Open NFC (New Architecture) for Android - Test Plan

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History

Version	Date	Comments
0.1	April 17, 2012	Release

Summary of Contents

1 Introduction

This document describes the test plan to validate the Android CTS for the porting OpenNFC4.4.2 on ICS 4.0.4 as well as its NFC related test cases.
This work aims to test exposed Android API for NFC. The current CTS is to enable an NFC application to run well on a compatible NFC forum Android device, it should run well on any other device that is compatible with the same Android platform version.
The first part focuses on the Android CTS for NFC, the second part focuses on the NFC scenario testing cases, including the tests on NFC reading, writing, P2P as well as security stack.

2 Compatibility Test Suite (CTS)

The Compatibility Test Suite is provided with Android framework tools. CTS is a command mode tool to run a series of test cases in Android. Why does Inside Secure Android Team pass the Compatibility Test Suite? Mainly, in order to provide a consistent behavior from Google Android NFC APIs to application developers and to be confident that any Android NFC applications will run well on any NFC forum device (including any NFC chipset).

CTS in Android is based on JUnit and Instrumentation testing.

2.1 CTS tool

Once we have working cts environment. To get help, type 'help'. You will get:

```
Android-4.0.4-MARS/out/host/linux-x86/cts/android-cts/tools$ cts-tradefed

cts-tf > 04-17 13:47:17 I/DeviceManager: Detected new device emulator-5554
```


As we can see above, we can list test plans, list test packages (and add/remove those from repository), execute test plans (or just some packages from them) on specified device and see some short information about test results (sessions)

```
cts-tf > list plans
RefApp
VM-TF
AppSecurity
Signature
CTS-TF
CTS
Java
Android
```

Check that you are connected to an Android Virtual device (e.g. emulator-5554)

```
cts-tf > list d
Serial          State       Product   Variant  Build   Battery
emulator-5554   Available   goldfish  generic  IMM76 50
```

2.2 CTS official and extended tests for NFC

We test the Android CTS for NFC: the first test package is “android.ndef”, the official package in Android ICS 4.0.4, the second test package (extended CTS NFC) is “android.nfc”, an extended package offered with OpenNFC.

For the second test, a cts.patch should be applied to include the source of extended CTS NFC to Android ICS 4.0.4.

