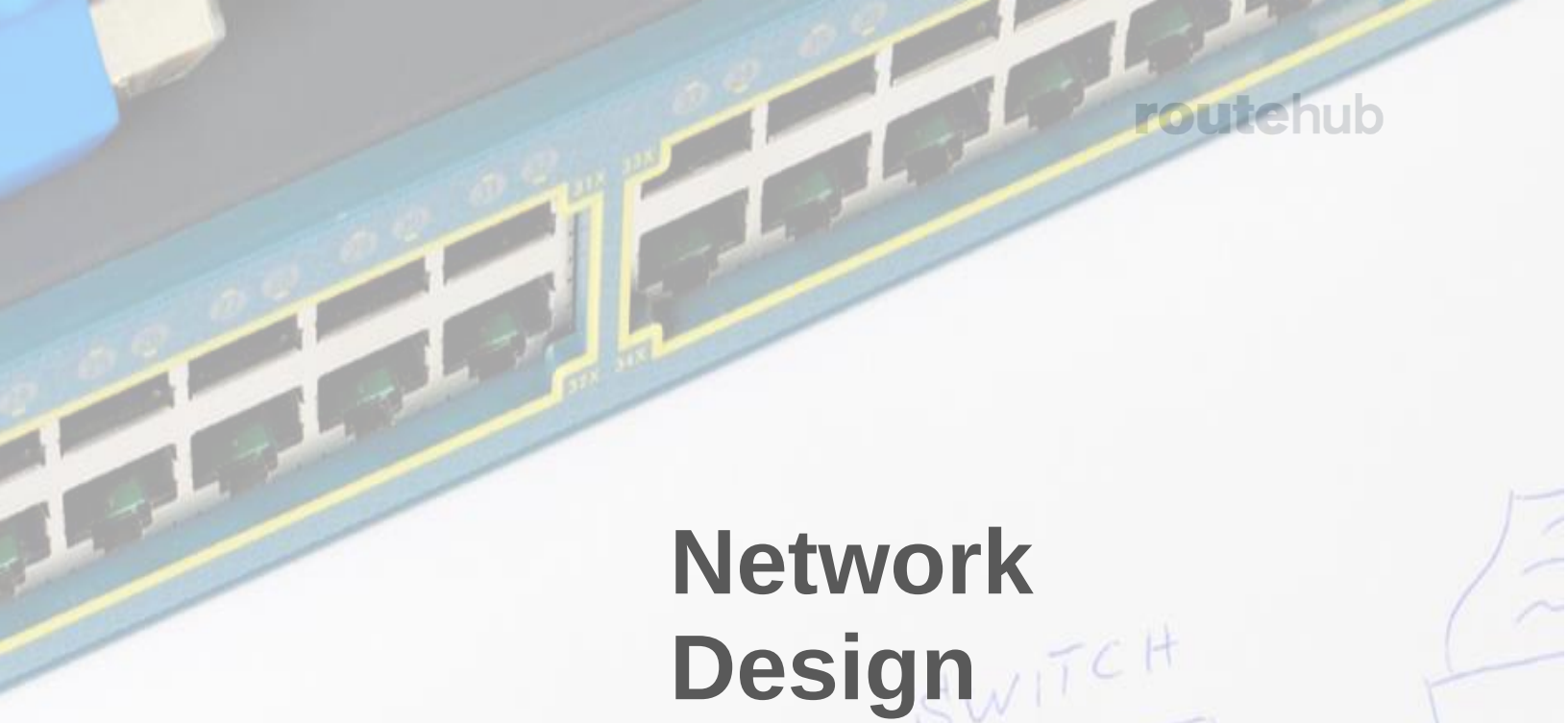

routehub

Network Design Report

RH EXAMPLE
Network Revamp Project
Version 1.1
December 22, 2020

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1 Introduction

This **Network Design Report** will provide a breakdown of a recommended network design that can be deployed in your network environment. This will show the recommendations of the topology, configuration, and possible hardware that can be used for the network devices.

The structure of the proposed design will be broken up into different network solutions based on your defined business and technical requirements. Below is a summary of the main business and technical requirements that this design is focused on:

- To provide a network for ~600 users, Internet services, and communication with all remote sites
- High requirements of scalability and reliability
- Other requirements would be listed here

The network design will have one or more **network frameworks** (e.g., LAN, WAN, Internet) which serves as the backbone for the network environment. From there you will have several **network solutions** based on the business requirements. Lastly, several **network services** would be configured on the framework and/or solutions as needed.

