

# IDENTIFICATION AND AUTHENTICATION OF CONSUMABLES AND ACCESSORIES VIA NFC

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SECURE CONNECTIONS  
FOR A SMARTER WORLD

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# AGENDA

- What is NFC?
- Why use NFC?
- Accessories identification
- Accessories authentication
- Mobile phone ecosystem integration
- Product portfolio & support





# 01.

## What is NFC?





# NFC

- NFC is a contactless short range technology, based on inductive coupling (10cm / 4 in)
- Operating frequency 13.56MHz, speed < 848 kbits/s
- Co-invented in 2002 by NXP and Sony
- NXP is NFC market leader (80% share in POS terminals, 82% NFC tags share)

## Big reasons to consider NFC



### **More intuitive than any technology**

It's like shaking hands



### **Use Power Very Efficiently**

Only one of the two devices needs to be powered



### **Trusted addition to other technology**

Especially for pairing devices

# RFID, proximity cards and NFC

## RFID



Generic term for **contactless** technology

**Wide** reading range  
(few cm to several meters)

Standardized in  
**ISO/IEC 18000**

## Proximity cards



Subset of RFID  
**HF 13,56 MHz**

**Short** reading range  
(few cm)

Standardized in  
**ISO/IEC 14443**

## NFC



Adds a **two-way** communication  
between NFC-enabled devices

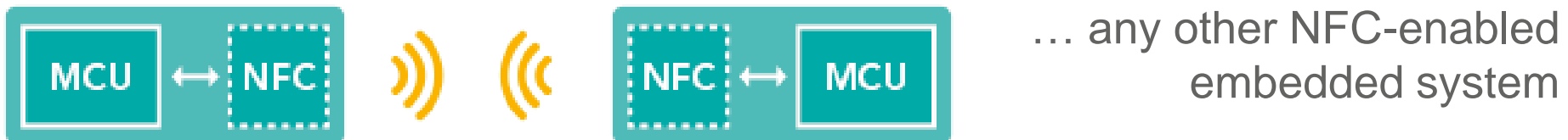
NFC-enabled device can behave as  
a contactless smartcard

Standardized in  
**ISO/IEC 18092** and **ISO/IEC 21481**

Act of will (“Tap to initiate an action”) • Zero-power • Highest Security

# Different possibilities of NFC interaction

An NFC device can interact with ...



# Every major Smartphone OS supports NFC tag reading

ALL NFC tag types [1-5] supported



**NFC feature to reach  
>2Bpcs smartphone  
population**

**Typical use cases using NDEF\* reading:**

- URL link
- Smart posters
- SMS
- Starting mobile APP
- Device paring (WLAN, Bluetooth)
- vCard
- Digital signature
- Text record (can be used for any data)

For more formats, check the NFC Forum website ([www.nfc-forum.org](http://www.nfc-forum.org)).

\*NFC Data Exchange Format (NDEF) is a standardized data format that can be used to exchange information between any compatible NFC device and another NFC device or tag.

OS specifics	ANDROID	iOS11 or higher
Phones	All ANDROID NFC Phones	iPhone 7 / 7Plus or higher
APP required	Reads with or without APP	YES
Data read	NDEF (built-in/via App) Non-NDEF (via App)	NDEF via App
NFC polling	Constant NFC polling	60 sec max.
NFC writing	YES	NOT announced. Personalization of tags can be done via NFC readers (e.g.: by tag provider, Android phone, USB NFC reader)
Energy harvesting	YES	YES



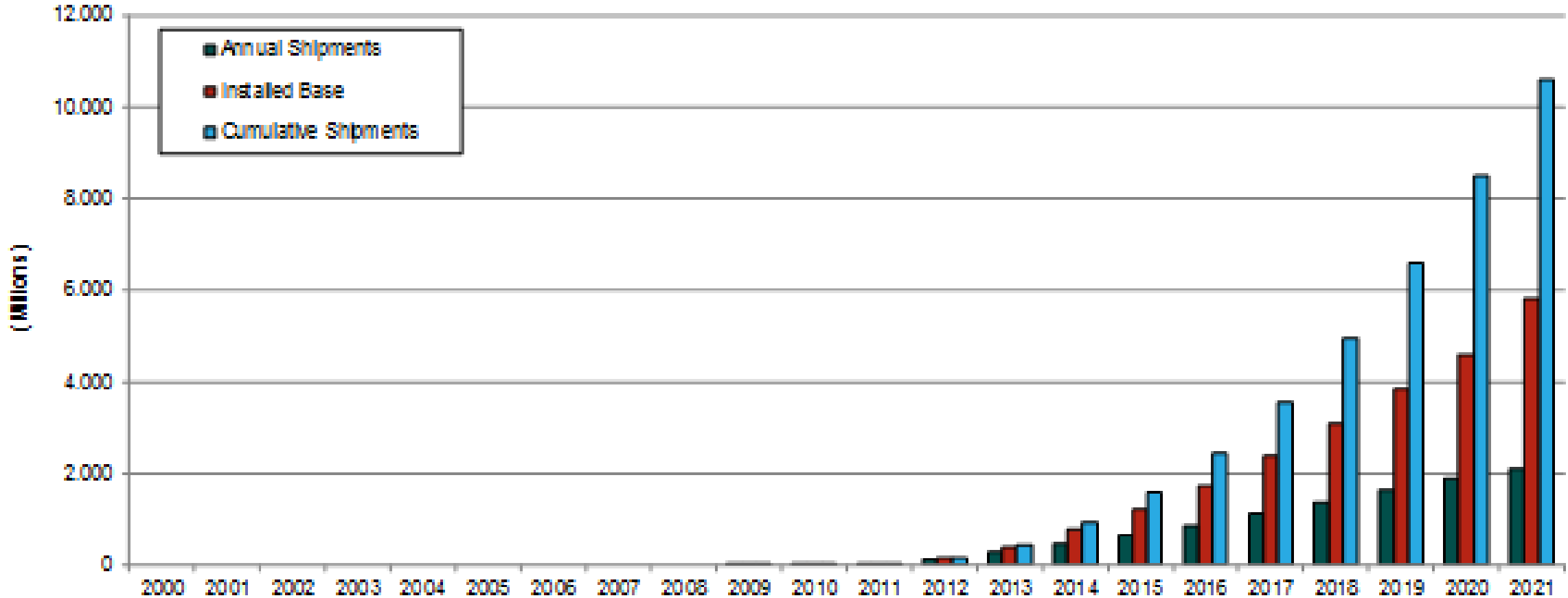
# 02.

