

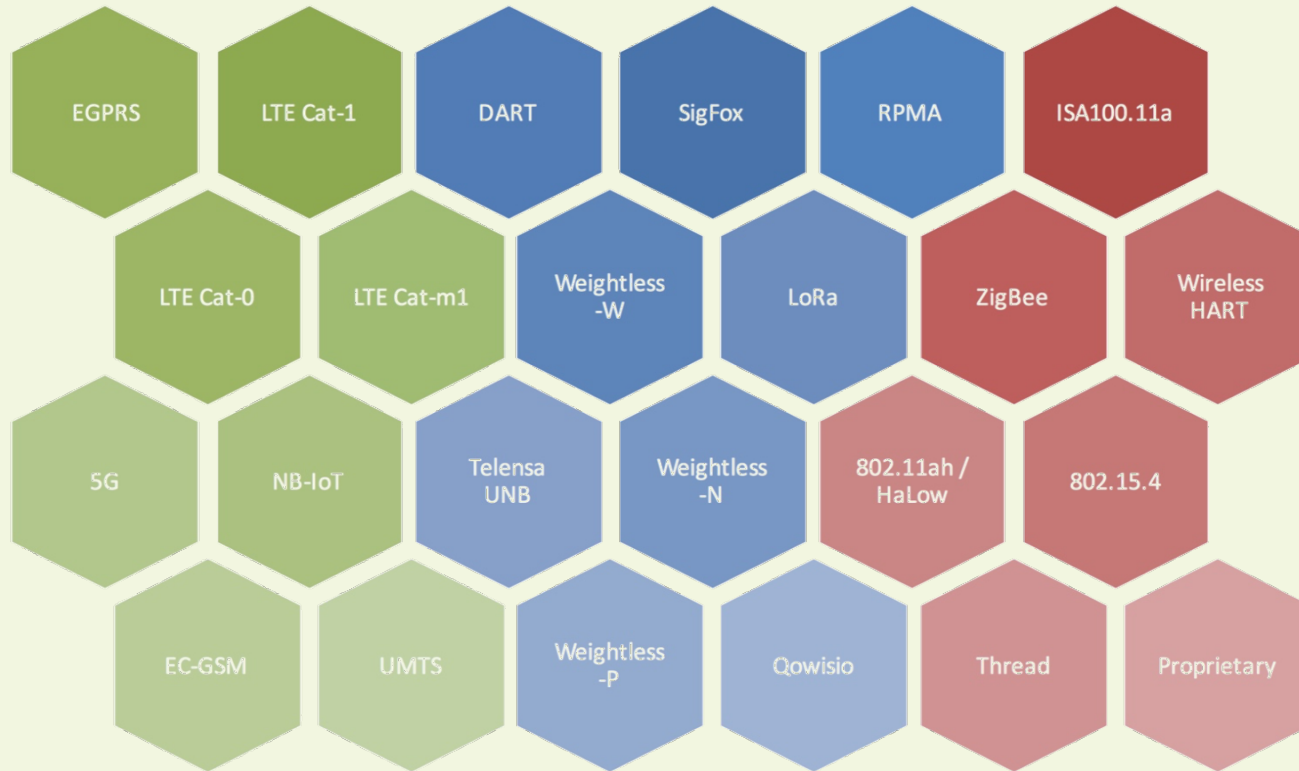


Mobile and Wide-Area IoT LPWA and LTE Connectivity

Executive Summary

January 2016

The Technologies

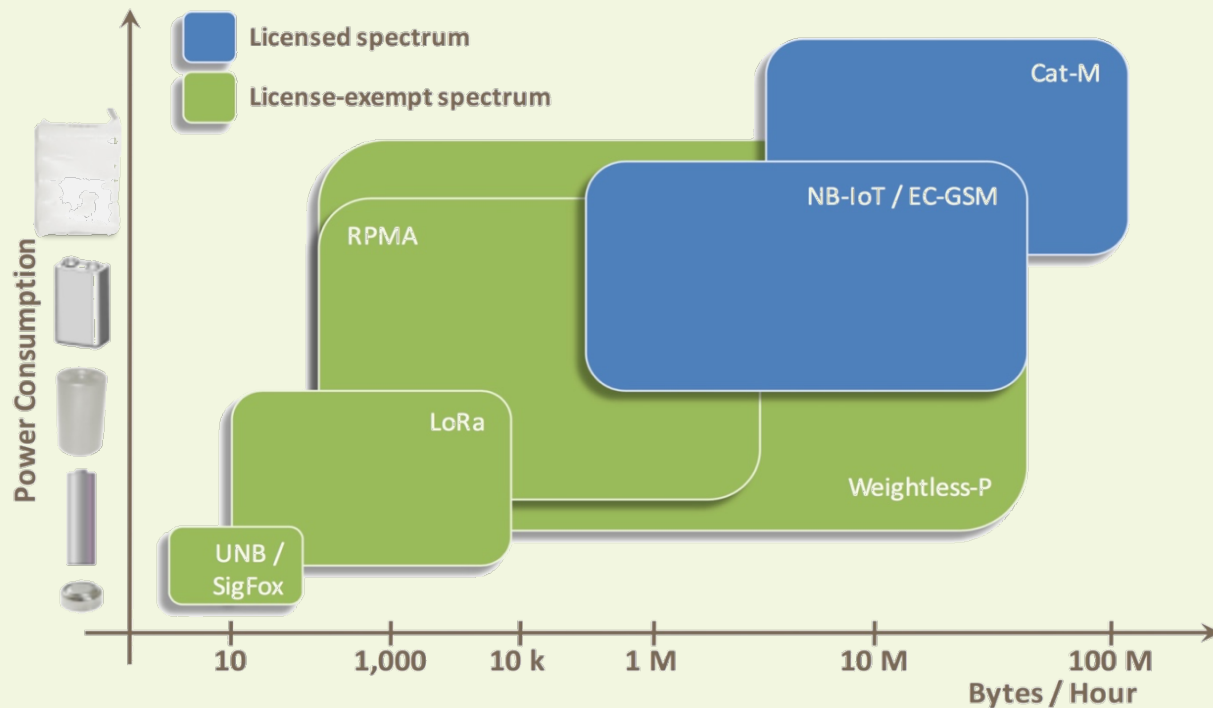


LPWA is **racing against LTE-based technologies** to