CoAP EdgeX Device Service

and low power wireless

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About Ken

- Software Engineer, 30+ years experince
- Broad background but focus on low power wireless
- Author of gcoap library for RIOT OS
- Commercial sensor network product team

Topics

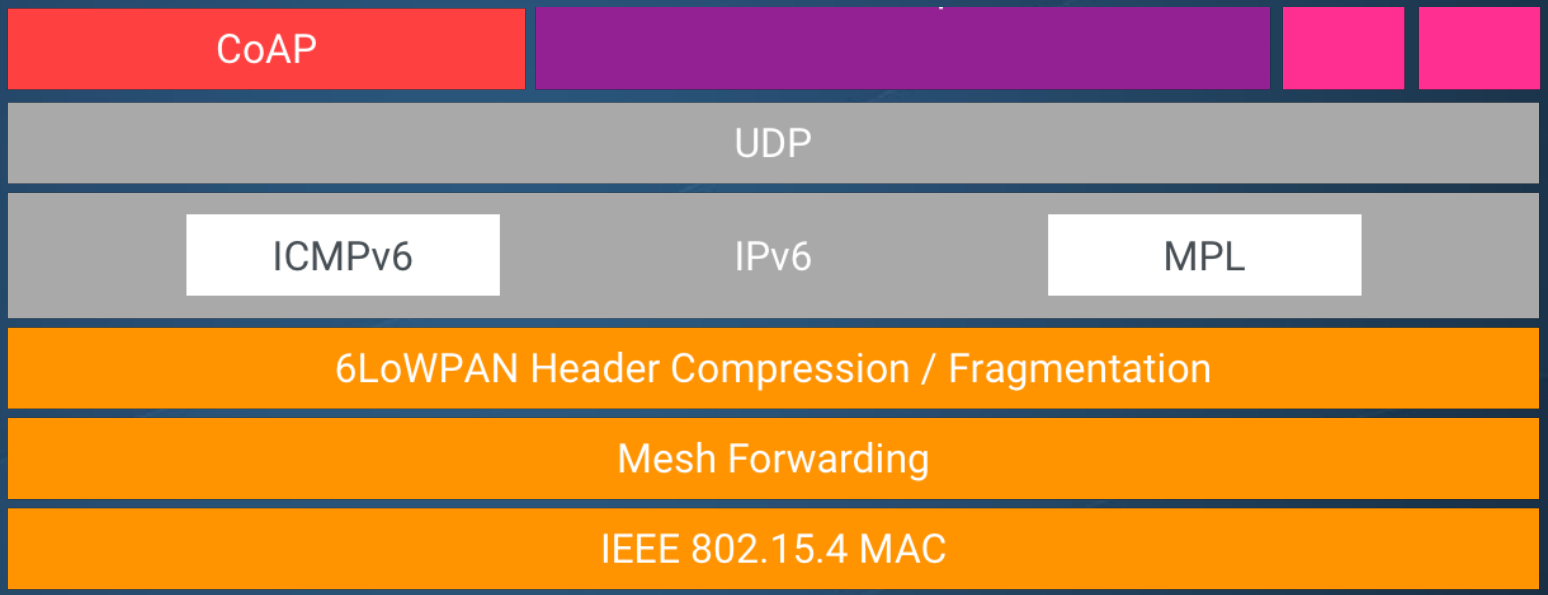
- CoAP format, stack, security
- device-coap-c integration
- Next steps
- Wireless use cases

CoAP

- Constrained Application Protocol
- IETF RFC 7252, 2014
- Compact, binary request/response
- UDP / IP

