College of Engineering

Electronics Engineering Department

ECE 551L: Data Communications Laboratory

Local Area Network (LAN) Design of On-Premises Network Infrastructure for Mineski Infinity Internet Cyber Café Marikina Branch

SUBMITTED BY:

Dimabayao, Bryan C.
Absalon, John Michael V.
Servidad, Reynier Noel C.
Celestra, Claire Danielle
Layug, Peeven G.

Date: May 24, 2021

SUBMITTED TO:

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Engr. Henry M. Romero


HUAWEI


mineski infinity
CYBER CAFE NETWORK

CHAPTER 1

INTRODUCTION

Today, the network consists of systems running three different operating systems such as Window several different types of common Linux distributions, and FreeBSD Unix connected to Ethernet local area networks (LANs). These systems are deployed in pairs, as either clients for now, defined as systems with users doing work in front of them and servers for now, defined as systems with administrators, and usually intended only for remote use. When we define the client and server terms more precisely, the host's role at the protocol level depends on which host initiates the connection or interaction. Addressing information is shown for each host, router, and link between devices.

The hosts only have link local IPv6 address, and not global ones or addresses reserved for documentation. The LANs are attached to routers also called intermediate nodes, although some are technically gateways, which in turn are connected in our network to other routers mainly by Gigabit Ethernet point-to-point links. Other types of links, such as asynchronous transfer mode (ATM) or synchronous optical network (SONET), can be used to connect widely separated routers, but we'll use only a few SONET links for our long-haul links between routers. There is a link to the global Internet and to a home-based wireless LAN as well. The home office link uses digital subscriber line (DSL), a form of dedicated broadband Internet access, and not dial-up modem connectivity.

TRANSMITTAL LETTER

Eng'r. Henry M. Romero

Engineering Faculty

Central Colleges of the Philippines

Electronics Engineering Department

Good day Sir,

We, the entire group very pleased to submit this project named "Local Area Network (LAN) Design of On-Premises Network Infrastructure for Mineski Infinity Internet Cyber Café Marikina Branch" as partial fulfillment of the subject entitled "Data Communications Laboratory (ECE551L)". We applied in this project ever lectures and modules that you have taught us from the beginning, and we mixed it together with some of our own research to be able to make it a successful project.

Respectfully yours,

Dimabayao, Bryan C.
Absalon, John Michael V.
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ACKNOWLEDGEMENT

We would like to express our gratitude to Engr. Henry M. Romero for assistance with our supplementary lectures and for comments that greatly improved our project.

We would like to thank our friends for showing their support and sharing their pearls of wisdom with us during those days, we did this project. To our family who been there to support us in financial and give us a moral support. Lastly to our heavenly father who give us the strength and wisdom.

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ABSTRACT

When we communicate, we are sharing information. This sharing can be local or remote. Between individuals, local communication usually occurs face to face, while remote communication takes place over distance. The term telecommunication, which includes telephony, telegraphy, and television, means communication at a distance (tele is Greek for "far"). The word data refers to information presented in whatever form is agreed upon by the parties creating and using the data. Data communications are the exchange of data between two devices via some form of transmission medium such as a wire cable. For data communications to occur, the communicating devices must be part of a communication system made up of a combination of hardware (physical equipment) and software (programs). The effectiveness of a data communications system depends on four fundamental characteristics: delivery, accuracy, timeliness, and jitter.

In data communications, text is represented as a bit pattern, a sequence of bits (Os or Is). Different sets of bit patterns have been designed to represent text symbols. Each set is called a code, and the process of representing symbols is called coding. Today, the prevalent coding system is called Unicode, which uses 32 bits to represent a symbol or character used in any language in the world. The American Standard Code for Information Interchange (ASCII), developed some decades ago in the United States, now constitutes the first 127 characters in Unicode and is also referred to as Basic Latin.

OBJECTIVES

General Objective

The main objective of the Data Communications project is to make a detailed design and consideration with presence of networking and computer components. To make a network design, the design of network requires a close analysis of balanced costs, security, speed, topology, scalability, reliability, and availability. Every network is different, and the solution of the design will be unique for each situation.

Specific Objectives

The specific objective of the project entitled "Local Area Network (LAN) Design for On-Premises Network Infrastructure and Internet Cyber Café for Mineski Infinity Marikina" is based on Huawei standards for network design. The following characteristics are used in designing the overall network design and ongoing maintenance; these are cost, security, speed, topology, scalability, reliability, and availability. The students added new products in the network design like Datacom, Security Wireless, Security Management, and Wireless devices.

SCOPE OF LIMITATIONS

The Data Communications Project entitled “Local Area Network (LAN) Design of On-Premises Network Infrastructure for Mineski Infinity Internet Cyber Café Marikina Branch” is exclusive for Small Office/Home Office (SOHO) and Branch Office network locations with security network environment. The network simulator used for the design is Cisco Packet Tracer, EVE-NG, and Huawei eNSP Network Simulator.

CHAPTER 2

REVIEW OF RELATED LITERATURE

THEORETICAL DISCUSSION

History of TCP/IP

Today, the world of computer networking uses one networking model: TCP/IP. However, the world has not always been so simple. Once upon a time, networking protocols didn't exist, including TCP/IP. Vendors created the first networking protocols; these protocols supported only that vendor's computers. For example, IBM, the computer company with the largest market share in many markets back in the 1970s and 1980s, published its Systems Network Architecture (SNA) networking model in 1974. Other vendors also created their own proprietary networking models. As a result, if your company bought computers from three vendors, network engineers often had to create three different networks based on the networking models created by each company, and then somehow connect those networks, making the combined networks much more complex.

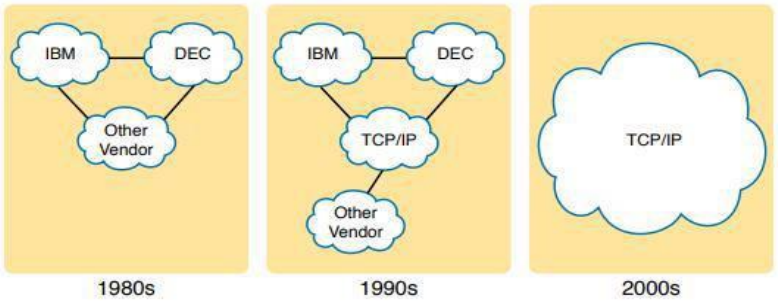

Figure 2.1. Historical Progression: Proprietary Models to the Open TCP/IP Model

TCP Network Model

A networking model, sometimes also called either a networking architecture or networking blueprint, refers to a comprehensive set of documents. Individually, each document describes one small function required for a network; collectively, these documents define everything that should happen for a computer network to work. Some documents define a protocol, which is a set of logical rules that devices must follow to communicate. Other documents define some physical requirements for networking. For example, a document could define the voltage and current levels used on a particular cable when transmitting data. The networking model as you think of an architectural blueprint for building a house.

However, the blueprint can ensure that the house has the right foundation and structure so that it will not fall down, and it has the correct hidden spaces to accommodate the plumbing, electrical, gas, and so on. Also, the many different people that build the house using the blueprint such as framers, electricians, bricklayers, painters, and so on know that if they follow the blueprint, their part of the work should not cause problems for the other workers. Similarly, you could build your own network write your own software, build your own networking cards, and so on to create a network. However, it is much easier to simply buy and use products that already conform to some well-known networking model or blueprint. Because the networking product vendors build their products with some networking model in mind, their products should work well together. Although vendor-defined proprietary networking models often worked well, having an open, vendor-neutral networking model would aid competition and reduce complexity. The International Organization for Standardization (ISO) took on the task to create such a model, starting as early as the late 1970s,

beginning work on what would become known as the Open Systems Interconnection (OSI) networking model. ISO had a noble goal for the OSI model: to standardize data networking protocols to allow communication among all computers across the entire planet. ISO worked toward this ambitious and noble goal, with participants from most of the technologically developed nations on Earth participating in the process. A second, less-formal effort to create an open, vendor-neutral, public networking model sprouted forth from a U.S. Department of Defense (DoD) contract. Researchers at various universities volunteered to help further develop the protocols surrounding the original DoD work. These efforts resulted in a competing open networking model called TCP/IP. During the 1990s, companies began adding OSI, TCP/IP, or both to their enterprise networks.

TCP/IP Networking

The TCP/IP model both defines and references a large collection of protocols that allow computers to communicate. To define a protocol, TCP/IP uses documents called Requests For Comments (RFC). The TCP/IP model also avoids repeating work already done by some other standards body or vendor consortium by simply referring to standards or protocols created by those groups. For example, the Institute of Electrical and Electronic Engineers (IEEE) defines Ethernet LANs; the TCP/IP model does not define Ethernet in RFCs, but refers to IEEE Ethernet as an option. The TCP/IP model creates a set of rules that allows us all to take a computer (or mobile device) out of the box, plug in all the right cables, turn it on, and connect to and use the network. You can use a web browser to connect to your favorite website, use most any app, and it all works. The OS on the computer implements parts of the TCP/IP model. The Ethernet card, or wireless LAN card, built-in to the computer implements some LAN standards referenced by the TCP/IP model. In short, the vendors that created the hardware and software implemented TCP/IP.

