Connected Cities

Getting to Smart – Cary, NC

The Research Triangle Park region has been a leading source of technical and programmatic innovation for many years. This workshop will focus on 2 areas of innovation using network technology: Internet of Things and Broadband/Digital Equity. Cary has received awards for its Smart City innovations and the team will share how they have created their own network to connect things using LoRaWAN. We will also explore innovations using CBRS and Private Cellular Networks, Fiber Optics and the latest on Federal Broadband Funding.

Featured Speakers

9:05 Welcome Peter Murray, Executive Director, Dense Networks

9:15 Keynote Nicole Coughlin, CIO, Town of Cary

9:40 Connected Cities Innovation Peter Murray, Moderator

Nicole Coughlin, Chief Innovation Officer, Town of Cary

Jon Minshew, Chief Innovation Officer, Dell

Tom Snyder, Executive Director, RIoT

Brian Davis, Director, Market Development, Corning

10:25 Break

10:40 North Carolina Broadband Program-Peter Murray,

Nate Denny, Deputy Secretary, North Carolina Broadband Office

Maggie Woods, Digital Equity, North Carolina Broadband Office

11:15 Network Innovations Peter Murray, Moderator

Derrick Frost, SVP, Kajeet

Ted Urbaniak, IoT Product Manager, Town of Cary

Youssef Abdelilah, CTO Office, American Tower

Eric Toenjes, National Market Manager, Graybar

12:00 Lunch

1:00	Cary Smart City Lightning Round	Cary Team
	Information Technology	Justin Sherwood, Assistant Director
	Fire Department	Matt Jacoby, Assistant Fire Chief
	Downtown Park	Sarah Alexander, Parks Department
	Public Safety – Drones	Tim Hegeter, Sergeant

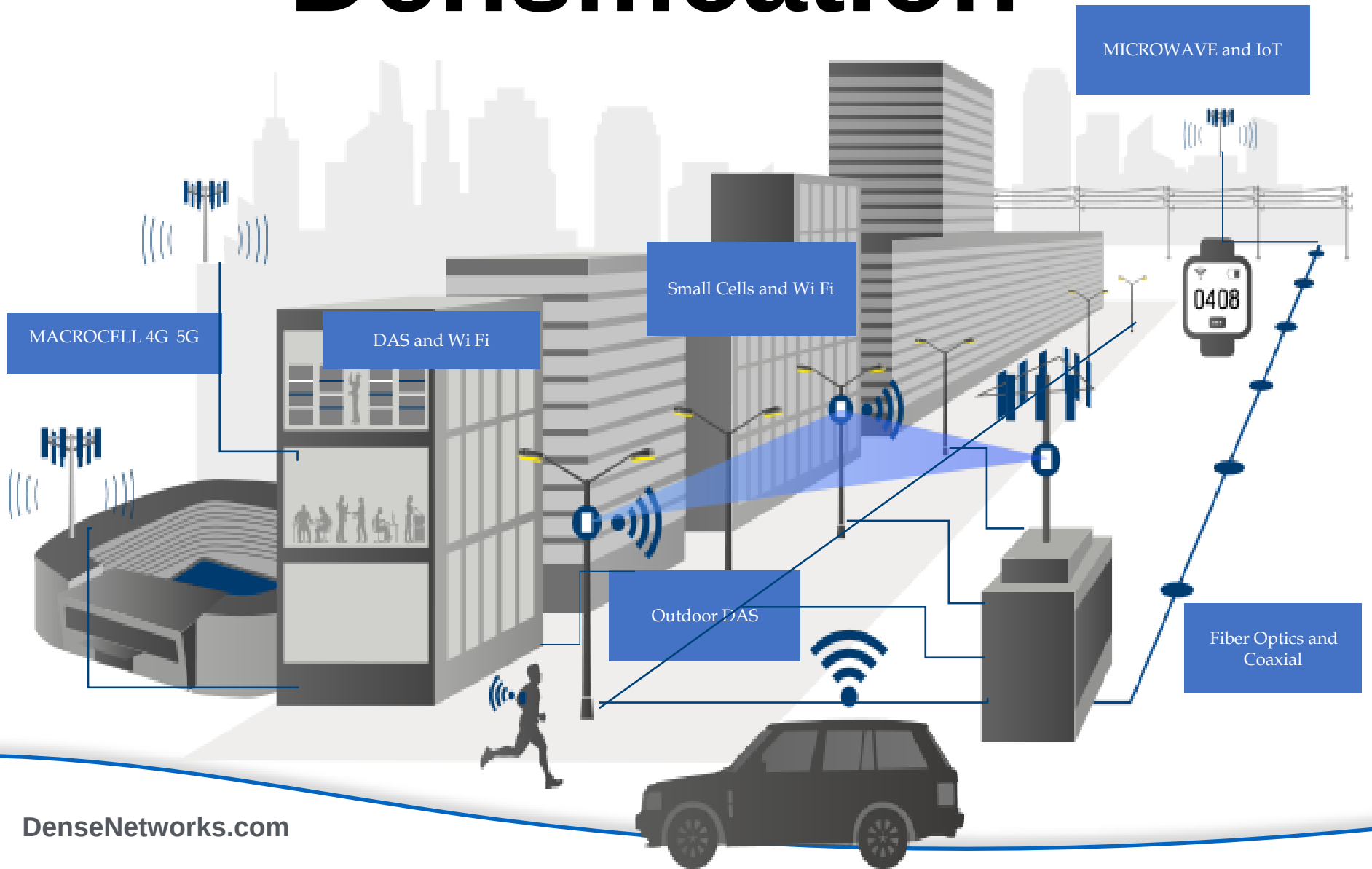
2:00 Move to Herb Young Community Center, 101 Wilkinson Avenue

