TRANSPORT & LOGISTICS:
HOW TO SECURE 5G CONNECTIVITY

UK 5G Innovation Network

INTRODUCTION

Amid the difficulties of trade post-Brexit and a pandemic, digital technology is crucial for the future of transport and logistics. Organisations need to become more resilient, agile and productive to succeed and thrive. 5G could be the key to unlocking a more efficient and sustainable sector—providing real-time control of operations, improving the passenger experience and increasing security by way of its stable and secure connection.

But while benefits and use cases emerge daily, we know from speaking to the industry that 5G can seem complex and intimidating. Our work is looking to address that, helping transport and logistics organisations—of all types and sizes—find the right resources and connections to map a path to 5G: this guide aims to increase understanding, generate immediate demand and facilitate commercial deployments.

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DEPLOYMENT MODELS: PUBLIC NETWORKS

Once you've decided you want to deploy 5G in your business, you need to consider how to do that. The key to clarifying the task ahead is to understand the range of deployment options available—and the first choice to make is between either a public or private 5G network.

How do you determine if a public or private 5G network is better suited to your needs? There are some important differences between the network options, and understanding this can help you make more informed decisions and initiate meaningful discussions with potential suppliers.

This section is designed as a stepping stone, hopefully growing your understanding of private and public mobile networks and helping you to make the most suitable choice for your organisation.

a) Public networks

A public mobile network is an online network to which anyone can connect. If you have a 5G-ready device, and funds to pay for the bill, you can access information—which most consumers see as 'the internet'—through a public 5G network delivered by MNOs (mobile network operators, such as EE or Vodafone).

Access to a public 5G network is binary: it is either deployed in your area or not. A public mobile network is what most people think of when they hear the term "5G". In a public 5G network, security, service and management are the responsibility of the MNO.

- Currently available, 'off-the-shelf' 5G, supplied by mobile network operators
- Coverage is dependent on the infrastructure deployed by mobile network operators
- Optimised for maximum download speed
- All users have equal access

- It may not offer the security and reliability required for critical operations/sensitive data
- Provides the capability for mass market use cases

Currently, there is a very good urban rollout of public 5G and this can be thought of as ‘consumer 5G’, with the networks optimised for the things that consumers care about. As a result, they focus on massive download speed. But the more people that use the devices, the more capacity becomes an issue—especially in scenarios where a large mass of people are congregated, such as at a train station.

This is known as a contended network—the more users or devices on a network, the more people may struggle for bandwidth at peak times.

In terms of the download vs upload, it's typically a 3:1 ratio for public 5G networks—roughly three amounts of download, to one upload. You can download a lot of information, but uploading vast amounts of information from your device, for instance a CCTV feed or sensors capturing data, is less straightforward.

If you’re looking to create a scalable network across a range of physical locations and transfer large amounts of data from those sites, upload – or uplink—will be of greater importance.

DEPLOYMENT MODELS: PRIVATE NETWORKS

b) Private networks

A private 5G network is any network to which access is restricted, essentially operating as a personal network. This could include a localised network, for instance, covering an urban area or a network in a definedvenue such as a train station.

- Customised to your specific needs
- Fully controllable: restricted for secure environments or operations
- Can be tailored to allow greater focus on uplink
- Guaranteed capacity
- Scalability options

Sometimes also referred to as a non-public network (NPN)*, a private 5G network is a secure, all-you-can-eat network that is exclusively yours—log on and go wild, as your organisation requires.

Security-wise, it comes with dedicated SIMs for whitelisted devices. While perhaps not as simple as clicking 'Join Wi-Fi', it provides the confidence that only devices you know and permit can connect to your network: a clear benefit when dealing with critical infrastructure.

This is attractive to a number of different organisations. For instance, smart vehicles, cities and depots don't want rogue connections into their network at the edge. Of course, a system is only as secure as its weakest link (managing the data securely on the cloud) but the 'front door' is effectively well guarded.

Furthermore, organisations dealing with operation-critical information – for example, tracking a shipping container —can ensure a greater deal of security in crucial daily operations and transfers of data.

If you are running a private 5G network, and you are catering to the public, you would more than likely 'hand off' to Wi-Fi, via a Wi-Fi-5G bridge, which could happen at bus stops or train stations. This means pushing consumer access to a universal frequency as not all individuals have a 5G phone yet.

Scalability is the next big difference between public 5G networks. How big can private 5G networks go? It could be as small as a tram, large enough to cover a key transport corridor through an urban area, or even a neighbourhood or port estate. The critical point is that it's available exactly where you need it, rather than where it happens to be available.

Flexibility is the third main difference—being fully in charge of the network enables you (or an expert within your organisation) to tweak the upload and download speeds, as well as security options—whitelisting or removing devices as you see fit.

