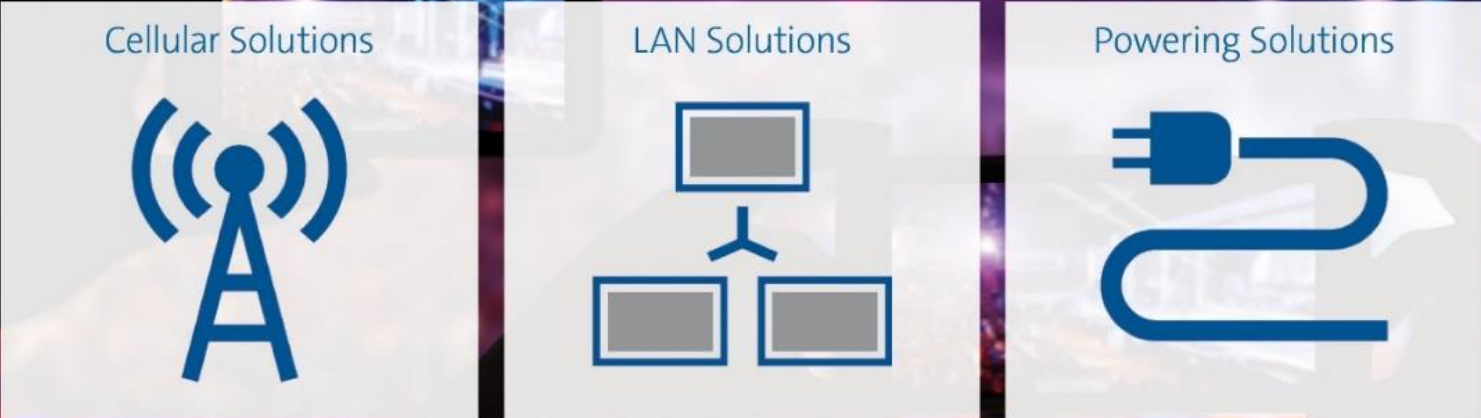


Optical network solutions provide a future-ready platform at less cost

End-User Experience (Customers, Tenants, Guests, Fans)



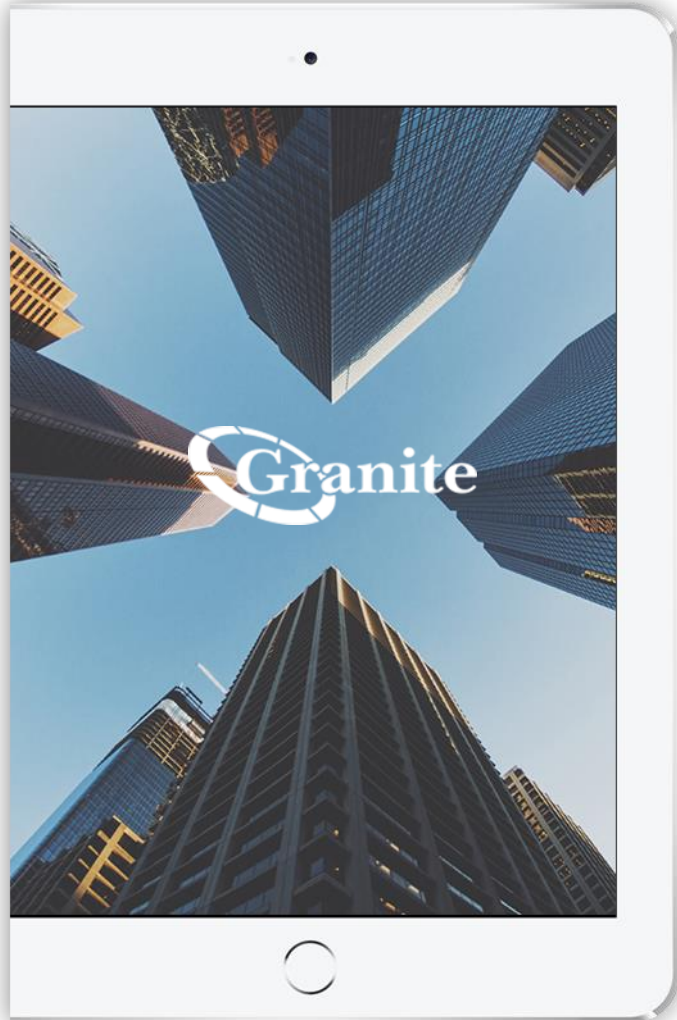
Corning's In-Building Network Solutions





The **Safer Buildings Coalition** is an independent, not for profit organization. The Safer Buildings Coalition mission is to work to ensure that every manner of mobile communication available inside buildings that would be useful during an emergency will function correctly, when and where needed: www.saferbuildings.org

