NFC FORUM

Automotive Digital Transformation and the Role of NFC

How can the NFC Forum support car manufacturers to deliver driver connectivity, convenience, and security?

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Contents:

The automotive ecosystem is undergoing a fundamental digital transformation. Similar to the transition of mobile devices to smartphones, we are entering an era in which vehicles are becoming connected, convenient and software-defined.

This trend goes far beyond vehicle locking and unlocking with a tap. The digitalization of cars brings about several key benefits, including:

- Intuitive charging systems, making it simpler for drivers to keep their vehicles powered up.
- Advanced authentication capabilities, enabling the intelligent tracking of vehicle parts, including their usage, maintenance needs, and potential replacement or recycling schedules.
- Easy and seamless payment options, both within the vehicle and through the vehicle, allowing for a more convenient driving experience.

New progressive partnerships need to be established and maintained to achieve the aim of a reliable, secure and functioning connected environment that is trusted and convenient for drivers.

In the same manner that NFC Forum Standards are synonymous with facilitating the secure delivery of a smartphone device-first approach[1], the technical body plays a key role in delivering digital transformation within the automotive sector.

What Value Does NFC Bring to Automotive?

The benefits of NFC

Every day millions of people use NFC technology to connect to the world around them in a highly intuitive way. The technology behind 'tap to pay' contactless payments has gained widespread acceptance and adoption across the global retail ecosystem and is quickly gaining popularity in other applications. This is largely due to its ease of use and the growing familiarity of users with the technology.

Some of the key industries that have adopted this technology include:

Transport ticketing: Allowing for quick and convenient payment of fares.

Access control: Enabling secure and efficient entry to buildings, events, and restricted areas.

Retail loyalty: Simplifying the process of earning and redeeming rewards.

Healthcare: Streamlining payment and identification processes in medical settings.

Identity verification: Providing a secure and efficient way to verify identities.

[1]As shown in the 2024 NFC Forum / ABI Research Usage and Adoption Study, where 55% of consumers said they now prefer to pay using a smartphone or smartwatch than a card.

The properties of NFC technology that are driving adoption in a range of use cases include:

User Intent

NFC is different from other wireless technologies as it is centered on user intent and control. Users must initiate a tap to complete an action.

Simplicity

NFC allows consumers to perform safe contactless transactions, access digital information, connect and charge electronic devices – all with the simplicity of a single touch.

Security

NFC's short proximity (2cm) transmission range means intercepting an NFC contactless signal is very unlikely to happen.

Power

NFC is unique in that one side of a connection can also transmit power to another device, which allows for battery-less operating modes.

> We are now entering an end user perception step change whereby NFC is not just considered a payments technology, but a technology that can underpin a variety of different applications and use cases, such as the ability to tap to receive additional product information, for digital car and/or house key storage, use across brand protection or tap to register a product warranty to name but a few.

Andrew Zignani,
Research Director at ABI Research

This quote is taken from the 2024 NFC Forum / ABI Research Usage and Adoption Study.

Why NFC in automotive?

For drivers:
NFC is a familiar, trusted technology that is reliable and easy to use. User intent is a key feature to transition drivers from physical to digital keys and will open up many additional use cases.

For manufacturers:
NFC is easy to implement, connecting into a wider existing ecosystem that is reliable and secure and readily endorsed by the industry.

How Can NFC Forum Support Car Manufacturers to Deliver Driver Connectivity, Convenience, and Security?

The NFC Forum, established in 2004, is a non-profit industry association comprised of leading mobile communications, semiconductor, and consumer electronics companies. Its mission is to advance the use of NFC technology by developing specifications, ensuring interoperability, and educating the market about NFC technology and use cases.

Led by its Board members, including representatives from Apple, Google, Huawei, Identiv, Infineon, NuCurrent, NXP, Qualcomm, Sony, and ST Microelectronics, the body has vast experience of supporting 'cross-domain interoperability', where multiple organizations work together and exchange information to enable different NFC products to function as intended.

For more than 20 years, the technical body has brought the ecosystem together to disrupt the technical norm and push the possibilities of NFC technology.

While an application layer can be professionally integrated, if the lower layer of the technology is not interoperable, a solution is at serious risk of failing and being unable to interact with other devices within the ecosystem. NFC Forum creates a collaborative environment in which the lower layers are set up to work flawlessly together so that Original Equipment Manufacturers (OEMs) can focus on what matters to them: their application level development.

