



LMN Financial Group Network

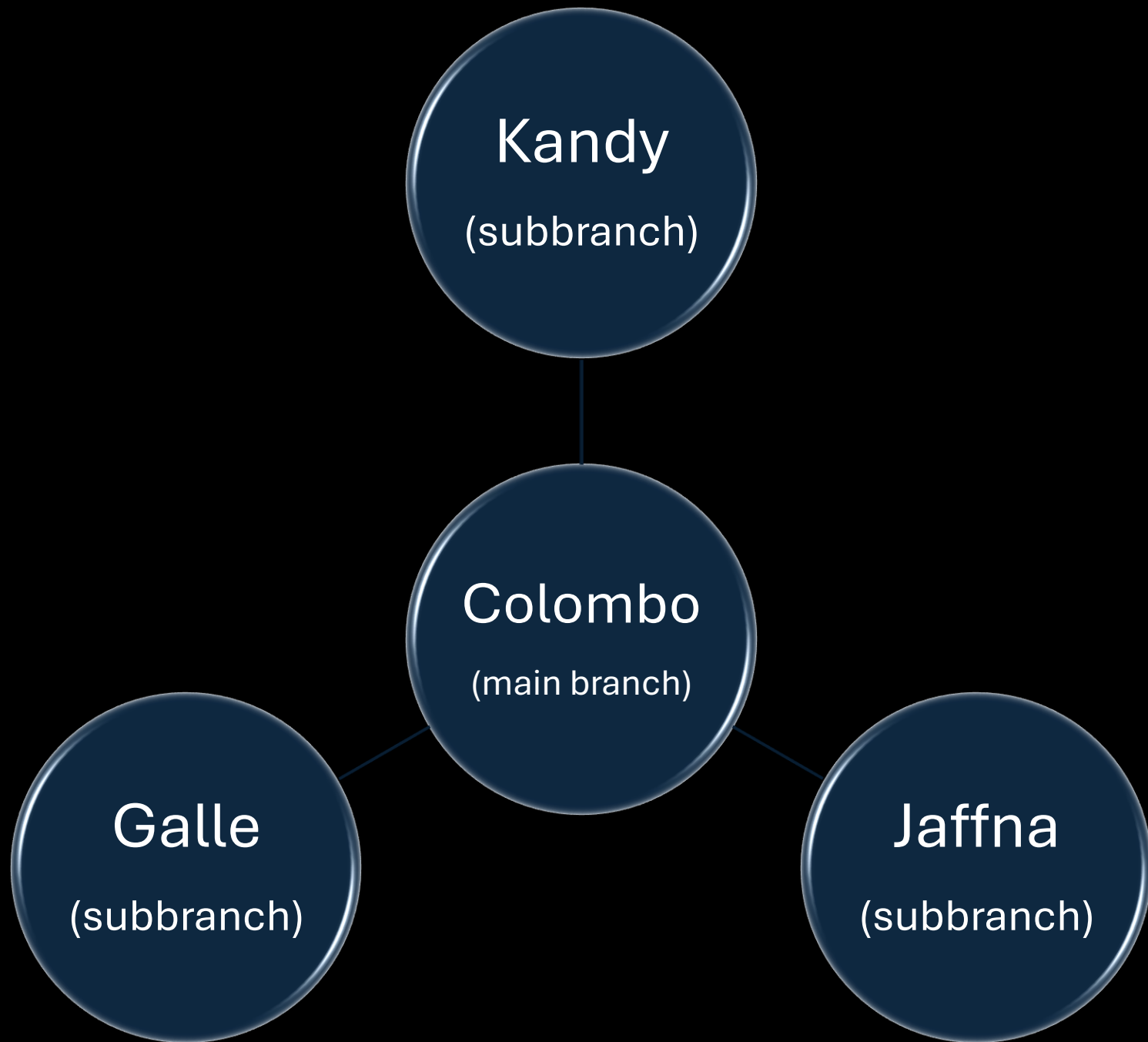
Batch No – Y1S2.WD.CSNE.01
Group No – Y1S2.WD.CSNE.01_09