You can also guarantee capacity, ensuring you always have the connectivity you need, whenever you need it, and there is no ceiling for uploads. If you don't have the expertise in-house, there are multiple private network vendors who can manage the service for you (see the UK5G Supplier Directory).

* In 3GPP parlance, a Non-Public Network (NPN) enables the deployment of a 5G System for private use. An NPN may be deployed as:

A Stand-alone Non-Public Network (SNPN): Operated by an NPN operator and not relying on network functions provided by a PLMN, or
A Public network integrated NPN (PNI-NPN): A non-public network deployed with the support of a PLMN.

WHAT ARE SOME OF THE PRIVATE 5G NETWORK OPTIONS?

Permanent vs temporary: You can switch private networks on (and off) as your organisation sees fit. Temporary networks could support transport infrastructure for a limited peak time, for instance, public transport around the West Midlands during the Commonwealth Games. Permanent networks may be better suited to industrial port or airport settings.

Carrier-grade vs lab-grade: Carrier-grade is the premium option, offering all the bells and whistles and performance guarantees (which comes at a cost).

Whereas lab grade is more experimental, rough and ready. While lab grade offers a more cost-effective option, the trade-off is you need to be comfortable—and have the engineering expertise internally—to be able to tinker and get your hands dirty. These can be a great option for a temporary network or a trial, but possibly not an effective long-term solution.

Hybrid Networks

Did you know that private networks can also be provided by public network operators (i.e. Mobile Network Operators)? A Hybrid public-private network is where a 'slice' of a public network is reserved for the sole use of a subset of users for additional services or service levels.

This means the service is deployed, integrated with, managed or otherwise enabled or supported by a mobile network operator.

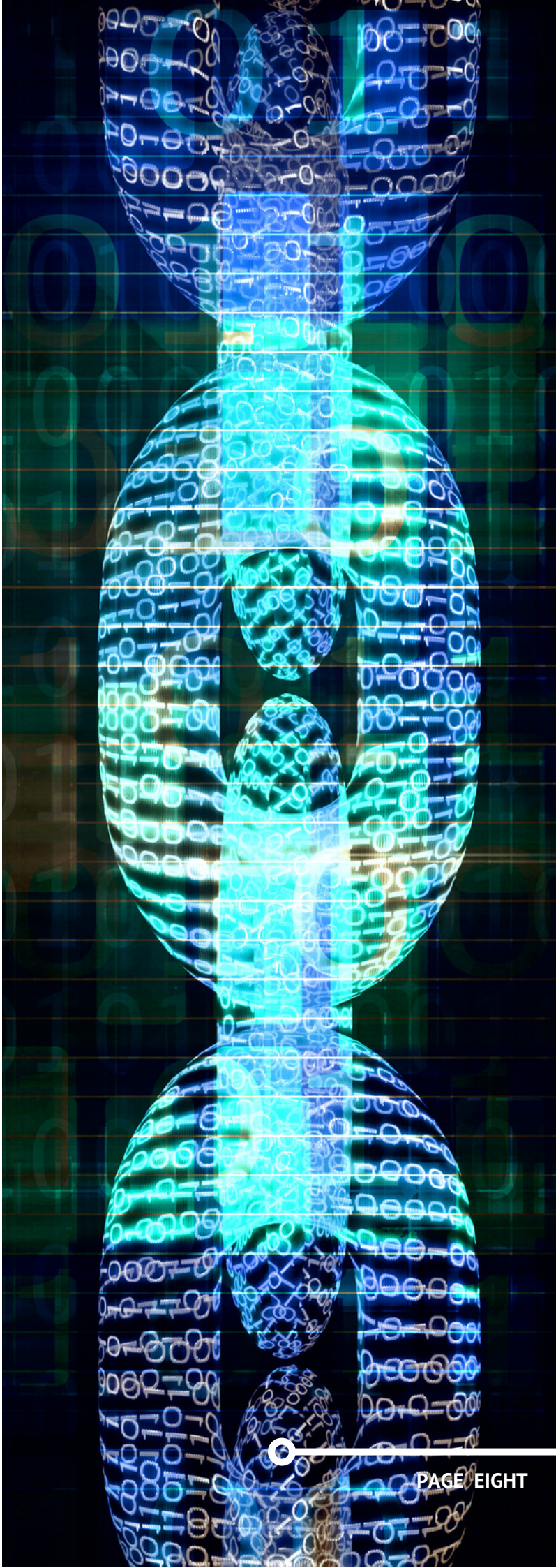
Such a hybrid network may well use nationally licenced operator spectrum but could use other types of spectrum licencing as an alternative. An operator may choose to dedicate a network operations team to supporting its private network customers.

