**COIT 20264: Network Design**

**Term 1, 2023**

**Assignment 2: Final Report of Logical and Physical**

**Network Design**

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# Executive Summary

The report covers an elaborated description and designing of 12 network designs in two specific cases; one for limited and another for unlimited budget for a company called “Prestige Auto Mart (PAM)”, whose head office is in Melbourne and has spans in five different cities of Australia; Darwin, Hobart, Brisbane, Perth, and Sydney.

The first section of report explains about the primary aims of the project such as the bandwidth, customer service, type of network in office and connecting all branch offices, etcetera. How these goals can be achieved is briefly explained in second section such as use of 100 Mbps internet service. In the third section, the report talks about the assumptions that were made for network, business goals and constraints. The next section of the report explain about how the business goals can be accomplished with the implementation of technologies, and what have been trade-off in limited and unlimited scenarios.

The report gives an information about the type of users in network, where the data is stored that is generated through applications, software, and devices, what kind of application is used, and traffic flow in those application through fifth section. In section six, IP range address distribution and abbreviation for local/devices are explained. Section seven and eight gives a justification and visual diagram of logical network design for limited and unlimited budget. Similarly, section nine and ten gives a justification and visual diagram of physical network design for limited and unlimited budget.

In section 11, the report gives an explanation about the name, cost, allocated IP address of products for limited and unlimited budget. Remaining last three sections gives explanation and justification of networking and communication devices and application moreover, it explains about the type of test to be performed in network using test scripts.

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# 1 Project Goal

The primary aim of the project is to create network designs based on the budget specification; one for limited budget and another for unlimited budget to provide a smooth, data secured, 24 hours a day, cost effective, possible high band width, and better customer services. This should be done considering the assumption of possible number of users, and employees, network bandwidth and uptime, business constraints and tread-off, business and technical goals, data stores, user community and much more. The project should come up with all together 12 network design; 3 logical network design and 3 physical network design for limited budget that include local area network (LAN) design within branch office, LAN design within a head office and wide area network (WAN) connecting all the offices. Similarly, 6 network design for unlimited budget.

# 2 Project Scope

The project scopes are listed below:

* The assumptions were done with consideration of possible 200 users, 20 employees, 98.70 % uptime and 100 Mbps bandwidth for limited budget network, 99.999 % uptime and 1 Gbps bandwidth for unlimited budget network, and so on.
* Explanation of what are the objectives of project and how the service should be with the required technical necessities.
* Trade-off models were created by valuating its several aspects which have adverse relation on each other for instance, prioritizing scalability reduce the adaptability.
* Implementation of network subnetting for addressing and use of abbreviations for naming.
* Creation of blueprint for logical network design and mentioning all the physical values of several components of network such as model and IP address of devices, types of cable, user type, name, and bandwidth of internet providers in the network.

# 3 Business Goals and Constraints

## 3.1 Assumptions

Logical Network design for any business is the implementation of various entities on a network to manage resources, operations, and various other constraints. The following proposal identifies, elaborates, and defines the various entities that are required to address while designing logical computer network for Prestige Auto Mart (PAM).

Following assumptions are made by analysing the scenario of PAM before starting the network design:

* There will be 200 users for the web application and the mobile app per day.
* There are 20 employees in each branch including delivery drivers.
* uptime for limited budget is 98.70% and uptime for unlimited budget is 99.999%
* There are 10 computers, 20 wireless devices, 15 cameras, 1 server and 2 printers in each branch.
* There are 10 guest users in each branch using Wi-Fi network.
* The limited budget uses 100 Mbps NBN fiber whereas unlimited budget uses 1 Gbps NBN.

## 3.2 Business Goals

* The network should serve PAM’s business objectives, provide seamless experience to the customers while using services from PAM like buying, selling, leasing, or exchanging new and old vehicles.
* The network should ensure the smooth integration of all PAM offices and showrooms across key Australian cities including efficient communication and collaboration between them.
* The network should enable PAM’s online portal and mobile app, allowing customers to place orders and make online payments.
* The network should be available 24 hours a day, seven days a week to track the vehicle fleet’s real-time state, reservations, and customer information.
* The network must protect the security of PAM’s proprietary algorithm as well as the various data and information stored in its information system.
* Since PAM is new in the business, a scalable network design to accommodate future growth and expansion.