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Introduction

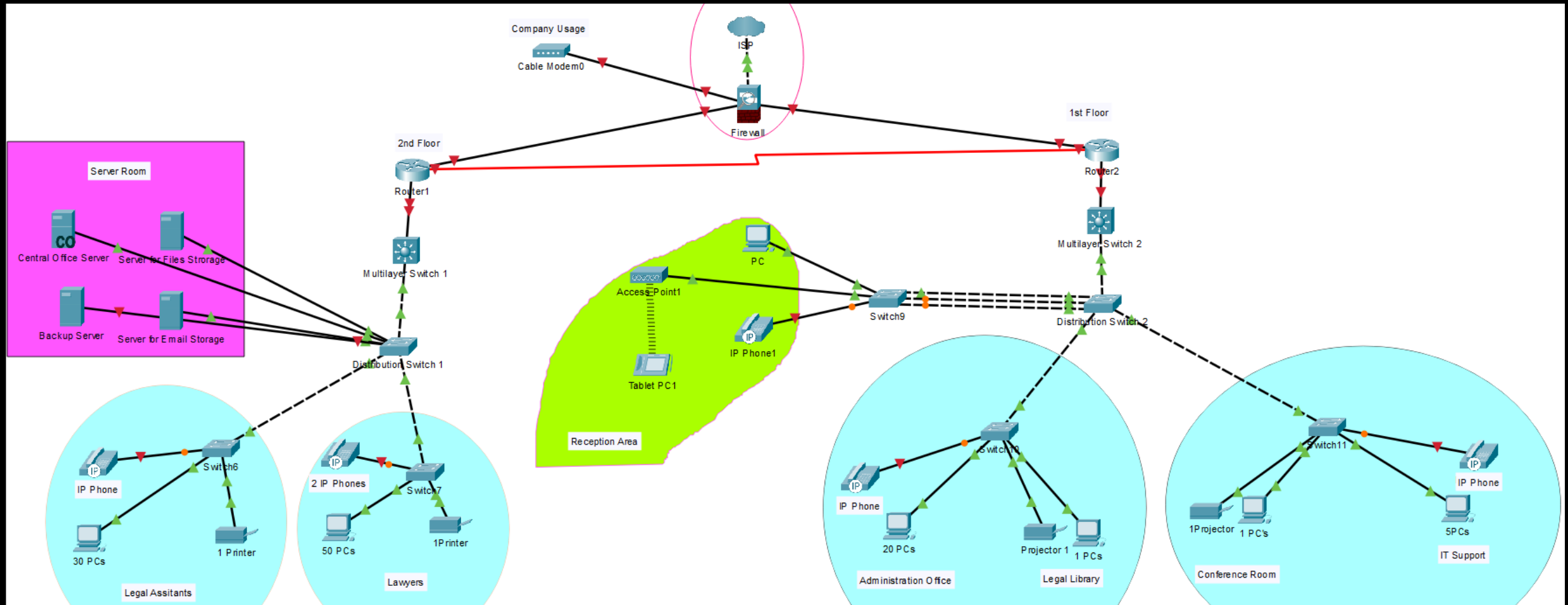
- This project involves for designing a network for a law firm. This law firm has a main branch in Colombo and three subbranches in Kandy, Galle and Jaffna.
- This network is designed for fast communication, safe data storage and efficient connection between the branches.
- The law firm consists of:
 - 50 lawyers , 30 legal assistants ,20 administrative staff ,5 IT support staff in the main branch.
 - 30 lawyers, 15 legal assistants, 10 administrative staff and 3 IT support staff in subbranches.





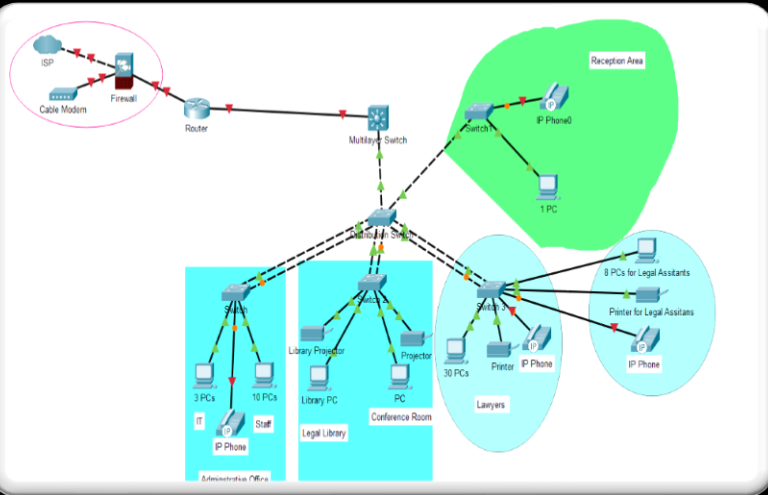
Logical Topology Diagrams

Colombo Branch (Main branch)