Run cts tests for the two packages:

```
cts-tf > run cts -p android.ndef

05-22 18:08:42 I/TestInvocation: Starting invocation for 'cts' on build '4.0.3_r2'
on device emulator-5554
05-22 18:08:42 I/emulator-5554: Created result dir 2012.05.22_18.08.42
cts-tf > 05-22 18:09:22 I/emulator-5554: Collecting device info
05-22 18:09:24 I/emulator-5554: ----------------------------------------
05-22 18:09:24 I/emulator-5554: Test package android.ndef started
05-22 18:09:24 I/emulator-5554: ----------------------------------------
```

```
05-22                          18:09:27                          I/emulator-5554:
android.ndef.cts.BasicNdefTest#test_parseSmartPoster PASS
05-22 18:09:29 I/emulator-5554: Saved log device_logcat_523507143269772713.zip
05-22 18:09:29 I/emulator-5554: Saved log host_log_5453248872526549544.zip
05-22 18:09:29 I/emulator-5554: android.ndef package complete: Passed 1, Failed 0,
Not Executed 0
05-22    18:09:29    I/emulator-5554:    Created    xml    report    file    at
file:///media/SecondDisk/Android_Projects/Android-4.0.4-MARS/out/host/linux-
x86/cts/android-cts/repository/results/2012.05.22_18.08.42/testResult.xml
05-22   18:09:29   I/emulator-5554:   XML   test   result   file   generated   at
2012.05.22_18.08.42. Passed 1, Failed 0, Not Executed 0
05-22 18:09:29 I/emulator-5554: Time: 46s

cts-tf > run cts -p android.nfc

05-22 18:04:41 I/TestInvocation: Starting invocation for 'cts' on build '4.0.3_r2'
on device emulator-5554
05-22 18:04:41 I/emulator-5554: Created result dir 2012.05.22_18.04.41
cts-tf > 05-22 18:05:23 I/emulator-5554: Collecting device info
05-22 18:05:26 I/emulator-5554: ----------------------------------------
05-22 18:05:26 I/emulator-5554: Test package android.nfc started
05-22 18:05:26 I/emulator-5554: ----------------------------------------
05-22 18:05:29 I/emulator-5554:
android.nfc.cts.NdefMessageTest#testByteArrayConstructor PASS
05-22 18:05:30 I/emulator-5554:
android.nfc.cts.NdefMessageTest#testCreateFromParcel PASS
05-22 18:05:30 I/emulator-5554: android.nfc.cts.NdefMessageTest#testToByteArray
PASS
05-22 18:05:30 I/emulator-5554: android.nfc.cts.NdefMessageTest#testWriteToParcel
PASS
05-22 18:05:30 I/emulator-5554:
android.nfc.cts.NdefRecordTest#testByteArrayConstructor PASS
05-22 18:05:30 I/emulator-5554: android.nfc.cts.NdefRecordTest#testFullConstructor
PASS
05-22 18:05:30 I/emulator-5554: android.nfc.cts.TagTest#testCreateFromParcel PASS
05-22 18:05:30 I/emulator-5554: android.nfc.cts.TagTest#testWriteToParcel PASS
05-22 18:05:30 I/emulator-5554: android.nfc.tech.cts.IsoDepTest#testGet PASS
05-22 18:05:30 I/emulator-5554: android.nfc.tech.cts.MifareClassicTest#testGet PASS
05-22 18:05:30 I/emulator-5554: android.nfc.tech.cts.MifareUltraLightTest#testGet
PASS
05-22 18:05:30 I/emulator-5554: android.nfc.tech.cts.NdefFormatableTest#testGet
PASS
05-22 18:05:30 I/emulator-5554: android.nfc.tech.cts.NdefTest#testGet PASS
05-22 18:05:30 I/emulator-5554: android.nfc.tech.cts.NfcATest#testGet PASS
05-22 18:05:30 I/emulator-5554: android.nfc.tech.cts.NfcBTest#testGet PASS
05-22 18:05:30 I/emulator-5554: android.nfc.tech.cts.NfcFTest#testGet PASS
05-22 18:05:30 I/emulator-5554: android.nfc.tech.cts.NfcVTest#testGet PASS
05-22 18:05:32 I/emulator-5554: Saved log device_logcat_8879764765210579871.zip
05-22 18:05:32 I/emulator-5554: Saved log host_log_6650102996551997184.zip
05-22 18:05:32 I/emulator-5554: android.nfc package complete: Passed 17, Failed 0,
Not Executed 0
05-22 18:05:32 I/emulator-5554: Created xml report file at
file:///media/SecondDisk/Android_Projects/Android-4.0.4-MARS/out/host/linux-
x86/cts/android-cts/repository/results/2012.05.22_18.04.41/testResult.xml
05-22 18:05:32 I/emulator-5554: XML test result file generated at
2012.05.22_18.04.41. Passed 17, Failed 0, Not Executed 0
05-22 18:05:32 I/emulator-5554: Time: 51s
```


2.3 CTS NFC results

We found useful CTS assets in the following folder:

- Package CTS: out/host/linux-x86/cts/android-cts.zip

- cts makefile: ${ANDROID_ROOT}/build/core/tasks/cts.mk
- run cts program: ${ANDROID_ROOT}/out/host/linux-x86/cts/android-cts/tools
- test plans: ${ANDROID_ROOT}/out/host/linux-x86/cts/android-cts/repository/plans
- test packages: ${ANDROID_ROOT}/out/host/linux-x86/cts/android-cts/repository/testcases
- test results: ${ANDROID_ROOT}/out/host/linux-x86/cts/android-cts/repository/results
- CTS program settings value: ${ANDROID_ROOT}/cts/tools/utils/host_config.xml

This will produce results in `out/host/linux-x86/cts/android-cts/repository/results/$session_date`, where $session_date can be here 2012.05.22_18.08.42.

Contents of this directory:

```
cts_result.css

cts_result.xsl

logo.gif

newrule-green.png

testResult.xml
```

The most important file is `testResult.xml`. It contains information on host machine, test device, test plan and tests execution status. This file is viewable in any most web browsers (e.g. Firefox).

