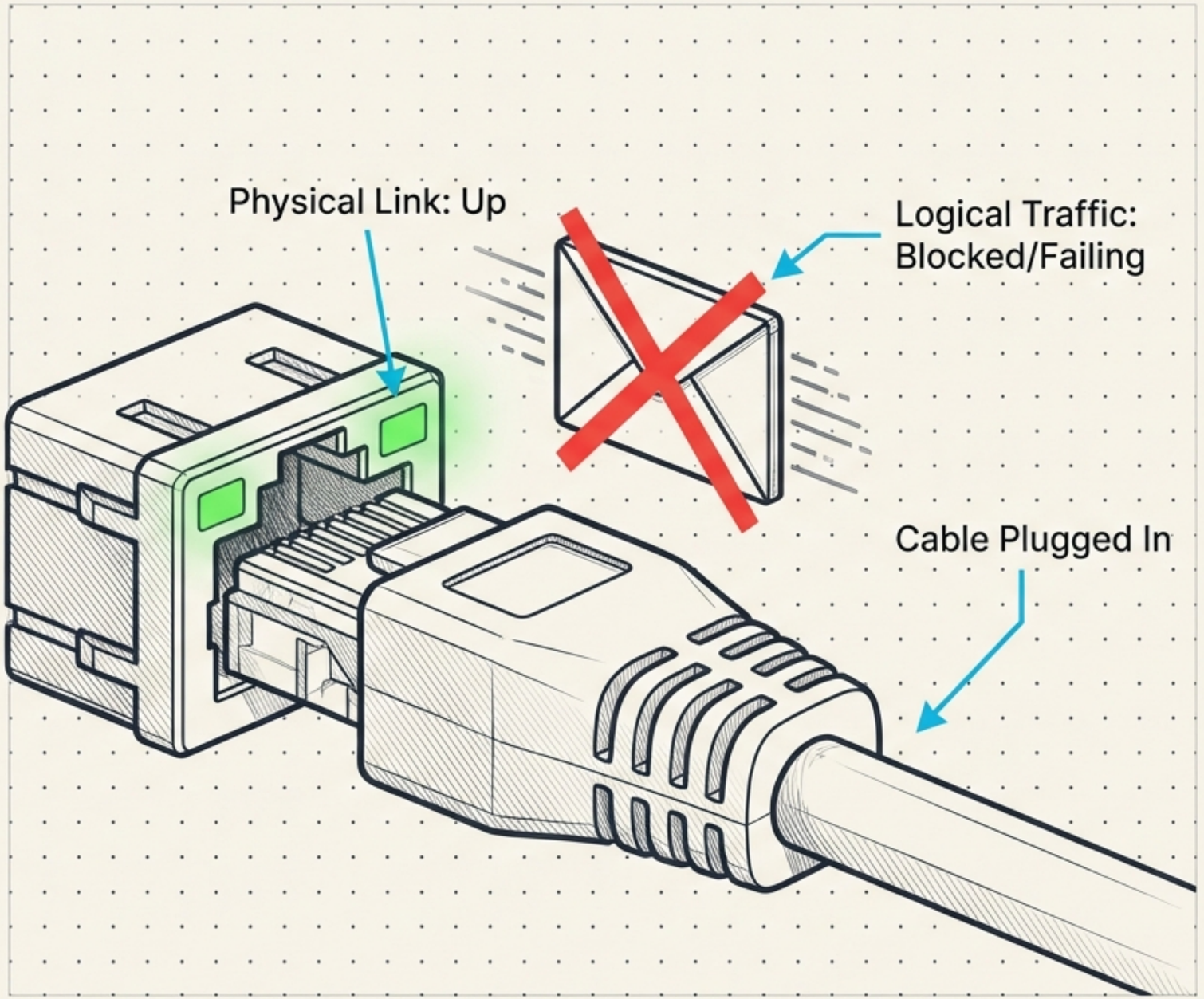
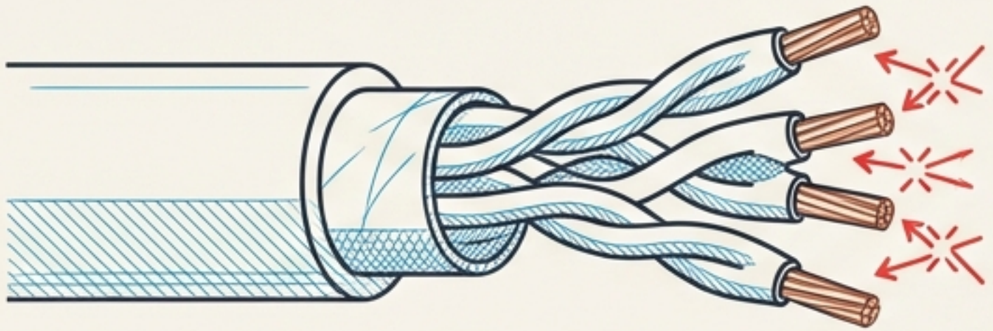
The Up/Up Illusion: Troubleshooting Port Duplex & IPv4

