Tutorial 01

01)

Advantages of Combining Data Communication with Computer Networks:

1) Resource Sharing: Through integration, resources like files, printers, and apps may be shared among users on a network. Users are able to access and make use of resources on other linked machines.

2) Better Communication: Faster and more effective communication between individuals and organizations is made possible by data communication over networks. Collaboration tools, chat apps, and email improve communication.

3) Remote Access: By employing network connections, users can access data and apps remotely from various locations. Businesses with several branches, business travelers, and remote workers will find this very helpful.

4)Cost Savings: Centralizing data storage and pooling resources can result in financial savings. It can simplify maintenance and support and lessen the need for duplicated hardware thanks to centralized control.

5)Scalability: Networked systems are easily scalable to meet expanding requirements. The network can accommodate the addition of new users and devices without causing any major problems.

6)Data security: Security controls can be applied by integrated networks to limit access to private data. Firewalls, encryption, and other security measures aid in the protection of data while it is being transmitted.

7)Effective Data Management: Centralized databases and data repositories made possible by integrated networks allow for effective data management. This makes the operations of backing up, retrieving, and storing data easier.

Constraints of Combining Data Communication with Computer Networks:

Security Issues: Unauthorized access, data breaches, and cyberattacks are just a few of the security risks that networked systems are susceptible to. Ensuring strong security protocols is essential.

Complexity: Complex network infrastructures can be difficult to design, deploy, and maintain. Network troubleshooting and management require qualified professionals.

Dependency on Infrastructure: Network infrastructure is vital to organizations. Business operations and productivity may be impacted by a network outage or disturbance.

02) Client-Server Framework:

Benefits

Advantage of Centralized Control One major advantage of the client-server architecture is centralized control. The server serves as a central storehouse for services and resources, facilitating effective administration, data integrity, and security enforcement. It offers a lone point of administration and control.

Scalability

Benefit: The scalability of the client-server architecture permits the addition of additional clients without materially impacting the server's performance. To maintain performance and responsiveness as the load grows, more servers can be deployed to spread it out.

Benefits of the Peer-to-Peer (P2P) model

Decentralization: Benefit: Every node (peer) in the network has an equal status thanks to the decentralized nature of the P2P paradigm. Because of its decentralization, the network is more resilient and fault-tolerant because the failure of one peer does not always affect the whole system. It also reduces reliance on a single point of failure by doing away with the requirement for a central server.

Redundancy and Sharing of Resources: Benefit: A peer in a P2P network has the ability to function as both a server and a client. Redundancy and resource sharing are made possible in this way. Distributing files and services among several peers enhances system resilience and encourages effective resource usage.

03) 1. Wires with twisted pairs:

Capacity for Data: Unshielded twisted pair (UTP) and shielded twisted pair (STP) are the two primary types of twisted pair cables. In networking, UTP is frequently used, and the category (e.g., Cat 5e, Cat 6) determines the data capacity. Higher data rates are typically supported by cables of a higher type.

Speed: Modern Cat 6 and Cat 6a connections can handle Gigabit and 10 Gigabit Ethernet, respectively. Twisted pair cables can accommodate a variety of transmission rates.

Data Transfer Distance: Without the use of repeaters or signal boosters, the data transfer distance for twisted pair cables is normally restricted to 100 meters.

2. Coaxial connections:

Compared to twisted pair connections, coaxial cables have a larger data capacity. The kind and architecture of the coaxial cable determine its specific capacity.

Speed: Coaxial connections may transport data at greater rates; certain types can even carry Gigabit Ethernet.

Data Transfer Distance: Compared to twisted pair cables, coaxial cables have a greater data transfer capacity. For instance, 500 meters can be reached via standard RG-6 coaxial wire without the need for repeaters.

3. Opto-Fiber Cables:

Data Capacity: Among guided media, fiber-optic cables offer the most data capacity. They are appropriate for high-bandwidth applications because they can handle incredibly high data rates.

Speed: Gigabit, 10 Gigabit, and even 100 Gigabit Ethernet data transmission are all supported using fiber-optic lines.

Data Transfer Distance: Without the need for repeaters, fiber-optic connections offer the longest data transfer distances. The range of possible distances is several hundred meters to tens of kilometers, contingent upon the type of fiber (single-mode or multi-mode).

