DIGITAL Connect
Enabling connected business outcomes

Computacenter

A SIMPLE ROUTE TO EXTRAORDINARY POSSIBILITIES

5G communication for business

EXECUTIVE SUMMARY

PURPOSE OF OUR 5G THOUGHT LEADERSHIP PAPER

Many companies have made 'mobile first' a key operational strategy, which is playing a pivotal role to increase productivity, enable flexible working, and promote employee satisfaction.

The introduction of 5G networks will usher in a new era of 'hyper-connectivity'. From a transformational perspective, it will bolster an Internet of Things (IoT) explosion with the potential to shape how we work tomorrow and beyond.

With our white paper, we offer a balanced view of the 5G landscape – its current and future opportunities, its risks and challenges, and a considered view of its pros and cons. Our practical advice on how 5G, or alternative wireless technologies, can transform your business is at the core of our research and development. In today's dynamic mobile environment, we want to help you successfully explore alternative and complementary solutions including but not limited to Wi-Fi 6. We want you to make the best decisions for your networking strategies – whether that's to yield immediate benefits, or to position you for a longer-term wireless transformation.

WHAT IS 5G?

In technology terms, it's a high speed, low latency transport layer for communications. 5G has been described as a simple route to extraordinary possibilities. Applied to the right solutions, 5G promises transformative business innovation on account of its scalability, versatility and sheer throughput capabilities.

Some of the benefits of 5G include:

- Extreme data performance – competitive to fixed wire solutions
- Stable wireless performance allowing devices to be always connected
- A scalable basis for the incumbent "Internet of Things" (IoT) expansion
- Ultra-low latency connections allowing real time field responsiveness
- Valuable new potential in the field of mobile augmented reality (AR)
- 100 Billion devices, quickly addressable for tomorrow's demands

MARKET SITUATION

There is a lot of noise and marketing about 5G today, but the roll-out depends on the preparedness and maturity of different markets, coverage by existing telco providers and geographic suitability.

Country by country 'readiness' of devices, infrastructure, regulations, and inter-country protocols presents a diverse picture. Where a business is operating will certainly affect the suitability for specific wireless technologies. European developments in 5G technology have traditionally been significantly behind the progress of China, South Korea or the USA. The agreement out of the European Commission programme, The Digital Agenda for Europe, has the objectives that one major city in each Member State should have at least one commercial 5G network by 2020.

Besides country readiness, we are also watching the Communication Service Providers (CSPs) who play a major role in the roll-out of 5G. Between now and the end of 2020, CSPs will need to gear up for the first phase of mass adoption including the delivery of new services, platforms and applications.

POTENTIAL OF 5G

New 5G technology can drive the pace of a business making it possible for all aspects of your operations to move faster – delivering instant, wireless connections between machines, people and devices. It can mitigate downtime and disruption associated with accessing large files and support more flexible working by enabling media-rich content to be downloaded quickly on phones or tablets without any infrastructure bottlenecks. Additionally, 5G's outdoor coverage will improve your ability to monitor assets in remote locations using Internet of Things (IoT) sensors. Data heavy solutions including remote video monitoring or AR will be made possible by the interoperability of devices and protocols across this flourishing sector.

We discuss the full potential of 5G with industry examples, showing why this technology will change how we do business today and into the future.

CONCLUSION

Our purpose in writing this paper is to provide our customers and partners with informed views on the changing connectivity world of the future. While we, as always, treat exaggerations and over-reaching predictions with care, we have no doubt that 5G offers businesses unrivalled potential for performance enhancement, business growth and innovation.

In a nutshell, we believe that 5G readiness is about options and possibilities. We can help you find your solution by giving insight into the latest global intelligence related to this extraordinary, and the complementary, new technologies.

FOREWORD

As legacy technologies are phased out, emerging and increasingly valuable business solutions will require enhanced mobile broadband and wireless technologies. 5G, an exciting evolution of today's 4G, has established itself as the new benchmark in mobile data. We believe that the future of this technology is a complementary one, whereby wireless technologies can be implemented alone or combined for the perfectly tailored solution to your business.

With the introduction of 5G as a standard for wireless connectivity, we will see a large manner of industries adapt this opportunity to grow and expand. Autonomous vehicles, smart cities, artificial intelligence (AI), augmented reality (AR), just to name a few; will finally have the infrastructure to support performance previously restricted to the world of wires.

5G technology doesn't just represent an improvement on past technologies, it unlocks true mobility for a range of applications otherwise rendered immobile. With fast transmission speeds of 10+ Gbps, wireless technologies are changing the way in how we plan our infrastructure by placing mobility at the very centre.

While we have a good level of insight into the practical applications of this technology and how it can be implemented, we cannot promise to have all the answers. What we can offer though is a considered and impartial compass for you to navigate the best way to grow your business. We aim to offer practical advice on how 5G, or complementary wireless technologies, can be used to achieve these goals together.

We see 5G as the gateway to next-generation business. We also recognise the range of networking decisions that companies will be faced with over the coming months and years – including how best to negotiate the transition to a more mobile-centric world.

WHAT IS 5G?

> “Potential 5G applications are limitless and wide-ranging. Businesses at the forefront of this technology may well gain strong competitive edge.”

Sabrina Ghebrehiwet
Group Product Marketing Manager, Networking

So, what is 5G? We see this technology as much more than just a new generation in mobile broadband. What sets this technology apart from previous evolutions of wireless communications comes down to the fact that wireless performance can now rival what we have only known to be possible from fixed wire solutions.

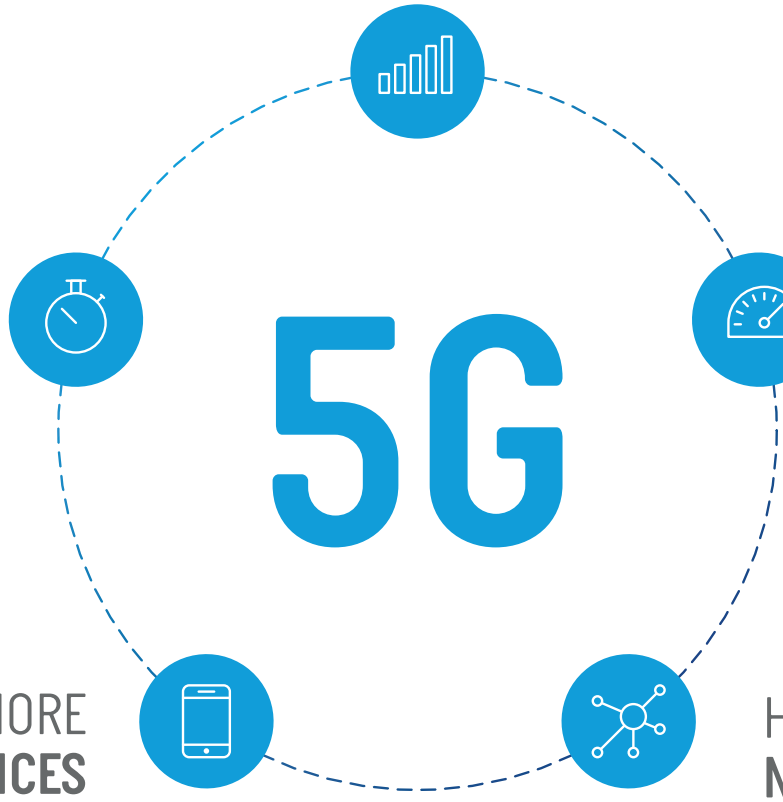
What does it mean to business? Applied to the right solutions, 5G promises hyper-mobility, centred around transforming the business landscape of tomorrow. With the scalability of this technology coupled with the advances in performance, taking big data into the field has never been easier.

