Smart cities:
What are the opportunities and threats for telcos?

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Introduction

There has been plenty made of the future market size of Internet of Things (IoT), and almost everyone in the telecoms industry is very familiar with numbers claiming "IoT will be worth billions by 2020". However, it would be fair to say that the IoT market in general failed to capture the public's imagination in 2016, with the majority of consumer offerings being picked up by early adopters and tech enthusiasts – it will still take some time before IoT solutions are more pervasive in society.

However, that said, one area where IoT is beginning to have an effect is in the smart cities and smart buildings industry. Mass rollouts of IoT in an industrial setting, including urban environments and business hubs, are beginning to garner success. If one were to look at the most recent figures, the opportunity for industrial applications of IoT in global cities becomes all the clearer and more compelling.

According to Gartner, there are now more than 220 cities across the world housing more than 1 million citizens. Of said 220, 90% are in emerging markets. In respect of varying levels of affluence across these 200-odd cities, it would still be fair to make the assumption that deploying even the most rudimentary IoT-ready sensors should be possible. With that in mind, the opportunity for smart cities infrastructure, and specifically the building out of smart buildings, is abundantly clear.

This paper will investigate the smart cities opportunity, and how the smart building figures as part of a city-wide IoT strategy. More importantly, we will look into how the telco typically figures as part of such IoT deployments.

Setting the scene

Some of the principal use cases for IoT across a city focus on integration between the city's infrastructure and the connected car. The momentum behind the connected car refuses to relent, as has been illustrated by the frenzy of activity at 2017's Consumer Electronics Show in Las Vegas. It stands to reason, therefore, that any city-wide IoT strategy should factor in road-based transport as one of its key elements.

In the infrastructure space, you might see more players coming together when they realise that smart cities technology can be more than just practical, it can be lifesaving. In the connected car area there's a lot of work going on with V2X (Vehicle-to-Anything) and the development of V2V (Vehicle-to-Vehicle) to standardise protocols between vehicles.

When it comes to autonomous driving, and the move towards level 3, 4 or 5 autonomy, the vehicles need to be able to communicate with each other. That in itself is driving more standards work, and it's likely that full autonomy won't be achieved for another five years at least.

Such inter-vehicle connectivity brings into question the role of the telecoms operator in the future IoT industry. Historically everyone would consider the telco to be the glue that holds together entire technology industries requiring connectivity. However, in recent years, the emergence of alternative IoT proprietary networks, such as SIGFOX and LoRA, have given birth to a significant threat to the operator's position within the industry. ›

About InterDigital:

InterDigital, Inc. designs and develops advanced technologies that enable and enhance mobile communications and capabilities. Since our founding in 1972, our engineers have designed and developed a wide range of innovations that are used in digital cellular and wireless products and networks, including 2G, 3G, 4G and IEEE 802-related products and networks.

For over four decades, InterDigital has been a pioneer in mobile technology and a key contributor to global wireless standards. Our team of approximately 160 engineers – approximately 80 percent of whom hold advanced degrees, including over 50 PhDs – has unparalleled expertise in major mobile connectivity and content delivery technologies. Since 2000, InterDigital has spent over $1 billion on technology research and development.

How does the telco figure?

While 2016 saw significant growth of these alternative players, research interviews conducted by Telecoms.com have suggested that the broader services offered by the telco are irreplaceable and absolutely fundamental to the successful delivery of IoT strategies – particularly across smart building and smart cities projects.

One incredibly important factor comes down to access to the core network and delivery of OSS/BSS functionality in the backend. When it comes to IoT and smart connectivity, whether it's in buildings or on city streets, it's extremely important to have work flows that the service providers are able to support based on the execution of the work flow and the billing of it. If smart city or smart building projects don't have core OSS and BSS implemented, customers won't be appropriately charged for the services they're using.

Elsewhere, the telco is vitally important when it comes to onboarding new customers of IoT services. The average portfolio of IoT services provided by a telco would average out at roughly several thousand devices. The telco itself needs to have a standardised framework for onboarding those devices, ensuring interoperability of which device talks to which. It's not just at a protocol level, but also about understanding what data is coming off of which devices. How is that data capable of being cleaned or scrubbed and analysed in the most appropriate fashion – it's down to the capabilities of the telecoms operator.

To make all of this possible, the telco is also becoming increasingly responsible for developing and delivering the dashboard and user interface that it sells to enterprise customers. With a sophisticated dashboard, enterprise users are able to analyse the data being generated by IoT applications, and can appropriately query or visualise it. Teams of data scientists are building out algorithms to test hypothesise, to recommend action based on analysed insights.

An interesting development in the smart buildings space at the moment is how government and cities are driving their own agenda and competitive strategy with regards to attracting business and growing its GDP. This strategy has seen a reverse in the traditional telco/client relationship. No longer is technology adoption driven by the telcos pushing solutions anymore, instead it's all about demand from the building developers and the city in which the structure will be developed. The fact that cities now employ their own CIOs today is a telling indication of the demand-supply relationship power shifting.

