**QUESTION : WHAT IS WIFI INTERNET CONNECTIVITY BACKHAUL , TYPES**

**BACKHAUL :**

1. Wi-Fi backhaul refers to the network infrastructure that connects Access Points (APs), mesh nodes, or wireless extenders to the main wired network (core network) or to each other.
2. It ensures efficient data transfer between local wireless clients and the broader internet.
3. Ensures high-speed data transfer between APs or mesh nodes.
4. Reduces latency in multi-AP or mesh networks.
5. Helps distribute network load across multiple access points.
6. Improves network coverage by interconnecting remote Wi-Fi nodes.
7. There are two types of backhaul – wired and wireless backhaul.
8. In wired backhaul, access points or routers are connected using physical cables such as Ethernet, fiber optics, or coaxial cables. This provides high reliability and low latency.

* Ethernet backhaul ensures following:

1. Uses CAT5e, CAT6, or CAT7 cables for communication.
2. Provides speeds up to 10 Gbps.
3. It supports PoE (Power over Ethernet) to power APs over a single cable.
4. It is extremely reliable and interference-free.
5. It supports high-bandwidth applications (4K streaming, gaming).
6. It provides consistent performance over long distances (up to 100m per segment).
7. It requires physical cabling, which may be difficult in existing buildings.
8. It requires high installation cost.

* Fibre backhaul ensures the following:

1. Uses single-mode or multi-mode fiber to connect APs.
2. Offers speeds of 1 Gbps to 100 Gbps.
3. Used in large-scale deployments like smart cities, enterprise networks.
4. Immune to electromagnetic interference (EMI).
5. Expensive infrastructure and installation.

* Co-axial Backhaul ensures the following:

1. Uses existing coaxial TV cables to provide wired backhaul.
2. Can deliver speeds up to 2.5 Gbps.
3. Suitable for home networks where Ethernet isn’t available.
4. Uses existing infrastructure (coaxial cables).
5. It offers high-speed and low latency.
6. Requires MoCA adapters for conversion.
7. Not ideal for enterprise environments.

* Power line backhaul ensures the following:

1. Uses electrical wiring to transmit network data.
2. Can provide speeds up to 2 Gbps.
3. No need for extra cables (uses existing power lines).
4. Works well in older buildings.
5. Performance depends on electrical wiring quality.
6. Susceptible to electrical noise and interference.
7. Wireless backhaul eliminates physical cables and connects APs or mesh nodes using wireless links.

* Wifi backhaul ensures the following:
  1. Uses Wi-Fi radios (2.4 GHz, 5 GHz, or 6 GHz) for backhaul communication.
  2. Used in Wi-Fi mesh networks, range extenders, wireless bridges.
  3. No cabling required, easy to deploy.
  4. Performance depends on interference and congestion.
  5. Bandwidth is shared between backhaul and client devices.
* mmWave backhaul ensures the following:

1. Uses millimeter-wave (mmWave) frequencies.
2. Supports speeds up to 10 Gbps.
3. Used in high-speed outdoor short range wireless backhaul.
4. Extremely high speed with low interference.
5. Ideal for urban and short-range (1 km) deployments.
6. Highly susceptible to obstruction (walls, rain, trees).
7. Requires line-of-sight (LOS).

* Cellular backhaul ensures the following:

1. Uses LTE or 5G links to connect APs to the internet.
2. Common in mobile hotspots and temporary Wi-Fi setups.
3. Works where wired backhaul is unavailable.
4. Can provide gigabit speeds (5G).
5. Higher latency than wired backhaul.
6. Common wifi internet backhaul deployment cases are as follows:
   1. Wi-Fi Mesh Networks : Uses wireless backhaul to interconnect mesh nodes.
   2. Enterprise APs (802.11r, 802.11k, 802.11v) : Use Ethernet backhaul.
   3. Outdoor Wi-Fi Hotspots : Uses microwave/mmWave backhaul.
   4. Rural Broadband : Uses cellular backhaul (4G/5G).
7. Considering ARUBA – 530 Series Indoor Access Point for example; properties of it are listed below:
   1. Up to 2.97 Gbps combined peak data rate
   2. WPA3 and Enhanced Open security
   3. OFDMA and MU-MIMO for enhanced multiuser efficiency
   4. four spatial streams (4SS) and 160 MHz channel bandwidth
   5. Target Wake Time (TWT) establishes a schedule when clients device need to communicate with an AP.
   6. Optimized use of available radio frequency (RF) spectrum
   7. AP type: Indoor, dual radio, 5G Hz and 2.4 GHz 802.11ax 4x4 MIMO
   8. Support for up to 1024 associated client devices per radio, and up to 16 BSSIDs per radio
   9. 802.11b: Direct-sequence spread spectrum (DSSS)
   10. 802.11a/g/n/ac: Orthogonal frequency-division multiplexing (OFDM)
   11. 802.11ax: OFDMA with up to 37 resource units (for an 80 MHz channel)
   12. E0, E1: HPE SmartRate port (RJ-45, maximum negotiated speed 5 Gbps) – BACKHAUL TECHNOLOGY FOLLOWED