WHITEPAPER

5G mobile networks - Review of the technological capabilities and the commercialization challenges

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01 Introduction

Commercial adaptation of 5G mobile networks - why has it not yet materialized?

In 2020, the first nationwide 5G mobile network in Denmark was deployed based on 5G Non Stand Alone (3GPP Release 15). In 2024, 5G Stand Alone was activated. In the same period, the current and the future capabilities of the 5G technology have been presented actively in demoes and trials to create interest and awareness in order to identify applications where 5G can bring a competitive advantage. As the technology matures towards 6G, 5G develops the capabilities necessary to support fully autonomous units that are reachable via a reliable secure wireless connection.

A strong interest of commercializing the 5G Stand Alone technology was expected due to its deterministic capabilities for latency, reliability, jitter and availability that are required for new services like artificial intelligence (AI)-based visual inspections and ability to perform remote operation. Furthermore, positioning data with centimetre-level accuracy enables accurate remote/autonomous steering of automated guided vehicles (AGVs). However, the commercial interest for the deterministic capabilities is still at the exploration stage.

It raises several questions:

- Are the illustrated new use cases on 5G effectively addressing industry-specific problems?
- Are external barriers, like restrictive regulations on automated robots and drones, obstructing the success of 5G technology?
- How does the business model for 5G Stand Alone services differ from typical models, and does the promise of a reliable wireless connection justify changes in work practice?

The whitepaper explores the current state of trends of the 5G deployments.

The whitepaper is structured in the following order:

1. The ambition of 5G
2. Introduction to the 5G technology
3. 5G Stand Alone based commercial services
4. Conclusions

In September 2024, according to GSA, there were 650+ Commercial Private Network with 5G and 143 mobile network operators that invest in deploying 5G Stand Alone.

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02 The 5G ambition

In 2022, NGMN gave a first glance of which use-cases 6G will support[1]:

- **Enhanced Human Communication:** Holographic telepresence communication; Intelligent sharing of sensations, skills and thoughts between humans and digital twins.
- **Enhanced Machine Communication:** Robot Network Fabric; Smarter vehicle; Collaborative robots with real-time command and control.
- **Enabling Services:** 3D hyper accurate positioning; Interactive Mapping, Digital Twins and Virtual Worlds; Automatic detection, protection & Inspection; Digital Health Care; Smart Industry; Enhanced boundless XR experience.
- **Network Evolution:** Trusted Native AI ("AI as a Service" aka. "AIaaS"); From micro connectivity to ultra-wide area coverage and Improved Energy Efficiency.

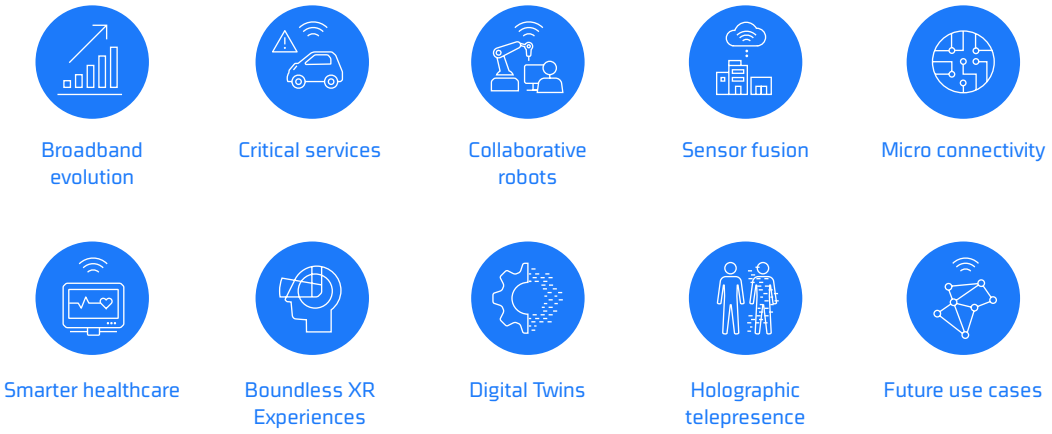

Figure 1. The 6G Vision - examples from a fully digitized society.

The ambitions shows that wireless connectivity is expected to become a central enabler for a more digitized world with much better interaction of the physical world and the digital world.

Clear regulations and attractive business models are essential to develop the market and to create sufficient demand, encouraging public and private mobile network operators to build infrastructure that meets the more stringent technical requirements rather than just supporting common best-effort services.