As organisations connect more devices, machines, and chips to communication networks and require greater bandwidth for content, there will be increased competition for capacity and resources across existing infrastructure. 5G will ease the 'mobility bottleneck' and help ensure that everyone gets the services and experience they expect and need, securely and reliably.

For many companies, preparing for 5G will mean a proactive approach to network management and future-planning. It's important that network architects and business leaders alike see infrastructure preparation as a shared goal toward mobilising workloads. To validate the expected outcome and identify the assumed benefits of this type of transition, we suggest that a comprehensive cost benefit analysis be performed to gauge applicability.

THE NEXT GENERATION MOBILE BROADBAND NETWORK

5G is the next generation mobile broadband network based on telecommunications standard development organisation, the 3rd Generation Partnership Project (3GPP), delivered by an evolution of new Radio Access and Core Network functionalities to provide business use cases



UNDER **1ms**

Network latency, compared to 40ms with 4G†

10 to 100x **FASTER**

than 4G networks - as high as 20Gbs has been achieved in testing*

MORE **DEVICES**

Massively increased number of connected devices will support development and usage of IoT devices

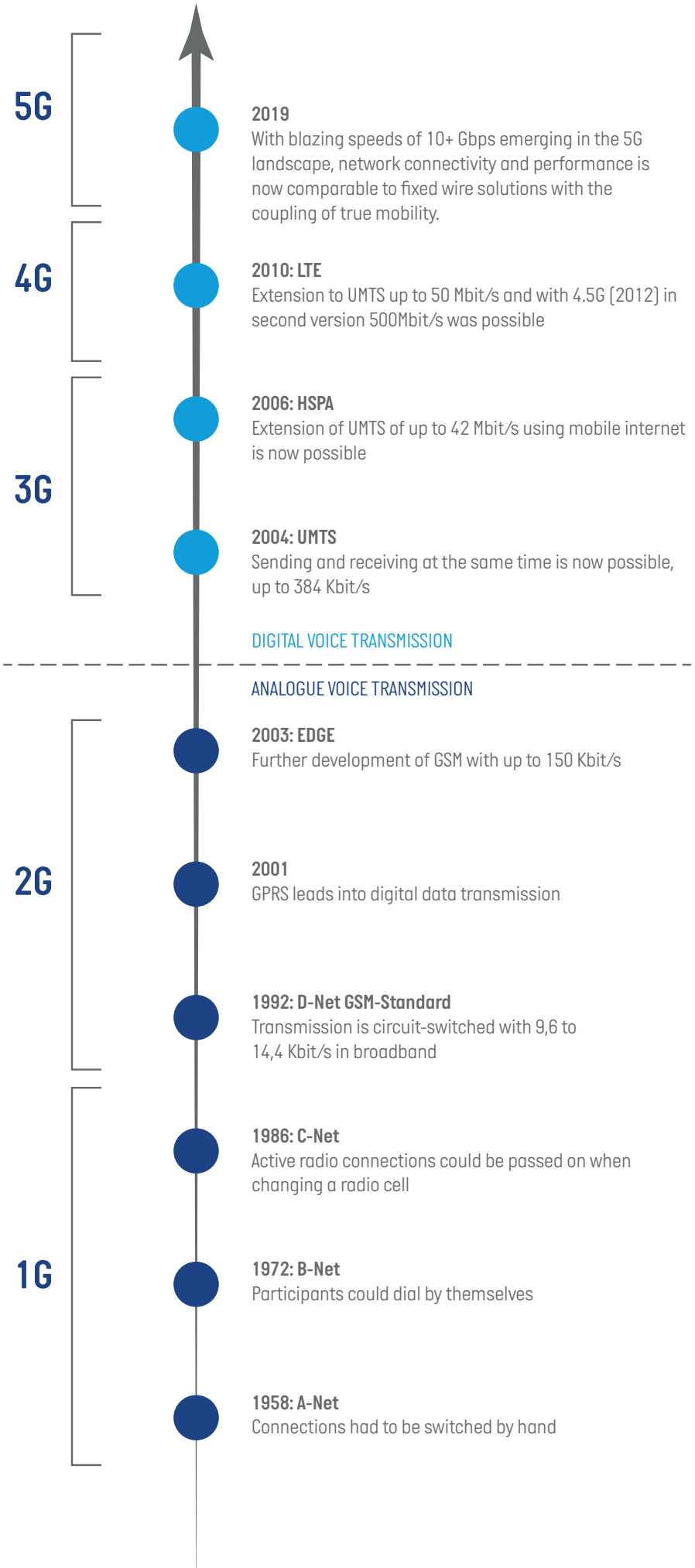
HYBRID **NETWORKS**

Mobile broadband networks will be a mix of the new 5G and today's 4G, 4G Advanced Long-Term Evolution (LTE) plus technologies, depending of various aspects like rollout speed, usage, coverage and density.

* Cellular Technology and Internet Association (CTIA)
† Qualcomm

5G VS 3G, LTE, ETC.

We've progressed a long way since the advent of 2G, the standard for governing wireless telephone calls, and a time pre-mobile internet. Today's cellular networks are being used more for mobile data than phone calls, indicative of future trends. What is 5G compared to the previous mobile standards? A historical chronicle of developments:



Started in 2019, 5G (3GPP Release 15) not only makes the internet faster; it lays the foundations for real-world field mobility. Ultra-low latency, high throughput and minimal radio interference posit this protocol as the beginning of a true wireless revolution. This leap will see the incorporation of the Internet of Things (IoT) into existing networks to offer greater analytics and functionality to any application.

At present, the speeds promised by 5G may not even be available in the fixed-line network area which also provides the infrastructure supporting today's mobile technology. As the speeds of the protocol increase with developments in the 5G and telecom sector, so too will connection quality and reliability. These advances will ensure that always-on reliable connections are at the centre of all future mobile operations.

5G will not immediately displace the existing 4G mobile phone standard. The technology is interoperable with existing networks meaning that the majority of end users, at least at a consumer level, will be guaranteed connectivity on alternative frequencies to ensure optimal up-time. In most instances, 4G delivers the performance needed to conduct many of today's tasks, but as consumer bases grow, so too will radio congestion and network stress. Whilst we cannot tell you precisely how much data will be consumed amongst mobile devices in the future, we can guarantee that this will only increase.

As many countries still have limited 5G deployments, it should be worth noting that 4G currently offers better network coverage as well as a variety of speeds. Qualcomm predicts there will be 200 million 5G subscribers by the end of 2020 (compared to 5.3 billion 4G mobile subscribers worldwide in 2020). Clearly 5G is far from ubiquitous and will remain that way for a while. In the meantime, 4G will remain an integral part of the 5G rollout.

It is expected that 5G will most likely come into its own for machine to machine (M2M) communication, where it can take advantage of the exceptionally low latency and to support real time communication (uRLLC, Ultra Reliable and Low Latency Communications).

PUBLIC VS. PRIVATE INFRASTRUCTURES

With 5G campus networks (exclusive mobile networks for defined areas, such as universities, office buildings, or industrial sites), companies receive secure, high-quality 5G-based mobile broadband coverage at their location.

The provision of a 5G campus network is integral to the continual development and adoption of the fourth industrial revolution, otherwise known as Industry 4.0. Here, smart robots can transport things from A to B, machines automatically report when they need spare parts, and a range of scenarios can be tested using augmented reality. Many of these situations require stable, reliable, and fast mobile data capabilities.

In such applications, working with cabled network access does often not make sense i.e. restricted mobility, cost and space. Traditional Wi-Fi often reaches its limits in traffic heavy environments resulting in compromised reliability, even with the newer wireless standards and protocols. This means that when newer devices are added to traditional Wi-Fi, they will inevitably use the same frequency as their older counterparts leading to more potential for interference and compromised performance. Already, telco providers are equipping companies with private mobile broadband networks like Advanced LTE and early deployments of 5G technology to mitigate these problems.