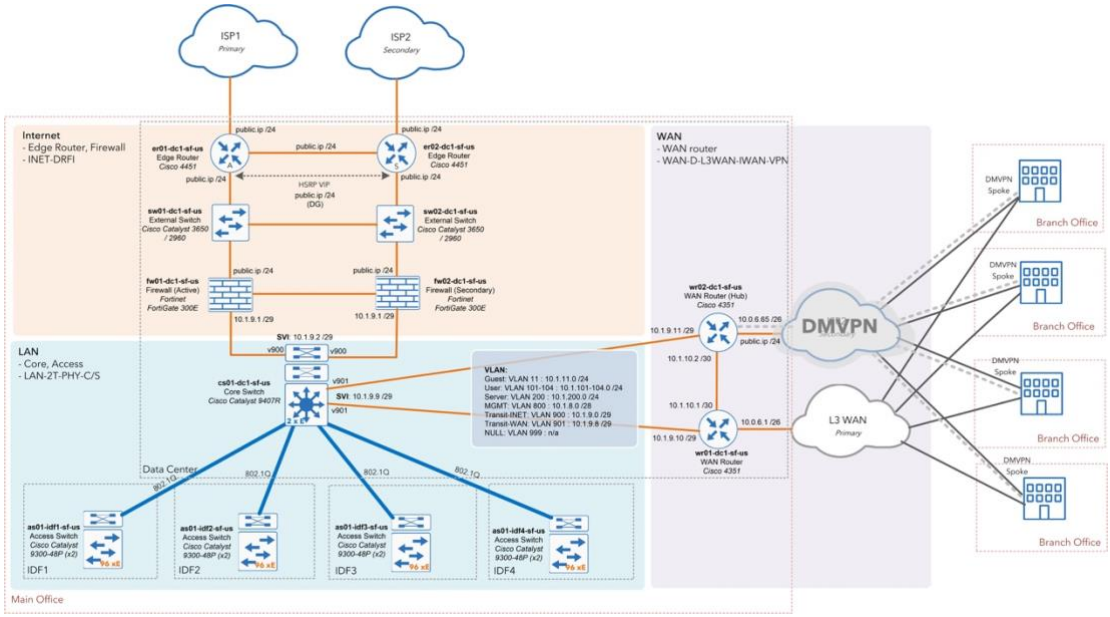
Each of these network types will be broken down into different sections in this report. Based on your requirements (in this reduced sample report), we have determined the following network frameworks, solutions, and/or services will be considered for the proposed design:

- **Network Frameworks**: LAN
- **Network Services**: OSPF Routing

For each solution in the design, we will provide a network diagram picture showing the topology of the solution. It will provide a summary describing the design solution. It will provide recommendations of the configuration elements that should be applied and it will provide recommended hardware options that you can use for the components in the solution.

2 Network Design

Below represents the recommended network design topology for the business:



In the proposed network design, the major framework and backbone of the network will be the **Local Area Network (LAN)** since the business location is a heavily user centric environment. All other frameworks and solutions would be connected to the LAN.

The LAN framework will consist of a two-tier topology with a single core switch and four access switches with 10GE interconnections.

An **Internet** framework is added to the design with redundant ISP clouds, edge routers and next-generation firewalls to provide security protection between the public and the internal network.

