DIGITAL TRANSFORMATION

A guide for manufacturers

The smart way to use locating data, real-time complex-event processing, and data analytics to enhance your competitive advantage and improve bottom-line results.

SIEMENS

Manufacturers around the world are being forced to deal with three megatrends that are imposing changes upon them. First, globalization continues to advance at a rapid clip, turning low-cost manufacturing regions into competitors and giving rise to new sources of goods from more low-wage countries. This puts ever greater pressure on manufacturers to **lower their costs** further to compete, while at the same time introducing more distinctive or customizable products to meet specific customer needs.

Second, manufacturers must respond to consumers who now want—and expect—to buy a product at any time, wherever they are, and have it delivered anywhere without delays or errors. Surveys show that these consumers will abandon a brand if their expectations are not met. This puts pressure on manufacturers to be able to **produce goods on demand**, and to ensure that they are delivered to their upstream customer or to the right store or warehouse at the right time, every time.

Data generates value in a data-driven factory.

Third, manufacturers and logistics providers are having to **deal with disruptions** to their increasingly global supply chains. The COVID-19 pandemic is the most recent and obvious example of the impact unforeseen events can have on a manufacturer's supply chain, but it is far from the only issue. Rising sea temperatures have doubled the annual number of worldwide Category 4 and 5 hurricanes over the past 35 years, according to a study conducted by researchers at the Georgia Institute of Technology and the National Center for Atmospheric Research (NCAR). And political instability has been rising around the world, which could impact a company's supply chain as well.

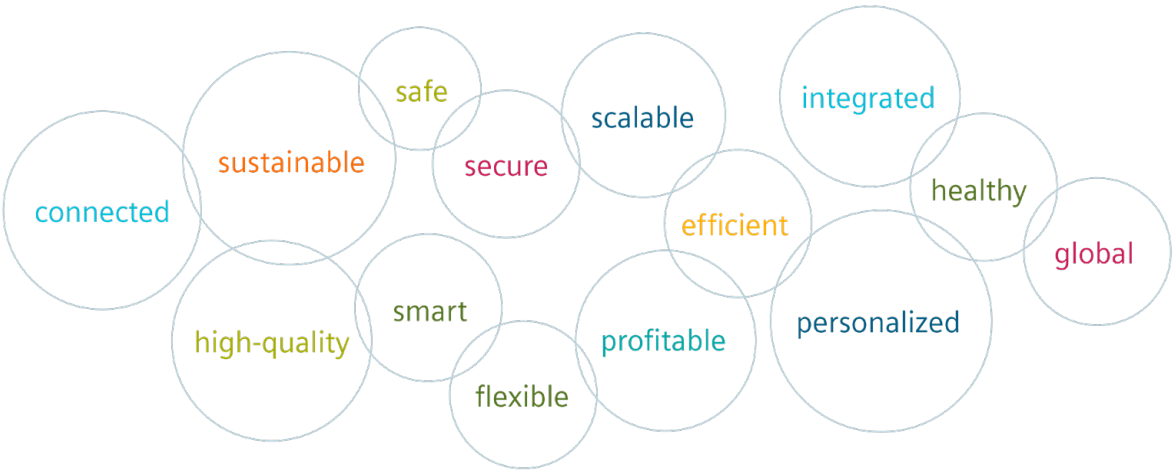
These megatrends affect all international manufacturers and their logistics providers. As a result, companies need systems to enable them to react quickly, with greater flexibility and a higher level of execution than markets previously demanded. Digital transformation is the only viable way forward. In this white paper, we will explain what digital transformation is and provide clear, feasible, and cost-effective steps manufacturers can take to achieve digital transformation and the flexibility, adaptability, and excellence in execution that it can provide.

"We hope that this document further clarifies for you the benefits that can be realized and proves a valuable source of inspiration on your journey toward a full understanding of manufacturing processes in real time and readiness for full automation."

Herbert Wegmann
General manager of Digital Connectivity and Power segment, Siemens

What does **digital transformation** really mean?

There are many definitions of digital transformation. Many Internet sites define it as a change brought on using digital technologies, though CIO Magazine goes a bit further. “Digital transformation is the application of digital capabilities to processes, products, and assets to improve efficiency, enhance customer value, manage risk, and uncover new monetization opportunities,” it says. But even this definition doesn’t go far enough, because it suggests a piecemeal application of digital technologies to various aspects of a business, rather than a coherent, integrated strategy.



