Smart Cities
The Need &
The Solution

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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 repositories 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

Rural OZ Scout

Community Summary

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
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 km²

<table>
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<tr>
<th>Local Area Network</th>
<th>Low Power Wide Area (LPWAN)</th>
<th>Cellular Network</th>
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- Bluetooth
- LoRa

- GSM
- 3G/H
- 4G

- Picture courtesy of LoRa Alliance
The Tech of IT

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<th>Application</th>
<th>MAC options</th>
<th>LoRa® Modulation</th>
<th>Regional ISM band</th>
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<td>EU 868</td>
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<td>Class B (Baseline)</td>
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<td>Class C (Continuous)</td>
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<td>US 915</td>
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<tr>
<td>LoRa® RF</td>
<td></td>
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<td>AS 430</td>
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</tbody>
</table>

Diagram:
- End Nodes
- Concentrator/Gateway
- Network Server
- Application Server
- AES Secured Payload
- TCP/IP SSL Secure Payload
- LoRa® RF LoRaWAN™
- TCP/IP SSL LoRaWAN™
- LoRa® Ethernet Backend
- End nodes: fire alarm, water leak, trash can, loading dock, gas monitoring
- Network server: cloud
- Application server: computer icons
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

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