Compared to the public radio network, which is mainly used for telephony, a private mobile broadband network offers improved coverage, higher security and reliability for internet or other data services.

For this purpose, specific radio access and back-end components need to be installed on the company premises to separate it from the public network in a logical and/or physical manner. This makes 5G campus networks perfect for demanding mobile scenarios, such as autonomous transport, teleoperated machinery, and other transmission-heavy applications.

A 5G campus network is particularly useful for IoT scenarios. Because it is designed to support a high number of devices, and is connected at the location by radio, the scalability of such a network makes IoT devices a perfect fit.

Even today, the usage of 5G private networks is at an early stage, because only a few countries (like Germany and the UK) have decided to allocate frequency spectrum for private usage. In terms of requests we get from our customers so far, they are planning more with their own private 5G network than attempting to use public ones.

Private networks have the following advantages over public services:

- Completely separate data transmission
- Flexibility: changes can be made quickly without relying on third parties
- Network capacity can be scaled internally

INFRASTRUCTURE REQUIREMENTS (MAINLY FOR PRIVATE INFRASTRUCTURES)

As with any other infrastructure, the 5G technology rollout needs to be complete to enable full coverage of a 5G service. First and foremost, this requires antenna masts and the necessary connectivity infrastructure to be planned and built.

As a result of the higher frequency spectrum used for 5G, radio cells have become smaller whilst still handling higher data rates than ever before. The trade-off with higher frequencies is a shorter range, and lower signal penetration. This means that in order to cover larger areas, more antenna masts are needed. Being able to realise this on a scale to provide full coverage is one of the central challenges that network providers and politicians must face.

It's not only about the masts and towers that form the radio access network. High speed and low latency mean that the whole core architecture (e.g. the backbone to regional Data Centers) needs to be built in an appropriate way. This investment must also be calculated for the business case of any 5G provider.

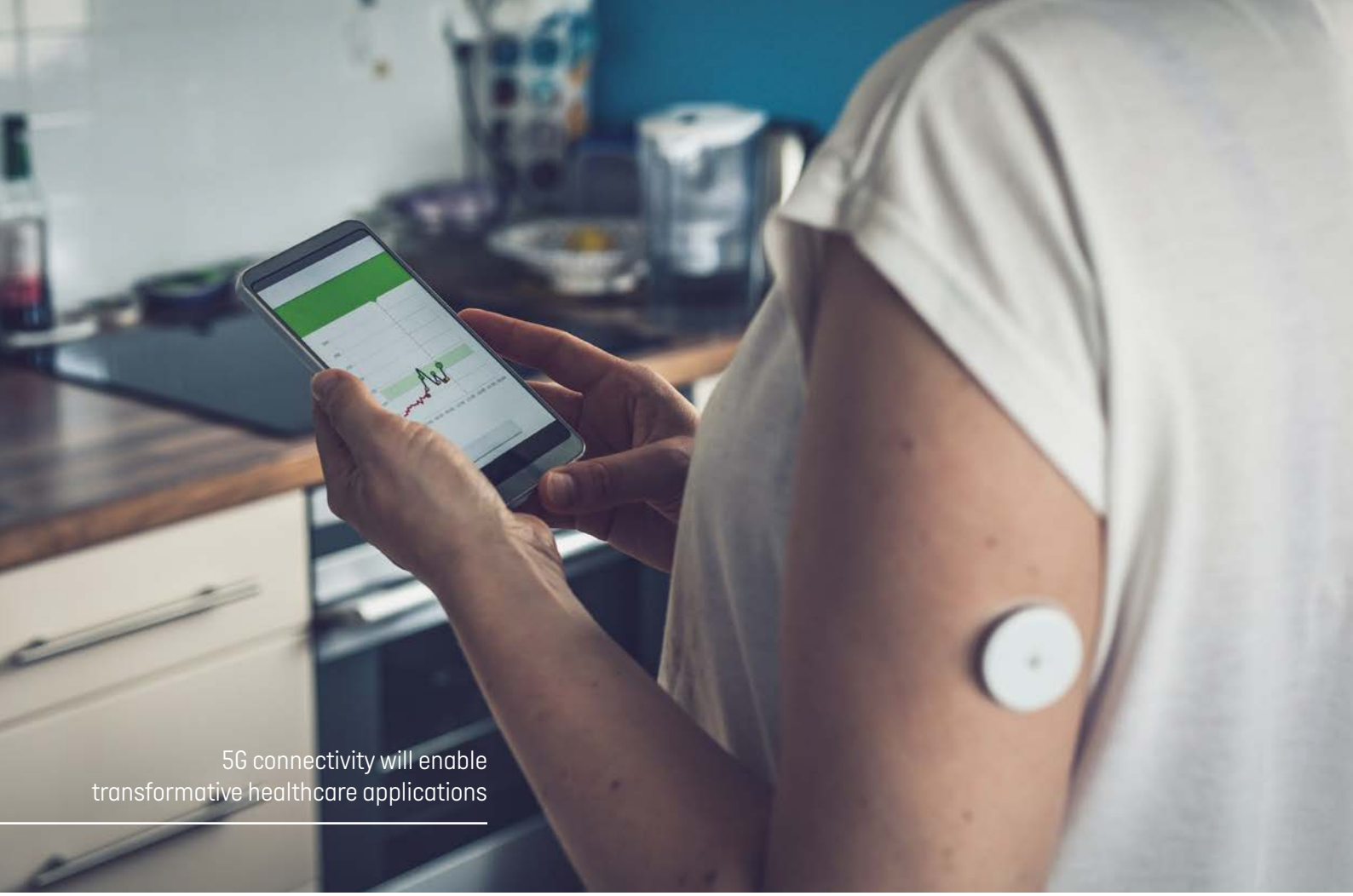
In the case of a private 5G network deployment, most of the above remains valid. The main difference here is the limited area where network coverage can be built; however, the core and back-end technology will be less complex than for a public provider. Every company that hopes to build a private 5G network needs to think about how to plan, build, and operate the infrastructure, taking into consideration business and regulatory requirements.

Therefore, several options for a private 5G network should be examined:

- Build and operate it with own resources
- Build and operate it by System Integrators and Managed Service Providers
- Buy a private 5G network service (a so-called "slice") from a public provider, who builds and operates it

Ultimately, the 5G service must deliver from a business point-of-view, this will subsequently define the criteria for the possible service model.

In the future, 5G networks will provide the basis for a large number of applications, which in the broadest sense, are primarily data communication services. As such, customers need to consider that it's not only public or private 5G networks that are well-positioned to guarantee the necessary requirements of the future in terms of data speed, network capacity, reaction time, and data security. Depending on specific application or use case, even Wi-Fi Networks - especially those based on Wi-Fi 6 technology – may also be able to deliver equitable outcomes.



5G connectivity will enable transformative healthcare applications

REQUIREMENTS FOR ENDPOINT

Of course, the network is only one part of the solution. What are the possibilities from the user and the business perspective, and what will a requirement for a 5G service in future look like?

We are potentially looking at an explosion of uptake amongst end-users and devices: connected cars, IoT sensors, smart manufacturing and machinery, smart stadiums, digitally immersive experiences, including VR/AR and person-to-person 3D video calling. In any case, the requirements and availability of the appropriate end point technology is an essential consideration for any 5G infrastructure planning.

