

MANUFACTURING **IN** AMERICA 20

Industrial 5G: Opportunities & Challenges

Jonathan Simpson, Siemens

Manufacturing in America | March 25-26, 2020



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World Leader in
Electrification, Automation
and **Digitalization**

379,000

Employees

\$92.53 bn

Revenue

**MANUFACTURING
IN AMERICA 20**

Community. Collaboration. Innovation.

Since its founding, Siemens shapes industrial revolutions





DI Digital Industries
Operating Company



PA Process Automation
Business Unit



CI Industrial Communication
and Identification



Become the premier provider of future-proof communication, identification, and secure power to our customers.

As an innovation leader, we think ahead to the next level of digital transformation – and integrate cutting-edge technologies into our portfolio, such as:

- Artificial Intelligence
- Edge Computing
- Industrial 5G
- WiFi 6 (802.11ax)
- Autonomous handling systems
- Blockchain
- Additive Manufacturing

Communication & Identification Verticals

Industrial Sectors

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Automotive



Chemical



Intra Logistics



Oil & Gas



Food & Beverage



Harsh Environment/ Mission Critical Sectors

Electric Power



Rail



Defense



ITS



W/ WW

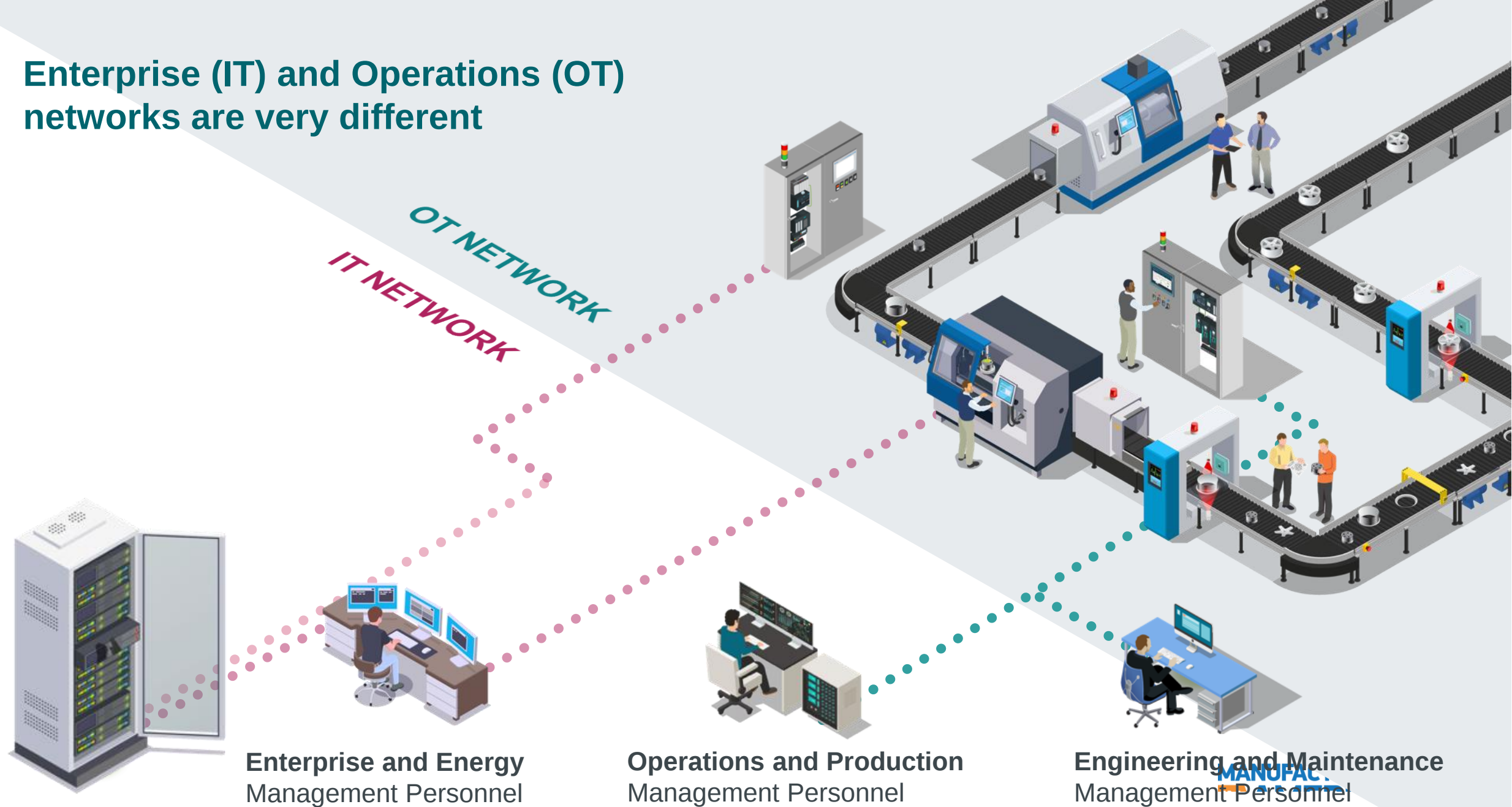


Our Customers

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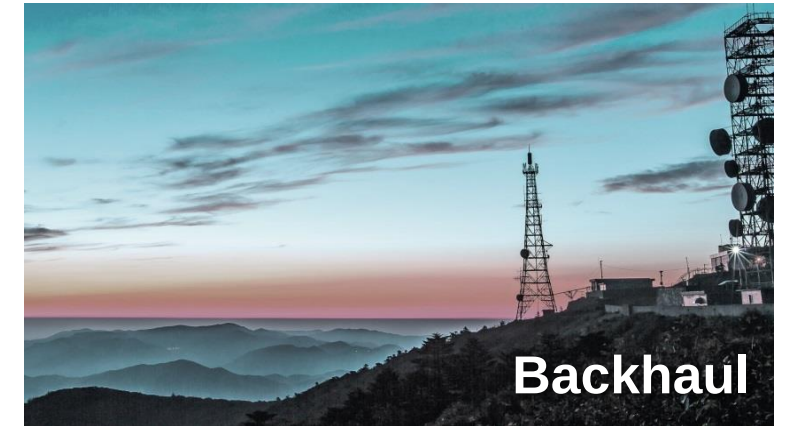
Enterprise (IT) and Operations (OT) networks are very different



The evolution of cellular networks in Industry from the first commercial network to the network of the future.

1G	2G	3G	4G	5G
Released: 1979 Standards: NMT, AMPS & TACS Capabilities: • Analog voice	Released: 1991 Standards: GSM & CDMA Capabilities: • Digital voice • Encrypted communication • Limited roaming • SMS & MMS Extensions: • GPRS (2.5G) • CDMA2000 (2.5G) • EDGE (2.75G)	Released: 2002 Standards: UMTS & EV-DO Capabilities: • Mobile broadband • Locating services • Multimedia streaming • Seamless global roaming Extensions: • HSPA+ (3.5G)	Released: 2009 Standards: LTE Capabilities: • High Speed mobile Internet • IP-based packet switching • HD multimedia streaming • Seamless global roaming Extensions: • Feature extension through new category/releases	Released: 2019 Standards: 5G Capabilities: • Private networks (local use frequency) • (I)IoT Ready • Massive Machine Type communication • Ultra-low-latency • Ultra-high reliability • Millimeter wave support Extensions: • Feature extension through new categories/releases
 0.0024 Mbit/s	 0.064 Mbit/s	 42 Mbit/s	 1000 Mbit/s	 10,000 Mbit/s
Industry Impact: – • No impact on industrial applications	Industry Impact: 0 • Remote control / Telecontrol • Text messages from and to remote machines	Industry Impact: + • Video monitoring • Remote Access to machines (e.g. for teleservice) • Remote Condition Monitoring	Industry Impact: ++ • Mobile service Technicians • Service via smart phones • Wireless Backhaul	Industry Impact: +++ • Autonomous Logistics • Autonomous Machines • Assisted Work • Wireless Backhaul • Edge Computing • Mobile Equipment

