1 The Wide IoT Opportunity

LPWA standards are off to a good start, with networks in the field in many countries, dozens of active customer scenarios, and millions of client devices already in service. Competing standards include: SigFox, LoRa, Weightless, RPMA, UNB, and others. These options vary in their range, capacity, and cost, but all are geared toward low data rates, long battery life, and very low cost. The proliferation of standards is natural for LPWA, as each proprietary standard is promoted by a different company. It’s a familiar scene: we will see some start-ups sizzle, while others go stale.

Figure 1 Range vs. data rate for IoT connectivity technologies.

In the LTE market, four major suppliers and one standard dominate the infrastructure, because all customers have essentially the same requirement. It’s all about data and voice for smartphones... so every network needs a similar combination of capacity, coverage, and bandwidth. Scaling back the LTE network for IoT applications is proving to be difficult and expensive, but the 3GPP community is moving quickly to implement LTE-M and NB-IoT.
2 How the market is segmented

In the big picture, we segment the IoT market into three major pieces:

- High-bandwidth applications where customers are willing to pay for high reliability will naturally use variations of LTE and GSM. In these cases, the high cost structure of the 3GPP world is acceptable, and the licensed spectrum allows for higher power operation and more robust link budgets.

- Mid-bandwidth applications between 100 kbps and 1 Mbps are likely to use scaled-back versions of LTE such as Cat-M1 or NB-IoT where wide-area performance is required, and short-range technologies such as Wi-Fi or Zigbee where only local links are required.

- The low-bandwidth area is the battleground, where the most interesting applications are percolating. Here, LPWA formats are likely to dominate some vertical markets due to their early lead and due to the low cost structure that is developing today. LTE-based approaches are expensive and will be limited to high-reliability applications where a price premium is possible.

![Figure 2 IoT connectivity market structure.](image-url)
3 LPWA: Distinctions compared to LTE

One key question centers on how quickly LTE can come down in terms of cost, to satisfy requirements with a budget measured in cents, not dollars. Meanwhile, LPWA is busy establishing equipment in the field and relationships which will prevent some low-cost applications from converting to another format later.

- 3GPP technologies are 2-4 years away from providing a competitive solution with similar 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 success of which will be the result of a complex interplay of different factors that include foremost the ability of LPWA proponents to penetrate a fragmented market landscape with long-sales cycle.
- When the NB-IoT standard is finalized and operators start to gain momentum, some operators will achieve wide coverage very quickly. In many cases, mobile operators will use NB-IoT on existing licensed bands, using existing radio equipment in the field. Through a software upgrade, an LTE operator can turn on a nationwide NB-IoT network in a single day. This change relies on software upgrades from the major OEM that supplied the macro base station, so it won’t be cheap. But it can be quick.
- LTE and other 3GPP based technologies suffer from a cost disadvantage in terms of the intellectual property cost of LTE. The industry structure has evolved with 2G/3G/4G such that 5-10% of a client device’s cost is paid to a collection of royalty recipients. No single company can unilaterally change this structure to make 3GPP more cost-competitive in IoT. Instead, the entire 3GPP ecosystem must magically agree to reduce their royalty from IoT devices. This is a highly unlikely scenario.
The LPWA ecosystem has the advantage of diversity and vitality which include startups as well as major technology players in adjacent markets that see LPWA as an opportunity to chip away at the traditional service provider market. For this reason, mobile network operators have been making investments in LPWA technologies which are essentially insurance policies on future market uptake in light of the late arrival of a standardized technology which they consider critical requirement.

LPWA are set to play a major role in private networks that address specific application requirements. Their success in public networks is gated to a great extent on the service value proposition and return on investment, the regulatory framework, and the competitive landscape.

Licensed-exempt spectrum saves more than money... the time delay associated with licensing a band, deploying equipment, and offering a service is measured in years. Therefore LPWA competes with existing GSM and LTE radios in existing bands, not with the future potential of new services on a new band.

Figure 3 Market prognosis and evolution roadmap for LPWA and 3GPP IoT
4 LPWA: Mapping Technologies to Applications

The Mobile Experts team has evaluated each LPWA technology with an unbiased view of link budget, capacity analysis, and cost analysis. Our rankings were based on a comparison of link budgets and network traffic capacity where factors such as antenna gain, fade margin, and propagation modelling are equalized. Then the technical analysis was used as a reference point to estimate network cost and device cost for each standard.

![Diagram showing comparison of various LPWA technologies](image)

Figure 4 Information rate and power consumption performance of wide area connectivity protocols.

The purpose of the Mobile Experts technical and cost study was to allow us to match up each LPWA format with the applications where it can be most effective. Today, LoRa, SigFox, UNB, and RPMA formats are competing directly for key vertical markets such as energy meters and street lighting.
There will be some fragmentation over the next few years as individual countries and companies choose different technologies.

Not all of the LPWA formats will survive. But each format has made progress toward locking down key vertical markets. In obvious LPWA markets such as street lighting and energy meters, each LPWA contender has successfully deployed in at least one or two countries, so it’s possible that these applications will remain fragmented for some time. In other areas, regional positioning is less important and we can expect the market to down select to one or two winners.

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<tr>
<th>LoRa</th>
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<th>RPMA</th>
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**Figure 5 Examples of applications where each LPWA format has established an installed base**

In the end, we expect LoRa to emerge with a solid grip on a few key vertical markets due to commitments from key operators such as Orange, KPN, Bouygues, Proximus, Swisscom, Fastnet, Everynet, Radiokomunikace, A2A, Tata, Senet and SK Telecom, as well as supporting ecosystem players such as Cisco, IBM, ST Micro Electronics and Microchip.
5 About Mobile Experts

Mobile Experts provides market research for the wireless ecosystem. Each of our Experts is focused on a single facet of the mobile radio access market, which establishes our technical depth and clear 360-degree insight into business trends.

What we do

We chart your course through the radio access market. Our analysts break down the mobile market into nitty-gritty details, such as frequency bands, power levels, and semiconductor integration levels. We provide enough detail to plan new semiconductor products.

How we do it

Like scuba divers, our analysts dive deep into the block diagram to fully understand wireless technology and its costs. We combine our top-down forecasts (from mobile operators and OEMs) with our bottom-up forecasts (data collected from semiconductor vendors).

Our Experts

Each analyst has at least 20 years of experience with a specific aspect of wireless technology. Our Experts are specialists, with long experience in technology and in key business drivers for their assigned technology segment.

More information can be found at http://www.mobile-experts.net
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