****

**PACKET TRACER PROJECT: Part 1**

**CMPG 315**

**Group 4**

**JP POULO 38225964 \* BL MAHLANGU 37751883 \* A MAQIZANA 37485229 \* SL TITTIES 33264740**

**TM HLATSHWAYO 38640406 \* MI NGOBENI 38016508 \* HH MASHABA 41014170**

**TABLE OF CONTENTS**

**Individual Reflections on Online Courses………………………………………………………page 3**

**Problem Description……………………………………………………………………………………..page 8**

**Network Design Description…………………………………………………………………………page 9**

**Budget….………………………………………………………………………………………………………page 11**

**Cabling and Connections in Our Network………..…………………………………………….page 13**

**Work Ethic and Communication…………………………………………………………………….page 14**

**Issues encountered ………………………………………………………………………..……….…….page 17**

**Additional Features Implementation……………………………………………………..………page 18**

**References…………………………………………………………………………………………………….page 20**

## **Individual Reflections on Online Courses:**

1. **A Maqizana 37485229**

To put it simply, project management is the process of applying tools, techniques, knowledge, and skills to project activities in order to achieve project requirements. Often referred to as the project management triangle, projects are limited by budget, schedule, and scope. Projects also need to efficiently manage risks, guarantee quality, and distribute resources. The structure of the project hierarchy is as follows: the project is separated into individual activities and then further subdivided into a Work Breakdown Structure (WBS). This hierarchical method aids in the project's overall organization and management. One crucial step in the start-up phase is creating a project charter. It describes the project's goals, parameters, and stakeholders in addition to formally authorizing it. A thorough Project Management Plan (PM Plan), which incorporates strategies for scope, time, cost, and human resource management, requires stakeholder identification. In order to carry out the project plan, the execution process group must coordinate personnel and resources. To guarantee that activities are finished on schedule during this phase, effective leadership and communication are essential. Process monitoring and control are essential for tracking project performance and making required modifications. By comparing actual performance with the plan and taking corrective action as necessary, this team makes sure that project objectives are met. The closing process group formally concludes the project or phase after completing all project activities and ensuring that all deliverables are finished. This entails recording lessons learnt and gaining support from stakeholders. Project timeline scheduling and management need the use of time management tools and procedures like the Program Evaluation and Review Technique (PERT) and the Precedence Diagramming Method (PDM). Primavera P6 is a robust project management tool that facilitates the planning, scheduling, and oversight of intricate projects while guaranteeing effective resource distribution and project monitoring. To sum up, a disciplined approach to planning and execution, a deep comprehension of project limitations, and the use of the right tools and techniques are all necessary for effective project management.

1. **TM Hlatshwayo 38640406**

Reflecting on my experience with time management, I’ve come to understand how crucial it is to connect my time with what genuinely matters. Seneca’s insight resonates profoundly: life is not short—we simply waste too much of it. This way of looking at things has encouraged me to be more intentional about how I spend my time.  
  
One of the most significant changes I’ve implemented is moving away from real-time decision-making. By establishing routines, I’ve minimized distractions and concentrated on meaningful tasks. Beginning my day with a structured morning ritual—silence, affirmations, exercise, and planning—sets a productive atmosphere. I’ve also recognised the significance of concentrating on a single task at a time, avoiding multitasking.  
  
Monitoring where my time is spent has been fulfilling. A time audit unveiled how much energy I dedicated to distractions instead of goal-oriented tasks. Now, I prioritise tasks that align with my goals and use to-do lists and time-blocking to maintain my focus.  
  
The greatest lesson I’ve learned has been the strength of small actions. Consistently working toward my priorities has yielded progress without feeling overwhelmed Time management is not about perfection but rather about consciousness and enhancement. By contemplating how I spend my time, I’ve learnt to live more intentionally and create room for both productivity and enjoyment

3. **SL Titties 33264740**

**REFLECTION ON SOFT SKILLS LEARNED**

Through the courses I recently completed, I’ve learned several soft skills that I’m eager to apply in my academic and professional endeavors. In Project Management, I gained valuable knowledge on organization, leadership, and strategic planning, all of which have prepared me to manage tasks more effectively. I now understand how to break down projects efficiently and lead teams while keeping an eye on long-term objectives.

The Time Management course introduced me to productivity strategies such as structured morning routines and the 80/20 rule. These techniques have helped me improve my focus and align my actions with my goals, making me more efficient in the process.

