#### **NFC PAIRING FOR AUDIO DEVICES**

#### WEBINAR SERIES: HOW TO BUILD NFC APPLICATIONS

JORDI JOFRE NFC READERS NFC EVERYWHERE 23/05/2017





SECURE CONNECTIONS FOR A SMARTER WORLD



#### Agenda

- NFC solution for easy Bluetooth and WiFi pairing.
- Multi-audio wireless speaker demo:
  - -Hardware details.
  - Software architecture and application logic.
  - Software integration details.
  - Available resources.
- Wrap up & Q&A



# Use case: Bluetooth & WiFi pairing with NFC



#### Many use cases for Bluetooth & WiFi pairing with NFC



View images and videos on a large screen with a tap of your mobile device to the set-top b ox



Allow friends to tap your NFCenabled gateway to establish a WiFi connection





Tap your phone to the camera to transfer pictures quickly over the camera's own WiFi



Use NFC to pair your phone to your new wearable device



Pair with Bluetooth speakers or headphones with just a tap



Multi-audio systems that share music between two headphones or speakers Multi-audio wireless speaker demo presented today

#### NFC pairing offers benefits for both consumers & manufacturers

#### — For consumers

- Faster, simpler connections no need for BT/WiFi sub-menus or searching through lists to find devices
- No conflicts pair only the devices you want to pair
- Secure exchanges share credentials securely with just a tap
- Easier disconnects tap twice to unpair
- Save power use NFC to enable / disable sleep mode from a battery-driven BT/WiFi device

#### For manufacturers

- Add value NFC is an easy upgrade to existing products
- Simplify interactions devices are easier to use
- Reduce support cost fewer requests for tech help
- Eliminate cables support the trend toward wireless peripherals.









#### Pair Bluetooth headphones with just a tap



NFC is the faster, simpler way to connect wireless devices, without creating conflicts.

Just tap your mobile phone to establish a secure, two-way connection. No menus, no waiting

\* For the scenario where pairing is only performed to an NFC phone, NTAG213 or NTAG I<sup>2</sup>C plus solution would be sufficient





### Share music by pairing two headphones



If all speakers are equipped with an NFC chip, you simply tap one speaker to another to establish the connection.





#### Easy disconnect – tap twice to unpair



Easier disconnect. Instant identification of the device to unpair. No probability of error





#### NXP multi-audio wireless speaker demo





prototype presented today





# Hardware details Multi-audio wireless speaker demo



#### Hardware architecture - Multi-audio wireless speaker demo





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#### Application circuit for Bluetooth power on by NFC triggering







#### **PN71xx family of NFC controllers**



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#### Plug-and-play solutions equipped with:

- Full NFC Forum-compliant
- Microcontroller core with integrated firmware
- Accompanied by Linux, Android, WinIoT drivers and several software examples
- NCI host interface
- Integrated power management unit allowing direct supply from a battery
- Industry-standard form factor packages

More info about PN71xx solutions: <u>http://www.nxp.com/products/identification-and-security/nfc-and-reader-ics/nfc-controller-</u> solutions/high-performance-nfc-controller-supporting-all-nfc-forum-modes-with-integrated-firmware-and-nci-interface:PN7150B0HN



## **PN71xx family positioning**



- NFC Forum Type 3 card emulation
- Lower PCB manufacturing cost
- Active load modulation

#### HVQFN40



- Requires less PCB space
- Works with 4-layers PCB



More info about PN71xx solutions: <u>http://www.nxp.com/products/identification-and-security/nfc-and-reader-ics/nfc-controller-solutions/high-performance-nfc-controller-supporting-all-nfc-forum-modes-with-integrated-firmware-and-nci-interface:PN7150B0HN</u>





PN7150

## **PN71xx NFC controller single board computer (SBC) kits**



#### PN71xx demokits cover integration with **Raspberry Pi**, **BeagleBone Black** and any board with **Arduino-compatible header**

More info about PN71xx demokits & ordering details: <u>http://www.nxp.com/products/identification-and-security/nfc-and-reader-ics/nfc-controller-solutions/development-kits-for-pn7150-plugn-play-nfc-controller:OM5578</u>





### **PN71xx** pinning adaptation to any platform





TB2	PN7150 signal
#1	VBAT / VDD (PAD): 3.3V supply voltage
#2	VANT: 5V optional supply voltage
#3	Not connected
#4	GND: ground
#5	IRQ: interrupt request output
#6	VEN: reset pin
#7	Not connected
#8	Not connected

TB3	PN7150 signal
#1	I2CSDA: I2C-bus serial data
#2	I2CSCL: I2C-bus serial clock input
#3	Not connected
#4	Not connected
#5	Not connected
#6	Not connected
#7	Not connected
#8	Not connected





# **SW architecture & application logic** Multi-audio wireless speaker demo



#### Block diagram - Multi-audio wireless speaker demo



## NFC Controller Interface (NCI) specification details



controller and the host device.

18 Training Mobile . Knowledg



The principle used to combine the various modes of operation (i.e. R/W, CE, P2P) is to build a cyclic activity which will sequentially activate various modes of operation

This loop alternates listening phase (NFC controller behaves as card or target) and polling phase (NFC controller behaves as a reader/writer or an initiator).

