

## OSI Model vs. TCP/IP Model

### OSI Reference Model

**Application** - Identifying and establishing the availability of intended communication partner and whether there are sufficient resources

**Presentation** - Data translation, encryption, code formatting

**Session** - Setting up, managing and tearing down sessions. Keeps application's data separate

**Transport** - Provides end-to-end transport services - establishes logical connections between hosts. Connection-oriented or connectionless data transfer.

**Network** - Manages logical addressing and path determination

**Data Link** - Provides physical transmission of data, handles error notification, flow control and network topology. Split into two sub layers (LLC and MAC)

**Physical** - Specifies electrical, mechanical, procedural and functional requirements for activating, maintaining and deactivating a physical link.

Protocol Data Units (PDU's)

Segment

packet

frame

bits

### TCP/IP Model Protocol Suite

**Process/Application layer**  
**FTP** - TCP file transfer service - port 20-21  
**Telnet** - Terminal emulation program - port 23  
**TFTP** - UDP file transfer - port 69  
**SMTP** - Send email service - port 25  
**DHCP** - Assigns IP addresses to hosts - ports 67 and 68  
**DNS** - Resolves FQDNs to IP addresses - port 53

**Host-to-Host layer**  
**TCP** - Connection-oriented protocol, provides reliable connections (acknowledgments, flow control, windowing)  
**UDP** - Connectionless protocol, low overhead but unreliable

**Internet layer**  
**IP** - connectionless protocol, provides network addressing and routing  
**ARP** - finds MAC addresses from known IP's  
**RARP** - finds IP's from known MAC addresses  
**ICMP** - provides diagnostics, used by ping and traceroute

### Network Access

### Cisco 3-Layer Hierarchical Model

**Core** - Backbone, common to all users, needs to be as fast as possible and fault tolerant, avoid ACL, VLAN trunking and packet filtering here.  
**Distribution** - Routing - provides access control policies, filtering, WAN access and VLAN trunking  
**Access** - Switching - User and workgroup access, segmentation

### Patch Cable Types

**Straight-through** - Connect PC to hub or switch (router to switch or hub)  
**Crossover** - Connect hub to hub/ switch to switch/PC to PC  
**Rolled** - Console connection for PC to router

### Troubleshooting Steps

1. Ping 127.0.0.1 (Loopback)
2. Ping default gateway
3. Ping remote device

### Windows DOS Troubleshooting Commands

- ping 127.0.0.1
- tracert
- ipconfig/all
- arp -a

### General Troubleshooting

#### Cisco Ping & Response Codes

```
Router> ping 172.15.9.1
!
.
U
|
?
C
&
```

Success  
 Timed out waiting for reply  
 Destination unreachable  
 Ping process interrupted  
 Unknown packet type  
 Congestion-experienced  
 Time to live exceeded

#### Cisco Trace Command & Responses

```
Router> traceroute 172.15.9.1
*
IH
N
P
U
```

Timed out  
 Router received packet but did not forward it  
 Network unreachable  
 Protocol unreachable  
 Port unreachable

### IP Classes

#### Class Ranges

**Class A** - 1-126 - network.node.node.node  
**Class B** - 128-191 - network.network.node.node  
**Class C** - 192-223 - network.network.network.node

#### Private Address Ranges

**Class A** - 10.0.0.0 - 10.255.255.255  
**Class B** - 172.16.0.0 - 172.31.255.255  
**Class C** - 192.168.0.0 - 192.168.255.255

#### CIDR Notation (Classless Inter-Domain Routing)

255.0.0.0	/8	255.255.240.0	/20
255.128.0.0	/9	255.255.248.0	/21
255.192.0.0	/10	255.255.252.0	/22
255.224.0.0	/11	255.255.254.0	/23
255.240.0.0	/12	255.255.255.0	/24
255.248.0.0	/13	255.255.255.128	/25
255.252.0.0	/14	255.255.255.192	/26
255.254.0.0	/15	255.255.255.224	/27
255.255.0.0	/16	255.255.255.240	/28
255.255.128.0	/17	255.255.255.248	/29
255.255.192.0	/18	255.255.255.252	/30
255.255.224.0	/19		

**Half Duplex Ethernet** shares a collision domain resulting in lower throughput than **Full Duplex Ethernet** which requires a point-to-point link between two compatible nodes

**Causes of LAN congestion** - Broadcast storms, too many hosts with a broadcast domain, multicasting, low bandwidth, bottlenecks

**Collision domain** - Switches/bridges breakup collision domains, hubs extend them

**Broadcast domains** - Routers and VLANs breakup broadcast domains