## 3.3 Business Constrains

* There is a budget limitation for minimum budget design options.
* The availability of the network should be high as it processes real-time data 24/7.
* The network design should support the mobile devices used by distribution truck drivers which are connected to PAM’s city offices.
* Seamless integration with PAM’s on-site customized proprietary software.
* Delivering cost-effective solutions while satisfying all business goals.

# 4 Technical Goals and Trade-offs

## 4.1 Technical Goals

* Prestige Auto Mart (PAM) requires a network architecture that ensures high network availability and reliability to minimize downtime, that provides performance for real-time reservations and processing of customer orders.
* Seamless data sharing and communication between the branches
* Implement a secure network design to protect sensitive data and prevent unauthorized access.
* Optimize network performance to ensure a seamless user experience.
* Convenient and secure payment system for online and on-site payment transactions.
* The network must support an integrated CCTV system for all showrooms while ensuring the security and confidentiality of all data and information.
* Provide a cost-effective network design that meets the client's budget constraints.

## 4.2 Trade-offs

### 4.2.1 Minimum Budget

For minimum budget, affordability takes priority as budget is low, but availability is given highest number as network needs to be available 24/7. Due to this security is being major trade-off parameter.

Table 1: Trade-off table for minimum budget

|  |  |
| --- | --- |
| Scalability | 5 |
| Availability | 30 |
| Network performance | 15 |
| Security | 10 |
| Manageability | 5 |
| Usability | 5 |
| Adaptability | 5 |
| Affordability | 25 |
| Total | 100 |

### 4.2.2 Unlimited Budget

For unlimited budget, network performance and security are taken in consideration compared to limited budget. While making more secure network, user convenience is being the trade-off parameter.

Table 2: Trade-off table for unlimited budget

|  |  |
| --- | --- |
| Scalability | 10 |
| Availability | 30 |
| Network performance | 20 |
| Security | 20 |
| Manageability | 5 |
| Usability | 5 |
| Adaptability | 5 |
| Affordability | 5 |
| Total | 100 |

# 5 Table of User Communities, Data Stores, Network Applications and Traffic Flows

The user communities for Prestige Auto Mart’s (PAM) network includes Employee at the headquarters and branch offices, corporate customers, individual customers etc. Inventory records for new and used vehicles, client information such as contact details, sales records, and financial transactions are all stored on the network servers. PAM’s customized software for vehicle reservations and orders, on-site payment facilities, a customer online web portal, a mobile app, and a CCTV system with remote monitoring are among the various network applications. The network traffic, its flow and management include Customers making orders through the web portal or mobile app which updates inventory data in real-time, vehicle reservation orders being processed by PAM’s proprietary software, and deliveries being made to customers etc. The traffic flow also includes the secure transfer of customer and financial data, as well as the integration of a cloud-based server and IPv6 addresses for improved security and performance.

## 5.1 User Communities

There are different users using the PAM’s network on daily basis through wired and wireless connection. Number of users per day is based on the assumption made earlier.

Table 3: User communities in PAM’s network

|  |  |  |  |
| --- | --- | --- | --- |
| User Community Name | Size per Day (Number of Users) | Location | Applications |
| Customers | 1200 | Melbourne  Sydney  Brisbane  Perth  Darwin  Hobart | Online Web Portal  Mobile Application  Email  Payment System |
| Staff | 90 | Melbourne  Sydney  Brisbane  Perth  Darwin  Hobart | Email  Proprietary Software  Database  CCTV |
| Delivery Driver | 30 | Melbourne  Sydney  Brisbane  Perth  Darwin  Hobart | Distribution Mobile App  Email  GPS |
| IT Department | 10 | Melbourne | Database  Servers  Propitiatory Software  Email  CCTV  Network |

## 5.2 Data Stores

The data generated or consumed while using PAM’s network is being stored in different data stores in which some of them are in all branches while majority of servers located at the head office.

