Design Proposal Document for

Waycool College – Packerton

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**Executive Summary**

Our Network Design Proposal aims to revitalize Waycool College's network infrastructure to meet the demands of modern connectivity and enhance the overall user experience on campus. Our approach will have the deployment of 16 switches strategically positioned across the campus to optimize network performance and reliability. Additionally, we propose the installation of 19 wireless access points to ensure seamless coverage and high-speed internet access throughout the campus buildings. The whole project’s total cost will be $214,383.28. With the proper calculations of users and devices across the campus, the network should be maintained well and efficiently for everyone. This comprehensive upgrade is complemented by a redesign of the IP addressing scheme, aligning it with good practices and resolving previous addressing conflicts.

Furthermore, there will be some non-hardware changes implementation of optimizing network configurations to improve the performance and reliability. Our proposal incorporates Quality of Service (QoS) protocols to prioritize critical network traffic, such as VOIP and video conferencing, ensuring consistent and uninterrupted communication across all departments. The implementation of advanced security measures, including 2 firewalls that are in the Main Computer Room building, will safeguard sensitive data, protect against potential cyber threats, and allow users a seamless connection to the internet. Our project differs from other projects by providing a very thorough study in understanding that Waycool College needs a comprehensive upgrade to their existing network and changing many different things such as the IP addressing scheme, upgrading the equipment’s, and ensuring that with the upgrades, there will be high performance and reliability. In addition, our team can provide on-site support and documentation to teach Waycool College's IT staff to ensure seamless integration and efficient management of the new network infrastructure. Owners and managers will understand how our team’s project can provide the upgrades based on the thorough information we collected on each building in this document, the VLANs and subnets spreadsheet, the Bill of Materials, and the upgrades we have designed in the Network Diagram. This will meet their goals and expectations of a modernized network that will meet the needs of everyone at Waycool College. As a result, Waycool College can expect improved network reliability, enhanced security, and modernized management, eventually adopting to a more productive and connected campus environment.

**Business Goals**

Modernize outdated technologies – With a business goal of modernizing outdated technologies at Waycool College, this will be important in updating and improving the network infrastructure that is outdated. The Network Design Proposal aims to upgrade the network infrastructure to a main vendor platform known as Cisco Systems. Cisco Systems with its Gigabit Ethernet (GbE) technology can be centrally managed, and it will be used to modernize the outdated technologies and equipment at Waycool College. Different equipment upgrades such as Cisco 3850 switches, Cisco GbE network modules, Cisco Aironet 2602i Autonomous wireless access points, and other main components that are Cisco related will be used for Waycool College buildings. Waycool College had old equipment’s such as a Lanplex 2500 switch, an old Netgear AP, and other equipment’s that led to slower speeds, not being efficient for users, and having a complicated understanding of how the older network as a whole works out. The migration from the current technology at Waycool College to a managed switched network with Gigabit Ethernet technology will represent a significant modernization effort, improving the network speeds, reliability, and having manageability.

Offer new customer services – Having a business goal that offers new customer services will be beneficial to Waycool College with the Network Design Proposal. Waycool College anticipates a 6% increase in their enrollments over the next four years, which emphasizes the need for network scalability to accommodate growth. The proposed network design should support the implementation of new services and technologies to enhance the learning experience for everyone such as students and staff, which will align with Waycool College’s goal to offer innovative and better educational experiences for everyone. Having wireless connections for guests, students, and staff in each building will be part of the new customer services offered to everyone. Also, implementing the Quality of Service (QoS) will prioritize the important applications that will focus on providing a great user experience and ensuring enhanced services to all users.

Avoid business disruption caused by network security problems – At Waycool College, a business goal of having to avoid business disruption that is caused by network security problems can be important. The Network Design proposal implements two firewalls with redundant/failover design in the Main Computer Room which will help with protecting the network infrastructure and ensure there is continuous network security. This is because if the primary firewall fails, the secondary firewall will still be operational. This will meet Waycool College’s requirement for secure remote access for up to 20 users at the same time while providing the strength against firewall failures. Also, there will be recognition of the importance of firewalls as a critical component of the network infrastructure and the proposed design prioritizes the deployment of firewalls which will ensure there is great network security and mitigating the risk of any security problems. When configuring the firewalls, it will allow secure remote access back to the network for authorized users, while it maintains security measures that will prevent any unauthorized access and protect any data from security problems.

