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**CNET237SL Computer Networks**

**Project Report**

**2020/21**

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**Approval**

This project work named “School net version 3” has been approved by the lecturer Mr. SCMB Attanayake (Senior lecture at the NSBM Green University Town.) since it satisfies the current academic standards and the requirements of the University of Plymouth and was done under the guidance of Mr. SCMB Attanayake at the faculty of computing, NSBM Green University.

We hereby state that this project work titled “School net version 3” to the faculty of computing of NSBM Green University.

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# ABSTRACT

The goal of this project is to create a network infrastructure that will allow the Ministry of Education to link these schools and create a detailed school network in developing countries like Sri Lanka. The vision was to develop a network with high-quality protection at a low cost, so that network devices in developing countries would meet the same requirements as those in developed countries.

This project will aid in the improvement of education in schools. Numerous devices, such as routers, switches, firewalls, and servers, were used in the network's design. All devices were linked together to form an integrated network system, which was then configured by assigning IP addresses to each device. Despite the low budget for this design network, it needed a high degree of security. As a result, multiple mechanisms were included, including a firewall system that prevents any unfavourable data from entering the network.

This study went into detail about the network's budget challenges in developing countries. Developing countries have a limited budget, which influences the selection of network devices such as servers. Additional components such as a web server and so on were included in this presentation and design.

# Introduction

One of Sri Lanka's most important ministries, the Education Ministry, requires the implementation of a network system called “School net version 3” and a setup to make their ministry more effective, accessible, and supportive.

Sri Lanka's Education Ministry has agreed to extend the school network. All schools will be granted network connectivity and control access to the Internet as part of the line extension. Since the ministry of education has already decided to provide laptops to high school students, network expansion is seen as a vital element. This will also give students access to school-based instructional materials. Larger schools will be able to save download material by using a Google-provided local cache data system. The plan is to connect these schools and build a detailed school network.

The schools are categorized into three groups they are Type I, Type II, Type III.

* There are 4000 total students in Type I, 5Labs (each with 41 computers), Admin PC/Laptops 5, WIFI- 10 access points with cashed.
* Type II has a total of 4000 students. 3 labs with 41 computers each, Admin PC/Laptops 2, WIFI 5 access points, with cashed engine.
* The total number of students in Type III is 2000. 1 lab with 10 computers, 1 admin PC/Laptops, no Wi-Fi, and no cashed engine.

School infrastructure is divided into two categories.

* Server/core
* Network management

**Chapter 02 Network Topologies**

**Why different network topologies**

* The network topologies define how interconnect the nodes.
* Different network connectivity logics have set of advantages disadvantages as well.
* The topology selecting process requires to be decided after careful study in application requirements.
* One to many communication models with Broadcasting models reduce the resources requirement on server end but create with complex problems.

**Network categorization**

* Standard network.
* Dynamic network deployments.
* Networks/ad-hoc networks

**What is a network topology?**

Simply, a system topology is signified as a diagram that helps to identify the topology type, overall areas of the source and terminus of the traffic streaming on the system and also it will select the perfect way for each stream where it is a collection of hubs, switches, routers that builds a network to connect all the systems. There are two main categories that this topology can be divided as physical topology and the logical topology. In the physical topology, it is simply a setup of hubs which has a physical association which includes wires like, Ethernet, DSL, and fiber optics. Moreover, these physical topology type has few regular topologies that can be described as follows,

**Bus topology:** in this kind of topology, each hub in the topology is connected in an arrangement along a straight way where we can find these kinds of arrangement today fundamentally in cable broadband systems.

**Star topology:** in this topology, it is a kind of connection where the focal hub is having a straight association with other every single hub. For an instance, switched LANs that has been made on Ethernet switches where it includes most wired home and office systems.

**Ring topology:** in this type of topology all the hubs are connected where it works as a loop arrangement. That means, some of them passes the data only to a one direction while other will pass the data for both directions. Since traffic can come at a hub from either way, these ring systems are much stronger than the bus topologies.

**Mesh topology:** it joins hubs with various connections so from that various ways, some of the few purposes of the system will give the access. And this system can be completely meshed if all the hubs relate to every other hub and also it can be incompletely meshed if some of them have numerous connections with the others. As a major advantage in this kind of topology we can take, flexibility under any kind of disaster, yet build cost. That is because, making to mesh to make various ways.

**Tree topology:** it is a kind of star topology where it has connected with star topologies themselves in a star setup. For this as tree topologies like, there are bigger Ethernet switch systems and data centers.

