

# Low-Power Wide-Area Networks

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SIGFOX

LoRa

NB-IoT

Weightless

RPMA

# Low-Power Wide-Area Networks

25 mW transmission power

# Low-Power Wide-Area Networks

20 years on simple battery

15-50 km rural outdoor

# Low-Power **Wide-Area** Networks

2-3 km urban indoor

# Low-Power Wide-Area **Networks**

No scheduling

No routing

ALOHA

Device-initiated com  
Huge densities  
Low throughput

250 kHz or less

**Narrow-band**

# Low-Power Wide-Area Networks

Collisions

Data-over-NAS In-band

Duty cycling

Acknowledgements

Guard-bands

License free

In licensed spectrum

250 kHz or less

# Narrow-band

# Low-Power Wide-Area Networks



Collisions  
Duty cycling  
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License free  
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**Narrow-band**

**Low-Power Wide-Area Networks**

15-50 km rural outdoor  
2-3 km urban indoor  
Device-initiated com  
Huge densities  
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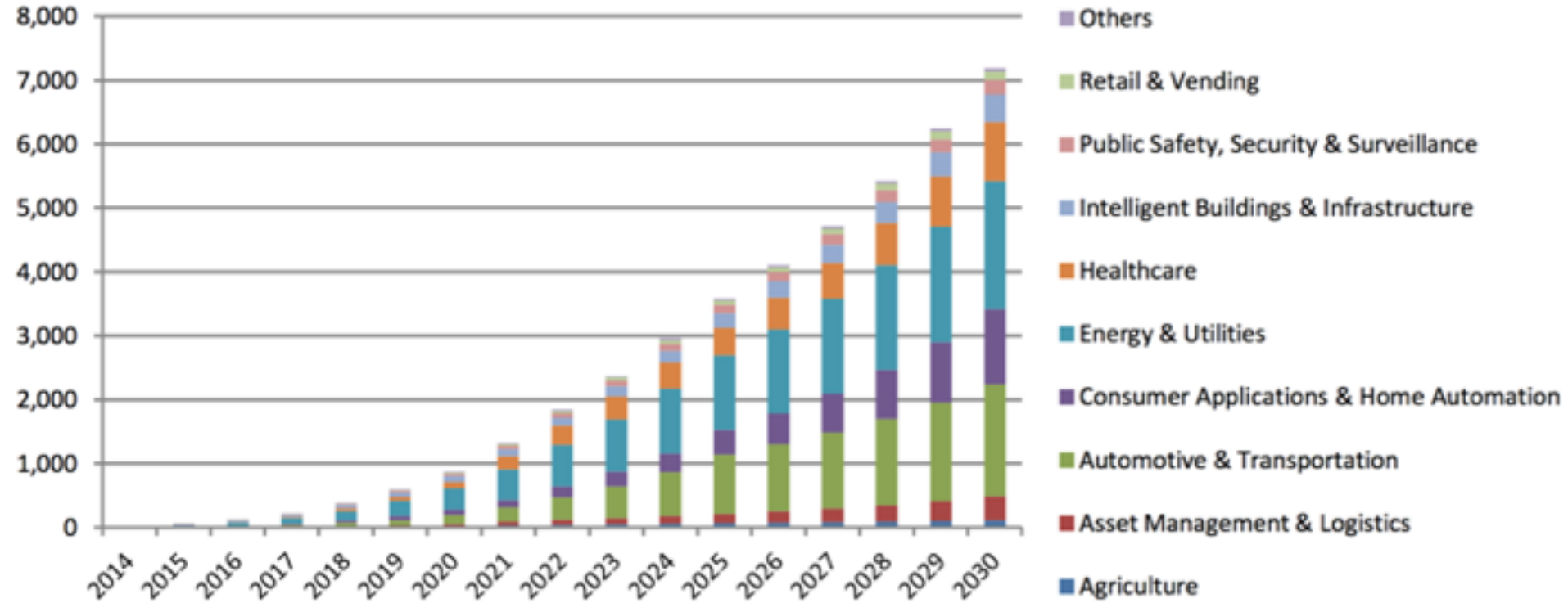
100 bps  
(50 kbps max)

