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The power of 5G Mobile Private Networks:

It’s all about the application

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CHAPTER 1

Are you ready for the revolution?

Industry is driving the next evolution in wireless technology

We are currently witnessing a unique moment in the history of wireless: the operational needs of b2b industries – not consumers – are powering the next big step forward.

Organizations in nearly every segment are on an endless quest to optimize their operational processes. As needs evolve and emerging technologies like IoT, Artificial Intelligence, and EDGE computing approach the mainstream, current connectivity networks are unable to provide reliable low latency connectivity for the vast amount of data generated across their operational chains.

Until the advent of 5G. 5G-powered Mobile Private Networks are poised to transform the fundamental processes of many industries.

How?

- By opening the data transfer floodgates.
- By replacing many disparate and outdated connectivity solutions.
- By delivering the ultimate reliability for core operational processes and mission critical communication.

As such, 5G blows current technologies out of the water.

The data floodgates are about to open

5G is the fifth-generation mobile network technology: a new global wireless standard that follows in the footsteps of 3G and 4G. It was developed specifically to directly, wirelessly connect machines, objects and devices – not just to enable the mind-blowing data transfer speeds that consumers are (not yet) clamoring for.

When deployed via a mobile private network (MPN), 5G brings unprecedented innovation opportunities to businesses in numerous sectors through five universal advantages:

1. Massive data throughput

5G was designed from the ground up to provide high-speed data rates (several Gbps) and to do this for a massive amount of interconnected and sensored devices. 5G will unlock use cases requiring real-time high-def video processing, machine-learning applications, complex communication networks and IoT processes. As such, 5G can be said to be the ultimate enabler of Industrial IoT.

2. High reliability and low latency (URLLC)

Ultra-reliable low-latency communication refers to a set of features that provides the low latency (i.e. minimal delay, as low as 1 millisecond) and extreme reliability (of 99.9999%) that is needed for mission critical industrial processes, always-on emergency communication, smart mobility, smart grids etc.

3. Network slicing (vLANs)

A 5G MPN can be "sliced" into highly secure virtual networks (vLANs), each of which has its own dedicated purpose and QoS (Quality of Service). Slices can be set up for core operational processes, mission-critical operations, tamper-free emergency communication channels, redundant networks, best-effort guest WiFi etc.

4. From 'standalone' to 'public network integrated'

An MPN can be deployed in several ways. At one end of the spectrum, as a standalone and isolated non-public network (SNPN), deployed entirely on-site, with no connection to the public network. On the other side, as a Public Network Integrated Non-Public Network (PNI-NPN), allowing humans and mobile objects to maintain ultra-reliable, highly secure and uninterrupted connectivity extra muros and realizing maximum economies of scale by sharing core network components across multiple deployments.

5. One solution, unlimited uses

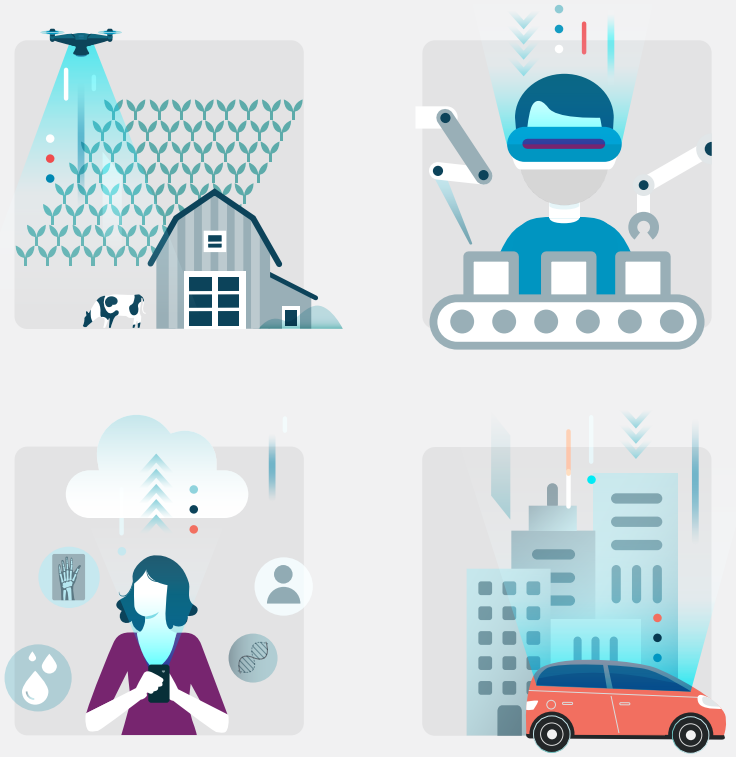
A single end-to-end 5G implementation can unlock several possible use cases simultaneously, replacing (legacy) communication networks while supporting existing as well as new communication services and operational applications.