Open Discussion and Meet and Greet Departments

4:00 Social Event-Triangle Beer Company, 320 E Durham Rd., Cary


Connected City
Smart City

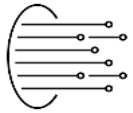
Densification



Digital Infrastructure

Scalable/Interconnected

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



NB-IoT

LTE

Lighting +

Cameras

Kiosks

LoRa®

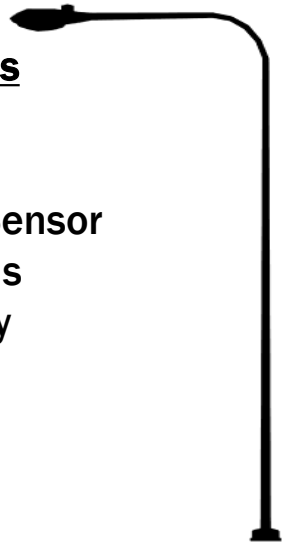
Computers/Tablets

Sensors

San Jose Broadband Strategy

STREETLIGHT

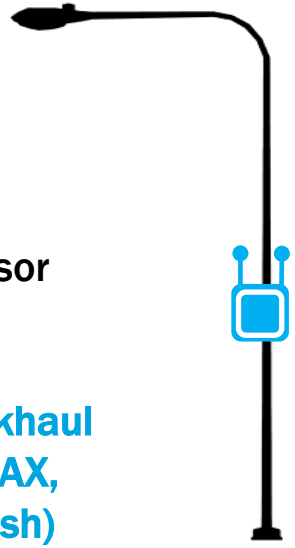
Light/Safety



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

SMALL CELLs

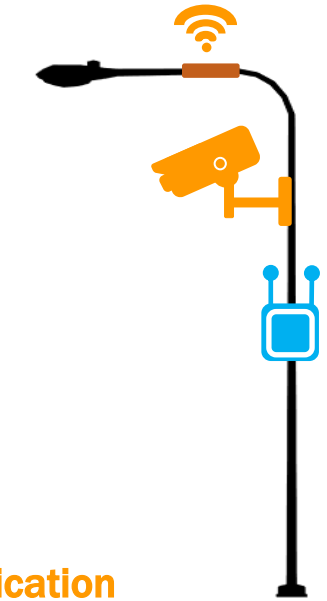
Broadband Digital Infrastructure



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**

SmartBlockPHL: Midtown Village

A collaborative effort among Comcast, US Ignite, and Philadelphia to deploy a multi-pronged solution designed to meet the needs of several stakeholders. The demonstration project entails retrofitting luminaires and sensors onto pre-existing streetlight poles. This project will deliver new insights to Philadelphia, its residents, and its partners in the business and the community.

Fast Facts:

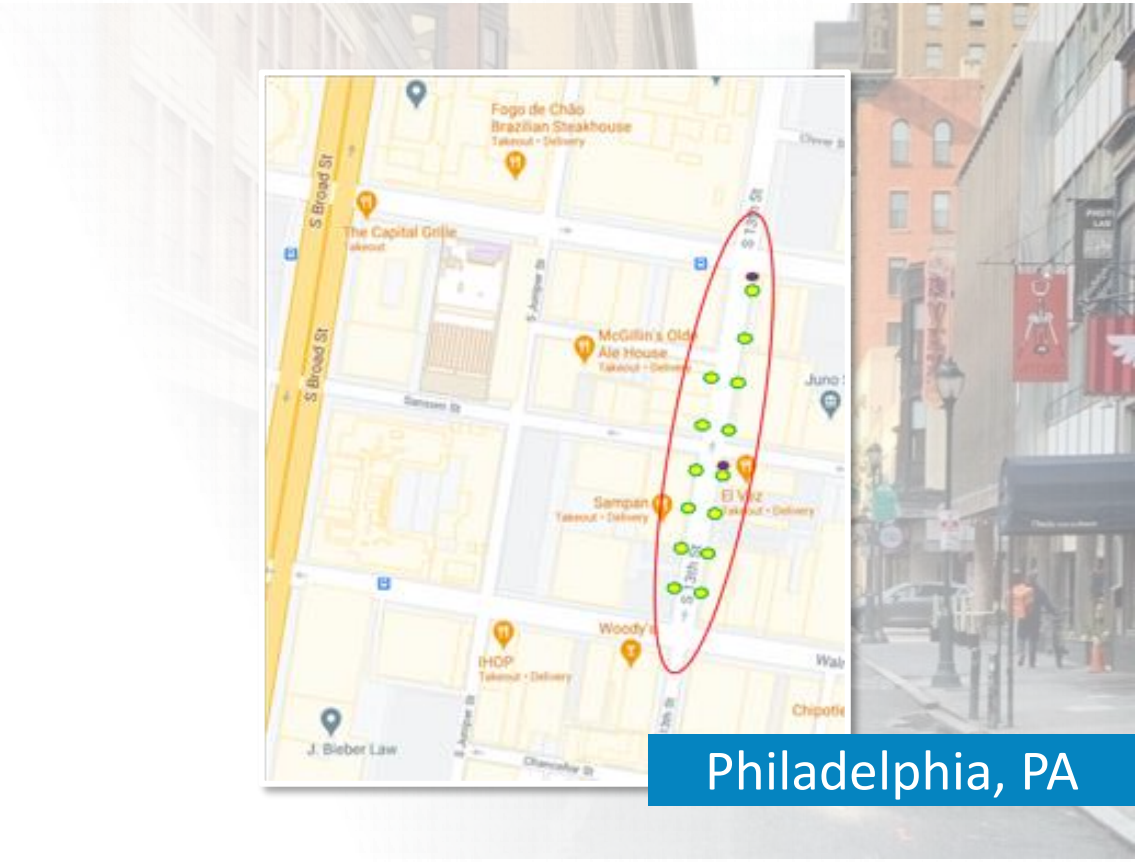
- 14 Smart Streetlights (Colonial Design) with sensors
- City owned and managed solution
- Collects meta-data about traffic, street activity and the environment
- No PPI is collected or stored
- PHL will not use data to enforce laws or issue tickets
- Uses the latest in EDGE processing
- Deliver new insights to Philadelphia, its residents, and its business partners

