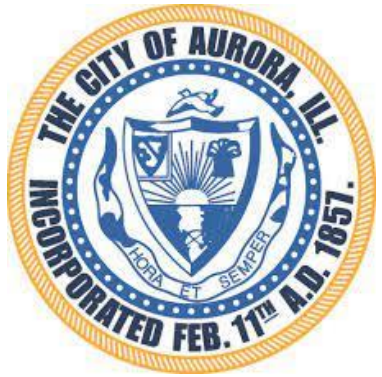
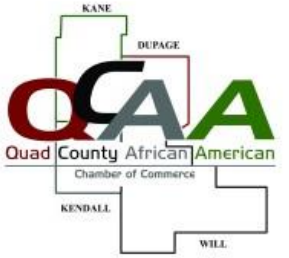

Connected City
Smart City



GraybaR

Thank You!!



NETWORK CONNEX

ALEF

CONNECTED CITIES

TOUR 2022

Smart Cities Council | Infrastructure Innovation Forum

www.infrastructureinnovationforum.com

www.densenetworks.com

2022

The Tour returns in 2022 with a focus on how Network Technology and the Cloud are enabling innovative new capabilities and services.

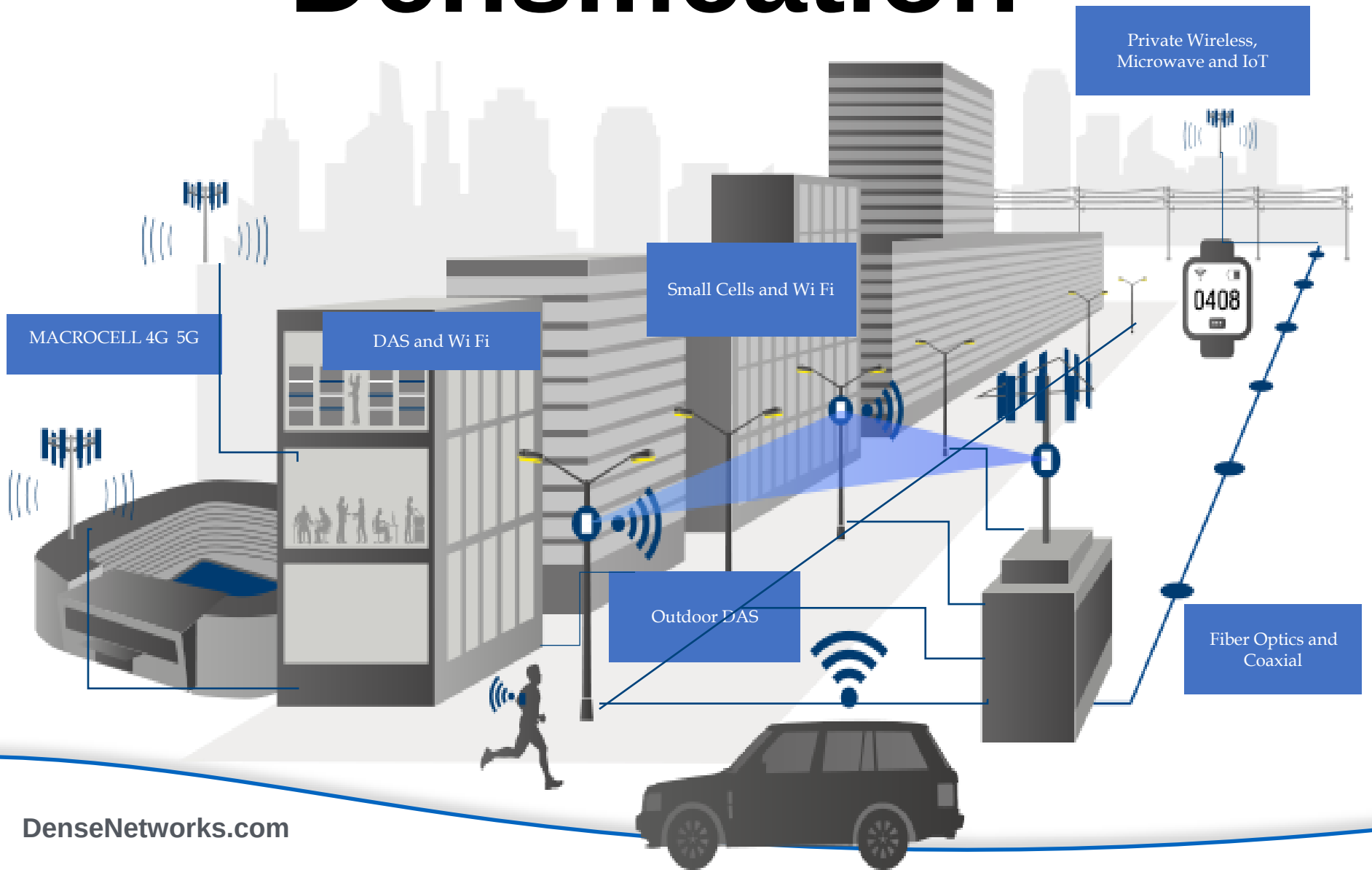
We will look at successful Use Cases, Technology Architectures, Business Models and Funding mechanisms for Cities, Schools, Building Owners, Utilities and Transportation.

