Fundamentos de Redes
Mini-Projeto

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1 Introduction

When performing address planning, some considerations are necessary in order to idealize a fully functioning network. First and foremost, since we have four available, interconnected, Layer 3 switching equipments, it becomes a priority to define and separate switching and routing domains. Taking a "if it's avoidable, do not complicate" approach, we opted to maximize Trunk connections by expanding the switching domain. That means that SWL3 F2 and SWL3 F1 are considered part of the switching domain, and, consequently, SWL3 C1 and SWL3 C2 are the gateways from the VLANs into the routing domain. For all the left-most VLANs, SWL3 C2 is pre-programmed as the default primary gateway, while for both DMZ and Datacenter, the default primary is SWL3 C1.

2 Objective 1

Assuming,
$x_0x_1x_2x_3x_4 = 89194$
$x_5x_6x_7x_8x_9 = 67591$

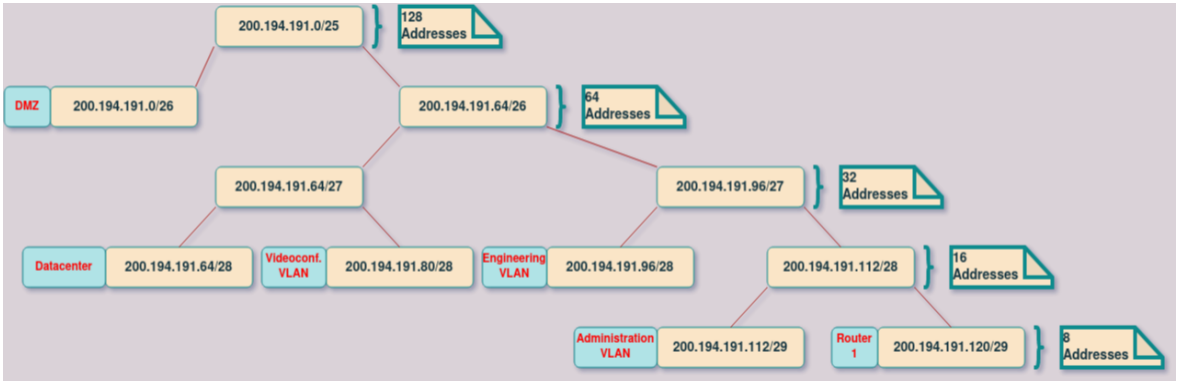
2.1 Defining public IPv4 sub-networks

IPv4 public network: 200.194.191.0/25

Initially taking notice of the different public IPv4 requirements for each VLAN, and the specific addressing preconditions of Router 1 for NAT/PAT mechanisms, we proceeded to calculate sub-network size. These judgments take into account the gateway necessities of the sub-networks, and the fact that prefix and broadcast addresses are not usable. Results are rounded up to the next power of 2 number figure, distributing the available IPv4 public addresses between the smallest ranges that still fulfill the sub-networks demands. Finally, masks are derived from the according sub-network sizes.

Network/Equipment	Nº of Equipments	Gateways	Prefix	Broadcast	Total	Power of 2	Mask
DMZ	32	1	1	1	35	64	/26
Datacenter	10	1	1	1	13	16	/28
Videoconf. VLAN	7	2	1	1	11	16	/28
Engineering VLAN	5	2	1	1	9	16	/28
Administration VLAN	2	2	1	1	6	8	/29
Router 1	5	0	1	1	7	8	/29

Sorting sub-networks from largest to smallest, we performed network partitioning. Opting for an even split solution, for every network division, the remaining size was compared to existing necessities. If a sub-network required it, an assignment would be made. Further splits were executed until all sub-networks could be accounted for.



Network/Equipment	Public IPv4
DMZ	200.194.191.0/26
Datacenter	200.194.191.64/28
Videoconf. VLAN	200.194.191.80/28
Engineering VLAN	200.194.191.96/28
Administration VLAN	200.194.191.112/29
Router 1	200.194.191.120/29

Recalling our previously delineated switching and routing domains, all left-most VLANs (Video Conference, Engineering and Administration) will have SWL3 C1 and SWL3 C2 as gateways. Both DMZ and Internal Datacenter remain with a single gateway in the way of the directly connected SWL3 C1. To avoid confusion, SWL3 C1 is always the first usable address of each sub-network, while SWL3 C2 (in case it exists as a gateway) is always the second. Router 1 does not require interface addressing for public IPv4 as its addresses are only used for NAT/PAT purposes.