Granite is a leading communications services provider for businesses with multiple locations



\$1.4B+
Granite's annual revenue

\$100m+
Granite's annual growth rate last 7 years

\$0
Granite's debt

9k+
Satisfied corporate clients

650k+
Locations served

85+
Fortune 100 customers serviced

1/3rd
Of staff in customer service role

5X
Higher retention rate than the industry aver.

1
Number of invoices

Who is ANS?

- ANS Advanced Network Services, LLC
 - In business since 1991
 - Regional operations centers - The ANS suite of services is provided from Chicago to the Northeast and down the East Coast with as-needed support nationwide.
 - Services including
 - In-Building Wireless Services
 - Network Infrastructure
 - Tower Services
 - AC & DC Power Services



LIGHTS? WATER? **WIRELESS!**

In office buildings and facilities across America, basic amenities like electrical, gas and plumbing are essential components that are planned and constructed.

The new amenity being planned or added by building owners, architects and operators?

Reliable, in-building wireless coverage.

Capacity

Coverage



Bandwidth

ENTER

[click here for more information](#)

Corning ONE Fiber & Power Deep *ONE Infrastructure for All Networks & Applications*



Multiple layers of single-purpose infrastructure



Reduce and eliminate single-purpose infrastructure

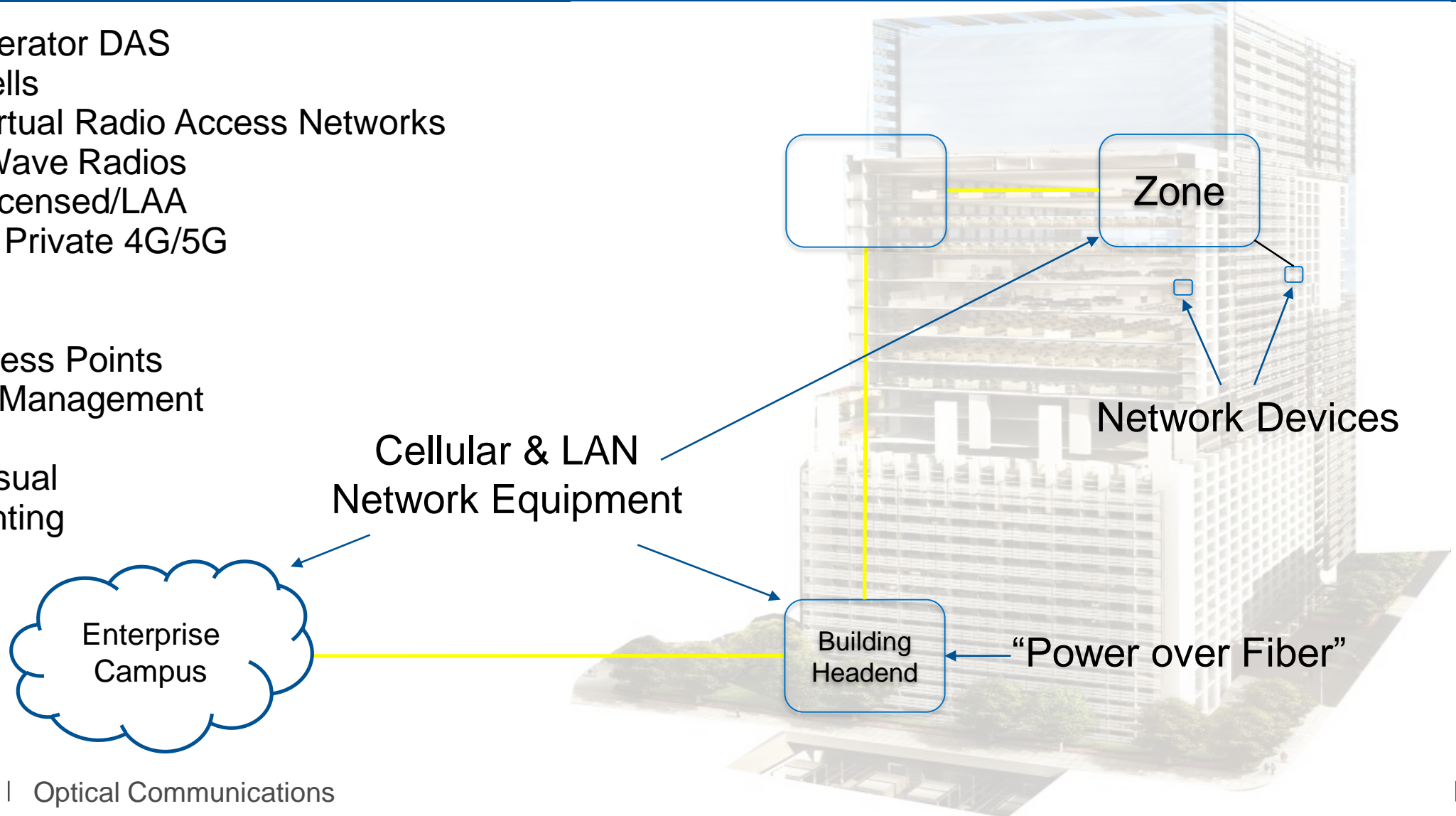
CORNING

Corning ONE Fiber & Power Deep

ONE Infrastructure for All Networks & Applications

- Multi-Operator DAS
- Small Cells
