VRF Lite

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Purpose

This lab was performed to carry out the intent to acquire the ability and the experience to conduct *VRF Lite* (Virtual Routing and Forwarding Lite)*.* The lab would grant us the ability to successfully deploy *VRFs* on the nodes, cooperating with different VLANs. During the research, we would come across a term, *VRF*, and would be able to differentiate between the two terms.

Background Information

virtual routing and forwarding (VRF) is a technology that allows multiple instances of a routing table to co-exist within the same router at the same time. Because the routing instances are independent, the same or overlapping IP addresses can be used without conflicting with each other. Network functionality is improved because network paths can be segmented without requiring multiple routers. VRF also increases network security and can eliminate the need for encryption and authentication. Internet service providers (ISPs) often take advantage of VRF to create separate virtual private networks (VPNs) for customers; thus the technology is also referred to as VPN routing and forwarding.

The simplest form of VRF implementation is VRF Lite. In this implementation, each router within the network participates in the virtual routing environment in a peer-based fashion. While simple to deploy and appropriate for small to medium enterprises and shared data centers, VRF Lite does not scale to the size required by global enterprises or large carriers, as there is the need to implement each VRF instance on every router, including intermediate routers. VRFs were initially introduced in combination with Multiprotocol Label Switching (MPLS), but VRF proved to be so useful that it eventually evolved to live independent of MPLS. This is the historical explanation of the term VRF Lite: usage of VRFs without MPLS.

Lab Summary

Because VRFs cannot be configured on Cisco Packet Tracer, I completed the lab on another Simulation application, known as *GNS3*. We had been handed the topology and we had to make it operate successfully by distributing the data into two different vrfs.

The VRFs must be created at the beginning of the lab and they must be linked with different VLANs and the port connecting the switches to the PC must be accessible to their respective VLANs of their respective VRFs. Since VRFs maintain separate routing tales, one can use similar IP Addresses on the interfaces. The port connection from the switch to the routers must be in trunk mode and the VLANs being utilized in the lab must be allowed. Prior to pinging and troubleshooting, all the nodes must maintain a connection with the other routers, for that we used the link state routing protocol, OSPF (One can refer to the multi-area OSPF Lab or the Special Area OSPF Lab to gain information on the protocol). Another element to note is that because the router cannot run VLANs, one must use sub-interfaces for the successful transfer of packets between VLANs.

