"Smart Cities Need Wireless Too!"

March 21, 2022

Agenda

- Introduction
- Smart City is ?
- Smart City Wireless Technology Review
- Q&A
- Closing

What is a "Smart City"?

- "Smart City is one in which sensor-driven data collection and powerful analytics are used to automate and orchestrate a wide range of services in the interests of better performance, lower costs and lessened environmental impact"
  - www.techopedia.com/definition/31494/smart-city
- Connectivity – Wired and wireless
- Data – From connected devices
- Government – Local government involvement

➢ ***Should improve service delivery, efficiency, citizen safety and security***

Federal Engineering®

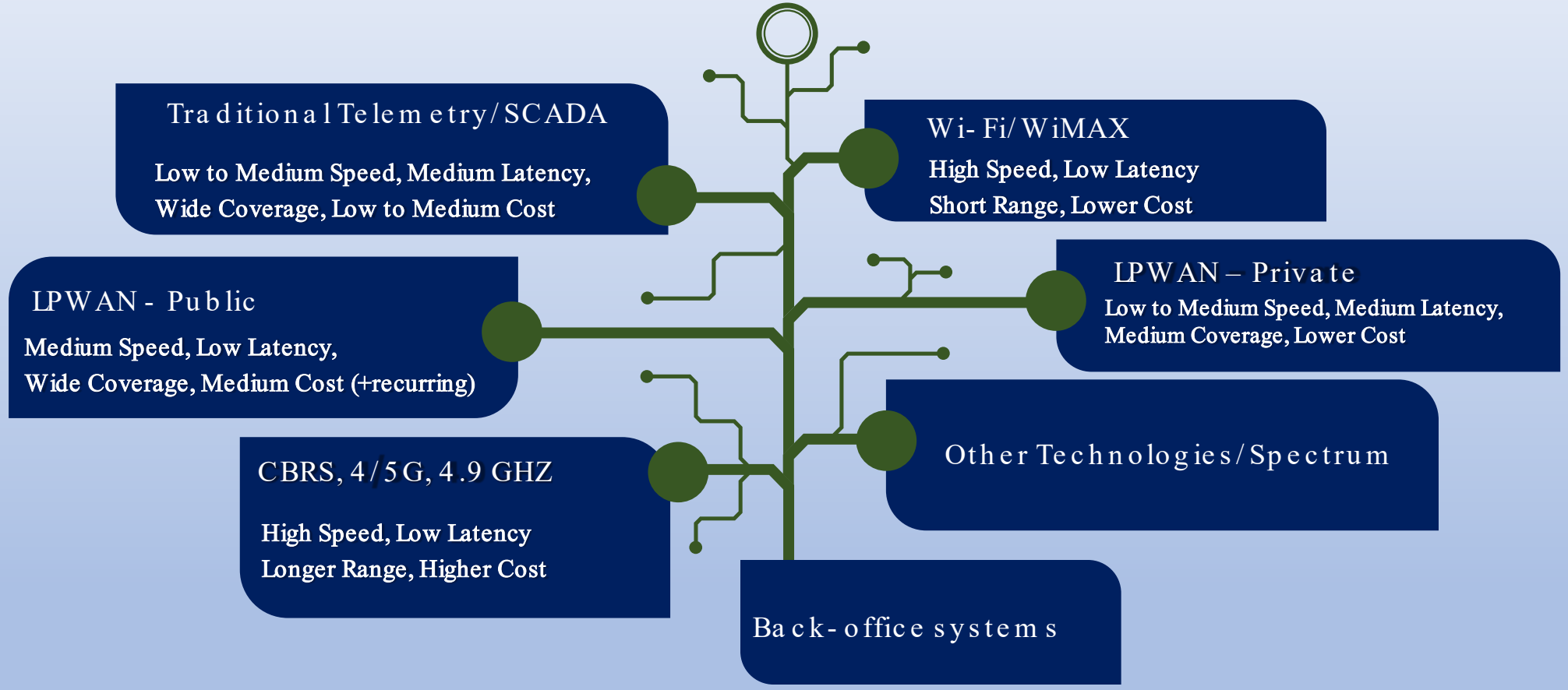
Smart City Connectivity

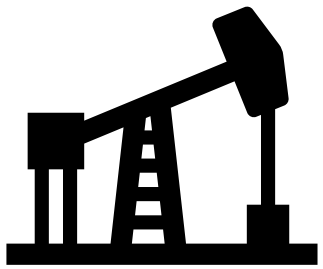
- Connectivity type is determined by the need, use case, cost,…
  - There is no single connectivity solution for EVERY use case
- Most common core connectivity is…..Fiber Optic
  - Ultra-broadband and low latency
  - Cost to deploy is high
  - Both backbone (ring) and spur (lateral) construction is needed
  - Not appropriate for all use cases
    - ❖Distance from backbone and laterals
    - ❖Service area density
    - ❖Bandwidth, latency, and resiliency requirements

