The IoT Smart Cities and Connectives

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IoT Smart Cities and Connectives

A research by Smart Cities Market predicts the smart cities market is expected to grow from $308 billion in 2018 to $717.2 billion by 2023. These figures do not only show how much investment is expected to be channeled to smart city solutions, but also how fast this industry is expected to grow in the next coming years. Ford has also promised to deploy cellular vehicle-to-everything (C-V2X) technology in all new U.S. vehicle models starting in 2022, as explained in Medium. These vehicles may require the smart cities infrastructure to have some significant level of intelligence and connectivity for them to fully show their capabilities. Smart cities will be enhanced by Internet of Things (IoT) solutions consisting of the following:

1. Sensor devices located within the smart city infrastructure to sense various conditions.

2. Smart city platform responsible for analyzing data from the sensors, communicating actions back to actuators and providing visualizations to the users.

3. Ubiquitious and resilient network connectivity, which is the other most crucial component ensuring communication between the sensor devices and the platform.

Network connectivity may either make or break a smart city solution, i.e., a very wise and intelligent choice has to be made in order to come up with a long-lasting sustainable solution. This article discusses some of the key considerations in choosing the right network for a smart city solution.

Resilient network connectivity may either make or break a smart city solution set. Smart cities should be built with a healthy range of wireless networking technologies.

Readily Available Cellular Wireless Networks

Most countries are working hard to catch up with this fast-growing field, which is promising to make city lives much better and more efficient. Solutions using readily available cellular technologies have been proposed, and some of them may have been deployed in various countries. Most countries already have a wide coverage of the Long-Term Evolution (LTE) in most of their cities, which can be used to offer connectivity for these new solutions.

Most buildings already have ubiquitous coverage of WiFi, which can be a faster way of deploying smart city solutions. Some may prefer hybrid solutions using SMS to communicate information from sensor devices to the platform via a GSM or CDMA network. These wireless networks can provide the needed communication for smart city solutions, which is usually small bits of data containing information about states of various conditions.

The advantage with readily available networks is that they are already covering most of the areas and therefore any organisation can develop a solution to address a certain field of smart city solutions without huge investments on the network infrastructure. This can encourage more organisations to contribute to building smart cities. Mobile operators also get more business by offering connectivity to the

exponentially growing number of IoT devices, which is expected to reach over 50 billion by 2020. However, using technologies like LTE and CDMA may result in the slow adoption of smart city solutions as consumers would prefer to get such services for free rather than at a price.

Mobile networks are usually priced a bit high because of the nature of their intended use and the huge licence fees required for transmission rights. Also, these technologies may involve usage of very expensive sensor devices requiring regular maintenance and recharging. Due to these high costs, readily available wireless networks on their own may not suffice for smart city solutions. Municipals may not have enough funds to pay for these services on behalf of consumers as well.

Recommended Low-Power Wide-Area Networks (LPWANs)

Various IoT specific technologies have been proposed over the years, and these are increasingly being adopted as the IoT space continues to grow. These wireless networks are designed to offer fast, efficient communications of the small bits of data usually transmitted in various smart city solutions. They're designed to ensure very long battery autonomy for the various sensor devices used in smart cities. Some of the most popular LPWANs are NB-IoT, Sigfox and LoRaWAN. LoRaWAN operates in an unlicensed radio spectrum and uses lower radio frequencies with a longer range. These are region specific with Europe, operating in 863-870 MHz frequency band, US 902-928 MHz, Australia 915-928 MHz, China 779-787 MHz and 470-510 MHz, and probably Africa will have its own range after the World Radiocommunication Conference 2019 (WRC-19). This could be one of the best technologies for smart cities due to the design specifications.

The long range offered by the technology ensures that an affordable network infrastructure budget is required to deploy smart city solutions. Also, the fact that it uses an unlicensed radio spectrum opens up the smart city innovation and contributions space to anyone and not just the large mobile networks. Organizations may use the radio frequencies without having to pay huge licence fees for transmission rights. The only disadvantage may be the availability of devices in areas where the above-mentioned frequency ranges are already in use for other technologies.

Sigfox offers LPWAN solutions (although not currently deployed in the US) for smart cities, which drastically brings down cost and energy consumption required for securely connecting IoT sensors to the smart city platforms in the cloud. It uses Ultra Narrow Band (UNB) radio technology and operates in the unlicensed bands (868 to 869 MHz and 902 to 928 MHz, depending on the region). Sigfox also has the same advantages and disadvantages as LoRaWAN. In Africa, it's only present in South Africa; hopefully, more countries will be covered very soon.

NB-IoT is another popular connectivity for smart cities and IoT, developed to enable connectivity for a wide range of new IoT devices. One of its advantages is that it can coexist with 2G, 3G and 4G under licensed frequency bands (700 MHz, 800 MHz, and 900 MHz), occupying a frequency bandwidth of 200 KHz. This is most likely the favorite of many manufactures and network operators, as it complements what they already have. It is however a disadvantage to other organizations not intending to pay huge licence fees for those licensed frequency bands; therefore, it may discourage the contributions of other smaller startups.

So, Which One Is Best?

All the networks are better in their own way, as explained above, and the choice of which to use may vary depending on the requirements, timelines and budget. The conclusion is that a heterogeneous network approach is necessary for smart cities. Smart cities should be built using solutions and connecting via a wide range of wireless networks, including the new 5G wireless. Therefore, regulators should open up the frequency space in support of these technologies.

About the Data Science Foundation

The Data Science Foundation is a professional body representing the interests of the Data Science Industry. Its membership consists of suppliers who offer a range of big data analytical and technical services and companies and individuals with an interest in the commercial advantages that can be gained from big data. The organisation aims to raise the profile of this developing industry, to educate people about the benefits of knowledge based decision making and to encourage firms to start using big data techniques.

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