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Artimar Since 1962
50 ANOS



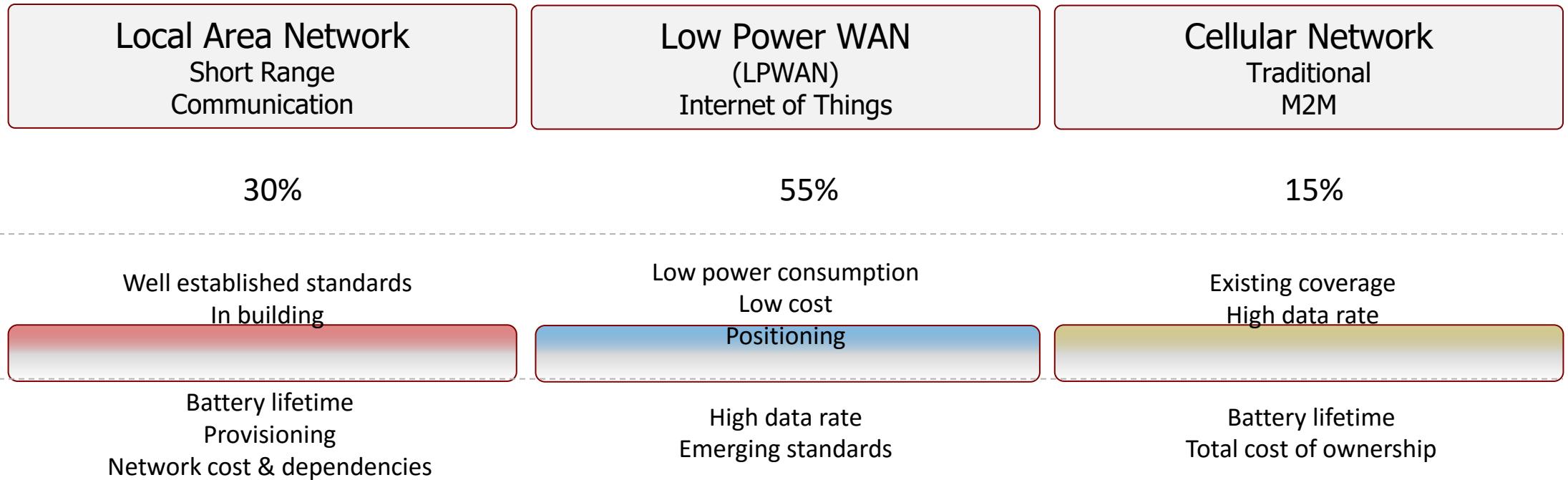
Introduction to LoRa®

IoT Requires Multiple Considerations

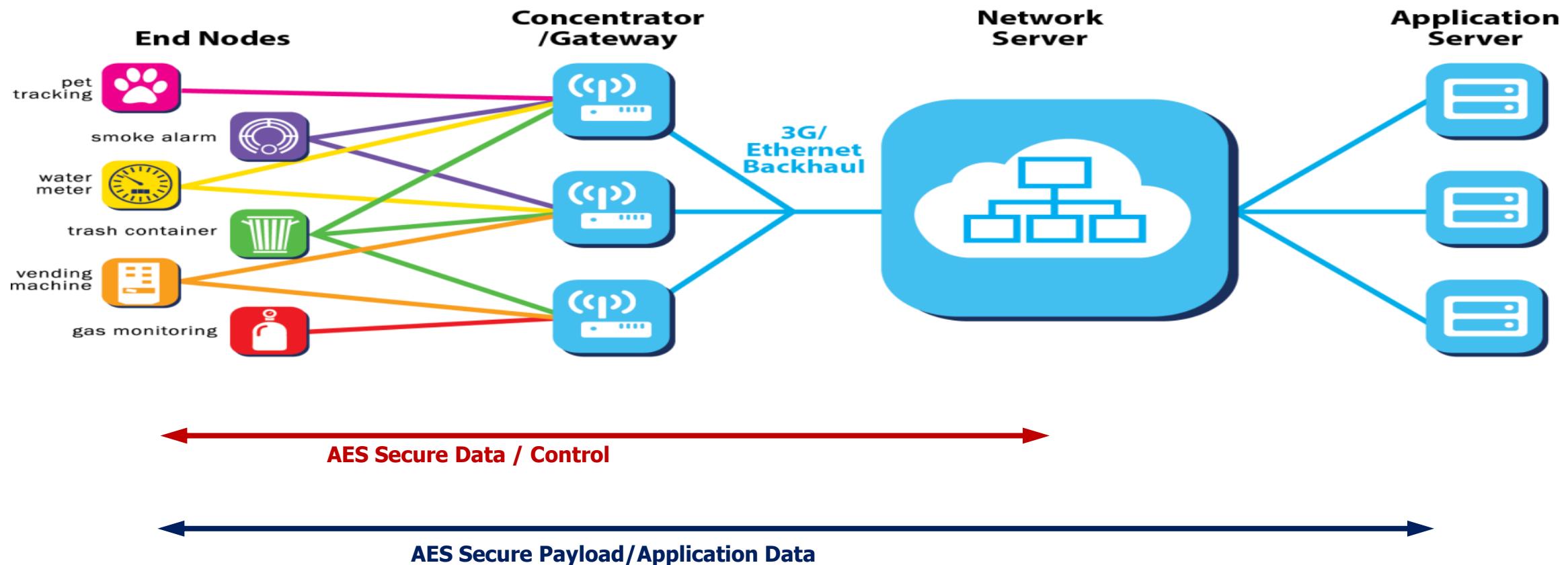


- Licensed versus unlicensed
- Short versus long range
- Stationary or moving objects
- Powered or battery operated
- Bytes versus MB's

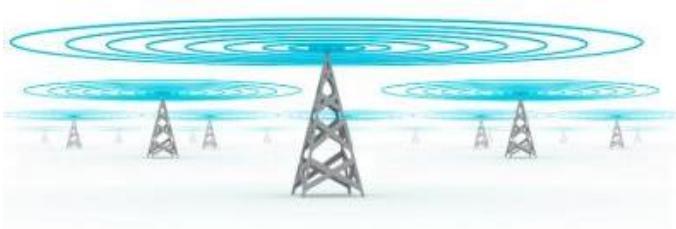
Where Does LPWAN Fit



LoRaWAN™ Network Concept



LoRa® Network Features



Long Range
<ul style="list-style-type: none"><input type="checkbox"/> Greater than cellular<input type="checkbox"/> Deep indoor coverage<input type="checkbox"/> Star topology<input type="checkbox"/> Interference Immunity