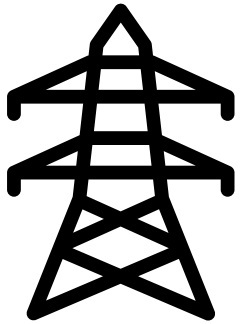
Federal Engineering®

Smart City Wireless

Choices, Choices, Choices







Legacy Wireless Data (Fixed)

- Supervisory Control and Data (SCADA) and Telemetry
  - Mainly used for utility metering and control
    - Electric, Gas, and Water metering
    - Lift station and load bank monitoring
    - Valve and electric switching controls
  - Primarily uses traditional land mobile radio spectrum
    - VHF, UHF, 800 and 900 MHz
    - Most operations occur on licensed spectrum
    - Unlicensed, spread spectrum also used
    - Low to medium speed data
    - High power devices and base stations
    - Wide area coverage

Wi-Fi: The building block

Most Smart City initiatives start with public Wi-Fi

- Bridge digital divides in the community
  - Schools, libraries, underserved neighborhoods
- Information access to citizens and tourists
- Remote access to City services

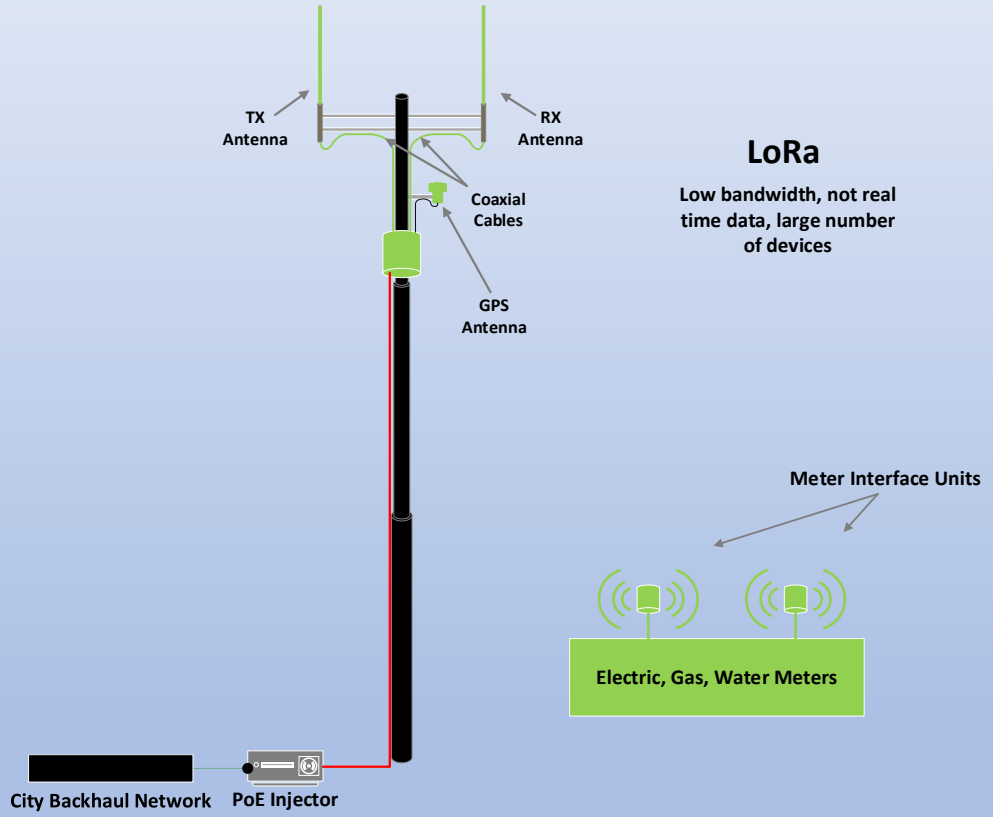
Backbone for Wi-Fi enables other “Smart” services

- Cameras for parking, parks, hi crime areas
- Dual purpose access points
  - Employee remote access to data
  - Multiple bands (2.4, 4.9, 5, 6 GHz)
  - Unlicensed wireless spectrum

Low Power Wide Area Networks (LPWAN)

- Wireless wide area network connecting low to medium speed, battery-powered devices over a wide area
- Lower cost devices with long battery life
- Includes multiple different technologies and spectrum
- In the U.S., primary technologies used are:
  - LoRa® and LoRaWAN®
  - LTE-M and Narrowband IoT
  - Wi-SUN®
  - Weightless SIG
  - Others…

