UBBA Broadband FAQ

- **What is Broadband?**
  - The term Broadband commonly refers to high-speed Internet access that is always on and faster than older dial-up access. Broadband includes several transmission technologies such as:
    - Wireless (Fixed or Mobile)
    - Cable Modem
    - Fiber
    - Satellite
    - Broadband over Powerlines (BPL)
    - Digital Subscriber Line (DSL)
  - The broadband technology chosen will depend on factors including location (urban or rural area), price, availability, use cases. Under the current FCC policy, created in 2015, 25 Mbps down/3 Mbps up is the minimum standard for Broadband in the US.

- **What is LTE and Private LTE?**
  - Public LTE: LTE stands for Long Term Evolution and is sometimes referred to as 4G LTE. It was the last step toward the 4th generation of radio technologies designed to increase the capacity and speed of mobile telephone networks. LTE introduced a number of new technologies (OFDM (Orthogonal Frequency Division Multiplex), MIMO (Multiple Input Multiple Output) and SAE (System Architecture Evolution)) enabling LTE to operate more efficiently in the use of spectrum and to provide higher data rates.
  - Private LTE network: is a dedicated LTE network that serves a specific enterprise business, government agency or educational outfit, who can own and operate the system or who may instead outsource to a commercial mobile operator or third-party network provider. The system is entirely separate from public commercial networks. Private LTE enables an organization to have the benefits of LTE without losing so much control. Outsourcing removes the need for total ownership or assuming full responsibility for operating the system.

- **What are the benefits of private LTE network?**

  Private LTE networks rely on the same technology as public LTE networks but offer several advantages. One key benefit is that they fill in the gaps when public networks just don't cut it. For example, when public networks aren't available due to coverage limitations, don't work well due to capacity issues, or are not secure enough for the application.

  Other benefits include:

  - **They're private:** Customer data never leaves private LTE networks, a critical advantage for highly regulated industries like finance, healthcare, and transportation.
  - **They're secure:** With SIM security, an organization's IT administrators can strictly control device access to ensure private LTE networks stay safe and secure.

- **They're flexible:** Each organization has unique application needs, and private LTE networks are flexible enough to allow customization.
- **They're high capacity:** Public LTE networks use a dedicated or shared spectrum and are tailored to put users in control of their infrastructure density.
- **They offer better QoS:** Quality of service, or QoS, is better with LTE technology because customers have control over how they prioritize data traffic end-to-end, enabling them to keep mission-critical applications up and running.
- **They have deterministic latency:** With private LTE networks, users can set a fixed time for data transfer. This is especially important in factory settings where tight synchronization for devices is critical.
- **They're resilient:** If an enterprise customer needs better resiliency or uptime, private LTE networks offer the ability to deploy additional cells. Plus, they can also allow fallback to public LTE on the same cellular device if needed.
- **They offer better coverage:** Forget connection loss. With private LTE networks, the handover between private LTE cells is seamless and error-free. Plus, they can reach through building walls and other obstacles that might block a Wi-Fi signal.
  They cost less: While individual cells cost more than enterprise-grade Wi-Fi access points, organizations need less of them to provide the same level of coverage. Not only that, but the cost of cables, power, and maintenance is less than public networks.

- **What is Spectrum?**
  - Radio Spectrum refers to the airwaves around the world used for wireless data transmission, it ranges from the single kilohertz (kHz) level all the way up to hundreds of gigahertz (GHz).

- **What are the main differences between Licensed and Unlicensed Spectrum?**
  - In the US, spectrum is carved into hundreds of thousands of licenses divided into hundreds of licensed and unlicensed bands with defined use cases. The FCC oversees spectrum allocation, use case definitions, licensing, and auctions.
  - Unlicensed Spectrum: In spectrum that is designated as unlicensed or license-exempt, any user can operate in the band without a government-issued license. They must, however, use certified radio equipment and comply with technical requirements, including transmission power limits. This is to minimize interference; yet, because users do not have exclusive access to the spectrum, as usage increases, the likelihood of interference grows. Range limits and higher latency may also result. Unlicensed bands commonly used by utilities are typically in what are known as the industrial, scientific, and medical (ISM) bands. These include the 902 MHz-928 MHz band, the 2.4 GHz band, and the 5.8 GHz band.

  - Licensed Spectrum: Licensed spectrum allows for exclusive use of frequencies or channels in specific locations. They generally offer higher transmit power (which also means fewer nodes and lower infrastructure costs) and better signal-to-noise ratios. In the US, the rights to use commercial spectrum have generally been auctioned and licensed by geographic area, such as Economic Areas (EAs) or

Cellular Market Areas (CMAs), among others. They may be vast—there are only six Economic Area Groupings (EAGs) nationwide in the US. Or they may be made up of only a few counties (e.g., there are more than 700 CMAs in the US). These areas may also be further divided into smaller licenses by dividing the band into narrower spectrum slices (disaggregating) or dividing the geographic area into smaller regions (partitioning; e.g., into a single county or an even smaller area). Licensed spectrum bands (or partitioned or disaggregated portions of the license) may be bought and sold or leased. Approval by the FCC is needed for transfer or lease of a license, although there are streamlined procedures under certain circumstances.

