

# A new age of industrial production

## The Internet of Things, Services and People

# Immense industrial opportunities

In the coming decades, the Internet will change the methods and processes of industry – just as it has changed the behavior of consumers in recent decades. The growing intelligence of machines will boost productivity, safety and efficiency, for instance by pre-empting service interruptions and making production lines more flexible. It is a revolution because it promises a transformational increase in productivity of 30 percent or more, which will help to solve the underlying causes of key challenges that are affecting the world today, namely climate change and weak economic growth.

ABB and our products and solutions – frequency converters, robots, and industrial automation and energy systems – have been improving the processes of our customers for decades. The gains in capacity, productivity and energy use are evident; our customers have improved their competitiveness and their production has become more environmentally friendly and energy efficient. The Internet of Things, Services and People is about more than just improving productivity by using intelligent products, sensors and analysis of measurement data.

The industrial Internet is a shift from factory-level solutions to the Internet. In practice, this means connecting people, services and things over the Internet, which opens up entirely new opportunities, including the development of the service business.



The industrial Internet and cloud services bring world-class analytics within reach of smaller production facilities.

So what role will people play in this industrial paradigm shift? Increasing automation has freed people from backbreaking, dangerous and tiresome routine tasks. This trend will continue as people, services, and things become interconnected through the Internet: people's responsibilities will shift to knowledge work requiring expertise, process control, and decision-making. Next-generation robots, such as the ABB's YuMi, will be able to work side-by-side with people.

The Internet of Things, Services and People still has its challenges, with the main ones being the massive amount of sensor data and the need for data security. All parties will have to cooperate to overcome these challenges. ABB is involved in the Industrial Internet Consortium, a group of more than 100 companies, to foster collaboration among technology companies as they seek to establish global standards for the Industrial Internet. ABB will work with others to ensure that end users reap the benefits it promises: improved efficiency, reduced costs and higher revenue.

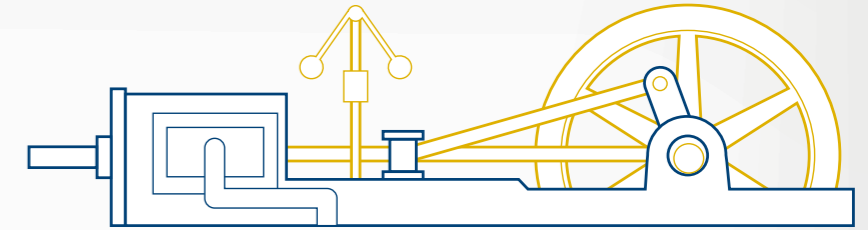
The new age of industrial production has arrived.

**Jari Kaija**  
Senior Vice President  
Service  
ABB Group

# Industry 4.0 From steam engines to smart factories

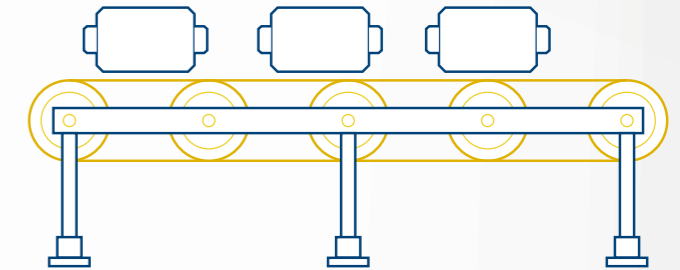
## 1712 – Industry 1.0

Thomas Newcome builds the first steam engine.



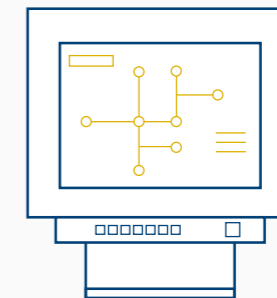
## 1870 – Industry 2.0

Electricity is used for industrial production.