HTTP / REST for constrained environments

Network Stack



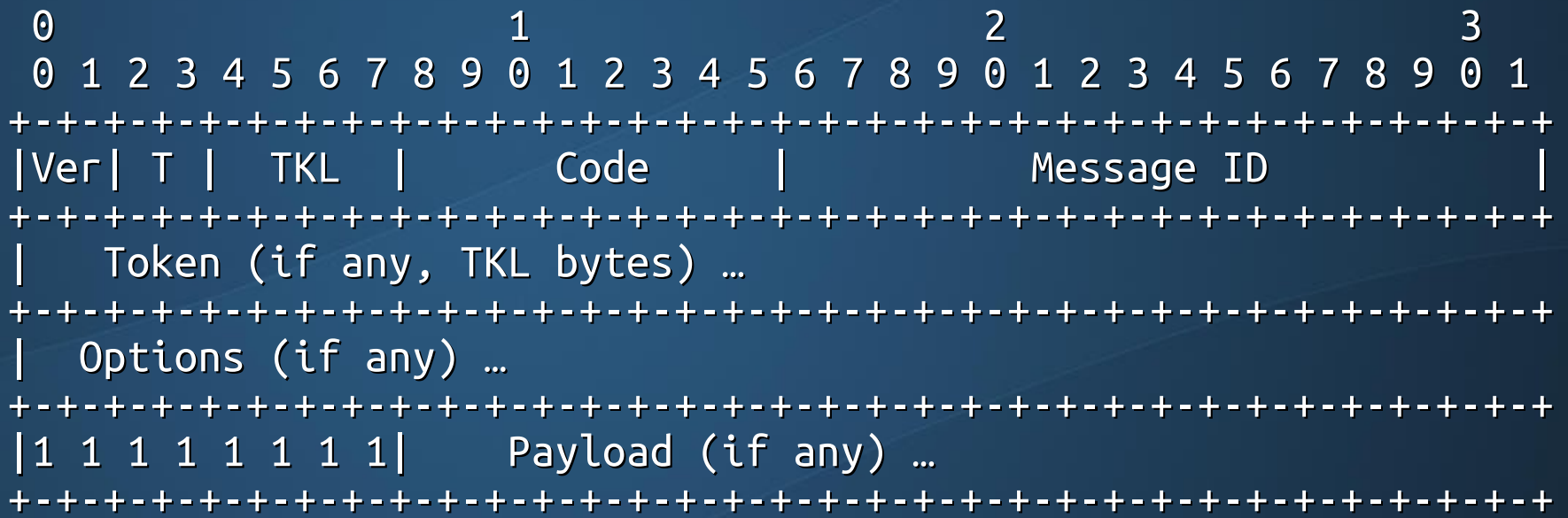
- 127 byte frame
- mesh network, sensors, lighting, Nest
- Nordic, TI, ST, NXP, SiLabs, Microchip
- CHIP – Connected Home over IP (Zigbee, Thread, BLE) Amazon, Apple, Google

https://openthread.io/platforms/

EdgeX for Wireless Sensors

- Segregate NB/SB networking
  - HTTP/MQTT (TCP) <--> CoAP (UDP)
  - IPv4 <--> IPv6
  - TLS <--> Link layer
- Aggregate sensor network data for NB
- Fuse sensor data into local actions

Message Format



Type	0 CONfirmable, 1 NON-confirmable, … *reliability*
Code	0.1 GET, 0.2 POST, … 2.05 Content, 4.04 Not Found
Message ID	Deduplication
Token	Up to 8 bytes, transaction management
Options	11 Uri-Path, 12 Content-Format, … *delta encoding*
Payload	Block protocol if not big enough

https://tools.ietf.org/html/rfc7252

Link Layer Security

- 802.15.4 AES-CCM, like DTLS PSK
- Thread
- EdgeX at wireless border

CoAP Transport Security

DTLS for UDP

- Pre-shared Key – AEC-CCM 16 bytes
- Full certificate or raw public key
- TinyDTLS, MbedTLS, OpenSSL, WolfSSL, GnuTLS
- See RFC 7925