04) Bandwidth: The capacity or range of frequencies that a communication channel may transport is referred to as "bandwidth" in the context of communication systems. It is frequently represented in hertz (Hz) or kilohertz (kHz), and it indicates the quantity of data that can be transmitted in a specific amount of time.

Units of measurement for bandwidth:

Broadband is commonly measured in gigahertz (GHz), megahertz (MHz), kilohertz (kHz), and hertz (Hz). Bits per second (bps), kilobits per second (kbps), megabits per second (Mbps), or gigabits per second (Gbps) are common units of measurement for bandwidth in networking.

Data Rate Calculation:

The speed at which data is processed or sent per unit of time is known as the data rate. Often, it is stated in bits per second (bps) or one of its multiples.

Given information

Data sent in the amount of 10240 kilobits

It took ten seconds.

Use the following calculation to determine the data rate:

Data Rate = Data Time Amount

Time = Data Rate

Quantity of Information

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Convert 10240 kilobits to bits in this instance (1 kilobit = 1000 bits), then enter the values into the formula:

10240 is the data rate.

Kilobits × 1000

bits/kilobit 10

seconds Data Rate equals ten seconds

10240 bits × 1000 bits per bit

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The data rate is 10, 240, 000.

bits 10

seconds Data Rate equals ten seconds

10,240,000 bits

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Data Rate = 1,024,000,000

Data Rate in bps: 1,024,000bps

As a result, the cable's data rate is 1,024 kilobits per second (kbps), or 1,024 000 1,024,000 bits per second.

05)

1) Radio Waves: Wi-Fi networks and other wireless communication methods rely on radio waves. They are frequently utilized for local area network (LAN) connectivity and are a component of the electromagnetic spectrum.

2) Microwaves: Microwaves are radio waves with a high frequency that can be utilized for direct communication between two points. In wireless networks, they are frequently utilized for backhaul links.

3) Infrared (IR): Infrared light is used in infrared technology to communicate. IrDA (Infrared Data Association) connections are one type of short-range communication between devices that is frequently used in networking.

4) Satellite Communication: In satellite communication, signals are relayed between sites on Earth via satellites. Long-distance communication is one of its frequent uses, particularly for global connectivity or in isolated locations.

Benefits of employing unguided media at a LAN's access level:

Adaptability and Mobility:

Unguided media offers device placement flexibility, particularly when it comes to wireless technologies like Wi-Fi. Users are encouraged to move about the local area network (LAN) by being able to connect to it from anywhere in the coverage region.

Installation Ease:

In general, installing guided media (wired solutions) is more complicated than installing unguided media. There is no need to lay cables, which saves money and time during installation.

Scalability

Wireless solutions don't require physically extending connections in order to expand to accommodate more devices. This facilitates the addition of new devices and network expansion.

Lower Infrastructure Expenses:

The cost of materials and installation is decreased when physical wires and related infrastructure are not required. This is especially useful in settings where wired solutions can be too costly or problematic.

Rapid Implementation:

Network connectivity can be quickly deployed using unguided media. Extensive cabling is not necessary for connecting devices to the network, which makes it appropriate for short-term deployments or scenarios requiring quick deployment.

Flexibility in Changing Circumstances:

Unguided media works best in settings where the physical arrangement is flexible. It can be readily adjusted to changes in the workspace without requiring rewiring.

06) Principal Benefits of Satellite-Based Communication

Worldwide Coverage: Satellite communication offers connectivity in far-flung and difficult-to-reach places where other forms of communication infrastructure would not be feasible.

Scalability: Satellites are a scalable option for mass communication demands since they can service a huge number of people at once.

Satellite communication systems are well-suited for emergency scenarios, disaster recovery plans, and short-term connectivity requirements due to their rapid deployment capabilities.

Ubiquitous Connectivity: Satellite communication is crucial for maritime, aviation, and distant land-based applications because it allows connectivity in places with inadequate terrestrial infrastructure.

