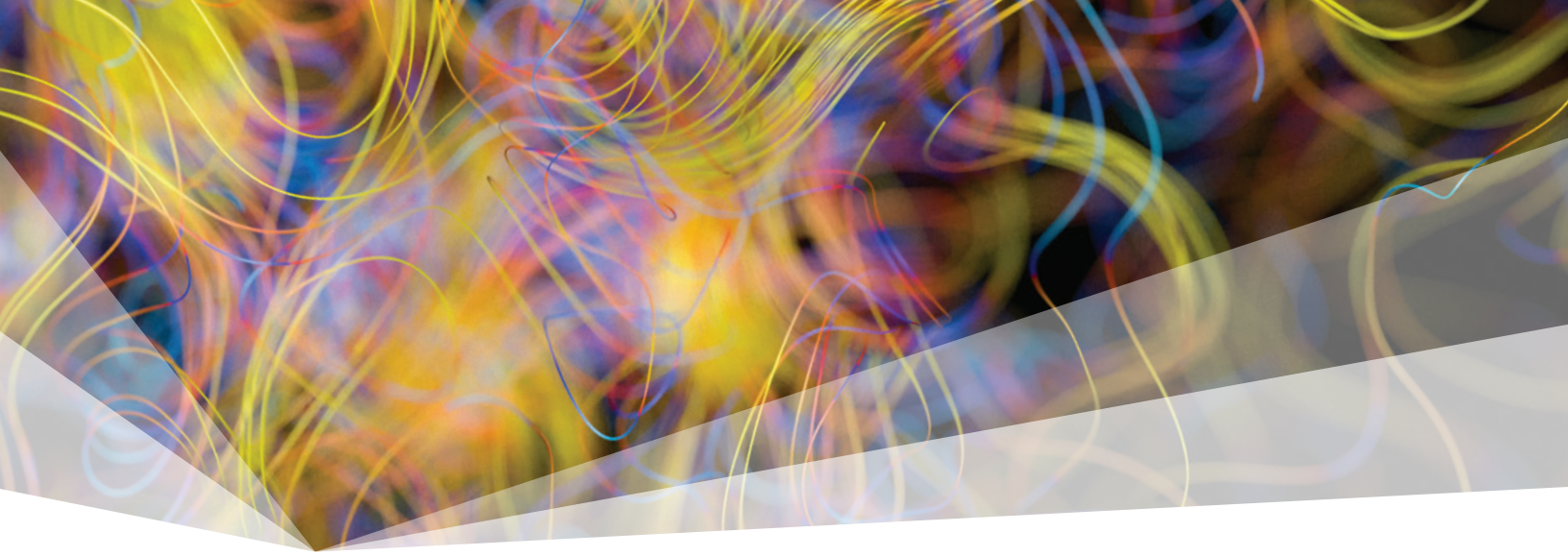


LTE-M and NB-IoT: Using 5G Technologies to Reduce IoT Connectivity Costs

INDUSTRY BRIEF

AT A GLANCE:

Narrowband IoT (NB-IoT) and LTE-M have set new standards for LPWA networking by prioritizing low cost, low power, minimal infrastructures, robust reach over massive distances, and scalability to cover a large number of devices.

The cost of cellular deployment, initially developed for high speed, high data volumes, is considered too expensive for widespread IoT use due to excessive power consumption and complex protocols that lower battery life. It has taken some time for these technologies to be simplified or stripped down for widespread, low-power IoT usage. A static solar sensor doesn't need the same capabilities as a mobile smart iPhone.

Cost always has been a concern for IoT applications at scale. Operating expenses have to be low enough to support the massive growth expected in the coming decades. Sustained battery power may be needed for hard-to-reach devices to increase their operational longevity while lowering maintenance costs. In so many cases, the power requirements may be low, but capacity has to be maintained to support many devices per square mile in dense urban areas.

Addressing this concept are several new low-power technologies that are trying to win over global enterprises. Overall, these connectivity strategies will afford a diverse range of business sectors to seek out operational efficiencies and competitive advantages through collecting, storing, and analyzing business-critical data at levels of scaling and granularity previously unseen.

Present-day cellular mobile technologies are designed to work on costlier, consumer-oriented data networks where the premium is placed on fast connections that can transport large amounts of data, whereas low-cost low-power wide area (LPWA) networks can support devices requiring low mobility, low power consumption, long-range abilities, and heightened security. One of the benefits of LPWA is that data transfer rates, as well as power consumption, are very low. Device connectivity, in this case, requires less bandwidth than standard cellular, which means that LPWA networks can

operate with far better power efficiency. Additionally, LPWA networks can support more devices at a lower cost than consumer mobile technologies.

Let's examine a couple of new data transport technologies that support the ever-growing needs of operators and IoT solution providers: NB-IoT and LTE-M. Each has its own set of characteristics and each is used for a specific set of IoT applications. And, with the oncoming of 5G, each will provide even more functionality, at a better price point, than previous protocol iterations.