LoRaWAN®



LoRa

Low bandwidth, not real time data, large number of devices

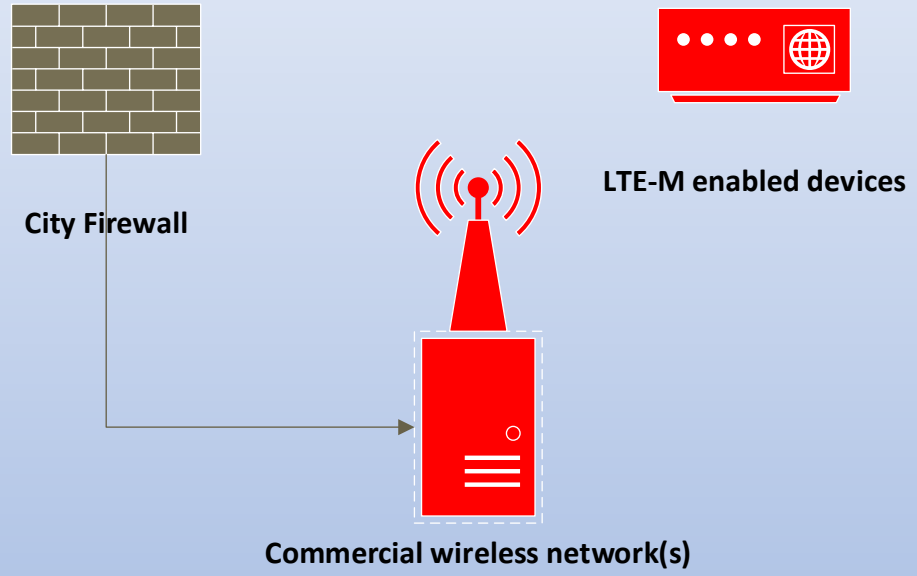
Low Power, Wide Area networking (LPWAN) protocol "…designed to wirelessly connect battery operated 'things'…" with "…bi-directional communication, end-to-end security, mobility and localization services.."

In the US, LoRa networks and devices are deployed in the unlicensed ISM spectrum (902-928 MHz)

Deployed both as client owned/operated and Network as a Service (NaaS) models

Federal Engineering®

LTE-M

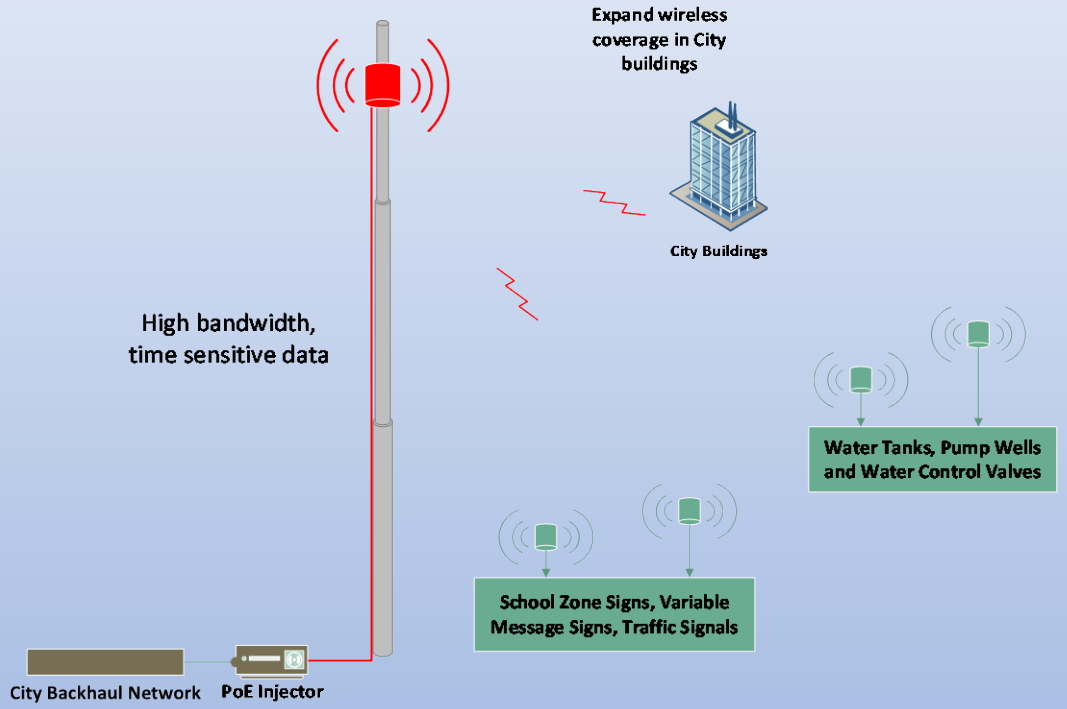


Long-Term Evolution (LTE) standard governed by the 3rd Generation Partnership Project (3GPP) standards organization

In the US, all the major commercial carriers have deployed LTE-M and there are multiple sources of LTE-M endpoints, modems and sensors.

