Comparison of water meter reading technologies

Comparison of remote reading technologies: LoRaWAN, LTE-M, NB-IoT and Wize

1. Introduction

Remote meter reading (RMR) of water meters has become a priority for municipalities wishing to optimize their water management, reduce losses and improve operational efficiency. Several technologies exist to meet this need, including **LoRaWAN, LTE-M, NB-IoT and Wize**. However, not all of them are equally suited to this purpose.

The aim of this document is to provide an objective, documented comparison of the main technologies, highlighting the advantages and disadvantages of each, based on recent sources and field experience.

2. Comparison criteria

Criteria	LoRaWAN	LTE-M	NB-IoT	Wize
Bandwidth	0.3 to 50 kbps	200 kbps to 1 Mbps	20 to 250 kbps	0.3 to 9.6 kbps
Signal range	**Excellent** (10-15 km outdoors, good penetration underground)	**Medium** (better than NB-IoT but less suitable for basements)	**Medium** (range lower than LoRaWAN), operator-dependent)	**Good**, optimized for water infrastructures
Energy consumption	**Low** 10+ year)battery	**High** (3-5 year)battery	**Average** (battery)7-9 year-old	**Very low** (optimized for 15+ years)

Service life of a battery2000mAh [1]	**105 months** (~ 9 years)	**18 months** (~ 1.5 years)	**90 months** (~ 7.5 years)	
Operating costs	**Low** (can operate on private or public network)	**High** (similar to NB-IoT)	**High** (subscription mobile)operator required	**Moderate** (but limited number of suppliers)
Independence from operators	Yes	No (mobile operators)	No (mobile operators)	Yes
Worldwide adoption	(France, Europe, North)America	In decline (abandoned by AT&T in North America)	Mainly IoT applicationsu sed for high-speed	Used France inand Europe

3. Market trends and analysis

3.1. NB-IoT abandonment in North America

Operators such as **AT&T** have announced the closure of their NB-IoT network by 2025, preferring to direct their efforts towards LTE-M. However, LTE-M is not ideal for remote reading of water meters due to its **higher energy consumption**, reducing the lifetime of the sensors.

The obsolescence of

3.2. LoRaWAN and Wize dominate the European market

According to a white paper published in 2023, the majority of meter remote reading deployments in France are water based on **LoRaWAN and Wize**, with NB-IoT used . only to a limited extentLoRaWAN offers **very good range and efficient energy management**, making it more suitable for meters located in basements or dense urban areas.

[1] Cloud Integrated with LoRa Watermeter Network: A Water Expense Repository

In the United Kingdom, Connexin , for a million meters connected via LoRaWAN.was awarded in 2024the largest water meter remote reading contract in history

3.3. Key factors to consider

- LoRaWAN is the only technology that can be used as a private or public network offering greater flexibility.
- LTE-M and NB-IoT require dependence on mobile , operatorsincreasing operating costs.
- Energy consumption is a decisive factor in guaranteeing sensor lifetime (LoRaWAN and Wize are the best performers).

4. Energy consumption comparison between LoRaWAN and LTE-M

Energy consumption is **a key criterion** when choosing a communications technology for battery-powered IoT devices, such as connected water meters. Two of the main technologies used in North America are **LoRaWAN** and **LTE-M**. Here's a comparative analysis of their energy consumption, backed up by references.

LoRaWAN energy consumption

LoRaWAN is renowned for its extremely low power , enabling sensors to operate for over 10 years on a single battery. technology **LoRaWAN** uses spread-spectrum modulation, specifically **Chirp Spread Spectrum (CSS)**, combined with an channel access protocol**ALOHA-type** . This combination offers several advantages:

• **Low power consumption**: CSS modulation is renowned for its low power , consumptionwhich extends the life of battery-operated IoT devices (source).

• **Protocol simplicity**: The ALOHA protocol used in LoRaWAN's is simple to implement, reducing device complexity and contributing to lower energy consumption MAC layer (source).

LTE-M energy consumption

LTE-M, despite being a lighter version of traditional cellular technologies, has a higher energy consumption than LoRaWAN. According to an independent study published in 2021 by a group of renowned universities, including the **University of California at Berkeley**, LoRaWAN would **consume six times less energy than LTE-M**. This means that, for

For equivalent battery life, an LTE-M device would require a battery with six times the capacity.

This difference partly explained by the higher bandwidth offered by LTE-M (200 kbps to 1 Mbps) compared to LoRaWAN (290 bps to 50 kbps), which results in higher power consumption. (See Appendix 1 for a detailed explanation)

5. The high risk technological obsolescence

3GPP (3rd Generation Partnership Project) is the international standardization body that defines standards for mobile communication technologies, from **2G (GSM)** to **5G (NR)** and future generations such as **6G**.