Max Lifetime
<ul style="list-style-type: none"><input type="checkbox"/> Low power optimized<input type="checkbox"/> 10-20 yr lifetime<input type="checkbox"/> >10x vs cellular M2M

Multi Usage
<ul style="list-style-type: none"><input type="checkbox"/> High capacity<input type="checkbox"/> Easily Scalable<input type="checkbox"/> Multi-tenant<input type="checkbox"/> Public network<input type="checkbox"/> Private Network<input type="checkbox"/> Hybrid Network

Low Cost
<ul style="list-style-type: none"><input type="checkbox"/> Minimal infrastructure<input type="checkbox"/> Low cost end-node<input type="checkbox"/> Open SW<input type="checkbox"/> Unlicensed Spectrum

Differentiators & Benefits



Location

- In/out door
- Accurate
- No Battery Impact

Bi-Directional

- Acknowledge
- Scalable Capacity
- Broadcast

LoRaWAN

- Global Standard
- True Mobility
- Seamless
- Roaming

Security

- Unique ID
- Application
- Network

Low Power WAN: Addressable Market

SMART ENVIRONMENT & INDUSTRIAL

- Forest fires
- Air pollution
- Earthquake sensors
- Avalanche and flooding
- Heating and AC
- Equipment status
- Factory control

75M

SMART METERING

- Electric
- Water
- Gas
- Infrastructure & production

450M

TRACKING

- Motor bikes
- Cars
- Bicycles
- Kids
- Pets
- Insurance – valuable assets
- Find My Stuff

250M

AGRICULTURE

- Irrigation control
- Environment sensing
- Animal tracking
- Animal sensing – ovulation, birth

25M

SMART CITY

- Smart parking
- Traffic sensors & control
- Street lighting
- Infrastructure monitoring
- Trash and waste containers
- Public events –location services
- Advertising displays

200M

250M

SECURITY/SMART HOME

- Smoke detectors
- Security systems
- Smart appliances
- Heating control / monitoring

Senet Silicon Valley Network

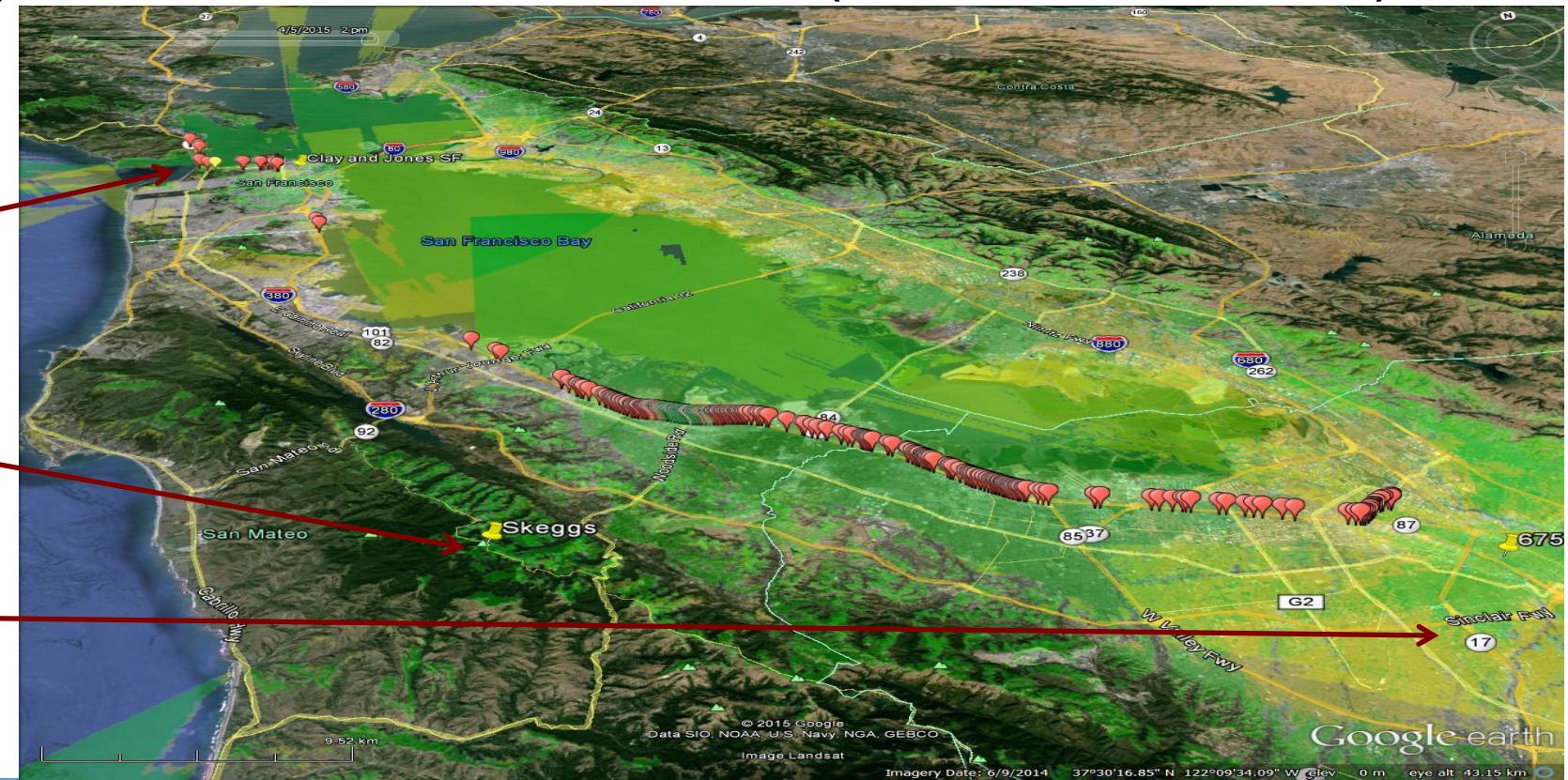
- Three Senet towers deployed in Silicon Valley
- Coverage map from three Senet towers (Joe's drive home)



