1. Topology

Figure 1 Ideal topology of this experiment

In this experiment, we need five switches and 18 machines in total as following figure shows.

 Figure 2 Simplified topology of this experiment

1. IP Setup
   1. Machines

|  |  |  |  |
| --- | --- | --- | --- |
| Id | Hostname | Control IP | App IP |
| 1 | Sing40 | 192.168.1.40 | 192.168.11.1 |
| 2 | Sing41 | 192.168.1.41 | 192.168.11.2 |
| 3 | Sing42 | 192.168.1.42 | 192.168.11.3 |
| 4 | Sing43 | 192.168.1.43 | 192.168.12.1 |
| 5 | Sing44 | 192.168.1.44 | 192.168.12.2 |
| 6 | Sing45 | 192.168.1.45 | 192.168.12.3 |
| 7 | Sing46 | 192.168.1.46 | 192.168.13.1 |
| 8 | Sing47 | 192.168.1.47 | 192.168.13.2 |
| 9 | Sing48 | 192.168.1.48 | 192.168.13.3 |
| 10 | Sing49 | 192.168.1.49 | 192.168.14.1 |
| 11 | Sing50 | 192.168.1.50 | 192.168.14.2 |
| 12 | Sing51 | 192.168.1.51 | 192.168.14.3 |
| 13 | Sing52 | 192.168.1.52 | 192.168.15.1 |
| 14 | Sing53 | 192.168.1.53 | 192.168.15.2 |
| 15 | Sing54 | 192.168.1.54 | 192.168.15.3 |
| 16 | Sing55 | 192.168.1.55 | 192.168.16.1 |
| 17 | Sing56 | 192.168.1.56 | 192.168.16.2 |
| 18 | Sing57 | 192.168.1.57 | 192.168.16.3 |

* 1. Switches
     1. Edge1

|  |  |  |
| --- | --- | --- |
| Port | VLan | IP |
| ge-1/1/1 | 2 | 192.168.11.254/24 |
| ge-1/1/2 |
| ge-1/1/3 |
| ge-1/1/4 | 3 | 192.168.12.254/24 |
| ge-1/1/5 |
| ge-1/1/6 |
| ge-1/1/7 | 4 | 192.168.13.254/24 |
| ge-1/1/8 |
| ge-1/1/9 |
| ge-1/1/10 | 5 | 10.0.1.1/24 |
| ge-1/1/11 | 6 | 10.0.2.1/24 |
| ge-1/1/12 | 7 | 10.0.3.1/24 |
| ge-1/1/13 | 8 | 10.0.4.1/24 |
| ge-1/1/14 | 9 | 10.0.5.1/24 |
| ge-1/1/15 | 10 | 10.0.6.1/24 |
| ge-1/1/16 | 11 | 10.0.7.1/24 |
| ge-1/1/17 | 12 | 10.0.8.1/24 |
| ge-1/1/18 | 13 | 10.0.9.1/24 |

* + 1. Edge2

|  |  |  |
| --- | --- | --- |
| Port | VLan | IP |
| ge-1/1/1 | 2 | 192.168.14.254/24 |
| ge-1/1/2 |
| ge-1/1/3 |
| ge-1/1/4 | 3 | 192.168.15.254/24 |
| ge-1/1/5 |
| ge-1/1/6 |
| ge-1/1/7 | 4 | 192.168.16.254/24 |
| ge-1/1/8 |
| ge-1/1/9 |
| ge-1/1/10 | 5 | 10.0.10.1/24 |
| ge-1/1/11 | 6 | 10.0.11.1/24 |
| ge-1/1/12 | 7 | 10.0.12.1/24 |
| ge-1/1/13 | 8 | 10.0.13.1/24 |
| ge-1/1/14 | 9 | 10.0.14.1/24 |
| ge-1/1/15 | 10 | 10.0.15.1/24 |
| ge-1/1/16 | 11 | 10.0.16.1/24 |
| ge-1/1/17 | 12 | 10.0.17.1/24 |
| ge-1/1/18 | 13 | 10.0.18.1/24 |

