



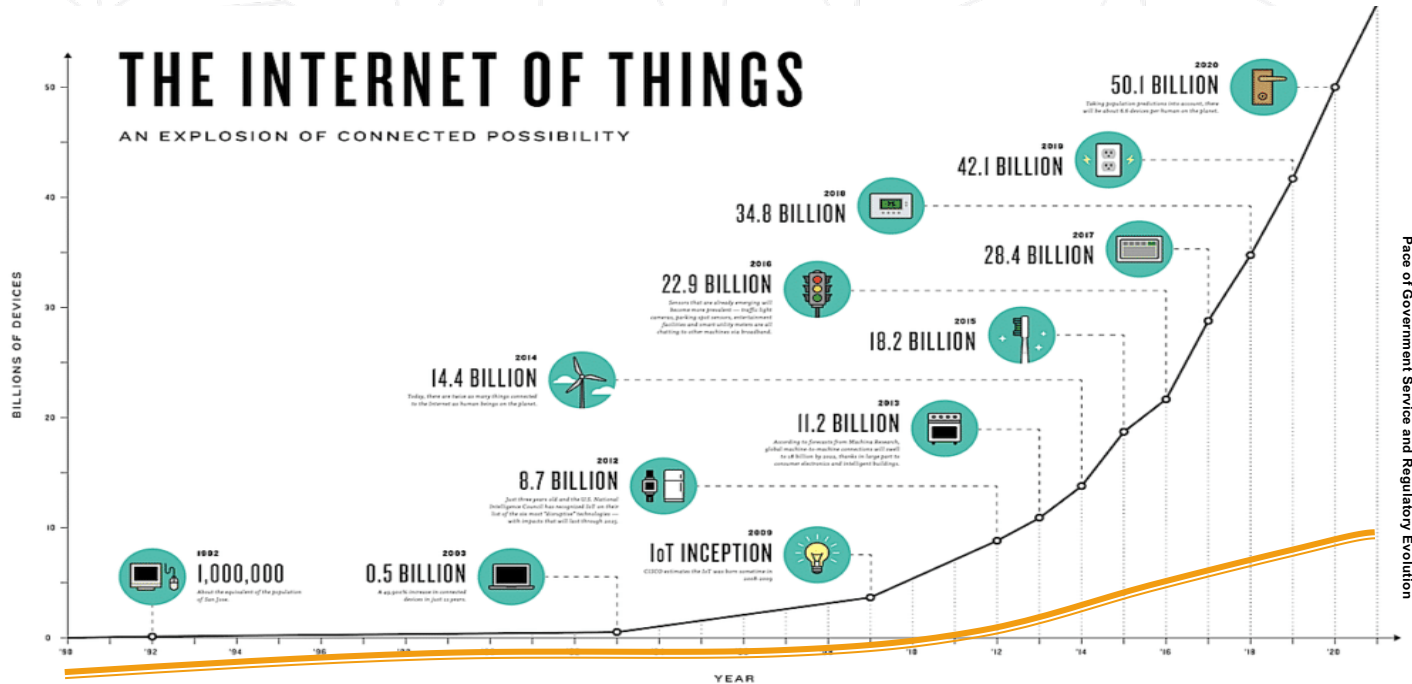
LIVE
Webinar

MAKING SMART CITIES SIMPLE
RESILIENCY FOR OUR NEW NORMAL

A woman in a white dress and hat is walking on a red carpet in front of a building at night. The scene is illuminated by city lights, and a blue car is partially visible on the right. The text "GET SMARTER" is overlaid in large, white, stylized letters.

GET SMARTER

Does it feel like the world is accelerating? It is, exponentially...



Source: National Cable & Telecommunications Association (NCTA), with speaker modifications

Making Smart Cities Simple | Change is inevitable

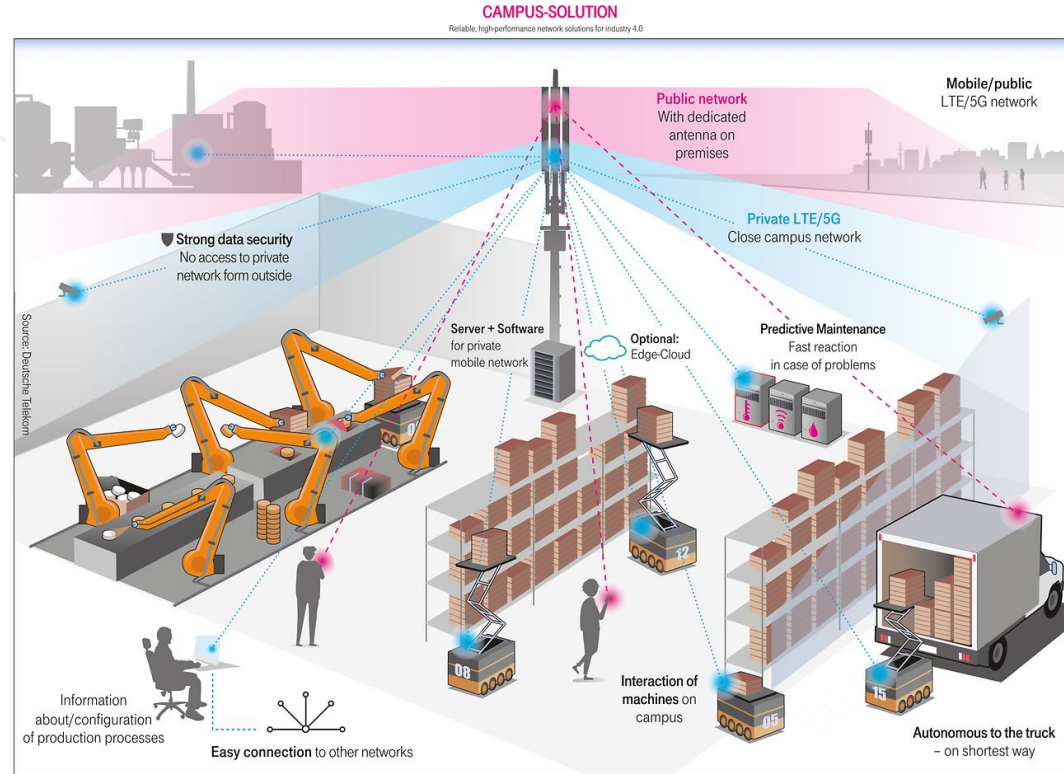
- Steam Power
- Electricity
- Computers
- The 4th: **Confluence** of:
 - Artificial intelligence
 - Internet of Things (IOT)
 - Nanotechnology
 - Quantum computing
 - 3D printing
 - 5G data transmission
 - Technologies that will fundamentally change our world
- Smart Cities!