capture an emerging wide-area IoT connectivity market.

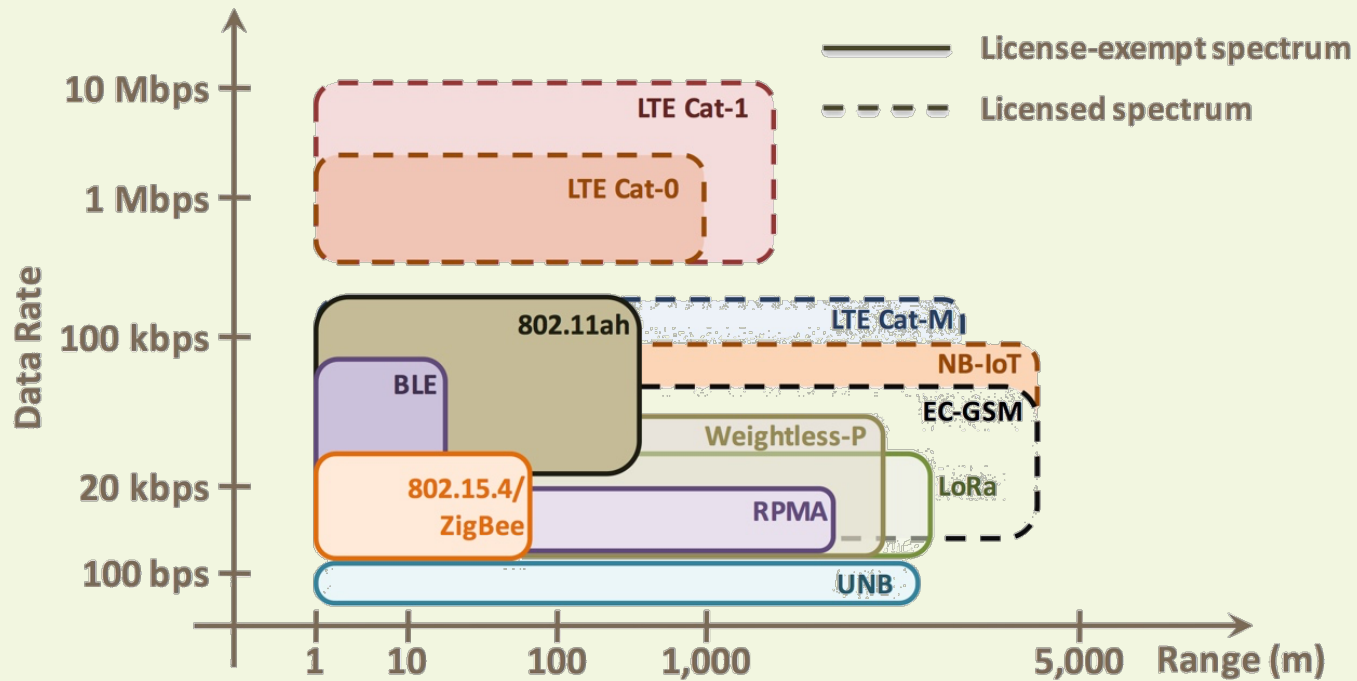
Proprietary and short-range wide-area technologies service many applications where LPWA can be used today: **Incumbent power is underestimated.**