* + 1. Aggr1

|  |  |  |
| --- | --- | --- |
| Port | VLan | IP |
| ge-1/1/1 | 2 | 10.0.1.2/24 |
| ge-1/1/2 | 3 | 10.0.4.2/24 |
| ge-1/1/3 | 4 | 10.0.7.2/24 |
| ge-1/1/4 | 5 | 10.0.2.2/24 |
| ge-1/1/5 | 6 | 10.0.5.2/24 |
| ge-1/1/6 | 7 | 10.0.8.2/24 |
| ge-1/1/7 | 8 | 10.0.3.2/24 |
| ge-1/1/8 | 9 | 10.0.6.2/24 |
| ge-1/1/9 | 10 | 10.0.9.2/24 |
| ge-1/1/10 | 11 | 172.16.1.1/24 |
| ge-1/1/11 | 12 | 172.16.2.1/24 |
| ge-1/1/12 | 13 | 172.16.3.1/24 |
| ge-1/1/13 | 14 | 172.16.4.1/24 |
| ge-1/1/14 | 15 | 172.16.5.1/24 |
| ge-1/1/15 | 16 | 172.16.6.1/24 |
| ge-1/1/16 | 17 | 172.16.7.1/24 |
| ge-1/1/17 | 18 | 172.16.8.1/24 |
| ge-1/1/18 | 19 | 172.16.9.1/24 |

* + 1. Aggr2

|  |  |  |
| --- | --- | --- |
| Port | VLan | IP |
| ge-1/1/1 | 2 | 10.0.10.2/24 |
| ge-1/1/2 | 3 | 10.0.13.2/24 |
| ge-1/1/3 | 4 | 10.0.16.2/24 |
| ge-1/1/4 | 5 | 10.0.11.2/24 |
| ge-1/1/5 | 6 | 10.0.14.2/24 |
| ge-1/1/6 | 7 | 10.0.17.2/24 |
| ge-1/1/7 | 8 | 10.0.12.2/24 |
| ge-1/1/8 | 9 | 10.0.15.2/24 |
| ge-1/1/9 | 10 | 10.0.18.2/24 |
| ge-1/1/10 | 11 | 172.16.10.1/24 |
| ge-1/1/11 | 12 | 172.16.11.1/24 |
| ge-1/1/12 | 13 | 172.16.12.1/24 |
| ge-1/1/13 | 14 | 172.16.13.1/24 |
| ge-1/1/14 | 15 | 172.16.14.1/24 |
| ge-1/1/15 | 16 | 172.16.15.1/24 |
| ge-1/1/16 | 17 | 172.16.16.1/24 |
| ge-1/1/17 | 18 | 172.16.17.1/24 |
| ge-1/1/18 | 19 | 172.16.18.1/24 |

* + 1. Core

|  |  |  |
| --- | --- | --- |
| Port | VLan | IP |
| ge-1/1/1 | 2 | 172.16.1.2/24 |
| ge-1/1/2 | 3 | 172.16.4.2/24 |
| ge-1/1/3 | 4 | 172.16.7.2/24 |
| ge-1/1/4 | 5 | 172.16.10.2/24 |
| ge-1/1/5 | 6 | 172.16.13.2/24 |
| ge-1/1/6 | 7 | 172.16.16.2/24 |
| ge-1/1/7 | 8 | 172.16.2.2/24 |
| ge-1/1/8 | 9 | 172.16.5.2/24 |
| ge-1/1/9 | 10 | 172.16.8.2/24 |
| ge-1/1/10 | 11 | 172.16.11.2/24 |
| ge-1/1/11 | 12 | 172.16.14.2/24 |
| ge-1/1/12 | 13 | 172.16.17.2/24 |
| ge-1/1/13 | 14 | 172.16.3.2/24 |
| ge-1/1/14 | 15 | 172.16.6.2/24 |
| ge-1/1/15 | 16 | 172.16.9.2/24 |
| ge-1/1/16 | 17 | 172.16.12.2/24 |
| ge-1/1/17 | 18 | 172.16.15.2/24 |
| ge-1/1/18 | 19 | 172.16.18.2/24 |