The GitHub course taught me how to collaborate effectively, communicate within teams, and troubleshoot issues in version control. Writing clear messages and resolving conflicts have enhanced my ability to work in a collaborative environment, which I’m eager to put into practice.

From the Cisco Packet Tracer course, I learned how to think critically and pay attention to detail, especially when configuring and troubleshooting networks. I now realize the importance of precision, and I look forward to applying these skills in real-world network scenarios.

Finally, the Expert4Hours Git course helped me develop patience and problem-solving skills as I worked through Git conflicts and managed branches. I’m excited to apply these techniques and approaches as I continue to learn.

Overall, these courses have given me the tools to manage tasks, collaborate effectively, think critically, and adapt to new challenges. I’m eager to put these soft skills into action in my upcoming projects and future career opportunities.

**4. BL Mahlangu 37751883**

## Time management

## This course taught me crucial soft skills that I intend to include in my everyday routine. Prioritization stood out as a great strategy, helping me in concentrating on impactful "10x activities" that correspond with my goals. Creating a morning routine based on Hal Elrod's SAVERS practices, including exercise and meditation, will energise me and improve my focus for the upcoming day. Another important insight was the necessity of working in uninterrupted time blocks to preserve flow and productivity. By employing tools like timers, I plan to reduce distractions and enhance efficiency in my tasks. These techniques will assist me in managing my time effectively and achieve more.

## Getting started with Git

The Basic Workflow with GitHub course educated me on essential soft skills that I will utilize in upcoming projects. I discovered the significance of organization via systematized folders and repositories, along with the value of communication by configuring Git with my email for accurate attribution. The need for flexibility was evident as I incorporated version control into workflows, while making commits highlighted the importance of documentation through comments to monitor progress. Publishing modifications strengthened collaboration, motivating me to participate in team feedback. These abilities will enable me to function more efficiently in technical and collaborative environments.

**Project Management**

My project management experiences has shown me the significance of balancing constraints such as budget, time, and scope while promoting collaboration. Tools such as WBS and Primavera P6 have proven to be essential for structuring tasks and monitoring progress. More importantly, reflection has aided me in learning from achievements and challenges, enhancing decision-making, and strengthening team dynamics. By examining past experiences critically, I’ve acquired insights that inform future projects and encourage ongoing development.

Cisco Packet Tracer course

I developed problem-solving and critical thinking abilities. Grasping how networks work, setting up devices, and that resolving typical networking problems needed logical reasoning and patience. These abilities will come in handy when creating and executing our network in the Packet Tracer simulation.

1. **JP Poulo 38225964**

After completing the Cisco Packet Tracer and GitHub courses as part of the CMPG315 Group Project preparation, I developed several important soft skills that will be useful for both this project and my future career.

One of the key skills I improved was time management. The courses required me to balance learning new concepts while keeping up with other academic responsibilities. As outlined in Group Task 1: Preparation, I learned how to plan my time effectively, break tasks into smaller steps, and stay organized skills that will be crucial when working on the upcoming project.

Another important skill I developed was teamwork and collaboration. The GitHub course introduced me to version control, which is essential for working efficiently with others on a shared codebase. It emphasized the importance of communication, resolving conflicts in code, and maintaining a structured workflow. These lessons will help me contribute effectively to my group’s work.

Through the Cisco Packet Tracer course, I gained problem-solving and critical thinking skills. Understanding how networks function, configuring devices, and troubleshooting common networking issues required logical thinking and patience. These skills will be beneficial when designing and implementing our network in the Packet Tracer simulation.

Lastly, these courses helped me improve my technical communication skills. Writing clear commit messages in GitHub and documenting network configurations in Packet Tracer reinforced the importance of explaining technical details in a structured and professional manner.

1. **MI Ngobeni 38016508:**

Learning Git was more than just computer stuff; it was like learning a new language for teamwork. At first, I just wanted a safe place to save my work, but I quickly realized Git was much more powerful. It taught me how important it is to keep projects organized. Making branches and merging them showed me how to communicate clearly with teammates. When we had conflicts, like when two people changed the same part of a file, I had to learn to talk things out and find a solution that everyone agreed on. That's a skill that's useful in any team, not just coding.