Deployed in a Network as a Service (NaaS) model

CBRS/LTE

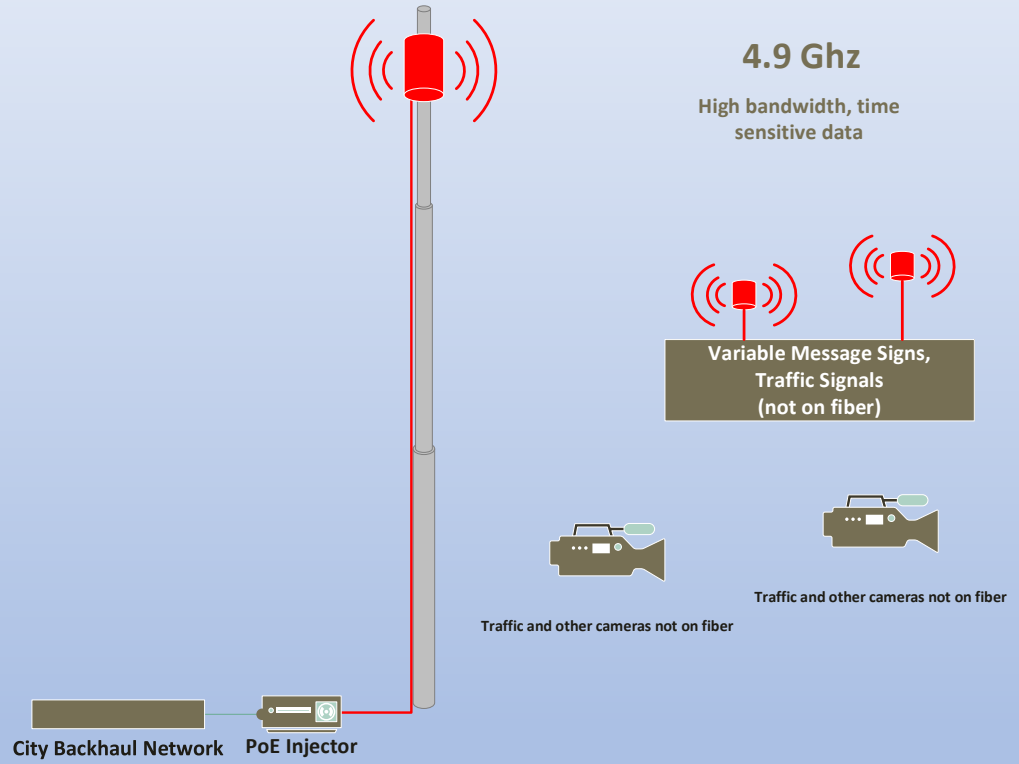


Can supplement current LTE networks and as an option to deploy private LTE networks

Shared commercial use spectrum in the 3550-3700 MHz band. Access and operations managed by automated frequency coordinator, AKA Spectrum Access System (SAS), per FCC

Deployed both as client owned/operated and Network as a Service (NaaS) models

4.9 GHz/802.XX



Most devices now using 802.XX type emissions

Fifty megahertz of licensable spectrum for fixed and mobile services designated for use in support of public safety

Deployed as client owned/operated model

Federal Engineering®

Alternate technologies/spectrum

700 MHz Block A

- Proprietary and LTE technologies
- Spectrum must be acquired
- Supports SCADA/telemetry, Mobile data (medium BW), PTP links