Physical connectivity is only the first step. When the link light is green but traffic is failing, the culprits are usually invisible. A CCNA study guide to diagnosing Ethernet mismatches and IPv4 routing blindness.



When Connected Doesn’t Mean Communicating

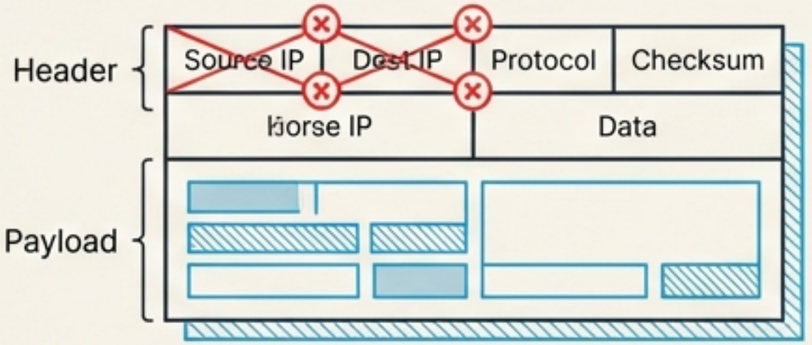
OSI L1 & L2



Port Duplex Mismatches

The physical link is established, but the mechanics of how data is sent and received are out of sync. Traffic flows, but is constantly colliding and dropping.

OSI L3



IPv4 Addressing Errors

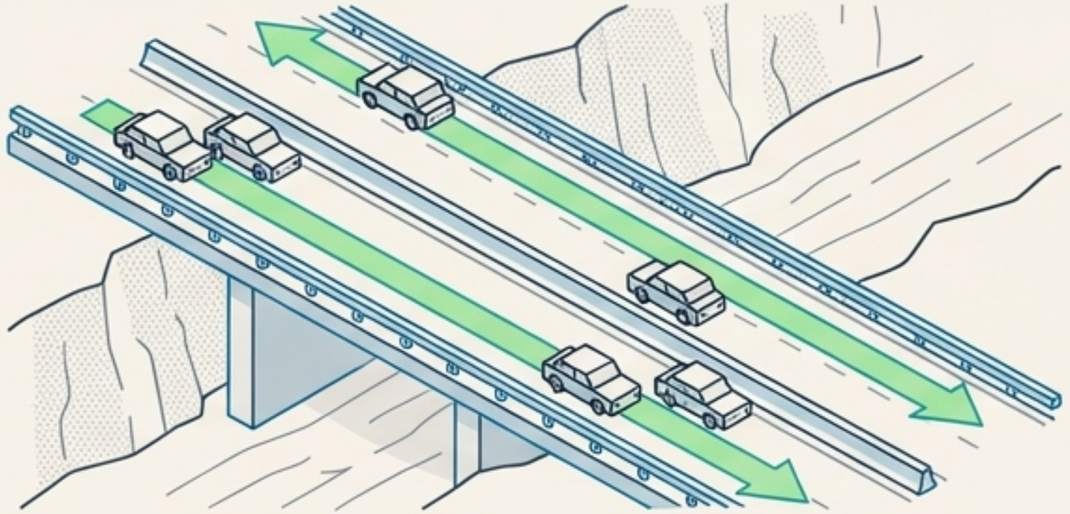
The physical mechanics are perfect, but the logical map is broken. Devices cannot identify their local networks, reach gateways, or route traffic to the intended destination.

The Mechanics of Ethernet: Port Duplex Defined

OSI L1 & L2

Half-Duplex

The interface can either transmit or receive at one time, but never both simultaneously.