The above-mentioned details are regarding the physical topology and the physical topology types. And when it comes to logical topology will be contrast from a physical topology where data will take an undetectable jump at middle focuses and, we can say it as a connection among hubs. Likewise, virtual circuits will have a physical topology as it is system dependent and the logical topology is dependent on the genuine association medium as an instance we can take, fiber that is because the logical topology dependent on the circuits. Furthermore, we can take IP and Ethernet networks as it is the most generally utilized nowadays which is completely meshed, from that any client can interface with other except the blocked ones. Occasionally, by referring the availability of the system, the topology can allude to the topology as the user’s perspectives. Additionally, IP and the Ethernet are instances we can take for the whole integration property of the network protocol utilized and not of the system topology only. And for the clients, any system can be seemed totally meshed.

**Proposed Network Topology**

**What VPN topology was used to create this system?**

In this assessment I have used the Full mesh VPN topology as it is the most common topology that has been used for wireless connections. And it gives a major benefit where it will work as same as before even if one of the connections fails. Since, this topology can convey information and data concurrently, it can handle a large amount of traffic also. Likewise, working with topology is easier where we can add additional devices if we need as it does not harm or interrupt the data transmission within the devices. All the remote sites can communicate with the Head office and the other remote locations without the need of routing through the Head office.

**What LAN topology was used to create this system?**

In this assessment we used Tree Topology as the Local Area Network (LAN) topology. Since this topology is a mix of both the bus topology and star topology. The main reason behind the choice of selecting tree topology is that even if one node is damaged there is no effect to the other outlets. It provides easy maintenance and authentication for the users within the LAN. This topology system is supported by many hardware and software venders. The backbone line should be protected, and it should be kept in a place where there are less chances of breaking the backbone line.

## 

## Chapter 03 Network Design

**Network Layouts For School Group one**

Diagram, engineering drawing

Description automatically generated

**Network Layouts For School Group Two**

Diagram, engineering drawing

Description automatically generated

**Network Layouts For School Group Three**

Diagram, engineering drawing

Description automatically generated

Diagram

Description automatically generated**Network Layouts For school net version 3**

We took this network diagram to implement our school network.

**Network Segmentation and Ip addresing**

* **Network Segmentation for School Group one Layout**

Diagram, engineering drawing

Description automatically generated

**Segment for School net version 3**

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| NO | NAME | VLAN Name | VLAN ID | IP Block |
| 01 | System Infrastructure | System Infrastructure | 100 | 2401: DD01:A000: :/36 |
| 02 | School Groups | School Groups | 200 | 2401: DD01:B000: :/36 |

**Segment for System Infrastructure**

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| NO | NAME | VLAN Name | VLAN ID | IP Block | Ip Address |
| 01 | System Infrastructure |  |  | 2401: DD01:A000: :/36 |  |
|  | Server/Core | Server | 100 | 2401: DD01:A100: :/48 | 2401: DD01:A100: :1/48 |
| Network Management | Network Management | 200 | 2401: DD01:A200: :/48 | 2401: DD01:A200: :2/48 |

**Segment for School Groups**

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| NO | NAME | VLAN Name | VLAN ID | IP Block |
| 01 | School Groups |  |  | 2401: DD01:B000: :/36 |
|  | School Group Part 01 | School\_Group\_01 | 100 | 2401: DD01:BA00: :/40 |
|  | School Group Part 02 | School\_Group\_02 | 200 | 2401: DD01:BB00: :/40 |
| School Group Part 03 | School\_Group\_03 | 300 | 2401: DD01:BC00: :/40 |

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| NO | NAME | VLAN Name | VLAN ID | IP Block |
| 01 | School Group Part 01 |  |  | 2401: DD01:BA00: :/40 |
|  | School No 0001 | School\_0001 | 500 | 2401: DD01:BA00:1000: :/52 |
|  | School No 0002 | School\_0002 | 501 | 2401: DD01:BA00:2000: :/52 |
| School No 0010 | School\_0010 | 510 | 2401: DD01:BA00:A000: :/52 |
| School No 3500 | School\_3500 | 4000 | 2401: DD01:BADA:C000: :/52 |

