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Inter-VLAN routing is configured in this topology because **devices in different VLANs cannot communicate with each other by default.**

In your topology, you have:

VLAN	Network	Example Gateway
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VLAN 10	172.16.10.0/24	172.16.10.1
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VLAN 20	172.16.20.0/24	172.16.20.1
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A Layer 2 switch (such as the Cisco 2960) separates VLANs into different broadcast domains.

That means:

-  PC in VLAN 10 can communicate with another PC in VLAN 10.
 -  PC in VLAN 20 can communicate with another PC in VLAN 20.
 -  PC in VLAN 10 **cannot** communicate with a PC in VLAN 20 without a Layer 3 device.
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Example

Suppose:

Laptop0

- IP: 172.16.10.10/24
- VLAN 10
- Gateway: 172.16.10.1

Laptop1

- IP: 172.16.20.10/24
- VLAN 20
- Gateway: 172.16.20.1

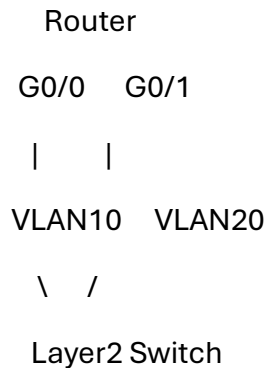
When Laptop0 tries to ping **172.16.20.10**:

1. Laptop0 realizes the destination is in another subnet.
2. It sends the packet to its default gateway (172.16.10.1).
3. The router or Layer 3 switch routes the packet to VLAN 20.
4. The packet reaches Laptop1.
5. Laptop1 replies through its gateway (172.16.20.1).

Without Inter-VLAN Routing, **Step 3 never happens**, so the ping fails.

Why each topology uses Inter-VLAN Routing

1. Legacy Inter-VLAN Routing



Purpose

- The router has **one physical interface for each VLAN**.
- Each interface acts as the default gateway for its VLAN.

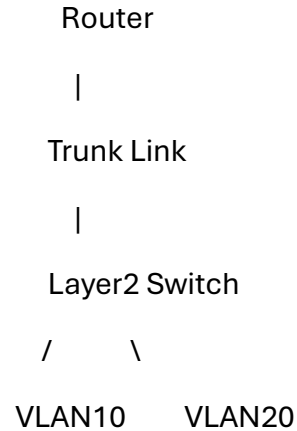
Advantages

- Easy to understand.
- Good for learning.

Disadvantages

- Requires one router interface per VLAN.
 - Not scalable.
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2. Router-on-a-Stick (ROAS)



Purpose

- Uses **one physical router interface**.
- Creates **subinterfaces** (e.g., G0/0.10 and G0/0.20).
- A trunk carries traffic for multiple VLANs.

Advantages

- Saves router interfaces.
- Supports many VLANs.

Disadvantages

- All VLAN traffic shares one physical link, which can become a bottleneck.

3. Layer 3 Switch Inter-VLAN Routing



Purpose

- The Layer 3 switch performs routing itself using **Switch Virtual Interfaces (SVIs)**.

- No external router is needed.

Advantages

- Fastest routing (hardware-based).
- Ideal for enterprise networks.
- Supports many VLANs efficiently.

Disadvantages

- Requires a multilayer switch (e.g., Cisco Catalyst 3560).

Why learn all three methods?

These three topologies demonstrate the evolution of Inter-VLAN routing:

Method	Routing Device	Interfaces Needed	Performance	Typical Use
Legacy Inter-VLAN Routing	Router	One interface per VLAN	Low	Learning and small legacy networks
Router-on-a-Stick	Router	One trunk interface	Medium	Small to medium businesses
Layer 3 Switch	Multilayer Switch	SVIs	High	Enterprise and campus networks

Learning Objective

By configuring all three topologies, students will understand:

- How VLANs isolate broadcast domains.
- Why devices in different VLANs cannot communicate without Layer 3 routing.
- The role of a **default gateway**.
- How routers and Layer 3 switches route traffic between VLANs.

- The differences between **Legacy Inter-VLAN Routing**, **Router-on-a-Stick**, and **Layer 3 Switch Inter-VLAN Routing**, including their advantages, limitations, and appropriate deployment scenarios.