Table 4: Showing data stores in relation with location, applications and user communities

|  |  |  |  |
| --- | --- | --- | --- |
| Data Store | Location | Applications | User Communities |
| Proprietary Software Database | All Branches | Propitiatory Software | Sales Team  IT Department |
| CCTV Database | All Branches | CCTV App | Sales Team  IT Department |
| Web Server | Melbourne | Internet Browser | Customers  Sales Team  IT Department |
| Mobile Application Server | Melbourne | Mobile App | Customers  Sales Team  IT Department  Delivery Drivers |
| Payment Gateway | Melbourne | Web Server | Customers  IT Department |
| Email Server | Melbourne | Email App  Internet Browser | Customers  Sales Team  IT Department  Delivery Drivers |
| SSH Server | Melbourne | Linux | IT Department |

## 5.3 Network Applications

The applications run in the PAM’s network using various protocols, the requirement of bandwidth differ from application to application which is shown in table below:

Table 5: Application run in PAM’s network and their protocols

|  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- |
| Name of Application | Type of Traffic Flow | Protocol Used by Application | User Communities | Data Stores | Required Bandwidth | QoS Requirements |
| Web Portal | Client- Server | HTTP/HTTPS | Customers  Staffs | Web Server | Moderate to High | Low Latency  High Availability  Secure Connection |
| Mobile App | Client- Server | HTTP/HTTPS | Customers  Delivery Drivers | Mobile App Server | Moderate to High | Low Latency  High Availability  Secure Connection |
| Proprietary Software | Client-Server | Custom Protocol | Staff  IT Department | Software Database | Moderate to High | Low Latency  High Availability  Secure Connection |
| Payment System | Client-Server | HTTPS  Secured Electronic Transaction (SET) | Customer | Customer  Database  Payment Gateway | High | Low Latency  Secure Connection |
| Network Management | Management Traffic | SNMP  SSH | IT Department | Network Devices | Low to Moderate | Low latency  Monitoring & Configuration |

## 5.4 Traffic Flows

The traffic flows while using different application requires different data speed according to the application type and data it consumes.

Table 6: Traffic flow with data speed

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| User Communities | Data Stores | Network Applications | Traffic Flows | Data Speed |
| Customers | Vehicle inventory | Online web portal | Web traffic  (HTTP/HTTPS) | 50 Kbps |
|  | Customer orders | Mobile app | Mobile app traffic | 100 Kbps |
|  | Payment information | PAM Proprietary software | Proprietary software traffic | 100 Kbps |
|  |  | Email server | Email traffic  (SMTP/POP/IMAP) | 20 Kbps |
| Sales Staff | Customer details | Proprietary software | Proprietary software traffic | 100 Kbps |
|  | Vehicle inventory | Showroom application | Showroom application traffic | 100 Kbps |
|  | Sales data | Business application | Application traffic | 50 Kbps |
|  |  | Email server | Email traffic  (SMTP/POP/IMAP) | 20 Kbps |
| Delivery drivers | Vehicle inventory | Distribution truck application | Distribution truck application traffic | 100 Kbps |
|  | Customer orders | Mobile app | Mobile app traffic | 100 Kbps |
|  | Delivery details | GPS tracking application | GPS tracking application traffic | 250 Kbps |
|  |  | Email server | Email traffic  (SMTP/POP/IMAP) | 20 Kbps |

# 6 Addressing and Naming

The addressing and naming strategy for PAM's Network should be designed in such a way that it recognizes various devices and applications on the network and supports inter-communication. [The domain name system (DNS) should be used to provide naming and address resolution for devices and services on the PAM network (Musiani, 2022).](https://learn.saylor.org/mod/page/view.php?id=27475) To accomplish this, a hierarchical addressing mechanism based on IP addresses and domain names should be utilized. The IP address system should be designed to accommodate the network's size as well as any future development scenarios (Author *et al.*, no date). So, Communication between internal devices is incorporated with Private IP addresses while for external communication with other networks, Public IP addresses are used.

Moreover, A naming convention for network devices and services should be developed in addition to IP addressing and domain name. This approach will help in the efficient management of network servers and the resources associated with them. This standard should be designed to make the identification of network devices and services as straightforward as possible, and it should be comparable across all sites.

DHCP (Dynamic Host Configuration Protocol) is used to as it allows each end system to learn its address automatically and it is feasible with both ipv4 and ipv6.

The IP addressing of different branches is given below:

Table 7: IP addressing for all offices and servers

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| Branch | CIDR | Network address | Broadcast address | Usable address |
| Melbourne head office | 10.1.0.0/25 | 10.1.0.0 | 10.1.0.127 | 10.1.0.1-10.1.0.126 |
| Sydney office | 10.2.0.0/25 | 10.2.0.0 | 10.2.0.127 | 10.2.0.1-10.2.0.126 |
| Brisbane office | 10.3.0.0/25 | 10.3.0.0 | 10.3.0.127 | 10.3.0.1-10.3.0.126 |
| Perth office | 10.4.0.0/25 | 10.4.0.0 | 10.4.0.127 | 10.4.0.1-10.4.0.126 |
| Darwin office | 10.5.0.0/25 | 10.5.0.0 | 10.5.0.127 | 10.5.0.1-10.5.0.126 |
| Hobart office | 10.6.0.0/25 | 10.6.0.0 | 10.6.0.127 | 10.6.0.1-10.6.0.126 |
| Web servers | 10.10.0.0/25 | 10.10.0.0 | 10.10.0.127 | 10.10.0.1-10.10.0.126 |
| Application servers | 10.20.0.0/25 | 10.20.0.0 | 10.20.0.127 | 10.20.0.1-10.20.0.126 |
| Database servers | 10.30.0.0/25 | 10.30.0.0 | 10.30.0.127 | 10.30.0.1-10.30.0.126 |

As far the naming concern for devices or location, three uppercase letter is chosen to make it short, meaningful, and distinct. Here is the list of naming for devices and locations:

Table 8: Naming convention for PAM’s network

|  |  |
| --- | --- |
| Device / location | Names |
| Router | RTR |
| Switch | SWC |
| Server | SRV |
| Application | APP |
| Computer | CMP |
| Mobile | MOB |
| Printer | PRT |
| Firewall | FWR |
| Camera | CAM |
| Melbourne | MEL |
| Sydney | SYD |
| Brisbane | BNE |
| Perth | PTH |
| Darwin | DRW |
| Hobart | HOB |

# 7 Explanation and Justification of Logical Network Design

The logical network design for Prestige Auto Mart (PAM) will be based on a hierarchical topology with a core, distribution, and access layer throughout the hierarchy (Wang *et al.*, 2017). The core layer will be responsible for high-speed interconnectivity between the distribution layers in the branch office, as well as the head office in Melbourne. WAN connection is used to connect multiple branches. The distribution layer will provide access to network services and segment the network into smaller sections of broadcast domains. The access layer will connect end-user devices to the network and provide access to various network resources.

Each branch office will have its individual LAN, with a switch acting as the distribution layer in the middle and providing connectivity to the core layer through a high-speed link.Access layer switches will provide connectivity to end-user devices, such as desktops, laptops, cameras, and mobile devices, as well as printers and other network devices. For limited budget, there will be limited number of networking devices such as routers, switches whereas for unlimited budget, multiple networking devices is proposed to ensure redundancy and traffic control. For example, there are 2 physical routers, and one VPN router is proposed for branch offices in which all the switches are connected with them. If one router is unable to perform or higher in traffic flow, connection is still established via other router enabling successful operation.

The head office will house the data centre along with servers and storage to support the centralized services required by PAM. These services include the web server, email server, reservation system, the inventory database, and the customer relationship management system. [The data centre will be connected to the core layer and will be replicated in all branch offices for redundancy processing as well as recovery after events of disaster.](https://learn.microsoft.com/en-us/azure/storage/common/storage-introduction)

The logical network design will also take into consideration the security requirements of PAM.The appropriate security mechanisms such as firewalls, intrusion detection and prevention systems (IDPS), and virtual private networks (VPNs) ensure the confidentiality, integrity, and availability of PAM’s data and network resources.

# 8 Logical Network Diagrams including Addressing and Naming

The logical network diagrams for Prestige Auto Mart's (PAM) network design will show the layout/representation of network devices as well as how they will be connected. Addressing and naming conventions for all network devices and interfaces are included in the diagrams.

The main office in Melbourne will require a core switch and a router to connect to the internet service provider (ISP) and to other branch offices. Each branch office will have its own switch, router, and wireless access points. In addition, each showroom will have its own switch and access points (Waldring, 2009).

The web server and database server will be hosted in a data centre in Melbourne, with [cloud-based servers used for redundancy and scalability](https://www.lucidchart.com/blog/reliability-availability-in-cloud-computing). [The payment gateway and inventory management software will be hosted side by side on the same server in the data centre](https://www.techtarget.com/searchdatacenter/definition/data-center).The network should be designed with redundancy consideration so that even if the server or device fails, the network can continue to function with minimal downtime.

The network diagrams should also illustrate traffic flows in the network, including customer orders and payments, inventory management, and remote monitoring of showrooms through CCTV cameras.The use of Quality of Service (QoS) mechanisms should be considered to prioritize traffic for critical applications, such as the inventory management software and payment gateway.

