Lillebaelt Academy of
University of applied sciences

IT Technology

Jeppe Dam-Hansen, Casper Gøtsche Olsen, Imad Ramez H Mostafa, Joakim Nielsen, Lierop Stijn v, Mannesse M, Martynas Saulytis, Shitiz Piplani

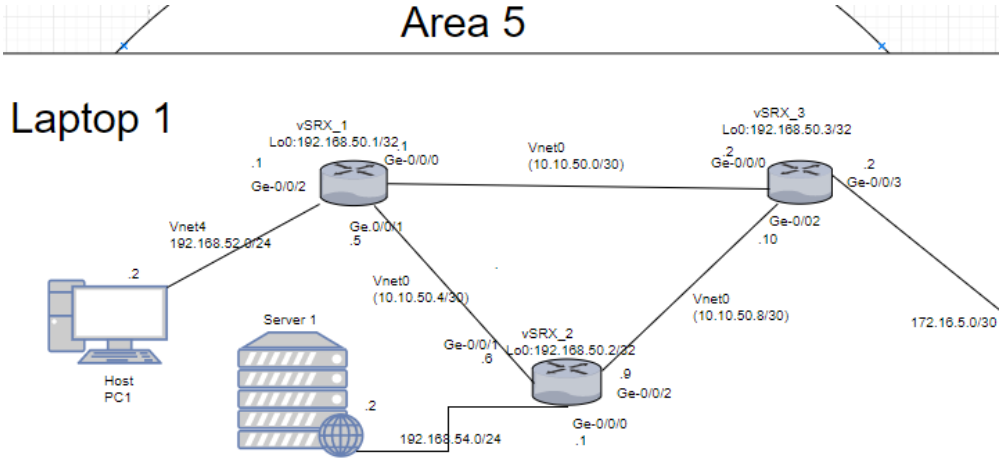
High Level Design

Introduction

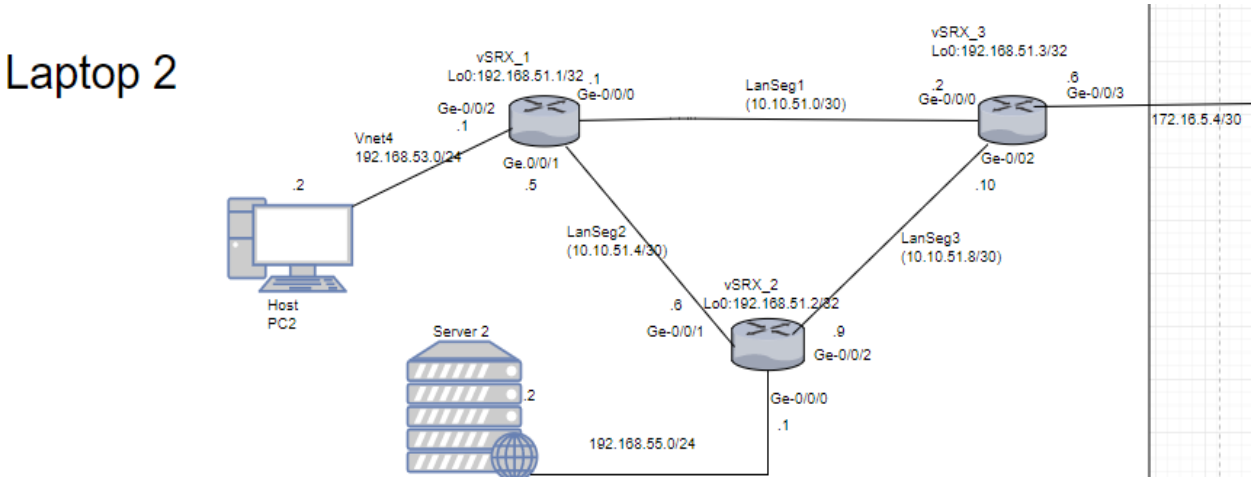
This HLD is one of the parts of the Fontys project. It is the fifth area out of nine connecting to the switch EX4200. Its main design is using OSPF to determine the shortest path between itself and any neighbor router. All of the different OSPF areas are connected to a backbone router in OSPF area 0. The goal of this project is to be able to connect to other clients that are connected through different OSPF areas to the main OSPF area 0.