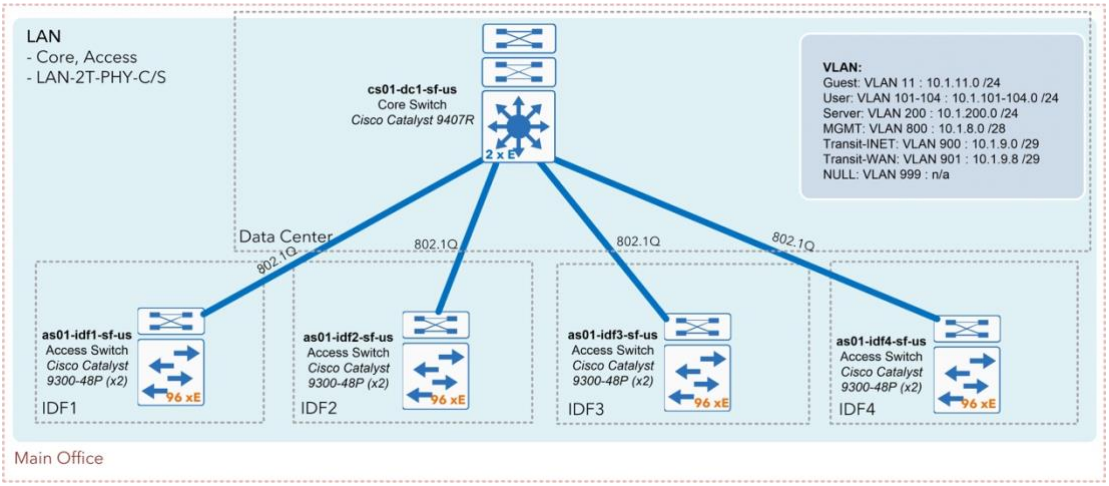
And the overall network will consist of a **Wide Area Network (WAN)** design based on the requirement that the business has four primary branch offices with users and local servers. The WAN framework will also consist of redundant WAN clouds and routers. However, the redundant WAN cloud would utilize the secondary ISP cloud where the WAN routers will be configured for DMVPN to act as a backup if the primary private WAN cloud is not available.

The full breakdown for each of these frameworks/solutions will be discussed in more detail in separate chapters in this report.

3 Network Frameworks

In this section, we will provide details for all **network frameworks** recommended in the proposed design.

3.1 Local Area Network (LAN)



The main framework in this network topology will be the **Local Area Network (LAN)** where all other solutions will be connected. This network framework is intended for user endpoints and services. The LAN uses a two-tier hierarchical design to provide scalability, performance, and flexibility to the network. Based on the total number of user endpoints and wiring closets, **4 access switches** will be connected up to the core switch, the backbone. All user endpoints would be connected among the access switches.

Each of the stacked access switches will **support up to 96-port GE ports**. The LAN will consider oversubscription and will use the recommended ratio of 20:1 between the core and each access switch. This means the uplink interface on each access switch needs to be at least 4.8Gbps, so the proposed bandwidth for the uplink/downlinks will use 10GE interfaces. This will also provide scalability and increased performance if the oversubscription increases during peak hours. Furthermore, **dual 10GE uplink/downlink interfaces** will be bundled together for the connection between the core and each access switch to provide reliability if one of the 10GE links should fail including providing increased scalability and performance.

All primary routing and VLANs will be rooted on the core switch in the LAN topology as a best practice. The LAN will be configured to support multiple VLANs between the switches (as needed) and routing services for exchanging routes dynamically among the other proposed network solutions (e.g., Internet, WAN).

3.1.1 Hardware

For **LAN core switch**, the recommended hardware choice would be the **Cisco Catalyst 9407R** (chassis-based switch) equipped with redundant Supervisor Engine 1XL modules and 1GE and 10GE line modules. Below is a quick summary of the hardware details:

- 7-slot chassis-based switch
- Supervisor Engine 1XL (x2)
- 24-port 10GE line module (x2)
- 48-port 1GE line module (x2)
- 480Gbps per slot (performance)

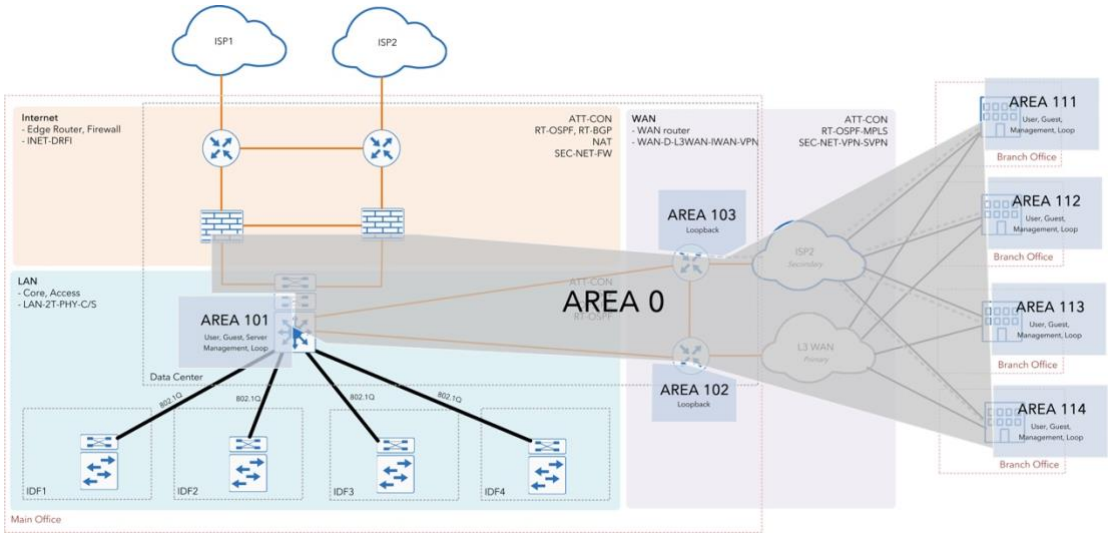
For each of the **LAN access switches,** the recommended hardware choice would use **two Cisco Catalyst 9300-48P** switches stacked together (stack-based switch) providing a total of 96 1GE ports and at least two 10GE uplinks bundled in a Port Channel using LACP. Below is a quick summary of the hardware details for each access switch:

