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Wireless Communication

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A wireless network is an infrastructure to communicate 'through the airwaves', in other words, no cables are needed to connect from one point to another. These connections can be used for speech, e-mail, surfing on the Web and to transmit audio and video. The most widespread use is mobile telephony. Wireless networks are also used to communicate between computers. The primary attraction is its ability to cross long distances without installing fixed lines and cables.

Wireless networks in development

The use of wireless networks in developing areas is promising. Since ground cables are only economic in high-density environments, a wireless network is much cheaper when long distances need to be crossed to rural areas.

The strengths of wireless networks are their easy installation, low costs, high capacity, and no transmission costs. Since there are no cables to be destroyed, they are also physically robust.

Weaknesses include their sensitive equipment and the need for 'line of sight' (LOS) and specialized expertise. Capacity is also lower than for fibre cables.

On the opportunity side, they can be used in almost any social or economic activity that needs to connect many people, especially in rural or remote areas.

Finally, regarding threats, radio transceivers and antennas can be stolen or destroyed, and they can be affected by sandstorms, heat, and power failure.

Politically, there may also be resistance to the wide access to information that wireless can bring. Read more in www.idrc.ca/acacia/03866/wireless/part2.htm

Some examples

Wireless schools

SchoolNet Namibia plans to install Internet enabled computers in all schools in Namibia. 'Wireless' schools in densely populated areas (that are close enough together to use wireless) will be connected to a central wired node using Ethernet bridges with high gain antennas.

By using, for example a WiLan Hopper Plus bridge, and the right antennas, ranges of up to 60 km are possible. Bandwidth can be 4.5 mps to even 12 mps. While the initial capital outlay for these bridges is high, there is no monthly operating cost and maintenance requirements are minimal.

In the central and southern regions of Namibia, Ethernet bridges are not a feasible solution because the schools are too far apart and the terrain is difficult. A possible solution here is to combine satellites (for receiving data) with the use of mobile phones or radiotelephones to send data. This will have a lower initial cost than the wireless bridges.

However, there are ongoing fees to be paid to both the satellite provider and Telecom Namibia for their services. In some of the more dense areas, a cell-node set-up will be used, where a central school has a satellite feed and wireless bridges link other near by schools. This will allow multiple schools to share the costs.

ISPs offer wireless services

Intercom Data Network - IDN, one of Ghana's ISPs has announced the design and manufacture of an integrated broadband system "designed to provide fast wireless communication access at a very competitive price", writes Kwami Ahiabenu.

The IDN Sava Series implements a DSS 802.11b compliant broadband wireless solution, together with a host of Internet applications that drastically reduce deployment costs for a 'business' Internet infrastructure. It comes packaged in a compact 1U set-up box, with a simple LED front panel display indicating system and link activities. Web based management interface functionality simplifies set-up and configuration.

Wireless communication in detail

Depending on the application, three major environments can be distinguished:

- A connection among computers in a local network;
- A connection between different points over a longer distance, using line of sight (LOS);
- A connection between different points using a satellite.

Connecting computers

A Local Area Network (LAN) connects computers from a few meters to a few kilometres. The wireless version of these networks (WLAN) is increasingly used in office environments because no wires need to be installed.

A village or a section in a town could also use such a network to connect to a wider network (Wide Area Network- WAN).

Before deciding on equipment, review the checklist at www.idrc.ca/acacia/03866/wireless/part4.htm.

The WLAN is mostly used to exchange files, to print, to send e-mail, and to surf the Web.

