Smart Cities

The Need & The Solution

Carrie Goetz, D.MCO, RCDD, NTS,
PSP, CNID, CDCP, AWS CCP, CSM

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Bicsi

Agenda

- What is a Smart City/Smart Community?
- Why?
- Urban versus Rural
- Connectivity of Things
- Where does the data go?
- Some Driving Applications

What is a Smart City/Smart Community?

- Definitions and applications vary widely
- For us:
  - Collection of applications and devices that use common infrastructures, data centers and device level data repositors for communication of critical and noncritical.

Why?

- Improve quality of life for residents and businesses
- Improve safety of life and property
- Provide intelligence to increase profits and yields
- Decrease carbon footprint (lighting, charging, traffic, etc.)
- Improve communications
- Improve transportation
- Provide interaction between systems
- Smart metering and resident empowerment through data

Covid and Beyond

- Remote work
- Telehealth
- Remote learning
- Consumer services
- $80 billion to close digital divide
- 42 million Americans can’t purchase
- 847,222 Americans have zero access options

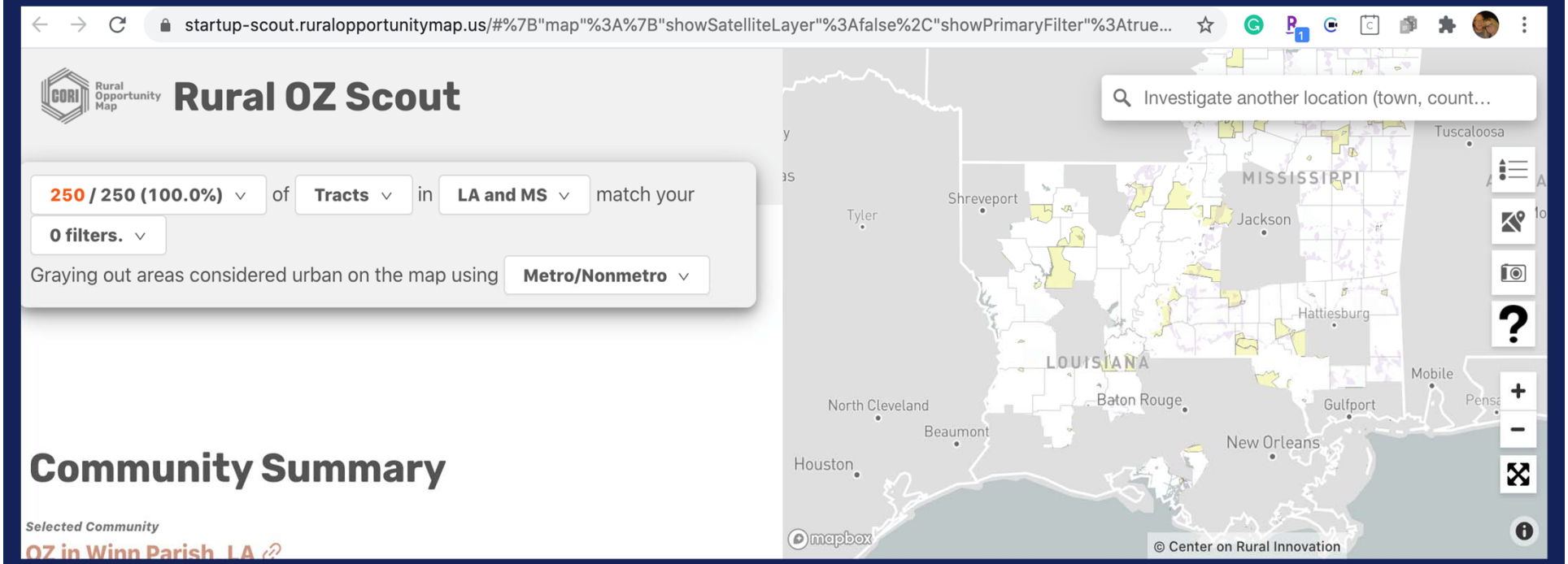
Predictions

- UN predicts 70% of world population will be in urban areas by 2050
- Digital divide is real
- Access in some cities is also an issue – not just rural America
- Physical connectivity only goes so far

