NA Assignment 2

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1. 10G Ethernet uses all four pairs of the UTP cable for transmission unlike the earlier 100M ethernet which used 2. In 10G ethernet, each pair transmits two bits at a time using **4D-PAM5**. 4D means four data symbols(two bits), and PAM5 is Pulse Amplitude Modulation with five signal levels. This happens at a rate of 125 million symbols per second. Also, there is a **complex scrambling procedure** which makes sure various properties like possible interference are optimized. However, the technology of transmission and collision detection - **CSMA/CD**, depends on the first bit of a packet travelling all the way across a collision domain before a station transmits the last bit of a packet so that there is a shared notion of "**transmitting at the same time**". This is to say that the last bit of the packet cannot be sent until the first bit of the packet is received. However, with the high speeds of transmission, the collision domain size needed to be reduced to an impractical 20 metres. To avoid this, **carrier extension** could be used with padded the signal to 512 bytes so that collision domain size could be around a workable 200m. But, another approach could be to use **ethernet switches** as with switches, CSMA/CD becomes redundant. The two ethernet systems could simply transmit at the same time(not that 10G ethernet uses all four pairs of transmission). This is called **full duplex operation**.
   Source : https://www.wired.com/2011/07/speed-matters/
2. Auto-negotiation is a protocol that when running on both communicating systems, determines the best match for speed of operation and duplex mode of transmission. This protocol does so by advertising it's best operation speed and duplex mode. When both the participating machines advertise their parameters, the best match is decided(higher speeds and full duplex is preferred.)
   Source :
   https://www.safaribooksonline.com/library/view/network-warrior-2nd/9781449307974/ch03s02.html
3. First thing a STP enable network do, is the election of Root Bridge. Switches share BPDUs(Bridge Protocol Data Unit which is a multicast frame that sends meta data about each switch) with each other to select the Root Bridge. Switch that has lowest priority will become root. Default priority is set to 32768. If priority value is same then switch with lowest MAC address would be selected as root. In our network switch S3 has lowest MAC address. Since we did not change priority value, switch S3 would be chosen as Root Bridge.
   Every switch selects single port (that has shortest path cost) from all its ports and marked it as root port.
   - If two switches have multiple connections, only single connection that has shortest path cost would be marked as designated port.(Path cost is determined using the ports on that path. Each port is designated a cost depending on the bandwidth of

the connection. Lower the bandwidth, higher the cost. Path cost is the accumulation of the cost of the ports on the path.)

- Any port that is not either a root port or designated port would be blocked.

Ports on switch running STP go through the five different states. During STP convergence, switches will move their root and designated ports through the various states: blocking, listening, learning, and forwarding, whereas any other ports will remain in a blocked state.

Blocking

In blocking state, switch only listen and process BPDUs on its ports. Any other frames except BPDUs are dropped. In this state, switch try to find out which port would be root port, which ports would be designated ports and which ports would remains in blocking state to remove loops. A port will remain in this state for twenty seconds. By default all ports are in blocking state, when we powered on the switch. Only root port and designated ports will move into next state. All remaining ports will remain in this state.

Listening

After twenty seconds, root port and designated ports will move into listening state. In this state ports still listen and process only BPDUs. All other frames except BPDUs are dropped. In this state switch will double check the layer 2 topology to make sure that no loops occur on the network before processing data frames. Ports remain in this state for fifteen seconds.

Learning

Root port and designated ports enter in learning state from listening state. In this state ports still listen and process BPDUs. However, in this state ports start processing user frames. Switch examines source address in the frames and updates its MAC Address Table. Switch will not forward user frames to destination ports in this state. Ports stay in this state for fifteen seconds.

Forwarding

In forwarding state, ports will listen and process BPDUs. In this state ports will also process user frames, update MAC Address Table and forward user traffic through the ports.