Use cases & Insights:

- Pedestrian occupancy
- Environment health
- Roadway Traffic
- Parking Utilization
- Managed WIFI

Technology:

- Comcast 1Gbps EDI Circuit
- Retrofit streetlights with Partner's smart solution
- Partner's lighting management and Smart City Platform



Utility Lease Model

Colorado Springs Utilities
It's how we're all connected

Utilities of the Future:
- Over 2,000 miles of fiber buildout over the next 6 years
- Demand Side Management
- Distributed generation
- Advanced Metering Infrastructure

Fiber connectivity available to:
- Every address
- Every signalized intersection
- Every street light

Enabling infrastructure:
- High speed
- Low latency
- Highly secure
- Highly reliable

Office of Innovation

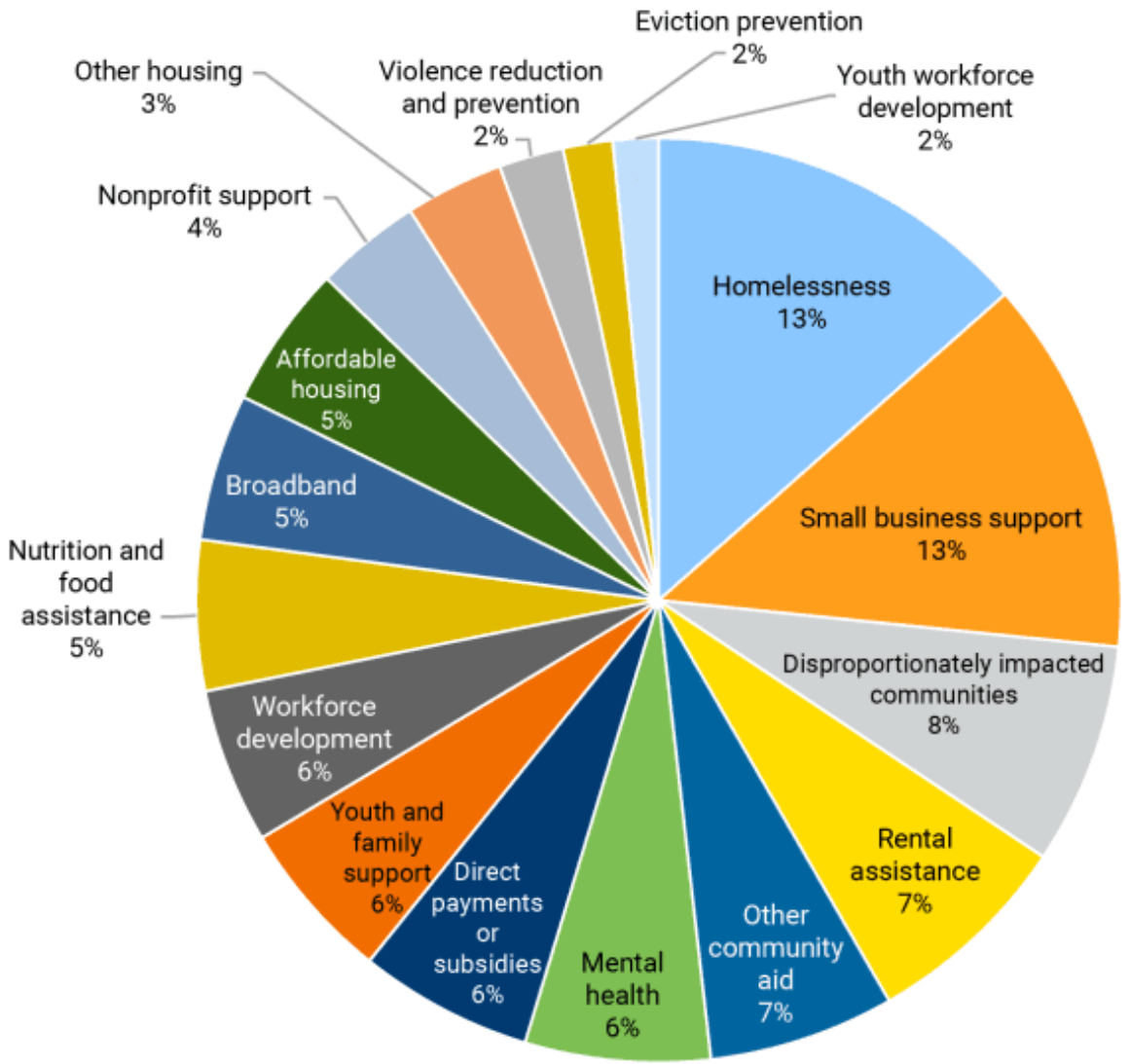
COLORADO SPRINGS
OLYMPIC CITY USA


100
FW C 128
FEDERAL RESERVE NOTE
MF 5703513 1 B
F6
UNITED STATES FEDERAL RESERVE SYSTEM
Secretary of the Treasury.
Treasurer of the United States.
ONE HUNDRED
THIS NOTE IS
FOR ALL DEBTS, P
JULY 4, 1776.