Rural Cloud Initiative

Diagram Courtesy of the Rural Cloud Initiative

Identifying Zones



https://ruralopportunitymap.us/#demo-map

City/Community Planning

- Criteria
- Short range versus long range goals
- Expected outcomes and savings
  - 61% savings on street light power costs
  - Resident satisfaction
  - Increase business satisfaction
  - Increase revenue for city
  - Make the city safer (fire, life, etc.)
  - Support events
  - Support electric vehicle charging

Planning Continued

- Resident interest
  - Prepaid utility services
  - Utility monitoring
  - Leak detection
- Business interest
  - Integrated fire systems
  - Utility monitoring
  - Enhanced security measures
  - Open Wi-Fi
  - Parking enhancements
  - Temperature sensors

Funding Options

- Tax
- Matching funds
- CARES act, HEAL act
- RCI
- American Connection Project
- BroadbandNow
- State funds
- Public/Private partnerships

American Connection Project Participants

RFI Cycle - Lab of Things

- Products and services are varied
- Create a development lab
- Enlist local schools/colleges
- Innovation platform
- Discovery cycle is important
- Clear understanding of need

Connecting it All

- Fiber
- Coax
- Copper
- Cellular
- WiFi
- LoRaWAN
- NB-IoT

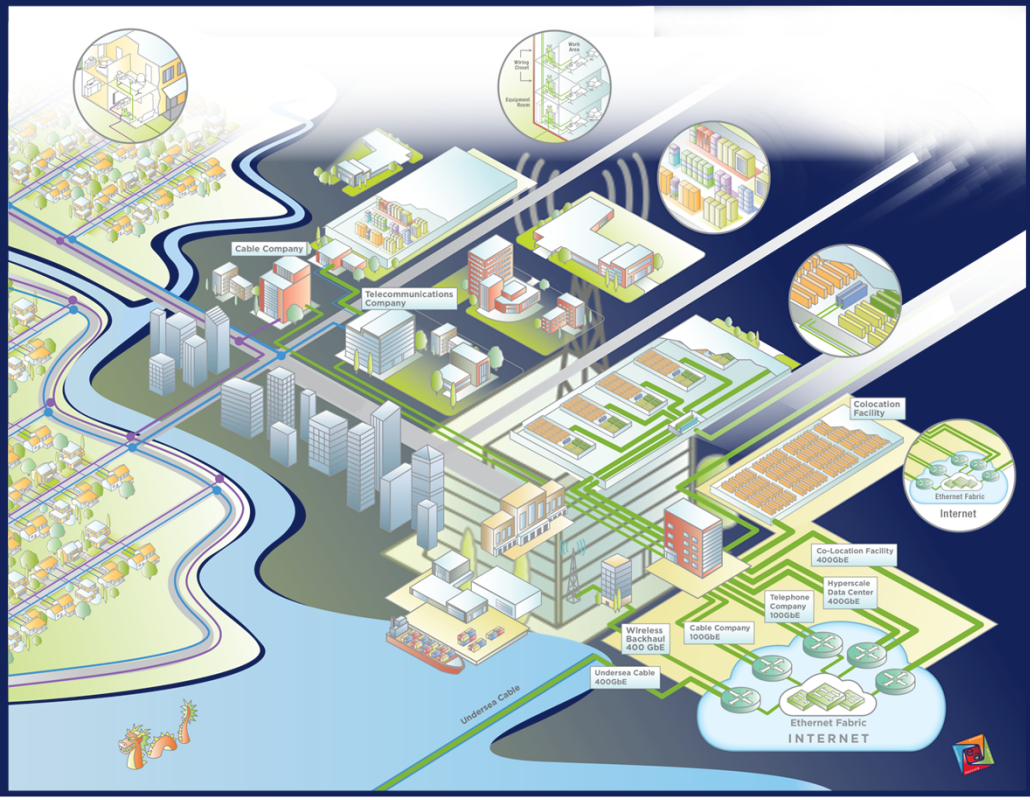


Diagram courtesy of Ethernet Alliance

Planning Connectivity

Diagram Courtesy of the Rural Cloud Initiative

Fiber

- Planning considerations
- Fiber study
- Pathway space
- Strands needed plus dark
- Where strands are to be located
- Some idea of supporting services
- Public private partnerships have proven successful
- Iterative process and new strands should be added as possible

