



# 5G Deterministic Networks for Industries

How 5G networks can deliver the reliable and predictable connectivity required to support key industrial processes

## **GSMA**

The GSMA is a global organisation unifying the mobile ecosystem to discover, develop and deliver innovation foundational to positive business environments and societal change. Our vision is to unlock the full power of connectivity so that people, industry and society thrive. Representing mobile operators and organisations across the mobile ecosystem and adjacent industries, the GSMA delivers for its members across three broad pillars: Connectivity for Good, Industry Services and Solutions, and Outreach. This activity includes advancing policy, tackling today's biggest societal challenges, underpinning the technology and interoperability that make mobile work, and providing the world's largest platform to convene the mobile ecosystem at the MWC and M360 series of events.

## **GSMA** Digital Industries

GSMA Digital Industries is a community of network operators, industrial organisations and the wider ecosystem working together to advance the adoption of mobile technologies in the industrial and manufacturing sector. As the industrial revolution continues towards digitalisation and connected intelligence, the community explores all aspects of the industrial value chain from raw material extraction, to refining, supply chain, component production, assembly, and smart warehousing.

Find out more and how to get involved at:  
[gsma.com/iot/digital-industries](https://gsma.com/iot/digital-industries)

## China Telecom



China Telecom is a large state-owned communication backbone enterprise. With a registered capital of 213.1 billion yuan, an asset scale of more than 800 billion yuan and an annual income scale of more than 520 billion yuan, it has been ranked among the Fortune Global 500 for many consecutive years.

China Telecom owns the technology-leading mobile communication network. It provides global customers with comprehensive information services and customer service channel system covering all regions and services. At present, it has become the world's largest 5G SA RAN sharing network, NB-IoT network, and gigabit optical fiber network.

For more information, please visit the China Telecom website at [www.chinatelecomglobal.com](http://www.chinatelecomglobal.com)

To better serve the needs of the start-up community, the GSMA has established 5G IN Sector Membership where members can gain insights from leading investment organisations and academic communities in the mobile industry; connect with other high-quality start-ups in the fields of AI, IoT, edge computing, cloud computing, big data, 5G network, security, chipset, AR/VR/XR, Fintech & vertical applications; and foster innovation and investment to drive the commercialisation of 5G applications.

GSMA 5G IN:

<https://www.gsma.com/greater-china/5g-in-2/>

## GSMA 5G IN



GSMA 5G IN (5G Innovation and Investment Group) is a GSMA Foundry project, aiming to help grow and leverage the rapidly expanding 5G start-up community. It was created by GSMA with 12 co-founding members: China Mobile Capital, China Telecom Investment, China Unicom Capital, China Mobile State Investment, China Broadband Capital, Chenshan Capital, Huawei, ZTE, Orient Securities Capital, CSDN, Shenzhen Valley Ventures and Deloitte China.

During this key window phase of 5G development, the group will fully leverage the global resources of GSMA mobile industries; aggregate key leadership opinions from leading investment organizations and communities in the mobile industry, and discover high-quality start-ups in the fields of AI, IoT, edge computing, cloud computing, big data, 5G network, security, chipset, AR/VR/XR, Fintech and vertical applications to match the innovation and investment and drive the commercialization of 5G applications.

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# Executive Summary

5G networks are beginning to enable the digital transformation of various industries, such as manufacturing, logistics and other sectors. As many use cases in these sectors place high demands on network capabilities, telecoms operators are developing 5G networks with deterministic capabilities for latency, reliability, jitter, availability and other key parameters. These networks are designed to meet the requirements of demanding use cases, such as high uplink capacity for artificial intelligence (AI)-based visual inspections, 99.99% availability for operations monitoring, and meter-level positioning data for the control of automated guided vehicles (AGVs).

Pilots in steel automobile manufacturing, warehouse logistics and port operations in China have demonstrated the potential of various 5G deterministic technologies working in tandem to realise major business benefits. For example, the combination of time division duplex (TDD) spectrum, 5G LAN, network and service collaboration (NSC) and frame replication and elimination for reliability (FRER) has enabled a 5G deterministic network to deliver 586 Mbps uplink bandwidth and a latency of 4ms at 99.999% reliability to support key processes in a steel rolling plant. By utilising the 5G network to remotely control overhead cranes and automated guided vehicles (AGVs), the number of on-site personnel can be lowered by 65%. With the 5G

network transmitting the 4K video required to support AI-based quality inspections of steel surfaces, the defect detection rate reaches 90%, and production capacity loss is reduced by 92%, helping to achieve greenhouse gas emissions goals, as well as lower costs.

However, at present, the integration of 5G deterministic networks into vertical industries is still at the exploration stage. Key challenges include the diversity of requirements, protocol compatibility issues, 5G technology and industry maturity, and business model maturity. Moreover, the selection of key deterministic technologies must consider the **trilemma of reliability, latency and radio resource efficiency**.

## **(5G)** 5G network utilisation



This paper proposes the merger of the protocols and mechanisms of 5G and industrial sectors to realise the integration of communication technology (CT) with information technology (IT) and operational technology (OT). As a result, 5G deterministic networks will further deepen the core production links of vertical industries to build successful models that can be copied and generalised to other industries, promoting the digital transformation process.

## Acknowledgements

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Lead GSMA member:



Supporting GSMA members:



Digital Industries Ecosystem Contributors:







# 1.0 Introduction