**Technical Goals**

Network performance – Addressing the technical goal of network performance, our proposed network design for Waycool College prioritizes high-speed connectivity, reliability, and flexibility, along with the quality of service (QoS) to optimize the network performance. By utilizing the Cisco 3850 switches with Gigabit Ethernet technology, this will ensure that there is fast high-speed, and reliable connectivity throughout the whole campus. The new network offers significantly faster connectivity compared to the previous infrastructure, with speeds up to 10 times faster. This will support services and buildings that use bandwidth a lot and it will ensure there is smooth network performance communication for everyone. To accommodate the 6% growth in enrollment over the next four years, the proposed network design is designed with the reliability to accommodate future growth. The use of Cisco devices and other components allows for reliability in the network performance and ensures that the network can adapt to future growth without compromising the network performance. The QoS protocols are implemented to prioritize critical devices and applications throughout the campus buildings, and it ensures there is ideal network performance. QoS enhances the user experience by minimizing latency and ensuring there is reliable access to the network and its resources.

Security – For Waycool College, security is an important technical goal. Our proposed Network Design includes important measures to enhance security beyond firewall implementation. The firewalls are installed in the Main Computer Room to protect the network infrastructure and enable secure remote access for up to 20 users simultaneously. This ensures there is good network security put into place, and it mitigates the risk of unauthorized access and potential security breaches. Besides firewall implementation, there are other security enhancements such as network segmentation and VLANs being implemented. Network segmentation will be isolating the sensitive data and has limited access to certain users, which will reduce the risk of unauthorized access and security breaches. Having an implementation of the firewalls and network segmentation will help contribute to the security of the network and protect it the best as possible from any threats.

Availability – Ensuring there is availability and uninterrupted access to Waycool College’s network is important for the whole campus community. The proposed network design will prioritize high availability through redundant hardware such as switches, fiber cables, wireless access points, and many other components. Specifically, redundant switches will be deployed in key areas to mitigate the risk of downtime in case of a failure and maintain network uptime. While StackWise cables offer redundancy, it's important to note that they may not cover every failure scenario broadly. To further the strength of availability, having disaster recovery measures will help by having backup power supplies, failover systems, and redundant network paths implemented, which will minimize the downtime due to any disasters or hardware failures. This approach will enhance the network’s availability and ensure that there will be continuous access to the resources on the network, even if a disaster occurs.

**Summary of Changes by Building**

**MDF301 – Main Computer Room** – There are significant changes that I am recommending in the Main Computer Room. Previously, the Main Computer Room had internet routers and 14 file servers, each with a primary and a secondary connection to the network that utilizes the Cat 6a cables. To address the 14 file servers in the room, there will be changes that we’ll add in such as 2x Cisco 3850 24 Port XS Switches, 2x Cisco 3850 48 Port Switch, 2x Cisco 5585 Firewall, 1x Cisco Wireless Access Point (AP), and other equipment’s that are mentioned in the Bill of Materials. This will help ensure there are redundant switches to be implemented and ensuring there is uninterrupted access to the internet. Here below is how I calculated the numbers for the Main Computer Room to understand the number of actual devices on the subnet of this room, along with the number of ports needed for the devices that are in the room.

**Calculation:**

14 Servers \* 2 (each with a primary and a secondary connection to the network) = 28. There are 28 devices on this subnet, but with the 6% growth, it would be 30 actual devices on the subnet. There is 1 AP and 1 VOIP Phone for this room, but they are not accounted for on this subnet.

VOIP Calculation: 1 IP Phone in Main Computer Room = 1 IP Phones.

The design meets the customer requirements for wired users, wireless users and the growth rate because there are 2x Cisco 3850 48 Port Switch, which is larger than usual, but this will allow for future growth without having to change the subnet. There are 2 staff members to control/maintain the servers, approximately 5 guests, and 0 students. This all would be considered as wireless users. The Cisco AP allows for more than enough future growth for all the users in the Main Computer Room as the room does not have many people, rather it is a small staff working inside.