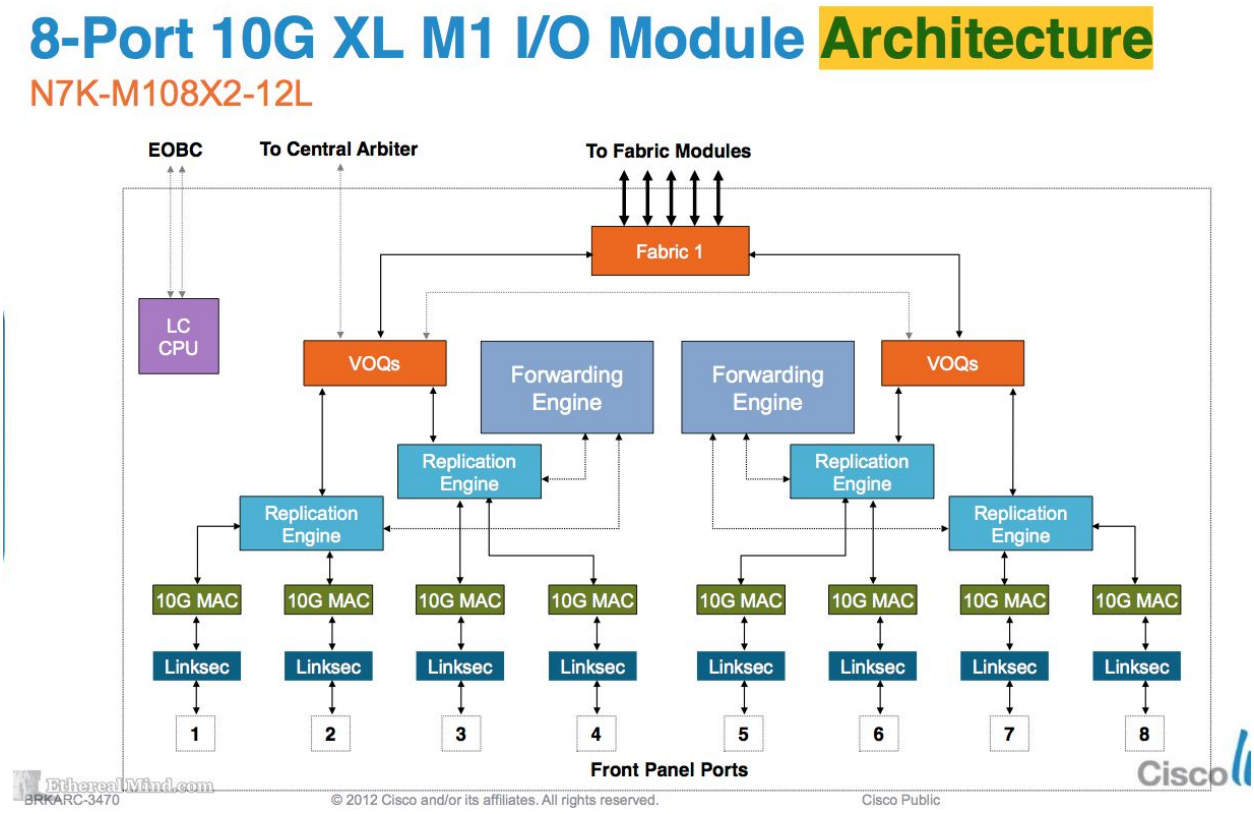
Disable

Disable ports are manually shut down or removed from STP by an administrator. All unplugged ports also remain in disable state. Disable ports do not participate in STP.

Convergence

Convergence is a state where all ports on switch have transitioned to either forwarding or blocking modes. During the STP converging, all user data frames would be dropped. No user data frame will be forwarded until convergence is complete. Usually convergence takes place in fifty seconds (20 seconds of blocking state + 15 seconds of listing state + 15 seconds of learning state).

Source : http://www.computernetworkingnotes.com/ccna-study-guide/stp-spanning-tree-protocol-explained-with-examples.html



4. Source : http://etherealmind.com/whats-happening-inside-an-ethernet-switch-or-network-switches-for-virtualization-people/
   Description of each component :
   - **Replication engine** : duplicates frames that are to be sent to multiple ports
   - **Forwarding engine** : This contains the TCAM lookup tables(MAC lookup tables analogue for ipv6). This basically means that there is a mapping from MAC address to port.
   - **VOQ** : Virtual Output queues. This is a very high speed memory modules that performs frame queueing in silicon. Queueing is needed to ensure that the fabric is not overrun in the outbound direction. Also, packets arriving from the fabric must no overrun the MAC interfaces.

- **Fabric** : Interface chip to the switch fabric. For the NX7K, this is a five interface connection to the fabric modules on a clos switch design.
- **10G MAC** : Media Access Control for 10 gigabit Ethernet port. Think of it as the signal encoder for SFP interface.

5.