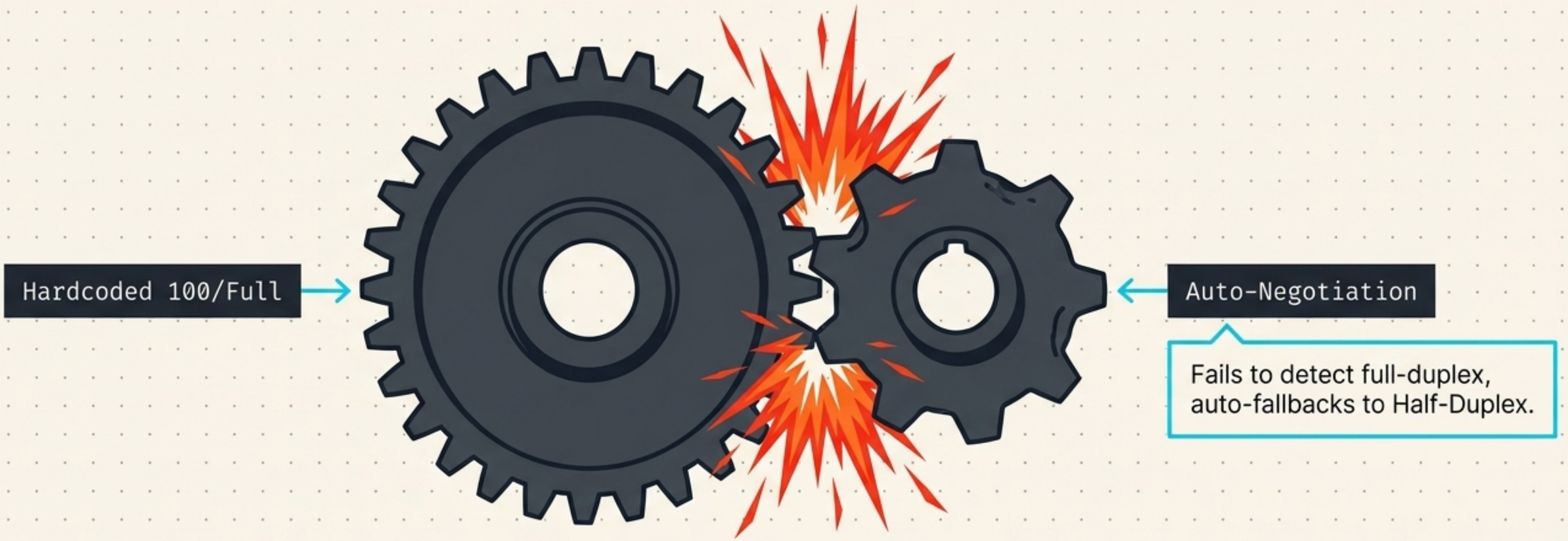


Full-Duplex

The interface can transmit and receive at the exact same time, effectively doubling potential throughput and eliminating collisions.

The Auto-Negotiation Trap

OSI L1 & L2



If both sides use auto-negotiation, they exchange capabilities and agree on settings. But if one side is manually hardcoded and the other is left on auto, the auto side assumes the worst and falls back to half-duplex. This creates a severe mismatch.

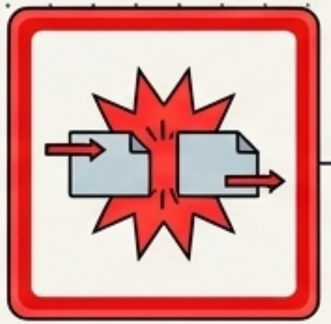
Symptoms of a Duplex Mismatch

OSI L1 & L2

The interface remains operational, but performance collapses. Watch for these indicators:

Late Collisions

Data crashing on the wire after the normal collision window.



Output Drops

The interface buffering and eventually discarding outbound traffic.