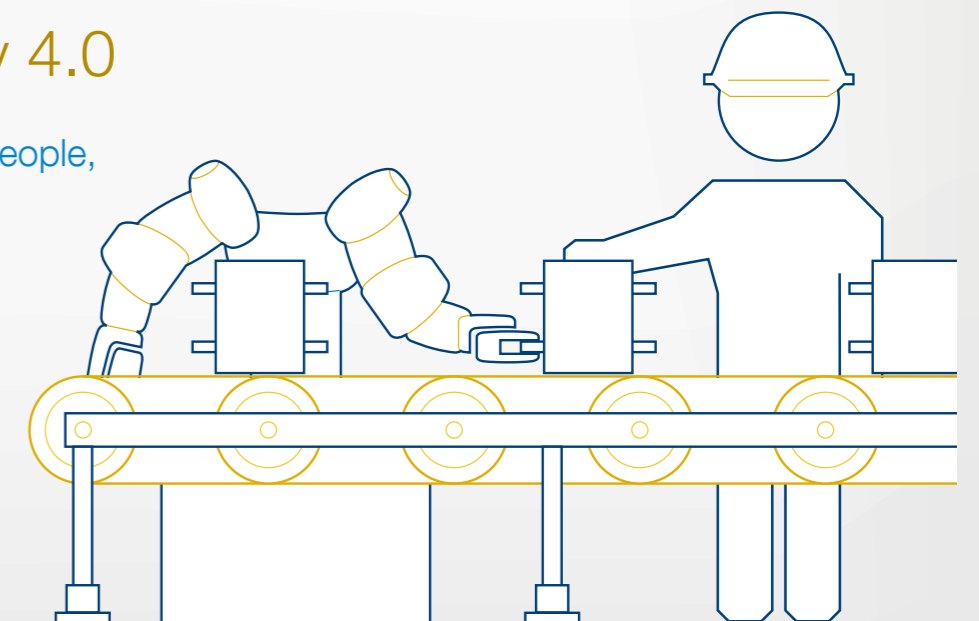
## 1969 – Industry 3.0

Programmable logic.



## Today – Industry 4.0

Communication between people, services, and things.



# Things

## Intelligent things and smart data

Industrial things are intelligent machines, devices, and systems that generate copious amounts of measurement data; from the operation of single devices to entire production processes, energy consumption, operating environment and production quality. Measurement data analysis allows functions to be controlled, prepared and automated.

For decades, measurement data has been utilized at the factory level to improve productivity and competitiveness and to save energy. Current data is compared to historical data to discern how a process should be run. Analytics provides recommendations, enhancements and warnings to support decision-making. This results in effective, productive, environmentally friendly and cost-effective production.

### Automation integrates measurement data

ABB's intelligent products and devices – from measuring equipment to frequency converters and motors – are a vital part of industrial processes and electrical systems. The data generated by smart equipment can be collected either directly or by automation systems. The same system can be used to control multiple production facilities. Integrated systems are irreplaceable when information must be delivered to experts who are far away from the facility itself, for example in applications for the oil and gas industry or for offshore wind power plants. Automated systems can pre-emptively detect and analyze faults, check resources and spare parts, and send reports to operation and production planning systems.