Using GitHub was like working in a shared office. I had to be careful and organized, making sure my changes didn't mess up anyone else's work. I learned to write good notes, called commit messages, about every change I made, so everyone could understand what I did and why. This taught me the importance of clear documentation.

Fixing problems when things went wrong, like when a merge failed or I couldn't push my changes, taught me to be patient and find solutions step by step. I learned to break down big problems into smaller, easier ones. That's a skill that's useful in any job.

I also saw how important it is to write things down clearly. Good instructions and notes help everyone work together smoothly. Git isn't just for coding; it's about being organized, communicating well, and solving problems as a team, which are all essential skills for success in any professional environment

1. **HH MASHABA 41014170**

I found the Cisco Packet Tracer online course very enriching in terms of technical knowledge and complementing my soft skills. It provided an insight into network simulation that has further widened my understanding of how the computer networks work. Practical exercises led me into configuring devices, connecting them, and troubleshooting different networking problems.

One soft skill that improved in the course was problem-solving. Along the coursework, network scenarios used to pop up and required logical analysis of the type of problem and proper solution to be made. This troubleshooting skill is very important for not only network issues, but also very relevant for other real-life problems to be solved.

Another skill that this course reinforced was attention to detail. One small error in configuration could start an enormous issue in connectivity; thus, it taught me to be very meticulous in setting up networks. This is an essential skill for any technical field because attention to detail can be the little line between success and failure.

Collaboration and communication were other major learned skills. In networking, it is usually teamwork in configuring, explaining, and sharing ideas on troubleshooting. Though self-paced, the course allowed me to share my friends' thoughts with ideas and help me out articulate my thoughts better.

To summarize, Cisco Packet Tracer was one of those courses that were a delightful experience not only strengthening my technical capabilities but also sharpening a few soft skills that will stand me in good stead in academic as well as professional spheres.

## Problem Description

The project involves designing a network infrastructure for a company expanding to a new office building, requiring a comprehensive approach to meet the organization's needs. The goal is to create a robust, yet affordable, network that provides isolated sections for different departments while ensuring internet connectivity and accommodating growth. The network design must be carefully planned to meet the specific requirements of various sections, including offices, reception, technicians' office, meeting room, machine room, and open floor space. Each section has unique needs, such as isolated network access, printer accessibility, and Wi-Fi availability, which must be addressed in the design. The network topology design is a critical aspect of the project, requiring the selection of appropriate network devices, such as routers, switches, and servers. The design must ensure that each section is isolated while providing internet connectivity and accommodating growth. The network devices must be chosen based on their capabilities, scalability, and cost-effectiveness. Additionally, the network design must consider security implications, remote access requirements, and the establishment of a cooperative virtual workspace. The project requires a detailed approach to IP addressing and routing, determining the best IP addresses, subnets, and routing setups to meet the company's needs. The network design must also consider the security implications of remote access, including the selection of remote software, security implications, and Bring Your Own Device (BYOD) considerations. Furthermore, the project demands careful planning and documentation to ensure a robust and efficient network infrastructure that meets the company's needs. To achieve this, the project involves several key components, including network design, documentation, and presentation. The network design must be simulated using Packet Tracer, a physical and logical network topology must be designed, and a detailed description of the network design must be provided. The documentation must include a comprehensive budget, including estimated labour costs and contingencies, and a discussion on the issues encountered during the project. The presentation must showcase the network design and functionality, highlighting its key features and benefits. The project also requires careful project management, including collaboration with group members, keeping records of meetings and tasks, and ensuring that all group members contribute to the project. The project leader must manage communications, coordinate efforts, and ensure that the project is completed on time. The project also involves a detailed evaluation of the designed network, including its ability to fulfil requirements, its strengths and weaknesses, and potential maintenance needs. The project demands a comprehensive approach to designing a network infrastructure that meets the company's needs. It requires careful planning, design, and documentation to ensure a robust and efficient network infrastructure that provides isolated sections, internet connectivity, and printer accessibility while accommodating growth and keeping costs low. The project's success depends on the ability to design a network that meets the company's specific needs, manage the project effectively, and document the process thoroughly. By achieving this, the company can ensure a reliable, efficient, and cost effective network infrastructure that supports its operations and growth.

## Network Design Description

## The network topology designed for the office building is a structured, layered configuration cantered around the machine room, tailored to meet the project’s requirements for isolation, internet access, and scalability while keeping costs low.

