



5G: Enabling smart manufacturing





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5G is the fuel powering what is being called “The Fourth Industrial Revolution” and “Industry 4.0.” It has opened the doors to the transformation that blends computer power with machine and sensor technology.

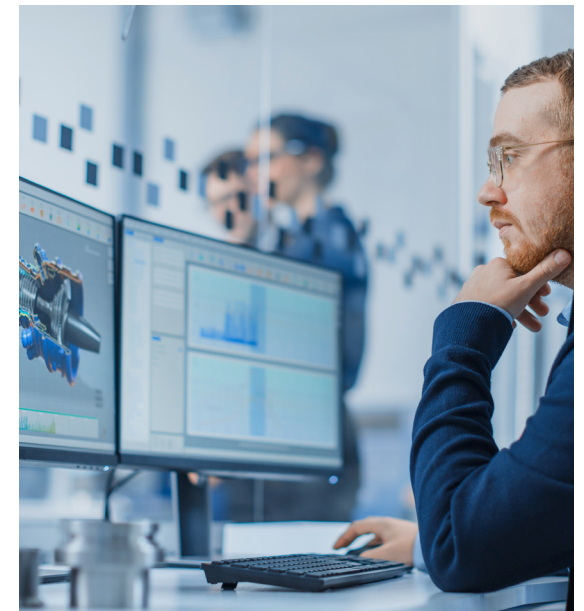
Faster speeds, lower latency, higher bandwidth, and edge computing capabilities have arrived with the advent of 5G.

5G paves the road for a more agile, fully connected, and automated manufacturing experience from design to distribution. Paired with machine learning, AI, and the Internet of Things (IoT), manufacturers are able to collect more data, compute information faster, and make better near-real-time business decisions.

Because manufacturing drives the global economy, every manufacturer can make a positive impact in other industries, whether it be transportation, retail, healthcare, or any of a number of others. 5G will make it possible for companies to innovate products and services using machine-to-machine

learning, augmented reality (AR) and artificial intelligence (AI).

Informed manufacturing IT leaders are realizing that their current network infrastructures can’t support their new goals and are investing in intelligent solutions such as edge computing and SD-WAN. Intelligent systems like SD-WAN can help manufacturers modernize and defend their network environments and achieve true modernization.



AI and the smart factory



Artificial intelligence will be a central feature in the smart factory of the future. But for AI to perform optimally, it needs access to large amounts of near-real-time data. 5G's IoT connections and fast speeds, combined with edge computing power, will allow AI to quickly "learn" and make smart, fast, and reliable decisions.

Today, AI is being used to complete repetitive tasks. Eventually, AI will be used to control factory floor production with almost no intervention from humans. Not only will AI control machines, but it will also predict issues in the supply chain, prevent fraud, and assess production opportunities.

The 5G smart factory of the future rests on a fully connected experience. 5G allows for massive device connectivity, near real-time automation, and network flexibility.

Supply chain transformation with IoT and 5G

Currently, manufacturing and transportation industries are investing in IoT more than any other sector. The trend is predicted to continue through 2022. In order to manage a large amount of data and information from all of the connected devices on the manufacturing floor, companies require 5G's capacity and speed.

5G allows manufacturers to connect more sensors, devices, and assets through a single network and ultimately give them clearer visibility into their supply chains. Manufacturers recognize the benefits that can be realized by extending the reach of their network beyond the factory floor. This is particularly relevant for verticals with a high-margin product where greater monitoring and visibility of assets in transit are critically important.

Using elements of both private and public 5G networks allows manufacturers to link together disparate systems both inside the factory and across the wider value process, including the supply chain, distribution, warehousing, and customer service.

The degree to which connectivity can be embedded in processes varies across the manufacturing sector, for example:

- The food and beverage sector is heavily regulated and required to demonstrate the traceability of consumer products. With 5G,

they can benefit from automation to establish digital traceability.

- Bespoke machinery manufacturers can benefit from connectivity to monitor performance by aggregating data across the entire production line.
- Pharmaceutical companies that have stringent requirements for data retention to ensure consumer safety can benefit much like the food and beverage industry with digital traceability.



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The role of edge computing

Edge computing enables new applications that require lower network latency for real-time operations, such as augmented and virtual reality, video and speech analytics, remote monitoring for video security, and more. Edge computing is needed at scale for augmented reality applications, which would quickly drain a battery if used on mobile devices, with processing in the cloud too slow for real-time uses due to network latency.

As 5G wireless networks continue to develop, you can imagine edge networks acting as “the nervous system,” which connects sensory cells at your fingertips with the core network, or “the brain.” Edge computing works as the interpreter for the sensory signals of the Internet of Things (IoT).



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5G data gathering and equipment repair

One hour of equipment downtime can cost more than \$100,000.

As networks grow and become smarter, they produce far more information than their predecessors. Manufacturers that can capture and analyze information can produce actionable intelligence that massively increases productivity. 5G's low latency and high-bandwidth capabilities can support the increased data flow.

5G-connected sensors can channel real-time information about equipment performance, ranging from vibration to noise data. When combined with machine learning algorithms, the data can help manufacturers predict when expensive equipment is about to fail, reducing the likelihood of costly downtime.

The network gives an advanced warning when a specialized piece of equipment needs a repair. When this happens, level one technicians can travel to the factory and, using augmented reality 5G-enabled headsets, have engineers at headquarters walk them through the repair process remotely using 3D animations.

5G and augmented and virtual reality

5G will enable manufacturers to achieve new levels of factory optimization with AR and VR.

These technologies can display overlays to guide workers through the production steps for intricate assembly processes. They'll help train new employees and shorten the learning curve. Manufacturers can direct operators in the field through repair procedures, reducing the costs of dispatched or third-party labor.