No.	Time	Source	Destination	Protocol	Length
1	0.000000000	fe80::892:4d75:96d5:d97d	ff02::fb	MDNS	621
2	1.775342101	192.168.60.85	224.0.0.251	MDNS	163
3	1.775442896	fe80::ca69:cdff:fe93:90dc	ff02::fb	MDNS	183
4	1.984445992	192.168.60.85	224.0.0.251	MDNS	368
5	1.984624169	fe80::ca69:cdff:fe93:90dc	ff02::fb	MDNS	388
6	1.984744840	192.168.60.85	224.0.0.251	MDNS	163
7	1.984864218	fe80::ca69:cdff:fe93:90dc	ff02::fb	MDNS	183
8	2.297667114	192.168.60.85	224.0.0.251	MDNS	418
9	2.297897534	fe80::ca69:cdff:fe93:90dc	ff02::fb	MDNS	438
10	2.402129111	192.168.60.216	224.0.0.251	MDNS	150
11	2.402253043	fe80::892:4d75:96d5:d97d	ff02::fb	MDNS	170
12	2.506864223	192.168.60.216	224.0.0.251	MDNS	762
13	2.507189413	fe80::892:4d75:96d5:d97d	ff02::fb	MDNS	782
14	2.715627894	fe80::8f13:2708:ff7a:46b5	ff02::fb	MDNS	112
15	5.848811222	192.168.57.196	224.0.0.251	MDNS	129
16	5.848881466	192.168.59.107	224.0.0.251	MDNS	82
17	5.848972720	fe80::195c:4c01:810c:8c3e	ff02::fb	MDNS	102
18	5.953741167	192.168.57.190	224.0.0.251	MDNS	1494
19	5.953977932	192.168.57.190	224.0.0.251	MDNS	643
20	5.954126256	192.168.57.190	224.0.0.251	MDNS	264
21	6.162403830	fe80::33cc:3ee7:1471:b943	ff02::fb	MDNS	145
22	6.266606081	192.168.59.164	224.0.0.251	MDNS	129
23	6.371054859	fe80::33cc:3ee7:1471:b943	ff02::fb	MDNS	156
24	6.371144795	192.168.57.190	224.0.0.251	MDNS	136
25	6.579993569	192.168.60.216	224.0.0.251	MDNS	273
26	6.580135932	fe80::892:4d75:96d5:d97d	ff02::fb	MDNS	293
27	8.774358022	192.168.58.147	224.0.0.251	MDNS	90
28	8.774685174	192.168.59.141	224.0.0.251	MDNS	203
29	8.774803650	fe80::18dd:281b:e464:1def	ff02::fb	MDNS	223
30	8.795030184	192.168.57.89	224.0.0.251	MDNS	180
31	9.108730706	fe80::434:2b82:5311:2000	ff02::fb	MDNS	310
32	9.110139090	192.168.55.22	224.0.0.251	MDNS	290

33 10.757909536 fe80::434:2b82:5311:2000 ff02::fb MDNS 310
34 10.758069124 192.168.55.22 224.0.0.251 MDNS 290
35 11.175738821 fe80::892:4d75:96d5:d97d ff02::fb MDNS 346
36 11.175889117 192.168.60.216 224.0.0.251 MDNS 326
37 12.324565714 192.168.59.107 224.0.0.251 MDNS 82
38 12.324646585 fe80::195c:4c01:810c:8c3e ff02::fb MDNS 102
39 12.324739920 192.168.59.107 224.0.0.251 MDNS 82
40 12.324861479 fe80::195c:4c01:810c:8c3e ff02::fb MDNS 102
41 12.429040649 fe80::cc57:622:373b:1474 ff02::fb MDNS 102
42 12.429111359 fe80::cc57:622:373b:1474 ff02::fb MDNS 102
43 12.429211013 192.168.59.108 224.0.0.251 MDNS 82
44 12.434449147 192.168.57.89 224.0.0.251 MDNS 198
45 12.533644596 192.168.55.196 224.0.0.251 MDNS 191
46 12.533761074 fe80::58:bd85:d5a0:35fa ff02::fb MDNS 211
47 12.637917153 192.168.0.10 224.0.0.1 IGMPv2 42
48 12.637975554 fe80::669e:f3ff:febf:402f ff02::1 ICMPv6 86
49 12.727342417 fe80::d17f:c1a8:6e4b:5be6 ff02::fb MDNS 112
50 13.613858507 fe80::d17f:c1a8:6e4b:5be6 ff02::1:ff4b:5be6 ICMPv6 86
51 13.787005004 192.168.57.190 224.0.0.251 MDNS 104
52 13.787289959 fe80::58:bd85:d5a0:35fa ff02::fb MDNS 211
53 13.787419524 192.168.55.196 224.0.0.251 MDNS 191
54 13.995952436 192.168.60.85 224.0.0.251 MDNS 350
55 13.996140550 fe80::ca69:cdff:fe93:90dc ff02::fb MDNS 370
56 14.100189151 192.168.60.190 224.0.0.251 MDNS 104
57 14.204751908 fe80::8f13:2708:ff7a:46b5 ff02::fb MDNS 102
58 14.334294863 fe80::d17f:c1a8:6e4b:5be6 ff02::fb MDNS 155
59 15.249108871 192.168.59.107 224.0.0.251 MDNS 82
60 15.249204950 fe80::195c:4c01:810c:8c3e ff02::fb MDNS 102
61 15.458009874 192.168.59.108 224.0.0.251 MDNS 82
62 15.458095464 fe80::cc57:622:373b:1474 ff02::fb MDNS 102
63 15.458191459 192.168.59.108 224.0.0.251 MDNS 82
64 15.458314668 fe80::cc57:622:373b:1474 ff02::fb MDNS 102
65 15.666932868 192.168.58.147 224.0.0.251 MDNS 102
66 16.225855327 fe80::d17f:c1a8:6e4b:5be6 ff02::fb ICMPv6 86
67 18.800511423 192.168.58.147 224.0.0.251 MDNS 198
68 18.800958600 fe80::8cc:b853:1165:4759 ff02::fb MDNS 310
69 18.801121948 192.168.55.83 224.0.0.251 MDNS 290
70 18.801215109 192.168.58.147 224.0.0.251 MDNS 90
71 18.904818866 192.168.55.196 224.0.0.251 MDNS 191