ARPA funds

	Budgeted ($)	Economic disadvantage ($)	Percentage (%)	Total Projects
Madison, Wisc.	22,800,000	21,800,000	95.6	28
Riverside, Calif.	29,242,594	27,090,000	92.6	29
Columbus, Ohio	53,284,081	48,209,406	90.5	8
St. Louis, Mo.	123,195,020	109,650,470	89.0	70
Nassau County, N.Y.	185,350,000	163,750,000	88.3	18
San Jose, Calif.	70,562,771	61,900,771	87.7	25
Clackamas County, Ore.	28,191,637	22,684,455	80.5	11
Washoe County, Nev.	46,312,296	37,192,053	80.3	25
Minneapolis, Minn.	108,527,983	84,885,905	78.2	67
Dane County, Wisc.	94,375,082	71,662,768	75.9	16
San Joaquin County, Calif.	66,011,593	49,932,146	75.6	11
Los Angeles County, Calif.	704,851,000	521,501,000	74.0	61
Prince William County, Va.	31,200,000	22,500,000	72.1	7
Northampton County, Pa.	22,658,617	15,704,262	69.3	6
San Mateo County, Calif.	74,448,909	50,748,909	68.2	19
Nashville-Davidson, Tenn.	78,381,250	51,713,996	66.0	17
Maricopa County, Ariz.	414,987,433	273,141,352	65.8	55
Pierce County, Wash.	175,781,445	115,159,256	65.5	79
Alameda County, Calif.	142,500,000	91,500,000	64.2	15
Phoenix, Ariz.	133,365,662	85,565,662	64.2	36
St Paul, Minn.	33,630,184	21,031,000	62.5	19
Orange County, Fla.	135,830,857	82,362,846	60.6	38
Ingham County, Mich.	29,601,971	17,318,000	58.5	13
York County, Pa.	65,753,816	37,983,311	57.8	105
Mesa. Ariz.	27.800.000	16.000.000	57.6	4

Brookings Metro



Maggie Woods

Nate Denny

Allocation	Amount	Agency
Federal Broadband Infrastructure Funding	*$65 Billion allocated ($.06 billion for other)*	NTIA
Middle-Mile Broadband Deployment Grant Program	*$1.0B*	NTIA
Digital Equity Competitive Grant Program	*$1.25B*	NTIA
State Digital Equity Capacity Grant Program	*$1.5B*	NTIA
Distance Learning, Telemedicine, and Broadband (DLT) Program & ReConnect Program	*$2.0B*	USDA
Tribal Broadband Connectivity Program	*$2.0B*	NTIA
Affordable Connectivity Program	*$14.2B*	FCC
Broadband Equity, Access, and Deployment Program	*$42.45B*	NTIA

Philadelphia

Office of Innovation & Technology

DEVICES	CONNECTIVITY	TRAINING & WORKFORCE	ECOSYSTEM
Philadelphians can access appropriate and affordable technology devices.	Philadelphians can access and afford the internet connectivity they need.	Philadelphians develop the digital skills necessary for work and life.	Philadelphia grows and sustains the capacity and infrastructure required to increase digital equity.

Orange County, Florida

$16.1 Million in ARPA Funds

Broadband Infrastructure and Digital Equity Programs

- Residential Broadband-Eliminated Unserved Homes
  - Availability, Adoption, Affordability, Ability

- Multipurpose Community Center-Innovation Lab
    - Network Tech Hands On Training/Workforce w/Charter/WIA/Fiber Broadband Association
    - AR/VR/Simulation
- Digital Devices, Connectivity, Helpdesk
  - 3rd Party Non-Profit-New and Repurposed Devices
- Programs-Digital Equity, Telehealth, Workforce Development
  - Digital Literacy Courses
  - Telehealth Station with Orlando Health
  - Workforce Development Program for fiber optic and wireless technicians.
  - STEM Support

Derrick Frost
Kajeet

Eric Toenjes
Graybar

Youseff Abdelilah
American Tower

Ted Urbaniak
Town of Cary

kajeet AT A GLANCE

- A Leading Public & Private Wireless Managed Service Provider
- Two Decades of Experience
- Leading US provider of off-campus wireless internet for students
- Over 3,000 Customers
- Service 7 Large High Growth Verticals
- 5.5M+ Lines Connected
- Award Winning Software Platforms
- 40 Foundational U.S. Wireless Patents
- 150+ employees
- MSP for Charter & Comcast
- 40+ Private Wireless Deployments