Tower 1:
Clay St, SFO

Tower 2:
Skeggs Peak

Tower 3:
North 1st, SJC



FedEx Experiment: LoRa for LP WAN Asset Tracking



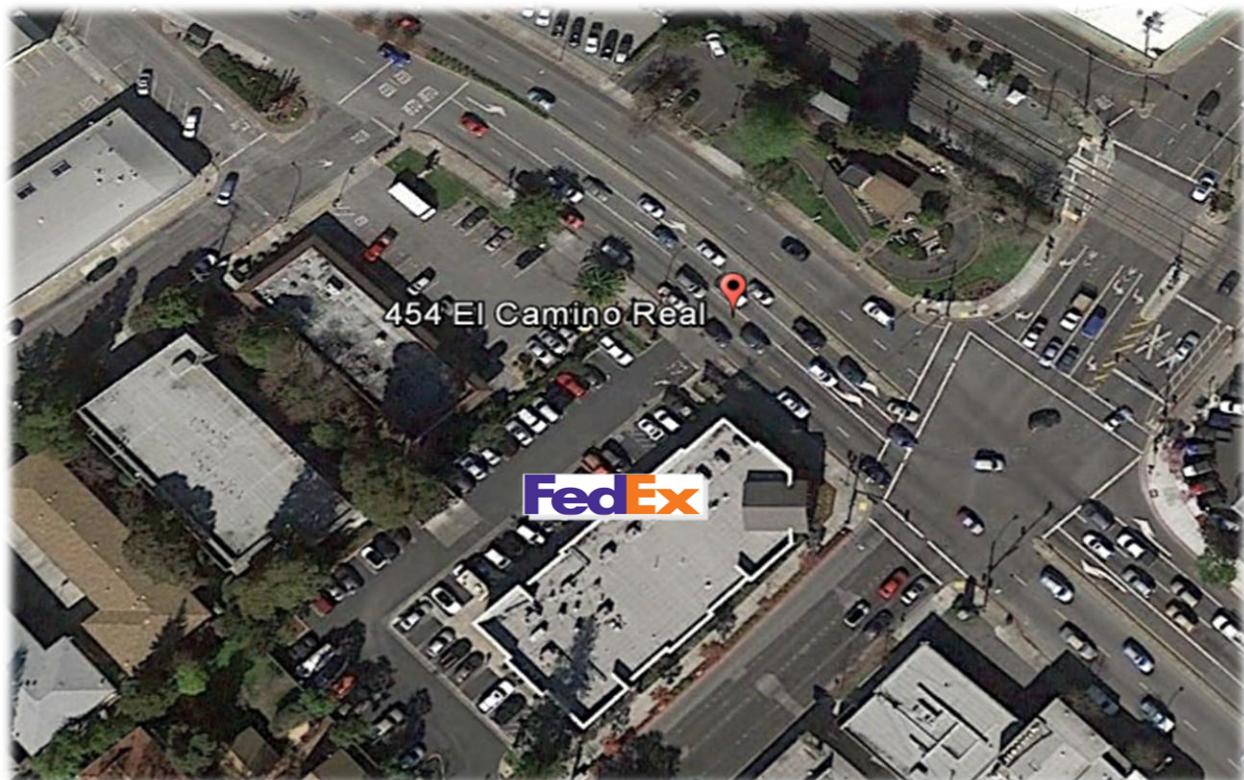
4/21/15 (5:00 pm)



LoRa Mote is dropped off / joins network



Fed Ex Office: 454 El Camino Real, Redwood City CA



FedEx Experiment: LoRa for LP WAN Asset Tracking



4/21/15 (7:10 pm)



LoRa Mote departs on truck



Fed Ex Office: 454 El Camino Real, Redwood City CA



Tower 1:
1st Street SJC



Tower 2:
Skeggs Peak



Tower 3:
Clay Street SFO



FedEx Experiment: LoRa for LP WAN Asset Tracking



4/21/15 (7:57 pm)



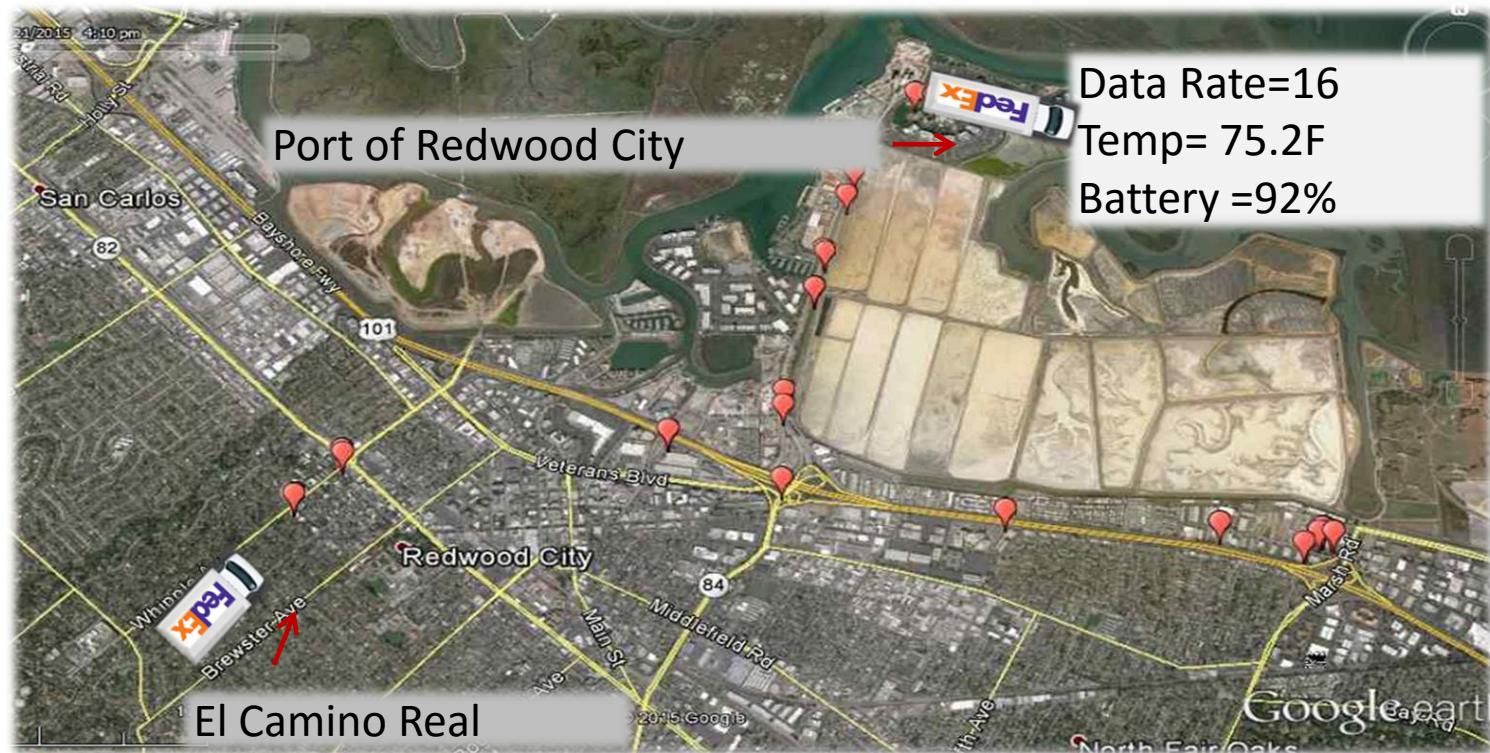
Driver goes to Port of Redwood City



Nearest Tower: 9 Miles / Skeggs Peak



75.2°



FedEx Experiment: LoRa for LP WAN Asset Tracking



4/21/15 (10:37 pm)