Topology and IP Addressing Scheme

A screenshot of a cell phone screen with text

Description generated with very high confidence

Configurations

ISP-S1 Configuration: -

hostname ISP-S1

boot-start-marker

boot-end-marker

no aaa new-model

system mtu routing 1500

ip routing

ip vrf Expedia

ip vrf Trivago

vtp domain cisco

vtp mode transparent

crypto pki trustpoint TP-self-signed-2495579008

enrollment selfsigned

subject-name cn=IOS-Self-Signed-Certificate-2495579008

revocation-check none

rsakeypair TP-self-signed-2495579008

spanning-tree mode pvst

spanning-tree extend system-id

vlan internal allocation policy ascending

vlan 2

name Data

vlan 3,10,20,30,50

vlan 996

name CUSTOMER\_NATIVE

interface FastEthernet1/0/1

switchport access vlan 10

switchport mode access

ip vrf forwarding Expedia

interface FastEthernet1/0/2

switchport trunk encapsulation dot1q

switchport trunk allowed vlan 10,20

switchport mode trunk

interface FastEthernet1/0/3

switchport access vlan 20

switchport mode access

ip vrf forwarding Trivago

interface FastEthernet1/0/4

interface FastEthernet1/0/5

interface FastEthernet1/0/6

interface FastEthernet1/0/7

interface FastEthernet1/0/8

interface FastEthernet1/0/9

interface FastEthernet1/0/10

interface FastEthernet1/0/11

interface FastEthernet1/0/12

interface FastEthernet1/0/13

interface FastEthernet1/0/14

interface FastEthernet1/0/15

interface FastEthernet1/0/16

interface FastEthernet1/0/17

interface FastEthernet1/0/18

interface FastEthernet1/0/19

interface FastEthernet1/0/20

interface FastEthernet1/0/21

interface FastEthernet1/0/22

interface FastEthernet1/0/23

interface FastEthernet1/0/24

interface GigabitEthernet1/0/1

interface GigabitEthernet1/0/2

interface GigabitEthernet1/1/1

interface GigabitEthernet1/1/2

interface Vlan1

no ip address

interface Vlan10

ip vrf forwarding Expedia

ip address 10.0.12.3 255.255.255.0

interface Vlan20

ip vrf forwarding Trivago

ip address 10.0.12.3 255.255.255.0

router ospf 1 vrf Expedia

router-id 0.0.1.1

network 10.0.0.0 0.0.0.255 area 0

network 10.0.12.0 0.0.0.255 area 0

router ospf 2 vrf Trivago

router-id 0.0.1.2

network 10.0.0.0 0.0.0.255 area 0

network 10.0.12.0 0.0.0.255 area 0

ip http server

ip http secure-server

logging esm config

line con 0

line vty 0 4

login

line vty 5 15

login

end

ISP-R1 Configuration: -

hostname ISP-R1

boot-start-marker

boot-end-marker

no aaa new-model

memory-size iomem 10

ip vrf Expedia

ip vrf Trivago

ip cef

no ipv6 cef

multilink bundle-name authenticated

voice-card 0

license udi pid CISCO2901/K9 sn FTX1704Y03F

license accept end user agreement

license boot module c2900 technology-package securityk9

license boot module c2900 technology-package uck9

vtp domain cisco

vtp mode transparent

redundancy

interface Embedded-Service-Engine0/0

no ip address

shutdown

interface GigabitEthernet0/0

no ip address

duplex auto

speed auto

no shut

interface GigabitEthernet0/0.10

encapsulation dot1Q 10

ip vrf forwarding Expedia

ip address 10.0.13.1 255.255.255.0

interface GigabitEthernet0/0.20

encapsulation dot1Q 20

ip vrf forwarding Trivago

ip address 10.0.13.1 255.255.255.0

interface GigabitEthernet0/1

no ip address

duplex auto

speed auto

no shut

interface GigabitEthernet0/1.10

encapsulation dot1Q 10

ip vrf forwarding Expedia

ip address 10.0.12.1 255.255.255.0

interface GigabitEthernet0/1.20

encapsulation dot1Q 20

ip vrf forwarding Trivago

ip address 10.0.12.1 255.255.255.0

interface Serial0/0/0

no ip address

shutdown

clock rate 2000000

interface Serial0/0/1

no ip address

shutdown

clock rate 2000000

router ospf 1 vrf Expedia

router-id 0.0.0.1

network 10.0.12.0 0.0.0.255 area 0

network 10.0.13.0 0.0.0.255 area 0

