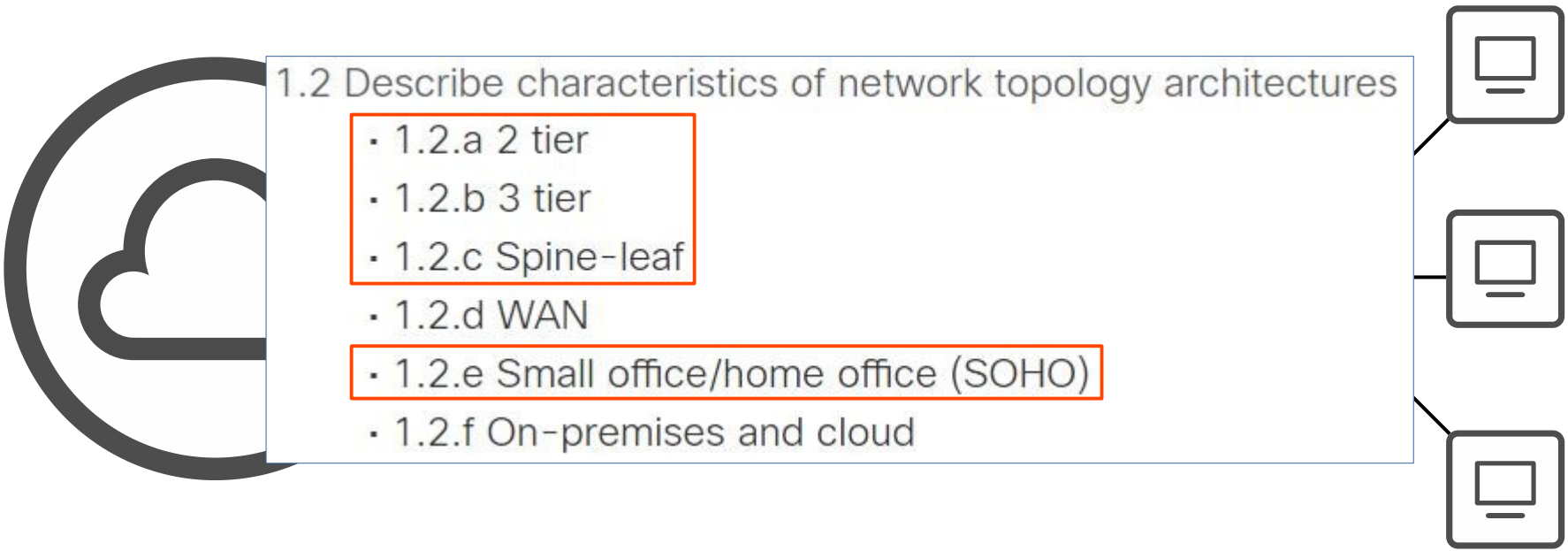
CCNA Day 52

LAN Architectures



Things we'll cover

- 2-Tier and 3-Tier LAN Architecture
- Spine-Leaf Architecture (Data Center)
- SOHO (Small Office/Home Office)

LAN Architectures

- You have studied various network technologies: routing, switching, STP, EtherChannel, OSPF, FHRPs, switch security features, etc.
  → Now let's look at some basic network design/architecture

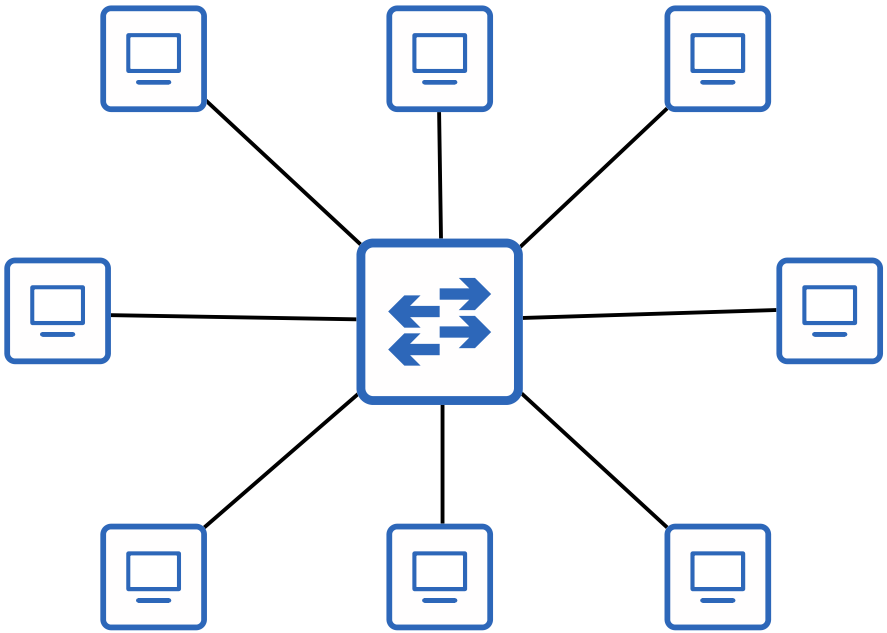
- There are standard 'best practices' for network design.
  → However there are few universal 'correct answers'.
  → The answer to most general questions about network design is 'it depends'.

- In the early stages of your networking career, you probably won't be asked to design networks yourself.

- However, to understand the networks you will be configuring and troubleshooting it's important to know some basics of network design.

