Assignment 1:

Draw your Home Network Topology and explain how you are accessing the RPS Lab environment.

**Home Network Topology**:

* **Components**:
  + **ISP Modem**: This is the device provided by your Internet Service Provider (ISP) that connects your home network to the Internet.
  + **Router**: The router acts as the central hub of your home network, managing connections between devices and providing access to the Internet. It may include built-in Wi-Fi capabilities and multiple Ethernet ports.
  + **Switch**: A switch can be used to expand the number of Ethernet ports available for wired connections within your home network.
  + **Access Point (AP)**: The access point provides wireless connectivity for devices that support Wi-Fi, extending the coverage of your home network.
  + **Devices**: Various devices connect to your home network, including computers, smartphones, tablets, smart TVs, printers, and smart home devices.
* **Topology**:
  + The home network typically follows a star topology, with all devices connected to the central router.
  + Devices may connect to the router via wired Ethernet connections (using Ethernet cables) or wirelessly through the access point (using Wi-Fi).

  Diagram:

[ISP Modem]

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[Router]

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[Switch] [Access Point]

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[Devices Wired] [Devices Wireless]

1. **Bus Topology**:
   * In a bus topology, all devices are connected to a single central cable, called the bus or backbone.
   * Devices communicate with each other by sending data along the bus.
   * Advantages: Simple and inexpensive to set up, suitable for small networks with few devices.
   * Disadvantages: Susceptible to cable failures, network slowdowns if multiple devices attempt to transmit simultaneously, difficult to troubleshoot.
2. **Ring Topology**:
   * In a ring topology, each device is connected to exactly two other devices, forming a closed loop or ring.
   * Data travels around the ring in one direction, passing through each device until it reaches its destination.
   * Advantages: Simple and easy to install, efficient data transmission with minimal collisions.
   * Disadvantages: Vulnerable to cable or device failures, a single point of failure can disrupt the entire network, difficult to add or remove devices without disrupting the network.
3. **Mesh Topology**:
   * In a mesh topology, each device is connected to every other device in the network, forming a fully interconnected mesh.
   * Data can travel along multiple paths, increasing reliability and fault tolerance.
   * Advantages: High redundancy and fault tolerance, efficient data transmission, scalable and flexible.
   * Disadvantages: Expensive and complex to set up, requires a large number of cables and ports, difficult to manage and troubleshoot.
4. **Star Topology**:
   * In a star topology, all devices are connected to a central hub or switch, forming a star-like configuration.
   * Data travels through the central hub, which manages communication between devices.
   * Advantages: Simple and easy to set up, centralized management, easy to add or remove devices without disrupting the network.
   * Disadvantages: Dependency on the central hub, if the hub fails, the entire network may become inaccessible, limited scalability.
5. **Hybrid Topology**:
   * A hybrid topology combines two or more different network topologies, such as a combination of star and mesh or star and ring.
   * Hybrid topologies are often used to leverage the strengths of multiple topologies and address specific network requirements.
   * Advantages: Provides flexibility and customization, allows for optimization of network performance and reliability.
   * Disadvantages: Increased complexity, may require additional hardware and management overhead.
6. **Accessing the RPS Lab Environment**:
   * **Remote Access**: If the RPS lab environment is hosted remotely, you can access it from your home network using remote access technologies such as Virtual Private Network (VPN) or Remote Desktop Protocol (RDP).
   * **VPN**: You can set up a VPN connection from your home network to the RPS lab environment, which allows you to securely access lab resources as if you were physically connected to the lab network.
   * **RDP**: Alternatively, if the lab environment provides a Windows-based interface, you can use Remote Desktop Protocol (RDP) to connect to a remote Windows server or workstation within the lab environment and interact with lab resources remotely.
   * **Configuration**: To set up remote access, you may need to configure your home network router to allow VPN passthrough or port forwarding, depending on the specific requirements of the remote lab environment.
   * **Security**: Ensure that you follow best practices for securing your remote access connections, such as using strong encryption, implementing multi-factor authentication, and keeping your VPN and RDP clients up to date with security patches.

Assignment 2:

Identify a real-world application for both parallel computing and networked systems. Explain how these technologies are used and why they are important in that context

1. **Parallel Computing: Genomic Sequencing**
   * **Application**: Genomic sequencing involves analysing and decoding the DNA sequence of organisms to understand genetic variations, identify disease-causing mutations, and develop personalized medicine treatments.
   * **How Parallel Computing is Used**: Genomic sequencing generates massive amounts of data, often consisting of billions of base pairs for each individual genome. Parallel computing techniques, such as parallel algorithms and high-performance computing (HPC) clusters, are used to accelerate the processing and analysis of genomic data.
   * **Importance**: Parallel computing enables researchers and healthcare professionals to analyse large genomic datasets more efficiently and accurately. By leveraging parallel processing capabilities, genomic sequencing workflows can be significantly accelerated, leading to faster diagnoses, more targeted treatments, and advancements in genomics research.
2. **Networked Systems: Smart Grids**
   * **Application**: Smart grids are modernized electrical grids that use networked systems and advanced technologies to optimize the generation, distribution, and consumption of electricity.
   * **How Networked Systems are Used**: Smart grids rely on networked systems, including sensors, meters, communication networks, and control systems, to collect real-time data on electricity supply and demand, monitor grid performance, and control grid operations remotely. These networked systems enable utilities to improve grid reliability, reduce energy waste, integrate renewable energy sources, and support demand response programs.
   * **Importance**: Networked systems play a crucial role in modernizing traditional electrical grids and transforming them into smart grids. By leveraging real-time data and communication technologies, smart grids can enhance grid resilience, optimize energy efficiency, reduce greenhouse gas emissions, and support the transition to a more sustainable and decentralized energy infrastructure.