Package spends the night at Oakland Airport on tarmac



Nearest Tower: 11.4 Miles / Clay & Joes St SFO)



75.2°



FedEx Experiment: LoRa for LP WAN Asset Tracking



4/22/15 (6:30 am)



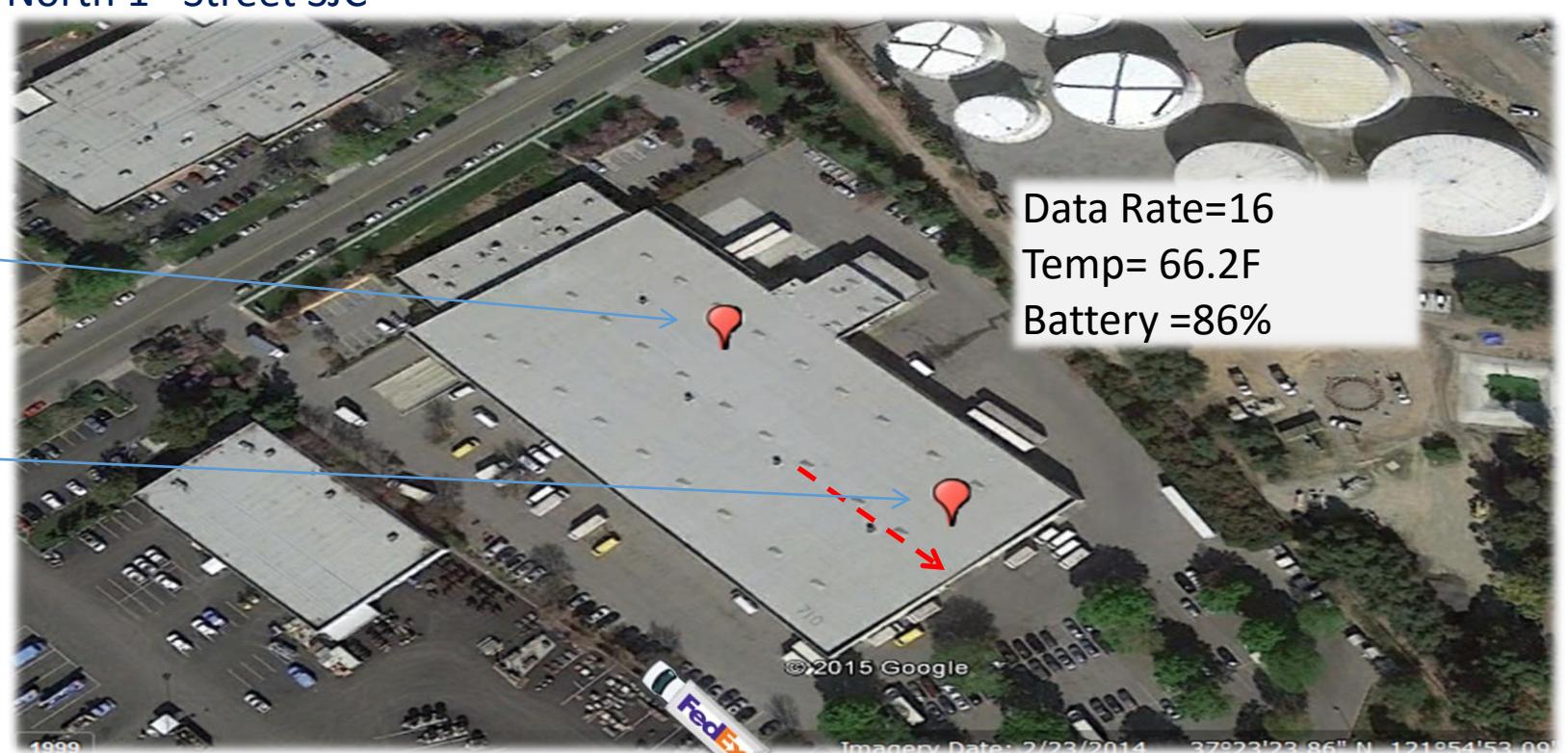
Package shows up at SJC sorting facility



Nearest Tower: 2.63 Miles / 675 North 1st Street SJC



66.2°



4/22/15 (7:47 am)



Package moves across
warehouse

FedEx Experiment: LoRa for LP WAN Asset Tracking



4/22/15 (10:00 am)



Driver arrives at FedEx drop box



Nearest Tower: 2.60 Miles / 675 North 1st Street SJC



2nd Tower reports: 21.0 Miles / Skeggs Peak!