Status: UP
Protocol: UP

Status: UP
Protocol: UP

Frame/CRC Errors

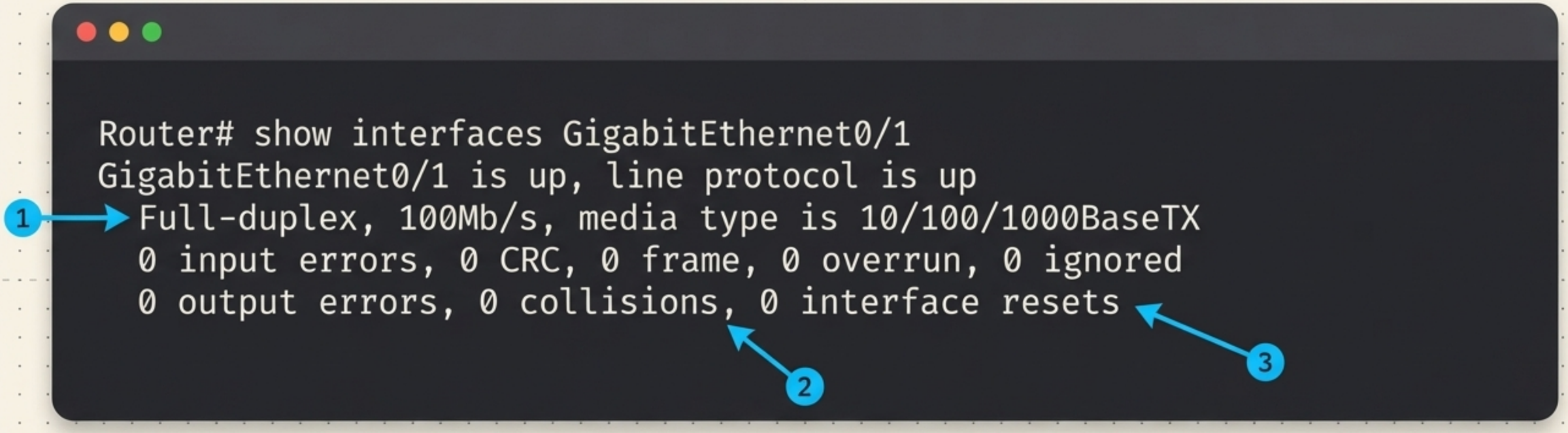
Packets arriving corrupted and failing cyclic redundancy checks.

Sluggish Performance

Extremely slow file transfers and application timeouts despite a physical connection.

Layer 1 & 2 Command Center

OSI L1 & L2



Verification:

Use show interfaces to hunt for collision and CRC error counters. Verify speed and duplex settings on both ends.

The Fix:

Configure both sides consistently. Either leave both on **auto-negotiation** (duplex auto, speed auto), or manually hardcode identical settings on both ends.

The IPv4 Diagnostic Triad

OSI L3

Layer 3 communication requires absolute precision across three configuration points. If points. If any one of these legs is broken or misconfigured, the structural integrity of the network communication collapses.

IP Address

The 32-bit logical identity.

Who am I?

Subnet Mask

The boundary definition separating the network portion from the host portion.

What is my local neighborhood?

