

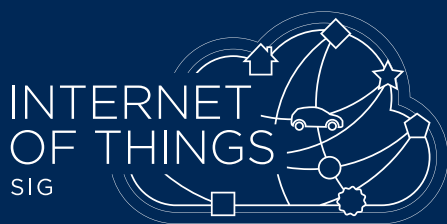


# Building a Stronger IoT Connection

How NFC Delivers Benefits for Consumers and Manufacturers in Control and Troubleshooting Assistance

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White Paper  
December 2019

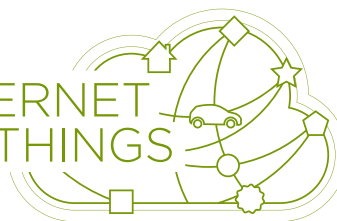


# Contents

Executive Summary.....	3
Why NFC for IoT?.....	3
Initial Configuration: Giving users a personalized head start.....	4
NFC IoT use case: last-stage configuration in a manufacturing line for host-connected NFC consumer devices.....	5
NFC IoT use case: in-field service subscription provisioning.....	5
NFC IoT use case: in-field initial configuration by user.....	5
Enabling User Control.....	6
NFC IoT use case: programming with a smartphone.....	7
NFC IoT use case: adding interactive displays.....	7
Troubleshooting: speeding results and lowering service costs.....	7
NFC IoT use case: addressing an appliance malfunction.....	8
Updating: keeping products performing at their best.....	9
NFC IoT use case: firmware updating.....	9
NFC IoT use case: replenishment of parts and supplies.....	9
Additional benefits of NFC to manufacturers of IoT products.....	10
Taking the next steps.....	11



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To learn how to differentiate your product with NFC technology visit our [Internet of Things page](#).

Help chart the course for NFC and the Internet of Things. Email our IoT SIG group at [scewg-chair@nfc-forum.org](mailto:scewg-chair@nfc-forum.org) to learn how to get involved.

## Executive Summary

As the Internet of Things (IoT) reaches into more aspects of business and consumer life, manufacturers must determine how best to IoT-enable their products and devices for control and troubleshooting assistance.

It's not a simple decision. Not every industrial or home IoT device is easily configurable for Internet connection. Many devices are not ideally suited to continuous connectivity via Bluetooth or Wi-Fi networks. Some devices would require the addition of prohibitively costly user interfaces. Others have security issues, form factor constraints, battery life concerns. And then there are those IoT devices that, when installed, are too distant from a reliable Internet connection.

NFC technology provides an effective answer for all of these issues and concerns by enabling network connectivity with its intuitive tap paradigm, providing access to the robust UI of smartphones, supporting security through brief, short-range connections, supplying its own power source, and more.

In doing so, NFC enables manufacturers to effectively deliver IoT industrial and home devices that support easy user-specific configuration and personalization, fast and intuitive user control, and swift, cost-effective troubleshooting assistance. For manufacturers, NFC delivers greater flexibility, better security, and reduced costs. For consumers, NFC is the key to enjoying products sooner, operating them with greater flexibility, and troubleshooting them with minimal effort.

## Why NFC for IoT?

According to IoT Analytics, there will be [22 billion active IoT devices globally by 2025](#). That's an increase of 13.7 billion over the next five years. That number will continue to grow as new industrial applications, smart home products, smart campus solutions, and smart office technologies come to market. And according to DBS Group Research, June 2018, by 2030, it is estimated there will be 125 billion IoT devices installed and connected to the Internet, up from 11 billion in 2018.

There is no mystery to the growth of IoT. By adding intelligence and network connectivity to appliances, home automation solutions, and other personal electronics, manufacturers can deliver more capabilities, value, and convenience to their users. IoT-enabling products also helps manufacturers to lower their costs by reducing call center, field service, and documentation expenses. At the same time, IoT-enabled products offer manufacturers opportunities for incremental revenue as users can go directly to manufacturers to order refills, filters, and other add-on products.

However, turning previously unconnected products into IoT devices also presents the following challenges:

- How do you deliver plug-and-play IoT devices that do not require complex initial configuration?
- How do you simplify the connection of IoT devices (some of which may lack a robust user interface) to the network?

- How do you avoid creating IoT devices that can be used maliciously as back doors into secured networks?
- How do you provide an easy-to-use user interface so that consumers can take advantage of IoT features and capabilities?
- How do you bring assistance when IoT devices need troubleshooting or updating?