MARKETS SERVED

SELECTED CUSTOMERS

EDUCATION

FIELD SERVICES

HEALTHCARE

TRANSPORTATION

MONITORING

TELCO & CABLE

PARTNERS

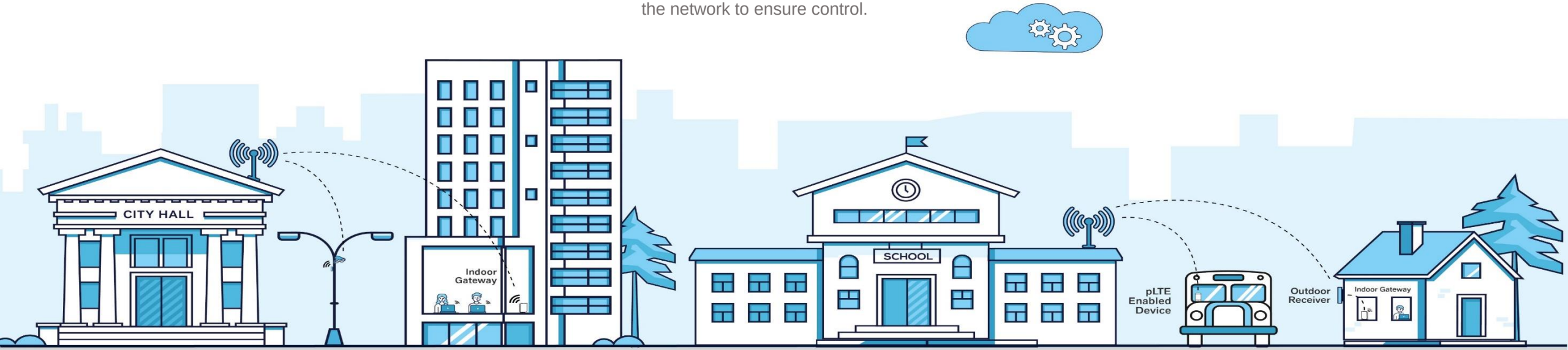
Alliance Membership – 165 Strong & Growing

4RF Limited
Accelleran
ADRF Technologies
Agri-Valley Communications, Inc
Airspan Networks
Airtower Networks
Allen Vanguard Wireless, LLC
Alpha Wireless
Amdocs Management Limited
American Tower Corporation
Amit Wireless Inc.
ANS Advanced Network Services, LLC
Anterix
Asiatelco Technologies, Inc
Askey Computer Corp.
Aspire Technology Partners
AT&T
ATDI
Athonet
Baicells Technologies Co., Ltd.
Ballast
Barich, Inc
Bearcom
BEC Technologies, Inc
Betacom
Black Box
Blinq Networks
BlueArcus Technologies
Boingo Wireless, Inc.
BTI Wireless
Cable Television Laboratories Inc
Cambium Networks
Capgemini America, Inc
Casa Systems
CellAntenna Corporation
Celona, Inc
Centerline Communications
Charter Communications
Ciena
Cirrus Core Networks, Inc
Cisco Systems
Codium Networks
Comba Telecom, Inc
Comcast Corporation
Commscope
Communication Technology Services, LLC
COMSovereign Holding Corp
Connected Devices, Inc
Connectivity Wireless Solutions
Contour Networks
Corning Optical Communications
Cox Communications
Cradlepoint
Crown Castle
CTIA
CTL
DEKRA Testing and Certification, S.A.U.
Dell Technologies
Dense Air Limited, LLC
Digi International
Digital Global Systems
Dish Network
Druid Software
EDX Wireless
Element Materials Technology Washington DC LLC
Encore Networks
Ericsson, Inc.
EUCAST Co., Inc
ExteNet Systems, Inc.
Facebook
Federated Wireless
Fibocom Wireless USA, Inc
Fibrolan
FreedomFi, Inc
Frequencz
Frontier Communications
Fujitsu Network Communications
Gadgetspace, LLC
GE MDS
Gemtek Technology Co., Ltd
GenXComm, Inc.
Geoverse
Giesecke+Devrient
Global Technology Associates, LLC (GTA)
Goodman Telecom
Google, LLC
Graybar
HALO DAS, LLC
HCL Technologies
Hewlett Packard Enterprises
Highway9 Networks, Inc
Huber + Suhner
Ibwave
Imagine Wireless
Impact Broadband Corporation
Inseego Corp
Insta Advance Oy
Intel Corporation
IOT4NET, Inc
JACS Solutions
JMA Wireless
JPU
Juniper Networks
Kajeet
Keysight Technologies, Inc
KLA Laboratories, Inc
Kleos UK Ltd
Kore Wireless
LandMark Dividend, LLC
Mavenir Systems, Inc
Midcontinent Communications
Miller Electric Company
Mobilitie, LLC
Monogoto, Ltd
Motorola Solutions
Multi-Tech Systems, Inc
Munisite Networks
Nesten, Inc
NextGen Global Resources, LLC
Nokia
NRTC
Nsight
OneLayer
Palo Alto Networks
Panasonic
Parsec Technologies, Inc
Pavlov Media, Inc
Pierson Wireless
Pyramid Network Services, LLC
QuadGen Wireless
Qualcomm
Quanta Cloud Technology
Quantum Wireless
Qucell
Qulsar
Radio Frequency Systems
Radisys Corporation
Radtonics, Inc
Rakuten USA, Inc
RANlytics
Ranplan Wireless, LLC
Redline Communications
RF Connect
Samsung Electronics America Inc.
SBA Communications
Securus Technologies
Seowonintech Co., Ltd
Sequans Communications
Sercomm USA, Inc
SGS North America, Inc
Shared Access
SNS Telecom & IT
Socionext America, Inc
Solid
Sony Group Corporation
Sporton International, Inc
Star Solutions International, Inc
Sterlite Technologies Limited
Super Micro Computer, Inc
SureSite Consulting Group, LLC
Syniverse Technologies, LLC
Tango Networks
Teal Communications
Tecore Government Services, LLC
Telecommunication Technology Labs, CAICT
Telit
Telka, LLC
Telrad Networks
Telsasoft
Terranet Communications, LLC
Tessco Technologies, Inc
Texas A & M University
The New York Library
The Quilt
T-Mobile USA
Transit Wireless
Trextel, LLC
TruConnect
U.S. Cellular
University of New Mexico
Valid8.com, Inc
Vedanta Telecom, LLC
Vergibility, LLC
Verizon Communications
Vertical Bridge Holdings LLC
View, Inc
VMware Inc
Wesco
Wilson Electronics
Winncom Technologies
Wispa (Wireless Internet Service Providers Association)
XCOM Labs, Inc
ZenFi Networks
Zyxel Communications Corporation