4th Industrial Revolution

Smart Factories with computing “on the edge”

- Connected Devices make independent decisions
- Sensors monitor and proactively identify needs on the shop floor
- “Real Time” changes
- Remote management





Post-Pandemic: 4 Things

Autonomous Cars = Extra capacity / widening (?)

Stimulus Programs: Infrastructure spending (?)

Telecommuting = Demand reduction (?)

Telecommunications: **MORE** critical for infrastructure

Transit

50% (maybe)

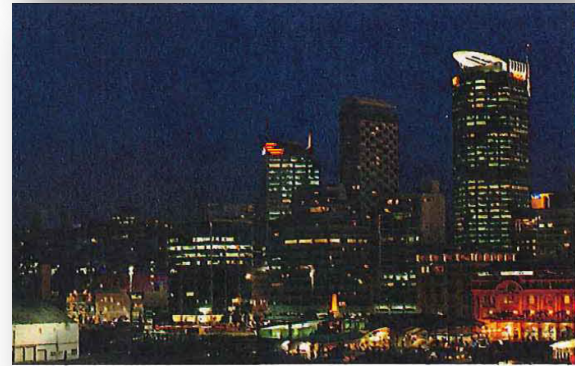
Telecommuting

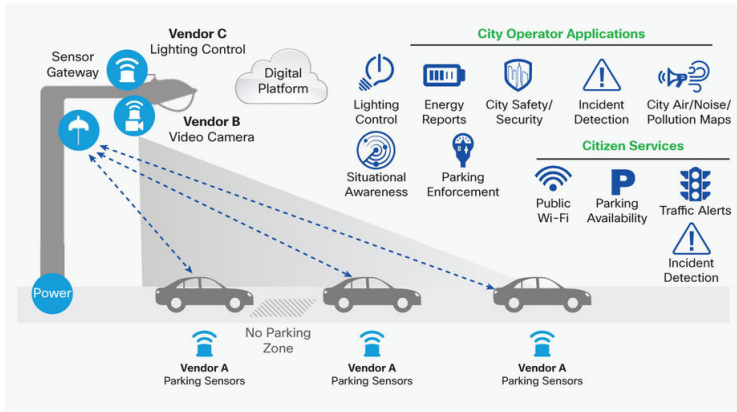
10-20% (maybe)

Driverless capacity

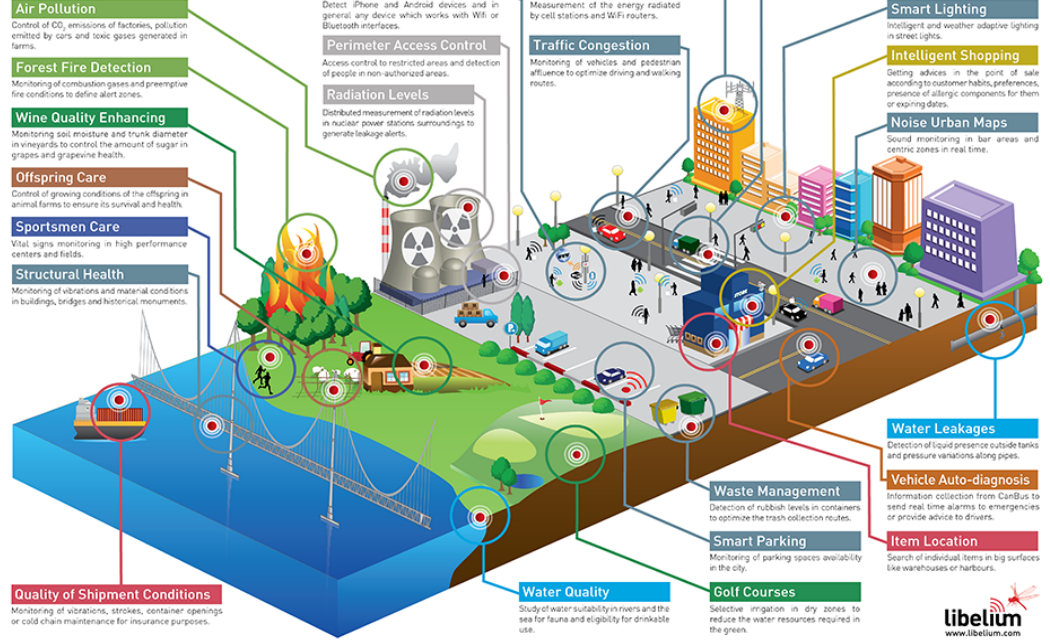
300 (yes) 300%

- Urbanization / Suburbanization
- Uberization - sharing economy
- Permanent work from home
- Distance: Education / Tele-Health
- Consumer demand changing