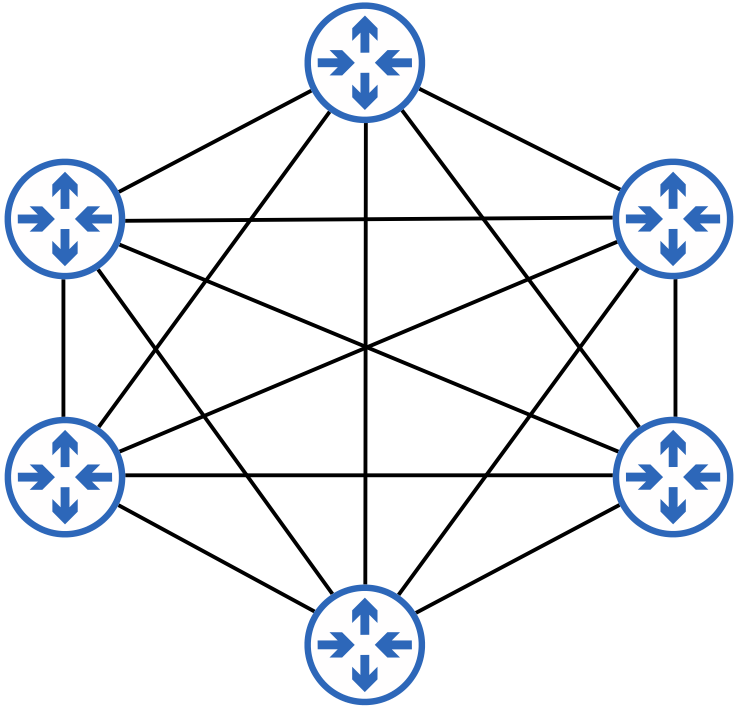
Common Terminologies - Star

- **Star**: When several devices all connect to one central device we can draw them in a ‘star’ shape like below, so this is often called a ‘star topology’.



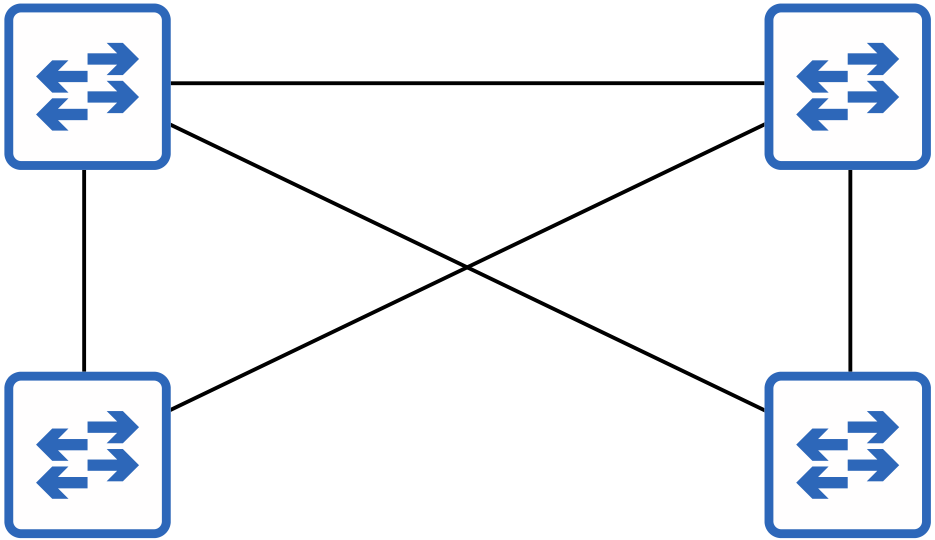
Common Terminologies – Full Mesh

- **Full Mesh**: When each device is connected to each other device.



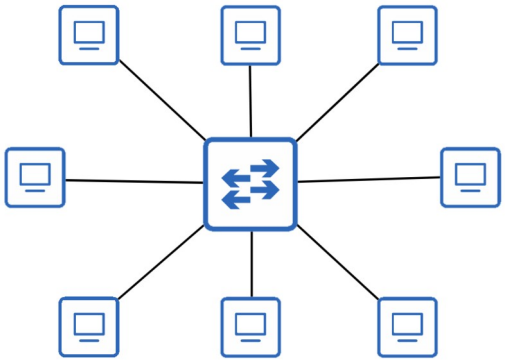
Common Terminologies – Partial Mesh

- **Partial Mesh**: When some devices are connected to each other, but not all.

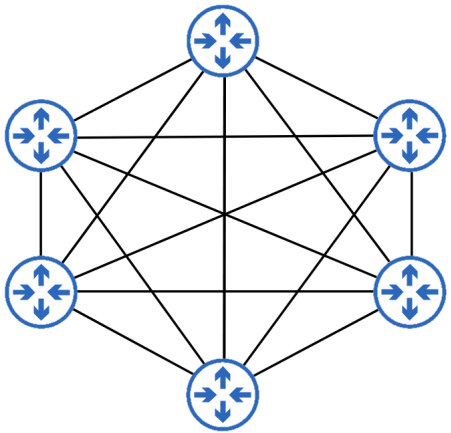


Common Terminologies

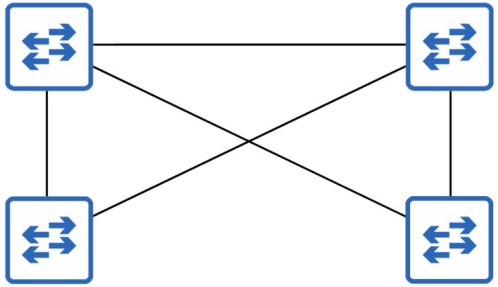
Star



Full Mesh



Partial Mesh



Two-Tier Campus LAN Design

- The two-tier LAN design consists of two hierarchical layers:
  → **Access Layer**
  → **Distribution Layer**

- Also called a ‘Collapsed Core’ design because it omits a layer that is found in the Three Tier design: the **Core Layer**