**Segment for School Groups -> School Group 01**

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| NO | NAME | VLAN Name | VLAN ID | IP Block | IP ADDRESS |
| 01 | School No 0001 |  |  | 2401: DD01:BA00:1000: :/52 |  |
|  | Admin | Admin | 500 | 2401: DD01:BA00:1A00: :/56 | 2401: DD01:BA00:1A00: :1/56  2401: DD01:BA00:1A00: :5/56 |
|  | Student | Student | 1000 | 2401: DD01:BA00:1B00: :/56 | 2401: DD01:BA00:1B00: :0001/56  2401: DD01:BA00:1B00: :4000/56 |
|  | Lab | Lab | 1500 | 2401: DD01:BA00:1C00: :/56 |  |
|  | Wi-Fi | Wi-Fi | 2000 | 2401: DD01:BA00:1D00::/56 |  |
|  | Cashed Engine | Cashed Engine | 3000 | 2401: DD01:BA00:1E00: :/56 | 2401: DD01:BA00:1E00: :0001/56  2401: DD01:BA00:1E00: :0100/56 |

**Segment for School Groups-> School Group 01-> School No 01**

**Segment for School Groups-> School Group 01-> School No 01-> lab**

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| NO | NAME | VLAN Name | VLAN ID | IP Block | IP ADDRESS |
| 01 | Lab |  |  | 2401: DD01:BA00:1C00: :/56 |  |
|  | Lab 1 with 41 pcs | LAB1 | 100 | 2401: DD01:BA00:1C10: :/60 | 2401: DD01:BA00:1C10: :1/60  2401: DD01:BA00:1C10: :41/60 |
| Lab 5 with 41 pcs | LAB5 | 105 | 2401: DD01:BA00:1C50: :/60 | 2401: DD01:BA00:1C50: :1/60  2401: DD01:BA00:1C50: :41/60 |

**Segment for School Groups-> School Group 01 ->School No 01-> Wi-Fi**

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| NO | NAME | VLAN Name | VLAN ID | IP Block | IP ADDRESS |
| 01 | Wi-Fi |  |  | 2401: DD01:BA00:1D00::/56 |  |
|  | Wi-Fi Access point 01 | Access\_Point\_1 | 100 | 2401: DD01:BA00:1D10::/60 | 2401: DD01:BA00:1D10::1/60 |
| Wi-Fi Access point 10 | Access\_Point\_10 | 200 | 2401: DD01:BA00:1DA0::/60 | 2401: DD01:BA00:1DA0::1/60 |

* **Network Segmentation for School Group two Layout**

Diagram, engineering drawing

Description automatically generated

**Segment for School net version 3**

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| NO | NAME | VLAN Name | VLAN ID | IP Block |
| 01 | System Infrastructure | System Infrastructure | 100 | 2401: DD01:A000: :/36 |
| 02 | School Groups | School Groups | 200 | 2401: DD01:B000: :/36 |

**Segment for System Infrastructure**

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| NO | NAME | VLAN Name | VLAN ID | IP Block | Ip Address |
| 01 | System Infrastructure |  |  | 2401: DD01:A000: :/36 |  |
|  | Server/Core | Server | 100 | 2401: DD01:A100: :/48 | 2401: DD01:A100: :1/48 |
| Network Management | Network Management | 200 | 2401: DD01:A200: :/48 | 2401: DD01:A200: :2/48 |

**Segment for School Groups**

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| NO | NAME | VLAN Name | VLAN ID | IP Block |
| 01 | School Groups |  |  | 2401: DD01:B000: :/36 |
|  | School Group Part 01 | School\_Group\_01 | 100 | 2401: DD01:BA00: :/40 |
|  | School Group Part 02 | School\_Group\_02 | 200 | 2401: DD01:BB00: :/40 |
| School Group Part 03 | School\_Group\_03 | 300 | 2401: DD01:BC00: :/40 |

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| NO | NAME | VLAN Name | VLAN ID | IP Block |
| 01 | School Group Part 02 |  |  | 2401: DD01:BB00: :/40 |
|  | School No 0001 | School\_0001 | 500 | 2401: DD01:BB00:1000: :/52 |
|  | School No 0002 | School\_0002 | 501 | 2401: DD01:BB00:2000: :/52 |
| School No 0010 | School\_0010 | 510 | 2401: DD01:BB00:A000: :/52 |
| School No 3500 | School\_3500 | 4000 | 2401: DD01:BBDA:C000: :/52 |