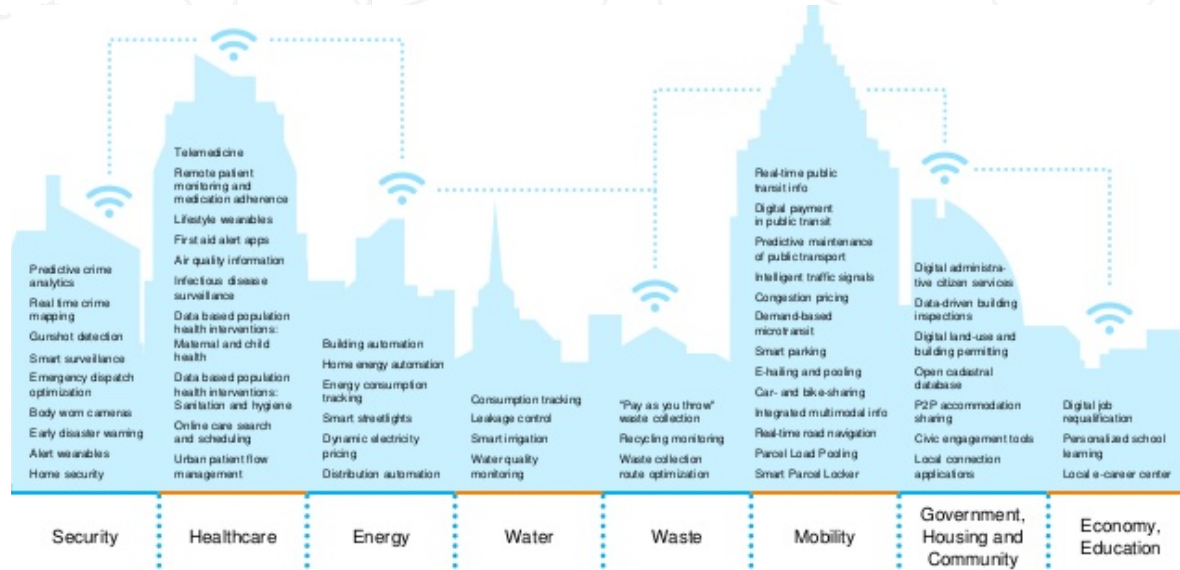


Libelium Smart World



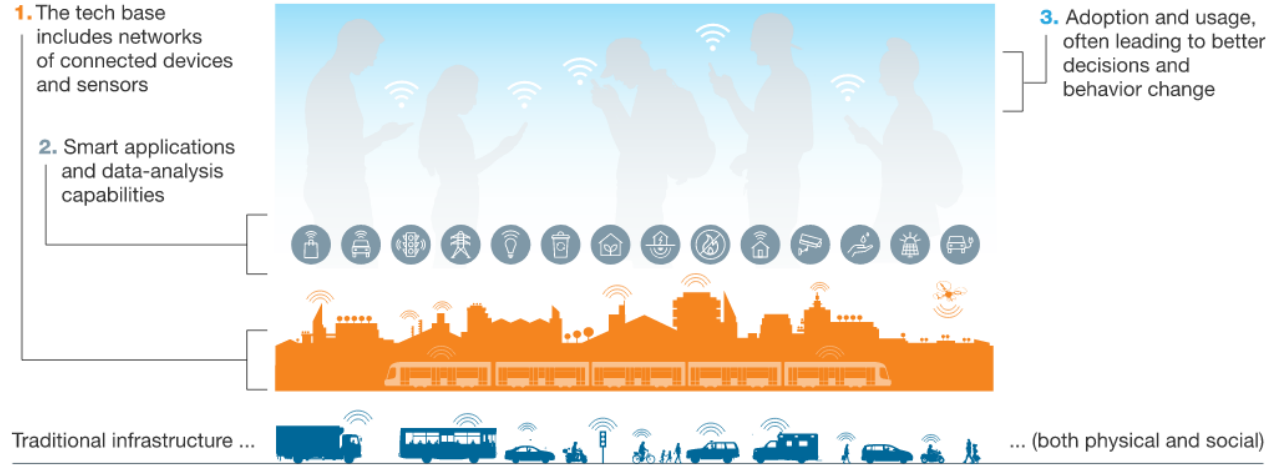
Making Smart Cities Simple | Smart Is Not Simple Today

- Pilot projects still prevalent
- Projects are often driven by a single department/goal
- Most common applications are emerging



- Connecting and converging technology & infrastructure
- Making infrastructure SMART to move citizens to ACTION

3 layers of “smartness” will elevate life in cities of the future



McKinsey&Company | Source: McKinsey Global Institute analysis

Making Smart Cities Simple | A Holistic Foundation for “Smart”

- What will constituents demand?

What Not to Do?

- Avoid it... It is coming/resistance is futile
- Too Expensive to solve yourself (partnerships)
- Isolated Solutions (ITS fiber is never just ITS fiber)



Interconnecting everything:

- Streetlights, Utilities, Energy
- Traffic Signals, Parking, Roads
- Transit, People, Logistic Systems
- Sensors: Fire, Wearables, Cameras, Drones
- Technology is the enabler
- Communications are the common thread