Near Field Communication (NFC) technology provides a solution for all of these challenges, in the following ways:

- **NFC enables network connectivity with a tap paradigm that's intuitive and fast** – even when the Wi-Fi network is down or the device loses power.
- **NFC provides access to a proven and familiar UI** via NFC-enabled devices such as smartphones.
- **NFC's secure short-range connection prevents neighbors from accidentally connecting to your devices**, and a lack of always-on IP connectivity shields them from attacks over the network.
- **NFC technology is secure** because it was developed for use cases and standards that demand the highest levels of security.

This white paper explores some of the most promising use cases for NFC in IoT for initial configuration, control, troubleshooting assistance, and updating. The use cases are different, but they all support a common goal: forging a stronger connection between product manufacturers and their customers.

## Initial Configuration: Giving users a personalized head start

Mass customization is a growing trend as manufacturers strive to gain a competitive edge by delivering products tailored to the needs and preferences of individual consumers. A recent [Industry Week article](#) noted, “demand for personalized products is growing,” and cited a YouGov survey that identifies the people driving this trend as primarily “millennials (40%), highly educated (30%) [with] \$1,000 or more in monthly disposable income (31%).”

IoT technologies enable manufacturers to deliver products customized to each customer, in effect offering a tailored solution already configured to their individual needs. In addition, manufacturers can enable in-field initialization whereby a user can quickly and easily personalize their IoT devices before starting to use them.

In the past, initial configuration and personalization of consumer IoT devices was a time-consuming, labor-intensive process involving many complex initialization steps before that user could efficiently use the device.

However, with the help of NFC technology, initial configuration can be performed quickly with a tap – by either manufacturing workers in the factory or users in their homes. Either way, the effect is to make the time between receiving a product and enjoying it as short as possible.

## **NFC IoT use case: last-stage configuration in a manufacturing line for host-connected NFC consumer devices**

Imagine ordering a smart TV and discovering that it has arrived already set up with your credentials and associated with your video streaming account. NFC technology can make this easy plug-and-play experience possible.<sup>1</sup>

As a product reaches the final steps in the manufacturing process, NFC-enabled provisioning can be performed either prior to or after packaging the product.

The manufacturing worker can provision the product with a user's individual key, which could be either private keys or public key certificates, by holding an NFC-enabled universal device close to the product's built-in NFC antenna, or using another mechanism (e.g., NFC token-based authentication). Using the NFC interface, it is possible to even provision a customer's individual credentials into an already packed product right before shipping the packed boxes to logistics.

The user benefits from receiving a product that's ready to use, connected, and associated with their account. Manufacturers benefit from a faster, easier personalized configuration process that even a less skilled worker can perform.

## **NFC IoT use case: in-field service subscription provisioning**

When a consumer receives a new consumer IoT device – say, a smart speaker – they want to immediately start using it with their preferred service provider and existing subscription for a streaming music service.

Typically, the process of provisioning the device for the subscription service would require the user to first pair the speaker to his or her mobile phone, then login to the music streaming service with a password via a phone app. This process could take as long as several minutes.

With NFC, that process is reduced to a single tap of the NFC-enabled phone on the smart speaker. In a moment, the smart speaker is configured with the consumer's credentials, enabling them to begin enjoying the music immediately.

For the consumer, the use of NFC delivers instant gratification and secure credential provisioning, both of which contribute to a positive customer experience.

The benefits to the manufacturer are even more significant. The fewer the actions and steps to be performed by the consumer, the lower the risk of human error. For manufacturers, that means fewer support center calls from disgruntled consumers and fewer support center resources required. For manufacturers experiencing high overhead costs with their smart devices, the use of NFC could mean more profitable operations.