2.3.1 Result of android.ndef

Device Information		Test Summary	
Build Model	Full Android on Emulator	CTS version	4.0.3_r2
Build Name	full	Test timeout	600000 ms
Build Brand	Android	Host Info	ubuntu (Linux - 2.6.38-8-generic)
Build Manufacturer	unknown		
Device ID	unknown	Plan name	NA
Firmware Version	4.0.4	Start time	Tue May 22 18:08:42 CEST 2012
Firmware Build Number	IMM76	End time	Tue May 22 18:09:29 CEST 2012
Build Fingerprint	Android/full/generic:4.0.4/IMM76/eng.lzhang.20120425.170138:eng/test-keys		
Build ABI	armeabi-v7a	Tests Passed	1
Build ABI2	armeabi	Tests Failed	0
Android Platform Version	15	Tests Timed out	0
		Tests Not Executed	0
Supported Locales	en_US ca da fa ja nb de af bg th fi hi vi sk uk el nl pl sl tl am rm in ko ro ar fr hr sr tr cs es ms it lt pt hu ru zu lv sv iw sw en_CA uk_UA en_GB in_ID ar_EG en_SG th_TH fi_FI sl_SI sk_SK zh_CN hi_IN vi_VN ro_RO hr_HR ca_ES sr_RS en_US es_US lt_LT pt_PT en_AU hu_HU lv_LV zh_TW en_NZ fr_CA af_ZA zu_ZA nl_BE fr_BE de_DE sv_SE bg_BG de_CH rm_CH fr_CH it_CH tl_PH de_LI da_DK iw_IL nl_NL pl_PL nb_NO ja_JP pt_BR fr_FR el_GR fa_IR ko_KR tr_TR es_ES de_AT am_ET it_IT ru_RU ms_MY cs_CZ sw_TZ en		
Screen Size	normal		
Resolution	320x480		
Density	1.0 (mdpi)		
Phone number	15555215554		
X dpi	160.0		
Y dpi	160.0		
Touch	finger		
Navigation	trackball		
Keypad	qwerty		
Network	Android		
IMEI	000000000000000		
IMSI	310260000000000		
Open GL ES Version	0.0		
Open GL Compressed Texture Formats	• GL_OES_compressed_paletted_texture • GL_OES_compressed_ETC1_RGB8_texture • GL_ARB_texture_compression		
Features	[_] android.hardware.audio.low_latency [_] android.hardware.bluetooth [_] android.hardware.camera [_] android.hardware.camera.autofocus [_] android.hardware.camera.flash [_] android.hardware.camera.front [_] android.hardware.faketouch [_] android.hardware.faketouch.multitouch.distinct [_] android.hardware.faketouch.multitouch.jazzhand [_] android.software.live_wallpaper [_] android.hardware.location [_] android.hardware.location.gps [_] android.hardware.location.network [_] android.hardware.microphone		

[X] android.hardware.nfc
[ ] android.hardware.screen.landscape
[ ] android.hardware.screen.portrait
[ ] android.hardware.sensor.accelerometer
[ ] android.hardware.sensor.barometer
[ ] android.hardware.sensor.compass
[ ] android.hardware.sensor.gyroscope
[ ] android.hardware.sensor.light
[ ] android.hardware.sensor.proximity
[ ] android.software.sip
[ ] android.software.sip.voip
[ ] android.hardware.telephony
[ ] android.hardware.telephony.cdma
[ ] android.hardware.telephony.gsm
[ ] android.hardware.touchscreen
[ ] android.hardware.touchscreen.multitouch
[ ] android.hardware.touchscreen.multitouch.distinct
[ ] android.hardware.touchscreen.multitouch.jazzhand
[ ] android.hardware.usb.accessory
[ ] android.hardware.usb.host
[ ] android.hardware.wifi
[ ] android.hardware.wifi.direct

Other Features

Root Processes

- ueventd
- netd
- server_open_nfc
- qemud
- adbd
- logcat
- sh
- app_process

Partitions

Filesystem	Size	Used	Free	Blksize
/dev	252M	32K	252M	4096
/mnt/asec	252M	0K	252M	4096
/mnt/obb	252M	0K	252M	4096
/system	163M	163M	0K	4096
/data	128M	7M	120M	4096
/cache	64M	1M	62M	4096