Once the property developers have decided what they want from a technology solution and fully defined its requirements, they can then approach the operator to find out how they are able to provide the appropriate services. In many Western cities, fibre to the home (FTTH) is beginning to be developed as standard in new office blocks, retail spaces and apartment complexes. FTTH can cater for seemingly infinite bandwidth requirements, and will, in all likelihood, form the backbone of the future smart building.

Driving efficiency

While FTTH is being built-in as standard today, is there an opportunity for IoT sensors and capabilities to be developed as standard in the future? There would certainly be a significant business justification, and in this case it is worth considering the vast efficiency gains of building in IoT functions as part of future building designs.

Principally, there's the opportunity to significantly reduce energy and resource consumption. Latest figures from the United Nations Environment Programme claim that buildings are responsible for the following:

- 40% of global energy
- 25% of global water
- 40% of global resources
- Emit approximately 1/3 of all greenhouse gas emissions

On top of this, UNEP also says that residential and commercial buildings consume approximately 60% of the world's electricity. Therefore, there exists an overwhelming opportunity for efficient IoT solutions to bring down unnecessary consumption. Of course, from a business perspective, intelligent sensors gauging requirements for lighting, heating, etc., can drastically reduce wasted use of energy. ›

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To put energy efficiency gains into a more realistic context, figures from PhysOrg.com suggest the US alone wastes nearly 60% of all energy it consumes due to inefficiencies relating to building maintenance, heating, lighting and transport. This, despite alleged progress being made in renewable and sustainable energy sources such as solar and wind.

That number is further exacerbated when the vehicular industry is looked at in isolation. While industrial sectors waste roughly 20% of the energy they consume, transportation is 75% inefficient – indicating that automotive transport is the least efficient means of getting from A to B. While specific predictions of energy savings across a whole city isn't going to be wholly accurate at this stage, it is perfectly valid to suggest there is an incredible amount of room to play with in terms of reducing energy consumption and particularly wastage through the adoption of smart infrastructure.

PhysOrg also studied smart city efficiency gains as part of the EU-funded BESOS project. Trials were conducted across a range of city-based infrastructure, and concluded that IoT rollouts across buildings and cities have the potential to deliver 30% cost reduction by minimising energy inefficiency, with deployment CAPEX being recouped within 5 years. The numbers are beginning to back up the theory.

To extrapolate that a step further, using the UN statistics saying 75% of global energy is consumed by cities, the International Energy Agency says the world consumes 12.3 TW of power per year, the equivalent of 9,301 megatons of oil (MTOE). 9,301 MTOE equates to approximately 66.5 billion barrels of oil. If we were to extend the energy savings based on smart technologies mentioned in the previous paragraph (approximately 30%), we can extrapolate the equivalent savings of 2,093 MTOE every year - roughly 15 billion barrels, the equivalent of 41 million barrels of oil a day.

Despite the potential benefits of smarter constructions, one of the biggest challenges in all of this is ensuring broadband penetration. For a significant percentage of cities, especially in emerging economies, lack of broadband infrastructure prohibits the creation of a smart city environment. For a lot of cities, there's a substantial conundrum most rudimentary in its nature, and that is how to encourage service providers to come and participate in public private partnerships to ensure that every citizen gets connected.

Government support is required, of course, but one of the principal challenges with bringing in connectivity and working on a smart building or city project for operators is avoiding myopia. A short-sighted view on return on investment will inevitably end in failure or a project aborted before it has been concluded. A smart city or smart buildings project won't deliver an ROI on a strategy based on one or two-year payback cycles. Instead, it has to be a longer term view over a five to 10-year period.

Separately, smart transport infrastructure is likely to be one of the most dominant weapons in the fight to reduce emissions and to consume less energy resources. In aid of targeting reduced energy emissions, governments need to incentivise and encourage telecoms operators to develop infrastructure across the city which can feed into individual building projects, without having to take on board the entire risk or cost. All of the elements of a smart cities project are logical evolutions of today's society – education, connectivity, reducing carbon emission, quality of life, improving communications and transportation. While it is widely considered that such projects are the way to go, what is less clear is the investment strategy for the required infrastructure.

A united approach

What is becoming clear is that this is not an industry that any one stake holder or player can dominate, and that the operator is very much to be considered to be the connectivity glue to help integrate all of the players in that ecosystem. Whether that be the platform provider, or the company that analyses the workflows in action, or the connectivity provider, or the manufacturer of sensors and smart infrastructure, or the city's council or government. That too extends to building management and property development organisations, particularly when defining the use case for smart buildings. One must, too, take into account what the residents of a city or the organisations therein desire from an infrastructure.