Opportunities for Industrial 5G

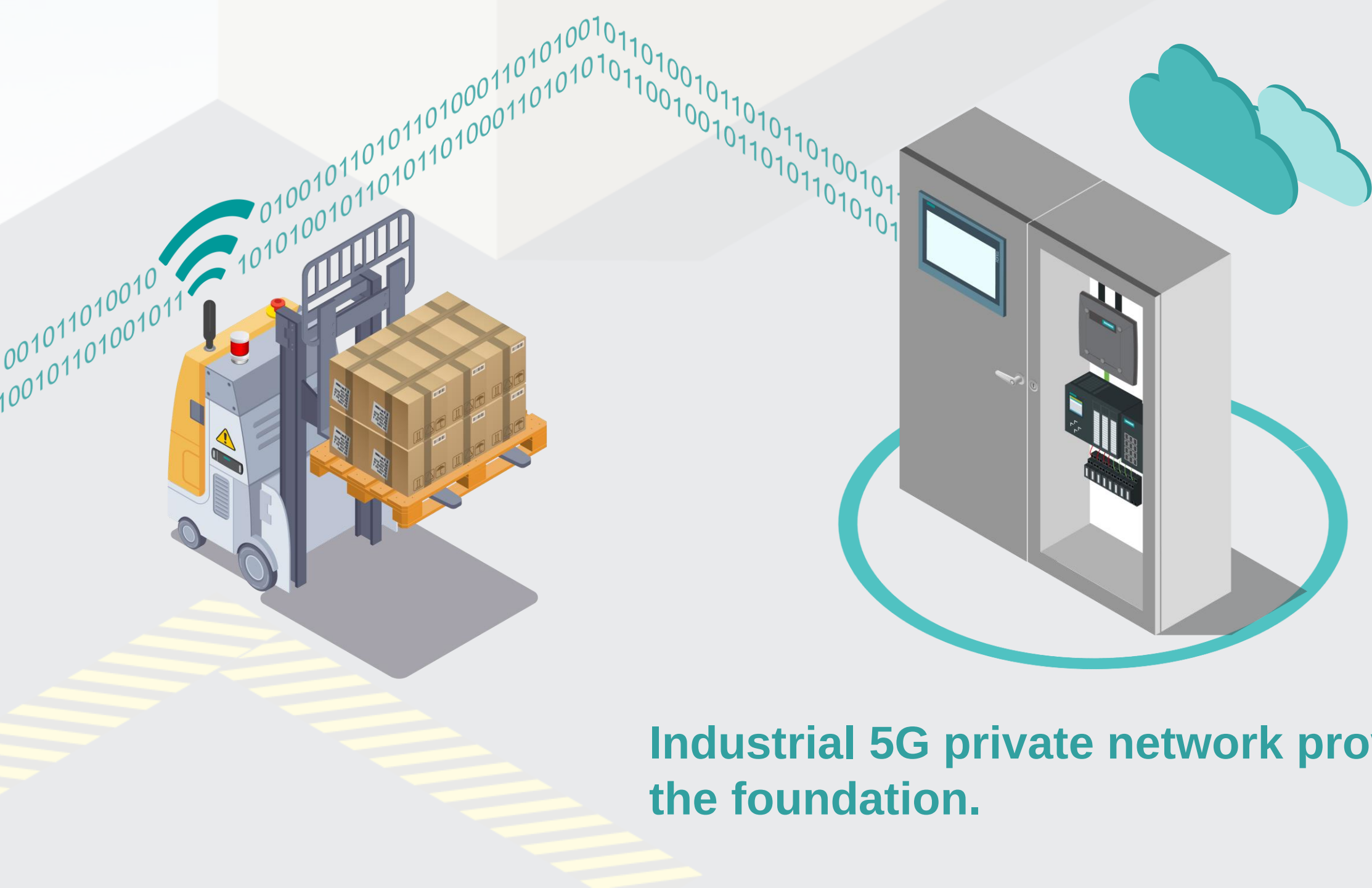


Industrial 5G has the potential change the way we make decisions, manufacture products, and maintain factories.

Industrial 5G in Factory Environments

Robust real-time control,
diagnostics and video



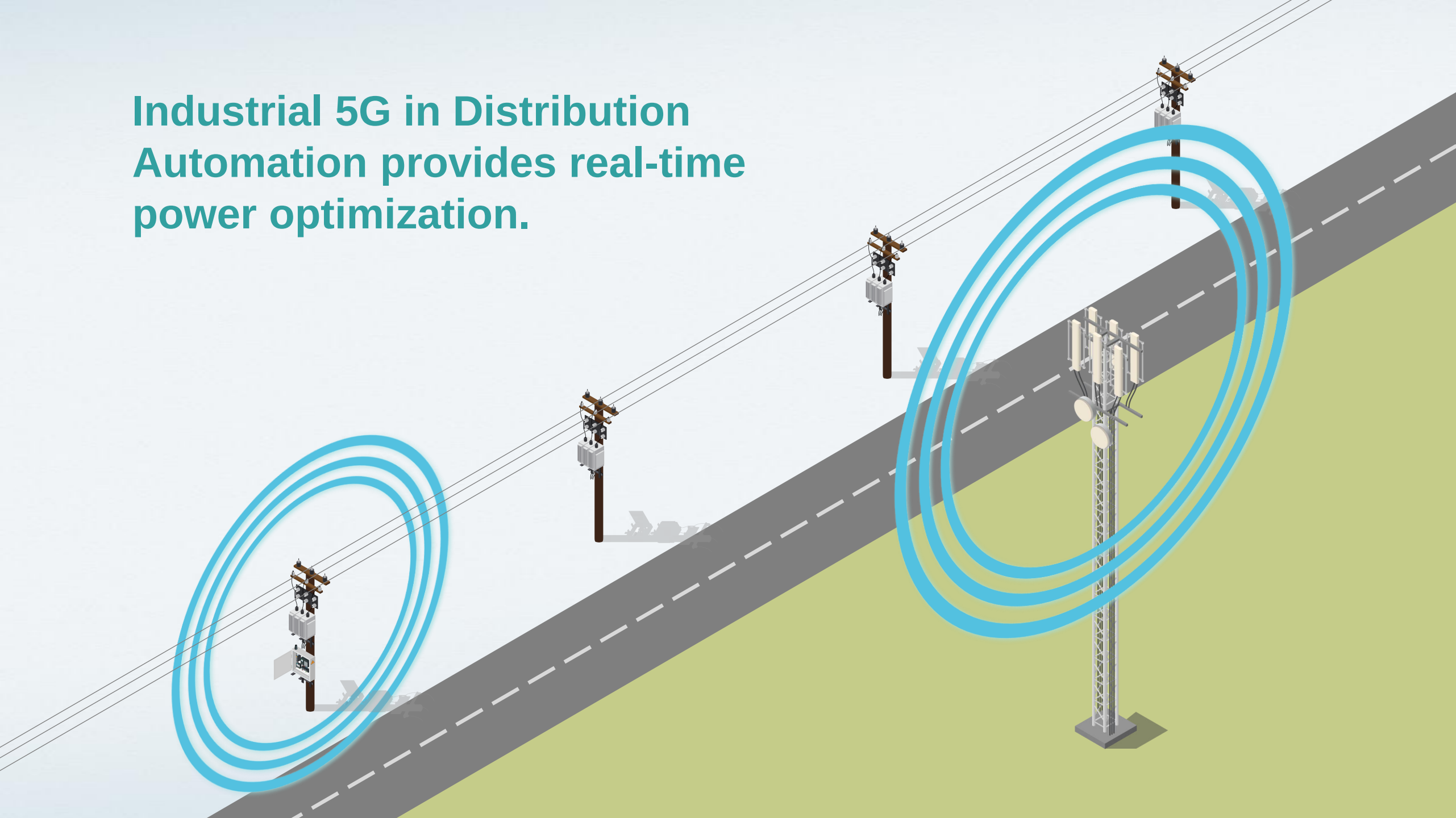


Industrial 5G private network provides the foundation.

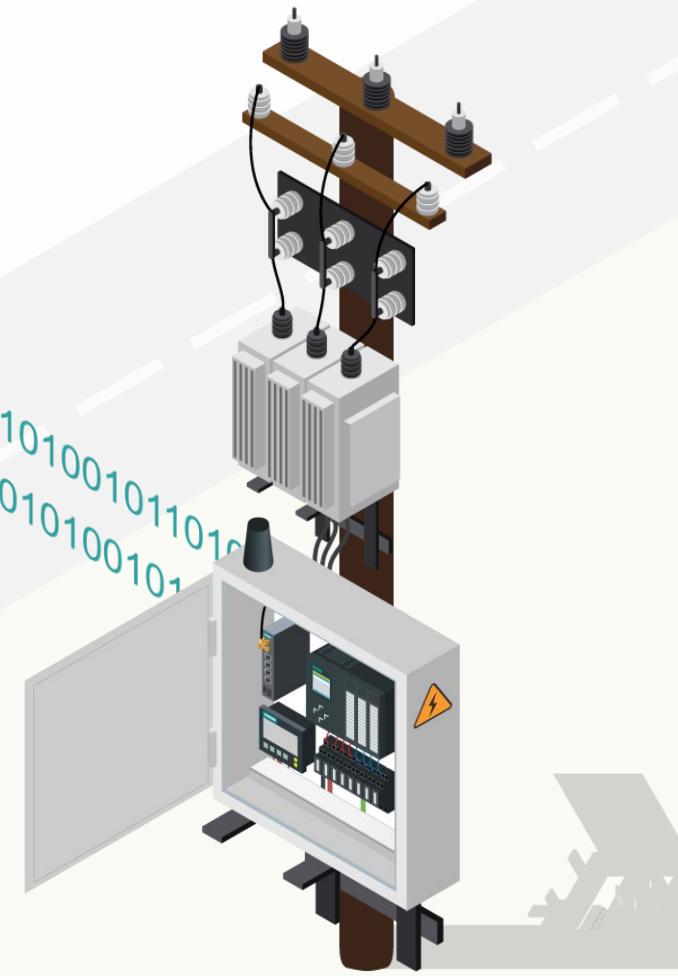
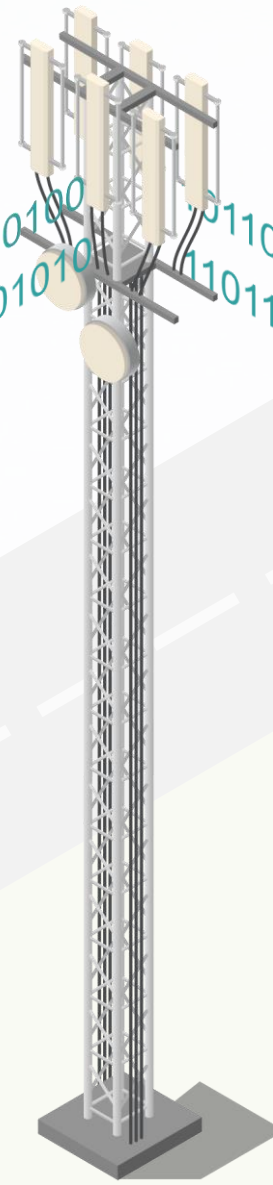
The AGV robot is equipped with
optimized compact, secure,
reliable 5G wireless
communication