The 2007 introduction of the iPhone and the 2009 rollout of 4G networks transformed digitalization. Previously, cellular networks focused on voice and SMS, limited to areas with cellular coverage. With mobile devices offering similar capabilities to computers, the demand for continuous coverage and capacity grew, as users expected constant internet access and connectivity for personal and business needs.

1 "6G use cases and analysis" by NGNM, see https://www.ngmn.org/wp-content/uploads/NGMN-6G-Use-Cases-and-Analysis.pdf

According to GSMA Intelligence, the number of connected devices has increased from 800 million to 10 billion with a revenue increasing from 300 bUSD to 1 trUSD since 2001. Most of this success is driven by the increasing demand of always being connected and available, but as the cellular technology offers new capabilities for IoT applications, see Figure 2, it is expected that the market for Industrial IoT will increase and hence encourage the operators to deploy features that are not directly linked to best effort consumer driven internet traffic.

However, it requires a business model that makes it interesting for the mobile network operators to deploy features that support mission critical applications.

A new 3GPP release is available every 1-2 years

The 5G technology comprises of the standards 3GPP Releases 15 to 20, the content of Releases 15 to 18 shown in Figure 2. 3GPP Release 21, to be available in 2030, is expected to be the first 6G release. The typical time-period between approval of a release and when commercial services are available are 2 years, while for 3GPP Release 16, it has taken 4 years slowing the uptake of new advanced services for the fully digital society.

In parallel to the new standards from 3GPP, additional spectrum for cellular technology is released at the World Radio Conference (WRC)[2] that is held every 3 to 4 years. With WRC 2023, spectrum for cellular communication is now available between 450 MHz and 52 GHz.

The features headlines in Figure 2 illustrate how each new release provides new capabilities that steadily improves the network technology so it continuously can support new use-cases.

Enhanced Mobile Broadband 3GPP Rel 15
Released 2019

Rel 15
- Non Stand Alone
- New Radio (NR)
- Massive MTC and IoT
- V2X phase 2
- Mission Critical Interworking
- Slicing (end-2-end logical networks)
- API exposure
- Service Based Architecture
- Mobile Communications System for Railways (FRMCS)

Ultra-reliable & Low Latency Communications 3GPP Rel 16 & 3GPP Rel 17
Released 2020 & 2022

Rel 16
- Stand Alone
- V2X Phase 3: platooning, extended sensors, automated driving
- Industrial IoT
- Location and positioning
- eDual Connectivity
- Integrated Access Backhaul
- Enh. Common API Framework for 3GPP Northbound APIs
- Mobile Communications System for Railways (FRMCS) Phase 2

Rel 17
- NR Sidelink enhancement
- Industrial IoT/URLLC enhancements
- NR over Non Terrestrial Network (NTN)
- Proximity Based Services in 5GS
- NR Positioning enh
- Enh. V2X services
- Unmanned Aerial Services
- 5GC Location Services

Massive Machine Type Communications 3GPP Rel 18
Released to 2024

Rel 18
- Passive IoT
- Edge Computing Phase 2
- Enh. support of Non-Public Networks Phase 2
- 5G multicast-broadcast services Phase 2
- Satellite access Phase 2
- 5G Timing Resiliency and TSC & URLLC enh.
- Personal IoT Networks
- Vehicle Mounted Relays Ranging based services & Sidelink positioning
- UAS, UAV & UAM Phase 2
- RedCap Phase 2

Figure 2: Main service enabling capabilities in the 3GPP Releases 15 to 18. 3GPP Rel 18 is the first of the coming 5G Advantage releases. The 3GPP Releases 19 and 20 are expected in 2025 and 2027, respectively. More details and information about the 3GPP Releases are available at www.3gpp.org

2 For more information about WRC, see https://www.itu.int/en/ITU-R/conferences/wrc/Pages/default.aspx

With 3GPP Release 16, the mobile core became 5G capable and hence enabling Stand Alone based services. It improves the support for V2X-services as well as Industrial IoT. Also very interesting is the introduction of eDual Connectivity that allows the UE to be connected to two different Radio Access Technologies sending the same data packages two ways to improve the reliability.

With 3GPP Release 17, NR Sidelink enables the device to connect to its neighbouring devices, and use those to send its data to the base station, and further into the core network. RedCap will focus on smart glasses, wearable and health monitoring that requires lower bandwidth and attention on the battery consumption. Furthermore, the support for Unmanned Aerial Service will improve and include command and control, location finding, cooperative perception and collision avoidance as well as remote identification to be send as prioritized payload.