The approach of "build it and they will come" is one that is becoming increasingly out of touch with modern society. Smartphone consumers are becoming ever more expectant of a tailored or bespoke service from their mobile operator, and the same applies to enterprise companies looking to design a new HQ in a city. ›

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Before building anything, however, the basic premise of reverse in-building intelligence into a city's infrastructure must be considered an option. The biggest problem for smart cities, particularly in the West, is legacy.

Connectivity and IoT aspirations can be swiftly curtailed because of ageing infrastructure that is limited in its capabilities. In some cities across the world, basic power is a constant struggle because transformers buried deep underground can blow easily. In ageing cities, maintenance teams from utilities firms need planning permission from the council in order to break ground in an area that wasn't supposed to contain old wiring.

It is a classic challenge a city will face while developing a smart infrastructure. In developing markets like India, however, construction predominantly occurs above ground. Breaking ground becomes far less complicated when it is just electricity pipes and sewers buried underground. Although, in some places there are of course challenges with ancient cities, ruins or artefacts being buried deep underground. But even before breaking ground, the fundamental proposition of the city's technology strategy needs to be concentrated, focussed and purposeful.

Cities of the future need to have a unique selling point; a focus that will define technology use cases, and therefore build infrastructure around that. To that extent, there are a number of cities around the world whose infrastructure has been specifically designed to allow businesses in specific industries to thrive.

If you were to think of large scale manufacturing, you'd probably think of Shenzhen in China. If you think of advanced biotech, you'd probably associate it with Cambridge in the UK. Computer science is synonymous with Silicon Valley, and similarly autonomous driving with Nevada. In each case the investment in technology has been appropriately directed to ensure the necessary infrastructure is in place to attract businesses of a specific industry.

Conclusion

Throughout this paper we have been constantly reminded that in order to achieve the extraordinary benefits of smart cities, and smarter building automation therein, collaboration between multiple companies in an ecosystem is essential. Rolling out an arbitrary set of technologies for technology's sake doesn't necessarily yield improvement, but a predefined technology journey for citizens and businesses of a city has the potential for an incredible amount of positive change.

One potential route for doing so is to start at the desired ends and working backwards through the steps required to get there. Many of the original smart cities projects from a decade ago are going through a complete replacement of the underlying technology. The reason for this comes down to a lack of strategic clarity, and strategies were being developed without the full scope of the project being defined in the first instance.

We're now looking at a natural lifecycle of technology replacement of roughly seven to ten years, where the majority of technology fails through excessive usage. From an architectural standpoint, products need to be designed for both scalability and upgradeability, which relates to both hardware and software upgrades provided over the air. The fact of the matter is that there's an element of futureproofing sensors and devices in the market against a future technology environment that's very, very difficult to predict. The software side of things is slightly easier to predict, or at least rectify, thanks to the emergence of cloud computing and the subsequent delivery of incredible compute power.

The combination of IoT technology, cloud computing and superfast broadband connectivity means that a sophisticated strategy from building owners, management companies and governments, in conjunction with telecoms operators, can have the ability to change how society operates. The potential benefit to city councils, to businesses and to telcos can be revolutionary, but the imperative nature of devising a collaborative strategy cannot be understated. ■

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InterDigital, Inc. (NASDAQ: IDCC) believes that the Smart Cities market and its associate segments which include Smart Buildings, Intelligent Transportation, Energy Management, among others, are all lucrative and growing IoT markets. Our belief is cemented by our own investment and initial successes in those areas. We have seen first hand how these segments can carry legacy burdens and regulatory challenges which are often more exemplified in developed rather than in emerging markets. We have also seen the demand for more standardized approaches and the absolute necessity of partnerships. This is why we believe that Telecom Operators are in a great position to step up and take a lead in Smart Cities markets. They are deeply familiar with regulations, standardization, and large infrastructure management or network overhauls. Furthermore, they have the existing relationships with different ecosystem players to be able to drive a more collaborative and unified strategy.

InterDigital provides horizontal solutions that integrate and manage connected devices and data feeds across industries and diverse communication networks. This is our own way to solve existing challenges and foster further market growth. With our wot.ioTM solution, we facilitate aggregation and transformation of varied, disparate and legacy data sources into unified systems. With our oneMPOWER™ solution, which conforms to the global oneM2M™ standard for the IoT, we take a long-term view of an open standard which lowers the risk of vendor and technology lock-in while future-proofing investments to capitalize on future IoT innovations.

In two complementary smart city applications, oneTRANSPORT™ and Smart Routing, InterDigital's oneMPOWER™ powered by wot.io™ platform is being used to demonstrate the world's first open and scalable IoT platform enabling multi-region, multi-modal and multi-system transport integration across geographies in the United Kingdom. Working with 14 other public-private partners, this solution is driven by dynamic business models which are supported by a brokerage structure based on an open marketplace for data and services. Similarly, InterDigital is developing other Smart Cities solutions such as Environmental Monitoring or Smart Buildings and Energy Management with its premier partners such as HARMAN International (NYSE: HAR).


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