## Why use NFC?



# Near-field-communication (NFC) devices are shipping in Billion units

NFC-enabled Products, Total Annual and Cumulative Shipments  
World Markets, Forecast: 2009 to 2021



Source: ABI Research

# List of countries by smartphone penetration

Rank ↕	Country ↕	Total Population ↕	Smartphone Penetration ↕	Smartphone Users ▼
26	China	1,388,233,000	51.7%	717,310,000
45	India	1,342,513,000	22.4%	300,124,000
7	United States	326,474,000	69.3%	226,289,000
33	Brazil	211,243,000	37.7%	79,578,000
25	Russia	143,375,000	54.7%	78,364,000
27	Japan	126,045,000	50.1%	63,089,000
9	Germany	80,636,000	68.8%	55,492,000
46	Indonesia	263,510,000	20.7%	54,494,000
30	Mexico	130,223,000	40.7%	52,993,000
10	United Kingdom	65,511,000	68.6%	44,953,000
16	France	64,939,000	65.3%	42,399,000
28	Turkey	80,418,000	49.8%	40,010,000
15	Italy	59,798,000	65.8%	39,323,000

# NFC vs QR vs BLE vs Web Browser



QR code



**NFC**

Static

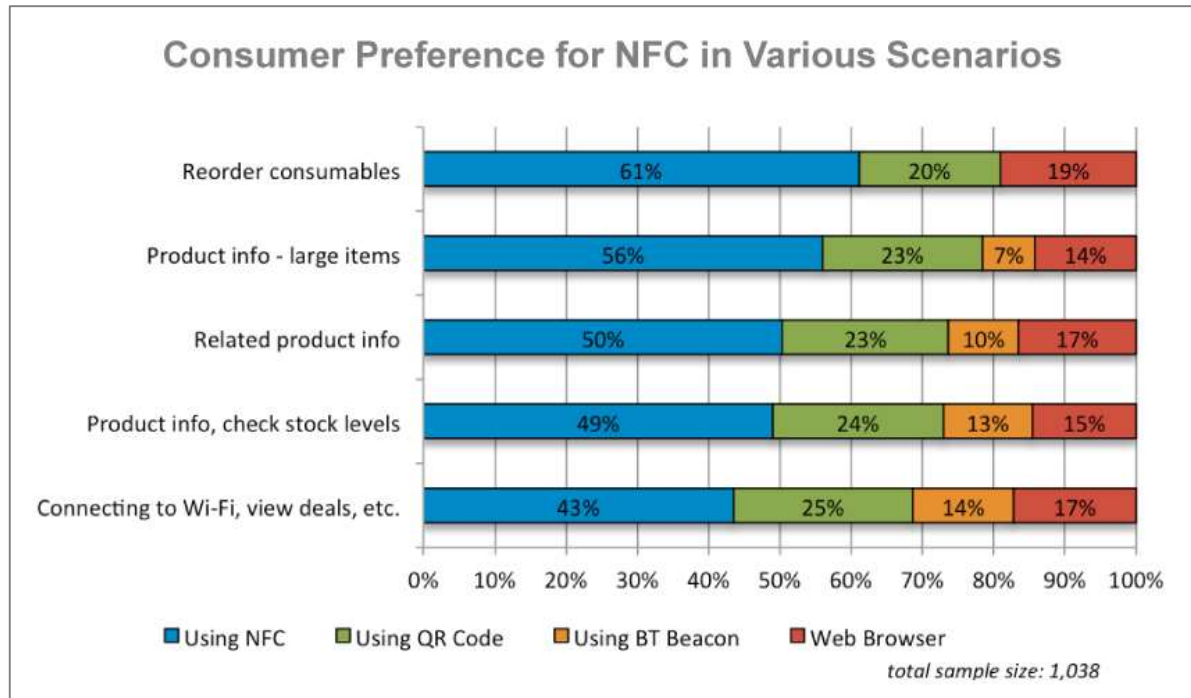
Serialized

**BLE**

**Web browser**

	NFC	Static	Serialized	BLE	Web browser
<b>Ease of use</b>	Simple, instant	Reader app required		App required	User typing required
<b>Communication</b>	Point to point	-		Point to many points	-
<b>Range</b>	4-5 cm	Middle (line of sight)		Up to 150 m	Middle (line of sight)
<b>Price</b>	Min. cost of tags	Printing	Backend code management	Higher hardware / maintenance costs	Printing URL
<b>Energy</b>	Battery-less	Battery-less		Battery-powered	Battery-less
<b>Security</b>	High	Low		High	Low
<b>Line of sight required</b>	No	Yes		No	Yes
<b>User experience</b>	Pull	Pull		Push	Pull
<b>Includes product ID</b>	Yes (serialization by default)	No	Yes (cost, complexity)	No	Possible
<b>Can be attached to sensor</b>	Yes	No		Yes	No

# Consumer preference: NFC vs alternatives



- Study conducted by **Strategy Analytics** on consumer preferences in retail technology
- Consumers evaluated NFC, QR code, Bluetooth beacon and web browser to 6 different in-store retail scenarios
- NFC was the preferred option in the 6 scenarios
  - In 5 of them, more than twice as many consumers preferred NFC to the leading alternative
- Three user benefits of NFC technology were highlighted: speed, convenience and control
- Reference: <http://nfc-forum.org/retail-study/>



# 03.

## Accessories identification





## VisaPure Essential Facial Cleansing Device

DualMotion Technology, Cleansing, 2 cleansing brush heads, pouch, 2 intensity settings | SC5275/10 | [Find similar products](#)

[Overview](#)
[Specifications](#)
[Reviews & Awards](#)
[Accessories](#)

## Optional Accessories



### VisaPure Exfoliating Cleansing Brush

- Gently exfoliates the skin
- For weekly use
- Replace every 6 months
- Easy to replace



SC5992/10

[Where to Buy](#)


### VisaPure Sensitive Skin Cleansing Brush

- For normal to sensitive skin
- For daily use
- Replace every 3 months
- Easy to replace