**IDF302 – Administration** – In the Administration building, I am recommending that we upgrade from the old equipment such as the old Netgear AP and upgrade the equipment to a Cisco based system that can provide redundant network and a seamless wireless connectivity. In the Administration building, we added a 2x Cisco 3850 48 Port Switch, 3x Cisco Wireless Access Point (WAP), and other equipment’s that are mentioned in the Bill of Materials. The reason we provided 2x Cisco 3850 48 Port Switch is because the ports will be enough to accommodate the users along with the 6% expected growth in enrollment. The 3 APs will also be good for the number of wireless users, and here below is the calculation of how the Administration building relates to the equipment that I ordered.

**Calculation:**

18 desks with PCs for staff + 8 offices, each with a PC = 26. You will need about 5 PCs in each conference room (2 conf. rooms), which equals 10 PCs. You will need an estimated 2 printers. Calculation is 26 + 10 + 2 = 38 wired devices on subnet. With 6% expected growth of the wired devices on the Administration subnet, it would be 41 actual devices. The final number would be 74 switch ports all together. This is because of the 28 VOIP’s and 3 AP's, which aren't accounted for this subnet, and it’s 6% growth for VOIP and AP together would be 33 devices. The final amount of ports calculation would be 41 + 33 = 74 ports.

VOIP Calculation: 8 administration offices each with an IP Phone + 18 desks for staff where each desk has an IP Phone + 2 IP Phones in both conference rooms = 28 IP Phones.

The design meets the customer requirements for wired users, wireless users, and the growth rate because there is 2x Cisco 3850 48 Port Switch that have a total of 96 ports. There is a total of 11 wireless staff users for wireless devices. (1 staff for the desks, 8 administrative staff for all the offices, 2 staff for both conference rooms. 1 + 8 + 2 = 11 total). There are approximately 30 devices wireless guests**.** (10 guests x 2 each conference room + 10 guests around offices and building = 30) Then, there are an estimated of about 10 wireless students that may be around. This is a total of 51 wireless devices for users, and the 3x Cisco APs allows for a solid future 6% growth to be accommodated for all the users that are in the Administration building.

**IDF303 – History** – In the History building, I am recommending that we upgrade from the old equipment such as the old AP firmware and upgrade the equipment to a Cisco based system that can provide wireless connectivity and better security. In the History building, we added a 1x Cisco 3850 48 Port Switch, 2x Cisco 3850 24 Port Switch, 4x Cisco Wireless Access Point (WAP), and other equipment’s that are mentioned in the Bill of Materials. The reason we provided 1x Cisco 3850 48 Port Switch and 2x Cisco 3850 24 Port Switch is because the ports will be enough to accommodate the users along with the 6% expected growth in enrollment. The 4 APs will also be good for the number of wireless users and become far better upgraded than the old firmware, and here below is the calculation of how the History building relates to the equipment that I ordered.

**Calculation:**

(18 PCs + 1 instructor PC) \* 3 classrooms = 57 connections. There will be 4 offices each with PCs. There will be 3 printers in the classrooms. Calculation is 57 + 4 + 3 = 64 wired devices. With 6% expected growth of the wired devices on the History subnet, it would be 68 actual devices. The final number would be 80 switch ports altogether. This is because of the 7 VOIP’s and 4 AP's, which aren't accounted for this subnet, and it’s 6% growth for VOIP and AP together would be 12 devices. The final amount of ports calculation would be 68 + 12 = 80 ports.

VOIP Calculation: 3 classrooms each with an IP Phone + 4 offices each with an IP Phone = 7 IP Phones.

The design meets the customer requirements for wired users, wireless users, and the growth rate because there is 1x Cisco 3850 48 Port Switch and 2x Cisco 3850 24 Port switches that will both have a total of 96 ports and great redundant connection. There are 3 instructors which are for all the classrooms, and 4 staff for offices. This would be 3 + 4 = 7 total wireless staff devices. Then, there are 10 wireless guest’s devices (4 x 1 guests in offices, and another 2 guests each classroom x 3 classrooms). For student wireless amount, there are 58 wireless devices for students (54 students + 4 x 1 student in each office for help = 58). The wireless connections are on their own subnets. This is a total of 75 wireless devices for users, and the 4x Cisco APs allows for a solid future 6% growth to be accommodated for all the users that are in the History building.