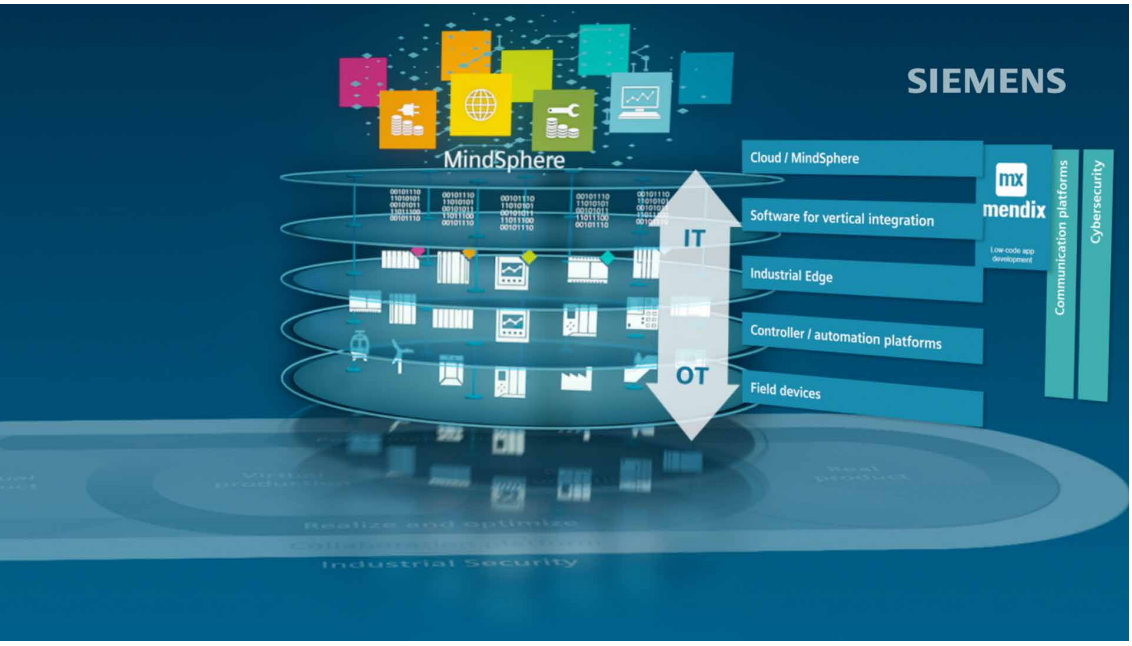
Digital transformation is the process of using digital technologies to transform existing traditional and nondigital business processes and services.

True digital transformation is the elimination of the barrier between the physical and digital aspects of a company's operations. For manufacturers, this means the automatic, real-time synchronization of processes with a digital image in its IT systems—a digital twin. It means knowing precisely what you have—whether it's raw materials, parts, tools, containers, or finished inventory—and where it's located in real time. And it means having systems that alert managers automatically when anomalies occur—if a shipment arrives at the wrong manufacturing line, for example, or if a tool leaves a particular area.

"Digital transformation sounds very fancy," says Andreas Werner, Siemens' system manager for **Real-Time Locating System (RTLS)**, "but what does it mean? It means you can get real-time data about what's happening in the factory and in your logistics operations. When that information is coupled with standardized processes, you can use data analytics and business-intelligence tools to make fast, fact-based decisions while ensuring the highest quality, even when people would not master situations without technology. Full automation is the next step above that."

Real digital transformation is possible, and it can be accomplished in a way that delivers a return on investment and prepares your company to succeed—and even thrive—in rapidly changing global markets. The approach outlined in this white paper will help manufacturers avoid mistakes, reduce costs, and deliver ordered products to customers on a just-in-time basis. "Conventional processes work well in a more traditional environment," says Berthold Varga, a technical consultant for Siemens, "but if you consider future developments, such as low lot sizes and greater variety in a company's product portfolio, you need to have more flexibility in your processes."

The following sections will guide you on the path to true digital transformation.



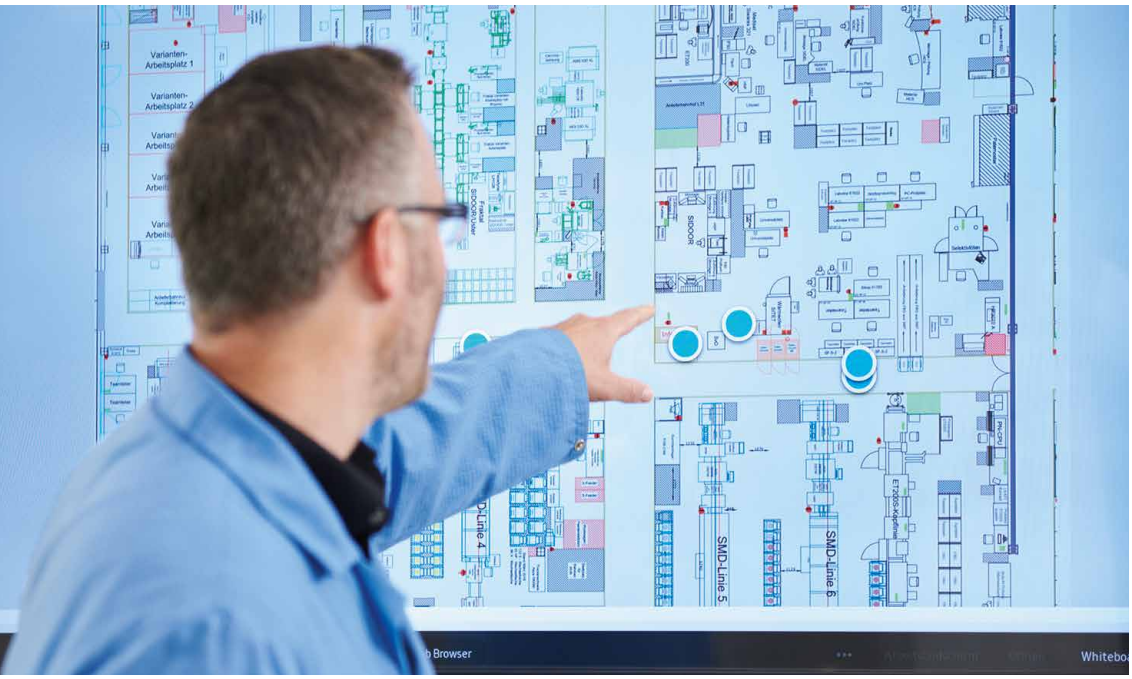
Industrial transformation covers IT and OT convergence, as well as vertical and horizontal integration, IIoT, the cloud, and cybersecurity.