Package accidentally remains on truck in “outgoing” bin

Driver alerted ☺

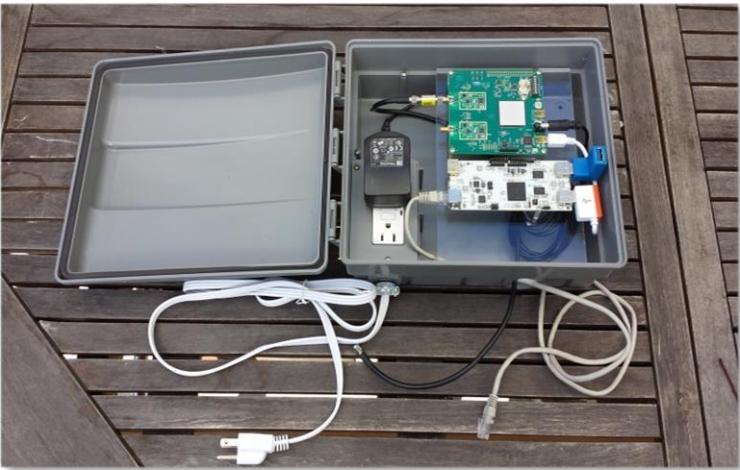




NYC LoRa™ Field Test



NYC Field Test



Gateway

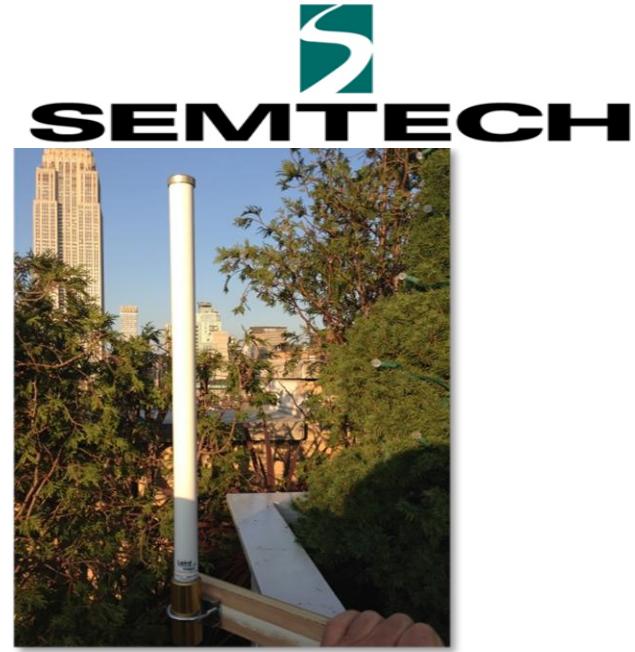
- FPGA based version
- Supports 4, 125KHz programmable channels
- Linux based embedded PC
- Thingspeak** provides real time histogram for 1-2 nodes
- Mote Runner** provides real time location and sensor data for many nodes



LoRa Mote

- 902-928MHz
- TX Power +20dBm (0 dBi)
- Programmable channels
- Data rate fixed @ 290 bps
- Provide:

✓ GPS	✓ Pressure
✓ Time	✓ Temp
✓ SNR / RSSI	✓ Acceleration



Antenna

- LAIRD FG9023 Omni Directional
- Height: 23"
- Nominal Gain: 3 dBd

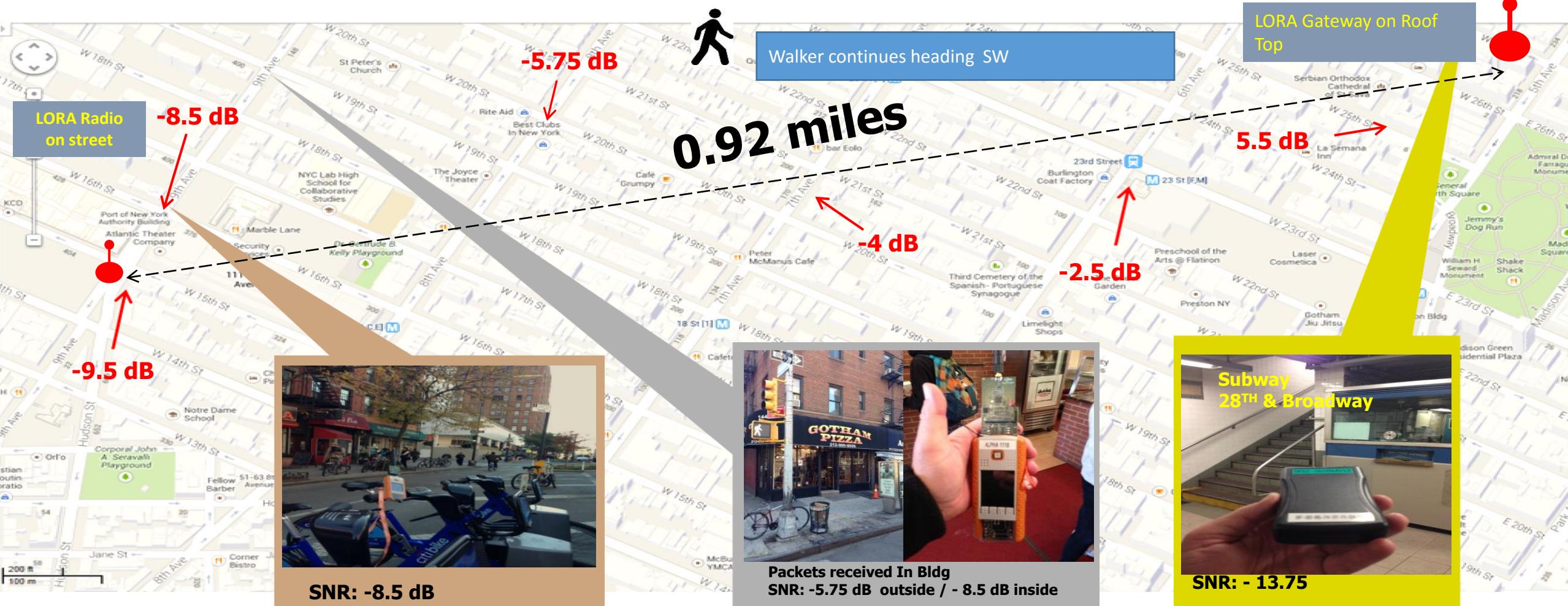
Walk North to the Met



Walker reported real-time location via text messages
SNR and **RSSI** were measured only on valid packets received by roof-top gateway.

