ENHANCED WIRELESS NETWORK INFRASTRUCTURE OF THE SOUTHERN AREA OF ISPSC SANTA MARIA CAMPUS

ROCKY D. GONZALES
JERRY D. MANZANO
JERIC C. MENDOZA
ELMER A. PALACIO

ILOCOS SUR POLYTECHNIC STATE COLLEGE
INSTITUTE OF COMPUTING STUDIES
SANTA MARIA, ILOCOS SUR

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INTRODUCTION

Project Context

According to Ross (2009), the simplest kind of computer network is no network at all. If you have been working with multiple computers without a network, you know the routine: Every time you need something from a different computer, you have to store a file on a floppy disk, a portable drive, or a flash drive, physically carry it from one computer to another, and load the file onto the second computer.

Sometimes people take the file from the computer they were originally using to the one that is connected to the right printer. If they have been writing a paper on a laptop computer, they might want to add an image that's stored on the desktop system's hard drive. Or maybe they want to give a copy to a colleague for review or approval. Whatever the reason, they have to carry a copy of one or more computer files from one machine to another. This usually involves some walking, so the process is often known as sneaker net. The name reflects the informal dress common in most computer centers, but if you and your family dress for dinner every evening, or if you're a slave to fashionable footwear, you can think of it as "Oxford net" or "Sling backnet" or "Espadrille net" instead. Whatever you choose to call it, physically carrying files from one place to another is often a distracting, time-consuming nuisance.

However, sneaker net does have its uses. When you travel, it can often be easier and more convenient to carry a few files with you rather than retrieve them from a distant computer through the Internet. If you plan to use computers in two or more locations, such as one at school and another at home, you might be better off storing the file on a small portable drive instead of hauling your laptop around.

When security is an important issue, you might not want to connect your computer to any network. The very best way to protect your confidential data from theft through a network is to make sure the computer where the data is stored has no network access.

Sneaker net is not always the slowest way to move data from one computer to another. If you want to move a lot of data over a relatively short distance when you don't have a high-speed data connection, it can often be faster to drive a handful of DVDs or a box of tapes across town than to send the same files through a dial-up connection or any other slow network link. It's one of the oldest maxims in the world of computers and networks, but it's still true: Never underestimate the bandwidth of a station wagon full of floppy disks.

The alternative to sneaker net is a network consisting of physical links that connect two or more computers and related equipment. These links can use wires, radio signals, or a combination of both to move computer data (and any other information that can be converted to and from computer data) between any pair of network nodes. Every computer

connected to a network sends and receives data through a connector or radio antenna. Depending on the data transfer speed and the network's specific requirements, the computer might use a parallel port, a serial port, an Ethernet port, a USB or FireWire port, or a Wi-Fi antenna. Because these connectors and antennas move data in both directions, they are input/output ports or I/O ports, but that term is more often used to describe the computer's serial and parallel data connectors. After you connect your computers together, you will discover that you can do many things through the network that you may not have expected. By the time you have lived with the network for a few weeks, you won't think much about it, but you'll use it all the time..

Marcia Robinson & Ravi Kalakota (2004), networking enables employees within corporations to work with each together and with people in various locations and businesses elsewhere. It enables contact in entirely new ways and entirely new levels, across the office and right around the world. When the business is properly networked, no one is ever very far away.

The complexity of information networks has been growing very rapidly as virtually every employee is connected to corporate information networks and to the Internet. The extent of this, of course, depends on the type of business. Information networks carry a growing amount of data traffic and, as more services run through networks, the data is becoming more versatile and thus the demand for network management

is growing. This has put a great amount of new requirements to enterprise IT departments, including data network administrators and managers. One popular approach has been to outsource network services, but the IT buyer still has to know the requirements and manage them to be fulfilled. These are key elements that have to be in order for outsourcing to be successful. Marcia Robinson states in her book Offshore Outsourcing that additional management needed for offshore outsourcing can dilute initial outsourcing savings by 20 30%. Regardless of the network services being outsourced or made in-house, they have to be managed efficiently.

A study by Thomas Mendel (2004) states that, on average, the information network causes 15% of all problems resulting in downtime at $1 billion-plus companies. However, only 2% are caused by actual networking hardware failures: The other 13% are due to different issues like human errors, unmanaged changes, misconfigurations, routing failures, and problems with networking software.

Few companies build their network infrastructure without a need for extension or replacement investments in the future. Although network equipment is nowadays usually fairly long-lived the network infrastructure might need replacement investment for other reasons for example, to improve functionality, data rates or response times. This also adds up the needs of effective Network Infrastructure Management, which means the process of building and maintaining the infrastructure

of the network.

Information and Communication Technology (ICT), which is the merger of telecommunication and computing, is the major enabling factor. However, rich communication is unlimited to human interaction. Technology is increasingly used to automate many tasks. In addition, Stansberry (2009) stated that most data centers today are interested in automation which helps them automate menial processes.