The value of **real-time** visibility

No matter how efficiently and effectively manufacturers plan, the manufacturing process is complex and imperfect. Workers don't always follow protocols. Parts or subassemblies don't always arrive on time. Tools can be moved to new locations without being recorded, causing delays in locating those items when needed. Bins and tools can end up lost or stolen. Disruptions can occur. Mistakes can be made. And all of this can impact a company's ability to produce the products needed and to deliver them to customers on time, every time.

Disruptions and mistakes are severely limited, of course, when you transform digitally. But by implementing technologies that deliver real-time visibility into key components, tools, parts bins, vehicles, and other items necessary to run a factory smoothly and efficiently, companies can monitor processes and be alerted immediately and automatically if things do not go as planned. This enables manufacturers to deal with issues far more quickly and effectively.

For example, an automobile manufacturer uses Siemens' RTLS to ensure that car door components—windows, audio speakers, electronic controls, etc.—are added to the door in the proper sequence, and that the correct door is put on the right vehicle every time. If the required components are not sent to the assembly area, an alert is issued to a manager automatically. Similarly, if a technician does not assemble the components in the proper sequence, the system detects this problem and he or she will receive an alert.



Full transparency with a RTLS solution.

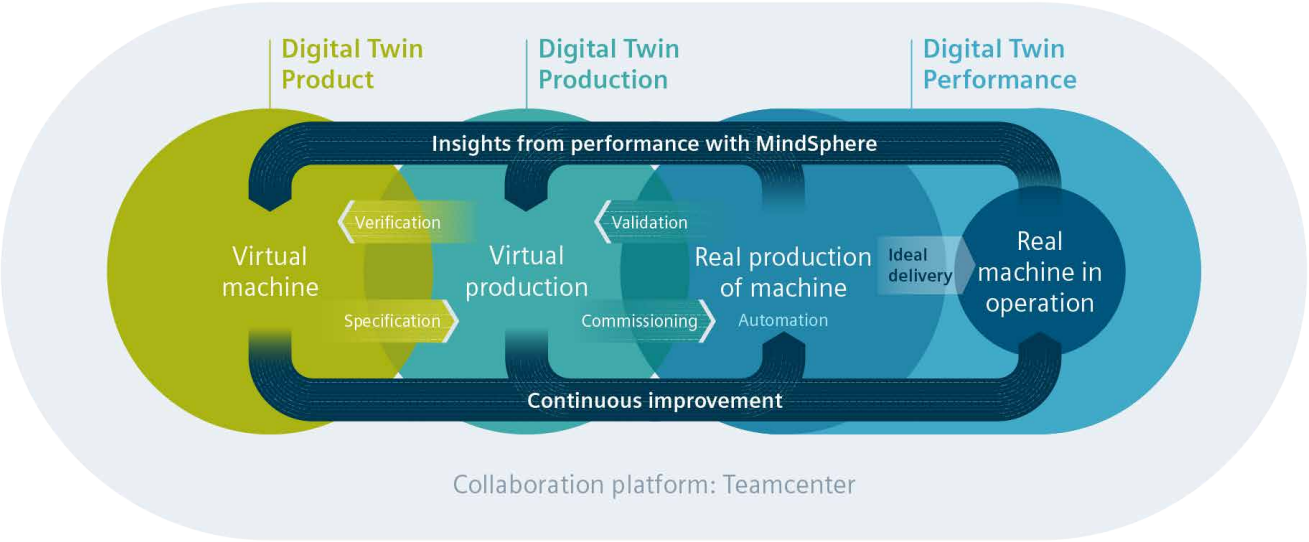
Thus, the first step in any digital transformation is to deploy a real-time locating system that provides visibility into what is happening in your factory and warehouse, and to provide alerts whenever anomalies occur. This RTLS solution can provide the data needed to create a digital twin. The information can be combined with software analytics, artificial intelligence, and other systems to enable companies to achieve efficiencies previously considered impossible.

"RTLS is the infrastructure that gives you visibility and transparency," Mr. Werner says. "If manufacturers start their digital transformation within their factories with an RTLS, they begin collecting the information they need to achieve flexibility and adaptability."

Until a few years ago, it was impossible for Siemens' customers to collect real-time locating data, so manufacturers were unable to have a full picture of their processes.

There were locations where a company could gather some information, but they could not collect consistent information across their value chain. That led to inconsistent processes. "With an RTLS, you have incredible transparency," Mr. Varga says. "You can see everything that's happening within your facilities: the movements of materials, people, tools, work in progress, and anything else you wish to tag."

For factories with flexible assembly lines, a digital twin is particularly essential. "If the manager decides to use an open area to produce a subassembly, the RTLS can locate all the necessary people, parts, materials, and tools, and ensure they are in the right location at the right time," Mr. Werner explains. "Without knowing the precise location of everything you need to start production, it is very difficult to bring all the components together in a timely manner."