- Cloud/Virtual Radio Access Networks
- 5G mmWave Radios
- LTE-Unlicensed/LAA
- CBRS & Private 4G/5G

- LAN
- WiFi Access Points
- Building Management
- Security
- Audio Visual
- LED Lighting
- Etc.



Low-e Glass

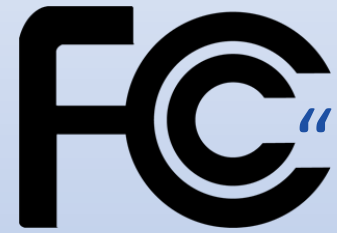
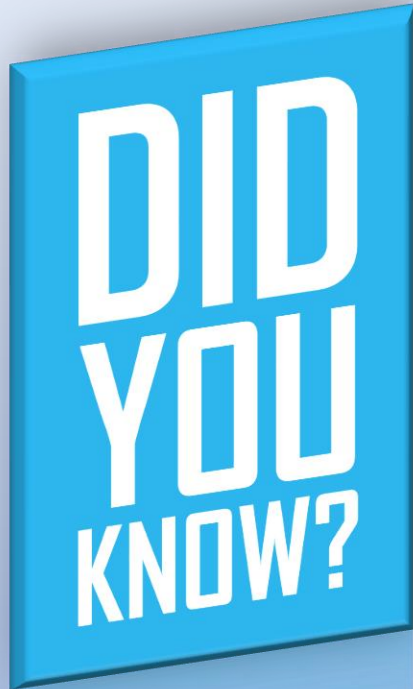
6 mm Glass Pane = **-0.8 dB** @ 900 MHz

Double Glazing w/ 2 coated Glass Pane = **-23 dB** @ 900 MHz

	Material	Source	Shielding effect / dB		
			900 MHz	1800 MHz	3 GHz
Glazing	Glass pane 6 mm	[8]	-0.8	-1.3	-1.9
	Double glazing 4 mm/air 12 mm/5mm	[5]	-0.8	-1.1	-1.2
	Double glazing with commercial low-e 4 mm coated/air 12 mm/5mm	[5]	-30.6	-26.8	-27
	Double glazing with 2 coated glass	[2]	-23	-30	-36
	Double glazing with square pattern (4 %) low-e coating 4 mm coated/air 12 mm/5mm (measured)	[5]	-1.3	-1.3	-1.9
Glazing with patterned low-e	Double glazing with triangle pattern (2 %) low-e coating 4 mm coated/air 12 mm/5mm (measured/ <i>simulated</i>)	This work	-2.0/-2.0	-2.3/-2.2	-4.0/-3.9
	Double glazing with triangle pattern (2 %) low-e coating 4 mm coated/air 8 mm/5mm (<i>simulated</i>)	This work	-2.1	-3.2	-1.5
	Double glazing with triangle pattern (2 %) low-e coating 4 mm coated/air 16 mm/5mm (<i>simulated</i>)	This work	-1.8	-1.4	-7.1

Source: Bouvard, Olivia & Lanini, Matteo & Burnier, Luc & Witte, Reiner & Cuttat, Bernard & Salvadè, Andrea & Schüler, Andreas. (2017). Mobile communication through insulating windows: a new type of low emissivity coating. Energy Procedia. 122. 781-786. 10.1016/j.egypro.2017.07.396.

