




# LEVERAGING RADIO NETWORKS FOR INDUSTRIAL INTERNET OF THINGS COMMUNICATION

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**“Due to advancements in technology and economies of scale, the cost of communication devices has been reduced to price points, which enable their use across more infrastructure and applications.”**

## **EXECUTIVE SUMMARY**

### THE EVER GROWING IMPORTANCE OF M2M

Water and Wastewater Utilities around the globe are being challenged to improve service delivery while at the same time deal with security threats that aim to take down their operations. Compounding these challenges are the pressures from investors and regulatory agencies to streamline operations and reduce costs all while dealing with the complexities of a retiring workforce. To conquer these formidable challenges, water and wastewater utilities will require greater visibility into their operations and are looking to leverage Industrial Internet of Things (SCADA/M2M) communications technology & communications to provide the means.

In its simplest form, IIoT identifies the ability to add communications to existing infrastructure equipment in a customer’s operations for monitoring and control purposes via relatively low-cost communication modules. These low cost communication modules can easily enable connectivity to the components in water facilities and deliver new levels of near real-time visibility into your operations. IIoT easily enables connectivity to applications. With the new levels of visibility, proactive decisions about water maintenance, quality management, maintenance schedules, consumption, theft of service and many others are viable. The addition of M2M communication devices facilitates the creation of a highly reliable, highly available Industrial Internet of Things (IIoT) network capable of delivering the needed visibility into your operations during the most critical times. In short, M2M is a game changer.

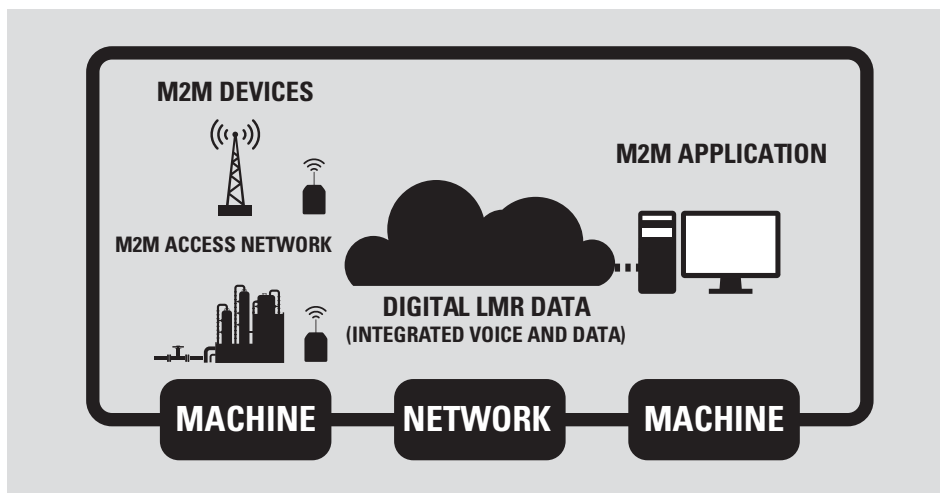
Despite all of its benefits, water utilities and other CI industries have been reluctant to implement M2M communication modules since they have typically only been available on public cellular networks - which haven’t been designed for the mission/life/safety critical needs that critical infrastructure industries require. Water utilities have been unable to get private licensed broadband spectrum assigned to their market from the federal government to support their increased data communications requirements. In lieu of obtaining private licensed broadband spectrum, these CI industries are virtually handcuffed to using non-mission critical public networks or even shared unlicensed spectrum to achieve their data needs. This creates vulnerabilities to their critical applications because public communications networks are susceptible to outages and congestion, and shared unlicensed spectrum is subject to interference. Utilities’ prefer to own their own private communication networks, which are designed to their specific coverage, capacity, reliability and availability needs. The men and women who support our critical infrastructure require mission critical radio networks that are always available to support their operations and protect their safety.

In the face of these challenges, the market has responded and there is good news to be reported. Water Utilities have traditionally relied on narrowband spectrum for mission critical Land Mobile Radio (LMR) voice systems to provide communications to their employees. As these systems have transitioned from analog to digital, the ability to support M2M and other IIoT applications becomes viable. Advancements in digital technology can double or quadruple the existing channel capacity on these narrowband LMR systems. Greater channel capacity enables the support of advanced data services — like M2M applications — without impacting voice operations on these LMR systems. By leveraging the new digital mission critical LMR systems, can now support both voice and data services like M2M applications on a highly reliable network that provides coverage across their entire service territory too. It’s a win-win!