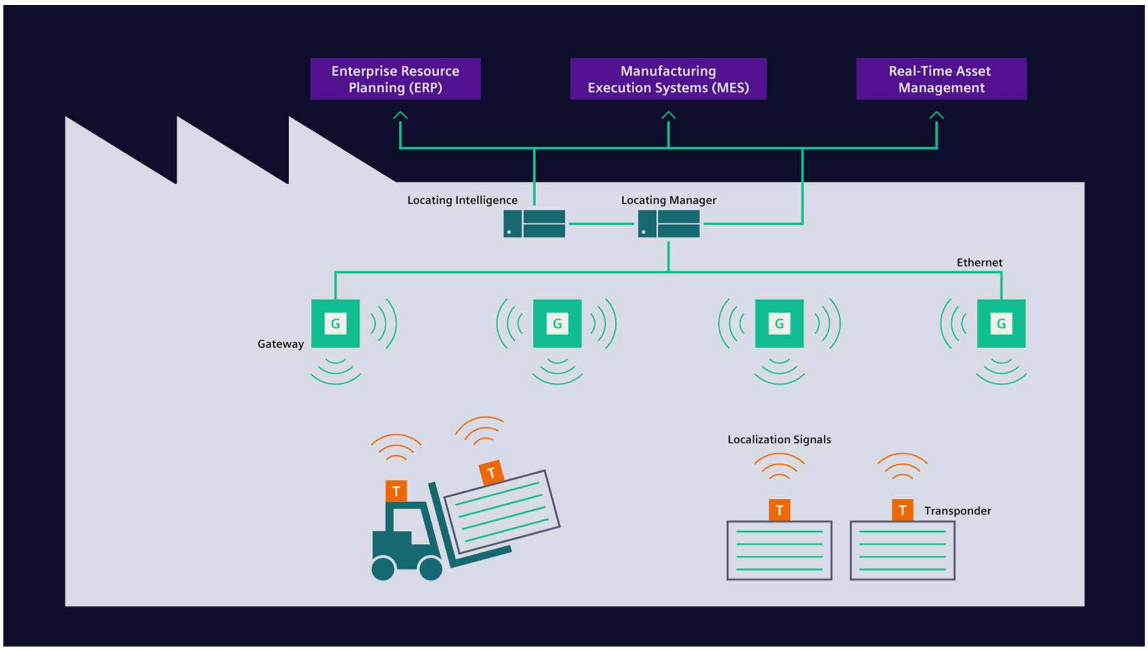


Digital twin as a key element for future industry.

Immediate benefits

Companies can start with deploying a small number of RTLS gateways around their factory to begin capturing real-time data regarding where tools, parts bins, large subassemblies, and other items are located, as well as personnel. However, the solution is so scalable that the company can decide according to its needs how to handle the localization solution. It can not only locate more objects, but also extend the localization by another zone and achieve higher accuracy of simultaneously localized objects. This helps to create a digital twin of processes.

As a company uses more transponders on items and installs more gateways, greater location accuracy can be achieved, and the company begins moving toward creating a digital twin—a digital version of its factory. The system can provide managers with a wealth of information about what is happening on a shop floor. For example, if several manufacturing lines are producing the same subassemblies, real-time data can allow managers to compare how long a given subassembly is worked on at each station across the lines. That can reveal where bottlenecks exist, enabling problems to be proactively addressed. A system that uses transponders on subassemblies or parts bins from third parties can reveal which suppliers are delivering just in time and which generate repeated delays.



Seamless locating on the entire company premises with RTLS infrastructure.

An RTLS solution can help companies move toward lean manufacturing. “Manufacturers need to reduce the stock,” Mr. Werner says, “but how can you reduce without running out of parts or materials? An RTLS gives you full transparency of your intralogistics, so you can reduce stocks without the risk of running out of critical items and causing delays.“