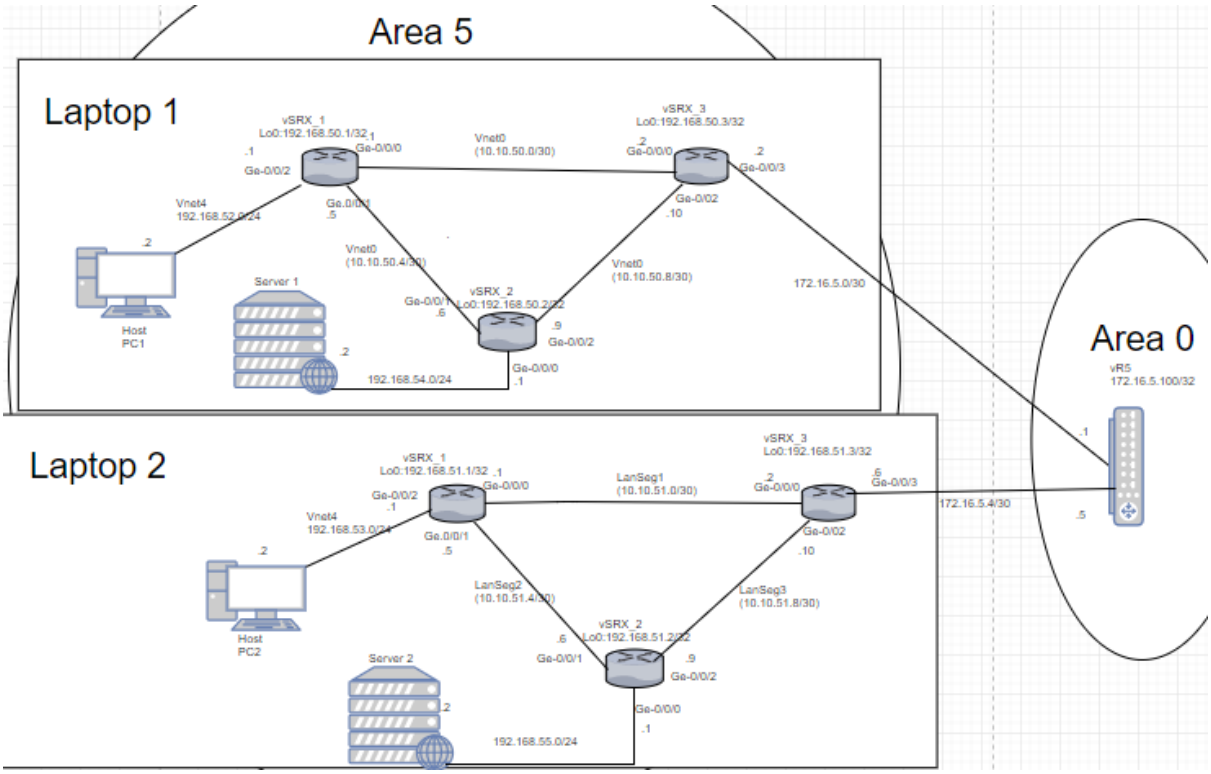
Overview

Our topology is composed out of 2 networks which are both connected to the same virtual instance on different interfaces which are configures on a router on the EX4200 switch. Our two networks are both connected to virtual router 5 in OSPF area 5 0.



There are two PC's connected to the network. "PC 1" is connected to "vSRX_1", and acts as a simple user. "vSRX_1" has been setup with DHCP, which gives "PC 1" its IP address.
"PC2" is connected to "vSRX_2". In addition, "PC2" has a webserver set up which has a static IP address. "vSRX_3" is the router which connects Area 5 to the backbone router which connects to Area 0.





