Enhancing everyday products with NFC – Welcome to the Internet of Things

www.nxp.com/nfc
The Internet of Things and NFC

NFC tagged products
- What they are
- How they work
- Typical applications
  - Brand engagement
  - Brand protection
- Some real use cases

NXP solutions
- The NTAG family
- Other NXP NFC tags
The Internet of Things
From the Internet of Devices to the Internet of Everyday Things

Our vision of the IoT

Exhibit 4: IoT emerging as the next mega-trend
Internet subscribers over time

Note: y-axis is on a logarithmic scale

Source: IDC, Ericsson, Goldman Sachs Global Investment Research.
The Internet of Things
The next mega-trend – Internet of Everyday Things

- 3 trillion products sold per year
- 99.4% of physical objects still unconnected
- 50 billion things expected to be connected by 2020
- The Internet of Things will create $14.4 trillion from 2013 to 2022

Source: Cisco IBSG, 2013
NFC: The critical link to the Internet of Things

**Home automation**
Tap your phone to adjust settings, or for commissioning.

**NFC Accessories**
Tap your phone to configure or retrieve personal data.

**Smart media**
Tap your phone for further information.

**Consumer Electronics**
Tap your phone to stream media, or to set the programming.

**Smart Meters**
Tap your phone to read out consumption data.

**Tagged products**
Tap your phone to get information on the object.
Why NFC?

Plenty of connectable products
3 trillion products per year waiting to be connected

NFC in your smartphone
1.1 billion NFC handsets in market globally

Smartphone availability
2.6 billion smartphone users globally

Connected consumers
Smartphones increasingly important in shoppers’ lives

Worldwide connectivity
95% of the World’s population covered by mobile networks

NFC technology uniqueness
NFC offers distinct advantages over other technologies
Smartphone NFC connectivity becoming ubiquitous

- Global smartphone sales of 1.5 billion units in 2013
  - Just 18.2% with NFC
- NFC-enabled mobile phone installed base more than 8 times higher in 2018 than in 2013
- 2 in 3 mobile phones to come with NFC by 2018
- “The majority of smartphone makers are adopting the NFC wireless communications and payment technology in their products as a de facto standard” *IHS*

Source: ABI 2014

![World NFC-enabled handsets installed base (in millions of handsets)](chart)
NFC Technology
Read/Write mode

Card Emulation

Peer to Peer

Read/Write
Reads / Writes data from any tag or contactless card
The ultimate in consumer experience: Just tap!

**Convenient:** Just tap - no app required

**Fast:** Fast one-tap data transfer

**User-controlled:** Pull approach

**Secure:** Short range point-to-point communication, tag features such as originality checker

**Power saving:** Only one device powered to drive the interaction – “battery-less tag”
NXP provides end-to-end solutions for NFC applications

Contactless readers
- MFRC630
- MFRC631
- CLRC663
- PN512

Mobile NFC controllers
- PR533
- PN533
- PR601
- PN7120

Smart tags and cards
- ntag
- ICODE
- MIFARE
- SmartMX
- NFC
- NFC
NFC TAGGED PRODUCTS
NFC tagged products
What they are

► Regular product with an NFC tag on it
► Each tag contains an ID that uniquely identifies the product
► By just tapping with one’s NFC phone, the user can interact with the tag
  ▪ He can get additional information about the product
  ▪ He can get customized information from the cloud
  ▪ E.g., get vouchers, verify authenticity, redeem loyalty points…
► The retailer/brand owner can track these interactions in real-time by a cloud service to generate valuable data and insights
► Depending on the application, the tag can be overt or covertly embedded; it can also be on-pack, on-case, on-shelf…
How they work