## 8.1 Limited Budget

### 8.1.1 Network Connection between All Branch Offices

A picture containing diagram, screenshot, text, design

Description automatically generated

Figure 1: WAN connection between all branches using internet (logical diagram – limited budget)

### 8.1.2 LAN Connection of Head Office

A diagram of a computer network

Description automatically generated with low confidence

Figure 2: LAN connection of head office (logical diagram – limited budget)

### 8.1.3 LAN Connection of Each Branch Office

A screenshot of a video game

Description automatically generated with medium confidence

Figure 3: LAN connection of branch offices (logical diagram – limited budget)

## 8.2 Unlimited Budget

### 8.2.1 Network Connection between All Branch Offices

A screenshot of a computer

Description automatically generated with low confidence

Figure 4: WAN connection between all branches using SDH (logical diagram – unlimited budget)

### 8.2.2 LAN Connection of Head Office

A screenshot of a computer

Description automatically generated with medium confidence

Figure 5: LAN connection of head office (logical diagram – unlimited budget

### 8.2.3 LAN Connection of Each Branch Office

A screenshot of a computer

Description automatically generated with medium confidence

Figure6: LAN connection of branch office (logical diagram – unlimited budget)

# 9 List of Routing and Switching Protocols, and Security Mechanisms

The routing and switching protocols used in the network design must be selected while considering the technical goals and constraints identified for this project. In this context, the network supports many users and high-volume data traffic, so efficient routing and switching protocols are necessary. Protocol selection must take into account the compatibility of existing equipment, scalability, and ease of management (Ahmed and Abadin, 2021).

For unlimited budget, we have chosen [recommended dynamic routing protocols such as OSPF or EIGRP for efficient traffic routing, as well as VLANs for logical network segmentation](https://www.comparitech.com/net-admin/routing-protocol-types-guide/).Additionally, for switching protocols, the project should implement the Spanning Tree Protocol (STP) or Rapid Spanning Tree Protocol (RSTP) for loop avoidance as well as Link Aggregation Control Protocol (LACP) for improved bandwidth utilization. In case of minimum budget, we have used RIP (Router Information Protocol) switching protocol is used as it is simple, easy to configure and does not require much processing power.

# 10 Physical Network Diagram

The physical diagram of PAM’s network follows the same logical network diagrams with more detail of devices used and connection made. For limited budget, low-cost devices and technologies are used whereas for unlimited budget multiple connections and high-cost devices has been used to ensure high availability and security. While selecting cables for data transmission, cat 6 ethernet is used within each office in limited budget whereas fibre connection is for unlimited budget. Necessary naming and IP addressing is presented in each diagram to provide enough information of physical diagrams.

WAN technology is being used to connect multiple branches. Internet is used for limited budget whereas Sonet SDH is used for unlimited budget. The connection is single line in limited option while point to multipoint connection in unlimited budget provide much higher traffic flow and redundancy.

## 10.1 Limited Budget

## 10.1.1 Network Connection between All Branch Offices

A picture containing screenshot, circle, art

Description automatically generated

Figure 7: WAN connection between all branches using internet (physical diagram – limited budget

### 10.1.2 LAN Connection of Head Office

A picture containing diagram, text

Description automatically generated

Figure 8: LAN connection of headquarter (physical diagram – limited budget)

### 10.1.3 LAN Connection of Each Branch Office

A screenshot of a computer

Description automatically generated with low confidence

Figure 9: LAN connection of branch office (physical diagram – limited budget)

## 10.2 Unlimited Budget

### 10.2.1 Network Connection between All Branch Offices

A screenshot of a video game

Description automatically generated with medium confidence

Figure 10: WAN connection between all branches using SDH (physical diagram – unlimited budget)

### 10.2.2 LAN Connection of Head Office

A screenshot of a computer game

Description automatically generated with medium confidence

Figure 11: LAN connection of Headquarter (physical diagram – unlimited budget)