Are you ready for the revolution?

For businesses and organizations, the 5G revolution is happening **where wireless connectivity and IT meet**, and it's happening right now.

It's clear that while the mobile network layer is the core of an MPN implementation, it's the **smart applications built on top** that will transform the way we do business in almost every sector. This makes Cegeka an invaluable partner in developing customized, high-impact, agile, 5G-enabled software that meets the unique needs of your industry and business.

Ready to dive into the possibilities? Read on to discover how 5G MPNs are poised to transform **industry, agri-food, smart cities and healthcare.**



CHAPTER 2

Driving the data tidal wave of smart industry

As a result of close collaboration between industrial companies and standardization bodies, 5G comes with plenty of ground-breaking enterprise-grade capabilities. The end result: lower operational costs, enhanced safety, higher efficiency and massive competitive advantages.

5G MPNs are made for industrial environments

Deployed in an MPN setup, 5G wireless technology seamlessly links up the numerous smart devices, sensors, equipment, camera's and vehicles on the production floor with data-driven apps. With just one implementation, industrial firms get everything they need to transform operational processes – simultaneously.

We've already mentioned the universal benefits of 5G MPNs, but here's how they align specifically with industrial needs and challenges:

- **Insanely fast data rates** make data-heavy machine-learning applications like predictive maintenance and visual quality inspection relatively easy to run.
- **Tiny, low-power, easy-to-place transceivers** bring wireless connectivity into every corner of a production zone, no matter how inaccessible.
- **Ultimate reliability** means virtually no downtime, no slowdowns and no bottlenecks on your wireless network.
- Ultralow latency makes a 5G MPN suitable for complex, mission-critical processes that rely on split-microsecond real time data exchange.
- The ability to divide the network into slices or vLANs with their own purpose and Quality of Service.

5 ground-breaking industrial domains

By combining the superior performance of 5G with the power of Artificial intelligence, six application domains benefit enormously from the reliability, speed and low latency offered by a 5G MPN:

1. **Smart safety and security**
   Vehicle and people detection and counting, detection and reporting of proper PPE (personalized protective equipment), posture detection in the case of emergency scenarios and the use of drones as sensors to handle asset inspection.

2. **Smart predictive maintenance**
   High-definition cameras monitor production line equipment to enhance efficiency and predict the ideal moment for maintenance – before anything breaks down.

3. **Smart access**
   Intelligent facial recognition algorithms enable personnel to gain access to specific zones at a glance. Employees can access detailed technical documentation anywhere, anytime.

4. **Smart operational excellence**
   Intelligent quality inspection using cameras and smart algorithms that detect defects, shapes, correct labeling and liquid levels. Analyze equipment sensor data to tweak production parameters in real time, boosting quality and resource efficiency.