**IDF315 English –** In theEnglish building,I am recommending that we upgradefrom the old two 3Com hubs and a Lanplex 2500 switch that were providing connectivity in this building, and we will update this to a Cisco based system that can provide better redundant connections, far better security, and stronger network connections. In the English building, we added key equipment’s such as 1x Cisco 3850 48 Port Switch, 1x Cisco 3850 24 Port Switch, 3x Cisco Wireless Access Point (WAP), and other equipment’s that are mentioned in the Bill of Materials. The reason we provided 1x Cisco 3850 48 Port Switch and 1x Cisco 3850 24 Port Switch is because the ports will accommodate the users along with the 6% expected growth in enrollment. The 3 APs will also be good for the number of wireless users and become far better upgraded than the older two 3Com hubs and a Lanplex 2500 switch, and here below is the calculation of how the English building relates to the equipment that I ordered.

**Calculation:**

(18 PCs + 1 instructor PC) \* 2 classrooms = 38 connections. There will be 4 offices each with PCs. Then there are 3 printers, 2 for the classrooms and 1 for the office. Calculation is 38 + 4 + 3 = 45 wired devices. With 6% expected growth of the wired devices on the English subnet, it would be 48 actual devices. The final number would be 58 switch ports altogether. This is because of the 6 VOIP’s and 3 AP's, which aren't accounted for this subnet, and it’s 6% growth for VOIP and AP together would be 10 devices. The final amount of ports calculation would be 48 + 10 = 58 ports.

VOIP Calculation: 2 classrooms each with an IP Phone + 4 offices, each with an IP Phone = 6 IP Phones.

The design meets the customer requirements for wired users, wireless users, and the growth rate because there is 1x Cisco 3850 48 Port Switch and 1x Cisco 3850 24 Port switches that will both have a total of 72 ports for wired devices and great redundant connections. There are 2 instructors which were for all the classrooms, 4 staff members for offices (2 + 4 =6 wireless staff devices total). Then, 14 wireless guest’s devices total (4 x 1 guests in offices and another 5 guests each classroom x 2 classrooms). For student wireless amount, there are 40 wireless devices for students. (36 students + 4 x 1 student in each office for help = 40). The wireless connections are on their own subnets. This is a total of 60 devices of wireless users, and the 3x Cisco APs allows for a solid future 6% growth to be accommodated for all the users that are in the English building.

**IDF393 Political Science –** In thePolitical Science building,I am recommending that we upgradefrom the older equipment and be able to provide wired PC for each student in each of the three classrooms and appropriate wireless connectivity. We will update this to a Cisco based system that can provide stronger network connections and is redundant. In the Political Science building, we added key equipment’s such as 1x Cisco 3850 48 Port Switch, 2x Cisco 3850 24 Port Switch, 4x Cisco Wireless Access Point (WAP), and other equipment’s that are mentioned in the Bill of Materials. The reason we provided 1x Cisco 3850 48 Port Switch and 2x Cisco 3850 24 Port Switch is because the ports will accommodate the users along with the 6% expected growth in enrollment. The 4 APs will also be good for the number of wireless users and will be able to sufficiently have a strong connection to the wireless network. Here below is the calculation of how the Political Science building relates to the equipment that I ordered.

**Calculation:**

(18 PCs + 1 instructor PC) \* 3 classrooms = 57 connections. There will be 1 office with a PC. Then will be 3 printers, three for classrooms. Calculation is 57 + 1 + 3 = 61 wired devices. With 6% expected growth of the wired devices on the Political Science subnet, it would be 65 actual devices. The final number would be 74 switch ports altogether. This is because of the 4 VOIP’s and 4 AP's, which aren't accounted for this subnet, and it’s 6% growth for VOIP and AP together would be 9 devices. The final amount of ports calculation would be 65 + 9 = 74 ports.

VOIP Calculation: 3 classrooms each with an IP Phone + 1 office with an IP Phone = 4 IP Phones.

The design meets the customer requirements for wired users, wireless users, and the growth rate because there is 1x Cisco 3850 48 Port Switch and 2x Cisco 3850 24 Port switches that will both have a total of 96 ports for wired devices and great efficient connections. There are 3 instructors which were for all the classrooms, 3 staff for offices (3 + 3 = 6 total wireless staff devices). Then there are 18 wireless guests (3 x 1 guests in offices and another 5 guests each classroom x 3 classrooms). For student wireless amount, there are 57 (54 students + 3 x 1 student in each office for help = 57). The wireless connections are on their own subnets. This is a total of 81 wireless devices for users, and the 4x Cisco APs allows for a solid future 6% growth to be accommodated for all the users that are in the Political Science building.