Driver: NG911 Location Accuracy



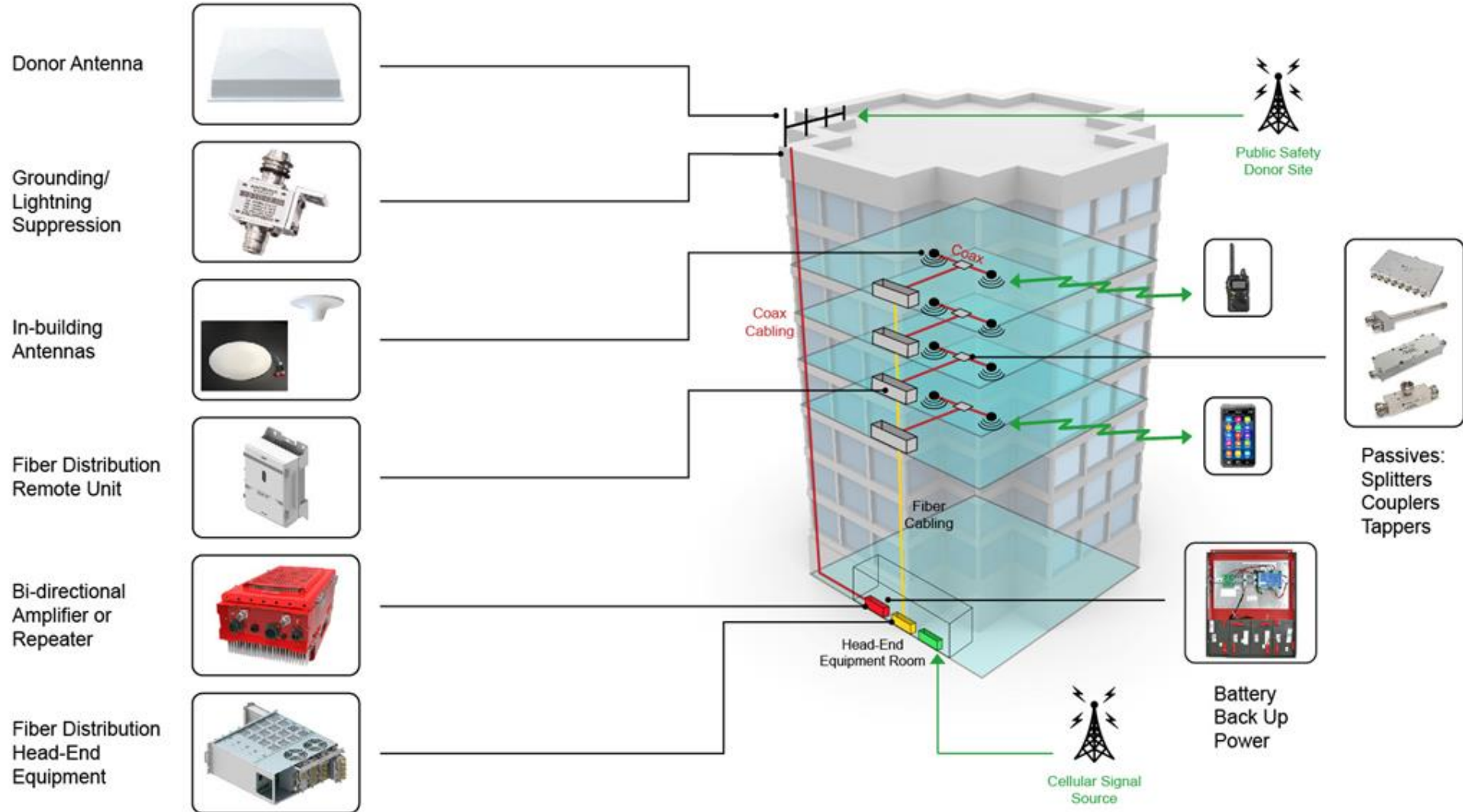
“The FCC estimates that a one minute improvement in 9-1-1 dispatch time could save 10,000 lives each year”