New Protocols to Improve Connectivity, Reduce Overall Costs

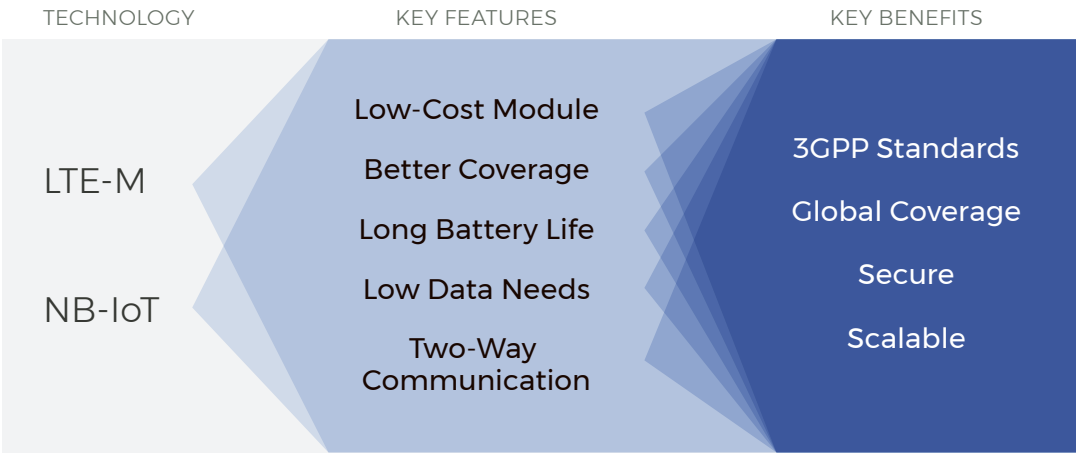
NB-IoT is the newest entry to the IoT scene. With its standards-based LPWA IoT technology, NB-IoT has a global reach with better bi-directional data than any of its unlicensed counterparts. And, unlike LTE-M, NB-IoT is based on Direct Sequence Spread Spectrum (DSSS) modulation, which 'widens' the signal to reduce interference. It also might make it a bit harder to go national (since it can't yet hook into the LTE network without infrastructure changes). NB-IoT has several large organizations, including Huawei, Ericsson, Qualcomm, and Vodafone, actively involved with this standard.

The NB-IoT LPWA solution is optimized for applications that need to communicate small amounts of data over long periods of time. NB-IoT usage results in lower latency with a higher transmit power limit (200 kHz bandwidth), which improves range and reliability, even underground or inside buildings. And since it operates in a licensed spectrum, it is secure with highly reliable data transmission, assuring a high quality of service. NB-IoT devices and hardware are at the lower end of the cost spectrum and improved efficiency helps batteries last more than a decade, allowing for long-term deployments. With its simpler underlying technology, costs for NB-IoT modules will continue to decrease as demand increases. The technology roll-out, with a commercial module and network, is here now. T-Mobile already has announced that its NB-IoT network is ready for commercial use, and AT&T has much of its national footprint ready for NB-IoT. The other major carriers in the U.S. are expected to provide the same in a few more quarters.

LTE-M is a bi-directional, standards-based protocol within the same spectrum as LTE. It provides carrier-grade security, long battery life, low data needs, and low-cost modules. This protocol has many active followers, including, Altair, Ericsson, Qualcomm Technologies, WNC, Sierra Wireless, Telit, and Xirgo, as well as a host of U.S. carriers. One of the strengths of LTE-M is that it does not need a new infrastructure as it can piggyback on existing LTE networks. As such, a carrier can update software on its network, get LTE-M functional, and not spend any additional funds on infrastructure or support services.

LTE-M, however, is a much simpler product than standard LTE, only using 1.4 MHz channels instead of varying bandwidths up to 20 MHz that LTE uses. Data rates for LTE-M are somewhat higher than NB-IoT, but it can transmit larger blocks of data due to the higher throughput.

Additionally, using an extended discontinuous repletion cycle (eDRX), the data collection devices can transmit data on a non-continuous schedule, as set by the end user. The device, when not sending data is not off, but just asleep. When data is scheduled to be sent, the device does not need to be re-activated to join the network, it just wakes up. Having intermittent data send-schedules, which are not active 24x7, can save battery life, leading to significant cost savings. LTE-M had an American roll-out in the second half of 2017, followed later that year by Mexico.



Mobile IoT: 3GPP standard technology for LPWA

Cost and Coverage Will Decide Winners and Losers

At Aeris, we believe that the future will see the expansion of NB-IoT and LTE-M over the other proprietary LPWA technologies in the field. One of the reasons will be cost. Another will be coverage. Like LTE-M, network upgrades will enable NB-IoT growth through already existing towers, making it an IoT force to be reckoned with. And while many other technologies might be highly applicable for many IoT deployments, tower distribution, or lack thereof in the U.S., will limit coverage and growth. NB-IoT, with fewer such restrictions, will be the big player in the expanding LWPA sandbox.

The bottom line for customer choice will come down to cost and coverage. Until standards emerge, many players, both licensed and not, will compete in the enormous IoT marketplace. The issue for companies will be to decide whether to be locked into a low-cost, proprietary system or to go with an IoT service provider linked into multiple carriers, thus providing seamless reliable, low-cost connectivity coverage.

ABOUT AERIS:

Aeris is a technology partner with a proven history of helping companies unlock the value of IoT. For more than a decade, we've powered critical projects for some of the most demanding customers of IoT services. Aeris strives to fundamentally improve businesses by dramatically reducing costs, accelerating time-to-market, and enabling new revenue streams. Built from the ground up for IoT and road tested at scale, Aeris IoT Services are based on the broadest technology stack in the industry, spanning connectivity up to vertical solutions. As veterans of the industry, we know that implementing an IoT solution can be complex, and we pride ourselves on making it simpler.

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