**Industrial 5G in Distribution
Automation provides real-time
power optimization.**

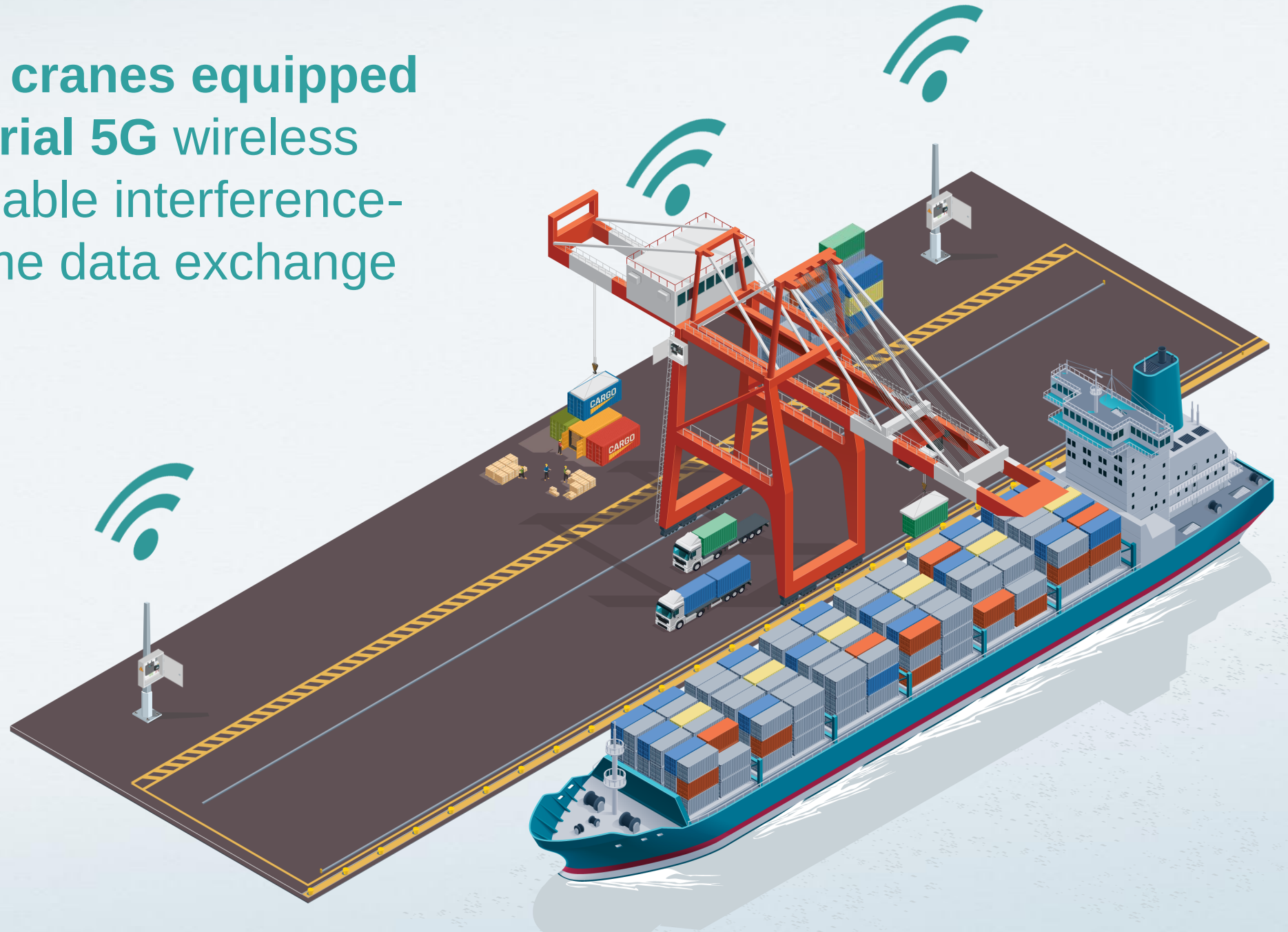


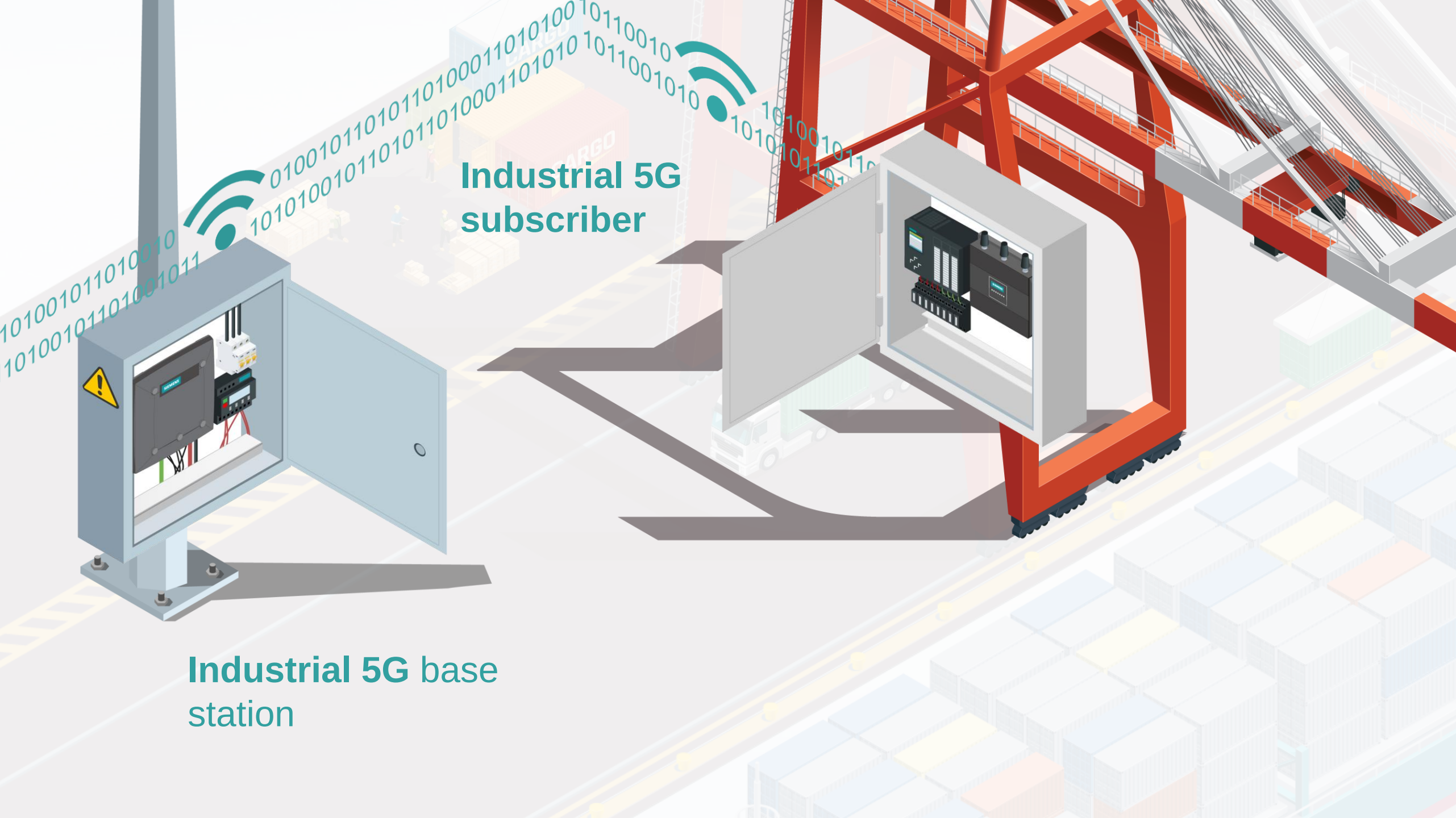
5G will enable large amounts of data to be transmitted quickly and securely for control, monitoring and analysis for better decision-making



5G subscribers can be installed far away from any IT infrastructure for real-time remote access.