SC5991/10

[Where to Buy](#)


### VisaPure Normal Skin Cleansing Brush

- For normal to oily skin
- For daily use
- Replace every 3 months
- Easy to replace



SC5990/10

[Where to Buy](#)

## Why identify accessories?

- Accessories identification becomes functional necessity as it enables more product features
- The feature richness enables sales channel for additional product configurations
- The uniqueness of every product used for monitoring of replenishment cycle

# A more familiar example

- Identification and authentication of genuine replacement parts or consumable refills
  - With the help of the device itself, or the phone
- Automated transfer of settings
  - Device reader communicates with tagged part / consumable in the unit for ease-of-use and best performance
- Facilitates purchasing and usage decisions
  - E.g. warranty registration, replenishment alert, promotion, how-to video, linking to service center



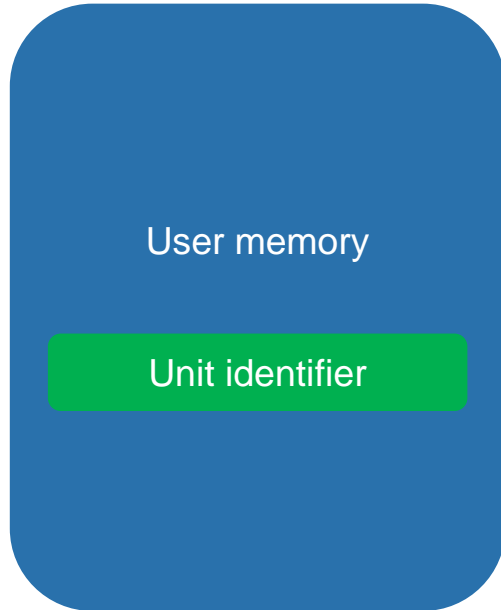
# Tag format building blocks

Unique ID (UID)

Tag unique ID; Programmed by NXP, read only

NXP internal configuration

NXP internal chip configuration; Programmed by NXP, read only

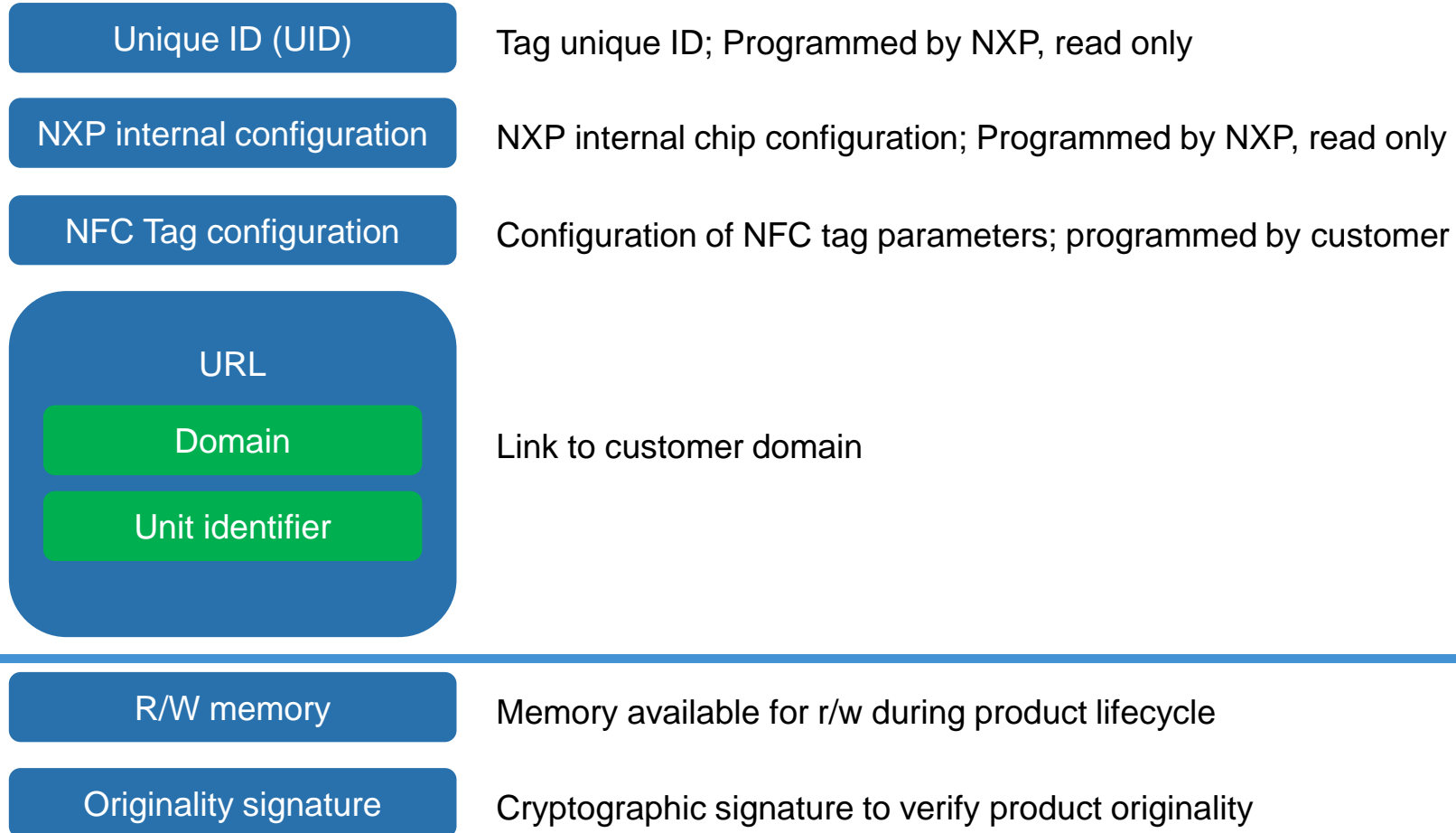


User memory, can be freely configured by the customer

Originality signature

Cryptographic signature to verify product originality

# NFC tag format building blocks



NFC Forum compliant





# 03.

## Accessories authentication



# NTAG 210 $\mu$

Entry level NFC label IC to replace barcode and QR codes

More features:

- NFC Forum Type 2 Tag
- 32-bit password protection
- Up to 10 cm reading distance
- Optimized for small label designs (high capacitance version)