Overview

Low-power wide-area (LPWA) technologies promise to open **new market opportunities** by providing **power-optimized, on demand spot-connectivity** for IoT devices.



Performance



LPWA technologies most suitable for **digital on/off applications** with a few messages per hour.

Features such as multicast/broadcast and traffic symmetry are key differentiators among LPWA technologies.

Relative Ranking of LPWA Technologies

Rank	Indoor Cell Range Performance		Capacity
	US	Europe	
1	LoRa	LoRa	RPMA
2	SigFox	Weightless-P	SigFox
3	Weightless-P	SigFox	LoRa
4	RPMA	RPMA	

Note: No information is available yet on Weightless-P capacity; standard was released at the same time as this report.

The capacity of LPWA networks is limited by **duty cycle requirements** and the range is limited by transmitted RF power limits.

LPWA Market Highlights

Licensed-exempt spectrum **regulations strongly impact network performance** and the investment required to build LPWA networks.

The regulatory framework in the United States is more advantageous than it is Europe where **between 2x – 8x more in capital expenditure** is required to achieve a similar level of service as in the US, depending on technology. The regulatory framework in many other major markets such as Japan, Korea, China, and others is still evolving.

LPWA are set to play a major role in **private networks** that address specific application requirements.

Success of LPWA in **public networks** is gated to on the service value proposition and return on investment, the regulatory framework, and the competitive landscape. MNOs following 3GPP roadmap will provide **considerable competitive challenge**.

The LPWA Window of Opportunity

3GPP technologies are **2-4 years** away from providing a competitive solution with similar or superlative performance characteristics to LPWA technologies.

The lynchpin of 3GPP strategy is the development of **LTE Cat-m1 and NB-IoT** technologies, both defined in 3GPP Release 13, with anticipated commercial availability in early and late 2018, respectively.

This time-gap provides the LPWA ecosystem an opportunity to establish market presence