**Segment for School Groups-> School Group 2 -> School 1**

**Segment for School Group 02**

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| NO | NAME | VLAN Name | VLAN ID | IP Block | IP ADDRESS |
| 01 | School No 0001 |  |  | 2401: DD01:BB00:1000: :/52 |  |
|  | Admin | Admin | 500 | 2401: DD01:BB00:1A00: :/56 | 2401: DD01:BB00:1A00: :1/56  2401: DD01:BB00:1A00: :2/56 |
|  | Student | Student | 1000 | 2401: DD01:BB00:1B00: :/56 | 2401: DD01:BB00:1B00: :0001/56  2401: DD01:BB00:1B00: :3000/56 |
|  | Lab | Lab | 1500 | 2401: DD01:BB00:1C00: :/56 |  |
|  | Wi-Fi | Wi-Fi | 2000 | 2401: DD01:BB00:1D00::/56 |  |
|  | Cashed Engine | Cashed Engine | 3000 | 2401: DD01:BB00:1E00: :/56 | 2401: DD01:BB00:1E00: :0001/56  2401: DD01:BB00:1E00: :0100/56 |

**Segment for School Groups-> School Group 2 -> School 1-> Lab 01**

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| NO | NAME | VLAN Name | VLAN ID | IP Block | IP ADDRESS |
| 01 | Lab |  |  | 2401: DD01:BB00:1C00: :/56 |  |
|  | Lab 1 with 41 pcs | LAB1 | 100 | 2401: DD01:BB00:1C10: :/60 | 2401: DD01:BB00:1C10: :1/60  2401: DD01:BB00:1C10: :41/60 |
|  | Lab 3 with 41 pcs | LAB3 | 105 | 2401: DD01:BB00:1C30: :/60 | 2401: DD01:BB00:1C30: :1/60  2401: DD01:BB00:1C30: :41/60 |

**Segment for School Groups -> School Group 2 -> School 1-> Wi-F**

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| NO | NAME | VLAN Name | VLAN ID | IP Block | IP ADDRESS |
| 01 | Wi-Fi |  |  | 2401: DD01:BB00:1D00::/56 |  |
|  | Wi-Fi Access point 01 | Access\_Point\_1 | 100 | 2401: DD01:BB00:1D10::/60 | 2401: DD01:BB00:1D10::1/60 |
| Wi-Fi Access point 5 | Access\_Point\_5 | 200 | 2401: DD01:BB00:1D50::/60 | 2401: DD01:BB00:1D50::1/60 |

* **Network Segmentation for School Group three Layout**

Diagram, engineering drawing

Description automatically generated

**Segment for School net version 3**

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| NO | NAME | VLAN Name | VLAN ID | IP Block |
| 01 | System Infrastructure | System Infrastructure | 100 | 2401: DD01:A000: :/36 |
| 02 | School Groups | School Groups | 200 | 2401: DD01:B000: :/36 |

**Segment for System infrastructure**

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| NO | NAME | VLAN Name | VLAN ID | IP Block | Ip Address |
| 01 | System Infrastructure |  |  | 2401: DD01:A000: :/36 |  |
|  | Server/Core | Server | 100 | 2401: DD01:A100: :/48 | 2401: DD01:A100: :1/48 |
| Network Management | Network Management | 200 | 2401: DD01:A200: :/48 | 2401: DD01:A200: :2/48 |

**Segment for School Groups**

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| NO | NAME | VLAN Name | VLAN ID | IP Block |
| 01 | School Groups |  |  | 2401: DD01:B000: :/36 |
|  | School Group Part 01 | School\_Group\_01 | 100 | 2401: DD01:BA00: :/40 |
|  | School Group Part 02 | School\_Group\_02 | 200 | 2401: DD01:BB00: :/40 |
| School Group Part 03 | School\_Group\_03 | 300 | 2401: DD01:BC00: :/40 |

**Segment for School Groups -> School Group 3 -> School 1**

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| NO | NAME | VLAN Name | VLAN ID | IP Block | IP ADDRESS |
| 01 | School No 0001 |  |  | 2401: DD01:BC00:1000: :/52 |  |
|  | Admin | Admin | 500 | 2401: DD01:BC00:1A00: :/56 | 2401: DD01:BC00:1A00::1/56 |
|  | Student | Student | 1000 | 2401: DD01:BC00:1B00: :/56 | 2401: DD01:BC00:1B00::1/56  2401: DD01:BC00:1B00: :4000/56 |
|  | Lab | Lab | 1500 | 2401: DD01:BC00:1C00: :/56 |  |

**Segment for School Groups -> School Group 3 -> School 1 -> Lab**

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| NO | NAME | VLAN Name | VLAN ID | IP Block | IP ADDRESS |
| 01 | Lab |  |  | 2401: DD01:BC00:1C00: :/56 |  |
|  | Lab 1 with 10pcs | LAB1 | 100 | 2401: DD01:BC00:1C10: :/60 | 2401: DD01:BC00:1C10: :1/60  2401: DD01:BC00:1C10: :10/60 |
|  | Lab 2 with 10pcs | LAB2 | 105 | 2401: DD01:BC00:1C20: :/60 | 2401: DD01:BC00:1C20: :1/60  2401: DD01:BC00:1C20: :10/60 |