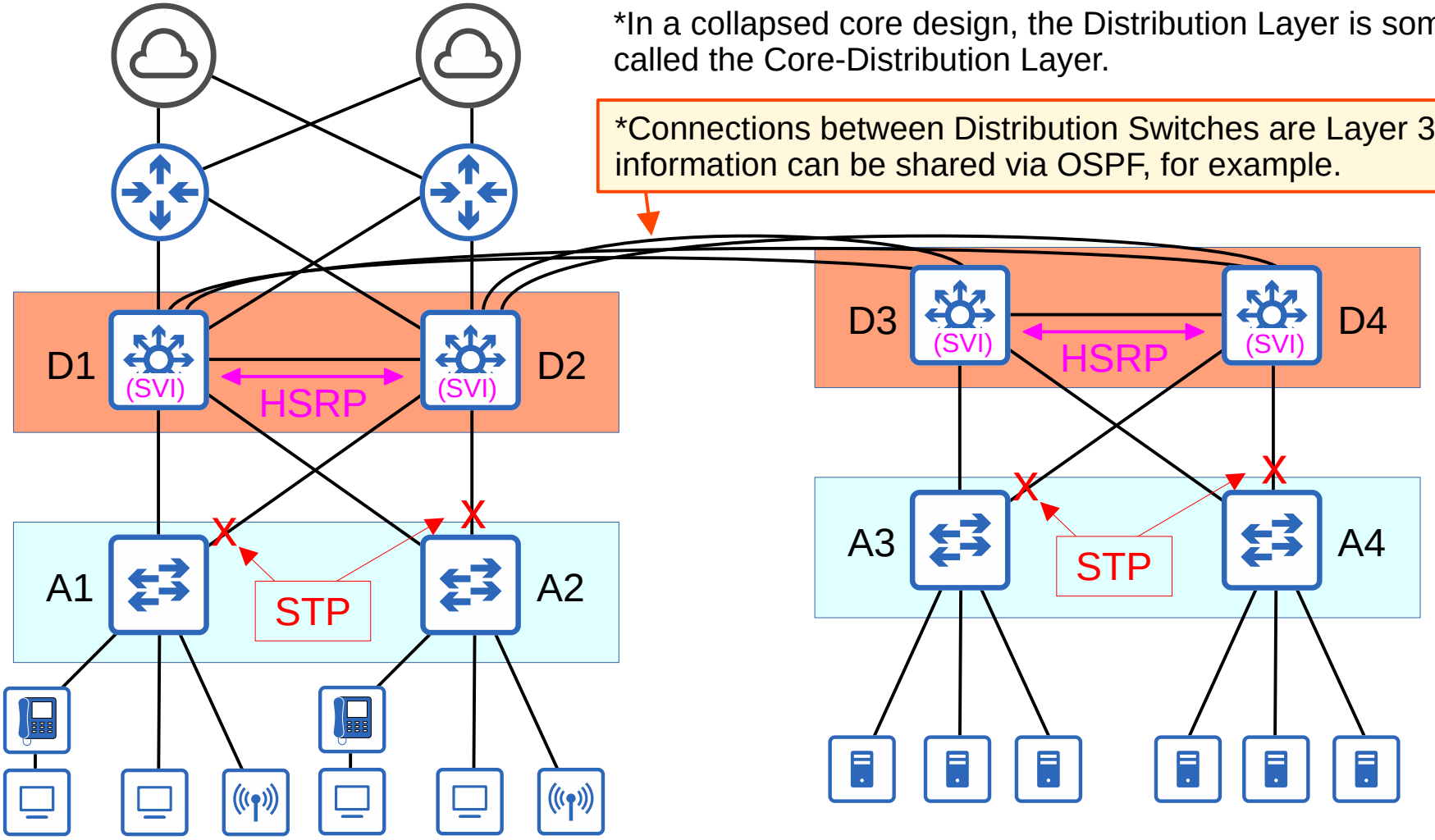
- **Access Layer:**
  → the layer that end hosts connect to (PCs, printers, cameras, etc.)
  → typically Access Layer Switches have lots of ports for end hosts to connect to
  → QoS marking is typically done here
  → Security services like port security, DAI, etc are typically performed here
  → switchports might be PoE-enabled for wireless APs, IP phones, etc.

- **Distribution Layer:**
  → aggregates connections from the Access Layer Switches
  → typically is the border between Layer 2 and Layer 3
  → connects to services such as Internet, WAN, etc.

