



IoT Connection Solutions

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Housekeeping

- Informal Format
- Do Not Save Questions Until The End
- Throw a Hand Up
- Got a Question, Ask a Question
- Interactivity Will Be Rewarded

RULES



Introductions

- Who Am I?
- Who Are We?
- Who Are You?



SERVICES



Connectivity



Design
Services



IoT
Integration



Custom
Products



Manufacturing

Edge-to-Enterprise

Partner with us for all your IoT needs.

PRODUCTS

SKYWIRE

END-DEVICE CERTIFIED MODEMS BY NIMBELINK®

- ✓ Buy It Certified
- ✓ Connect Easy
- ✓ Deploy FasterSM



- 2G, 3G, 4G LTE, and 5G

SOLUTIONS

Asset Tracking Solution

Connect. Track. Optimize

Edge-to-enterprise, application ready

solutions:

- Logistics
- Utilization
- Protection



Introductions

- Who Are You?



Connecting Devices to the Cloud

- Ethernet
- WiFi
- 802.15.4 (Mesh Networks, Star)
- Bluetooth
- LoRA
- Sigfox
- Cellular

Power

Range

Bandwidth

Price

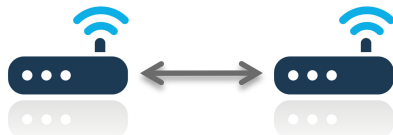


Wireless Radio Technologies

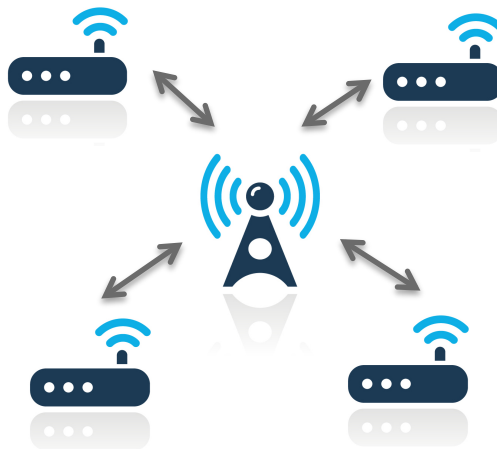
Standard	IEEE 802.15.4	Bluetooth 5.0	WiFi	LoRA	Sigfox	Cellular for IoT
Frequencies	868/915 MHz, 2.4GHz	2.4 GHz	2.4, 5.8 GHz	169, 433, 868, 915 MHz	433/868/915 MHz	400 - 2600 MHz
Data Rate	250 kpbs	2 Mbps	11 to 105 Mbps	25-50 kbps	100-600 bps	10 to 150 Mbps
Range	10 to 300 m	240 m	10 to 100m	5-20 km	10-40 km	1-20 km
Power	Very Low	Low	High	Low	Very Low	Low to High
Hub Required	Yes	Yes	Yes	Yes	No	No
Licensing	Un-Licensed	Un-Licensed	Un-Licensed	Un-Licensed	Un-Licensed	Licensed
Monthly Cost	\$0	\$0	\$0	\$0	\$10 per year	\$1 - \$10 per month



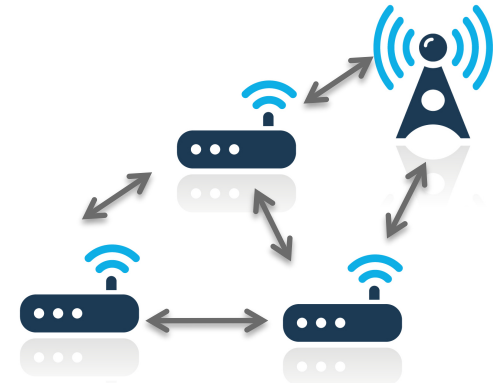
Wireless Topologies



Point to Point



Star



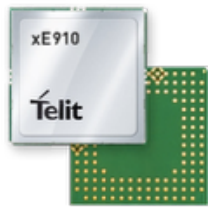
Mesh



Product Availability/Evolution



Chipsets



Modules



Modems



SOM/Boxed Products



Wireless Design Considerations

- Technology
- Antennas (Frequencies, Bands)
- Countries
- Power
- Cost
- FOTA
- Future Proofing
- Carriers (Roaming) (SIM cards)
- Certifications (PTCRB/GCF, CE, FCC, Carrier certs)



