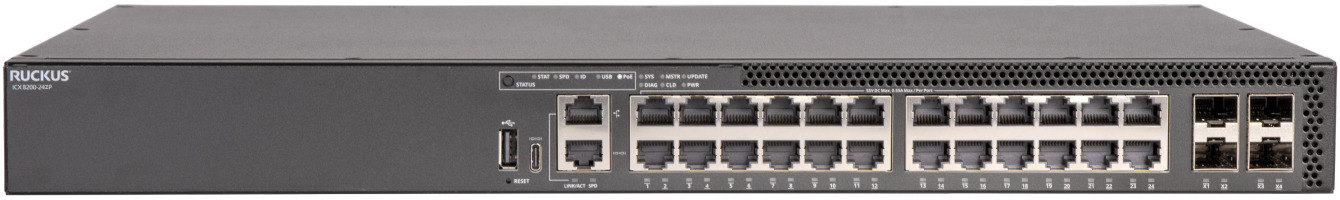
Switches

Smart Switch

https://www.youtube.com/watch?v=DWukAUHi4Oc

Here are some key characteristics and features of smart network switches:

1. **Management Capabilities:** Smart switches can be configured and monitored through a web interface, command-line interface (CLI), or a dedicated management software. This allows network administrators to have more control over the switch's behavior and settings.
2. **VLAN Support:** Virtual Local Area Networks (VLANs) can be set up on smart switches to segment the network and improve security and performance.
3. **Quality of Service (QoS):** Smart switches often support QoS features, enabling administrators to prioritize certain types of traffic to ensure critical applications get sufficient bandwidth.
4. **Port Mirroring:** This feature allows traffic from one port to be mirrored to another port, which is useful for network analysis and monitoring purposes.
5. **Link Aggregation (LAG):** Smart switches may support link aggregation, which allows multiple physical ports to be combined into a single logical link, increasing bandwidth and providing redundancy. #question
6. **Spanning Tree Protocol (STP):** STP is used to prevent network loops in Ethernet networks, and smart switches often include this feature to ensure network stability.
7. **Security Features:** Smart switches offer various security features such as port security, MAC-based authentication, and access control lists (ACLs) to enhance network security.
8. **Remote Management:** Many smart switches support remote management, enabling administrators to access and configure the switch from off-site locations.
9. **Monitoring and Troubleshooting Tools:** These switches often provide various monitoring tools like port statistics, error logs, and diagnostic utilities to assist with network troubleshooting.
10. **Firmware Upgrades:** Smart switches can have firmware updates, ensuring the switch remains up-to-date with the latest features and security fixes.



Typical Ports on a smart switch

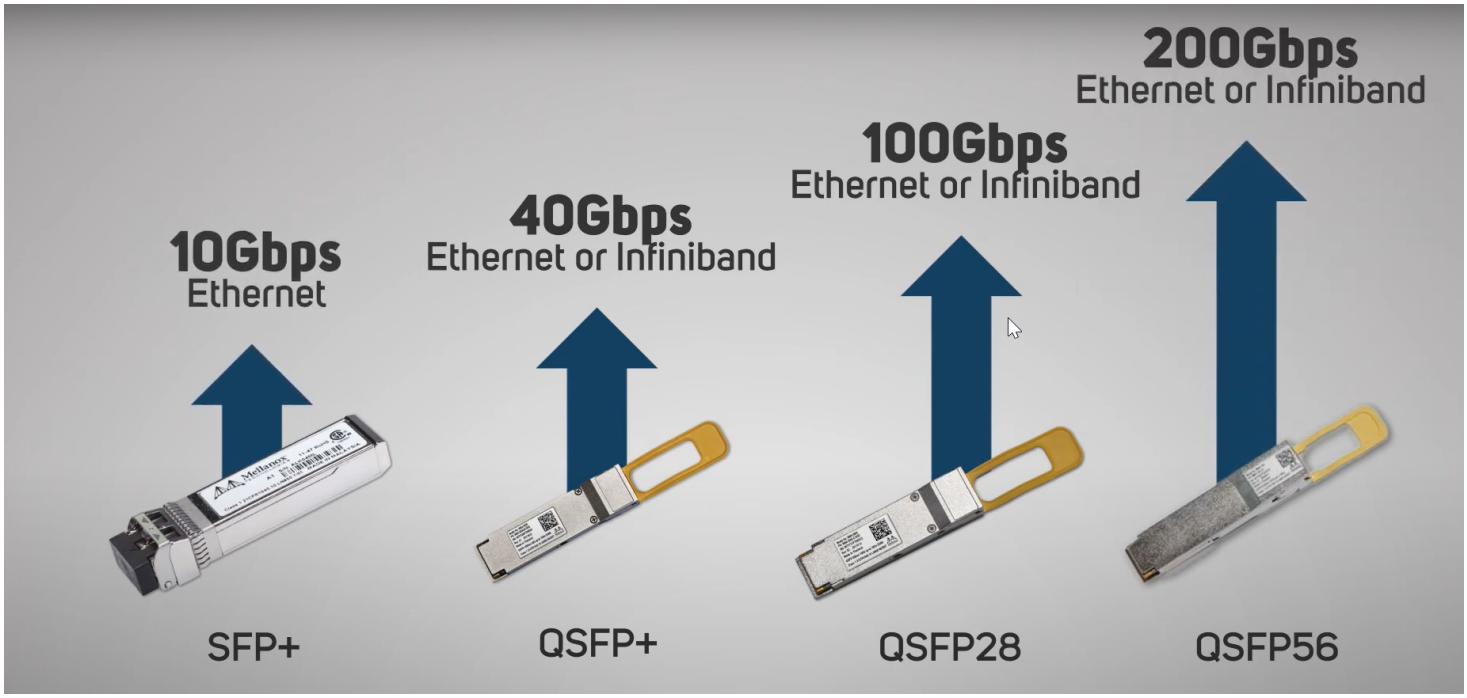
Managed or smart network switches typically come with a variety of ports to accommodate different network connectivity needs. Here are the typical ports you can find on such switches:

