

Connected Cities Tour "GETTING TO SMART" Los Angeles

The Palm, 1100 S Flower St.
October 23 10:30 am to 3 pm



Ken DiScipio
Managing Director
Tavistock Group

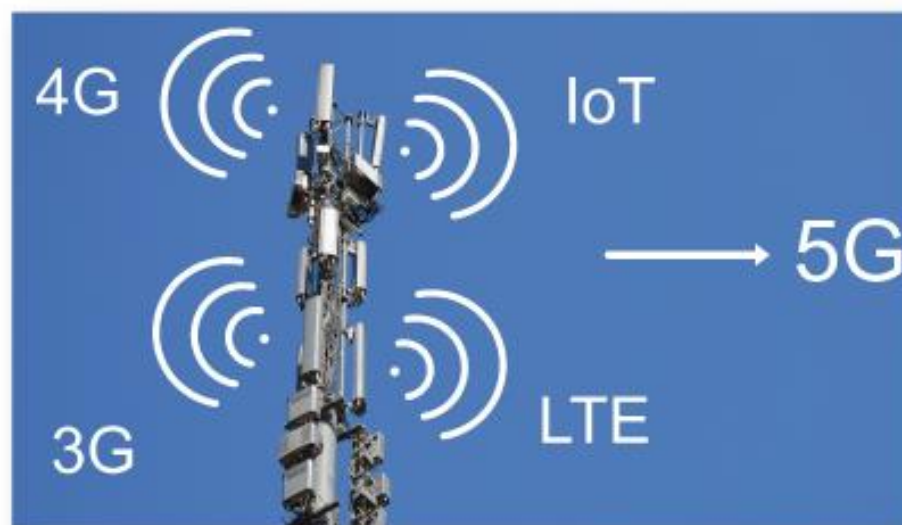
PRESENTING SPONSOR: GraybaR.

"Getting to Smart" is a quick dose of knowledge to help you navigate in our increasingly mobile, always-on, information intensive, and SMART Society.

Smart Cities require connectivity to enable Smart.

- Fiber Optics are essential to dense network capacity and coverage.
- 4G coverage and capacity is becoming widespread. 5G is emerging. Small Cell Demand is exponential.
- Video is driving bandwidth demand. Learn how a Smart Spaces approach is enabling new capability.
- DAS Networks are critical to Commercial Real Estate both for Public Safety and Functionality.

Join government, tech and enterprise thought leaders as we explore the business models, technology architectures and action plans that are driving innovation and disruptive solutions.



HITACHI
Inspire the Next

JMA
WIRELESS



extenet
SYSTEMS



5th Gen
MEDIA



www.densenetworks.com

"Getting to Smart" Connected Cities Tour

5G



Connectivity and Bandwidth are the oil
of the Gig Economy.

Network Technologies such as:
4G/5G, IoT, Fiber, Small Cell and Wi Fi
are Transforming How Society Operates.

These sessions bring together thought leaders from Government, Enterprise, Academia and the Tech Community to look at the Business Models, Technology Architectures and action plans that City and Community ecosystems are using to build Dense Broadband Infrastructure.

Be part of the Solution



2020 Event Schedule

February 11	Miami
March 12	Tampa
March 26	Atlanta
April 23	Dallas
April 30	New Orleans
May 14	Phoenix
June 11	Washington DC
June 18	Chicago
September 10	Boston
September 17	Charlotte
September 24	Houston
October 8	Philadelphia
October 29	Orlando
November 11	Nashville
December 3	San Antonio
December 10	New York

www.connectedcities tour.com





Cooperative Program Overview



Government Purchasing, Cooperatives and U.S. Communities

- Government requires Three Bid or Solicitation Process
 - Best Value
 - Equal Access
- Cooperative purchasing saves money & time
 - Satisfy the competitive solicitation requirement of public agencies
 - Invest less time and money in the procurement process
 - Leveraging the aggregate volume government agencies nationwide
 - Speeds up the process
 - Maintain quality business partners and practices
- Omnia Partners U.S. Communities - A national cooperative purchasing alliance for local governments including States, Cities, Counties, Special Districts, Schools, Colleges and Universities & Non-profits.
- Website: www.uscommunities.org

Advantages of Cooperative Procurement

Agency, Consultant, Contractor / Integrator, Manufacturer, Supplier

- Offer Total Solutions
 - Specify, Finance, Integration, Product
 - Product & Project Management
- Flexible & Legal Contract Vehicle
- Saves Overall Costs

No Bid

- Saves Money on Procurement Process
- Speeds up Project Timelines
- Eliminates the Unknown

Partnerships

- Brings Together the Necessary Partners



ELIGIBLE AGENCIES

- Over 98,000 eligible agencies can participate
 - Registration & MICPA
 - Over 60,000 registered with US Communities
 - Over 17,000 using Graybar's contracts
- Eligible Agencies Include:
 - State Agencies, Counties, Cities, Towns and Villages
 - Specials Districts: Water, MUD's, Transportation, Airports
 - Public and Private Higher Education
 - Colleges, Universities, Technical Schools
 - K-12 School Districts, Charter Schools & Other
 - Non-Profits Churches, Education, Hospitals, YMCA & Other



Graybar's Role with U.S. Communities

- One Combined Contract # EV2370
 - Valid date February 1, 2018
 - 5 years initial term (with “three” two year extension options)
 - Electrical, Lighting, Utility
 - Data/Communications, Networking, Wireless, Service Provider, Security
 - Comprehensive Service Offering
 - Other Related Products & Services
- Graybar has a 21-year history with USC
- City of Kansas City, Lead Public Agency
- Large Breadth of Product - Consistent and competitive pricing
- Project & Volume Discounts Available
- No contracts to sign, no spend limits, non-binding & best overall value

Easter morning 1900: 5th Ave, New York City. Spot the automobile.

Disruption can happen very fast...



Source: US National Archives.

**Easter morning 1913: 5th Ave, New York City.
Spot the horse.**

Disruption can happen very fast...



Source: George Grantham Bain Collection.



Connected City
Smart City

4 aspects of a smart city



1
Collect



2
Communicate



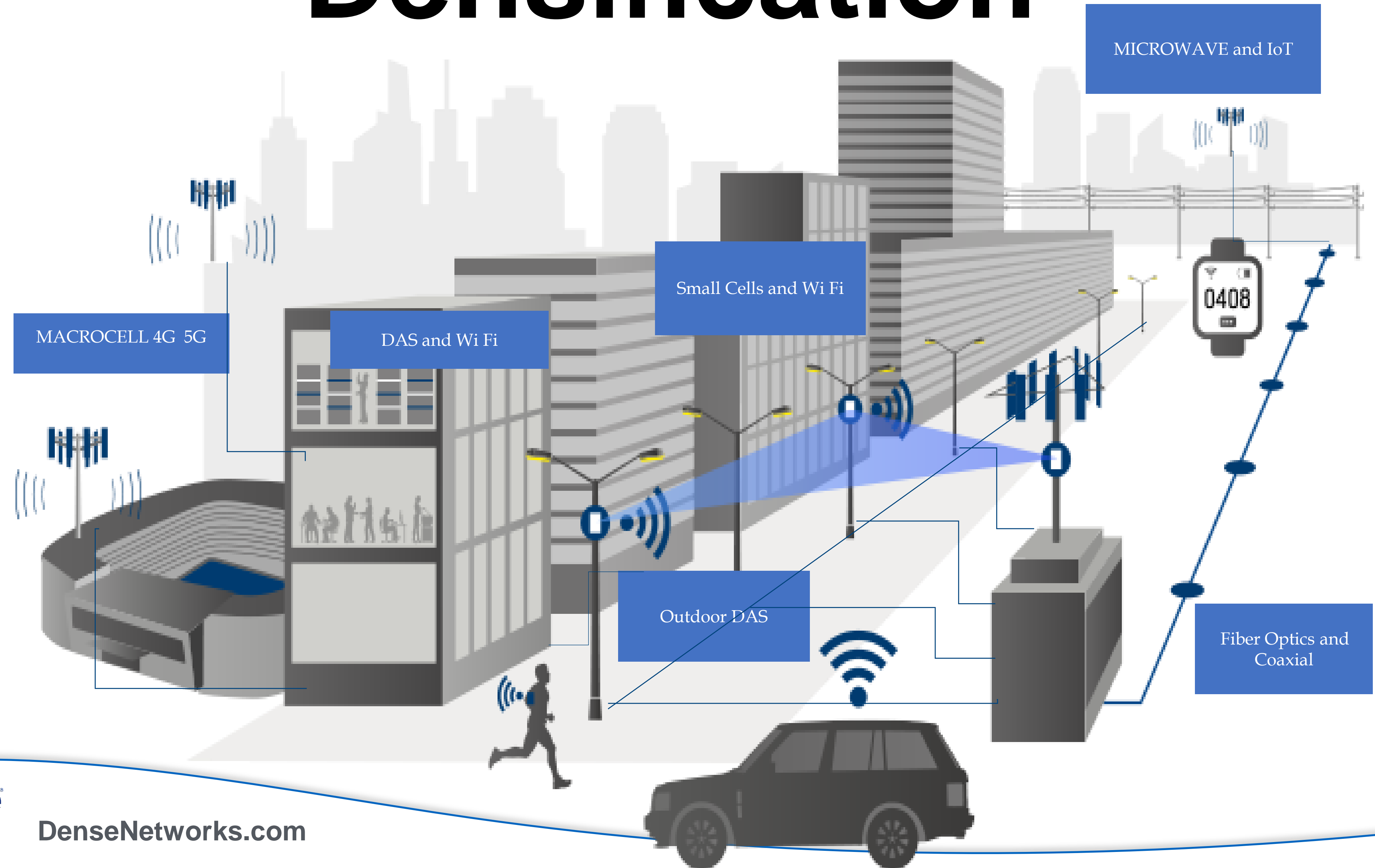
3
Compute



4
Control



Densification



Capacity

Coverage



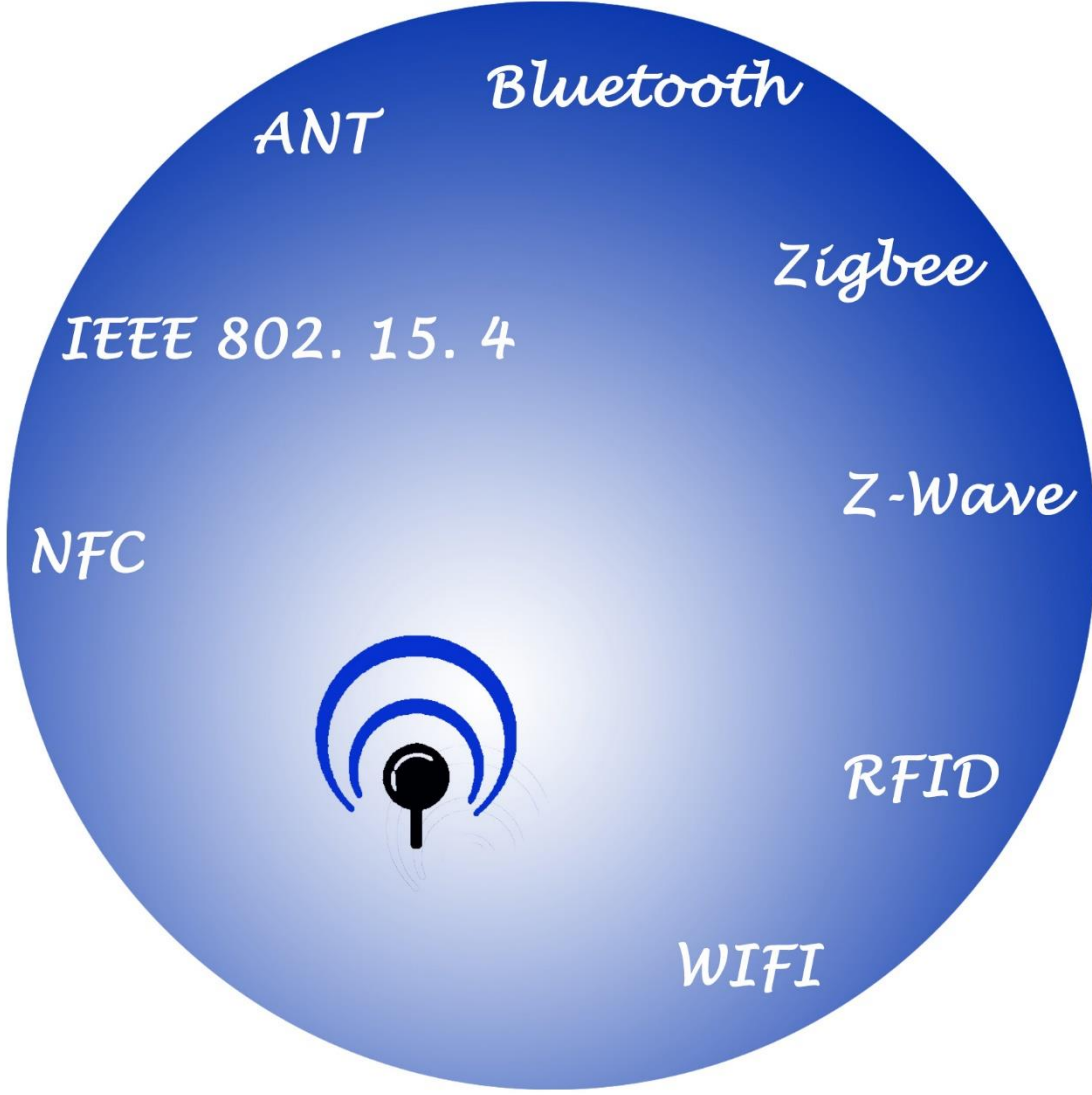
Bandwidth

ENTER

[click here for more information](#)

How Many Networks?

Capacity, Coverage, Compliance

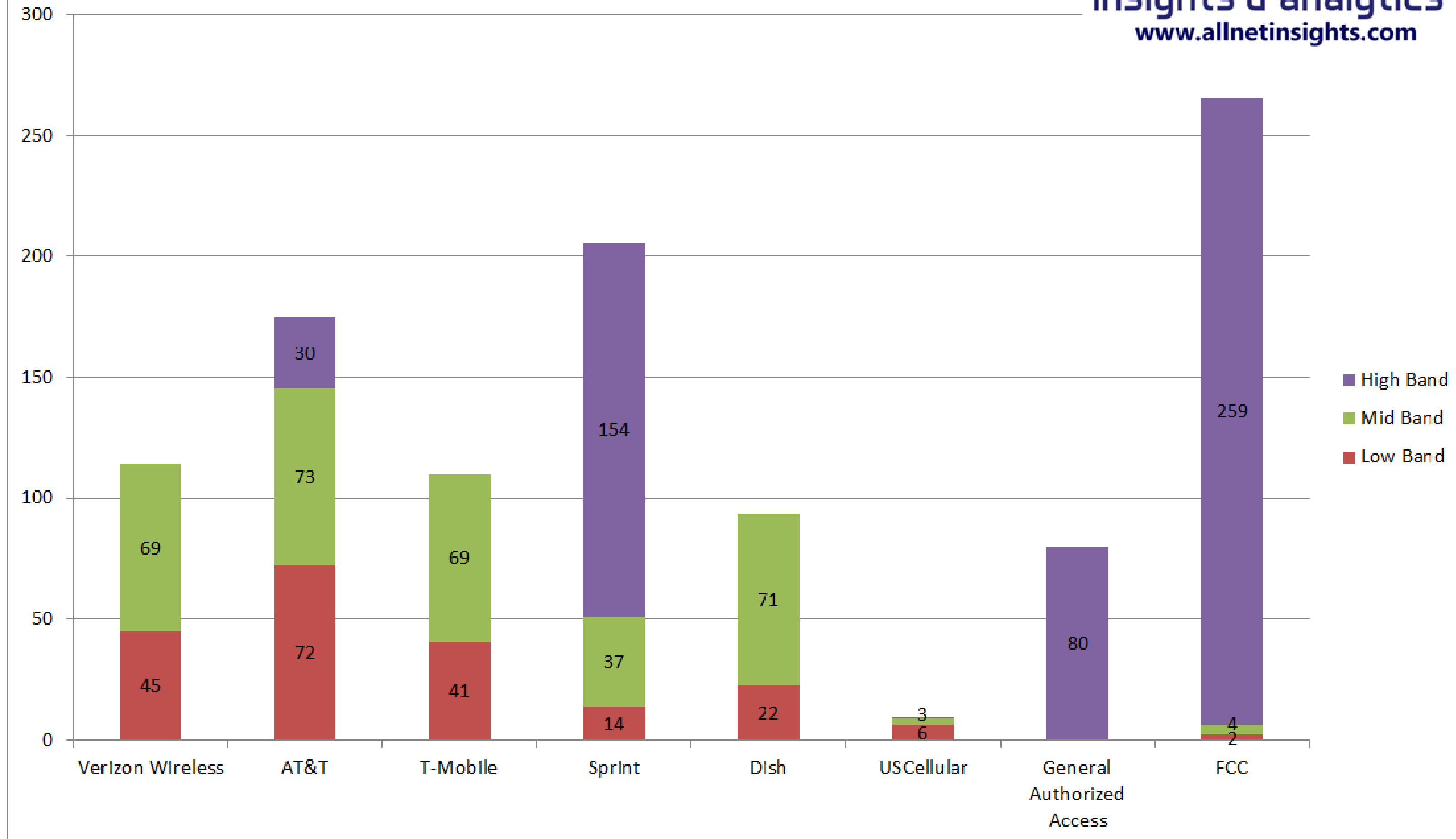


A Tidal Wave of Antennas

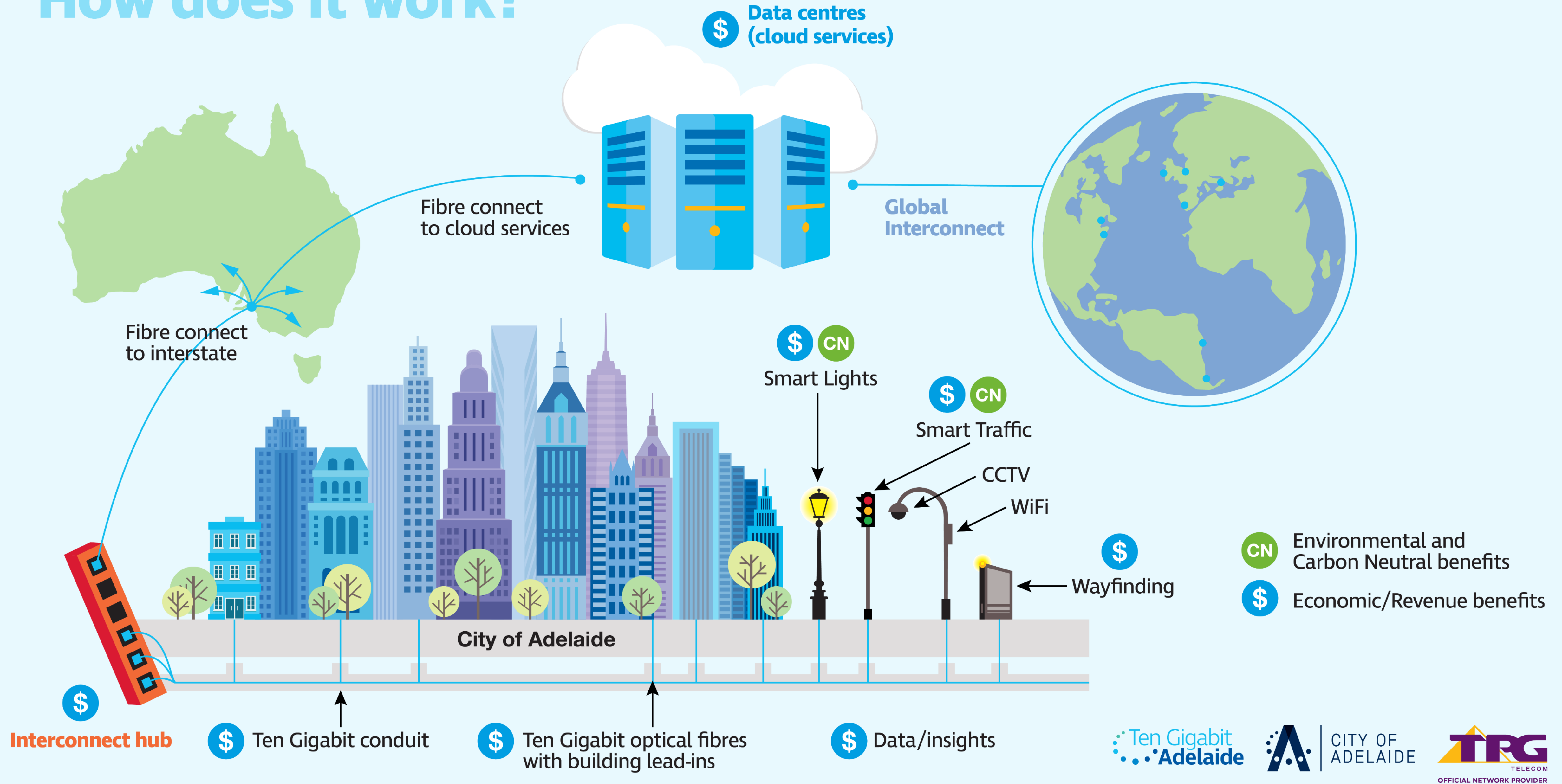


Significant opportunity exists to evolve to a *shared* infrastructure model in urban centers

Mobile Carrier National Weighted Average Spectrum Depth (MHz) by Band Classification



How does it work?