**High volume NFC applications**

Lowest cost NTAG offering



**Customer specific product signature**

Originality signature customizable to a customer's unique originality signature



**40 bytes user memory**

for basic device information



**Connectivity**

Easy information transfer via NFC-enabled devices

**NFC  
ISO14443**



# NTAG 210p

Entry level NFC label IC to replace barcodes and QR codes

## More features

- NFC Forum Type 2 Tag
- 20-bit password protection
- Up to 10 cm reading distance
- Optimized for small label designs (high-capacitance version)

High volume NFC applications



## Customer specific product signature

Originality signature customizable to a customer's unique originality signature



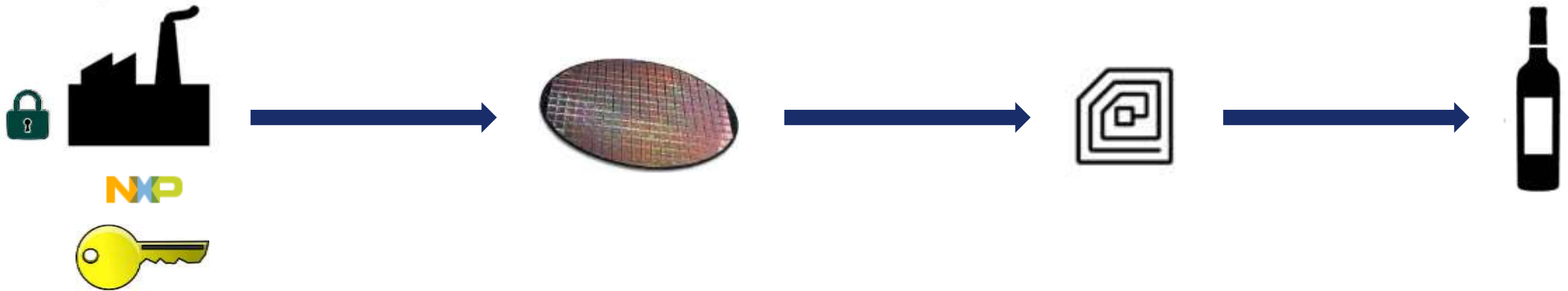
High capacity memory



Connectivity

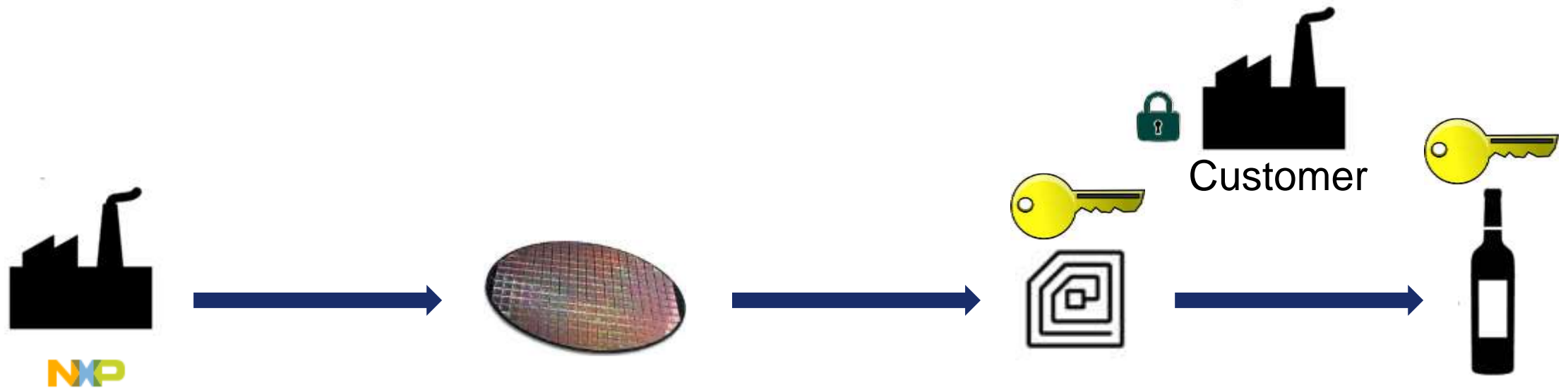


# Originality signature provisioning - NXP



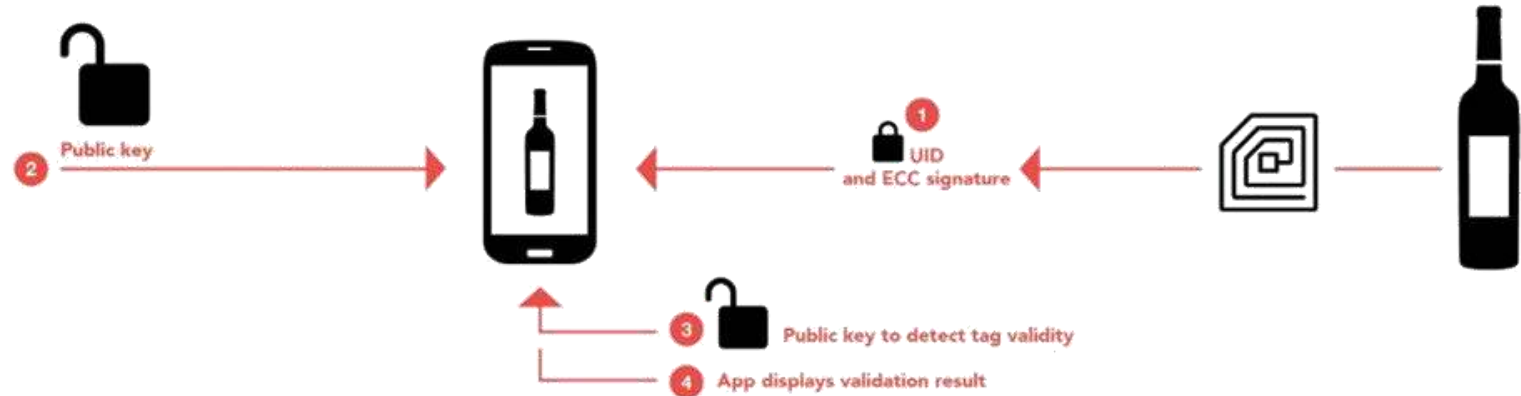
NXP programs the signature in the factory

