Navigating the Future of Cargo Monitoring and Tracking

How the cellular network transition is impacting real-time perishable cold chain technology
Abstract

For many years, 2G and 3G cellular networks have provided the technology infrastructure that enabled real-time trackers to deliver live location and temperature data on shipments traveling throughout the global perishable cold chain. Over the next several years, many of these networks will become obsolete and potentially present gaps in real-time monitoring and tracking capabilities. End users of real-time cargo trackers will need to make the transition to devices built to utilize the next generation of low-power, low-bandwidth networks. This white paper will examine the intricacies of this complicated cellular landscape and discuss strategies for successfully navigating the cellular transition.

An industry in transition — the 2G and 3G cellular network turndown

The insatiable demands for faster internet speeds, high-bandwidth data transmission and high-definition content are driving cellular companies to continually iterate toward the next generation of cellular network technologies. In a little more than a decade, we’ve seen mobile phones advance from 2G networks — which were used by the first-generation Apple® iPhone® in 2007 — to the current 4G LTE standard and the ongoing rollout of 5G.

But the evolution of cellular technology has impacts far beyond the mobile device industry, specifically those companies that rely on legacy 2G and 3G networks to monitor and track cargo shipments in real-time. In many ways, 2G network capabilities are ideally suited for the needs of the cargo tracking industry, whose real-time trackers don’t need to continually transmit large amounts of data at industry-leading speeds. They simply need to frequently transmit small packets of data — such as location, temperature, humidity and other sensor types — so that end users of these devices can monitor the locations and conditions of their in-transit shipments.

Until very recently, most real-time trackers were designed with cellular connectivity protocols that utilize 2G or 3G SIM cards. Since 2G technology doesn’t share the same memory requirements, high battery power and data transmission capabilities of 4G and 5G networks, these devices could be manufactured and sold at accessible price points without compromising their ability to perform their critical functions.

But the quickly evolving mobile device industry is outgrowing both 2G and 3G cellular networks. As 4G LTE and 5G technologies are introduced and/or expanded, 2G and 3G networks will become obsolete. Because specific turndown timelines are dependent on the cellular carrier and specific global regions, coverage zones may vary. For example, AT&T has

What’s taking the place of 2G and 3G networks in the cargo tracking industry?

With the global sunsetting of 2G and 3G networks, real-time trackers will need to leverage the next generation of cellular network technology. But this doesn’t mean moving to the same 4G or 5G bandwidths used by today’s smartphones and cellular-enabled mobile devices. Rather, new real-time trackers will be designed to leverage emerging low-power, wide area network (LPWAN) technologies that have evolved from 4G LTE:

- Category M (Cat-M), where “M” stands for mobile
- Narrow band IoT (NB-IoT)

These new LPWAN technologies are the logical successors to 2G and 3G — allowing real-time trackers to transmit small packets of data without requiring the memory, battery power and data transmission capabilities of 4G and 5G.

As a result, these new LPWAN technologies will deliver similar performance characteristics to 2G while keeping real-time trackers affordable and cost-effective.
already turned down its 2G network in the U.S.; cellular companies in Japan have not supported 2G networks since 2012.

From a cargo tracking industry perspective, it’s important to realize that there may not be industry-wide conformity for quite some time. This variability will create complexity when trying to ensure real-time coverage of perishable shipments around the globe.

Data gaps and other impacts to the cargo tracking industry

Real-time trackers help end users monitor food quality and safety by providing access to location and sensor data such as temperature, humidity and much more. Combined with a cloud-enabled technology infrastructure and supporting tracking software, this enables growers, logistics companies and retailers to monitor in-transit shipments in real time.

From 2G and 3G to Cat-M and NB-IoT — Sunset and roll-out timing

Around the world, cellular carriers are upgrading their network infrastructures to meet the growing demand for faster speeds and higher bandwidths. As a result, carriers are shifting resources from 2G and 3G support toward newer 4G and 5G networks. With these new investments come the next generation of LPWAN technologies which will be used by the cargo tracking industry. While it can be difficult to uncover specific details about when each cellular company or country will make this transition, it’s safe to expect it will continue well into the coming decade.