### 10.2.3 LAN Connection of Each Branch Office

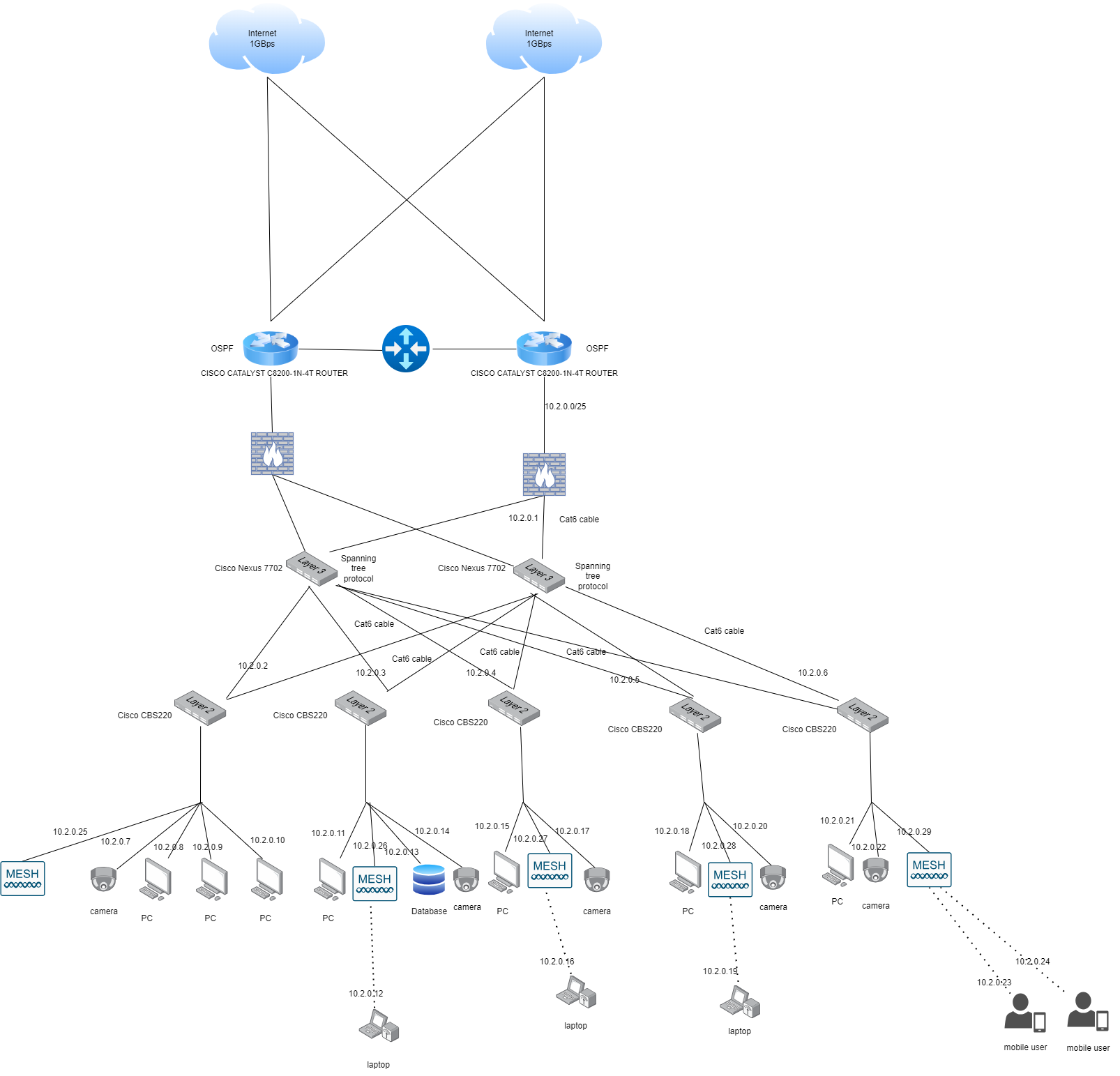


Figure 12: LAN connection of branch office (physical diagram – unlimited budget)

# 11 Networking and Communication Devices and Applications Required

Whole network design consists of networking and communication devices such as router, switch, cables, internet connection. Also, network management application plays vital role while managing such complex network.

## 11.1 Limited budget devices and applications

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| S. N | Product name | Product number | IP address allocated | Approximated price |
| 1. | 100 Mbps Internet | NBN™  Enterprise Ethernet | - | $299 per month |
| 2. | VPN router | Cisco RV260 | 10.2.0.0/25 | $349 per device |
| 3. | Cable | Cat6 | - | $2 per metre |
| 4. | Switch (Layer 3) | S5850-24S2Q | 10.2.0.1 | $2,430 per device |
| 5. | Switch (Layer 2) | Cisco CBS220-24FP-4X-AU | 10.2.0.2 | $1750 per device |