Performance

The expected performance of this Fontys network is to be low latency, high availability, high band-with. It has close to none concurrent users. The expected traffic is close to zero because the potential amount of client users connected to it is approximately 16. The fifth area's expected client amount is 4, which means there is a tremendous amount of room being unused.

Security

The network we have set up does not really have any security set up. We have set up OSPF protocols in the security Trust-zone. Also we allowed inbound traffic to allow everything through in the Trust-zone as well.

Hardware

Juniper Router srx

https://www.juniper.net/us/en/products-services/security/srx-series/srx1500/

Juniper Switch EX4200

https://www.juniper.net/us/en/products-services/switching/ex-series/ex4200/

Protocols and standards

root@VSRX1# run show OSPF neighbor.

```
Address          Interface              State     ID               Pri  Dead
10.10.50.2       ge-0/0/1.0             Full      192.168.50.3     128    33
10.10.50.6       ge-0/0/2.0             Full      192.168.50.2     128    32
```

root@VSRX1# run show OSPF database

```
    OSPF database, Area 0.0.0.5
 Type       ID               Adv Rtr           Seq      Age  Opt  Cksum  Len
Router  *192.168.50.1     192.168.50.1     0x80000007  1389  0x22 0x530e  72
Router   192.168.50.2     192.168.50.2     0x80000008  1386  0x22 0x32c8  60
Router   192.168.50.3     192.168.50.3     0x80000008  1386  0x22 0xfd01  60
Network  10.10.50.2       192.168.50.3     0x80000005   377  0x22 0x80f   32
Network  10.10.50.6       192.168.50.2     0x80000004  1390  0x22 0xdd38  32
Network  10.10.50.10      192.168.50.3     0x80000004  2368  0x22 0xc747  32
```

root@VSRX1# run show route terse

```
inet.0: 11 destinations, 11 routes (11 active, 0 holddown, 0 hidden)
+ = Active Route, - = Last Active, * = Both

A Destination        P Prf   Metric 1   Metric 2  Next hop         AS path
* 10.10.50.0/30      D   0                        >ge-0/0/1.0
* 10.10.50.1/32      L   0                         Local
* 10.10.50.4/30      D   0                        >ge-0/0/2.0
* 10.10.50.5/32      L   0                         Local
* 10.10.50.8/30      O  10          2             >10.10.50.2
                                                   10.10.50.6
* 192.168.50.1/32    D   0                        >lo0.0
* 192.168.50.2/32    O  10          1             >10.10.50.6
* 192.168.50.3/32    O  10          1             >10.10.50.2
* 192.168.52.0/24    D   0                        >ge-0/0/3.0
* 192.168.52.1/32    L   0                         Local
* 224.0.0.5/32       O  10          1              MultiRecv
```

OSPF: OSPF is Open Shortest Path First and are setup on all three routers, which all are in Area 5. This means that all the routers have the same database of the other routers and the routes between them in the same area. Every 10 seconds a “hello” message is being sent from a router to its neighbours, and if it receives a reply the connection is preserved. If the message is not replied to in 10*4 seconds, the connection is dead, and the router alerts all other routers in the area that they need to update their database.

IP layout Vlan layout

LAPTOP 1

1. Subnet: 192.168.52.0/24
    a. 192.168.52.1 → VSRX1
2. Subnet: 10.10.50.0/30
    a. 10.10.50.1 → VSRX1
    b. 10.10.50.2 → VSRX3
3. Subnet: 10.10.50.4/30
    a. 10.10.50.5 → VSRX1
    b. 10.10.50.6 → VSRX2
4. Subnet: 10.10.50.8/30
    a. 10.10.50.9 → VSRX2
    b. 10.10.50.10 →VSRX3
5. Subnet: 172.16.5.0/30
    a. 172.16.5.2 → VSRX3
    b. 172.16.5.1 → VR1 - AREA 0