System Integrators

Knowing exactly what you need and how to put it all together can be tricky, especially if you don't have all the technical know-how in-house. A systems integrator is an individual or business that builds computing systems by combining hardware, software, networking and storage products from multiple vendors.

This can be particularly useful for facilitating communication between systems that do not usually communicate: for example, granting access to third parties in the case of remote maintenance, training or security.

For help meeting key business goals, head to our Supplier Directory.



OTHER USEFUL TERMS

Neutral host

Mobile network operators have strong commitments to providing coverage. However, rural and remote areas tend to be particularly challenging due to the lack of commercial viability. A neutral host provides a network to operators as 'tenants'—multiple operators share the same infrastructure—which can be used to provide vastly improved connections.

This could enable more effective coverage for local communities, either in the existing MNOs' spectrum or in new bands—supporting logistics firms whose bases are not always located in areas with high population density, as well as providers of rural and semi-rural transport services.

Road and rail agencies could also consider establishing themselves as the anchor tenant in such a model, making it easier for infrastructure providers to invest in an area.

Given there are practical issues with backhaul connectivity, having each MNO deploy its own 5G infrastructure alongside transport arteries is likely to prove difficult.

Transport authority-owned infrastructure

Street furniture and buildings can be used to host 5G network equipment more cheaply, quickly and with less visual impact compared with traditional phone masts; from lighting columns to bus shelters, small cells can provide extra capacity to a network, especially in urban areas where there is greater demand which will require a densification of networks. However, network operators often find it difficult to identify potential infrastructure and acquire the information needed to verify that a structure is suitable, such as its location, physical dimensions, proximity to the street or access to a power source.

Led by the Department for Digital, Culture, Media & Sport (DCMS) in partnership with the Department for Transport (DfT), the Digital Connectivity Infrastructure Accelerator (DCIA) project aims to maximise the use of 'publicly-owned infrastructure assets'—street lighting columns, rooftops, bus shelters and so forth—in accelerating digital connectivity and inclusion across the UK. Eight pilots, representing a mix of urban and rural environments, are developing digital asset management platforms, to test asset management capability, and reflect DCMS' commitment to maximising the rollout of 5G across the whole of the UK.

And all of this is big news for the transport industry; with greater connectivity, deployed more quickly, comes more opportunities to enhance transport offerings and exceed passenger expectations. Of course, with more physical assets in urban areas, there are more opportunities to deploy digital infrastructure, but the data and information that enhanced connectivity offers can be used to ensure rural communities and passengers are not left behind. If anything, this is a real opportunity to optimise rural transport links and bridge digital divides across the country.

Organisations can support the effort in several ways: for example, by engaging with local authorities to see if they are mapping public assets, and ensuring their assets are included and visible to MNOs and infrastructure providers (the more open you are to sharing your assets, the easier it is for public 5G connectivity to be deployed that you can benefit from, and ubiquity to be achieved).

CASE STUDIES

Public transport

Smart Junctions 5G uses a private 5G network to enhance the Vivacity Labs' Smart Junction Project—an AI-based traffic signal optimisation system, deployed in Manchester. This has already been shown to cut waiting times at traffic signals, prioritise traffic by class, and respond dynamically in emerging situations. By using a 5G small cell network, the project is decreasing the infrastructure cost for the connection of the sensors at every junction. Critically, the system requires low-latency communications to achieve its goal-making 5G the perfect connectivity solution.

Tests conducted by the project across key junctions along the A6—a major transport corridor in and out of the city centre—reported a 1% journey time improvement at a four-arm urban junction controlled by 5G connected systems. This might not sound like a lot, but with the average journey time across that junction being 100 seconds and 16m journeys taking place across that junction each year, this equates to an impressive £45k yearly road user cost saving.

Ports

The 5G Logistics project connected Bristol Port to 5G, enabling full traceability of products through geo-fencing and continuous monitoring of the movement of goods and materials.

Tracking at a container, pallet and individual item level not only improves visibility but boosts efficiency, as real-time automated monitoring and recognition replaces existing manual scanned barcode identification.

The project successfully captured 2 million data points over a six-hour period, which tests showed was a 20:1 improvement compared to a public network. Critically, they were able to monitor light and temperature within mobile containers and achieve centimetre location accuracy for goods in transit - delivering a granularity of insight not previously possible. As a result, goods can be precisely tracked and potential issues such as a container being opened en route or unexplained movement within the container can be quickly identified. For logistics firms (and their customers), this means reassurance that goods are secure, where they're supposed to be and can move through ports quickly and seamlessly.

The project has also explored how 5G can empower the use of automated port police drones. These can be used for boundary inspections, ad-hoc and event-triggered surveillance. For ports—Bristol has 500 acres of car compounds alone—surveillance is a real and expensive challenge. With the ability to quickly deploy drones to cover large areas in a short time, the security of the area will be greatly enhanced.

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