Wireless Options

- All require some connectivity
- Protocols will not necessarily be Ethernet
- Cellular (4G, 5G)
- LoRaWAN
- NB-IoT
- WiFi 5, WiFi 6, CB, Cell size
- Iterative also
- Security is paramount

Factors

- Distances spanned
- Connections passed
- Priority
- Signal Loss
- Movement
- Reach
- Multipath and Fading
- Density

Lincoln, NE

- Doug Young
- Public/Private
- Fiber 144 private plus 48/96 public one pull
- Partnership with UN
- Public research VLAN 400 miles of fiber
- Testbed of Things
- Statewide LoRaWAN Network

Florence, AZ

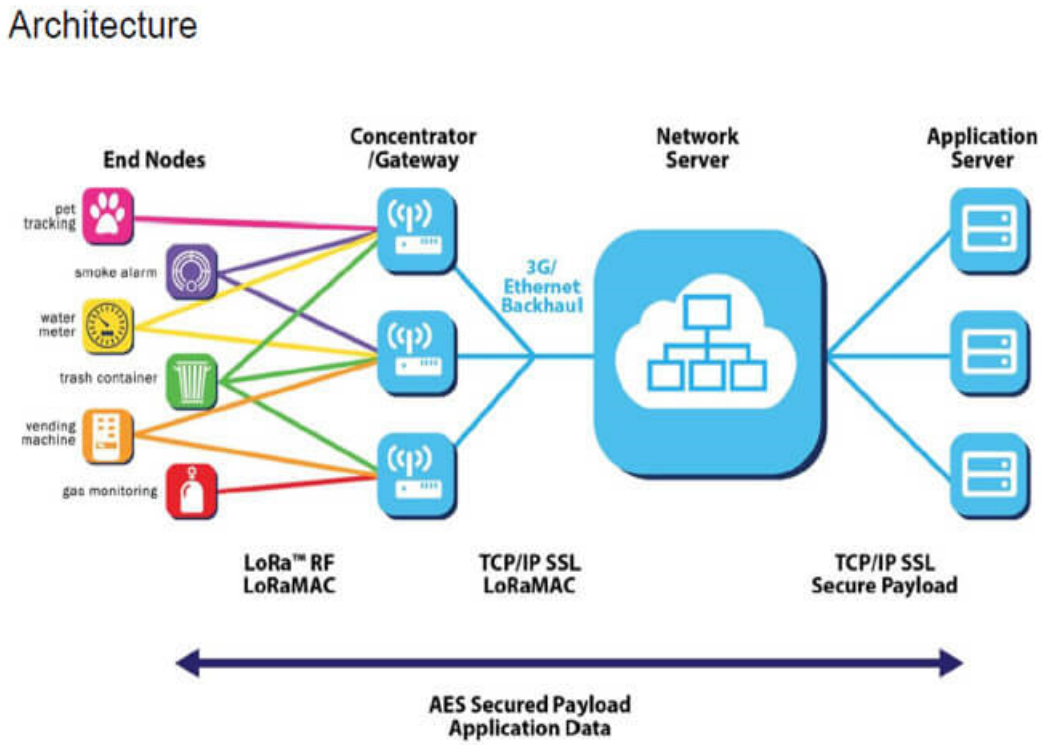
- Brent Billingsley
- Trenton Schaffer
- Smart Water Meters
- LoRaWAN networked
- Public/private partnership
- Open network and security first
- IoT Advent custom coding for smart metering, adds the resident smarts

About LoRaWAN

- Low Power Wide Area (LPWA)
- Converts RF to IP
- Encrypted – security first
- Device to infrastructure
- Utilizes Gateways and can be multicast for updates (FOTA –Firmware Over the Air)
- Single hop link from device to gateway(s)

LoRaWAN

- Optimized for:
  - Battery life
  - Network capacity
  - Range
  - Cost
  - Security
  - Variety
  - Robustness to interference