SAN FRANCISCO
DEPARTMENT OF
TECHNOLOGY

Fiber for San Francisco Internet for All

Date RFQ Issued:	January 31, 2018
Pre-Submittal Conference:	February 12, 2018 (10:00 a.m. PST) View livestream: http://sfgovtv.org/youtube_live
Deadline for Respondent Team Written Questions or Requests for Clarification:	March 2, 2018
Respondent Team Submittals Due:	March 26, 2018
Issue Notice of Shortlist of Respondent Teams Selected for Oral Interviews:	April 9, 2018
Oral Interview with Selected Respondent Teams:	Week of April 16, 2018
Issue Notice of Qualified Bidders:	April 30, 2018

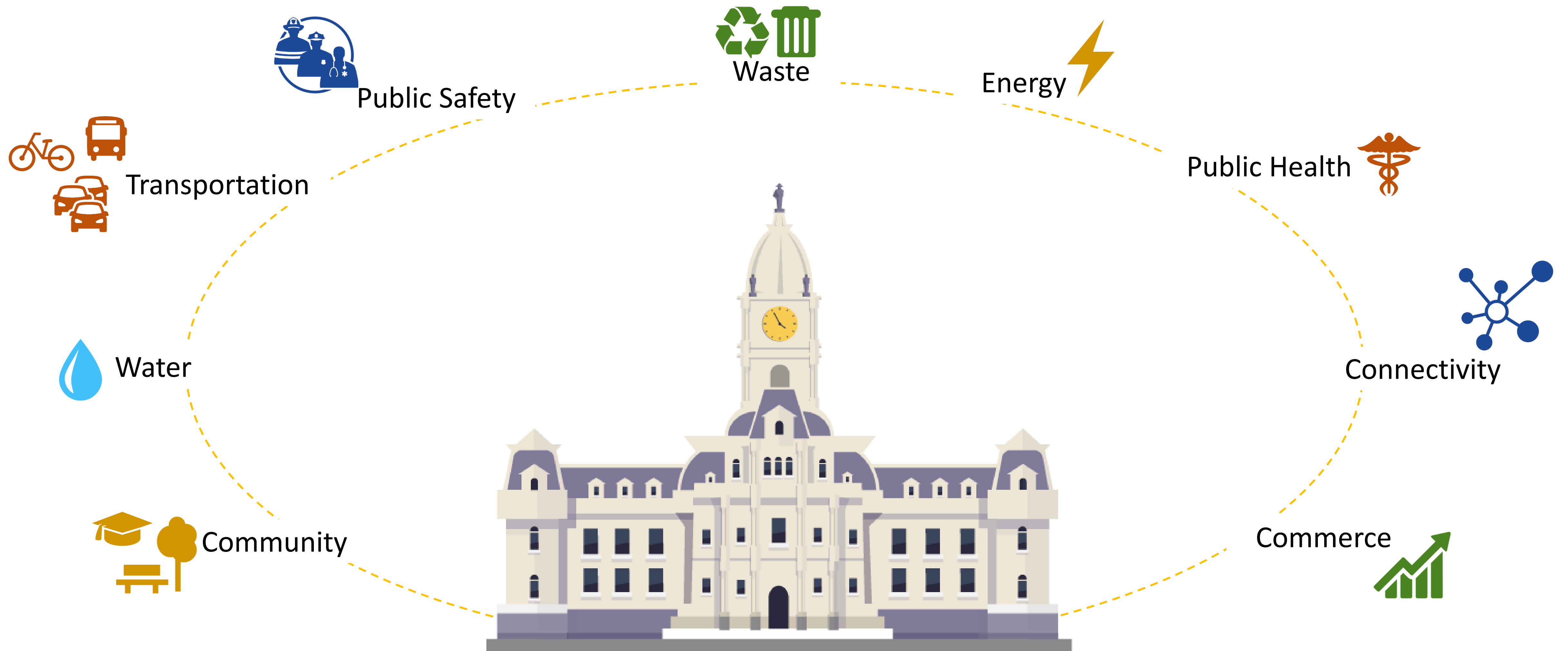


DenseNetworks.com

*Dates are subject to change.

The Big Picture

Smart Collaboration > Improved Efficiency > Faster Response > Better Service



A Smart Miami is:

- *Connected*
- *Equitable*
- *Resilient*
- *Sustainable*
- *Transparent*
- *Self-Aware*



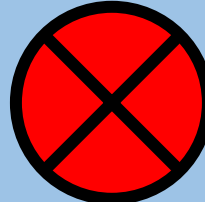

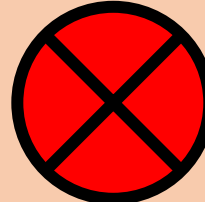
Internet of Things (IoT)



IoT is sensors...	Sending data to...	For the purpose of...
Audio monitoring	Traffic control	Keeping people with asthma out of dangerously polluted parts of the cities.
Garbage fill level	Mobile apps	
Traffic monitoring	The police	Alerting the police to a shooting. Mapping pedestrian traffic around a city.
Air quality	The fire department	
Gunshot detection	EMS	Relieving traffic congestion.
Foot traffic monitoring	Community organizations	Watering flowers.
Facial recognition	City Governments	Alerting the police to crimes in progress.
Soil moisture levels	University researchers	Sending the fire department and rescue vehicles to a crash.
Flood sensors	Citizen Scientists	
Cameras	Digital Kiosks	Predicting flood locations.

Broadband Strategy

Hybrid Approach – 80% results for 20% effort

	Government-led	Hybrid model <u>(Recommended)</u>	Market-led
Summary	<p>Cities building full fiber networks is expensive, complex, and risky</p> <p></p> <p>Too Risky</p>	<p>Cities that welcome private investment with appropriate guidance are most successful</p> <p></p> <p>Just Right</p>	<p>Cities with laissez faire broadband stagnate as cable-telecom duopolies</p> <p></p> <p>Too Ineffective</p>
Key Takeaways	<ul style="list-style-type: none"> • Seattle, Palo Alto and others have determined that city-led full fiber build-outs are not practical, after detailed assessments • Chattanooga’s unique buildout included control by the utility and federal funds 	<ul style="list-style-type: none"> • Seattle leveraged streamlined policies to drive competition and massive fiber buildout • NYC used franchise agreements to drive fiber build-out 	<ul style="list-style-type: none"> • Broadband speed and price cluster to the bottom of the peer set • No substantial competition in any market-led city
Potential costs	Very high. City-owned fiber-to-the-premise would cost \$800M+.	Moderate. Working with carriers could cost \$50-250M based on build types.	Very low or none. City relies on private sector investment.
Results	Peers show 90%+ fiber build-out.	Peers show 55-70% fiber build-out.	Peers show 0-5% fiber build-out.

Broadband Strategy

Emerging landscape for voice and DATA

Effective in Dense Urban, Urban, and Suburban

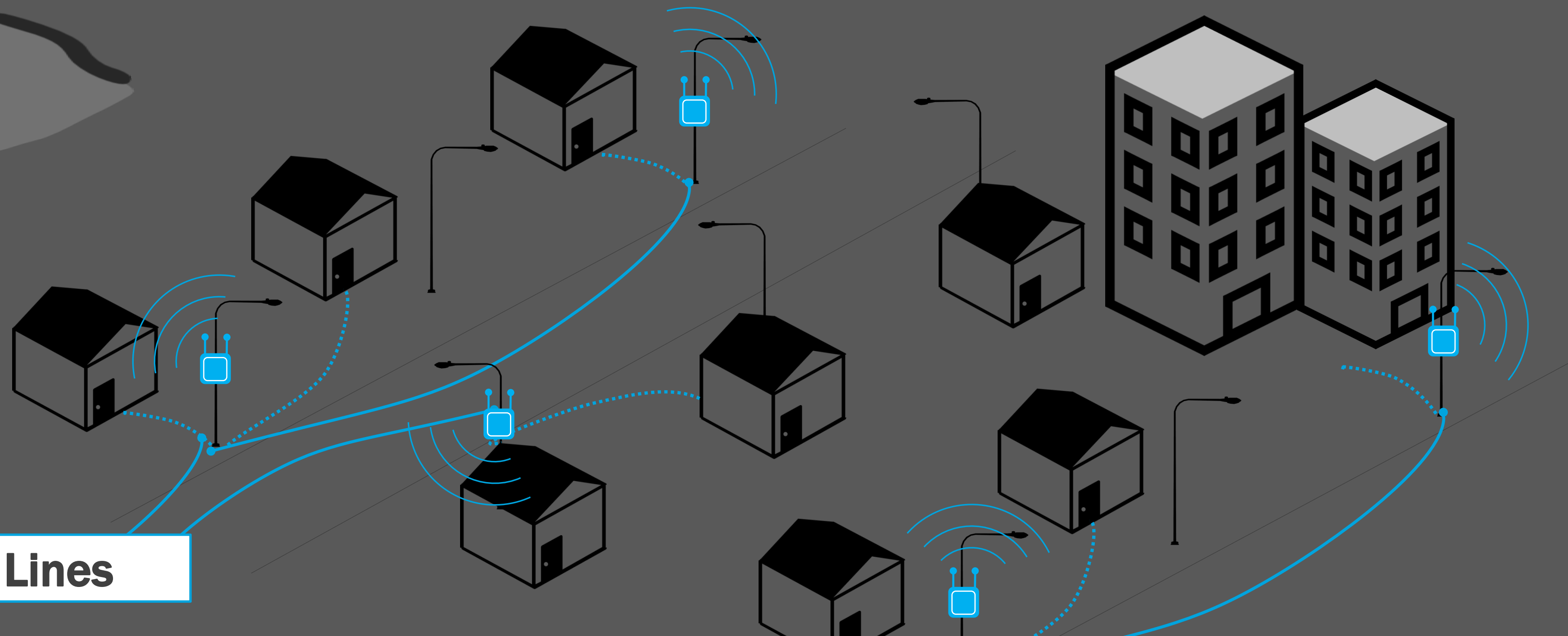
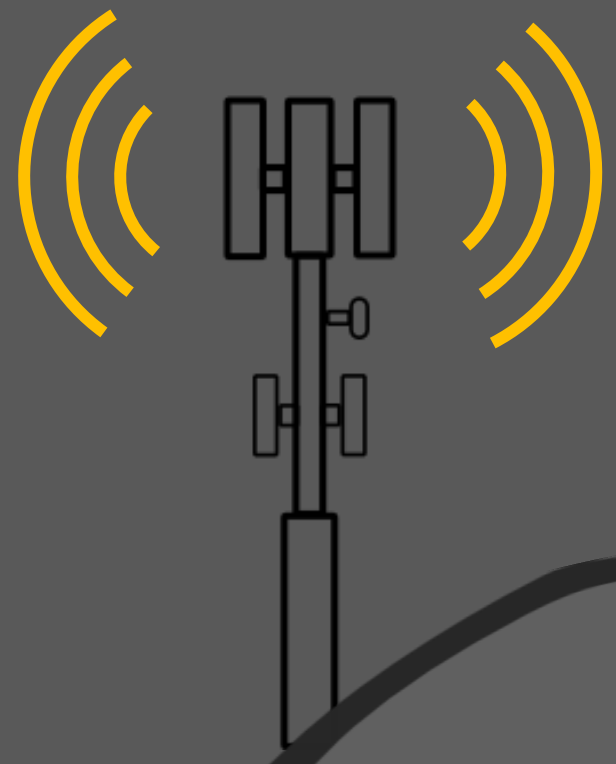
Cell towers: carry all mobile voice & some data

 **4G/5G Small-Cells**

Gigabit speed
up to 50x faster

Fiber Lines

Light pole is most valuable asset for broadband



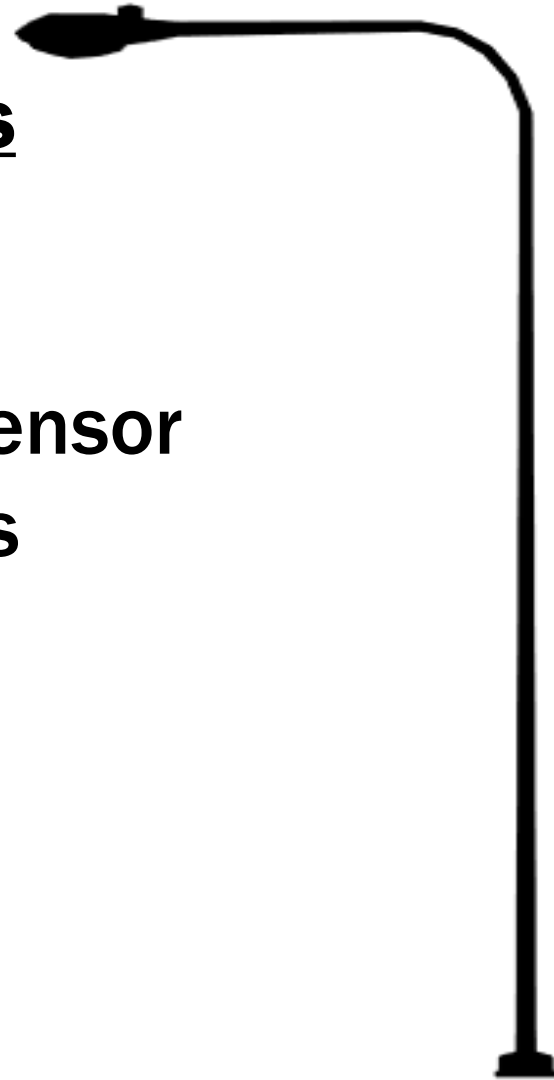
Broadband Strategy

STREETLIGHT

Light/Safety

Properties

- Height
- Power
- Light Sensor
- Lumens
- Density

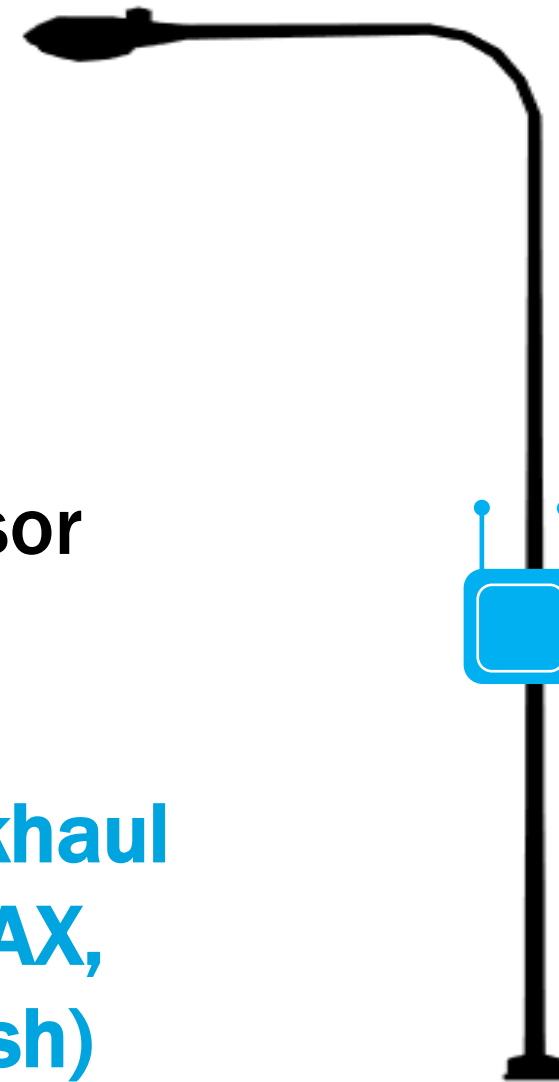


SMALL CELLS

Broadband Digital Infrastructure

Properties

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

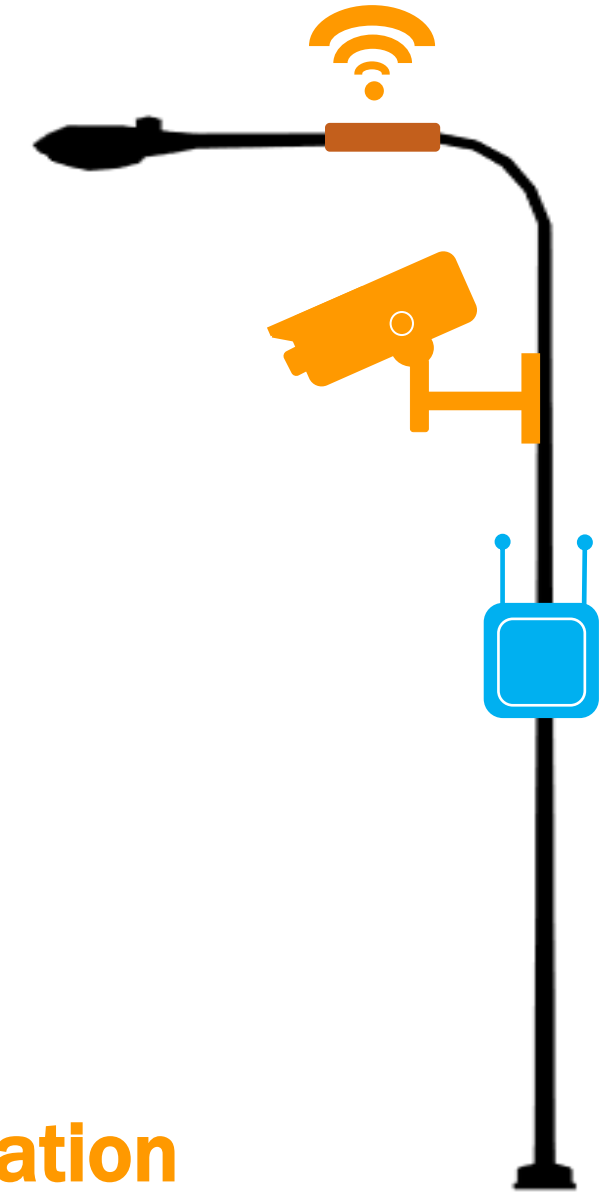


INTERNET OF THINGS

Smart Cities

Properties

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



Maturity:

Mature

Emerging

Extremely Immature

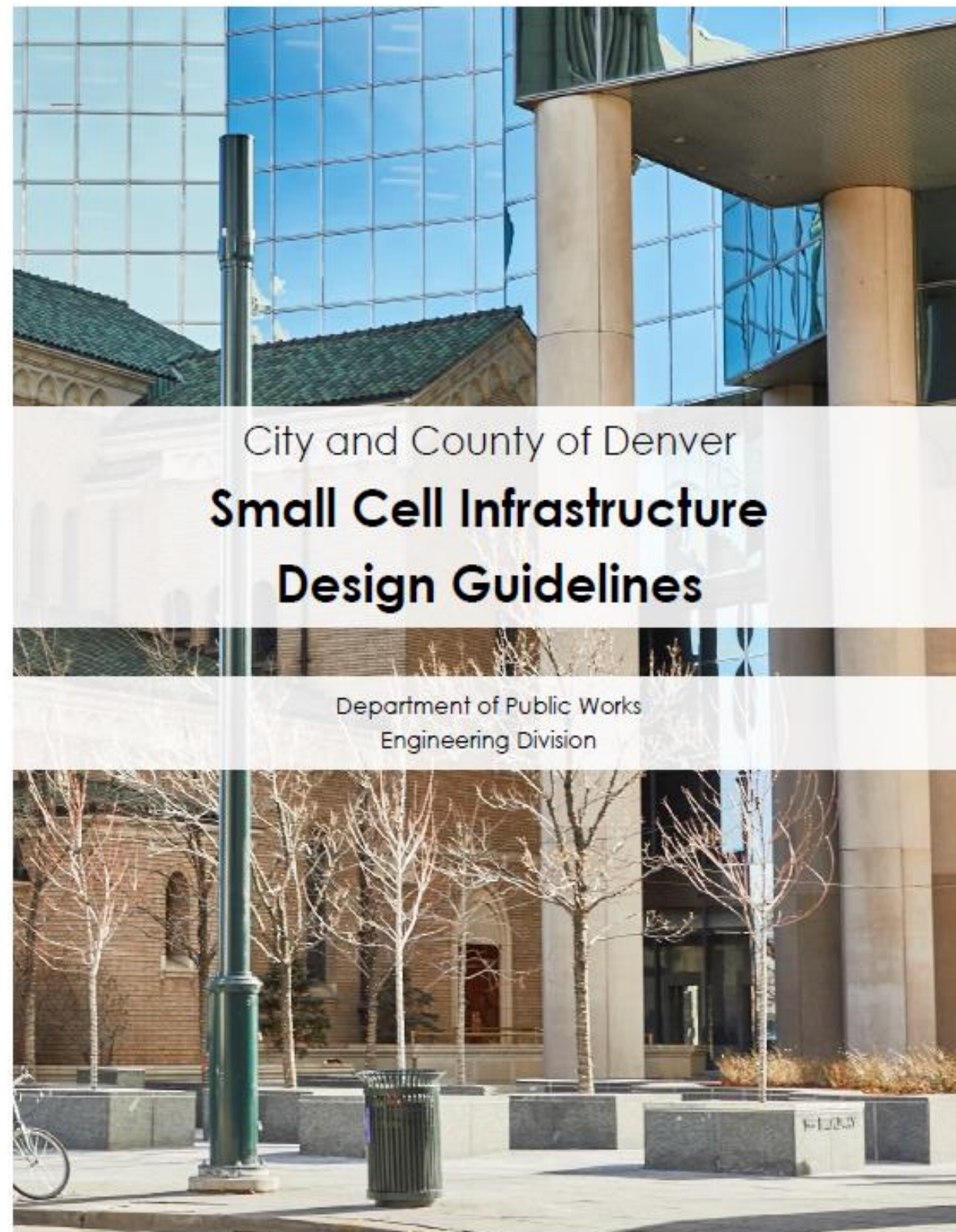
Possible Action:

Proceed w/ LED Light Replacement Only

Re-examine in Broadband Strategy

Seek to Understand with Knight IoT Grant

Public Works has created Design Guidelines and a custom Permit process to address:



April 2018

- ❑ Public-facing review process including Districts, City Departments, Neighborhood Orgs
- ❑ Policy for co-location first
- ❑ Notification of adjacent property owner
- ❑ Restricting new pole density through min **250'** spacing
- ❑ Restricting placement (along parks, historic & residential frontages)
- ❑ Restricting placement in front of residential & valuable sight lines
- ❑ Requiring camouflage and concealment
- ❑ Limiting height and equipment size
- ❑ Opportunity to coordinate fiber conduit



The City and County of Denver
Public Works Department
Jon Reynolds, Engineering Supervisor



Jacobs Engineering Group
Mike Butters, Project Manger



LIGHTING DESIGN AND ENGINEERING

Clanton & Associates:
Nancy Clanton, CEO
Dane Sanders, Principal
Arnie Kuczowski, Engineer II - Lighting



Aero Wireless Group:
Jim Lockwood, CEO
Mike Hoganson, Chief Operating Officer

CITY GOALS

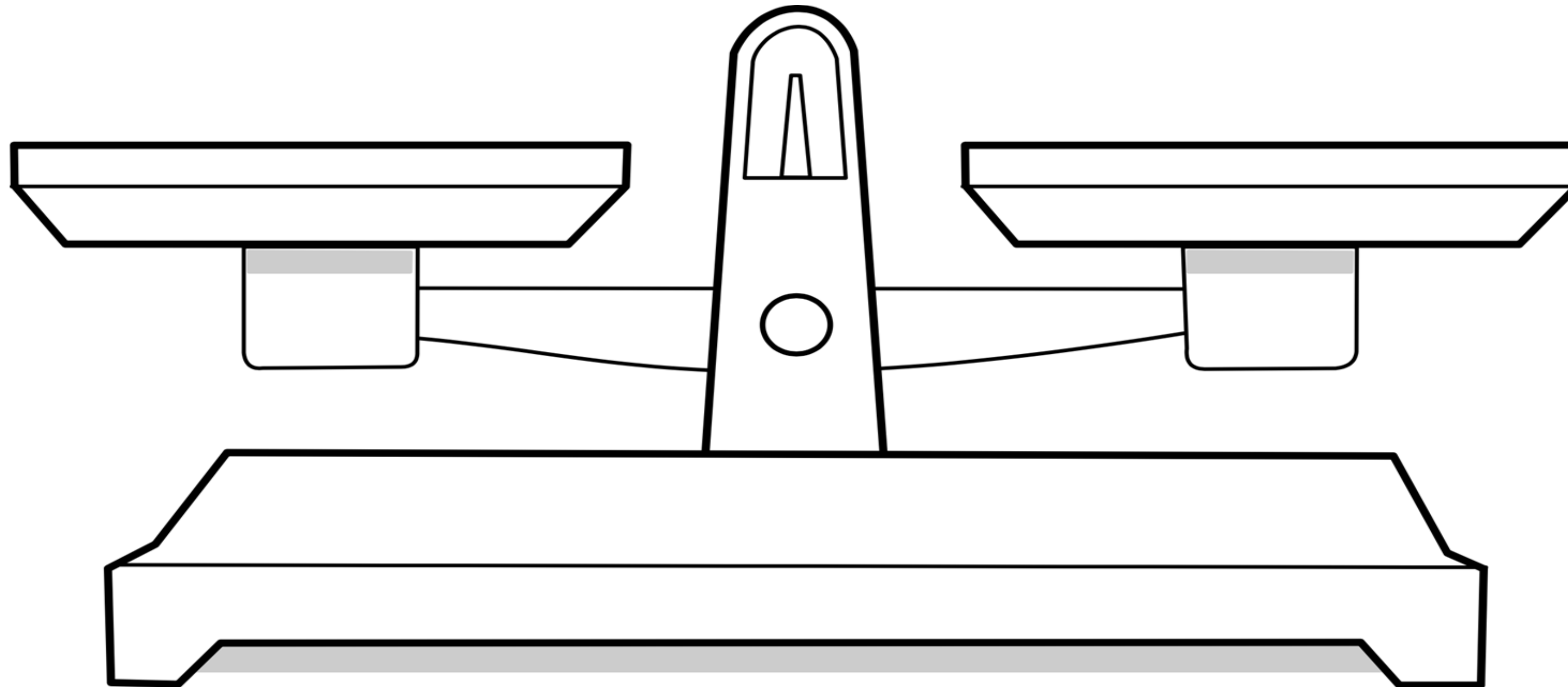
- *Minimize aesthetic impacts*
- *Encourage competition in wireless market*
- *Community awareness / comfort*
- *Fair compensation for use of public asset*

INDUSTRY GOALS

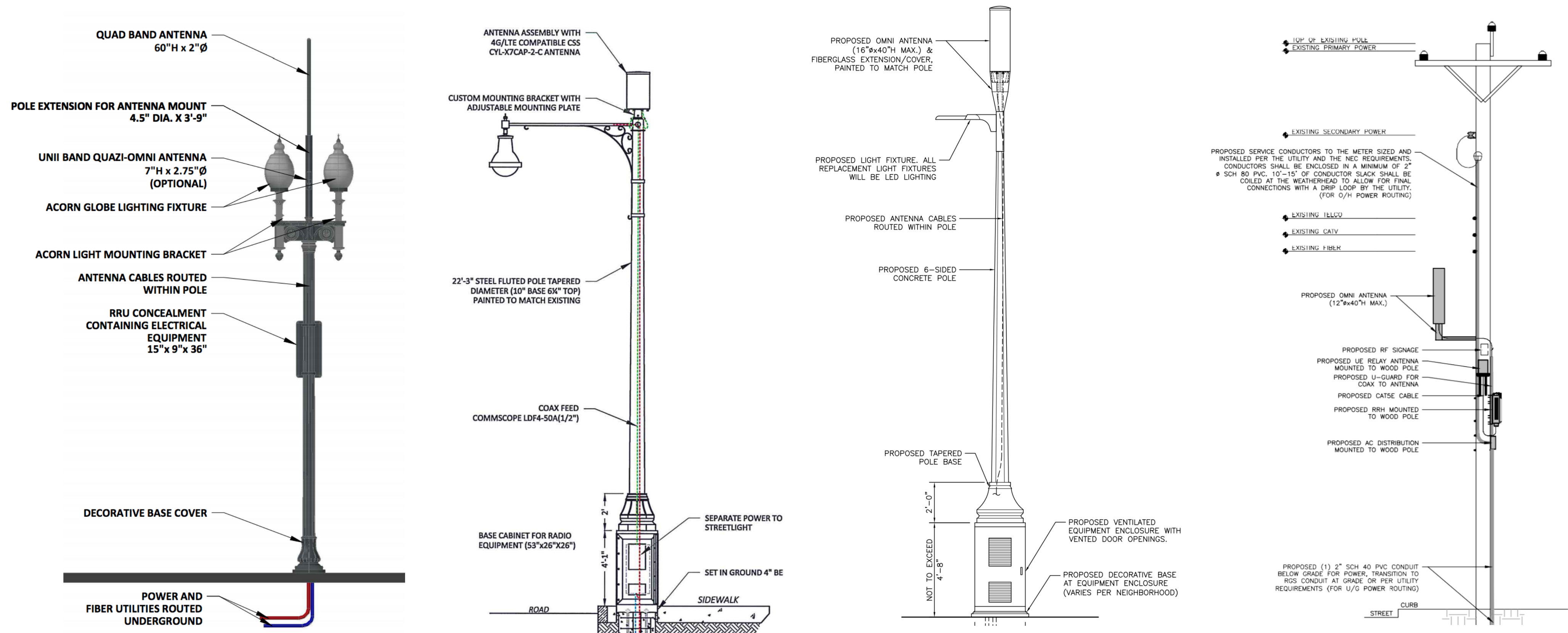
- *Fast and predictable approvals*
- *Large volume of installations*
- *Manageable community process*
- *Appropriate pricing models for carriers and neutral hosts*

SHARED GOALS

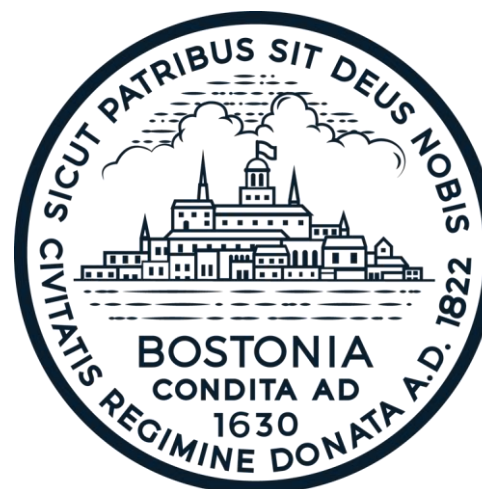
- *Great wireless service in every neighborhood*
- *Avoid community concerns with deployment*



COOPERATIVE DESIGN PROCESS

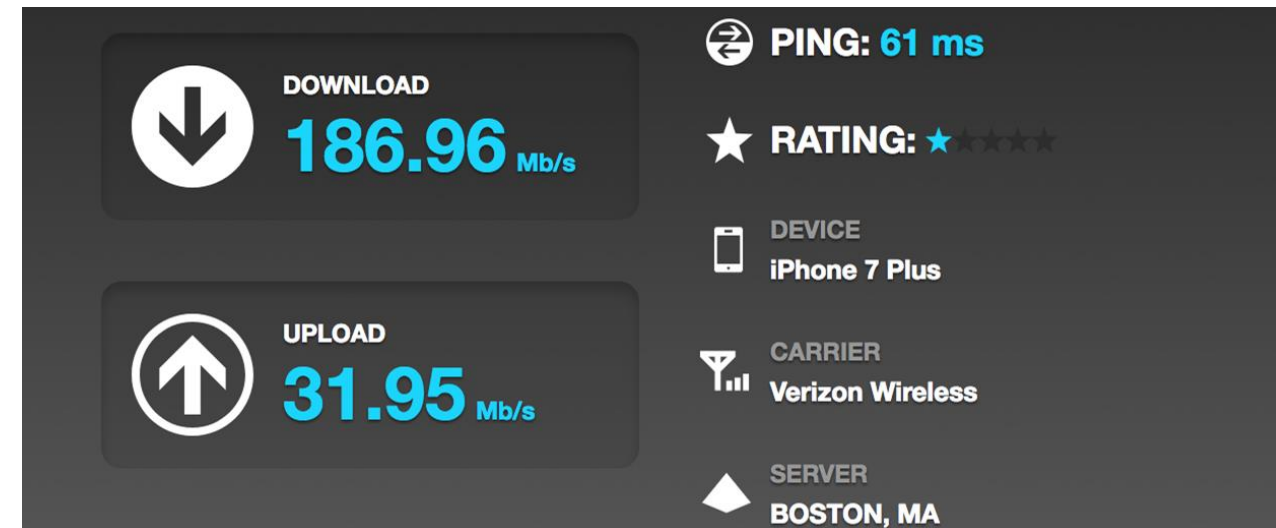


- *City and Licensees develop designs for replacement lights together*
- *Heavy focus on aesthetics, concealment, and historic character*
- *Once approved, design can be used by any licensee*



RESULTS (OCTOBER 2017)

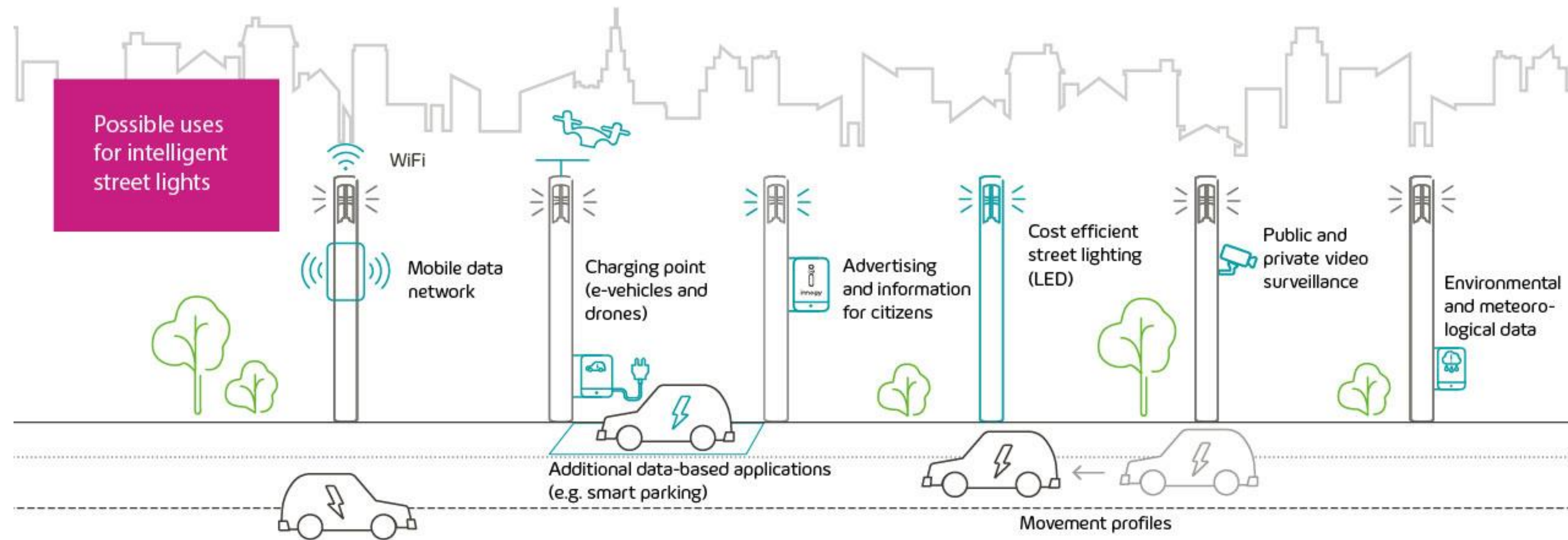
- *>800 approved or installed, 314 in process*
- *90% approved within 10 business days, 100% within 28 business days*
- *Improved wireless service*