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.



GraybaR

What is LoRaWAN®?

LoRaWAN is the Open Global Standard for Carrier-Grade Low Power Wide Area Network Connectivity

The Technology

utilized in a network supporting the LoRaWAN protocol is designed to connect low-cost, battery-operated sensors over long distances

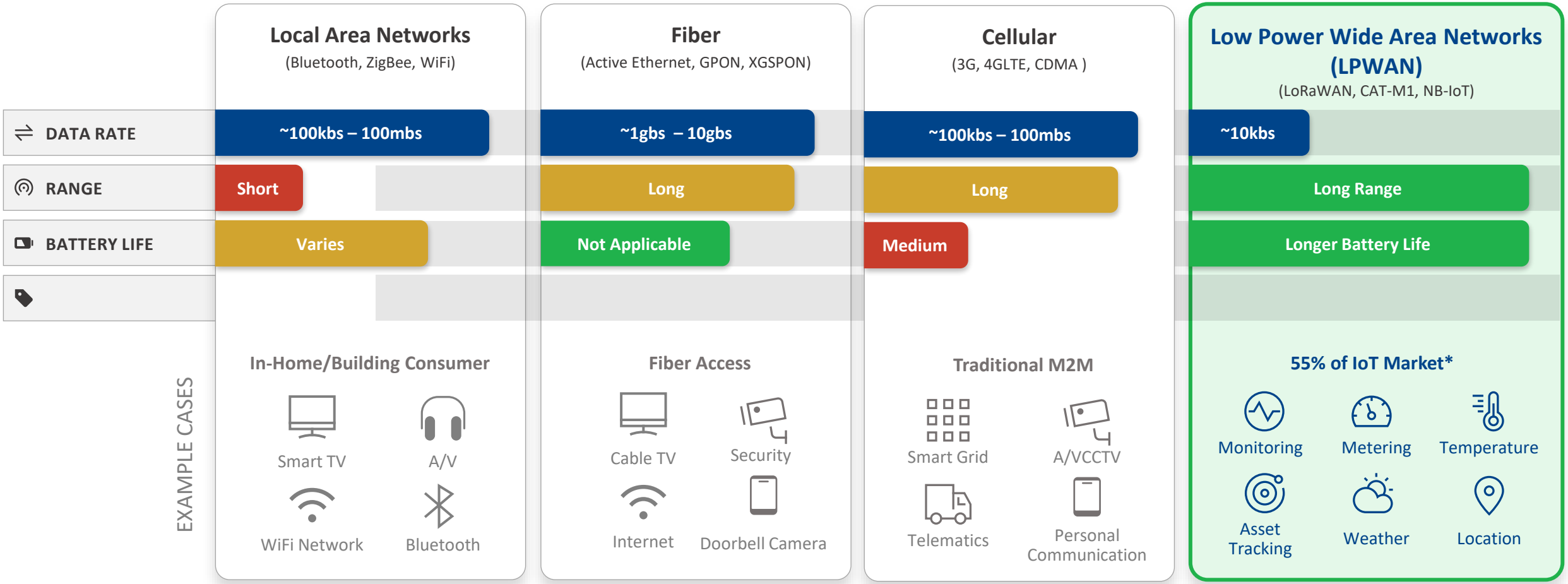
The LoRaWAN Protocol

offers unique and unequaled benefits with security, bi-directional communication, mobility, and location services

The LoRa Alliance®

an open, non-profit association promoting the LoRaWAN protocol has grown to include more than 500 members since its inception in March of 2015