With 3GPP Release 18 many of the features introduced in the previous releases are being improved. Special attention should be paid to Passive IoT (removing the need for a power source at the IoT devices), XR (Extended Reality) & media services. Furthermore, the capabilities for Edge Computing will be improved and hence strengthen the deployment of local network. 5G Timing Resiliency will be available for Time Sensitive Communication (TSC) & Ultra Reliable Low Latency Communication (URLLC).

In summary, the three service-enabling capabilities eMBB, URLLC, and mMTC, outlined in Figure 3, enable the deployment of new applications in cellular communication. The combination of these capabilities makes it possible to support a wide range of innovative use cases.

New use-cases evolves with the introduction of new capabilities

Every new feature mentioned in Figure 2 enables new use-cases as shown in Figure 3. The features in Release 15 focus on Best Effort Services that require high bitrate such as 3D video, work and play in the cloud, smart homes, voice and augmented reality. In 3GPP Release 16, and the introduction of 5G Stand Alone, as well as 3GPP Release 17, the new services cover industry automation, self-driving cars and mission critical applications such as e-health.

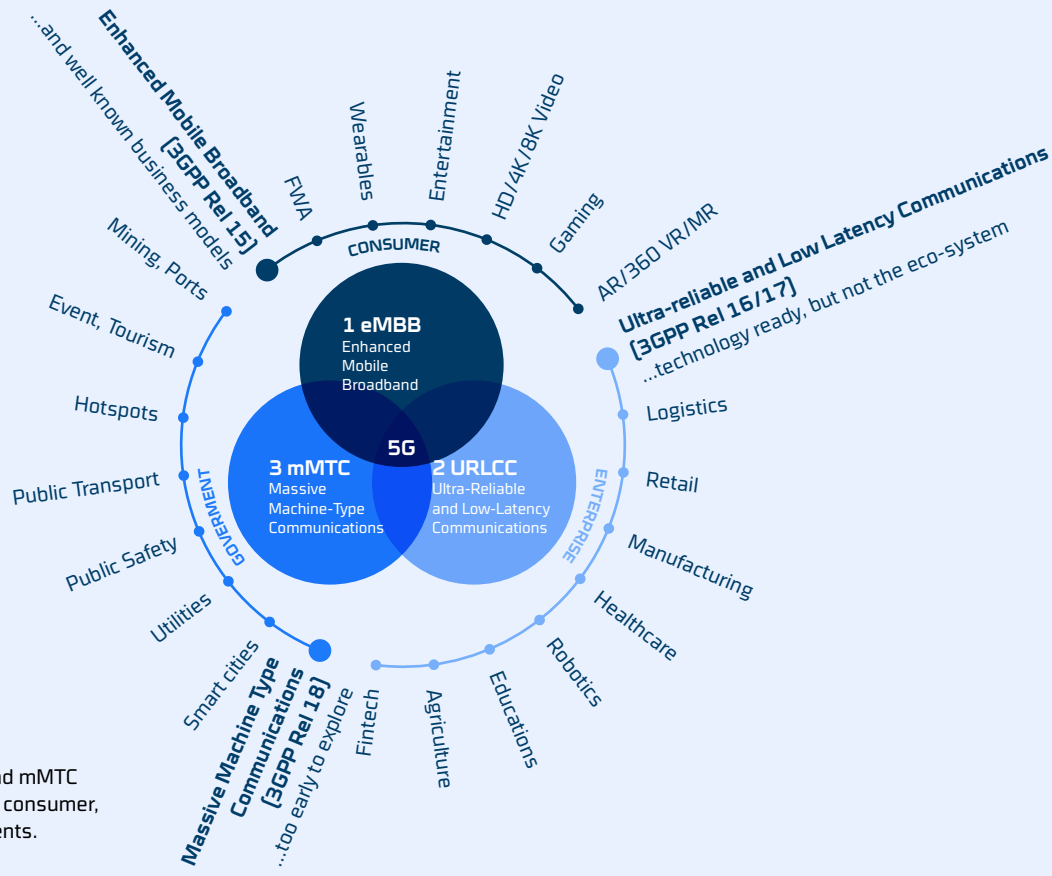

Figure 3: eMBB, uRLLC and mMTC enable new use-cases for consumer, enterprises and governments.

The smart city is expected to be the corner stone in the use-cases being deployable based on 3GPP Rel 18. This is due to its ability to massively collection of data from self powered devices and process those close to the EDGE. Hereby, the data can be applied in a more autonomic society.
It is expected that the technical demands to some of those use-cases are beyond what can be delivered with 3GPP Release 15, but instead requires a latency of 5 ms and a jitter of maximum 50 microseconds that are available with 3GPP Release 18. Similarly, will the network enabled position accuracy improves from 10 meter in 3GPP Rel 15 to Centimetre level in 3GPP Rel 18. By these new QoS capabilities, it is expected that new, and yet unknown, use-cases can be deployed.

