home or small office or to set up a temporary wireless network for a meeting.

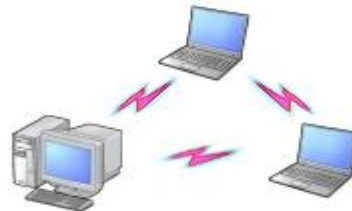


Fig. 7 Peer-to-peer WLAN

In WLAN arena, WiMAX is actually coming into being right now and will battle to WiFi and 3G cellular technology. WiMAX is short for Worldwide Interoperability for Microwave Access and also known as IEEE 802.16 standard. WiMAX has the potential to do broadband internet access what cellular phones have done for communication. In practical terms, WiMAX would operate similar to WiFi but at higher speeds, over greater distance and for a greater number of users. WiMAX could potentially erase the suburban and rural blackout areas that currently have no broadband internet access because telecommunication line has not yet run the necessary wires to those remote locations.

A WiMAX system consists of two parts: tower and receiver. Actually, WiMAX can provide two forms of wireless service: Non Line-of-Sight (NLOS) and Line-of-Sight (LOS). In NLOS mode, a small antenna on computer connects to the tower and uses a lower frequency range, 2 to 11 GHz (similar to WiFi). For LOS mode, a fixed dish antenna has to install and point straight at the WiMAX tower from a rooftop or pole. LOS transmission use higher

frequencies, with range reaching a possible 66 GHz. At higher frequencies, there is less interference and lots more bandwidth. For short comparison, WiFi range is about 30 meter while WiMAX will reach a radius of 50 km with wireless access. The fastest WiFi connection can transmit up to 54 Mbps under optimal conditions. WiMAX should be able to handle up to 70 Mbps. Even once that 70 Mbps 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. Of course, at the longer distance, terrain, weather and large buildings will act to reduce the maximum range in some circumstances.

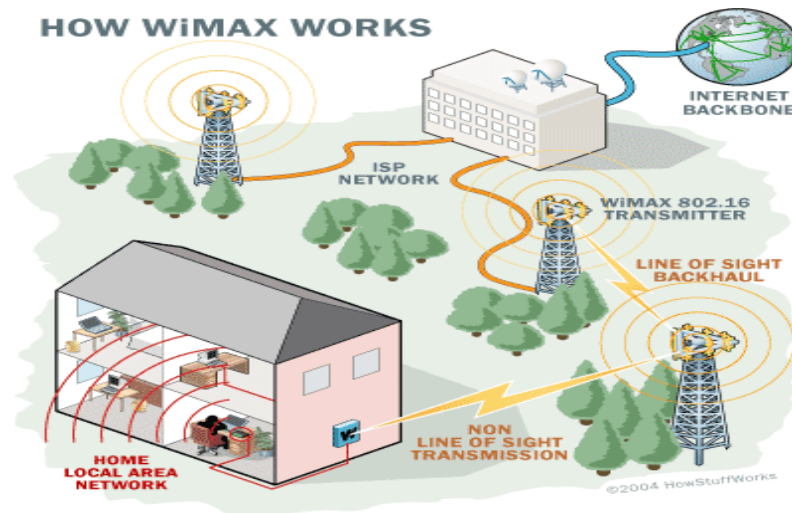


Fig. 8 WiMAX works

Fig. 8 WiMAX access and network configuration [2]

Table 1. Wireless networking standard [3]

IEEE Standard	Data Rate	Modulation Scheme	Security	Pros/Cons & More Info
802.11	Up to 2Mbps in the 2.4GHz band	FHSS or DSSS	WEP & WPA	This specification has been extended into 802.11b.
802.11a (Wi-Fi)	Up to 54Mbps in the 5GHz band	OFDM	WEP & WPA	Products that adhere to this standard are considered "Wi-Fi Certified." Eight available channels. Less potential for RF interference than 802.11b and 802.11g. Better than 802.11b at supporting multimedia voice, video and large-image applications in densely populated user environments. Relatively shorter range than 802.11b. Not interoperable with 802.11b.
802.11b (Wi-Fi)	Up to 11Mbps in the 2.4GHz band	DSSS with CCK	WEP & WPA	Products that adhere to this standard are considered "Wi-Fi Certified." Not interoperable with 802.11a. Requires fewer access points than 802.11a for coverage of large areas. Offers high-speed access to data at up to 300 feet from base station. 14 channels available in the 2.4GHz band (only 11 of which can be used in the U.S. due to FCC regulations) with only three non-overlapping channels.
802.11g (Wi-Fi)	Up to 54Mbps in the 2.4GHz band	OFDM above 20Mbps, DSSS with CCK below 20Mbps	WEP & WPA	Products that adhere to this standard are considered "Wi-Fi Certified." May replace 802.11b. Improved security enhancements over 802.11. Compatible with 802.11b. 14 channels available in the 2.4GHz band (only 11 of which can be used in the U.S. due to FCC regulations) with only three non-overlapping channels.
802.16 (WiMAX)	Specifies WiMAX in the 10 to 66 GHz range	OFDM	DES3 and AES	Commonly referred to as WiMAX or less commonly as WirelessMAN or the Air Interface Standard, IEEE 802.16 is a specification for fixed broadband wireless metropolitan access networks (MANs)
802.16a (WiMAX)	Added support for the 2 to 11 GHz range.	OFDM	DES3 and AES	Commonly referred to as WiMAX or less commonly as WirelessMAN or the Air Interface Standard, IEEE 802.16 is a specification for fixed broadband wireless metropolitan access networks (MANs)

