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City Of Dublin: Lessons From A Smart City Private Network Deployment

A Technical Paper prepared for SCTE•ISBE by

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1. Introduction

According to Harbor Research and analysis by Fujitsu, the Smart City market will reach $5.6B in North America by 2025.

Cities own hundreds of departments that are using software targeted to their functions. These datasets are generally local to the organization. In addition, real-time access to digital representation of city's physical assets are rare.

Using the CBRS-band (Citizens Band Radio Service), cable companies can build private networks for cities to bring together disparate systems and make it economically feasible to digitize and access physical assets in real-time. Visibility to data from multiple systems will provide insight to improve operational efficiencies, provide better experiences for citizens, and improve environmental impact.

In this paper, we will discuss the lessons learned from our private network deployment and Parking Occupancy App that was deployed by City of Dublin. We will also discuss the positive unintended consequences of the private network and App during COVID-19 outbreak.

2. Smart City Market in North America

$ Millions

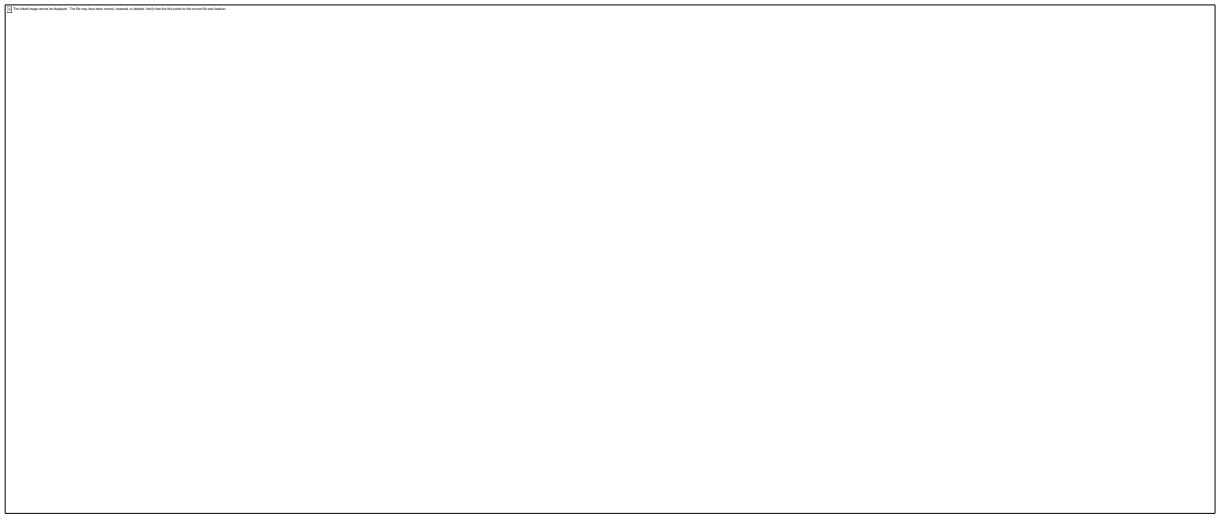

Figure 1- Smart City Market North America

Table 1- 5G NA Market

Smart Cities NA	2020	2021	2022	2023	2024	2025
Public	$425.8	$782.7	$1,285.2	$1,987.2	$2,954.1	$4,270.6
Private	$151.48	$273.17	$438.81	$661.97	$957.79	$1,347.72

Source: Harbor Research & Fujitsu Extrapolation

3. Why is Digital Transformation Important to Cities?

Digital representation of cities' assets such as parking spaces, roads, utilities and fuel consumption is important to the cities because it provides citizens with better experiences, reduces the carbon foot print, improves emergency response, and reduces operational cost.

Historical data based on the digital representation of assets and processes help cities better understand their operations, predict the future, and improve decision making and planning processes.

Software virtualization, low cost sensors, cameras, GPUs, and most importantly the shared spectrum have enabled this digital transformation to be economically feasible.

