

# 5G



HOW WILL IT ENABLE THE  
DIGITAL TRANSFORMATION OF  
THE PUBLIC SECTOR - AND  
IS IT THE ONLY ANSWER?

A E Q U O S

# INTRODUCTION

The world's connectivity needs are changing. Even before COVID-19 sent everyone home, global mobile data traffic was on the increase. Global mobile traffic is expected to rise fivefold by 2025 and, particularly in densely populated areas, there's a risk that the current 4G networks won't be able to keep up.

While organisations have adapted quickly to the sudden scale-up in mobile demands, they've been doing it in different ways. For some, the solution has been to increase the Virtual Desktop footprint allowing employees to access their work computers remotely, which maintains a consistent delivery model. For others, transformation has been significantly more aggressive. We've seen overhauls of application estates to hyper-scale cloud providers like Microsoft Azure and Amazon Web Services, with application re-architecture to utilise SaaS models. What these solutions demand is fast, reliable and high-capacity connectivity.

End-user mobility has reached the point that no matter where people are, they are usually connected. When inside offices and homes, connectivity typically comes from WiFi networks. When out and about, connectivity typically is made possible by the mobile carrier network such as 3G/4G LTE - although next-generation technologies are starting to blur the lines.

Now, as staff continue to flex and work untethered, organisations across the country are turning to 5G technologies to help with digital transformation and a seamless working experience. After a slow start characterised by hype over substance, 5G is becoming a key lever for advancing digitalisation, representing a quantum leap in terms of speed, reliability and connectivity for many more devices. The claim is that 5G will push WiFi into obscurity, replacing fixed lines entirely.

For public sector organisations, however, the jump from 4G to 5G is not straightforward. In lockstep with the 5G evolution, we are also seeing the next evolution of WiFi to WiFi 6 - a technology that also promises greater speeds, higher device densities and better mobile experiences. How do you know which technology is the right one for your organisation? By even trying to pick a winner, are we missing the point?

This paper will examine the business case for 5G in three parts:

**PART ONE:** IN "WHY IS 5G A GAME CHANGER?" we discuss the benefits of 5G for the public and commercial sectors, and show where we're going from where we are today.

**PART TWO:** IN "WHAT ARE THE POTENTIAL USES OF 5G", we examine some potential use cases that will define 5G digital transformation for the public sector.

**PART THREE:** IN "IS A 5G STRATEGY ALWAYS THE ANSWER?" we share why public sector organisations should be thinking of their 5G strategy as a hybrid process, to be used alongside legacy systems and new WiFi developments to achieve the digital transformation they need.

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# PART ONE: WHY IS 5G A GAME CHANGER?

Being able to download a full-length HD movie in seconds – that’s just the beginning.  
The true value of 5G is its ability to improve the network connection dramatically.