NFC tags

► Usually ISO/IEC 14443 (proximity) or ISO/IEC 15693 (vicinity) compliant
► Usually NFC Forum compliant
► Composed of
  ▪ Chip
    ❖ Characterized by a unique ID
    ❖ Contains information stored in a standard way, according to NFC Forum
      - May also contain other proprietary information
    ❖ E.g., NXP NTAG family
  ▪ Antenna
    ❖ Allows the chip to communicate with NFC devices through wireless communication
  ▪ Packaging
    ❖ E.g., a sticker containing the chip and the antenna

Chip: Holds information about the physical object to which the tag is attached

Antenna: Receiving energy (radio waves) and data from the reader (e.g.: handheld, professional reader) and transmits information back

Packaging: Encases the chip and antenna so that the tag can be attached to physical object.
How they work
Tag-phone interaction

- Most usual data elements stored in the NFC tag:

**URL**

- The NFC tag contains a URL leading to a cloud-based content platform (CMS)
- This URL may be unique, based, e.g., on the UID of the tag
- All the information related to the product is available in the cloud and can be easily managed and updated

**APP**

- The NFC tag contains the identifier of a certain app
- E.g., in Android:
  - If the app is installed, it launches it
  - If it is not, it launches Google Play to download it
- Advantage: enables a higher control over the handset
- Disadvantage: Dependent on the operating system
The NXP NTAG

2nd generation NTAG enables mass-market NFC applications

NTAG21x paves the way to mass-market applications in retail, brand engagement and brand authentication. In addition to increasing radio sensitivity even further, the NTAG family delivers additional memory options and a number of new key features, including UID mirror, originality signature, and password protection.

Key features

- Passive, NFC Forum type 2 tag
- Unique 7-byte serial number
- Read-only locking function
- Password authentication
- Originality signature
- UID mirror
How they work
Usual system architecture

The tag has a unique identifier

UID: 04E141118C

www.brand.com/04E141118C

The product is uniquely identified in the cloud

All product digital information tied to this ID

04E141118C:
San Francisco
8:00 warranty

By tapping the tag, the phone interacts with the cloud

Directs the phone to specific content

Captures information about each interaction

Your bag:
5 likes
How they work
Usual system architecture

NFC connectivity together with a unique tag ID and cloud service enables this whole system.

Both environment and custom variables can be used for content triggers.

Each product interaction can be captured in real time and generate valuable data (analytics).

The UID mirroring functionality from the NXP NTAG enables automatic unique cloud address, e.g., www.brand.com/04E141118C.
Cloud NFC – making products smart

Every object uniquely identified in the cloud

Contextual information allows customized experiences

NFC and cloud make products smart and trackable
Typical application: brand engagement

- Deeper **brand engagement** between a brand and its consumers/prospects is a **key objective** for brand owners.

- Nowadays, in purchase decisions, brand name and advertising still matter, but what matters even more are things such as people’s **experiences** with a product and **social media**, which are becoming the **key elements** (Ipsos).

- **NFC tagging** is a great opportunity for brand owners to **address** these **new trends**:
  - Through a **one-to-one relationship** with the consumer, it allows brand owners to be more **customer-oriented**.
  - At the **point of purchase**, it provides potential customers with **useful information**.
  - At the **point of usage**, it allows brand owners to offer **enhanced services** and **loyalty programs**.

- **Data** can be captured about each transaction – this becomes a **valuable source of insight into consumer behavior**.
Typical application: brand engagement
Possibilities at the point of purchase

- Discover product information
- Check product ratings/reviews
- Verify product authenticity
- Find offers
- Find complementary items
- Special offer
- Receive customized information
- Location-based services
- Add to the shopping cart
- Check other colors/sizes in-stock

Some of them, e.g., authenticity checking or product tracing, also relevant in the B2B supply chain.
Typical application: brand engagement
Possibilities post-purchase/at point of usage

- Download user guide
- Personalized services
- Rate product
- VIP event access
- Troubleshooting
- Loyalty program enrollment
- View warranties
- Re-order authentic parts
- Connect with social media
- Register product under own name
- Also permits accessory configuration, e.g., electronic tooth or skin brush
Typical application: brand protection