* **Network Segmentation for School Net version 3**

Diagram

Description automatically generated

|  |  |  |  |
| --- | --- | --- | --- |
|  | | | |
| NO | Name | IP Block | Ip Address |
| 1 | System Infrastructure | 2401: DD01:A000: :/36 |  |
|  | Server/Core | 2401: DD01:A100: :/48 | 2401: DD01:A100: :1/48 |
| Network Management | 2401: DD01:A200: :/48 | 2401: DD01:A200: :1/48 |
| 2 | School Groups | 2401: DD01:B000: :/36 |  |
|  | School Group Part 01 | 2401: DD01:BA00: :/40 |  |
| School No 0001 | 2401: DD01:BA00:1000: :/52 | 2401: DD01:BA00:1000: :1/52 |
| Admin | 2401: DD01:BA00:1A00: :/56 | 2401: DD01:BA00:1A00: :1/56  2401: DD01:BA00:1A00: :5/56 |
|  | Student | 2401: DD01:BA00:1B00: :/56 | 2401: DD01:BA00:1B00: :0001/56  2401: DD01:BA00:1B00: :4000/56 |
|  | Labs | 2401: DD01:BA00:1C00: :/56 |  |
|  | Lab 1 with 41 pcs | 2401: DD01:BA00:1C10: :/60 | 2401: DD01:BA00:1C10: :1/60  2401: DD01:BA00:1C10: :41/60 |
|  | Wi-Fi | 2401: DD01:BA00:1D00: :/56 | 2401: DD01:BA00:1D10: :1/60  2401: DD01:BA00:1DA0: :1/60 |
|  | Cashed Engine | 2401: DD01:BA00:1E00: :/56 | 2401: DD01:BA00:1E00: :0001/56  2401: DD01:BA00:1E00: :0100/56 |
|  | School Group Part 02 | 2401: DD01:BB00: :/40 |  |
|  | School No  0001 | 2401: DD01:BB00:1000: :/52 | 2401: DD01:BB00:1000: :1/52 |
|  | Admin | 2401: DD01:BB00:1A00: :/56 | 2401: DD01:BB00:1A00: :1/56  2401: DD01:BB00:1A00: :5/56 |
|  | Student | 2401: DD01:BB00:1B00: :/56 | 2401: DD01:BB00:1B00: :0001/56  2401: DD01:BB00:1B00: :4000/56 |
|  | Lab | 2401: DD01:BB00:1C00: :/56 |  |
|  | Lab 1 with 41 pcs | 2401: DD01:BA00:1C10: :/60 | 2401: DD01:BB00:1C10: :1/60  2401: DD01:BB00:1C10: :41/60 |
|  | Wi-Fi | 2401: DD01:BB00:1D00: :/56 | 2401: DD01:BB00:1D10: :1/60  2401: DD01:BB00:1D50: :10/60 |
|  | Cashed Engine | 2401: DD01:BB00:1E00: :/56 | 2401: DD01:BB00:1E00: :0001/56  2401: DD01:BB00:1E00: :0100/56 |
|  | School Group Part 03 | 2401: DD01:BC00: :/40 |  |
|  | School No  0001 | 2401: DD01:BC00:1000: :/52 | 2401: DD01:BC00:1000: :1/52 |
|  | Admin | 2401: DD01:BC00:1A00: :/56 | 2401: DD01:BC00:1A00: :1/56  2401: DD01:BC00:1A00: :5/56 |
|  | Student | 2401: DD01:BC00:1B00: :/56 | 2401: DD01:BC00:1B00: :0001/56  2401: DD01:BC00:1B00: :4000/56 |
|  | Lab | 2401: DD01:BC00:1C00: :/56 |  |
|  | Lab 1 with 10 pcs | 2401: DD01:BA00:1C10: :/60 | 2401: DD01:BC00:1C10: :1/60  2401: DD01:BC00:1C10: :10/60 |

**Network Security Design**

**Cisco:** “Network security" refers to any activity designed to protect the usability and integrity of your network and data. It includes both hardware and software technologies. Effective network security manages access to the network. It targets a variety of threats and stops them from entering or spreading on your network.”