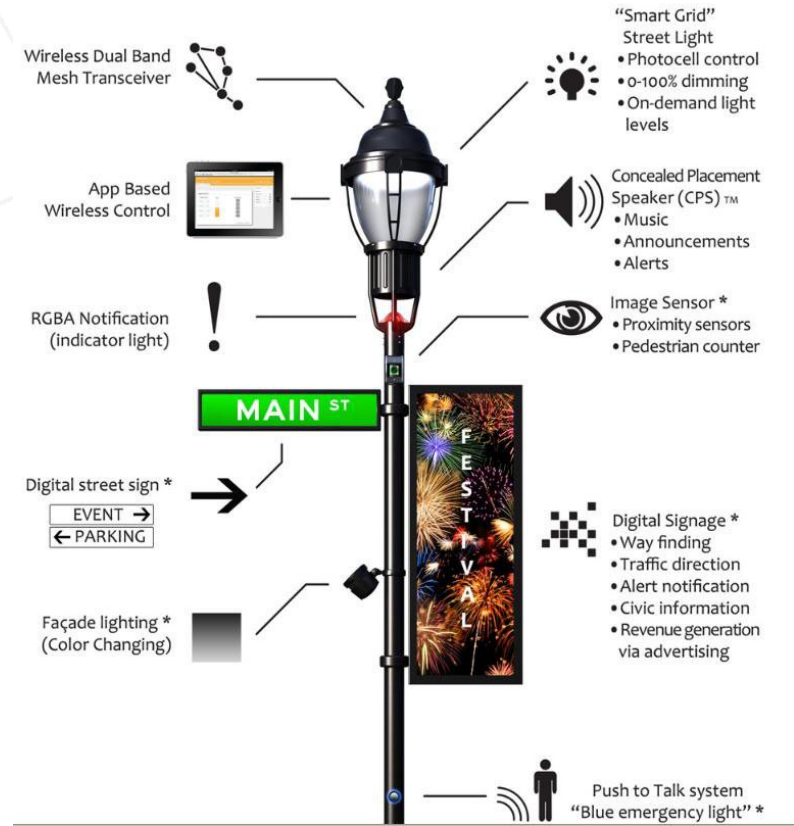
BECOMING SMART EXAMPLES FROM OUR WORLD



Value through Streetlights

- First streetlight municipalization in Colorado
- SIGNIFICANT annual budget reduction... AND...
- Identified platform for future smart city initiatives

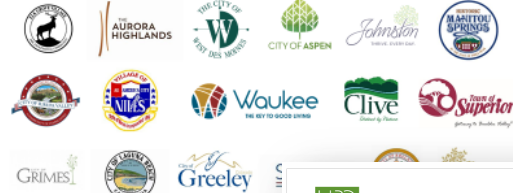
- Streetlights are an intersection of traditional infrastructure and technologies
- Requires a holistic approach
- Nothing happens in a vacuum... if the path has been determined



* Graphic by IntelliStreets, Inc.

- Millions in costs avoidance / savings
- More important: **asset value**
- Even more savings: LED (10-20 yr ROI's)
- Lighting at the next level
- “Smart” streetlights: sensors, counters
- 5G cellular enabled **small cells**
- Revenue source (\$250 - \$6,000)
- Conduit: May be most valuable

A National 5G Leader – Focused on Community Outcomes



Citywide Fiber Optics Master Plan | City of Pico Rivera, CA



BY DAVE ZELONKA, P.E. AND GEORGE WENTZ, P.E.



Transportation technologies are evolving at an unprecedented pace and will have profound effects. Engineers and public officials must start preparing today for an inevitable, very different future.

“Big data,” high-speed communications and transportation options such as autonomous vehicles and technologies that will affect how we live, work, and play.

Although the primary impacts of these changes are becoming better understood, the secondary consequences have been largely overlooked. Facing the largest model shift since the invention of the automobile, the engineering profession will be challenged to share parts of our daily lives, including transportation networks and entire urban fabric.

New Levels of Communicating
For the past decade, industry has been communicating and testing vehicles that use sense the environment around them and communicate with other vehicles and

infrastructure. The key to vehicle-to-vehicle (V2V) and vehicle-to-infrastructure (V2I) communications is a robust communication network—which is still lacking.

While fiber-optic-based communication systems are highly regarded for their speed and reliability, their real value will come from their own-on-boards, or ability to communicate in real time with the network.

Vehicle-to-vehicle and vehicle-to-infrastructure communications will require the ability to locate themselves and share to an accuracy of less than three centimeters. This will require real-time sensing at 400 kilohertz to communicate with their networks to less than one millisecond.

Initially, fiber optic backbone won't be available everywhere, but satellite will be the infrastructure to support these connected platforms. As our communication becomes “smarter” than our infrastructure, our systems will be expanded, improved, and redesigned for many parts of our daily lives, including transportation.

“Big Data” and Transportation Technologies
Over our communication networks are up to you, what's next? Don't fully managed systems, autonomous systems often using big data, will be able to reduce accidents and congestion by predicting and

avoiding traffic jams—changing traffic routes, speeds, and signal coordination (use to bottleneck traffic flows).

AV driving in platoons more closely with other may also reduce fuel consumption. The ownership will like decrease as people opt for different and drive changes in the way that we drive our infrastructure.

Which future transportation technology are showing the most promise?
Autonomous vehicles. Think Tesla, with steering wheels. (Same today)
Personal rapid transit systems. Directed low cost or ride vehicles on fixed guideways or dedicated street networks. (Same today)
“Microtransit.” Shared, hyperlocal, microtransportation providing “last-half-mile” trips. (Share today, often lacking regulations)
Driverless cars. Vehicles without steering wheels. (Perhaps beginning in about five years; may be the niche by about 2040)
Transportation as a service. Purchase only the transportation you need, or ownership, drivers, wide access, and free-on-garage become unnecessary. (Coming soon)
Flexible aerial vehicles. Vertical

February 15, 2019

Street Light Municipalization Initial Assessment

(WORKING DRAFT - Proprietary and Confidential)