But with the advancement of technology particularly on network, there are lying threats like data theft, eavesdropping, DoS attacks etc. Secured and proper network infrastructure is a must for enterprise networks. Securing your servers and workstations with end point protections are not enough. Especially if your network is exposed to the internet. According to Curtin (1997), network security is a complicated subject, historically only tackled by well-trained and experienced experts. However as more and more people become "wired", an increasing number of people need to understand the basics of security in a networked world. Today, layer 3 network security, Unified Treat Management (UTM), Network Address Translation (NAT) etc must be observed for a proper and secure network.

This study would pave way for ISPSC to realize the need of getting connected to the Internet with the use of a dedicated Internet Service and with the utilization of an Access Point and Station Receivers to the buildings at the southern area of ISPSC.

Problem

Even with the advancement of information technology, ISPSC still have hard time with network maintenance, troubleshooting and security. The ISPSC still encounters problems such as poor internet connectivity since all offices has their own internet subscription.

Importance

This study as perceived by the proponent is meaningful and significant to the following:

To Ilocos Sur Polytechnic State College, that they will benefit to this study in a way that it will guide them to improve their network security, with a secured data transfer and communications that rely with the internet. This study will eliminate the current problems encountered and will give way for future plans that is related to the wireless computer networking.

ISPSC Employees, the plan helps employees to have better and way of communication in different offices.

Network Administrators and Engineers, that they can use this as a basis for creation of wireless network infrastructure and to make upgrade and troubleshooting of network infrastructure easier.

Future Researchers, that they will use the result of this study as their reference for the conduct of similar studies and serves as a reference for their review of literature.

Finally, the Researchers, that this study helped them enhance their capabilities and skills of designing a wireless network for ISPSC.

Literatures

Clustering Protocols in Computer Networking

Clustering protocols can be broadly categorized into cluster head-based clustering protocols and non-cluster head-based clustering protocols. In the cluster head-based clustering protocols, the cluster head with extra control functions are chosen in each cluster, whereas in the non-cluster head-based clustering protocols, and all mobile nodes are identical with no chosen cluster head. Cluster head-based clustering protocols outperform non-cluster head-based clustering protocols in terms of traffic overhead. Based on the hop distance of the cluster members from its associated cluster head, the cluster head-based clustering can be further divided into 1-hop clustering and multi-hop clustering. In 1-hop clustering, the maximum distance between two cluster members is 2-hops, thereby maintaining one hop distance between the cluster members and its associated cluster head. In multi-hop clustering, cluster head can reach its farther member nodes by taking multiple hops through intermediate cluster members and relax its restriction of having direct connection with its associated members. Low-Maintenance clustering aims at providing stable cluster structure architecture without the excessive consumption of network resources for cluster maintenance, thereby incurring less maintenance cost. The re-

affiliation and re-clustering are the two major events that influence the cost of cluster maintenance. The re-affiliation refers to the disassociation of cluster member from its cluster head and associating itself to another cluster without affecting the corresponding cluster head(s). Re-clustering is an event that completely rebuilds the cluster topology over the whole network. These two events change the network topology more frequently with the drastic increase of clustering maintenance overheads.

Hierarchical- based routing

Aaron Clauset (2016), in a hierarchical architecture, higher energy nodes can be used to process and send the information and lower energy nodes used to sense the environment. So there is a hierarchy of low and high energy nodes. The creation of clusters and assigning special tasks to cluster heads can affect the scalability, lifetime, and energy efficiency. Hierarchical routing is two-layer routing where one layer is used to select cluster heads and the other for routing. This can be further divided into two parts dynamic hierarchical based routing scheme and static hierarchical based routing scheme. In dynamic, clusters are formed dynamically whereas in static once the clusters are formed remains same throughout the network life time. Energy Efficient Protocol with Static Clustering (EEPSC) is a static clustering-based routing algorithm. EEPSC divided the network into static clusters, temporary-cluster-heads are used to distribute the energy load among high energy sensor nodes; thus, extends the network lifetime and there is no overhead to select the

clusters dynamically. The operation of EEPSC is divided into rounds, where each round contains set-up phase, responsible node selection phase and steady state phase.

Hierarchical Structure in Networks

According to Lancichinetti, Fortunato and Kertész (2009) many networks in nature, society and technology are characterized by a mesoscopic level of organization, with groups of nodes forming tightly connected units, called communities or modules that are only weakly linked to each other. Uncovering this community structure is one of the most important problems in the field of complex networks. Networks often show a hierarchical organization, with communities embedded within other communities; moreover, nodes can be shared between different communities. The study of networks as the 'scaffold of complexity' has proved very successful to understand both the structure and the function of many natural and artificial systems. A common feature of complex networks is *community structures* the existence of groups of nodes such that nodes within a group are much more connected to each other than to the rest of the network. Modules or communities reflect topological relationships between elements of the underlying system and represent functional entities. Therefore, the identification of communities is of central importance, but it has remained a formidable task. The hierarchical form of organization can be

very efficient, with the modules taking care of specific functions of the system. In the presence of hierarchy, the concept of community structure becomes richer, and demands a method that is able to detect all modular levels, not just a single one.