Target to Operate Normal flow

 Picture 4                                                      00000002JAC-HG4                        ABA78158:

**What Do We Have**

* Needs to secure entry exits (fire walls).
* Needs to secure all hosts (end level security)
* Make sure the required have access to secure Info. (access control)
* Need spy to report back the intel n the place (IPS/IDS).
* Needs to register the known (Digital Signatures, PKI).
* Needs to send information in secure and secretly (encoding and Steganography).
* Write all the movements(logs)

**Technologies for Implementation of Security**

* Firewalls.
* IPS & IDS end point security.
* Encryption (cryptography and steganography).
* Digital signatures
* Central user authentication LADP, AD, RADIUS.
* Public Key Infrastructure.

**Firewall**

* And ancient technology for defend from enemy.
* Very effective for gateway or excites.
* First line of defense in the perimeter.
* Focus to segregate the network based on security risk or protection level and filter in and out traffic.

**Firewall deployment Architectures**

**Multi-Legged Firewall**

![Diagram, engineering drawing

Description automatically generated]()

**Network Management**

The process of controlling a complex data network to maximize efficiency and productivity is called Network Management.

* Network Management Area can be divided into five functional parts:
  + Accounting Management
  + Configuration Management
  + Fault Management
  + Performance Management
  + Security Management
* **Accounting Management** Involves tracking individual’s utilization and grouping of network resources to ensure that users have sufficient resources.And itinvolves granting or removing permission for access to the network.
* **Configuration Management is the** configuration of certain network devices controls the behavior of the data network.
* Configuration management is the process of finding and setting up (configuring) these critical devices.
* Managing the configuration changers with the life span of the design will be very challenging.

**Fault Management** called as the process of locating problems, or faults, on the data network. It involves the 3 steps.

* + Discover the problem.
  + Isolate the problem.
  + Fix the problem.

**Performance Management** involves measuring the performance of the network hardware, software, and media.

* Examples activities are:
  + Overall throughput
  + Percentage utilization
  + Error rates
  + Response time.

**Security Management** is the process of controlling access to information on the data network.

* + Provides a way to monitor access points and records information on a periodic basis.
  + Provides audit trails and sounds alarms for security breaches.

**Network Management Protocols**

* The most common protocols are:
  + SNMP (Simple Network Management Protocol)
  + SNMPv2 (SNMP version 2)
  + CMIS/CMIP (Common Management Information Services/Common Management Information Protocol)

**Network Management Architectures**

* The Network Management Platform can use various architectures to provide functionality.
* The 3 most common are:
  + Centralized
  + Hierarchical
  + Distributed

**Hierarchical Architecture (Selected)**

* Uses multiple computer systems.
  + One system acting as the central server.
  + Other systems working as clients.
* Central server requires backups for redundancy.
* Key features:
  + Not dependent on a single system
  + Distribution of network management tasks
  + Network monitoring distributed throughout network.
  + Centralized information storage
* Pros:
  + Multiple systems to manage the network.
* Cons:
  + Information gathering is more difficult and time consuming.
  + The list of managed devices managed by each client needs to be predetermined and manually configured.

**Choosing a Network Management System**

* Built from two major components: The Platform and Applications
* A practical approach follows these steps:
  + Perform device inventory.
  + Prioritize the functional areas of network management.
  + Survey network management applications
  + Choose the network management platform.
* Nagios
  + Currently the most widely implemented Open-Source Network Management Solution.
  + Based on Linux,
  + Majority of the work needs to be done by code.  
    Pros: Free Open-Source Solution, very powerful agents.

Cons: steep learning curve, devices and tests need to be managed via config files

**Chapter 04 Network Development Anysis**

**Communication media**

**Coaxial Cable**

This is a type of cable that has three layers which is covered by an inner copper insulator and then it is covered by cladding material and then the upper layer is covered with an outer jacket. The appearance of the outer layer is like a braided copper which produces electromagnetic field around the central cable. Where these two cables are separated by using a plastic shield. These types of cables are used in businesses Ethernet and other LAN types such as cable TV, telephone communications which are in long distances. And also, this can be used to transmit analog and digital signals.

**Twisted pair cable**

Simply this type of cables are copper conductors where each of the wires are insulated separately. And these can be used when connecting telephones at homes, offices, etc. and can be used for digital signaling in buildings as well. Yet these are cost effective, and, they have a restricted distance, data rate and bandwidth. These copper wires can be used for data transmission where they can categorize into two main types such as, (UTP and STP).