The rising cost of counterfeiting

- By 2013 global financial losses from counterfeiting and piracy had soared to $1 trillion - forecast to jump to $2.3 trillion by 2018
  - Global counterfeiting growing at 15.6% p.a. 2013-2018
  - The global solutions market is running at only 0.52% of financial losses from product crime
- Counterfeits are big brand value detractors:
  - Direct financial costs: lower revenues, eroded market share, stolen know-how, fraudulent returns ...
  - Brand image at risk: less value seen in authentic products vs look-alikes, injured brand reputation as customers are let down by low-quality counterfeits; suffering relationships with distribution partners ...

### Percentage of counterfeits in total market

<table>
<thead>
<tr>
<th>Percentage</th>
<th>Category</th>
</tr>
</thead>
<tbody>
<tr>
<td>10%</td>
<td>Luxury beauty</td>
</tr>
<tr>
<td>10%</td>
<td>Luxury apparel</td>
</tr>
<tr>
<td>12%</td>
<td>Spirits</td>
</tr>
<tr>
<td>20% / 15%</td>
<td>Fragrances / color cosmetics (mass)</td>
</tr>
<tr>
<td>20%</td>
<td>Sports apparel &amp; footwear</td>
</tr>
<tr>
<td>30%</td>
<td>Sunglasses</td>
</tr>
</tbody>
</table>
Typical application: brand protection
NFC as the next step in brand protection

- **Brand authentication**: Brands can empower their customers to know they are buying an authentic product, anywhere at any time.

- **Anti-counterfeiting**: Shoppers can now become partners in the battle against counterfeits.

- **Data capture & channel control**: Data can be captured through a cloud-based platform and location-based service: location of tap, distribution channel, time of product authentication etc.

NFC gives each product its own unique identity - and forms the base to which all other information is tied.
Typical application: brand protection
NFC allows brand authentication and traceability

- A brand authentication app – such as the NXP Auth Checker – functions in conjunction with an NFC tag carried on the product

- Authentication can be configured to work standalone (via phone app), or with a cloud-based service

- For added levels of assurance, secure NXP cryptography can be integrated into the tag
Typical application: brand protection

NXP Auth Checker

- Standards based private / public key cryptography
- The user’s smartphone becomes an authentication terminal, running a verification app
- A digital signature is stored in the NFC tag
- A public key is used to authenticate information in the tag
- Enables detection of unauthorized tags (and hence a first alert on unauthorized products they're attached to)
- + Can be combined with an online ID check to further raise the level of protection

NXP Authentication app available
Some real use cases
Aki Choklat bags

► Aki Choklat’s bags are equipped with NFC tags that work with an app and a cloud-based service

► By tapping, consumers can verify authenticity, displaying when and where the bags were made

► The app also works with GPS data, creating a digital diary that logs the bag’s whereabouts, complete with updates to social media

► GPS can also be used to trace the bag if it’s ever lost or stolen
Some real use cases

Duclot wines

- Users can tap their mobile phone against Duclot’s NFC-tagged Bordeaux collection cases to verify their authenticity via a cloud-based solution.

- It also offers integrated traceability all the way from the wineries to the point of sale.

- Consumers can gain access to extra information, such as cellar location, serving tips etc.
Some real use cases

Adidas shoes

► Adidas featured NFC embedded shoe laces (2013)

► Customers tapped in-store for product info, reviews and social feeds

► Sales associates tapped upon purchase, linking to inventory and CRM systems

► At home, customers tapped to register the shoe under their names, when linking to the myCoach running app

► Reference: http://www.nfcworld.com/2013/06/19/324726/adidas-adds-nfc-to-running-shoes/
Some real use cases

Pepsi at PoS

► US shoppers could tap NFC tagged plastic bottles to access Pepsi promotional information (2014)