LAPTOP 2

1. Subnet: 192.168.51.0/24
    a. 192.168.51.1 → VSRX1
2. Subnet: 10.10.51.0/30
    a. 10.10.51.1 → VSRX1
    b. 10.10.51.2 → VSRX3
3. Subnet: 10.10.51.4/30
    a. 10.10.51.5 → VSRX1
    b. 10.10.51.6 → VSRX2
4. Subnet: 10.10.51.8/30
    a. 10.10.51.9 → VSRX2
    b. 10.10.51.10 →VSRX3
5. Subnet: 172.16.5.4/30
    a. 172.16.5.6 → VSRX3
    b. 172.16.5.5 → VR1 - AREA 0

Naming convention

The way we have setup our interfaces, is so that they routers always will face the same interface, as they are outputting from. So Ge-0/0/0 from vSRX_1 will face Ge-0/0/0 from vSRX_3. This way the diagram topology seemed more logical to us. We used subnetting to make the subnets between the routers, to not waste IP addresses and to make an easil y reproduceable network, so everyone in our group could setup the network correctly. The ones we used was 10.10.50.0/30, were each different subnet then were 4 higher, so 10.10.50.4/30 and 10.10.50.8/30.
Then we mirrored the pattern for the second laptop, just with using 51 instead of 50, as on laptop 1. This made the 2 laptops topology nearly identical, which makes our troubleshooting much easier, since we were all basically working on the same network setup. Then for the 2 VPC on each network, we used 52 and 54 for Laptop 1 and on laptop 2 we used 53 and 55.

LAPTOP 1

Router 1: VSRX1:

VSRX1 Name: 192.168.50.1

Router 2: VSRX2:

VSRX2 Name: 192.168.50.2

Router 3: VSRX3:

VSRX3 Name: 192.168.50.3

LABTOP 2

Router 1: VSRX1:

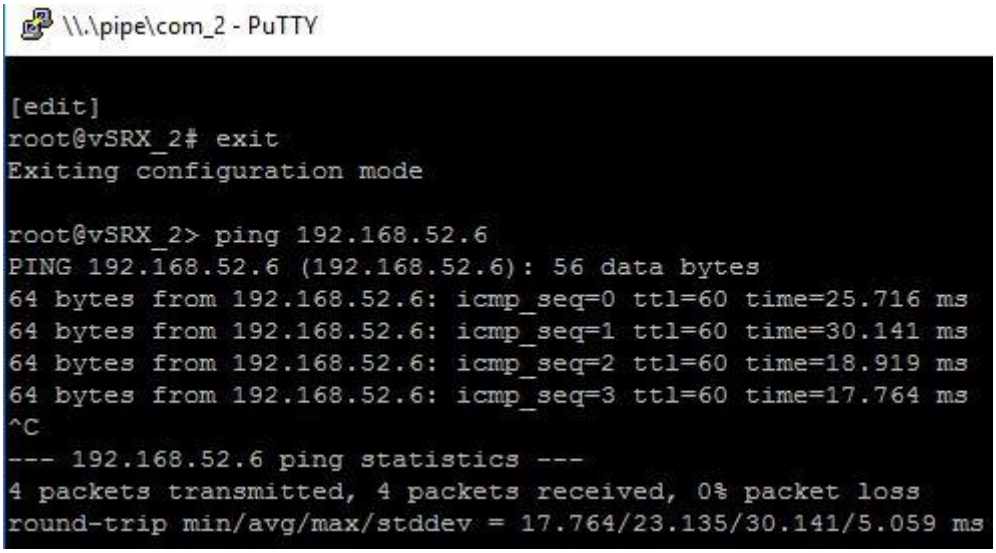
VSRX1 Name: 192.168.51.1

Router 2: VSRX2:

VSRX2 Name: 192.168.51.2

Router 3: VSRX3:

Pinging our webserver



This was an attempt to ping the webserver on Laptop 1 (192.168.52.6) from the webserver on laptop 2 (192.168.55.2). This attempt was successful. However earlier attempts were unsuccessful, for a variety of reasons. One of these were that we had forgotten to setup OSPF on the webservers interface on vSRX_2, which resulted made the webserver unable to be found by OSPF, meaning that laptop 1 webserver didn't recognize the webserver on laptop 2.