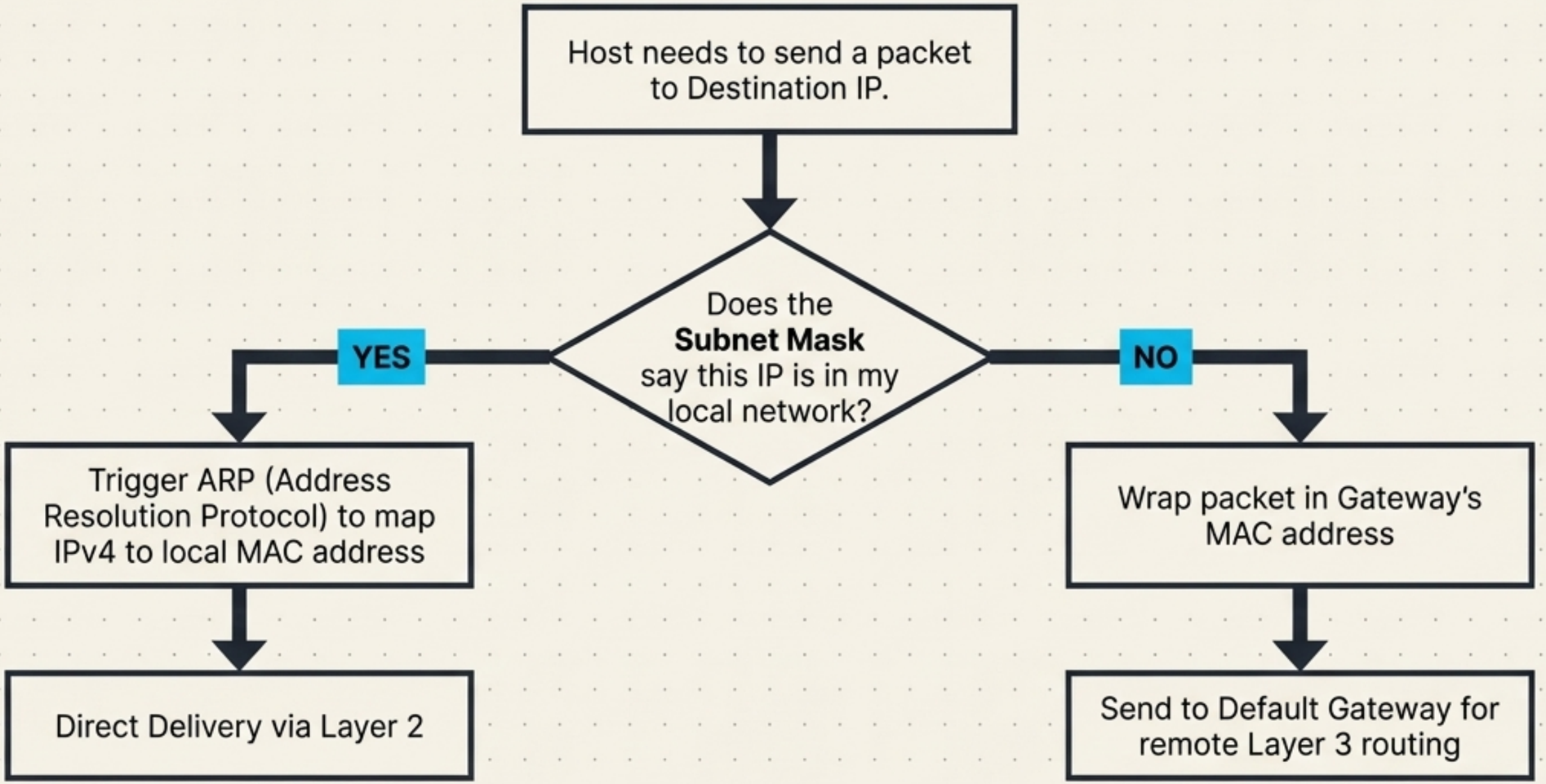
Default Gateway

The exit point for remote networks.

How do I leave my neighborhood?

The Forwarding Decision Engine

OSI L3 (with L2 ARP interaction)



The Subnet Mask dictates every forwarding decision. If the mask is wrong, a host will mistakenly ARP for remote IP addresses (failing to reach the internet) or send local traffic to the gateway (breaking local peer-to-peer communication).

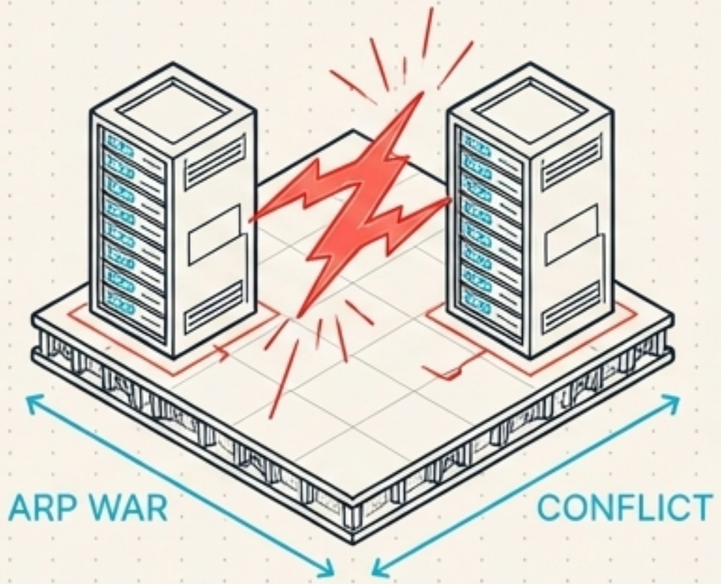
Symptoms of IPv4 Misconfiguration

OSI L3

Wrong Subnet Mask

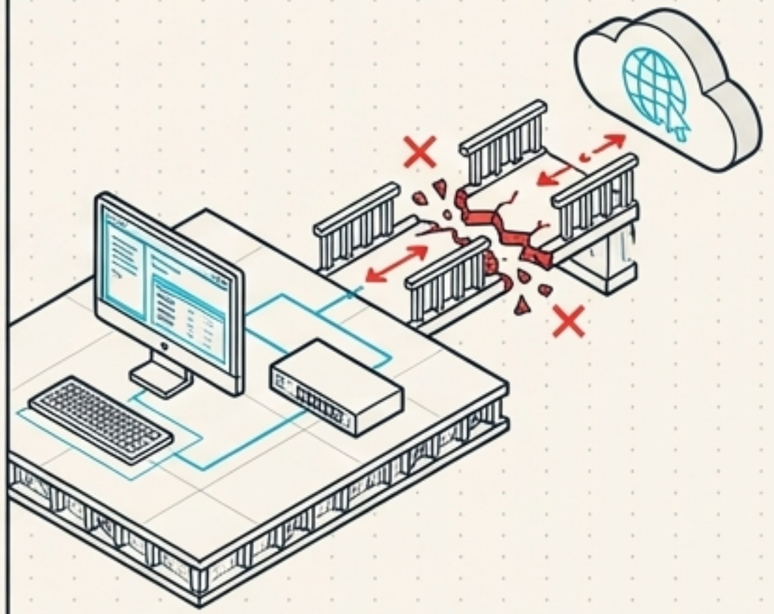
Host is logically isolated; cannot ping local peers or the gateway.