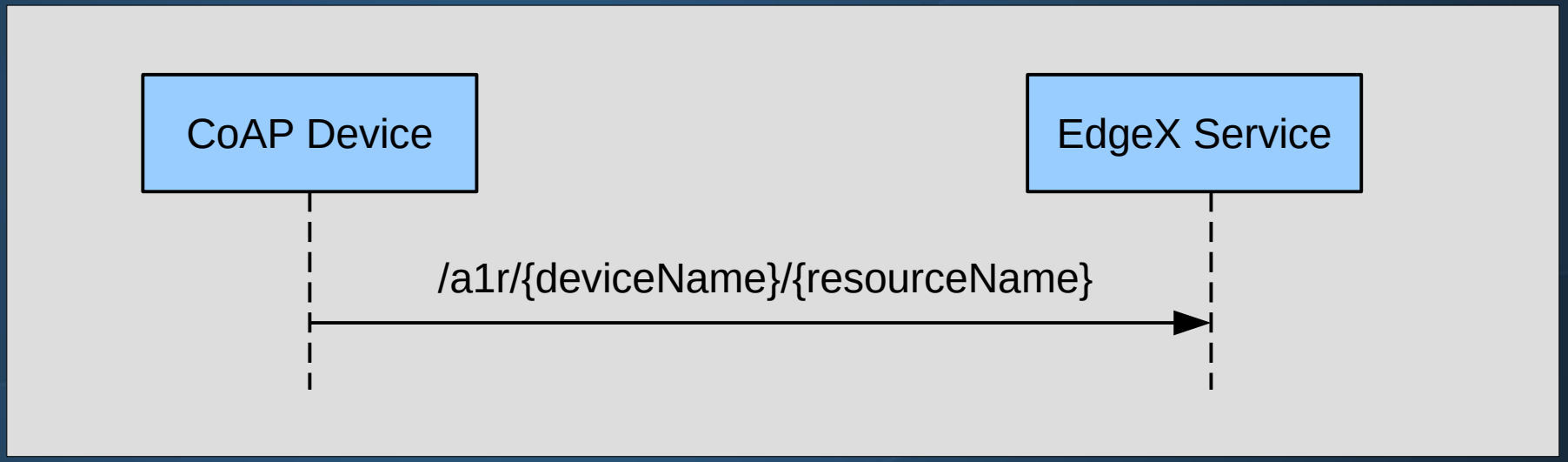
OSCORE Security

- Application level, end to end
- Payload and some options
- 2019

device-coap-c

- async data post, like *device-rest-go*
- libcoap - mature
- DTLS PSK security
- GitHub: kb2ma/device-coap-c