1. **RJ-45 Ethernet Ports:** These are the standard Ethernet ports that support twisted-pair copper cables and are used for connecting end devices such as computers, printers, servers, and other networking equipment.
2. **SFP (Small Form-Factor Pluggable) Ports:** SFP ports are for fiber-optic connections, providing high-speed and long-distance data transmission. SFP ports allow you to use different types of SFP modules to adapt to various fiber types and distances.
3. **SFP+ (Small Form-Factor Pluggable Plus) Ports:** These are an upgraded version of SFP ports, offering higher data rates and often used for 10 Gigabit Ethernet connections over fiber-optic cables.
4. **10GBASE-T Ports:** These ports support 10 Gigabit Ethernet over standard twisted-pair copper cables (Cat 6a or Cat 7), allowing for high-speed connections to compatible devices.
5. **Console Port:** A serial console port (usually an RJ-45 port) is provided to access the switch's command-line interface (CLI) for initial setup, configuration, and troubleshooting.
6. **USB Ports:** Some smart switches may have USB ports used for various purposes, such as firmware upgrades or connecting external storage devices.
7. **Management Port:** Some higher-end smart switches may include a dedicated management port, allowing administrators to connect to a separate management network for enhanced security.
8. **Stacking Ports:** In certain models, you may find special stacking ports that enable multiple switches to be interconnected and operate as a single logical unit, improving scalability and management.

SFP

SFP (Small Form-Factor Pluggable) and SFP+ (Small Form-Factor Pluggable Plus) are types of transceiver modules used in networking equipment to provide high-speed data transmission over fiber-optic cables. They are hot-swappable, meaning they can be plugged and unplugged from compatible ports without powering down the networking equipment.

Feature	SFP	SFP+
Data Rate	Up to 1 Gbps	Up to 10 Gbps
Applications	1 Gigabit Ethernet, Fiber Channel	10 Gigabit Ethernet
Backward Compatibility	Yes (Can work in SFP ports)	N/A
Physical Size	Same as SFP (Small Form Factor)	Same as SFP (Small Form Factor)
Fiber Types	Multimode and Single-mode	Multimode and Single-mode
Connector Type	LC Connector	LC Connector
Common Use Cases	Fast Ethernet connections,	10 Gigabit Ethernet connections,
	Fiber Channel connections	Data center deployments



Stacking

Switch stacking refers to the process of interconnecting multiple network switches to operate as a single logical unit, enhancing performance, management, and scalability. Stacking technology enables network administrators to create a stack of switches that appears and operates as a single switch, simplifying network management and allowing for seamless expansion and high availability. There are typically two main methods of switch stacking: physical stacking and virtual stacking.