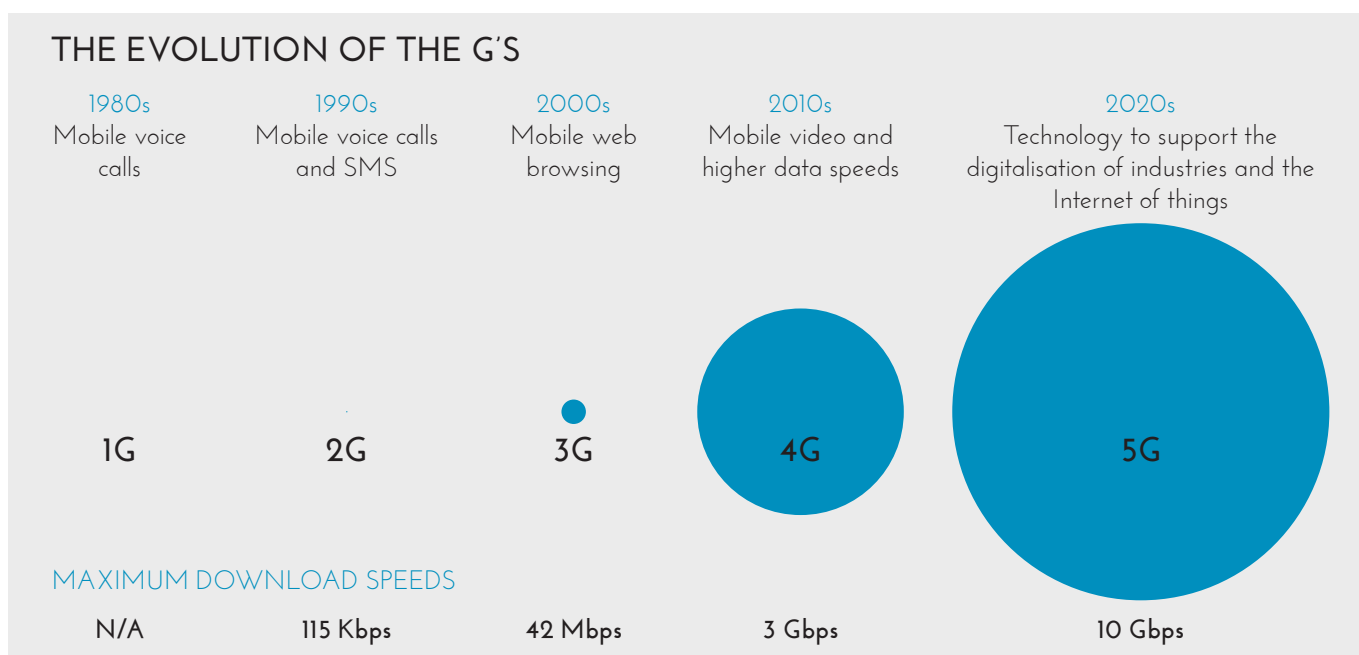
Under ideal conditions, 5G will be capable of connecting a million devices every square kilometre at speeds of up to 10 gigabits per second – meaning near instantaneous downloads and uploads. Staff will be able to work multi-departmentally from anywhere, and they won’t have to deal with disruptions when holding mobile video conferencing calls, nor will uploads to your various document management systems cause frustration from all the buffering.

Other intangible benefits of 5G include boosting worker efficiency and allowing people to work and collaborate even when they do not have a fixed line connection – a particularly compelling advantage given the new pattern of hybrid remote and office working that looks like it is here to stay.

## THE PROMISE OF 5G

### IT’S FAST, EXTREMELY FAST

Whereas 4G offers average speeds 20-35 Mbps (megabits per second), 5G is up to 10 times faster. Peak speeds of 10 Gbps (gigabits per second) are theoretically possible, with average speeds of 150-200 Mbps currently – although these are set to get faster as networks improve. Imagine superfast broadband speeds but accessible everywhere, for when you’re out and about.



## ULTRA-LOW LAG TIMES

Latency is the measure of how long a network takes to respond to a command before data starts moving, and it is a lot lower with 5G. While latency averages around 50-100 milliseconds on 4G, it's currently around 21-26 milliseconds with 5G. Lags of just 1 millisecond may be achieved as the technology evolves over time. To put that into context, human reflexes respond at a latency of around 200-250 milliseconds - that's how long it takes for us to recognise a situation and respond!

## MASSIVELY INCREASED CAPACITY

5G has up to 50 times the throughput of 4G thanks to the use of multiple antennas transmitting in higher frequency bands to improve coverage. With 5G, it's possible to connect thousands of devices to the system at the same time, and at a much greater density. For instance, if 4G allows 100,000 devices per km<sup>2</sup>, then 5G will allow 1 million per km<sup>2</sup> with guaranteed transmission quality. This makes 5G perfect for the exponentially growing Internet of Things.