HR GREEN, INC.
1260 Corona Pointe Court | Suite 305 | Corona, California 92879



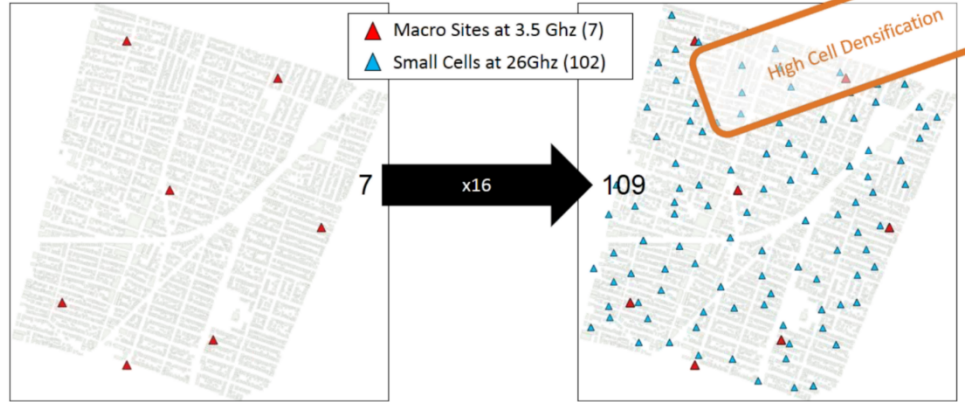
Playing 5G Defense

- Needed policies to effectively manage private sector deployments
- Dedicated focus on health concerns & compliance
- Ongoing plan review

...and next, offense

- 3 Miles vs 300 Feet
- A tidal wave of attachments – your poles and streetlights
- Densified fiber optics to serve wireless applications

Cell Density – High: 5G Small Cells (26 Ghz – 95% coverage)



Graphic Courtesy – American Tower

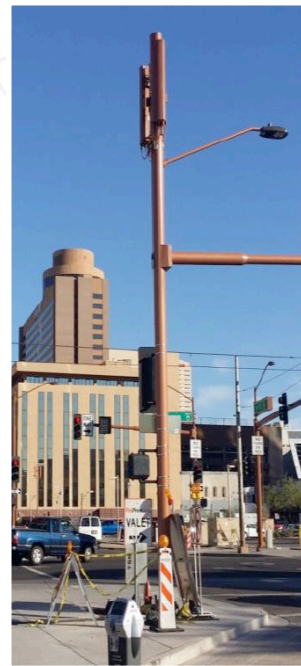




Street Light Pole



Stand-Alone Pole



Traffic Signal Pole



Existing – Dual Use

Source: "Verizon Small Cell Program", 2017 CML Conference Presentation

Making Smart Cities Simple | Small Cells – Manage Above Ground



Underground Communication Vault



Concealed Equipment Enclosure

Making Smart Cities Simple | Small Cells – Manage the Ground

The New York Times

The 5G Health Hazard That Isn't

How one scientist and his inaccurate chart led to unwarranted fears of wireless technology.



Golden Cosmos

5G Is Coming: How Worried Should We Be about the Health Risks?

So far, at least, there's little evidence of danger

By Kenneth R. Foster on September 16, 2019

“ 5G is an emerging technology that hasn't really been defined yet.

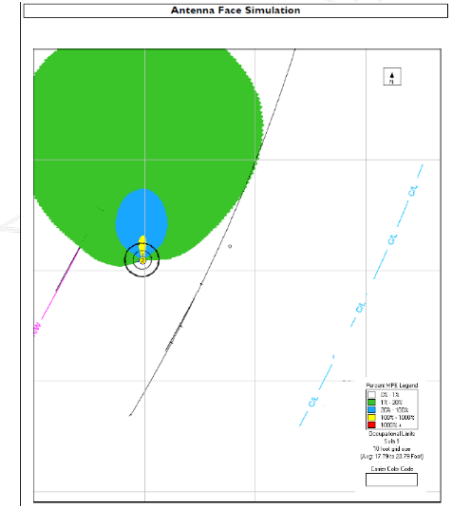
Michael Wyde, toxicologist

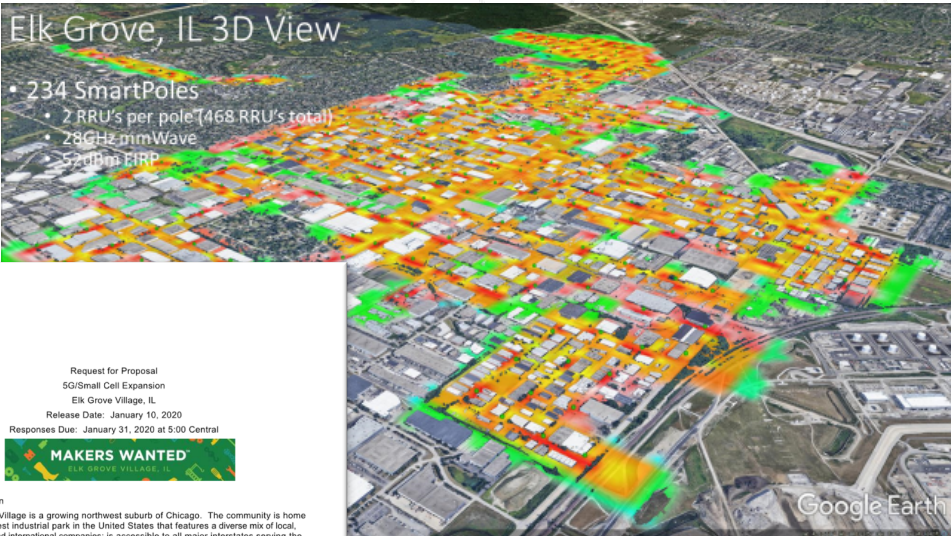


Activists fear radiation from 5G wireless service could be dangerous to public health. And they want more research done before carriers deploy the technology.

NurPhoto

Making Smart Cities Simple | Health Concerns: Science is undecided... The fear is real.