Duplicate IP



Creates ARP instability, leading to flickering, intermittent communication loss.

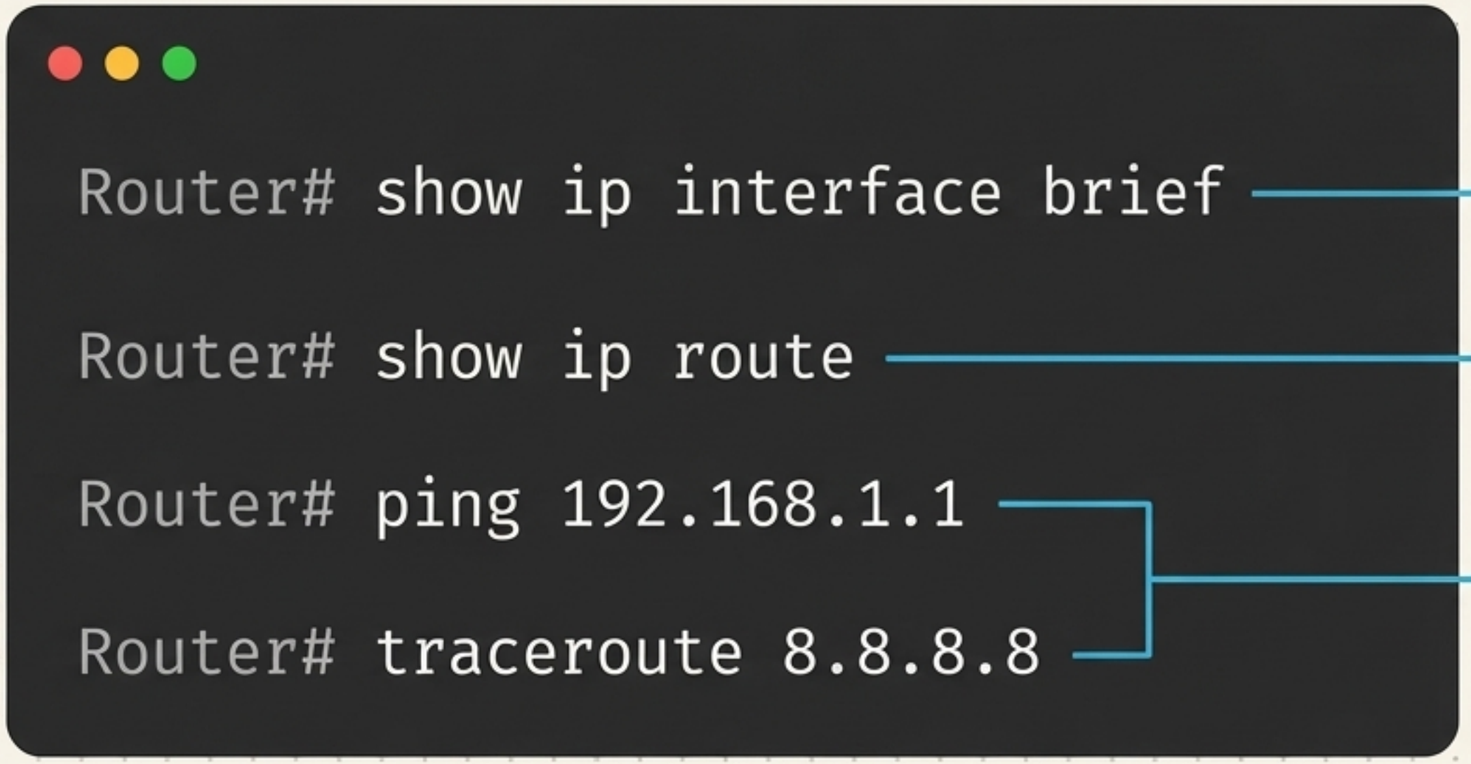
Wrong Default Gateway



Local communication works perfectly, but remote websites, branch networks, and outside administration completely fail.