System Libraries

- android.test.runner
- com.android.location.provider
- NfcExt
- javax.obex

Test Summary by Package

Test Package	Passed	Failed	Timed Out	Not Executed	Total Tests
android.ndef	1	0	0	0	1

Detailed Test Report

Compatibility Test Package: android.ndef

Test	Result	Failure Details
android.ndef.cts.BasicNdefTest		
– test_parseSmartPoster	pass	

2.3.2 Result of android.nfc

Device Information	
Build Model	Full Android on Emulator
Build Name	full
Build Brand	Android
Build Manufacturer	unknown
Device ID	unknown
Firmware Version	4.0.4
Firmware Build Number	IMM76
Build Fingerprint	Android/full/generic:4.0.4/IMM76/eng.lzhang.20120425.170138:eng/test-keys
Build ABI	armeabi-v7a
Build ABI2	armeabi
Android Platform Version	15
Supported Locales	en_US ca da fa ja nb de af bg th fi hi vi sk uk el nl pl sl tl am rm in ko ro ar fr hr sr tr cs es ms it lt pt hu ru zu lv sv iw sw en_CA uk_UA en_GB in_ID ar_EG en_SG th_TH fi_FI sl_SI sk_SK zh_CN hi_IN vi_VN ro_RO hr_HR ca_ES sr_RS en_US es_US lt_LT pt_PT en_AU hu_HU lv_LV zh_TW en_NZ fr_CA af_ZA zu_ZA nl_BE fr_BE de_DE sv_SE bg_BG de_CH rm_CH fr_CH it_CH tl_PH de_LI da_DK iw_IL nl_NL pl_PL nb_NO ja_JP pt_BR fr_FR el_GR fa_IR ko_KR tr_TR es_ES de_AT am_ET it_IT ru_RU ms_MY cs_CZ sw_TZ en
Screen Size	normal
Resolution	320x480
Density	1.0 (mdpi)
Phone number	15555215554
X dpi	160.0
Y dpi	160.0
Touch	finger
Navigation	trackball
Keypad	qwerty
Network	Android
IMEI	000000000000000
IMSI	310260000000000
Open GL ES Version	0.0
Open GL Compressed Texture Formats	• GL_OES_compressed_paletted_texture • GL_OES_compressed_ETC1_RGB8_texture • GL_ARB_texture_compression
Features	[_] android.hardware.audio.low_latency [_] android.hardware.bluetooth [_] android.hardware.camera [_] android.hardware.camera.autofocus [_] android.hardware.camera.flash [_] android.hardware.camera.front [_] android.hardware.faketouch [_] android.hardware.faketouch.multitouch.distinct [_] android.hardware.faketouch.multitouch.jazzhand [_] android.software.live_wallpaper [_] android.hardware.location [_] android.hardware.location.gps [_] android.hardware.location.network [_] android.hardware.microphone [X] android.hardware.nfc [_] android.hardware.screen.landscape [_] android.hardware.screen.portrait [_] android.hardware.sensor.accelerometer [_] android.hardware.sensor.barometer [_] android.hardware.sensor.compass [_] android.hardware.sensor.gyroscope [_] android.hardware.sensor.light [_] android.hardware.sensor.proximity [_] android.software.sip [_] android.software.sip.voip [_] android.hardware.telephony [_] android.hardware.telephony.cdma [_] android.hardware.telephony.gsm [_] android.hardware.touchscreen [_] android.hardware.touchscreen.multitouch [_] android.hardware.touchscreen.multitouch.distinct [_] android.hardware.touchscreen.multitouch.jazzhand [_] android.hardware.usb.accessory [_] android.hardware.usb.host [_] android.hardware.wifi [_] android.hardware.wifi.direct
Other Features	
Root Processes	• ueventd • netd • server_open_nfc • qemud • adbd • logcat • sh • app_process • sh • logcat
Partitions	Filesystem Size Used Free Blksize /dev 252M 32K 252M 4096 /mnt/asec 252M 0K 252M 4096 /mnt/obb 252M 0K 252M 4096 /system 163M 163M 0K 4096 /data 128M 7M 120M 4096 /cache 64M 1M 62M 4096
System Libraries	• android.test.runner • com.android.location.provider • NfcExt • javax.obex