The TCP/IP model shows the more common terms and layers used when people talk about TCP/IP today. The bottom layer focuses on how to transmit bits over each individual link. The data-link layer focuses on sending data over one type of physical link: for instance, networks use different data-link protocols for Ethernet LANs versus wireless LANs. The network layer focuses on delivering data over the entire path from the original sending computer to the last destination computer and the top two layers focus more on the applications that need to send and receive data.

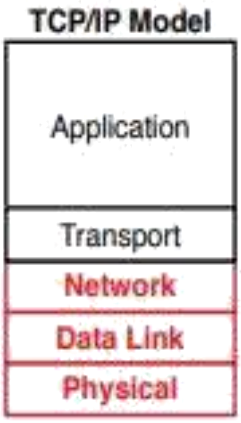

Figure 2.2. TCP/IP Model

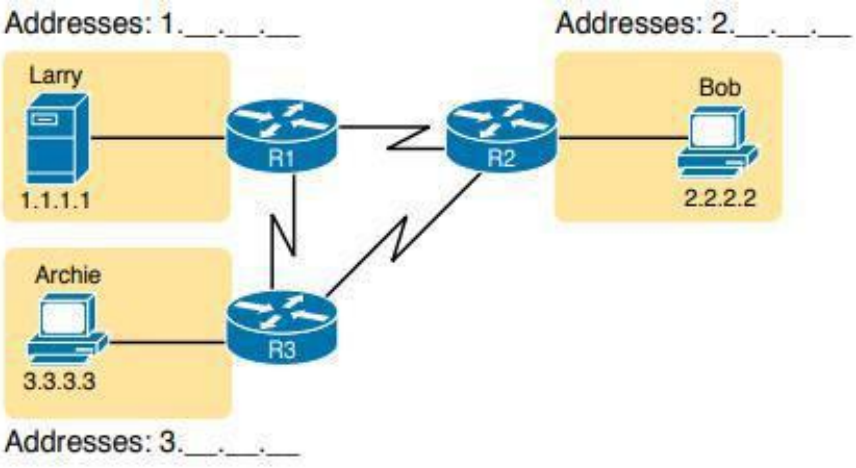

Figure 2.3. Sample Network Design using three routers

Figure 2.4. Versatile Routing Platform (VRP) of Huawei

CHAPTER 3

Network Design, Technical Specifications, and Results

Technical Specifications of Huawei Network Devices

The network components used for the network design of Local Area Network (LAN) Design of On-Premises Network Infrastructure for Mineski Infinity Internet Cyber Café Marikina Branch are any of the following: Huawei Campus WLAN, Data Center Switches, Edge Routing: AR G3, Core Routing: NE Products, Security Products. These components are based on the datasheets provided by Huawei. The proposed network design is combination of Huawei Campus WLAN, Data Center Switches, Edge Routing: AR G3, Core Routing: NE Products, Security Products to give efficient and reliable internet services for gamers and clients.

CloudEngine S6730-S Series Switches

Huawei CloudEngine S6730-S series full-featured 10 GE switches are Huawei's new generation fixed switches to provide 10GE downlink ports as well as 40GE uplink ports. Huawei CloudEngine S6730-S can be used to provide high-speed access for 10 Gbit/s access to high-density servers or function as a core/aggregation switch on a campus network to provide 40 Gbit/s rate. In addition, S6730-S provides a wide variety of services, comprehensive security policies, and various QoS features to help customers build scalable, manageable, reliable, and secure campus and data center networks.

Figure 3.1. Physical Appearance of Huawei CloudEngine S6730-S Series Switches

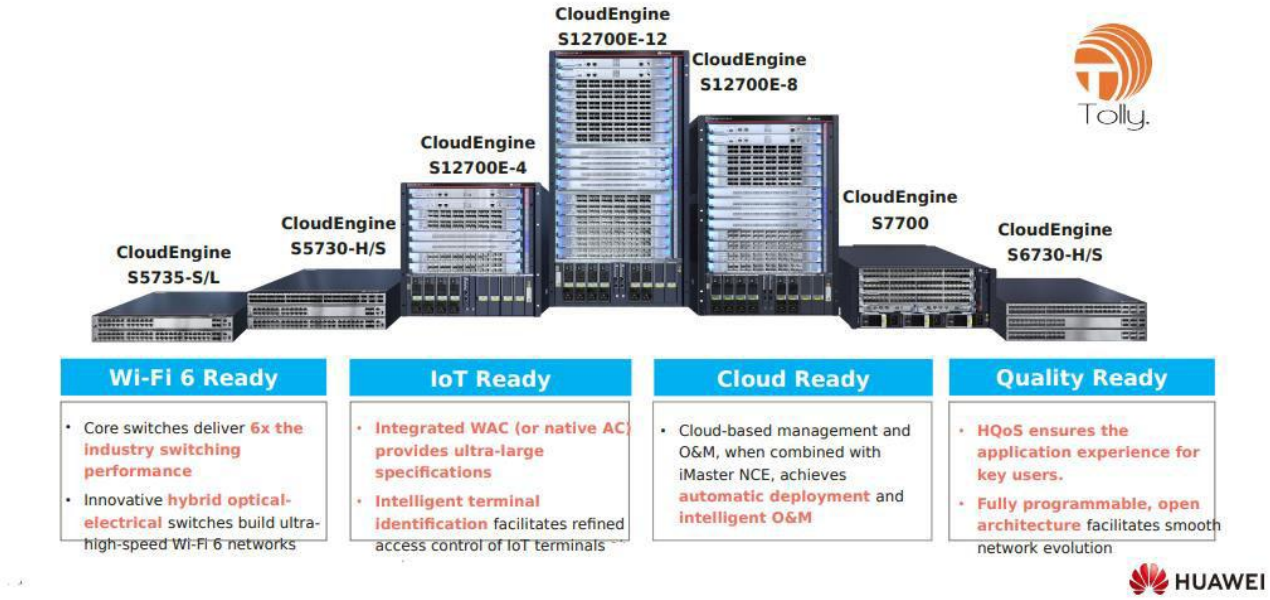

Figure 3.2. Huawei CloudEngine S Series Switches Family

Huawei AirEngine 8760-X1 (Campus WLAN)

Huawei AirEngine 8760-X1-PRO is a next-generation flagship indoor access point (AP) that complies with the Wi-Fi 6 (802.11ax) standards. This high-performance AP supports flexible switching among three modes: dual-radio, triple-radio, and dual-radio + one scanning radio* , achieving a device rate of up to 10.75 Gbps. The AP uses built-in smart antennas to move Wi-Fi signals with users, significantly enhancing users' wireless network experience. The AP provides uplink optical and electrical ports, allowing customers to select different deployment modes based on scenarios. These strengths make AirEngine 8760-X1-PRO ideal for scenarios such as enterprise office, government, higher education, and primary/secondary education. The AP supports a maximum of 16 spatial streams: four spatial streams for the 2.4 GHz radio and 12 spatial streams for 5 GHz radios. UL/DL MU-MIMO technology enables an AP to send data to multiple STAs simultaneously, which doubles the radio spectrum resource usage, increases the number of access users and bandwidth, and improves user experience in high-density access scenarios.

The AP provides 160 MHz bandwidth, signifying many more available data subcarriers and extending the signal transmission channel. In addition, the AP adopts 1024-QAM and MU-MIMO technologies, increasing the rate of 5 GHz radios up to 9.6 Gbps. The AP rate can reach 10.75 Gbps for the device. The AP provides dual 10GE ports, dual PoE power supplies, and dual-link redundancy backup, achieving a much stable device performance. In addition, the AP provides a 10GE SFP+ uplink port, which frees users from the optical/electrical port selection issue and helps implement flexible networking in scenarios requiring internal/external network isolation and hybrid networking of optical/electrical ports.

The AP supports a maximum of 16 spatial streams: four spatial streams for the 2.4 GHz radio and 12 spatial streams for 5 GHz radios. UL/DL MU-MIMO technology enables an AP to send data to multiple STAs simultaneously, which doubles the radio spectrum resource usage, increases the number of access users and bandwidth, and improves user experience in high-density access scenarios. The AP equipped with the dual-band smart antenna array and intelligent switchover algorithm can intelligently detect the application environment and access density, achieving more accurate signal coverage and interference suppression. In addition, each smart antenna has four elements that are controlled by a high-frequency electronic switch to achieve better performance. This design helps provide the optimal signal coverage direction and signal q