- *Funding for digital equity programs and hotspot lending*
- *Positive relationship between City and licensees*



Tampa LED Streetlight Program



- **5-year LED Upgrade Program**
- **Secure Smart Grid**
- **Enables Smart City Initiatives**
- **Low Energy Consumption**

Near-Term

- Gunshot detection
- Parking Space Management
- Traffic Counting

Future

- Flood Detection
- EV Charging
- Pedestrian Counting
- Environmental Sensing
- Motion Detection Services
- Drone Charging
- LED Banners
- Data Mining
- Customer Awareness

PROJECTS

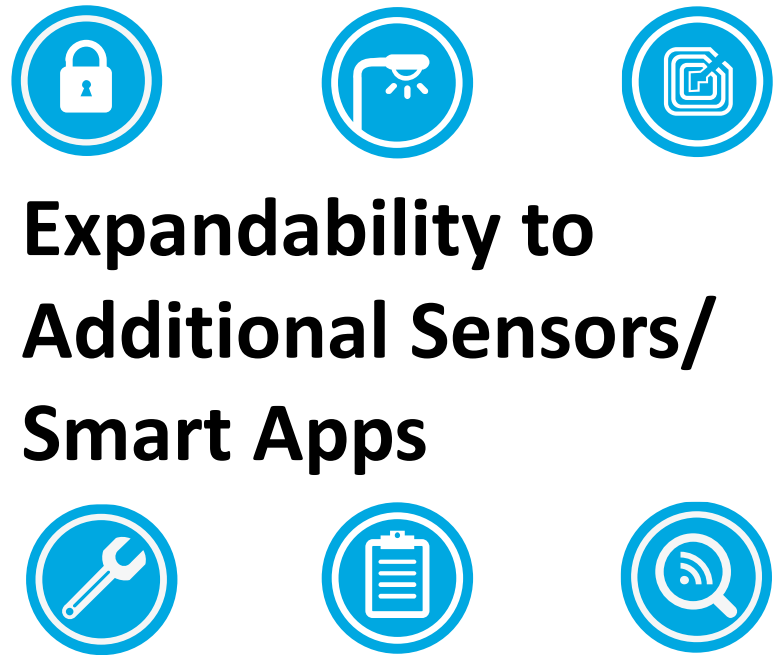
Smart Street lighting

- **GOAL:** 100% LED streetlight by 2020
- OUC working to retrofit 25,000+ streetlights to LED
 - 18,000 currently retrofitted
- Exploring test of new “Smart Streetlights” in Downtown
 - LED technology
 - Video surveillance
 - Environmental monitoring
 - Traffic analytics
 - Wi-fi / DAS systems
 - Gun shot detection



Light Pole as Smart Venue Information Hub

Smart Lighting



Expandability to Additional Sensors/ Smart Apps

Wi-Fi Connectivity



One Network, No New Poles or Trenching

Smart Parking



Smart Traffic



Video Surveillance



OUC Approach

Secure



Connected



Mobile



Sustainable



Energy



Water



Resilient



Smart Community Ideas: Secure

	Apartments	Master Planned Residential	Office & Retail	Industrial	Hospitality/Community
Smart Streetlights	●	●	●	●	●
Incident Detection	●	○	●	◐	●
Real-time Surveillance	◐	◐	●	●	●
Crowd Monitoring	○	○	◐	◐	●
Wearables	◐	◐	○	○	◐
Real-time Recognition	○	○	◐	◐	●



Less

More

Smart Community Ideas: Mobile

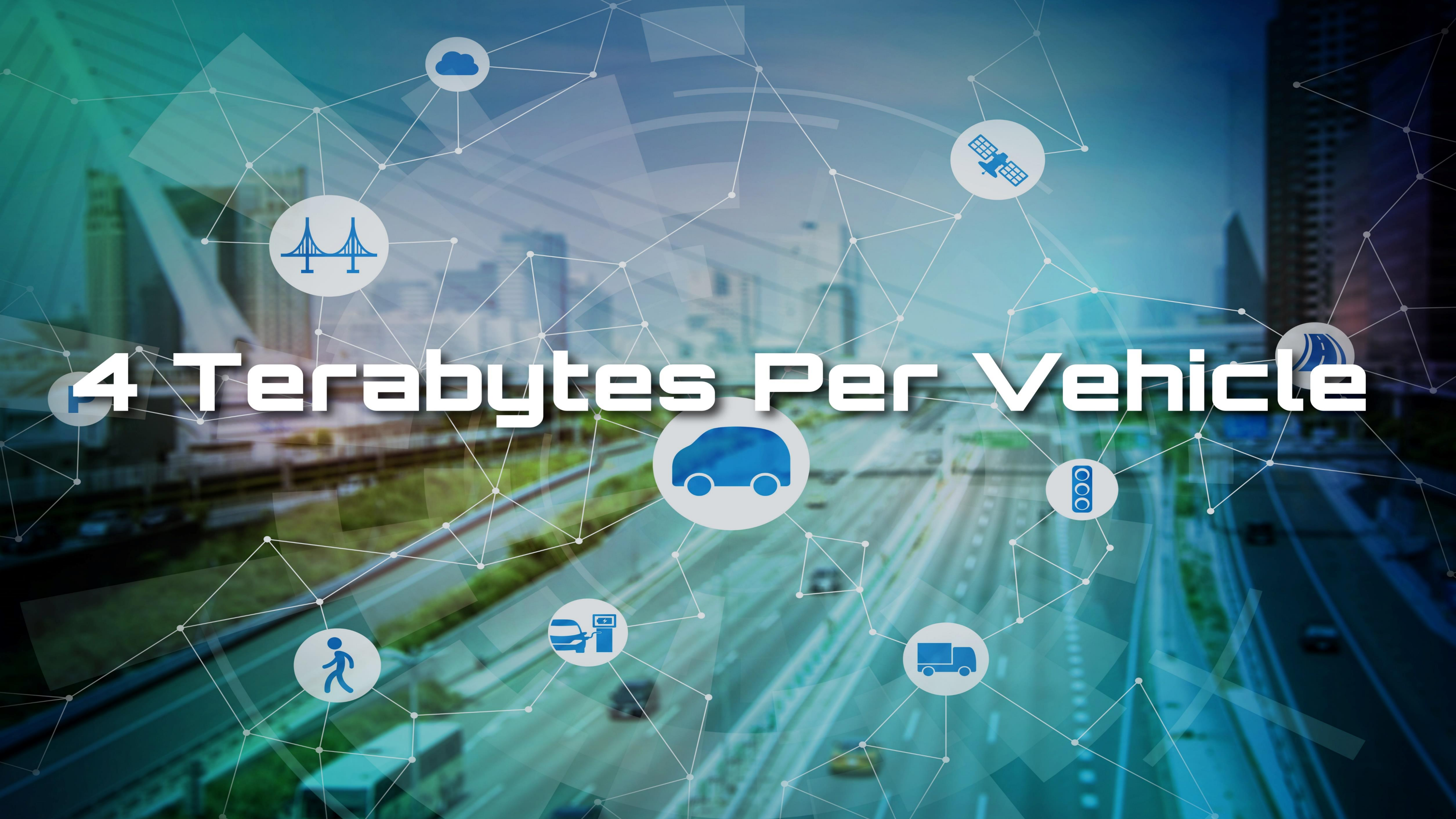
	Apartments	Master Planned Residential	Office & Retail	Industrial	Hospitality/Community
Bike Hubs	●	●	●	◐	●
EV Charging Infrastructure	●	●	●	◐	●
Car Sharing Programs	●	●	●	●	●
Autonomous + Electric Shuttles	●	●	●	●	●
Traffic Analytics	◐	◐	●	●	●



Less

More

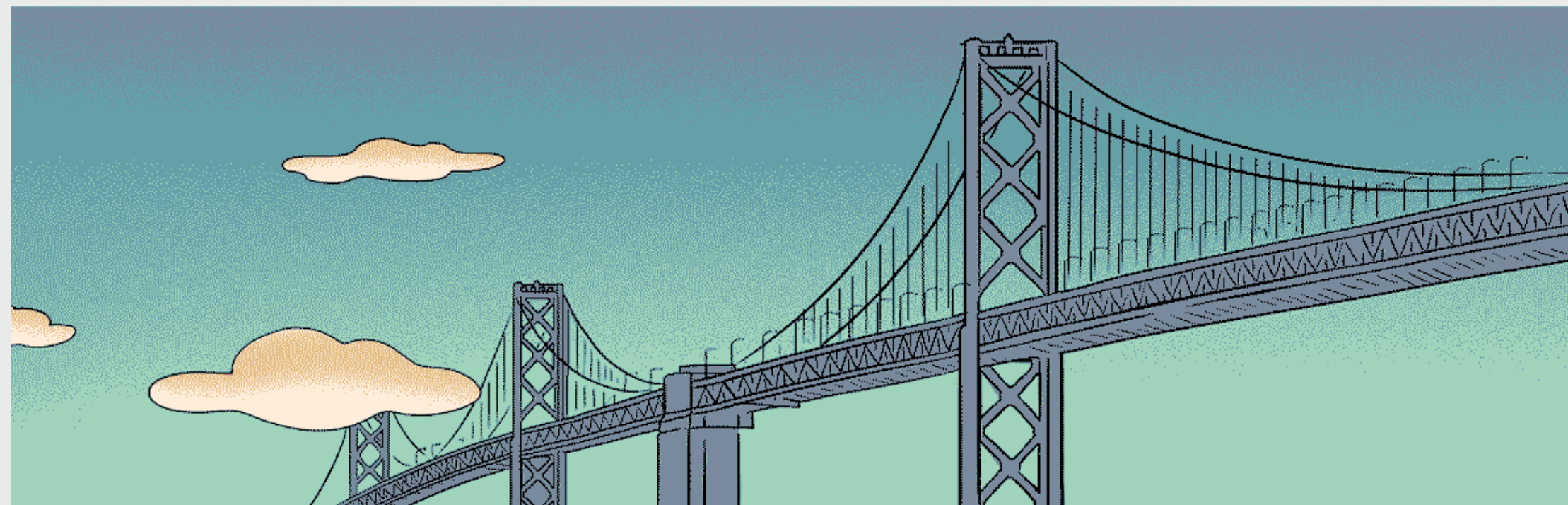
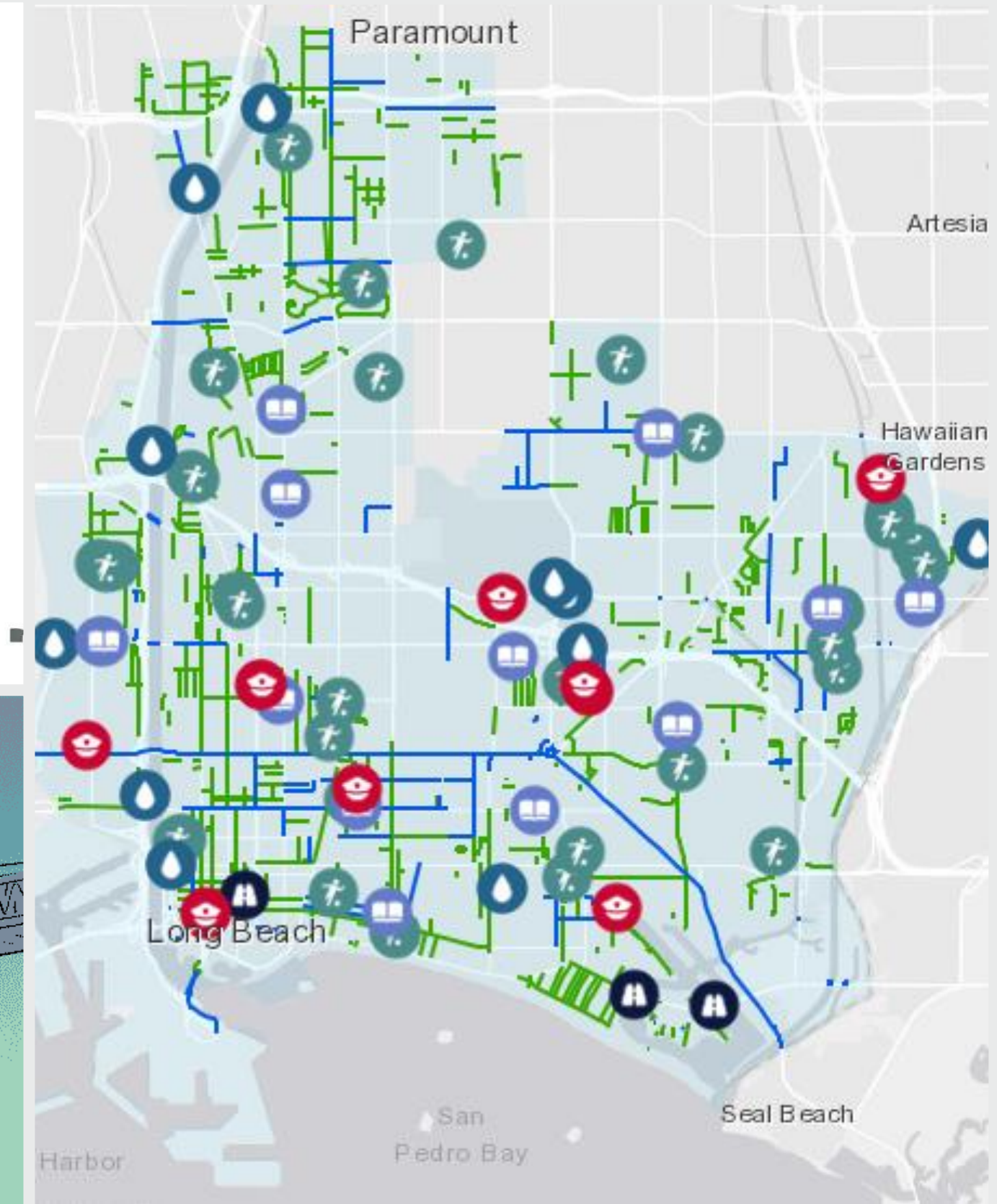
4 Terabytes Per Vehicle





Connected City
Smart City

What are we doing to be more responsive?



The demand for managed connectivity as a service is rapidly expanding.

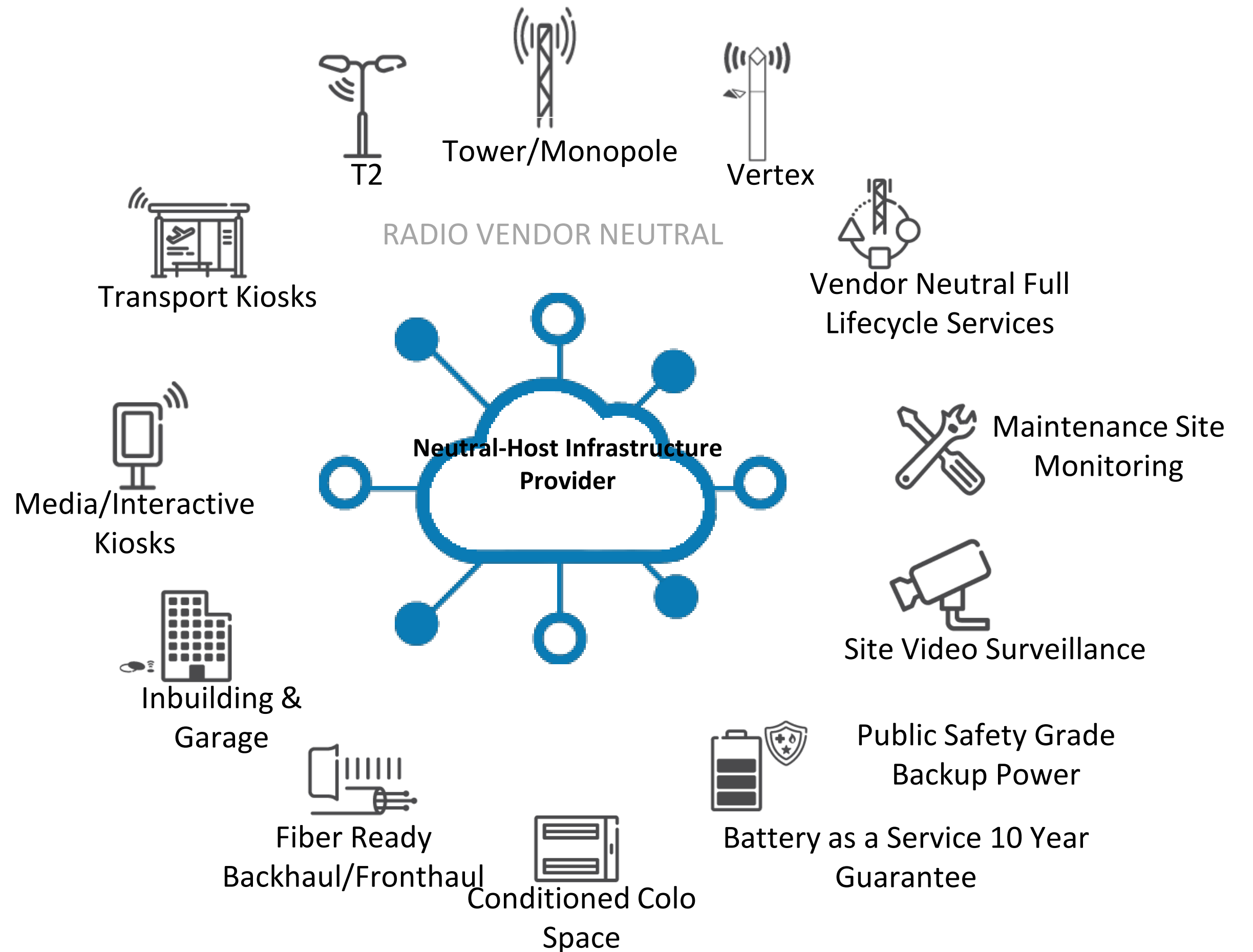
We provide a multitude of stakeholder benefits surrounding the deployment of 4G & 5G Telecom smart enabled infrastructure including:

- Marquee Commercial and Enterprise Real Estate
- Smart Cities and Planned Communities
- Electric Vehicle and Fleet Charging Stations



Fixed Wireless (CaaS) Connectivity as a Service

- Kiosk, Transit Station and Digital Signage Collocation Solutions
 - Energy Storage & MicroGrid Ecosystems
 - Macro and Small Cell neutral-host Tower and Light Standard Collocation Solutions
 - LED Smart Street Lighting Collocation Solutions
 - In-Building – Subterranean Collocation Solutions



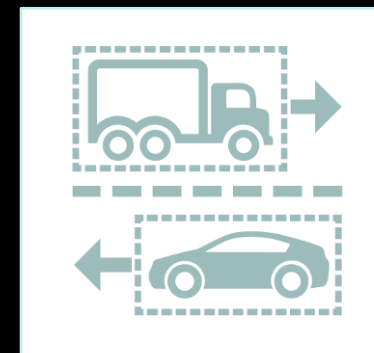
Hitachi Video Analytics Delivers Digital Insights

NEXT
2018

Operational & Business Intelligence



People Counter



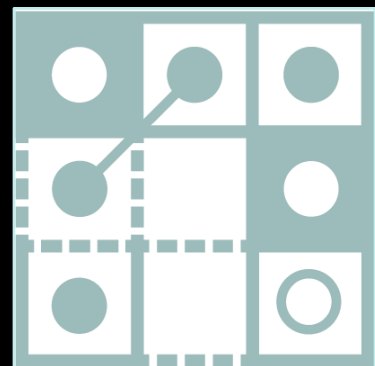
Traffic Analyzer



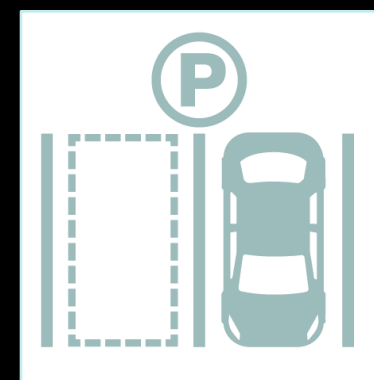
Queue Detector



License Plate Recognizer



Activity Visualizer



Parking Space Analyzer



Direction Controller



Camera Health Monitor

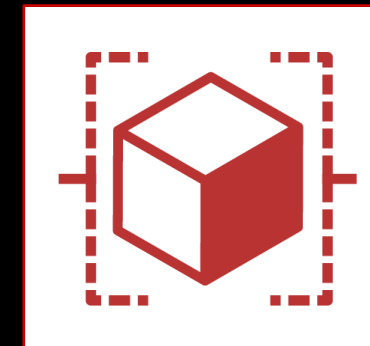
Security



Intrusion Detector



Facial Recognition

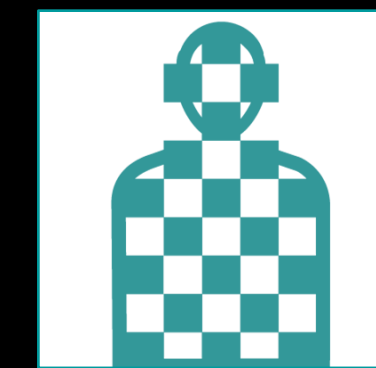


Object Detector



Video Enhancer

Privacy



Privacy Protector



European Privacy Seal
EP-P-F9LDTM / Valid till 2017-10

Police • Hospitals • Campuses • City Agencies • Retail • Financial Services • Transportation • Utilities



- **20 years – Innovative Wireless Infrastructure**
- **Smart Pole Concealment Solutions**
- **Wireless Infrastructure Planning Product Solutions**
- **Professional Engineering Services**
 - Municipalities
 - Wireless Operators
 - Public and Private Utilities





Path to 5G

Kurt Jacobs – [kjacobson@jmawireless.com](mailto:kjacobs@jmawireless.com)



OUC Approach

Secure



Connected



Mobile



Sustainable



Energy



Water



Resilient



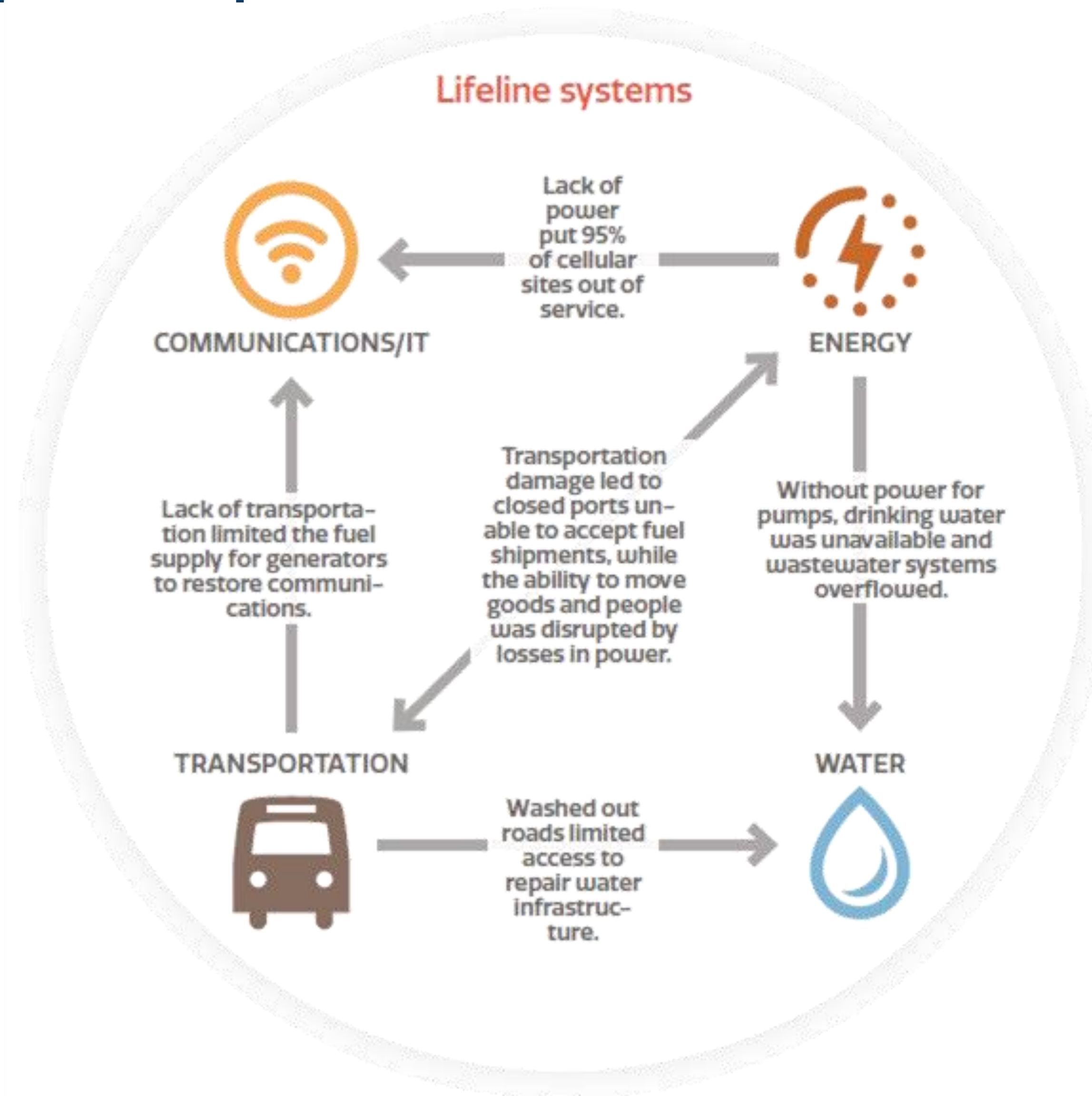
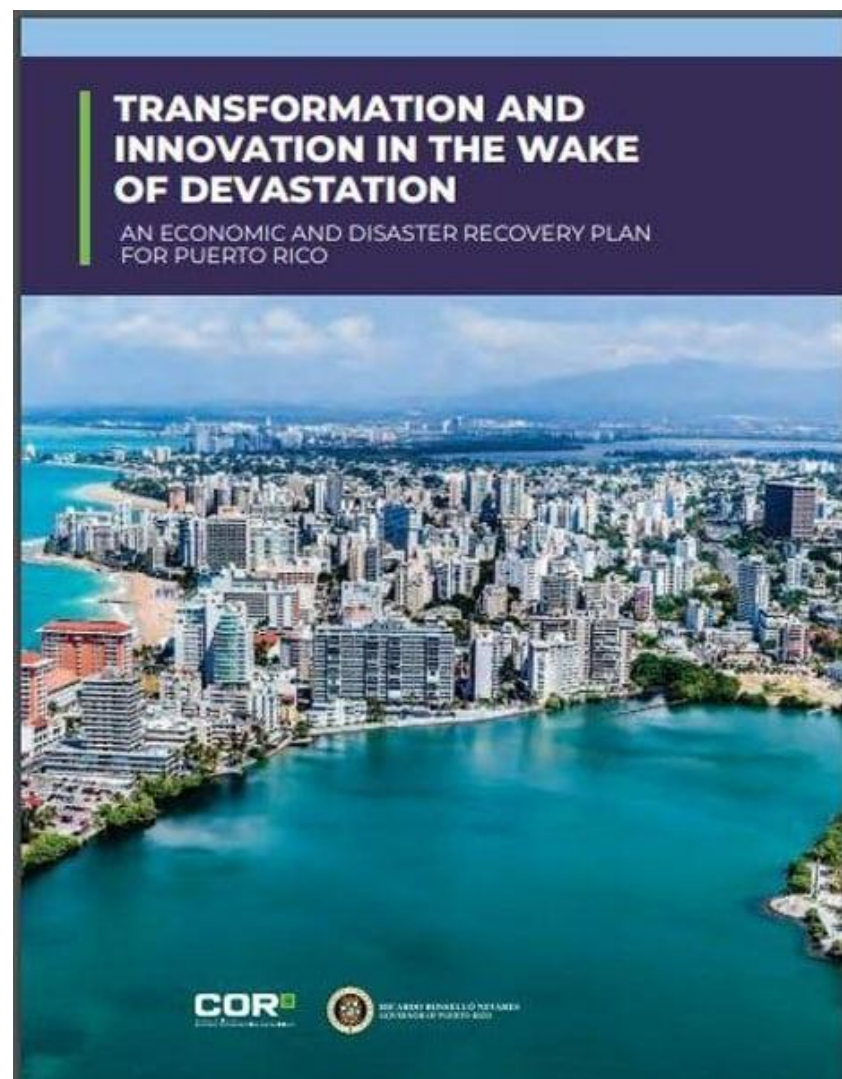
Smart Community Ideas: Connected

Less
More

	Apartments	Master Planned Residential	Office & Retail	Industrial	Hospitality/Community
Smart Controls	●	●	●	●	●
Interactive Kiosks	◐	○	◐	○	●
Waste Collection	●	●	●	●	●
Real-time Community Info App	●	●	●	○	●



Connectivity Dependence – 4G World



And without those lifeline systems:



Many healthcare facilities were not open, and people were unable to travel to those that were.



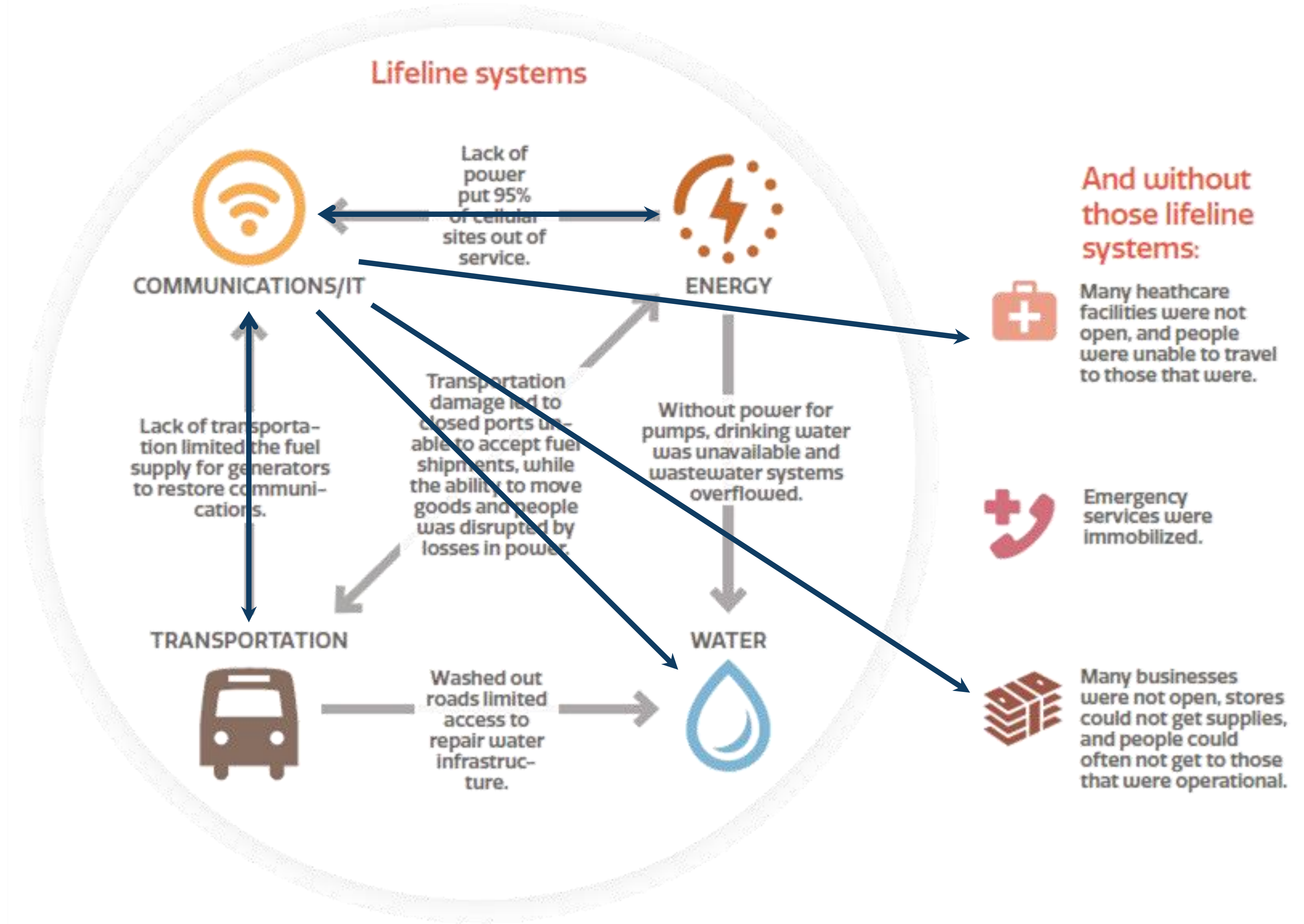
Emergency services were immobilized.



Many businesses were not open, stores could not get supplies, and people could often not get to those that were operational.

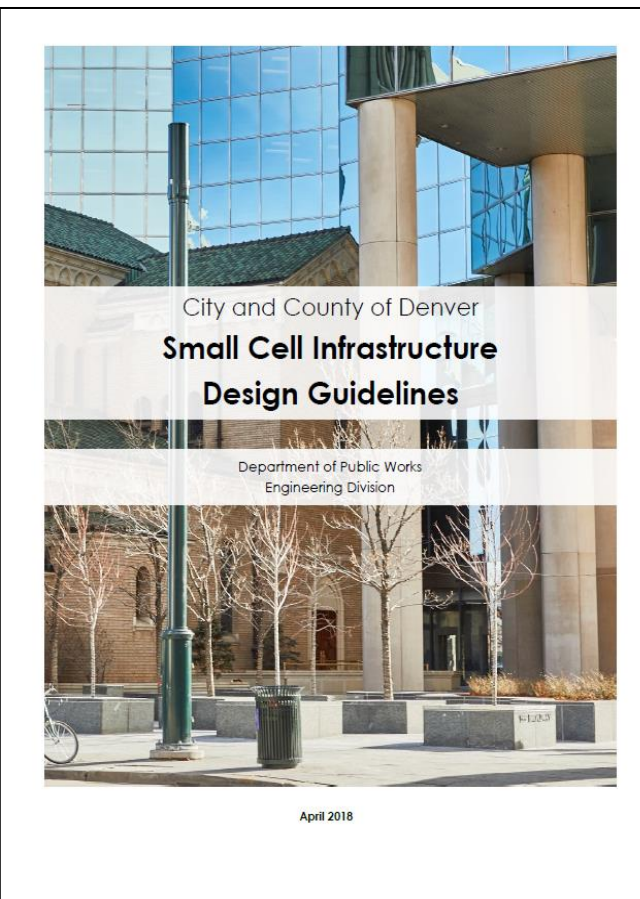
Connectivity Dependence – 5G World

- Smart Grid
- Smart Health
- Smart Enterprise
- Smart Water
- Smart City
- Autonomous and Connected Vehicle



Establish Design Guidelines

– Supports Expediting Small Cell Deployments

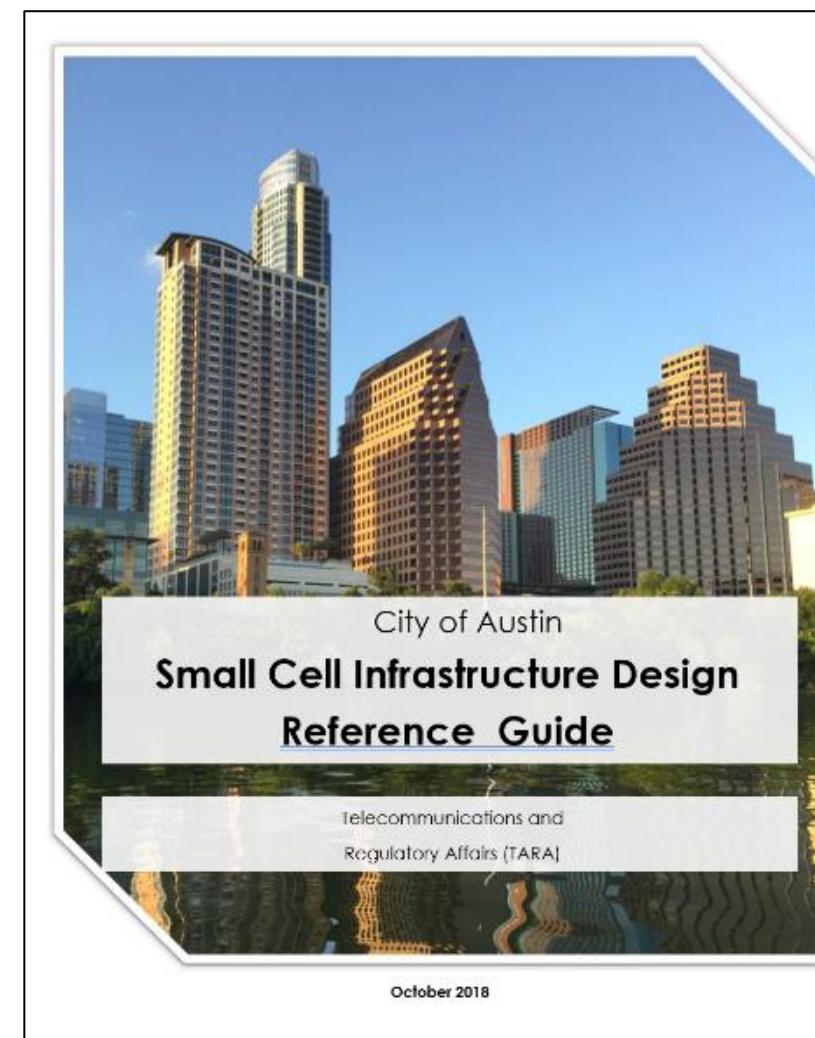


- ❑ Public-facing review process including Districts, City Departments, Neighborhood Orgs
- ❑ Policy for co-location first
- ❑ Notification of adjacent property owner
- ❑ Restricting new pole density through min 250' spacing
- ❑ Restricting placement (along parks, historic & residential frontages)
- ❑ Restricting placement in front of residential & valuable sight lines
- ❑ Requiring camouflage and concealment
- ❑ Limiting height and equipment size
- ❑ Opportunity to coordinate fiber conduit

