

# What NFC means for smart factories, intelligent supply chains, and Industry 4.0

by Paul Hubmer

*There is a growing trend, in today's factories, to use innovations like smart objects, autonomous production, and access to the cloud to support customization on a large scale and manufacture products in close to real time. This trend, which is seen to be part of the fourth industrial revolution, or Industry 4.0, is accelerated by the use of wireless technologies, including Near Field Communication (NFC). NFC is an enabling technology for Industry 4.0, since it can increase automation and change the way goods and services are offered.*

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## Introduction

Near Field Communication (NFC), the wireless technology that brings tap-and-go convenience to a number of applications, including payment, transport, access, authentication, and entertainment, is making headlines for a number of reasons. Every major phone manufacturer now includes NFC in its most recent product offerings, NFC is part of next-generation ticketing schemes and sharing services like short-term bike and car rentals, and NFC's at the heart of the new trend for wearables, which includes fitness trackers, health monitors, and smart watches.

But there's another side to NFC, and that's how it relates to the manufacturing sector. NFC is an enabler of what's being termed the fourth industrial revolution, or Industry 4.0. That's because NFC helps make production processes and supply chains more flexible, more efficient, and more responsive. This article takes a closer look at the industrial aspects of NFC, and summarizes some of its more notable use cases.

## The next industrial revolution

Historians and economists have defined three distinct industrial revolutions, each resulting in significantly higher output. The first, which began in the mid-1800s, involved the use of steam power and machine tools, and resulted in wider access to a broader range of manufactured goods. The second, which spanned the late 1800s and early 1900s, saw the use of electricity and assembly lines to support mass production. The third, which began in the late 1900s, when computers became widely available, introduced the use of digital technologies to improve quality and increase efficiency.

And now, with the availability of a new information network, driven by developments like cloud computing, intelligent machines, and omnipresent connectivity, manufacturing is entering another phase – one that promises to bring with it such dramatic transformations that many analysts are calling it a fourth industrial revolution, or Industry 4.0.



## The promise of Industry 4.0

Industry 4.0 can refer to a number of things, since it encompasses a wide variety of innovations in several areas, from factory automation and enterprise-wide process optimization to cyber security and energy management. For the purposes of explaining NFC in an industrial context, we use a fairly specific definition of the term.

We consider Industry 4.0 to be the integration of physical objects into the information network to improve manufacturing and change the way goods and services are offered. More specifically, Industry 4.0 describes a working environment in which every item involved in the creation and delivery of products – from raw materials and machinery to the manufactured good itself – is equipped with the intelligence and connectivity needed to interact with the network.

This ability to connect anything and everything to a single computer network creates a new way of tracking, managing, and interacting at every point in the production process. Individual items can supply information about themselves in real time, and machines can be managed – brought online, given instructions, or replaced – at a moment's notice. This makes manufacturing more efficient and more productive, and delivers a significant increase in flexibility, since production lines can be configured to able to customize on a very large scale.

One real-world example of Industry 4.0, cited by the consulting group Roland Berger, is the US motorcycle maker Harley-Davidson. The company can, in its new digital factory, build 1,300 different versions of its five basic model series, and it only has to have the desired configuration, chosen by the customer, within a few hours of starting.

The trend toward Industry 4.0 is still in its infancy, but several notable companies around the world have, like Harley-Davidson, begun working this way. According to the World Bank and the United Nations Conference on Trade and Development, manufacturers in established markets, including the United States and a number of European countries, are well positioned to adopt Industry 4.0 techniques. At the same time, manufacturers in emerging economies, such as China and Brazil, are investing in Industry 4.0 technologies, too, as they work to expand their infrastructures and increase output.

## NFC's place in the Industry 4.0 picture

From a high-level standpoint, Industry 4.0 relies on a number of technologies that add intelligence to production, inspection, security, service support, and business operations. On the factory floor, for example, sensors that measure temperature, humidity, or movement can gauge what's happening inside a machine or in its local environment, while microcontrollers and other system components can track usage, record events, and execute tasks received from other machines. Wireless connectivity provides access to the cloud, video cameras give remote managers a view of what's happening onsite, complex software algorithms help track and manage items and processes, and data centers monitor the network, store data, analyze results, and implement remote updates.

NFC is an enabling technology for this new way of working, since it can be used at every point in the manufacturing process to support Industry 4.0 environments. Co-invented by NXP Semiconductors and Sony Electronics, NFC is a specialized subset of radio-frequency identification (RFID), the technology used throughout supply chains to identify and track items. NFC can store and transmit data in much the same way that RFID tags (and contactless smartcards) do, but it also supports two-way communication over a short range, similar to Bluetooth and WiFi.

NFC is a proximity technology that works when two devices are brought to within 10 cm (4 inches) of each other. Being able to communicate over only very short distances increases security, because eavesdropping is a near impossibility. Another advantage of NFC is that it's unique among wireless communication technologies in the way it conserves energy. Only one of the two devices needs to be powered for an NFC interaction to take place. The first can power the second, so the second can save its battery for other things, or not have a battery at all. This is an especially important feature for NFC tags. The tags don't need a battery, so they can be made very thin and flexible, and can easily be affixed to (or integrated into) just about any object.