For More Information Contact:
PeterMurray@DenseNetworks.com
267-237-5907

May	24	Denver	Smart Cities Week
June	08	Virtual	Broadband Funding
June	23	Virtual	CBRS/Private Wireless 101
July	13	Virtual	IoT Networks-LoRa
August	11	Aurora	Connected Cities Tour
September	15	Virtual	Broadband Funding
September	22	Philadelphia	Connected Cities Tour
October	06	Virtual	Fiber Optic Deployment
October	13	New York	Smart Building Networks
October	25	Los Angeles	Connected Cities Tour
November	06	Virtual	Smart Cities
December	08	Virtual	5G

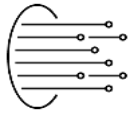
www.densenetworks.com

Densification



Digital Infrastructure

Fiber	IoT	Cell-Macro, Small & DAS	Wi Fi	Private LTE & 5G	Smart Poles	Devices



NB-IoT

LTE

Lighting +

Cameras

Kiosks

LoRa®

OnGo alliance™

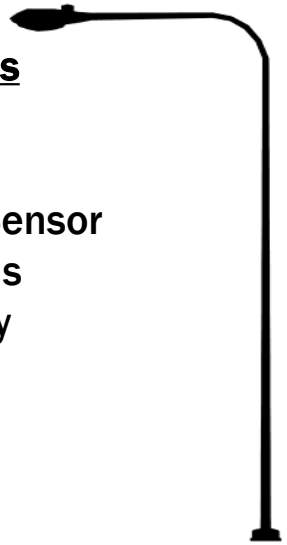
Computers/Tablets

Sensors

Broadband Strategy San Jose

STREETLIGHT

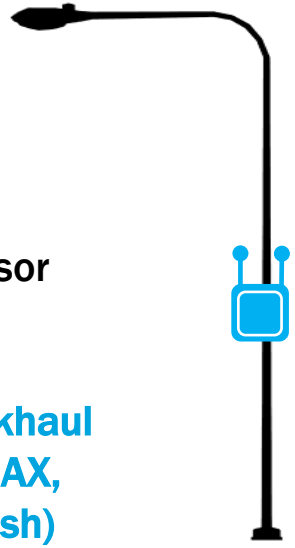
Light/Safety



Properties
- Height
- Power
- Light Sensor
- Lumens
- Density

SMALL CELLs

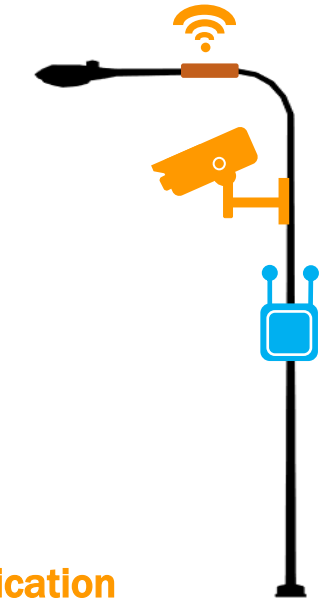
Broadband Digital Infrastructure



Properties
- Height
- Power
- Light Sensor
- Lumens
- Density
- Data Backhaul (Fiber, COAX, Radio mesh)

INTERNET OF THINGS

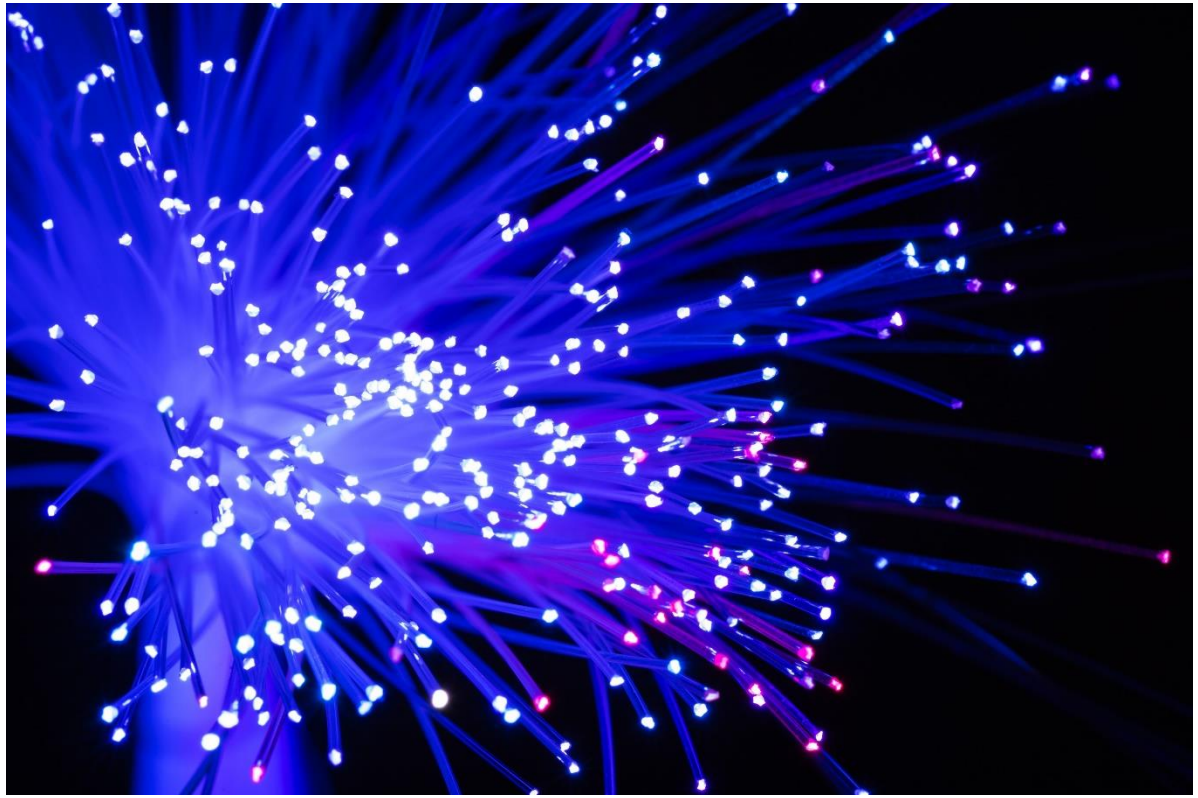
Smart Cities



Properties
- Height
- Power
- Light Sensor
- Lumens
- Density
- Data Backhaul
- Sensors
- Cameras
- 2-way Communication
- Banner Advertising