4. Parking Occupancy App

Customer Problem

Multiple congested parking lots and lack of parking management impact local businesses

Solution

Private network and edge computing with video surveillance and analytics

Figure 2- Smart Parking, City of Dublin

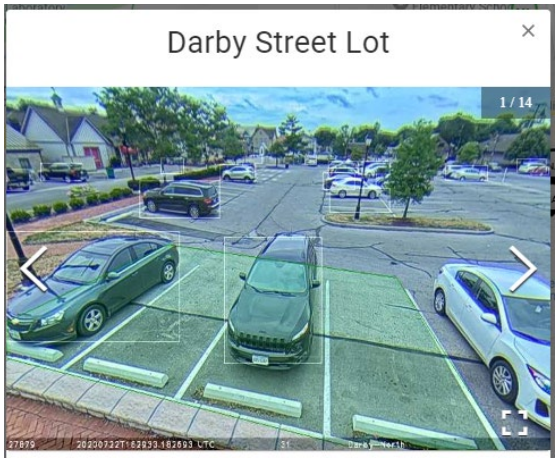

Figure 3- Darby Street Lot

5. Dublin Architecture

The physical connectivity in the City of Dublin included, Radios, BBU (Base Band Unit), cameras, and CPEs (Customer Premise Equipment). Radios and BBU were installed on a utility Pole at the parking lot. The cameras and CPEs were installed on the city light poles around the parking lot.

Application software used the whilebox servers that provide network functionality. The Video-Analytics software ran on the MEC (Multi-access Edge Compute) node. IoT-framework and application software ran on the Core.

Figure 4- Dublin Architecutre

6. Why CBRS?

Many critical Enterprise applications that require low-latency, high bandwidth, or a massive number of connections cannot be solved using Wifi (Unlicensed Spectrum) or are economically infeasible to address through public networks (licensed Spectrum).

FCC opened CBRS (Citizen's Broadband Radio Service) which operates at 3.5 GHz band and allows 80 mHz of spectrum to be shared. CBRS is not unlicensed spectrum like Wifi, and it is not licensed spectrum that is controlled by the service providers. It is a new concept where the spectrum is shared in a 3 layer model. When an incumbent is not fully utilizing the spectrum, the Authorize Access Users can jump in and use the spectrum. SAS (Spectrum Access Sharing) is provided through 3rd party vendors (Google, Commscope, SONY, ...) that control access.

Cable companies can provide access points that are CBRS-enabled and enter the wireless market to provide Private Networks or Neutral hosts services to enterprises and cities.

Source: commscope

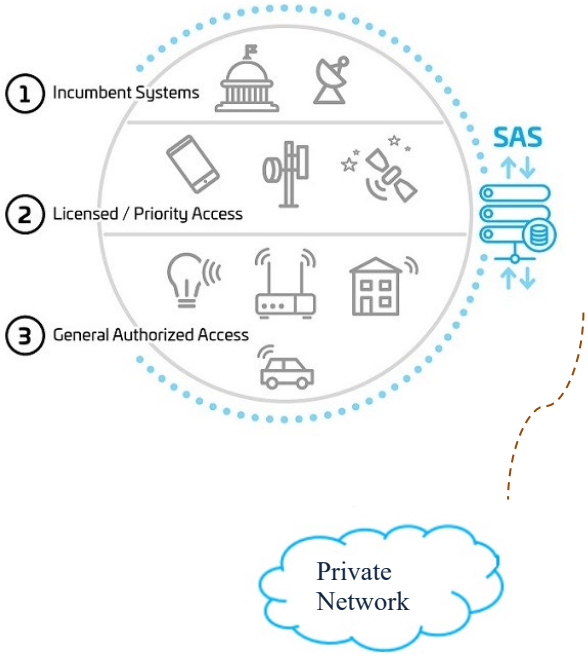

Figure 5- CBRS Architecture

7. Lesson #1 – Deployment

- Permitting and inspection takes time
- Installation can be expensive
- MEC connectivity should be planned early
- Cameras are not UE's (today)
- Appearance Matters - Customer facing eqpt must look professional and SW must be intuitive

8. Lesson #2 – It is all about data

- Automatic data collection is important
- Site access statistics can alert hacks/security attempts
- Data must be simplified through Graphs/Charts in order to facilitate quick path from "data to decision"
- Open APIs are a must
- Access to real-time images/video streams is important

9. Lesson #3 – Environmental challenges

- **Rain & Snow** – Rain drops and snow flakes can attach to the camera and cover portion of the view. This will effect the accuracy of the Video-Analytics
- **Trees & Leaves** – As spring roles around, the leaves on the trees may obscure portion of the camera view.
- **Storms and high wind** – Camera attachments must be highly secure to avoid camera movement during a storm, if the cameras move, adjustment must be made to correct field of view.
- **Sunset/Dusk** – Visibilty of the camera view is effected by the change of lighting during sunset.
- **Length of the attachment poles** – If cameras are attached to short poles, the visibility is reduced and more cameras will be required.