Examples:

- A business environment where retailers use heat mapping technology and AI algorithms to analyse security footage in real-time to better understand human movement patterns with the addition of passive surveillance help understand customers patterns.
- A sensor that fits into the palm of your hand, as easy to use as a smartphone, will enable patients to measure their health at home and instantly report the results to their doctors. This mobility will enable monitoring of patients remotely thus freeing up valuable clinical resources.
- A factory of the future, where machines, devices, and vehicles will be conducted by 5G technologies, and made intelligent by edge and cloud analytics, enabling factory managers to adjust their production lines to meet dynamic demand.

Technologies such as 5G and Wi-Fi 6, by enabling considerably more connected devices to the network and linking them together, opens huge potential for businesses; to introduce new products and services, for market reinvention, and opportunities for growth.

The capabilities of 5G open new markets that require constant monitoring of IoT developments. Computacenter has more than 30 years' experience working with manufacturers – evaluating, sourcing and deploying emerging technologies – and we are certain that these kinds of 5G applications will be truly transformative. Gartner predicts 5.8 billion enterprise and automotive IoT endpoints will be in use by then end of 2020 – a 21% increase from 2019.

The number and type of different endpoints like beacons, tags, sensors and other edge devices will grow massively in volume and variety. These will ensure products, processes and

resources can be tracked, controlled and optimised across business processes – in ways that defy the most visionary predictions. Today's landscape is filled with some of these devices; however, their limitations restrict their capabilities. We are just as excited to see how we can implement this technology to see new applications and solutions for your business tomorrow.

The big picture view of 5G – known and unknown – is important, because to have any concept of how transformational 5G could be in your business, you need to think outside the box. This means being prepared to rethink connectedness and being mindful of the challenges it may present. For example, while mobile networks will play a role in IoT communications, the number of IoT applications that require the characteristics of 5G is currently limited. High bandwidth, low latency and a million connections per base station are not required for most IoT connections today.

However, developments move fast, and a single transformative idea can have enormous effects to open new business areas.

While 5G is under development there remains a central question about availability of 5G-ready endpoints today. Therefore, Wi-Fi technology (particularly Wi-Fi 6) will continue to be an alternative. Wi-Fi is already available and operates on the same frequency as its previous generations making new developments backwards compatible.

WHAT COULD YOUR NEXT STEPS BE?

Networking is at the heart of a connected organisation, and getting your strategy right is fundamental for leveraging 5G benefits

Ensure your network is as adaptable as it can be to support new wireless infrastructure

Deploy a proven roadmap to implement your tested solution

Embracing innovation means careful testing and monitoring of results using proven testing facilities like Computacenter's Global Solution Centers

Work with vendor-neutral but innovative partners

> A combination of 5G and Wi-Fi 6 will have a profound effect on developments in almost every kind of industry, answering many of the critical questions for competitive success and survival.

Damian Hamber
Group Product Manager, Networking

SERVICES MODEL

As covered in previous chapters, 5G services can be consumed in many ways. The challenge can be identifying which of the possible options is the most appropriate for the individual customer's demands.

In terms of our approach, every potential project should start with the analysis phase of the business use case. From this, a list of criteria, and a possible solution needs to be prescribed. Based on the solution criteria, we would advise customers to define the test scenario, decide where to build the solution environment, and run a proof of value assessment. At this stage, customers will and can see the results of real-world tests, in order to establish the feasibility and the complexity of the solution. Depending on the proof of value results, further steps for the planning phase of the solution can be made.

Occasionally, what can look like a straightforward and easy-to-implement approach can actually take many days or weeks. Therefore, we would advise our customers to follow the 'fail fast and fail cheap' approach. That is, to focus and spend time on the analysis of the use case and the suggested results of the possible solution – before going into the test and proof of value phase.

For example, if analysis shows that the solution can be realised by a public 5G network service, this means it can be utilised much easier than building private 5G networks, or vice versa.

Alternatively, the analysis of business requirements and solution criteria can show that today's availability of endpoints which aim to be connected to 5G are insufficient. In this case, the question would be which alternatives are available and does the business use case really need the latest 5G technology? Does any existing wireless technology like LTE or Wi-Fi offer easier access and/or cost-friendly approach?

Whatever results the analysis and proof of value phase bring; it forms the basis for further planning of the solution implementation and the operating model. From this, some additional activities may need to be taken, including:

- Frequency planning/Spectrum usage
- SIM-Card/eSIM Management, e.g. Mobile Station International Subscriber Directory Number (MSISDN), International Mobile Subscriber Identify (IMSI)
- Regulatory compliance

Depending on the decision for a target solution – if it is a public or private 5G network, or to build or extend a Wi-Fi network, there are several activities within to the 'plan-build-run' that must be followed.

Computacenter will help customers with advisory, design and build, as well as maintenance and support services at every step of the journey.

THE BIG QUESTION: 5G VS. WI-FI

Mobile broadband and Wi-Fi technologies have been on the market for many years now. Today, 5G is setting market expectations, but it should not be overlooked that Wi-Fi 6 can also offer a wireless environment with other advantages. Which of the available technologies will bring the most benefit? And is one better than the other? The answer isn't so clear cut. For starters, 5G could be seen as the more innovative approach, however a Wi-Fi solution may offer the best legacy compatibility.

From farming to self-driving cars and smart cities, the choice of 5G or Wi-Fi 6 will ultimately be based on the cost of investment, geography and specific application. The new connectivity world will have a much broader range of wireless and cellular technologies, and the best advice is to pick the technology that is ideally suited to your user experience and business goals.

Wi-Fi 6 (also known as 802.11ax) is an evolution of existing wireless LAN technology, with new access points and controllers available in the market from the leading network vendors. The Wi-Fi 6 proposition is compelling, with performance, security, and latency advantages available to home, campus, enterprise and potentially metropolitan area customers using off-the-shelf network infrastructure solutions. Upgrading to Wi-Fi 6 technology is the next logical upgrade for today's legacy Wi-Fi infrastructure customers.

On the other hand, 5G mobile networks will unleash never-before-seen performance, reliability and capacity standards, encouraging innovation and unlocking new ways of working. With the potential for a 100-fold increase in network throughput (subject to the capability of the connected device), 5G will enable new user experiences for tomorrow's high-performance requirements.

Wi-Fi 6 and 5G will coexist in a manner that's highly beneficial to prospective customers. Cellular Networks like 4G are have become proven standards for rural areas and countrywide network coverage, extending outdoor coverage of for internet connectivity. Wireless LAN (WLAN) networks are the standard to build wireless access for coverage inside buildings.

The new Wi-Fi 6 standard will become the most exciting leap for indoor performance and metropolitan site-specific connectivity outcomes (stadiums, shopping malls, etc.). However, since 80% of the data consumption originates within a building, a 5G infrastructure could also make a valuable case. We will help evaluate all pathways, providing the best solution for your network, business aspirations, and end users.

> "Organisations will need to carefully examine and apply technology innovations to fulfil changing business needs. Effectively, a 'hybrid network architecture' is likely, by integration of new innovations such as 5G or Wi-Fi 6."

Frank Witte
Group Strategy Director, Networking

THE MARKET LANDSCAPE

Whilst there is a lot of buzz around 5G today, the question stands – is the market, its providers and manufacturers ready to establish 5G as a real alternative?

5G infrastructure and connectivity will bring the Smart City to life

The roll-out depends on the grade of maturity in the different markets, with the coverage of the telco providers and manufacturers. Businesses with a global footprint should also be mindful about the different states of 5G readiness in different regions of the world.