Maturity:	**Mature**	**Emerging**	**Extremely Immature**
Possible Action:	**Proceed w/ LED Light Replacement Only**	**Re-examine in Broadband Strategy**	**Seek to Understand with Knight IoT Grant**

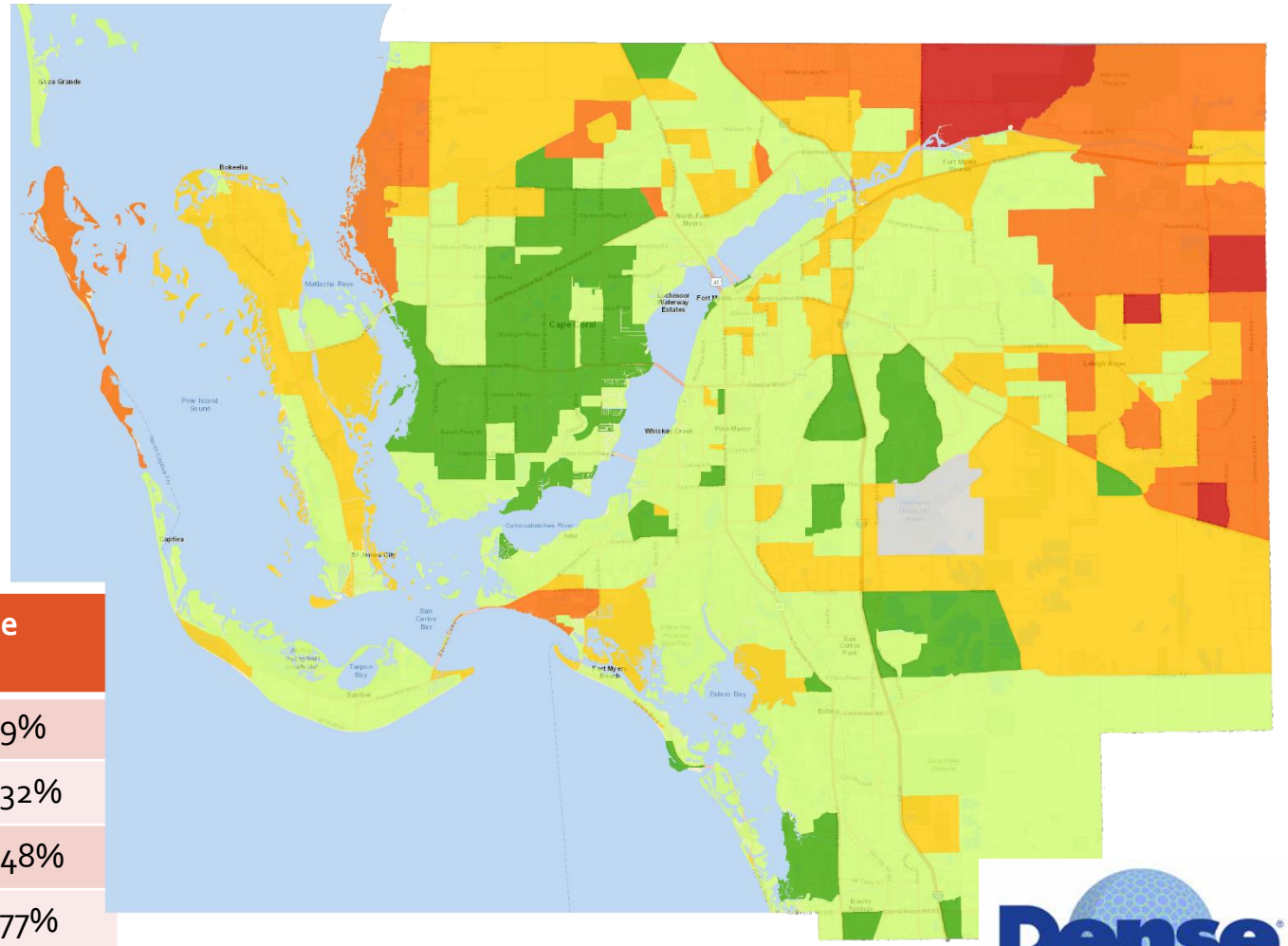
Broadband and Digital Equity



Broadband Availability Fixed-East, North and NW Unserved

72% of households and 77% of populated square miles are **underserved** according to IIJA standard.

7% of households and 32% of populated square miles are **unserved** according to FCC standard.