The MNO Perspective

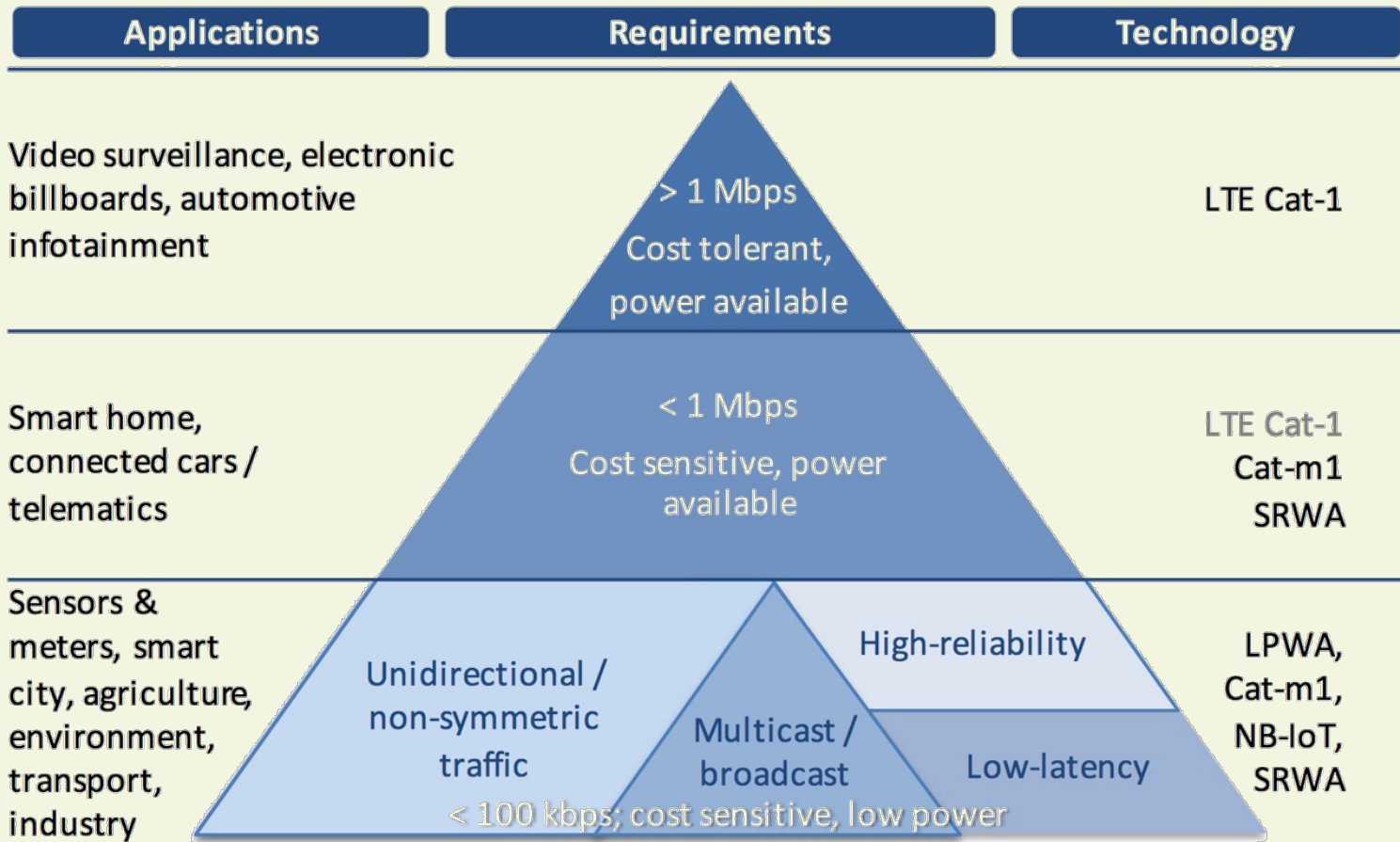
MNOs have a major strategic advantage in licensed spectrum holdings, physical infrastructure assets, and operation and maintenance processes efficiency over IoT service provider entrants.

MNOs will largely base their business model around 3GPP technologies over the long-term, especially LTE Cat-m1 devices as defined in 3GPP Release 13. The NB-IoT standard provides the ultimate in range and performance, but it is the last of the standards to become commercially available.

IoT service providers must leverage agility to tailor a nimble go-to-market strategy that addresses a fragmented market with differing requirements where custom services will play an important role in business success.

Data management becomes a critical part of the MNO value chain. IoT connectivity is a commodity. Services that offers information to end users rather than connectivity are critical to profitability.

Market Structure



Market Evolution

2016

- LTE Cat-m1 and NB-IoT under definition and development
- LPWA ecosystem coalescing; focus on alliances; setting the fundamentals for growth (e.g. network buildout)
- All players engaged in long sales cycles to validate value proposition and RoI
- New LPWA applications begin to emerge
- LTE in IoT begins to gain traction with Cat-1 but overall size remains well below EGPRS; market to bypass Cat-0 technology in favor of Cat-m1
- New entrants to LPWA market

2017

- LPWA technologies expand market share organically; more public networks emerge
- Market trials with LTE Cat-m1 begin
- MNOs hedging market risk with LPWA develop plans for potential future expansion with 3GPP technologies
- LPWA market begins to consolidate as ecosystem streamlines around successful applications and business models

2018

- LTE Cat-m1 becomes commercially available presenting first competitive challenge to LPWA ecosystem
- Market trials for NB-IoT begin
- LPWA device prices drop due to increased volume and intensifying competition