12 byte payload  
(50 byte payload)

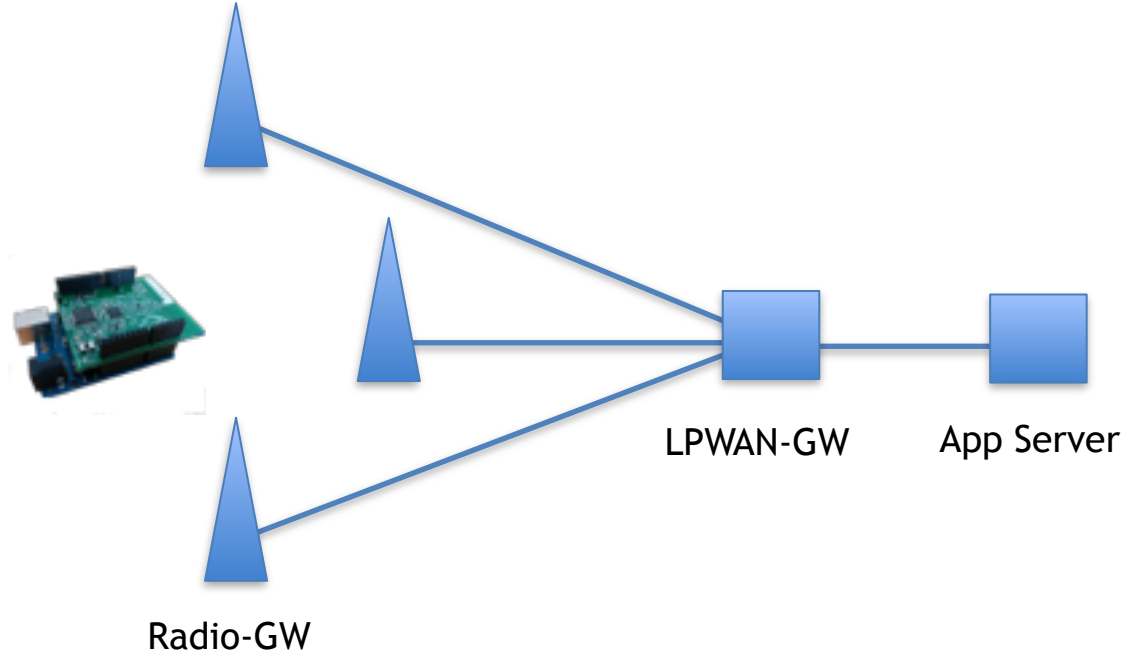
140 messages  
uplink

4 messages  
downlink

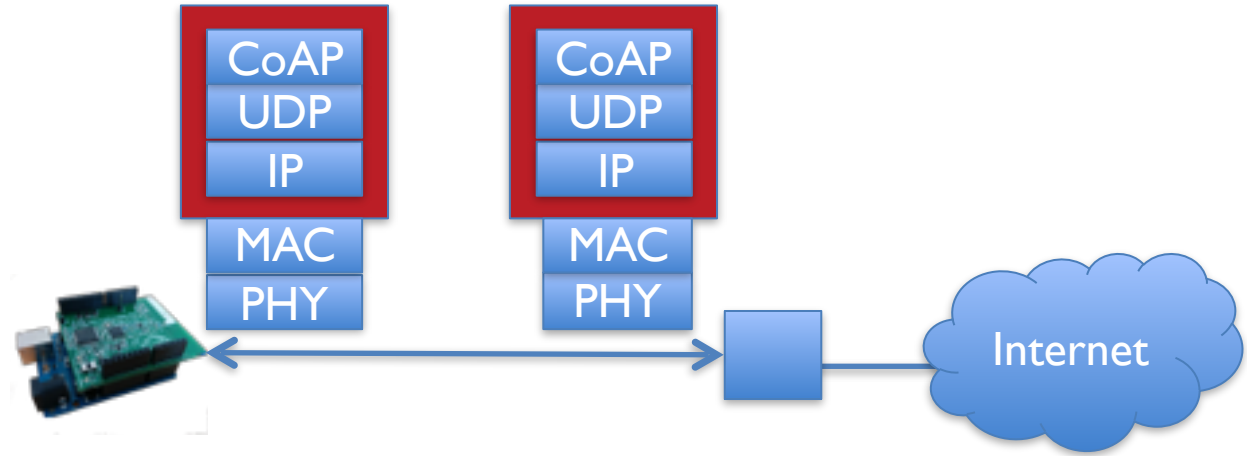




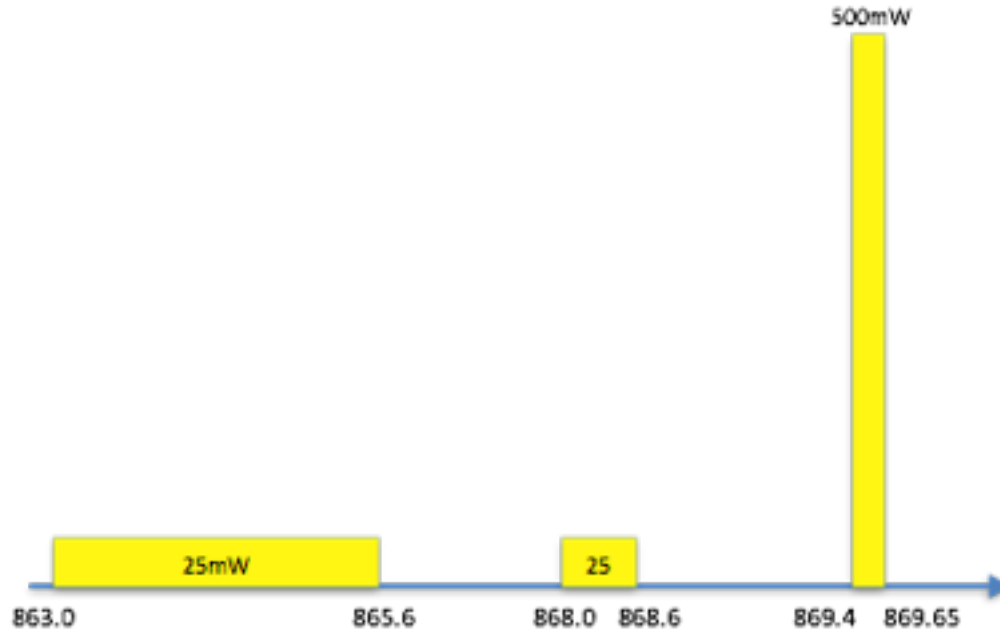
Source : SNS Research, November 2015



# Compression



# Management



# Building the next 10 bln devices

- Device software stack
  - Drivers (available for Contiki)
  - MAC (e.g. LoRaMAC – open C implementation)
  - IP/UDP/CoAP with SCHC IP compression
  - CoOL/CoMI for network and app management
  - RESTful APIs
  - Certificates, COSE, secure element, code verification
    - Design for disposable devices + devices that will be there for 10+ years
- Development tools!
  - Independent of LPWAN technology
- But wait, there is more...
  - 6TiSCH

# Thank you! Questions?

## IETF LPWAN BoF on Monday

- Join the lp-wan mailing list
- Technical session on Sunday
- Key documents:
  - draft-toutain-6lpwa-ipv6-static-context-hc
  - draft-gomez-lpwan-fragmentation-header

## CoOL/CoMI on CoRE:

- draft-ietf-core-yang-cbor
- draft-veillette-core-cool
- draft-somaraju-core-sid