## **NFC IoT use case: in-field initial configuration by user**

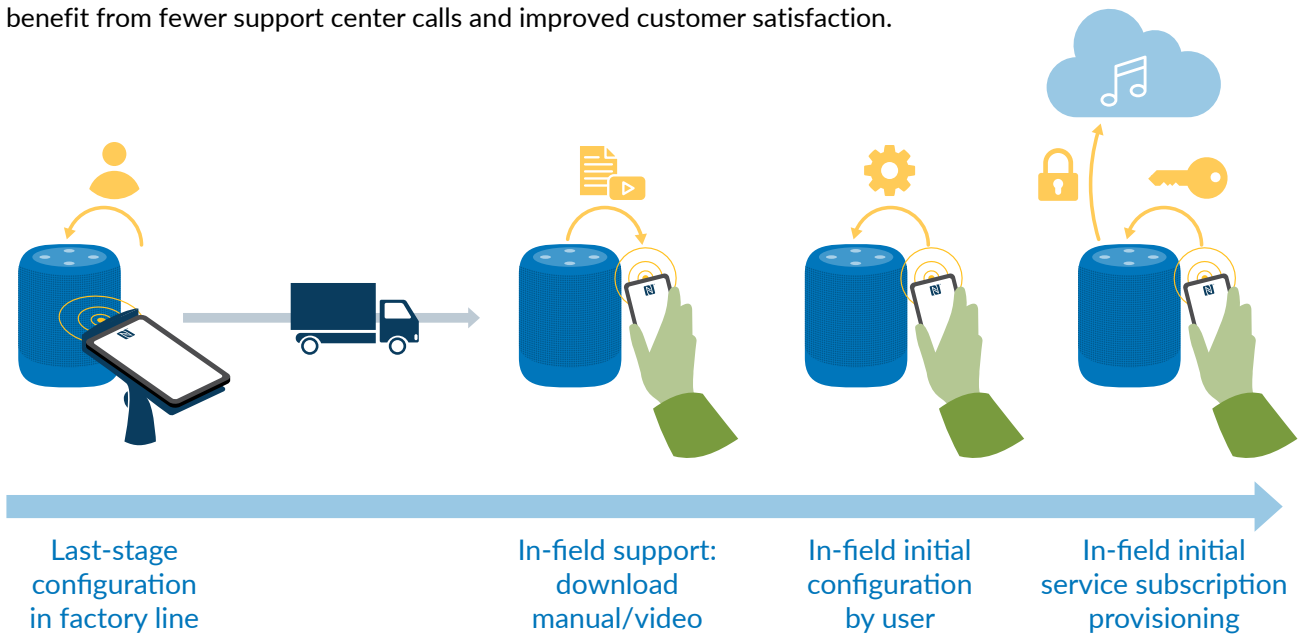
When consumers purchase new consumer IoT devices, they want to quickly configure the products' settings to their personal preferences or needs. Here again, NFC speeds and simplifies the process.

<sup>1</sup>Please note: this use case applies to products that are equipped with host-connected NFC devices that provide their configuration to the host when the product is first powered up.

For example, say a consumer buys a smart speaker and wants to use it with his or her preferred equalizer settings. Without NFC, the user would have to follow a series of complex steps to connect the smart speaker to his or her account, then initialize the device from the respective control applications or adjust the equalizer settings by hand.

NFC makes this process a simple tap and configure. Within seconds, the consumer is listening to music on the smart speaker with the preferred equalizer settings.

Users can begin enjoying their new purchases almost immediately, while manufacturers benefit from fewer support center calls and improved customer satisfaction.



## Enabling User Control

One of the biggest challenges for manufacturers seeking to deliver smart appliances and consumer electronics is enabling user control. Existing traditional product interfaces – say, the touch-sensitive LED display on an oven – are too limited in their capabilities to fulfill all of a user’s needs easily. The alternative – adding a large display or touchscreen interface – is costly. This limits IoT smart capabilities to only the top-of-the-line product models. And of course, some devices – for example, a door detector – are simply too small to accommodate a display of any size.

As a result, manufacturers have had to feature limited UI displays in their products with multiple menu levels and scrolling wheels to accommodate all the control options. Users find these interfaces unsatisfyingly slow, cumbersome, and limited.

NFC solves this problem by acting as a one-touch control enabler leveraging the power and connectivity of consumers’ smartphones. The combination of the always-available smartphone touchscreen and the one-tap convenience of NFC technology enable the consumer to fully and easily control their IoT devices.

## NFC IoT use case: programming with a smartphone

Typically, appliances and consumer electronics need to be programmed after purchase. For example, a consumer with a new smart TV needs to methodically select the inputs, audio settings, streaming video subscription services, and more before the TV can be enjoyed.

The use of NFC can simplify and accelerate this process. The manufacturer can simply direct the consumer to download an app on their phones, select the settings directly in the phone app, and then transfer those settings to the smart TV all at once with a single tap of their NFC-enabled phone. Instead of scrolling through numerous screens on the TV and relying on the limited capabilities of the TV remote to make selections, the consumer can do it all via a clean and simple app interface on the phone.

Result? The user can begin enjoying the product sooner, and the manufacturer can reduce the number of calls to its customer support center.

## NFC IoT use case: adding interactive displays

One of the major advantages of IoT consumer products is their ability to offer greater intelligence and more sophisticated capabilities than conventional products – and hence, more value to the consumer. However, that intelligence and those capabilities are of little use if they are inaccessible to the typical user.

Take smart washing machines, for example. These appliances offer users the ability to program and adjust washing, rinsing, and water temperature settings over a wide range of parameters. If those settings were only available via the washing machine's small display, consumers would be less likely to access them and enjoy their benefits.

Manufacturers could overcome these limitations by adding more buttons to their products, but that adds complexity and cost and mechanical elements are often subject to fatigue and failure.

