5G

and Future Connectivity

An Emerging Framework for Irish Cities and Towns

Executive Summary

SMART DOCKLANDS
A Smart Dublin District

An Roinn Forbartha
Tuaithe agus Pobail
Department of Rural and
Community Development

Comhairle Cathrach
Bhaile Átha Cliath
Dublin City Council

Sligo County Council
Comhairle Chontae Shligigh

CONNECT
SFI Research Centre for
Future Networks

Contents

01 Acknowledgments and Background to the Report

This report is funded and supported through the Digital Innovation Programme which is administered by the Department of Rural and Community Development. The project was led by the Smart City team based in Dublin City Council and the Smart Docklands team in collaboration with leading telecoms experts.

We would also like to acknowledge input, comments, and feedback, from the Department of Rural and Community Development, CONNECT - the Science Foundation Ireland Research Centre for Future Networks and Communications, Sligo County Council, as well as the National Broadband Officer Network.

A number of one-on-one interviews were held with telecoms operators and vendors. Additionally, an online survey was carried out to gather opinions from two main perspectives: telecoms vendors/ mobile operators (11 respondents) and broadband officers (representing 21 out of 31 local authorities) from across Ireland.

This report was designed to enable local authorities across Ireland to consider the implications that 5G and future connectivity needs will have on their future planning and development policies. It sets out to achieve the following:

- **To bring together industry and academic experts, local authority, as well as other public asset-owners to catalogue and address issues related to the deployment of 5G across Irish cities and towns;**

- **To develop a suite of recommendations to support a rollout of 5G access across Ireland.**

The impact of Covid-19 has highlighted the importance of current and future connectivity needs not just in city centres, but also across our suburbs, towns, and rural communities. In a world where remote working is a necessity, we need to future proof our cities, towns, and communities, to support more flexible working options in a way that protects Ireland's future competitiveness. This executive summary, and full discussion paper report, is intended to stimulate debate and discussion from all stakeholders to ensure that Ireland realises its connectivity potential. For more information on the full version of the 5G discussion paper, go to the following: http://smartdocklands.ie/5G

Disclaimer: This document is intended solely for discussion purposes only.
*All content is based on current knowledge and may change over time.*

02 Introduction

5G stands for "Fifth Generation" Wireless Technology, also known as the next evolution of mobile technology after 4G LTE. 5G will bring faster speeds, higher capacity, lower latency, improve efficiency and reliability, as well as sustain much more connections between devices and the internet. The technology that underpins 5G (based on higher radio frequencies) is a step change from 4G networks, meaning local authorities will have to play a much larger (and more active) role in supporting the roll out of 5G.

The higher we go in radio frequency, the better our 'connectivity performance' but the poorer our 'penetration performance' across buildings, glass, and other materials in the urban landscape. The first option to address this challenge is to deploy even more of the conventional cell towers currently in existence e.g. macro cells. However, this is simply not economically and logistically viable. The most likely solution would be to deploy additional 'small cells' to complement existing macro cells, to ensure pervasive coverage on these higher frequencies. These small cells will likely need to be deployed in high numbers and densities across our cities and towns.

This executive summary provides a 'high-level snap-shot' of Ireland's 5G proposition, including its importance, the key stakeholders involved, the current roll-out situation, and most importantly, it delivers a set of recommended actions to fully take advantage of this game-changing enabler of growth.