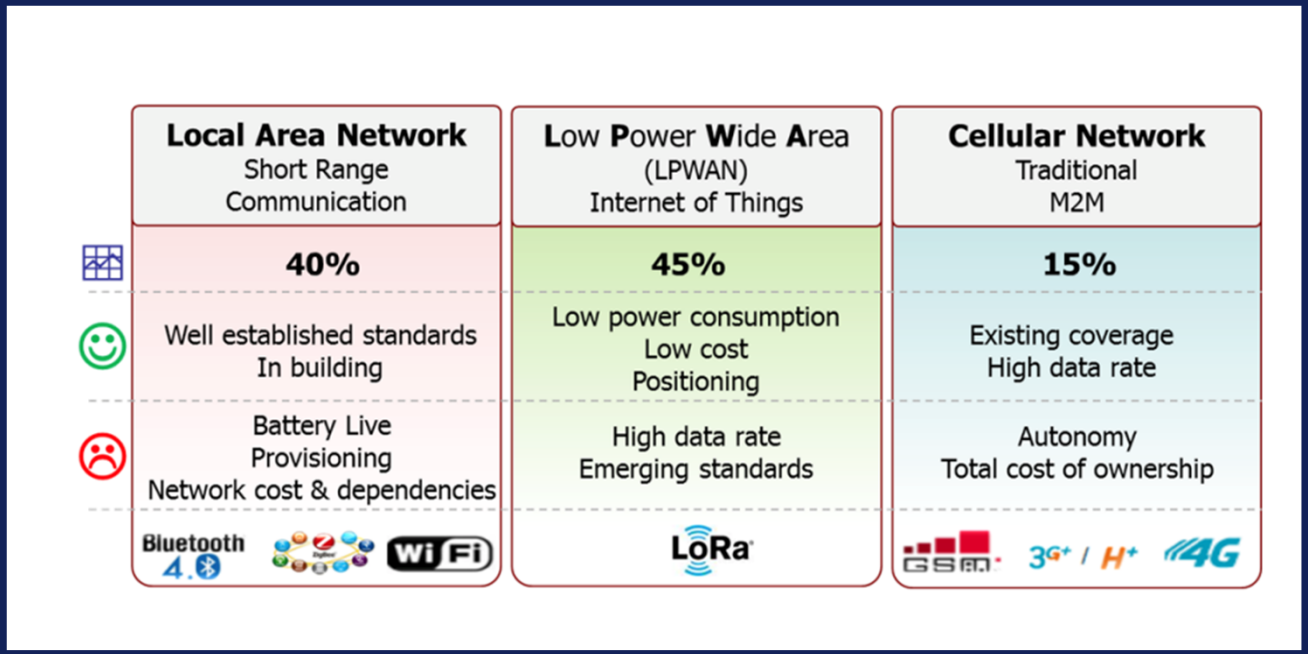


- Longer range than Frequency Shift Keying – uses Chirp Spread Spectrum

Diagram courtesy of Element14

LoRaWAN Comparison

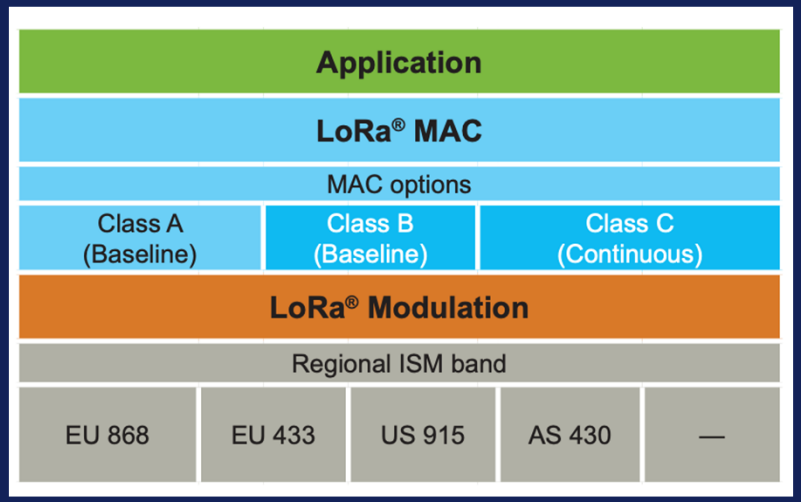
One gateway can cover an entire city or 100's of km^2