Test Summary	
CTS version	4.0.3_r2
Test timeout	600000 ms
Host Info	ubuntu (Linux - 2.6.38-8-generic)
Plan name	NA
Start time	Tue May 22 18:04:41 CEST 2012
End time	Tue May 22 18:05:32 CEST 2012
Tests Passed	17
Tests Failed	0
Tests Timed out	0
Tests Not Executed	0

Test Summary by Package

Test Package	Passed	Failed	Timed Out	Not Executed	Total Tests
android.nfc	17	0	0	0	17

Detailed Test Report

Compatibility Test Package: android.nfc

Test	Result	Failure Details
android.nfc.cts.NdefMessageTest		
-- testByteArrayConstructor	pass	
-- testCreateFromParcel	pass	
-- testToByteArray	pass	
-- testWriteToParcel	pass	
android.nfc.cts.NdefRecordTest		
-- testByteArrayConstructor	pass	
-- testFullConstructor	pass	
android.nfc.cts.TagTest		
-- testCreateFromParcel	pass	
-- testWriteToParcel	pass	
android.nfc.tech.cts.IsoDepTest		
-- testGet	pass	
android.nfc.tech.cts.MifareClassicTest		
-- testGet	pass	
android.nfc.tech.cts.MifareUltraLightTest		
-- testGet	pass	
android.nfc.tech.cts.NdefFormatableTest		
-- testGet	pass	
android.nfc.tech.cts.NdefTest		
-- testGet	pass	
android.nfc.tech.cts.NfcATest		
-- testGet	pass	
android.nfc.tech.cts.NfcBTest		
-- testGet	pass	
android.nfc.tech.cts.NfcFTest		
-- testGet	pass	
android.nfc.tech.cts.NfcVTest		
-- testGet	pass	

3 NFC scenario testing cases

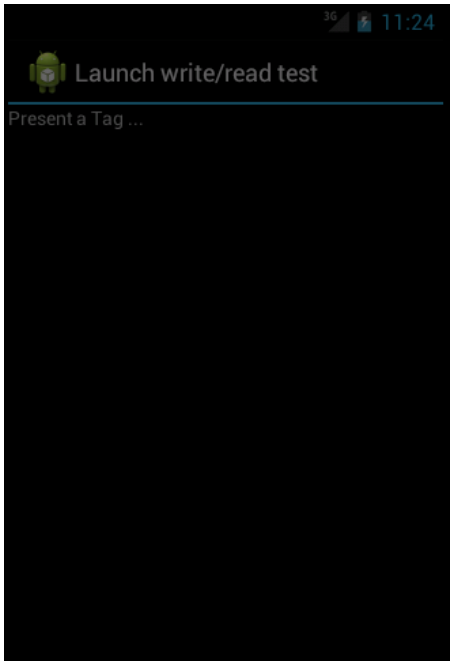
NFC scenario testing cases include the tests on NFC reading, writing, P2P as well as secure element. All these testing cases are launched one by one successively by the built application named “TestAppLauncher”

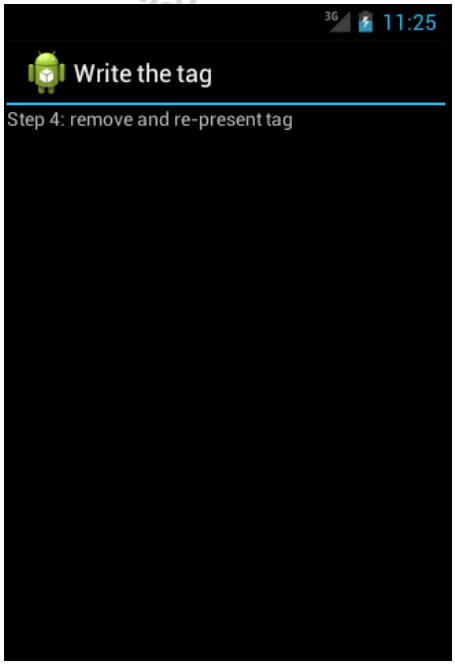
All these testing cases use the standard Android NFC API, which calls the NFC service level and finally call the OpenNFC native code. These tests allow validating the compatibility of OpenNFC to standard Android NFC API.