	Speed rating	Households		Square miles	
unserved	Below 10/1	5,681	2%	58	9%
unserved	Below 25/3	24,437	7%	214	32%
underserved	Below 50/10	89,808	24%	317	48%
underserved	Below 100/20	266,634	72%	511	77%
	Above 100/20	104,465	28%	154	23%

Dense NETWORKS
Disruptive Innovation Solutions℠

Residential Broadband Technology

Best Available Technology Class

- Fiber | Speeds >= 100 Mbps/100 Mbps (symmetric)
- Cable (DOCSIS 3.1+) | Speeds >= 100 Mbps/100 Mbps (symmetric)
- Cable (DOCSIS 3.0) | Speeds >= 100 Mbps/20 Mbps
- Cable (DOCSIS < 2.0) | Speeds >= 25 Mbps/3 Mbps
- VDSL (Fiber-To-The-Curb) | Speeds >= 10 Mbps/1 Mbps
- ADSL2, ADSL2+ | Speeds >= 6 Mbps/1 Mbps
- Fixed Wireless | Speeds >= 10 Mbps/1 Mbps
- ADSL | Speeds >= 3 Mbps/768 kbps
- No Internet Service Available
- Zero Households

Copper & Fixed Wireless

Copper technology (xDSL) cannot deliver reliable 25/3. End of useful life.

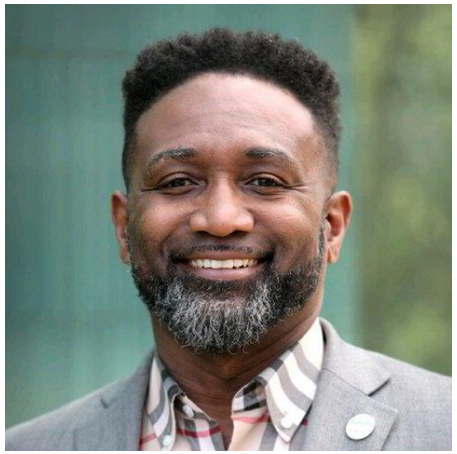
Fixed Wireless requires optimum conditions to exceed 25/3; however, it delivers *Speed to Access* meaning that high need areas have the potential to get coverage fast while physical connections to each house are built.

No Internet Options Exist

This has nothing to do with affordability!
Customers in these areas cannot receive service at their physical address.

Agenda

9:05	Welcome	Peter Murray, Executive Director, Dense Networks
9:15	Keynote	Michael Pegues, CIO, City of Aurora
9:35	Smart Cities Innovation	Michael Pegues, CIO, City of Aurora Roger Fahnestock, CIO, Kane County Joe Gallo, Mayor, Rolling Meadows/Executive Director, ISCRA Charles Baker, Executive Director, On Light Aurora
10:30	Broadband Funding	Andy Lipman, Lead Attorney, Morgan Lewis
10:50	Break	
11:15	Connected City Innovations	Bob Blair-Smith, Sr. Manager, Solution Engineering, T-Mobile Greg Spraetz, Chief Revenue Officer, Network Connex Eric Toenjes, National Market Manager, Graybar Jim Jacobellis, CRO, ALEF Brad Bersch, Account Manager, United Systems



Michael Pegues
CIO, City of Aurora

Roger Fahnestock
Kane County

Joe Gallo
Mayor, Rolling Meadows
Executive Director, ISCRA

Charles Baker
Executive Director, OnLight Aurora

Andy Lipman
Telecommunications Practice Lead Attorney, Morgan Lewis

Bob Blair-Smith
Sr. Mgr., T-Mobile

Jim Jacobellis
SVP, Alef

Greg Spraetz
CRO, Network Connex

Eric Toenjes
Market Mgr., Graybar

Brad Bersch
United Systems

Smart Cities: Why Connectivity Matters

T-MOBILE FOR GOVERNMENT

Results of a survey by the Center for Digital Government demonstrate why connectivity is important to public officials:

- 90% of government decision-makers polled believe communication networks are a requirement for attracting new businesses to their jurisdictions
- 81% said high-performance networks support economic growth and competitiveness
- 94% said the future of eGovernment requires ubiquitous network connectivity

Public Safety

In addition to 911 calls, mobile apps for safety help educators alert parents, students and teachers when necessary. Search and rescue teams use mobile phone GPS to track missing hikers. Amber Alerts send an urgent bulletin to assist in the recovery of an abducted child. Ride sharing apps can provide a safe late-night ride home.

Health

The new field of mobile health is changing how public health and medical problems are identified, prevented and treated. Health issues can now be researched and tracked using mobile device data. That information can then be delivered to the right people when it is needed, no matter where they are located.

Transportation

Mobile connectivity is the engine behind innovations like smart parking and traffic controls, self-driving cars, ride sharing apps, and immediate access to schedules for public transportation.

Energy

Wireless technology is a key to reducing energy usage and offers the most reliable, economical way to manage renewable energy systems, even in harsh environments. The Internet of Things allows for smart waste management, and for gas and electric meters to relay information.

Natural Disasters & Extreme Weather

In the event of a natural disaster or extreme weather, Wireless Emergency Alerts let you know of a threatening situation. Reverse 911 allows authorities to notify large groups of residents in the event of an emergency or when a tragedy has occurred, and new applications like the Facebook disaster maps assist responders during natural disasters.