1. Physical Stacking:
In physical stacking, switches are connected using specialized stacking ports and stacking cables. These stacking ports are designed specifically for creating the interconnection between switches within the stack. The stacking cables can vary depending on the switch model and manufacturer. To create a stack, you physically connect the stacking ports of the switches using the

appropriate stacking cables. This creates a "daisy chain" or "ring" topology, where each switch is connected to the next in line, forming a loop or chain of switches. One of the switches is responsible of all type of operations of the stack and is called the stack master. The stack master along with other switches in the stack are stack members. Whenever we want to add a new switch to the stack, the master switch automatically configures it

Key characteristics of physical stacking:

- **Dedicated Stacking Ports:** Stacking ports are distinct from regular Ethernet ports and are used solely for stacking purposes.
- **Single Logical Unit:** Once the switches are stacked, they act as a single logical switch. They share a single management IP address and configuration, simplifying administration.
- **Enhanced Performance:** Stacked switches work together to provide increased overall switching capacity, aggregate bandwidth, and processing power, leading to improved performance for the network.

2. Virtual Stacking:
https://www.cisco.com/c/en/us/products/collateral/switches/catalyst-9000/nb-06-cat-9k-stack-wp-cte-en.html

EXAMPLE: Cisco StackWise Virtual

Virtual stacking, also known as "cluster management" or "logical stacking," is a software-based approach to stacking that does not require specialized stacking ports or cables. Instead, switches are interconnected using regular Ethernet ports. They communicate with each other through the network, and their configuration and management are handled centrally through software.

Key characteristics of virtual stacking:

- **Regular Ethernet Ports:** Virtual stacking relies on standard Ethernet ports for interconnection, making it more flexible and easier to deploy compared to physical stacking.
- **Single Logical Unit:** Similar to physical stacking, virtual stacking creates a unified logical switch, allowing centralized management and configuration.
- **Simplified Management:** Network administrators can manage and configure all switches in the virtual stack through a single interface.

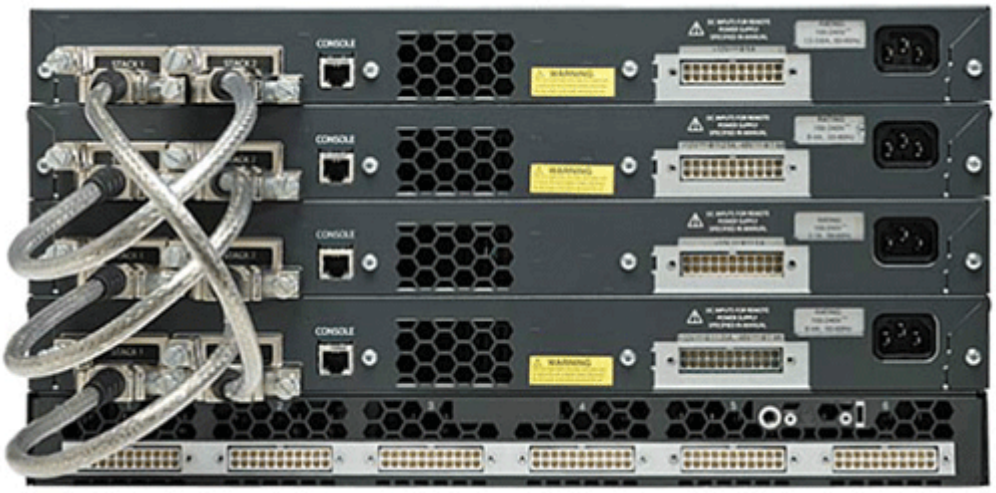
Both physical and virtual stacking offer benefits in terms of enhanced performance, simplified management, scalability, and high availability. The choice between the two methods depends on the specific needs of the network, the switch models available, and the desired level of flexibility.

Here are the key features and benefits of stacking :

1. **Enhanced Performance:** By stacking switches, you can increase the overall switching capacity and bandwidth of the network. Stacked switches can share data and processing tasks, leading to improved performance and reduced bottlenecks.
2. **Single Logical Unit:** Stacked switches operate as a single logical entity, so they can be managed as if they were a single switch. This simplifies network management, as

administrators don't need to configure each switch individually. They provide us with a shared MAC address table, shared VLAN configuration, and consolidated management.