Define the Problem

- There are over 5.6 million commercial buildings in the U.S
- People need to be able call 911 from inside those buildings
- First Responders need to be able communicate with each other inside and outside buildings
- **SBC survey shows that in a large percentage of buildings critical communication can't happen**



The Solution: In-Building Booster System



BUILD YOUR OWN COVERAGE

T-MOBILE HELPS BUILD INDOOR WIRELESS NETWORKS FOR:

- Arenas / Stadiums
- Casinos
- Commercial Real Estate
- Government Buildings
- Hospitals
- Hotels
- Malls
- Military Facilities
- Resorts
- Residential Buildings
- University Campuses
- Warehouses

Business Model



Granite Approach

- Serve 98% users Day-1
- In-building wireless service provided by Granite to building owners and developers
- Project executed by Granite
- Granite retains control of in-building wireless service

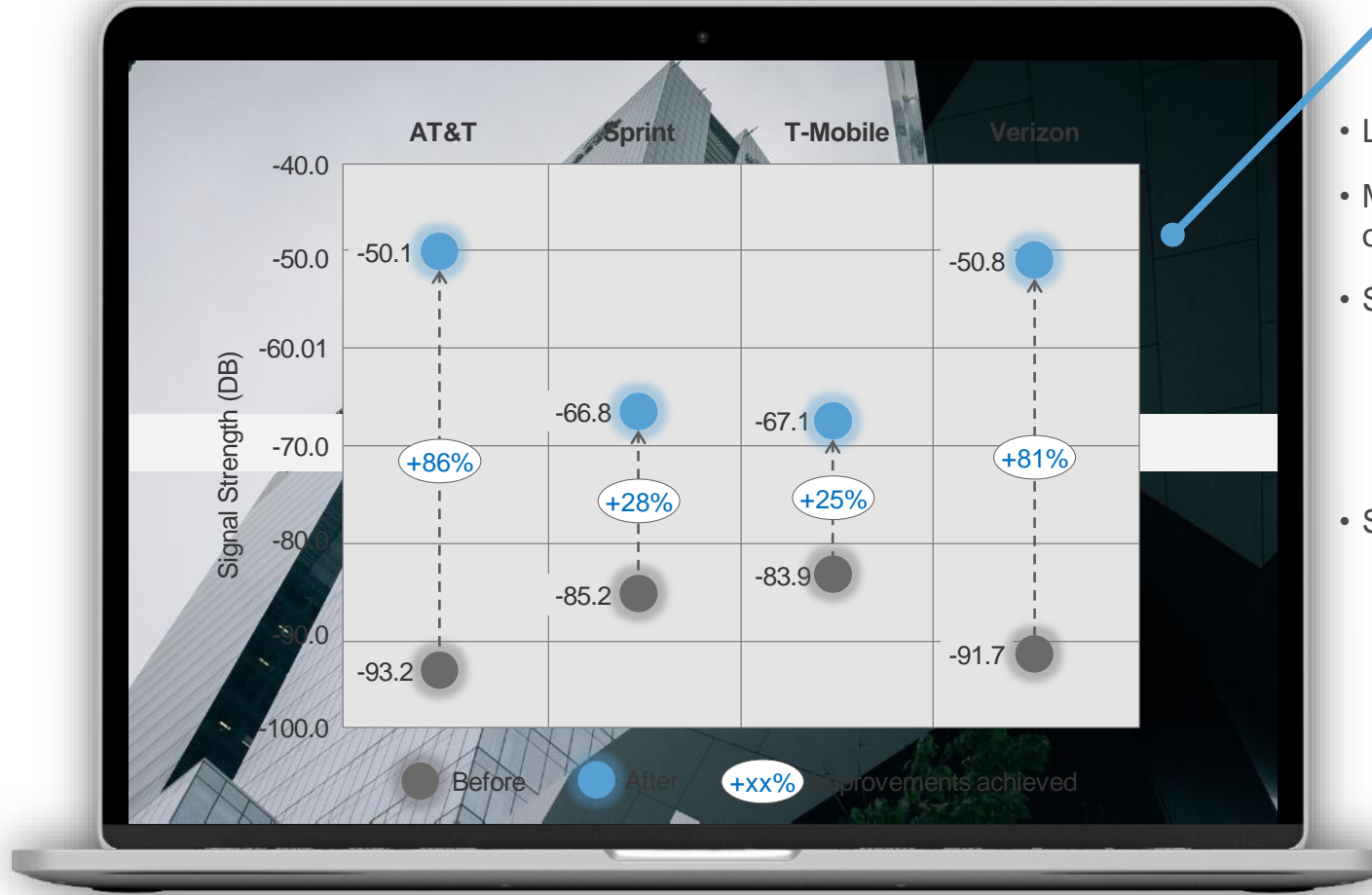
Past Industry Approach

- In-building wireless system led by one operator and equipment vendor
- Project executed by system integrator or operator
- Operators retain effective control of the system
- Repeat for second, third and fourth operators