Fiber, Power & Poles are the Foundation for a Smart City

Broadband Solutions- Whats being deployed now

5G Solution

- Wireless
  - Macro
  - Small Cell (indoor and outdoor)
- Mid-band 5G deployments
  - C-Band
  - 2.5GHz
  - CBRS- private network option
- Fixed Wireless
  - Home
  - Enterprise

Fiber Solution

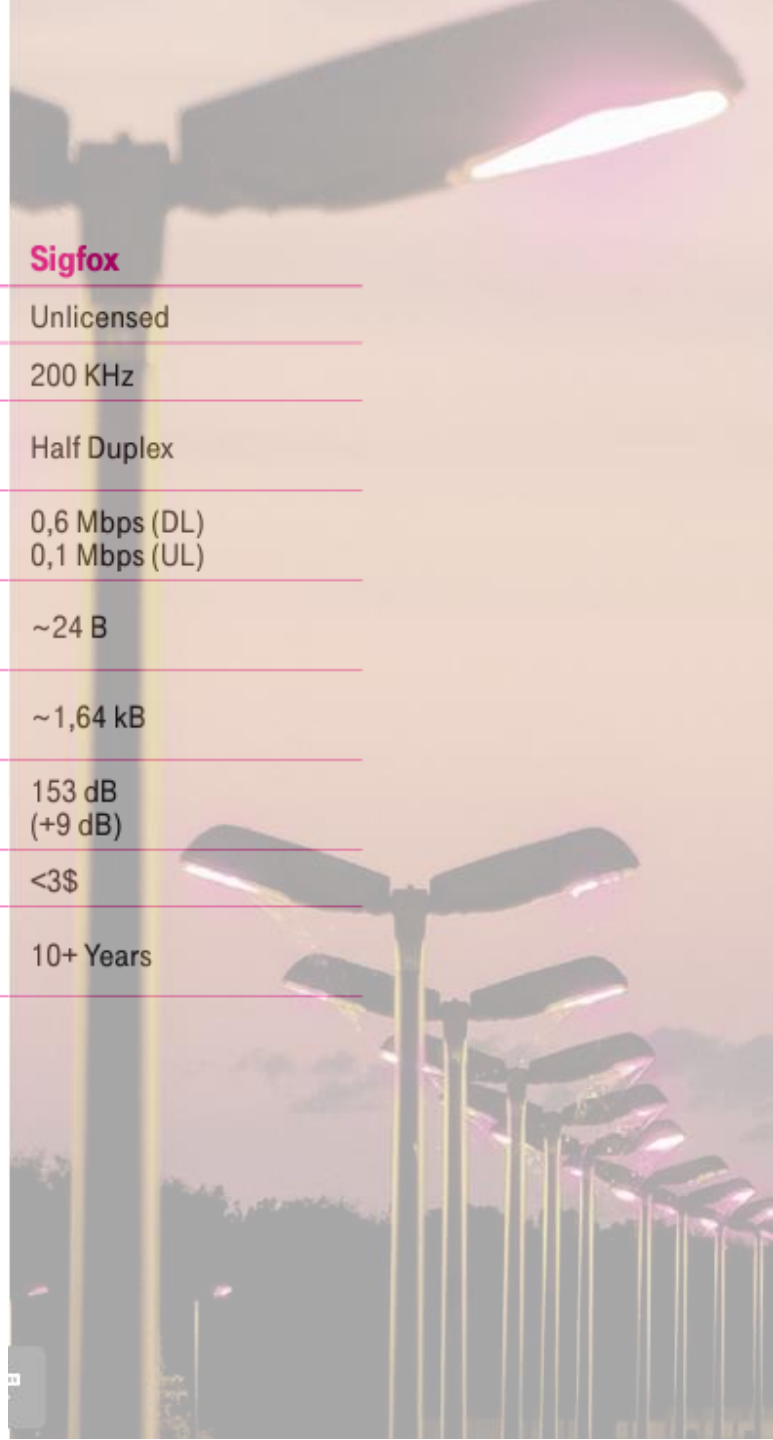
- Wired
  - Middle Mile
  - FTTX
  - Long Haul
  - Datacenters
- FTTX
  - Fiber to the home
  - Fiber to the premise/building
  - Fiber to the Tower/Small Cell

Tech Talk: Types of IoT Connectivity

	LTE Cat-1	LTE-M	NB-IoT	LoRa	Sigfox
Spectrum	Licensed	Licensed	Licensed	Unlicensed	Unlicensed
Bandwidth	20 MHz	1.4 MHz	180 KHz	125-500KHz	200 KHz
Biodirectional Data Transfer	Full Duplex	Half Duplex & Full Duplex	Half Duplex	Half Duplex	Half Duplex
Peak Data Rate	10 Mbps (DL) 5 Mbps (UL)	1 Mbps (DL) 1 Mbps (UL)	250 Kbps (DL) 230 Kbps (UL)	50 Kbps (DL) 50 Kbps (UL)	0,6 Mbps (DL) 0,1 Mbps (UL)
Typical Downlink Daily Throughput	Limited only by battery power, radio signaling condition and commercial terms (e.g. monthly data volume, amount of messages/size per period)			~200 B	~24 B
Typical Uplink Daily Throughput				~200 kB	~1,64 kB
Max Coupling (vs. GSM)	144 dB (0 dB)	156 dB (+12 dB)	164 dB (+20 dB)	157 dB (+13 dB)	153 dB (+9 dB)
Expected Module Cost	>10$	<10$	<5$	<7$	<3$
Epected Max. Battery Lifetime[1]	3-5 Years	5-10 Years	10+ Years	10+ Years	10+ Years