► They linked to a URL with a ‘What’s your flavor?’ choice menu to access product info and coupons. They also had a chance to win a $5 coupon for National Hockey League tournament tickets

► They were invited to share e-mail details, providing Pepsi with the option to re-contact them again

► Result - Sales increased about 2 percent, and 48% clicked through to Pepsi media

# NFC vs QR vs BLE vs Web Browser

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

- NFC: Near Field Communication
- QR code: Quick Response Code
- BLE: Bluetooth Low Energy
- Web browser: Web-based solution
NFC is the preferred technology for retail applications

- 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 where highlighted: speed, convenience and control
NXP SOLUTIONS
NXP Solutions

Reading range

The ICODE product family offers vicinity reading distances and compliance with NFC phones.

NXP offers different NFC tagging technologies so that you can find the right product for your application.

The ICODE read range can be very useful in the B2B supply chain.

NTAG 21x IC product family, designed for consumer product tagging and smart retail applications.

The MIFARE product family offers embedded cryptography for high security applications.

Security
NXP NTAG as the solution for NFC consumer product tagging

**Unique identifier for each product**
- Unique 7-byte serial number
- UID ASCII mirror, e.g., www.brand.com/04E141118C

**Compliant with standards**
- Fully ISO/IEC 14443A 2-3 compliant
- Fully NFC Forum Type 2 Tag compliant

**Security features**
- Read-only lock function
- 32-bit password protection
- ECC based originality signature

**Different memory sizes for different needs**
- From 48 to 888 bytes

**Other special unique features**
- 24-bit NFC counter + mirror
- FAST_READ command
- GET_VERSION command
The NTAG family

NTAG Smart products, smart retail….
# NTAG 21x family features

<table>
<thead>
<tr>
<th>Feature</th>
<th>210</th>
<th>212</th>
<th>213</th>
<th>215</th>
<th>216</th>
</tr>
</thead>
<tbody>
<tr>
<td>Memory</td>
<td>48 bytes</td>
<td>128 bytes</td>
<td>144 bytes</td>
<td>504 bytes</td>
<td>888 bytes</td>
</tr>
<tr>
<td>Input capacitance</td>
<td>17 pF</td>
<td>17 pF</td>
<td>50 pF</td>
<td>50 pF</td>
<td>50 pF</td>
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<tr>
<td>UID mirror</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
</tr>
<tr>
<td>Originality signature</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
</tr>
<tr>
<td>Password protection</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
</tr>
<tr>
<td>Fast read</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
</tr>
<tr>
<td>NFC counter</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
</tr>
<tr>
<td>NFC counter mirror</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
</tr>
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</table>
Leveraging the NXP NFC portfolio for advanced security / reading range needs

<table>
<thead>
<tr>
<th></th>
<th>21x</th>
<th>Ultralight C</th>
<th>DESFire EV1</th>
<th>SLIX</th>
<th>SLIX2</th>
</tr>
</thead>
<tbody>
<tr>
<td>Frequency</td>
<td>13.56 MHz</td>
<td>13.56 MHz</td>
<td>13.56 MHz</td>
<td>13.56 MHz</td>
<td></td>
</tr>
<tr>
<td>Reading range</td>
<td>4-5 cm (proximity)</td>
<td>4-5 cm (proximity)</td>
<td></td>
<td>Up to 1.5 m (vicinity)</td>
<td></td>
</tr>
<tr>
<td>Bit rate</td>
<td>106 kbps</td>
<td>106 kbps</td>
<td>106 – 848 kbps</td>
<td>Up to 53 kbps</td>
<td></td>
</tr>
<tr>
<td>User memory</td>
<td>48 – 888 Bytes</td>
<td>144 Bytes</td>
<td>2k, 4k, 8k Bytes</td>
<td>112 Bytes</td>
<td></td>
</tr>
<tr>
<td>NFC compatibility</td>
<td>Yes (NFC tag type 2)</td>
<td>Yes (NFC tag type 2)</td>
<td>Yes (NFC tag type 4)</td>
<td>Pending (NFC tag type 5)</td>
<td></td>
</tr>
<tr>
<td>Security</td>
<td>Password protection, originality signature</td>
<td>Embedded crypto (TDES)</td>
<td>Embedded crypto (TDES/AES), tamper resistance, CC certification</td>
<td>- Password protection, originality signature</td>
<td></td>
</tr>
<tr>
<td>Typical applications</td>
<td>Authentication, consumer interaction…</td>
<td>Authentication, high-value asset tagging…</td>
<td>High-value asset tagging, loyalty credit, micropayment…</td>
<td>Authentication, supply chain logistics, consumer interaction…</td>
<td></td>
</tr>
</tbody>
</table>

