NFC

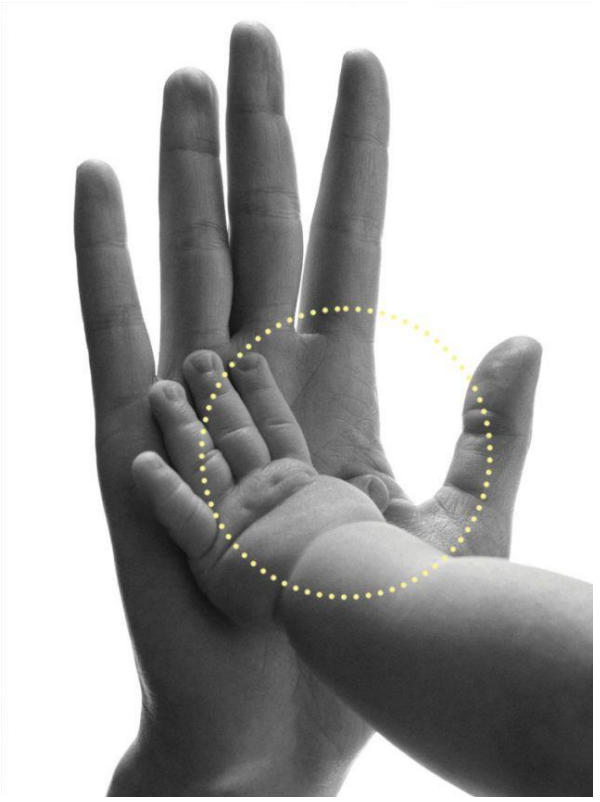
nRF52 Global Tech Tour

About these slides

- Bluetooth LE pairing options
- How NFC works
- Hardware and software for NFC in nRF52
- Demo

Options for Bluetooth Smart pairing

- Passkey entry
  - Moderate security and complex
- Just works
  - Moderate easiness and not so secure
- OOB pairing (Out-of-Band pairing)
  - Simple and secure



Touch to pair

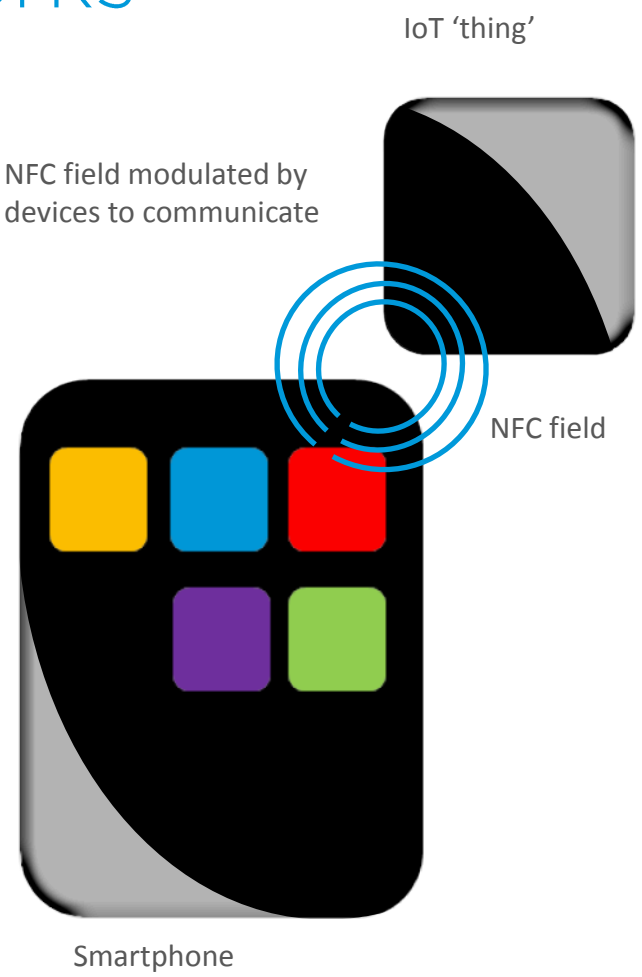
NFC pairing, simple & secure

The best pairing option for most IoT products:

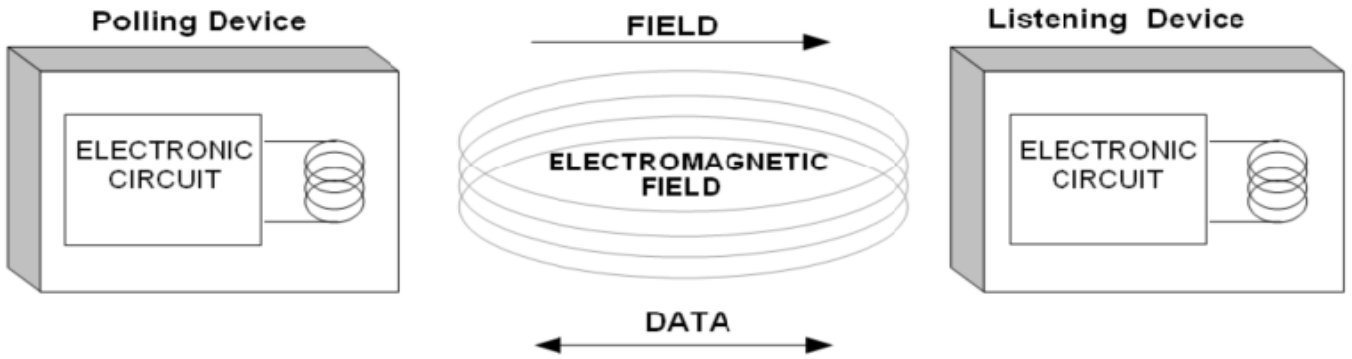
- Intuititive – touch to pair
- Secure due to proximity demands
- No requirement for UI features on product
- Simpler than normal Bluetooth pairing

Reading a tag – how it works

- NFC operates @ 13.56MHz (ISM band)
- Smartphone generates NFC field
- NFC tag detects field in close proximity
- Communication takes place by modulating the NFC field



NFC modes



Mode	Polling Device	Listening Device
Read/Write Mode	**NFC Forum Device**	**Tag e.g. nRF52 NFCT**
Peer Mode	**NFC Forum Device**	**NFC Forum Device**
Card Emulation Mode	**NFC Forum Device**	**NFC Forum Device emulating a Tag**

Figure: NFC-Forum Analog specification 1.0

Bluetooth pairing using NFC – a standard solution

- Connection Handover: NFC Forum standard describes a general method to activate another wireless protocol.
- In addition: Intended use for Bluetooth defined by Bluetooth SIG and NFC Forum.

NFC Forum terminology

- NFC Forum uses the term Out-of-Band in a different way than the Bluetooth standard
- Following two options are called Out-of-Band pairing in the NFC Forum terminology:
  - Bluetooth Just Works pairing using NFC
  - Bluetooth OOB pairing using NFC

Bluetooth pairing using NFC – how it works

Handover Requestor

Handover Selector

Read NFC Forum Tag

NDEF with Handover Select record

nRF52

BLE OOB pairing

Data exchange on BLE

NFCT (nRF52 peripheral) – key features

- Based on NFC Forum specification
- NFC-A Listen mode compliant
  - Date rate 106 kbps
  - Can only be a target (a tag), cannot be an initiator – it means it is able to expose information but is NOT able to read information from or write information into another tag.
- System Wake-On-Field function
- Configurable Easy DMA channel to RAM
- Hardware supported NFC features
  - Automatic Collision resolution algorithm
  - Configurable frame assembler/disassembler including CRC and parity calculation
  - Timing

NFC
NEAR FEILD COMMUNICATION

NFCT – modes of operation

DISABLE:

- Everything is off

SENSE:

- System Off or System On
- Detects if there is a field present
- Adds 100nA current consumption

ACTIVATED:

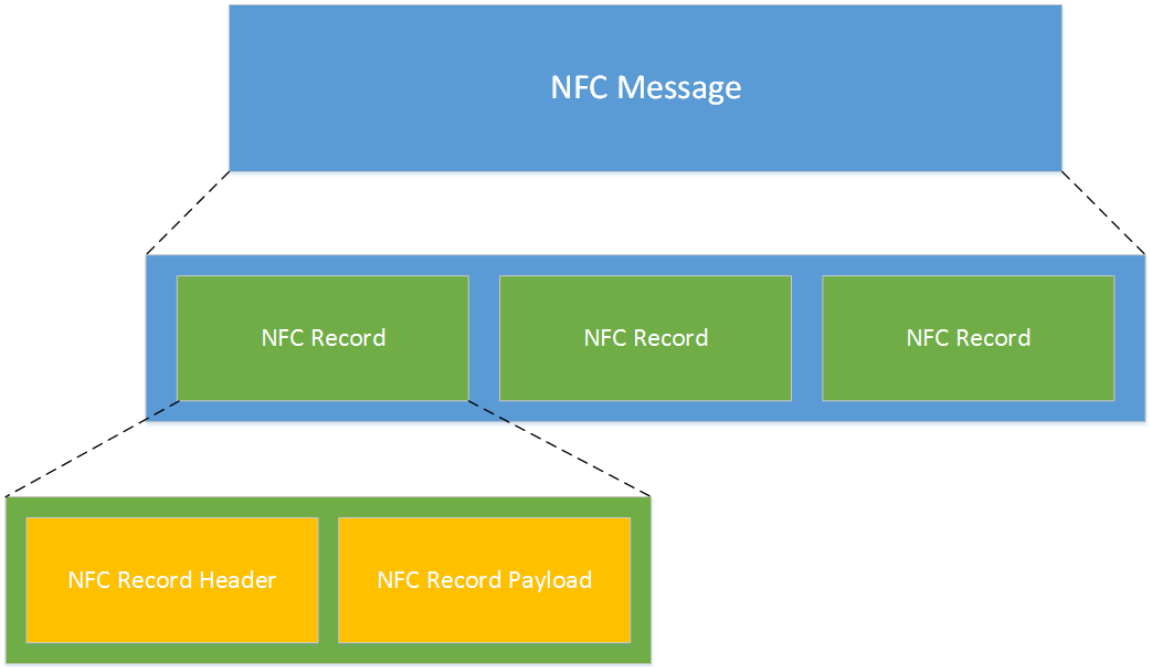
- Can receive and transmit frames
- Typically adds ~400 uA current consumption

SW for nRF52 NFCT

- The NFC-A library supports Type 2 Tag as a driver included in the SDK
  - Not a SoftDevice
- Present NFC-A library supports Read-Only state which is what is needed for Out-of-Band Pairing and most other functionalities.
  - Precompiled
- Layers and examples on top of the NFC library:
  - NFC NDEF message format
  - Connection Handover record
  - Application launch record
  - URI record

NFC NDEF

- The 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.
- Generic NDFEF generator implementation available in SDK 0.9.2



NFC use cases(1) – Waking up a device

- Many IoT products do not have keypads or buttons
- nRF52 NFCT Wake-On-Field function adds only 100 nA and allows to wake up a device from System Off.

NFC use cases(2) – opening webpage, guide, manual etc.

- Reading a tag launches a default web browser with provided URI
- This scenario is standardized by the NFC Forum and natively supported by OSes providers (no additional application needed on mobile side)
- URI Example is a part of the experimental nRF52 SDK release 0.9.2

- Demo…

NFC use cases(3) – Launching an application

- Reading a tag launches already installed app or downloads new app from the store if the user doesn't already have the app installed
- This scenario isn't standardized by the NFC Forum, but is standaralized and natively supported by OSes providers (no additional application needed on the mobile side)
- App launch example for windows and android is a part of the experimental nRF52 SDK release 0.9.2

- Demo…

BLE pairing over NFC – mobiles support

- Android:
  - Most current Android phones & tablets have NFC HW
  - Supports only Just Works over NFC.
- Windows:
  - Windows Phone (smartphones) supports only Just Works over NFC.
  - Windows 8.1/10 (laptops and tablets) and Windows RT (tablets) are the only OSes right now that support OOB pairing over NFC.
- iOS:
  - iPhone 6, latest iPad Air, iPad Mini & Apple Watch have NFC HW
  - Does not support Reader/Writer mode at all.