2019

- NB-IoT becomes commercially available
- LPWA adoption scales to higher volume

Additional Information

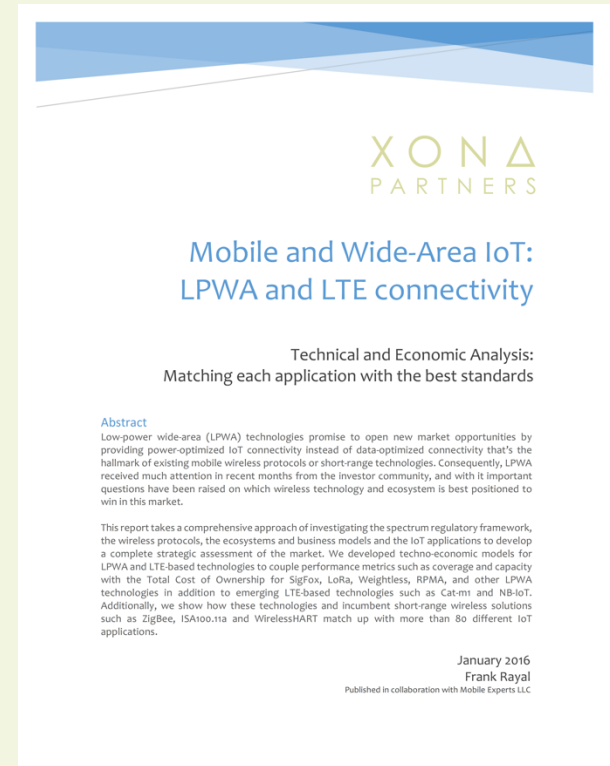
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<http://www.xonapartners.com/wp-content/uploads/2016/01/Xona-lpwa-16-rev2-ToC.pdf>

Xona Partners completed a comprehensive analysis of the LPWA market to quantify the cost-benefit trade offs and define the investment opportunity, the competitive dynamics and the future outlook.

Our research includes:

- Spectrum regulatory framework
- Technology competitive analysis
 - LPWA technologies include: SigFox, LoRa, RPMA, Weightless, DART, Qowisio, Telensa
 - 3GPP: EC-GSM, LTE (Cat-1, Cat-0, Cat-m1, NB-IoT)
 - Other: WirelessHART, 802.15.4, 802.11ah, ISA100.11a, and more
- Business models and ecosystem developments
- Application and technology mapping – 86 applications
- Performance analysis: link budgets, coverage, capacity, power consumption
- Financial models / TCO analysis for network deployment and operation



About Xona Partners

A Boutique Advisory Firm Specialized in Developing New Technology Ventures & Growth Strategies

Clients / Activities



Private Equity & Venture Funds

- M&A due diligence; competitive analysis & positioning



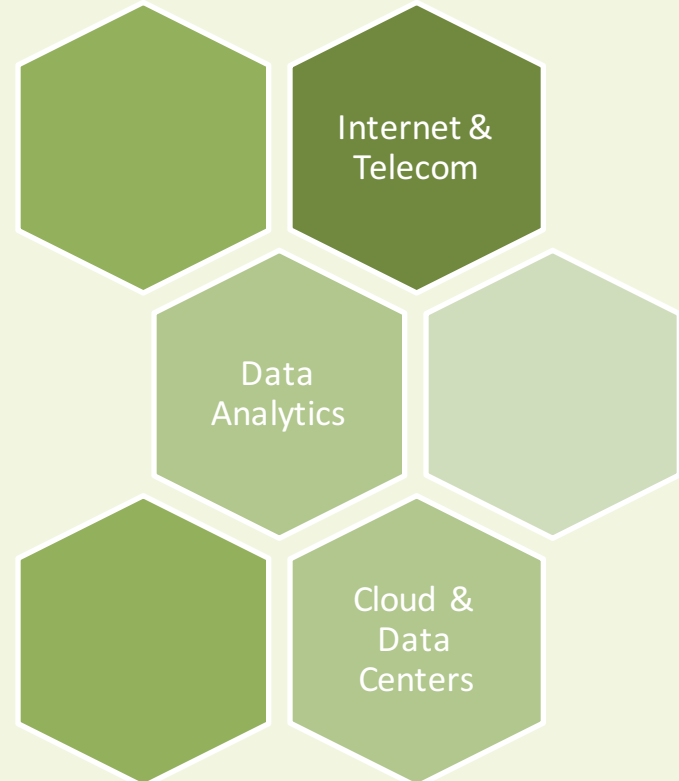
Technology Corporations

- Develop new business ventures



Governments, Regulatory & Policy Makers

- Market & technology assessment to form policy decisions



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