



## Basic Network Troubleshooting Tools

## Ping

<b>Description:</b>	Tests basic network connectivity by sending ICMP echo requests to a target host.
<b>Command:</b>	<code>ping &lt;destination&gt;</code>
<b>Example:</b>	<code>ping google.com</code> or <code>ping 192.168.1.1</code>
<b>Troubleshooting Use:</b>	Verify network connectivity, check for packet loss, and measure round-trip time.
<b>Common Issues:</b>	Destination unreachable, request timeout, high latency.
<b>Solutions:</b>	Check network configuration, verify DNS resolution, investigate network congestion or hardware issues.

## Traceroute/Tracepath

<b>Description:</b>	Traces the route taken by packets to reach a destination, displaying each hop along the path.
<b>Command:</b>	<code>traceroute &lt;destination&gt;</code> (or <code>tracepath &lt;destination&gt;</code> on Linux)
<b>Example:</b>	<code>traceroute google.com</code>
<b>Troubleshooting Use:</b>	Identify network bottlenecks, locate points of failure, and map the network path.
<b>Common Issues:</b>	Hops timing out, unexpected routing paths, excessive latency at specific hops.
<b>Solutions:</b>	Investigate problematic hops, check firewall configurations, and review routing tables.

## Nslookup/Dig

<b>Description:</b>	Queries DNS servers to obtain domain name or IP address information.
<b>Command:</b>	<code>nslookup &lt;hostname&gt;</code> or <code>dig &lt;hostname&gt;</code>
<b>Example:</b>	<code>nslookup google.com</code> or <code>dig google.com</code>
<b>Troubleshooting Use:</b>	Verify DNS resolution, check DNS records, and troubleshoot DNS-related issues.
<b>Common Issues:</b>	Incorrect DNS resolution, DNS server unreachable, incorrect DNS records.
<b>Solutions:</b>	Verify DNS server settings, check DNS records, and troubleshoot DNS server connectivity.

## Advanced Network Analysis

## Tcpdump/Wireshark

<b>Description:</b>	Packet capture and analysis tools used to inspect network traffic.
<b>Command:</b>	<code>tcpdump -i &lt;interface&gt; &lt;filter&gt;</code> or Wireshark GUI
<b>Example:</b>	<code>tcpdump -i eth0 port 80</code>
<b>Troubleshooting Use:</b>	Analyze network traffic, identify protocols, troubleshoot network performance issues, and detect security threats.
<b>Common Issues:</b>	Excessive traffic, unexpected protocols, suspicious activity, performance bottlenecks.
<b>Solutions:</b>	Filter traffic, analyze packet contents, and identify root causes of network issues.

## Netstat/Ss

<b>Description:</b>	Displays network connections, routing tables, interface statistics, and masquerade connections.
<b>Command:</b>	<code>netstat -an</code> or <code>ss -an</code>
<b>Example:</b>	<code>netstat -an   grep :80</code>
<b>Troubleshooting Use:</b>	Identify listening ports, check connection states, and monitor network traffic.
<b>Common Issues:</b>	High number of connections, connections in CLOSE_WAIT state, unauthorized listening ports.
<b>Solutions:</b>	Investigate suspicious connections, identify resource-intensive processes, and secure listening ports.

## Iperf/Nuttcp

<b>Description:</b>	Network bandwidth measurement tools used to test network throughput and performance.
<b>Command:</b>	<code>iperf -s</code> (server) and <code>iperf -c &lt;server_ip&gt;</code> (client)
<b>Example:</b>	<code>iperf -c 192.168.1.100</code>
<b>Troubleshooting Use:</b>	Measure network bandwidth, identify network bottlenecks, and evaluate network performance.
<b>Common Issues:</b>	Low bandwidth, high latency, packet loss.
<b>Solutions:</b>	Check network infrastructure, identify bandwidth-intensive applications, and optimize network configuration.

# Common Network Issues and Solutions

## IP Address Conflicts

**Issue:** Two or more devices are configured with the same IP address.

**Symptoms:** Intermittent connectivity issues, inability to access network resources.

**Solutions:**

- Use DHCP to dynamically assign IP addresses.
- Manually configure static IP addresses, ensuring each device has a unique address.
- Use `ping` to identify the conflicting IP address.
- Check ARP tables to determine the MAC address associated with the conflicting IP address.

## DNS Resolution Problems

**Issue:** Inability to resolve domain names to IP addresses.

**Symptoms:** Cannot access websites by name, but can access them by IP address.

**Solutions:**

- Verify DNS server settings.
- Use `nslookup` or `dig` to query DNS servers.
- Flush the DNS cache using `ipconfig /flushdns` (Windows) or `sudo dscacheutil -flushcache; sudo killall -HUP mDNSResponder` (macOS).
- Check the host file for incorrect entries.

## Gateway Issues

**Issue:** Devices are unable to communicate outside the local network.

**Symptoms:** Cannot access the internet, cannot ping external IP addresses.

**Solutions:**

- Verify the default gateway setting.
- Ensure the gateway device is reachable.
- Check the gateway device's configuration.
- Traceroute to a known external IP address to identify the point of failure.

# Wireless Network Troubleshooting

## Signal Strength and Interference

**Issue:** Weak wireless signal or interference affecting network performance.

**Symptoms:** Slow connection speeds, intermittent disconnections, high latency.

**Solutions:**

- Check the wireless signal strength using a Wi-Fi analyzer tool.
- Identify sources of interference (e.g., microwave ovens, cordless phones).
- Move closer to the wireless access point.
- Change the wireless channel to avoid overlapping with other networks.

## Authentication Problems

**Issue:** Inability to connect to the wireless network due to incorrect credentials or authentication failures.

**Symptoms:** Incorrect password error, authentication timeout.

**Solutions:**

- Verify the wireless password.
- Check the wireless security settings (e.g., WPA2, WPA3).
- Ensure the wireless client is configured to use the correct authentication method.
- Restart the wireless access point and client device.

## DHCP Issues

**Issue:** Devices are unable to obtain an IP address from the DHCP server.

**Symptoms:** APIPA address (169.254.x.x), no internet access.

**Solutions:**

- Verify the DHCP server is running and reachable.
- Check the DHCP scope and lease time.
- Release and renew the IP address on the client device.
- Restart the DHCP server.