Figure 3.3. Huawei AirEngine 8760-X1- PRO Access Point

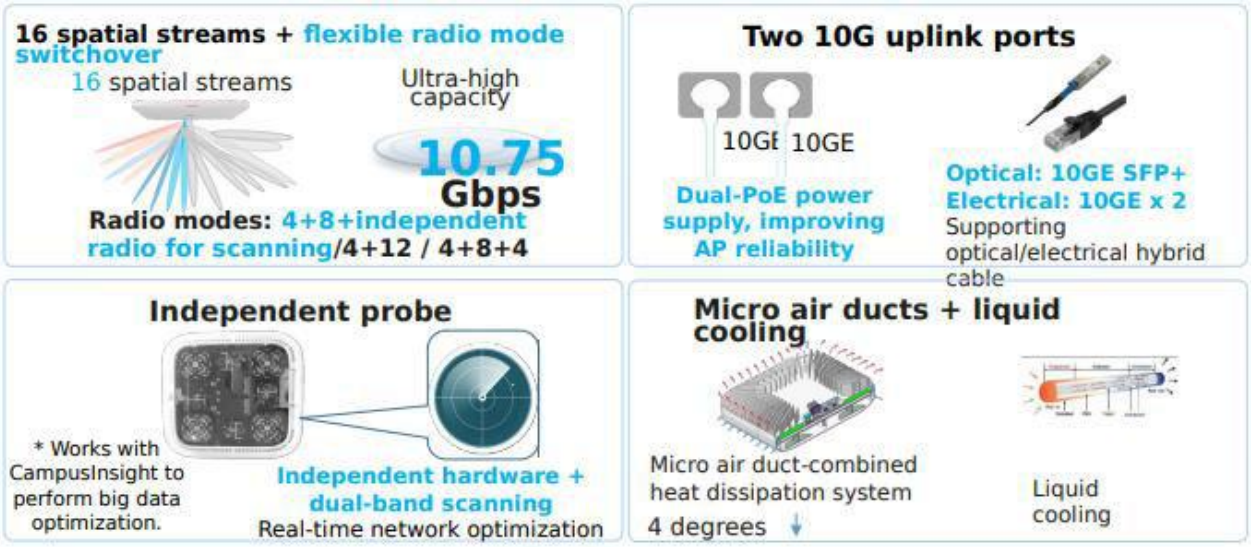

Figure 3.4. Huawei AirEngine 8760-X1- PRO Access Point Overview and Features

Huawei NetEngine AR Series Enterprise Routers

The Mineski Infinity Campus branch needs Huawei's next-generation NetEngine AR6000 series enterprise routers use high-performance multi-core processors and a nonblocking switching structure, helping to deliver higher forwarding performance than the industry average. The NetEngine AR6000 also integrates functions such as SD-WAN, 5G, routing, switching, VPN, voice, security, and MPLS, ensuring diversified and cloud-based services are fully supported. Huawei NetEngine AR6000 series enterprise routers can be deployed at enterprise headquarters or branches as required to provide enterprise network egress capabilities. The NetEngine AR6000 series consists of models such as NetEngine AR6120, NetEngine AR6120-VW, NetEngine AR6121, NetEngine AR6121E, NetEngine AR6140-9G-2AC, NetEngine AR6140E-9G-2AC, NetEngine AR6140-16G4XG, NetEngine AR6280, and NetEngine AR6300, which can meet networking requirements of enterprises of different scales.

The features and benefits of Huawei NetEngine AR Series Enterprise Routers are Multi-core processors and a non-blocking switching structure, higher forwarding performance than the industry average, providing the low latency for key services, the NetEngine AR6280/6300: CPU + NP heterogeneous forwarding, and eliminating service processing bottlenecks. Integration of functions such as routing, switching, VPN, security, WLAN, meeting diversified enterprise service requirements, saving space, and reducing TCO. Built-in firewall, IPS, URL filtering, and multiple VPN technologies, providing comprehensive security protection capabilities.

Figure 3.5. Physical Appearance of Huawei NetEngineAR6140

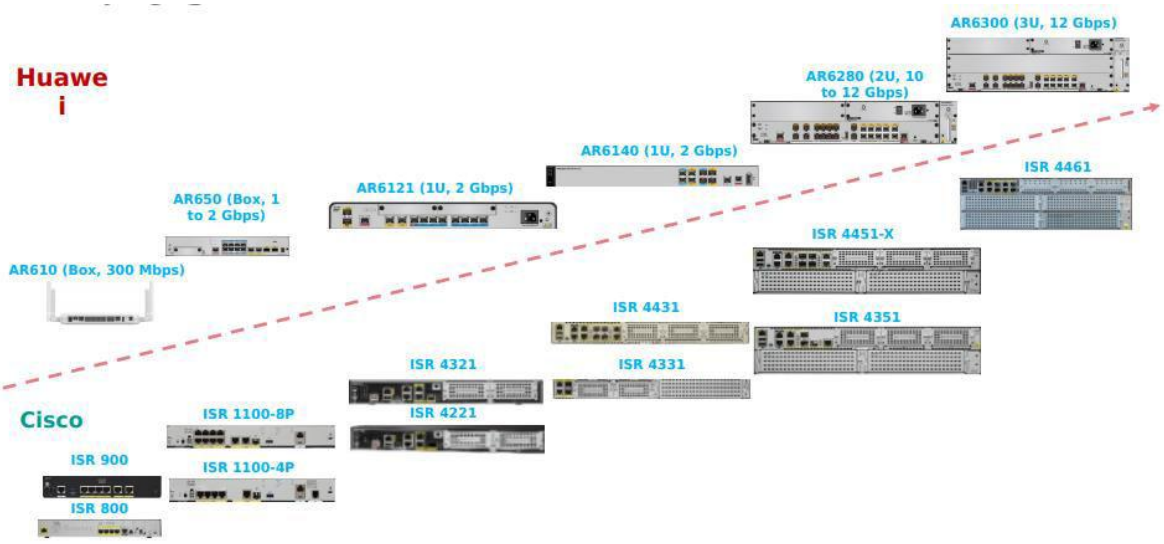

Figure 3.6. Comparison and Equivalency of Network Devices of Cisco and Huawei

Core Routing: NE Routers

The NetEngine 9000 series are large-capacity, high-reliability, energy-efficient routers designed to meet interconnection requirements in the cloud era. NetEngine 9000 series routers serve as core nodes on large Data Center Interconnect (DCI) networks, large enterprise networks, and metro networks, and as super-core nodes on carriers' backbone networks. The NetEngine 9000 series routers are the industry's largest petabit-capacity routers. They feature non-blocking switching technologies based on the CLOS distributed switching architecture, which deliver excellent line-speed forwarding performance. The NetEngine 9000 series routers can be used in a wide range of Software-Defined Networking (SDN) applications, such as real-time traffic optimization, IP + optical synergy, and DCI E2E service provisioning. With a continuously improving industry-leading platform, a well-designed Quality of Service (QoS) mechanism, and carrier-class reliability, NetEngine 9000 is well-equipped to take on interconnection challenges facing backbone networks now and in the future.

Figure 3.7. Physical Appearance of NE 9000 Core Router

Figure 3.8. Benefits of Huawei Core Routers

Huawei Security Firewall USG Series

Huawei HiSecEngine USG6500E series fixed-configuration next-generation firewalls are enterprise-class firewalls designed for small and medium-sized enterprises and chain organizations. In addition to basic NGFW capabilities, the HiSecEngine USG6500E series can interwork with other security devices to proactively defend against network threats, enhance border detection capabilities, effectively defend against advanced threats, and resolve performance deterioration problems. The product provides pattern matching and accelerated encryption and decryption service processing, which significantly improves the performance of processing content security detection and IPSec services.

With the continuous digitalization and cloudification of enterprise services, networks play an important role in enterprise operations, and must be protected. Network attackers use various methods, such as identity spoofing, website Trojan horses, and malware, to initiate network penetration and attacks, affecting the normal use of enterprise networks. Deploying firewalls on network borders is a common way to protect enterprise network security. However, firewalls can only analyze and block threats based on signatures. This method cannot effectively handle unknown threats and may deteriorate device performance. This single-point and passive method does not pre-empt or effectively defend against unknown threat attacks. Threats hidden in encrypted traffic in particular cannot be effectively identified without breaching user privacy. Huawei's next-generation firewalls provide the latest capabilities and work with other security devices to proactively defend against network threats, enhance border detection capabilities, effectively defend against advanced threats, and resolve performance deterioration problems. The product provides pattern matching and encryption/decryption service processing acceleration functions, which greatly improve the firewall ability to process content security detection and IPSec services.

Figure 3.9. Physical Appearance of Huawei Security Firewall USG6500E

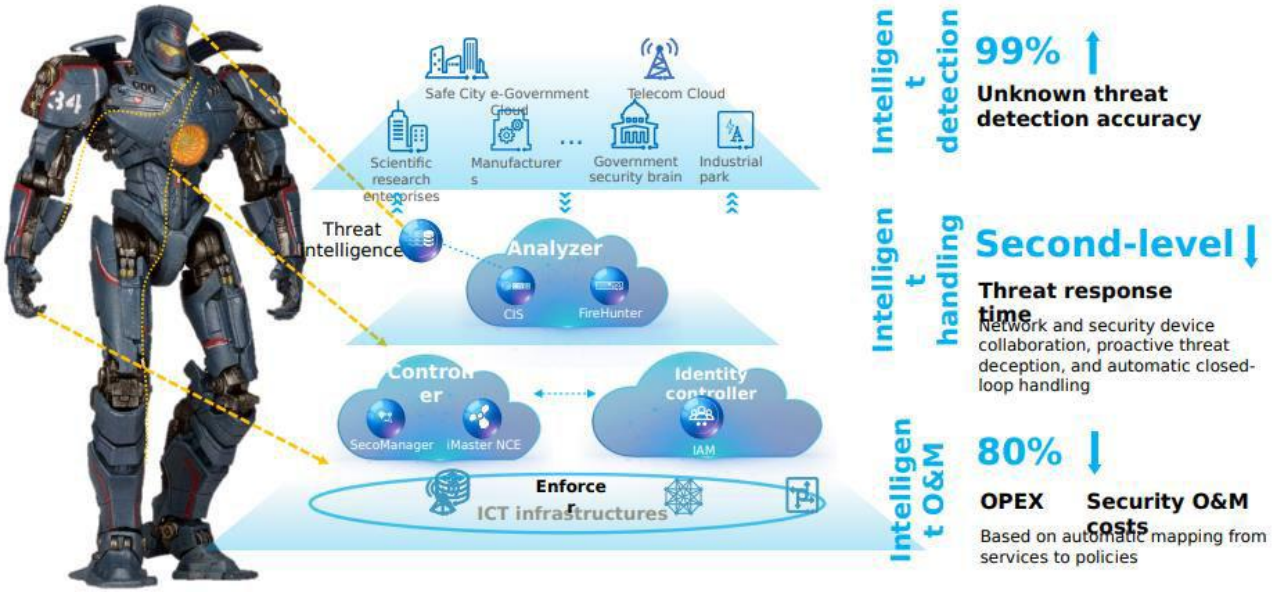

Figure 3.10. Benefits of Huawei Security Products

IP Addressing Planning and Subnetting

To begin with the basics of IP Address/Addressing, the IP address is a logical address for the network layer of the host connected to the network. Note that each interface of the host has an IP address, and if a host has two interfaces connected to two different networks, it will have two different IP addresses with one for each interface. The host may also have an address for a logical interface, which is different from a physical interface. As an example, most devices on a network will have a logical interface configured as a loop back interface. This is purely a logical interface with no physical interface mapping. This is done to identify the device on the network through the logical interface, as that interface would never go down as long as any one interface on the device is connected to the network and the TCP/IP stack on the device works normally.