[1] Assuming typical traffic pattern and battery size

Table 1: Overview of IoT transmission technologies



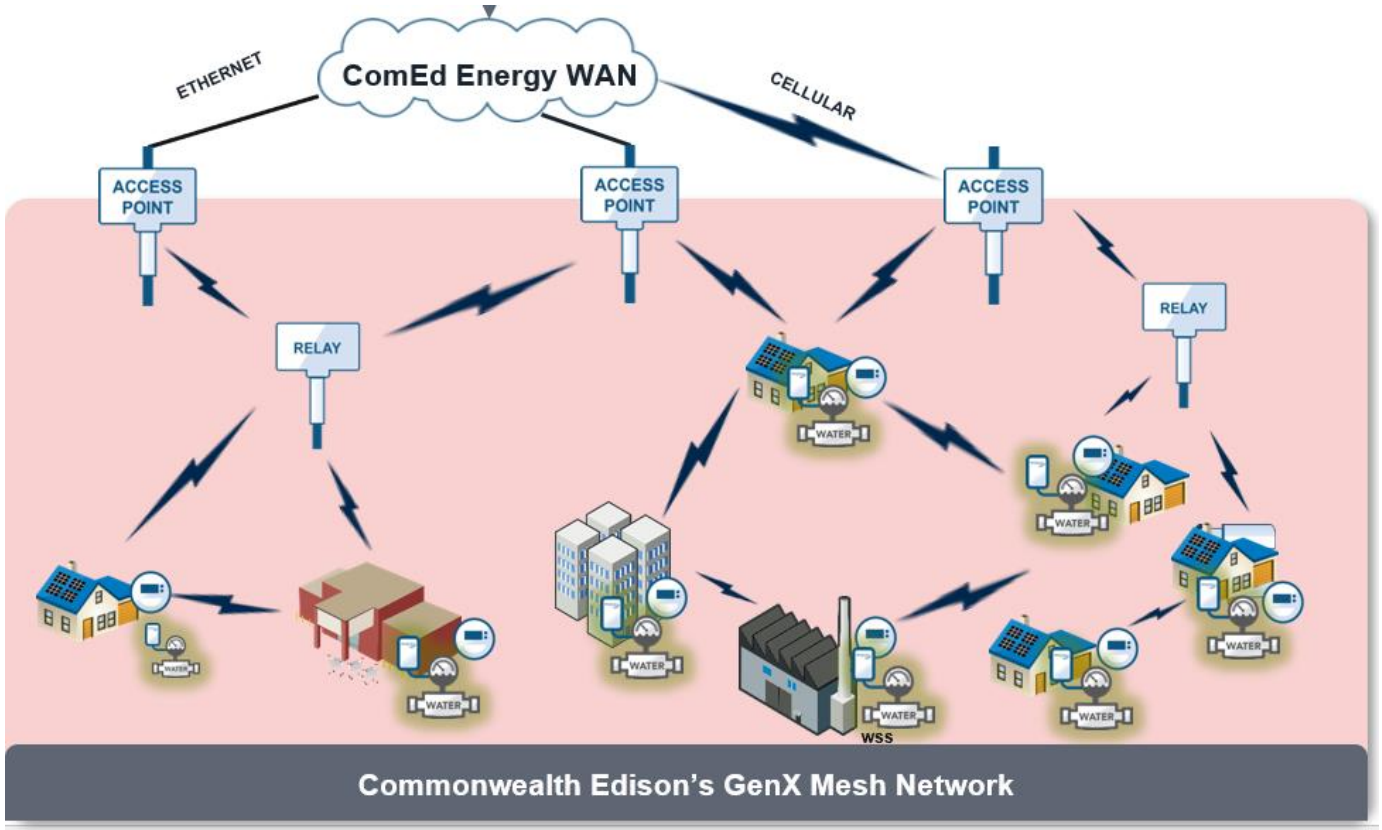
T-MOBILE FOR GOVERNMENT

Deployed a System-wide ITRON AMI Solution with 4.2 Million Electric Meters.

Offering Smart City Network as a Service (NaaS) to Municipalities under their coverage area.

Exclusive provider of ITRON Water products (hardware & software) in 18 States.

Allows City to read Water Meters automatically and provide citizens with proactive leak alerts and online monitoring of their usage.



Potential beyond Water, Gas & Electric AMI

MULTI-PURPOSE NETWORKING

CREATING RESOURCEFUL CITIES AND COMMUNITIES

Smart City applications using Itron technology under ComEd's Network Canopy.

