L2 Networking Protocols - Technical Writeup

1. What is Layer 2?

Layer 2 of the OSI model is the **Data Link Layer**. It ensures reliable **node-to-node** delivery and works **locally** (within the same broadcast domain). It includes MAC addressing and defines how devices on the same LAN communicate.

2.2 ARP (Address Resolution Protocol)

- Resolves IP → MAC within the same LAN.
- ARP Request is a broadcast (ff:ff:ff:ff:ff), ARP Reply is unicast.

Example: Using ARP in Linux

```
arping 192.168.1.1
```

Output:

```
ARPING 192.168.1.1
60 bytes from 192.168.1.1 (xx:xx:xx:xx:xx): arp reply ...
```

◆ 2.4 Spanning Tree Protocol (STP - IEEE 802.1D)

- Prevents Layer 2 loops.
- Elects a Root Bridge, blocks redundant paths.
- Convergence may take 30-50 seconds.

Example: Cisco STP Configuration

Switch(config)# spanning-tree vlan 10 priority 4096 Switch(config)# show spanning-tree

Output:

Root ID: 32778 (priority 32768 + VLAN ID 10)

Root Bridge: 00:11:22:33:44:55
Cost: 19 Port: FastEthernet0/1

◆ 2.6 CSMA/CD (Carrier Sense Multiple Access / Collision Detection)

- Used in legacy half-duplex Ethernet.
- Detects collisions and waits random time before retransmitting.

ii Note:

Not used in full-duplex modern Ethernet; now replaced by switching infrastructure.

4. Layer 2 Security Features

Common Threats:

Threat	Description	
ARP Spoofing	Attacker sends forged ARP replies	
MAC Flooding	Overflows MAC table, causes broadcast	
VLAN Hopping	Attacker gains access to other VLANs	

Defenses:

• Port Security: Limit MACs per port.

- Dynamic ARP Inspection (DAI): Drops invalid ARP.
- **BPDU Guard**: Protects STP topology.

Cisco Example:

```
Switch(config)# interface fa0/1
Switch(config-if)# switchport port-security
Switch(config-if)# switchport port-security maximum 1
Switch(config-if)# switchport port-security violation shutdown
```

5. Summary Table of Layer 2 Protocols

Protocol	Purpose	Key Feature
Ethernet	LAN communication	MAC-based addressing
ARP	IP → MAC resolution	Broadcast + reply
VLAN	Logical segmentation	Tagged frames
STP	Loop prevention	Root Bridge election
LACP	Link bundling	Active/Passive modes
CSMA/CD	Medium access	Collision detection