IoT Technology Landscape

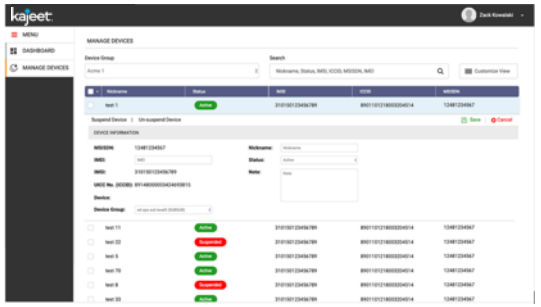


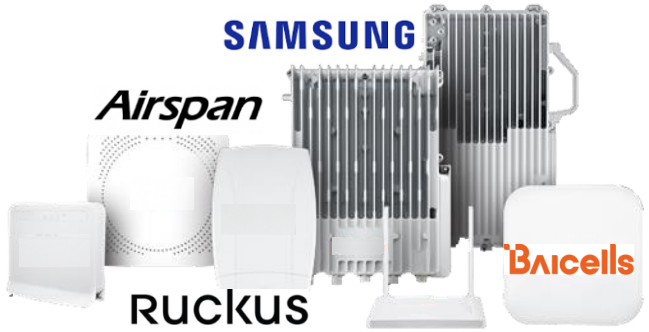
* IoT Analytics, LPWAN Market Report 2019-2025, published January 2020

senet

Smart Private 5G™ Platform

Smart, Simple & Secure Cloud-Based Platform To Manage Private 5G & LTE Networks





Private 5G **CLOUD**

SIM, Device, Subscriber & Network Management

Private 5G **EDGE-CORE**

5G Cloud Core & Edge Core

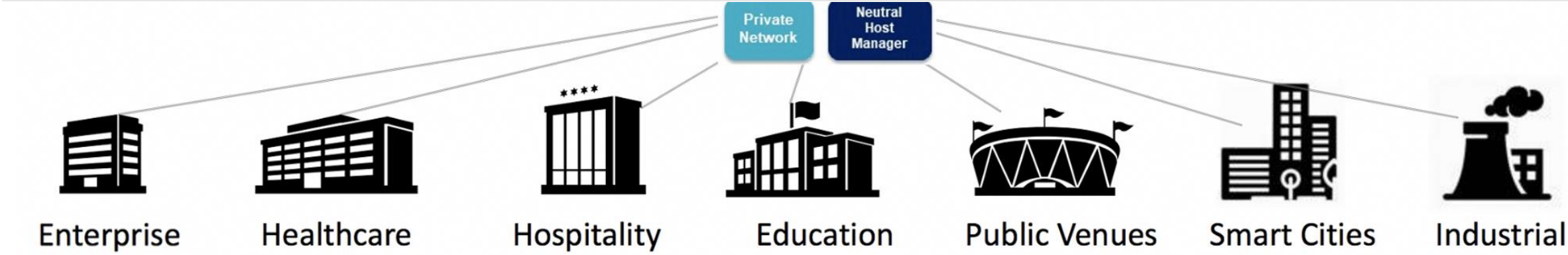
Multivendor **RADIOS**

Private Radio Access Network

Private 5G **SIMs**

Private Wireless SIM & eSIM

- **Network Design & Installation**
- **SIM & Device Management & Logistics**
- **Network Slicing & Management**
- **Open APIs Application & Developer Platform**
- **Neutral Host & Carrier Connectivity**
- **Private 5G/LTE as a Service**

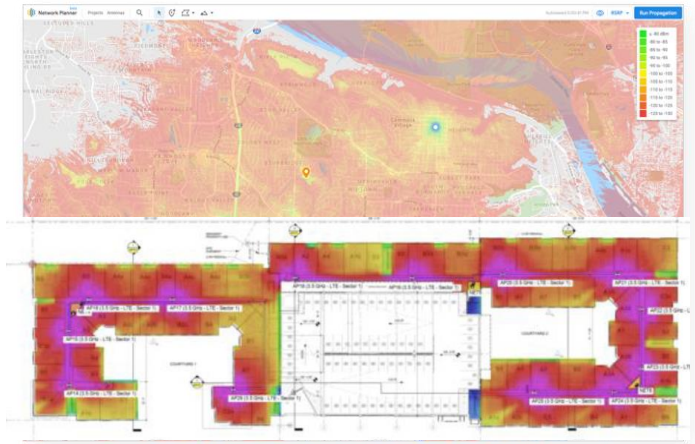


Turnkey Smart Private 5G™ Managed Services

Planning Site Selection Acquisition Deployment Integration Operations Maintenance

Private 5G Design

- Kajeet Private Network Design
- Is the initial step in determining customer requirements.
- Gather customer requirements, number of locations, user devices, coverage and throughput.
- Determine Spectrum requirements, CBRS, PAL or GAA, EBS, or other.
- Create propagation map and review with customer
- Provide Budgetary Pricing for network and firm pricing for Site Survey.