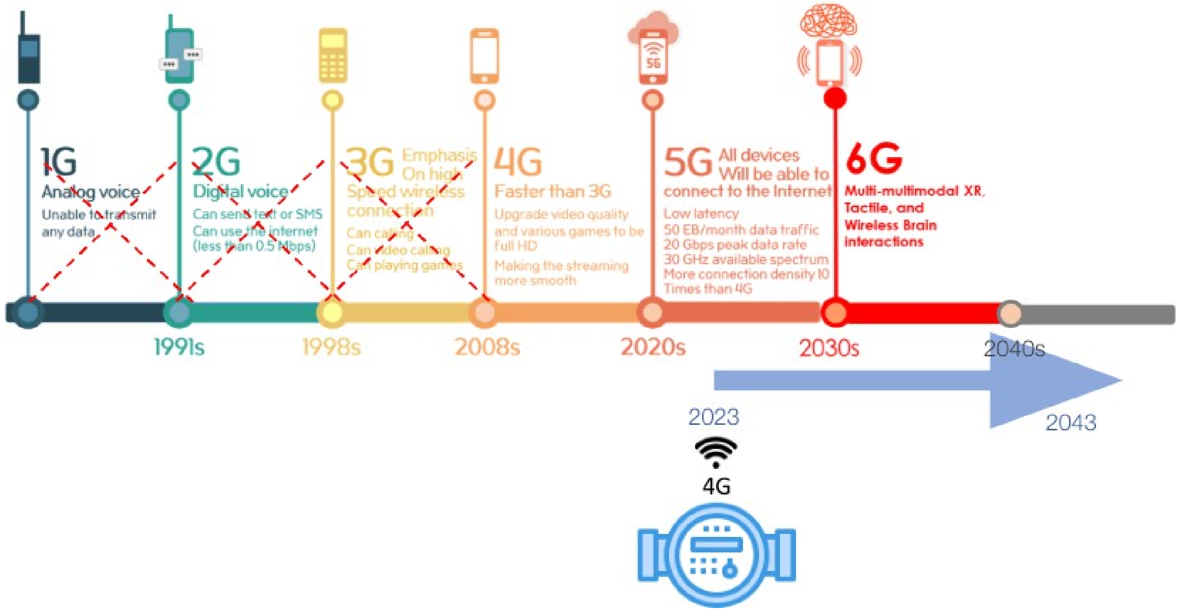
3GPP launches a new generation of cellular technology approximately **every 10 years**. Here's a summary of the launches of the main mobile generations:

- **1G**: Deployed in the **1980s**
- **2G (GSM)**: Introduced in **1991**
- **3G (UMTS**) : Deployed in **2001**
- **4G (LTE)**: Deployed in **2009**
- **5G (NR)**: Deployed in **2019**
- **6G (planned)** : Expected around **2030**

This cycle around **10 years** enables operators and equipment manufacturers to prepare for the transition to new standards, while ensuring gradual adoption by consumers and industries. This poses a challenge for applications**long-life** , such as remote reading of water , meterswhich are likely be affected by the obsolescence of previous cellular generations.

For example, in 2024, US mobile operators shut down their 3G networks. Canadian operators have announced the end of theirs in 2025. The wireless cellular interfaces sold in Canada today **are generally 4G (LTE-M) technology**. For such an interface to last as long as a new water meter (20 years+), technology 4G cellular would have to be supported by Canadian mobile operators until at least 2045. As 3GPP has already announced the release of 6G for around 2030, it's likely that 4G networks (LTE-M) will cease to exist in Canada well before 2045.

Cell technology obsolescence cycle



5. Conclusion

Choosing the right technology for the job

For applications such as **remote reading of water meters**, where the transmission of small amounts of data at regular intervals is sufficient, and where the lifespan of a water meter is often more than 20 years, LoRaWAN appears to be the most suitable solution due to its low energy . consumptionOn the other hand, for applications requiring higher data rates or lower latency, LTE-M could be considered, albeit at the cost of reduced device autonomy.

It is therefore crucial to assess the specific needs of the application in order to choose the most appropriate , taking into account the trade-offs between energy consumption, data throughput and operational requirements.technology

Remote reading of water meters is based on key criteria such as **signal , rangeenergy consumption, network flexibility and operating costs**.

LoRaWAN stands out as the most suitable solution for municipalities, thanksto :

✔ **Low power consumption** for extended sensor .autonomy

✔ Its **long range** and ability to penetrate basements.

✔ **Low operating costs** and the option running a private or public .network

✔ **Mass adoption** in Europe and North America.

With the phasing out of NB-IoT in North America and the high energy of LTE-M, LoRaWAN is emerging as the most sustainable solution for cities looking to modernize their water management.consumption

Appendix 1 - The link between bandwidth and energy consumption

The energy consumption of a communication device is closely linked to the bandwidth used. A higher bandwidth allows more data to in a shorter time, but requires higher transmission power, which be transmitted increases energy consumption.

This relationship is described by the Shannon-Hartley theorem, which states that the maximum capacity C of a communication channel is a function of the bandwidth W and the signal-to-noise ratio SNR :

$$C= W(1+ SNR)$$

According to this formula, to increase the capacity C , it is necessary to increase either the bandwidth W , or the signal-to-noise ratio SNR . However, increasing SNR generally implies an increase in transmitted signal power P_t , which leads to higher energy consumption. In addition, a wider bandwidth W leads to an increase in thermal noise P_{N_{th}} = kTW (where k is Boltzmann's constant and T is the temperature in Kelvin), requiring even greater to maintain a transmission power constant . Thus, increasing the bandwidth leads to an increase in the system's energy consumption.SNR

This relationship is detailed in the thesis paper entitled "Modeling Internet energy consumption according to changes in demand and technological efficiency" :

> "The thermal noise power is: P_{N_{th}}= kTW where k 's constant is Boltzmann(1.38 × 10⁻ ²³ W-s/K), T is the absolute temperature and W is the bandwidthfrequency . The signal-to-noise ratio is therefore : SNR = \frac{P_t}{kTW} where P_t is the transmitted "signal power[2]

In short, increased bandwidth enables higher , but at the cost of higher energy consumption due to the need for greater transmission power to maintain adequate signal quality.data rates

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[2] https://perso.uclouvain.be/david.bol/TFE/Baudoin-TFE13.pdf