Successful Business Case

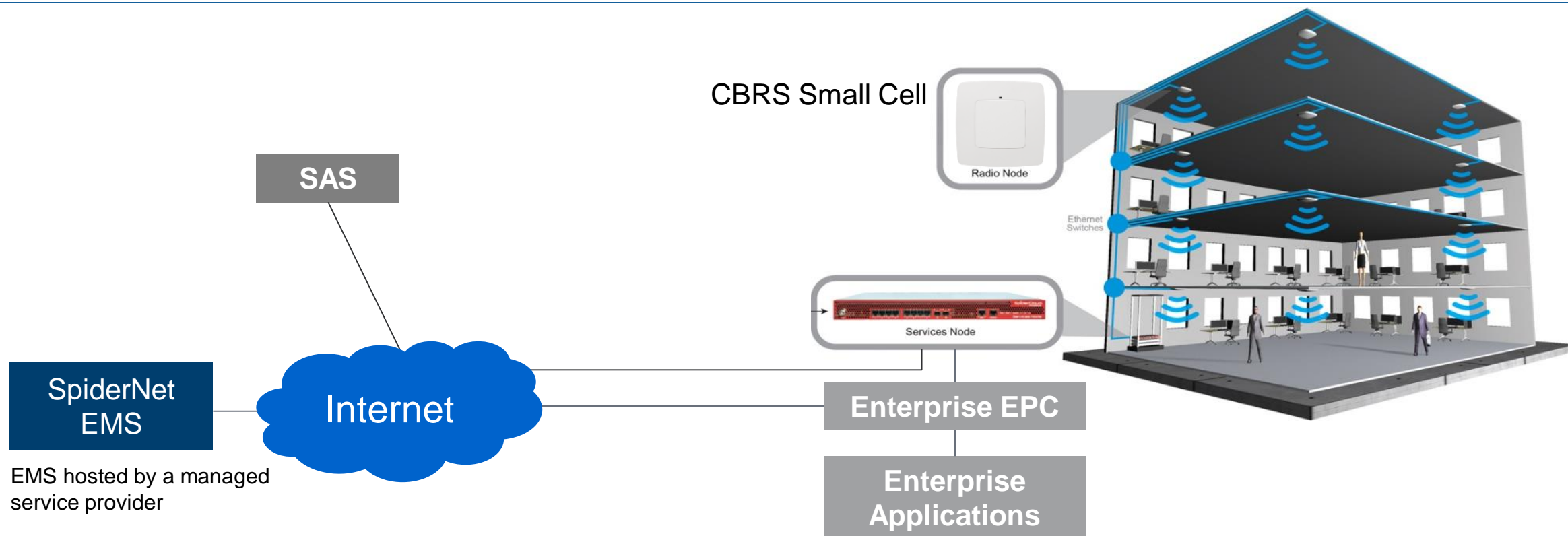
Proof Point: Senior-Living Apartments



Signal Improvements

- Located in Lake Worth, FL
- Measurements from first floor of main building
- Spectrum
 - AT&T: 850 MHz
 - Sprint: 1900 MHz
 - T-Mobile: 1900 MHz
 - Verizon: 700 MHz
- Signal source
 - AT&T and Verizon: femtocells
 - Sprint and T-Mobile: over-the-air