3.1 NFC Reading and writing

Once the application “TestAppLauncher” is launched, it will firstly trigger the test of NFC reading and writing.
This validation is by the following sequence: firstly the test writes a given message into a present tag, and then read the message from tag and compared it to the given message.

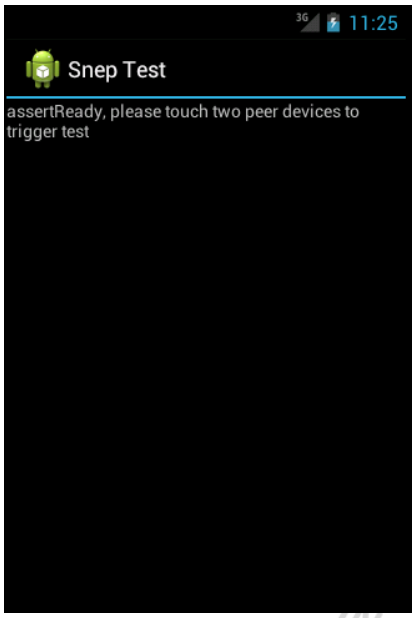
The manipulation is in the following way, firstly present a writable tag to the NFC enabled device that launching the tests, and then remove it and re-present to the device.





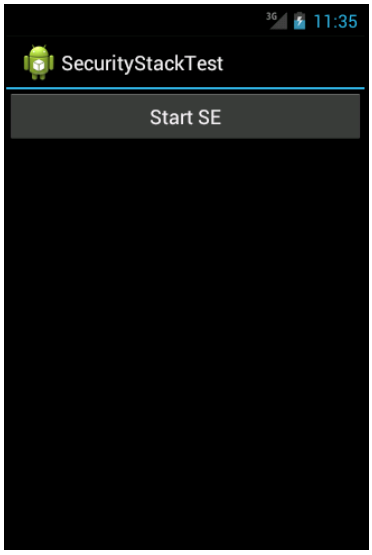
3.2 NFC P2P Beam

This test allows validating P2P beam communication; this test requires two NFC enabled devices that are launching the current testing cases simultaneously.
The two devices will send a given message to each other, and then each device compares the received message to the given message.



3.3 Secure Element testing case

This test uses the hidden Android NFC API “nfc-extra”, transceive an APDU to the security element, retrieve the response, and compared to the expected response.



All the three above tests are launched automatically by sequence. A report is generated in the NFC testing device within the following path /data/data/org.opennfc.service/files/log.txt.

3.4 Testing case result

Here is an example of the generated result report:

```
=== Tests results  ===
  *** Tests of TestSecurityStack ***
  =>  Assert Passed : Security APDU response ON org.opennfc.tests.unit.TestSecurityStack$1.onClick at 101
  *** Result of TestSecurityStack : 1 OK | 0 Failed ! | On 1 Tests
  ************************
  *** Tests of TestSnepOnDevices ***
  =>  Assert Passed : Snep message exchanged ON org.opennfc.tests.unit.TestSnepOnDevices.processIntent at 165
  *** Result of TestSnepOnDevices : 1 OK | 0 Failed ! | On 1 Tests
  ************************
  *** Tests of ActivityForReadingTag ***
  =>  Assert Passed : Test: TestWritingTag problem ON org.opennfc.tests.unit.ActivityForReadingTag.assertReady at 160
  *** Result of ActivityForReadingTag : 1 OK | 0 Failed ! | On 1 Tests
  ************************
  *** Tests of ActivityForWritingTag ***
  =>  Assert Passed : Writing passed ON org.opennfc.tests.unit.ActivityForWritingTag.assertReady at 172
  *** Result of ActivityForWritingTag : 1 OK | 0 Failed ! | On 1 Tests
  ************************
========================
TOTAL : 4 OK | 0 Failed ! | On 4 Tests
========================
```