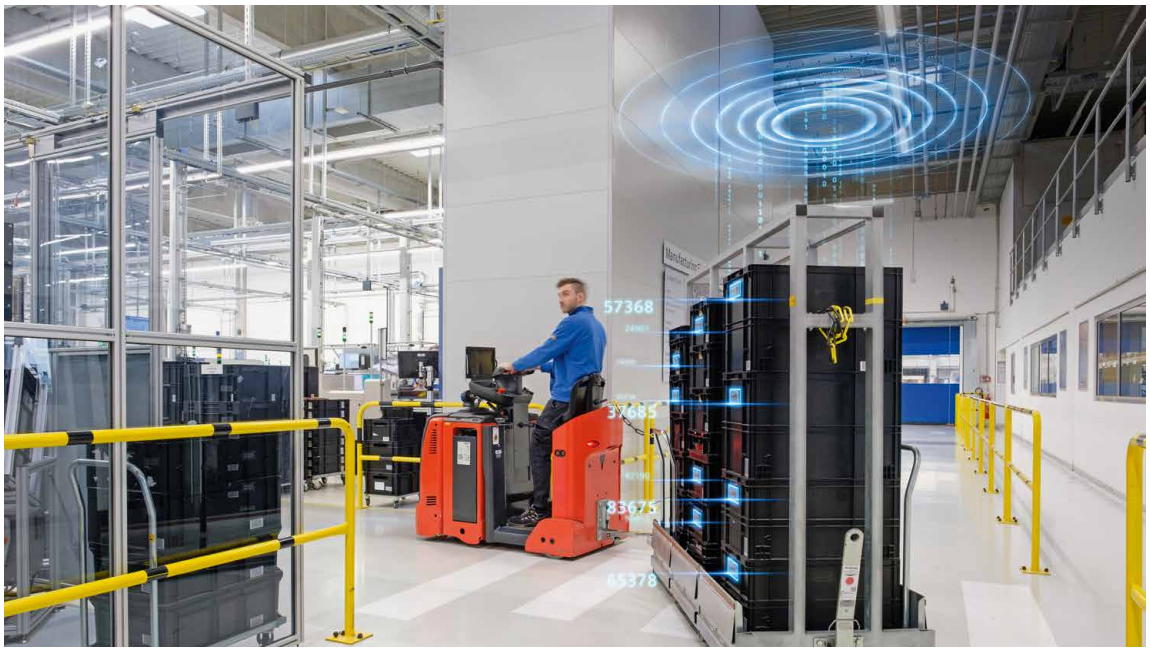
An RTLS solution can also be used to improve or speed up maintenance processes. When a machine goes down, managers can use the RTLS data to summon the closest maintenance personnel to fix the problem. That person could be given the precise location of the specific machine facing an issue, thereby reducing the amount of time he or she would otherwise waste looking for the unit that needs to be repaired.

Vehicles—including automated guided vehicles (AGVs)—and factory workers can be tagged, and the system can report alerts to avert potential accidents, as well as potential bottlenecks at cross aisles within the factory. And, of course, in the age of COVID-19, the system can alert workers if they are too close to one another for safety.

In addition, an RTLS can be set up to trigger a variety of actions. For example, as parts are consumed at the manufacturing line, that data can be shared with the warehouse or suppliers, so they know what to deliver and when. When work in progress (WIP) is moving in a non-serialized process, RTLS works in conjunctions with the automation system to identify the correct next step.

RTLS software can interact with program logic controllers (PLCs) to automate tasks. Siemens recently deployed a solution with tagged AGVs. As each AGV approached a gate, the RTLS detected its presence and opened the gate before the vehicle arrived so that it wouldn’t need to slow down.

Safety checks and documentation can also be triggered, based on location. This kind of automation provides factories with a new level of efficiency, as well as command and control.



RTLS solution locates various objects within the factory and provides real-time data for further processing.

Choosing the **right technology**

There are a variety of real-time locating systems that can locate objects in real time or near–real time within a large factory. Some operate at 433 MHz, others at 2.4 GHz. Some use Wi-Fi access points, while others employ Bluetooth beacons or even GPS. Each system has advantages and disadvantages.

GPS works well outside but is usually inaccurate indoors. Wi-Fi-based real-time locating systems have the benefit of leveraging some existing access points—many more will need to be added in a factory—but they do not deliver the location accuracy required for many industrial applications.

Locating with UWB provides the highest indoor accuracy, system stability, and almost no interferences with a 2.4 GHz range.

"A RTLS using active tags that operate at 2.4 GHz might be good enough to track containers," Mr. Werner states, "but when a manufacturer decides to add automation functions to the system—for example, having a process executed when WIP is in a specific area—you need a much more accurate system. You need to be sure that the WIP is in that area. Ultra-wideband gives manufacturers that high degree of accuracy required for these use cases."

A typical RTLS using only 2.4 GHz transponders can locate a tagged object to within about 3 meters. Siemens' SIMATIC RTLS features transponders that operate at this frequency. These are used in situations for which more precise positioning is not required. The SIMATIC RTLS also utilizes Ultra-wideband (UWB) transponders that can be located to within 30 centimeters with 99.9 percent reliability. This makes it useful for industrial automation and other applications for which a more precise position is required.

For example, a highly accurate UWB RTLS can be used to document that processes are being performed properly. If an automaker needed to document the installation of a specific part on the right side of a chassis being assembled, the RTLS could stream position data to other applications to document it accordingly. A less accurate system would not be able to distinguish the exact position of operation, so it could not prove that the correct process had been carried out properly.

Paperless scanning from order data.

RTLS delivers locating data in real time.

"If you want to have a process that is consistent and stable, then you need to be certain that you know the position of the object," Mr. Varga says. "Having an exact position lets you monitor the process closely. If you have a virtual area, a geofence, you can demonstrate that this process step has been accomplished. But if you are not sure it's there, then you are putting your process in jeopardy."

The central processing instance for SIMATIC RTLS from Siemens is the Locating Manager, with which the user can operate and manage the RTLS system. If a factory floor were reorganized, an IT person would then update the layout in the Locating Manager, enabling items to be located on an accurate representation of the factory floor.

Business users can utilize Siemens' Location Intelligence, which offers front-end software for mapping and geofencing. Both come with graphical user interfaces. The system also has application programming interfaces (APIs) for SAP and several manufacturing execution software applications, meaning data can be transferred easily to a company's existing IT systems.

