List down the Wi-Fi topologies and use cases of each one.

Wi-Fi networks can be structured in different topologies based on their purpose, range, and device interconnections. Below is a detailed breakdown of each topology and its use cases.

Infrastructure Mode (Basic Service Set - BSS)

- The most common Wi-Fi topology where all devices (clients) connect to a central **Access Point (AP)** or router.
- The AP manages the communication between devices and routes traffic to external networks (like the internet).
- Each AP covers a limited area called a **Basic Service Area (BSA)**.

Use Cases:

Home Networks – Used in households where devices like laptops, smartphones, and smart TVs connect to a Wi-Fi router.
Office Networks – Used in workplaces where employees access the internet and company resources through a managed AP.
Public Hotspots – Found in cafes, malls, airports, and hotels where users connect via a centralized access point.

2. Extended Service Set (ESS)

- An extended version of the Basic Service Set, where multiple access points (APs) are interconnected via a wired network to provide wider coverage.
- APs are strategically placed to offer **seamless roaming**, ensuring users remain connected as they move across different areas.

Use Cases:

University & Corporate Campuses – Used to provide uniform Wi-Fi coverage across multiple buildings.
Hospitals – Ensures medical staff and equipment remain connected across floors and departments.

Hotels & Large Buildings – Offers seamless connectivity for guests moving within the premises.

3. Ad-Hoc Mode (Independent Basic Service Set - IBSS)

- A decentralized network where devices communicate **directly** with each other **without** an access point.
- Each device acts as a **peer**, creating an **on-demand** network for temporary connectivity.

Use Cases:

File Sharing – Used in scenarios where two or more devices need to exchange files without internet access.
Gaming Networks – Some multiplayer games use ad-hoc mode for local wireless gaming.
Emergency Communication – Can be set up in disaster-struck areas for quick communication between rescue teams.

4. Mesh Wi-Fi Network

- A self-healing and decentralized network where multiple **interconnected nodes (APs)** work together to provide **wider and stronger** Wi-Fi coverage.
- Each node relays data dynamically, ensuring the best possible connection path.

Use Cases:

Smart Cities – Used to provide public Wi-Fi coverage across large areas.
Large Homes – Eliminates dead zones by distributing connectivity across multiple rooms.
Industrial & Enterprise Networks – Ensures stable connections in factories, warehouses, and offices with complex layouts.

5. Wi-Fi Direct

- A peer-to-peer (P2P) connection method allowing two devices to communicate **without requiring a traditional AP or router**.
- Works similarly to Bluetooth but with higher speed and range.

Use Cases:

Wireless Printing – Connects smartphones or laptops directly to printers without needing a network.
File Transfers – Used for fast wireless file sharing between phones and laptops (e.g., Android's Wi-Fi Direct).
IoT & Smart Devices – Enables smart home gadgets to connect directly for control and communication.

6. Point-to-Point (PtP) Wi-Fi

- A dedicated wireless link between two locations, usually **over long distances**, to transmit high-speed data.
- Uses directional antennas for a focused and reliable connection.

Use Cases:

Building-to-Building Connectivity – Used by businesses to link offices without physical cables.
Surveillance Systems – Connects security cameras to monitoring stations.
Rural Broadband – Helps ISPs provide internet to remote areas without fiber deployment.

7. Point-to-Multipoint (PtMP) Wi-Fi

- A **single central AP** distributes wireless connectivity to multiple endpoints (clients or locations).
- Used for **wide-area coverage**, especially in outdoor or large-scale networks.

Use Cases:

ISP Wireless Distribution – Used by internet providers to distribute broadband in cities and rural areas.

Enterprise & Campus Networks – Links multiple branch offices to a single main office.

Public Wi-Fi Deployment – Provides internet in parks, stadiums, and urban areas.