# Originality signature provisioning - Customer



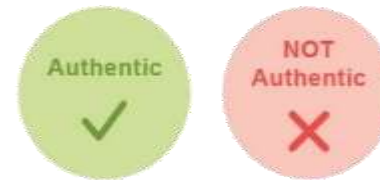
# Digital Signature – offline validation

- An NFC reader (smartphone) acts as a validation terminal, using NXP's standards-based ECC signature on the tag, without the need to access the cloud
- NXP can provide customer specific signatures (for production volumes of 20+ million pieces) to enhance data protection



## NXP Originality Signature for offline validation

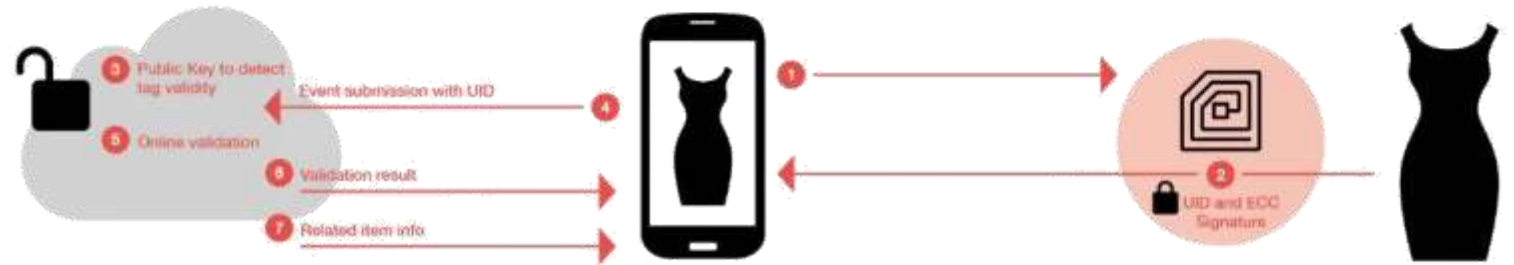
- 1 Mobile phone application scans the item equipped with NFC tag retrieve the chip's unique identifier (UID) and signature (Signature = identifier signed with a private key at tag initialization).
- 2 App gets public key from cloud or local app storage.
- 3 App uses the public key to check the chip's signature versus its identifier, hence detecting offline the tag's validity.
- 4 App displays validation result.





# Digital Signature – online validation

- The NFC reader acts as a communication terminal to transfer information from the tag (UID) and the scan incidence to a secure server in the cloud, where validation takes place
- Cloud management checks information about location, time and usage, to immediately detect and flag any deviation



## NXP Originality signature with online validation

- 1 Reader talks first – ‘Reader on – Tag here’
- 2 Mobile phone application scans the item equipped with NFC tag to retrieve the chip’s unique identifier (UID) and ECC signature (Signature = UID signed with the private key).
- 3 Secure validation server has public key to detect the tag’s validity.
- 4 App submits to secure validation server the full event’s info (tag identifier, location, time).
- 5 Server validates tag based on historic knowledge and newly provided information.
- 6 Server returns validation result to the phone.
- 7 Optional: App retrieves and displays information associated with the scanned item.





# 04.

## Recap

# Content Recap

- Smartphones provide unmatched and growing NFC installation base
- With fraction of the cost of BLE, NFC tags can be used to
  - ❑ Identify the consumable or accessory, enabling new functionality
  - ❑ Authenticate the consumable or accessory, protecting the integrity of the installation and business interests
  - ❑ Enable web based services to increase product revenue
- The originality signature can be verified offline or online without any increased security requirements on the consumer product
- The originality signature can be programmed by NXP or customer, depending on product and business volume



# 05.

## Mobile phone ecosystem integration



NXP introduces a new consumable replenishment method that expands market share, increases revenue, and provides a pleasingly efficient consumer experience.

# Authenticated Redirection™

Effortless consumable replenishment with one tap



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# Consumable experience with NFC

1

Unit notifies consumer of, or consumer recognizes the need for consumable replacement

2

Consumer scans the consumable with an NFC-enabled phone. Data stored on the tag directs user phone to initiate appropriate action.

3

Authentication of current consumable and supplier identification occurs via the cloud.

4

Convenient selection of authorized replacement suppliers presented to consumer via phone.



URL, SKU,  
S/N, UID,  
Count, O.S.



Rotate, or provide a listing of authorized partners for customer selection.

Facilitates purchasing decision, ensuring the correct, and authentic model is always selected



# Consumable authentication with NFC

## Benefits to the OEM

- Automatic expiration notification:** Counter on consumable tracks usage and provides opportunity to alert consumer for timely replacements.
- Product authentication:** Data sent to cloud helps identify authentic products and curbs counterfeit liability costs without requiring encryption for products where its use would be cost-prohibitive.
- Lead generation:** Sales leads sent to affiliates that guarantee authentic replacement parts offset tag costs, generate affiliate commission revenue, and reduce advertising costs. OEMs can control choice of affiliates and the percentage of leads they receive dynamically via the cloud.
- Real-time analytics:** Use of cloud service provider to track leads and actions provides real-time results.
- Reduced advertising costs:** Instant sale at time of need, while generated leads organically improve search engine results without paying for privilege.
- Increased revenue:** Expanded market share of genuine replacement parts increases revenue while offsetting tag cost.
- Promotion vehicle:** Method supports delivery of incentives and upgrade opportunities to proven customer.

## Benefits to the consumer

- Built-in counter:** Unit automatically notifies consumer when consumable has reached its expiration.
- Verifies correct model:** Purchase options that include only the correct model replacement part removes confusion and saves consumer time.
- Ensure genuine replacements:** Genuine consumable replacements maximize compatibility and user satisfaction.
- List of participating e-Retailers:** Preapproved retailer list enables more efficient shopping and supports one-touch ordering from anywhere with direct-to-home delivery.



...time to replace?



counter

vs.



color /  
bristle flair



competitive  
distractions?



...counterfeits?