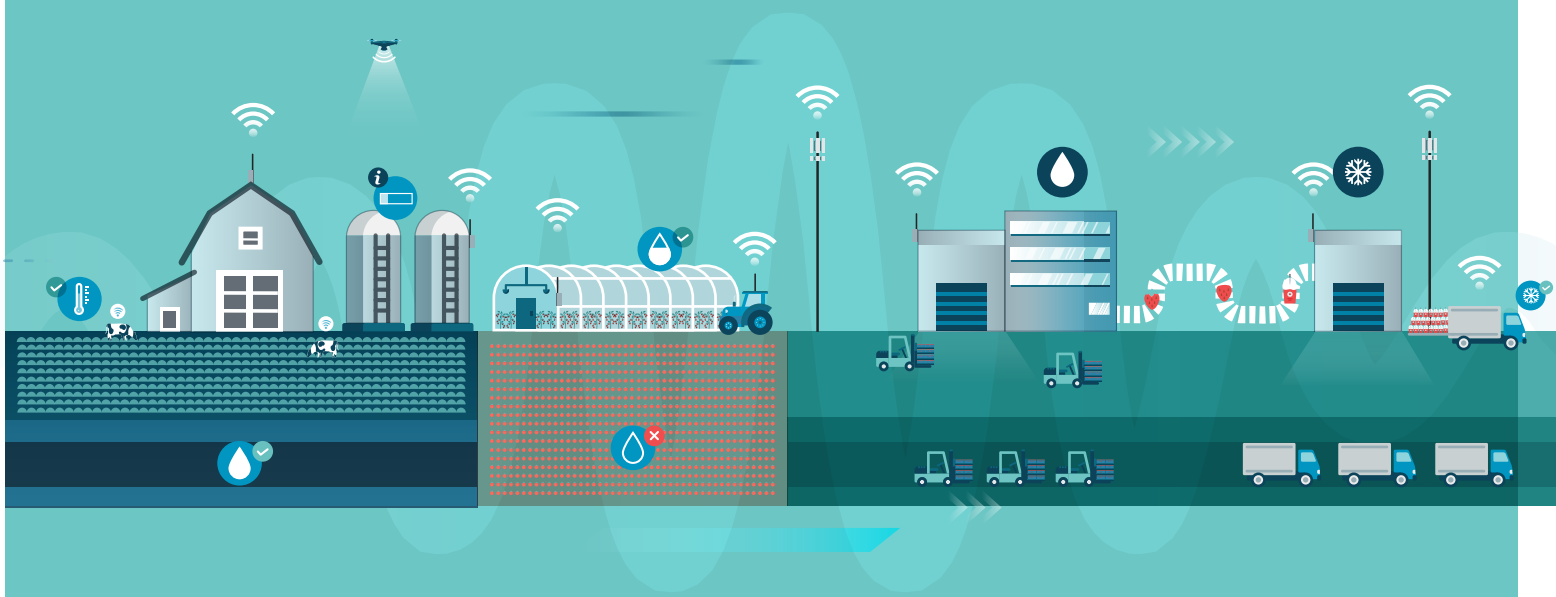
5. **Smart communication**
   Replace push-to-talk factory floor communication solutions with next-generation telephony, high-definition video – and even augmented reality.

5G as a lever for the factory of the future

5G will be the catalyst for rapid factory floor reconfiguration. Operation Managers will increasingly want to move all kinds of equipment around the production hall to flexibly accommodate production changes or orders. All their requirements – extreme mobility, reliability, security and so on – point to 5G as the most logical technological investment for the factory of the future in many verticals.

CHAPTER 3

Transforming field-to-fork into a reality



Just like production floors around the world, the agri-food landscape is changing. It's all thanks to new apps, better connectivity and other trends that are reshaping the world's expectations of every stakeholder in the food chain – from farmer to consumer. 5G will play an integral role in meeting them.

A fertile field for impactful digital applications

Data and farming absolutely go together – and **three data-driven movements** are shaping a diverse landscape of digital applications.

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1. Consumers are sustainability focused and **looking for rich details about the food** they eat, including where it was produced, by which party, using which ingredients, etc.
2. Regulators must **verify all the details** regarding the source, contents, supply chains, etc. of food products in order to certify them.
3. Operational excellence is driving **the rise of precision farming** – ultra-efficiency in farm equipment, crop and livestock management enabled by digital tools and apps.