Elk Grove, IL 3D View

- 234 SmartPoles
 - 2 RRU's per pole (468 RRU's total)
 - 28GHz mmWave
 - 5200m ERP

Google Earth

NW View from O'Hare Airport



Request for Proposal
5G/Small Cell Expansion
Elk Grove Village, IL

Release Date: January 10, 2020
Responses Due: January 31, 2020 at 5:00 Central



I. Introduction

Elk Grove Village is a growing northwest suburb of Chicago. The community is home to the largest industrial park in the United States that features a diverse mix of local, national, and international companies, is accessible to all major interstates serving the metropolitan area, and is immediately adjacent to O'Hare International Airport. These location advantages are complemented by the Village's ideal suburban setting affording a high quality of life for its businesses and their employees.

The Village is a proactive and business-friendly community that values its citizens and corporate residents and works diligently to support the growth of their businesses. The Village consistently invests in the modernization and infrastructure improvements to its business districts.

- The Village is a commercial hub for Chicago and boasts:
- Over 3,800 businesses and more than 400 manufacturers in the Business Park
 - Proximity to O'Hare International Airport and the City of Chicago
 - Convenient access to Interstates 90, 290, 294, 355, & 390 Expressway
 - Extensive freight rail service throughout the Business Park
 - A highly educated and notably creative workforce
 - Recent expansion via the creation of the Elk Grove Technology Park, which contains more than 1.2 million square feet of high-image, state-of-the-art space

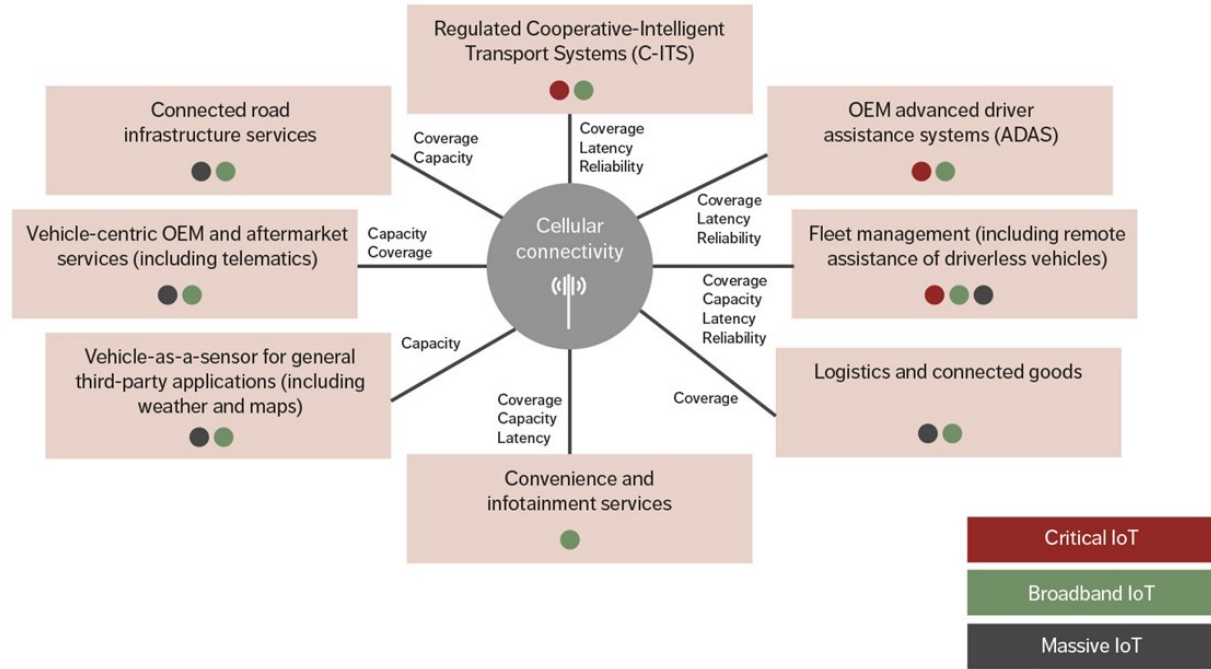
In 2019, the Village began the process of evaluating the future of this important, Midwest asset. It was determined by Village leadership that the creation of advanced communication technology through 5G and Small Cell technologies will be crucial to creating a technology-friendly, future-proofed community.

Going on 5G Offense

- Creating the smartest business park in North America
- Leveraging National Partner(s)
- Enabling future industrial automation technologies

Autonomous Vehicles

- V2V and V2I Technology
- Real Time Telemetry Data
- Fleet Management





Future Proofed Communities

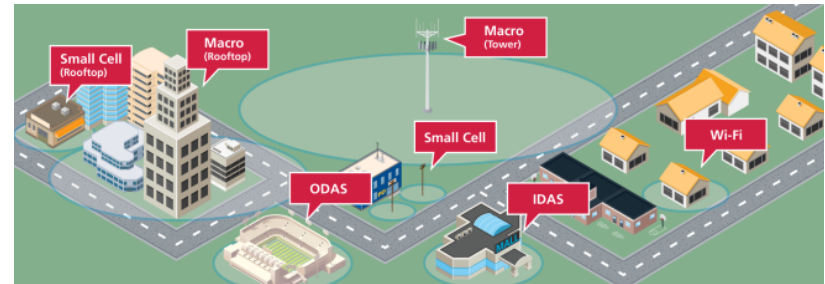
- 5,000-acre master planned community east of Denver
- Wanted technology “hooks” to attract residents and developers

- Converged fiber-optic network
- Scalable Macro Tower Network
- 5G Enabled Smart Poles
- Carrier Grade WiFi
- Commercial ODAS/IDAS