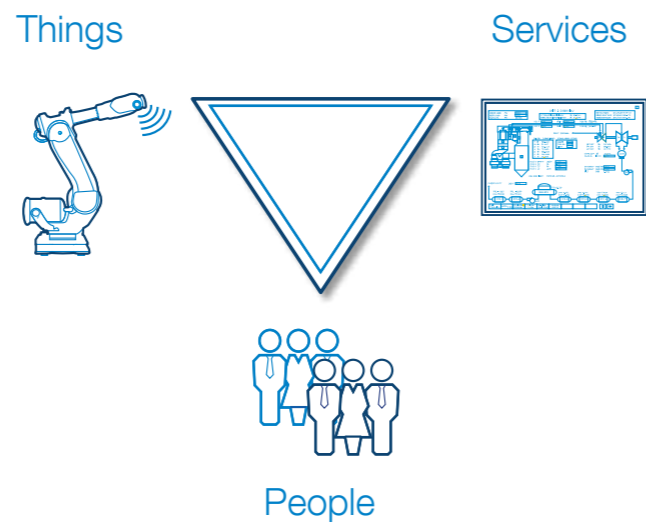


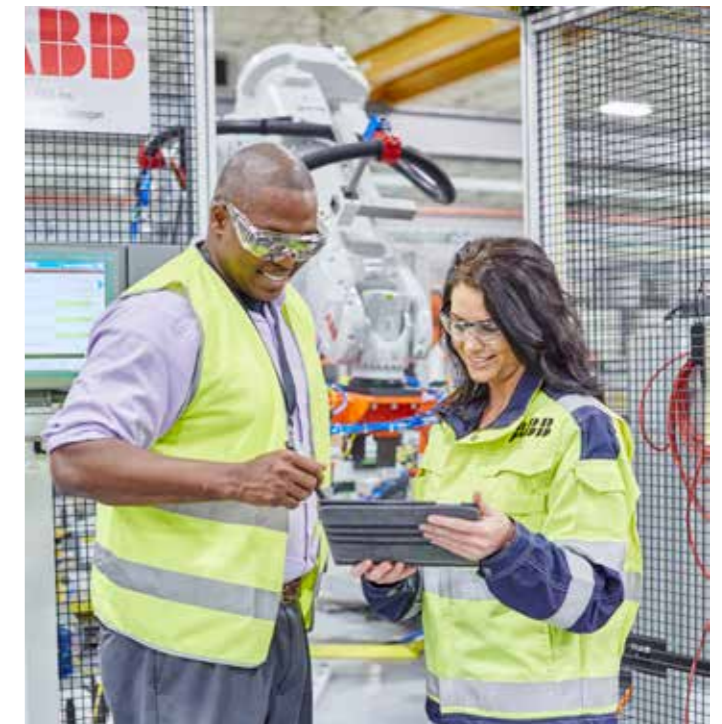
ABB information systems are based on the information processing platform that collects all measurement data in real time. The platform gives simultaneous access to production, monitoring and business processes from a combined real-time view. Examples of systems using the platform include resource planning in the process industry, fleet-wide energy management optimization in the marine industry, and productivity enhancement in mining.

### The Internet is the next step

Advances in mobile technology and cloud services are creating new opportunities for industrial Internet solutions that combine people, services and things. The next big step in industrial evolution will be the availability of measurement data outside a facility, either through cloud services or standardized secure interfaces and remote access. In this concept, everything is connected and information from all over the globe can be combined in new ways. For example, by combining factory-level measurement data with the availability and price data of raw materials and energy, decisions can be made based on remarkably enhanced information. This information can also be used for entirely new purposes, such as creating new, pre-emptive maintenance services.



The EMMA energy management system used on board the Viking Grace reduces the ship's fuel costs and emissions by about 5 percent.



Remote service allows any necessary maintenance and repair work to begin before any interruptions occur.

### Digital substation

ABB participates in the first digital substation project in the United Kingdom that will improve efficiency, safety and system visibility in a future-oriented power grid. ABB will contribute its grid automation technology to this project, which will enable a digital substation scheme to protect, monitor and control the transmission network in parts of Scotland.

### Machine condition monitoring

ABB's machine condition monitoring solution is based on a PLC and generates time-synchronized and analyzed measurement data, be it from the equipment of a single production line or dozens of facilities. This system can be seamlessly integrated with any data collection system.

### Energy savings in Kalasatama

The Fregatti and Fiskari apartment buildings in Helsinki's Kalasatama, Finland use the latest building services. Residents are provided with real-time consumption figures for water and electricity, which can be viewed on mobile devices as well. An open, standardized data exchange interface allows flexible demand and capacity management. By using real-time measurement data, water and energy consumption can be reduced by up to 15 percent.

### Smart mine management

The Kiiruna, Malmberget, and Svappavaara mines of LKAB in Sweden, all rely on ABB's energy management system. The system refines useful data from the information collected from various information systems. The system gives an overview of energy consumption, along with the related costs and carbon dioxide emissions. This overview is then used to optimize the processes at the mines.