Founded on national coverage

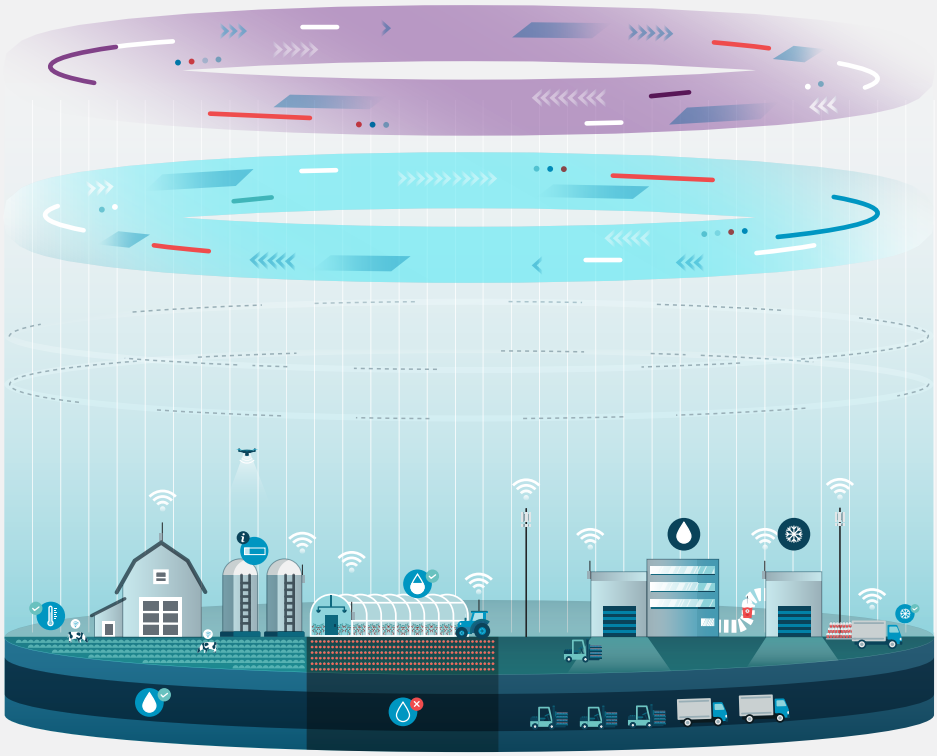
All of these trends rely on an integrated chain of stakeholders – farmers, agribusinesses, retailers, etc. – sharing and processing large volumes of data. Regional or national 5G connectivity is set to become a cornerstone of **sustainable, connected, data-driven agri-food ecosystems** that are greener than ever before

The sheer size of farms, the distances between the links in the supply chain and the decentralized nature of agriculture, require local Mobile Private Networks to be seamlessly integrated with the public network, thus allowing humans, animals and mobile devices such as drones or tractors, to maintain secure, reliable and continued connectivity beyond the farm.

Envisioning the farm of the future

While most areas of the world aren't yet equipped with regional/national 5G coverage, we are starting to see visionary applications appear on farms around the world even today:

- autonomous drones inspecting fields for yield prediction, weather damage etc.;
- precision fertilizer and pest control applications via intelligent machines;
- the use of predictive models containing supply chain-wide data to perfectly meet demand;
- self-driving tractors, harvesters, sprayers and other farm machinery interacting to coordinate their movements without human intervention;
- weed-picking or harvesting robots that reshape existing business models.



CHAPTER 4

Laying the foundation for truly connected cities

Smart cities are the only way forward to solve the challenges posed by climate change and overpopulation and guarantee safe and sustainable urban environments. Using data collected from IoT sensors and high-definition cameras, intelligent apps can ensure smooth traffic flows, safe intersections, optimized resources use and more, in real time. What's missing? One single standard to rule all wireless communication needs, that is also able to scale IoT to entire cities.

Smart cities: built on 5 pillars

There are five core domains where smart cities add intelligence to municipal processes:

1. **Smart mobility:** the use of AI, IoT and digital twins to minimize traffic congestion.
2. **Smart resource use:** applying insights from sensor data to optimize maintenance of hard assets such as roads, sewers and other city equipment.
3. **Smart energy use:** adding intelligence to public devices (like streetlights), enabling them to turn on and off at the right moments.
4. **Smart safety:** analyzing flows of traffic and people to predict the potential for collisions and conflicts, making it possible to intervene before accidents happen.
5. **Smart engagement:** collecting qualitative, sentiment-based information from people and including citizens digitally in public dialogues and decision-making processes.