## 5G IS RELIABLE

Since a 5G connection runs in parallel over several antennas and frequencies, it is able to offer a highly robust connectivity - meaning missed calls should be a thing of the past. One of the government's design requirements of the new 5G infrastructure is guaranteeing 99.999% uptime and ultra-reliable network services, meaning 5G should provide airtime and data transmission rates that are a massive upgrade on the older network technologies.

## 5G IS ENERGY EFFICIENT

Energy efficiency may not be front of mind when considering a 5G digital transformation strategy but, in terms of energy efficiency per bit transmitted, 5G approaches the theoretical optimum. In the long term, we expect the energy consumption of the future 5G network to reduce by a factor of 20 compared to 4G. For the end user, it's anticipated that 5G will bring about a dramatic change in the battery life of mobile devices, with smartphone users only having to charge their devices once a month.

# FROM 4G TO 5G: BUSINESS ARE GETTING EXCITED

At the organisation level, there is growing anticipation for 5G within the commercial sector. A recent report from Vodafone reveals how 5G could pave a new path for British startups, with 60% of respondents believing that 5G will help them compete against more established rivals. More than half (56%) of those surveyed said they expect 5G to change the way they operate their businesses, and 54% are more excited by 5G than any other new enterprise technology.

With that in mind, it's clear that organisations have high hopes - and expectations - about what 5G technology can deliver for their businesses. However, greater clarity is needed. More organisations want proof of 5G's benefits in action, and want to see 5G brought to life before they form a use case for their business.

# PART TWO: WHAT ARE THE POTENTIAL USES OF 5G?

Many think 5G is simply the next step up from 4G, but it's much more than just an upgrade. 5G is set to change the way we work, live and navigate our cities, kick-starting the 4th Industrial Revolution.

## THE INTERNET COMES OF AGE WITH 5G

As a mobile technology, 5G is both an evolution and a revolution, opening up whole new use cases that just weren't viable with 4G. For the first time, the focus will no longer primarily be on the mobile phone as the end device. The new 5G standard is optimised for the Internet of Things; for the billions of smart and connected devices that will communicate with each other and with us in the future. From security cameras that can be controlled by an app on a phone to motion sensors that can tell the lights to turn on as you enter a room, virtually anything can be transformed into an IoT device if it is connected to the internet.

With the speed of 5G as a catalyst, we may soon be seeing the adoption of hundreds of new technologies such as artificial intelligence, robotics, connected cities, telemedicine and self-driving cars with many industries – from automotive to financial services, entertainment and media to health – set to benefit.

Consider the following examples:

- **For industry**, 5G can serve as the communications standards for large-scale machine-to-machine communications that operate in real time, such as sensors on a production line. Optimum production conditions may be maintained without a human operator and faults can be predicted, and rectified, before processes and assets break down.
- **For retail and consumer goods**, the reduced latency of 5G is crucial in making virtual reality and augmented reality applications faster to respond. This means that customers could visit pop-up shops and browse a limitless catalogue of products through a mixed-reality headset. Customers could try on clothes and matching accessories virtually, in different sizes and colours, before buying or scheduling a delivery.
- **For insurance, wealth management and financial services**, IoT connectivity allows insurers to move towards usage-based insurance with real-time pricing models, more widely and for cheaper products, thus reducing risk and claims volume.

- **For cities**, connected and autonomous vehicles for both individual and corporate use, including transportation and distribution, become possible when data is transmitted in real-time. Imagine the impact on commuting when smart traffic lights, road signs, traffic management systems and every vehicle on the road are connected.
- **For healthcare**, applications including personal fitness and health monitors, drug dispensing devices and expanding telemedicine appointments – with body-sensor data feeding directly to healthcare practitioners – are all possible through the communication medium of 5G. Surgeons could even operate surgical robots remotely.
- **For agriculture**, we expect to see a move towards drone usage to monitor crops and determine the need for fertilisers, thus cutting costs.