Host and Network Requirements

In this method, the students determined the number of hosts or the largest segment in the network need for the network design of accounting and administrative office. The number of hosts will determine the number of segments available in the network. In this matter, the number of subnets will determine also from the number of segments by using the formulas. The computers, routers, switches, IP phones, and firewalls are counted to the number of hosts/segments. The network design is suitable with Class C network number (192.168.1.0) and have 4 bits requirements for host addresses and 3 bits for the subnets.

Determination of total number of networks:

S = 4 (subnet bits)

2^{S} **= 16 subnets**

Hence, the total number of subnets is 16 but the needed for hosts is 14 subnets.

Determination of total number of hosts on the largest segment:

H = 4 host bits

$2^{H} - 2$ **= 14 hosts**

Hence, the total number of hosts is 14.

Determination of number of host bits for Class C network addresses:

Formula: S + H

Where S is equal subnets bits while H is equal to 4 host bits.

S + H <= 4 + 4 = **8 host bits**

Hence, the total number of host bits is greater than or equal to 8.

Determination of Subnet Masks

To determine the networking and subnet masks, the default number for Class C network is 24. At this point, the total number of network bits added to the default number of Class C network which is 28. For the Class C masks, the first 24 bits are set to 1. The mast at least begins with 255.255.255. Therefore, the subnet mask for Class C network 192.168.1.0 is 255.255.255.240 or 192.168.1.0/28. In Table 3.6. served as guide in number of valid subnet masks depends on network requirements.

Subnet Mask	Networking Bits	Number of Subnets	Number of Hosts per Subnet
255.255.255.252	/30	64	2
255.255.255.248	/29	32	6
255.255.255.249	/28	16	14
255.255.255.224	/27	8	30
255.255.255.192	/26	4	62
255.255.255.128	/25	2	126
255.255.255.0	/24	1	254

Table 3.1. Valid Subnet Masks for Class C Networks

Determination of Host and Directed Broadcast Addresses

The directed broadcast of a subnet is one number less than the next network number. The broadcast address has all of its host bits in the subnet set to binary of 1s. In Table 3.7. the highest possible value is 255 bytes. To complete the addressing in 192.168.1.0, recall the address between network address and directed broadcast address shown in Table 3.8.

Network Address	Mathematics	Directed Broadcast Address
192.168.1.0	16-1	192.168.1.15
192.168.1.16	32-1	192.168.1.31
192.168.1.32	48-1	192.168.1.47
192.168.1.48	64-1	192.168.1.63
192.168.1.64	80-1	192.168.1.79
192.168.1.80	96-1	192.168.1.95
192.168.1.96	112-1	192.168.1.111
192.168.1.112	128-1	192.168.1.127
192.168.1.128	144-1	192.168.1.143
192.168.1.144	160-1	192.168.1.159
192.168.1.160	176-1	192.168.1.175
192.168.1.176	192-1	192.168.1.191
192.168.1.192	208-1	192.168.1.207
192.168.1.208	224-1	192.168.1.223
192.168.1.224	240-1	192.168.1.239
192.168.1.240	-	192.168.1.255

Table 3.2. Network and Directed Broadcast Addresses for 192.168.1.0/28

Network Address	Host Address	Directed Broadcast Address
192.168.1.0	192.168.1.1-192.168.1.14	192.168.1.15
192.168.1.16	192.168.1.17-192.168.1.30	192.168.1.31
192.168.1.32	192.168.1.33-192.168.1.46	192.168.1.47
192.168.1.48	192.168.1.49-192.168.1.62	192.168.1.63
192.168.1.64	192.168.1.65-192.168.1.78	192.168.1.79
192.168.1.80	192.168.1.81-192.168.1.94	192.168.1.95
192.168.1.96	192.168.1.91-192.168.1.110	192.168.1.111
192.168.1.112	192.168.1.113-192.168.1.126	192.168.1.127
192.168.1.128	192.168.1.129-192.168.1.142	192.168.1.143
192.168.1.144	192.168.1.145-192.168.1.158	192.168.1.159
192.168.1.160	192.168.1.161-192.168.1.174	192.168.1.175
192.168.1.176	192.168.1.177-192.168.1.190	192.168.1.191
192.168.1.192	192.168.1.193-192.168.1.206	192.168.1.207
192.168.1.208	192.168.1.209-192.168.1.222	192.168.1.223
192.168.1.224	192.168.1.225- 92.168.1.236	192.168.1.239
192.168.1.240	192.168.1.241-192.168.1.234	192.168.1.255

Table 3.3. IP Addressing for 192.168.1.0/28 that can be use in Network Design

Network Design

In Figure 3.11. shown the full view of first portion of overall network design created by the students for the Local Area Network (LAN) Design of On-Premises Network Infrastructure for Mineski Infinity Internet Cyber Café Marikina Branch. The network equipment used for this design are combination of Huawei Campus WLAN, Data Center Switches, Edge Routing: AR G3, Core Routing: NE Products, Security Products to give efficient and reliable internet services for gamers and clients. These components are based on the datasheets provided by Huawei. The proposed network design is combination of core network and local area network that gave efficient solution among clients. While the figures 3.12. and 3.13. shown the first and second network designs in full view.

The 1st network design in Figure 3.11. gave the full solution to two gaming stations that cater gamers and clients which needs internet connectivity and telephony to be able to communicate with other networks and backbone or core network of On-Premises Network Infrastructure. While the 2nd network design that shows in Figure 3.12., gave the implementation to the gaming station, administrator's workstation, and the network engineers' station. The Network Engineers' station serves as the maintenance engineers to the core routers or the backbone network that connected to other branches of Mineski Inifinity and Internet Service Provider. This solution with Enhanced Interior Gateway Routing Protocol (EIGRP) is an advanced distance-vector routing protocol that is used on a computer network for automating routing decisions and configuration. The protocol was designed by Cisco Systems as a proprietary protocol, available only on Cisco routers. Functionality of EIGRP was converted to an open standard in 2013 and was published with informational status as RFC 7868 in 2016. EIGRP is used on a router to share routes with other routers within the same autonomous system. Unlike other well known

routing protocols, such as RIP, EIGRP only sends incremental updates, reducing the workload on the router and the amount of data that needs to be transmitted and helps to communicate effectively in local and international web conference without delay, jitter, and latency. In Figure 3.14. shows the full floor plan of Local Area Network (LAN) Design of On-Premises Network Infrastructure for Mineski Infinity Internet Cyber Café Marikina Branch. The server room in the floor plan served as the central office of the networks and gateway to core network/backbone network connected to the computer components to deliver analog telephony, digital telephony, and internet connectivity. The Figures 3.14. and 3.15., shows the different architectural perspectives to fully understand the application of networks to the real environment of Internet Café.