Automated cranes equipped with **Industrial 5G** wireless solutions enable interference-free, real-time data exchange

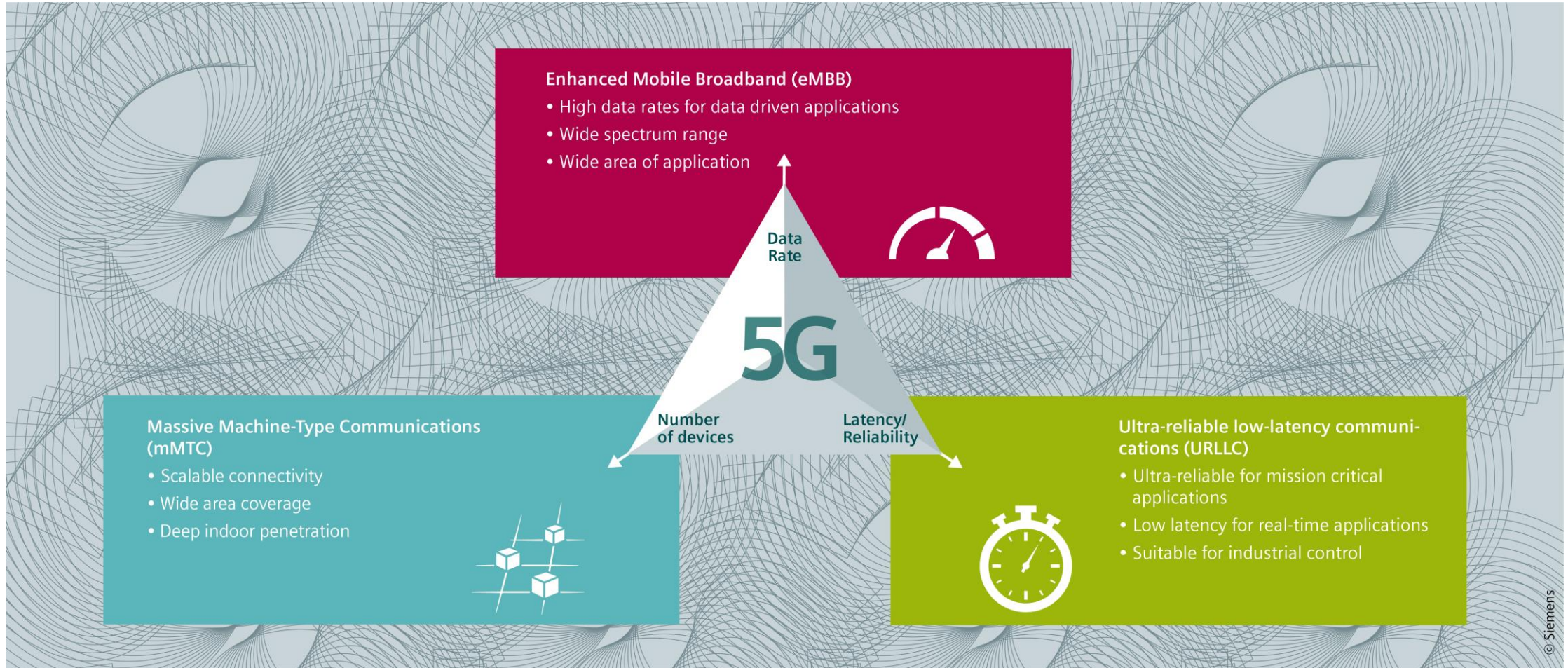




**Industrial 5G
subscriber**

**Industrial 5G base
station**

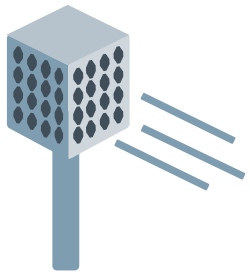
Industrial 5G. Future Possibilities.



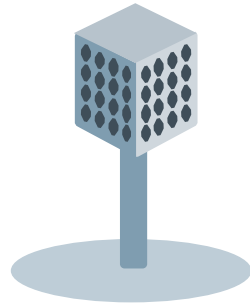
Exactly What is 5G?



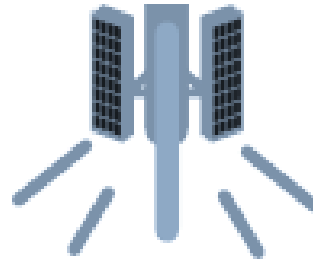
Exactly What is 5G?