What Are Small Cell Deployments?
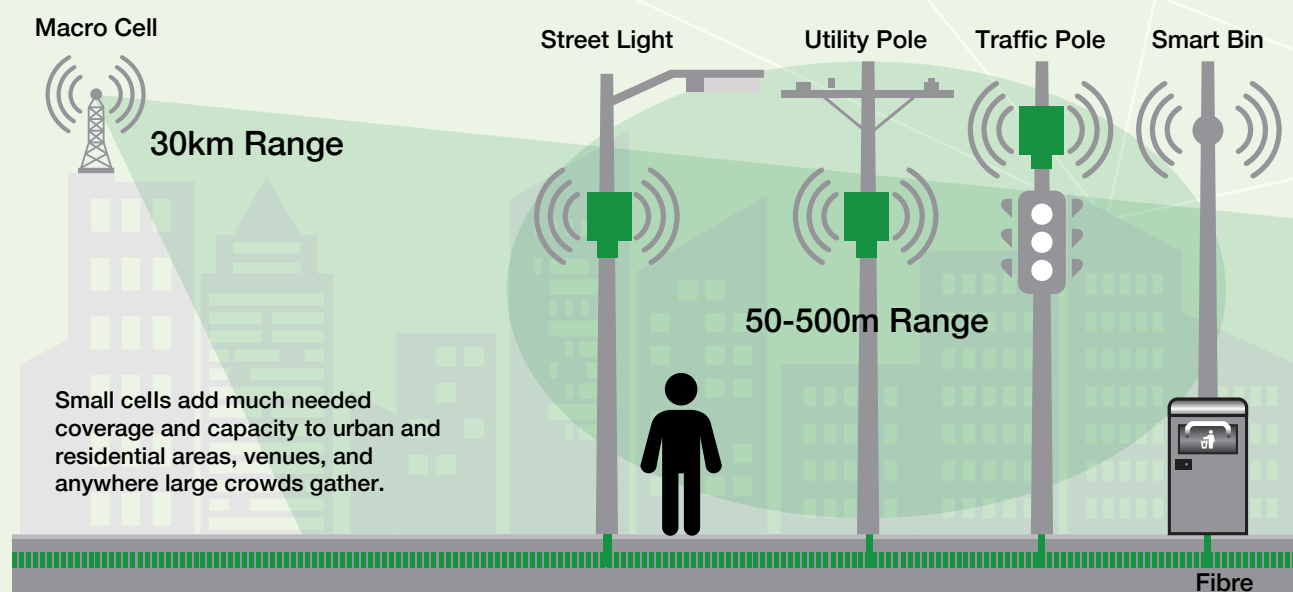
Small Cells will complement the existing macro cell, ensuring pervasive 5G coverage.
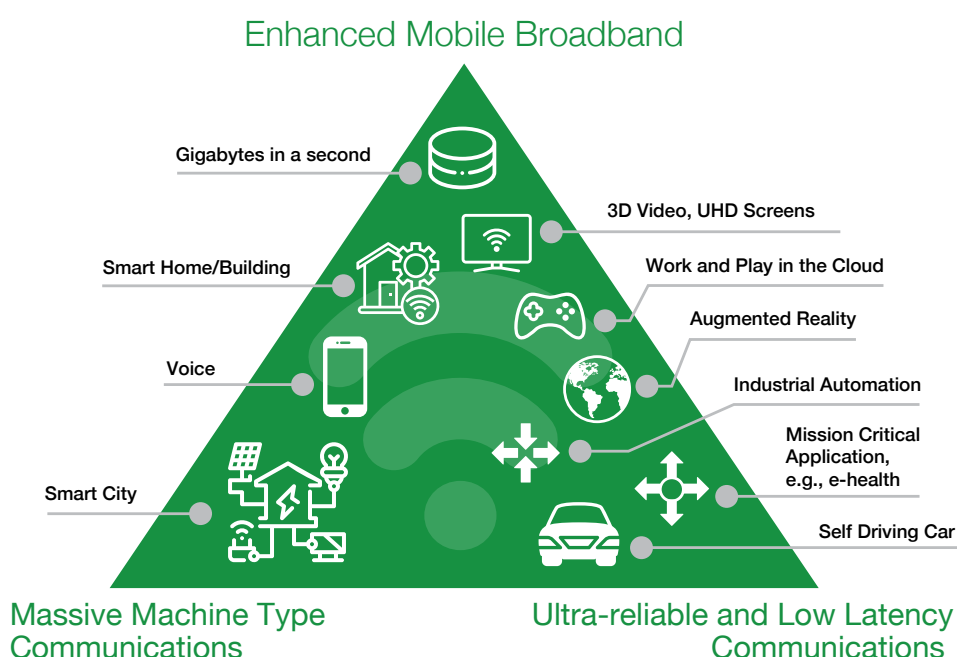
03 Why Is **5G** Important?