- Stack-based switch
- 48-port 1GE switches (x2)
- 10-GE uplinks (module required) (x2)
- 480Gbps / 256Gbps (performance)

4 Network Services

In this section, we will provide details for all **network services** recommended in the proposed design.

4.1 OSPF Routing



Among the network frameworks (LAN, WAN, and Internet) there will be several Layer-3 devices and network subnets that will be configured. To provide ease of management and flexibility, it is recommended to implement a dynamic routing protocol using OSPF.

This will allow the network devices to exchange routing information between them automatically for reaching other networks at the main office and the four branch sites.

OSPF configuration requires area networks and the OSPF backbone area (area 0) will be configured among the main devices in each framework. It will be configured among the LAN Core, Internet Edge Firewalls (LAN facing interface), the WAN Aggregation routers, and extended over the WAN to each of the branch routers (WAN facing interface).

All other networks (endpoints, loopback interfaces) will be configured in standard OSPF areas, all connected to the required backbone area.

The recommendations for OSPF configuration will be listed in a separate section.

4.1.1 Configuration

Required Configuration:

Below reflects the required configuration needed when deploying this network service on the network.

- **Backbone Area**: configure the OSPF Backbone Area (AREA 0) for the networks/interfaces that connect between the LAN Core Switch, the Internet Firewall (LAN facing interface), the WAN Aggregation Routers, and the WAN Branch Routers (WAN facing interface)
- **Standard Area**: on the LAN core switch, configure all endpoint-based networks (user, guest, server), the management network, and all loopback interfaces into standard areas based on the areas defined in the network diagram.
- **Advertised Networks**: for each OSPF enabled device (LAN Core, WAN Aggregation, and WAN Branch routers), add each network configured on that device under the OSPF routing process with its corresponding area identifier.

Recommended Configuration:

Below reflects the recommended configuration to implement for this network service on the network.

- **Passive Interfaces**: passive interfaces should be enabled on all Layer-3 interfaces where there are endpoints (Users, Guests, Servers, Management) that exist to prevent rogue routing devices from injecting bad routes.
- **Hello and Dead Timers**: it is recommended to tune the OSPF default timers between all interfaces between the LAN Core, WAN Aggregation, and WAN Branch routers to provide fast convergence if a failure occurs. You can tune the timers to smaller values like 1 second for the hello timer and 4 seconds for the dead timer. Furthermore, OSPF in later OS versions can provide fast timers in sub-second intervals which can be configured instead (if supported).
- **Route Summarization**: configure summarization on the WAN Aggregation and LAN core switch to summarize multiple routes as a single route to help minimize the size of the routing table, reduce hardware resources (CPU, memory), and to limit LSA flooding. The LAN core should advertise all endpoint-based networks (user, guest, server, etc.) to a single summarized route towards the WAN. And the WAN Aggregation should advertise all branch office networks to a single summarized route towards the LAN.
- **Loopback Interfaces**: it is recommended to use Loopback interfaces on all OSPF routing devices (LAN Core, WAN Aggregation, and WAN Branch) in the topology which will be used for the router identifier. This is reflected in the network diagram for each of those critical devices.
- **Network Type using Point-to-Point**: it is recommended to configure an OSPF point-to-point network type between all interfaces among the LAN Core, WAN Aggregation, and WAN Branch routers.
- Other recommendations would be listed here