Network	Gateways	Public IPv4 Address
DMZ	SWL3 C1	200.194.191.1/26
Datacenter	SWL3 C1	200.194.191.65/26
Videoconf. VLAN	SWL3 C1	200.194.191.81/26
	SWL3 C2	200.194.191.82/26
Engineering VLAN	SWL3 C1	200.194.191.97/26
	SWL3 C2	200.194.191.98/26
Administration VLAN	SWL3 C1	200.194.191.113/26
	SWL3 C2	200.194.191.114/26

2.2 Defining private IPv4 sub-networks

IPv4 private network: 10.141.0.0/16

When regarding private IPv4 address planning, the number of addresses and the number of hosts within each sub-network becomes of lesser relevance. Since no specific requirements were made in this area, the network was split in standard format, with a /24 mask. Also of note, Marketing VLAN is now eligible for a private IPv4 network, even though it had no public IPv4 requirements. Interfaces were also given private addresses, elected with the same method as before, in order to promote consistency.

Network	Private IPv4 Network	Gateways	Interface Private IPv4 Address
DMZ	10.141.1.0/24	SWL3 C1	10.141.1.1/24
Datacenter	10.141.2.0/24	SWL3 C1	10.141.2.1/24
Videoconf. VLAN	10.141.3.0/24	SWL3 C1	10.141.3.1/24
		SWL3 C2	10.141.3.2/24
Engineering VLAN	10.141.4.0/24	SWL3 C1	10.141.4.1/24
		SWL3 C2	10.141.4.2/24
Administration VLAN	10.141.5.0/24	SWL3 C1	10.141.5.1/24
		SWL3 C2	10.141.5.2/24
Marketing VLAN	10.141.6.0/24	SWL3 C1	10.141.6.1/24
		SWL3 C2	10.141.6.2/24

Recalling established switching and routing domain, the following connections are treated as trunk types.

Switches	Connects to	Type
SWL3 F1	Floors 0-10	Trunk
	SWL3 C1	Trunk
	SWL3 C2	Trunk
	SWL3 F2	Trunk
SWL3 F2	Floors 11-20	Trunk
	SWL3 C1	Trunk
	SWL3 C2	Trunk
	SWL3 F1	Trunk

Connections made at routing level require point-to-point connections, created through the use of /30 type masks.

Network	Equipment	IPv4 Address	Equipment	IPv4 Address
10.141.7.0/30	SWL3 C1	10.141.7.1/30	Router 1	10.141.7.2/30
10.141.7.4/30	SWL3 C1	10.141.7.5/30	Router A	10.141.7.6/30
10.141.7.8/30	SWL3 C1	10.141.7.9/30	SWL3 C2	10.141.7.10/30
10.141.7.12/30	SWL3 C2	10.141.7.13/30	Router A	10.141.7.14/30
10.141.7.16/30	SWL3 C2	10.141.7.17/30	Router 1	10.141.7.18/30

Lastly, Router A connects to the Old Building through the following Gateway:

Equipment	Interface IPv4 Address	Network
Router A	192.168.2.1/23	Old Building

2.3 Defining global IPv6 networks

IPv6 global network: 2100:0:0:1500::/60

Time to organize our IPv6 global network. Acknowledging that every VLAN requires addressing, we opted on a 64 bit mask. The Old Building does not require IPv6 connectivity.

Network	Global IPv6 Address	Gateways	Interface Global IPv6 Address
DMZ	2100:0:0:1500::/64	SWL3 C1	2100:0:0:1500::1/64
Datacenter	2100:0:0:1501::/64	SWL3 C1	2100:0:0:1501::1/64
Videoconf. VLAN	2100:0:0:1502::/64	SWL3 C1	2100:0:0:1502::1/64
		SWL3 C2	2100:0:0:1502::2/64
Engineering VLAN	2100:0:0:1503::/64	SWL3 C1	2100:0:0:1503::1/64
		SWL3 C2	2100:0:0:1503::2/64
Administration VLAN	2100:0:0:1504::/64	SWL3 C1	2100:0:0:1504::1/64
		SWL3 C2	2100:0:0:1504::2/64
Marketing VLAN	2100:0:0:1505::/64	SWL3 C1	2100:0:0:1505::1/64
		SWL3 C2	2100:0:0:1505::2/64

Trunk connections replicate the ones used in IPv4.

Switches	Connects to	Type
SWL3 F1	Floors 0-10	Trunk
	SWL3 C1	Trunk
	SWL3 C2	Trunk
	SWL3 F2	Trunk
SWL3 F2	Floors 11-20	Trunk
	SWL3 C1	Trunk
	SWL3 C2	Trunk
	SWL3 F1	Trunk

Point-to-point connections call for 126 bit masks, since 127 bit masks are not supported by every equipment.

Equipment 1	IPv6 Global Address	Equipment 2	IPv6 Global Address
SWL3 C1	2100:0:0:1506::1/126	Router 1	2100:0:0:1506::2/126
SWL3 C1	2100:0:0:1507::1/126	Router A	2100:0:0:1507::2/126
SWL3 C1	2100:0:0:1508::1/126	SWL3 C2	2100:0:0:1508::2/126
SWL3 C2	2100:0:0:1509::1/126	Router A	2100:0:0:1509::2/126
SWL3 C2	2100:0:0:1510::1/126	Router 1	2100:0:0:1510::2/126