

# Modeling Wireless Local Area Networking in Higher Education Institutes

Ossi Väänänen

*Turku University of Applied Sciences, Finland*

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## INTRODUCTION

In recent decades, local area network (LAN) has taken a dominating role as communication media inside organisations between individual users and the services they would like to use. The personal computer (PC) has become a basic piece of furniture in every workplace like a chair and a desk. The communication media has evolved from a thick clumsy coaxial cable to flexible thin pair cable or even thinner very high capacity optical cable. In other tools, the development has not been stopped either, but instead computing tools, equipment, software, and communication applications have seen further development with increasing speed. The computers have been packed to very compact form, and they move around with people everywhere, and the network is following them in wireless form. Fast moving, modern people are choosing their own time and place to work.

The radical change does not concern only enterprises, but various organisations, particularly educational institutes, are changing. Computerisation and the increase of networking have been very fast. Wireless LANs are one of the latest examples on this; many institutes are forerunners in taking new network innovation into use. New methods of teaching and learning and better ways of student working are matters of interest in many scientific communities and schools.

This article is partly based on the research being done by Turku University of Applied Sciences in Turku, Finland. The research was started in spring 2006 and is backed by the Ministry of Education in Finland. The aim of the research is to do the basic information collation of the current implementations and the use of wireless local area networking in Finnish universities of applied sciences (former polytechnics). Based on certain models and best practices for WLAN (wireless local area networking), networking is created.

## BACKGROUND

The tendency towards networking has been started at the same time at schools, rather than in other kinds of organisations in society. The school system as a whole is multiform because the lowest level of education is very different from the highest educational and scientific institutes. Also the information technology and networking needs, use, and resources vary. How equipped a school organisation is with information technology tools is very dependent on the resources of the bearer organisation. The owner of an institute can be a public company, city, or state organisation. In the past, institutes of higher education with IT programs and scientific research organisations got the very first central computers around which the computer centres were built. Nearby these centres, the first computer classes were established where the students could get access to the computers either by queuing their turn in computer terminal rooms or by reserving their time slots beforehand to few computer terminals.

In the course of time, the central computer capacity was squeezed into even smaller space giving birth to mini- and microcomputers and at last the widespread computer capacity was connected together with networks. Modern local area networking was created. Today, much of the information handling intelligence and capacity lays on the client desktop PCs. Different services, applications, communication, and other facilities are fetched from different servers behind the network. The physical structure of the modern local area network is mostly based on fixed cables that reach out to all relevant rooms and workplaces. The computers are plugged to wall panels with a data cable and not at all easily moved around.

At schools, the computer based learning happens in computer classrooms. Entire rooms have been furnished with computers, cables, computer tables, and special air conditioning to fit for computer based working. The students have scheduled times for working in these classrooms based on their specialisation, group, or

class. Some students do also have a computer at home, but still most often the devices are firmly plugged to the wall.

As the information needs have grown and the technology has improved, the ways to access and handle information have also changed. One of the biggest changes has been the way to transmit voice communication between people. Earlier, there was the fixed network to carry the speech, but then the telephone cut the wires and started the time of personal communication by jumping into each individuals' pocket. People could move about based on their instant needs and perform work tasks or leisure activities in different places as they wish.

Computers have started to demand the same grade of freedom as telephones. Two things have happened by the help of electrical circuit and component development. The computer processors have penetrated the telephones and personal computers have turned to very small laptop computers that can easily be carried with a person. The communication line is converting into wireless and the era of wireless local area networking has started.

## **THE TECHNOLOGY OF THE WIRELINE AND WIRELESS NETWORK**

A modern data network in an organisation consists of wired (fixed) and wireless IP-network. IP stands for Internet protocol and refers to transmission of data packets according to certain way defined in the communication protocol specification. WLAN network uses wireless communication between the base station and the end user station. The main components of the wireless communication are the wireless adapter inside the user device and the base station. Both have transceiver-receiver hardware and certain software installed. In addition, there are antennas, power equipment and possibly some routing, switching, data security, and printing services available in the base station.

In the course of time, many new standards to refine WLAN were accomplished and the possibilities of using the WLAN have been made better. In the beginning, the speed and other features of wireless communication were minimal. After the first standard called IEEE 802.11b, new standards were published soon and the communication features were substantially increased.

For example, the speed was increased from 11 Mbps (millions bits per second) to 54 Mbps.

One of the most important things in WLAN is the radio technique used. The use of radio frequencies is strictly regulated as whole and actually the frequency space is divided into regulated and unregulated frequency band. The WLAN typically uses the latter and thus the organisation or an individual person implementing WLAN need not to apply for license from the authorities. The unregulated frequency band is typically in the 2.4 or 5 GHz area. Furthermore, radio waves as communication media do have qualities and characteristics that have to be carefully taken into account like reflections, absorption, attenuation, and radiation. One of the future challenges is also how to overcome the constant lack of radio frequencies for communication purposes as wireless communication volumes grow.

The construction of WLAN network demands careful planning and considerable amount of work. With measurement equipment, the location for each base station is defined to ensure the coverage without gaps to desired areas. The coverage area of each base station is spherical although the borderline is not unbroken. Because of this, the coverage of neighbouring base stations has to overlap somewhat to the next station to avoid breaking down the communication signal while moving from one coverage area to another. The recommendation is usually to have approximately 30% of overlap in signals from base stations next to each other. The signal is degraded fast while moving away from the base station and walls, and other constructions can quicken the degradation and even kill the signal completely.

The capacity of the network is strongly dependent on the amount of users within reach of the base station, because the total capacity is divided between the users based on competitive reservation of resources. Additionally, the use of different radio channels on the frequency area is important. The unregulated 2.4 GHz frequency area is divided into 13 different channels, and they are overlapping somewhat to each other. Actually, only 3-4 clear channels can be used in the same area at the same time. It is thus recommended that either a proper channel usage plan is made or automatic channel selection feature is set on in the base stations.

The most severe concern in WLAN is related to data security. The most important definition of policy is whether the network is open or closed security-wise.

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