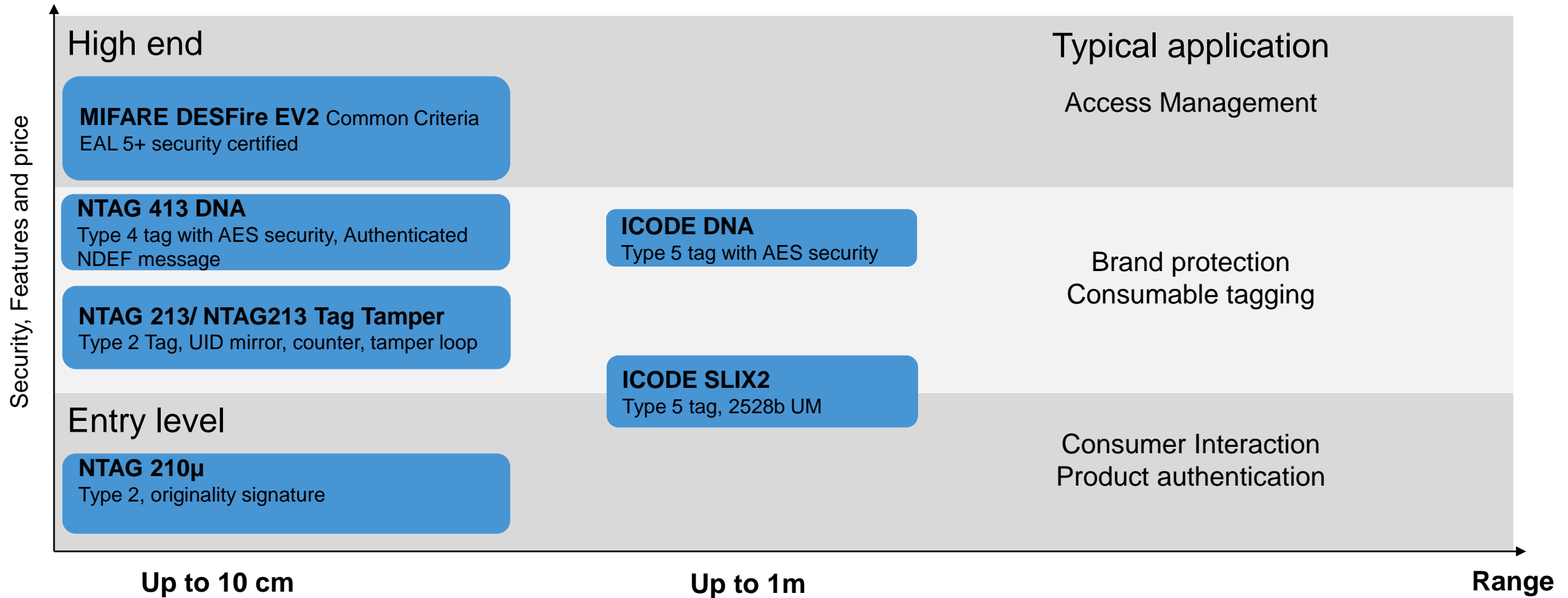




# 06.

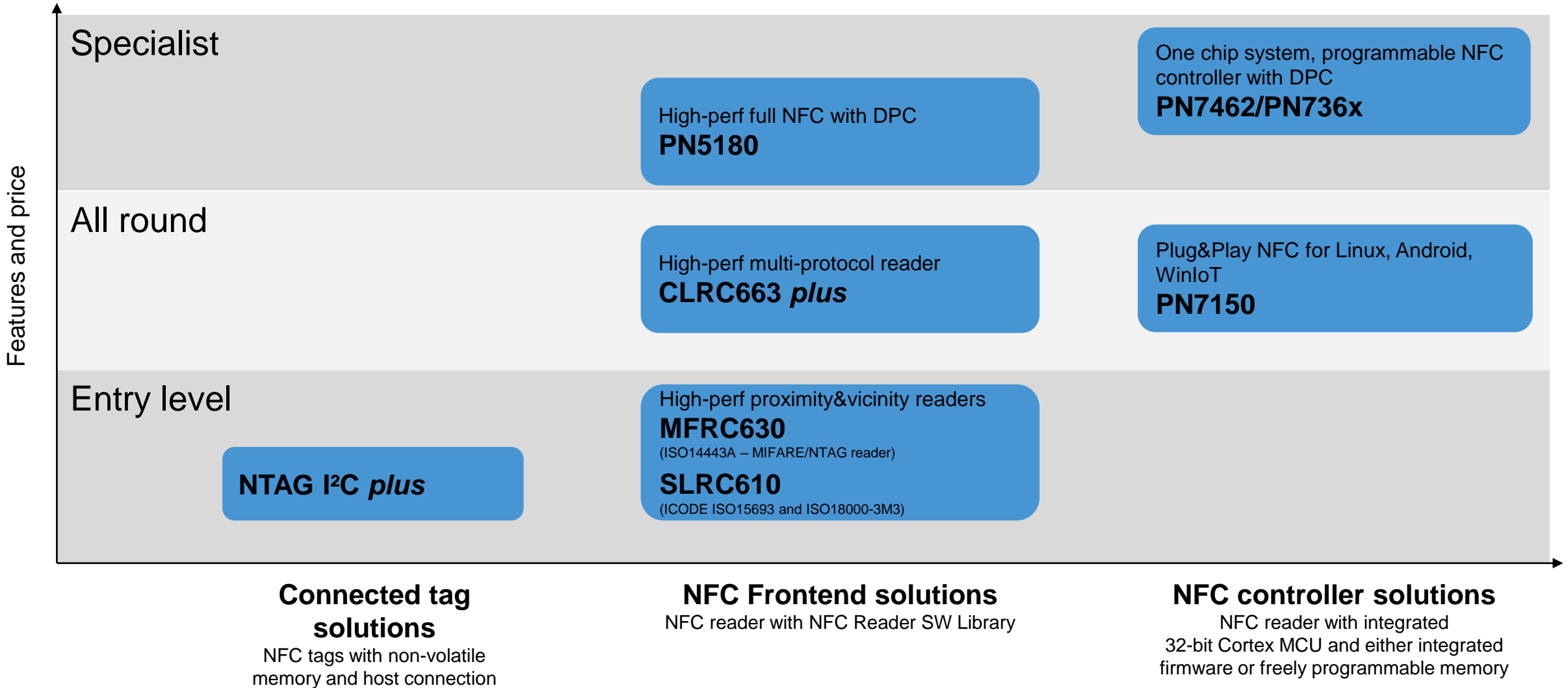
## Product portfolio

# NFC focus products for each application need – ICs for tags, labels and cards



# NFC focus products for each application need –

## Readers/connected tags



\* Single chip: Cortex M0 MCU + last generation NFC reader + ISO 7816 Contact reader