READINESS (BY COUNTRY)

Country by country 'readiness' of devices, infrastructure, regulations, and inter-country protocols presents a diverse picture, not always blessed with consistency. Where businesses operate will inevitably affect their suitability for certain wireless applications. For example, China, South Korea and USA are known leaders in the field, and if your business is geared toward those countries, your planning can draw upon these national advantages. European countries like Switzerland, Finland and Italy have already launched comprehensive 5G services. Providers in Canada, France, Germany, Hong Kong, Spain, Sweden, Qatar and the United Arab Emirates have already drawn up plans to accelerate the roll-out of 5G networks by 2020. According to reports, 5G is already available in 378 cities globally, across 34 countries, while Gartner estimates that 7% of providers worldwide will have 5G infrastructure in their networks by 2020. Volume and market demand will accelerate technological maturity and reduce the cost of delivery over the long term.

Western Europe and countries like France, Germany and the UK, have not made substantive progress in preparing for 5G leadership. This is clearly disappointing for European based businesses, whose plans to leverage 5G advantage are on hold. One agreement out of the European Commission programme, The Digital Agenda for Europe, has the objectives that one major city in each Member State should have a commercial 5G network by 2020.

BY COMMUNICATIONS SERVICE PROVIDERS

CSPs play a major role in the roll-out of 5G. This includes the well-known telco providers, who have already made considerable progress in the expansion of 5G networks in 2019. Many countries have also auctioned or allocated frequencies, so that telco providers can make further developments in the expansion of networks.

Beyond selling 5G connections in mobile devices such as smartphones, tablets, laptops and wearables, CSPs have a great opportunity to broaden their scope to targeted verticals. However, CSPs need to pinpoint which use cases are best answered by the 5G value proposition in order to build the right solutions and turn that into a success. Most of the telco providers are offering their services to experiment with 5G, including private 5G networks. However, CSPs face the challenge of focusing on marketing 5G as an enhancement to current offerings, we see 5G as much more than that.

> “In Germany, statutory requirements expect established providers to cover 98% of all households by the end of 2022 with 100 Mb/s, as well as Autobahn roads and rail lines by the end of 2022. So, market readiness must ramp up next year.”

Dr. Peter Klostermaier
Solution Director Networking, Germany

Instead, market analysts suggest that 5G should be seen as a platform that delivers business results for various industries, where improved connectivity is only part of the solution. This includes the due investment of most CSPs in data and AI capabilities, along with multi-access edge computing and the incorporation of IoT as part of the 5G platform. The added value of this approach enables a horizontal technology platform that is agile, flexible, open, extensible and easily scalable to deliver use cases for different industries.

To achieve this, its focus is not on connectivity, but on enabling data flows (the collection and transport of data). For example, enabling different transactions between machines, processes and people, and using AI to gain meaningful and value-added insights. Other capabilities that result from this include edge computing, network slicing, and improved resource management.

New networks and services also mean one must be prepared for the potential of new security concerns and challenges. Low latency, faster connections and larger amounts of data are much more vulnerable without the right security provisions. Here, we see CSPs in particular as having a duty to find the necessary security strategy for customers. However, we also can help with our offerings and services as part of our Digital Trust portfolio. We endeavour to support you in finding a suitable security architecture that can better prepare you to identify vulnerabilities, close security gaps, and establish controls for a secure state.

Between now and the end of 2020, CSPs will need to gear up for the first phase of mass adoption. But are CSPs' monetisation platforms ready to provision, enable, and charge for these new network performances and create a connecting tissue between CSPs and their partners? These are the kind of questions that our networking experts are asking on behalf of customers all over the world.

In 2035, 5G will enable $12.3 trillion of global economic output: nearly equivalent to US consumer spend in 2016 [IHS Markit 2017]

The global 5G value chain will generate $3.5 trillion in output and support 22 million jobs in 2035 [IHS Markit 2017]

The total contribution of 5G to real global GDP from 2020 to 2035 will be equivalent to an economy the size of India [IHS Markit 2017]

A report from PSB Research, which surveyed over 3,500 people including business decision leaders, analysts and tech enthusiasts, found that as a result of 5G:

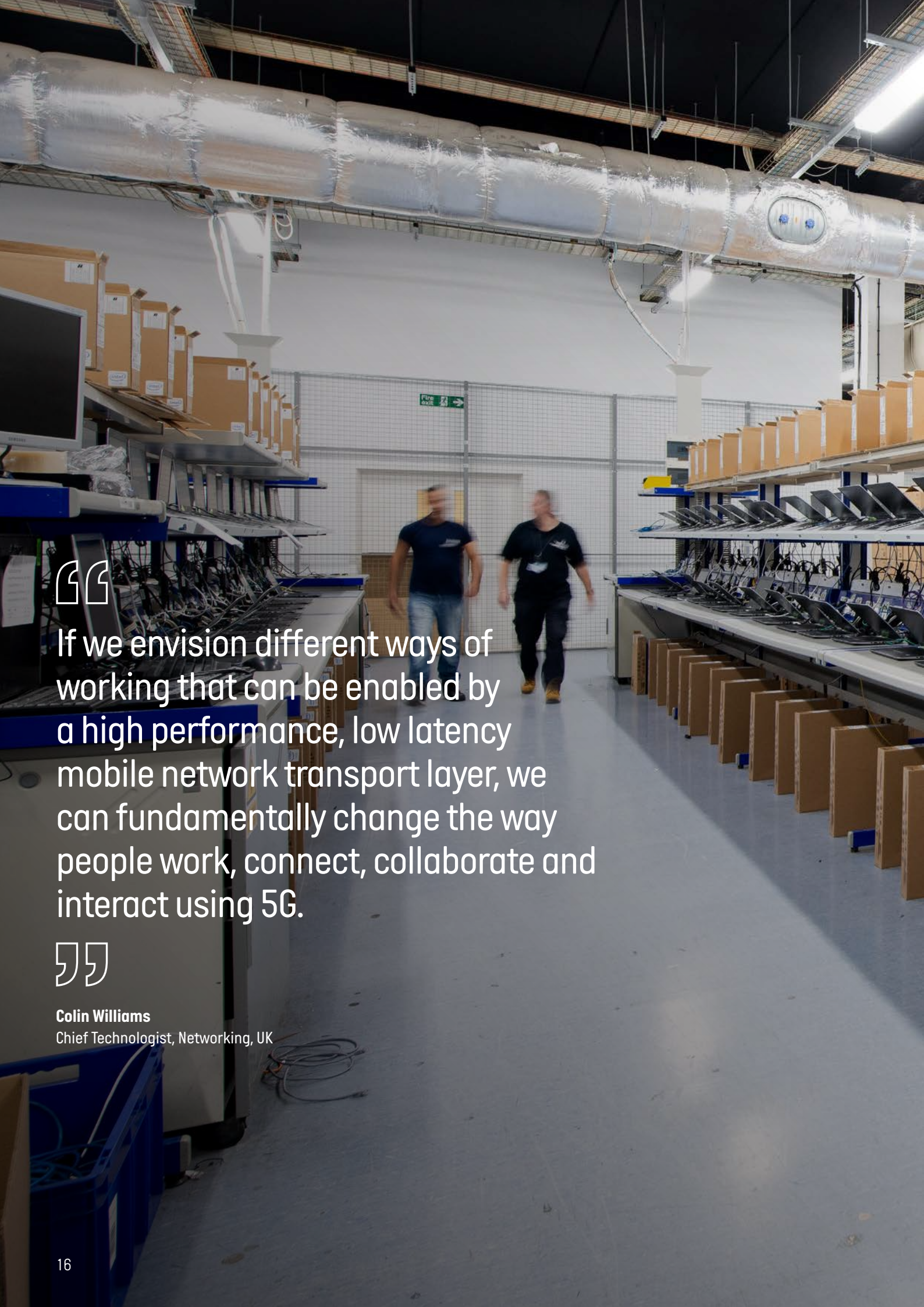
91% expect new products and services that have yet to be invented

87% expect new industries to emerge

82% expect small business growth and more global competition

85% expect it to make companies more globally competitive

89% expect increased productivity



> If we envision different ways of working that can be enabled by a high performance, low latency mobile network transport layer, we can fundamentally change the way people work, connect, collaborate and interact using 5G.