default-information originate

router ospf 2 vrf Trivago

router-id 0.0.0.11

network 10.0.12.0 0.0.0.255 area 0

network 10.0.13.0 0.0.0.255 area 0

default-information originate

ip forward-protocol nd

no ip http server

no ip http secure-server

ip route vrf Expedia 0.0.0.0 0.0.0.0 10.0.12.2

ip route vrf Trivago 0.0.0.0 0.0.0.0 10.0.12.2

control-plane

mgcp profile default

gatekeeper

shutdown

line con 0

line aux 0

line 2

no activation-character

no exec

transport preferred none

transport input all

transport output pad telnet rlogin lapb-ta mop udptn v120 ssh

stopbits 1

line vty 0 4

login

transport input all

scheduler allocate 20000 1000

end

ISP-R2 Configuration: -

hostname ISP-R2

boot-start-marker

boot-end-marker

no aaa new-model

memory-size iomem 10

ip cef

ip vrf Expedia

ip vrf Trivago

no ipv6 cef

multilink bundle-name authenticated

voice-card 0

license udi pid CISCO2901/K9 sn FTX180180LM

license accept end user agreement

license boot module c2900 technology-package securityk9

license boot module c2900 technology-package uck9

redundancy

interface Embedded-Service-Engine0/0

no ip address

shutdown

interface GigabitEthernet0/0

no ip address

duplex auto

speed auto

no shut

interface GigabitEthernet0/0.10

encapsulation dot1Q 10

ip vrf forwarding Expedia

ip address 10.0.14.1 255.255.255.0

interface GigabitEthernet0/0.20

encapsulation dot1Q 20

ip vrf forwarding Trivago

ip address 10.0.14.1 255.255.255.0

interface GigabitEthernet0/1

no ip address

duplex auto

speed auto

no shut

interface GigabitEthernet0/1.10

encapsulation dot1Q 10

ip vrf forwarding Expedia

ip address 10.0.13.2 255.255.255.0

interface GigabitEthernet0/1.20

encapsulation dot1Q 20

ip vrf forwarding Trivago

ip address 10.0.13.2 255.255.255.0

interface Serial0/0/0

no ip address

shutdown

clock rate 2000000

interface Serial0/0/1

no ip address

shutdown

clock rate 2000000

router ospf 1 vrf Expedia

router-id 0.0.0.2

network 10.0.13.0 0.0.0.255 area 0

network 10.0.14.0 0.0.0.255 area 0

default-information originate

router ospf 2 vrf Trivago

router-id 0.0.0.21

network 10.0.13.0 0.0.0.255 area 0

network 10.0.14.0 0.0.0.255 area 0

default-information originate

ip forward-protocol nd

no ip http server

no ip http secure-server

control-plane

mgcp profile default

gatekeeper

shutdown

line con 0

line aux 0

line 2

no activation-character

no exec

transport preferred none

transport output lat pad telnet rlogin lapb-ta mop udptn v120 ssh

stopbits 1

line vty 0 4

login

transport input all

scheduler allocate 20000 1000

end

ISP-R3 Configuration: -

hostname ISP-R3

boot-start-marker

boot-end-marker

no aaa new-model

memory-size iomem 10

ip cef

ip vrf Expedia

ip vrf Trivago

no ipv6 cef

multilink bundle-name authenticated

voice-card 0

license udi pid CISCO2901/K9 sn FTX180180LX

license accept end user agreement

license boot module c2900 technology-package securityk9

license boot module c2900 technology-package uck9

vtp domain cisco

vtp mode transparent

redundancy

interface Embedded-Service-Engine0/0

no ip address

shutdown

interface GigabitEthernet0/0

no ip address

duplex auto

speed auto

no shut

interface GigabitEthernet0/0.10

encapsulation dot1Q 10

ip vrf forwarding Expedia

ip address 10.0.15.1 255.255.255.0

interface GigabitEthernet0/0.20

encapsulation dot1Q 20

ip vrf forwarding Trivago

ip address 10.0.15.1 255.255.255.0

interface GigabitEthernet0/1

no ip address

duplex auto

speed auto

no shut

interface GigabitEthernet0/1.10

encapsulation dot1Q 10

ip vrf forwarding Expedia

ip address 10.0.14.2 255.255.255.0

interface GigabitEthernet0/1.20

encapsulation dot1Q 20

ip vrf forwarding Trivago

ip address 10.0.14.2 255.255.255.0

interface Serial0/0/0

