

What type of media link you may use in your network design project? How do u choose UTP Ethernet cables as your best media links for your project (Cat3, 5, 5e, 6, 6a, 7,8)? (cost, no.of twist, rate, BWD...) "It is a confusing task to select the appropriate media link for your network design unless you are an expert." Why cat5e reduced potential crosstalk than cat5? (cat5=3-twists per inch, cat5e=2twists per cm, what does this mean?) (1 inch=2.54cm) Factors to choose cables, when designing your network? Cost, rate, signal attenuation, bandwidth, expansion capabilities, travel distance..... How do they communicate? When do we use fiber cables, Ethernet cables, copper cables?? How do we access data at endpoints?

ChatGPT

In a network design project, selecting the appropriate media link is crucial for ensuring efficient communication and data transmission. Different types of media links include:

1. Ethernet cables (UTP, STP, FTP)
2. Fiber optic cables (single-mode, multi-mode)
3. Wireless links (Wi-Fi, cellular)
4. Coaxial cables
5. Powerline communication
6. Microwave links

Choosing UTP Ethernet cables, which are widely used in networking, involves considering various factors:

1. **Category:** Cat3, Cat5, Cat5e, Cat6, Cat6a, Cat7, Cat8 represent different standards with varying capabilities. The higher the category, the better the performance in terms of data rate, bandwidth, and resistance to crosstalk and interference.
2. **Cost:** Higher category cables usually come with a higher cost. Balancing performance requirements with budget constraints is essential.
3. **Twists per Inch/Centimeter:** The number of twists per inch or centimeter affects the cable's ability to mitigate crosstalk. More twists per inch/centimeter generally result in better performance.
4. **Data Rate/Bandwidth:** Higher category cables support higher data rates and wider bandwidths, which are essential for modern networking requirements.
5. **Crosstalk Reduction:** Cat5e reduces potential crosstalk compared to Cat5 due to tighter twists per centimeter, which helps in minimizing interference between adjacent wires. This means that Cat5e has better performance in terms of reducing signal degradation caused by electromagnetic interference.

Factors to consider when designing a network and selecting cables include:

1. **Cost-effectiveness:** Balancing performance requirements with the available budget.
2. **Data Rate and Bandwidth:** Ensuring that the selected cables can support the required data rates and bandwidth for current and future network demands.
3. **Signal Attenuation:** Minimizing signal loss over distance to maintain signal integrity.
4. **Expansion Capabilities:** Choosing cables that allow for easy scalability and expansion of the network.

5. **Reliability and Durability:** Selecting cables that are reliable and durable, capable of withstanding environmental factors and physical wear and tear.
6. **Compatibility:** Ensuring compatibility with existing network infrastructure and equipment.

Regarding when to use different types of cables:

1. **Fiber Optic Cables:** Fiber optic cables are typically used for long-distance communication and where high bandwidth and immunity to electromagnetic interference are required. They are commonly used in backbone networks and for connecting buildings in campus environments.
2. **Ethernet Cables (Copper):** Ethernet cables, especially UTP cables, are suitable for shorter distances within buildings or local area networks (LANs). They are cost-effective and offer sufficient performance for most applications.
3. **Wireless Links:** Wireless links are used for providing connectivity in areas where laying cables is impractical or costly, or for providing mobility within a network.

Data is accessed at endpoints through network interfaces such as network interface cards (NICs) in computers, routers, switches, and other network devices. These devices convert data signals between digital form (used by computers) and analog or optical form (used for transmission over cables or wireless links). At endpoints, data is processed, forwarded, or received based on the specific function of the device within the network.

CA

Users in Haramaya University are complaining that the performance of the network is not satisfactory. It takes a long time to pull files from the server and under heavy loads workstations can become disconnected from the server. The network is heavily used and a new video conferencing application is about to be installed. The network is a 100baseT system created with Ethernet hubs. What network device most likely will be installed to alleviate the performance problems? Justify your answer? How Bridges block or permit data from passing to a specified network segment? What type of network topology do you recommend for HU ICT and HU CCI office? Justify why? Discuss differences between Internet and a network. Why a hub forwards data packets to all connected ports? Analyze and write a short note about the network performance of Haramaya University regarding to its throughput and delay including both Wired and Wi-Fi networks?

