



5G-ACIA Position Paper

# Our view on the Evolution of 5G towards 6G

5G Alliance for Connected Industries and Automation

# Executive Summary

5G-ACIA will continue to focus on enabling the full potential of 5G in connected industries and automation, in particular in the manufacturing and process industries. At the same time, we want to ensure that the needs and requirements of the industrial automation sector are considered beyond the year 2030 (e.g. in the context of beyond 5G). Therefore, 5G-ACIA will continue to bring forward requirements to the relevant standardization bodies in order to ensure the long-term success of mobile communications in the industrial domain. 5G networks have just recently started to be deployed, hence only initial thoughts\* can be given on the industrial requirements that need to be supported in the next decade.

Key aspects that 5G-ACIA sees applicable for the further development of industrial communication in 3GPP (independent of 5G or 6G) include:

- A continued strong focus on vertical industry applications and requirements, including those of the manufacturing and process industries.
- The strengthening of non-public networks and associated flexible deployment and operating models.
- Sophisticated self-management capabilities of corresponding networks, for example based on network automation and AI/ML.

## Details

5G-ACIA's mission focuses on ensuring the best possible applicability of 5G technology for connected industries, in particular in the manufacturing and process industries. It ensures that the industrial domain and its requirements are adequately considered in 5G standardization and regulation, and that a seamless and easy integration of 5G into existing industrial infrastructures and applications is possible.

Since the full potential of 5G has by far not been reached in the industry yet, 5G-ACIA's current focus is on enabling the utilization of 5G to its fullest extent. This will help its members

- Backwards compatible solutions in line with the long lifetimes of industrial equipment (>20 years in some cases), thus protecting investments of the manufacturing sector in 5G.
- Flexible and modular solutions, supporting custom-tailored, energy-efficient and cost-efficient deployments taking into account EMF exposure.
- Supporting requirements such as sub-ms latency in specific scenarios, and high-precision positioning.
- The further evolution of open interfaces, architecture and APIs along with a consequent virtualization of the entire network infrastructure in order to facilitate highly modular and industry-optimized solutions.
- The integration of additional functionalities, such as sensing or imaging, for providing additional value-adds to the manufacturing industry.
- Accelerating the automation and digitalization to improve resource efficiency in production, speed up the adoption of green technologies, and to boost sustainability.

5G-ACIA recommends to simplify the direct engagement of vertical industries and the tracking of relevant activities as the current standardization process in organizations like 3GPP is rather complex and resource-intensive.

to prepare for the disruptive changes 5G brings and enable them to deploy 5G for maximum benefits. Furthermore, 5G technology is undergoing an evolution itself – with new features and enhancements continuously being added to 5G standards in upcoming releases.

One of the objectives of 5G-ACIA is to ensure that the requirements of the represented industries are considered in future releases of the 5G standards to further increase the potential benefits as well as protecting the investments of the industry in 5G technology in future evolutions of

the standard and the following generations. The features designed according to 5G-ACIA requirements and covered by 3GPP standards will likely remain valid for many industrial use cases for many years to come. This is fundamental as industrial equipment (and thus in future also the corresponding 5G components) is typically in use for significantly long periods.

## 5G evolution

5G-ACIA recognizes the ongoing activities on 5G evolution and 6G and appreciates the effort to advance cellular technology further. 5G-ACIA's mission towards influencing future developments of the 5G standard releases naturally extends also to next generations of wireless technologies, including 6G.

One of the foremost paradigms towards future development is that the requirements of the represented industry brought into 5G are carried forward into 6G. Ongoing and upcoming investments of industrial users in 5G applications, equipment, and infrastructure must be protected and 5G deployments need to be able to evolve into upcoming next generation technology. Diversion from carrying the aforementioned requirements and investments brought into 5G may result in slowdown and delay in adoption of cellular connectivity in the industry. Time scales for new generations of mobile communications are typically driven by the consumer mass market. Thereafter, adjacent sectors and industries might benefit from the progress made. Some of those industries, such as manufacturing and process industry require backwards compatible solutions, for adopted technologies e.g. 5G, in line with the often long lifetimes of industrial equipment. Therefore, ensuring an adequate evolution of 5G meeting the evolving challenging requirements of industrial automation is very important to 5G-ACIA.

## Targets

The flexibility of the 5G architecture makes it possible to accommodate new functional requirements and to evolve seamlessly beyond 5G. Additional targets will be achieved by future technology advances and realized by next generation mobile networks.

The trend of flexible production system, shorter and more efficient engineering phases results in a higher demand of wireless connections. More **energy efficient** and **cost-efficient** solutions providing services for much higher number of reliable connections are important requirements. In this respect, **sophisticated self-management** capabilities based on AI/ML become more and more important, so that networks can intelligently and automatically adapt to changing conditions.

In addition, **non-public networks** and associated flexible deployment and operating models should be strengthened in order even better support the specific requirements of industrial customers in terms of security, performance, reliability, availability, and independence.

Even though radio technology is mainly used for communication, already in 5G additional capabilities were part of standardization such as e.g. **high-precision positioning**. Further evolution might integrate additional capabilities such as **integrated sensing** to allow better use of the infrastructure, and the utilization of additional bandwidth in higher frequencies in particular for campus networks.

Demanding control loops with **latency** targets of less than 1ms, not supported by 5G as of today but necessary to realize specific motion control use cases, can be assumed as a target for further 5G evolution and probably 6G. The enhancements may be targeted specifically to applications in Non-Public Networks deployed in a limited area, such as the factory floor or a production campus.

As the manufacturing sector is by itself very heterogeneous with many niche applications and constraints, it is important that technology providers can easily offer tailored and optimized solutions for different scenarios. This should be enabled by **truly open interfaces, scalable architecture and APIs** along with a consequent **virtualization** of the entire network infrastructure in order to facilitate highly modular and industry-optimized solutions.

Finally, an important aspect is to enable accelerated automation and digital transformation in connected industries in order to improve resource efficiency in production, speed up the adoption of green technologies, and to boost sustainability. Hence, allowing to move closer toward a circular economy.

\* As the understanding of the industrial requirements for the next decade is expected to progressively mature, 5G-ACIA will update the position statements accordingly

[www.5g-acia.org](http://www.5g-acia.org)

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