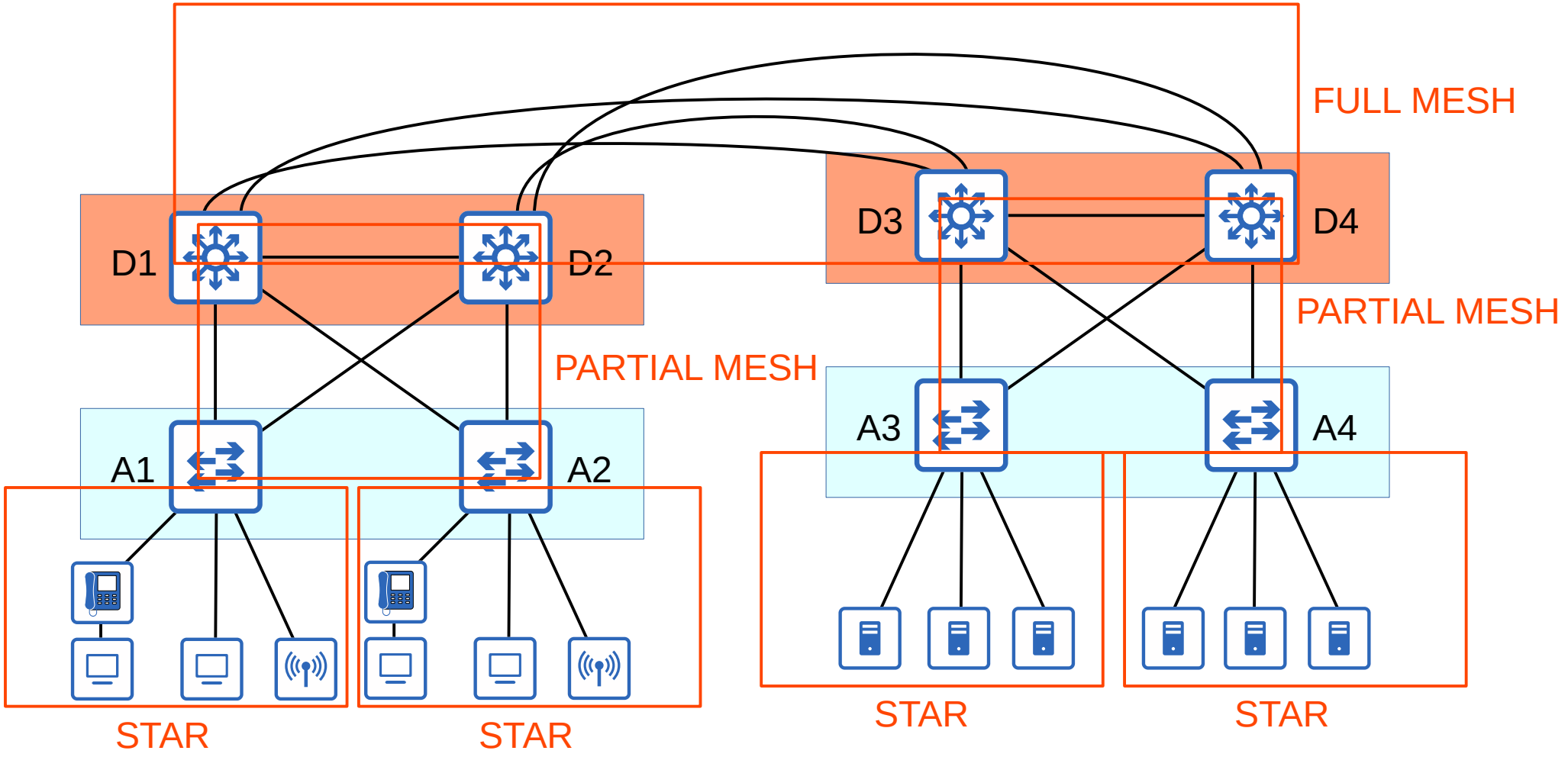
Two-Tier Campus LAN Design

*In a collapsed core design, the Distribution Layer is sometimes called the Core-Distribution Layer.

*Connections between Distribution Switches are Layer 3. Routing information can be shared via OSPF, for example.