One of the most exciting things about 5G is that we can't predict everything it will deliver. We're likely to see a range of exciting evolutionary leaps in connected services and applications in the future – many which have scarcely been imagined. As the technology develops, you'll see even more transformational use cases where 5G contributes to significant areas of end-user mobility.

## THE SOUTH KOREA MODEL

As it stands, South Korea is the world leader in 5G coverage, with Kuwait and Switzerland following – although it is not necessarily a close race. The scale of market adoption in South Korea can highlight best practices and new use cases for British public sector organisations in the near term.

Historically, dedicated networks have been deployed to cater for specific use cases. This controls network resource allocation and safeguards critical data on-site, but it is expensive and leaves little room to adapt to new services and user needs. With 5G, this will change. 5G allows for intelligent network slicing, which means that a single physical network can be split into numerous virtual networks, with different 'slices' being used for different services.

For example, network slices at a sports venue could include:

- General Internet access
- Live video broadcast to TV
- Broadcasting a 360-degree video experience to VR headsets
- Emergency services communication

With network slicing, data from each application class is transferred over its own virtual mobile communications network. This stops separate data streams from interfering with each other, and each application can be set up with optimal network functionality. How often has there been frustration with performance at large events? Network slicing allows you to maintain consistent connectivity across all network slices, and using the same physical network to support multiple use cases leads to higher resource utilisation and economies of scale.

This is critical for the success of many digital transformation strategies – and historically has not been possible with WiFi.

# WHAT'S NEXT IN NETWORKING?

Within public sector organisations, we've already seen an acceleration in the use of Microsoft 365 and similar cloud-based SaaS which have opened up significant opportunities for remote working. Good connectivity is the cornerstone of enterprise technology, and 5G will seamlessly support increasing numbers of employees working outside the office while delivering that all-important consistent office working model.

Given that 5G could surpass the speed of fibre broadband, applications such as lag-free video conferencing and screen-sharing will become standard practice on-the-go, providing substantial productivity gains and facilitating a full-scale switch to remote working. That's especially true in rural or sparsely populated areas where residents often have to make do with sub-par broadband and patchy WiFi coverage.

5G could also usher in new enterprise experiences, such as the annotation of documents over mixed reality displays.

The simple fact is, with 5G connectivity, employees will be able to perform tasks remotely that once required they be physically present on site, next to decent connectivity. In fact, as more and more business-critical tasks are moved to the cloud and with both speed and coverage increasing, asking people to sit at desks in offices will start to look rather old fashioned. The work environment no longer has to be dictated by a job role or function, and it's expected that 5G will lead to increased productivity as workers are able to create an environment that works for them.



# PART THREE: IS A 5G STRATEGY ALWAYS THE ANSWER?

So far, we have examined the potential use cases of 5G and learned of its transformative potential. However, there are two key drawbacks: coverage and cost. While 5G is still baking, is there a business case for your organisation to invest?

While it is certainly possible that 5G can replace WiFi as the network of choice, the reality is that it probably won't. Currently, 5G has too many limitations that prevent it from forming the backbone of a comprehensive digital transformation strategy - including coverage issues and cost. In view of these limitations, it is better to think of 5G and WiFi as complements rather than competition.

## THE 5G ROLLOUT CLOCK

Here in the UK, the full-scale commercial rollout of 5G has not happened yet. Even with the networks that have launched, their 5G offerings are limited to a few major towns and cities, so there is variability in terms where and how much 5G coverage is available. The reality is that not many can take advantage of the new, super-fast connectivity just yet - meaning WiFi will stay 'best effort' in the short term.

### THE NEXT TEN YEARS

**2022:** 3G will start to be phased out, with frequencies freed up for use by 5G as well as aggregation technologies to provide better speeds on 4G. Some 2G will remain to support legacy use cases such as smart meters.