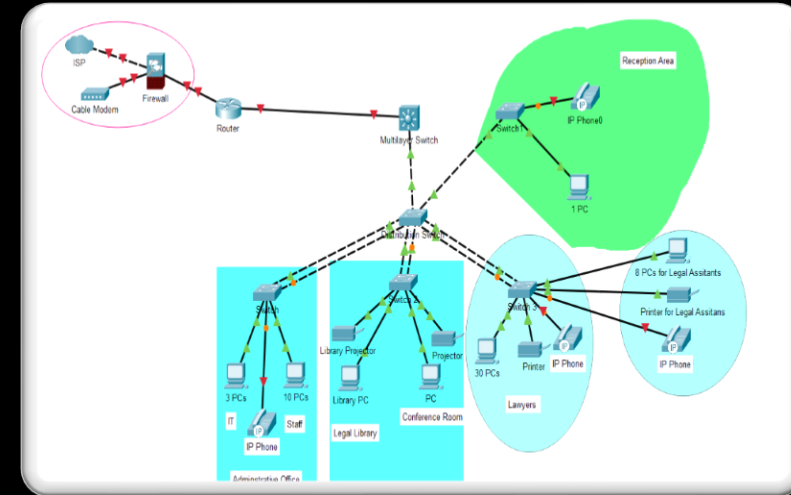


Sub branches

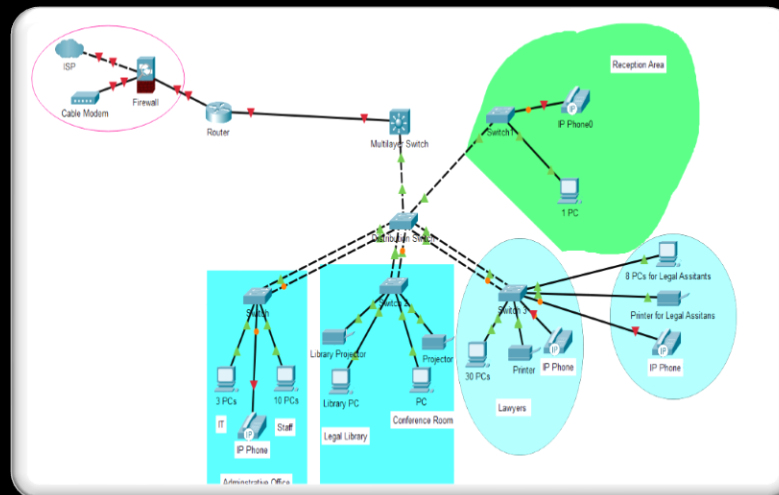
Kandy



Galle



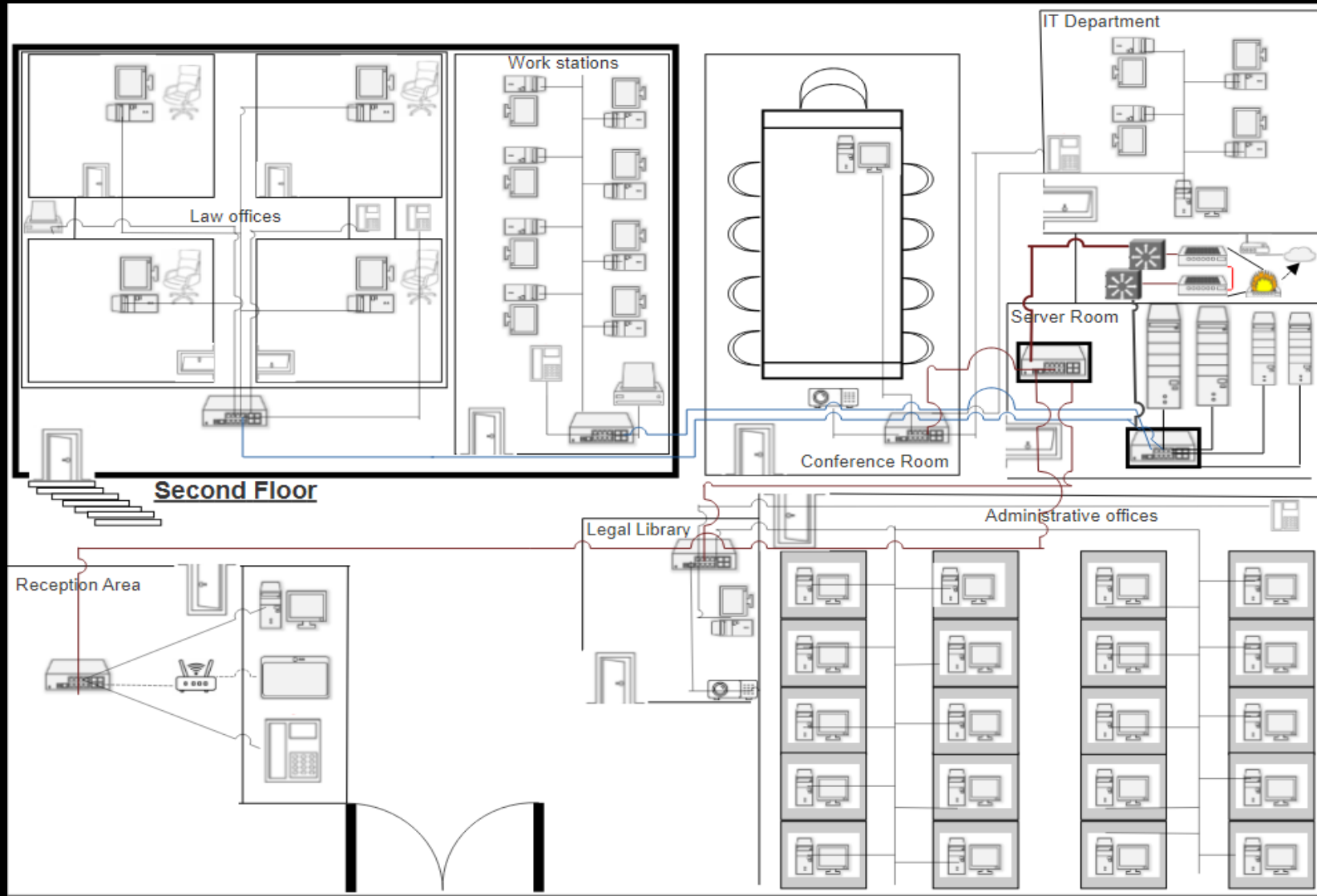
Jaffna



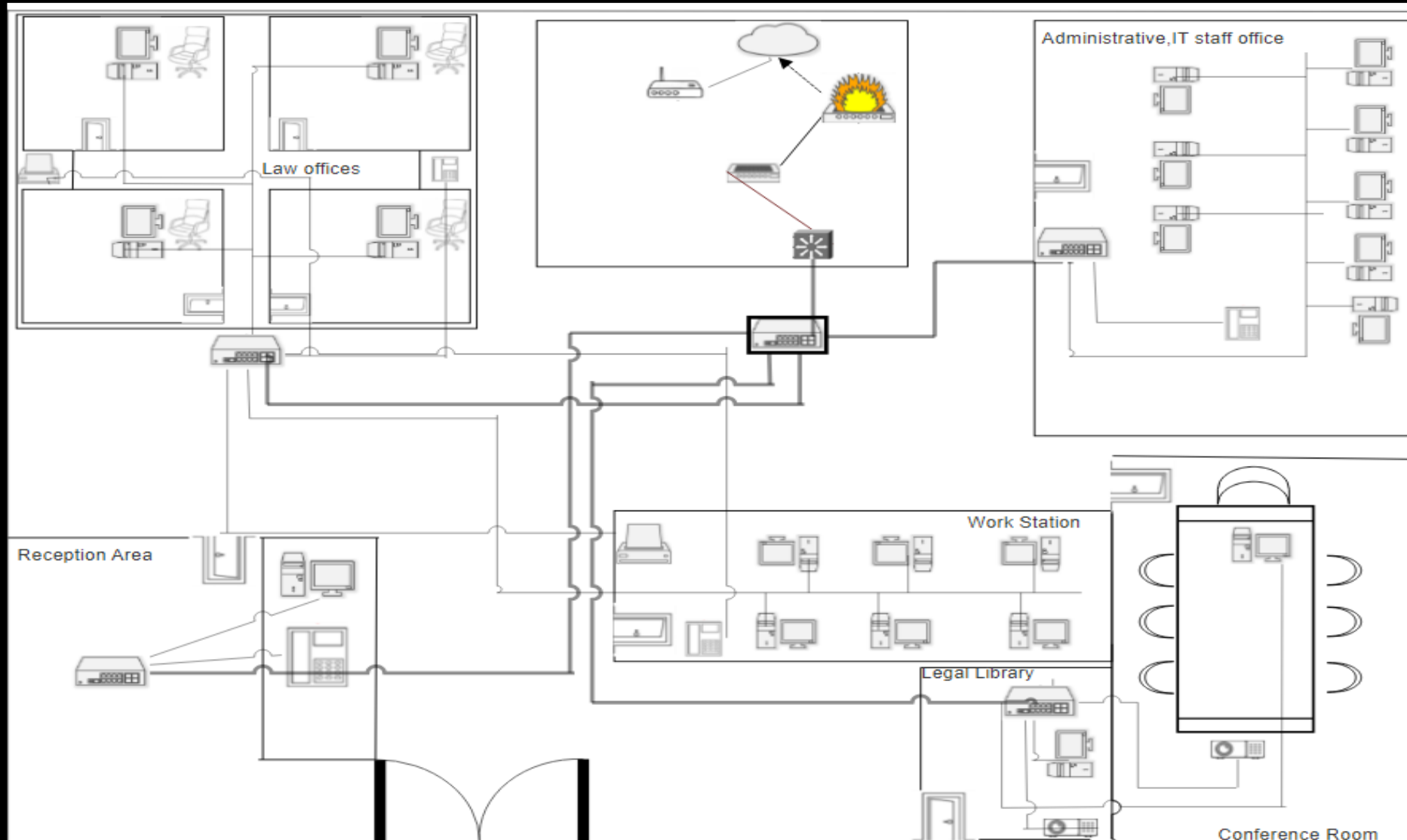


Physical Topology Diagrams

Physical Topology Diagram- Main Branch



Physical Topology Diagram-Sub Branches





Real World Network Devices

Desktop



Vendor: DELL Technologies

Model name: Dell Vostro
3910 – i5

Printer



Vendor: Canon

Model name: Canon
G4010 ink tank printer

IP Phone



Vendor: Grandstream

Model name: Grandstream
GRP 2061

Projector



Vendor : ViewSonic

Model name : ViewSonic
PA503S

Tablet



Vendor : Samsung

Model name : Samsung
Galaxy Tab S9

Core Network

- **Routers** (Cisco ASR 1000 series) –
Essential for interconnecting different networks, high performance, scalability and advanced routing capabilities, built in firewall, VPN and advance security features, offers SD-WAN support.
- **Switches**(Cisco Catalyst 9300L-48P-4X-A switch)-
Power over ethernet support, available 48 ports, security features.
- **Central office server** (HPE DL380 Gen10 8SFF NC CTO server)-
Excellent reliability and security features, great for virtualization, databases and general enterprise tasks.



Distribution Network

- **Multilayer Switches**(Cisco Catalyst 3850 series) –

Layer 3 routing, supports 1G and 10G uplink ports, advanced security options, allowing them to route traffic at high speeds, high availability and simplified management.

- **Routers**- Routers may also needed for the distribution level to provide additional routing capabilities and redundancy.



Access Network

- **Gigabit Ethernet switches** (Cisco Catalyst 2960 series) -

provide high-speed connectivity to end user devices, offer Gigabit Ethernet ports, PoE support for powering devices like IP phones and wireless access points, and robust security features



- **Netgear Nighthawk CM1200 (DOCSIS 3.1) cable Modem**

Multi-gig speeds, supports high bandwidth applications and offers four gigabit Ethernet ports for wired connections.