Broadband Solutions- Deployment Challenges

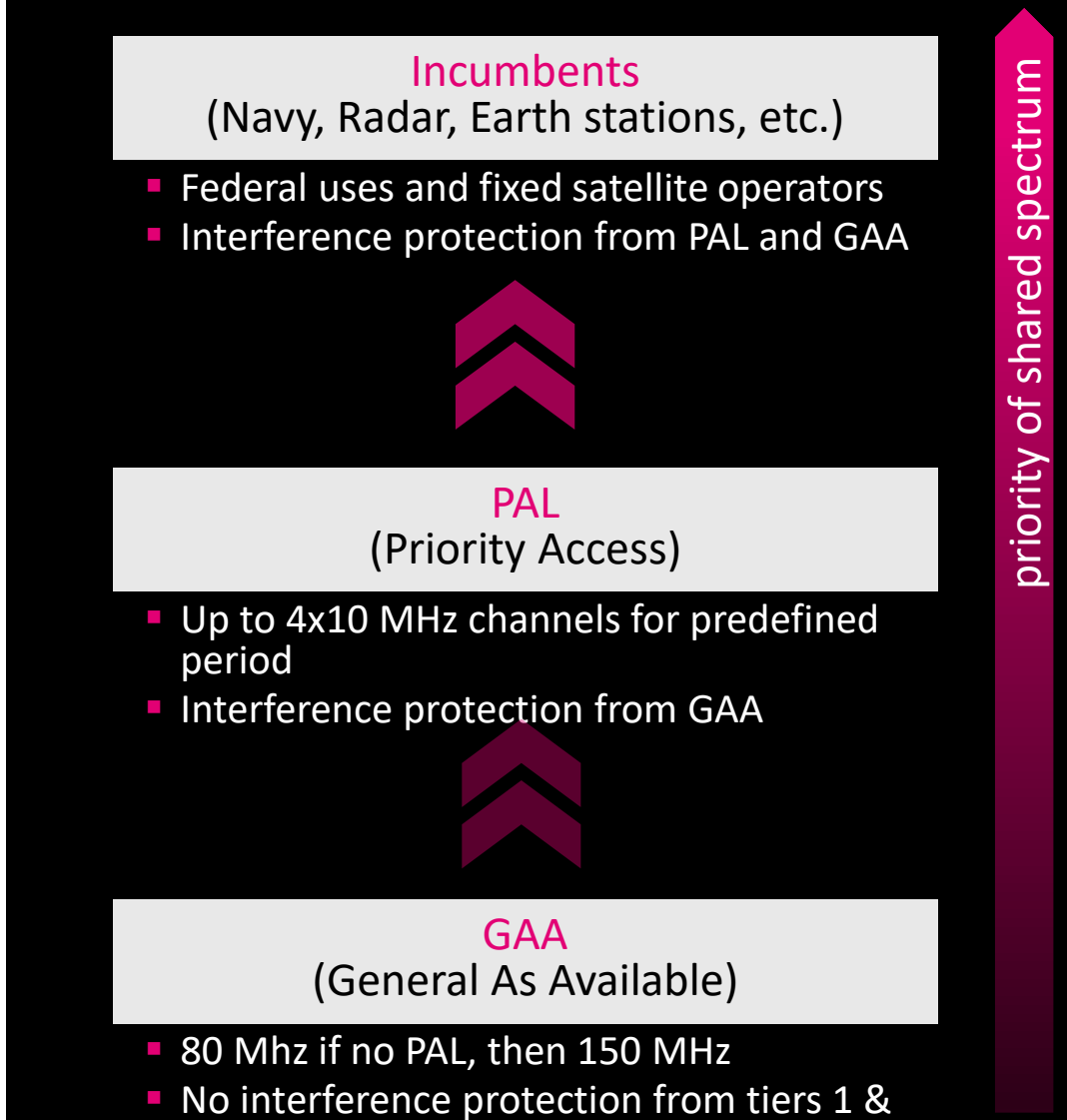
5G Solution + Fiber

- Critical to success
  - Zoning/Permitting
    - High volume of applications
  - Fiber availability
    - Supply chain challenges
    - Timely installation
  - Power availability
    - High volume of applications
    - Timely installations
  - Trained and trusted professional service providers to support
    - Design
    - A&E
    - Site Acquisition
    - Construction

T-MOBILE FOR GOVERNMENT

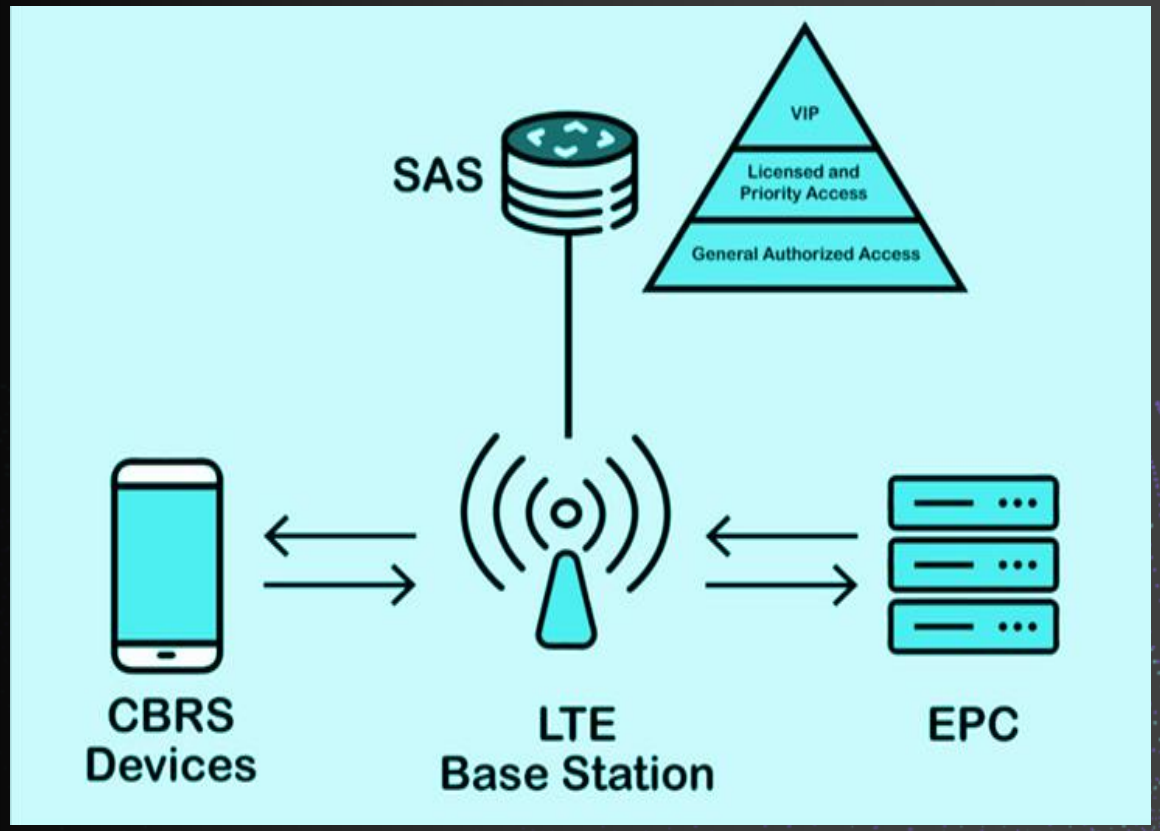
Private LTE (CBRS)

