

### Network Types

<b>LAN</b>	Local Area Network	A single home or office network
<b>WAN</b>	Wide Area Network	Linking multiple resources or LANs - Multiple office networks
<b>MAN</b>	Metropolitan Area Network	Linking multiple LANs - SOC, school networks, city networks

### Network Topologies

<b>Bus Topology</b>	All computers are connected to a single cable	Antiquated process - still used in broadcast media
<b>Star Topology</b>	Each node is connected to a switch	Most common network setup you will see
<b>Ring Topology</b>	Each node is connected to one other. Reduces chances of packet collision	Rarely seen outside of a MAN or ISP datacenter-to-datacenter connection
<b>Mesh Topology</b>	Each node has an independent connection to every other node on the network	Used by MSPs and ISPs for highly-available and fault tolerant networks.

### Network Cables - Copper

Cable Type	Max data transfer speed	Max Operating Length
<b>CAT5</b>	100 Mbps	100 Meters
<b>CAT5e</b>	1 Gbps	100 Meters
<b>CAT6</b>	10 Gbps	55 Meters
<b>CAT6a</b>	10 Gbps	100 Meters
<b>CAT7</b>	10 Gbps	100 Meters
<b>CAT8</b>	40 Gbps	30 Meters

### Network Cables - Fiber

Cable Type	Max Speed/Distance	Typical Use
<b>OM1 - Orange Jacket</b>	10 Gbps/33 Meters	100 Mbps Ethernet
<b>OM2 - Orange Jacket</b>	10 Gbps/82 Meters	1 Gbps Ethernet
<b>OM3 - Aqua Jacket</b>	10 Gbps/300 Meters	10 Gbps Ethernet
<b>OM4 - Aqua Jacket</b>	10 Gbps/400 Meters	100 Gbps Ethernet @ 150 meters
<b>OM5 - Green Jacket</b>	10 Gbps/400 Meters	Improvements on OM4. It breaks down light wavelengths more efficiently.
<b>OS1 - Yellow Jacket</b>	up to 100 Gbps/10 km	Single mode fiber for connecting indoor nodes. Used in fiber internet connections and datacenters.
<b>OS2 - Yellow Jacket</b>	up to 100 Gbps/200 km	Single mode fiber for connecting infrastructure outdoors. Used for MANs, ISPs, or MSPs.

### 7 Layer OSI Model

Layer	Typical Use	Protocols
<b>Application</b>	End User Layer	HTTP, FTP, SSH, DNS
<b>Presentation</b>	Syntax Layer	SSL, SSH, IMAP, MPEG, JPEG
<b>Session</b>	Sync & Send Layer	APIs, Sockets
<b>Transport</b>	End-to-end Connections	TCP, UDP
<b>Network</b>	Packets	IP, ICMP, IPSec, IGMP
<b>Data Link</b>	Frames	Ethernet, PPP, Switch
<b>Physical</b>	Physical Structure	Fiber, Access Points, Copper Cabling



By **Thatdudeoverthere**

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### OSI Troubleshooting

Layer	Command	Purpose
<b>Physical</b>	<code>ip -br -c link</code>	Is your physical interface up? Gives you detailed information on your NICs and virtual NICs.
<b>Data Link</b>	<code>ip neighbor show</code>	Displays the Address Resolution Protocol (ARP) table. Shows the IP and MAC addresses of computers you can reach on the network.
<b>Network</b>	<code>ip -br -c address show or ip -br -c a'</code>	Displays your network cards, their connection status, the IP address and CIDR. Make sure you have a valid IP address on your LAN NIC.
	<code>ping &lt;website or IP address&gt;</code>	Ping the device you're trying to connect to, or ping a commonly used server like Google's DNS (8.8.8.8) .
	<code>trace-route &lt;website or IP address&gt;</code>	Sends a packet out to a destination using Time to Live (TTL). The end result is a list of routers that the packet interacted with on the way to the destination
	<code>ns lookup &lt;website name&gt;</code>	Checks recognized DNS entries on your server. Make sure the IPs match up with results from ping

### OSI Troubleshooting (cont)

<b>Transport</b>	<code>ss - tunlp4</code>	<i>Socket Statistics</i> gives you a list of connections and ports on your server. Use it to make sure you are able to connect to certain devices <ul style="list-style-type: none"> <li><b>-t</b> Show TCP ports</li> <li><b>-u</b> Show UDP ports</li> <li><b>-n</b> Do not try to resolve hostnames</li> <li><b>-l</b> Show only listening ports</li> <li><b>-p</b> Show processes that are using a particular socket</li> <li><b>-4</b> Only show IPv4 sockets</li> </ul>
<b>Session</b>	SSH or RTP	Get a device to accept your SSH session or initialize an RTP session from a camera. Keep in mind, RTP is different from RTSP.
<b>Presentation</b>	HTML, RTSP	Connect to a camera's webpage, or query a camera stream through VLC.
<b>Application</b>	Using the program	Can you interact with a webpage? Can you view DS logs once it's running? Good! Then you've confirmed the <i>Application</i> is up and running.



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### Network Hardware

#### Network Border

<b>Firewall</b>	Prevents unauthorized access into a LAN.
<b>Residential Gateway</b>	"The wifi" - That little black box that people have near their TVs that they call: the internet. This will be the handoff from an ISP to your LAN or firewall.

#### Network Core

<b>Gateway</b>	Provides compatibility between different networks.
<b>Router</b>	Forwards data packets between different networks. They "direct traffic" typically received from outside networks.
<b>Switch</b>	Connects devices together by using packet switching. Used for internal traffic.
<b>Wireless Access Point</b>	The Wifi! This allows wireless devices to connect to a network rather than plugging into a switch directly.
<b>Patch Panel</b>	You plug your computer into a wall port. The wall port is connected to a patch panel. The patch panel connects to the switch. This prevents a tech from running new cables through a wall every time a computer joins the network.

### Network Hardware (cont)

#### Network End Stations

<b>Network Interface Controller (NIC)</b>	The ethernet jack on a computer.
<b>Wireless Network Interface Controller</b>	Same thing as a NIC, but it uses radio waves to connect to an access point instead of a cable.



By **Thatdudeoverthere**

[cheatography.com/thatdudeoverthere/](https://cheatography.com/thatdudeoverthere/)

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