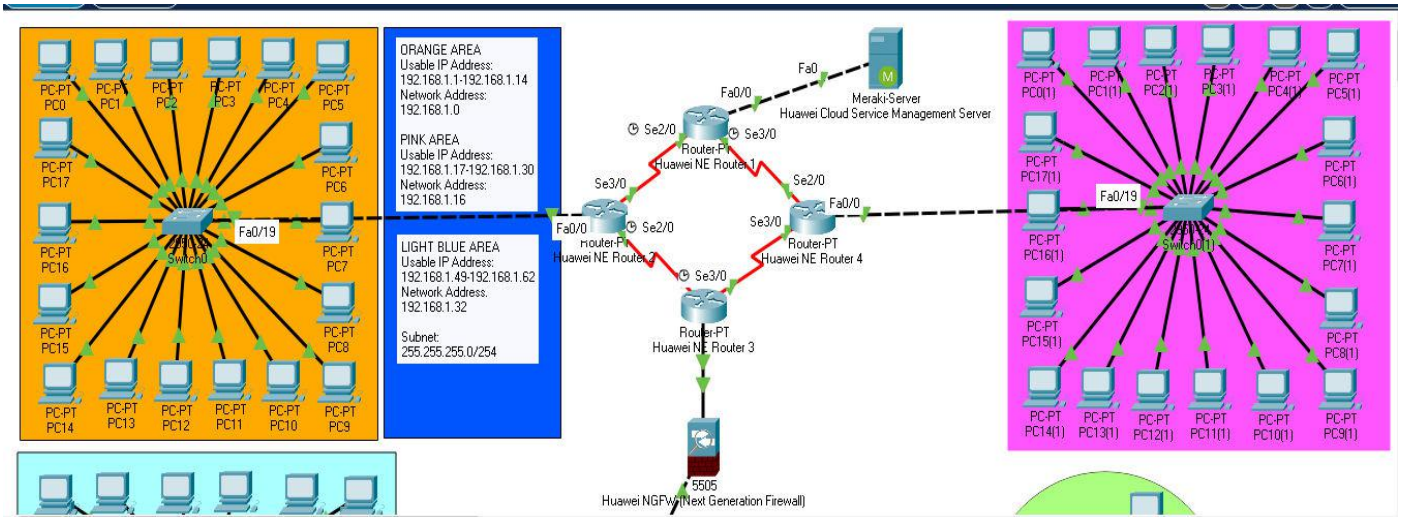

Figure 3.11. First portion of Overall Network Design

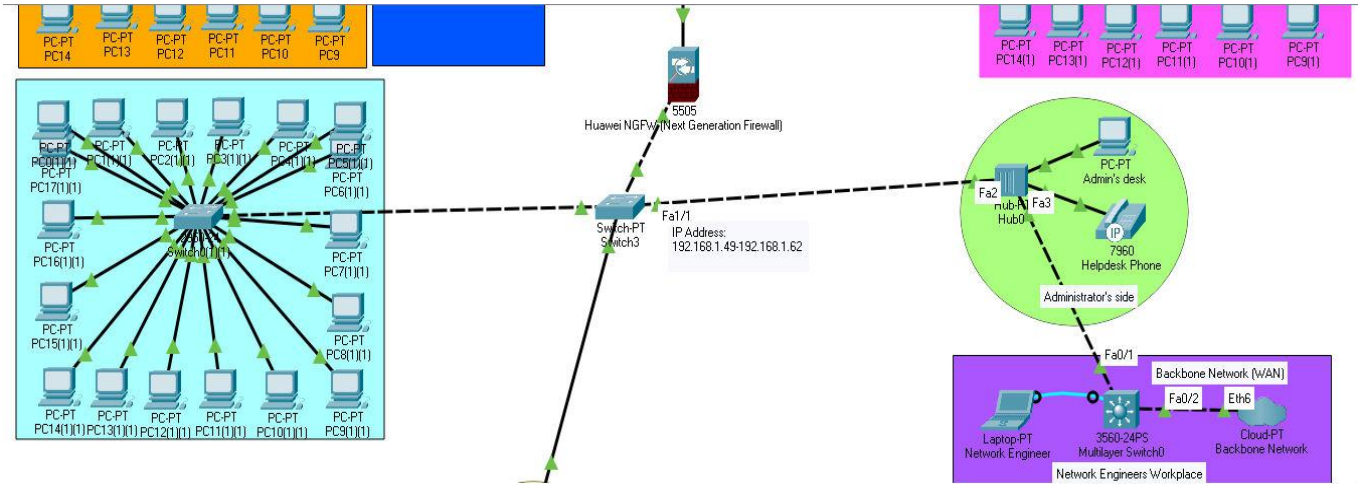

Figure 3.12. Second Portion of Overall Network Design

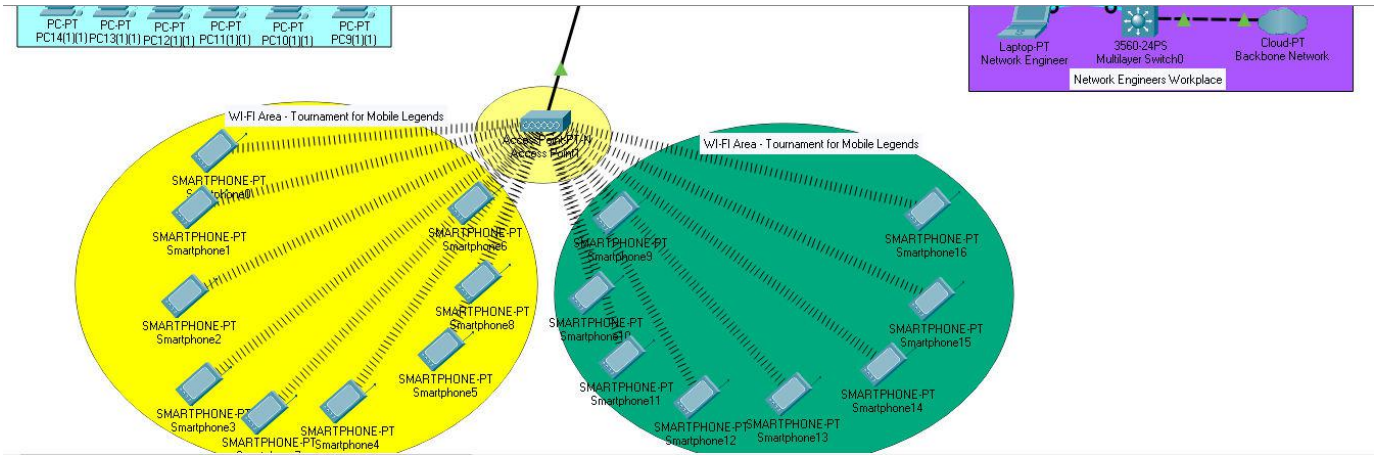

Figure 3.13. Third Portion of Overall Network Design

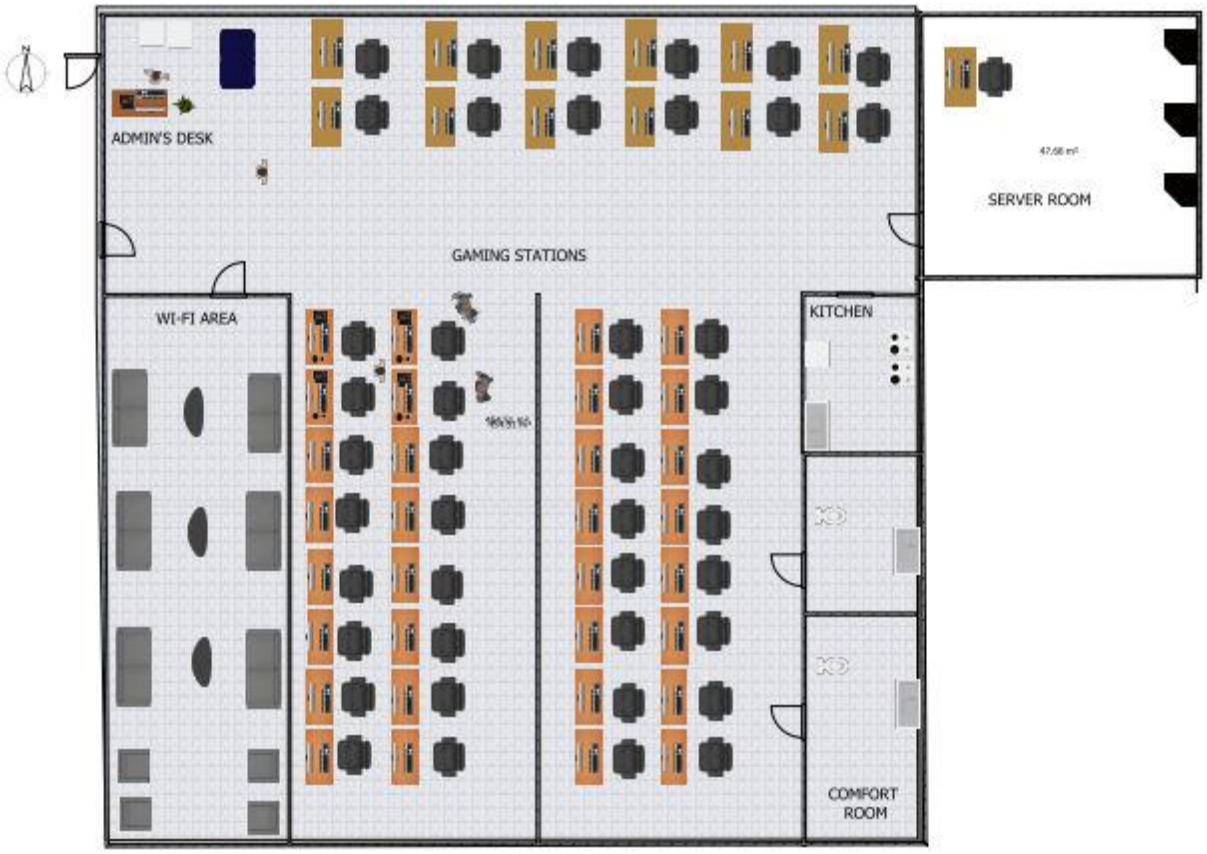

Figure 3.14. Floor Plan of Mineski Infinity Internet Cafe

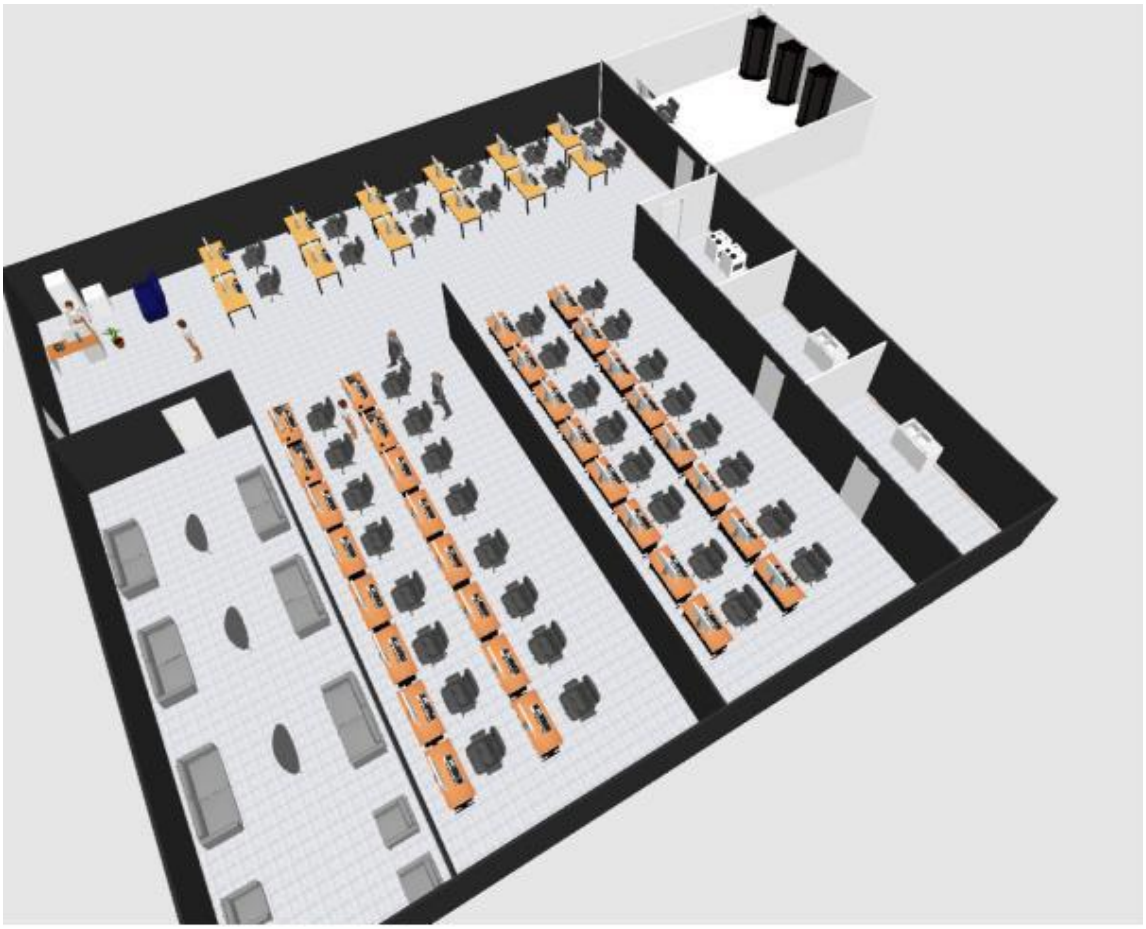

Figure 3.15. 3D Interior Design of Mineski Infinity Internet Cafe

CHAPTER 4

Conclusion

Therefore, we conclude that network design interface together with advance routing, switching, digital IP telephony of Voice over Internet Protocol (VoIP) technology is effective and efficient for gaming purposes. EIGRP (Enhanced Interior Gateway Routing Protocol) and OSPF (Open Shortest Path First) are two common Interior Gateway Protocols (IGP) specifying how routers or data switches communicate with each other. They are often applied in different situations for varied performance on speed, delay, and latency.

Huawei has been dedicated to developing the Versatile Routing Platform (VRP) for the last 10-plus years to provide improved IP routing services. The VRP has been widely applied to Huawei IP network devices, including high-end and low-end switches and routers. As network convergence and IP orientation develop, the VRP has also been applied to wireless and transmission devices, such as the Gateway GPRS Support Node (GGSN) and Serving GPRS Support Node (SGSN) wireless devices and the multi-service transmission platform (MSTP) and packet transport network (PTN) transmission devices.

EIGRP is a popular choice for routing within small and big campus networks. While OSPF is the best choice when your network hardware devices come from various vendors. In addition, If you are using MPLS as the WAN technology, OSPF is also a better option as it has MPLS traffic engineering support with CSPF (Constrained Shortest Path First). By the power of Huawei devices, the students can design Versatile Routing Platform (VRP) for new Mineski Infinity Internet Café located at Marikina.

CHAPTER 5

Appendices

Appearance	Description
 CloudEngine S6730-S24X6Q	• 24 x 10 Gig SFP+, 6 x 40 Gig QSFP+ • Dual pluggable power modules, 1+1 power backup • Forwarding performance: 490Mpps • Switching capacity: 960Gbps/2.4Tbps NOTE The value before the slash (/) refers to the device's switching capability, while the value after the slash (/) means the chip's switching capability.

Figure 5.1. Technical Specification of Huawei CloudEngine S series

Item	Description
WLAN features	Compliance with IEEE 802.11ax and compatibility with IEEE 802.11a/b/g/n/ac/ac Wave 2 Flexible switchover between triple-radio and dual-radio modes, 16 spatial streams, providing up to 10.75 Gbps Maximum ratio combining (MRC) Space time block code (STBC) Cyclic Delay Diversity (CDD)/Cyclic Shift Diversity (CSD) Beamforming

Figure 5.2. Technical Specification of Huawei AirEngine 8760-X1- PRO Access Point

 NetEngine AR6120/AR6120-VW	• Forwarding Performance: 2 Gbps • Fixed WAN ports: 1*GE Combo, 1*GE RJ45, 1*10GE SFP+ (compatible with GE SFP) • Fixed LAN ports: 8*GE RJ45 (can be configured as WAN) • DSP: 64 channels supported (AR6120-VW support) • WiFi: compliance with 802.11b/g/n/ac (AR6120-VW support) • Dimensions (H x W x D): 44.5mm × 390mm × 232.5mm
 NetEngine AR6121/ AR6121E	• Forwarding Performance: 2 Gbps • Fixed WAN ports: 2*GE Combo, 1*10GE SFP+ (compatible with GE SFP) • Fixed LAN ports: 1*GE Combo, 8*GE RJ45 (can be configured as WAN) • Dimensions (H x W x D): 43.6mm × 442mm × 220mm