Layer 3 Command Center

OSI L3



Rapidly verify assigned IPs and interface up/up status.

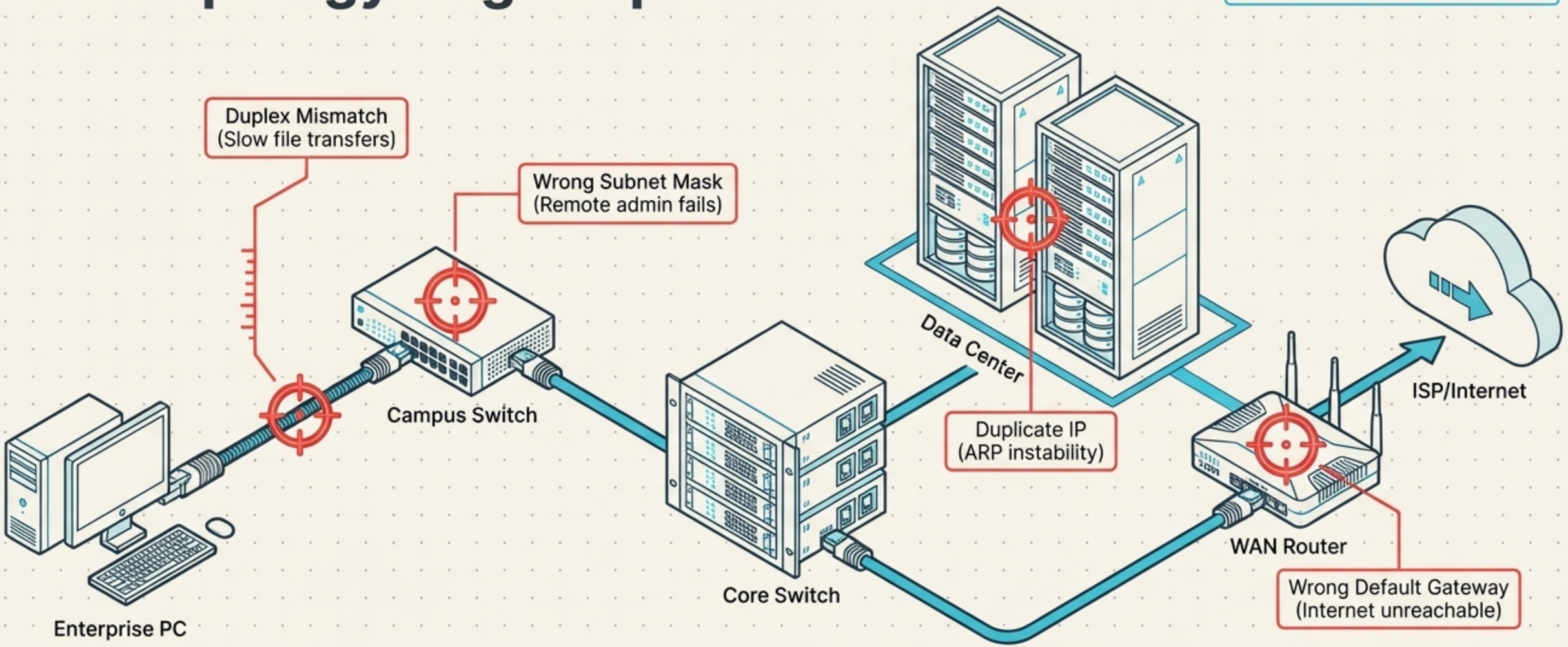
Confirm the device actually knows the path to the remote network.

Test local stack, gateway **reachability**, and trace the exact **drop point** of remote traffic.

The Fix:
Apply the correct 32-bit address and mask using the interface command:
`ip address <ip> <mask`