Date: 9/11-2017
Tested by: Jeppe

Pinging other webservers

root@vSRX_1> ping 10.10.2.242

PING 10.10.2.242 (10.10.2.242): 56 data bytes

64 bytes from 10.10.2.242: icmp_seq=0 ttl=60 time=22.820 ms

64 bytes from 10.10.2.242: icmp_seq=1 ttl=60 time=12.111 ms

64 bytes from 10.10.2.242: icmp_seq=2 ttl=60 time=18.105 ms

^C

--- 10.10.2.242 ping statistics ---

3 packets transmitted, 3 packets received, 0% packet loss

round-trip min/avg/max/stddev = 12.111/17.679/22.820/4.382 ms

root@vSRX_1> ping 10.10.3.14

PING 10.10.3.14 (10.10.3.14): 56 data bytes

64 bytes from 10.10.3.14: icmp_seq=0 ttl=59 time=23.434 ms
64 bytes from 10.10.3.14: icmp_seq=1 ttl=59 time=24.078 ms
64 bytes from 10.10.3.14: icmp_seq=2 ttl=59 time=18.357 ms
^C
--- 10.10.3.14 ping statistics ---
3 packets transmitted, 3 packets received, 0% packet loss
round-trip min/avg/max/stddev = 18.357/21.956/24.078/2.559 ms

root@vSRX_1> ping 172.16.4.2
PING 172.16.4.2 (172.16.4.2): 56 data bytes
64 bytes from 172.16.4.2: icmp_seq=0 ttl=59 time=15.610 ms
64 bytes from 172.16.4.2: icmp_seq=1 ttl=59 time=30.302 ms
64 bytes from 172.16.4.2: icmp_seq=2 ttl=59 time=18.400 ms
64 bytes from 172.16.4.2: icmp_seq=3 ttl=59 time=13.457 ms
^C
--- 172.16.4.2 ping statistics ---
4 packets transmitted, 4 packets received, 0% packet loss
round-trip min/avg/max/stddev = 13.457/19.442/30.302/6.510 ms

root@vSRX_1> ping 192.168.55.2
PING 192.168.55.2 (192.168.55.2): 56 data bytes
64 bytes from 192.168.55.2: icmp_seq=0 ttl=63 time=16.412 ms
64 bytes from 192.168.55.2: icmp_seq=1 ttl=63 time=12.690 ms
64 bytes from 192.168.55.2: icmp_seq=2 ttl=63 time=12.010 ms
64 bytes from 192.168.55.2: icmp_seq=3 ttl=63 time=7.047 ms
^C
--- 192.168.55.2 ping statistics ---
4 packets transmitted, 4 packets received, 0% packet loss
round-trip min/avg/max/stddev = 7.047/12.040/16.412/3.334 ms

root@vSRX_1> ping 192.168.64.69
PING 192.168.64.69 (192.168.64.69): 56 data bytes