10. COVID-19 - Compliance

Although the goal of the project was to better understand the parking congestion, the project allowed City of Dublin staff to remotely monitor compliance to COVID-19 “Stay at Home” orders.

Remote access to the city resources can save lives by eliminating the need for city staff to physically come close to the public.

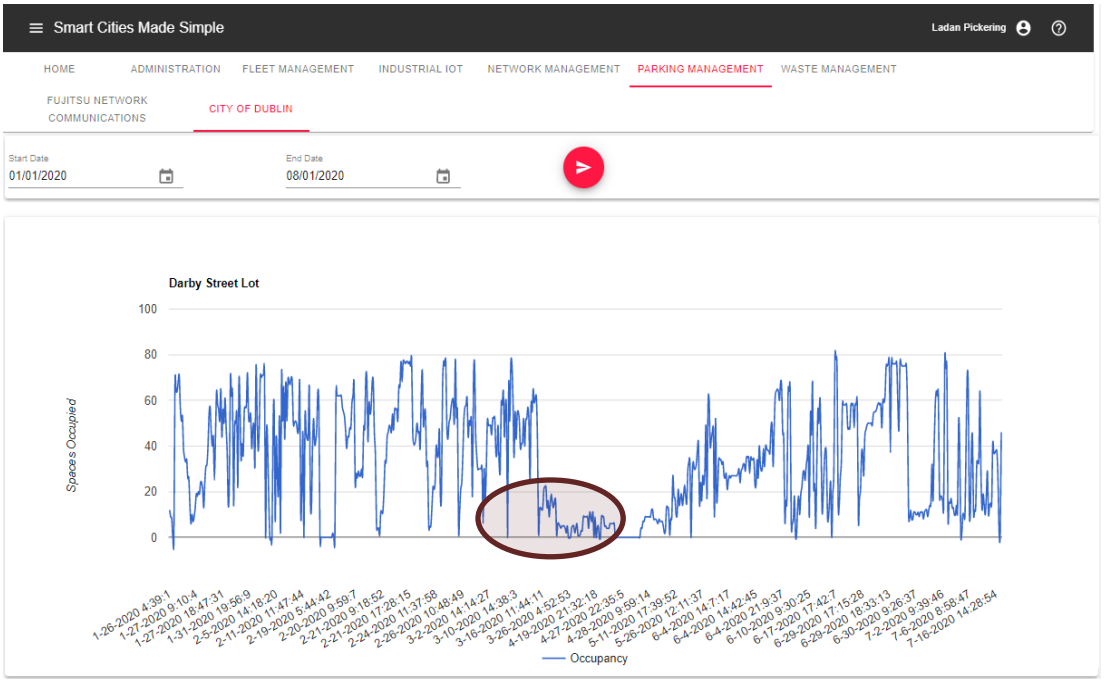

Figure 6 - COVID-19 Compliance

11. Conclusion

Private Networks enable deployment of additional Apps. Now that the Dublin Private Network is in place, we can add our COVID-19 based applications (Smart Distancing and Smart Masks) over the air to the network servers to enable additional compliance measurements.

The low cost of CBRS allows cable companies to enter the wireless market by building private networks for enterprises and cities. Once the network is in place, the white box servers that provide network function virtualization can be re-used to run additional application software and therefore, allow cable companies to provide Apps that provide digital twins of Cities' assets.

Abbreviations

App	Application Software
BBU	Base Band Unit
COVID-19	Coronavirus 2019
CPE	Customer Premise Equipment
CBRS	Citizen's Broadband Radio Service
FCC	Federal Communications Commission
GPU	Graphics Processing Unit
ISBE	International Society of Broadband Experts
MEC	Multi-access Edge Computing
SAS	Spectrum Access Sharing
SCTE	Society of Cable Telecommunications Engineers
UE	User Equipment