Colin Williams
Chief Technologist, Networking, UK

WHY COMPUTACENTER?

Our Solution Centers can map and test customers' entire network infrastructure and present new and innovative approaches to network management. In terms of 5G we are focussing to show the benefits of 5G endpoints alongside comprehensively tested 5G carrier infrastructure. With our extensive experience, we are well positioned to support you in planning, building, and running IT services, and we do not believe that this should inhibit your preparation and exploration into how 5G will build new paths for business transformation.

Ultimately, we believe that the key for 5G readiness is to keep your choices open, and we can help you do that by providing the latest intelligence about this extraordinary new technology.

ADOPTION CHALLENGES AND PRE-REQUISITES

Before 5G can be rolled out everywhere, to guarantee infinite opportunities the following pre-requisites need to be positioned:

TECHNOLOGICAL REQUIREMENTS

The structural requirements for 5G means roll-out will be gradual. Whereas lower frequencies can cover a wider area, 5G with higher frequencies will mean more towers or cells are required to make the network function properly. Most countries are trying to retrofit this new infrastructure on existing equipment like streetlamps, antennae or electricity boxes. This means 5G will only initially be deployed in densely populated areas, with the highest speed and capacity reserved for dedicated networks.

It is likely that the added infrastructure burden means it could be decades before 5G is as commonplace as today's mobile LTE networks. The message we believe is to keep your options open as long as possible but be ready to move as the technology matures.

PEOPLE AND SKILLS

5G offers an incredible capacity for data flow, number of connected devices, low latency, and both flexibility and agility in network applications. What does this mean for administrators and engineers working with these networks?

It is already apparent that there is a shortfall of qualified people in 5G deployment and roll-out, as the new technology is structured differently from 2G, 3G or 4G. It is a huge area of infrastructure that is now being covered worldwide. Wireless connection jobs are constantly and rapidly changing. Technicians will need to develop skills quickly to meet the increasing demand.

There is a demand to expand and diversify their skillsets, to include training in areas such as small cell antenna installation, 5G equipment specifications, 5G construction practices, 5G infrastructure design, distributed antenna systems, and fibre rollout. Equipment maintenance will also increase the need for skilled employees.

But it is not only the technicians and engineers who are missing skills and talent. The companies planning on using 5G networks also need to be prepared.

For example, M2M communication could be a challenge for engineers, synchronising several network layers for interoperability. The example of autonomous cars shows that this application also has human safety at the centre of its function with auto-piloting features becoming increasingly reliant on wireless data. Capacity, coverage and latency must be precisely coordinated. The challenge for engineers will be to ensure the flexibility to meet precisely these requirements of high availability and reliability. Another key challenge for 5G will be to design the existing spectrum and infrastructure in such a way that capacity is increased without significant additional costs.

ORGANISATIONAL

Companies that want to make use of 5G may need to rethink their structure, operations, and culture. First of all, the 'network' should no longer be considered only an IT concern. **After all, without an appropriate network, a business simply cannot function.**

Moving forward, developers and IT will need to work together to get the most out of new opportunities. In organisational terms, this means that new roles may need to be created that serve as an interface between the two departments. For example, a Chief Digital Officer can be a leader to drive new opportunities whilst also being responsible for digital transformation.

Since there is still a lot of research in 5G and it is not yet clear what all the possibilities are, companies should also agree on how much experimentation should be allowed. A commitment to innovation does not only concern the available budget and funding, but also the resources to be made available in order to be able to decide which use cases are likely to bring the greatest overall business value.

Organisational changes may also mean entering into new partnerships to help monetise 5G and IoT. This could mean partnerships and strong relationships with providers, ecosystem partners, regulators and even competitors.

Companies from other areas can help to make certain use cases work. For example, this could result partnerships with platform providers for the creation of digital ecosystems; strategic IT partners with end-to-end solutions; telcos partnering with authorities for the development of smart cities; or perhaps managed service providers running robotic and IoT production lines on behalf on an industrial brand.

THE POTENTIAL: IMAGINE THE UNIMAGINABLE

The pace of business is due to pick up with the introduction of 5G making it possible for every aspect of your operations to move faster – delivering instant, wireless connection between machines and devices. It should challenge the downtime and work disruption associated with accessing large files and support more flexible working by enabling media-rich content to be downloaded to phones or tablets quickly and securely. 5G's outdoor coverage will also improve your ability to monitor assets in remote locations using IoT technology such as smart cameras or sensors.

The workplace is changing, becoming faster, lower cost, with easy and reliable remote connectivity. Higher worker productivity, and more flexible office spaces should be part of the advantages this technology offers.

5G's low latency will help your workforce to collaborate in real-time with customers and react to requests instantly. 5G's high bandwidth will mean you can stay connected and responsive even in crowded areas, and improve connections in video conferences with high quality, pixilation-free images and no buffering. In time, 5G will offer much faster speeds on the move, enabling instant responses to anyone, anywhere, from home, the airport, or on the train.

We could see improvements in the field of autonomous vehicles with leaps in intelligence and reaction times (and therefore safety) for on-board computing. With data able to be transferred from the sender to the receiver ten times faster than before, this could also be valuable for the remote operation of robotics, or using augmented reality, or to perform surgeries. Here, a 5-millisecond delay could be the difference between life or death, so high data rates and a stable connection are mission critical.

EXAMPLES FROM ACROSS VERTICALS

There's still a lot to consider as we prepare for 5G. But what will the 5G future look like? For which challenges can 5G provide an answer to?

Of course, the concepts below are likely to quickly evolve far beyond this as businesses increasingly adopt this technology. However, these examples can help indicate the sort of innovations we could be likely to see, and the direction they can take.