Diagram

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**Unshielded twisted pair (UTP)**

These types of cables are used for connecting telephones at homes and buildings. And they are very cost effective and have a good flexibility but the main difficulty we face here is the restricted distance. That means, it is very difficult to transmit data or the information at a very long distance by using these types of UTP cables. The maximum length that can be used using this UTP cables are up to only 100meters.

**Shielded twisted pair (STP**

When it comes to this type of cabling, it has a much better quality than the other cable and also it guarantees the security of the data transmission. Yet it builds cost.

**Fiber optic cable**

This is a type of cable that has a hundred of thin glass wires that will transmit a beam of light through these glass wires. It has a type of insulating material called cladding and to protect that cover a jacket have wrapped around that material. Another major benefit we got here by using these cables are supportive for long distance telecommunication and also very small in size and has a lighter weight. And also, it has a greater capacity and lower attenuation. Fiber optics cable yet expensive. Because not like other cables it uses low resistance than the other cables.

**Wireless**

This will transmit the data without any physical equipment where it transmits the data as signals through air and it’s totally different from the coaxial or optical fiber.

Example1 - radio waves

* In this type of wireless communication, transmitting of data is done through radio waves.
* We can take WIFI and Bluetooth for instances to these types of wireless media.

Example2 - microwaves

* In microwaves, data is traveled in a linear mode.
* And also, the position of transmission center is located facing each other.
* Satellite uses these microwaves in order to transmit their data and those data is known as transponders and also uses in internet communication too.

Example 3- infrared

* This type of wireless media has been used in TV remote controllers, mouse, barcode readers and wireless keyboards etc.

**POE Cabling**

This is a type of feature that allows the cables to carry power over a current data connection by using a solitary cat5 or cat6 Ethernet cable. Where this can be used and installed in or outside without using the AC power. And also, we don’t have to install set-ups for each and every endpoint as this provides power to a large area where this supply and will cover a whole large area. Likewise, this doesn’t need an electrician for the installation process where this is cost effective and frequently, most of the organizations have installed these cables in their buildings. And also, this cabling guarantees the security and the protection of the connection. And this kind of cabling have the ability to collect large amount of data and information where it increases the production as well.

Guarantee the security and the protection of the connection: this cable type doesn’t need of metal cladding and conduits and also these POE cables have been divided into different types. And in type three’s voltage is normally less than 60volts where type four’s voltage is less than 90 volts. This can be installed by following only few steps by utilizing a cat5 or cat6 cable.

* Have the ability to collect a large amount of data and information: this type of technology can collect data as much as we need that means an admin user can allow a group of members to check and to control some features like they can identify if there any spaces unavailable and also when to disable the existing features as well.
* So above are the detailed explanation about some of the benefits we get by using POE cabling technology.

**Cat6 Cabling**

* Cat6 cabling takes the sixth place in the Ethernet cabling generation where this cabling type has been used in the organizations as well as in homes too. And this cat6 type is more powerful than cat5 generation. This is a kind of twisted pair cabling type normally utilized in gigabit. This was introduced in the year of 2002 and this cat6 type was made well matched with other previously introduced types such as, cat5, cat5e, cat3 etc. likewise, this cat6 category allows some characteristics and those can be listed as follows,
* It has made up of using four copper wires where that has been used to transmit data and information.
* This allows a speed of 10gbps and the distance can be overextended to hundred meters where this provides 250 MHZ of bandwidth.
* As this shows a higher performance than the previous versions, it has developed new features for crosstalk and system noise.
* And the newest version of the cat6 is the cat6a where it has developed the newest features than the cat6 and also it has a speed of 10gbps.
* By referring the above explanation, cat6 cabling have restricted the length of the transmitting data that is up to 328 feet for the normal connection speed. 9

**Cat5 vs Cat6 cabling**

These are two different types of twisted Ethernet cabling where this has been used for many purposes mostly this has been used as network cables where this will help in connecting modems with servers.

* Cat6 has a higher speed than cat5.
* Cat6 has reduced the crosstalk where cat5 has increased the crosstalk.
* Cat6 have lot of technical developments where cat5 lacks technical developments. That means cat6 has four wires to transmit data so that has been more efficient than the cat5 though it has four wires like the cat6, but it only uses two wires to transmit data.
* Cat6 is higher in price than cat5.
* Cat6 supports a better installation than cat5.

**Devices and Equipment**

**Racks**

The total rack space requirement with expansions is estimated for 30U. One rack consumes around 5KVA power in normal operation.