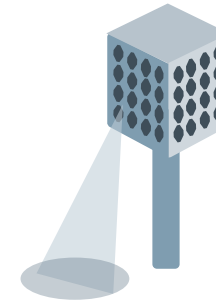
mmWave



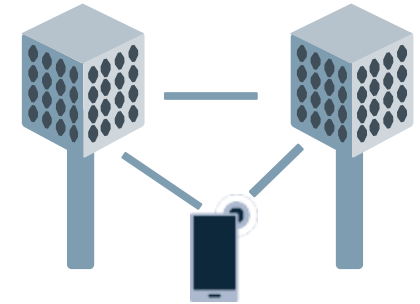
Small Cell



Massive MIMO

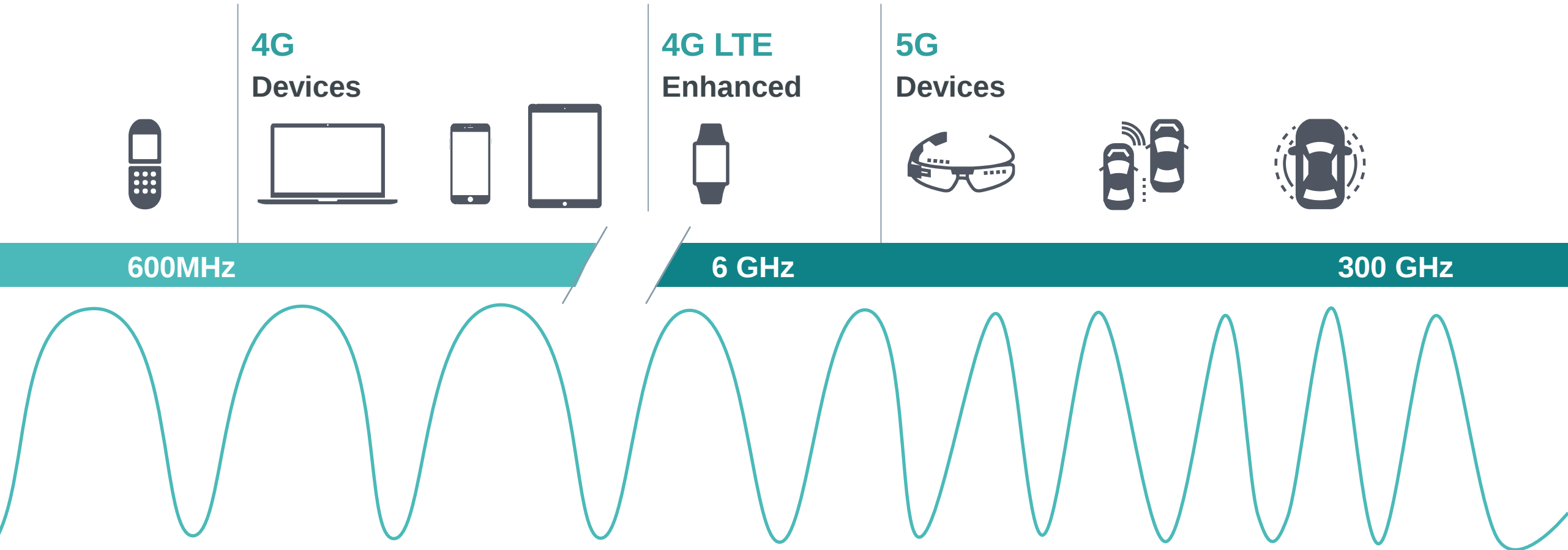


Beamforming



Full Duplex

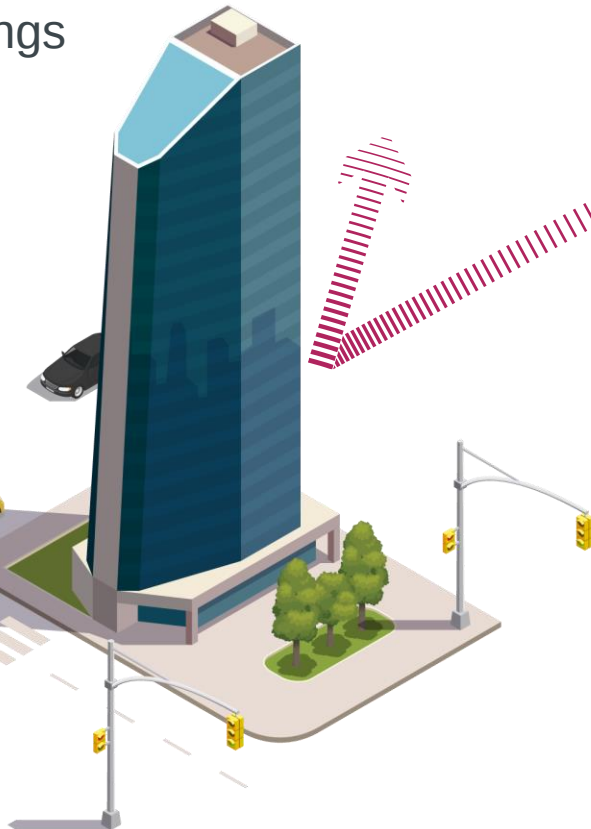
What is 5G – mmWaves



5G – mmWaves

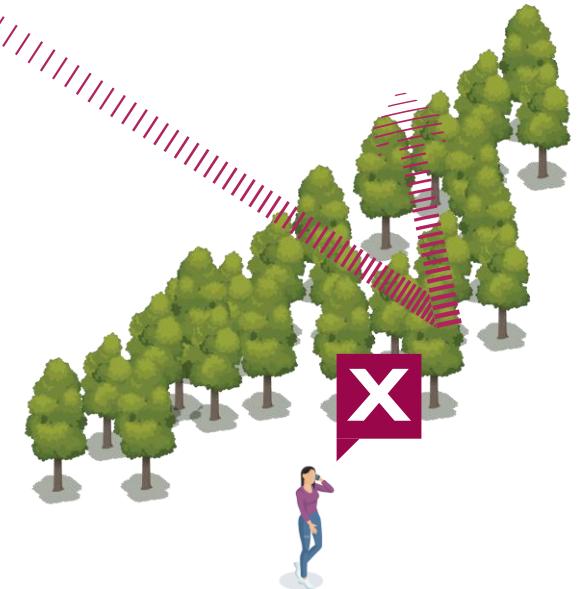
mmWaves

Don't travel well
through buildings
and obstacles



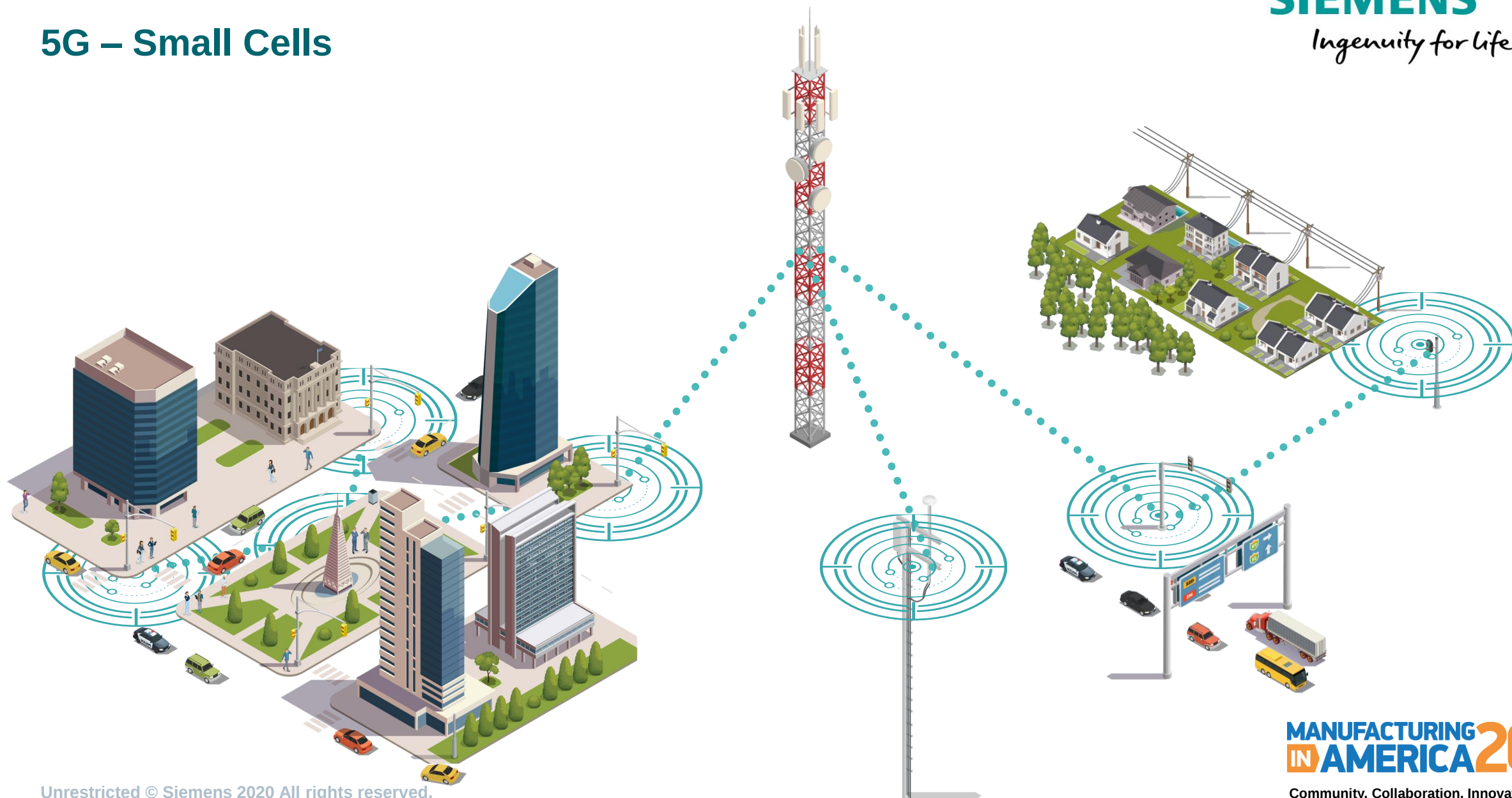
mmWaves

Tend to be
absorbed by trees,
water and plants



5G – Small Cells

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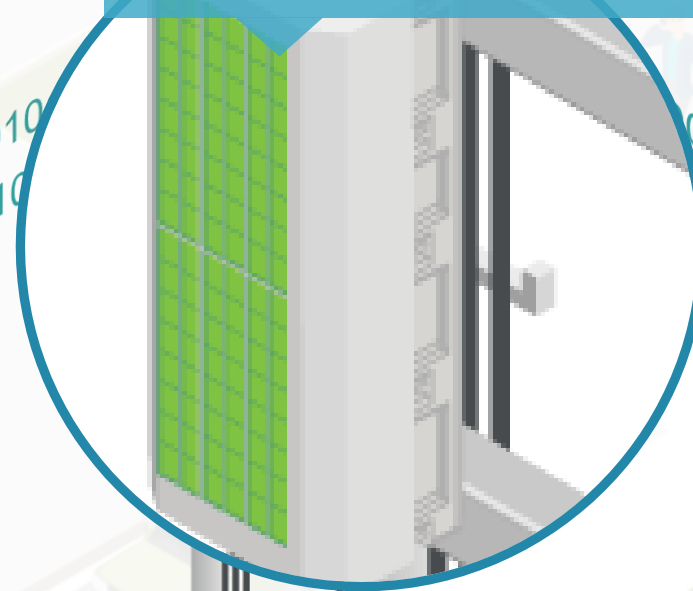
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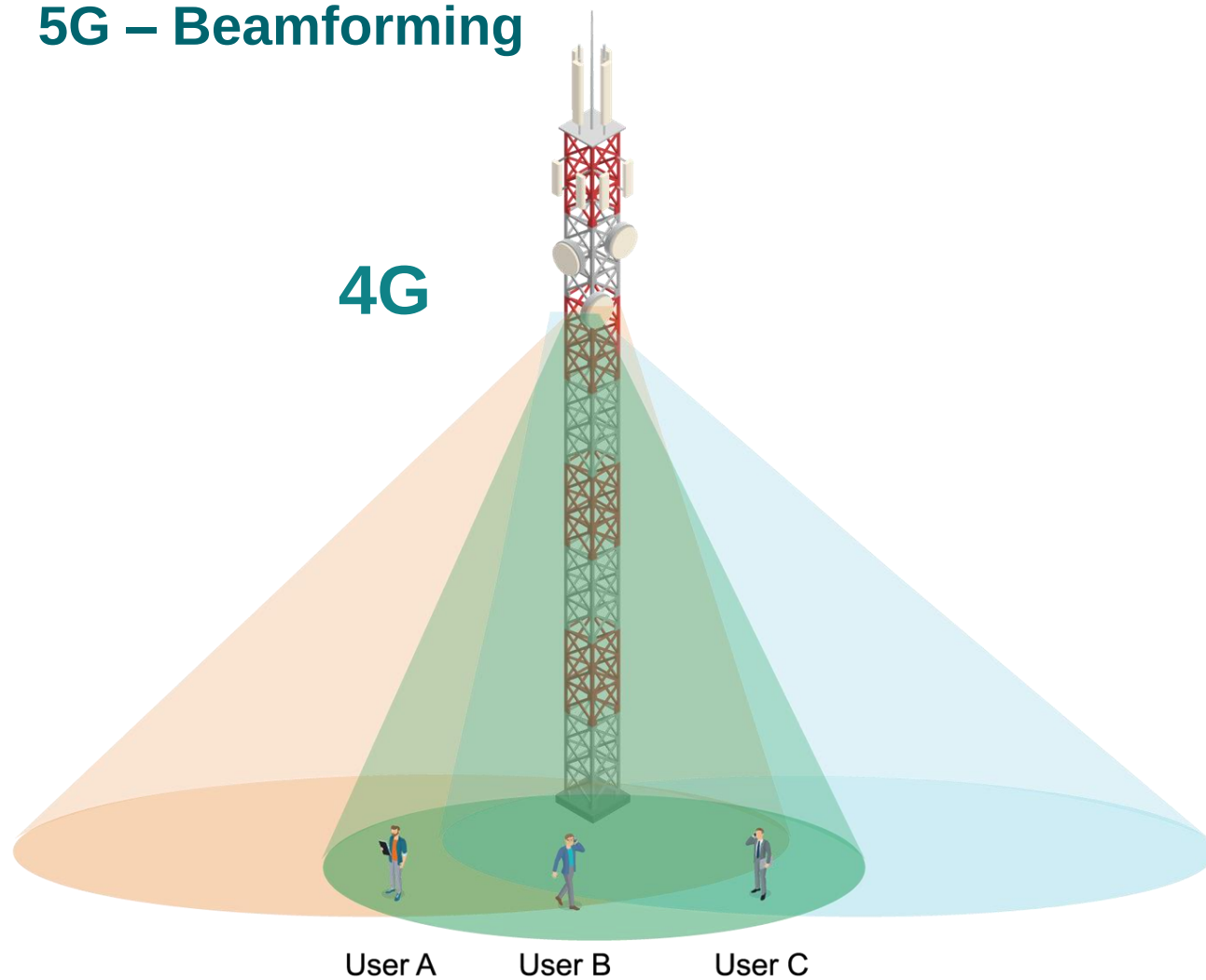
5G – MIMO (Small Cell Networks)