**IDF399 Library –** In theLibrary building,I am recommending that we upgradefrom the older equipment and be able to provide wireless connection for this building. We will update this to a Cisco based system that can provide stronger network connections and is redundant. In the Library building, we added key equipment’s such as 1x Cisco 3850 48 Port Switch, 1x Cisco 3850 24 Port Switch, 4x Cisco Wireless Access Point (WAP), and other equipment’s that are mentioned in the Bill of Materials. The reason we provided 1x Cisco 3850 48 Port Switch and 1x Cisco 3850 24 Port Switch is because the ports will accommodate the users along with the 6% expected growth in enrollment. The 4 APs will also be good for the number of wireless users that are in the Library and will be able to sufficiently have a strong redundant connection to the wireless network.

**Calculation:**

26 students that may use PC in Library. There are 6 desks where each desk has a PC for the staff. Then there are 2 offices each with PCs. There are 4 printers around the Library. Calculation is 26 + 6 + 2 + 4 = 38 wired devices. With 6% expected growth of the wired devices on the Political Science subnet, it would be 41 actual devices. The final number would be 51 switch ports altogether. This is because of the 9 VOIP’s and 4 AP's, which aren't accounted for this subnet, and it’s 6% growth for VOIP and AP together would be 14 devices. The final amount of ports calculation would be 41 + 14 = 55 ports.   
  
VOIP Calculation: 1 IP Phone in Library + 6 desks each with IP Phones + 2 offices each with IP Phones = 9 IP Phones.

The design meets the customer requirements for wired users, wireless users, and the growth rate because there is 1x Cisco 3850 48 Port Switch and 1x Cisco 3850 24 Port switches that will both have a total of 72 wired ports and good connection for all users. There are 6 staff members on desks, 2 staff for both offices, and 2 staff estimate in the library building (6 + 2 + 2 =10 total wireless staff devices). Then 23 wireless guest’s devices (6 x 1 guests each at a desk and 1 x 2 in each office, say 15 guests around library estimated). For student wireless amount, it is a total of 43 wireless devices (26 students who are using PC will have wireless devices + 15 extra students around using library with wireless devices + 2 x 1 student in each office = 43). The wireless connections are on their own subnets. This is a total of 76 wireless devices for users, and the 4x Cisco APs allows for a solid future 6% growth to be accommodated for all the users amount that are in the Library building.

**Routing Protocol Selection**

For Waycool College, I recommend implementing Enhanced Interior Gateway Routing Protocol (EIGRP) as the routing protocol selection for their network. EIGRP offers many different benefits and advantages that can be suitable for Waycool College’s network environment. EIGRP is a proprietary protocol that was developed by Cisco, and this can align well with Waycool College’s network requirements. First, EIGRP provides rapid convergence, which can be very crucial for a large campus network like Waycool College. With having EIDRP network as the routing protocol, different devices such as Cisco wireless access points can quickly and easily adapt to the changes in the network topology, which will ensure there is little disruption to the network, and making sure there is high availability. Secondly EIGRP’s scalability makes it suitable for Waycool College’s growing network infrastructure. The reason for this is because as the college anticipates a 6% growth in enrollment over the four years, EIGRP can efficiently be able to scale to accommodate the increasing network nodes and traffic. This integration would go seamlessly well with Cisco’s devices and hardware that are being used in Waycool College.

Furthermore, EIGRP uses a composite metric that considers factors such as bandwidth, delay, reliability, and load. These composite metrics enable optimization of the network performance and resource utilization, which will ensure efficient routing across the campus network all while using Cisco’s advanced routing features. EIGRP can redistribute routes to other protocols such as OSPF, RIP, IS-IS, and BGP, which provides flexibility for future network expansions or integrations with different systems. While OSPF does offer many advantages such as widespread support across many vendors, EIGRP ensures a smooth integration with Cisco devices, which will enhance performance and simplify the network management. Overall, EIGRP rapid convergence, scalability, control over routing decisions, compatibility with other routing protocols, and integration with Cisco devices makes it the preferred choice for Waycool College’s proposed network design, which will ensure there is a reliable and efficient routing throughout their campus network.