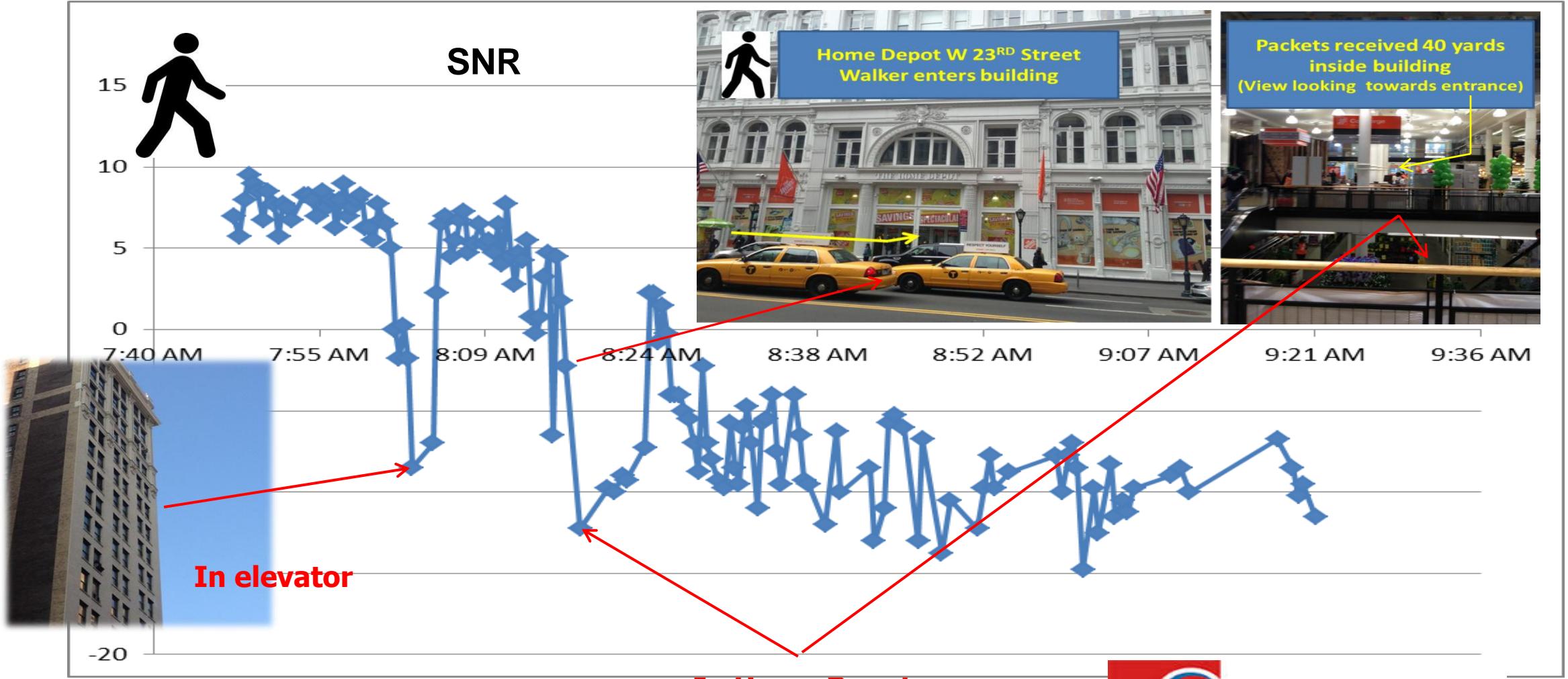
LORA Radio on street

Opposite Direction of Antenna/Extreme Urban

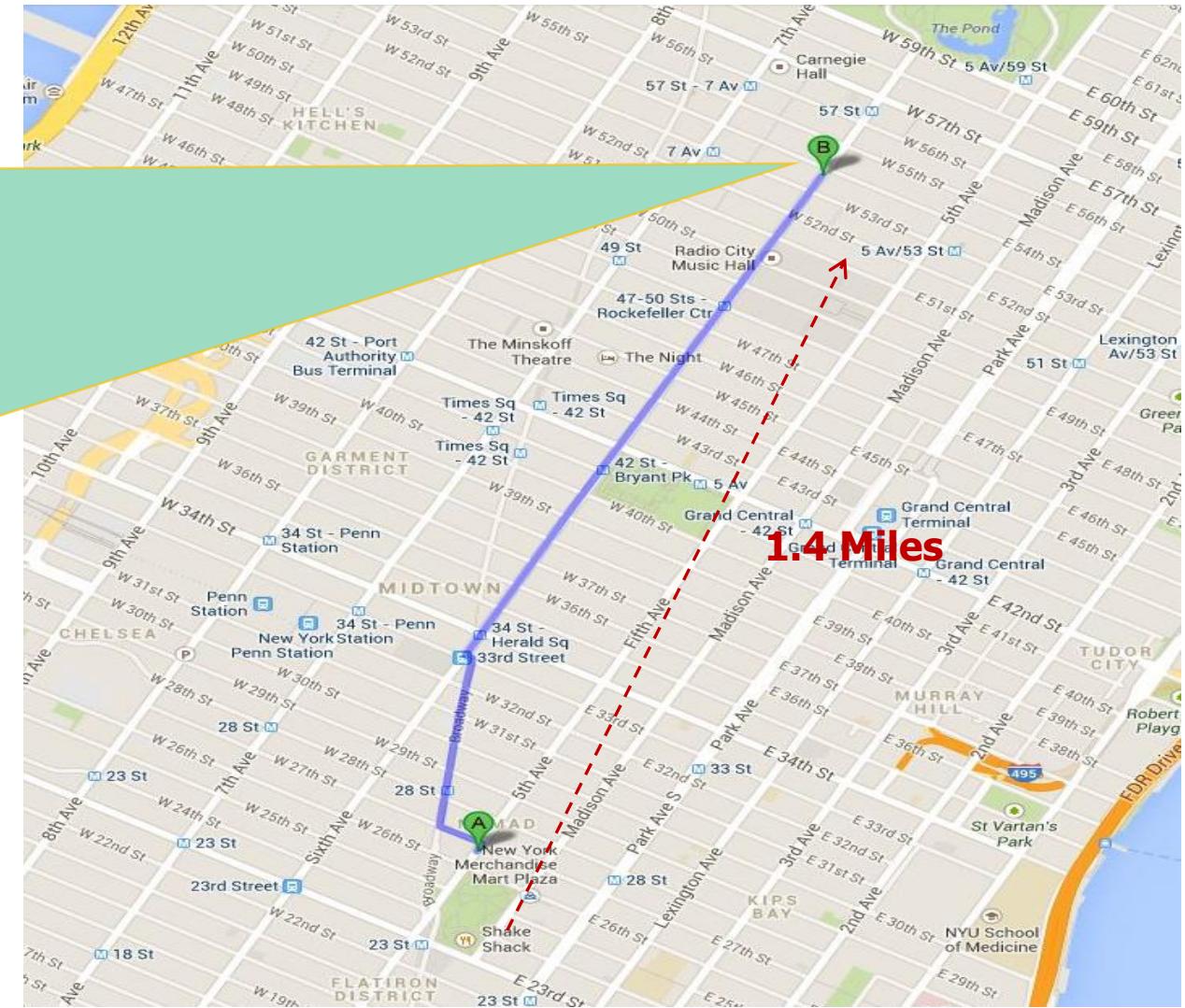


- Walker reported real-time location via text messages
- SNR was measured only on valid packets received by roof-top gateway.