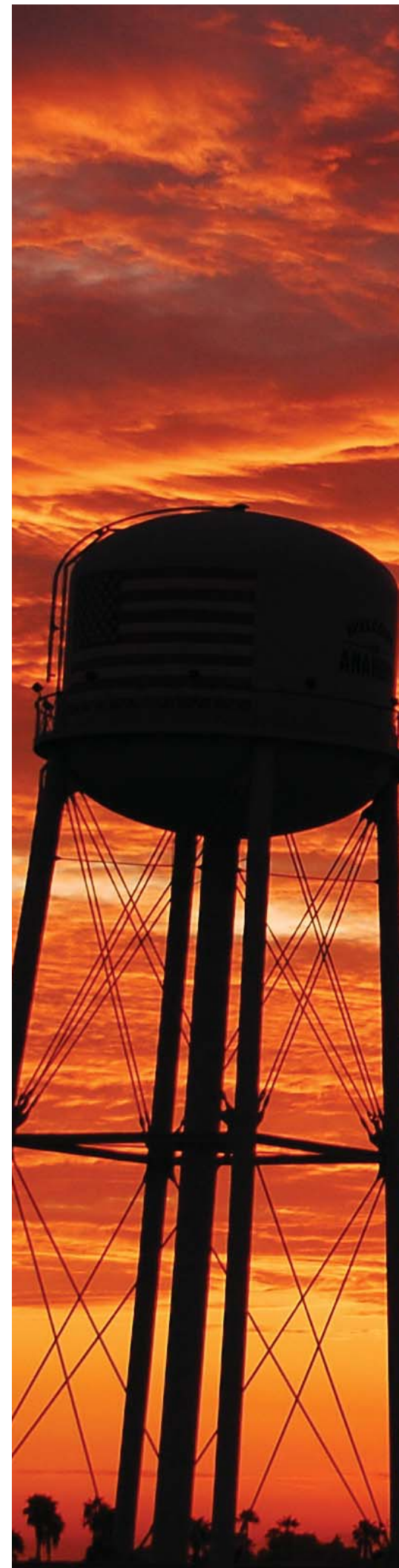
For decades, CI industries have been using a variety of communication technologies in some form or another for supervisory control and data acquisition (SCADA), and other applications, but they were never placed in a blanket category such as M2M nor were they connected together to create an IIoT. Coupled with the lack of private licensed broadband spectrum options, communication to these applications has been limited and typically only deployed at key locations on a cost-effective basis. Due to advancements in technology and economies of scale, the cost of communication devices has been reduced to price points, which enable their use across more infrastructure and applications.

Water and wastewater utilities have been increasingly focused on M2M. It has been estimated that, by 2021, the utility sector will account for 61% of overall M2M device connections, growing at a CAGR of 50%.<sup>1</sup> The same report estimates revenue associated with M2M connectivity will also increase dramatically over the same period, from \$5.7 billion in 2011 to \$50.9 billion in 2021.<sup>2</sup> Through M2M communication, utility companies can remotely monitor and control assets like water quality monitoring, water leak detection, motor operated valve control, and many other key critical infrastructure applications. In addition, water utilities can leverage M2M communications for applications like demand response, which provides tremendous cost savings to both the utility and its customers. Enabled by M2M communications, the potential benefits for the utility sectors are far-reaching, including improved water efficiency, reduced equipment failures, enhanced safety and security, as well as faster and better decision-making.

M2M enables water utilities to be proactive in their operations rather than be reactive. Utilities can greatly reduce maintenance and administration costs by automating leak detection and cutting down on the number of site visits to check equipment. Scheduling regular site visits to perform routine checks on equipment is time-consuming and expensive, especially for assets in remote locations. With M2M solutions, equipment can be remotely monitored and controlled continuously without human intervention. This allows utilities to check for gradual changes in the status and performance of assets and to schedule equipment maintenance during times that will minimize disruption and inconvenience to customers.



The secure and reliable exchange of information is of paramount importance to water utility operations and customer service. M2M communication is a key differentiator in generating the intelligence that utilities need to make informed real-time decisions.