1. ECMP Configurations
2. RoX Configurations

|  |  |  |  |
| --- | --- | --- | --- |
| Machine | Control IP Address | APP IP Address | Path |
| M1 | 192.168.1.40 | 192.168.11.1 | 192.168.11.51 |
| M2 | 192.168.1.41 | 192.168.11.2 | 192.168.11.52 |
| M3 | 192.168.1.42 | 192.168.11.3 | 192.168.11.53 |
| M4 | 192.168.1.43 | 192.168.12.1 | 192.168.12.51 |
| M5 | 192.168.1.44 | 192.168.12.2 | 192.168.12.52 |
| M6 | 192.168.1.45 | 192.168.12.3 | 192.168.12.53 |
| M7 | 192.168.1.46 | 192.168.13.1 | 192.168.13.51 |
| M8 | 192.168.1.47 | 192.168.13.2 | 192.168.13.52 |
| M9 | 192.168.1.48 | 192.168.13.3 | 192.168.13.53 |
| M10 | 192.168.1.49 | 192.168.14.1 | 192.168.14.51 |
| M11 | 192.168.1.50 | 192.168.14.2 | 192.168.14.52 |
| M12 | 192.168.1.51 | 192.168.14.3 | 192.168.14.53 |
| M13 | 192.168.1.52 | 192.168.15.1 | 192.168.15.51 |
| M14 | 192.168.1.53 | 192.168.15.2 | 192.168.15.52 |
| M15 | 192.168.1.54 | 192.168.15.3 | 192.168.15.53 |
| M16 | 192.168.1.55 | 192.168.16.1 | 192.168.16.51 |
| M17 | 192.168.1.56 | 192.168.16.2 | 192.168.16.52 |
| M18 | 192.168.1.57 | 192.168.16.3 | 192.168.16.53 |

Encoding path

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| Path ID | Src | Dst | Path | IP |
| 1 | M10,M11,M12 | M1 | M10,E2,A2,C,A1,E1,M1  M11,E2,A2,C,A1,E1,M1  M12,E2,A2,C,A1,E1,M1 | 192.168.11.51 |
| 2 | M10,M11,M12 | M2 | M10,E2,A2,C,A1,E1,M2  M11,E2,A2,C,A1,E1,M2  M12,E2,A2,C,A1,E1,M2 | 192.168.11.52 |
| 3 | M10,M11,M12 | M3 | M10,E2,A2,C,A1,E1,M3  M11,E2,A2,C,A1,E1,M3  M12,E2,A2,C,A1,E1,M3 | 192.168.11.53 |
| 4 | M13,M14,M15 | M4 | M13,E2,A2,C,A1,E1,M4  M14,E2,A2,C,A1,E1,M4  M15,E2,A2,C,A1,E1,M4 | 192.168.12.51 |
| 5 | M13,M14,M15 | M5 | M13,E2,A2,C,A1,E1,M5  M14,E2,A2,C,A1,E1,M5  M15,E2,A2,C,A1,E1,M5 | 192.168.12.52 |
| 6 | M13,M14,M15 | M6 | M13,E2,A2,C,A1,E1,M6  M14,E2,A2,C,A1,E1,M6  M15,E2,A2,C,A1,E1,M6 | 192.168.12.53 |
| 7 | M16,M17,M18 | M7 | M16,E2,A2,C,A1,E1,M7  M17,E2,A2,C,A1,E1,M7  M18,E2,A2,C,A1,E1,M7 | 192.168.13.51 |
| 8 | M16,M17,M18 | M8 | M16,E2,A2,C,A1,E1,M8  M17,E2,A2,C,A1,E1,M8  M18,E2,A2,C,A1,E1,M8 | 192.168.13.52 |
| 9 | M16,M17,M18 | M9 | M16,E2,A2,C,A1,E1,M9  M17,E2,A2,C,A1,E1,M9  M18,E2,A2,C,A1,E1,M9 | 192.168.13.53 |
| 10 | M1,M2,M3 | M10 | M1,E1,A1,C,A2,E2,M10  M2,E1,A1,C,A2,E2,M10  M3,E1,A1,C,A2,E2,M10 | 192.168.14.51 |
| 11 | M1,M2,M3 | M11 | M1,E1,A1,C,A2,E2,M11  M2,E1,A1,C,A2,E2,M11  M3,E1,A1,C,A2,E2,M11 | 192.168.14.52 |
| 12 | M1,M2,M3 | M12 | M1,E1,A1,C,A2,E2,M12  M2,E1,A1,C,A2,E2,M12  M3,E1,A1,C,A2,E2,M12 | 192.168.14.53 |
| 13 | M4,M5,M6 | M13 | M4,E1,A1,C,A2,E2,M13  M5,E1,A1,C,A2,E2,M13  M6,E1,A1,C,A2,E2,M13 | 192.168.15.51 |
| 14 | M4,M5,M6 | M14 | M4,E1,A1,C,A2,E2,M14  M5,E1,A1,C,A2,E2,M14  M6,E1,A1,C,A2,E2,M14 | 192.168.15.52 |
| 15 | M4,M5,M6 | M15 | M4,E1,A1,C,A2,E2,M15  M5,E1,A1,C,A2,E2,M15  M6,E1,A1,C,A2,E2,M15 | 192.168.15.53 |
| 16 | M7,M8,M9 | M16 | M7,E1,A1,C,A2,E2,M16  M8,E1,A1,C,A2,E2,M16  M9,E1,A1,C,A2,E2,M16 | 192.168.16.51 |
| 17 | M7,M8,M9 | M17 | M7,E1,A1,C,A2,E2,M17  M8,E1,A1,C,A2,E2,M17  M9,E1,A1,C,A2,E2,M17 | 192.168.16.52 |
| 18 | M7,M8,M9 | M18 | M7,E1,A1,C,A2,E2,M18  M8,E1,A1,C,A2,E2,M18  M9,E1,A1,C,A2,E2,M18 | 192.168.16.53 |