The Topology Bug-Map

OSI L1-L3 Synthesis



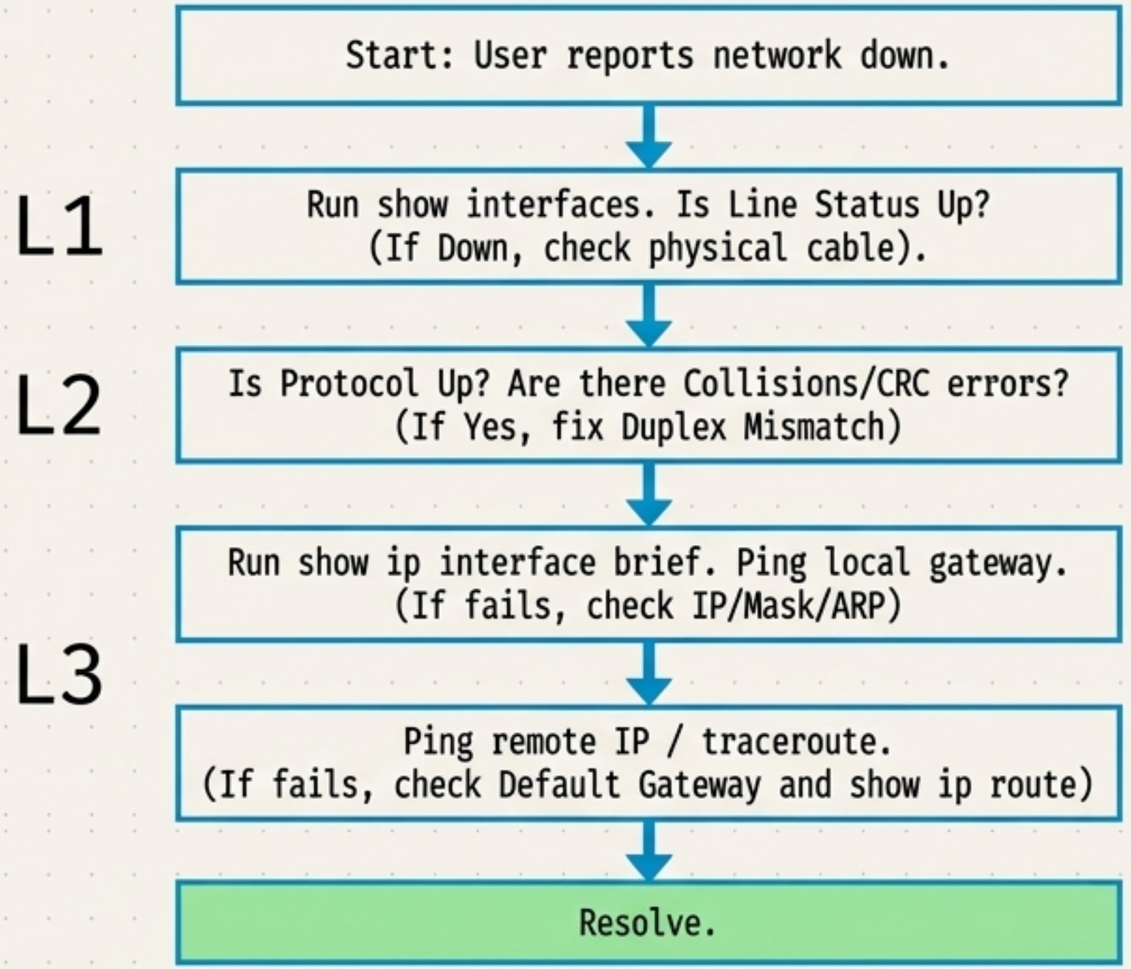
Misconfigurations are not isolated to edge devices; they live everywhere from the access layer to the WAN edge. Identifying the specific scope of the failure (local vs. remote, slow vs. down) pinpoints where on the map the bug lives.

The CCNA Troubleshooting Matrix

Issue Type	OSI Layer	Core Protocols	Primary Symptom	Verification	Fix
Port Duplex	Layers 1 & 2	Ethernet, Auto-Negotiation	Up/Up status but late collisions, CRC errors, extreme slowness.	`show interfaces`	`duplex auto, speed auto`
IPv4 Addressing	Layer 3 (with L2 ARP)	IPv4, ARP, ICMP	Clean interfaces, but absolute failure to ping local or remote destinations.	`show ip interface brief, ping`	`ip address <ip> <mask>`

The Engineer's Diagnostic Flowchart

OSI L1-L3 Synthesis



Professional network engineers do not guess. They troubleshoot from the bottom of the OSI model upward. Never check routing tables until you have proven the physical layer is error-free.

Key Takeaways & CCNA Study Sheet

Port duplex problems affect Ethernet communication at Layers 1 and 2 by creating transmission errors. IPv4 addressing problems problems affect Layer 3 communication by preventing devices from identifying networks or routing traffic correctly.

- A link can be physically “up/up” and still suffer from a **duplex mismatch**.
- Late collisions and **CRC errors** are the primary indicators of duplex issues.
- Incorrect **subnet masks** cause devices to misjudge local vs. remote delivery.
- A **default gateway** is strictly required for reaching remote networks.
- **ARP** bridges the gap, mapping Layer 3 IPv4 addresses to Layer 2 MAC addresses for local delivery.