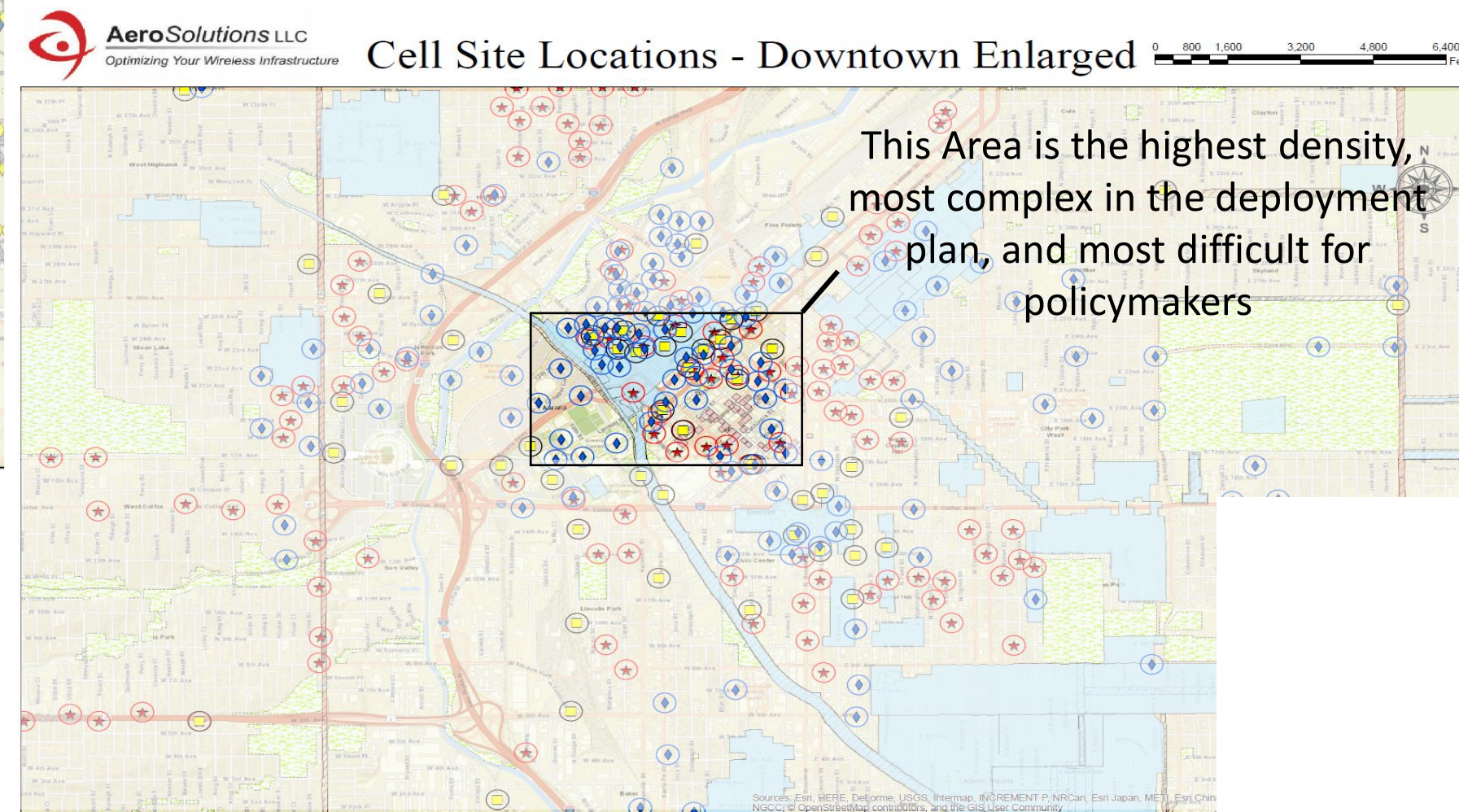
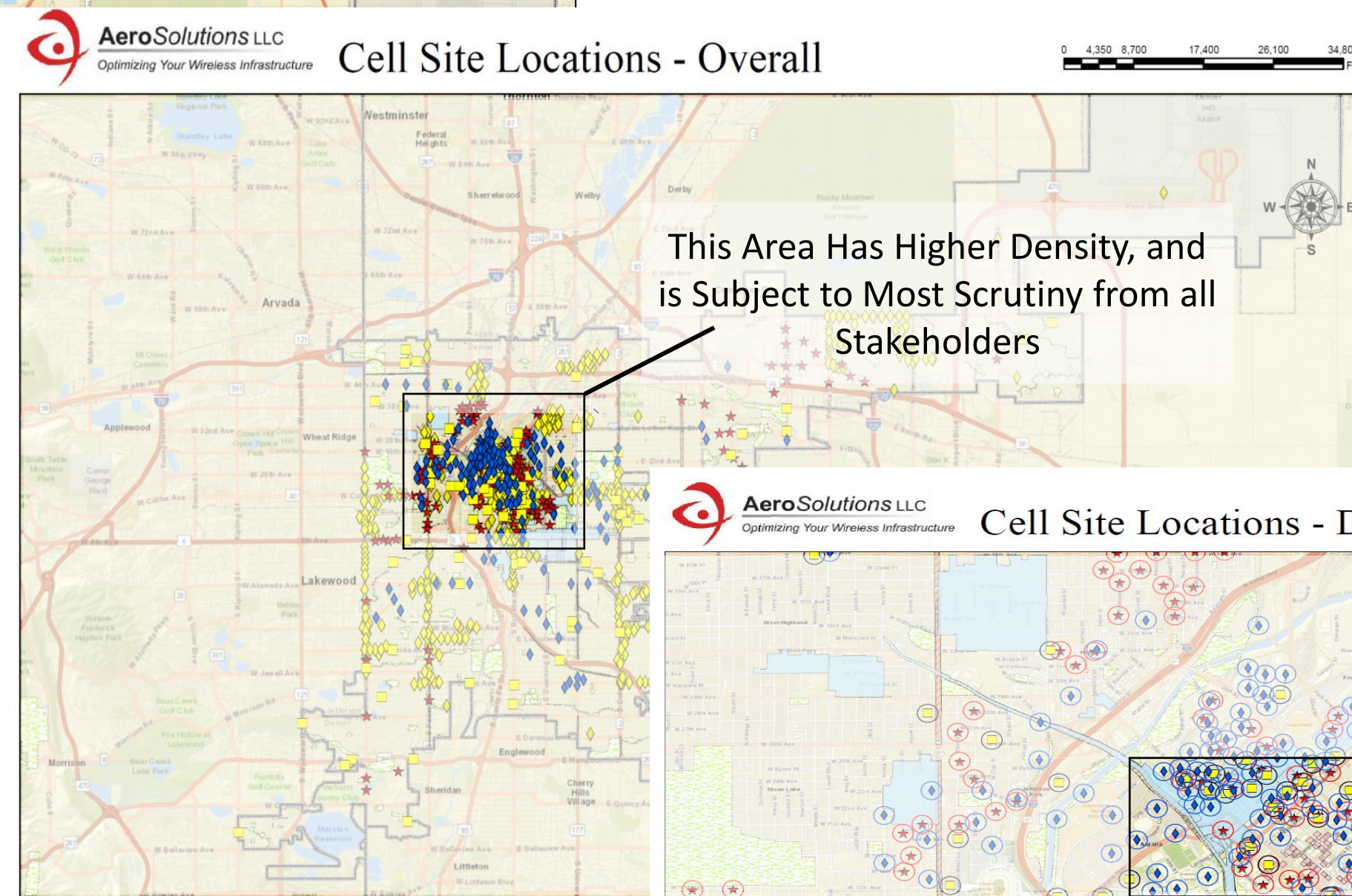
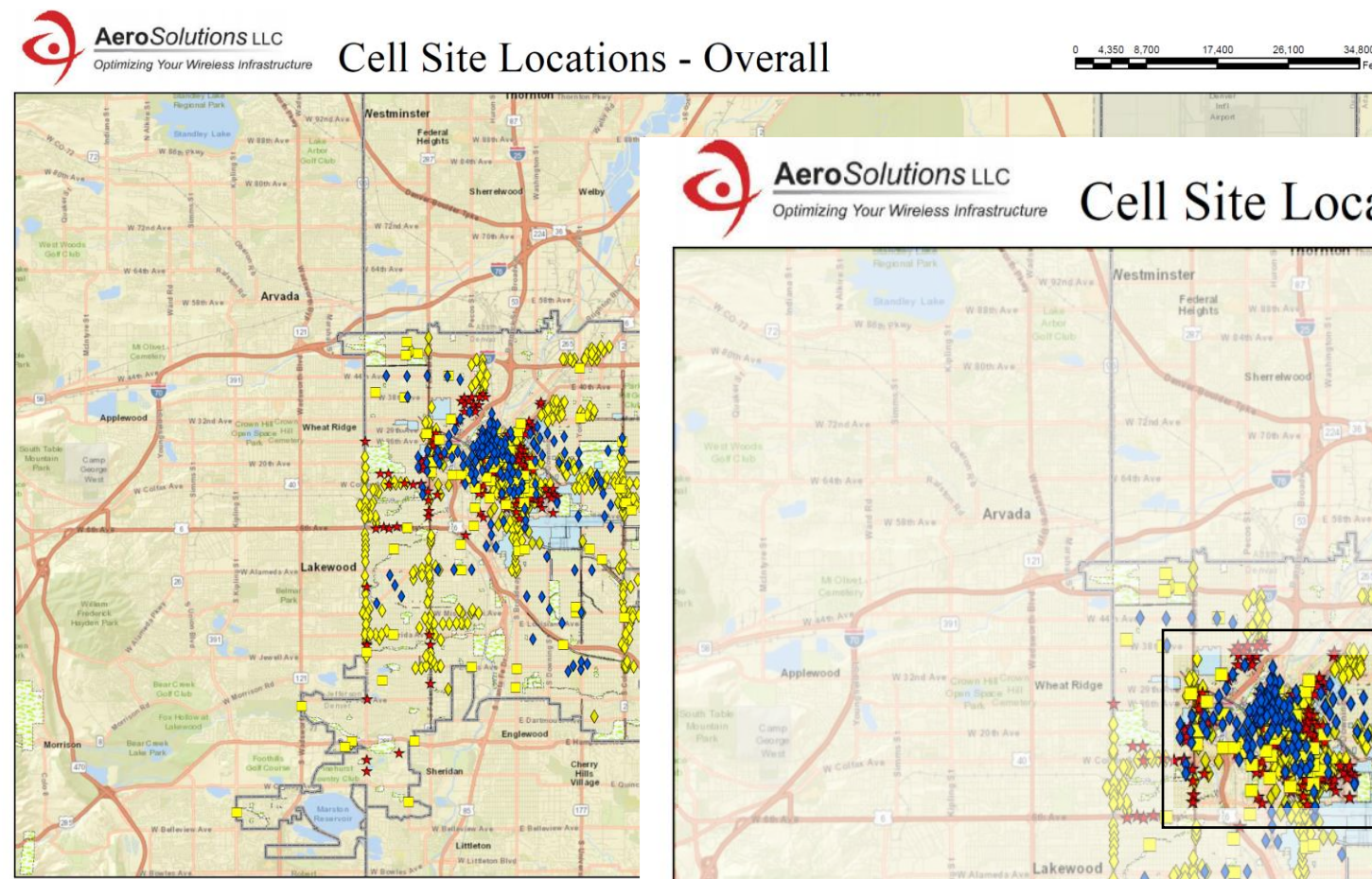
Detailed PROCESS Guidance

Each Municipality is Unique, and Each Should Create its Own Plans Informed by the Local Stakeholders

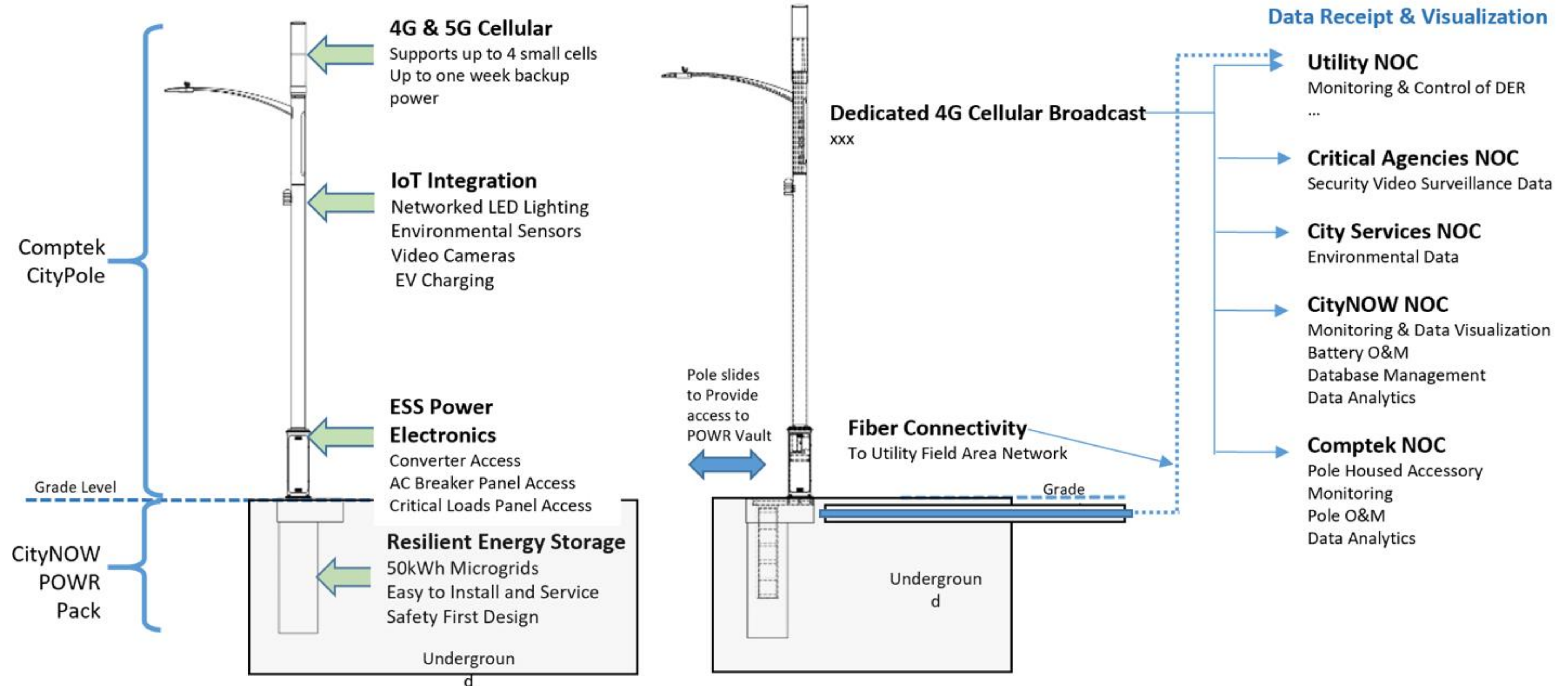
The Important Part: There's a Plan



Map Small Cell Deployment Plan Early under NDA's to Inform Policy Making



CityPole Power Vault - Network Resiliency



Vertex™ Smart Pole Radio Concealment



LANDMARK
DIVIDEND

HIGH POWER RRUS
SUPPORT

18

6

1-2

3

0

0

OR

AND

OR

LOW POWER
MRRUS SUPPORT

0

18

3

4

2

1

Designed for radio & antenna vendor neutral deployment configurations and freedom for operator configuration



4G / 5G
READY

V1



4G / 5G
READY

V2



4G / 5G
READY

V3



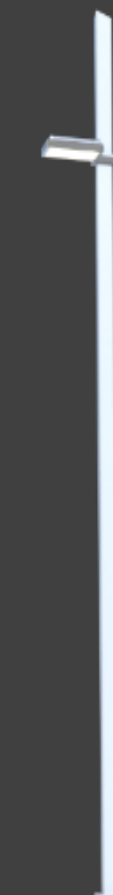
4G ONLY

T2



4G/5G
Ready

V0^T



V0

INTEGRATED POLE PORTFOLIO RADIO DENSITY

FlexGrid™ Dallas DART Ecosystem



CONFIDENTIAL ©2018 Smart City Media LLC



- Revenue Opportunities
 - Advertising
 - Telecom collocation
- Enhanced Security
 - Up to 2,000 high def video streams
- Private LTE Network
 - IoT Platform
- Improved Rider Metrics
 - Video Analytics
- Enhanced Rider Experience
 - 5G Coverage
 - Free WiFi
 - Wayfinding
 - Community Engagement