The highly accurate location data collected via UWB RTLS can be used to create a digital twin. Transponders are associated with parts bins, subassemblies, tools, vehicles, individuals, and so on, and these are displayed on a screen. As they move around, the RTLS data shows their location in real time. Rules associated with tagged objects can be set up, so that if someone were to operate a tool without the proper certification, an alert would be sent to a manager, or if a parts bin were brought to the wrong station on the shop floor, it would be flagged by the system.

The advantages of SIMATIC RTLS

Siemens SIMATIC RTLS has been designed for maximum flexibility, so it can be used effectively for a wide variety of use cases within the same factory. The SIMATIC RTLS transponders are small to avoid impacting factory operations. The portfolio includes a large number of transponders, each with different typical areas of application, which provides increased flexibility.

SIMATIC RTLS infrastructure has been designed for maximum flexibility.

Ultra-wideband technology is crucial in industrial environments. The transponder also has a chip that operates at 2.4 GHz, which is used for data communication, if necessary, to locate an object. The 2.4 GHz chip can receive firmware upgrades and commands from the Locating Manager, and it can transmit data back to the Locating Manager, over long distances.

The UWB chip can be disabled and a manufacturer can use the 2.4 GHz chip for localization in applications that do not require a high degree of location accuracy. The system is accurate to within about 1 to 3 meters (3.3 to 9.8 feet), compared to 30 centimeters for the UWB technology.

Some countries prohibit the use of UWB outdoors, so the system can be set to switch to 2.4 GHz for tracking outside of a facility.

"The big advantage of UWB is ultrahigh precision," says Florian Funke-Meisel, Siemens' presales service consultant for RTLS. "The radio signals are high quality and provide highly accurate distance measurements, so we can get good location accuracy." The UWB chip can operate between 3.5GHz and 7GHz. The actual frequency range used will depend on the regulations in place in the country where the system is being deployed.

During a locating event, the transponder emits a signal containing identifiers of the transponder and the event itself, as well as the time of the event and other data, if available. The signal is received by a net of infrastructure devices called gateways. The gateways, which are mounted within the premises in a fixed and known position, add a time stamp to the signal and forward it to the server. The Locating Manager server uses the position of the gateways together with the two time stamps from the signal to calculate all possible positions of the transponder. Three gateways are enough to determine the transponder's location.

The high precision of UWB locating systems originates from its wide bandwidth. Alongside pure precision, UWB overcomes multipath propagation and interference within many environmental conditions. These are effects that arise especially in industrial setups with many radio-reflective objects while using narrowband locating methods with higher energy. As a result, a UWB RTLS can achieve more accurate and stable location data than any other type of RTLS solution.

UWB does not interfere with other wireless networks employed within warehouse management systems due to low-power transmission and a not commonly used frequency range. Furthermore, UWB is also very stable against disturbances from other radio sources installed. However, the SIMATIC RTLS system uses an additional 2.4 GHz channel for internal communication. The 2.4 GHz communication uses a very narrow band—just 2 MHz of the 80 MHz band available. The communication channel can be set up anywhere within the 80 MHz band, even between Wi-Fi channels, which have a gap between them. "The ability to coexist with other systems is one of the reasons we use hybrid technologies," Mr. Funke-Meisel explains. "It offers the best of both worlds: highly accurate and robust positioning and no interference with existing RF systems."

The SIMATIC RTLS is designed to be highly configurable, so it can be used for a wide variety of applications within a factory. The frequency used by the transponder, the data rate, and the interval at which it broadcasts can all be controlled. "You might have different settings on transponders for tracking work in progess, where precise location information is essential, than for tracking logistics containers or maintenance equipment," Mr. Funke-Meisel explains. "You can configure the transponders for the specific use cases."

All SIMATIC RTLS transponders contain a motion sensor that can be set up to trigger an action if an object is moved or to issue an alert if an object hasn't moved for a specific period of time. This feature can be used to increase asset utilization, by showing workers and managers where tools not being used are located.

The transponder can be set to beacon at different rates, depending on the application. If highly accurate real-time information is required, the transponder can send out a signal continually. On the other hand, if an object moves infrequently or the precise location is not needed in real time, the transponder can be set to send out a signal once every few seconds or minutes.

Special transponders can be ordered with an ePaper screen (ePaper is the term used for a transponder with an e-ink display) that allows users to read information on the tag. The transponder ID in the ePaper transponder is linked to the existing order data. Depending on the process step and order status, order information can then be displayed on the ePaper transponders, thereby providing a paperless solution.

The ePaper transponder displays relevant information for production and logistics.

Turning location data into **business value**

Deploying a real-time locating system is the starting point for a manufacturer's digitalization journey. There are some short-term benefits that can be achieved, as we have shown, but the primary mission is to provide actionable insights that improve a firm's business processes, based on data of actual movements. This is a key enabler for full factory automation.

However, the main challenge is to be able to make the most of the obtained data, to quickly transform it into the right information, and to integrate it effectively into other systems (horizontal and vertical integration) that forecast based on pattern recognition. It is important to have a data-driven strategy to transform the data into actionable insights into the specific business.

As we are moving more toward the digital world, we can talk about the transformation from purely human-driven to data-driven management. Therefore, it is necessary to define key performance indicators (KPIs) that are the most important to monitor and analyze.