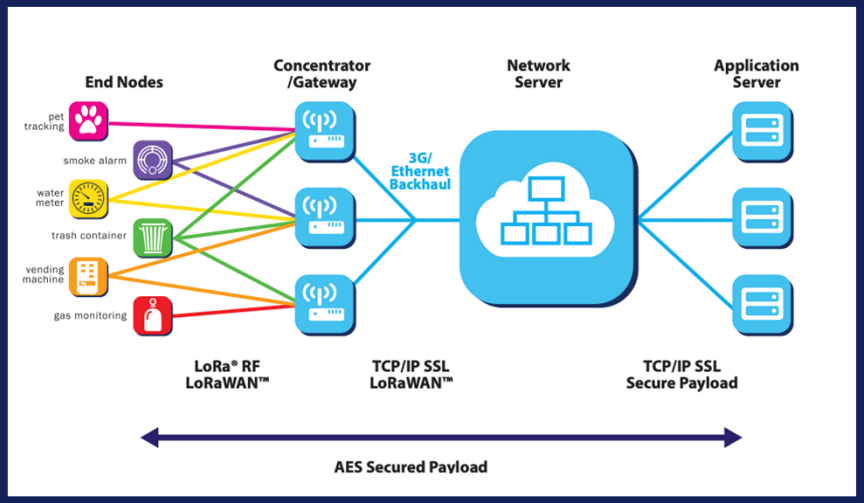


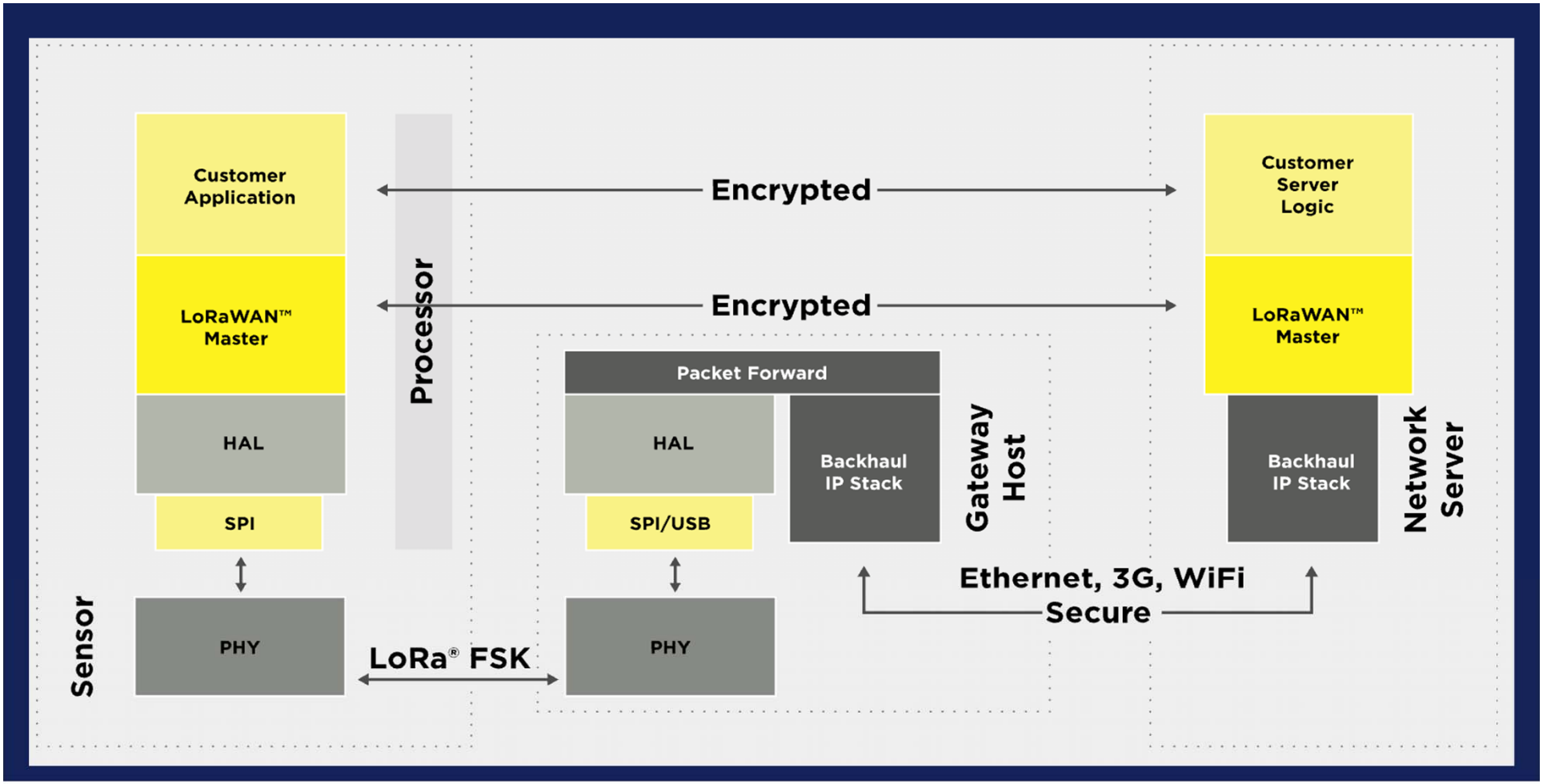
	Local Area Network Short Range Communication	Low Power Wide Area (LPWAN) Internet of Things	Cellular Network Traditional M2M
	40%	**45%**	**15%**
☺	Well established standards In building	Low power consumption Low cost Positioning	Existing coverage High data rate
☹	Battery Live Provisioning Network cost & dependencies	High data rate Emerging standards	Autonomy Total cost of ownership
	Bluetooth 4.0 · ZigBee · Wi Fi	LoRa	GSM · 3G+ / H+ · 4G