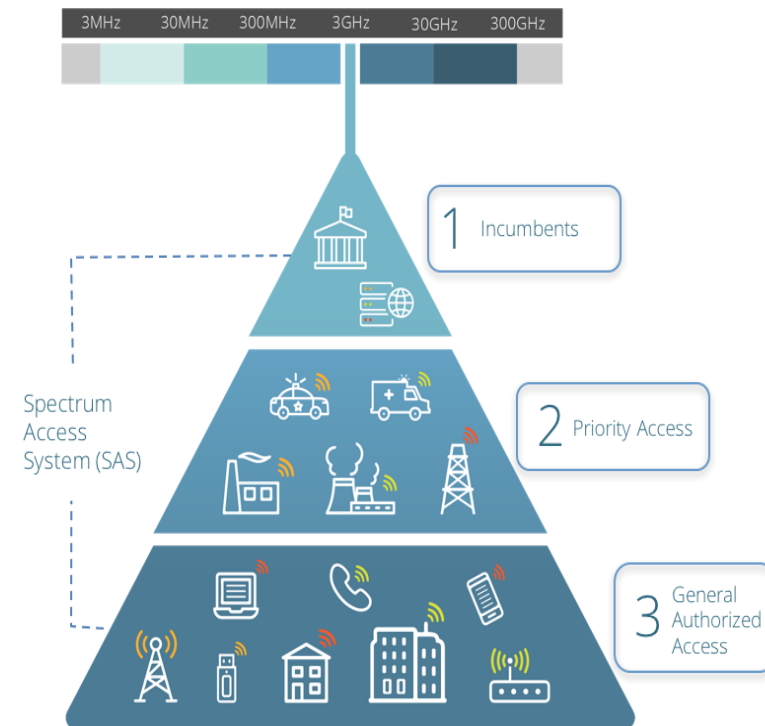
CBRS Private LTE as Managed Service



SpiderCloud E-RAN can be deployed like Enterprise Wi-Fi in CBRS band with local EPC
Enterprise data stays local (local breakout). Easy to integrate with enterprise applications.

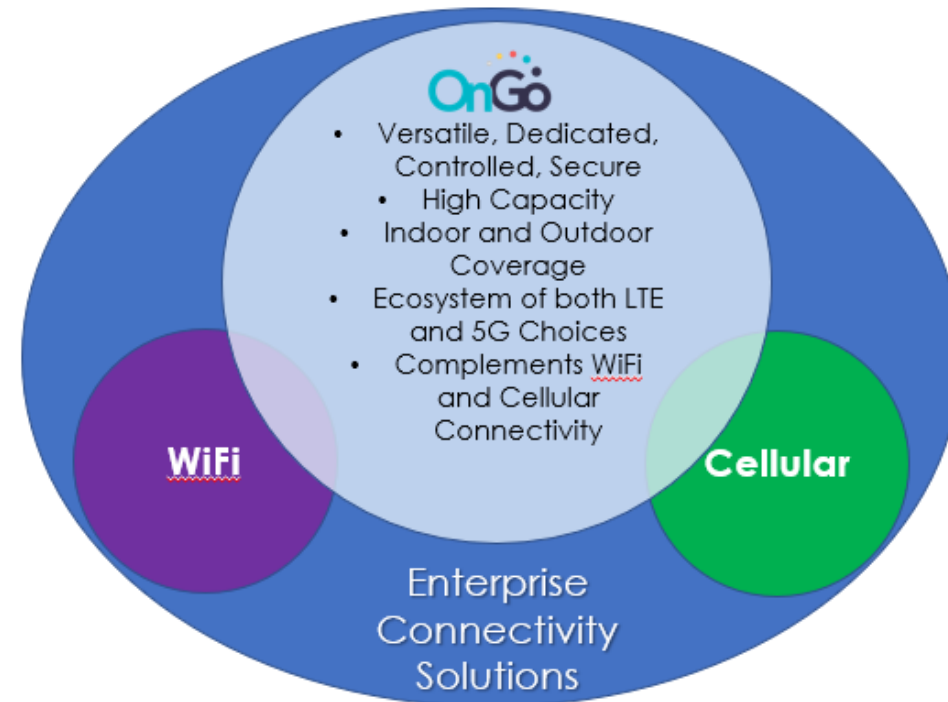
Planning for the Future CBRS Private LTE Network

- Tiered Approach
 - Incumbents
 - Priority Access
 - General Authorized Access
- Spectrum Access System (SAS)
- Evolved Packet Core (EPC)
- Radio Access Network (RAN)
- The OnGo Ecosystem