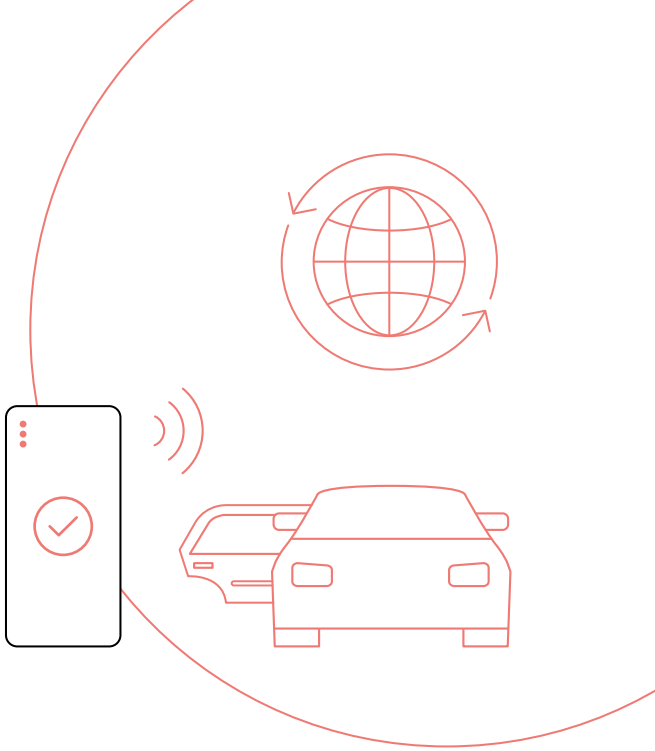
NFC Forum recognizes that cross-partnership engagement to set standards is essential. It achieves this through:

- Member-driven identification of technical requirements.
- Industry collaboration to set standards.
- A widely deployed certification program, to confirm products will perform universally and safely.

Mike McCamon, Executive Director of the NFC Forum, explains:

> "NFC Forum operates a comprehensive certification program with independently recognized laboratories and certification test plans that evolve with the evolution of NFC Specifications. It rigorously tests the physical and protocol interface and confirms approved products are interoperable. This means that they work with the same signals, stay within specified timing constraints, and talk the same language. Vitally we address device classes, which align to the specific market conditions of our partners. For example, our work with the Car Connectivity Consortium for its digital key reader device class."

What Are the Use Cases for NFC Forum Standards in Automotive?



Car Access

Using NFC Forum Standards to drive interoperability across the ecosystem

A car key is digitalized onto a smartphone using the Car Connectivity Consortium's (CCC) Digital Key Specification. Digital keys provide ease of use to the consumer, and digital key management systems reduce the cost and complexity of physical key handling for OEMs. They enable functionalities for the user such as lock, unlock, engine start/stop, emergency/panic and many more to be imported to their smartphone in addition to the digital key fob or smart card.

The digital key backend also supports features such as remote access and secure sharing of digital keys, which is specifically valuable to fleet management and car rental companies.

NFC Forum Standards are used to provide the NFC interface that supports the digital key transaction to lock and unlock the door. Using global standards ensures products have been designed and manufactured to the industry requirements, delivering a reliable and consistent user experience.

NFC Forum compliant digital keys bring many other benefits:

Drivers / car owners are already familiar with smartphones and smartcards and know how to use them.

It can operate and open a vehicle even when the smartphone battery is low and other connectivity technologies are not available.

It provides a one stop vehicle authentication for the primary user which enables digital key sharing; once the digital key is enabled, the primary key owner can share the keys with others in the family.

The vast majority of smartphones and watches are nowadays equipped with NFC, making it by far the most readily available technology for performing secure transactions.

Case Study:
The Car Connectivity Consortium (CCC) Digital Key™

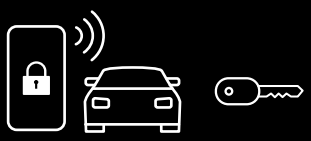
The CCC comprises

200+

strong memberships, which consist of leaders across the automotive, smartphone and chip industries.

In 2017, CCC set out to establish an ecosystem that standardizes digital car keys to work across all devices and cars. This was vital to deliver a consistent, familiar and trusted user experience.

Working across a range of technical bodies, CCC stipulated how three different wireless connectivity technologies could complement the needs/ preferences of drivers.



At the core of CCC's Digital Key are NFC Forum Standards that allow:

- Phone tap to open/close vehicle.
- Phone tap to drive vehicle.
- Digital Key usage, even if the smartphone has no battery.
- Complete key management – such as sharing the key, owner pairing or termination.
- Smartcard as digital key in addition to the phone, if desired.