Link Quality

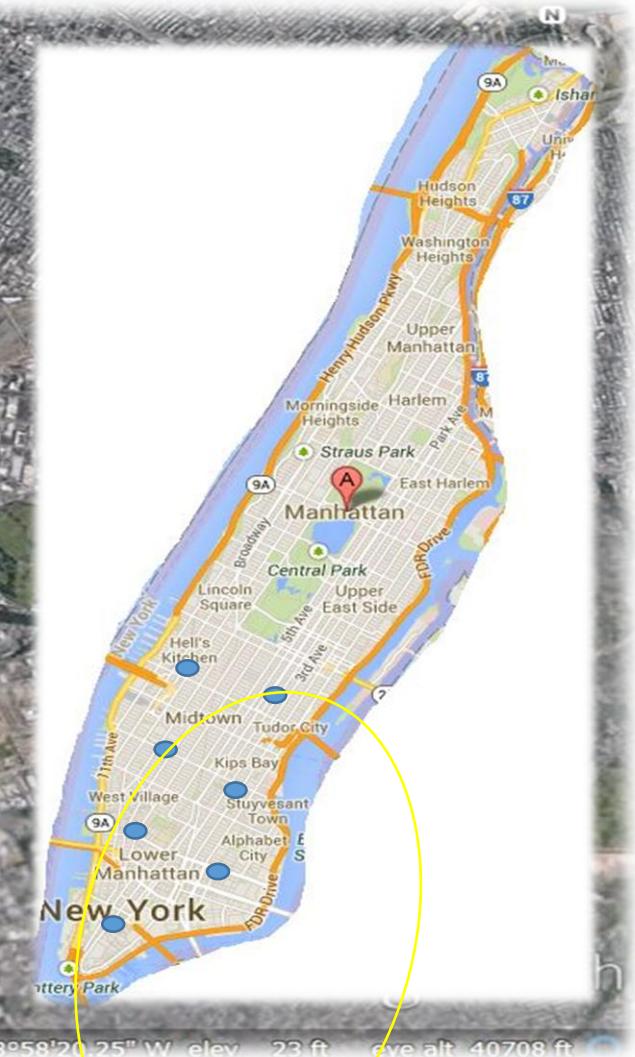
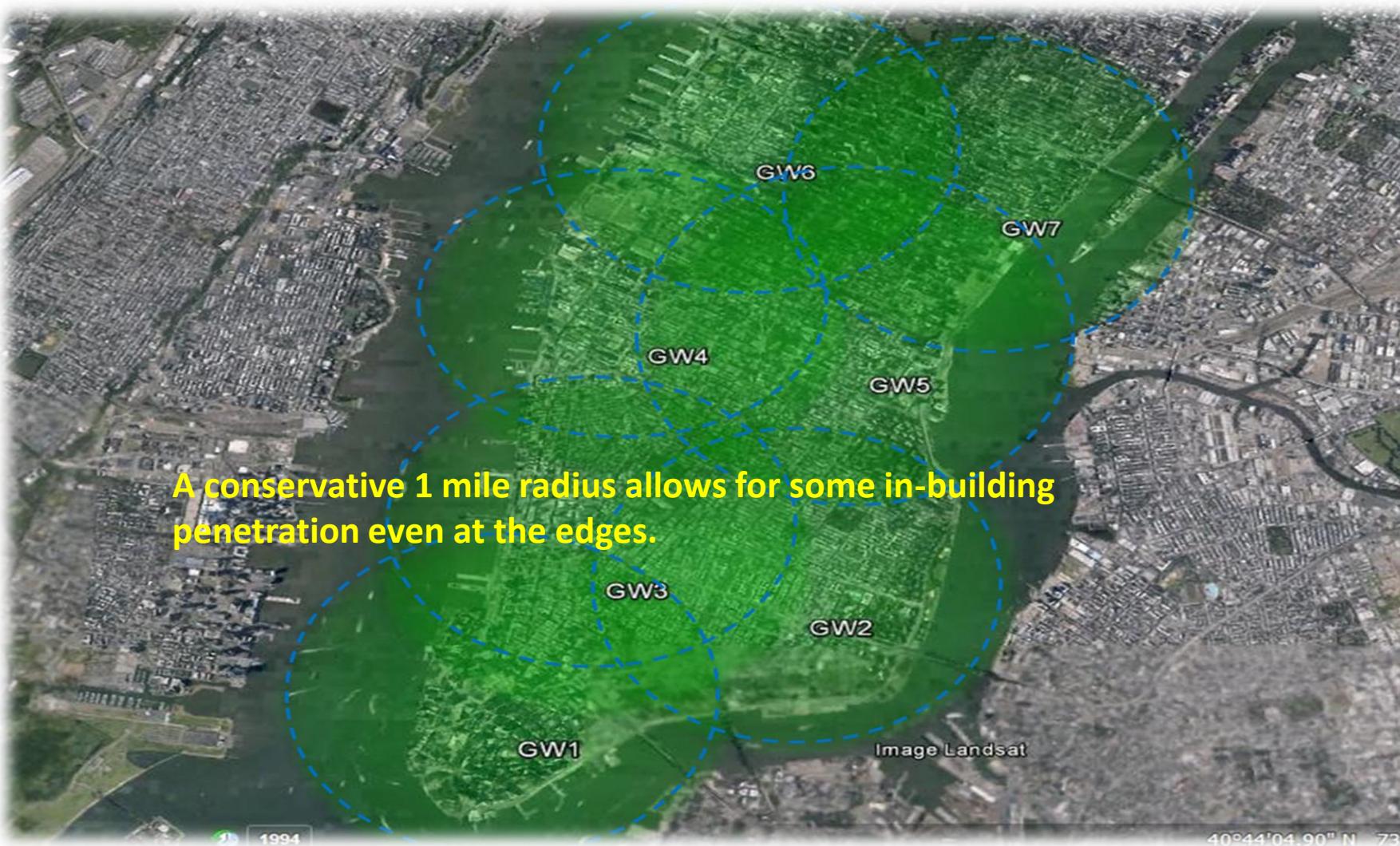


NYC Field Test - Walk to Radio City



NYC Field Test

7 Gateways cover all of lower Manhattan



Agenda

 Welcome

 9:15 – 11:00 LoRa™ In the Market

- In the IoT world
- Benefits
- Case studies
- **LoRa™ Alliance Introduction**
- LoRa™ Ecosystem

 11:00 – 11:15 Break

 11:15 – 1:00 LoRa™ & LoRaWAN™ Technology

- Architecture
- Coverage
- Capacity
- Battery life
- Security

 1:00 – 2:00 LoRa™ & LoRaWAN™ Demonstration

- Questions



Wide Area Networks for IoT



LoRa Alliance™ and LoRaWAN™

The LoRa Alliance

- An open non-profit organization of Members who believe that the Internet of Things era is here
 - Collaborate and share knowledge
 - Drive the ubiquitous LoRaWAN standard
 - Secure, carrier grade LPWA Networks
 - Guaranteed interoperability