The global economy is at a pivotal point as we see a move towards an increasingly connected society driven by the Internet of Things (IoT), Artificial Intelligence and Big Data. The application and impact of these emerging technologies however, will be reliant on the unimpeded 'gigabit' connectivity that 5G will provide. Economists estimate the global economic impact of 5G through new goods and services will reach $12 trillion by 2035[2]. The pace of adoption of these types of technologies will become the basis for long-term national economic growth.

> Economists estimate the global economic impact of 5G through new goods and services will reach $12 trillion by 2035.

We took some time to see the impacts of 4G technology and how its deployment changed our personal, social, and commercial landscape forever. For example, think about how we take google maps, ride-hailing apps, and the streaming of YouTube, Netflix, Google maps and Spotify as everyday occurrences on our smartphones. It was hard to predict our current reliance on mobile data and smartphones as short as a decade ago!

Having said that, 5G is not simply an extension of 4G, nor is it merely a faster wireless technology. 5G will serve as the basis of connecting billions of devices of almost any type, and the collection of data from those devices in real-time. It will serve critical use-cases that would need to rely on this real-time communication on a massive scale. Similar to our current dependence on 4G connectivity, it is almost impossible to predict the fullest extent of opportunities 5G will deliver, other than the fact it will create our new baseline of 'normal'. The below diagram illustrates just some of the key uses expected from 5G connectivity, such as enabling Self-Driving Vehicles, and connecting sensors to provide powerful data-driven insights for local authorities (i.e. Smart City).

5G Usage Scenarios

Enhanced Mobile Broadband

- Gigabytes in a second
- 3D Video, UHD Screens
- Smart Home/Building
- Work and Play in the Cloud
- Augmented Reality
- Voice
- Industrial Automation
- Mission Critical Application, e.g., e-health
- Smart City
- Self Driving Car

Massive Machine Type Communications

Ultra-reliable and Low Latency Communications

---

[2] WeForum - https://www.weforum.org/agenda/2018/01/the-world-is-about-to-become-even-more-interconnected-here-s-how/

5G and Future Connectivity: An Emerging Framework for Irish Cities and Towns

04 Ireland's Key **5G** Stakeholders

There are a number of key stakeholders influencing the 5G agenda in Ireland, such as state bodies like the Commission for Communications Regulation (ComReg), The Department of Communications Climate and Environment (DCCE), Electrical Supply Board Networks (ESBn), and local authorities, as well as private sector actors such as mobile operators, vendors and asset owners. If Ireland is to deliver world class 5G services it will require a joined up approach as well as streamlined regulatory and policy responses.

The **5G** Ecosystem in Ireland

Key stakeholders with roles in realising 5G in Ireland

05 Where Are We Right Now?

From a commercial perspective, the first wave of 5G deployments are being deployed across Irish cities with Vodafone and Eir announcing their first offerings at the end of 2019. What is clear is that the telecoms industry is just at the start of the 5G journey and it is likely to take 5-10 years before there is a mainstream adoption and commercialisation of these services.

> If Ireland wants to position itself as a global leader and be at the forefront of technological innovation, it is essential that we embrace 5G as it scales out over the coming years.

This poses questions as to how 5G deployments will play out geographically in Ireland as the technology is more challenging to deploy in high levels of concentration, which is critical to enable the fullest extent of its value. The first wave of 5G networks in Ireland are supported by spectrum in the 3.6 GHz frequency band (auctioned by ComReg in 2017). A further auction of spectrum is expected to take place this year in 2020, where ComReg is proposing to release low-band spectrum (700 MHz, 2.3GHz, and 2.6GHz).

If Ireland wants to position itself as a global leader and be at the forefront of technological innovation, it is essential that we embrace 5G as it scales out over the coming years. At its most basic level, this will require us to align our national research and science agenda, facilitating testbeds that support local and international industry R&D teams.

Examples of this include one of the first 5G neutral host deployments across Dublin's Smart Docklands as part of a research and industry partnership with CONNECT research centre for future networks, and Dense Air Ireland.

