AN11690

NXP-NCI Android Porting Guidelines

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Application note
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Document information

Info	Content
Keywords	Android, NFC, NXP, NCI
Abstract	This notes describes how to add support for a NXP NCI based NFC Controller to an Android system

Revision history

Rev	Date	Description
1.0	20150602	First release

Contact information

For more information, please visit: http://www.nxp.com

1. Introduction

This document provides guidelines for the integration of NXP NCI based NFC Controller to an Android platform from software perspective.

It first explains how install the required kernel driver, then it describes step by step how to adapt the Android Open Source Project sources from the NXP-NCI Android NFC package delivery. Fig 1 shows the architecture of the Android NFC stack.

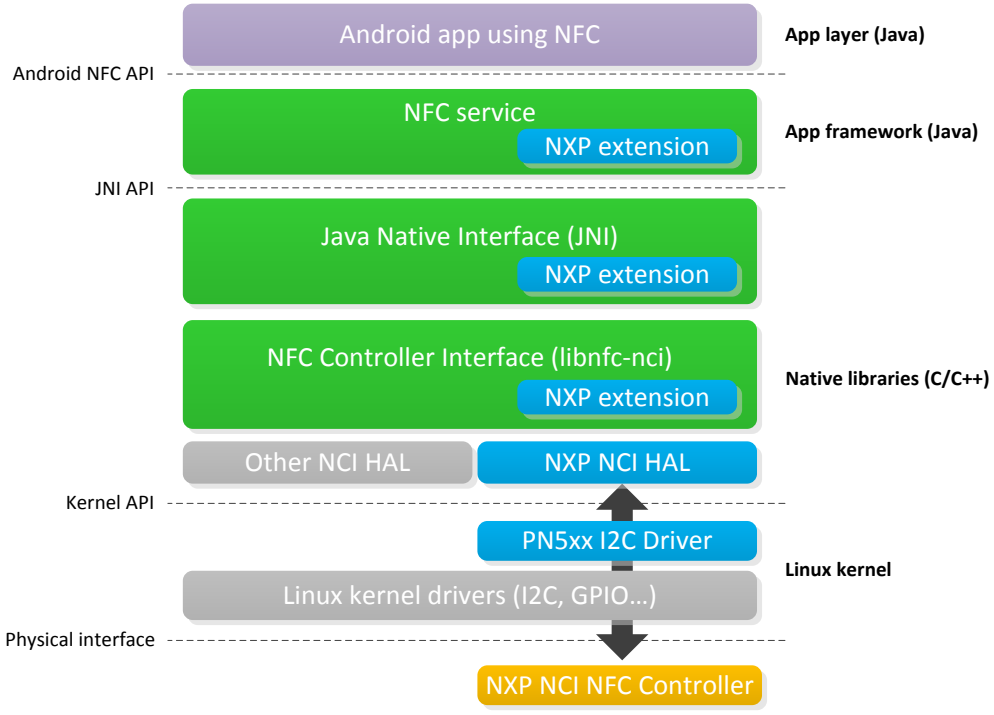

Fig 1. Android NFC stack overview

- The pn5xx_I2c driver is the kernel module allowing to access NXP NCI based NFC Controller hardware resource.
- The NXP NCI HAL module is the implementation of NXP NFC Controller specific Hardware Abstraction Layer.
- The libnfc-nci is the native library providing NFC functionality for which extension is added to support NXP proprietary features (e.g. MIFARE classic support).
- The JNI is a glue code between Java and Native classes. Extension exposes related additional interface.
- The NFC service is the application framework module providing access to NFC functionality. Extension is delivered to support NXP proprietary features.

2. Kernel driver

The NXP-NCI Android stack uses PN5xx I2C kernel mode driver to communicate with the NXP NCI NFC Controller. It is available from the following repository: www.nxp.com/redirect/github.com/NXPNFCLinux/linux_libnfc-nci

2.1 Driver details

The PN5xx I2C driver offers communication to the NFC Controller connected over I2C physical interface. This is insure through the device node named */dev/pn544*. This driver is compatible with a large range of NXP's NFC Controllers (e.g. PN544).

2.2 Installation instructions

The following instructions assume the driver being installed under the *drivers/misc* kernel source sub-folder. Below instructions may have to be adapted accordingly in case another path is chosen for the driver installation.

2.2.1 Getting the driver

Clone the nxp-pn5xx repository into the kernel directory:

```
$ cd drivers/misc
$ git clone https://github.com/NXPNFCLinux/nxp-pn5xx.git
```

This will create the sub-folder *nxp-pn5xx* containing the following files:

- *pn5xx_i2c.c*: driver implementation
- *pn5xx_i2c.h*: driver interface definition
- *README.md*: repository comments
- *Makefile*: driver related makefile
- *Kconfig*: driver related config file
- *LICENSE*: driver licensing terms
- *sample_devicetree.txt*: example of device tree definition

2.2.2 Including the driver to the kernel

Include the driver to the compilation by adding below line to the heading makefile (*drivers/misc/Makefile*).

```
obj-y          += nxp-pn5xx/
```

Include the driver config by adding below line to the heading configuration file (*drivers/misc/Kconfig*).

```
source "drivers/misc/nxp-pn5xx/Kconfig"
```

2.2.3 Creating the device node

Two methods are supported for the creation of the */dev/pn544* device node: device tree and platform data. Any of the two methods can be used, but of course the I2C address (0x28 in the below examples) and GPIO assignments must be adapted to the hardware integration in the platform.