The RF technologies and modes to be polled and listened to can be configured within the discovery loop

### **Demo NCI RF configuration**

The wireless speaker demo is configured to:

- 1. During the polling phase, it polls for NFC-A cards or P2P remote devices.
- 2. If no card or target P2P device is detected, enter in Listen phase.
- 3. If no P2P initiator or NFC-A reader is detected, switch back to polling phase after a programmable timeout.



In our demo, the remote device/tag is the other wireless speaker when they are tapped together. The communication between the two speakers will change depending in the polling loop interval they are when they are tapped together.



#### Block diagram - Multi-audio wireless speaker demo



## NFC pairing application is based on NFC Forum specs



#### NFC pairing: Static handover

speakers is currently polling

NFC-A technology



is currently showing an NDEF message in a T4T emulated tag.





## Simplified tag format for a single BT carrier



\*More info Bluetooth Secure Simple Pairing Using NFC: http://members.nfc-forum.org/apps/group\_public/download.php/18688/NFCForum-AD-BTSSP\_1\_1.pdf





### NFC pairing: Negotiated handover



Discovery loop in one of the speakers is currently polling NFC-ACM technology (P2P initiator)

Discovery loop in the other speaker is currently listening for NFC-ACM (P2P target)





#### **Negotiated handover: Handover Request & Select messages**



\*More info Bluetooth Secure Simple Pairing Using NFC: http://members.nfc-forum.org/apps/group\_public/download.php/18688/NFCForum-AD-BTSSP\_1\_1.pdf





# Software integration Multi-audio wireless speaker demo



#### Block diagram - Multi-audio wireless speaker demo



### PN71xx software drivers for SW integration into any platform



PN5xx I2C Driver

NXP NCI NFC Controller

Linux NFC architecture Linux integration is offered through NXP's Linux libnfcnci SW stack





Android NFC architecture Android integration is offered through the Android AOSP SW stack for which NXP delivers dedicated patches.



Windows NFC architecture Windows integration is offered through Microsoft Windows universal NFC device driver model,

> Multi-audio wireless speaker demo is based on this SW stack



#### Detail on PN71xx software driver for RTOS/NullOS integration



Application

NXP-NCI module offers high level NFC API for connection and configuration of the NFC controller:

- Start of the NFC discovery
- Wait for NFC discovery

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Process the NFC discovery

TML module brings HW abstraction to NFC library (abstract how the connection to NFC controller IC is managed).

N	IXP-NCI NullOS	<b>5 / RTOS library</b> ibrary	
	NXP NCI	NDEF library	
	Transport Mapp	ing Layer (TML)	

\* Including Kinetis, and LPCXpresso platforms

NDEF library module is composed of independent sub-modules:

- RW\_NDEF implements NDEF extraction from NFC Forum tags (all 4 NFC Forum defined tag types)
- P2P\_NDEF implements NDEF data exchange with P2P device (over NFC Forum LLCP and SNEP protocols)
- T4T\_NDEF\_emu implements NDEF message exposure through card emulation (NFC Forum Type 4 Tag protocol)







#### Source code example description

#### **NdefLibrary**

Implements dedicated API for the NDEF handling for

- Reader/Writer mode f( T1T, T2T, T3T and T4T)
- Card emulation mode (T4T emulation)
- P2P mode (Initiator and target)

#### **NXP-NCI** lib functions

NxpNciConnect(...); NxpNci\_ConfigureSettings(...); NxpNci\_ConfigureMode(...); NxpNci\_CheckDevPres(...); NxpNci\_HostTransceive(...); NxpNci\_WaitForReception(...) NxpNci\_WaitForDiscoveryNotification(...) NxpNci\_StartDiscovery(...)

#### **TML** library

Implements the low level hardware abstraction for the physical connection with PN71xx over I2C

Source code download <u>here</u>

Available for Kinetis, and LPCXpresso platforms



/NXP-NCI\_LPC11Uxx\_example/Application/nfc\_task.h

#### Multi-audio wireless speaker application workflow



## EVERYTHING YOU NEED TO BUILD YOUR NFC PAIRING FOR AUDIO DEVICES SOLUTION IS HERE!





#### Summary of available resources

- PN71xx NFC controllers with embedded firmware solutions <u>http://www.nxp.com/products/:PN7150B0HN</u> <u>http://www.nxp.com/products/:PN7120</u>
- PN71xx demokits
   <u>http://www.nxp.com/products/:OM5577</u>

  <u>http://www.nxp.com/products/:OM5578</u>
- Reference source code

https://www.nxp.com/webapp/Download?colCode= SW3241&appType=license&Parent\_nodeld=14648 44405019729073788&Parent\_pageType=product





Software development in Android and iOS Embedded software for MCUs JCOP, Java Card operating Systems Hardware design and development Digital, analog, sensor acquisition, power management Wireless communications WiFi, ZigBee, Bluetooth, BLE Contactless antenna RF design, evaluation and testing

**MIFARE® product-based** applications End-to-end systems, readers and card-related designs **EMVco** applications Readers, cards, design for test compliancy (including PCI) Secure Element management GlobalPlatform compliant backend solutions Secure services provisioning OTA, TSM services



We help companies leverage the mobile and contactless revolution



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#### NFC pairing for audio devices

Jordi Jofre (Speaker) Angela Gemio (Host)

#### Thank you for your kind attention!

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