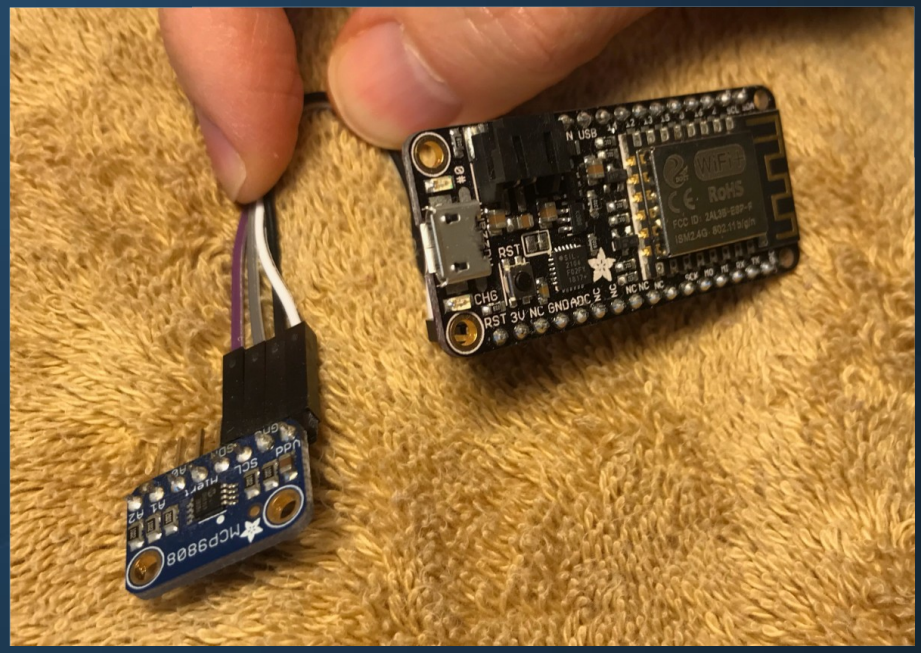
Device–Service Mapping



- deviceName – pre-defined in service config
- resourceName - same for device and service

Demo Time!

- Adafruit ESP8266 + MCP9808 I2C temperature sensor
- riot-edgex-coap-client firmware
- README, profile, config



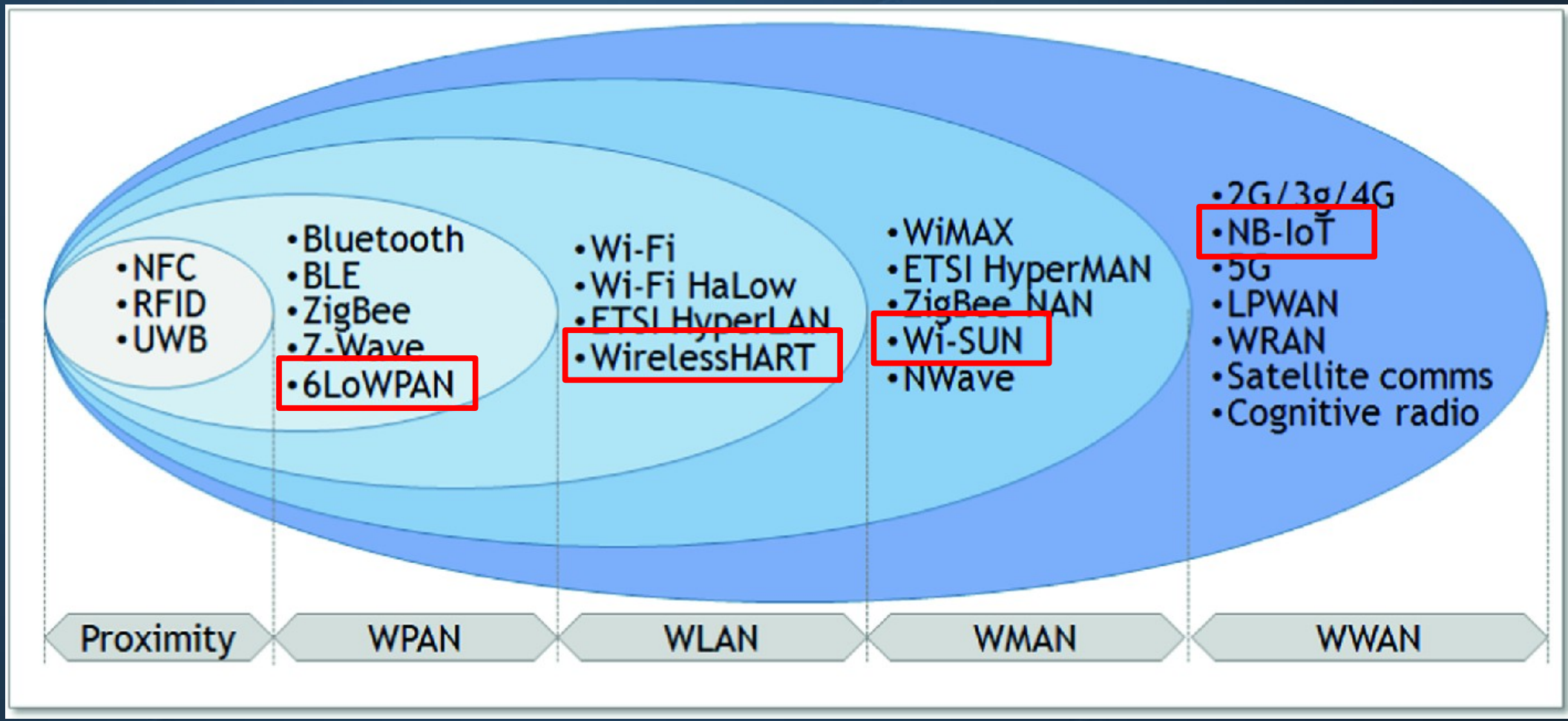
Next Steps

- EdgeX site link to device-coap-c repo?