We would like to share some examples of which performance indicators are most common among our customers' projects in manufacturing. The entire industry was built on the following key principle: fast production or intralogistics at the lowest cost. The search for savings then comes with various lean strategies, which are based on traditional practices, such as creating a snapshot of the forklift driver's workday. This is based on the physical data recording over a selected period. Then, based on the findings, changes are applied. The question is how a forklift driver behaves all year round. Based on this, we are then able to evaluate the necessary changes and apply the requirements for changes.

The goal of digitalization is not to point out the mistakes of individuals. The mission of digitization is to continuously help improve the processes based on facts, control, and check compliance, and to increase quality and security. This makes digitization significantly different from the current, traditional way of managing and thinking about change.

For manufacturing companies, these important analyzes could be chosen as KPI metrics. The throughput time is relevant for specific zone and production operation. This can be annotated by information from the worker who performed the operation, including the time spent. Another important indicator could be the optimization of stocks and inventory placement, and whether they are always prepared in the best place for immediate production.

"Time matters," says Jana Kucerova, Siemens' regional sales and solution development manager for RTLS. "Time is something that distinguishes today's manufacturing companies from others. SIMATIC RTLS provides accurate and reliable data on what is moving when and where in factories and warehouses. We are also helping our customers with new digitization projects and key-metric definitions for measuring the efficiency of new optimized processes."

Siemens is also closely working with solution partners to develop an application library that will enable customers to select existing software applications that are relevant to their business needs. "The market is changing, so we are creating a partner ecosystem that is developing new applications that can use the data stream to integrate into a customer's existing software applications," says Ms. Kucerova. "This will reduce the need for custom applications and lower the overall system cost."

Cybersecurity

Cybersecurity is critical for all businesses, but it becomes especially important when you are automating processes. Manufacturers often want on-premises automation solutions. Siemens provides products and solutions with industrial security functions that support the secure operation of plants, systems, machines and networks at all levels.

"We understand that this is a high priority for customers," says Ms. Kucerova. "We have a solution for on-premises installations. If the customer would like to use the cloud or select their own solution, we are ready to integrate this as well."

Automation and optimization

Full factory automation cannot be achieved without technology such as an RTLS, because full automation requires real-time information about what's happening within the factory. With real-time data, processes can be set up to trigger actions. For example, the movement of a work in progess to a new station within the factory could trigger a new process step. And having precise knowledge regarding the real-time localization of key assets across the entire process flow enables a company to create just-in-time processes.

"Until now, processes were typically not linked to other process areas, so manufacturers had to have buffer stocks and materials waiting for further handling," Mr. Varga says. "With an RTLS, you know when a work in progess is on the way and exactly when it is arriving to a specific geofence (virtual zone). You can use this information to optimize your processes."

How do we generate ROI from digital transformation?
Focus on data management, process mapping, value quantification, and change management.

If a manufacturer had expensive tools in its factory, it would typically keep extra tools on hand to ensure that one was available when needed to complete a task and avoid manufacturing delays. The SIMATIC RTLS can be set to update a tool's status to "available" when it is moved to a particular location or if it hasn't moved in, say, 20 minutes. By optimizing usage rates, companies can reduce their capital expenditures on tools. "Everything that you can locate can be optimized," Mr. Varga says.

Forklift trucks can be tracked via an RTLS transponder. As companies gather data about thousands or tens of thousands of forklift truck movements, these can be compared using business-intelligence tools to determine which routes are optimal, and to investigate why drivers took certain detours. "Optimization comes down to the data you can acquire," Mr. Varga explains. "With an RTLS, you can definitely gather the information needed to optimize routes."

As manufacturers build on the initial business benefits, they can optimize the use of—and reduce the replacement of—tools, jigs, parts, containers, and more, thus creating a factory that is both highly flexible and extremely efficient. The SIMATIC RTLS together with web-based software Location Intelligence can be used to define areas within a factory or warehouse. These virtually defined areas are known as geofences. The RTLS can detect entry into and exit from these defined areas by tagged individuals or objects. Such events can trigger an action, such as a machine being repaired if it is moved into an area defined for damaged equipment, and can be statistically evaluated, visualized, or linked to additional actions.

Next-level benefits

Once manufacturers have gained visibility into the locations of assets within their factory, reduced the amount of time workers spend searching for tools, jigs, containers, and so on, and fine-tuned their business processes, they can begin to combine their RTLS solution with other systems. In this way, they can achieve greater efficiencies and business benefits, as well as a higher level of digital transformation. Here are some ways in which companies can accomplish this goal.

Automated Guided Vehicles and Robots:
In the near future, AGVs and robots will be able to integrate the learning aspect from previous behavior and use pattern recognition to improve their performance. Today, an RTLS can track AGVs and help to optimize their routes. But it will be possible to also provide AGVs with RTLS data, enabling them to "see" potential obstacles, learn from similar situations in the past—when, for example, a forklift blocked their path—and choose the best route, depending on the locations of vehicles and other assets within the area.

Robots receiving RTLS data could be used to retrieve parts, tools, and subassemblies. These will also benefit from having real-time data regarding the locations of not just the objects they are retrieving, but those that might end up in their way. Combining advanced robots with RTLS data enables the robots to work faster and smarter, and to make more-effective business decisions.

Machine Learning:
Algorithms can use real-time locating data culled from an RTLS to make better decisions related to a wide variety of operational issues. For example, if a manager wanted to assemble parts at a flexible manufacturing plant, the locations of the people, materials, tools, and other items could be fed into a business-intelligence software, and algorithms could then be used to determine the best location for the assembly area.