3. **Simplified Management:** With stacking, you only need to manage one switch, even if there are multiple physical devices in the stack. This centralized management approach streamlines configuration, monitoring, and troubleshooting tasks.
4. **High Availability:** Stacking provides redundancy and high availability. If one switch in the stack fails, the remaining switches can continue to function, ensuring minimal downtime and seamless network operation.
5. **Scalability:** Stacking allows for easy expansion of the network by adding more switches to the stack. This makes it convenient to grow the network as demands increase without complex reconfiguration.
6. **Single IP Address:** When switches are stacked, they often share a single IP address, which simplifies network monitoring and management, as you only need to access one IP address to manage the entire stack.
7. **Interconnect Cables:** To stack switches, you'll need specific stacking cables that connect the stacking ports on each switch. The type of stacking cables required can vary depending on the switch manufacturer and model.



Info

n general, the number of switches in a stack can range from a few switches to as many as eight or more, depending on the specific model and technology used. For example, some enterprise-grade switches support stacking sizes of up to 8, 12, or even more switches.

Info

The aggregate stack bandwidth is a sum of the individual bandwidth capacities of each switch in the stack. For example, if you have four switches in a stack, and each switch has a stacking bandwidth of 40 Gbps, the aggregate stack bandwidth would be 4 switches * 40 Gbps = 160 Gbps.

Long distance stacking

Long-distance stacking, also known as extended stacking or remote stacking, is a networking technology that allows network switches to be interconnected over long distances to form a single logical stack. It enables network administrators to create a stacked switch configuration even when the switches are physically located in different areas, buildings, or even remote sites.

Traditional stacking typically requires the switches to be connected using specialized stacking cables, limiting the stack's physical reach to a relatively short distance, often within the same rack or data center. However, long-distance stacking overcomes this limitation by leveraging alternative technologies to extend the stack's reach over greater distances.

The methods used for long-distance stacking can vary based on the switch manufacturer and the specific stacking technology they employ. Some common approaches to achieve long-distance stacking include:

1. Fiber-Optic Stacking:
Using fiber-optic connections between switches can extend the stacking reach to longer distances. Optical fiber cables are capable of transmitting data over several kilometers with minimal signal degradation, making them suitable for long-distance stacking.

2. Stacking over MPLS or IP Networks:
Some advanced stacking technologies allow switches to communicate over MPLS (Multiprotocol Label Switching) or IP (Internet Protocol) networks. This enables the creation of a virtual stack across geographically dispersed locations connected through a wide-area network (WAN).

3. Stacking over Dedicated Links:
In certain cases, dedicated point-to-point links can be established between switches to achieve long-distance stacking. These links might use technologies like leased lines or wireless point-to-point links.

Switch cascading

Switch Cascading:
Switch cascading, also known as "daisy-chaining," is the practice of connecting multiple switches together in a linear or hierarchical manner to expand the number of ports available for network devices.

Key characteristics of switch cascading:

1. **Physical Connection:** Switch cascading involves physical connections using regular Ethernet cables between the switches' Ethernet ports.
2. **Individual Management:** Each switch in the cascaded setup is managed as an individual entity. They have separate IP addresses and require individual configurations.
3. **Limited Performance Improvement:** While cascading allows for more ports, it does not significantly enhance overall network performance. Each switch operates independently, and the traffic is not shared or aggregated between switches.
4. **Limited Scalability:** Cascading has limitations on scalability due to the linear or hierarchical nature of the connections. As more switches are added to the chain, the complexity of the setup and potential points of failure increase.
5. **Link Aggregation Limitations:** Traditional cascaded setups may not support advanced link aggregation techniques that combine multiple physical connections into a single logical link.

Stacking Vs. Cascading

Concept	Switch Stacking	Switch Cascading
Physical Connection	Specialized stacking ports and stacking cables or virtual stacking technology	Regular Ethernet ports and Ethernet cables
Logical Connection	Creates a single logical unit (single IP address for management)	Operates switches independently (separate IP addresses for each)
Enhanced Performance	Aggregates bandwidth and switching capacity for better performance	Does not significantly improve overall network performance
Simplified Management	Managed as a single entity with centralized management	Each switch requires individual configuration and management
Scalability	Easy expansion by adding more switches to the stack	Limited scalability as complexity increases with more cascaded switches
Link Aggregation	Supports advanced link aggregation techniques for increased bandwidth	May have limitations on link aggregation capabilities
Purpose	Enhances performance, simplifies management, and provides scalability	Expands the number of available ports for network devices

Power over Ethernet (PoE)

Power over Ethernet (PoE) is an access layer technology that combines data signals and electrical power into a single Ethernet cable connection to enable remote powered device operation. Using the data signal capabilities, PoE and device status can be monitored, and information shared between a switch and powered device in order to manage the amount of power delivered to the

remote device.

