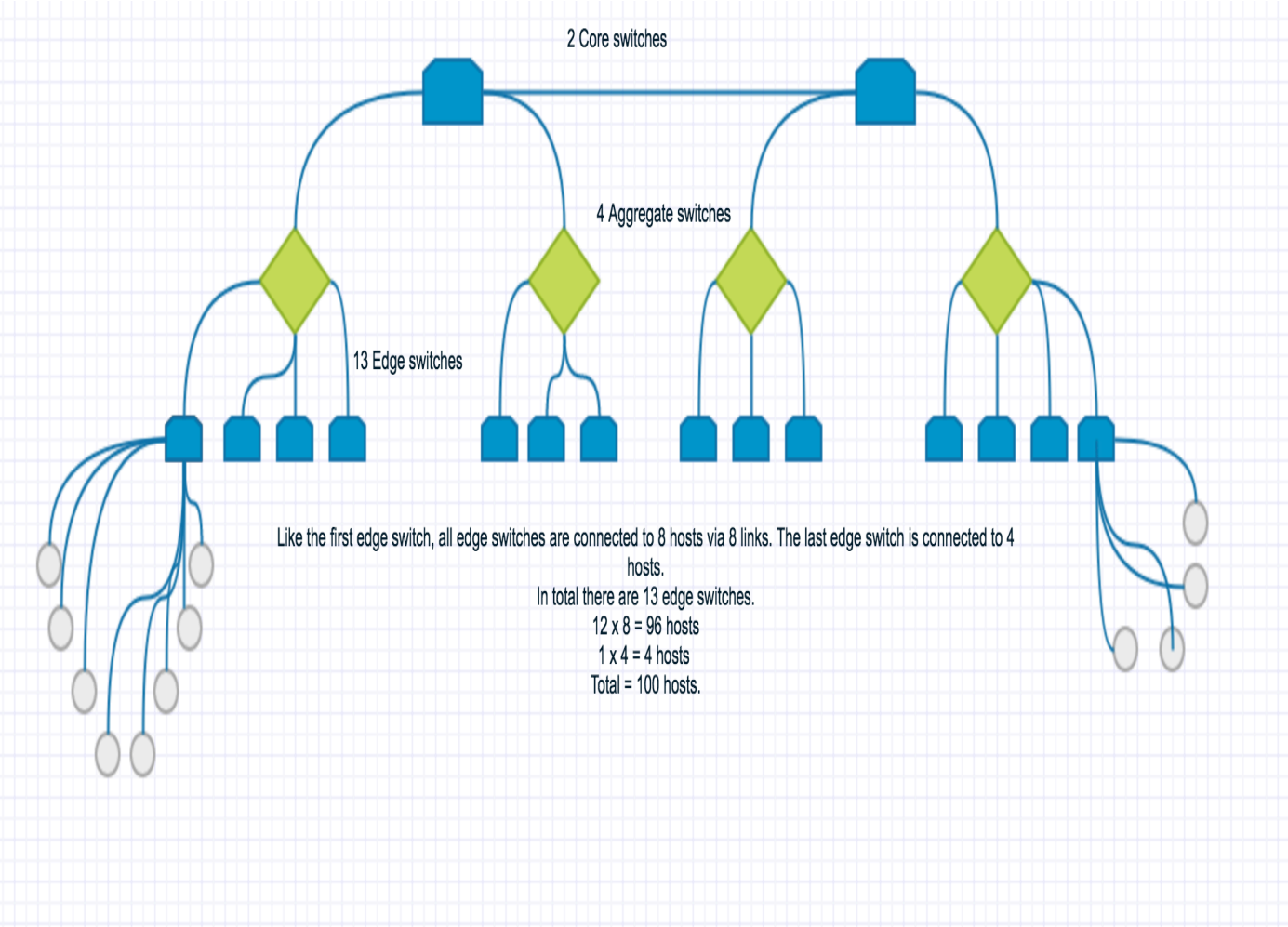
TOPOLOGY DESIGN:



These are the key elements in the topology we chose to stay in the budget.