2.2.3.1 Device tree

Below is an example of definition to be added to the platform device tree file (*.dts* file located for instance under *arch/arm/boot/dts* kernel sub-folder for ARM based platform).

```
&i2c{
   status = "okay";
   pn547: pn547@28 {
      compatible = "nxp,pn547";
      reg = <0x28>;
      clock-frequency = <400000>;
      interrupt-gpios = <&gpio2 17 0>;
      enable-gpios = <&gpio4 21 0>;
   };
};
```

2.2.3.2 Platform data

Below is an example of definition to be added to the platform definition file. The structure *pn544_i2c_platform_data* being defined in the driver interface header file, *pn5xx_i2c.h* must be included in the platform definition file, and *pn5xx_i2c.h* file must be copied to *include/linux* kernel source sub-folder.

```
static struct pn544_i2c_platform_data nfc_pdata = {
   .irq_gpio = GPIO_TO_PIN(1,29),
   .ven_gpio = GPIO_TO_PIN(0,30),
   .firm_gpio = GPIO_UNUSED
   .clkreq_gpio = GPIO_UNUSED
};

static struct i2c_board_info __initdata nfc_board_info[] = {
   {
      I2C_BOARD_INFO("pn547", 0x28),
      .platform_data = &nfc_pdata,
   },
};
```

Then the declared ***nfc_board_info*** structure must be added to the platform using dedicated procedure (platform specific).

2.2.4 Building the driver

Through *menuconfig* procedure include the driver to the build, as built-in (<*>) or modularizes features (<M>):

```
Device Drivers --->
     Misc devices --->
          < > NXP PN5XX based driver
```

If <M> option is selected, build the driver and install the generated *pn5xx_i2c.ko* module. Otherwise if built-in, build the complete kernel, the driver will be included in the kernel.

If the device tree method was used in previous step, build the platform related device tree and install generated .dtb file.

3. AOSP adaptation

Below step-by-step procedure is based on NXP-NCI Android NFC package delivered by NXP on the following repository:
www.nxp.com/redirect/github.com/NXPNFCLinux/android_nxp-nci

3.1 Step 1: getting the release package

Clone the related repository:

```
$ git clone https://github.com/NXPNFCLinux/android_nxp-nci.git
```

The following directory structure will be created:

```
├── aosp
│   └── bionic
│       └── ...
│   └── external
│       └── ...
│   └── frameworks
│       └── ...
│   └── hardware
│       └── ...
│   └── packages
│       └── ...
│   └── system
│       └── ...
│
├── conf
│   └── libnfc-brcm.conf
│   └── libnfc-nxp.conf
│
├── doc
│   └── AN11690 – NXP-NCI Android Porting Guidelines.pdf
│
└── README.txt
```

3.2 Step 2: merging files

Merge the files from the NXP-NCI Android NFC package (*aosp* sub-folder) into the target AOSP source directory.

3.3 Step 3: adding NFC to the build

In the *device.mk* makefile (e.g. *device/**brand**/**platform**/device.mk*)

- Add the NFC related packages to the android build

```
# NFC packages
PRODUCT_PACKAGES += \
            libnfc-nci \
            libnfc_nci_jni \
            nfc_nci_pn547.platform\
            NfcNci \
            Tag \
            com.android.nfc_extras
```

- Add xml files to Android launches the NFC functionalities:

```
PRODUCT_COPY_FILES += \

frameworks/native/data/etc/com.nxp.mifare.xml:system/etc/permissions/com
.nxp.mifare.xml \

frameworks/native/data/etc/com.android.nfc_extras.xml:system/etc/permiss
ions/com.android.nfc_extras.xml \

frameworks/native/data/etc/android.hardware.nfc.xml:system/etc/permissio
ns/android.hardware.nfc.xml \

frameworks/native/data/etc/android.hardware.nfc.hce.xml:system/etc/permi
ssions/android.hardware.nfc.hce.xml
```

3.4 Step 4: Changing device owner and permissions

On the *system/core/rootdir/init.rc* file, add the following lines to the end of the *on boot* section:

```
# NFC
setprop ro.nfc.port "I2C"
chmod 0660 /dev/pn544
chown nfc nfc /dev/pn544
```

3.5 Step 5: building and installing NFC

Build the android image and install the whole on the target (kernel, uRamDisk, system.img, userdata.img and cache.img).

Once the Android platform boots up, add the 2 configuration files related to the NFC controller used (included in the NXP-NCI Android NFC package, under *conf* sub-directory*).*

```
$ adb push libnfc-brcm.conf /etc/
$ adb push libnfc-nxp.conf /etc/
```

Then reboot the platform

3.6 Step 6: verifying NFC functionality

In “Settings” app check NFC is ON.

NFC functionality should be then up and running, ready to discover NFC tags or exchange data with remote NFC devices.

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