## 11.2 Unlimited budget devices and application

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| S.N. | Product name | Product number | Ip address allocated | Approximated price |
| 1. | SONET SDH | - | Provided by TPG | $100,000 per year |
| 2. | 1GBps internet speed | Fibre1000 | Provided by TPG | $800 per month |
| 3. | Cisco Catalyst C8200-1N-4T Router. | C8200-1N-4T | 10.1.0.0/25 | $8174.61 per device |
| 4. | Cisco Nexus 7702-layer 3 switch | N77-C7702 | 10.1.0.1 | $17,400 per device |
| 5. | Cisco CBS220 – layer 2 switch | CBS220-24FP-4X | 10.1.0.2 | $1750 per device |
| 6. | Fibre Optic cable | Optical fibre 2 core | - | $7 per meter |
| 7. | Ninja One network management software | ninjaone | - | $130 per month |

# 12 Explanation and Justification of Networking and Communication Devices and Applications

## 12.1 For limited budget project

To get the reasonable speed and connectivity we have used 100 Mbps NBN™ Enterprise Ethernet which will cost $299 per month. For VPN router we have provided Cisco RV260 that allows secure remote access to the network and have been allocated with 10.2.0.0/25 IP addresses with cost of $349 per device. To have a better performance and bandwidth with affordable price we have used Cat6 cable that will cost $2 per meter. To have moderate price range layer 3 switch that can offer advanced routing capabilities we have used S5850-24S2Q. And for layer 2 switch that have basic network connectivity but does not have routing capabilities we have choose Cisco CBS220-24FP-4X-AU.

## 12.2 For unlimited budget project

Since, the budget for this network design is unlimited we have selected the best options for all the components of the network that prices very high. For long-distance high-speed communication network with fibre-optic based transmission technologies we have used SONET (Synchronous Optical Networking) and SDH (Synchronous Digital Hierarchy) with cost of $ 100,000 per year. To get a speed of 1Gbps we used fibre 1000 which is excellent for high demanding bandwidth requirement. For the powerful router that have a high switching capabilities and advance routing in the network we selected Cisco Catalyst C8200-1N-4T Router which will cost $8,174.61 per device and been allocated with IP address of 10.1.0.0/25. And for layer 3 and 2 switches we used Cisco Nexus 7702 and Cisco CBS220 respectively.

# 13 Test Plan

Test plan is approach that are performed to determine the response time, efficiency, delay variation, delay, and throughput in network architecture. Using tools like ping, traceroute, and Wireshark, these tests are run on a network with a PAM-like network architecture and network devices including routers, switches, access points, and servers. These testing are of four types: application response time testing, throughput testing, availability testing, and regression testing.

## 13.1 Application response time testing

The test is executed in simulation tools to simulate user behaviour, which is first tested with specific defined number of users then the user’s number is increased to check if the response time increased or not.

## 13.2 Throughput testing

The test measures the throughput through a router or switch in form of packet per second. It is also predefined with certain number of users and then increased gradually.

## 13.3 Availability testing

This is done to determine the error rate and failure by executing test under medium to heavy load for 24 to 72 hours.

## 13.4 Regression testing

The test is normally automated and focused on existing application. It is performed to make sure the new introduced system does not break any application.

# 14 Detailed Test Script for the Test Plan

The detailed test scripts are described below:

## 14.1 Test case1: Application response time testing

1. We first consider any network application, such a web portal.
2. While the network is operating normally, note the web portal's typical response time.
3. Note the web portal's response time when latency is increased, and bandwidth is constrained.
4. Evaluate the outcomes in relation to the typical and anticipated response times.
5. If the performance equals or exceeds the expected performance, pass the test; if not, fail the test.

## 14.2 Test case2: Throughput testing

Sample: throughput testing between switch and end user

1. Using tools like Speedtest or iPerf determine the standard throughput between switch and end user.
2. Saturate the link by generating network traffic and record the result.
3. If the result meets the standard throughput or exceed it, pass the test otherwise fail the test.

## 14.3 Test case3: Availability testing

1. Perform a network disruption test in switch and end user device such as unplugging cables and simulate network congestion.
2. Observe the network device and service during the test.
3. Check if the network performs normal operation after the disruption.
4. Pass the test if device and service show high availability. Otherwise, fail the test.

## 14.4 Test case4: Regression testing

1. Record the baseline configuration of router.
2. Implement some changes in configuration and see the result.
3. If the functionality of router work as baseline record that means no regression, then pass the test. Otherwise, fail the test.

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