- 2 Core switches connected to each other.
- 4 Aggregate switches, with 2 each connected to a core switch.
- 13 Edge switches
    - 2 x 4 Edge switches connected to an aggregate switch
    - 2 x 3 Edge switches connected to an aggregate switch
- 100 Hosts.
    - 12 x 8 Hosts connected to each edge switch
    - 1 x 4 hosts to the last edge switch.

Total Cost of the network: 6070
19 * 300 = 5700 = cost of switches
5 * 15 = 75 = cost of 1Gbps links between Core and Aggregate
13 * 15 = 195 = cost of 1Gbps links between Edge and Aggregate
100 * 1 = 100 = cost of 100Mbps links

Total Cost = 5700 + 75 + 195 + 100 = 6070

LEARNING SWITCH:

- We used the l2_learning.py default switch given in pox for our switch.

TESTS:

1. PINGALL:

- We performed a pingall test for all the 100 hosts and achieved 100 percent connectivity.

IPERF WITH 100Mbps Bandwidth:

('iperf -c 10.0.0.1 -u -t 10 -i 1 -b 100m',)

```
------------------------------------------------------------
Client connecting to 10.0.0.1, UDP port 5001
Sending 1470 byte datagrams
UDP buffer size:  208 KByte (default)
------------------------------------------------------------
[  3] local 10.0.0.100 port 51950 connected with 10.0.0.1 port 5001
[ ID] Interval       Transfer     Bandwidth
[  3]  0.0- 1.0 sec  11.8 MBytes  99.1 Mbits/sec
[  3]  1.0- 2.0 sec  12.0 MBytes   100 Mbits/sec
[  3]  2.0- 3.0 sec  11.9 MBytes   100 Mbits/sec
[  3]  3.0- 4.0 sec  11.9 MBytes   100 Mbits/sec
[  3]  4.0- 5.0 sec  11.9 MBytes  99.7 Mbits/sec
[  3]  5.0- 6.0 sec  12.0 MBytes   100 Mbits/sec
[  3]  6.0- 7.0 sec  11.9 MBytes  99.9 Mbits/sec
[  3]  7.0- 8.0 sec  11.9 MBytes  99.8 Mbits/sec
[  3]  8.0- 9.0 sec  11.6 MBytes  97.3 Mbits/sec
[  3]  9.0-10.0 sec  11.8 MBytes  99.2 Mbits/sec
[  3]  0.0-10.0 sec   119 MBytes  99.6 Mbits/sec
[  3] Sent 84686 datagrams
[  3] Server Report:
```

[3] 0.0-10.2 sec 83.8 MBytes 69.2 Mbits/sec 0.240 ms 24909/84685 (29%)
[3] 0.0-10.2 sec 663 datagrams received out-of-order
('iperf -c 10.0.0.50 -u -t 10 -i 1 -b 100m',)

Client connecting to 10.0.0.50, UDP port 5001
Sending 1470 byte datagrams
UDP buffer size: 208 KByte (default)
---
[3] local 10.0.0.100 port 40869 connected with 10.0.0.50 port 5001
[ID] Interval Transfer Bandwidth
[3] 0.0- 1.0 sec 11.8 MBytes 99.4 Mbits/sec
[3] 1.0- 2.0 sec 11.9 MBytes 99.9 Mbits/sec
[3] 2.0- 3.0 sec 11.9 MBytes 99.9 Mbits/sec
[3] 3.0- 4.0 sec 12.0 MBytes 100 Mbits/sec
[3] 4.0- 5.0 sec 11.9 MBytes 99.7 Mbits/sec
[3] 5.0- 6.0 sec 11.8 MBytes 99.3 Mbits/sec
[3] 6.0- 7.0 sec 11.9 MBytes 99.7 Mbits/sec
[3] 7.0- 8.0 sec 11.9 MBytes 99.6 Mbits/sec
[3] 8.0- 9.0 sec 11.9 MBytes 99.9 Mbits/sec
[3] 9.0-10.0 sec 11.8 MBytes 99.3 Mbits/sec
[3] 0.0-10.0 sec 119 MBytes 99.7 Mbits/sec
[3] Sent 84794 datagrams
[3] Server Report:
[3] 0.0-10.2 sec 82.5 MBytes 67.9 Mbits/sec 0.262 ms 25912/84793 (31%)
[3] 0.0-10.2 sec 768 datagrams received out-of-order