**Device Naming Standard**

I have created a proposed device naming standard that will work for all devices in Waycool College and future locations for Waycool College. This should be flexible enough to understand the naming convention created below because of the specific descriptions that were added onto the device naming convention. The device naming standard goes as follows:

**State (with 2 characters):** The reason we need state in the naming convention is so that if the college decides in the future to expand its campus to another state, this will be crucial in determining what the device is by first knowing the state location. Two characters should work well for the state name because all states in the U.S. are abbreviated to two letters, which are recognized by the USPS.

An example of this would be WI (Wisconsin).   
**City (with 4 characters):** The reason I added city into the device naming conventions is because this is important in knowing where the device is located not just in the state, but also for the city in case if the college has campus locations in other cities. Four characters should help determine the city name when it is shortened and should be easy to determine the city based on the four characters along with the state name that comes first. Examples of this can be PACK (for Packerton).

**Building (with 3 characters):** Building is important for the device naming convention because it is important to know where the device is located based on the abbreviated three letter characters of the building name. Three characters for the building should work fine, as they’re usually easy to tell what it is. Examples of this can be ENG (for English) or POS (for Political Science).

**Device Type (with 2 characters):** For the device type, there are three devices that should be recognized in the naming convention. Each name should have two characters. These are the examples of how the device types would be labeled: SW (for Switch), AP (for Wireless Access Point), and FW (for Firewall).

**Manufacturer (with 3 characters):** Manufacturer name can be an important component to the device naming standard. The reason for this is because Waycool College may use other manufacturers for the device types, and it is important to always know which device is correlated to the manufacturer. Three characters should work well in determining the manufacturer, and this can be like CIS (for Cisco) or DEL (for Dell).

**Index # (with 2 characters):** For Index #, this determines the number of the device type. For example, if you have 3 switches in a building, you will need to know which naming convention correlates to the correct switch. Examples of this can be 01, 02, 03, and so on.

|  |  |
| --- | --- |
| **Device Type** | **Device Type Abbreviation** |
| **Switch** | SW |
| **Wireless Access Point** | AP |
| **Firewall** | FW |

Here below is an example of how the naming standard should work across Waycool College’s devices naming convention. You will have a range of six descriptions with their corresponding number of characters. This example below is how the naming standard would be applied to a device at city of Packerton.

|  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- |
|  | **Item 1** | **Item 2** | **Item 3** | **Item 4** | **Item 5** | **Item 6** |
| **Description** | State | City | Building | Device Type | Manufacturer | Index # |
| **Number of characters** | 2 | 4 | 3 | 2 | 3 | 2 |
| **Example** | WI | PACK | LIB | SW | CIS | 01 |
|  |  |  |  |  |  |  |

**IP Addressing Standard**

The IP addressing scheme that I have chosen for the site adheres to the requirements that were outlined in the RFP while also resolving the issues of unauthorized use of public IP addresses belonging to the University of Southern California (USC). Our approach aims to ensure efficient utilization of address space while accommodating future growth. This scheme will be designed to efficiently allocate IP addresses, accommodate future growth, and ensure proper procedures are followed.

The main reason to the motivation of the IP address change is to fix the unauthorized use of public IP addresses belonging to USC. This misuse poses legal risks to the organization due to the previous administrator’s lack of understanding of public IP addresses. By implementing a new IP addressing scheme, we aim to ensure compliance with regulations, mitigating potential network disruptions, and update the network management.

Here below are the IP address ranges that I selected for each network locations/types:

IP Address Range Selection:

Main Comp Room (VLAN 10): 192.168.10.0/26

Administration (VLAN 20): 192.168.2.128/26

History (VLAN 30): 192.168.1.128/25

English (VLAN 40): 192.168.3.0/26

Political Science (VLAN 50): 192.168.2.0/25

Library (VLAN 60): 192.168.3.128/26

Guests (VLAN 100): 192.168.1.0/25

Students (VLAN 110): 192.168.0.0/24

Staff (VLAN 120): 192.168.2.192/26

VOIP (VLAN 200): 192.168.3.64/26

Network Management VLAN (VLAN 999): 192.168.4.0/25

The reason I chose these selected IP address range(s) is based on different factors. The first factor is efficiency, where each range was thoroughly chosen to accommodate the estimated number of devices in the VLAN while ensuring efficient use of address space. Another factor would be subnetting, where the VLSM was applied to create the appropriate sized and contiguous subnets whenever possible, which optimizes the use of available IP addresses. Another factor would be that the ranges were structured to facilitate network management and scalability, with separate VLANs for different departments such as the wireless networks, VOIP, and network management. The final factor would be future growth, where the addressing scheme considers the expectations of future growth which provides acceptable address space within each VLAN to accommodate additional devices without the need for frequent subnet resizing.