### *Smarter production lines*

When NFC is part of the production line, individual products can communicate with machinery. Each product is equipped with an NFC tag, and each machine along the line has an onboard NFC reader. The NFC tag can provide processing and status information to machines, and can be wirelessly reconfigured at any point in the process. The tag can provide the machine with exact instructions or specifications for the operation. Then, once the machine has performed the operation, it can update status on the tag to record completion before sending the product on for further processing.

### *Increased automation*

When products can speak for themselves, there's less need for human intervention. Using NFC, a product can tell a machine "here's how I should be handled," alert a conveyor that "I need to be retrieved," or send an email that says "I'm ready to ship." Machines can also communicate more effectively with one another, adjusting downstream machinery to accommodate a particular set of customizations. With NFC, robots can also communicate with factory personnel. If a problem occurs, a robot can send a message to a worker's mobile phone or tablet.

### *Authenticated tools*

NFC tags can be used to verify the authenticity of individual components, to ensure that robots use the right item for a given task. Since NFC tags require no battery, they don't need to be charged. A tool that is used only infrequently can be idle for an extended period and yet still be ready to report its status at a moment's notice.

### *Enhanced logistics*

NFC tags simplify inventory and asset management because they make it easier to track items and monitor usage. A bin that stores raw materials, for example, can notify the network when supplies are getting low and trigger a refill, or a work order can provide updates on its progress. Even the most complex operations, involving high-volume quantities and suppliers or partners on different continents, can be controlled in real time. The central office can have a global view, and can respond quickly to changing requirements anywhere in the world.

### *Extended displays*

Adding NFC functionality to just about any kind of tool, machine, or motor makes it possible to add a display for enhanced interactions. This is especially true for items that can't support a display because they're too small or operate in too harsh an environment. The display on a worker's tablet or on another piece of equipment can be used as the man-machine interface, making it easier to verify or change parameters, check calibrations, refine settings, or simply monitor activity.

### *Easy pairing with Bluetooth and WiFi*

NFC works at close range, but can easily be extended to work over longer distances, by pairing with Bluetooth or WiFi. One-touch pairing is helpful when adding new components to a network, since the NFC function can supply the necessary device IDs and security codes to join the network. A simple tap is all it takes, so workers don't waste time entering passwords and setting configurations. Similarly, when workers log onto a VPN, they can use an NFC tag to launch pre-set configurations, even if they're using a different access point. That means people can move freely throughout the site – or from site to site – without disrupting their online work.



### *Better equipment uptime*

Easy pairing with WiFi also means tap-and-go cloud access from the manufacturing floor, for quick referrals to operating manuals, automatic firmware downloads, and other kinds of assistance. Giving machines access to the cloud reduces maintenance costs, too, since personnel can interact with equipment, even from a remote location. Workers can check the history and usage of each machine in the line, to schedule maintenance based on actual wear, and the machines themselves can send a message if a calibration or repair is needed. NFC makes it easy to access all the necessary data for troubleshooting, including model number, serial number, usage, and status, so repair personnel can arrive on site with the relevant spare parts already in hand.

### *Controlled environment*

NFC can be used to restrict physical and logical access in the manufacturing facility, ensuring that only authorized people have access to production areas and the network that controls machinery. This means that an NFC-enabled smartphone or tablet can perform the same access functions as a contactless smartcard, providing entry to corporate offices, government buildings, and other restricted areas. The smartphone or tablet doesn't have to be powered on for the access function to work, so the setup can save battery power while making access both easier and faster.

### *Late customization*

NFC tags give the product a smart memory, and can contain all the relevant information needed throughout the supply chain. Since a single tag can be configured for different purposes at different points in the process, the instructions can change as required. For example, a product with a global customer base can have particular settings, such as the language for the user interface, configured at the factory or a local warehouse, before being shipped to a particular region.

### *Better customer experiences*

Manufacturers can use NFC to personalize products and offer features on demand. Individual settings can be configured at the store, before or after the sale. Tapping an NFC-enabled smartphone to a product label can help the consumer verify authenticity, get details on the product and its origins, or find reviews on social media. After the sale, NFC tags can also increase customer loyalty by, for example, providing links to sites that lead to exclusive offers or special, members-only benefits.

### *Brand protection*

NFC's authentication features can be used with after-market products and accessories, to ensure that consumers use only branded or certified goods. Once the right item – a branded ink cartridge, battery, or coffee pod, for example – has been authenticated, the NFC-enabled appliance can also optimize operation to suit the part. When it's time to replace the item, a brief pass of an NFC-enabled smartphone, tablet, or product can initiate a purchasing cycle for authentic replacements, with links to various sites that carry the item.

### *Conclusion*

The manufacturing sector is entering a new phase in its evolution. Over the next decade or so, several technologies will combine to make production processes and supply chains more flexible, more efficient, and more responsive. This trend, which is being hailed as the next industrial revolution, or Industry 4.0, combines a number of recent innovations, such as cloud computing and Internet-connected machinery, that are already relatively familiar topics in the marketplace. One enabling technology of Industry 4.0, though, which is still fairly new to many in manufacturing, is NFC, which is an outgrowth of RFID. NFC brings many advantages to manufacturing, including smarter production lines, better man-machine interfaces, easier maintenance and commissioning of machinery, enhanced logistics, late customization, and brand protection.

*For more about NFC and what it means for smart factories, intelligent supply chains, and Industry 4.0, visit NXP's dedicated site for NFC at [www.nxp.com/nfc](http://www.nxp.com/nfc).*

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