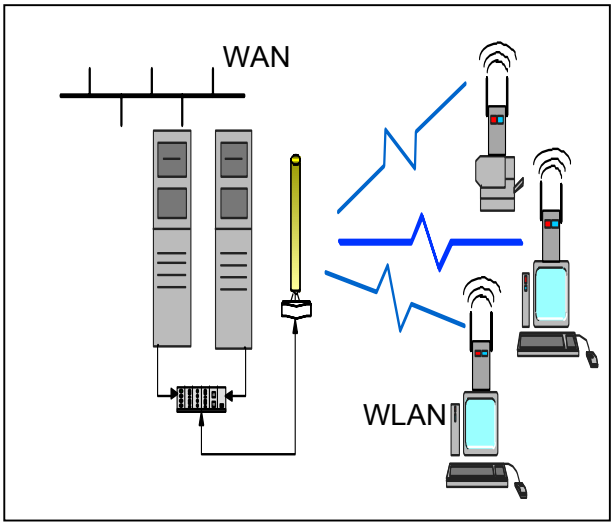
A disadvantage is that the signal can suffer from thick walls and other obstacles. A line of sight is actually needed, but in some cases walls are not a problem.

There are many WLAN products on the market and the price/performance ratio is getting better all the time.

A WLAN can be set up for:

- Administrative processes where several computers are involved**.**
- To give a group of people (or an individual) access to an existing network like a university network.
- To give access to email and Internet browsing. These connections can then be used for e-learning, e-commerce and in general any application available on the Web.
- The WLAN can also be used for video, audio and voice services.
- Analogue telephone lines can be connected to this network.
- A WLAN is usually connected via a 'router' to another network like the Internet, a company network or a bigger network that is used over longer distances.

An Example of a WLAN (Wireless Local Area Network) connected to a fixed WAN (Wide Area Network) is shown in the picture below.

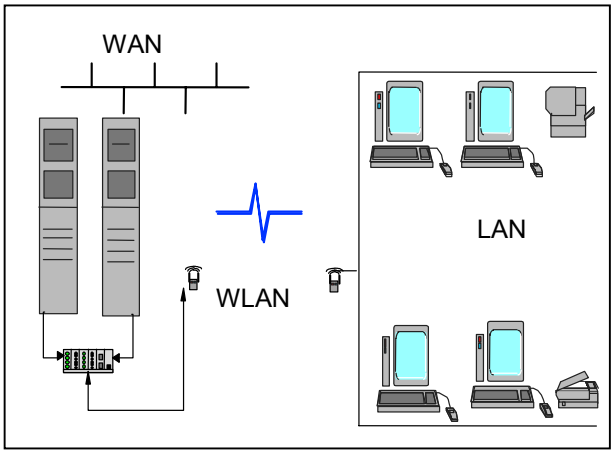


Here, a LAN is connected to another network using a wireless connection. The two transmitters/ receivers function as a point-to-point connection, but the distance is limited. Since the antennas do not need to point towards each other, devices can be placed anywhere within the range of the transmitter/receiver.

More information can be found at:

- www.idrc.ca/acacia/03866/wireless/part2.htm
- www.wlana.org/
- www.radiolan.com/

In the next picture, each station has a separate wireless connection to a central antenna. This is called Multi Point Access or Point to Multi Point. The nominal distance is a few hundred meters, depending on different conditions. There are systems that provide longer distances (http://hydra.carleton.ca/info/wlan.html).



Connecting networks

To connect over a longer distance, a Point-To-Point connection is used. Two antennas point toward each other and a box connected to the antenna translates the signal to phone or data infrastructure (www.tripointglobal.com/Gabriel/default.htm)

These connections use a certain band - or frequency - over which the signal travels. There are licensed bands (based on regulations) and unlicensed bands (which can be used if another user is not yet using this band).

Equipment for unlicensed bands usually costs one third of equipment needed for licensed bands. Generally, the lower the frequency, the further the signal travels, but with lower bandwidth (www.idrc.ca/acacia/03866/wireless/part2.htm).

Consequently, with higher frequencies, more data can be transmitted, but over shorter distances and requiring a line of sight.

High placed antennas are needed to cross obstacles and to rise above the curve of the earth surface. When longer distances are needed, a repeater station can be used.

A repeater consists of two antennas, each focussed on a different site and placed between the two locations. The signals are received and amplified for further transmission in both directions.

Such wireless networks are mostly used to connect networks with each other over longer distances.