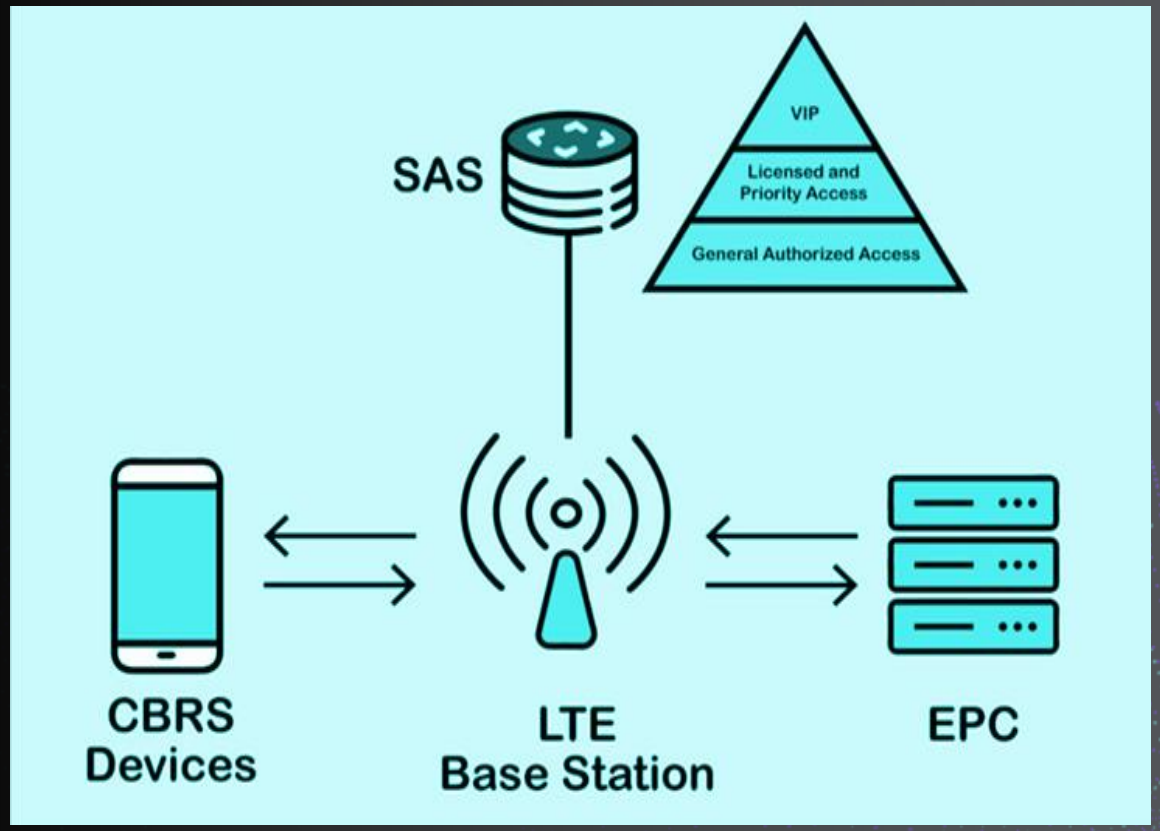
Private 5G Installation

- Kajeet Private Network Implementation
- References the Smart 5G Design to determine the RAN elements required for the Private Network.
- Acquisition of equipment and services
- Core and Site turnup of services
- Integration with Kajeet's network core and Sentinel™ application
- End-2-End network integration
- System/coverage and acceptance testing

Private 5G-as-a-Service

- Kajeet Private 5GaaS is a complete Managed Service for your Private Network Infrastructure and end user equipment.
- 7x24x365 Network Operations Center to monitor all Private Network elements.
- Customer Support Tiers that range from standard business hours to 7x24x365 support for your end users and their devices
- Access to Sentinel™ application for device management and reporting
- On-Site network support Tiers

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

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

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

Longmont, CO, USA

City of Longmont, Colorado

- Longmont is a growing community of 100K people ~ 10 miles Northeast of Boulder
- Began as a student broadband project to provide connectivity to 4,000 low-income student locations.
- The City of Longmont and their ISP (Nextlight) saw the possibilities of Private LTE and leveraging it for public security cameras.
- Network is currently at 37 base stations and will continue to expand.
- City planning to extend CBRS coverage across entire city in 2023

Closing the Digital Divide in Shreveport, LA with CBRS

Problem

- 40% of City residents lacked access to Wi-Fi at home
- Limited budget (American Rescue Funds)
- Tight timeline for deployment

Solution

- City contracted Spread Networks, who selected Pollen
- Pollen designed a RAN using CBRS radios on city buildings
- Spread Networks deployed the radios with Pollen support

Universal Digital Access

- Residents check out a CPE (Wi-Fi Hotspot) from the library
- City provides internet backhaul using existing network
- Pollen monitors and operates the Cellular network
- Spread Networks is working with city officials to expand into other underserved areas and improve coverage

Available from Graybar via Omnia Contract
Private Cellular Network Connectivity

Rapid Deployment, Single Site & Concept Testing Scenarios

- Large pelican case
  - Cellular Base Station with Antenna (CBRS/EBS)
  - SAS & Radio Cloud control
  - Switching and Routing Hardware
  - Cellular, Satellite or Wired backhaul to Alef core

- Kitted pre-provisioned with the following and Alef (e)SIMs.:
  - CBRS Mobile Point of Sale Devices
  - CBRS Tablet
  - CBRS Router for creating Wi-Fi Hotspot's
  - Up to 25 SIMS/ESIMs
  - Additional Devices Ala Carte including outdoor CBRS Camera with A.I. Functionality

ALEF

OMNIA PARTNERS | Public Sector

GraybaR

OMNIA PARTNERS

POWER. ACCESS. TRUST.

OMNIA PARTNERS PUBLIC SECTOR COOPERATIVE PROGRAM

GraybaR

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

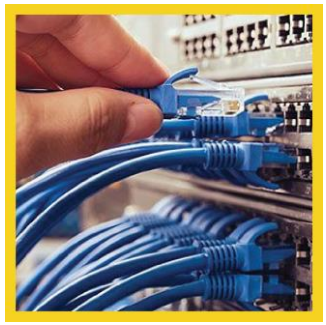
Key Benefits:

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

GraybaR

TYPES OF PRODUCTS

Electrical



DataComm

Lighting & Controls

Power Distribution

Industrial Control & Automation

Conduit, Raceway & Cable Support

Wire, Cable & Wiring Devices

Power Protection & Maintenance Supply

GraybaR