# NTAG<sup>®</sup> 413 DNA – higher security and exclusive experiences with each tap

## Key features at a glance

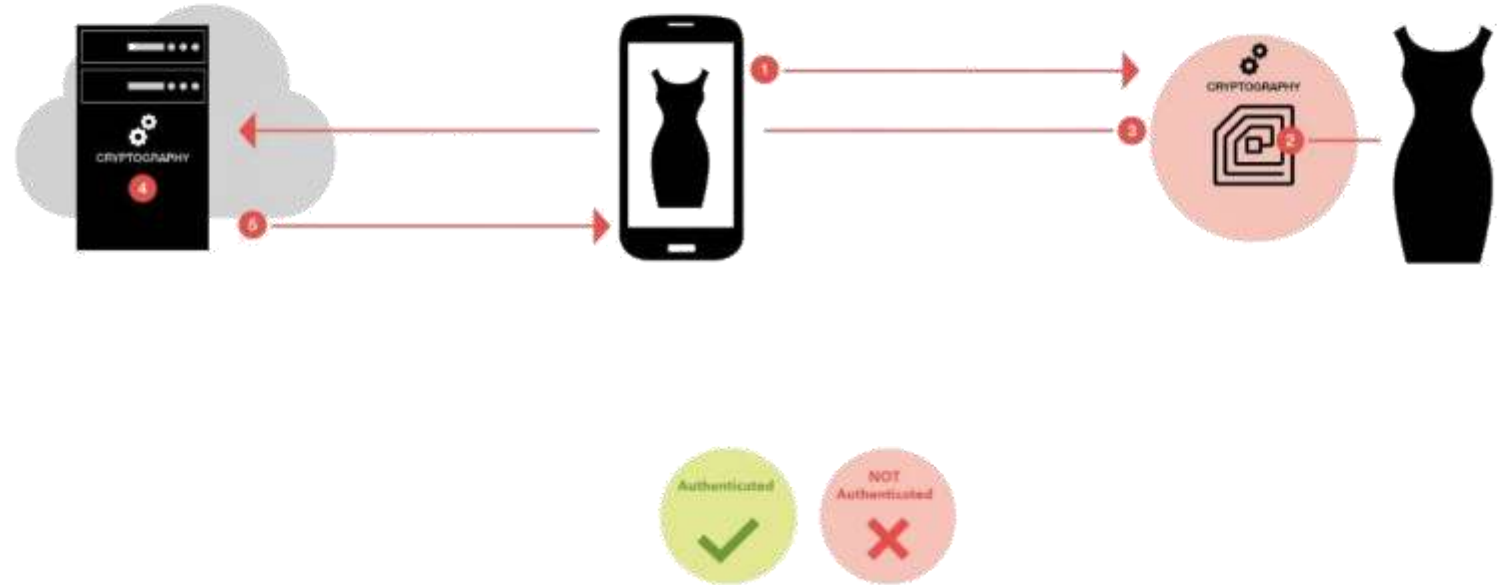
- NFC Forum Type 4 Tag compliant
- New **Secure Unique NFC message (SUN)** feature
  - Creates tap-unique authentication data
  - Protects the tag, the message, and proves tag presence
- Standard **AES 128 Cryptography** (3 x 128-bit AES keys)
- Unique URL for automatic tag connection to web – without an app
- Configurable: Access protection to tag (Mutual authentication)
- Configurable: Encrypted communication tag - host
- NXP originality signature
  - ECC-based, 56-byte
- Unique 7-byte identifier (UID)
- Tamper-resistant secure hardware
- 70pF input capacitance for smaller antenna design

NEW!



# How NTAG 413 DNA with SUN works

- The tag generates a one-time cryptogram – a secure unique NFC message (SUN) authentication, based on a CMAC calculation
- Both host and tag use the same secret key (AES) to authenticate the data being sent
- Communication uses NFC data exchange format (NDEF) – no app needed



- 1 Reader phone talks first
- 2 Tag calculates secure unique NFC authentication message (SUN) code upon each tap
- 3 Phone reads tap-unique URL with SUN authentication code and sends to the host
- 4 Host verifies SUN authentication code
- 5 Based on verification result, host sends information back to the phone

# Simplified NFC Reader portfolio

	Zero Power Access	NFC Modes RW/CE/P2P*	Reader/Writer Protocols A/B/F/V**	Output Power Supply Voltage TX Current	Dynamic Power Control	Low Power Card Detection	Embedded MCU (32bit ARM Cortex-M0)	Contact Reader ISO7618
<b>NTAG I<sup>2</sup>C plus</b>	✓ energy harvesting	type 2 tag						
<b>MFRC630 SLRC610</b>		✓ × ×	✓ × × × × × × ✓	1.3 W 3.0 to 5.5 V 250 mA		✓		
<b>CLRC663 plus</b>		✓ × ✓ ***	✓ ✓ ✓ ✓	1.9 W 2.5 to 5.5 V 350mA		✓		
<b>PN5180</b>		✓ ✓ ✓	✓ ✓ ✓ ✓	1.3 W 2.7 to 5.5 V 250 mA	✓	✓		
<b>PN7150</b>		✓ ✓ ✓	✓ ✓ ✓ ✓	0.9 W 2.7 to 4.75 V 150 mA		✓	✓ fixed firmware	
<b>PN7462 PN736x</b>		✓ ✓ ✓	✓ ✓ ✓ ✓	1.3 W 3 to 5.5 V 250 mA	✓	✓	✓ 160 kB user Flash ✓ 160/80 kB	✓ ×

\* RW: Reader/Writer ; CE: Card Emulation ; P2P: Peer to Peer

\*\* A: ISO/IEC 14443A , B: ISO/IEC 14443B, F: Felica, V: ISO/IEC 15693 (Vicinity)

\*\*\* Peer to Peer Passive Initiator only! The initial RF collision avoidance according to ISO/IEC 18092 is not integrated in CLRC663 therefore the host controller has to take care to establish the communication link to the target by e.g. random field on duty cycles