- Picture courtesy of LoRa Alliance

The Tech of IT






Customer Application
LoRaWAN™ Master
HAL
SPI
PHY
Sensor
Processor
LoRa® FSK
Encrypted
Encrypted
Packet Forward
HAL
SPI/USB
PHY
Backhaul IP Stack
Gateway Host
Ethernet, 3G, WiFi
Secure
Customer Server Logic
LoRaWAN™ Master
Backhaul IP Stack
Network Server

5G

- Not all 5G is the same (low, medium and high frequency bands)
- Higher frequency has lower range requiring more cells
- Radios and receivers may vary
- Low frequency NB, IoT and eMTC (LTE-M) can be used for IoT devices over LPWA
- Power consumption is expected to be vast
- FCC opened new spectrum in US
- Can offload to LTE-U (unlicensed 2.4 and 5GHz)

WeHo (West Hollywood)

- Francisco Contreras
- Smart Public Safety
- Civic Innovation
- Public/Private partners
- Smart Pole
  - Incorporate Electric Charging, lighting, sensors, 5G carrier services, WiFi
  - Optional services not yet incorporated – touch screens, CCTV, event power, etc.
- Smart bus enclosures

Smart Bus Shelters (WeHo)

- USB charging stations
- free Wi-Fi,
- real-time bus arrival information screens,
- push button audible arrival information (for visually impaired), and
- digital advertising panels that will display ads and public service announcements.
- Can have surveillance and other options

Data Center Considerations

- Edge Data Centers
- Not all devices or communications will end in a DC
- Data centers can be distributed, this may lessen ”N” requirements with failover
- Importance on energy efficiency
- Software defined power, renewables, microgrids
- Colo on premise push
- Cloud may not be most efficient
- Local, state and other regulations may trump business needs

Edge Data Centers

- Containers (shipping containers)
- Modular
  - Various sizes, pre-engineered, constructed on site, esthetically pleasing, wider variety of options
- City/municipality data center
  - Security and location may not support in the best manner

Q&A

Carrie Goetz
Principal/CTO
StrategITcom, LLC
D.MCO, RCDD/NTS, CDCP, CDCS, CNID, Master IM, AWS CCP, PSP, Cert SCRUM Master
carrieg@StrategITcom.com
https://www.linkedin.com/in/carrie-goetz/
www.StrategITcom.com
@carriejgoetz