Each new release will improve the 5G technology towards the ambitions for IMT-2020, see Figure 4. Each release from 14 to release 20 will help evolving these performance parameters and hence over a period of 10 years, the IMT 2020 will almost fulfil the expectations, however, better on some parameters, inferior on others.

In a more digital world where cellular network usage includes support for autonomous units, the quality requirements to the networks increase. This will require both the new features coming with the new 3GPP releases and a network deployment that can fulfil the requirements to low latency and high resiliency.

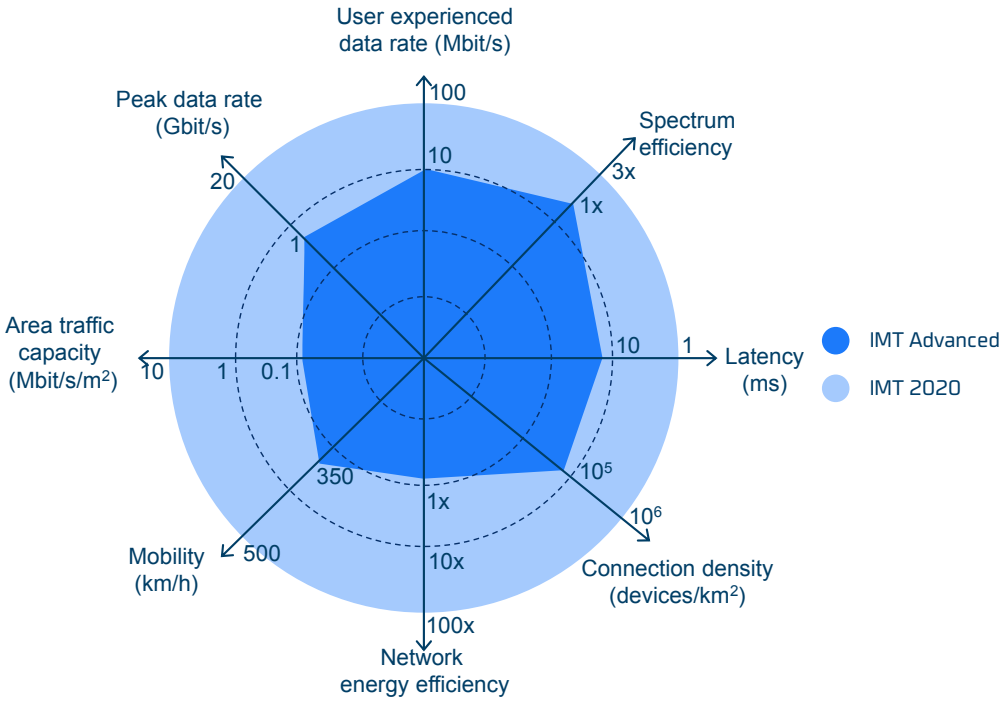

Figure 4: The network technology is expected be improved by up to 100 times on certain parameters when developing from 4G (IMT Advanced) to 5G (IMT 2020)

Beyond higher bitrates; the deployed 5G mobile network must also support the demands to latency and QoS (e.g., 3GPP TR 22.804 for mobile robots). If the requirements to QoS are not being available, the services will fail, preventing robots or drones from operating effectively. This reliance on human intervention raises costs significantly, impacting both labour and safety measures.

03 A technology overview

In principle, a mobile network consists of the User Equipment (UE), the Network and access to the cloud. Many services require access to the cloud to be able to process the collected data and return the result to the device. In the following, the cloud has been renamed to the Decision Maker in order to illustrate this. The UEs, or connected devices, access the network and share and get the data necessary to perform its tasks, see Figure 5:

- The radio network provides coverage and capacity allowing the UE to get access to the services offered by the mobile network. The radio network is connected to the core network.
- The core network allows the UE to access the network and ensures that the requested services can be delivered, and the traffic routed most optimally.
- The "cloud" (the Decision Maker) is where the data are stored and processed.

With the introduction of the Network Function Virtualization in 3GPP Release 14 and 5G Stand Alone in 3GPP Release 16, the flexibility of the network has increased and allows the user traffic to take a different path through the network than the control traffic thereby reducing the latency. Furthermore, the dual route user traffic has been enabled to ensure a more reliable connection between the device and the cloud.