All of these domains require the ability to gather, process and derive insights from huge volumes of data in real time. This requirement has proven to be a critical hurdle in scaling up smart cities pilot projects.

Flexible, low-cost, powerful – what's not to like?

The 5G wireless standard was developed specifically for data volume and speed, as well as the ability to link up huge numbers of different devices and platforms – all extremely important capabilities for smart cities, which rely mainly on IoT and video processing in combination with artificial intelligence.

Citywide 5G MPNs offer huge benefits for smart cities, including:

- **a globally standardized tech stack**, making it suitable for use with a range of hardware and sensors;
- **easy, minimally invasive, low-cost scalability** through the placement of low-power transceivers – without tearing up roadways.
- **one implementation** of a citywide 5G MPN supports all five pillars of a smart city, simultaneously, without any compromises on performance.
- **agility** through rapid implementation, as the setup of new applications takes days and is easy to redeploy and modify as needs change.

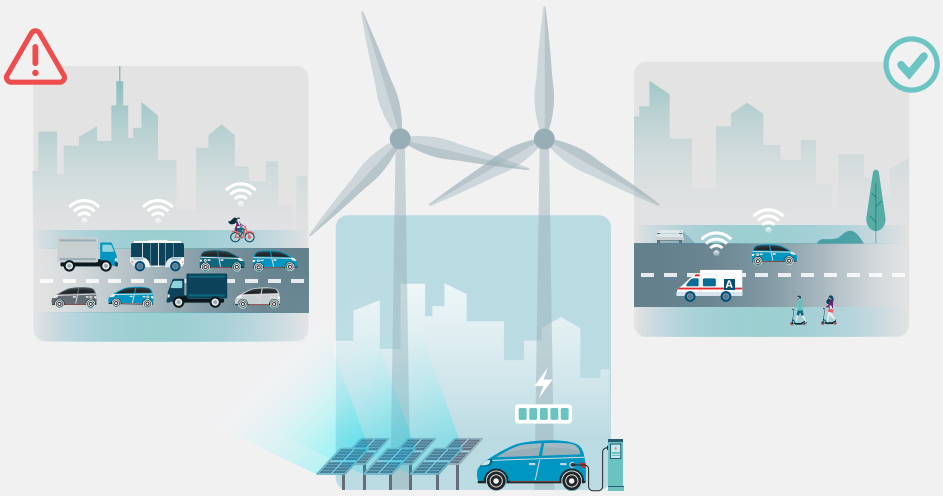
Digital twins: virtual playgrounds for smart cities

What's better than seeing the future? Seeing multiple possible futures and choosing the best one!

Digital twins are **virtual models of urban environments** – including systems and processes like electrical grids, roadways and more. As a sort of sandbox, they allow city leaders not just to gain a clear idea of what's happening right now, but also to play around with different scenarios and decisions, view their predicted results, and pick the scenario that has the best outcome – all before investing anything.

Proposing the development of a new and complex intersection in a high-traffic area? A digital twin makes it possible to feed real-time data into the modeled traffic flow to **estimate the impact it would have on real traffic flows.** Test the outcomes of different plans to design an intersection that meets every need.

The only limiter here is data transfer speed and volume. This is where citywide 5G MPNs click right into the smart cities vision of a safer, more connected, more efficient and sustainable future.



CHAPTER 5

Putting the future of human health in digital hands

We're entering the age of the truly connected hospital – and it's an emergency, as chronic diseases are on the rise, medical workloads are growing, global pandemics are emerging and new healthcare models are right on the horizon. 5G mobile private networks have a defining role to play in the hospital – and healthcare system – of the future.

Limited resources, high pressure, urgent IT needs

Hospitals are run more and more like businesses, and budgets are tighter than ever. At the same time, digital medical records have become indispensable in ensuring the high-quality care that patients expect, and network downtime can mean a facility-wide shutdown. However, while the need to keep investing in new technologies is certainly felt, a fast and high return on investment is very high on the wish list.

With a single implementation of a 5G mobile private network, a medical facility can replace outdated communication systems such as DECT portable phones, offer rock-solid wireless connectivity everywhere, enable high-definition video calling and more – all at once.