	• Forwarding Performance: 2 Gbps • Fixed WAN ports: 2*GE RJ45, 2*GE SFP • Fixed LAN ports: 2*GE SFP, 3*GE RJ45 (can be configured as WAN) • Dimensions (H x W x D): 44.5 mm x 442 mm x 420 mm

Figure 5.3. Technical Specification of Huawei NetEngine AR6000 Series Enterprise Router

What have I learned?

Bryan C. Dimabayao

"As a Network Engineer, I applied routing and switching protocols to Huawei Network equipment. I have been learned many techniques on how to design a network with public switched telephone network (PSTN) and Voice over Internet Protocol (VoIP). I had work experience, certifications, and skills to make a network design, the design of network requires a close analysis of balanced costs, security, speed, topology, scalability, reliability, and availability. Every network is different, and the solution of the design will be unique for each situation. EIGRP (Enhanced Interior Gateway Routing Protocol) and OSPF (Open Shortest Path First) are two common Interior Gateway Protocols (IGP) specifying how routers or data switches communicate with each other. They are often applied in different situations for varied performance on speed, delay, and latency."

John Michael V. Absalon

"Computers and information networks are critical to the success of businesses, both large and small. They connect people, support applications and services, and provide access to the resources that keep the businesses running. To meet the daily requirements of businesses, networks themselves are becoming quite complex. There are multiple types of network which provide efficient connection between devices and computers for sharing files or data, or simply executing tasks. These various types of network are made to cater to needs depending on the size, security, architecture and number of devices involved in the network. One of these networks is LAN. It is one of the most popular networks and many of the networks are built on

its basis. This network provides efficient communication and internet services to its users. The process of designing a good network requires concerted efforts by network designers and technicians, who identify 39 network requirements and select the best solutions to meet the needs of a business. The four fundamental technical requirements of network design are scalability, availability, security, and manageability."

Peeven G. Layug

"The best transmission line for very high-speed data or wide bandwidth is a glass fiber. It is often difficult to view the glass fiber as a transmission line because the signals within the fiber are not electrical but light waves. But, light waves are electromagnetic waves just like radio. The glass fiber has characteristics exactly like a wire transmission line. However, the transmission rate is generally higher. Many computer communications applications require a "wireless" communications medium. Of course, in modern terminology it must be understood that wireless also implies "fiber optic-less." Clearly this is the only communications solution for portable and vehicle-mounted devices. Wireless transmission is accomplished through electromagnetic waves, radio, and light. These electromagnetic waves require no physical medium because they are able to flourish through a vacuum better than through any substance. In fact, wireless signals can be partially blocked by common building materials causing difficulties with wireless systems used indoors."