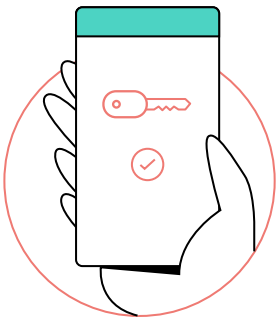
This can be complemented by other technologies to further enhance the user experience:

Bluetooth Low Energy (BLE)

- Remote command to open/close vehicle over BLE

Ultra-Wide Band (UWB) and BLE

- Approach (passive) to open the vehicle
- Walkaway (passive) to close the vehicle
- Detect phone inside the vehicle to drive



CCC uses the NFC Forum Certification Program to instill confidence between vehicle and smartphone manufacturers that the CCC Digital Key™ technology will be interoperable across the entire ecosystem.

> “Automotive NFC implementation has unlocked significant potential thanks to its strong connectivity performance. It empowers manufacturers to pursue innovative ways to improve the consumer experience. The automotive industry rolls out new features with a thoughtful pace - widespread adoption depends on users feeling confident with these advancements. NFC solutions conforming to NFC Forum standards offer proven reliability and are already familiar to the public through successful deployment in multiple sectors.”
>
> **Ganesh Venkatesan,**
> **Technical Director at Car Connectivity Consortium**

NFC Forum Standards are continually evolving to deliver faster, reliable car entry

In 2025 NFC Forum launched Certification Release 15, which requires that an NFC chip in reader mode needs to operate with an operating volume (OV) of 20 mm, four times the previous requirement of 5 mm. This larger OV means that the antenna of the drivers NFC digital key and the car door do not have to be as precisely align to communicate and unlock the door.

Linyi Gao, a representative from the Intelligent Car Connectivity Ecosystem Alliance (ICCE) and member of the NFC Forum, commented that to enable NFC to be used effectively within a digital key use case, there was no choice but to increase the range:

> “When considering the diverse positioning of an NFC chip within a smartphone and the range of a car door handle or side mirror design, the angle in which the smartphone needs to be positioned to unlock the door will vary considerably. ICCE research showed that 47.4% of Chinese car manufacturers needed the operating volume to be 20 mm at a minimum to ensure a reliable connection.”

The result: *a significantly improved user-friendliness. With the OV extension, the reader can have a good connection despite less accurate alignment with the phone, offering a faster and more consistent user experience.*

Auto Part Identification and the Digital Product Passport

Product and component manufacturers are looking to support green manufacturing and circularity. A key element of these requirements is providing businesses and consumers with robust access to information on lifecycle and supply chain data, to allow for effective re-using, remanufacturing, or recycling a product.

NFC Forum Standard compliant tags are ideally suited to store Digital Product Passport (DPP) data in a vast range of use cases. The ability for this information to coexist with existing NFC applications lays the foundation for an accessible and interoperable data management ecosystem that can vastly accelerate the advancement of the circular economy.

Business and consumers are also familiar and comfortable with the technology, promoting use and expediting adoption.

The NFC Forum Digital Product Passport Standard defines a flexible, data agnostic framework to allow a **single NFC tag embedded in a product to store and transmit both standard and extended DPP data** using common NFC Data Exchange Format (NDEF) records.

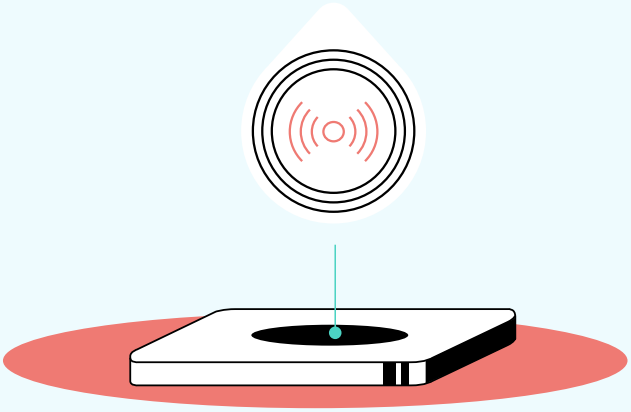
Unlike other expected data carrier solutions, the NFC Forum Standard **offers static and dynamic data to be hosted and accessed offline** using non-volatile memory stored on the product itself. This gives it a significant benefit over, for example, QR codes that are used in similar applications.

As the overall DPP architecture is expected to include both cloud-based systems for online data storage and methodologies to connect products to these systems (known in the industry as DPP Data Carriers), the **NFC Forum Standards extend the capability of using NFC Forum technologies as data carriers.**

Additionally, and most critically, by embedding DPP data directly into products, **manufacturers can ensure the data is available for the life of the product** while also providing additional anti-tampering capabilities and not having to rely entirely on a cloud data infrastructure for lifecycle data.

Using NFC Forum Standards to embed DPP data to a product creates a transparent and accessible chain of custody throughout the product's lifecycle to differentiate between authentic and counterfeit products. Embedded data can also be used to validate the integrity of an online DPP.