thousands of low-power line base stations
much closer together than traditional
towers forming a sort of relay team to
transmit signals around obstacles

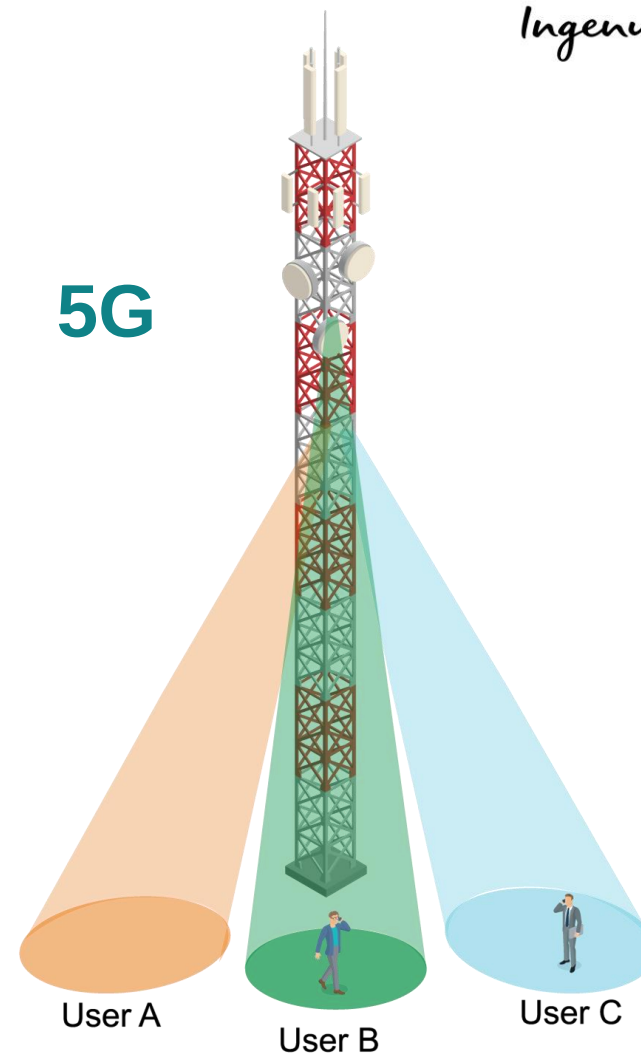
Today's 4G base stations have about a dozen ports
5G massive MIMO can support hundred ports



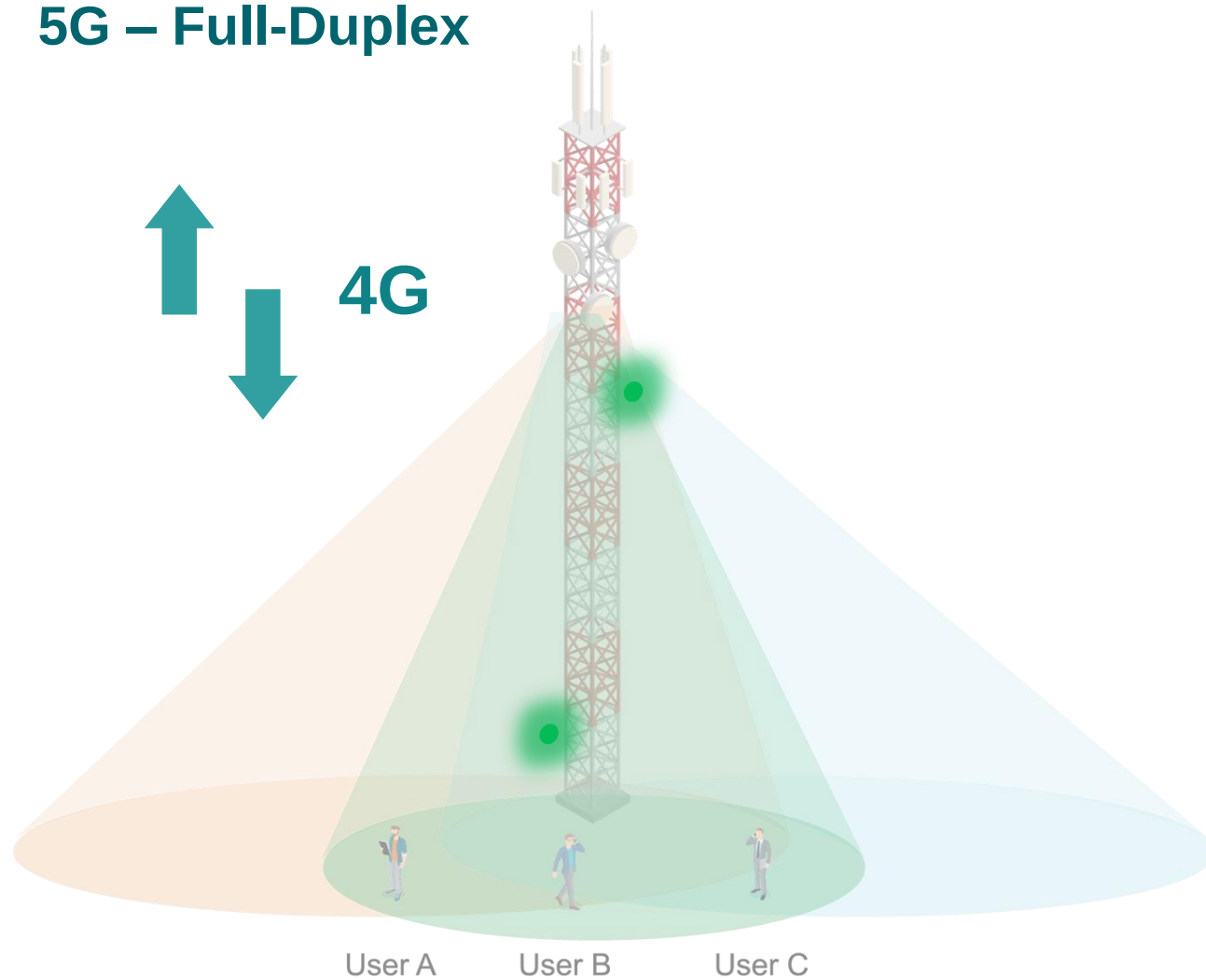
5G – Beamforming



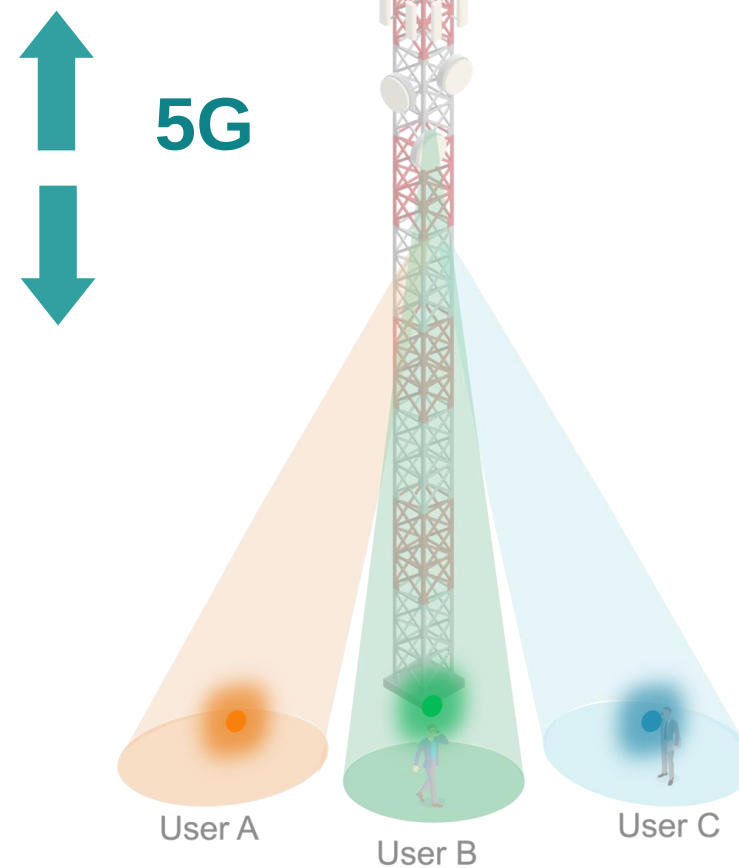
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5G – Full-Duplex