Reynier Noel C. Servidad

"The key technology of the information age is communications. Data communications and networking is a truly global area of study, both because the technology enables global communication, and because new technologies and applications often emerge from a variety of countries and spread rapidly around the world. The movement of computer information from one point to another by means of electrical or optical transmission systems. Such systems are often called data communications networks. Cisco Packet Tracer as the name suggests, is a tool built by Cisco. This tool provides a network simulation to practice simple and complex networks. As Cisco believes, the best way to learn about networking is to do it. The main purpose of Cisco Packet Tracer is to help students learn the principles of networking with hands-on experience as well as develop Cisco technology specific skills. Since the protocols are implemented in software only method, this tool cannot replace the hardware Routers or Switches. Interestingly, this tool does not only include Cisco products but also many more networking devices. Using this tool is widely encouraged as it is part of the curriculum like CCNA, CCENT where Faculties use Packet Trace to demonstrate technical concepts and networking systems. Students complete assignments using this tool, working on their own or in teams.

Engineers prefer to test any protocols on Cisco Packet Tracer before implementing them. Also, Engineers who would like to deploy any change in the production network prefer to use Cisco Packet Tracer to first test the required changes and proceed to deploy if and only if everything is working as expected. This makes the job easier for Engineers allowing them to add or remove simulated network devices, with a Command line interface and a drag and drop user interface. By familiarizing with the interface and commands of the Cisco Packet Tracer and by learning to

navigate through the software, it is easy for us to construct a simple system of network that showcases the data communication within the components. The configuration of the interfaces challenges us to be more knowledgeable about the uses of the components and to make them communicate with each other. The basics of the packet tracer are taught with a step-by-step instructions that allow us to understand more about the functions of the components and about the utilization of such for the network building processes."

Claire Danielle Celestra

"I've learned that Data communications and networking is a truly global area of study, both because the technology enables global communication, and because new technologies and applications often emerge from a variety of countries and spread rapidly around the world allows businesses to reduce expenses and improve efficiency by sharing data and common equipment among many different computers. At the same time, the network may be connected through cables, telephone lines, infrared beams, which is cheaper and helps to reduce the expenses."

References

Frenzel L. (1995). Communication Electronics. McGraw Hill School International Publishing.

Tomasi W. (2004). Electronic Communications Systems: Fundamentals through Advance (5th ed.). Pearson Education.

Odom W. (2020). CCNA 200-301 Official Cert Guide. Cisco Press.

Lammie T. (2020). CompTIA Network+ Study Guide: Exam N10-007. CompTIA Press.

RESUMES/CV

INFORMATION
NAME: *Bryan C. Dimabayao*

ADDRESS: *Blk 7 Lot 13, St. Claire Street, Ismael Parkhomes Subdivision, Ampid 1, San Mateo, Rizal*

PHONE: *(+63)9158146918*

LINKEDIN:
www.linkedin.com/in/bryandyao

GITHUB:
www.github.com/brianxfury

EMAIL:
dimabayaobryan@gmail.com
dimabayaobryan@hotmail.com

DATE OF BIRTH: *January 24, 1997*

CITIZENSHIP: *Filipino*

Verify his industry recognized professional IT Certifications with credential ID here:
www.youracclaim.com/users/bryan-dimabayao
www.credential.net/profile/bryandimabayao/wallet

Bryan C. Dimabayao

Network Engineer

***ICSI CNSS, Aviatrix Certified Engineer-Multi-Cloud Network Associate, CSFPC, ZCNP Switching, ZCNP Security, ZCNP Wireless LAN, CIPPE, GCS, ZCNP Nebula Cloud, ZCNP LTE, ZCNP VoIP, ZCNP Foundation,* Google IT Support Professional, HCSA-IP Network**

CAREER OBJECTIVE:
To utilize my IT technical, telecommunications engineering, and management skills for achieving the goal and striving the best performance. I would like to implement my innovative ideas, skills, and creativity for accomplishing the projects.

PROFESSIONAL LICENSES/CERTIFICATIONS

- **Huawei Certified Specialist Associate (HCSA) – IP Network**
  Huawei | *Certification Issued: May 19, 2021 - May 19, 2023*
- **Alibaba Cloud Networking Engineer Specialty Certified**
  Alibaba Cloud | *Certification Issued: January 24, 2021*
- **Google IT Support Professional Certified**
  Google | *Certification Issued: February 13, 2021*
- **Yealink Junior Certified IP Phone Engineer (CIPPE)**
  Yealink | *Certification Issued: November 9, 2020 – November 9, 2022*
- **Grandstream Certified Specialist (GCS) – Unified Communications Solutions**
  Grandstream Networks | *Certification Issued: Nov 13, 2020 – Nov 13, 2021*
- **Zyxel Certified Network Professional (ZCNP) Nebula Cloud**
  Zyxel Communications | *Certification Issued: January 10, 2021*
- **Zyxel Certified Network Professional (ZCNP) Voice over Internet Protocol**
  Zyxel Communications | *Certification Issued: October 30, 2020*
- **Zyxel Certified Network Professional (ZCNP) LTE**
  Zyxel Communications | *Certification Issued: October 10, 2020*
- **Zyxel Certified Network Professional (ZCNP) Wireless LAN**
  Zyxel Communications | *Certification Issued: September 28, 2020*
- **Zyxel Certified Network Professional (ZCNP) Switching**
  Zyxel Communications | *Certification Issued: September 24, 2021*
- **Zyxel Certified Network Professional (ZCNP) Security**
  Zyxel Communications | *Certification Issued: September 24, 2020*
- **Aviatrix Certified Engineer – Multi-Cloud Network Associate**
  Aviatrix® Systems | *Certification Issued: June 30, 2020 – June 30, 2023*
- **ICSI Certified Network Security Specialist (CNSS)**
  International Cybersecurity Institute, UK | *Certification Issued: May 15, 2020*
- **Cyber Security Foundation Professional Certified (CSFPC)**
  CertiProf® | *Certification Issued: November 23, 2020 – November 23, 2022*

EDUCATION

TERTIARY
Bachelor of Science in Electronics and Communications Engineering,
Two Specializations in Communications Engineering and Cisco Network Administration
Central Colleges of the Philippines | *52 Aurora Blvd., Quezon City*
January 2019 - June 2021
Bachelor of Science in Electronics Engineering
Adamson University | *900 San Marcelino Street, Ermita, Manila*
June 2014 – December 2018

Bryan C. Dimabayao

Network Engineer

***ICSI CNSS, Aviatrix Certified Engineer-Multi-Cloud Network Associate, CSFPC, ZCNP Switching, ZCNP Security, ZCNP Wireless LAN, CIPPE, GCS, ZCNP Nebula Cloud, ZCNP LTE, ZCNP VoIP, ZCNP Foundation,* Google IT Support Professional, HCSA-IP Network**

INFORMATION
NAME: *Bryan C. Dimabayao*

ADDRESS: *Blk 7 Lot 13, St. Claire Street, Ismael Parkhomes Subdivision, Ampid 1, San Mateo, Rizal*

PHONE: *(+63)9158146918*

LINKEDIN:
www.linkedin.com/in/bryandyao

GITHUB:
www.github.com/brianxfury

EMAIL:
dimabayaobryan@gmail.com
dimabayaobryan@hotmail.com

CHARACTER REFERENCES:

Mr. Aaren John N. Aguirre
IT Generalist, 24-7 Intouch Philippines,
(+63)9260813509

Engr. Efren Victor Tolentino Jr., PECE, MSICT
Professional Electronics Engineer – Research Adviser and Professor, Central Colleges of the Philippines,
(+63)9157629447

SECONDARY SCHOOL
Nuestra Señora de Aranzazu Parochial School
General Luna Street, Guitnangbayan I, San Mateo, Rizal
2009-2013

WORK EXPERIENCE

Jr. Network Engineer
Questronix Corporation | *Employment Status: Full-time*
178 Yakal Street, Makati City
May 2021 - Present
• Ensure 99.999% Network uptime and manage Telco escalations.
• Maintain SLA on the availability of Network Infrastructure.
• Handle and manage Campus and Branch Network Equipment.
• Manage Wi-Fi and fixed lines and ensure stability and usage are compliant to security standards.
• Manage Telephony routers and equipment.

Information Technology/Network Support Engineer
24-7 Intouch Philippines Inc. | *Employment Status: Internship*
10th Floor, Cyberpark Tower 1, 60 Avenue, Cubao, Quezon City
June 2019 - July 2019
• Perform initial network troubleshooting, maintenance, and monitoring of layer 1 devices (LAN/WLAN/Network connectivity issues) from company computers and servers; Provide accurate, timely, and creative solutions; and escalate more complex problems to IT Supervisor and IT Generalists.
• Provides hands-on IT hardware/technical support including Avaya IP Phones/Phone System, Jabra headsets, Cisco VoIP/IP Phones, SAP Software Solutions for Business Operations Application, and G Suite (Google Apps for Work); Perform endpoint security standards (antivirus/firewall/patching/two-factor authentication).
• Handle system access and maintain user accounts, passwords, data integrity & security; Help evaluate hardware and software solutions and participate in IT projects.