## Network Topology

## **Machine Room Core**: The topology features two routers located in the machine room, connected to the ISP fibre line. These routers act as the central hubs, managing all internet traffic and linking to a central switch that distributes data to the rest of the network.

## **Sectional Distribution**: From the central switch, connections extend to individual sections via dedicated switches, each isolated using VLANs to prevent communication between sections:

## **Offices**: include a switch connecting multiple PCs, laptops, and wired access points, ensuring dedicated network access for this area.

## **Meeting room**: contains a switch linking tablets, PCs, and a wired access point, supporting teleconferencing and staff devices.

## **Open floor space** features a network of switches supporting numerous PCs, laptops, and wired access points, along with five networked printers positioned near the machine room for shared use.

## **Technicians Office**: connecting PCs, laptops, and wired access points, with a direct wired link to the machine room for server access.

## **Reception**: A switch connects 2 PCs for reception staff, 1 networked printer, and a wired access point for staff and limited guest access.

## **Kitchen**: includes a switch with tablets, PCs, and wired access points for IoT devices and staff use.

## VLANs ensure that sections like the purple offices and red reception cannot communicate, adhering to the project’s isolation requirements.

## Access Points: Wired access points are strategically placed in all sections except the machine room, providing Wi-Fi coverage for staff and guest devices across the 100 x 50-meter building layout.

## Device Selection and Motivation

## Routers: Two high-capacity routers are selected for the machine room. They are chosen for their ability to handle significant data traffic and provide reliability, with a second router included as a failover to prevent network downtime. This setup aligns with the need for a robust connection and complies with the company’s policy to locate routers in the machine room.

## Switches: A central Layer 3 switch in the machine room connects to sectional Layer 2 switches. The Layer 3 switch is selected for its capability to manage VLANs and efficiently route traffic between isolated sections, meeting the isolation requirement. Layer 2 switches in each section are chosen for their affordability and ability to connect multiple devices, adhering to the project guideline that switches outside the machine room should have fewer than 8 ports where applicable.

## Wired Access Points: These are deployed across all sections except the machine room to enable Wi-Fi connectivity. They are motivated by the need to support 2–4 devices per person, including untrustworthy devices, and ensure comprehensive coverage without additional hardware.

## Servers: The company’s existing servers are utilized in the machine room. They are selected to eliminate additional costs and provide essential network services such as DHCP, DNS, data storage, intranet hosting, and remote work support, fully meeting the project’s requirements.

## Rationale for the Design

## The cost-effectiveness of this topology is achieved using both modern equipment and affordable devices like Layer 2 switches. It fulfils all project requirements by delivering internet access to every device, guaranteeing section isolation, and facilitating Wi-Fi for both staff and guests. The design is also expandable, able to support future increases in personnel and devices.

## **Budget**

Estimated Budget with all prices in south African ran and based on real retailers and listings

| **Device** | **Qty** | **Unit Price (ZAR)** | **Total (ZAR)** | **Retailer** |
| --- | --- | --- | --- | --- |
| Dell OptiPlex 3080 PC | 13 | R7,999.00 | R103,987.00 | Takealot |
| HP 250 G8 Laptop | 13 | R7,699.00 | R100,087.00 | Takealot |
| **Subtotal (End Devices)** |  |  | **R204074.00** |  |

1. **End-Devices**
2. **Printers**

| **Printer** | **Qty** | **Unit Price (ZAR)** | **Total (ZAR)** | **Retailer** |
| --- | --- | --- | --- | --- |
| HP LaserJet Pro M404dn | 5 | R4,320.00 | R21,600.00 | Toner Corporation |
| **Subtotal (Printers)** |  |  | **R21,600.00** |  |

1. **Networking Equipment**

| **Equipment** | **Qty** | **Unit Price (ZAR)** | **Total (ZAR)** | **Retailer** |
| --- | --- | --- | --- | --- |
| Ubiquiti UniFi AP Access Point LITE | 112 | R 2,379.00 | R266448.00 | UniFi |
| Cisco Catalyst WS-C3650-24TS Switch | 7 | R5,679.00 | R39,753.00 | Network Hardwares |
| TP-LINK 48 Port Ethernet Switch | 1 | R2 199.00 | R2 199.00 | Takealot |
| Linksys WRT300N Router (used/refurb) | 1 | R919.52 | R919.52 | eBay |
| **Subtotal (Networking)** |  |  | **R309 319.52** |  |