Transmission and Multicast Functionality:

Why Sri Lankans Do Not Frequently Use Satellite Communication to Access the Internet:

Cost: The establishment and upkeep of satellite communication infrastructure is associated with substantial charges, encompassing the launch of satellites, the deployment of ground stations, and continuous operations costs. The affordability of alternative terrestrial options may detract from the appeal of satellite communication for nations such as Sri Lanka.

Latency: The time it takes for signals to travel to and from satellites in orbit causes latency in satellite communication. Although there are some applications where this latency is acceptable, real-time applications such as online gaming and video conferencing may suffer from it.

Evolution of Technology:

Developments in fiber-optic networks and other terrestrial communication technologies have made high-speed, low-latency options available. The necessity for satellite communication for internet connectivity has decreased as a result of the increasing popularity and affordability of these technologies.

Restricted Bandwidth: In areas where user demand is high, satellite communication systems may have bandwidth constraints that could result in congestion and lower data transfer speeds.

Weather Interference: Unfavorable weather, like intense rain or storms, can interfere with satellite communication signals and cause service interruptions.

Regulatory Difficulties: The deployment of satellite communication systems necessitates regulatory permissions and coordination with international authorities. The implementation of satellite solutions may be complicated and delayed by these procedures.

07) 1. Bluetooth (BT) data rates:

Data Rates: Bluetooth technology may support a range of data rates; the most recent iterations, such as Bluetooth 5.2, can reach many megabits per second. The Bluetooth version and the particular profiles being used determine the precise data rate.

Data rates for infrared (IR) communication are often lower than those for Bluetooth. Data rates for infrared communication, like those of IrDA (Infrared Data Association), can reach up to 16 Mbps.

2. Modes of Communication:

Bluetooth (BT): Various Communication Modes: Bluetooth facilitates point-to-point, point-to-multipoint, and mesh networking communication. It enables adaptable setups ideal for integrating various kinds of gadgets.

Communication Modes for Infrared (IR): Point-to-point and short-range point-to-multipoint setups are common uses for IR communication. In situations where direct line-of-sight communication is feasible, it is frequently observed.

3. Easy to use: Bluetooth (BT):

Ease: Connectivity-wise, Bluetooth technology is renowned for being straightforward. Bluetooth technology facilitates effortless pairing between devices and is engineered to provide user-friendly interaction. Many Bluetooth devices include an easy-to-use pairing procedure.

infrared (IR): Simplicity: Using infrared communication is easy and uncomplicated. For infrared devices to communicate, there usually has to be a direct line of sight. Direct line-of-sight communication's simplicity is a benefit, but there are times when it might be a drawback.

In brief:

Data Rates: Applications needing faster data transfer are better suited for Bluetooth since it often delivers higher data rates than Infrared.

Communication Modes: With support for several topologies and setups, Bluetooth offers more flexible communication options. Simpler point-to-point or short-range point-to-multipoint configurations frequently employ infrared technology.

08) Fibre-Optic Wire:

Reasoning

Elevated Bandwidth:

Due to their high capacity, fiber-optic cables can handle a university network's high volume of data traffic. Supporting a wide range of applications, virtual learning environments, and multimedia material requires this.

Minimal Latency:

The low latency of fiber-optic cables ensures that data transfer is delayed as little as possible. Real-time apps, video conferences, and interactive online courses all require this.

Extended-range Communication:

Long-distance data transmission without signal deterioration is possible using fiber-optic cables. Connecting various buildings and lecture halls throughout the university campus is made easier with this.

Fiber-optic cables possess the ability to withstand both electromagnetic and radiofrequency interference, ensuring reliability and signal integrity. This improves communication's dependability and signal integrity, particularly in settings with electrical devices and equipment.

Scalability: The network can be expanded to handle future increases in the number of users, devices, and applications thanks to the great scalability of fiber-optic infrastructure.

Security: Because it is more difficult to tap into or intercept transmitted signals, fiber-optic communication is more secure than traditional copper lines. In an academic setting, this is essential for protecting the confidentiality and integrity of sensitive data.

Future-Proofing: Since fiber-optic infrastructure can withstand growing bandwidth demands and developing technologies in the long run, it is a method for future-proofing.

Centralized Internet Service Provider Connection: Fiber-optic cables offer a reliable, fast connection to the ISP, guaranteeing that the external internet connection is strong and able to manage the volume of internet traffic generated by the university.