If longer distances need to be crossed, a repeater or satellite techniques are used. This decision usually depends on costs per bandwidth. These costs will be influenced by terrain, distance, needed bandwidth and other factors (www.idrc.ca/acacia/03866/wireless/part4.htm).

In developing countries these lines are much quicker and more cheaply installed than traditional wires. A disadvantage is that highly skilled, costly technicians are needed to perform a site review and to set up the equipment.

Such networks using the 2.4 GHz – 5.8 GHz band (licence free) are used for:

- Data transfer, such as files, e-mail, web surfing etc.
- Speech. Depending on the local system, digital and analogue phones can be connected at either end.
- Voice over the Internet (VOIP). The disadvantage is mostly the latency of the signal. But in a wireless network, the bandwidth can be allocated for VOIP giving good quality (http://studentweb.tulane.edu/~jrewell/).

International connections

Satellite connections are needed when the distance to cross is too long or where there is no fixed place to put a transceiver. Satellite links can range from low bandwidth cellular telephones to high bandwidth dishes that connect an area with a data or telephone network.

Examples include the Iridium (www.iridium.com/) and Inmarsat satellite networks (www.inmarsat.com). Both offer telephone connections at any location.

VSAT techniques are used to communicate with satellites. A dish needs to be pointed at the satellite. Any desired bandwidth can be required. Examples are www.gilat.com/gilat/ or www.carrier2carrier.com/

More information on satellites is contained in IICD Advisory Note 6, by Michiel Hegener.

Conclusion

Wireless communication is becoming more and more important. Prices are decreasing and management of these technologies becomes easier.

Wireless connections can be used to connect computers in a Local Area Network (LAN), to connect networks in a Wide Area Network (WAN), and to establish international connections.

The main advantage is the decreasing costs for installation and maintenance.

The main challenge is that there is no standard solution, but the technical solution always depends on distance, geographical situation, requirements in terms of bandwidth, speed and licences.

More information

- The Wireless Toolbox; the "must read" by Mike Jensen: www.idrc.ca/acacia/03866/wireless/
- A list of equipment manufacturers and service providers, including local suppliers: www.idrc.ca/acacia/03866/wireless/part6.htm
- An update since the Jensen report: www.oreillynet.com/pub/a/308
- Tutorial on wireless networks: http://iec.org/tutorials/wll/
- Practical guide, step by step: www.reliefweb.int/library/wtint/toc.html
- ZDNet info: www.zdnet.com/enterprise/filters/resources/0,10227,6016597,00.html
- Wireless newsfactor: www.wirelessnewsfactor.com/perl/section/wlsnetw/
- Telecom research: a portal to wireless: www.telecomresearch.com
- To stay updated: www.commnow.com/frmRegister14Days.asp#paid
- About transmitters: www.transmitter.org
- Radiolan, one of the many: www.radiolan.com
- Telecom glossary 2000: www.atis.org/tg2k/

IICD profile

The International Institute for Communication and Development (IICD) assists developing countries to realise locally owned sustainable development by harnessing the potential of information and communication technologies (ICTs). IICD realises its mission through two strategic approaches. First, Country Programmes bring local organisations together and help them to formulate and execute ICT-supported development policies and projects. The approach aims to strengthen local institutional capacities to develop and manage Country Programmes, which are currently being implemented in Bolivia, Burkina Faso, Ecuador, Ghana, Jamaica, Mali, Tanzania, Uganda and Zambia. Second, Thematic Networks link local and international partners working in similar areas, connecting local knowledge with global knowledge and promoting South-South and South-North exchanges. Thematic Networks focus on sectors and themes like education, health, governance, the environment, livelihood opportunities – especially agriculture – and training. These efforts are supported by various information and communication activities provided by IICD or its partners. IICD is an independent non-profit foundation, established by the Netherlands Ministry for Development Cooperation in 1997. Its core funders include the Directorate-General for Development Cooperation (DGIS), the UK Department for International Development (DFID) and the Swiss Agency for Development and Cooperation (SDC).

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