1. **Server**

| **Server** | **Qty** | **Unit Price (ZAR)** | **Total (ZAR)** | **Retailer** |
| --- | --- | --- | --- | --- |
| Dell PowerEdge R720 Server | 1 | R10 199.00 | R10 199.00 | ServerBasket |
| **Subtotal (Server)** |  |  | **R10 199.00** |  |

1. **Cabling & Installation**

| **Item** | **Estimated Cost (ZAR)** |
| --- | --- |
| Data Cabling (100 points @ R600) | R60,000.00 |
| Installation Labour | R50,000.00 |
| **Subtotal (Labour & Cabling)** | **R110,000.00** |

1. **Contingency (10%)**

| **Item** | **Amount (ZAR)** |
| --- | --- |
| 10% of all above categories | R117,030.13 |

1. **Grand Total Estimate**

| **Category** | **Amount (ZAR)** |
| --- | --- |
| End Devices | R204 074.00 |
| Printers | R21 600.00 |
| Networking Equipment | R309 319.52 |
| Server | R10 199.00 |
| Cabling & Labour | R120 000.00 |
| Contingency | R117 030.13 |
| **Total Estimate** | **R782 222.65** |

## Cabling and Connections in Our Network

In our Cisco Packet Tracer project, we implemented various cabling methods and configurations to establish a well-organized network. Here’s a detailed overview of our setup:

1. **Copper Straight-Through Cables**:
   * We connected our PCs to the main switch using copper straight-through cables. This type of cable is perfect for linking different devices, ensuring seamless data transmission between the PCs and the switch.
2. **Copper Crossover Cables**:
   * For connections between similar devices, such as switches, we utilized copper crossover cables. This allows for direct communication between switches, enabling efficient data transfer.
3. **Main Switch Connection**:
   * All our devices are wired to a central main switch, which acts as the hub of our network. This centralization enhances organization and ensures effective management of data traffic.
4. **Server Connection**:
   * The main switch is connected to our server, which provides essential services, such as providing IP addresses to the devices. This connection is crucial for allowing all devices to access shared resources.
5. **DHCP Configuration**:
   * Each PC is configured to use DHCP (Dynamic Host Configuration Protocol) settings, allowing them to automatically request an IP address from the server. This process ensures that each device receives a unique IP address, facilitating smooth communication across the network.
6. **VLAN Implementation**:
   * To enhance network segmentation and security, we created multiple VLANs (Virtual Local Area Networks) for different groups within our organization:
     + **Office VLAN**: This VLAN is designated for office staff, allowing them to access necessary resources and communicate efficiently.
     + **Technicians VLAN**: Technicians are assigned their own VLAN to ensure they have secure access to specific tools and systems required for their work.
     + **Staff VLAN**: This VLAN accommodates general staff members, providing them with access to shared resources and internet connectivity.
     + **Reception VLAN**: The reception area has its own VLAN to manage guest interactions and access to relevant systems.
     + **Guest VLAN**: A separate VLAN for guests ensures that visitors can access the internet while keeping the internal network secure.

**Summary of Our Network Setup**

By integrating straight-through and crossover cables, along with a central switch, a DHCP-enabled server, and VLAN configurations, we have established a robust and efficient network infrastructure. This setup not only facilitates effective communication among devices but also enhances security and resource management for different groups within the organization.

## Work Ethic and Communication

**Work Ethic**

|  |  |  |
| --- | --- | --- |
| **Member** | **Main Role** | **Role Description** |
| A Maqizana | Project Manager | Planning, progress meeting scheduling, management of risks as well team coordination |
| TM Hlatshwayo | Time Management & Productivity Lead | Controlling workflow optimisation and distribution, milestone tracking, productivity coaching |
| SL Titties | Workflow & Soft Skills Facilitator | Development of soft skills, devising focus strategies and progress tracking, as well outsourcing guidance and understanding |
| HH Mashaba | Version Control & Collaboration Lead | Git/GitHub management, conflict resolution and gathering collaboration tools |
| JP Poulo | Technical Documentation & Troubleshooting | Formal documentation, troubleshooting, technical communication |
| MI Ngobeni | Organization & Communication Coordinator | Project organization, general communication and conflict resolving as well as enhancing visual aspects of the project. |
| BL Mahlangu | Network Simulation & QA Lead | Device configuration, troubleshooting and quality assurance of functionality |

