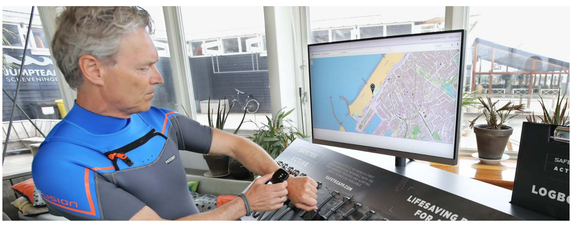
CONNECTIVITY EXPLAINED



What is LTE-M and why should I be interested in it?

The mSafety from Sony is not your normal watch. In fact it's not a watch. It's a wearable computer. So, what is the difference you may ask? Well, it all depends on where you want to start from. A smartwatch or a sportswatch has a very defined set of capabilities. Originally designed to be companions for smartphones, smartwatches started off as a more convenient way to get messages and notifications. They then crossed over into the field of sports competing with dedicated sport watches. With both smartwatches and sports watches, the typical means of communicating is over Bluetooth to the owner's smartphone. The watches were essentially tethered to the smartphones. Bluetooth as most people know is pretty short range, in most cases just a couple of meters. For smartwatch apps that need to connect to the outside world they need to Bluetooth connect to the smartphone and then use the 5G/4G/3G or even 2G modem on the smartphone to communicate to the internet. Not the most convenient and you need to bring two devices with you.

There are smartwatches that now have 4G or LTE (the same thing basically) modems built in. This gives the smartwatch a good deal of autonomy meaning that you do not need to bring your smartphone with you. This is a good thing. On most smartwatches and smartphones not all apps are equal however. The operating system is the king and all other 'third party' (as in not Google or Apple) apps must comply with the device manufacturer rules and are subservient to the operating system. For example, with some smartwatch operating systems, when the operating system decides that it needs to save battery, it will stop all third-party apps from running. A bit inconvenient if your app is SafeTrx Active and it's trying to send an alert message. The other downside is that these watches are using 4G or LTE modems which is the same communication technology as your own smartphone. I can hear you say, 'What is the downside in that', well, the downside is that your phone could have a 2000mAh battery and your watch may have a sub 400mAh battery. Apart from the screen, the modem is the next biggest consumer of power, and you will burn through the battery quicker if you happen to use the modem a lot.

There are other technologies out there that do not consume as much power as cellular devices but it's worth noting what is good about cellular or mobile networks:

1. *They are everywhere and cell coverage in many countries is close to 100% of population centres*
2. *They typically cover coastal areas as well as cities, rural areas, and mountains*
3. *They have rich features, meaning that we can run quite sophisticated applications on the / cellular networks with a decent quality of service*
4. *And they allow roaming from tower to tower and country to country*
5. *Oh, and its relatively inexpensive.*

Cellular technologies cover a broad range of communication technologies: 2G, 3G, 4G and 5G.

While in the process of being phased out by mobile phone companies, 2G is still out there in the market and is used by simple electronic trackers, old mobile phones and embedded devices. 2G is well known for its relatively long range and low data transmission rates.

3G is still quite common and is used by smartphones and is typically short range but high data transmission rates.

4G or LTE is the current smartphone standard with good range and very high data transmission rates. Good enough speeds for streaming video etc.

5G is the new future for smartphones and for large scale industrial broadband as well (it could well replace Wi-Fi in certain circumstances). 5G has three bands; high, medium and low with high having the very highest data transfer rates but short range, medium having high data transfer rates but medium distances and low for long range 4G type data rates.

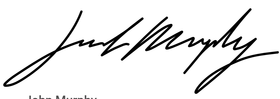
I think it's fair to say that the majority of the general public understand 2G/3G/4G/5G standards in data speed terms (we take voice quality for granted these days). 2G=slow, 3G=kind of fast, 4G=fast, 5G=light speed. And while smartphones have been upgraded to handle these new frequencies, we have definitely noticed that battery life has not increased even though the size of the batteries have. This is the catch. The higher data rates, the faster the battery depletes itself.

This is all well and good but it's not the type of technology we need for small Internet of Things (IoT) devices which have small batteries and don't need to stream the latest shows on Netflix. Fortunately, the cellular industry has recognised this and there are two standards for low power cellular devices. NB-IoT (narrow band IoT) and LTE-M. NB-IoT is a great technology if you want to get a sensor reading once or twice a day and it's in a fixed position. It uses very little battery power, has very long range and it has a pretty slow data transfer speed. The downside is that NB-IoT networks don't like devices that are mobile (roaming between cell towers) or send a lot of data. LTE-M on the other hand is a great solution if you want a mobile, low power, long range technology. It uses the same LTE technology that most cellular companies have today, and it has some nice features that allow developers such as ourselves to build efficient applications.

There are other low power wide area network (also known as LPWAN) technologies out there that compete in the IoT space with NB-IoT and LTE-M and its worth discussing two of them SIGFOX and LORA. Both SIGFOX and LORA are low power, long-range communications technologies used in a lot of low priced IoT sensors. Both run on the unlicensed ISM radio frequency band and neither need SIMs. We did quite an amount of work with these devices and indeed we still have the videos of our work online on the SafeTrx YouTube channel (in the R+D playlist). While these were lightweight devices, we had issues with trying to get two-way messaging to work (for example sending an acknowledgement to the device that the emergency alert has been received) and there was no way to inform the user (easily) that there is no network coverage in the area they are in. Which is kind of important if you are trying to send an alert message.

Finally, and I am very impressed if you have got this far, let's talk a little bit about satellite communications. I will cover PLBs and EPIRBs in a different post so let's just concentrate on satellite trackers for the moment. We have used satellite tracking technology for a couple of years and found it great for tracking vessels and in some cases exchanging very important messages (all be it rather slowly). Satellite tracking is perfect when you are in a remote area such as the mid Atlantic, the Himalayas, somewhere very remote. Communicating with satellites is both slow and expensive, and definitely needs line of sight to the sky. If you are indoors or you have not got a clear view of the sky, then it is likely that the data connection will fail. There are essentially two types of satellite communication devices, ones that communicate to geostationary satellites which offer some reasonable data speeds (reasonable for the 1990s) and low earth orbiting satellites (also known as LEO) which offer 1980 data speeds. The LEO satellites typically just offer data connectivity (although that is changing now), while the geostationary ones, which are further out in space, offer data, voice and video. The length of time it takes to send a message over a LEO satellite network could range for a minute to nearly 20 minutes, while communicating with a geostationary satellite is certainly faster. Getting a satellite transceiver into something the size of a watch while having some reasonable battery life is a bit away yet regardless of what Hollywood tells us!

In summary, we have picked a device that uses LTE-M because it offers the best combination of battery usage, range and quality of service in a really small, less than 40 gram package. We think it's a good choice.



John Murphy
CEO, 8 West Consulting