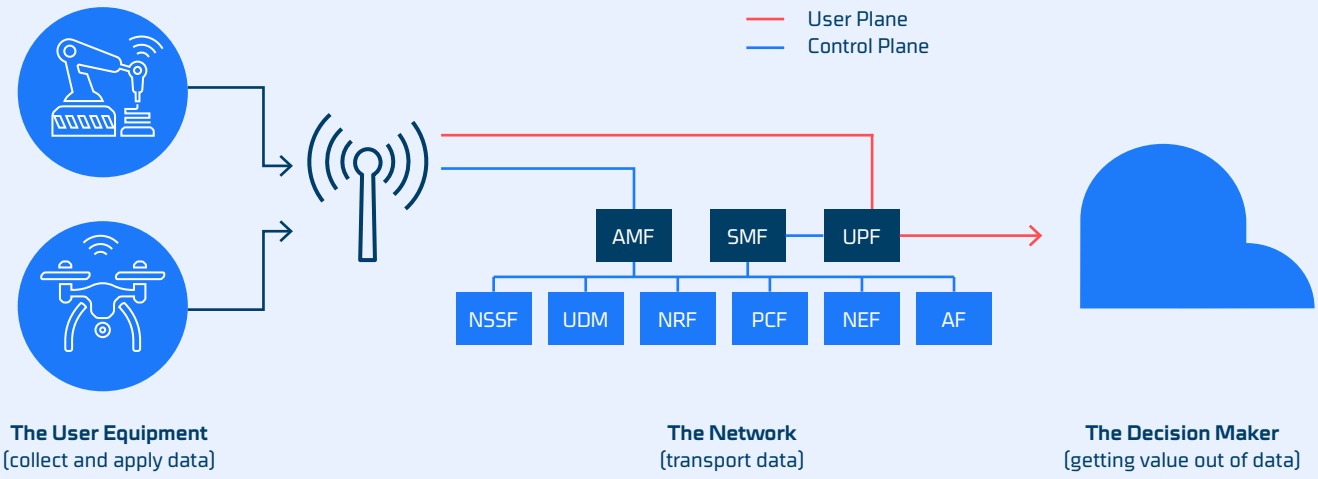

Figure 5: To realize a use-case, support is required at all levels: devices, network and in the cloud.

For the technology to be able to work as intended, both the UE and the Mobile Network must support the expected features. This means that it is insufficient if it is only the network that supports the desired features in e.g. 3GPP Release 16 since also the UEs must have those capabilities before a service with these features can be established.

According to 3GPP TS 38.201, one of key improvement in the RAN part is the reduction of the timeslot size that allows for End-2-End latency as low as 1 ms depending on the carrier frequency being used to connect the UE.

The components in the 5G Network Core

In the network core, the software-based architecture is one of the key enablers since it allows for the selection or deselection of features based on service needs. Figure 5 illustrates some of the network components in the 5G core and their connections to the RAN and the cloud.

The Control Plane Traffic from the RAN part is connected to the AMF (Access and Mobility Function), while the User Plane Traffic goes directly to the UPF (User Plane Function).

The AMF is described in 3GPP 29.518 and allows the UE to access the network and be reachable while connected. The UPF (see 3GPP TS 33.513) forwards the data to the cloud according to the information it receives from SMF (Session Management Function, see 3GPP TS33.515) about e.g. the requested Quality of Service (QoS).

Furthermore, the closer the UPF is located to the RAN, the more local the user data can be processed. This reduces the latency as well as the amount of user traffic that needs to propagate further into the network, a need that depends on the service type and can be different for services like manufacturing automation, railway control or typical smart phone traffic.

The different kinds of services can use different network slices. With Network Slicing (see 3GPP TS 28.530), each service gets its own 5QI (5G Quality of Service Index) that describes the end-2-end demands to e.g. data capacity, coverage area, end to end latency, mobility, priority requirements, service availability, service reliability and UE speed. Each slice can be selected by the NSSF (Network Slicing Selection Function, see 3GPP TS 23.501) and be defined at application level, at device level or a service provider level.

For each service stream, the NSSF interacts with the AMF to assist with the selection of the network slice instances that will serve a particular device and therefore the allowed NSSAI (Network Slice Selection Assistance Information) that is supplied to the device. In case the current AMF does not support the network slices for a given device, the NSSF will redirect the device to another AMF.

As illustrated on Figure 5, the 5G Network Core does also consists of other nodes that are involved in the services depending on the service requirements, e.g.