**Work Schedule**

|  |  |  |
| --- | --- | --- |
| **Date** | **Activity Description** | **Attendance** |
| 03.03.2025 | Group Members all joined Group 4 on the efundi site | 7/7 |
| 07.03.2025 | Group members formal introduction of group members | 7/7 |
| 14.03.2025 | Submission (to the our own group chat) of individual reflections and their compilation into one document for Phase 1 | 7/7 |
| 17.03.2025 | First official meeting at 47 Cassandra, Bedworth Park. Setting up github for communication and collaboration. Initial setup of the topology on Packet Tracer | 7/7 |
| 18.03.2025 | Compilation of questions for the purpose of outsourcing guidance from a profession who works with networks and internet connection and wiring | 7/7 |
| 24.03.2025 | Further setting up the topology on Packet Tracer | 7/7 |
| 26.03.2025 | DHCP set up to allow automatic IP addresses to be assigned. | 7/7 |
| 27.03.2025 | An attempt on configuring the access points to restrict the guests in terms of their access to the Wi-Fi. | 7/7 |
| 02.04.2025 | Adding to and improving our initial reflections about what we learnt on the online courses in preparation for the actual submission | 7/7 |
| 03.04.2025 | More attempts on configuration of access points and routers. | 7/7 |
| 03.04.2025 | Actual submission of Phase 1 |  |
| 09.04.2025 | Intervention of a professional to help us understand the real world of wiring computer networks components | 7/7 |
| 17.04.2025 | Connection of all computer network components and attempting to simulate the actual sending and receiving of packets | 6/7  JP POULO had issues with transport, therefore was excused |
| 23.04.2025 | Consultation to the lecturer to get clarity on certain instruction on the project | 7/7 |
| 29.04.2025 | Editing the topology, and fixing other misplaced components.  Improving the transportation of packets and overall communication within the network | 5/7  MI Ngobeni was attending a family issue, therefore was excused  JP Poulo had transportation issues, therefore was excused |
| 02.05.2025 | BL Mahlangu led us into a more detailed session of troubleshooting | 5/7  MI Ngobeni and JP Poulo were absent since it was recess |
| 03.05.2025 | Restructuring mainly the computer networks components mainly in the machine room to solve issues encountered during testing | 5/7  MI Ngobeni and JP Poulo were absent since it was recess |
| 05.05.2025 | Final submission and preparation for the presentation | 7/7 |

Our group shows a strong work ethic characterised by dependability, self-discipline, and professionalism, sticking to a defined work schedule with clear expectations for presence and completion of tasks. We primarily interact via a WhatsApp group chat, where professional, yet friendly communications allow efficient collaboration. By integrating open idea exchange with clear task assignment, we guarantee transparency and productivity in accomplishing our collective objectives.

## Issues encountered

* When adding devices, the application tends to slow down slightly—particularly while waiting for the connection arrows to turn green, which indicates that the connection has likely been established successfully.
* Setting up the entire network within the application is quite challenging, as it requires constant manual configuration.
* Some switches only support a limited number of ports, so we had to carefully choose switches that could accommodate a specific number of devices to avoid overloading them. This also helped prevent increased VLAN and port management complexity or the need to add unnecessary switches—especially considering budget constraints.
* Simple mistakes, such as entering an incorrect subnet mask or default gateway, caused large parts of the network to fail connectivity tests and required manual troubleshooting.
* Configuring IP addresses, gateways, and VLANs for all devices proved to be a very time-consuming task.
* Some devices failed to receive or forward packets for unknown reasons, and we had to restart the simulation.
* With the high number of devices involved, Subnet planning became more difficult as the number of devices increased.
* The large number of devices and network cables made the workspace visually overloaded, which made it difficult to trace connections and identify configuration issues quickly.
* Each time we opened our project file, an oblique line would appear on the workspace
* No group conflicts occurred, but one scheduling problem we experienced is the need to cancel meetings due to Tests

## **Additional Features Implementation**

This section explains how some extra features that are not required in the Packet Tracer simulation can still be added in the real world. These features are useful, realistic, and affordable for the company described in the project. Each one is connected to the actual needs of the new office building and its network setup.

**1. Firewall for Better Security**

* **What is it?**

A firewall protects the corporate network from outside attacks or hacking.