Typical applications: Authentication, consumer interaction, high-value asset tagging, supply chain logistics, consumer interaction.
NXP is the right choice

- NXP is the **best choice** when talking about NFC-related ICs
  - Offers the best **performance** at a competitive price
- NXP is the global **#1** NFC chip **supplier** in the identification, tags and mobile industries
- NXP is the **co-inventor of NFC** and **founding member of NFC Forum**
- NXP **NTAG** offers plenty of special **features** for consumer product tagging
  - E.g., read/write, UID mirror, password protection, signature, counter…
- NXP offers other smart NFC chip solutions for enhanced security (MIFARE) and reading range (ICODE) needs
- NXP considers **silicon** as the best present-day technology for electronics
  - NXP silicon tags outperform tags from other technologies, e.g., printed electronics
  - Silicon is the proven cost-efficient solution for mass production
Wrap up

► The **Internet of everyday Things** is THE mega-trend, with 3 trillion products sold per year waiting to be connected

► **NFC technology** is the key enabler for the Internet of Things
  - Each object contains an NFC tag
  - The tag has an ID that uniquely identifies the object and is linkable to a cloud address and object

► **NFC together with phone connectivity** enables a whole new scenario where every object has its digital identity
  - This gives the consumer the opportunity to interact in complete new ways with the product
  - It also gives the opportunity to the retailer/brand owner to gather real-time data about the consumer-product interactions

► **Brand engagement** and **brand authentication** are examples of applications where NFC tagging can be the right solution

► In this scenario, NXP offers the **NTAG** family products, which offer several unique features. It also offers MIFARE for advanced security, ICODE for vicinity reading range needs
Further material

**Articles**

► It’s personal: deeper brand relationships with NFC and cloud – Part 1

► It’s personal: deeper brand relationships with NFC and cloud – Part 2

► 10 creative uses for Near Field Communication… Smartly connecting everything
http://blog.nxp.com/10-creative-uses-for-near-field-communicationsmartly-connecting-everything-part-one/

► The digitally enhanced shopper journey: NFC and BLE

**Videos**

► NFC connects everyday products to the Internet of Things
https://www.youtube.com/watch?v=cFU-6UkGLw8

► The power of NFC connectivity for brands and retail
https://www.youtube.com/watch?v=gCZfdckjk4

**NXP solutions**

► NTAG 21x leaflet

► NTAG 21x website

**Other references**

► RFID/NFC for brand protection brochure

► NFC Everywhere
http://www.nxp.com/techzones/nfc-zone/overview.html
We are a global competence team of hardware and software technical experts in all areas related to contactless technologies and applications.

Our services include:
- Application and system Design Engineering support
- Project Management
- Technological Consulting
- Advanced Technical Training services

We address all the exploding identification technologies that include NFC, secure micro-controllers for smart cards and mobile applications, reader ICs, smart tags and labels, MIFARE family and authentication devices.
Thank you for your kind attention!

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► Please check NXP and MobileKnowledge websites for upcoming webinars and training sessions

www.themobileknowledge.com/content/knowledge-catalog-0