Wireless Network

- **Wireless Access Points (Cisco Aironet 3802i Access Point)**

Offers enterprise-grade wireless connectivity, advanced security protocols and centralized management, provides reliable wireless connectivity to end devices such as smartphones and laptops across all branches.



Security

- **Firewall** (Cisco Adaptive Security Appliance Firewall ASA)

Helps organizations increase capacity and improve performance, Meets the unique needs of both the network and the data center, Offers integrated IPS, VPN, and Unified Communications capabilities, Adds security to the network.



Management

- The network will be managed using a centralized network management system that will allow the IT department to monitor and control the network devices from a single location.
- **Network Management System (e.g. : Cisco Prime Infrastructure) -**

offers centralized management and monitoring of network devices, allowing IT administrators to efficiently configure, troubleshoot, and optimize the network infrastructure.



Server – Supermicro Super Server 2014TP – HTR

- Dual Intel Xeon Scalable processors for high-performance computing
- Supports DDR4 ECC registered memory and various storage options
- Flexible networking connectivity with onboard Gigabit Ethernet ports
- Reliability with redundant power supplies, cooling fans and remote management features.



Backup and redundancy

- **Backup server (DELL PowerEdge R740xd Server)**

Offers flexible storage and large memory capacity, fast data processing, made with enterprise -grade components, suitable for various workloads.





Appropriate Media Types

Fiber Optical Cables

ST-ST-10-Meter-Singlemode-FiberOptic-Cable

Fiber Optic Cable, ST/ST, Single mode – 1
Meter (9/125 Type)

- Low signal loss
- high speed performance
- secure connection



Ethernet Cables

Cat 8 Ethernet Cables 10 feet.

- provide reliable wired connections
- offering high bandwidth and low latency
- support Gigabit Ethernet speeds
- suitable for handling the network traffic within the premises.



Serial DCE Cables

- Used for better communication between various networking devices and computers.
- Transfer reliable data
- Protocol is straightforward.
- Cost effective



Crossover Serial cables

- Essential for direct communication between two similar devices.
- Enabling smooth communication between devices in networking.



Wireless connection

Cisco Aironet 2800 Series.

- Wi-Fi provides convenient wireless connectivity for mobile devices, offer increased bandwidth and improved performance





LAN and WAN Technologies

LAN Technology

Gigabit Ethernet

- Offers speeds up to 1GB per second with potential for higher speeds like 10GB per second .
- Fast data transmission .
- Support high speed internet connections, facilitating fast access to online services and multimedia content.
- Accommodating multiple devices simultaneously.

Wi-Fi

- Enables wireless connectivity
- Providing flexibility for device placement and mobility for users
- Users can connect to the network from anywhere
- Supporting the mobile devices such as laptops, smartphones, tablets
- Scalability and convenience
- Allowing employees to work from anywhere
- Integration with IoT Devices



WAN Technology



ISP- Internet Service Provider (SLT Mobitel)

- **Core Efficiency:** Readily available internet connections to create a secure overlay network, SDWAN solutions typically utilize affordable, reduce costs.
- **Increased Bandwidth Efficiency:** manages and optimizes network traffic flows, dynamically routing data across the most efficient path based on real-time network conditions.
- **Enhanced Network Performance:** Quality of Service (QoS), traffic shaping, give more responsive and reliable network experience for users.
- **Managed by SLT Mobitel:** can handle tasks such as network monitoring, maintenance, troubleshooting and providing peace of mind to the organization.
- **Future-Proofing:** Allowing organizations to adapt to changing business needs and technology advancement.

Cellular

- Used by the ISP to interconnect all 5 branches.
- Wide coverage
- High flexibility for packet switching
- Acts as a failover option in case the primary wired WAN connections fails.
- Very scalable



A photograph of a server rack. On the left, a vertical strip of blue lights is visible. The main part of the image shows a dense array of network cables in various colors (red, yellow, green, blue, white) plugged into ports on a server unit. The word "Protocols" is overlaid in white serif font in the center.