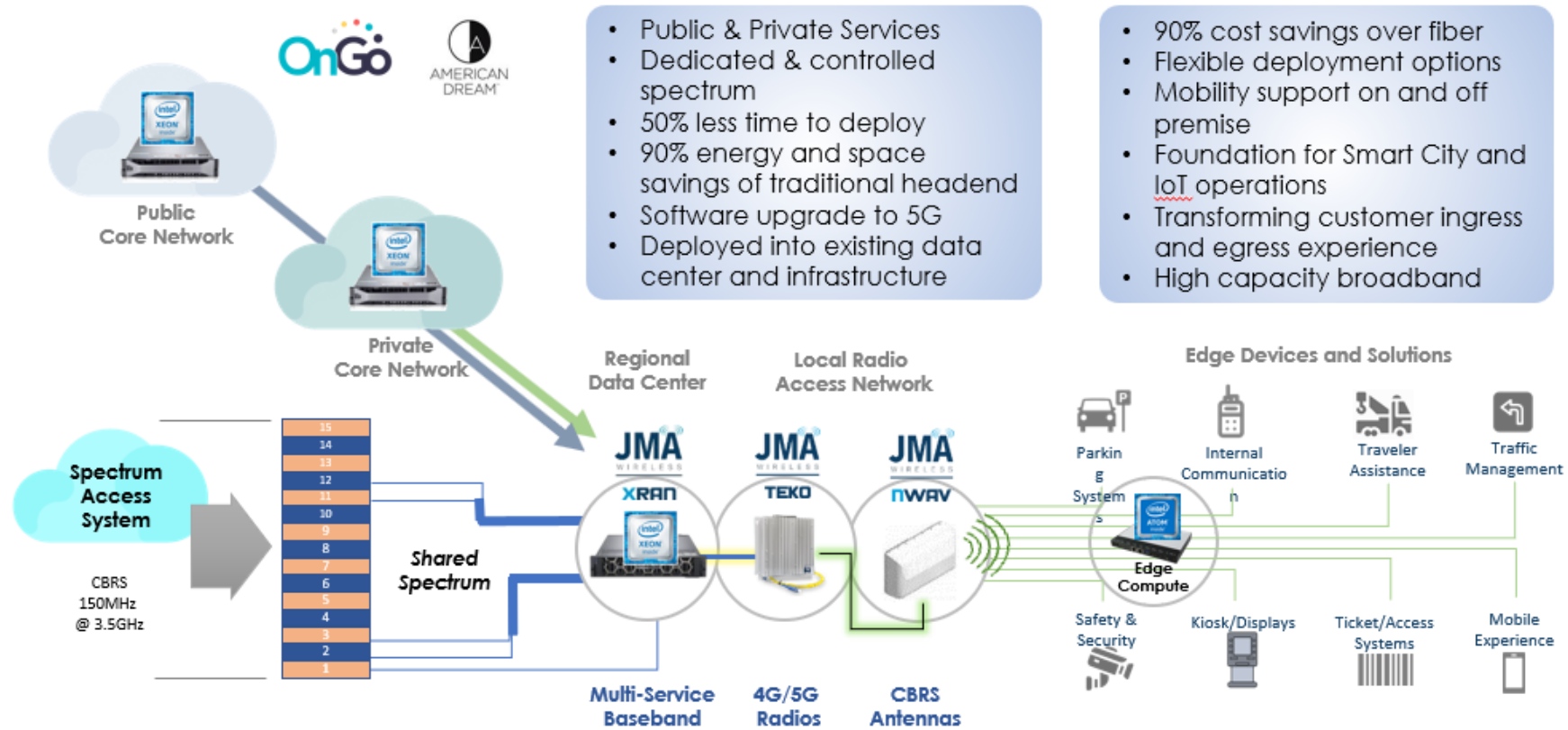


How OnGo Enables IT

- Empowerment & Ownership
- HOV Lane Connectivity
- Capacity & Coverage
- Interoperability & Choice
- Private LTE Today
- 5G and Network Sharing Tomorrow



American Dream Entertainment & Retail Experience



- Public & Private Services
- Dedicated & controlled spectrum
- 50% less time to deploy
- 90% energy and space savings of traditional headend
- Software upgrade to 5G
- Deployed into existing data center and infrastructure

- 90% cost savings over fiber
- Flexible deployment options
- Mobility support on and off premise
- Foundation for Smart City and IoT operations
- Transforming customer ingress and egress experience
- High capacity broadband



LTE in Public Safety



- All the major carriers count numerous Public Safety Agencies as customers
- DRIVERS:
 - Applications, Data Capabilities
 - COST
 - Situational Awareness, Interoperability
 - Able to call Civilian and other Agencies
 - In-Building Coverage
 - FirstNet
- Lines Getting Blurrier – Public Safety not just LMR!