Cellular for IoT

	LTE Cat-1 (Today)	LTE Cat-M1 (Rel-13)	LTE Cat-NB1 (Rel-13)
Peak data rate	DL: 10 Mbps UL: 5 Mbps	DL: 1 Mbps UL: 1 Mbps	DL: ~20 kbps UL: ~60 kbps
Bandwidth	20 MHz	1.4 MHz	200 kHz
Rx antenna	MIMO	Single Rx	Single Rx
Duplex mode	Full duplex FDD/TDD	Supports half duplex FDD/TDD	Half duplex FDD only
Transmit power	23 dBm	20 dBm ¹	20 dBm ¹

← Higher throughput, lower latency, full mobility



**Simplified
RF hardware**
Reduces baseband
complexity and
decreases memory

Cellular Applications

NB-IoT

5G ready

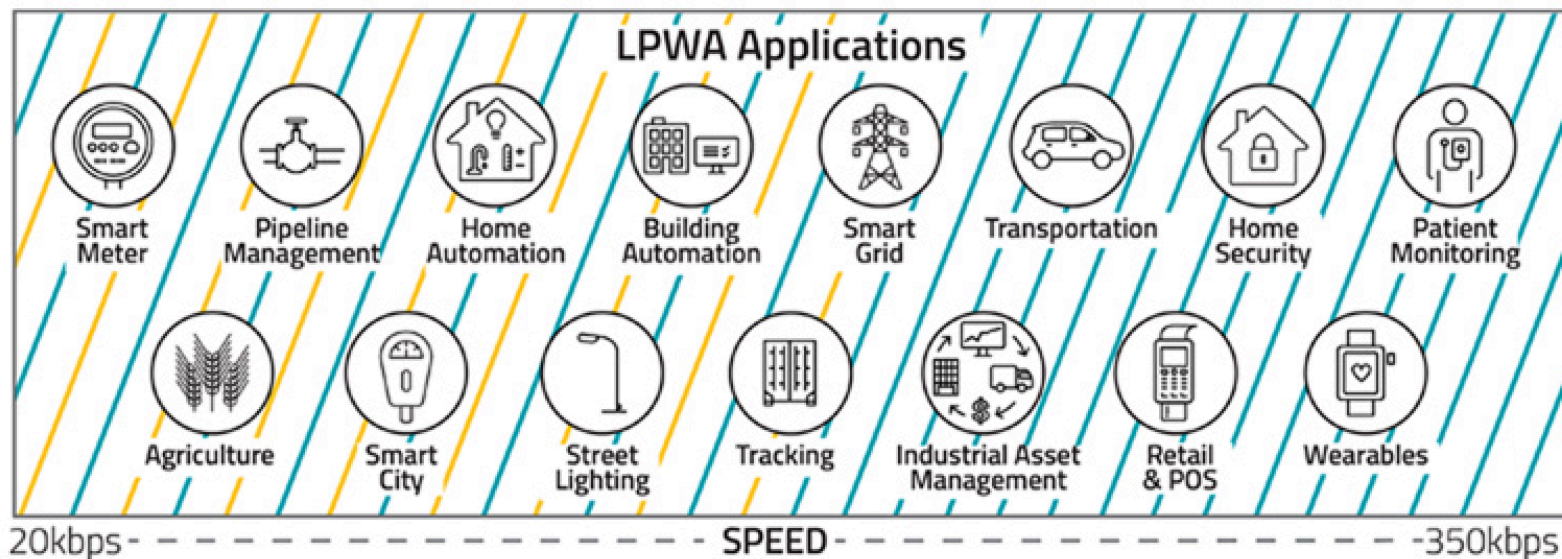
LTE-M / eMTC / Cat-M

5G ready

- Focused on very low data rates
- Ideal for simpler static sensor applications

- Highest bandwidth of any LPWA technology
- Ideal for fixed and mobile applications

Batch Communication LATENCY Real-Time Communication



5G – What is it

- 100x faster, 100x more devices per cell, 5x lower latency
- Millimeter Waves requiring more small cells (6GHz to 300GHz)
- Massive MIMO, beam forming to reduce interference
- Full Duplex, single frequency for data going in and out

New Networks!
New Frequencies!



5G – When is it coming out in the US

- ATT
 - Deployed sparsely in 12 cities
 - One hotspot that supports 5G
 - 5GE rolling out but this LTE with some enhancements
- Verizon
 - Deployed in sparsely 4 cities, focus on home internet replacement
- T-Mobile/Sprint
 - Using low-band (600MHz) frequency for 5G rollout plus 28GHz
 - Longer range, less interference but less data rates
- SmartPhones – Demoed at CES and MWC, production 2H2019
 - All will have LTE fallback





Thank you

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