In one case, using augmented reality, an aircraft manufacturer was able to reduce the production time of a complex assembly wiring by 25% and cut error rates to almost zero.

Manufacturing companies are currently in the beginning stages of implementing augmented and virtual reality but haven't fully invested in the technologies because of the large bandwidth it takes to run them. With 5G, employees will be able to work with the technologies anywhere on a factory floor.

More flexible networking

5G allows manufacturers to be more flexible and adjust their networks based on their unique needs. With on-premises edge computing capabilities, they'll be able to control sensitive data locally. They will have the ability to separate a single physical 5G network into multiple virtual networks via network slicing. For example, a portion of the network in a manufacturing plant could be split off for operational equipment efficiency or when market demand increases.



The role of robotics in smart manufacturing

5G fuels the creation of smaller, cost-effective, untethered robots. Auto manufacturers, for example, are already using co-bots, or collaborative robots, to complete hard-to-reach or dangerous tasks underneath a vehicle while human workers continue to perform other tasks on the manufacturing line. 5G is helping these robots become more agile and make faster decisions and adjust to changes in near-real time.

In the near future, with the help of 5G, we'll see more types of smaller autonomous and collaborative robots on the factory floor performing more complex tasks, taking the burden off human workers, and ultimately helping factories optimize their production.

Increased productivity on the factory floor

5G can also be viewed as an evolutionary progression of the already present large-scale automation seen on the floors of automotive manufacturers. Examples include:

- Operator control screens for schematics of every car to accommodate all custom build specifications.
- Embedded barcode data on parts for detailed installation instructions.

- Torque, ramp up, and rotation angle recording tools for quality assurance and auditing.
- Linking Manufacturing Execution Systems (MES) to an entire production line for better automation and traceability.
- Wi-Fi "button pushers" to call new parts for dynamic inventory stock delivery.
- Automated Guided Vehicles to manage internal supply chains.

More flexible production

Automotive manufacturers have expressed interest in replacing current fixed ethernet connections to workstations with a 5G IoT network. This allows for greater flexibility to make production line changes and reduce initial site capital costs due to lower cabling costs. With the growing amount of software being installed in cars, the time required to load firmware is in danger of running up against the cycle time allocated on production lines as the data volumes continue to increase.

A wireless 5G solution would allow firmware loads to span more than a single production cell and remove the cycle time constraint.

How to prepare for 5G

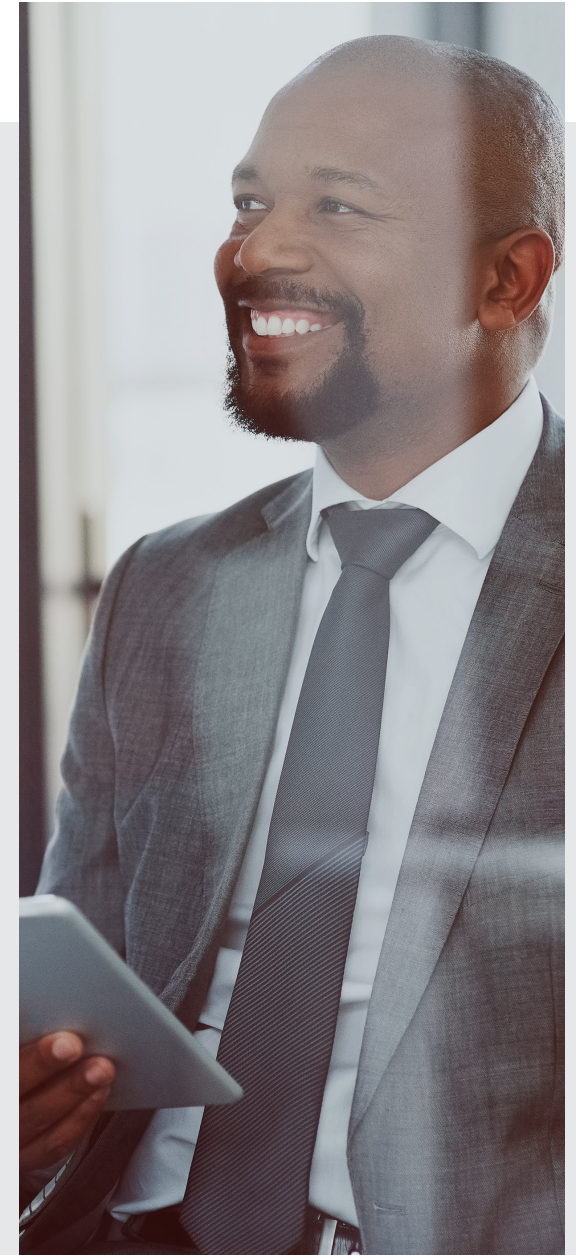


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There's little doubt that 5G is the future for smart manufacturing. Reduced latency is the key differentiator setting 5G apart from existing wireless connectivity solutions. Edge computing allows critical network functions and applications to be placed much closer to where they are needed. Network slicing provides operational networks with virtually separated and dedicated network resources. The result is a flexible and responsive future-proof network that is resilient, reliable, and secure.

What do manufacturing operations need to do to prepare for and take advantage of 5G smart manufacturing?

1. Adopt Multi-access Edge Computing (MEC) technology and SD-WAN.
2. Get decision-makers to consider the primary technologies, processes, and applications that will realize the improved efficiencies and integrations 5G can provide.
3. Partner with CBTS to bring 5G inside your manufacturing facility with a private wireless network, such as Private LTE or Distributed Antenna System (DAS).



About CBTS

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Contact us for more information on how your organization can embrace 4G/5G-enabled smart manufacturing with a private wireless network solution.