64 bytes from 192.168.64.69: icmp_seq=0 ttl=59 time=26.133 ms

64 bytes from 192.168.64.69: icmp_seq=1 ttl=59 time=23.677 ms

64 bytes from 192.168.64.69: icmp_seq=2 ttl=59 time=23.875 ms

64 bytes from 192.168.64.69: icmp_seq=3 ttl=59 time=19.171 ms

^C

--- 192.168.64.69 ping statistics ---

4 packets transmitted, 4 packets received, 0% packet loss

round-trip min/avg/max/stddev = 19.171/23.214/26.133/2.526 ms

root@vSRX_1> ping 192.168.76.2

PING 192.168.76.2 (192.168.76.2): 56 data bytes

64 bytes from 192.168.76.2: icmp_seq=0 ttl=59 time=21.773 ms

64 bytes from 192.168.76.2: icmp_seq=1 ttl=59 time=24.901 ms

64 bytes from 192.168.76.2: icmp_seq=2 ttl=59 time=25.681 ms

64 bytes from 192.168.76.2: icmp_seq=3 ttl=59 time=19.588 ms

--- 192.168.76.2 ping statistics ---

4 packets transmitted, 4 packets received, 0% packet loss

round-trip min/avg/max/stddev = 19.588/22.986/25.681/2.447 ms

root@vSRX_1> ping 10.10.85.1

PING 10.10.85.1 (10.10.85.1): 56 data bytes

64 bytes from 10.10.85.1: icmp_seq=0 ttl=57 time=21.206 ms

64 bytes from 10.10.85.1: icmp_seq=1 ttl=57 time=19.283 ms

64 bytes from 10.10.85.1: icmp_seq=2 ttl=57 time=23.868 ms

64 bytes from 10.10.85.1: icmp_seq=3 ttl=57 time=17.762 ms

--- 10.10.85.1 ping statistics ---

4 packets transmitted, 4 packets received, 0% packet loss

round-trip min/avg/max/stddev = 17.762/20.530/23.868/2.281 ms

This is the logs of pinging all the other webserver in the order of the groups (1-8).
This worked just as the other since every webserver was set up correctly

Date: 9/11-2017
Tested by: Jeppe

Proof of work

```
root@VSRX2> traceroute 192.168.55.2
traceroute to 192.168.55.2 (192.168.55.2), 30 hops max, 40 byte packets
 1  10.10.50.10 (10.10.50.10)  17.609 ms  13.492 ms  17.895 ms
 2  172.16.5.1 (172.16.5.1)  15.312 ms  17.054 ms  18.867 ms
 3  172.16.5.6 (172.16.5.6)  29.955 ms  20.306 ms  19.904 ms
 4  10.10.51.9 (10.10.51.9)  17.703 ms  31.624 ms  33.006 ms
 5  192.168.55.2 (192.168.55.2)  22.981 ms  34.455 ms  27.370 ms
```

Here is a traceroute from VSRX2 (10.10.50.2) to 192.168.55.2, which is a host connected in the same Area, but on a different PC. For it to work, the packet must first enter the router that connects Area 5 and Area 0, on the switch. The IP Address 172.16.5.1 are the address on the virtual router on the switch. The packet then enters the connected PC's routers (172.16.5.6 and 10.10.51.9), then the host (192.168.55.2).

Low Level Design

Router: SRXDC-1													
Node	Item	Interface	Tag	Unit	Vlan-id	Family	Address	Mask	Connect to	Interface	vr	Cable	Comment
SRXA-1	*Interfaces*	ge-0/0/0	na	0	na	inet	10.10.50.1	/30	VSRX3	Ge-0/0/0	na	VMnet1	User Lan 1
		ge-0/0/1	na	0	na	inet	10.10.50.5	/30	VSRX2	Ge-0/0/1	na	VMnet2	User Lan 2
		ge-0/0/2	na	0	na	inet	192.168.52.1	/24	Host	Ethernet 1	na	VMnet3	Inter Router Connection
		lo.5	na	0	Na	Inet	192.168.50.1	/32	VSRX1	Lo0	na		
	Protocols	Protocol	*Type*	*area/AS*	*interface*	LSP	Egress	Path	ip Hop	Stricht/Loose			Comment
		OSPF	0.0.0.0	0.0.0.5	ge-0/0/1								

Router: SRXDC-1													
Node	Item	Interface	Tag	Unit	Vlan-id	Family	Address	Mask	Connect to	Interface	vr	Cable	Comment
SRXA-1	*Interfaces*	ge-0/0/0	na	0	na	inet	10.10.51.1	/30	VSRX3	Ge-0/0/0	na	VMnet1	User Lan 1
		ge-0/0/1	na	0	na	inet	10.10.51.5	/30	VSRX2	Ge-0/0/1	na	VMnet2	User Lan 2
		ge-0/0/2	na	0	na	inet	192.168.53.1	/24	Host	Ethernet 1	na	VMnet3	Inter Router Connection
		lo.5	na	0	Na	Inet	192.168.50.1	/32	VSRX1	Lo0	na		
	Protocols	Protocol	*Type*	*area/AS*	*interface*	LSP	Egress	Path	ip Hop	Stricht/Loose			Comment
		OSPF	0.0.0.0	0.0.0.5	ge-0/0/1								