### Optimizing routes for efficiency and safety

ABB is working with MeteoGroup to equip 140 container ships from Maersk Line with advisory software to optimize routes, boost maritime safety and protect precious cargo based on factors including the hull design and the weather; helping them avoid conditions that could be harmful to the ship, its crew or its cargo.

The deal will see ABB combine its Octopus motion-monitoring, forecasting and decision-support software, which improves vessel availability and safety, with MeteoGroup's SPOS Seekeeping plug-in. Once fitted on Maersk Line ships, this will enable captains to define on-board loading conditions, and more accurately determine areas of the ocean where their ship's motion is likely to exceed threshold values. Routes can then be optimized automatically to skirt adverse conditions, ensuring cargo arrives safely and on-time at its destination port.

### Centralized fleet control

All ten ships in the German-based AIDA Cruises fleet use ABB's EMMA energy management system to control their propulsion power and efficiency, vessel trim, energy production, air conditioning, the specific fuel oil consumption of the main diesel generators, and total fuel consumption. This information is transmitted to a cloud application for ship-to-ship comparison and can be remotely monitored.

### Energy efficiency improvements

ABB has supplied its pioneering building automation solutions, including daylight harvesting, to increase the energy efficiency and comfort for new Microsoft offices near Copenhagen, Denmark. The proven KNX building control platform from ABB, used in several thousand installations worldwide, utilizes the Internet of Things, Services and People to adapt control functions in line with the natural rhythm of the day. Studies demonstrate that intelligent building control can reduce energy usage by up to 30%.

# Services

## A new dimension for services

Traditional repairs of sudden production equipment failures take a heavy toll on valuable production hours. The Internet of Things, Services and People makes pre-emptive diagnostics and maintenance possible.

Predictability increases operational reliability, uniformity, cost-effectiveness and safety, all while making it easier to control remote locations.

### Frequency converters in the cloud

ABB offers a remote support service for collecting frequency converter data in the cloud. Having this data means that maintenance work can be adjusted according to the actual condition and environmental information of the equipment. Frequency converters no longer need to be serviced according to an annual schedule, but can be serviced based on actual need. This translates into improved reliability and availability in harsh conditions, and reduced maintenance costs for less demanding environments. Internet-based, pre-emptive services require industrial processes to be flexible; compatible and intelligent machines and devices with measurements and analysis. The development of new operating models will require close cooperation with customers.

### Industry as a demand-buffering resource in the energy market

The changes in the energy market combined with solutions from the industrial Internet are creating opportunities for industry to become a resource for demand management. Great cost savings can be achieved by utilizing fluctuations in energy prices; home and building automation can already achieve these by using energy at times of day when it is more affordable.

### Improved performance

ServicePort™ is a secure remote service delivery platform for providing local and remote services. It also enables the use of advanced diagnostics in ABB's latest equipment and processes. By automatically collecting the customer's KPI data, ServicePort helps its users make informed decisions. This increases the availability, quality and productivity of systems, while reducing production costs.

### Remotely controlled robots

The robots at Metsä Board's Simpele paperboard mill in Finland are monitored using the ABB Robotics Remote Service. Each robot in the facility has its own 3G modem. Scheduled backups are created of programs and parameters currently used by every robot. This allows abnormalities to be detected remotely and any necessary maintenance and repair work to begin before any interruptions occur.

### Smart monitoring of frequency converters

Drivetune, ABB's smartphone application, can now be used to remotely adjust frequency converters. Technicians can use their smartphones as control panels to set and adjust control values. Equipment maintenance will be faster, easier and safer, as there is no need to go to dangerous and difficult areas.



# People

## Humans in charge

People will still have a key role in the future of industry: it takes a person to control, monitor and make decisions. ABB YuMi® ("You and Me") is the first robot in the world capable of safe cooperation with humans.

Automation has already changed the role of people in industry. Work is less physically demanding, as automation and robots have come to replace human effort in strenuous and dangerous tasks, and human responsibility now lies more in expert knowledge work and process control.

People will still play a key role in the new age of industrial production. The Internet can be used to integrate information from machines, services and users and process it into a format that can be easily and automatically utilized. People can then use this information to program and control operations and make decisions to optimize the quality, safety, efficiency and environmental aspects of production.