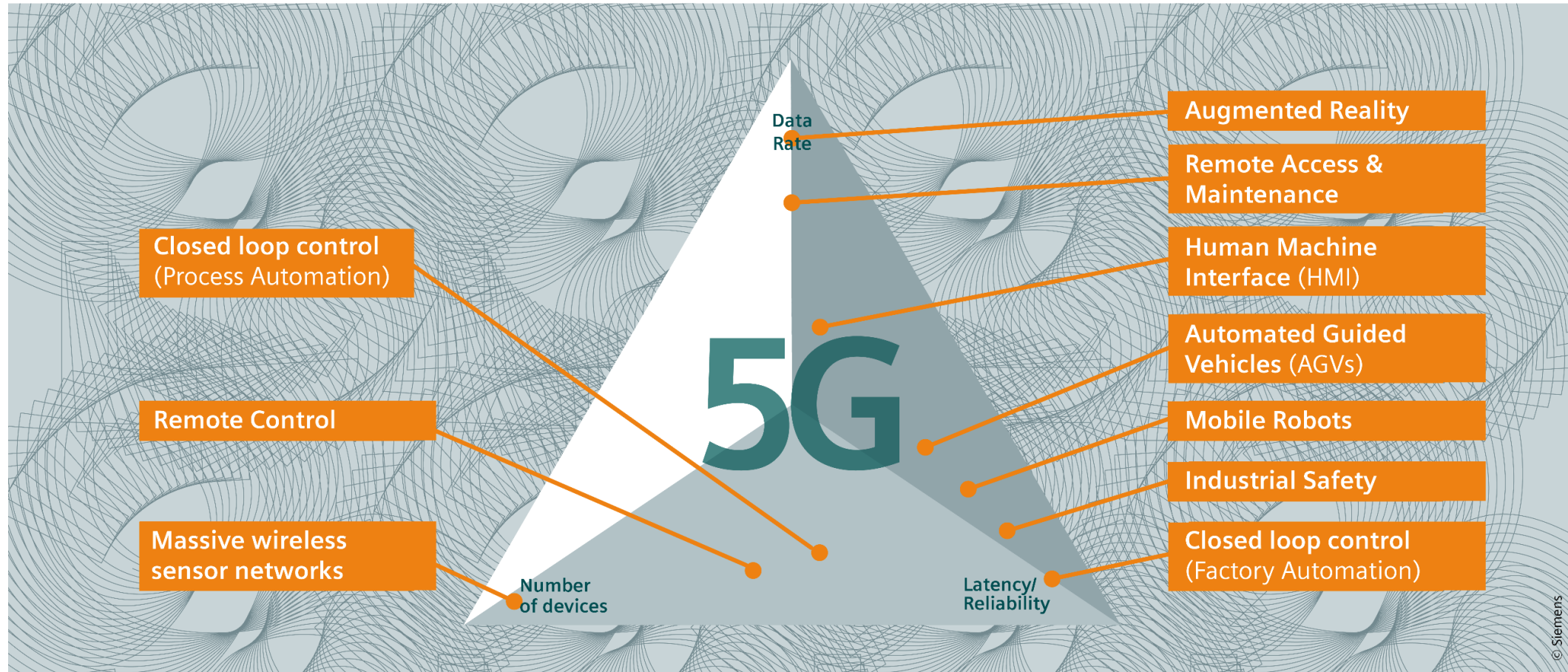


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Future Possibilities for 5G in the Industrial Space

Low Latency and Reliability is a Must!!



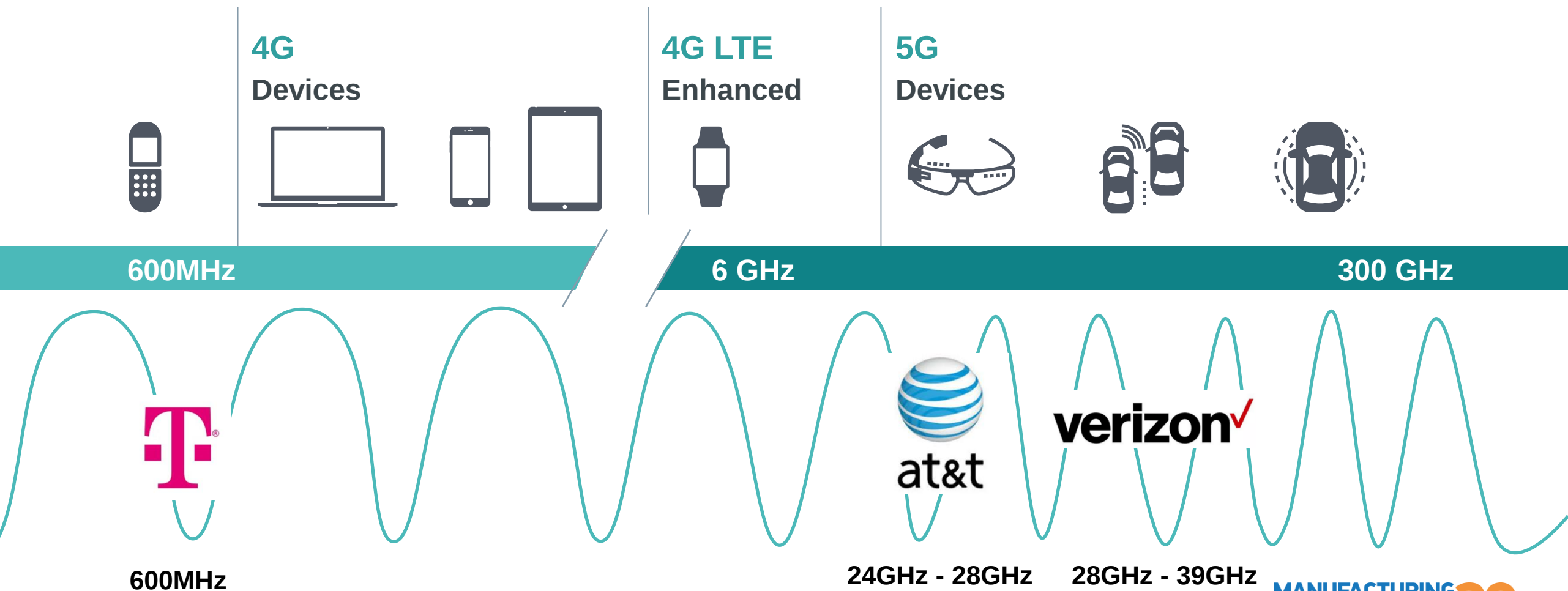
Challenges with Industrial 5G in the U.S. Region



- Not all 5G is equal in the U.S.
- Not all locations will have 5G.
- Hardware requirements will differ by carrier.
- 3GPP Release 16 for Industrial Applications
- New OpEx and CapEx expense structures for 5G the industrial environment.

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U.S. Spectrum Differences – MHz vs GHz Spectrum Ranges



Carrier-Based 5G Speed (as of 2020)



5G EVOLUTION	5G	5G+
400 Mbps peak	400 Mbps peak	2+ Gbps
40+ Mbps Avg.	40+ Mbps Avg.	400+ Mbps Avg
<10 Avg. Latency		

- 30 major metropolitan areas today
- 60 more major and mid-major metropolitan areas by end of 2020

* Functionality will differ not be available in each geography of deployment.