Card Protection: Ensuring Technologies Complement and Coexist



NFC Forum Standards can identify all different types on NFC tags. Using NFC Forum Certified Readers ensures that different NFC products in the car will be recognized and function as intended.

For example: NFC technology and the wireless (Qi) charger often share the same location in the middle console of a vehicle; as the smartphone needs to be placed in a central location to authorize the engine to start via NFC, and while there, Qi charges the device.

NFC tags or cards, for example in the phone's cover or placed on the charging tray, might be exposed excessively to the Qi field and damaged. An NFC Forum Certified Reader can serve a second purpose in the Qi charger by detecting smart cards, tags, and key fobs and preventing the charger from enabling the field and damaging the cards and notifying the user about the issue.

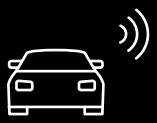
Rick van Kemenade,
Chair of the NFC Forum Automotive Special Interest Group, explains:

"Integration of multiple technologies in a limited space – such as a vehicle's center console – can add complexity and interoperability challenges.

Using an NFC Forum Certified Reader's capabilities to scan for all the tag technologies and – if detected – preventing charging is a prime example of how NFC Forum offering can be extended to serve purposes well beyond the existing standards and use cases and enable further system integration."

What Are the Future Use Cases for NFC Forum Standards in Automotive?

NFC Forum's Automotive Special Interest Group is working to define how NFC Forum Standards can support future automotive innovations to deliver ultimate driver convenience. Such as personalizing car settings to allow drivers to tailor their driving experience to their preferences, or even collecting loyalty points that reward drivers for their in-car purchases and interactions.



Personalization

Vehicles have many personalization settings, such as the infotainment system, car seat positioning, climate control settings, mirrors, lights, as well as the driver's payment accounts and other in-car apps.

The controls to amend these settings are positioned throughout the vehicle. For vehicles being driven by multiple drivers, these settings can be tedious to set-up on every occasion.

Using NFC technology, when the smartphone or fob is tapped to unlock the vehicle, the driver's preferences can automatically be adjusted. NFC technology ensures more secure personalization with easy implementation across multiple profiles.

In-Car Payments

In-car payment systems allow drivers and passengers to make transactions without leaving their vehicle. This enhances the overall user experience by offering convenience, minimizing / limiting unnecessary stops as well as reducing congestion at some locations, such as road toll booths.

In-car payments can be delivered as:
Contactless payments – making payments using credit cards, smartphones, wearables.

Infotainment integration – supporting online payments for in-car services.

Protecting sensitive personal and financial details throughout a car system requires robust security. Systems must also meet the requirements of payment service providers, regional regulation and national compliance. This would see in-car payments implemented using a dedicated NFC payment-interface inside the car, based on EMV® Specifications.

e-Ticketing can also extend to in-car payment services. For example, a driver can buy an e-ticket for an event, and while driving to the event, the ticket is transferred onto their smartphone. The device is then used to gain entry to the venue.

NFC Forum lays the foundation to make such features a reality.
NFC Forum Standards and Certification will ensure a technology ecosystem that instills:

Trust

Inspiring confidence in the driver and ensuring that their personal and financial information is protected.

Dependability

Functioning reliably and consistently, even in a variety of environments and conditions.

Safety

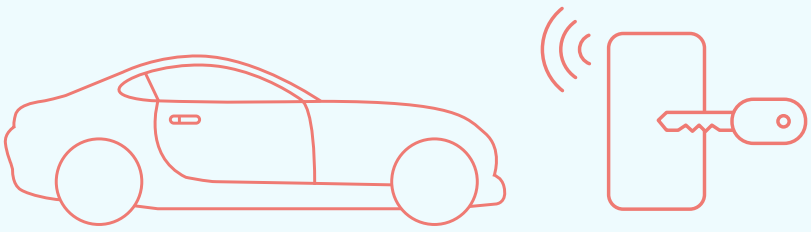
Protecting the driver and vehicle from potential risks and threats.

Security

Safeguarding sensitive information and preventing unauthorized access or tampering.

> We recognize the impressive contributions NFC Forum has made in creating international standards and understand their important position within the NFC ecosystem. Partnering with them made perfect sense to deliver robust and secure certification of the NFC technology deployed in cars and the devices that communicate with them.

Ganesh Venkatesan,
Technical Director at Car Connectivity Consortium



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Join the Conversation

NFC Forum is actively defining use cases and working with associations and partners across the automotive ecosystem to make the digital vehicle a reality. In addition to ensuring NFC technology is part of the automotive OEMs connected car strategy, we want automotive representatives to speak to us, use our infrastructure, join us and share their technical and business requirements.

Get in touch today.