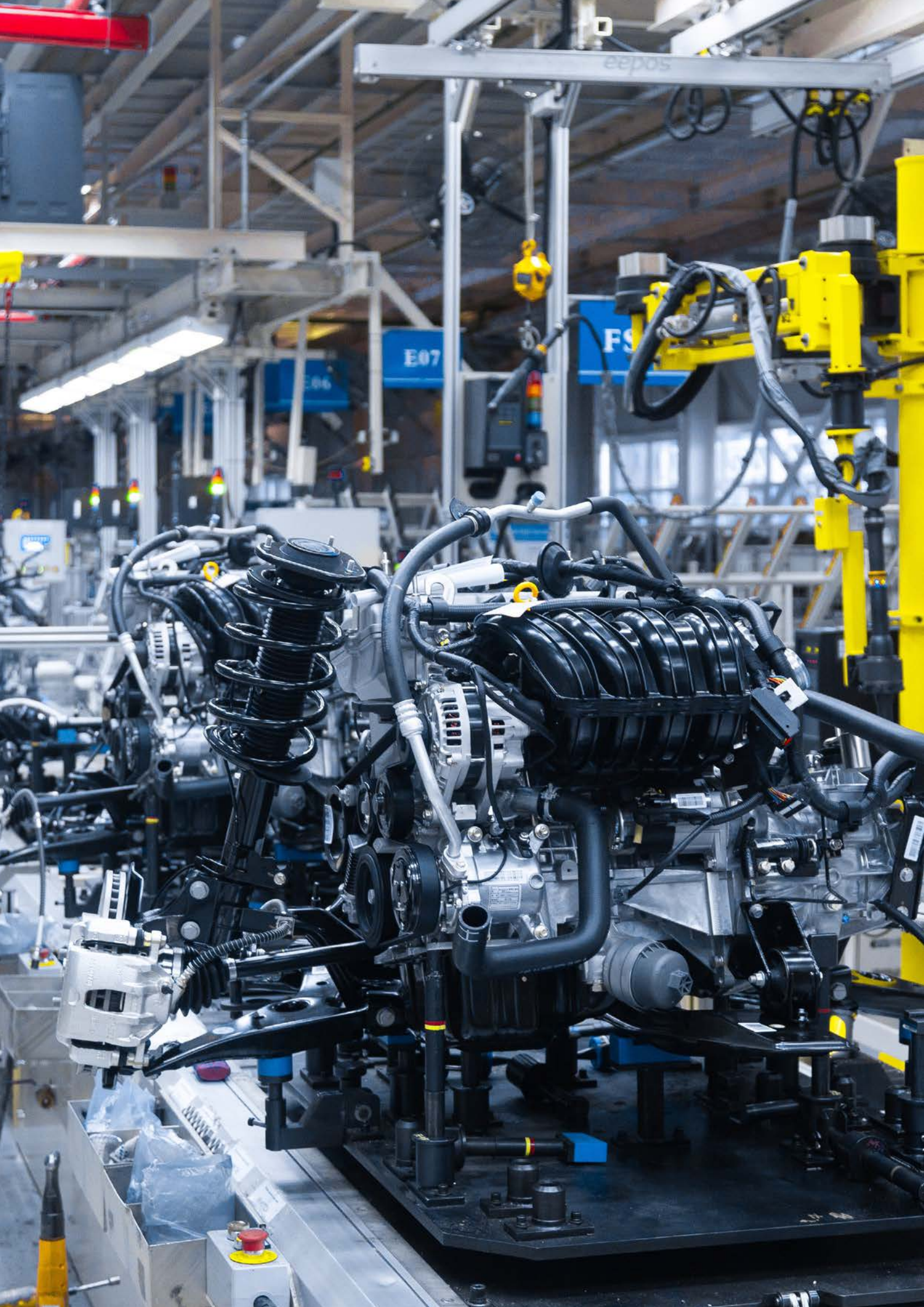
Industrial & Automotive

Wireless communication is already an integral part of factory operations. However, our customers tell us that there are often problems with network coverage, and interferences with other Wi-Fi networks. Often, many use cases are not feasible because of high latency or unpredictable performance. These limitations are likely to be resolved by 5G. The potential to deliver real value in manufacturing based on the potential for high performance, low latency networking will be realised best with complementary wireless solutions. In conjunction with Wi-Fi 6, a plant could be operable with consistent connectivity allowing industrial plant to run unencumbered with minimal interruption.

Customers ask us to help them in building and supporting a private 5G infrastructure, and to integrate this to existing enterprise IT services. The aim of implementing 5G infrastructure is to evaluate use cases for potential future applications. For example, 5G could be used to exchange real-time data from a vehicle in transit carrying sensitive resources for a just-in-time production environment, allowing the data stream to adjust production line activities based on the vehicle's location. Further examples of use cases for manufacturing and automotive customers include:

- Over-the-Air (OTA) updates of data images or software into car onboard units
- Connecting Automated Guided Vehicles (AGV) via 5G to realise lean manufacturing and streamline production flows more dynamically
- Equipping forklift vehicles with 5G connectivity and additional intelligence to enable real-time data analysis and automate logistic processes
- Equipping robots with 5G modules to evaluate real time control and data analytics of the production process

Because the biggest challenge is the limitation in availability of industrial ready 5G devices, many of the use cases are still in the planning phase. Manufacturers hope that 5G connectivity will increase productivity and reduce costs significantly once a wide variety of automation devices are available in the marketplace.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Banking and Financial Services

The 5G customer experience benefits are compelling. Low latency, high-data capacity and reliability will help finance companies and create new ways to deliver mobile, online and in-branch services. The potential to deliver high-bandwidth, interactive services to a consumer-owned 5G mobile device may help financial services organisations deliver a consistent, video-based, media-rich user experiences – whether the customer is mobile, remote, or within a banking branch.

New customer experiences through augmented and virtual reality (VR), or high-definition/4K video will be possible via 5G-compatible handsets. This will make it possible to give customers real-time access to video consultations with financial representatives, like face-to-face appointments, maybe with a level of service and experience exceeding what is available today?

It may allow customers to start a conversation outside of a banking branch or environment and continue that interaction walking into a branch in-person with minimal impact.

From a branch queue-busting perspective, it may be possible for a central pool of staff to service more customers who may – via their own device – still have the potential for a high-definition, high- quality interactive experience delivered by 5G. The implementation of a new technology also allows the opportunity to integrate new security features from the ground up, further securing customer's data and the financial institution's infrastructure.

Examples of use cases for banking and financial services customers include:

- Ultra-low latency of 5G connections will transform high-frequency and automated trading operations, which could be vital for capital market firms
- Build new customer experience through AR and VR products, which make it possible to walk customers through their investments and the wealth management lifecycle via immersive data presentations
- Give customers real-time access to video consultations with financial representatives – both virtual and human – who can help them make informed financing decisions

Combining 5G with other technologies, like edge computing and data analytics, will enable the finance service sector to create new experiences for employees and their customers. We expect most of the use cases for the finance sector will be implemented on public 5G networks.

The main question for the success of those use cases is the availability of 5G network services in the specific region or geography. If available, 5G could also open up unbanked or underbanked regions of the world, because it will be easier to give access to high-speed broadband in remote areas.

Public Sector

5G has the potential to transform societies, by enabling people, IoT devices, and systems to interact and engage via ultra-high-speed communications networks. In turn, this will open the door to new business and new consumer experiences. We expect that the creation and management of smart cities will become increasingly relevant in the coming years. 5G will be able to drive their evolution. This high-speed connectivity, low-latency, energy-efficient protocol, coupled with the ability to handle a massive number of connections will help create a myriad of new services.

The main players in this field will be telecom operators, who will drive the market forward by rolling out 5G services and supporting use cases, such as:

- The rich media potential of 5G, where higher levels of video and audio quality can enable an 'in person-like' visual experience for providers and recipient of the customer services experience – anywhere 5G connectivity exists
- Improving transportation systems using 5G is a common use case. For example, connecting IoT sensors deployed inside pavements and on streetlights to a centralised traffic management system – providing granular information to local authorities and planning bodies for traffic flow
- Enhancing services related to public safety and security. High bandwidth, the low-latency functions and new edge capabilities – for example, real-time analytics of image data – enabling the quick identification of dangerous situations - and alert authorities automatically
- Specialised services over 5G can also significantly improve the quality of life for disabled citizens. By offering remote assistance services, the elderly, the disabled, or vulnerable people can remove some of the physical limitations currently in place. By providing citizen services remotely, people will be able to save a significant amount of time and money on travel and mobility costs.

In the coming years we expect that Smart City use cases will emerge. 5G can help with social inclusion, delivering high-speed connectivity where previous cable or legacy broadband connectivity environments fail to reach. This can broaden community access to the internet and high-speed networks in previously challenged areas. The combination of high bandwidth, low latency, better energy efficiency and processing of concurrently connected devices will enable new services to be created, especially in the areas of transportation, public safety, security, and welfare services.

5G BENEFITS

While we foresee many new use cases emerging, 5G also brings with it a number of general benefits and opportunities that are likely to be applicable to all of them. These include...

SPEED

Greater speed will enable users to access files, programs and remote applications directly and without waiting. It will also mean that users can start intensively using the cloud for mobile devices, meaning there will no longer be a need to download apps, as the information will immediately be available in real-time. Large numbers of processors will not be needed anymore, as computing is possible in cloud-based infrastructure. This will also free up storage, with data and content stored remotely, rather than on devices.