Ireland should be in prime position to take advantage of the opportunities 5G will present us in enabling improved quality of living, working, and economic activity

06 Why Local Authorities Must Get Involved

Local authorities, by virtue of their sheer operational influence and ownership of assets such as poles, ducting and street furniture in key locations will play an instrumental role in Ireland's path to 5G. The criticality of collaboration and engagement between local authorities and stakeholders such as mobile operators, and electricity supply will be elevated with 5G:

> *"In the future local authorities, street asset owners and building owners will play a key role in the roll-out of 5G - this will require new ways of working and partnerships if we are to realise the opportunity"*

> *"Key priorities for the rollout of 5G for local authorities will include: Minimizing road openings and associated disruptions, shared use of assets minimizing clutter, ensuring equitable and fair access to assets for operators, reducing CapEx costs and also delivering a digitally inclusive city"*

> *"We need to move quickly to resolve the unmetered power supply issue with Electrical Supply Board Networks. Local authorities require more efficient ways to attach low power equipment (such as small cells and IoT devices) to existing unmetered powered assets"*

- Survey respondents

There is a strong consensus that local authorities and state bodies as well as state agencies need to be more proactive in how they can leverage their assets to support 5G. This needs to go beyond the current situation which deals with ad-hoc requests to a more structured model where the local authority facilitates access to assets in a manner which is open and transparent for operators, as well as for users, and citizens in general. Local authorities must ensure equal access to their assets considering their strategic importance, rather than reward a first come first served, or highest bidder exclusive approach, to small cell deployments. Ideally, a 'neutral host' network can be implemented to maximise this asset utilisation, and wide-spread connectivity.

The reality is that when there is a lack of collaboration and coordination between the relevant stakeholders in a process as intricate as the deployment of 5G, the end network will fail to achieve its full potential and citizens will be left disadvantaged with only pockets of neighbourhoods and central business districts covered. By playing a central role in these processes, local authorities can help to ensure that 5G develops in ways that benefit all sections of society.

07 Small Cell Deployment Models

> The 'Neutral Host' deployment model is an attractive one from a local authority perspective with the main benefit being one single piece of equipment that propagates signals for multiple operators.

There is a lot of discussion emerging on models that could help accelerate 5G deployments. The models include options such as shared infrastructure (multiple pieces of equipment from different operators on one city asset), exclusive concession (one operator gains exclusive access to city assets) and Neutral Host.

It should be highlighted that there are many flavours of Neutral Host, however for the purpose of our discussion paper, we see Neutral Host as meaning the local authority working with a facilitating entity who manages one physical small cell on a city asset.

It is an attractive model from a local authority perspective seeing that the neutral host network will rely on single equipment and devices compared to multiple such installations. This is especially true in high footfall areas of cities and towns where there is risk of limited number of assets for installation, and potential 'visual pollution' from too many deployments as seen in the following graphics.