no ip address

shutdown

clock rate 2000000

interface Serial0/0/1

no ip address

shutdown

clock rate 2000000

router ospf 1 vrf Expedia

router-id 0.0.0.3

network 10.0.14.0 0.0.0.255 area 0

network 10.0.15.0 0.0.0.255 area 0

default-information originate

router ospf 2 vrf Trivago

router-id 0.0.0.31

network 10.0.14.0 0.0.0.255 area 0

network 10.0.15.0 0.0.0.255 area 0

default-information originate

ip forward-protocol nd

no ip http server

no ip http secure-server

ip route vrf Expedia 0.0.0.0 0.0.0.0 10.0.15.2

ip route vrf Trivago 0.0.0.0 0.0.0.0 10.0.15.2

control-plane

mgcp profile default

gatekeeper

shutdown

line con 0

line aux 0

line 2

no activation-character

no exec

transport preferred none

transport output lat pad telnet rlogin lapb-ta mop udptn v120 ssh

stopbits 1

line vty 0 4

login

transport input all

scheduler allocate 20000 1000

end

ISP-S2

hostname ISP-S2

boot-start-marker

boot-end-marker

no aaa new-model

system mtu routing 1500

ip routing

ip vrf Expedia

ip vrf Trivago

vtp domain cisco

vtp mode transparent

crypto pki trustpoint TP-self-signed-2429703424

enrollment selfsigned

subject-name cn=IOS-Self-Signed-Certificate-2429703424

revocation-check none

rsakeypair TP-self-signed-2429703424

spanning-tree mode pvst

spanning-tree extend system-id

vlan internal allocation policy ascending

vlan 3,10,20

interface FastEthernet1/0/1

switchport trunk encapsulation dot1q

switchport trunk allowed vlan 10,20

switchport mode trunk

interface FastEthernet1/0/2

switchport access vlan 10

switchport mode access

ip vrf forwarding Expedia

interface FastEthernet1/0/3

switchport access vlan 20

switchport mode access

ip vrf forwarding Trivago

interface FastEthernet1/0/4

interface FastEthernet1/0/5

interface FastEthernet1/0/6

interface FastEthernet1/0/7

interface FastEthernet1/0/8

interface FastEthernet1/0/9

interface FastEthernet1/0/10

interface FastEthernet1/0/11

interface FastEthernet1/0/12

interface FastEthernet1/0/13

interface FastEthernet1/0/14

interface FastEthernet1/0/15

interface FastEthernet1/0/16

interface FastEthernet1/0/17

interface FastEthernet1/0/18

interface FastEthernet1/0/19

interface FastEthernet1/0/20

interface FastEthernet1/0/21

interface FastEthernet1/0/22

interface FastEthernet1/0/23

interface FastEthernet1/0/24

interface GigabitEthernet1/0/1

interface GigabitEthernet1/0/2

interface GigabitEthernet1/1/1

speed auto 1000

interface GigabitEthernet1/1/2

interface Vlan1

no ip address

interface Vlan10

ip vrf forwarding Expedia

ip address 10.0.15.2 255.255.255.0

interface Vlan20

ip vrf forwarding Trivago

ip address 10.0.15.2 255.255.255.0

router ospf 1 vrf Expedia

router-id 0.0.2.1

network 10.0.15.0 0.0.0.255 area 0

network 10.3.3.0 0.0.0.255 area 0

router ospf 2 vrf Trivago

router-id 0.0.2.2

network 10.0.15.0 0.0.0.255 area 0

network 10.3.3.0 0.0.0.255 area 0

ip http server

ip http secure-server

logging esm config

line con 0

line vty 0 4

login

line vty 5 15

login

end

Problems: -

I did not face many problems in this lab. There, however was a problem that ruffled me towards the conclusion of the lab. The IP Addresses on my ISP-S1 LAN were not on the subnet, due to which the node was left isolated in the topology. That issue was resolved after two days of troubleshooting, and all the nodes in the topology were able to make adjacencies with one another.

Conclusions: -

The lab was successfully completed and fulfilled its motive. VRF Lite compared to the erstwhile labs, was fairly undemanding. We gained the knowledge of building different routing tables on the nodes. Although this lab was uncomplicated, but it was joyous lab to complete and provided us with plenty of information for the future.