**LAB 1**

**TASK 1: Differences Between Routers in Cisco Packet Tracer and When to Use Them**

1. **Cisco 819 H1G Router**
   * **Purpose**: A compact IoT/M2M router with integrated 3G/4G support.
   * **Key Features**: Supports IOx for edge computing, cellular (3G/4G LTE) connectivity, and has a rugged design.
   * **Use Case**: Best for mobile, transportation, or remote industrial deployments requiring cellular connectivity.
2. **PT-Router (Packet Tracer Router)**
   * **Purpose**: A generic, customizable router used for simulation within Packet Tracer.
   * **Key Features**: Configurable with different modules and interfaces for network simulations.
   * **Use Case**: Primarily for learning and practicing routing concepts in Cisco Packet Tracer.
3. **PT-Empty 2901**
   * **Purpose**: An empty router chassis that allows manual insertion of modules like Ethernet and Serial interfaces.
   * **Key Features**: Flexible, allowing users to simulate different network configurations.
   * **Use Case**: Ideal for educational purposes, enabling hardware customization in simulations.
4. **Cisco 1841 Router**
   * **Purpose**: An entry-level router for small branch offices.
   * **Key Features**: Provides WAN and LAN connectivity, along with basic security features like VPN and firewall.
   * **Use Case**: Suited for small businesses or branch offices that require basic routing and security.
5. **Cisco 1941 Router**
   * **Purpose**: An Integrated Services Router (ISR) designed for small-to-medium business networks.
   * **Key Features**: Modular with improved security (VPN, firewall) and performance compared to the 1841.
   * **Use Case**: Ideal for small branches needing more versatile and secure routing solutions.
6. **Cisco 2620XM & 2621XM Routers**
   * **Purpose**: Multi-service routers for small and branch offices.
   * **Key Features**: Modular slots for adding interfaces, supporting limited security and voice services.
   * **Differences**: The 2620XM has one Ethernet port, while the 2621XM offers two.
   * **Use Case**: Suitable for small branches with basic connectivity needs.
7. **Cisco 2811 Router**
   * **Purpose**: A member of the Cisco 2800 series ISR, offering improved performance and service options.
   * **Key Features**: Modular, supporting voice, security, and wireless services.
   * **Use Case**: Appropriate for small-to-medium-sized offices requiring advanced services like VoIP and VPN.
8. **Cisco 2911 Router**
   * **Purpose**: A mid-range ISR for small-to-medium-sized offices.
   * **Key Features**: Supports integrated voice, data, video, security, and wireless services with better throughput than the 2811.
   * **Use Case**: Ideal for organizations needing comprehensive communication solutions in a single device.
9. **Cisco 819 Router**
   * **Purpose**: Similar to the Cisco 819 H1G, focused on IoT and M2M applications.
   * **Key Features**: Integrated 3G/4G connectivity, designed for remote sites and machine-to-machine communication.
   * **Use Case**: Deployed in IoT environments where cellular connectivity and edge computing are essential.
10. **Cisco 4331 ISR Router**
    * **Purpose**: A high-performance ISR router for large branch offices.
    * **Key Features**: Modular design, supports high-speed WAN connectivity, SD-WAN, and cloud services.
    * **Use Case**: Suitable for large branches needing fast WAN services and cloud integration.
11. **Cisco 4321 ISR Router**
    * **Purpose**: Similar to the Cisco 4331 but with slightly lower performance and scalability.
    * **Key Features**: Compact ISR for medium-to-large branch offices, offering modularity.
    * **Use Case**: Ideal for branches needing solid performance and room for future network expansion.
12. **Cisco 4221 ISR Router**
    * **Purpose**: Entry-level model in the Cisco ISR 4000 series.
    * **Key Features**: Compact design, supporting advanced services like SD-WAN and cloud connectivity.
    * **Use Case**: Small branch offices needing advanced services with moderate performance levels.