# Frequently Asked Questions

- **Q: Are older products and products not on the focus-list EOL soon?**
- **A:** No. Older products continue to be supported, and there is no plan to obsolete them in the foreseeable future. However for new projects, we do not recommend design-in of these older products due to the better performance/feature-to-price ratio of the focus products.
- **Q: Why is PN512 not on the focus product list?**
- **A:** PN512 is a high-runner NFC frontend which will keep on being supported. Newer product generations however offer more performance (e.g. high output power) as well as features (e.g. iso15693 support). For new design-ins we suggest PN5180 (full NFC), CLRC663 (multi-protocol reader), or RC610/630 (single-protocol reader), depending on project requirements.
- **Q: Why is PN532 not on the focus product list?**
- **A:** PN532 will keep on being supported. For updates of platforms where the PN532 is already designed into the software, stay with the PN532. For new designs however, we recommend the PN7150 which has a standardized simple NCI software interface. The PN7150 can also read ISO15693 tags, while the PN532 is limited to ISO14443.
- **Q: How to choose between an NFC frontend solution and an NFC controller solution?**
- **A:** A frontend is for customers who plan to implement their own additional protocols with a need to change configuration registers. This provide full flexibility and optimum performance but requires a certain level of expertise and efforts. Customers who want to add NFC feature to their design without a strong expertise should use a PN7150 which provides a standard NCI interface to the system, this is what we call Plug&Play. This is frequently seen in OS-environment like Android, Linux or Windows.





# 07.

## Support resources

# NFC Webinars

Best place for getting quick information on

- NFC technology
- Application use cases
- Products description
- In-depth technical Training

## 2 ways to get there

- Support → Online training academy → NFC Webinars
- Or in 1 click from [nxp.com/nfc](http://www.nxp.com/nfc): NFC Webinars (at the bottom right hand side under “NFC support”)

<http://www.nxp.com/support:/NFC-WEBINARS>



NFC Basics			
Topic	Description		
NFC Essentials	Introduction to NFC technology and functionality.	Full Webinar	<a href="#">Short Read</a>
NFC use cases	Introduction to NFC use cases, including recommended product solutions.	Full Webinar	<a href="#">Short Read</a>
NXP's NFC product portfolio	Introduction to NXP's NFC Reader IC portfolio: NFC frontends, NFC controllers, NFC connected tag ICs.	Full Webinar	<a href="#">Short Read</a>
NFC reader design - how to build your own reader	How to design and build an NFC reader, main components, how to choose the right reader and microcontroller ICs, reader architecture with respect to security requirements, NFC antenna theoretical fundamentals, how to match it in our NFC reader design.	Full Webinar Part 1	<a href="#">Short Read</a>
		Full Webinar Part 2	

Products			
Topic	Description		
PN71xx product presentation	Overview, features and applications of PN71xx high-performance plug'n play full NFC Forum compliant controller family.	Full Webinar	<a href="#">Short Read</a>
PN71xx product support package	Getting started with OM5577 and OM5578 kits for the PN7120 and PN7150 NFC Controllers, interface boards compatible with Raspberry Pi, BeagleBone Black, and boards featuring Arduino compatible headers including many LPCXpresso, Kinets and i.MX boards.	Full Webinar	
PN7462 - First all-in-one full NFC solution	Overview, features and applications of PN7462 NXP's all-in-one NFC contact smart card reader.	Full Webinar	
PN7462 - Product support package	Getting started with C...		
NTAG I2C plus - Your entryway to NFC	Overview, features and applications of NTAG I2C plus.		
NTAG I2C plus - Product support package	Getting started with C...		

Applications			
Topic	Description		
NFC use cases for industrial applications	NFC use cases in industrial applications, overview, requirements, NFC Reader solutions.	Full Webinar	<a href="#">Short Read</a>
Tap-and-Play: NFC in gaming	NFC use cases in gaming applications, overview, requirements, NFC Reader solutions.	Full Webinar	
Smart Home NFC commissioning solution	NFC use cases in smart home and IoT, overview, requirements, NFC Reader solutions.	Full Webinar	

Technical			
Topic	Description		
How to develop NFC applications 1: Parametrization via NFC	30 min hands-on session on how to integrate NFC into your application for configuration and parametrization, along the concrete implementation of a DIN rail demo.	Full Webinar	<a href="#">Demolab</a>
How to develop NFC applications 2: Device-to-device communication via NFC	30 min hands-on session on how to integrate NFC for device-to-device communication, e.g. when you need to exchange data between devices which cannot be connected via a cable, as sealed, moving or rotating parts.	Full Webinar	<a href="#">Demolab</a>
Design and Implement NFC applications 1: Product support package for NXP NFC readers	Hardware support, software support and design support resources for NXP connected NFC tags, NFC frontends and NFC controllers.	Full Webinar	<a href="#">Short Read</a>
Design and Implement NFC applications 2: Antenna design considerations for NXP NFC reader solutions	Theoretical fundamentals and antenna principle, NFC antenna design procedure for NXP solutions, NFC reader test and qualification.	Full Webinar	

# Use our technical community for your questions

- Become a registered member and get expert advice from the developer community

## How to get there

- NFC and Reader ICs → NFC Technology hub → NFC support → NFC community

<https://community.nxp.com/community/nfc>

**Log in** Log in to follow, share, and participate in this community.

WELCOME TO NFC

**NFC**

Welcome to the NFC community. With our broad portfolio ranging from high power RF reader ICs to NFC enabled solutions we address all your needs. Based on our long experience we continue to lead the expansion from traditional smart card applications to a wide infrastructure based on NFC enabled devices. Get expert advice from the developer community. The support team also monitors these forums to provide answers and take your feedback.

Anyone can read the discussions, but only registered NXP Community members may participate. Before you ask a question, please search the community to find if someone has already offered a solution. If you don't see a solution, then ask the community your question.

ASK NFC YOUR QUESTION

Type your question **Ask your question**

Ask it

CATEGORIES

Category	Posts	Answers	Comments
Contact Smart Card Reader ICs	24	0	0
HITAG Reader ICs	16	0	0
Connected Tag Solutions	28	0	0
MIFARE SAMs for Reader Systems	20	0	0
NFC Frontend Solutions	52	0	1
NFC Controller Solutions	48	1	0
NFC Reader Library	30	0	1

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