Router: SRXDC-2

Node	Item	Interface	Tag	Unit	Vlan-id	Family	Address	Mask	Connect to	Interface	vr	Cable	Comment
SRXA-1	*Interfaces*												
		ge-0/0/1	na	0	na	inet	10.10.51.6	/30	VSRX1	Ge-0/0/1	na	VMnet2	Inter Router Connection
		ge-0/0/2	na	0	na	inet	10.10.51.9	/30	VSRX3	Ge-0/0/2	na	VMnet3	Inter Router Connection
		lo.5	Na	0	Na	Inet	192.168.50.2	/32	VSRX2	Lo0	na		
	Protocols	Protocol	*Type*	*area/AS*	*interface*	LSP	Egress	Path	ip Hop	Stricht/Loose			Comment
		OSPF	0.0.0.0	0.0.0.5	ge-0/0/1								

Router: SRXDC-2

Node	Item	Interface	Tag	Unit	Vlan-id	Family	Address	Mask	Connect to	Interface	vr	Cable	Comment
SRXA-1	*Interfaces*												
		ge-0/0/1	na	0	na	inet	10.10.50.6	/30	VSRX1	Ge-0/0/1	na	VMnet2	Inter Router Connection
		ge-0/0/2	na	0	na	inet	10.10.50.9	/30	VSRX3	Ge-0/0/2	na	VMnet3	Inter Router Connection
		lo.0	Na	0	Na	Inet	192.168.50.2	/32	VSRX2	Lo0	na		
	Protocols	Protocol	*Type*	*area/AS*	*interface*	LSP	Egress	Path	ip Hop	Stricht/Loose			Comment
		OSPF	0.0.0.0	0.0.0.5	ge-0/0/1								

Router: SRXDC-3

Node	Item	Interface	Tag	Unit	Vlan-id	Family	Address	Mask	Connect to	Interface	vr	Cable	Comment
SRXA-1	*Interfaces*	ge-0/0/0	Na	0	na	inet	10.10.51.2	/30	VSRX1	Ge-0/0/0	Na		Inter Router Connection
		ge-0/0/1											
		ge-0/0/2	na	0	na	inet	10.10.51.10	/30	VSRX2	Ge-0/0/2	na	VMnet3	Inter Router Connection
		ge-0/0/3	Na	0	Na	Inet	172.16.5.6	/30	Switch-EX2	Ge-0/0/11	na		
		lo.5	na	0	Na	Inet	192.168.50.3	/32	VSRX3	Lo.0	Na		
	Protocols	Protocol	*Type*	*area/AS*	*interface*	LSP	Egress	Path	ip Hop	Stricht/Loose			Comment
		OSPF	0.0.0.0	0.0.0.5	ge-0/0/1								

Router: SRXDC-3

Node	Item	Interface	Tag	Unit	Vlan-id	Family	Address	Mask	Connect to	Interface	vr	Cable	Comment
SRXA-1	*Interfaces*	ge-0/0/0	Na	0	na	inet	10.10.50.2	/30	VSRX1	Ge-0/0/0	Na		Inter Router Connection
		ge-0/0/1											
		ge-0/0/2	na	0	na	inet	10.10.50.10	/30	VSRX2	Ge-0/0/2	na	VMnet3	Inter Router Connection
		ge-0/0/3	Na	0	Na	Inet	172.16.5.2	/30	Switch-EX2	Ge-0/0/10	na		
		lo.0	na	0	Na	Inet	192.168.50.3	/32	VSRX3	Lo.0	Na		
	Protocols	Protocol	*Type*	*area/AS*	*interface*	LSP	Egress	Path	ip Hop	Stricht/Loose			Comment
		OSPF	0.0.0.0	0.0.0.5	ge-0/0/1								