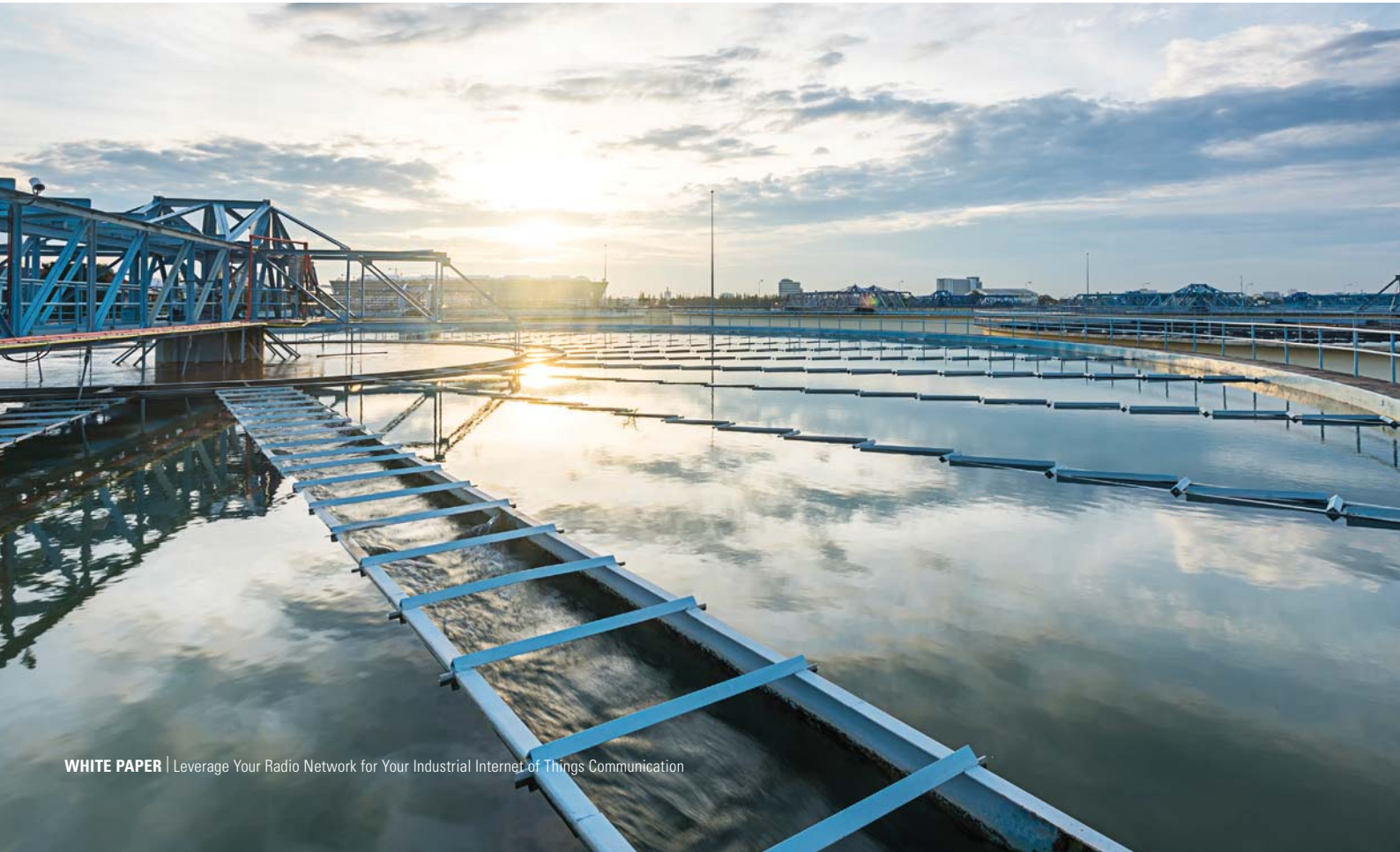




# KEY FEATURES OF MISSION CRITICAL M2M COMMUNICATIONS

THE MOST IMPORTANT FEATURES OF AN M2M COMMUNICATION SYSTEM ARE:<sup>3</sup>

- **Low Mobility:** M2M devices do not move, move infrequently, or move only within a certain region.
- **Application Independent:** M2M devices enable communications to key applications that don't have any communication today and are completely transparent to the application. The application is unaware that the communication service is provided by a wired or wireless connection. IP-based: As LMR communication networks migrate from analog to digital, these new digital networks support IP bearer services and have the ability to transport both IP and serial-based protocols over the IP-based network.
- **Small Data Transmissions:** M2M devices frequently send or receive small amounts of data, leveraging the extra capacity enabled by migrating to a new TDMA-based digital LMR network.
- **High Reliability:** High reliability means that whenever and wherever M2M communication is required or triggered, the connection and reliable transmission between the M2M device and the M2M server shall be available, regardless of the operating environment. High reliability is required in M2M applications that involve either the prospect of an emergency or highly sensitive data. Utility LMR systems have long been designed for high reliability for their voice needs, and the benefit of this is extended directly to the M2M applications that leverage the same network. Mission critical radio networks are designed for high reliability and redundancy where failure is not an option while business enterprise operations networks are not designed to meet the same redundancy and reliability specifications.
- **Network Priority:** Network priority means that there is a method for providing a hierarchical prioritization of users or applications within the solution when applications, voice or data, are competing for network access. The P25, TETRA and DMR standards and the systems provided by the manufacturers have provisions in their protocols to accommodate a prioritization scheme, whether it is simple or sophisticated. This is important as utilities have long considered their voice communications to be mission critical because they rely on them for both safety and security, such that prioritization cannot be disrupted. Many fixed data applications, which weren't previously considered mission critical, are now being considered as such since the information about the water facility's performance has a direct impact on a utility's operation and performance.
- **Security:** Security functions include the protection and confidentiality of M2M data, authentication of users prior to access to M2M devices, and encryption of the data transferred across M2M networks. Knowing that utilities desire private LMR networks for their higher levels of security provides a strong platform that can be leveraged when using the same security for M2M applications.