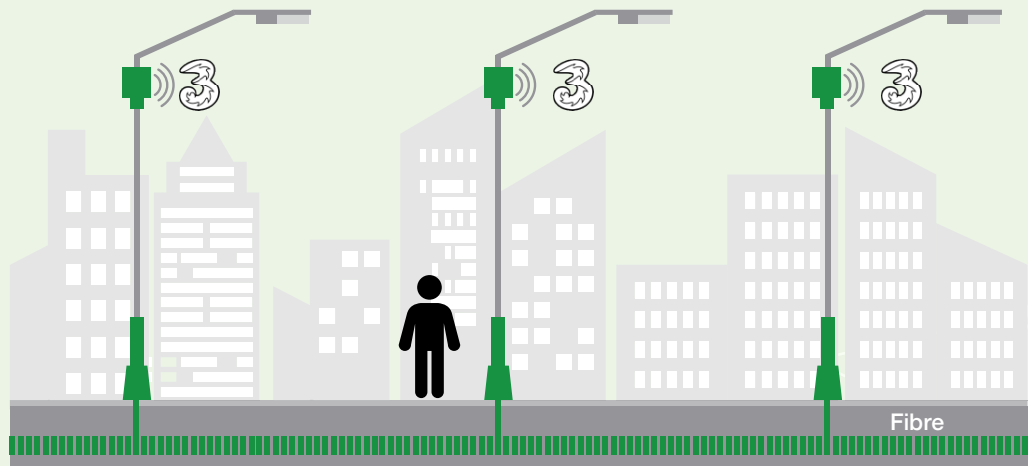## Small Cell Deployment Models

1. Shared Infrastructure
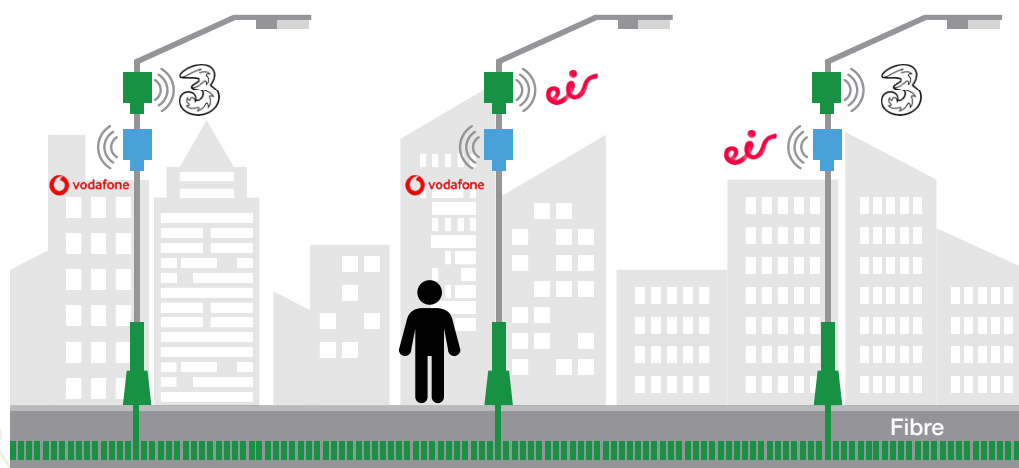
Example above where multiple MNOs deploy their own equipment on shared city assets such as traffic or street lighting poles.
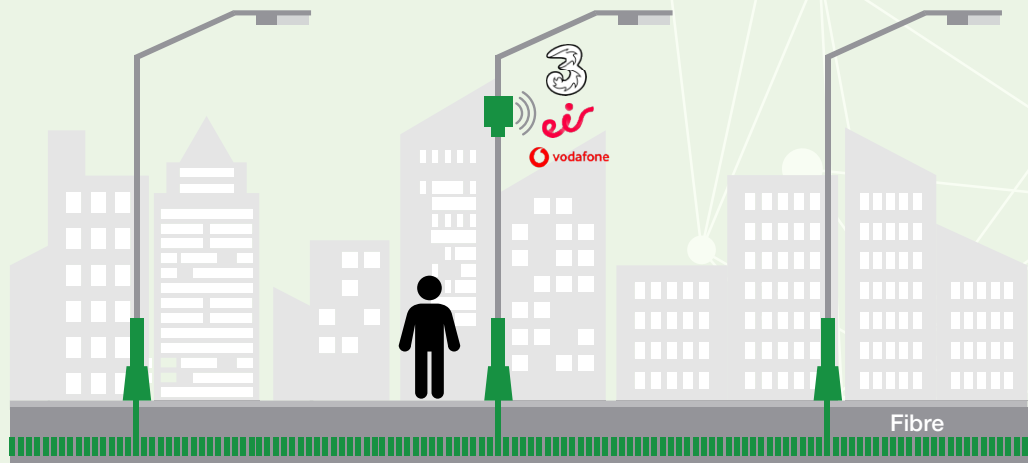
Logo and city assets for illustrative purposes only. Other scenarios may apply.

2. Exclusive Concession

This gives exclusive rights to one MNO, which makes it difficult for other MNOs to gain access.

Logo and city assets for illustrative purposes only. Other scenarios may apply.

3. Neutral Host

Neutral Host involves a single physical device deployed on city assets that can be shared by multiple operators (as opposed to multiple installations of such equipment).

Logo and city assets for illustrative purposes only. Other scenarios may apply.

However the neutral host model also comes with additional costs and technical risks for operators which will require a lot more upskilling across the wider telecoms sector, which are likely to be offset by reduced infrastructure and maintenance costs.

A holistic approach to deploying a neutral host network within Irish cities and towns would be for respective local authorities to engage with a third-party operator through the development of a public/private partnership (3P) to help fund, operate and maintain the network for 'open access'.

Collaboration with a third-party operator would enable local authorities to explore opportunities to generate new revenue streams from the neutral host network. A full comparison with different deployment models can be found in the full discussion paper report.