IPERF WITH 1000Mbps Bandwidth:

('iperf -c 10.0.0.1 -u -t 10 -i 1 -b 1000m',)

Client connecting to 10.0.0.1, UDP port 5001
Sending 1470 byte datagrams
UDP buffer size: 208 KByte (default)
---
[3] local 10.0.0.100 port 49991 connected with 10.0.0.1 port 5001
[ID] Interval Transfer Bandwidth
[3] 0.0- 1.0 sec 57.8 MBytes 485 Mbits/sec
[3] 1.0- 2.0 sec 52.5 MBytes 441 Mbits/sec
[3] 2.0- 3.0 sec 50.0 MBytes 419 Mbits/sec
[3] 3.0- 4.0 sec 49.3 MBytes 414 Mbits/sec
[3] 4.0- 5.0 sec 53.0 MBytes 445 Mbits/sec
[3] 5.0- 6.0 sec 53.0 MBytes 445 Mbits/sec
[3] 6.0- 7.0 sec 48.9 MBytes 410 Mbits/sec

[3] 7.0- 8.0 sec 34.1 MBytes 286 Mbits/sec
[3] 8.0- 9.0 sec 43.3 MBytes 363 Mbits/sec
[3] 9.0-10.0 sec 43.5 MBytes 365 Mbits/sec
[3] 0.0-10.0 sec 485 MBytes 407 Mbits/sec
[3] Sent 346315 datagrams
[3] Server Report:
[3] 0.0- 9.9 sec 99.9 MBytes 85.0 Mbits/sec 5.931 ms 275067/346314 (79%)
[3] 0.0- 9.9 sec 4156 datagrams received out-of-order

('iperf -c 10.0.0.50 -u -t 10 -i 1 -b 1000m',)

Client connecting to 10.0.0.50, UDP port 5001
Sending 1470 byte datagrams
UDP buffer size: 208 KByte (default)

---

[3] local 10.0.0.100 port 35354 connected with 10.0.0.50 port 5001
[ID] Interval Transfer Bandwidth
[3] 0.0- 1.0 sec 33.7 MBytes 282 Mbits/sec
[3] 1.0- 2.0 sec 49.6 MBytes 416 Mbits/sec
[3] 2.0- 3.0 sec 53.9 MBytes 452 Mbits/sec
[3] 3.0- 4.0 sec 62.2 MBytes 522 Mbits/sec
[3] 4.0- 5.0 sec 54.7 MBytes 459 Mbits/sec
[3] 5.0- 6.0 sec 71.0 MBytes 596 Mbits/sec
[3] 6.0- 7.0 sec 73.7 MBytes 618 Mbits/sec
[3] 7.0- 8.0 sec 67.3 MBytes 565 Mbits/sec
[3] 8.0- 9.0 sec 71.9 MBytes 603 Mbits/sec
[3] 9.0-10.0 sec 71.3 MBytes 598 Mbits/sec
[3] 0.0-10.0 sec 609 MBytes 511 Mbits/sec
[3] Sent 434615 datagrams
[3] Server Report:
[3] 0.0-10.0 sec 106 MBytes 88.8 Mbits/sec 2.744 ms 359157/434613 (83%)
[3] 0.0-10.0 sec 2451 datagrams received out-of-order

OBSERVATIONS:

- When the bandwidth of the test was 100 which is the max bandwidth associated per link from a host to the edge switch, the overall network bandwith stayed near 100
- When the bandwidth of the test was upped to 1000, the bandwidth stayed around 50 percent of the max allowed, potentially due to the congestion and bottleneck between the edge to the host links.

CODE:

All the associated code is attached in the zip file.