DART Deployment in Progress



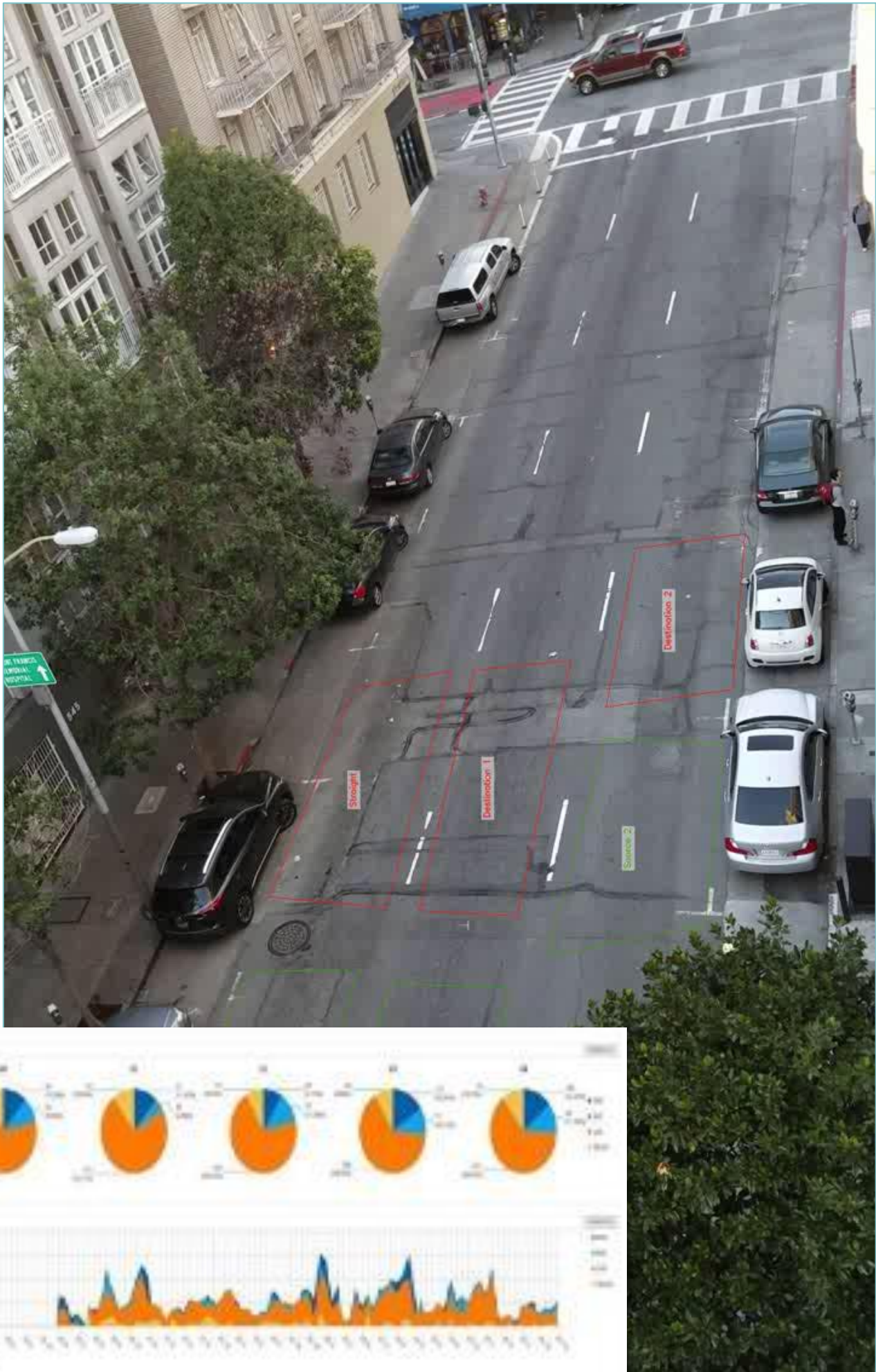
LANDMARK
DIVIDEND



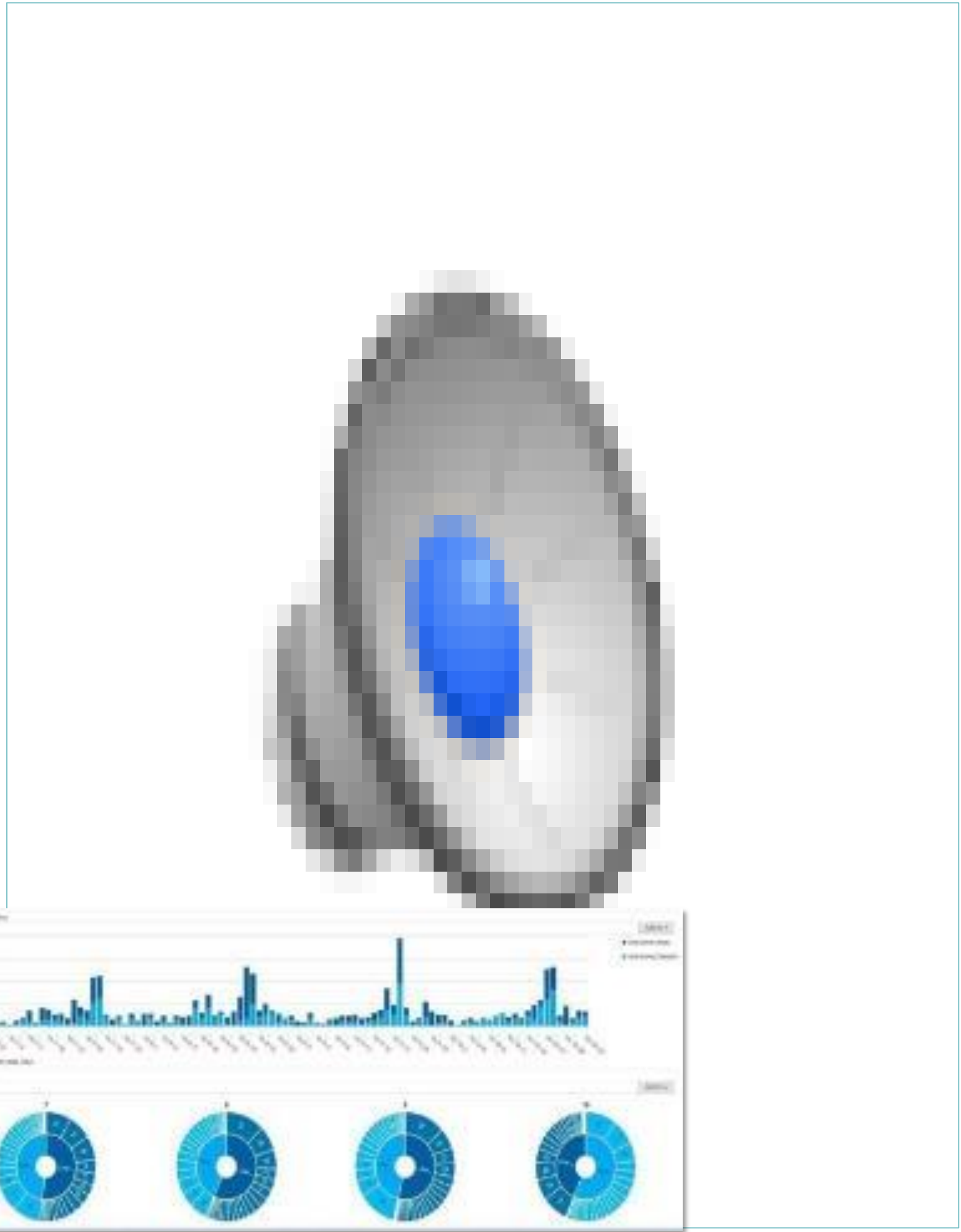
Technology Opportunity: Insights From Video

Operational, Safety and Business Intelligence

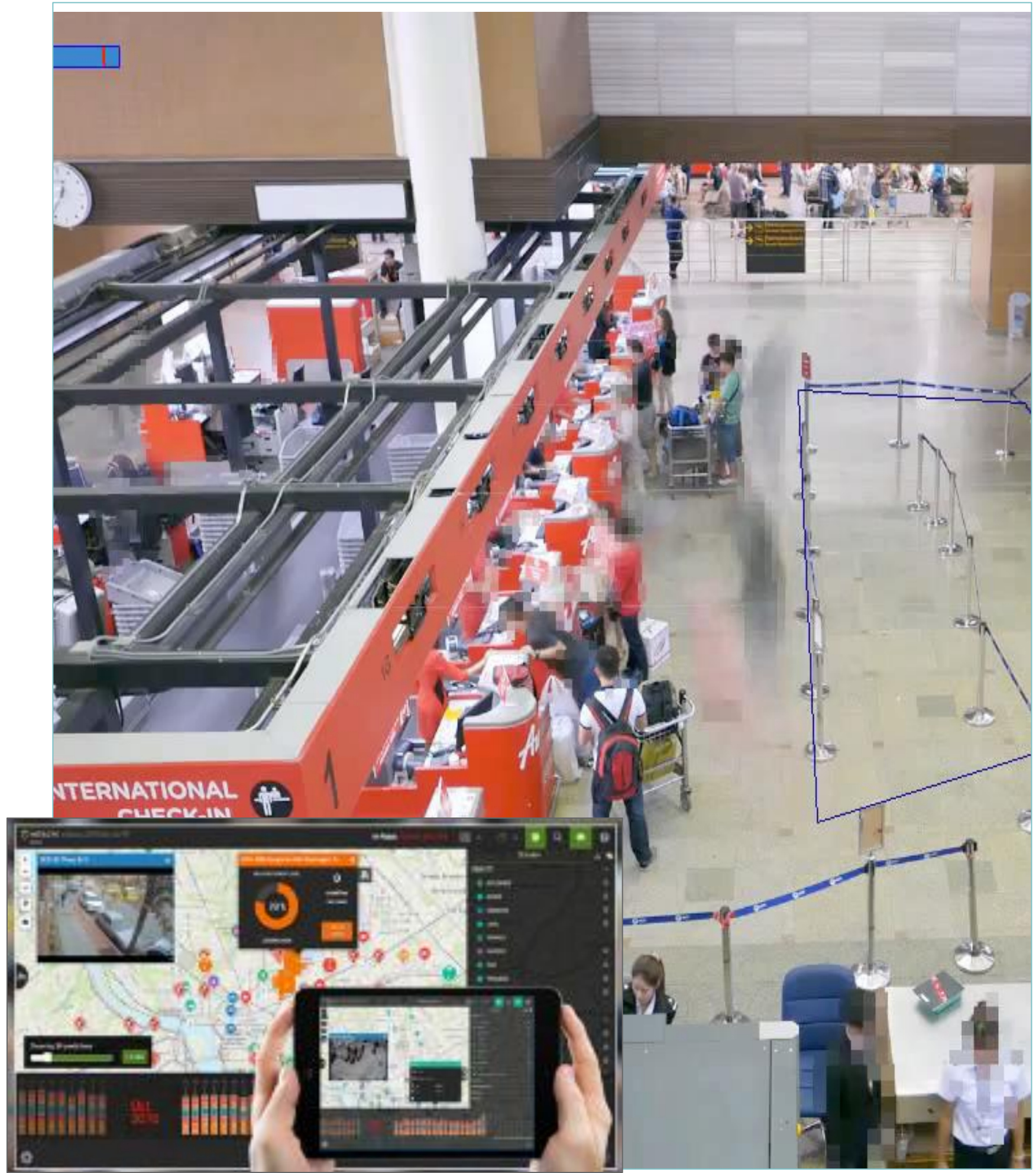
Transportation



Customer Experience



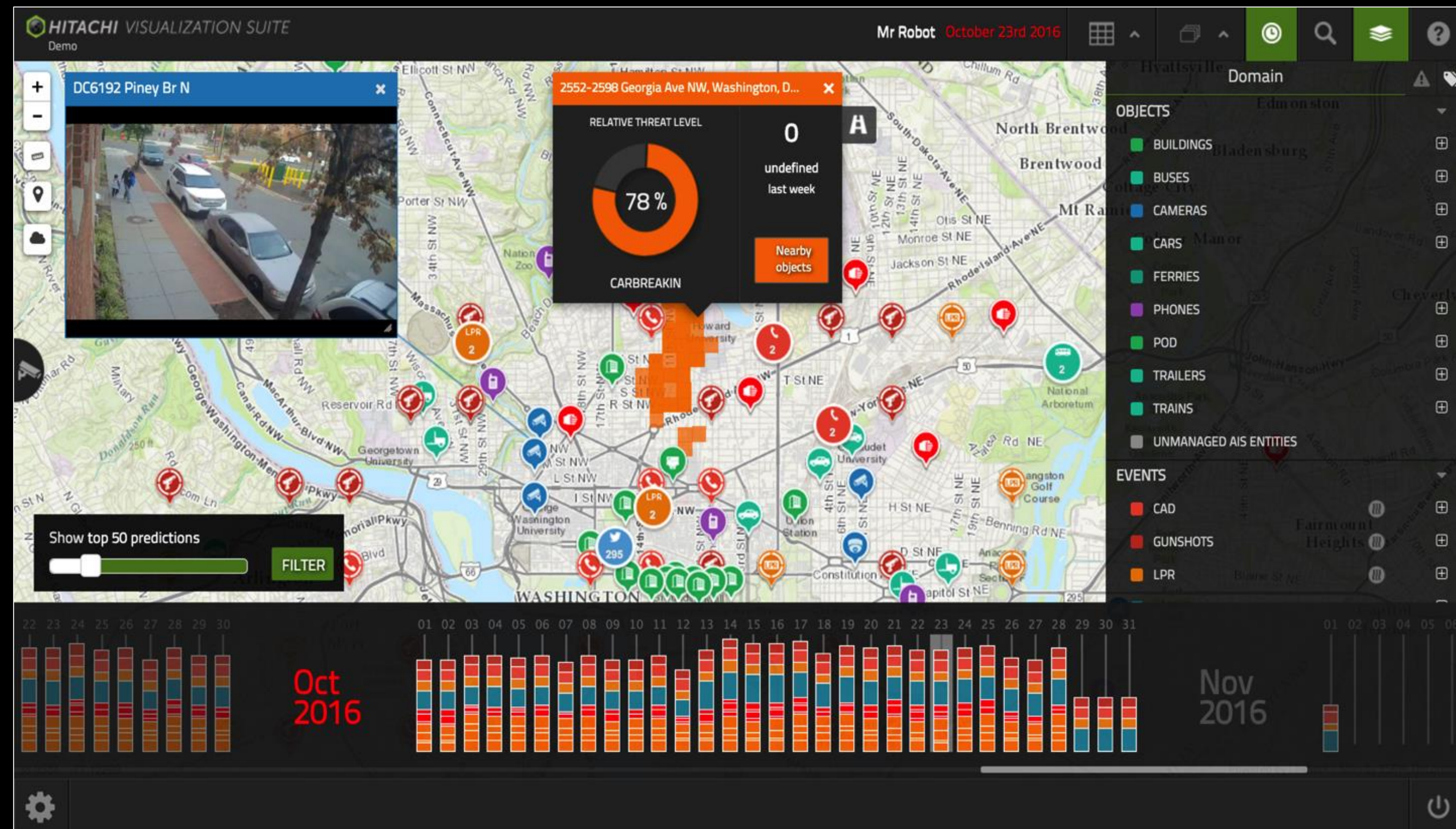
Operations and Safety



Situational Awareness Through Hitachi Visualization Suite

NEXT
2018

- Real-time video and IoT data from facilities, vehicles, infrastructure, security, and shops
- Unlimited data layers on a single pane of glass
- Distributed intelligence for all staff with browser-based desktop or mobile capability
- Workflow automation for setting alerts for customer needs or security incidents



Privacy Protection: Generating Rich Insights Without Personally Identifiable Information (PII)

Video Privacy Protection:

- Detects people and pixelates or color-masks full body
- Additional analytics can analyze original images
- **Transparency:**
- Original feed can be accessed for investigations, requiring a keycard and passcode; actions are tracked for GDPR readiness

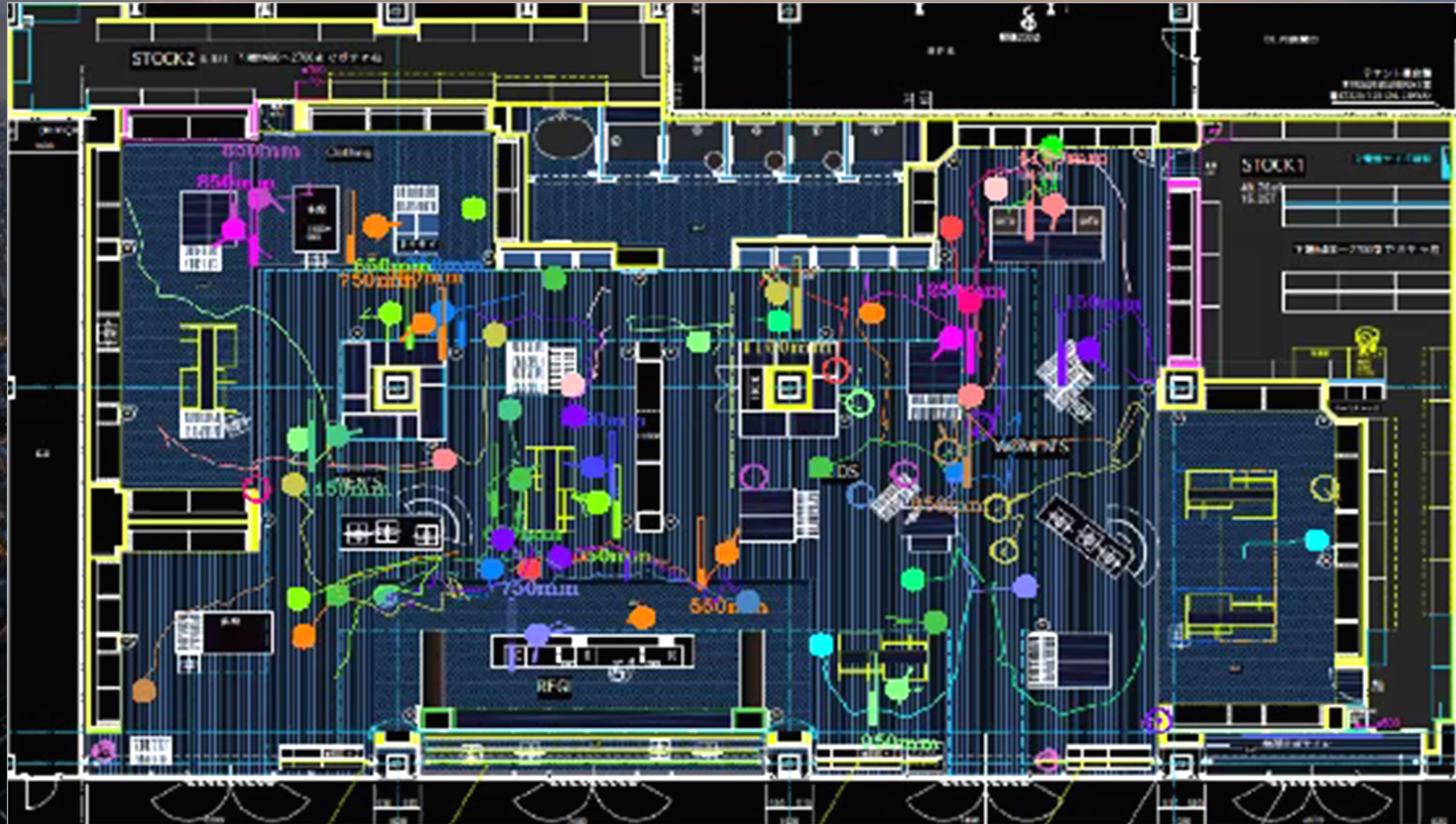
3D Lidar:

- No personally identifiable information (PII) is captured
- Can be used in privacy-sensitive locations
- Privacy protected by design



Hospitals • Schools • Cities • Retail • Financial Services • Transportation

3D Lidar Facility Movement and Journey Tracking



Federal Funding: How to Get Your Fair Share

Hitachi provides free federal funding consultation.