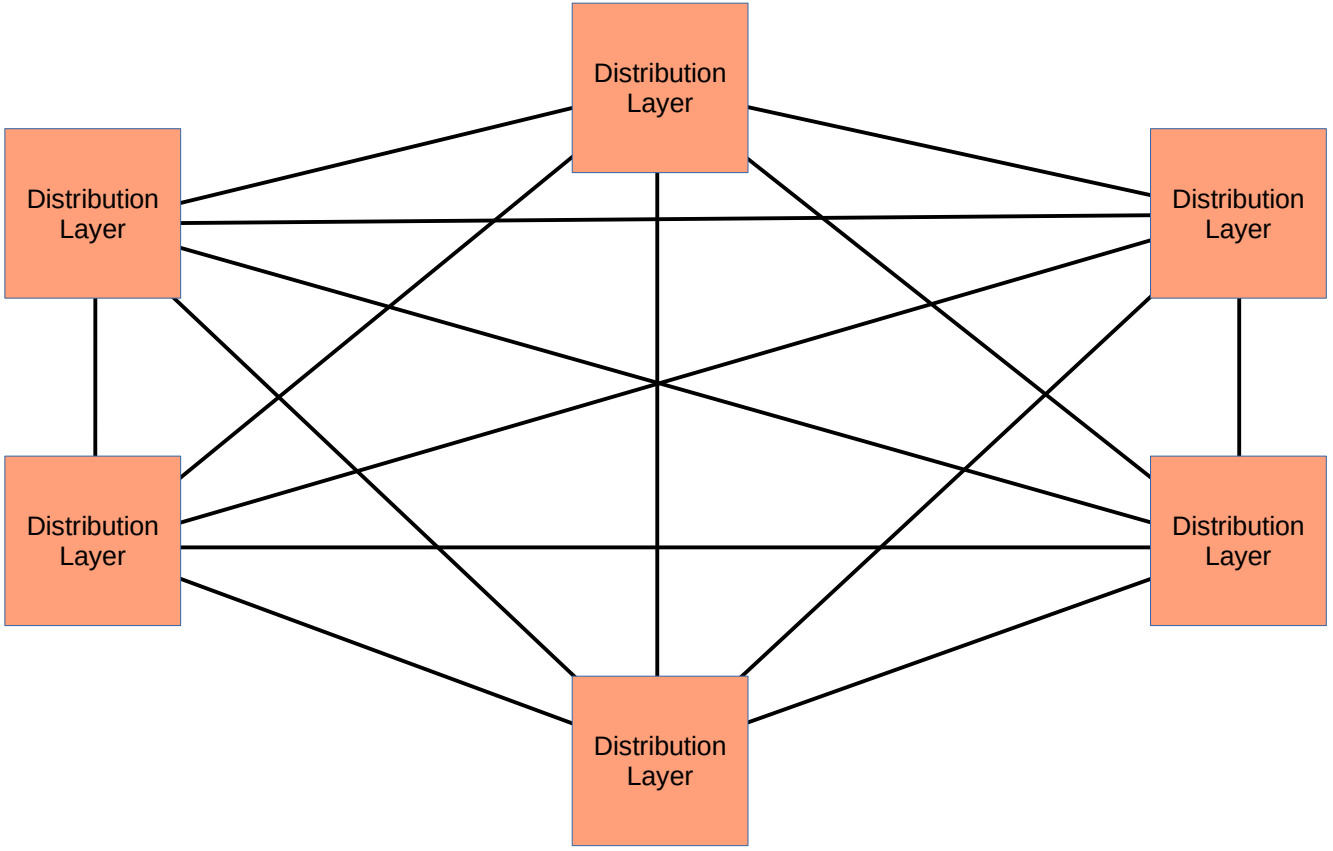


Two-Tier Campus LAN Design



Two-Tier Campus LAN Design

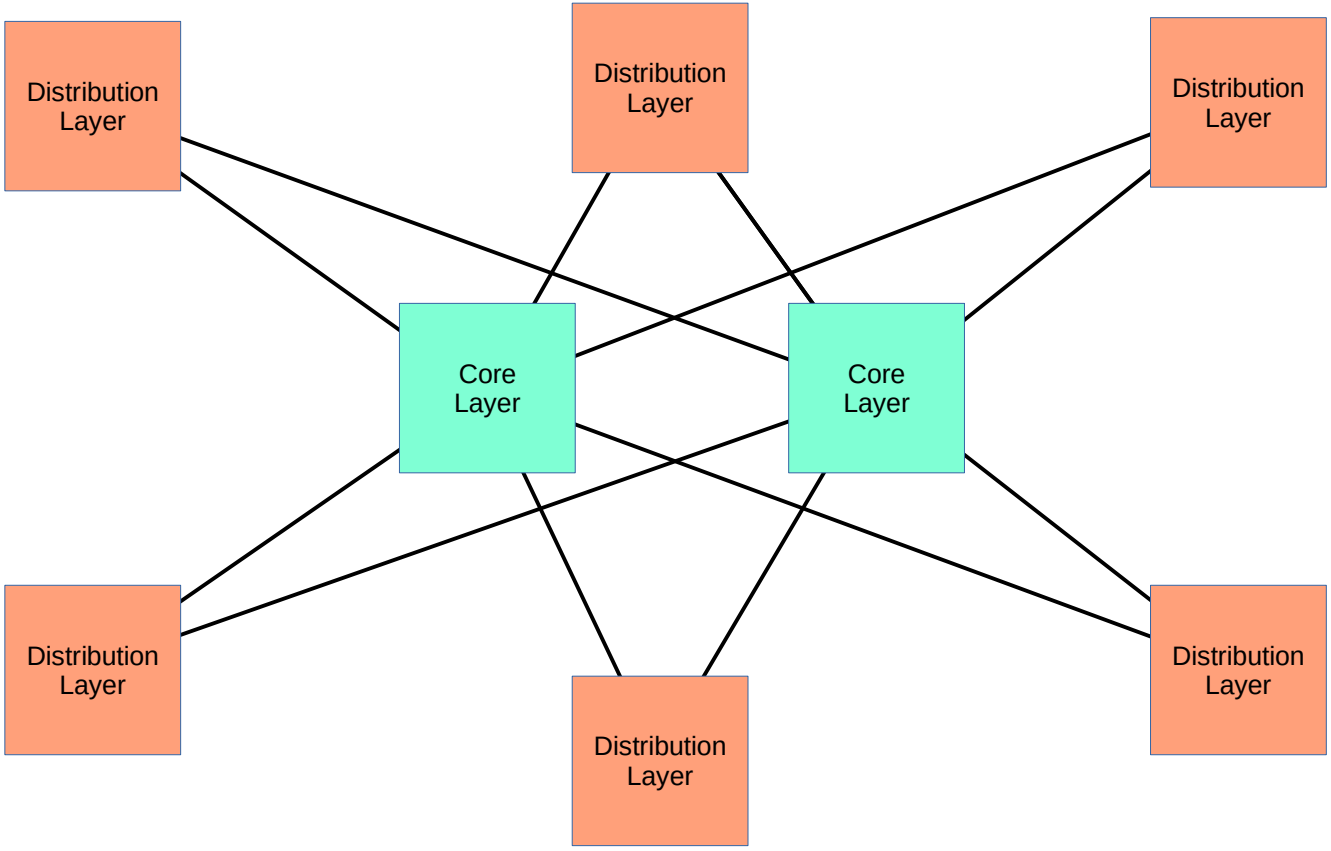
In large LAN networks with many Distribution Layer switches (for example in separate buildings), the number of connections required between Distribution Layer switches grows rapidly.



To help scale large LAN networks, you can add a Core Layer.
*Cisco recommends adding a Core Layer if there are more than three Distribution Layers in a single location.

Three-Tier Campus LAN Design

In large LAN networks with many Distribution Layer switches (for example in separate buildings), the number of connections required between Distribution Layer switches grows rapidly.



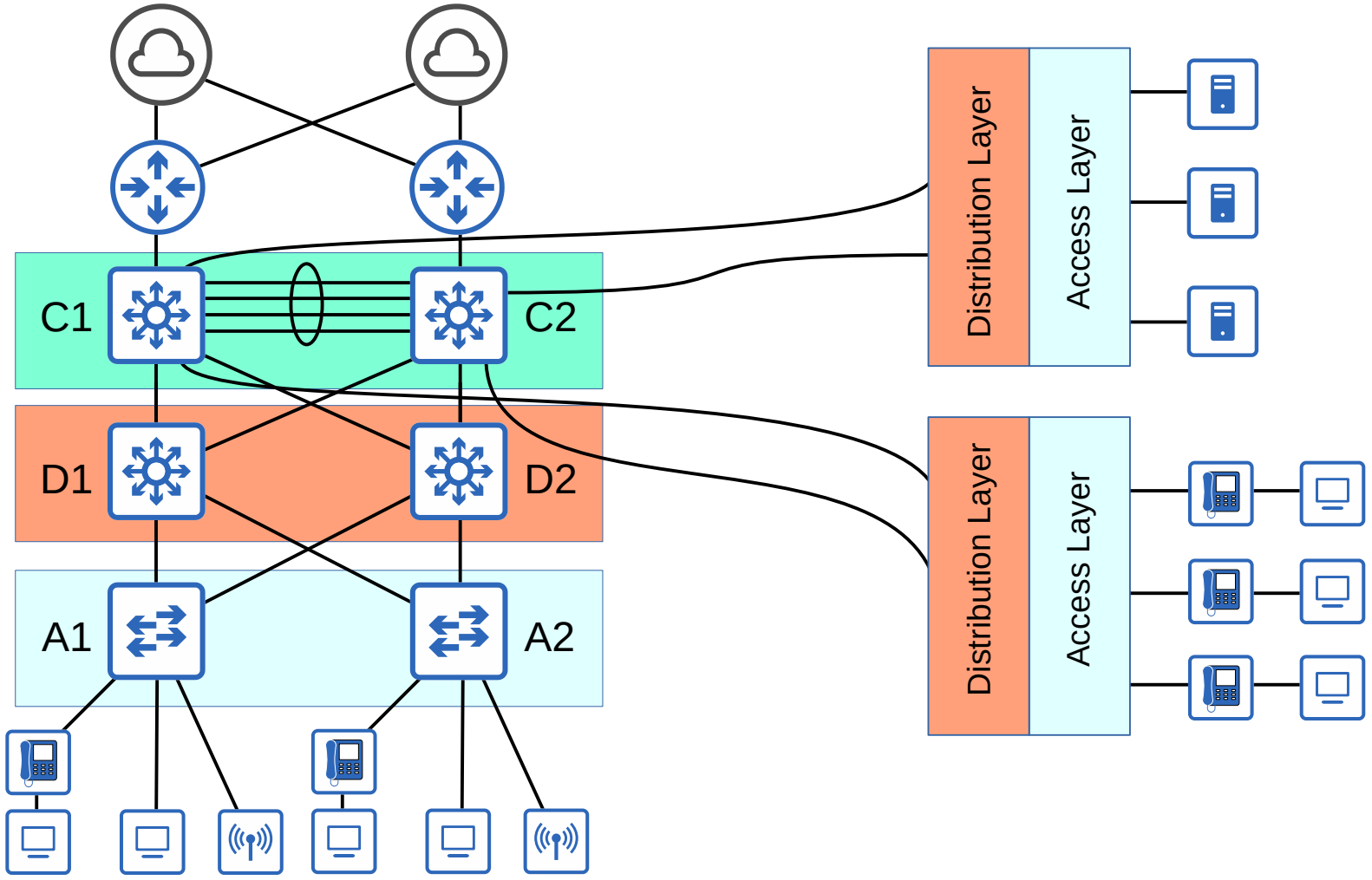
To help scale large LAN networks, you can add a Core Layer.
*Cisco recommends adding a Core Layer if there are more than three Distribution Layers in a single location.