Protocols

Application Layer

- HTTP/HTTPS: used for communication between web browsers and servers.
- SMTP: utilized for sending and receiving email messages between email servers.

Presentation Layer

- SSL/TLS: provide encryption and authentication mechanisms for secure communication over the internet.

Session Layer

- TCP: establishes and maintains reliable connections between devices on a network, it ensure data delivery by managing packet sequencing and error detection.

Transport Layer

- IP: responsible for routing packets between devices across interconnected networks.
- UDP: connectionless transport protocol that offers low – latency, unreliable data transmission.

Network Layer

- IPv4: fourth version of the internet protocol, responsible for addressing and routing packets between devices on a network, IPv4 addresses are 32 bits long

Data Link Layer

- Ethernet: It defines the format of data packets (frames) transmitted over Ethernet networks and provides mechanisms for addressing, error detection, and flow control.

Physical Layer

- Fiber optic and Ethernet cables: Fiber optic cables use light signals to transmit data over long distances at high speeds.
- Ethernet cables: such as Cat5e, Cat6 or Cat6a are commonly used for local connectivity within buildings or campuses, provide reliable, wired connections between network devices .

IP Addressing Schema



Private IP Range

- Class B Private IP address range

172.16.0.0 – 172.31.255.255

- Class A address range is too large.
- It will waste a large amount of IP addresses.
- Class C is too small.
- It is not sufficient to accommodate the required amount of IP addresses.

IP Addressing schema with VLSM

Branch	Number of employees	Network Address	1'st usable IP address	Last usable IP address	Broadcast Address
Colombo	126	172.16.0.0/25	172.16.0.1	172.16.0.126	172.16.0.127
Kandy	62	172.16.0.128/26	172.16.0.129	172.16.0.190	172.16.0.191
Galle	62	172.16.0.192/26	172.16.0.193	172.16.0.254	172.16.0.255
Jaffna	62	172.16.1.0/26	172.16.1.1	172.16.1.62	172.16.1.63

Overall Budget



Device	Quantity	Price
Desktop	235	$729\$ \times 235 = 171,315\$$
Printer	8	$293\$ \times 8 = 2344\$$
IP Phone	18	$75\$ \times 18 = 1350\$$
Projector	8	$247\$ \times 8 = 1976\$$
Tablet	1	$533\$ \times 1 = 533\$$
Crossover Serial cables	17	$9.95\$ \times 17 = 169.15\$$
Cisco ASR 1000 series router	5	$8800\$ \times 5 = 44000\$$
Cisco Catalyst 9300L-48P-4X-A switch	19	$3500\$ \times 19 = 56500\$$
HPE DL380 Gen10 8SFF NC CTO server	1	$2377\$ \times 1 = 2377\$$

Cisco Catalyst 3850 series switch	5	3650\$*5=18250\$
Cisco Catalyst 2960 series Gigabit Ethernet switch	5	262\$*5 = 1310\$
Cisco Aironet 3802i Access Point	1	408\$*1 = 408\$
Cisco Adaptive Security Appliance Firewall (ASA)	1	199\$*1 = 199\$
Supermicro Super Server 2014TP – HTR	2	8189\$*2 = 16378\$
DELL PowerEdge R740xd Server	1	2898\$*1 = 2898\$
ST-ST-10-Meter-Singlemode-FiberOptic-Cables	1	16.95\$*1=16.95\$
Copper straight through	44	23.66\$*44=1041.04\$
Serial DCE cables	1	14.99\$*1=14.99\$
Total Budget	302 830.13\$	

References

- **(Details about Devices)** <https://www.netacad.com/cisco-packet-tracer>
- <https://www.youtube.com/watch?v=VwN91x5i25g&list=PLBlnK6fEyqRgMCUAG0XRw78UA8qnv6jEx>
- **(Prices for Devices)** <https://www.router-switch.com/>
- <https://www.geeksforgeeks.org/>
- **(Difference of Central office server and Server)** <https://community.cisco.com/t5/network-management/different-between-central-office-and-point-of-presence/td-p/4095504>
- **(Topology images for devices)** <https://www.softwareideas.net/computer-network-diagram>,
<https://images.app.goo.gl/73kLWsKgznv8vWWcA>.

Questions ?



Thank
you