Switch Configurations

Edge 1

|  |  |  |
| --- | --- | --- |
| Path ID | Destination | Next Hop |
| 10 | 192.168.14.1 | 10.0.1.2 |
| 11 | 192.168.14.2 | 10.0.2.2 |
| 12 | 192.168.14.3 | 10.0.3.2 |
| 13 | 192.168.15.1 | 10.0.5.2 |
| 14 | 192.168.15.2 | 10.0.6.2 |
| 15 | 192.168.15.3 | 10.0.4.2 |
| 16 | 192.168.16.1 | 10.0.9.2 |
| 17 | 192.168.16.2 | 10.0.7.2 |
| 18 | 192.168.16.3 | 10.0.8.2 |

Edge 2

|  |  |  |
| --- | --- | --- |
| Path ID | Destination | Next Hop |
| 1 | 192.168.11.1 | 10.0.10.2 |
| 2 | 192.168.11.2 | 10.0.11.2 |
| 3 | 192.168.11.3 | 10.0.12.2 |
| 4 | 192.168.12.1 | 10.0.14.2 |
| 5 | 192.168.12.2 | 10.0.15.2 |
| 6 | 192.168.12.3 | 10.0.13.2 |
| 7 | 192.168.13.1 | 10.0.18.2 |
| 8 | 192.168.13.2 | 10.0.16.2 |
| 9 | 192.168.13.3 | 10.0.17.2 |