Progression of IEEE standards for PoE (Power over Ethernet)

Standard	IEEE 802.3af	IEEE 802.3at	IEEE 802.3bt			
Power	15.4 Watt	30 Watt	45 Watt	60 Watt	75 Watt	90 Watt
Year	2003	2009	2018 High power standard			

PoE Technology	IEEE Standard	Max Power Output	Supported Ethernet Speeds	Key Features and Notes
PoE (802.3af)	802.3af	15.4W	10/100 Mbps	First standard for PoE; Suitable for low-power devices
PoE+ (802.3at)	802.3at	30W	10/100/1000 Mbps	Higher power output; Used for devices like IP phones and Wi-Fi APs
PoE++ (802.3bt)	802.3bt	Up to 90W	10/100/1000 Mbps	Provides higher power for demanding devices such as PTZ cameras
UPoE (Cisco)	Proprietary	Up to 60W	10/100/1000 Mbps	Cisco's proprietary PoE technology; Offers higher power delivery
4PPoE (4-pair PoE)	802.3bt	Up to 100W	10/100/1000 Mbps	Utilizes all four pairs of Ethernet cables for increased power
PoE Ultra (Cisco)	Proprietary	Up to 60W	10/100/1000 Mbps	Cisco's enhanced PoE technology; Provides higher power delivery
LTPoE++ (802.3bt)	802.3bt	Up to 90W	10/100/1000 Mbps	A Long-Term PoE technology for higher power delivery over 10 years
PoH (Power over HDBaseT)	HDBaseT	Up to 100W	Up to 10 Gbps	Used for AV and video applications over HDBaseT cabling

Power over HDBaseT (PoH)

Power over HDBaseT (PoH) is a Power over Ethernet (PoE) technology designed specifically for HDBaseT systems. HDBaseT is a connectivity standard that enables the transmission of high-definition video, audio, Ethernet, and control signals over a single category cable (commonly Cat5e, Cat6, or Cat6a).

PoH extends the capabilities of HDBaseT by providing power to the HDBaseT devices, allowing them to be powered directly through the same category cable used for data and video transmission. This eliminates the need for separate power cables and simplifies the installation and setup of HDBaseT systems.

POH technology opens the door for a cost-effective, easy way to deliver power to digital signage in airports, hotels, hospitals, cafeterias or any other environment in need of a video display--eliminating the need for AC power.

Key features and aspects of Power over HDBaseT (PoH):

1. **Power Delivery:** PoH supports power delivery of up to 100 watts (W) over the HDBaseT category cable. This is significantly higher power delivery compared to traditional PoE standards like 802.3af (15.4W) and 802.3at (30W).
2. **HDBaseT Connectivity:** PoH works in conjunction with HDBaseT technology, allowing for the transmission of uncompressed high-definition video, audio, Ethernet, control signals, and power over the same cable.
3. **Single Cable Solution:** By combining data, video, audio, control, and power over a single cable, PoH simplifies installations and reduces cable clutter, making it ideal for applications like audiovisual (AV) installations, digital signage, and video conferencing.
4. **Backward Compatibility:** PoH is backward compatible with standard PoE devices and equipment. It can supply power to HDBaseT devices as well as traditional PoE devices, allowing a mix of PoH and standard PoE devices in the same network.
5. **Extended Reach:** PoH can deliver power and data over longer distances compared to traditional PoE. HDBaseT technology allows for transmission distances of up to 100 meters (328 feet).
6. **Standardization:** PoH is not an official IEEE standard like traditional PoE technologies (e.g., 802.3af, 802.3at, 802.3bt). Instead, it is specific to the HDBaseT Alliance, a consortium of companies promoting the HDBaseT standard.

PoH is commonly used in AV installations, where it simplifies the wiring and power requirements for AV equipment, displays, and projectors. It provides a convenient and efficient solution for delivering power to various devices without the need for separate power outlets or additional power cables, making HDBaseT installations more streamlined and cost-effective.

HDBaseT

https://www.youtube.com/watch?v=ZcovWvme9PQ

In addition to using a standard RJ45 connector and balanced twisted pair cabling, HDBaseT supports five different specifications. 5Play™ is a term created by HDBaseT Alliance to represent the five features supported over twisted pair cabling:

1. Uncompressed HD video (HD, 3D and 2K/4K)
2. HD audio (Dolby Digital, DTS, Dolby TrueHD and DTS HD-Master Audio)

3. 100BaseT Ethernet
4. Control channel (RS-232, infrared, or USB device)
5. Up to 100 watts of power