- The UDM (User Data Management, see 3GPP TS 29.503) manages access authorization, user registration and data network profile.
- The UDR (User Data Repository, see 3GPP TS 29.504) is a converged database that stores and manage subscriber data and network service configurations.
- The PCF (Policy Control Function, see 3GPP TS 29.514) is responsible for the policy and control management on session level and hereby defines policies for different network slices.
- The NEF, described in 3GPP TS 29.522, exposes different 3GPP Network Functions events and capabilities like Application Function (AF) and EDGE Computing.
- The AF, described in 3GPP TS 29.517, exposes the application layer for the interaction with 5G Network Function (NF) and network resources, and allows NF service consumers to subscribe and unsubscribe to different application events depending on their needs.

The 5G Network Core does also contain other network functions that are not described in this whitepaper. In summary, the service-based architecture of 5G offers greater flexibility, scalability, and efficiency compared to previous generation of cellular networks. The service-based architecture provides the foundation for deploying advanced applications. By decoupling network functions and leveraging cloud-native technologies, 5G can support a diverse range of use cases across industries, paving the way for innovations beyond traditional mobile services. This architecture empowers faster rollouts of new services and enables future-proof solutions for emerging applications in 5G and beyond.

04 Commercial 5G Stand Alone services

Even in 2024, the 5G Stand Alone market is still in its infancy, and hence the number of commercial services is rather limited.

In relation to the whitepaper, desk research was conducted to explore current trends in 5G deployments. Of the 67 commercial use cases identified, the majority were concentrated in Mining, Seaports, Large Events, Smart Factory and Education & Research, see Figure 6. It is expected that the actual number of commercial use-cases is higher, but it is also expected that the desk research gives a good indication of where the 5G is primarily being applied.

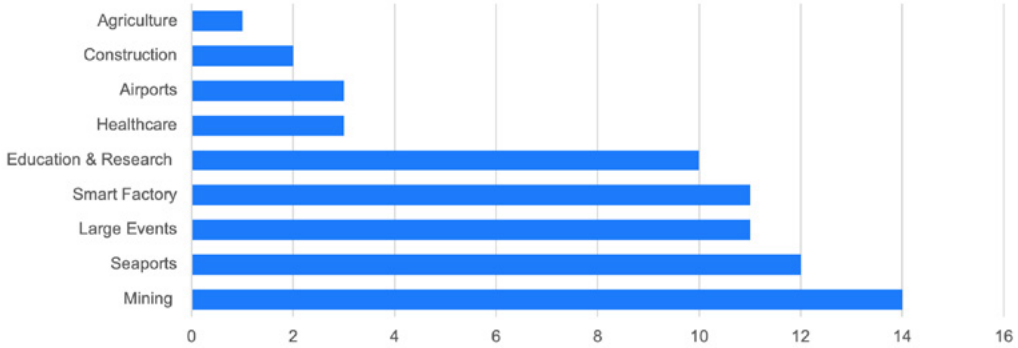

Figure 6: Identified commercial services on 5G Stand Alone in September 2024 based on their numbers, not their value.

For reference, Ericsson predicted in 2019/2020[3] that the 5G market value in 2026 will spread across the different industrial verticals as follows: Healthcare (21%), Manufacturing (19%), Energy and Utilities (12%), Automotive (12%), Public Safety (10%), Media and Entertainment (10%), Financial Services (5%), Public transport (5%), Retail (4%) and Agriculture (2%). The market may have developed differently from what was expected due to both a slower uptake of 5G Stand Alone as well as the introduction of QoS enabling technologies like Wi-Fi 6 and Wi-Fi 7.

Based on the discussions in the Danish 5G Innovation Hub & Testbed, and the global market search, it has become the assumption that for 5G Stand Alone to become relevant, at least 2 out of the 3 criteria below shall be fulfilled:

- Large area coverage (e.g. outside a production facility, a building or in the rural environment)
- Nomadic behavior where either the connected unit has dynamic moving pattern, or where the need for coverage area often differs (e.g. in ports or for TV production)
- High value of the service (e.g. for item tracking, BVLOS drones or TV production where the alternative solutions are rather costly)

Figure 7 highlights some of the arguments for that 5G has been deployed in different verticals, ranked by how frequently each argument appeared in the above-mentioned cases. However, it does not show if the service has been deployed in the public network or a non-public network. For more information about the service, all links can be found below the figure.