If certain components might be late in arriving at the manufacturing line, business processes might be changed on the fly based on algorithms to keep production moving without a delay. The benefit of such systems to a manufacturer is continuous process improvement.

B2B e-commerce:
A 2019 report from Forrester Research predicted that B2B e-commerce sales will hit $1.8 trillion by 2023 in the United States alone. Many manufacturers struggle with e-commerce because they lack visibility into workflows and inventory, can't guarantee delivery dates, and have limited capabilities to personalize their products. With an RTLS, a manufacturer can automatically sync real-time locating data with its enterprise resource planning (ERP) and warehouse management system (WMS), enabling it to cut down on inventory-management efforts, achieve greater visibility of WIP, optimize workflows, and manage product customization. This will enable them to achieve higher B2B e-commerce sales and tap into a growing market opportunity.

Internet of Things (IoT):
Many objects within a factory—tools, machines, containers—have or will soon have RF sensors that will provide data about their condition and/or the condition of the environment around them, and will enable them to communicate with one another. IoT device data, combined with real-time locating data, will enable factories to better manage inventory, assets, personnel, and more. A tool that is overheating, for example, might communicate that data to other IoT devices, which would then relay that information to a back-end system. RTLS data can tell a technician precisely where a tool in need of maintenance is located. Combining IoT data with RTLS data can help companies to improve efficiencies, boost worker productivity, and reduce risk by enabling preemptive maintenance.

How to **get started**

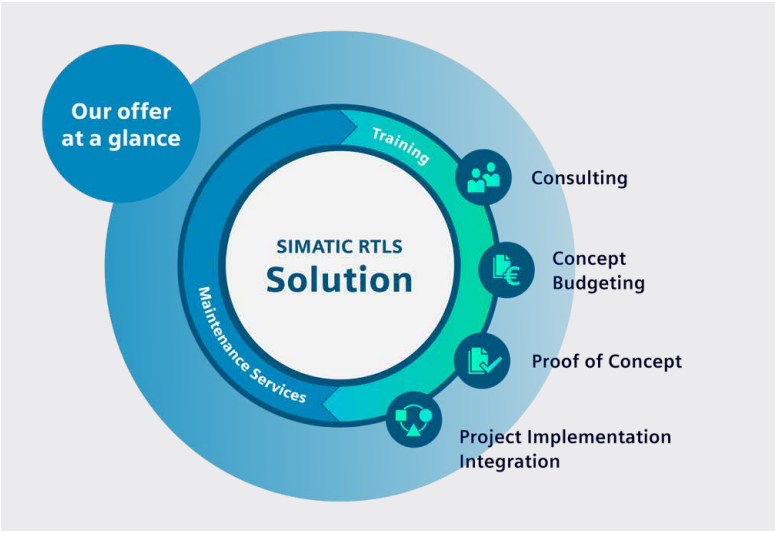
Siemens has experts that can help manufacturers determine the type of RTLS applications that will resolve existing business issues and add value to ensure that the solutions they deploy will deliver a return on investment.

Siemens offers consulting services to help companies start figuring out where RTLS technology could deliver value. Experts from Siemens will develop a concept and a budget. Collaboration with a customer is the key to developing and fine-tuning the SIMATIC RTLS solution. Together with the customer, Siemens will create a detailed overview of the current topography and the state of that customer's facility. It will then combine the Siemens technology and architecture to put together an initial concept that addresses multiple use cases.

This collaborative process ensures that the project remains on the right track and within budget. Siemens will conduct site surveys to provide the basis for ensuring locating accuracy. It will then perform a proof of concept (POC) to assess and prepare for successful project implementation. The on-site testing that comes with a POC provides Siemens with an in-depth practical understanding of a project, while also reducing risk.

When a manufacturer decides to move forward with a deployment, the company has options for how to deploy the Siemens SIMATIC RTLS. The customer can choose to hire Siemens to execute the entire project, including hardware, software, and deployment services. Siemens has a professional services arm with engineering and RTLS expertise that can be brought in to ensure success. The customer can also engage with a Siemens-certified partner to deploy the solution, and engage Siemens services on an as-needed basis. When a customer engages Siemens, a team will conduct a site visit to determine the customer's project requirements, as well as the hardware needed to achieve the project's goal.

Gateways are installed in a grid pattern. A tighter grid will provide greater location accuracy, so the team will determine exactly what is required to capture the locating data necessary to achieve the customer's goal. The costs will be spelled out, along with the potential hard-dollar benefits, so that the return on investment can be calculated. Once the customer decides to move forward, Siemens will install the gateways and transponders on all of the assets that need to be tracked. Software will be installed locally to run the Locating Manager system and Locating Intelligence and training will be provided.



Typical stages of the RTLS project life cycle.

"Siemens can do the whole project for the customer," says Werner Ammon, head of Siemens' SIMATIC RTLS professional services group. "We set up the IT hardware and software on the customer's computers. We have staff on hand 24-7 to resolve any issues."

Published by
Siemens AG

Digital Industries
Customer Services
P.O. Box 31 80
91050 Erlangen
Germany

Article no.: DIPA-B10216-00-7600

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