Here are the examples of our IP addressing scheme.

- For example, in the Main Computer Room (VLAN 10), the IP address range of 192.168.10.0/26 was chosen to provide sufficient addresses for network devices in this room. This addresses the issue of unauthorized IP usage by ensuring compliance with network rules and avoiding potential future problems. Also, the IP address has a range of 192.168.10.1 to 192.168.10.162, which allows for a great range to be sufficient for the Main Computer Room and there are 62 usable hosts in which the room only has 30 actual devices on the subnet.

- Another example of the IP addressing scheme involves the Administration building. In the Administration VLAN, the IP address range of 192.168.2.128/26 was chosen to accommodate the network devices in this area. This selection addresses the issue of unauthorized IP usage by ensuring compliance with network regulations and mitigating potential future problems. With a range from 192.168.2.128 to 192.168.2.191, the subnet provides 62 usable hosts, which exceeds the current 41 actual devices that are in the Administration area, allowing for scalability and future growth while maintaining efficient address space utilization.  
- The final example of the IP addressing scheme would be the Network Management VLAN network, which has the IP address range of 192.168.4.0/25 which was selected to serve to the network management devices such as switches and wireless access points. This choice resolves potential IP address conflicts and unauthorized usage by segregating network management traffic into its dedicated VLAN. With a range from 192.168.4.1 to 192.168.4.126, the subnet provides 126 usable hosts, ensuring efficient address space for managing network devices and enabling future expansion of network management capabilities. This subnet is bigger than normal which is totally fine, and it accommodates future devices without having to change the network addressing on the subnet.

Overall, the new IP addressing scheme resolves the IP address problems identified in the RFP and from the previous design in several ways. The first way is compliance, because by addressing the unauthorized use of public IP addresses, the new scheme ensures compliance with network regulations and avoids legal issues associated with unauthorized IP usage. The second way would be efficiency. Efficiency plays a role through VLSM and subnetting, where the new scheme optimizes address space utilization and avoids address depletion. It also allows for scalable growth without frequent subnet resizing. The final way would be how by considering future growth expectation of 6%, the scheme provides a good address space within each VLAN to accommodate additional devices, and reduces the need for frequent network reconfiguration,

**Quality of Service (QoS)**

|  |  |  |
| --- | --- | --- |
| **Priority** | **Traffic Type** | **Explanation** |
| 1 | Network Management | Network management traffic includes critical protocols for smooth monitoring and managing network devices. Prioritizing this traffic ensures there is efficient network operations. |
| 2 | VOIP | VOIP traffic requires real-time transmission to maintain the call quality and it is prioritized highest to minimize latency and ensure there is clear communication. |
| 3 | Video Conferencing | Video conferencing demands low latency to prevent delays and maintain smooth video and audio synchronization, which is why it should be prioritized as third. |
| 4 | Video Streaming | Video streaming can be important, but it can tolerate some latency. It is prioritized lower than VOIP and video conferencing but is higher than less delay sensitive traffic. |
| 5 | Music Streaming | Music streaming is a moderate priority similar to video streaming, as buffering can handle some delays without significantly impacting the user experience, making it a lower priority than the categories above |
| 6 | Email | Email traffic is generally less time sensitive than real time communication and media streaming, which is why it is prioritized lower. |
| 7 | Printing | Printing jobs are not real time, and it can tolerate some delates without any significant impact, making it a lower traffic type priority. |
| 8 | Best Effort | This category is a catchall for all other traffic that does not fit into the prioritized categories. It receives the lowest priority and is handled on a best-effort basis. |

**Closing**

In conclusion, thank you for taking the time to review our Network Design Proposal. We appreciate the opportunity to present our Network Design Proposal plan for enhancing your network infrastructure at Waycool College. If you have any questions or require further clarification on any aspect of our proposal, please don't hesitate to contact us. We look forward to the opportunity to contribute to the enhancement of your network infrastructure and the overall connectivity experience on your campus. Our team is committed to delivering a solution that is tailored to your specific needs, with a focus on efficiency, scalability, and reliable performance. We look forward to the possibility of working together to implement these improvements and help Waycool College achieve its Network Design goals.