In the future, the Internet of Things, Services and People will enable innovations in other sectors, such as game design, to be incorporated into the industrial environment. An excellent example of cross-sector incorporation would be the use of "smart glasses" to enhance the efficiency and safety of maintenance work.

### Safe human-robot cooperation

Major advances in robotics will mean that robots will become colleagues for humans. ABB's YuMi is the first robot in the world capable of safely working alongside humans. YuMi was developed to provide the flexibility and dexterity required in the industrial production of electronics.



YuMi can take on assembly tasks with two hands. It can both touch and see. The robot has special flexible hands and an innovative sense of touch that make it a safe colleague for humans.

# Factories of the future

## Automated from order to delivery

Case: ABB production plant, Breakers and Switches

In the smart factories of the future, processes take place in real time, production is flexible, and the entire value chain is automated from order to delivery. Production can be monitored remotely and customer orders and manufacturing handled automatically, even at night. This future has already arrived at ABB's switch production plant. The plant benefits from improved competitiveness, more reliable deliveries, better quality and happier staff.



Robots can detect faults without error. They work exactly as programmed.

There are 22 robots working safely alongside humans at ABB's Breakers and Switches plant in Vaasa Finland. Two more robots will be added in 2015. The plant is largely automated, and automation is used throughout the order-delivery process chain. The plant has applied automation to functions from material procurement to switch assembly and logistics. Automation has increased the reliability of deliveries, competitiveness and profitability, as well as reducing the amount of sick leave.

The vision for 2020 is to have the entire value chain highly automated, from order to delivery. People will not become obsolete: humans will be needed to control and monitor the automation systems and to make decisions. Complex products will also still require manual assembly.

### RFID eliminates bottlenecks

The switch production plant uses RFID gates to register every shipments both in inbound and outbound logistics. As components arrive, they are unloaded by automatic conveyors and sorted for reception, where they will be picked up by automated guided vehicles (AGVs) and put in storage or a production cell. The use of RFID prevents bottlenecks and human logging errors and enhances the accuracy of the inventory.

Assembly workers can use touchscreens to request more parts, and order is immediately placed in the work queue. AGVs will bring the necessary components to the assembly line and transport assembled products away for delivery.

### Robot night shift

An automated ordering system is used to guide customer orders to production in real time. Even if the order arrives at night, an automatic assembly line will assemble and test switches. In the

Increasing automation improves the quality of the entire value chain.



Automation has changed the nature of the work. As less manual assembly is required, the work has become less physically taxing.

morning switches are ready to be packed and shipped. These automatic workers further reduce the lead time for products. Traceability is integrated into the automatic production lines, and each switch is uniquely marked.

### Automatic logistics

Automated storage controls the assembly line. New orders are generated as stock runs low or big order is received. Storage automation reduces the need to stock finished products. In smart factories, automated production lines pack the products and AGVs transport them from production cells to delivery area. Internal logistics is highly automated. Pallets are weighed, wrapped and strapped automatically. Products pass through RFID gates to make sure that the right items go in the correct truck. This reduces the risk of delivery errors to a minimum.