## Troubleshooting: speeding results and lowering service costs

Maintaining a service capability is a major overhead cost for appliance and consumer electronics manufacturers. There is the considerable expense of staffing and operating call centers to handle customer issues. Manufacturers must also produce and stockpile an adequate inventory of replacement parts. Many companies – either directly or through third parties – support field service teams that must be strategically located throughout the markets that they serve.

Anything that can reduce those costs without negatively impacting effectiveness is worth pursuing.

Customers have needs when it comes to service, too. The first priority is to get an accurate diagnosis of the problem. As anyone who's ever called a telephone support center can attest, describing the symptoms of a problem over the phone can be a lengthy and frustrating process. Few people have the time to spend calling support centers, conducting online chats, or searching the Internet for answers.

Even when a service request has been initiated, there are frustrations. While waiting – perhaps for days – for a field service technician to arrive, the consumer is left unable to use the product. Customers have to schedule time and stay at home to await a repair technician. And even when a technician has arrived and identified the problem, there may be additional delays and follow-up appointments due to a lack of the right spare parts.

NFC can help address all of these needs by supporting remote diagnosis and helping to ensure that the first service appointment successfully resolves the problem.

## **NFC IoT use case: addressing an appliance malfunction**

When an appliance malfunctions, it often produces an error code that can be used to diagnose the problem. Some appliances display the error code, while others require a repair technician's diagnostic tool to access the code. In the past, the consumer would have to read the error code off the appliance display (if available), look up the code on the Internet, or call the appliance support center to share the error code and get the proper diagnosis and begin the process of fixing the malfunction.

With NFC, this process is streamlined considerably by using an NFC-enabled phone and cloud assistance to diagnose the problem.

Here's how it works:

1. When a malfunction occurs, an error code is written in the memory of the NFC tag embedded in the appliance, in the host processor memory, or in a specific memory integrated circuit.
2. The consumer taps the NFC phone to the appliance to retrieve the error code.
3. The code is sent directly to the cloud servers for analysis, via either the Wi-Fi network or the mobile phone network.
4. If the problem can be solved with a firmware download, the consumer can download the firmware and transfer it to the appliance with NFC.
5. If more assistance is required, the consumer can be automatically redirected to a chatbot, hotline operator, or other means to connect with the correct next steps.

For the consumer, it means faster problem resolution and less wasted time. The manufacturer benefits from reduce support center call volume, fewer service visits when a firmware fix can solve the issue, and accurate diagnosis of a problem before a service technician visits. This means the service technician can arrive with any needed parts on the first visit and go directly to the repair, skipping the diagnosis. That translates to fewer, more productive service appointments.

Also note that this approach works even if the appliance is disabled or the Wi-Fi network is down. The NFC-enabled phone can still read the "dead" appliance's NFC tag and the mobile network can provide the connectivity.



## Updating: keeping products performing at their best

One way to build customer loyalty is to maintain an ongoing relationship with the consumer after the sale. This ensures that the consumer is still benefiting from the product and that you, the manufacturer, care about their satisfaction. Stronger customer relationships enable you to capture more future sales from existing customers, which is much less costly than attracting new ones.

NFC can play a key role in this effort, whether it's downloading new firmware to update a product or streamlining the process of replenishing supplies.

### **NFC IoT use case: firmware updating**

As manufacturers build greater intelligence into their products, they need to keep the firmware updated to address bugs and new security threats, as well as delivering new capabilities as they become available.

Traditionally, a firmware update was a complicated process for the consumer. It could require the user to find the right USB cable, connect it to a PC, and follow a complicated set of procedures – not a user-friendly process at all.

NFC can make the process of downloading new firmware easy for product consumers.

It begins with the manufacturer creating an app for the product that users can easily install on their phones. With the app on their phones, users can then download the new firmware into the phone as soon as it becomes available. The process of transferring that firmware update to the product is easy; the user simply holds the NFC-enabled phone next to touchpoint on the product.

Consumers are assured that their products are up to date, secure, and delivering maximum value. For manufacturers, it's an affordable and practical way to keep products in the field up-to-date, ensuring continued customer satisfaction without expending field service resources.

### **NFC IoT use case: replenishment of parts and supplies**

Many products require periodic replenishment of parts and supplies, such as toner cartridges for printers and water filters for refrigerators. In the past, replenishment of these parts and accessories was an elaborate and unwieldy process. Customers would have to look up the part number, find a source for the replacement part, order the part, and figure out how to perform the replacement when the part arrived.