- The FCC set aside 150 MHz of 3.5 GHz band spectrum (TDD Band 48) for private cellular networks
- A portion was auctioned off for Priority Access in 2020 and the remainder will remain unlicensed for General Access
- Most suitable for indoor and short range outdoor. Why?
  - Installation cost is 1/3 less than DAS.
  - Equipment footprint is small and easier to install in commercial spaces.



The first Edge API Platform that offers edge as a service to empower cities to create, customize, and control their own private LTE/5G network, inside their firewall using programmable APIs.

What is CBRS & How to Leverage for a Private Network?



- Allows Enterprise to use cellular technology (LTE or 5G) to enable a private network instead of connecting to AT&T/VZW/TMO
- Provides connectivity for enterprise applications using 150 MHz of spectrum in the 3.5GHz range
- SAS coordinates all frequencies to be used to ensure QOS
- SIM/eSIM at device level required for network access
- EPC can have local break out to LAN and provide devices with private IP addresses


OnGo
alliance™

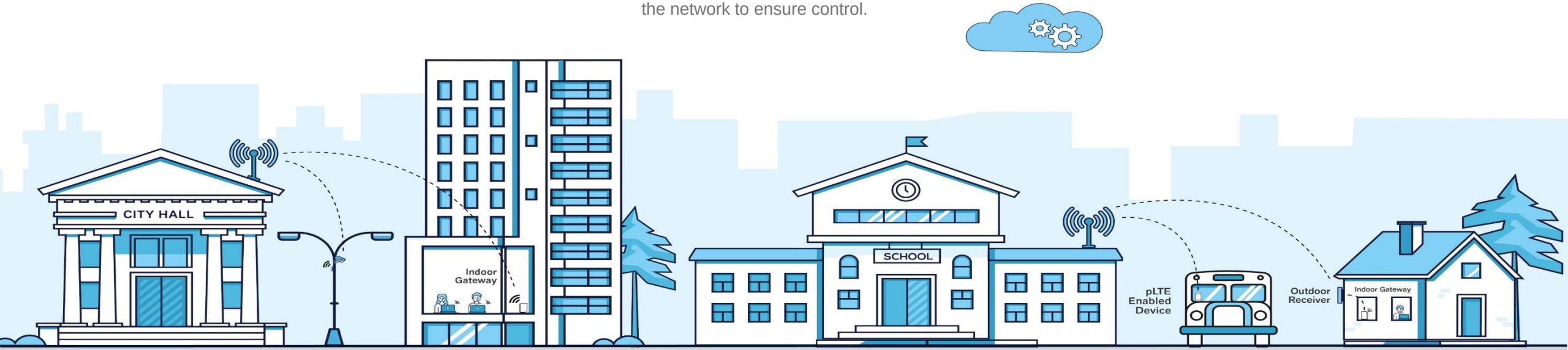
What does a CBRS Private Network Look Like?

City Fiber Network

Bridge the Digital Divide & Extend the Smart City Foundation

Build a private LTE/5G wireless network broadcast from city and school facilities

Secure Network
Monitors the wireless network, all connected gateways and private LTE enabled devices. Data stays local to the network to ensure control.



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CBRS versus Wi-Fi

	CBRS	Wi-Fi
Devices	Handles many	System performance unpredictable as devices added
Infererence	Greatly reduces	Prone to interference from signals in most unlicensed bands
Authentication & Encryption	End-to-end SIM based	Requires proprietary / conflicting coordination
Security	Channel monitoring and coordination of spectrum	Poorer security vs LTE/5G
Handover	Controlled between devices managed by standards	Proprietary best effort for roaming
Latency	Consistently Lower	Unpredictable
Radio	Works well in complex environments with many wireless clients/devices	Works well in simple environments with a moderate number of devices

OMNIA PARTNERS

POWER. ACCESS. TRUST.

OMNIA PARTNERS PUBLIC SECTOR COOPERATIVE PROGRAM

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OMNIA PARTNERS | Public Sector

- Competed Contract satisfies Public Solicitation Process
- 23 years and 20,000 cities / agencies
- Kansas City – Lead public agency
- No Cost / Non-Binding
- Products & Services eligible
- Best in Class Vendors
- National Volume
- Best Overall Value

Key Benefits:

- **No RFP or Solicitation required**
- **Flexibility to choose suppliers and installation partners**
- **Shorten timeframes from concept to completion**
- **Great pricing resulting from competed contract**

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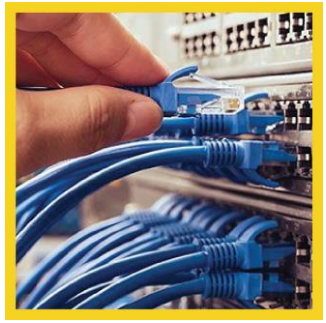
TYPES OF PRODUCTS

Electrical



DataComm

Lighting & Controls

Power Distribution

Industrial Control & Automation

Conduit, Raceway & Cable Support

Wire, Cable & Wiring Devices

Power Protection & Maintenance Supply

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