Three-Tier Campus LAN Design

- The three-tier LAN design consists of three hierarchical layers:
  → **Access Layer**
  → **Distribution Layer**
  → **Core Layer**

- **Core Layer:**
  → Connects Distribution Layers together in large LAN networks
  → The focus is speed (‘fast transport’)
  → CPU-intensive operations such as security, QoS marking/classification, etc. should be avoided at this Layer
  → Connections are all Layer 3. No spanning-tree!
  → Should maintain connectivity throughout the LAN even if devices fail

Three-Tier Campus LAN Design



Three-Tier Campus LAN Design

- **Access Layer:**
  - → the layer that end hosts connect to (PCs, printers, cameras, etc.)
  - → typically Access Layer Switches have lots of ports for end hosts to connect to
  - → QoS marking is typically done here
  - → Security services like port security, DAI, etc are typically performed here
  - → switchports might be PoE-enabled for wireless APs, IP phones, etc.

- **Distribution Layer: *sometimes called Aggregration Layer**
  - → aggregates connections from the Access Layer Switches
  - → typically is the border between Layer 2 and Layer 3
  - → connects to services such as Internet, WAN, etc. *in a two-tier design

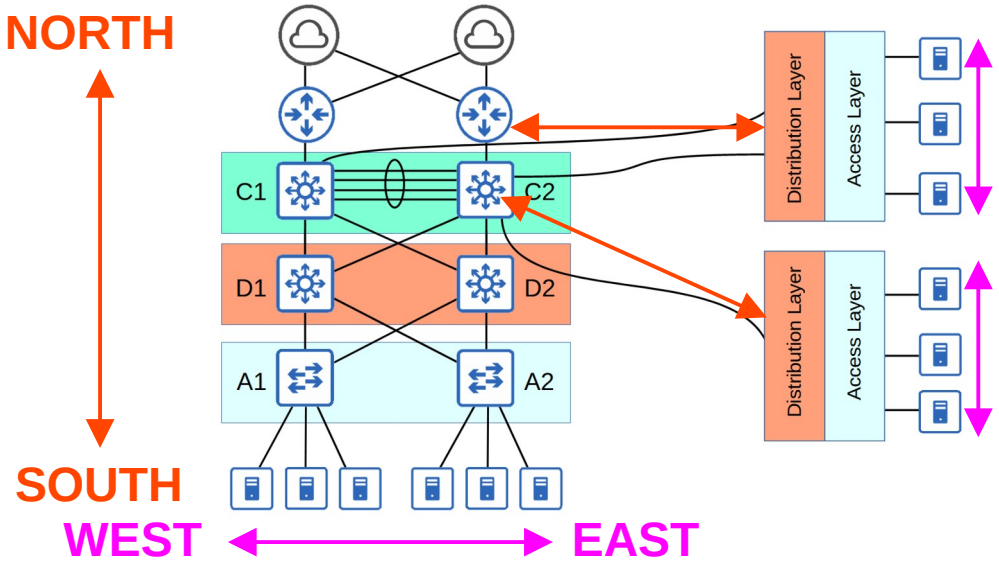
- **Core Layer:**
  - → Connects Distribution Layers together in large LAN networks
  - → The focus is speed (‘fast transport’)
  - → CPU-intensive operations such as security, QoS marking/classification, etc. should be avoided at this Layer
  - → Connections are all Layer 3. No spanning-tree!
  - → Should maintain connectivity throughout the LAN even if devices fail

JEREMY'S IT LAB

Spine-Leaf Architecture

Spine-Leaf Architecture

- Data centers are dedicated spaces/buildings used to store computer systems such as servers and network devices.
- Traditional data center designs used a three-tier architecture (Access-Distribution-Core) like we just covered.
- This worked well when most traffic in the data center was North-South.