5G
2+ Gbps
1.5+ Gbps Avg.
<5 Avg. Latency

- 30 major metropolitan areas today
- 60+ major and mid-major metropolitan areas by end of 2020



3GPP Release 16 powers Industrial applications

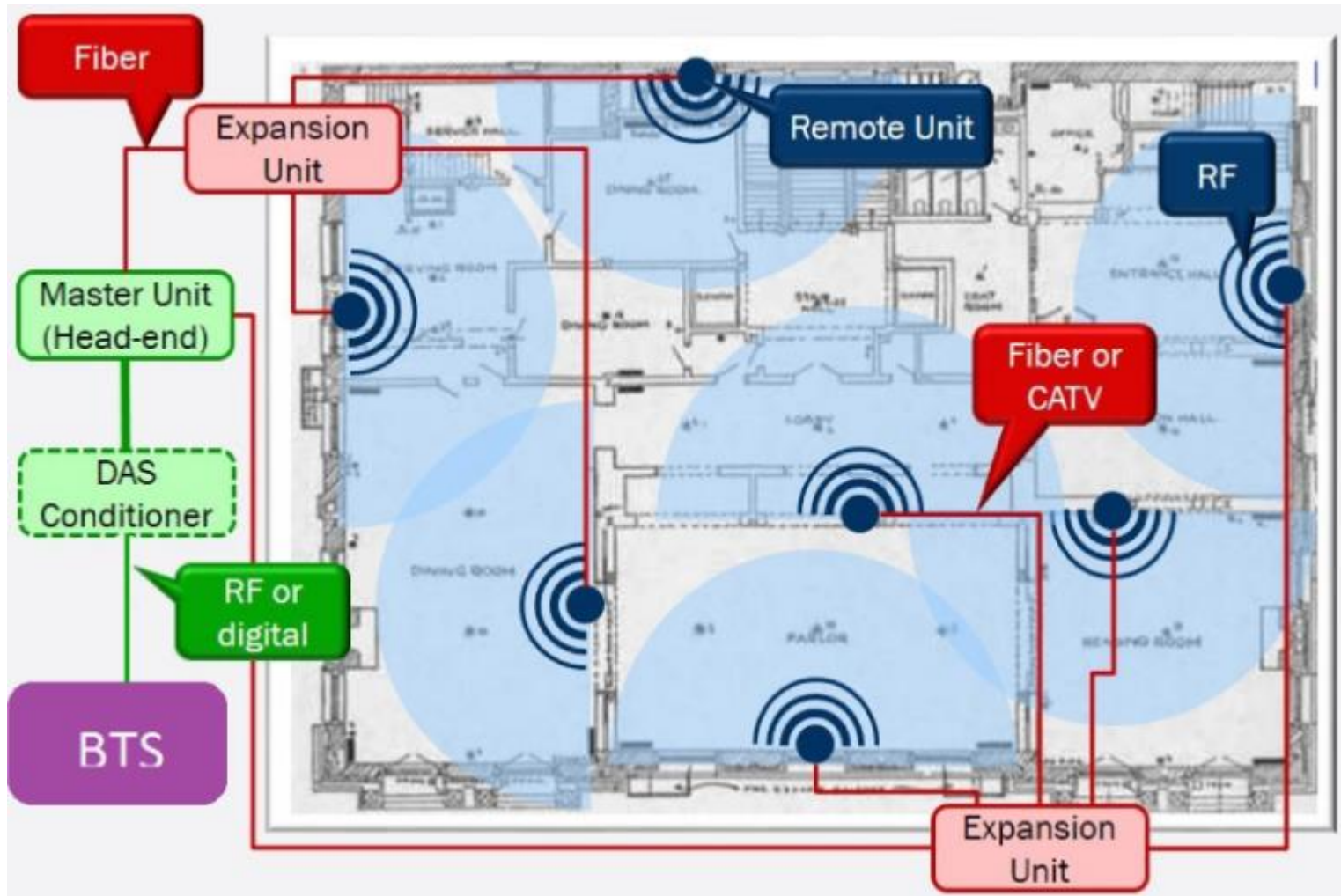
- **Enhancement of Ultra-Reliable (UR) Low Latency Communications (URLLC)**
- **5G System - Phase 2**
- **V2x Phase 3: Platooning, extended sensors, automated driving, remote driving**
- **Industrial IoT**
- **Enhancement of Ultra-Reliable (UR) Low Latency Communications (URLLC)**
- **NR-based access to unlicensed spectrum**
- **5G Efficiency: Interference Mitigation, SON, eMiMO, Location and Positioning Services, Power Consumption, eDual Connectivity, Device Capabilities Exchange, Mobility Enhancements.**
- **Enhancements for Common Framework for 3GPP Northbound APIs (eCAPIF).**
- **FRMCS Phase 2**

5G Infrastructure

Which one is best for Industrial Use?



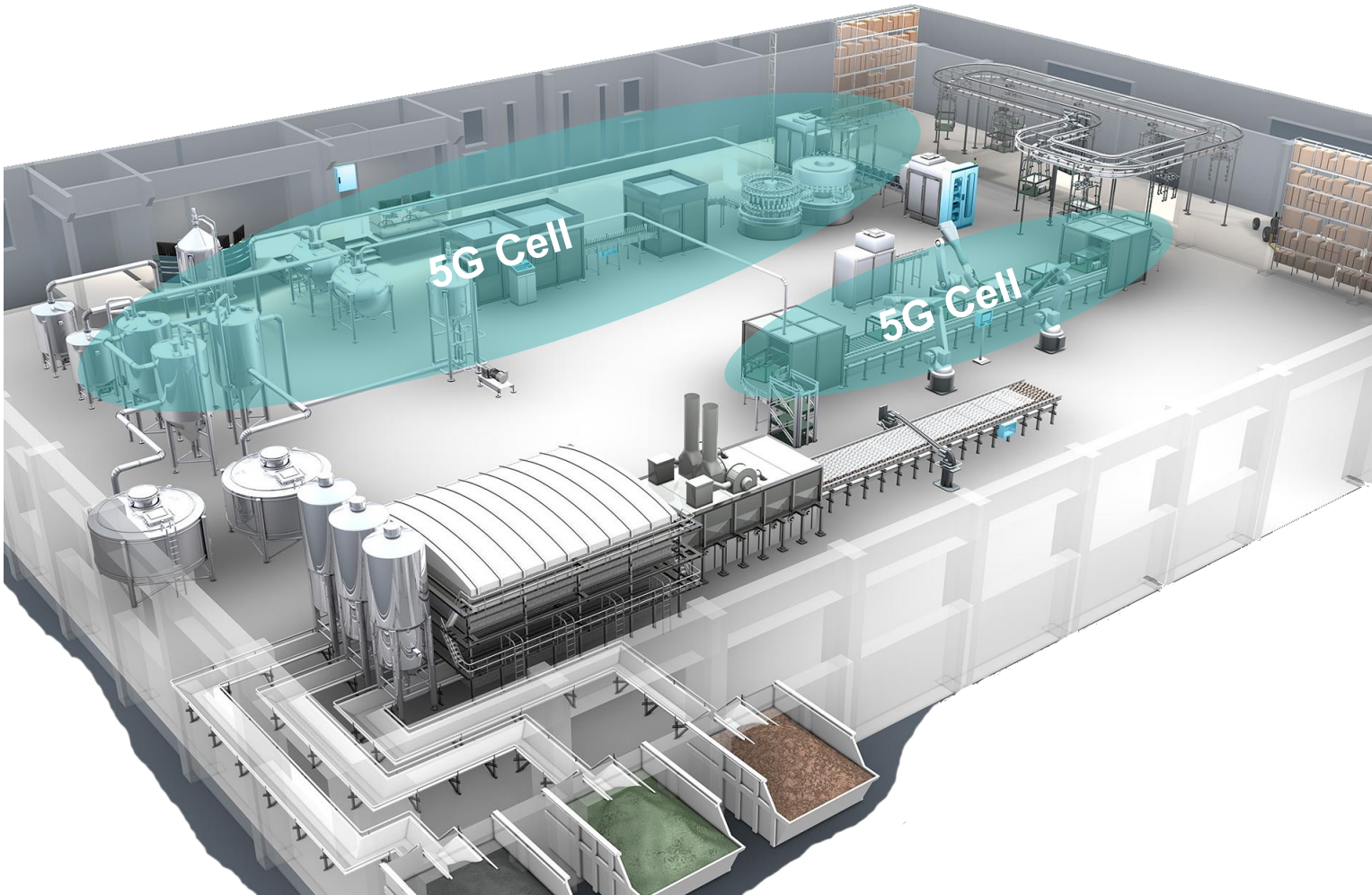
5G Multicarrier Active DAS Infrastructure



Active DAS Elements

- Built and managed by the end user
- Secure: Production Data does not leave the premises
- Will cover the entire industrial facility
- Highest Bandwidth, Security and Reliability.
- Multiple carriers can exist on the same network
- **Carrier Approval Necessary**
 - 6 – 8 week process
 - upfront & monthly signal leasing fees

5G Small Cell Infrastructure



Small Cell Elements

- Built and managed by the end user
- Secure: Production data does not leave the premises.
- Smaller coverage area – only manufacturing sites/cells that need 5G.
- High bandwidth, Security and Reliability.
- Only one carrier can exist on the network.
- **Carrier Approval Necessary**
 - 6 – 8 week process
 - upfront signal leasing fees

Industrial 5G networks require private networks

- Ownership of the wireless network in the production facility:
 - Added flexibility by self management, important for the flexible factory of the future
 - Qualified staff with OT-knowledge on-site allowing for 24/7 support and maintenance of the network.
- Maximum data-privacy and security:
 - Data stays on-premises
 - Protection of trade secrets, production data and patents
- Support ultra-reliable and low-latency communication is critical
- Dedicated network for industrial use
- Interference free wireless network



What needs to be Overcome until 5G is fit for industry?

**5G Hardware
Availability**

**Industrial Protocol
Releases**

**Industrial Use/ Positive
Business Cases of
Deployment**

+ Industrial Hardware & Protocol Services Support



Industrial 5G!

Questions?



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Product Marketing Manager - Wireless SME (U.S., Canada and LATAM Regions)