- **Latency Tolerant:** Latency is a time interval between the stimulation and response. When leveraging a LMR network for M2M the target applications should be those that aren't latency sensitive. The general one-way latency of an LMR network is approximately 1 second. Those polled applications or reports by exception-based applications that don't require immediate responses measured in milliseconds but rather in seconds are target applications for M2M over LMR.







Being the most crucial of the critical infrastructure markets utilities require systems that are highly reliable and available to be always on when you need them. Previously, radio systems supporting M2M communications were limited to public cellular and unlicensed wireless technologies – which weren't designed to the demanding levels of reliability and availability that water utilities require. The wireless communication networks that utilities have been using for decades that were designed for these high performance levels have been their LMR systems which provide the mission/life/safety critical link to workers during workplace problems and daily operations. The radio system is relied upon heavily for restoration activities and during that time failure is not an option because lives are of workers and communities are at stake.

As LMR networks are transitioning from analog to digital they now have the ability to support data communications and M2M devices in addition to the current voice communications – all over a highly reliable and available network that they have relied upon and trusted for years. Enabled with data connectivity, choosing the right digital LMR standard to which to migrate is incredibly important because now both lives and key water utility operations are at stake. There are three global IP-based digital LMR standards that are available to utilities and understanding their differences is imperative. The three global standards are P25, TETRA and DMR and each vary considerably on their applicability for mission critical or business critical use, their maturity level, architecture, security, adoption in the market, and performance characteristics. Despite the fact that the standards have similar sounding feature sets in their marketing materials, their implementation and resulting performance vary greatly so thorough investigation of the technical details is required. Many factors go into selecting to either purchase a new digital LMR technology platform or to leverage an existing digital LMR platform for your M2M communications needs. Digital LMR networks based on global standards like P25, TETRA and DMR offer a large ecosystem of vendors that provide solutions and products to meet a variety of coverage, capacity, security and interoperability needs.

To learn how you can leverage your existing LMR voice network for all of your Industrial Internet of Things communications visit [www.motorolasolutions.com/industrialiot](http://www.motorolasolutions.com/industrialiot)

**SOURCES:**

1. M2M device connections, revenue and ARPU: worldwide forecast 2011–2021, Analysis Mason, May 2012
2. Id.
3. Government of India, Telecommunications Engineering Centre, White Paper Machine to Machine Communication, 2011.

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