LoRa™ Alliance: Status

- Founded: March-2015
- Board
 - IBM, Cisco, Bouygues, KPN, Semtech, Proximus, Actility, Kerlink, Agutek, Homerider
- Charimen
 - Geoff Mulligan
- Life time Management
 - Global Inventure
- Committees
 - Technical: Nicolas Sornin, Semtech
 - Marketing: Tracy Hopkins, Stream Technologies
 - Strategy: Stephen Cadwell, Microchip
 - Certification: Derek Hunt, Semtech
- Specification
 - LoRaWAN R1.0
- Member Status (April)
 - >275+ Members
 - 13 announced public operator IoT deployments,
 - 56 on-going operator trials
 - meeting



LoRa Alliance™ Activities

- Quarterly all-member's meetings and Open House's
 - Paris -- summer '15
 - Rotterdam -- fall '15
 - Las Vegas (CES) -- Jan '16
 - San Jose – last week
- Industry promotion
 - CES
 - MWC
- Publish updated ecosystem catalog (latest edition published early Feb)
- Release new specifications – 1.0 released in June 2015. 1.1 in process for September
- New product innovation award contests
 - Leroy – Merlin first winner announced at CES.
 - New contest will kick off May 1

Get Up To Speed

- LoRa Alliance: <https://www.lora-alliance.org/>
- LoRa Alliance Events: <https://www.lora-alliance.org/News-Events/Events>
 - All Member's Meeting and Open House– 5-7 April in San Jose hosted by Cisco
- LoRa Alliance Challenge: <https://www.lora-alliance.org/News-Events/Global-IoT-Challenge>
- LinkedIn Group: <https://www.linkedin.com/groups/8241459>
- Twitter: @LoRaAlliance
- Whitepapers: [LoRa-Alliance-Whitepaper-web.pdf](#)
[LoRaWAN101.pdf](#)
- Request the LoRaWAN™ specification
 - <https://www.lora-alliance.org/Contact/Request-Specification-Form>
- See why Members are supporting the Alliance
 - <https://www.youtube.com/channel/UCXYkZ2wgVloGHLkmynVIYmQ>



Request LoRaWAN Specification

Fill in the form below to download LoRaWAN Specification. The specification will not be sent to public domain email addresses; e.g. yahoo, gmail, etc.

After submitting this form, your email address will be subscribed to our LoRa Specification email list to keep you informed of specification updates. You will be asked to confirm your subscription by email. You can always unsubscribe at any time by clicking the unsubscribe link in emails sent from the Alliance.



Telstra, Australia's leading provider of mobile phones, mobile devices to deploy LoRaWAN



Telstra to trial LoRaWAN IoT wireless technology in Melbourne | ZDNet

zdnet.com • As part of an event in partnership with the City of Melbourne, Telstra will trial a low-power wide area network.

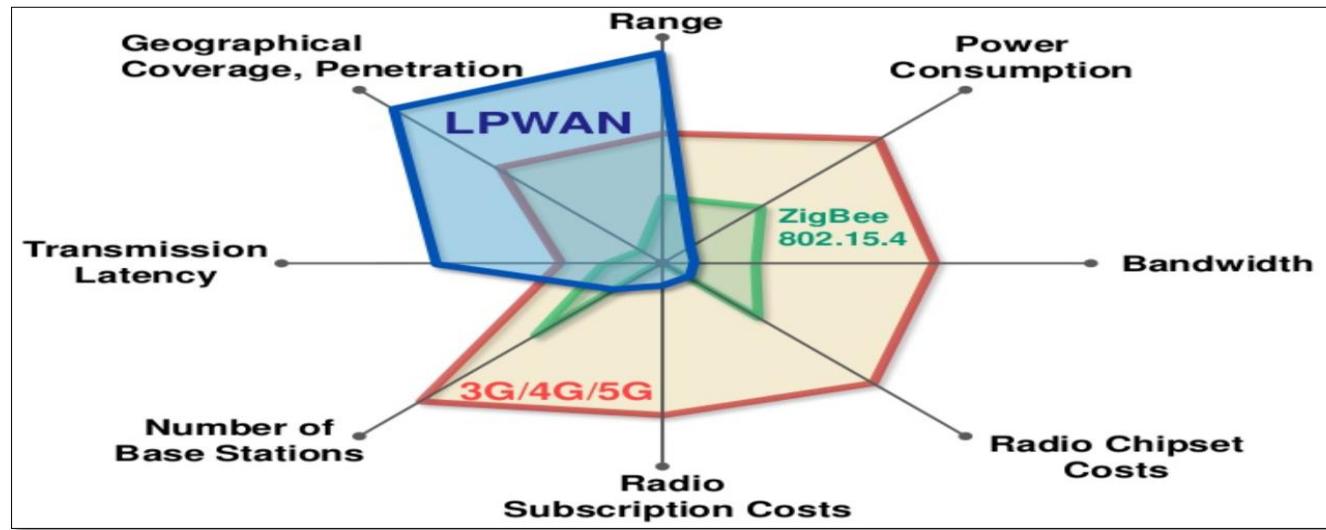
Membership Benefits

MEMBERSHIP RIGHTS	SPONSOR (\$50k)	CONTRIBUTOR (\$20k)	ADOPTER (\$3k)	PUBLIC (Free)
The right to request Board of Director seat	•			
The right to submit Alliance Deliverables for final approval by the Board Of Director	•			
The right to access Alliance operational data	•			
The right to initiate, participate in, vote and chair Committees	•			
The right to initiate, participate in, vote and chair Work Groups	•	•		
The right to contribute to Draft Deliverables and access Final Deliverables	•	•		
The right to participation in press articles & interviews	•	•		
The right to certify Compliant Products	•	•	•	
The right to use Alliance and/or Certification Logo on certified products	•	•	•	
The right to access to members only website	•	•	•	
The right to participate in general or annual meetings	•	•	•	
The right to receive Alliance communications	•	•	•	
The access Final Deliverables	•	•	•	
Access to Released Deliverables	•	•	•	•

Getting Started....

- Opportunities in sensor development, application development, network deployment and system integration services
- Order Development and/or Starter Kits
 - Microchip
- Attend a Microchip class
- Join the LoRa Alliance and/or attend a LoRa Alliance Meeting
- Find a network....
 - The Things Network -- <http://thethingsnetwork.org/>
 - Crowd sourced, open source network operating in many cities globally
 - Local entrepreneurs are planning networks
-Or build one.....
 - Build a network for a one or two core “anchor” applications then open it up for public use

LoRa Summary: Unique Sustainable Differentiators



Current Analysis – November 2015

Machina Research – December 2015

- Complementary to GSMA standards
- Best in class power consumption
- Device classes enable access to all use cases
- Not impacted by mobility
- Designed for scalable capacity (ADR)
- Allow for hybrid networks