72	18.904957154	fe80::58:bd85:d5a0:35fa	ff02::fb	MDNS	211
73	19.845103928	fe80::8f13:2708:ff7a:46b5	ff02::fb	MDNS	124
74	21.515987510	192.168.57.190	224.0.0.251	MDNS	82
75	21.516089464	fe80::33cc:3ee7:1471:b943	ff02::fb	MDNS	102
76	21.516180947	192.168.57.190	224.0.0.251	MDNS	82
77	21.516281769	fe80::33cc:3ee7:1471:b943	ff02::fb	MDNS	102
78	22.874020894	192.168.56.70	224.0.0.251	MDNS	249
79	23.082776797	192.168.56.70	224.0.0.251	MDNS	231
80	23.291619570	192.168.56.70	224.0.0.251	MDNS	129
81	23.500510419	fe80::3e77:e6ff:fee6:1e77	ff02::fb	MDNS	107
82	23.918516827	fe80::3e77:e6ff:fee6:1e77	ff02::fb	MDNS	327
83	23.918637671	192.168.56.70	224.0.0.251	MDNS	195
84	24.231720469	fe80::3e77:e6ff:fee6:1e77	ff02::fb	MDNS	327
85	24.231843351	192.168.56.70	224.0.0.251	MDNS	195
86	24.231944807	192.168.56.70	224.0.0.251	MDNS	110
87	24.753907740	192.168.58.147	224.0.0.251	MDNS	168
88	24.858411015	fe80::8cc:b853:1165:4759	ff02::fb	MDNS	310
89	24.858563956	192.168.55.83	224.0.0.251	MDNS	290
90	24.858839794	192.168.58.147	224.0.0.251	MDNS	90
91	26.007306186	192.168.56.70	224.0.0.251	MDNS	217
92	26.216200851	fe80::1c2c:ff5e:b790:f48	ff02::fb	MDNS	216
93	26.425346356	fe80::3e77:e6ff:fee6:1e77	ff02::fb	MDNS	149
94	26.634007906	192.168.56.70	224.0.0.251	MDNS	259
95	26.634235488	192.168.59.97	224.0.0.251	MDNS	82
96	26.634344552	fe80::f42d:6937:b2e9:42a4	ff02::fb	MDNS	102
97	26.634434062	192.168.59.97	224.0.0.251	MDNS	82
98	26.634541324	fe80::f42d:6937:b2e9:42a4	ff02::fb	MDNS	102
99	29.036362995	192.168.60.85	224.0.0.251	MDNS	236
100	29.036786947	fe80::ca69:cdff:fe93:90dc	ff02::fb	MDNS	256

The packets can be categorised based on the protocol of transfer used. The following three distinct protocols are identified in the captured packets :

- MDNS
- IGMPv2
- ICMPv6