SUSCEPTIBILITY

In addition to the low latency, low susceptibility to shared frequency radio interference is a big plus with 5G. A reliable network is the foundation of everyone's business and keeps a company running smoothly. Exclusive radio channels on public or private networks help to keep traffic secure and reliable.

PERFORMANCE

An increasing number of human, device, and machine users will be added to the network, massively increasing data flows. Data traffic will need much more space, particularly in smart city scenarios, where traffic lights, streetlamps and industrial plants are sending information. Previous generation radio cells could not have served all these users simultaneously. All connected devices will have access to the internet, and be able to exchange information with each other, in real-time.

STABILITY

If entire city councils, hospitals, aeroplanes and factories are controlled via the Internet, a power failure or a radio dead spot poses extremely high risks to normal operations. Coupled with uninterruptable power supply units, the speed and stability of 5G technology would help eradicate many of these concerns.

BANDWIDTH

As use cases such as VR and AR become more data intensive, transmission rates also increase enormously. Remote assistance and machine upkeep will be much easier as employees can optimise and maintain assets without needing to be in the same location.

EFFICIENCY

The transition to a more efficient model of infrastructure helps us to save time and money at all levels of operation. Companies could even optimise workforces, because faster networks enable the use of AI and automation to simplify or automate processes, making more efficient use of the human workforce.

RELIABILITY

5G has a reputation for being reliable and stable. The connection is not very susceptible to interference because of the unique frequencies it operates on and the fact it is planned with tomorrow in mind. It can continue to remain stable even with increased Internet traffic as the result of more attached devices or greater bandwidth consumption.

RECOMMENDATIONS

YOU AND 5G

When it comes to establishing your own plans, there are no easy answers of how to best take advantage of 5G. Our recommendation is – as for any major strategic decisions – that you will need to ask and answer a series of fundamental questions about your own business needs first. We help customers to answer questions such as:

- What are my business requirements and the use cases where 5G could deliver serious benefit?
- Can 5G and/or Wi-Fi 6 provide the solution, and what are the pros and cons?
- In what countries will my solution be implemented, and what are the local conditions, protocols and regulations?
- Does the solution I'm thinking about meet my security requirements?
- Does it integrate into my business model?
- Does the investment cost – OpEX or CapEX – work for me?
- Do I need help to reach a decision?

By going through this process we can work with you to:

- Define a roadmap to build and deploy an appropriate solution, with our expert networking professionals
- Pilot your solution (with Wi-Fi 6 and / or 5G), testing it in a safe technical environment that matches the business application, enabling you to see, adjust and try the solution before implementation
- Provide continuing advice on the changing international networking environment, to keep you one step ahead, and avoiding wasted investment.
- Stay up to date with new developments within the field. We appreciate that 5G is a new technology and will consequently develop in line with consumer demand.

PREPARING FOR CHANGE TOGETHER

Our purpose is to provide our customers and partners with educated views on the connectivity world ahead of us. While we, as always, treat over-claims and over-reaching predictions with care, we have no doubt that 5G offers business unrivalled potential for performance enhancement, efficiency, business growth and innovation.

5G is an emerging set of technologies, and the geographic and regulatory environments for its adoption will continue to evolve with the tech. There will inevitably be challenges, and in order to overcome them and unleash the power of 5G, we will be there to offer guidance, advice and solutions.

We do not believe that this should inhibit your preparation for novel wireless technology, we pledge to drive your business transformation through our up-to-the-minute insight and valuable relationship with your business.

In a nutshell, we believe that the key for 5G readiness is to keep your choices open, and we can help you do that by providing all the latest intelligence and technologies available worldwide.

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DIGITAL Connect.
Enabling connected business outcomes

MAKING DIGITAL WORK ACROSS YOUR NETWORKING ENVIRONMENT

Our networking capabilities are captured in our **Digital Connect** proposition. Our approach is based on improving operational efficiency through technical innovation and cost-benefit analysis. Digital Connect is a key aspect of our 'Digital First' offerings and capability – which also supports our customers in workplaces, within their security considerations, and across their cloud and private infrastructure.

DIGITAL Me.
Workplace designed for people, engineered for business

MAKING DIGITAL WORK IN THE WORKPLACE

Taking the 'Digital First' idea into the working environment, **Digital Me** recognises the tight link between connectivity and the workplace. Delivering personalised experiences and seamless collaborative opportunities will become central to how we deploy 5G solutions.

DIGITAL Trust.
Mastering business security

MAKING DIGITAL WORK SECURELY

As a new technology wave such as 5G emerges, you need extra assurance that your IT is truly secure, so you can grow and make strategic decisions with complete confidence. Our **Digital Trust** capabilities provide that assurance by making business outcomes secure, identifying vulnerabilities, closing security gaps, and establishing controls to protect your privacy and business.

DIGITAL Power.
Cloud accelerating business

MAKING DIGITAL WORK FOR YOUR DATA CENTER AND CLOUD

Cloud is a business process that is inevitably going to grow in significance as more and more 5G generated data requires cost effective and secure storage. Our blend of on-premise and cloud expertise is invested in our **Digital Power** proposition, designed to optimise every aspect of your 5G requirements.

We can help you respond faster and more effectively to the digital business ecosystem. We will be there every step of the way in developing 5G networks, getting you to market faster, and providing ongoing, reliable, and honest support.

We can help you address and deploy 5G in ways that you may not have considered, combining a visionary approach coupled with our reputation for practical solutions to drive your potential further.

GET IN TOUCH

To discover how Computacenter can help transform your business and make it future-ready, please contact your Computacenter Account Manager, call **01707 631 000** or email **enquiries@computacenter.com**

CONTRIBUTORS

Sabrina Ghebrehiwet
Group Product Marketing Manager Networking

Sabrina is an experienced product marketing specialist. With a background of more than 10 years in ICT marketing, Sabrina is responsible for the go-to-market of our networking portfolio and the strategic development of our Digital Connect proposition.

Damian Hamber
Group Product Manager Networking

Damian has worked in operational, commercial and service focused IT roles for more than 20 years, notably leading a large global team delivering networking services to key customers. He is responsible for managing the product portfolio of new and existing developments, and executing Computacenter's networking strategy.

Dr. Peter Klostermaier
Solution Director Networking, Germany

Peter Klostermaier joined Computacenter in 1999 and is responsible for pre-sales support and solution management for networking in Germany. He leads a team of consultants and solution managers, advising customers on strategic direction for all networking issues.

Colin Williams
Chief Technologist Networking, UK

Colin is responsible for strategy, demand creation, solution development and customer enablement. He believes that optimum alignment of business and technology outcomes are key to customer satisfaction. Colin analyses the IT market, emerging and existing technology vendors, the business aims and objectives of customers, and develops strategies to ensure our solutions leverage technology that enables customers to realise business outcomes.

Frank Witte
Group Strategy Director, Networking

Frank's responsibility is to define the long-term direction for the Networking business. Frank analyses and takes into account new market trends and technologies to drive business growth, but also supports current best practice to transform innovation to business success. Frank has more than 25 years' experience in the IT and Telecommunication industry and contributed significantly to the success of the networking business.

ABOUT COMPUTACENTER

Computacenter is a leading independent technology partner, trusted by large corporate and public sector organisations. We help our customers to source, transform and manage their IT infrastructure to deliver digital transformation, enabling users and their business. Computacenter is a public company quoted on the London FTSE 250 (CCC.L) and employs over 16,000 people worldwide.

Computacenter (UK) Ltd
Hatfield Avenue, Hatfield, Hertfordshire AL10 9TW, United Kingdom

computacenter.com
+44 (0)1707 631000