Aggr 1

|  |  |  |
| --- | --- | --- |
| Path ID | Destination | Next Hop |
| 1 | 192.168.11.1 | 10.0.1.1 |
| 2 | 192.168.11.2 | 10.0.2.1 |
| 3 | 192.168.11.3 | 10.0.3.1 |
| 4 | 192.168.12.1 | 10.0.5.1 |
| 5 | 192.168.12.2 | 10.0.6.1 |
| 6 | 192.168.12.3 | 10.0.4.1 |
| 7 | 192.168.13.1 | 10.0.9.1 |
| 8 | 192.168.13.2 | 10.0.7.1 |
| 9 | 192.168.13.3 | 10.0.8.1 |
| 10 | 192.168.14.1 | 172.16.1.2 |
| 11 | 192.168.14.2 | 172.16.4.2 |
| 12 | 192.168.14.3 | 172.16.7.2 |
| 13 | 192.168.15.1 | 172.16.5.2 |
| 14 | 192.168.15.2 | 172.16.8.2 |
| 15 | 192.168.15.3 | 172.16.2.2 |
| 16 | 192.168.16.1 | 172.16.9.2 |
| 17 | 192.168.16.2 | 172.16.3.2 |
| 18 | 192.168.16.3 | 172.16.6.2 |

Aggr 2

|  |  |  |
| --- | --- | --- |
| Path ID | Destination | Next Hop |
| 1 | 192.168.11.1 | 172.16.10.2 |
| 2 | 192.168.11.2 | 172.16.13.2 |
| 3 | 192.168.11.3 | 172.16.16.2 |
| 4 | 192.168.12.1 | 172.16.14.2 |
| 5 | 192.168.12.2 | 172.16.17.2 |
| 6 | 192.168.12.3 | 172.16.11.2 |
| 7 | 192.168.13.1 | 172.16.18.2 |
| 8 | 192.168.13.2 | 172.16.12.2 |
| 9 | 192.168.13.3 | 172.16.15.2 |
| 10 | 192.168.14.1 | 10.0.10.1 |
| 11 | 192.168.14.2 | 10.0.11.1 |
| 12 | 192.168.14.3 | 10.0.12.1 |
| 13 | 192.168.15.1 | 10.0.14.1 |
| 14 | 192.168.15.2 | 10.0.15.1 |
| 15 | 192.168.15.3 | 10.0.13.1 |
| 16 | 192.168.16.1 | 10.0.18.1 |
| 17 | 192.168.16.2 | 10.0.16.1 |
| 18 | 192.168.16.3 | 10.0.17.1 |

Core

|  |  |  |
| --- | --- | --- |
| Path ID | Destination | Next Hop |
| 1 | 192.168.11.1 | 172.16.1.1 |
| 2 | 192.168.11.2 | 172.16.4.1 |
| 3 | 192.168.11.3 | 172.16.7.1 |
| 4 | 192.168.12.1 | 172.16.5.1 |
| 5 | 192.168.12.2 | 172.16.8.1 |
| 6 | 192.168.12.3 | 172.16.2.1 |
| 7 | 192.168.13.1 | 172.16.9.1 |
| 8 | 192.168.13.2 | 172.16.3.1 |
| 9 | 192.168.13.3 | 172.16.6.1 |
| 10 | 192.168.14.1 | 172.16.10.1 |
| 11 | 192.168.14.2 | 172.16.13.1 |
| 12 | 192.168.14.3 | 172.16.16.1 |
| 13 | 192.168.15.1 | 172.16.14.1 |
| 14 | 192.168.15.2 | 172.16.17.1 |
| 15 | 192.168.15.3 | 172.16.11.1 |
| 16 | 192.168.16.1 | 172.16.18.1 |
| 17 | 192.168.16.2 | 172.16.12.1 |
| 18 | 192.168.16.3 | 172.16.15.1 |

File Size

|  |  |  |
| --- | --- | --- |
| Path ID | src | File Size |
| 1 | M1  M2  M3 | 5000M  1000M  100M |
| 2 | M1  M2  M3 | 5000M  1000M  100M |
| 3 | M1  M2  M3 | 5000M  1000M  100M |
| 4 | M4  M5  M6 | 5000M  1000M  100M |
| 5 | M4  M5  M6 | 5000M  1000M  100M |
| 6 | M4  M5  M6 | 5000M  1000M  100M |
| 7 | M7  M8  M9 | 5000M  1000M  100M |
| 8 | M7  M8  M9 | 5000M  1000M  100M |
| 9 | M7  M8  M9 | 5000M  1000M  100M |