NETWORK DESIGN

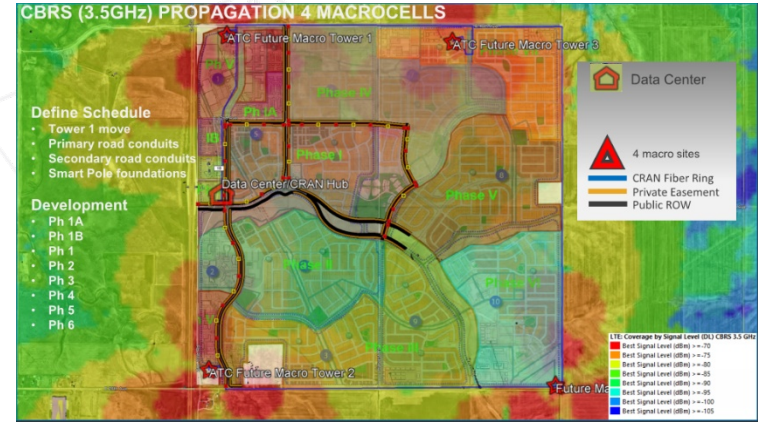
Use Cases

MOBILITY	FIXED WIRELESS	CONNECTIVITY	IN-BUILDING & VENUE	ALL
<ul style="list-style-type: none"> 4G macro tower coverage 4G capacity in high traffic areas Design for licensed and unlicensed spectrum Prepare for 5G mmWave overlay network Prepare for multi tenant 4G and 5G deployments 	<ul style="list-style-type: none"> Cost effective alternative to FTTH Each node covers ~25 single homes mmWave "Fiber over Radio" Ability to add 5G Mobility functionality 	<ul style="list-style-type: none"> FTTH (dark fiber) Licensed spectrum <ul style="list-style-type: none"> 4G/5G Un-licensed 4G/5G <ul style="list-style-type: none"> Carrier Grade Wi-Fi 6.0 CBRS Private LTE 	<ul style="list-style-type: none"> Enhanced services <ul style="list-style-type: none"> Retail Offices Light Industry Enhanced end user experience added to Public Schools Private LTE/CBRS Carrier Grade WiFi 	<ul style="list-style-type: none"> Shared BBU Hotel, C-RAN Shared MEC, Mobile Edge Computing Shared edge data center (e.g.Netflix) Dark fiber Hub Carrier Fronthaul Carrier Backhaul



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- Developer: Land and conduit infrastructure
- Partner: Carrier data center, fiber, smart poles & ongoing operations management
- Cable/Telcom firms lease capacity
- Revenue Sharing
- Smart City Pilot Zone





Managing Right of Way

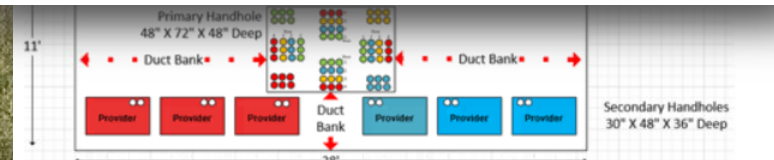
- Fiber optics mean ever dwindling right of way
- Creative approach to solving a key municipal problem

- Solves shared problems
- Creates shared infrastructure to protect right of way
- Future and built infrastructure
- Facilitate provider engagement
- Operationalizing the system

Why Does the City Need a Broadband Management Process?

Advance City Broadband Goals:

- Increase Ubiquity
- Have Broadband Ready for New Houses
- Protect ROW
- Future Proof West Des Moines



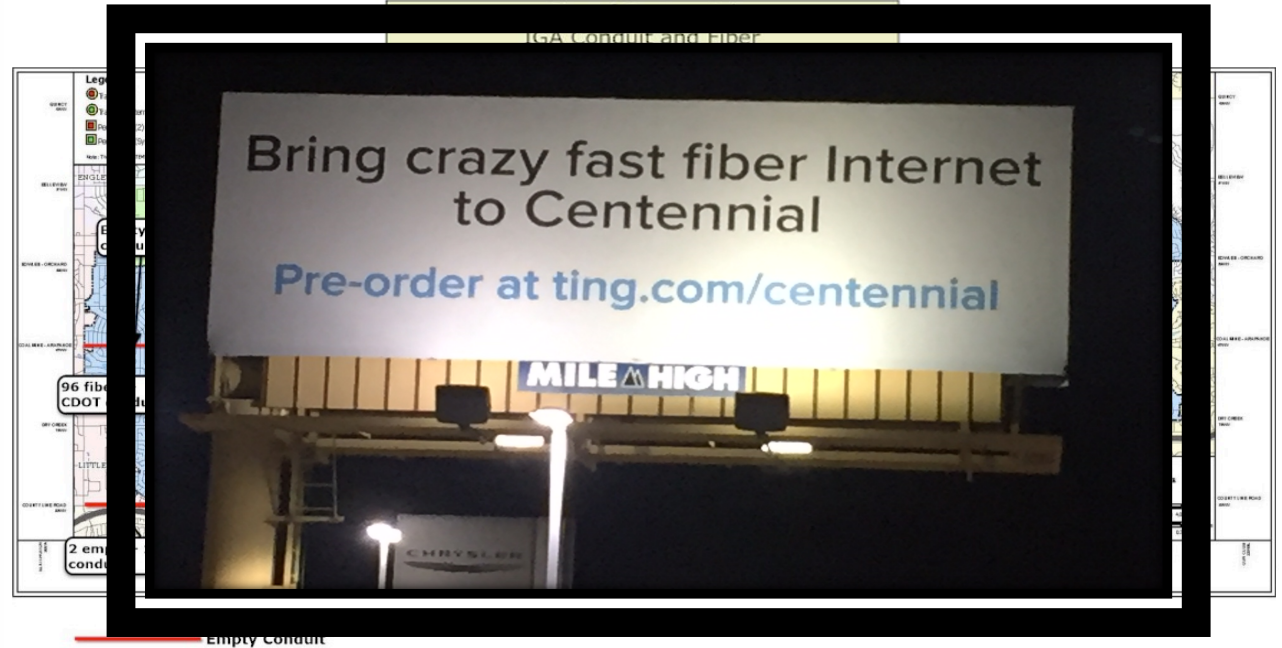


- Desire to upgrade city infrastructure
- Acquiring streetlights
- Implementing signal controls (ITS)
- Needs a plan for convergence