**2023:** 5G coverage in all UK provisional target towns and cities across core mobile networks.

**2025:** Investment and innovation in 4G will slow down as 5G takes prominence.

**2030:** Extensive coverage nationwide. In the best case, at least 95% population coverage will be achieved by 2030.

## COSTS ARE HIGH (BUT COMING DOWN)

The typical corporate environment will have many devices that do not support 5G. Though 5G chipsets are certainly available, they tend to be considerably more expensive than their 4G counterparts.

At some point, the communications industry will go all-in on 5G devices, and we expect functionality to improve and the cost to come down considerably. Until then, it may be difficult to justify a major capital investment in 5G technology, especially while coverage is in its infancy. We all know the challenges of large-scale end-user hardware refreshes in the public sector.

It's of necessity then, that the vast majority of organisations will continue to rely on WiFi and 4G coverage in the medium term. And in fact, there is an argument that WiFi will pull ahead of 5G and not be replaced.

## WIFI IS ABOUT TO GET FASTER

At the same time that 5G is evolving, Wi-Fi is also transforming to the newest wireless standard: 802.11ax or WiFi 6. WiFi 6 is a backward-compatible upgrade which means that compatible routers can take advantage of the new standard to transmit WiFi signals more efficiently

Like 5G, WiFi 6 promises far greater speeds. Theoretically, WiFi 6 routers can offer speeds of 10Gbps; that's up from 3Gbps on the previous WiFi standard.

It isn't just about top speeds for individual devices though. Another feature of WiFi 6 is Orthogonal Frequency-Division Multiple Access (OFDMA) modulation, which allows over 70 clients to share a channel at the same time without this taking a toll on your network. Without getting technical, OFDMA takes a WiFi channel and parses it into smaller frequency allocations, transmitting data to multiple devices at the same time with no queuing. The goal behind OFDMA is to reduce latency and increase network efficiency, especially in high-demand environments like sports stadiums and public spaces.

If that sounds a lot like 5G, you are not wrong. The latest evolutions of WiFi and mobile cellular networks offer similar benefits, such that it is becoming increasingly difficult to distinguish between the two. The reality is that both solutions will be able to connect more and more end-points, and do so in a way that's faster and more reliable than before.

## WIFI WILL REMAIN THE INDOOR DATA NETWORK OF CHOICE

Whilst we gradually shift to a South Korean model of 5G adoption, the use of the hybrid network will be critical. A hybrid network is any computer network that uses more than one type of connecting technology. For example, a company network that uses both WiFi and Ethernet cables to connect computers is a hybrid.

The magic of hybrid networks is they give organisations the ability to use 4G, 5G and broadband simultaneously through technologies such as SD-WAN and SASE (Secure Access Service Edge) delivery models to give the end-user one delivery model.

## TO 5G OR NOT TO 5G?

From a TFM Networks perspective, we believe that 5G will create the environment for innovation and new user experiences. There is no doubt that it presents gigantic opportunities for public sector organisations to reimagine how they work and serve their clients. Increased speeds alone will enable entirely new business models and ways of working, in much the same way that the introduction of broadband did.

But it will be an evolution rather than an overnight sensation.

The reality is, it's going to be some time before 5G will truly change the world. For now, it seems that the safer choice is to stick with what you have but keep a watchful eye on things. For most public sector organisations, that means holding the industry patterns of WiFi and transitioning to WiFi 6.

As fast and high-capacity 5G networks become more available, 5G could become the solution. For now, the key is to envision 5G and WiFi working together to offer the best connectivity - anytime, anywhere, and at the most affordable price.

# A EQUOS

POWERED BY



Advanced Technology Innovation Centre,  
Loughborough University Science &  
Enterprise Park, 5 Oakwood Drive,  
Loughborough, Leicestershire, LE11 3QF

## CALL US AT

0345 872 6060

## EMAIL

[shabrul.uddin@aequos.co.uk](mailto:shabrul.uddin@aequos.co.uk)

## WEBSITE

[aequos.co.uk](http://aequos.co.uk)