3 Ericsson business report: https://www.ericsson.com/en/5g/forms/5gforbusiness-2019-report

Smart Factory

1. Ultra reliable control of and communication between mobile machines
2. Improved security.
3. Real-time data collection and analysis, leading to improved production efficiencies and sustainability.
4. Eliminating costs and time used to roll out and maintain fiber cables.
5. Increased market responsiveness through flexible manufacturing.
6. Reducing the need for stand-alone equipment for data processing on mobile machines, with ULCC and high bandwidth.
7. Next-generation smart manufacturing through a modular and flexible production setup.
8. Enabling AR capabilities for inspection.

Seaports

1. Remote operation of cranes and other machinery.
2. Automation of machines at sites (drones, cranes, trucks).
3. Improved safety and security via detection of humans, (speed of) vehicles (cars and trucks) and fraud.
4. Internet coverage over a larger geographical area.
5. Tracking condition of cranes and the number of containers transported.
6. Accurate and fast management of containers through smart cameras and artificial intelligence to link the containers, which were lifted from the ship to the trucks and identify the truck card numbers.
7. Providing the necessary capacity and scalability for the massive connection of sensors and devices, facilitating the real-time location of ships, merchandise and other assets.
8. Quickly reestablish connection to cameras or sensors (compared to fiber).

Large Events

1. Prioritized connection with network slicing to different users; spectators, premium subs, broadcasters, public safety.
2. Connectivity within area with high density of connected devices.
3. Instant and flexible transfer of media from sport photographers/broadcasters.
4. App fan engagement at events with multi-camera streaming, replay options, AR features, gamification.
5. Eliminating the need for costly large on-site crews, gear and hiring satellite links.
6. Private local network to enhance security and reliability.
7. High speed coverage in a larger geographical area, indoor and outdoor.
8. Crowd management using real-time data from critical sites and extensive security systems.
9. Live holographic performances.

Mining

1. Improve efficiency & safety - remote operation of machinery.
2. Allow real-time communication among the mine workers while reducing the risk across the operations.
3. 4K cameras and numerous other sensors to monitor and manage its mining operators.
4. Decrease complex cabling.

Agriculture

1. Reducing soil sampling timelines from weeks to days.

Healthcare

1. Real-time remote-control surgery.
2. Remote sickness diagnosis.

Airports

1. Connectivity coverage over larger area.
2. Transportation of luggage and other items with autonomous driving vehicles.
3. Video analytics to visually check the condition of assets.
4. Improved security.
5. Localization of devices.
6. Autonomous patrol of area with drones and robots.
7. Premium customer feature "facial pass", using facial recognition to access areas in airport.

Construction

1. Improve safety for workers.
2. Support applications like drone-based monitoring, IoT concrete sensors and real-time CCTV video to help reduce on-site hazards and errors.
3. Workers can check large files, including building plans and exchange revisions among themselves in real time and on site.
4. Network slicing to improve connectivity on construction site.

Education & Research

1. Allow students, faculty, and staff to develop, test, and use the next generation of digital apps, with data-intensive and/or ultra-short response time demands (like mixed reality).
2. Research of 5G applications.
3. Help large video and graphic files load faster when teaching.
4. Improve the connectivity in areas of campus with high device density.
5. Educating within virtual reality.
6. Improve security of network with private network.
7. Providing connectivity to remote educational institutions.

Figure 7: Overview of the advantages of the commercial services deployed in the different industries.

Mining

In the mining sector, 5G enhances both efficiency and safety by enabling remote operation of machinery, a significant focus with widespread use across several cases. It also facilitates real-time communication among workers and in some cases integrates proximity detection systems to minimize risks. 5G's role extends to monitoring operations with 4K cameras and sensors, while also reducing the complexity of cabling. The most prominent application is the remote operation of machinery, as it appeared in most cases.

→ Cases: Hongliulin & Xiaobaodang, Sandaozhuang, 7 South africa, Kittilä, Tampere, Shanxi, Indonesia

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Seaports

At seaports, 5G supports the automation and remote operation of site machinery like drones, cranes, and trucks. In some cases, it also improves safety through facial recognition and real-time alerts for speeding vehicles. Other key uses include internet coverage over large areas, and efficient container management via AI and smart cameras. Remote crane operation and automation of machines were the most frequent found use cases.

→ Cases: Saudi ports, Virginia, Barcelona, 6 ports in china, 2025 Rijeka Gateway, Indonesia, Qatar, hamad port

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Large Events

For large events, 5G facilitates prioritized network access with network slicing for spectators, broadcasters, and/or public safety, making it the most common use-case. It has also been frequently used to ensure connectivity in areas with high density of connected devices, and to support real-time flexible media transfers for photographers. Furthermore, it has also been used to powers fan engagement through AR features and multi-camera streaming.