ChatGPT

Given the issues described with the network at Haramaya University, the most likely solution to alleviate performance problems would be to replace the Ethernet hubs with Ethernet switches. Ethernet hubs operate at the physical layer of the OSI model and simply broadcast all data packets to every device connected to them. This can lead to network congestion, collisions, and decreased performance, especially under heavy loads.

On the other hand, Ethernet switches operate at the data link layer of the OSI model and can intelligently forward data packets only to the devices that need them. By doing so, switches can alleviate network congestion, reduce collisions, and improve overall network performance. With a switch in place, data transmission between devices will be more

efficient, and the likelihood of workstations becoming disconnected from the server due to heavy loads will be significantly reduced.

Bridges are devices that operate at the data link layer of the OSI model and are used to connect two or more network segments, effectively extending the network. Bridges examine the MAC addresses of incoming data packets and make forwarding decisions based on the destination MAC address and the segment to which it belongs.

To block or permit data from passing to a specified network segment, bridges use MAC address filtering. They maintain a table of MAC addresses and the corresponding network segments they are associated with. When a data packet arrives at a bridge, it checks the destination MAC address against its table. If the MAC address is associated with a segment that the bridge is not configured to forward to, it will block the packet. If the MAC address is associated with a segment that the bridge is allowed to forward to, it will permit the packet to pass through.

For the network topology at Haramaya University's ICT and CCI offices, a hierarchical or star topology is recommended. In a hierarchical topology, devices are organized in a hierarchical manner, typically with core switches at the top, distribution switches in the middle, and access switches at the bottom. This topology provides scalability, ease of management, and efficient traffic flow, which are essential for large organizations like universities. Additionally, a star topology, where each device is connected directly to a central switch or hub, can provide better performance and easier troubleshooting compared to other topologies like bus or ring.

Differences between the Internet and a network:

1. **Scope:** The Internet is a global network of interconnected networks that spans the entire world, allowing communication and data exchange between millions of devices. A network, on the other hand, can refer to a smaller-scale collection of interconnected devices within a specific location or organization.
2. **Ownership and Control:** The Internet is a public network that is owned and maintained by various organizations, governments, and service providers around the world. A network can be privately owned and controlled by a single entity, such as a company or institution, for its internal communication and data sharing needs.
3. **Access:** Access to the Internet is typically provided by Internet service providers (ISPs) through various technologies such as DSL, cable, fiber, or wireless connections. Access to a private network is usually restricted to authorized users within the organization, often through wired or wireless connections within the organization's premises.
4. **Purpose:** The Internet is used for a wide range of purposes, including communication, information sharing, entertainment, e-commerce, and more. A network may serve specific purposes tailored to the needs of the organization, such as file sharing, resource sharing, printing, collaboration, and access to internal applications and services.

A hub forwards data packets to all connected ports because it operates at the physical layer of the OSI model and does not perform any intelligence or filtering based on MAC addresses. When a hub receives a data packet, it simply regenerates the signal and sends it

out through all of its ports, regardless of the intended recipient. This can lead to network congestion and collisions, especially in heavily utilized networks.

Regarding the network performance of Haramaya University:

1. **Throughput:** Throughput refers to the amount of data transferred successfully over a network in a given amount of time. The wired network at Haramaya University, especially with the introduction of Ethernet switches, would likely have higher throughput compared to Wi-Fi due to the more reliable and higher bandwidth connections provided by Ethernet cables.
2. **Delay:** Delay, also known as latency, refers to the time it takes for data to travel from the source to the destination. In general, wired networks have lower latency compared to Wi-Fi networks due to the inherent characteristics of wired connections. With the implementation of Ethernet switches, the delay in the university's wired network would likely be minimized, improving overall network performance and responsiveness.

Overall, by upgrading from Ethernet hubs to Ethernet switches and maintaining a well-designed network infrastructure, Haramaya University can improve network performance, reduce delays, and better support its users' needs, including the upcoming installation of a video conferencing application.