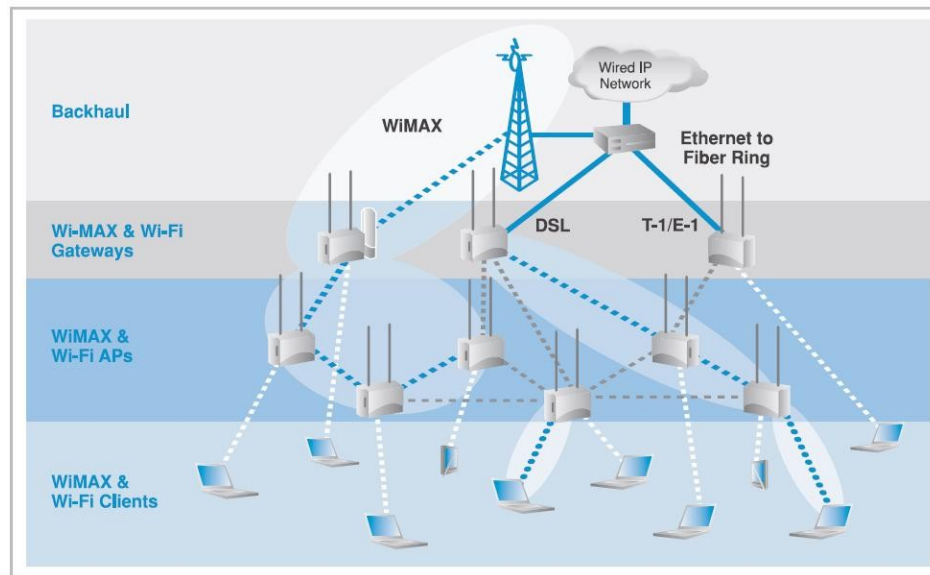


Fig. 9 WiMAX and WiFi networking system [4]

4. ICT Applications

ICT have the potential to create new types of economic activity and employment opportunities, and enhance the quality of life. They have changed the nature of work, the range of occupations and skills requirements, making it necessary for workers to acquire a broader and more adaptable knowledge base. Nowadays, ICT terminology with e- as a preceding letter for short of electronics has widely used in many applications, such as *e-government*, *e-banking*, *e-commerce*, *e-learning*, *e-ticket*, etc. E-government is used by government agencies to offer a paperless administration using ICT technology. In e-government, many derivative applications can be offered. For example, identity card to record citizen data and driving license are already applied in our neighbor country, Malaysia.

E-commerce is creating opportunities for even small firms to market their products and services directly in a globalizing market. Education and training, and access to relevant institutions, are critical factors in taking advantage of ICT-related opportunities. At the same time, ICT are transforming education itself, and are creating new possibilities for achieving educational goals. Distance learning, lifelong education, alternatives to formal education, as well as community-based learning are among the areas where important ICT-based applications are emerging. ICT have also brought improvements to health-care delivery, research and training, and the health sector has become one of the major areas where knowledge is shared and used through ICT. As an information- and knowledge-based tool, ICT have vast potential for participation, networking and advocacy among citizens, and for a variety of purposes.

5. Conclusion

In this information era, industrialized nations has transformed and implemented the ICT service in many aspect. Role of ICT should also influence government policy in developing country like Indonesia, especially in Aceh to provide better services to their community. Many

ICT applications will help to build better and efficient service to society in modern life. To conduct this technology, telecommunication infrastructure and management have to consider to be planned in good manner. Existing infrastructure should be upgrade and to boost the fastest service, wireless technology has been a prominent option. This infrastructure is technology-based, but its most profound effects will be on the people and society using it.

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