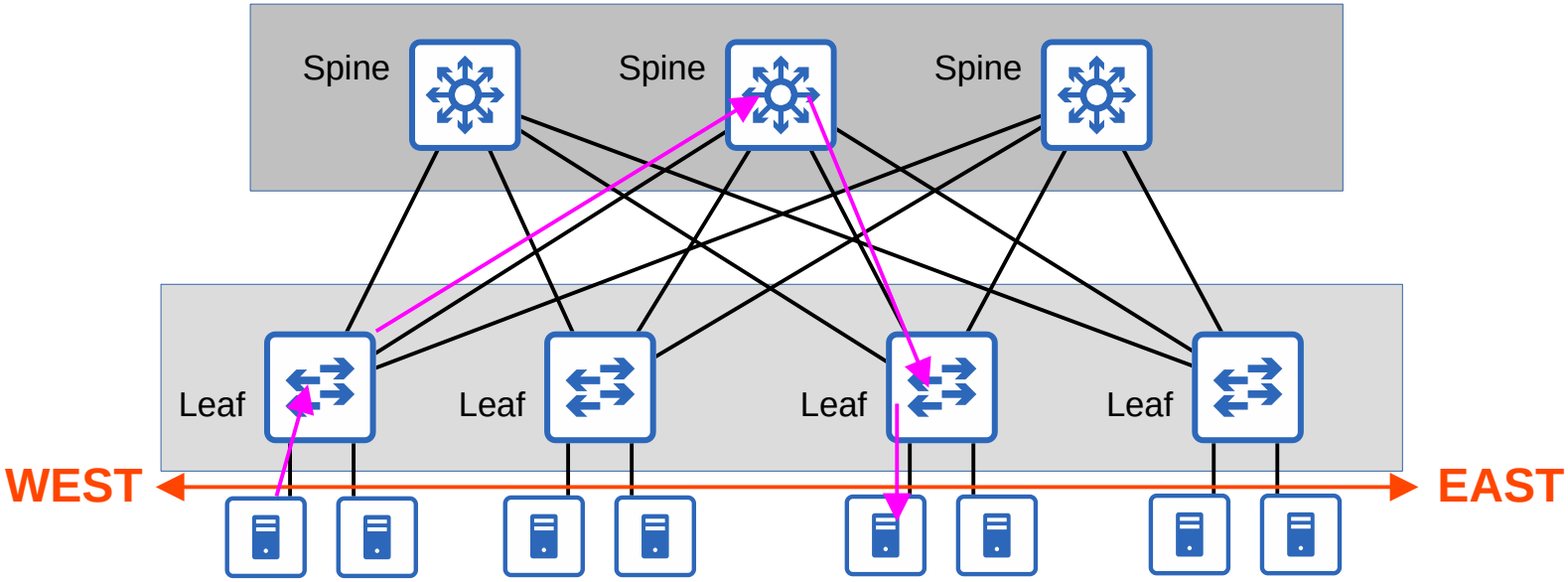


Spine-Leaf Architecture

- Data centers are dedicated spaces/buildings used to store computer systems such as servers and network devices.
- Traditional data center designs used a three-tier architecture (Access-Distribution-Core) like we just covered.
- This worked well when most traffic in the data center was North-South.
- With the precedence of virtual servers, applications are often deployed in a distributed manner (across multiple physical servers), which increases the amount of East-West traffic in the data center.
- The traditional three-tier architecture led to bottlenecks in bandwidth as well as variability in the server-to-server latency depending on the path the traffic takes.
- To solve this, Spine-Leaf architecture (also called Clos architecture) has become prominent in data centers.

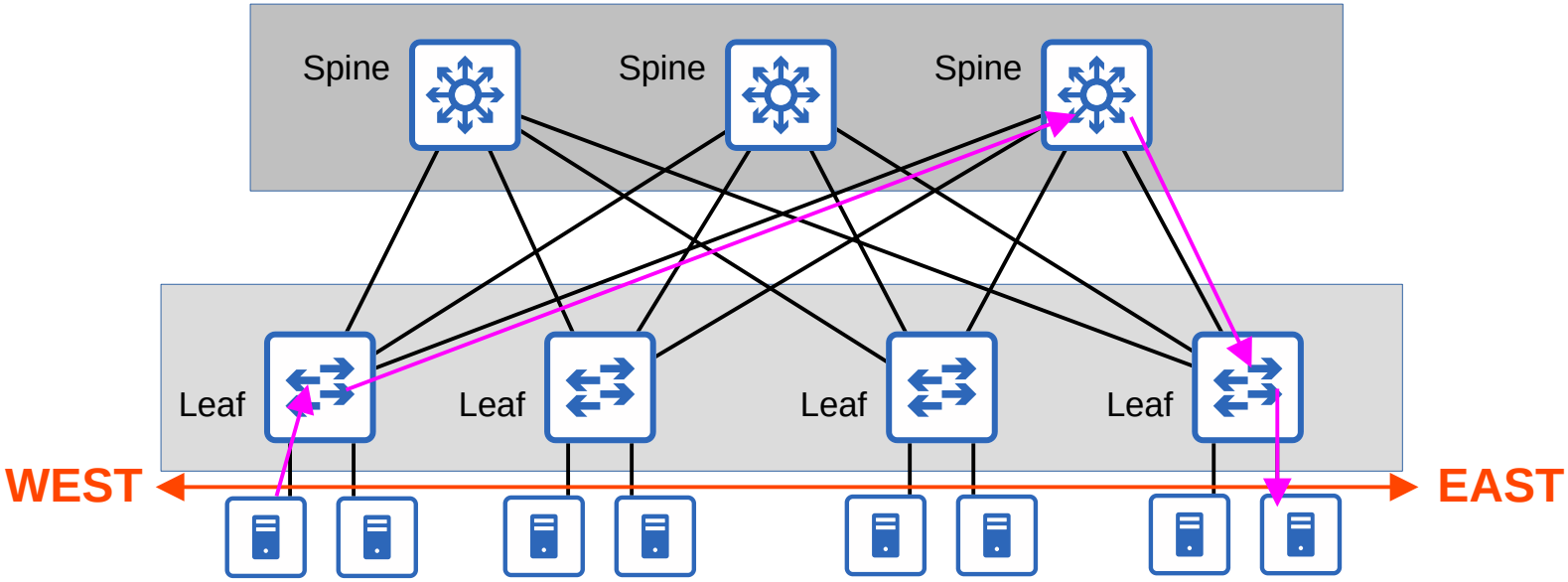
Spine-Leaf Architecture

- There are some rules about Spine-Leaf architecture:
  - → Every Leaf switch is connected to every Spine switch.
  - → Every Spine switch is connected to every Leaf switch.
  - → Leaf switches do not connect to other Leaf switches.
  - → Spine switches do not connect to other Spine switches.
  - → End hosts (servers etc.) only connect to Leaf switches.
- The path taken by traffic is randomly chosen to balance the traffic load among the Spine switches.
- Each server is separated by the same number of ‘hops’ (except those connected to the same Leaf), providing consistent latency for East-West traffic.