08 Recommended Actions

We have identified four broad areas of actions to be taken in order to lay the groundwork of delivering world class pervasive 5G access across Ireland. They include a review of international best practices, better alignment across national and local stakeholders, and a more detailed review of the most appropriate deployment & business models.

Action 1

Review International Best Practice

The challenges faced by Irish cities and towns are not unique. Hence, lessons can be learned from the models being explored by other cities such as San Jose in the US, Helsinki in Finland, and Amsterdam in the Netherlands. Dublin City Council recently hosted an international 5G accelerator with Harvard TECH, which brought together over 20 cities to share experiences and best practices in 5G. Presentations and information from this event can be found in the following hyperlink: http://smartdocklands.ie/5G

We should continue to build upon international best practice and share and learn from international city networks such as Harvard TECH City Innovators Forum.

Action 2

Better National Alignment

At a national level, there is a requirement to align on objectives and goals in order to successfully deploy pervasive 5G connectivity across Irish cities and towns:

2.1 Creating a working group and forum for Ireland's 5G ambitions

A working group should be established to include national and local stakeholders to agree a 5-10 year roadmap overseeing this roll out. It should include local authorities, the Department of Rural and Community Development, the Department of Business, Enterprise and Innovation (DBEI), the Department of Communications, Climate Action and Environment (DCCAE), Commission for Communications Regulation (ComReg), Environmental Protection Agency (EPA), Electrical Supply Board Networks (ESBn), Irish Business and Employers Confederation (IBEC), as well as Science Foundation Ireland (SFI), and their research centres such as CONNECT, the Science Foundation Ireland Research Centre for Future Networks and Communications.

In addition, we should create a forum where local authorities can discuss 'future connectivity proofing' of projects with their funding bodies (National Transport Authority, various Government Departments, etc). This will ensure that additional capital costs for future proofing infrastructure can be included in budget allocations when determining longer-term investment opportunities.

2.2 Enhancing alignment with national R&D centres to support future 5G applications

This should focus on supporting emerging application areas and testbeds in mobility, connected health, emergency response, safety and other emerging applications. The development of dedicated physical testbeds should be facilitated to support this national R&D agenda, of which stakeholders will be able to congregate, discuss, and test hypotheses. Key stakeholders should include actors such as Science Foundation Ireland (SFI), its research centre CONNECT, the Irish Development Agency (IDA), and Enterprise Ireland (EI) etc.

2.3 Continue to monitor safety concerns of 5G

The government, together with local authorities, must continue to monitor the latest scientific guidance from the World Health Organisation (WHO) and Environmental Protection Agency (EPA) on 5G health concerns. There also needs to be more consistency in communication across government bodies, local authorities, vendors and mobile operators in regards to these concerns.

2.4 Address unmetered power issue with ESBn

The challenge of accessing power in an affordable manner is a make or break issue for future deployment of 5G. There must be continuous communication with ESBn via the Mobile Phone and Broadband Taskforce to resolve unmetered power issues for the installation of small cells on unmetered supply. A review of ESBn's policy document must be undertaken by all other other actors, in order to fully understand the suggested approaches to address the power issue. This should avoid the requirement for additional infrastructure installations such as mini pillars, which would add further street clutter and additional costs that could make small cell deployments commercially unfeasible.

Action

3

Better Local Alignment

Local authorities will play an instrumental role in Ireland's path to 5G. The criticality of collaboration and engagement between local authorities and stakeholders such as mobile operators will be essential to allow for a sustainable rollout:

3.1 Establish a centralised point of contact for connectivity requests in each local authority

A single point of contact is required within each local authority in order to engage with mobile network operators and mobile infrastructure providers. This will likely necessitate a permanent role in each local authority to coordinate this activity. For example, having a dedicated broadband officer or digital officer.

3.2 Develop a 'single view' of local authority assets and condition of assets

All ducting, fibre, street furniture, streetlights, buildings, traffic, and other assets owned by local authorities should be compiled into a database and asset map that includes an assessment of suitability/condition for use in 5G deployments. To ensure that a complete and accurate database of these assets are recorded and mapped, a common standard for mapping and recording assets should be agreed with industry. This should help to ensure uniformity of records across the country but also help to maximise the possible take up by telecoms of these assets.