→ Cases: Leksands IF, Qatar, Stockholm Marathon, 5G parade, Stockholm concerts, France smart stadium, Euro 24, Paris Olympics, Gran Teatre del Lice, UK coronation, WC cycling

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Smart Factory

In smart factories, many cases have highlighted the use of 5G to enable ultra-reliable machine control and communication. Security improvements and real-time data analysis for boosting production efficiency and sustainability are also common. Others highlight the reduced costs and time spent on roll out of fiber cables, increased market responsiveness through flexible manufacturing, and reduced need for stand-alone equipment for data processing on mobile machines. Machine control and communication were the top use cases.

→ Cases: Berlin Tesla, Nestlé Latin America, Slovenia, Ericsson factory, Huaheng China, Wolverhampton, Huaya Technology Park, Gree electric, Airbus, Wichita, ArcelorMittal

Education & Research

In educational and research institutions, 5G empowers the development of next-gen digital apps, especially those requiring ultra-short response times, making it the most widespread application. Other common uses include improved loading times for large files and enabling virtual reality for educational purposes.

→ Cases: Miami, Arizona, Kai XR, VictoryXR, Prism VR, Hamburg, Merseberg, Athlone, Coventry, South Africa Digischool

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Healthcare

In healthcare, 5G cases were few. The ones found used 5G for real-time remote surgeries (laser eye surgery and brain surgery) or to facilitate remote diagnosis of Covid-19.

→ Cases: Tecknexus, Dr. Zhipei (page 8), National telemedicine center China

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Airports

Airports have used 5G for broader connectivity coverage and enabling autonomous transport systems like luggage vehicles. Other applications include video analytics for asset monitoring, enhanced security, and the autonomous patrol of areas using drones.

→ Cases: Frankfurt airport, Bejing airport, Hong Kong airport

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Construction

5G has been used to reduce on-site hazards and errors through real-time CCTV video, drone-based inspection, and IoT sensor networks. It has also been used to enable workers to share large files like building plans using 5G tablets.

→ Cases: Samsung Korea, Telstra Melbourne

Agriculture

The amount of real 5G commercial cases found in agriculture was limited, however it was found to be used to reduce soil sampling timelines from weeks to days by sending and analyzing data over the network.

→ Cases: Precision decisions

05 Conclusions

5G mobile technology is a key enabler for the ongoing digitalization of the society due to its ability to provide a reliable, highly secure, prioritized wireless connection for both consumer, industry and government applications.

How 5G will mature in the different industry verticals depends on the individual market demands, e.g. is there a request for dependable communication e.g. for mission critical communication or deterministic communication within manufacturing process. This need could be caused by lack of resources, more stringent safety requirements, challenging operations or other issues that makes it beneficial to deploy the QoS capabilities that 5G can provide.

For the services to be available, it requires that the technology has been deployed. At the same time, the mobile operators expect a market pull for capabilities like QoS and positioning before activating the necessary features in the network. Without the needed market pull, those capabilities may never be activated. It means that the markets that could benefit from 5G do also need to develop AGV or other units that can be connected to the 5G network.

According to the study, there is a need for 5G enabled services. And for those to mature, the eco-system can benefit from collaborations, e.g. in the Danish 5G Innovation Hub & Testbed. Furthermore, the eco-system benefits from that the 5G technology is a worldwide technology. Hence, the 5G services developed in e.g. Denmark can be deployed in many other countries and hereby ensure economy of scale.

The findings from the study shows:

1. Most of identified cases benefit from the deterministic latency, the flexibility in the network, the extended coverage, the cyber resilience and the added capacity.
2. Only 3 out of 67 cases are deployed in a geographical limited area.
3. The most popular cases are those that automate processes and reallocate the human resources from the working area to the control room.
4. Areas that are difficult to connect by cables have a higher adaptation rate than others.
5. Domains that utilize larger machines often have more commercial use-cases.
6. 5G often becomes the key-enabler for mixed reality technologies.

In the continuation of the work of commercializing 5G Stand Alone, and hence provide support for the on-going digitalization with the services shown in the beginning, collaboration across the eco-system is crucial for understanding where there are the biggest pains and most economic value to gain, the regulatory boundaries, the business model challenges as well as to map the technical needs to the technical capabilities.

And as part of this work, prove that adoption by co-deploying proposition, benefits and business model and hereafter scale the adoption of the proposition by supporting other organizations to engage.

The 5G Stand Alone market is still in its infancy, but the significant investment put into 5G and the huge number of both public- and non-public network deployments indicates that there is a strong believe in the market that commercial success of 5G will come.

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