Network Performance Evaluation

To better understand what iperf, as mentioned from http://en.wikipedia.org/wiki/Iperf is, iperf is a commonly used network testing tool that can create Transmission Control Protocol (TCP) and User Datagram Protocol (UDP) data streams and measure the throughput of a network that is carrying them. Iperf is a tool for network performance measurement written in C. It is a compatible reimplementation of the ttcp program that was developed by the Distributed Applications Support Team (DAST) at the National Laboratory for Applied Network Research (NLANR), a research lab that merged with the University of California, San Diego's Cooperative Association for Internet Data Analysis (CAIDA) group, but which was shut down on December 31, 2006, due to termination of funding by the United States' National Science Foundation. Iperf allows the user to set various parameters that can be used for testing a network, or alternatively for optimizing or tuning a network. Iperf has a client and server functionality, and can measure the throughput between the two ends, either unidirectional or bi-directionally. It is open-source software and runs on various platforms including Linux, Unix and Windows (either natively or inside Cygwin).

Iperf has two mode of testing environment which is: a) UDP-When used for testing UDP capacity, Iperf allows the user to specify the datagram size and provides results for the datagram throughput and the packet loss; b) TCP-When used for testing TCP capacity, Iperf measures the throughput of the payload. Iperf uses 1024 × 1024 for megabytes and 1000 × 1000 for megabits. Typical Iperf output contains a time-stamped report of the amount of data transferred and the throughput measured *(Iperf Overview, 2015).*

Computer Network

A computer network is a group of computer systems and other computing hardware devices that are linked together through communication channels to facilitate communication and resource-sharing among a wide range of users. (Technopedia, 2013)

A network consists of two or more computers that are linked in order to share resources (such as printers and CDs), exchange files, or allow electronic communications. The computers on a network may be linked through cables, telephone lines, radio waves, satellites, or infrared light beams. (Florida Center for Instructional Technology, University of South Florida, Dr. Roy Winkelman, Director)

Networking enables employees within organizations to work with each other and with people in various locations and businesses elsewhere. It enables contact in entirely new levels, across office and

right around the world. When the business is properly networked, no one is ever very far away.

The Ilocos Sur Polytechnic State College has several computer networks which are used primarily for Internet connectivity. The computer networks of ISPSC are isolated units, located and maintained in different departments or buildings. These networks are connected to the Internet through various Internet Service Providers. With the present structure and set-up of the computer networks of ISPSC, there is difficulty in maintaining the system, computer networks do not communicate with each other.

Hierarchical Network Clustering for ISPSC (previous study)

The previous study of Soliven et al. (2015) only focused in the reliability of the data packets (packet loss). It was concluded as the overall result the researchers concludes that the farther the bridge device connection getting connected to the main access point shows a poor Quality of Service, therefore a consideration of good quality devices should then be realized.

Objectives

To establish a wireless network at the Northern Area of ISPSC Sta. Maria campus that will provide internet access and other means of communication and data packet transmission. Specifically, the study sought to answer the following objectives, to wit:

1. To determine the current Internet and WIFI set-up at the southern area of ISPSC Sta. Maria campus.
2. To design a wireless network infrastructure for southern area of ISPSC Santa Maria.
3. To determine the performance of the designed wireless network infrastructure.

Time and Place of the Study

The study made use of 5ghz Access Point to connect AP Stations from buildings from the Northern Area of ISPSC. The proponents designed a wireless network infrastructure for ISPSC and determined the performance of the Access Points using iperf. The advantages gained through this study will serve its purpose in the deployment of a good access point that can be a basis of deployment for the wireless network infrastructure of the southern area of ISPSC. This study aimed to determine the performance of the 5ghz Access Points and Base Station which were tested at the southern area of ISPSC.