### Rapid response through remote monitoring

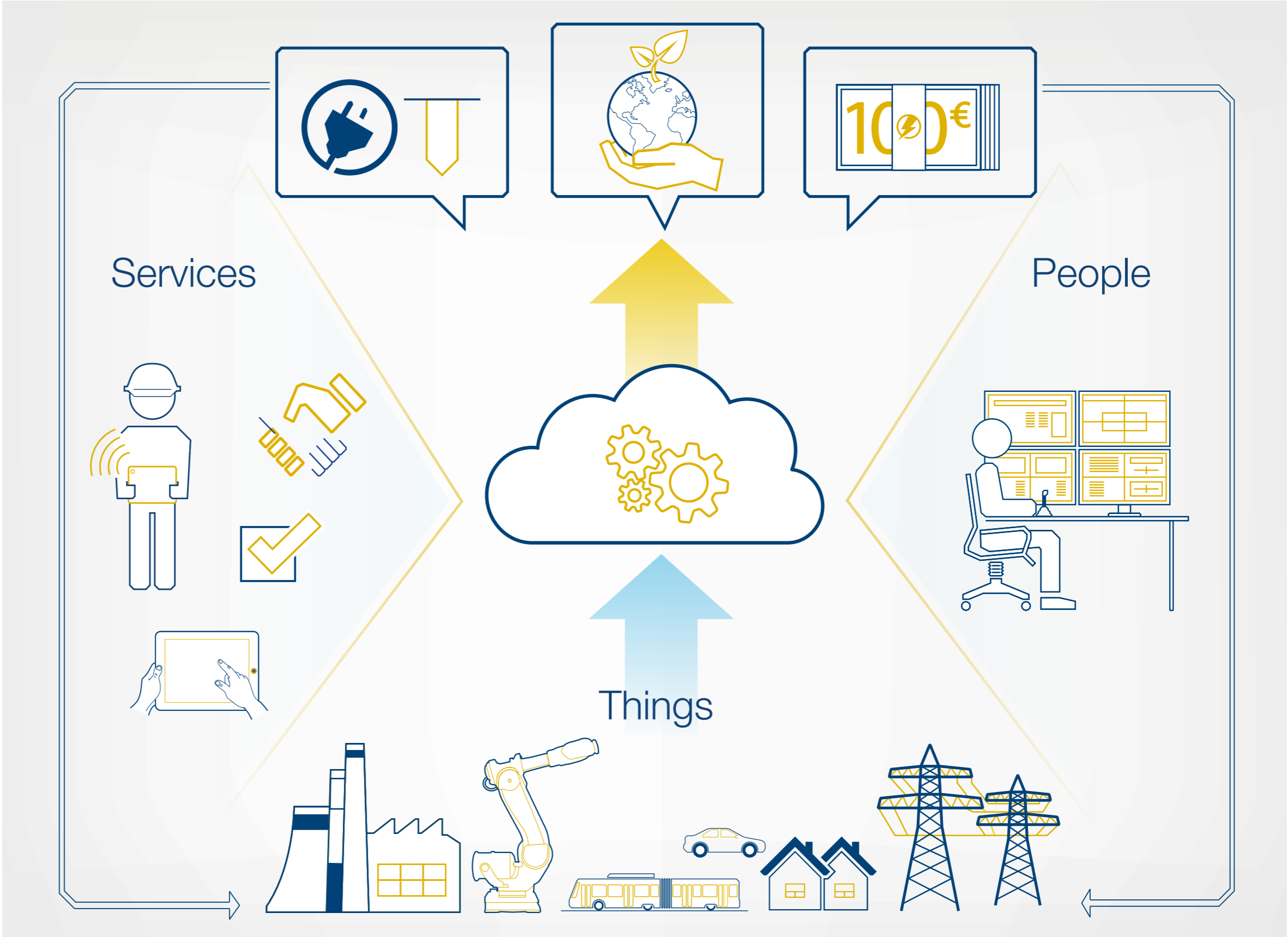
The status of the switch production plant can be monitored remotely. The production monitoring system works in real time and indicates equipment malfunctions, reports test results with root causes for rejected switches, shows inventory levels and generates statistics from production data. Remote monitoring allows faster response.

### Plant benefits from automation

- The reliability of deliveries is now 98.3 percent, up from 94.4 percent.
- The average lead time has improved from ten days to five.
- Profitability has nearly doubled in four years.
- Production can be adjusted according to demand.
- The quality of work has improved, and the number of customer reclamations has halved.
- Sick leaves are down 30 percent.

# The Internet of Things, Services and People

In the smart factories of the future, people will control the operations and make decisions based on measurement data from the factory's equipment, as well as information regarding the availability of raw materials and the price of energy. This will improve productivity, be more environmentally friendly and reduce costs.



# Contact information

ABB

[www.abb.com/middle-east](http://www.abb.com/middle-east)

© Copyright 2016 ABB. All rights reserved.