HITACHI
Inspire the Next

There are currently over 1,000 grant programs administered by 26 Federal agencies providing more than \$400 billion to states and local governments through grants, formula allocations and other payments.

Funds are primarily available from:

- Department of Justice
- Department of Homeland Security
- Department of Housing and Urban Development
- Department of Transportation

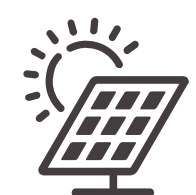
Billions of \$ go unused every year.

Expanded REIT Opportunities



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Infrastructure Partnership Opportunities Generating Positive Returns & New Capabilities Around the Following Areas:



RENEWABLE
ENERGY



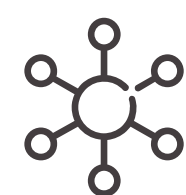
LIGHTING
CONTROL
MGMT



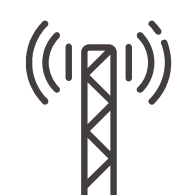
LANDSCAPE
MGMT



BLDG
ENERGY
MGMT



IOT
SENSOR
NETWORK



CONCEALED
RADIO
COLLOCATION



PRODUCT
INVENTORY
MGMT



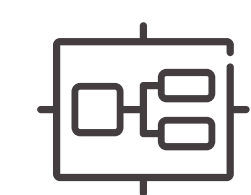
PROPERTY MGMT
CENTRALIZATION



REGIONAL / GLOBAL
PROPERTY MGMT
NETWORK



PRIVATE LTE ON
PROPERTY
NETWORK



BLDG CONTROL
AUTOMATION



FIRE ALARM
CONTROL



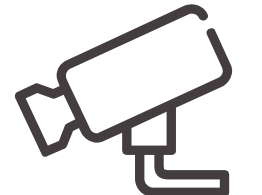
ENVIRONMENTAL
SENSORS



UBIQUITOUS
PROPERTY WIFI



BEACON
TECHNOLOGY

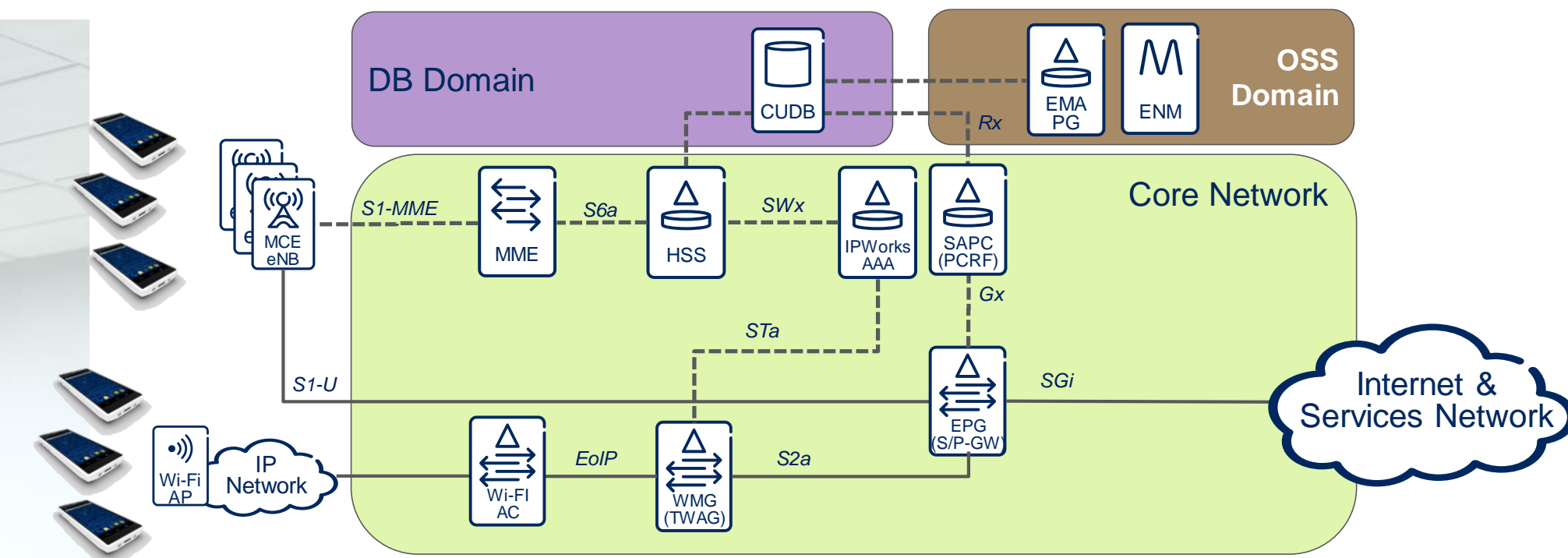


ENHANCED
SECURITY VIDEO
SURVEILLANCE

Private LTE Evolved Packet Core Network



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5G Technology Basket

“Its all good but you don't have to eat everything!”



5G

Spectrum: Expanded, Shared, Dynamic, mmWave

Topology: Distributed, User & Control Separation

Antennas: Massive MIMO, Beam Forming

Edge Computing: Applications, APIs

Security: Authentication, Privacy

Radio: New Radio (NR), Software, Micro Cells

IoT: Low Power, Low Latency, NB-IoT, CAT-M

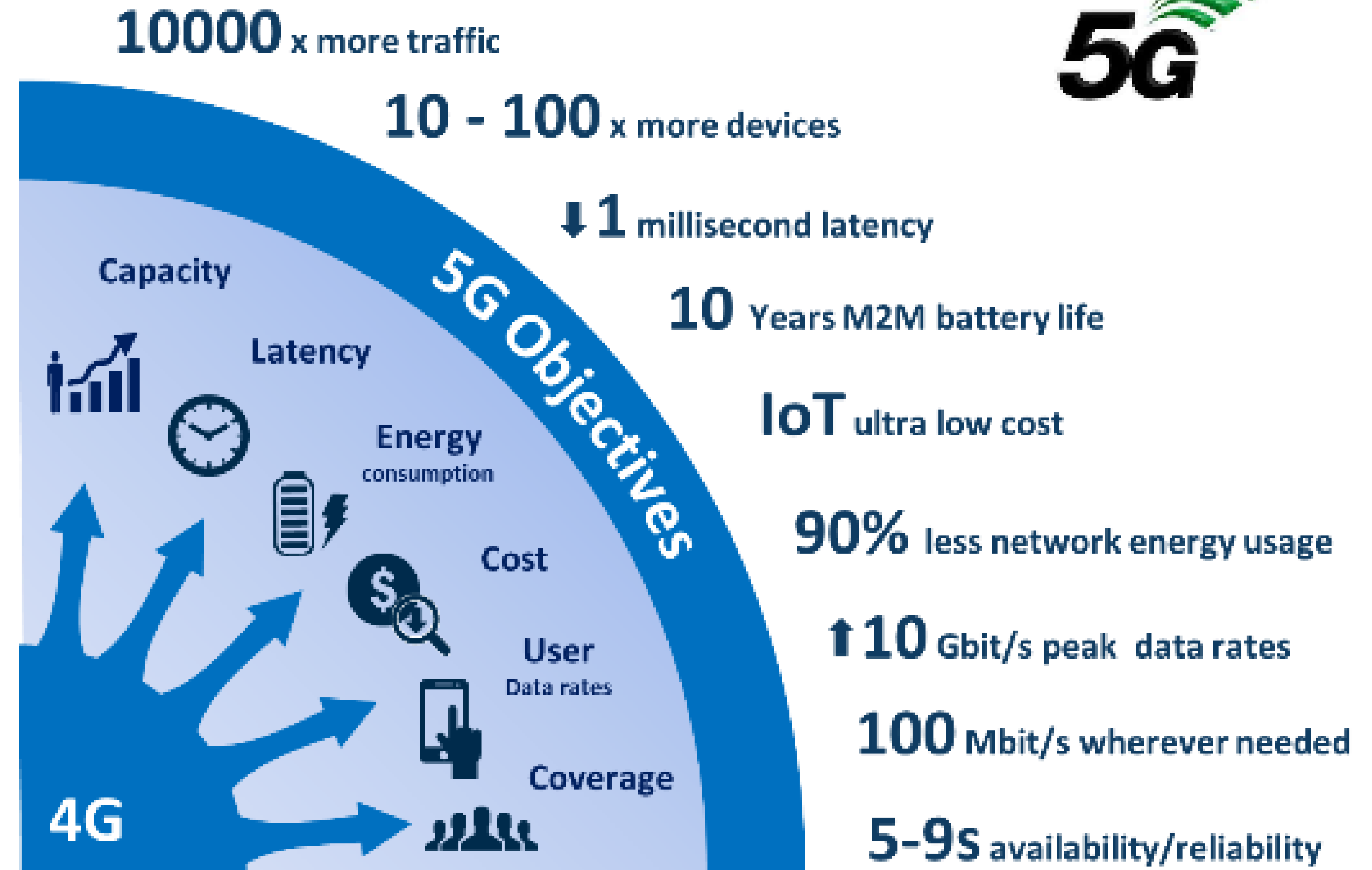
Network: Slicing, Virtualization, SDN, SON, COTS

Interoperability: Path from 4G (NSA), Coexist with 4G (SA)

5G Objectives



- User vs. Edge vs. Core
- Not just about speed and scale
 - Energy/Power
 - Availability/Reliability
 - Cost
 - Ease of Deployment
- Different users will value different objectives
- Builds on 4G infrastructure
- Other technology and business shifts are concurrently happening



Network Virtualization

Off the Shelf Hardware

Data Center and Edge

Software Defined

Spectrum Diversity on the Path to 5G

Mobile Cellular

- Multiple Carriers -



Shared & Unlicensed

- CBRS, 5G, LAA, WiFi -



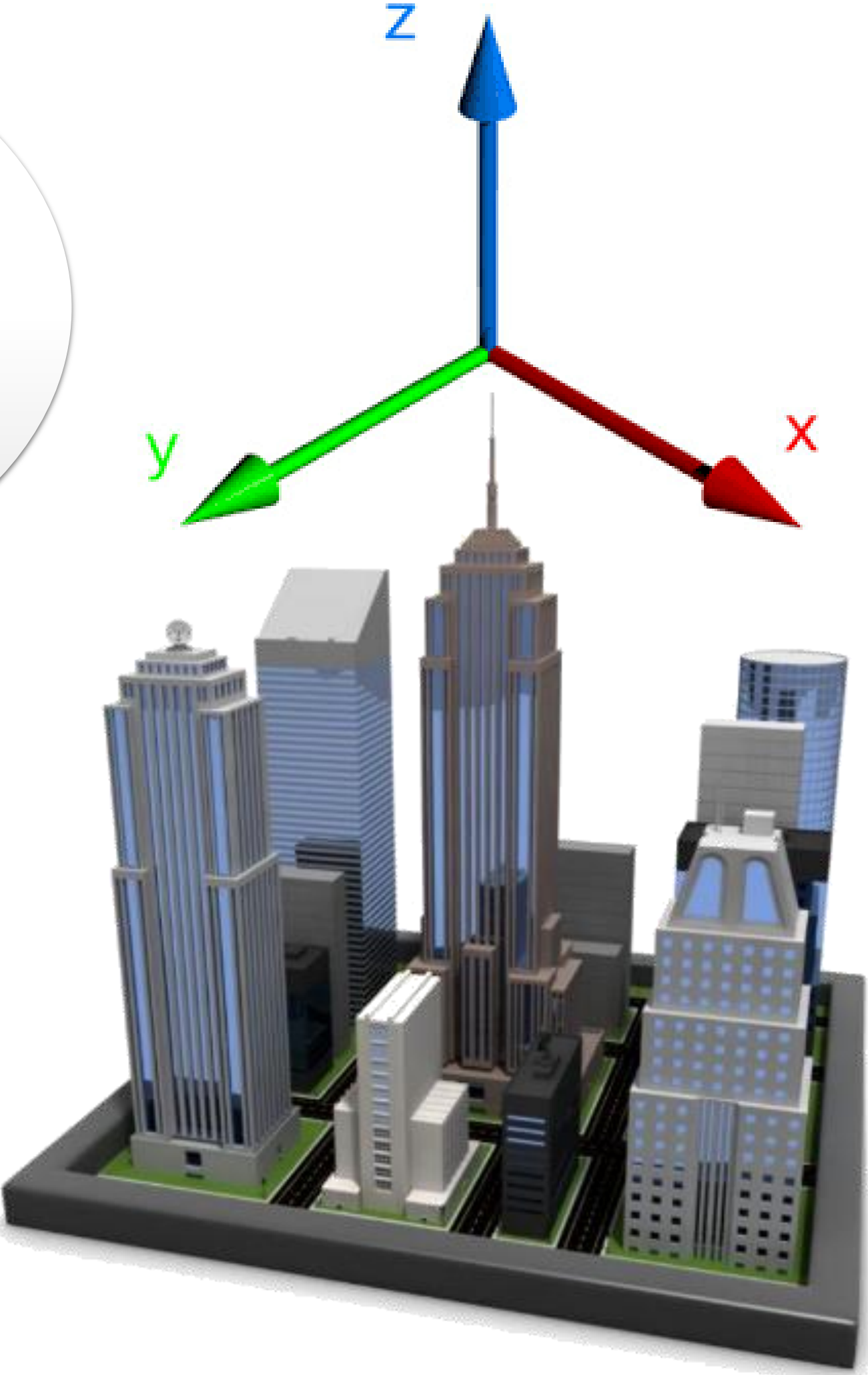
Public Safety

- FirstNet, LMR -



Internet of Things

- NB-IoT, CAT-M, LoRa



Spectrum Utilization: Today to 5G



600MHz (2x35MHz) 2.5GHz (LTE B41) 3.55-3.7 GHz 3.7-4.2GHz



600MHz (2x35MHz)

5.9-7.1GHz

24.25-24.45GHz
24.75-25.25GHz
27.5-28.35GHz

37-37.6GHz
37.6-40GHz
47.2-48.2GHz

64-71GHz

37-37.6GHz
37.6-40GHz

64-71GHz

Existing

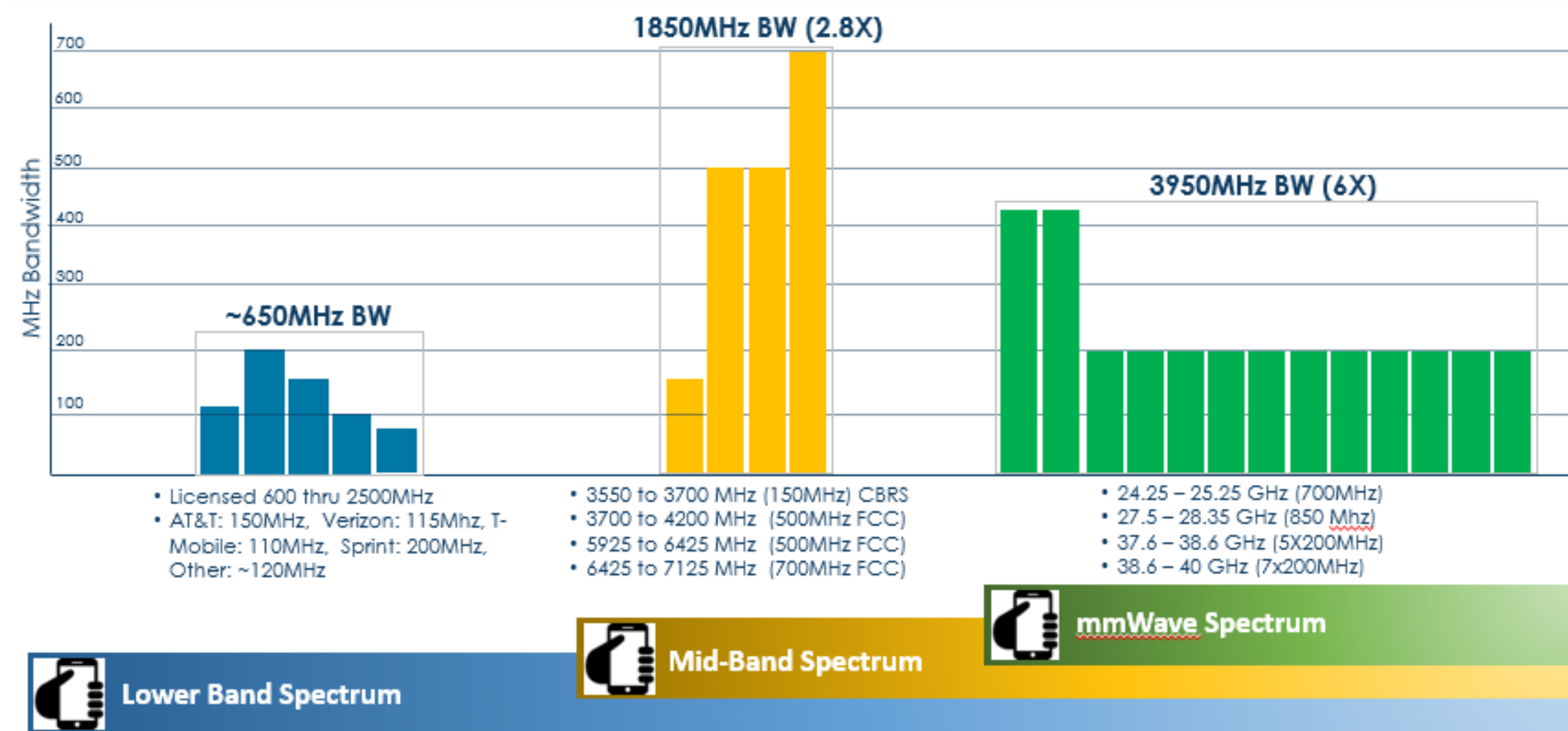


New 5G band

- Licensed
- Unlicensed/shared
- Existing band

More Capacity
More Antennas
More Radios
Smaller Antennas

Less Penetration
Less Coverage
Less Latency



Future Proof Poles - Interchangeable Equipment Modules



Flex Space for Multiple Equipment Loadouts.

Allows New Pole Configurations with minimal impact.

Flex-Rail System to simplify mounting.

Thermal Management System and remote monitoring.



Capacity

Coverage



Bandwidth

ENTER

[click here for more information](#)