- More data types
- Vault credentials
- Device specific authentication

  Long term: LwM2M
- Device registration, configuration

CoAP by Wireless Range

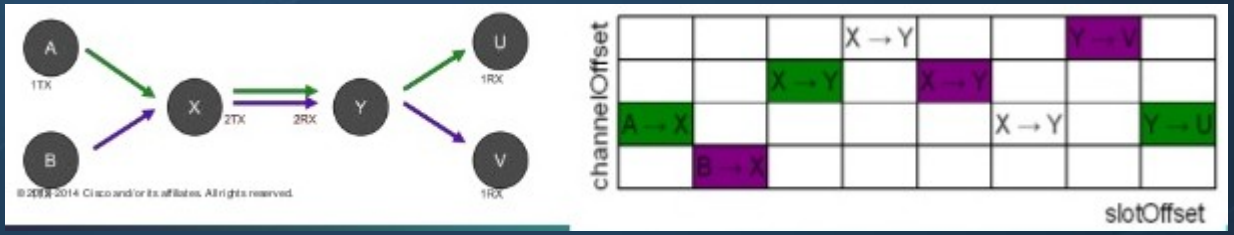


Low power, IP, low latency, mesh networks

https://link.springer.com/chapter/10.1007/978-3-030-36625-4_42

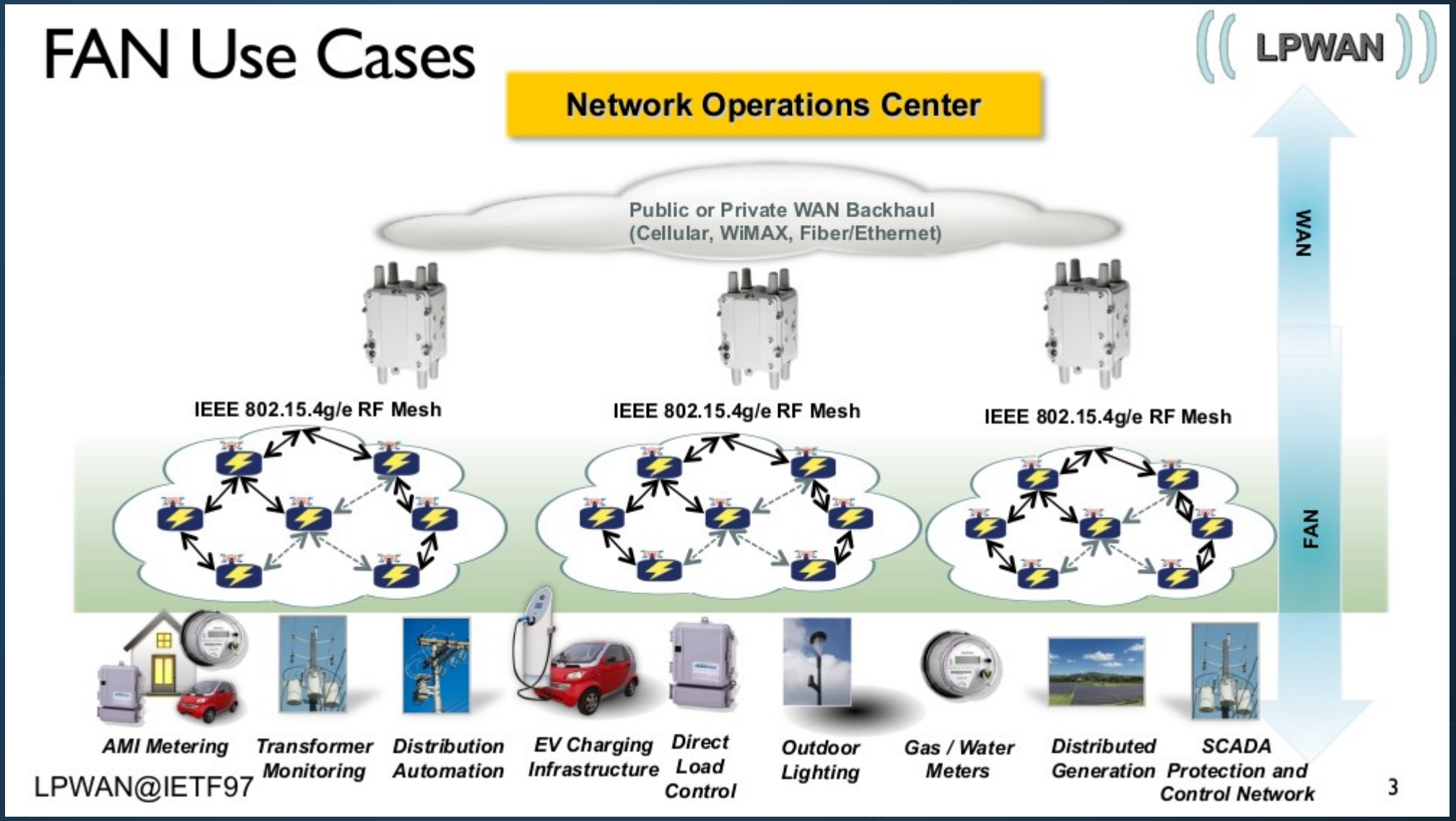
LAN – 6TiSCH and IIOT

- IPv6 + Time slotted channel hopping
- TSCH = 802.15.4e, WirelessHART, ISA 100
- Mesh networks, high reliability, low power
- Analog Devices (Dust), Cisco



https://www.slideshare.net/pascalthubert/rpl-telecom-bretagnengv2

MAN - Wi-SUN

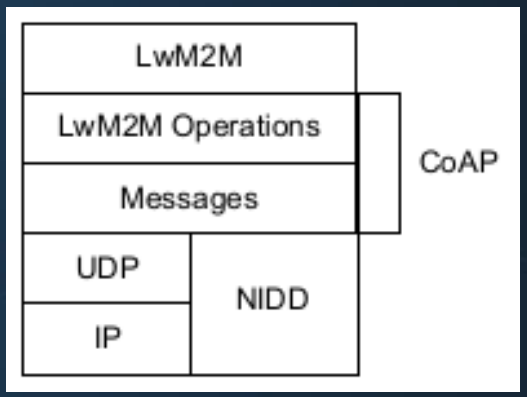


Smart Grid – Itron, Landis+Gyr
Smart City – City of London, Copenhagen, Tokyo

https://www.ietf.org/proceedings/97/slides/slides-97-lpwan-35-wi-sun-presentation-00.pdf

WAN – LwM2M, NB-IoT

- LwM2M – OMA application spec
- Generic, end-to-end solution
- Bootstrap server, Queue mode, ...
- Path `/3303/{n}/5700` = temperature value
- NB-IoT – long range, no mesh
- NIDD – non-IP transport
- T-Mobile, AT&T, Verizon,
  ARM Pelion, Ericsson



https://www.t-mobile.com/content/dam/tfb/pdf/IoT-Solution-Developer-Protocols-Guide.pdf

Next Generation

- Scavenge energy – ambient light, heat, vibration
- Very small, implantable
- Range 10s of meters
- Presumably low cost
- Cortex M0, 16k RAM
- Validates tiered networking

https://www.cubeworks.io/product/cubisens-tc110/