![A picture containing text, computer

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**Server rack may also contain.**

* Ethernet Switch/Hub
* C2960 Switch
* C2960 Switch C2960 Switch
* KVM Switch C3560 Switch
* Server
* Power Strip
* 19 LCD Monitor Keyboard/KVM
* Tray 10 Spacer
* RAID Array
* UPS

**Advantage of Racks.**

* Can Save Floor Space
* Easy to mount Devices and Equipment.
* Have Good protection of Equipment from moving or falling.
* Very Easy to maintenance
* Air circulation to Devices and Equipment
* Easy to manage Network cables and power Cables.

**Servers**

We selected an industry grade server which are built for special industry grade requirements. The Chip manufacturers design special processors by Intel –Zeon. The server hardware is optimized for the purpose huge I/O rates and bays, large number of storages, number of Memory slots, wattage multiple power supply, cooling fans and number of network connections.

Servers can divide in to three main types based on physical design. There are.

* Rack Servers
* Tower Servers
* Blade Servers

For this implementation we selected **Rack servers** which do not require down time for maintenance.

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**Routers and Switches**

For this implementation we needed Cisco PT-Switches and Cisco PT-Routers



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## Identification of components for School Groups

|  |  |
| --- | --- |
| **School Group** | **Requirements Components** |
| School Group 01 | Cisco [Firepower 4100 Series](https://www.cisco.com/c/en/us/products/security/firepower-4100-series/index.html) Firewall  * Cisco Multi-layer Switch * Cisco PT- Switches * Server * Cisco PT- Routers * Cisco WRT300N Wireless Routers * Cisco PT Wireless End Devices * Network Rack * Cables * PCs * etc.. |
| School Group 02 | Cisco [Firepower 4100 Series](https://www.cisco.com/c/en/us/products/security/firepower-4100-series/index.html) Firewall  * Cisco Multi-layer Switch * Cisco PT- Switches * Server * Cisco PT- Routers * Cisco WRT300N Wireless Routers * Cisco PT Wireless End Devices * Network Rack * Cables * PCs   etc.. |
| School Group 03 | Cisco [Firepower 4100 Series](https://www.cisco.com/c/en/us/products/security/firepower-4100-series/index.html) Firewall  * Cisco Multi-layer Switch * Cisco PT- Switches * Server * Cisco PT- Routers * Network Rack * Cables * PCs   etc.. |

**Chapter 04 Network Implementation**

**Packet Tracer implementation for school net version 3**

**![Diagram, schematic

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**Packet Tracer implementation for System Infrastructure**

**![Diagram

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**Packet Tracer implementation for School types**

**![Diagram

Description automatically generated]()**

**Packet Tracer implementation for School types**

**![Diagram

Description automatically generated]()**

1. **Explaining the implementation details**

* Sample implementation part was not hard because we segment our whole network correctly. therefore, that process was easy to implement.
* We selected multi-layer switch there fore we did switching part and routing part in one device.
* We selected **OSPFv3** as our network routing protocol.
* We assigned IPV6 addressing for each device and vlans with saving IPs for future implementation.
* We created vlans for Each School for (Admin, Student, Lab, Wi-Fi, Cashed Engine)
* We selected Cisco PT- switches and Routers to configure our network.
* WE selected WRT300N Wireless router to provide wireless connection.
* Finally, we chose gigabit Ethernet, Fast Ethernet and ethernets to connect devices.

# Group Details

### Group Name: Team 75

Members:

|  |  |  |  |
| --- | --- | --- | --- |
| ID | Name | Degree Program (CN/CS) | Work Area |
| 10707110 | K.S.L. Silva | CN | Network Design (  Network Layouts and  network segmentation with ipv6 addressing) |
| 10707077 | H.U.P. Fonseka | CN | Network management Area |
| 10707114 | L.G.L. Tiran | CN | Network Topology selection Area |
| 10707111 | S.S.R. Silva | CN | Security setup for the entire network Area |
| 10707068 | K.M.J.D.S. Amaranath | CN | System Implementation Area |
| 10707016 | M.G.S.C. Bandara | CS | Network Development Analysis Area |

# Group meeting minutes

10707110 K.S.L. Silva

I will do Network Design (Network Layouts and network segmentation with ipv6 addressing) area.

10707077 H.U.P. Fonseka

I will do Network management Area.

10707114 L.G.L. Tiran

I will do Network Topology selection Area.

10707111

S.S.R. Silva

I will do Security setup for the entire network Area.

10707068 K.M.J.D.S. Amaranath

I will do System Implementation Area.

10707016

M.G.S.C. Bandara

I will do Network Development Analysis Area.