Chapter II

METHODOLOGY

The Top-Down Approach Model

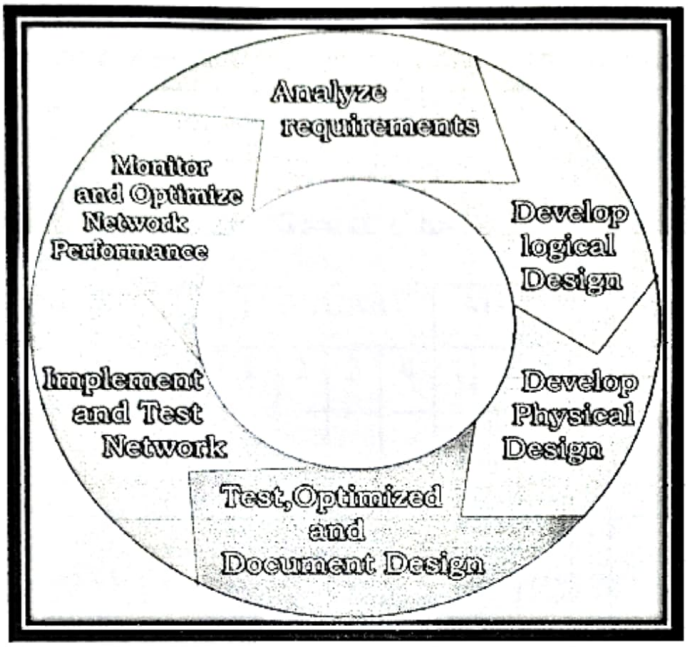

Figure 1. Top-Down Approach

The study was conducted at Ilocos Sur Polytechnic State College Santa Maria Ilocos Sur Campus. The researchers used the Top-Down Approaches their Network Life Cycle model in order to process and design an appropriate network plan based on the requirements that will be gathered which is shown in Figure 1.

A top-down approach enables a network designer to get "the big picture" first before spiraling downward into detailed technical requirements and specification.

The top-down network design is a methodology for designing networks that begins at the upper layers of the OSI reference model

before moving to the lower layers. It includes exploring organizational and group structures to find the people for whom the network will provide services and from whom the designer should get valuable information to make the design succeed. Top-down network design recognizes that the logical and the physical design can change as more information is gathered.

Table 1. The Project Schedule Gantt Chart

ACTIVITIES	JANUARY				FEBRUARY				MARCH				APRIL				MAY			
	1	2	3	4	1	2	3	4	1	2	3	4	1	2	3	4	1	2	3	4
Analyze Requirements																				
Develop Logical Design																				
Develop Physical Design																				
Test, Optimize and Document Design																				
Implement and Test Network																				
Monitor and Optimize Network Performance																				

Table 1 shows the cycle of the methods and procedures that the researchers applied in this study.

Analyze requirements. In this phase, the researchers interview the previous adviser of the study and technical personnel to gain an understanding of the study for new or enhanced plan. The task of characterizing the existing network, including the logical and physical

topology and network performance, follows. The last step in this phase is to analyze current and future network traffic, including traffic flow and load, protocol behavior, and quality of service (QoS) requirements.

Develop the logical design. This phase deals with a logical topology for the new or enhanced network, network layer addressing, naming, and switching and routing protocols. Logical design also includes security planning, network management design, and the initial investigation into which service providers can meet WAN and remote access requirements.

Develop the physical design. During the physical design phase, specific technologies and products that realize the logical design are selected. Also, the investigation into service providers, which began during the logical design phase, must be completed during this phase.

Test, optimize, and document the design. The steps in top-down network design are to write and implement a test plan, build a prototype or pilot, optimize the network design, and document your work with a network design proposal.

Implement and Test Network. To put the enhanced network plan into effect or action and to test if how reliable the plan could be.

Monitor and Optimization Network Performance. To monitor and optimize by analyzing network performance such as monitoring network traffic and resource utilization, that affects both hardware and software.

Project Staff and Functions

Table 2. Role Requirements and Responsibility

Project Leader	Lead team, report status Review deliverables and assure quality	1	Elmer Palacio
Documenter	Create framework content	3	Jeric Mendoza Elmer Palacio Jerry Manzano
Planner and Designer	Design the project performance management tool	4	Rocky Gonzales Jeric Mendoza Elmer Palacio Jerry Manzano
Review Team	Build the project performance Evaluate deliverables and promote of use	4	Rocky Gonzales Jeric Mendoza Elmer Palacio Jerry Manzano

The role requirements and responsibility of the members of the team can be seen in Table 2. The table shows that each member has their different tasks and responsible of any actions assigned. The leader, who provides and give assignments to his members according to the skills they have and to help and builds a cooperative teamwork. The leader would not only assign the team a work but must work according to the role responsibility. Members are grouped to be the project developer, documentation developer and a review team. Furthermore,

each of the staff assigned need to meet the goals and requirements needed with specific due or time.

Data Gathering Procedures

The following are the methods used in gathering data which was utilized in the conduct of this study.

Survey. The survey questionnaire was used to determine the existing ICT equipment in terms of hardware, software and peopleware of ISPSC.

Internet. This tool was very useful in providing the background and literature of this study, some needed literature can be found in the internet. Specifically, published and unpublished researches will be the basis of this study.

Network Experiment. Iperf, was used to test the experimental network under different simulated network conditions and applying it with the use of Ubiquiti 5 Ghz access point to determine the performance of the packet transfer, bandwidth and transfer rate.

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