U.S. begins 2G and 3G turndown — In the U.S., AT&T formally discontinued its 2G service in 2017, citing a 250,000% increase\(^1\) in data usage since the days of 2G in 2007. Verizon indicated that it would be discontinuing both 2G and 3G networks as of year-end 2020\(^2\), and has already discontinued all 2G and 3G devices as of Jan. 1, 2020\(^3\). T-Mobile is also planning for its 2G and 3G switch-off by year-end 2020.

Waning global 2G support — Asian countries were also among the first to switch off 2G, beginning with Japan, which ended its 2G support in 2012. Shortly thereafter, cellular companies in other countries, such as South Korea, Thailand, New Zealand and Australia, have followed suit. In specific global regions, 2G is expected to remain until 2025 while 3G may turn down sooner than 2G in some countries.

Potential 2G and 3G longevity — Despite the global trend toward high bandwidths, 2G is believed to have greater staying power than 3G. This is especially true in developing markets that are keeping 2G primarily for its wide installed base and cost-effectiveness\(^4\).

New network emergence — New Cat-M and NB-IoT networks — both utilizing LPWAN technology — are currently in the process of rolling out, typically in tandem with the installation of new 4G LTE and 5G infrastructures. These have similar performance characteristics of 2G and will support the unique cellular network requirements of the cargo tracking industry.

Device evolution — Leading real-time trackers have been designed to switch between 2G and 3G, giving cold chain stakeholders in these regions the abilities to monitor and track in-transit shipments through these regions. The next generation of devices will be based on either Cat-M or NB-IoT technology, with fallback support to 2G.
As 2G and 3G networks turn down, cold chain stakeholders will begin to experience interruptions in the temperature and location data streams produced by their 2G- and 3G-enabled, real-time trackers. These coverage gaps could result in any of the following challenges:

- Inability to monitor food quality (freshness) and safety in real time
- Missing real-time alerts (emails/text messages) of temperature excursions
- Potential risks to brand reputations
- Incomplete data for prompt resolution of shipment disputes

If your company is currently using 2G and 3G real-time trackers, you may have already experienced the impacts of cellular network turndown. Unless you’re closely monitoring in-transit shipment data or have been made aware of gaps in real-time data, you may not have noticed any disruptions. Companies should be on the lookout for the following signs of network connectivity issues:

- Increasing blind spots in visibility to shipment location/temperature data
- Intermittent brown-outs of real-time access
- Gaps in historic trip coverage and data points

A new generation of real-time trackers

To minimize gaps in real-time tracker coverage due to the 2G and 3G turndown, cargo tracking manufacturers are developing tracking devices that utilize the new Cat-M and NB-IoT networks. At Emerson, our Cargo Solutions business is committed to helping the industry make this transition. We’re expanding our suite of 2G and 3G real-time trackers with the next generation of devices engineered to enable new, multi-network compatibility.

Multi-network technology will allow end users of these new devices to utilize emerging networks when they are available, while “falling back” to 2G as needed. In doing so, these new devices will help eliminate real-time dead zones by providing coverage for shipments that travel between 2G and emerging LPWAN areas. Devices will be available in dual- and tri-mode network capabilities:

- Dual-mode: Cat-M or NB-IoT with 2G fallback capabilities
- Tri-mode: Cat-M and NB-IoT with 2G fallback capabilities

Navigate the future with cold chain experts

The cellular network transition — from 2G and 3G to 4G, 5G and LPWAN — has created a complex landscape that will be in flux for the next several years. As cold chain experts and cargo industry stewards, Emerson is doing everything possible to help prepare the cargo tracking industry for this ongoing transition. We’re addressing this challenge on multiple fronts.

First, we’re working closely with our customers to determine which real-time trackers work best for their shipping routes, and then providing them with next-generation, real-time trackers to achieve their goals. We’re also working with cellular companies to get a better understanding of the specific timing of 2G and 3G network turndowns. Wherever your business ships its perishable cargo, we’ll help you navigate this cellular transition and achieve uninterrupted real-time cargo tracking.

1  https://www.commsupdate.com/articles/2017/01/18/att-confirms-2g-shutdown-took-place-on-1-january/
2  https://www.lightreading.com/mobile/3g-hspa/verizon-delays-3g-network-shutdown/d/d-id/753147
3  https://www.verizonwireless.com/support/knowledge-base-218813/
4  https://blog.telegeography.com/2g-is-fading-away-but-it-might-outlive-3g-in-europe
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