- **How can a utility get Licensed Spectrum?**
    - There are two ways a utility may use licensed spectrum in its networking: it may acquire infrastructure and services from a vendor that owns the spectrum and leases it to the utility, or it may acquire its own licenses and equipment and deploy and operate independently. Many utilities do both, using different bands and technologies for different applications.

- **What is Spectrum Sharing?**
    - Spectrum sharing is the simultaneous usage of a specific RF band in a specific geographical area by several independent entities, leveraged through mechanisms other than traditional multiple- and random-access techniques. In addition to governmental regulatory bodies like the FCC, private companies such as Google, Intel, and Qualcomm are promoting shared spectrum standards. The bands being explored are typically underutilized, such as 150 MHz partially controlled by the US military at 3.5 GHz, also known as CBRS. Table 5-1 summarizes the characteristics of licensed, unlicensed, and shared CBRS spectrum.

- **What is Narrowband?**
    - Narrowband refers to telecommunications tools, technologies and services that utilize a narrower set or band of frequencies in the communication channel. These utilize the channel frequency that is considered flat or which will use a lesser number of frequency sets. The lower frequency bands used by narrowband systems propagate much further, due to physics. This reduces power requirements for the same distance or increases the range for the same power consumption.
    - Many applications, such as smart metering and oil/gas monitoring, have historically used narrowband communications for their increased range and reliability. With the growing demand for advanced surveillance and more data-heavy applications like video streaming, many industries are looking into the benefits of broadband technologies for those applications.

- **How is Private LTE different from Public Carrier LTE?**
    - Private LTE enables organizations to have a dedicated broadband network with flat-rate pricing, most often when Wi-Fi and public LTE don't provide the performance, cost-effectiveness, or security necessary for particular use cases

    - On-site micro towers and small cells mimic a standard public cellular network, but with less traffic congestion and greater security.

    - In large areas where organizations are dealing with significant amounts of data traffic, public LTE infrastructure isn't always available. Even if public LTE is available, per-bit pricing may be cost-prohibitive. Private LTE can be provisioned anywhere, with flat-rate pricing. Private LTE infrastructure also enables organizations to keep certain data on-site instead of sending all of it off site, and to prevent the performance fluctuations that can result from bandwidth competition on public LTE networks.

- **Why is low-latency important for utilities and how can it be achieved in Private LTE?**

    - The utility industry is undergoing a transformation as it modernizes to a more efficient and smarter grid. Networks will have to carry a wide variety of mission-critical data from substations, generation facilities, and other locations back to their control centers to ensure reliable energy delivery. Determinism and guaranteed performance are required by protection applications to keep the lights on.

    - Latency, or lag, is defined as the average time between the transmission of a packet of data and the reception of an acknowledgment. There are several mission critical applications that do not necessarily require very high data rate, but they do require low latency.

    - Lower latency refers to a minimal delay in the processing of computer data over a network connection. The lower the processing latency, the closer it approaches real-time. ... Any latency below 100 milliseconds (ms) is considered good, and below 50 ms is very good. Latest advances in 4G LTE have already reached latency times in the low 20ms range.

- **Why select Private LTE over Wi-Fi ?**

    - Private LTE is emerging as a solution to augment and, in some cases, replace Wi-Fi in enterprise networks. Private LTE is a standards-based LTE network scaled down to fit the needs of entities. These include large corporations, utility metering, smart cities, drones, transportation hubs, education campuses, stadiums and other venues.

    - Big organizations like private LTE networks because they offer a more secure, scalable and resilient solution compared to traditional Wi-Fi. Wi-Fi networks have come under hacking attempts and are vulnerable to intrusion threats more than cellular networks like LTE.

- A company who needs to customize their systems for mission-critical applications and optimize them for low latency with high-level security and separated from an otherwise public network, would choose private LTE. It is effectively a local cellular network that incorporates nonpublic cell sites that can support a company's specific requirements outside of what is generally supplied by mobile networks, all inside the corporate firewall. If they choose Wi-Fi for the same purpose, they cannot achieve the level of performance that LTE networks can offer from the perspective of security, reliability, coverage and latency.

- Furthermore, Wi-Fi cannot compete with private LTE networks that can support mobility, can enable point-to-point HD/UHD video, native voice support, remote operability, configurable quality of service (QoS) on a class of device basis, and enhanced security robustness in general.

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