Three applications of MPNs in medical facilities that add immediate value

1. **Ultra-reliable communication**
   With 5G's ultimate reliability and deep coverage it's ideally suited to serve as the primary on-site communication network and thanks to its exponentially faster data rates instantaneous high-definition video calling is possible anywhere, all the time.

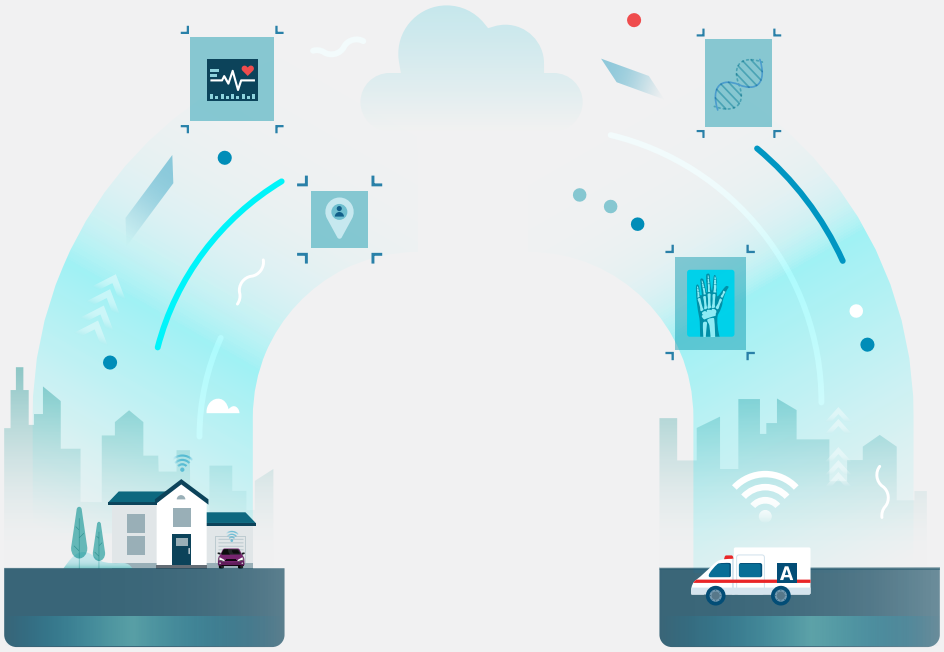
2. **One system to replace them all**
   Replace outdated telephony systems and old networks with one MPN implementation or create redundant networks in case primary networks fail – without tearing up the walls.

3. **Wayfinding & location tracking**
   Enable medical professionals, patients and visitors to find their ways through the mazes of large-scale medical campuses and to the right facilities and waiting rooms quickly and easily. Pinpoint where equipment, devices, patients, doctors and expensive medical assets are at any moment – without GPS.

Beyond the MPN – the future of connected health

5G MPNs deployed on campus can be securely integrated with the public network, thus enabling a number of care-enhancing extra muros applications with the potential to reduce costs and save lives.

- **First responders become extensions of the emergency room,** with doctors monitoring vital signs and making informed medical decisions before the patient arrives.
- **IoT sensors and patient devices** dump accurate medical data into the cloud for instantaneous data insights.
- **Care providers can engage with patients** at home, reducing the length of hospital stays and ensuring excellent follow-up.



VISION

5G is (just) a revolution – but with the right partner, your organization can grasp every opportunity this powerful technology offers in b2b.

As a software development expert with deep experience in your sector, Cegeka is ideally placed to provide you with **custom-made 5G applications** that:

- optimize operational efficiency on a hitherto unseen scale
- support you in achieving your business goals faster
- help you unlock entirely new and lucrative business models

With 5G Mobile Private Networks, you will benefit from economies of scale, a highly secure set-up and greater agility, for your business or organization.

When developing solutions, **we always strive to add simplicity**, clarity and insight to your way of working.

For more information, visit www.cegeka.com/5g or get in contact with one of our 5G experts at +32 11 24 02 34.

Herbert Vanhove
Division Director 5G, IIoT and Industry 4.0

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