Spine-Leaf Architecture

- There are some rules about Spine-Leaf architecture:
  - → Every Leaf switch is connected to every Spine switch.
  - → Every Spine switch is connected to every Leaf switch.
  - → Leaf switches do not connect to other Leaf switches.
  - → Spine switches do not connect to other Spine switches.
  - → End hosts (servers etc.) only connect to Leaf switches.
- The path taken by traffic is randomly chosen to balance the traffic load among the Spine switches.
- Each server is separated by the same number of ‘hops’ (except those connected to the same Leaf), providing consistent latency for East-West traffic.

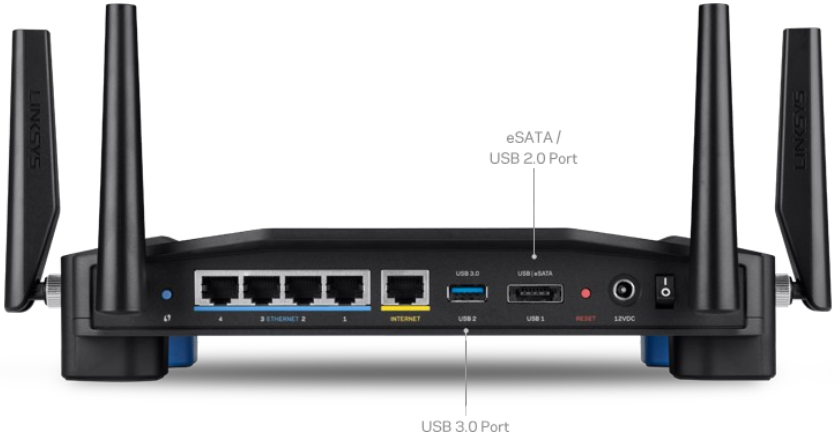


SOHO Networks

- Small Office/Home Office (SOHO) refers to the office of a small company, or a small home office with few devices.
  → Doesn't have to be an actual home 'office', if your home has a network connected to the Internet it is considered a SOHO network.

- SOHO networks don't have complex needs, so all networking functions are typically provided by a single device, often called a 'home router' or 'wireless router'.

- This one device can serve as a:
  → Router
  → Switch
  → Firewall
  → Wireless Access Point
  → Modem

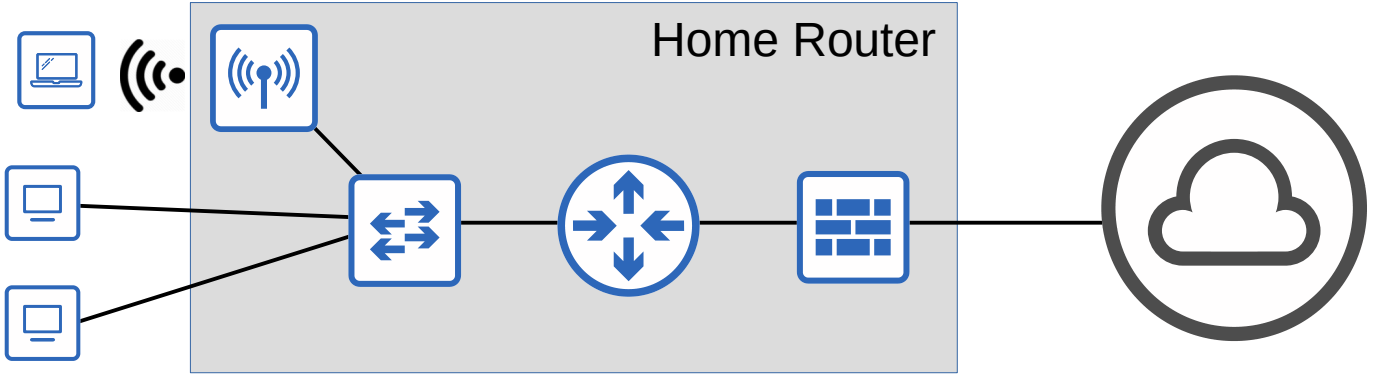


SOHO Networks

- Small Office/Home Office (SOHO) refers to the office of a small company, or a small home office with few devices.
  → Doesn't have to be an actual home 'office', if your home has a network connected to the Internet it is considered a SOHO network.

- SOHO networks don't have complex needs, so all networking functions are typically provided by a single device, often called a 'home router' or 'wireless router'.

- This one device can serve as a:
  → Router
  → Switch
  → Firewall
  → Wireless Access Point
  → Modem



Things we covered

- 2-Tier and 3-Tier LAN Architecture
- Spine-Leaf Architecture (Data Center)
- SOHO (Small Office/Home Office)

Quiz 1

Which Layer typically serves as the boundary between Layer 2 and Layer 3 in a traditional 2-tier or 3-tier network?

a) Core

b) Distribution

c) Access

d) Leaf

Quiz 2

Which of the following would you NOT expect to find in the Core Layer of a traditional 3-tier LAN?

a) Layer 3 connections

b) STP

c) A full mesh of connections to all Distribution Layer switches.

d) Powerful switches focused on speed.

Quiz 3

At which layer would you expect to find PoE-enabled switchports in a traditional 3-tier LAN?

a) Access

b) Core

c) Distribution

d) Leaf

Quiz 4

In a Spine-Leaf architecture, which of the following should not be connected to a Leaf switch?

a) A spine switch

b) A leaf switch

c) A server

Quiz 5

Which of the following functions might be included in the device known as a wireless router?

a) Routing

b) Switching

c) Wireless Access

d) Security

e) a) and c)

f) a), b), c), and d)