* **How to add it?**

Using an actual firewall device (Cisco ASA or FortiGate) between the Internet fibre connection in the machine room and the rest of the network.

* **Benefits**

Packet Tracer allows the use of ACLs (Access Control Lists). However, a firewall provides an extra layer of protection, being able to block access to malicious websites, virus uploads and intrusion.

2. **Power Backup (UPS)**

* **What is it?**

UPS (Uninterruptible Power Supply) is a device that maintains an electric supply to the devices for a limited period during short power failures.

* **How to add it?**

Installing UPS devices in the machine room for servers, routers, and switches.

* **Benefits**

This protects such sensitive devices from sudden shutdowns, which could cause data loss. Packet Tracer fails to depict any power failure events, but in the real world these events happen quite frequently.

3. **Remote Access (VPN for Work-from-Home)**

* **What is it?**

It is a secure connection for employees to access the office network from their home.

* **How to add it?**

Creating Virtual Private Network server using existing company's servers in main machine room.

* **Benefits**

Staff working from home can safely access files, email or internal tools. This supports the work from home option mentioned in the project.

4. **Wi-Fi Management for Staff and Guests**

* **What is it?**

Restricting who uses the Wi-Fi and making sure it is fast and secure.

* **How to add it?**

Using a wireless controller or business-grade access points like UniFi to split the Wi-Fi into Staff Wi-Fi and Guest Wi-Fi.

* **Benefits**

This is done to enhance the security of the main network and also not to disturb the performance.

5. **Network Monitoring and Alerts**

* **What is it?**

Software that checks if the network is working and sends alerts when some malfunction occurs.

* **How to add it?**

Using real software like PRTG or Zabbix on one of the company servers to keep an eye on the network.

* **Benefits**

This helps technicians fix problems faster, especially in large spaces like the open floor area or meeting rooms. Packet Tracer doesn’t show hardware failures or overloads.

6. **Device and User Access Control**

* **What is it?**

Ensure only approved devices and users can connect to the network.

* **How to add it?**

Using MAC address filtering or login authentication on the network switches and Wi-Fi routers.

* **Benefits**

A lot of employees may use their personal phones or laptops (BYOD). Thus, it also prevents untrusted devices from accessing sensitive areas of the network.

7. **Data Backup for Servers**

* **What is it?**

Regular saving of company files and server data to prevent loss.

* **How to add it?**

Using external storage drives, NAS devices or cloud backup tools like Google Drive or OneDrive.

* **Benefits**

There could be data loss due to hardware failure or a virus attack. Such backup will safeguard the information even from these issues.

**8. Environmental Monitoring in the Machine Room**

* **What is it?**

Sensors that check the physical state of temperature and humidity levels.

* **How to add it?**

Placing IoT sensors that can alert technicians if the room gets too hot or too humid.

* **Benefits**

The machine room has ventilation. Adding this feature helps protect sensitive equipment in the room.

## References

* eSecurity Planet (2024) 'How To Set Up a Firewall in 8 Easy Steps + Best Practices', eSecurity Planet, 28 May. Available at: https://www.esecurityplanet.com/networks/how-to-set-up-a-firewall/ [Accessed 4 May 2025].
* Security Metrics (2023) 'How to Configure a Firewall in 5 Steps', Security Metrics, 9 November. Available at: https://www.securitymetrics.com/blog/how-configure-firewall-5-steps [Accessed 23 April 2025].
* ManageEngine (n.d.) 'IT Operations Management'. Available at: https://www.manageengine.com/it-operations-management/unified-network-management.html [Accessed 2 May 2025].
* ManageEngine (n.d.) 'IT Operations Management'. Available at: https://www.manageengine.com/it-operations-management/unified-network-management.html [Accessed 28 April 2025].
* CMIT Solutions (n.d.) 'Ultimate Network Management Guide'. Available at: https://cmitsolutions.com/frederick-md-1072/blog/network-management-guide/ [Accessed 28 April 2025].
* <https://www.rectron.co.za/home>
* <https://scoop.co.za/>
* <https://www.takealot.com/>
* <https://miro.co.za/>
* [MashM@tshwane.gov.za](mailto:MashM@tshwane.gov.za)
* [**https://www.networkhardwares.com/**](https://www.networkhardwares.com/)
* [**https://www.firstshop.co.za/**](https://www.firstshop.co.za/)
* [**https://www.ebay.com/**](https://www.ebay.com/)