3.3 Develop policies on rules of engagement for third parties accessing local authority assets

Local authorities must agree protocols around access to their assets, ensuring all involved parties have clearly defined roles and processes to follow. Any Service Level Agreements need to take into account safety considerations, city operational priorities and insurance risks.

3.4 Develop streamlined interpretation and issuing of section 254 licences for delivery of new mobile sites or equipment installs such as small cells

This should have clearer definition and indications across local authorities. This alignment should be done in collaboration with the Department of Housing, Planning, and Local Government to develop a set of draft guidelines.

3.5 Develop streamlined processes to allow for bulk planning requests for deployment of small cells and other next generation wireless equipment

This should align with the current transposition of the European Electronic Communications Code on opening up access to support small cell rollout currently titled as 'Light deployment regime for small-area wireless access'.

3.6 Develop reasonable pricing and access of local authority assets

The development of standard rate-cards should be explored to ensure consistency on pricing and scalability across local authorities and priority locations in high density areas in urban centres.

5G and Future Connectivity: An Emerging Framework for Irish Cities and Towns

Action 4

Assess Deployment Models

As mentioned in this executive summary and complementing discussion paper, the pathways for asset-sharing should be thoroughly assessed, including the preferred model(s) and options.

4.1 Local authorities and mobile operators must agree key principles that underpin enhanced sharing of assets for mobile and connectivity purposes

These principles should include:

- Minimise road openings and associated disruption

- Open access to local authority assets on equal terms to all operators where appropriate to support densification plans

- Minimise visual pollution and clutter (reducing duplication of installations where possible)

- Ensuring that the interests of citizens and communities are put at the centre of this process by minimising digital divide and social exclusion risks

4.2 To further explore the deployment models in particular 'Neutral Host' model

Based on an evaluation of the various deployment options for rollout of 5G, the 'Neutral Host' model has emerged as an attractive future deployment model for local authorities across Ireland. This model would enable better sharing of local authority assets in a way that addresses the key principles of small cell and 5G deployment as set out above.

It is proposed that Dublin City Council will lead a market engagement exercise in Q2 2020 to review the opportunity of neutral host and shared infrastructure deployment models to support 5G rollouts.

Action

5

Development Of A 5-year Roadmap For Ireland

This roadmap is open to discussion and consultation with all stakeholders to better guide Ireland's 5G connectivity vision. It is clear from our engagement with stakeholders that it will be a number of years before Irish cities realise the benefits of 5G at scale. The pace of this uptake will be dependent on the recommendations prescribed in this discussion paper, and moving in tandem with fast-growing developments in this space.

The **5G** Journey in Ireland

2017

ComReg assigns 350 MHz of spectrum in the 3.6 GHz band, a pioneering medium for sub-6 GHz 5G, to five winning bidders.

2019

Ireland's mobile opperators commence the 5G journey, deploying the **3.6 GHz band** atop existing 4G macrocells in **high traffic hotspots** across Irish cities.

Consumer adoption of 5G is limited - the high cost of entry and lack of devices in the ecosystem is prohibitive.

2020

ComReg completes the largest **multi-band award** in its history, releasing the **700 MHz** band to enable **pervasive 5G**.

2021

Mid to High-end handsets are graced with 5G modems. There is a **densification** of **connected device**.

Low-band deployment brings 5G to rural Ireland, densification begins in cities.

2022

The **possible limitations** of the **macrocell** grid become more apparent.

Investment pivots to small cells - a new revenue opportunity emerges for local authorities.

2023

Sharing of small cells **reduces cost** and **visual pollution** while **increasing** attainable **density**.

The density of fibre at the edge increases, supporting small cells.

2024

Mobile operators exploit **mmWave spectrum** in dense environments to deliver a dramatic **uplift** in **capacity**.

If Ireland wants to continue being a leader in technology and innovation, fast tracking the suggested actions in this report should be made a priority. Our future competitiveness depends on it.

5G and Future Connectivity: An Emerging Framework for Irish Cities and Towns

5G
and Future Connectivity

An Emerging Framework
for Irish Cities
and Towns