- Fiber optic connectivity
- Streetlights as a platform for 5G Services
- Signals to drive mobility upgrades
- Upgrade IT network
- Evaluating broadband upgrades for business & residents



- 3 Miles to 60+ Miles
- Conduit Cost = \$600,000
- Value = \$10-\$20MM



Utility + Fiber = Another New Revenue Source!

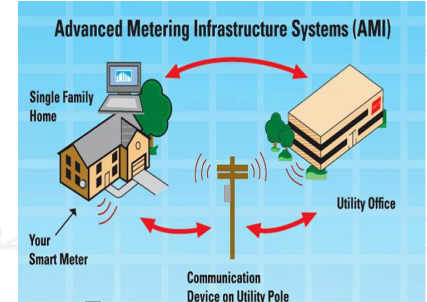
The data network that meter companies will most often recommend is a single-function RF system.

BUT – it is not the only option and may not be the best for:

- Longer term investments
- Smart City initiatives

STUDY:

- What role should **fiber** play?



AMR



vs

AMI



AMI Metering

- Reliable
- Safe
- Secure
- Accurate



ACHIEVING SMART GOALS A PRACTICAL GUIDE

First Phase

- ~2010
- focused on “Big Data” companies (think: IBM)

Second Phase

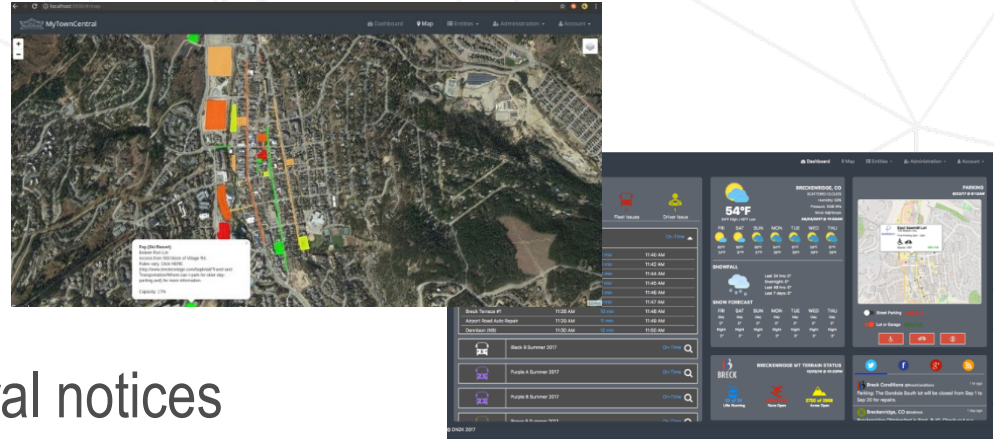
- ~2015
- “Open Data” Easy to gather but hard to understand, meaningless

Third Phase

- Dashboards to Action
- P3 Approach with Private Sector – Profit Motives
- Inter-related apps (Google + Uber + Marriott)
- Valuable / High Demand

■ Smart City is IoT-Based... Localized Data is Smarter!

- ✓ Smoke detection, indicating a **fire**
- ✓ **Flood / tsunami** warning
- ✓ **Mud / debris flows** (Rain event: “all reds”)
- ✓ Abnormal vehicle congestion (events)
- ✓ Stolen vehicle on a corridor
- ✓ Signal / **utility malfunction** (water leaks)
- ✓ Obstruction on the road (tree falls)
- ✓ Events/parking/congestion/unusually large crowds
- ✓ Gunshots/crime prevention/video
- ✓ Signals reduced accidents



■ Citizens are oblivious to general notices

- They want information on kids, schools and immediate impacts

SENSORS

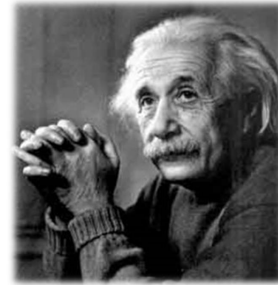


DASHBOARDS



ACTION

- **Identify** fiber-related **assets**:
 - Conduits, agreements, splice points, vaults,
 - Streetlights & poles
 - Identify underutilized capacity
- **Upgrade** public policy **items**
 - Develop fiber friendly policies
 - Update management systems
- Create **strategic plan/vision**



“If I had an hour to solve a problem, I’d spend **55 minutes thinking about the problem** and **5 minutes thinking about solutions.**”

- Albert Einstein

- Deploy fiber and sensors to create technology core
- Identify internal champion / leadership team
- Identify community partners and seek mutual benefit



- **Facilitate private sector competition** and consumer choice
- **Make** some **public** assets available to **private** sector
- **Encourage** internet-based **economic development, job creation**, new business start-ups and entrepreneurs
- **Encourage the private sector to invest**
- **Facilitate** access in public places
- **Monetize** access to connectivity assets



- Be a big city with resources (!!!)
- Align to community goals and Vision
- Assess needs across department boundaries
- Create Master Plan and Strategy to avoid application thinking
- CARES Act and Other Funding available



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QUESTIONS