Anterix

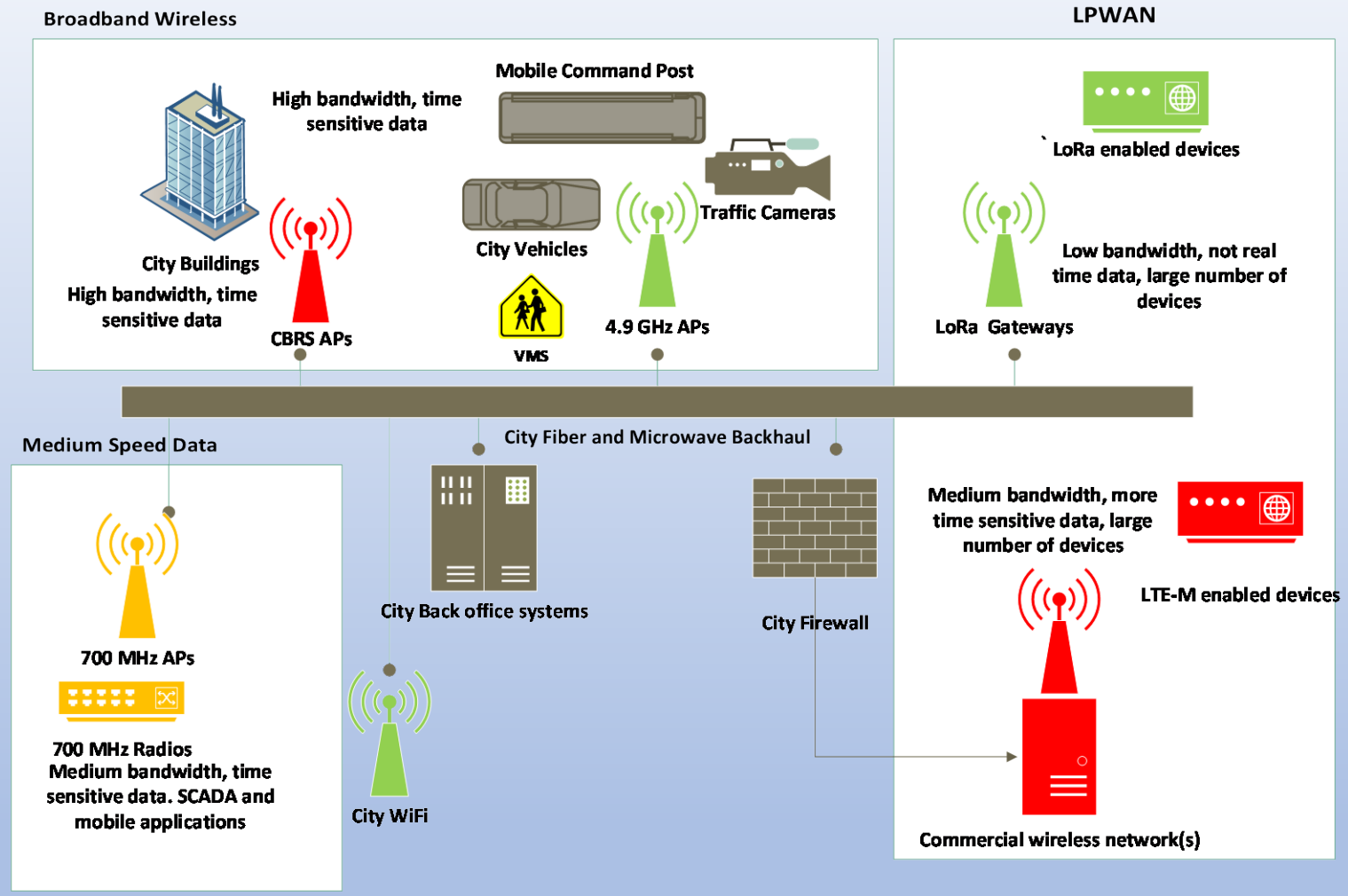
- Private LTE
- 900 MHz licensed nationwide spectrum
- Spectrum is leased

Both are most suitable for LTE-M/NB-IoT type deployments

Comparison

	Traditional Telemetry	LoRaWAN®	LTE-M	CBRS/LTE	4.9GHz/802.XX
Pros	Coverage, interference protection, licensed spectrum	Excellent battery life, low-cost end points, no spectrum costs	Good battery life, low-cost end points, wide area coverage, easy to deploy	Can be used for private LTE networks, high data speeds	Licensed, public safety spectrum, coverage, devices may also support other bands
Cons	Low data rates, proprietary technology	Unlicensed spectrum, potential noise/ inteference	Carrier solution, coverage holes possible, recurring costs	Shared spectrum	FCC may open use to other licensees
Use Cases	Point to Point (PtP, Point to Multipoint (PtMP)	PtP, PtMP	PtMP, mobility	PtP, PtMP, mobility	PtP, PtMP, mobility
Coverage	Wide area	Wide area	Wide area	Local area	Wide area
Data	<65 kbps	< 50kbps	≤ 1 Mbps	≤ 1 Gbps	≤ 1.3 Gbps

Smart City Wireless Conceptual Design



Q&A

Thank You!

Brad Barber

VP, Special Projects

Email: bbarber@fedeng.com

Phone: 850-377-7707