**TASK 2: Differences Between Switches in Cisco Packet Tracer and When to Use Them**

1. **Cisco 2960 Switch**
   * **Type**: Layer 2 switch.
   * **Key Features**: Supports VLANs, STP (Spanning Tree Protocol), basic QoS, and port security.
   * **Use Case**: Suitable for small to medium-sized networks needing basic LAN segmentation and security without routing.
2. **Cisco 2950 Switch**
   * **Type**: Layer 2 switch.
   * **Key Features**: Offers basic VLAN support, STP, and minimal port security but lacks advanced features.
   * **Use Case**: Used in small networks or for educational purposes when advanced Layer 2 features are not necessary.
3. **Cisco 3560 Switch**
   * **Type**: Layer 3 switch (Multi-layer).
   * **Key Features**: Provides Layer 2 switching and Layer 3 routing capabilities with support for routing protocols, QoS, and advanced security.
   * **Use Case**: Best for medium to large networks requiring routing between VLANs or subnets, commonly used in enterprise or campus environments.
4. **Cisco 3650 Switch**
   * **Type**: Layer 3 switch (Multi-layer).
   * **Key Features**: Advanced Layer 3 functions, including routing protocols (OSPF, EIGRP, BGP), inter-VLAN routing, and PoE (Power over Ethernet).
   * **Use Case**: Ideal for larger networks where high-performance routing, switching, and PoE are needed, such as enterprise networks.
5. **PT-Switch**
   * **Type**: Layer 2 switch (Generic in Packet Tracer).
   * **Key Features**: Provides basic switch functionality, including VLANs and Layer 2 operations but lacks advanced features.
   * **Use Case**: Used for simple simulations or for beginners learning basic network concepts.
6. **PT-Empty Switch**
   * **Type**: Customizable switch chassis.
   * **Key Features**: Allows users to add and configure different modules and interfaces.
   * **Use Case**: Ideal for simulating custom-built switches in situations requiring specific hardware configurations.
7. **Cisco IE 2000 Switch**
   * **Type**: Industrial Ethernet switch (Layer 2).
   * **Key Features**: Designed for harsh environments, supports VLANs, STP, and advanced security features.
   * **Use Case**: Best for industrial, transportation, or energy networks requiring rugged, reliable connectivity.
8. **Cisco 2950T Switch**
   * **Type**: Layer 2 switch (with gigabit uplink).
   * **Key Features**: Similar to the Cisco 2950 but includes gigabit Ethernet uplinks for faster backbone connectivity.
   * **Use Case**: Suitable for small networks needing basic VLANs with high-speed uplinks to the core network or backbone.
9. **PT Bridge**
   * **Type**: Basic bridge device (Layer 2).
   * **Key Features**: Simple device for connecting different network segments, lacks VLAN support or advanced switching.
   * **Use Case**: Used in basic simulations for connecting small network segments, though switches offer more functionality.

**TASK 3: Differences Between Connection Wires in Cisco Packet Tracer and When to Use Them**

1. **Console Cable**
   * **Use**: Connects a computer (PC or laptop) to a router or switch for configuration via CLI.
   * **Purpose**: Used primarily for device management and initial configuration through the console port.
2. **Straight-Through Cable**
   * **Use**: Connects different types of devices (e.g., PC to switch, switch to router).
   * **Purpose**: Common for connecting end devices to networking equipment.
3. **Copper Crossover Cable**
   * **Use**: Connects similar devices (e.g., PC to PC, switch to switch, router to router).
   * **Purpose**: Used when connecting two devices of the same type directly without the need for a switch.
4. **Fiber Cable**
   * **Use**: Connects devices over long distances, usually in WAN environments or network backbones.
   * **Purpose**: Provides high-speed, long-distance communication between devices like switches or routers.
5. **Phone Cable**
   * **Use**: Connects VoIP phones to switches or voice-enabled routers.
   * **Purpose**: Specifically for voice communication in VoIP networks.
6. **Coaxial Cable**
   * **Use**: Typically used in WAN emulation, especially when simulating older broadband technologies.
   * **Purpose**: Provides a physical medium for cable-based WAN connections or legacy systems.
7. **Serial DCE Cable**
   * **Use**: Connects routers via serial interfaces in WAN setups, where one device provides clocking signals.
   * **Purpose**: Needed in simulations where one router controls the clock rate in point-to-point WAN connections.
8. **Serial DTE Cable**
   * **Use**: Connects routers via serial interfaces in WAN setups, where no clocking rate is required.
   * **Purpose**: Used in WAN links where the receiving device (DTE) does not control the clocking.