This approach is fraught with opportunities for issues. Incorrect parts could be ordered, the replacement process could be difficult, and in the case of non-essential part replacement, such as refrigerator water filters, consumers might simply forego periodic replacement because of the hassle involved – thereby depriving themselves of properly filtered water and depriving the manufacturer of a recurring revenue stream.

NFC simplifies this process considerably, to the benefit of both consumers and manufacturers. Here's how it works:

1. The user begins the replacement part ordering process by simply holding an NFC-enabled smartphone next to the touchpoint on the product indicating the location of an embedded NFC tag.
2. The tag automatically communicates the replacement part number to the phone.
3. NFC launches a phone app or a webpage for replacement ordering. The part number is automatically entered – no user involvement required.
4. The user completes the order via the app or webpage.
5. Upon receipt of the replacement part, the user taps the embedded NFC tag to launch a phone app or website, which in turn guides the user to select “reorder” or “how to replace.”

The user benefits from minimized product downtime and a swifter, more convenient replacement process. Meanwhile, the advantages to the manufacturer are many: fewer calls to the support center, increased and recurring revenue from the direct purchase of replacement parts and accessories, and greater assurance that product warranties will not be invalidated or product performance impaired by customers using inferior “knock-off” parts and accessories. Plus, manufacturers benefit from maintaining an ongoing relationship with each customer long after the initial product purchase.

## Additional benefits of NFC to manufacturers of IoT products

In addition to the benefits cited in the preceding examples, NFC offers the following advantages to manufacturers of IoT products:

**Implementing NFC can be easy and affordable.** NFC tags are small and inexpensive and can be added to products without requiring redesigns or major changes to electronics. For use cases that demand more robust capabilities, manufacturers may also opt for inclusion of powered NFC chips in their products to enable read/write and peer-to-peer capabilities. With NFC read/write capabilities, manufacturers gain more flexibility to support multiple use cases; for example, integrating a NFC reader/writer into a smart TV to both enable NFC connectivity with a smartphone and Bluetooth pairing with a NFC headset. This would not be possible with a tag-only solution.

**NFC can be used globally.** Two billion NFC-enabled devices like a smartphone are in use today (IHS). In other words, 20%+ of the world’s population have access to NFC. Most of your customers are ready to use NFC with your products, and its simple, one-tap paradigm helps avoid language and cultural issues.

**NFC may reduce the need to create and publish user documentation.** As products become more complex and markets become more global, manufacturers are faced with developing and publishing lengthier user documentation in multiple languages. This is driving up the cost of printed user manuals. However, manufacturers can avoid this expense by including basic instructions in a printed startup guide in their product packaging, and making more extensive documentation available via a tap of an NFC-enabled device. A single tap directs the user to a product website and a PDF file of the documentation in the correct language.

**NFC can connect the unconnected.** Many manufacturers would like to take advantage of IoT to turn standalone products into smart products, but obstacles stand in their way. For example, their products – say, a swimming pool pump – may be located too far from the Wi-Fi network to connect reliably, or perhaps the product form factor or design does not allow for an IP connection. In these cases, NFC can provide the connection to IoT via the mobile phone network.

**NFC can provide network connectivity only when it is needed.** Many people are concerned about the vulnerability of network-attached products that are always online. The news is full of stories about hackers accessing home networks and taking over control of baby monitor cameras, security systems, and more. Rather than exposing consumers to that risk – and being required to constantly update the product software to thwart hackers – manufacturers can design products that only connect to the network when necessary using NFC.

**NFC enables explicit user intent and user control.** Any action triggered using NFC technology explicitly demonstrates user intent and consent as it requires the user to touch the target NFC device with the NFC-enabled phone.

## Taking the next steps

This white paper offers a selection of broadly-applicable use cases where NFC can leverage IoT to better serve customers, improve business performance, and lower costs. There are many other specific use cases that address the particular needs of industries, vertical markets, or product categories.

Manufacturers who are interested in taking a closer look at how NFC can help their business are encouraged to pursue the following steps:

**Consult an NFC solutions provider.** The growth of NFC has led to a proliferation of systems integrators and vertical market solutions providers with NFC expertise.

**Explore NFC technology providers.** Many developers of NFC chips and tags have worked with companies to develop their NFC/IoT plans.

**Visit the NFC Forum.** The [NFC Forum website](#) offers an array of information and resources on [IoT](#), use cases and implementations, as well as detailed information on NFC Forum specifications.

**Join the NFC Forum.** One of the best ways to stay current with – and have influence on – NFC/IoT developments is by [joining the NFC Forum](#). There are [several membership levels](#), and all NFC Forum members can participate in the organization's many events and committee activities, including the Forum's Internet of Things (IoT) special interest group.