GENERAL SKILLS

- *Committed to finish tasks and eager to learn new technology.*
- *A hardworking team player, ability to work within a distributed multi-cultural team environment.*
- *Has positive attitude, honest, and can work effectively under time pressure.*
- *"Can do" attitude and have strong problem solving/analytical skills.*

Bryan C. Dimabayao

Network Engineer

***ICSI CNSS, Aviatrix Certified Engineer-Multi-Cloud Network Associate, CSFPC, ZCNP Switching, ZCNP Security, ZCNP Wireless LAN, CIPPE, GCS, ZCNP Nebula Cloud, ZCNP LTE, ZCNP VoIP, ZCNP Foundation,* Google IT Support Professional, HCSA-IP Network**

INFORMATION
NAME: *Bryan C. Dimabayao*

ADDRESS: *Blk 7 Lot 13, St. Claire Street, Ismael Parkhomes Subdivision, Ampid 1, San Mateo, Rizal*

PHONE: *(+63)9158146918*

LINKEDIN:
www.linkedin.com/in/bryandyao

GITHUB:
www.github.com/brianxfury

EMAIL:
dimabayaobryan@gmail.com
dimabayaobryan@hotmail.com

CHARACTER REFERENCES:

Mr. Aaren John N. Aguirre
IT Generalist, 24-7 Intouch Philippines,
(+63)9260813509

Engr. Efren Victor Tolentino Jr., PECE, MSICT
Professional Electronics Engineer –
Research Adviser and Professor,
Central Colleges of the Philippines,
(+63)9157629447

TECHNICAL SKILLS

- *Network Simulators and Network Security tools: Cisco Packet Tracer, Boson NetSim, Huawei eNSP, PuTTY, SecureCRT, Wireshark, Nessus*
- *Telecom & Network Technologies skills: PTP/PMP Microwave Transmission, PSTN/ISDN, IaaS, SIP/RTP, TCP/IP, VoIP, QoS, VPN IPsec/SSL*
- *Basic Knowledge in Cloud based Networking and Cloud Computing: Microsoft Azure, Amazon Web Services (AWS), Google Cloud Platform, Alibaba Cloud, Oracle Cloud Infrastructure.*
- *Know IP Addressing/Subnetting and Virtualization.*
- *Have experience in writing scripts in Windows PowerShell and Linux Bash/Shell script.*
- *Have software development experience with these programming languages: Perl, Java, Python, and MySQL and dev tools: Git/Github.*
- *Have knowledge in Voice over Internet Protocol, Unified Communications, Public Switched Network Telephony (PSTN) and IP telephony.*
- *Can conduct initial network troubleshooting, maintenance, and monitoring; LAN/WLAN/Network Security/Network connectivity issues; computer hardware troubleshooting.*
- *Have graphic design experience using Microsoft Visio and Adobe Design Suite Software. Proficient in Microsoft Office.*

TRAININGS, SEMINARS, AND CONFERENCES

- **Trainings: CISCO NETWORKING ACADEMY –** CCNA Routing and Switching, CCNA Security, CyberOps Associate, CCNA v7.0 Bridging, Networking Essentials, PCAP: Programming Essentials in Python, NDG Linux Essentials, NDG Linux Unhatched; Intro to Packet Tracer
- **Seminar: "WiFi Networks: Basic Planning and Design",** *Department of Information and Communications Technology (DICT) Republic of the Philippines – December 5, 2020*
- **Seminar: "Introduction to Malware Threats",** *Trend Micro – October 22, 2020*
- **Seminar: "Code Red: Cybersecurity in the Philippines",** *Institute of Electrical and Electronics Engineers Mapúa University Student Branch, Mapúa University, Intramuros, Manila – July 2019*
- **Seminar: "Impact of Emerging Wireless Communications to IOT",** *Institute of Electrical and Electronics Engineers Mapúa University Student Branch, Mapúa University, Intramuros, Manila – July 2019*

AWARDS AND ACHIEVEMENTS

- **One of Outstanding Research Papers in Agricultural Engineering Category**, 7th International Conference on Food and Agricultural Engineering | Hong Kong Chemical, Biological & Environmental Engineering Society (HKCBEES), Nov 2020

Electronics Engineer

John Michael V. Absalon

Professional Goals

I have recently completed a degree in electronics engineering with distinction. Always driving innovation and delivering quality, I am ideally positioned to add value to organizational operations.

Get in touch!

Landline:
02-8-2474938

Mobile:
+639190063438

Email:
johnmichaelabsalon@protonmail.ch

Address:
Unit E-12 Bldg. 7 Bahay Caridad Brgy. Doña Imelda Bayani Street Quezon City

Work Experience

Service Engineer
Noveaulab Asia Corp. | 2018 - 2019

- Calibration of several laboratory equipment.
- Worked closely on preventive maintenance of laboratory equipment,

Academic History

Central Colleges of the Philippines | March 2012 – Present
Bachelor of Science in Electronics and Communications Engineering (BSECE) Student

Dra. Josefa Jara Martinez High School
High School Graduate | 2008 - 2012

Seminars

PIFPO QC Chapter 1st Technical Seminar
Philippine Integrated Fire Protection Organization | 2020

Intellectual Property System
Association of Electronics and Communication Engineering Students – Central Colleges of the Philippines | 2020

Areas of Expertise

- PCB Designing
- Schematic and diagram Designing
- Arduino Programming
- Processing IDE Programming

Other Skills

-The ability to analyze complex technical information
-Can analyze, design
-Excellent problem solver

REYNIER NOEL C. SERVIDAD

815 – JAIME STREET, SAMPALOC, MANILA, 1008
0916 5133986, REYNIER.SERVIDAD12@GMAIL.COM

OBJECTIVE

To acquire more experience in telecommunication industry and further improve myself.

SKILLS

- Communication
- Ability to Work Under Pressure
- Decision Making
- Time Management

EXPERIENCE

PRESS-SCANNER • STELLAR INTL • 2010 - 2013
Gathered data in every medium of advertisements to be stored in our database.

INSTALLER • WSA (WIRELESS SERVICES ASIA) (SUB-CON) • 2016 - 2017
Installation of racks and cabinets for routers and servers

EDUCATION

HIGH SCHOOL • 2002 - 2006 • HOLY TRINITY ACADEMY

ELECTRONICS AND COMMUNICATION ENGINEERING • 2016 - PRESENT • CENTRAL COLLEGES OF THE PHILIPPINES

VOLUNTEER EXPERIENCE OR LEADERSHIP

MERUI (MALMON EMERGENCY RESCUE UNIT INC.)
January 2016 – Present
Volunteer first aid responder in every Black Nazarene Parade.

CLAIRE DANIELLE CELESTRA

ABOUT ME

Date of Birth: August 17, 1997
Age: 23
Gender: Female
Birth Place: Angono, Rizal

CONTACT

#83 Mh. Del Pilar St.
Layunan Binangonan,
Rizal

+639456219129

cdcelestra@gmail.com

SKILLS

Attentive Listening and Effective

Great at Problem Solving

Ability to Quickly Create and Apply Ideas and Solutions

Good Leadership Skills

Critical Thinker

EXPERTISE

Instrumentation and Controls

Building Wiring

Practical Electronics

CAREER OBJECTIVE

I am a Claire Danielle Celestra who aims to be able to find an exciting and challenging entry level position in the Biomedical and Instrumentation industry alongside a company who will continuously motivate and drive me to do my best and improve on my skills and abilities in order to be able to assist the company in achieving its company mission and goals.

ACADEMIC BACKGROUND

2020 - 2021 — **BACHELORS DEGREE**
BS Electronics and Communication Engineering
Central Colleges of the Philippines

2012 - 2013 — **DIPLOMA**
Binangonan Catholic Colleges
Binangonan, Rizal

INTERNSHIPS

2018
Pasig Doctors Medical Center – Biomedical Engineer Intern
Eulogio Amang Rodriguez Ave, Pasig, Metro

CERTIFICATES

- INTRODUCTION TO PROJECT MANAGEMENT — AskLexPH Academy — September 19, 2020
- BECOMING AN INTELLIGENT HOSPITAL:FUTURE OF CONNECTED MEDICAL DEVICES— Drager Webinar— September 1, 2020
- INNOVATEE: BIOMEDICAL ENGINEERING R&D IN THE PHILIPPINES—Henry Sy Bldg, De Lasalle University—March 6,2019

TRAININGS

- INSTRUMENTATION AND CONTROLS NCII—Mfi Polythecnic Institute Inc., F. Ortigas Jr. Road, Pasig City 1600 Metro Manila— July 17, 2019 – July 26, 2020

CHARACTER REFERENCES

Engr. Efren Tolentino
BS ECE, MSICT, MIE
International Biomeical Engineer
Mobile: +63915-762-9447
Email: evntjr@yahoo.com

Engr. Lance Adrian Valdez
Cloud Application Consultant—Opentext
Mobile: +63977-427-2951
Email: lvaldez@opentxt.com

LAYUG, PEEVEN G.

BS ELECTRONICS ENGINEERING

Hardware and Software Proficiency

AutoCAD

C+

JAVA

HTML 5

Microsoft Applications

Objective

To build a long term career in working with industries that is Connected with my specialization. Enhance my educational and professional skills that will help not only the company but also the community.

Accomplished Projects

- Barangay Database
- Simple C+Programs
- Fruit Detector

Member, Institute of Electronics Engineers of the Philippines – Student Edition
2015-2018

Central Colleges of the Philippines 2020

Education

BSElectronics Engineering 2015–2019
FEU Institute of Technology
P. Paredes St., Sampaloc,Manila

BS Electronics Engineering 2019-Present
Central Colleges of the Philippines
52 Aurora Blvd, Quezon City

High School 2011-2015
Sta Monica de Minalin Montessori School
San Nicolas Minalin Pampanga

Personal Information

Address	:	#96 San Nicolas Minalin Pampanga
Mobile	:	09975014007
E-mail	:	layugpg16@gmail.com
Birthday	:	January 16, 1999
Parent	:	Carmela Layug & Reyno Layug