4 NFC applications for compatibility tests

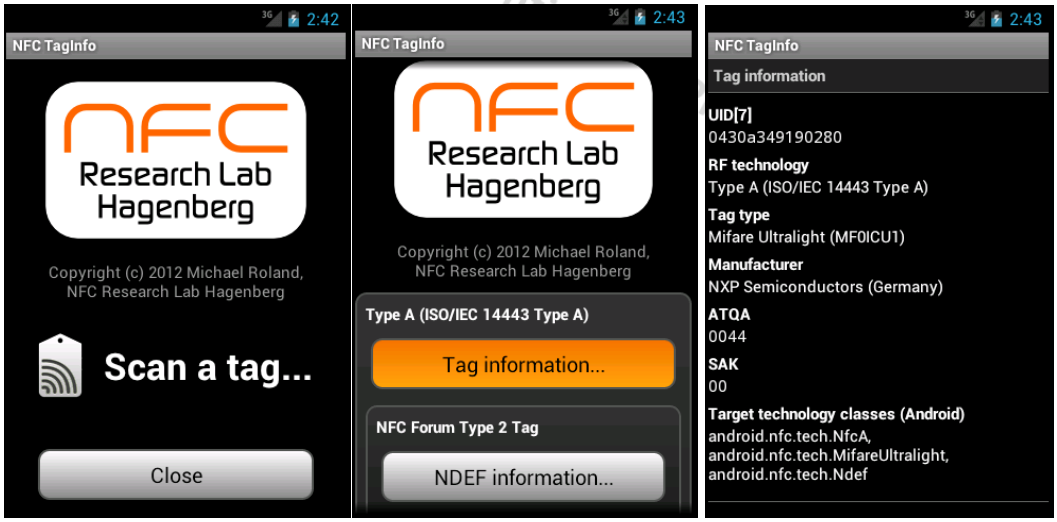
The OpenNFC new architecture has been validated by several NFC applications from the Android market as well as an application proposed by android Dev guide, which are:

1) at.mroland.android.apps.nfctaginfo-2.apk
2) com.nxp.taginfolite-2.apk
3) com.nxp.nfc.tagwriter-1.apk
4) com.example.android.beam proposed by android Dev guide on the site http://developer.android.com/guide/topics/nfc/nfc.html

We compared the results issue from our new architecture to the results from a Nexus S phone with embedded ICS 4.0.3 to validate OpenNFC new architecture.

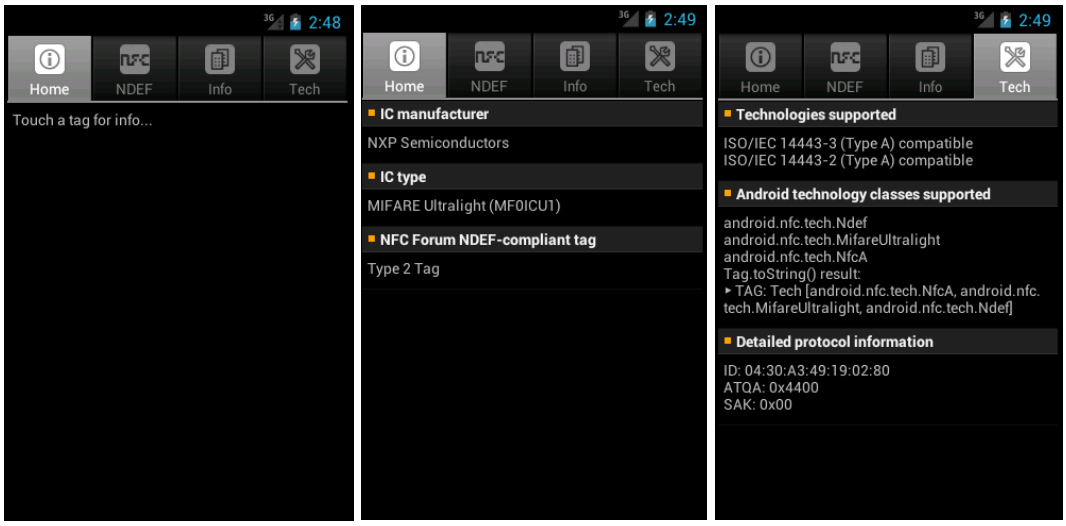
4.1 at.mroland.android.apps.nfctaginfo-2.apk

This application is developed by Reseach Lab Hagenberg, and allows retrieving all the information of a present tag, including UID, NFC embedded technology, manufacture, technology classes, Ndef message information, Memory information, Data, Access conditions, etc.
The following images are screenshots of this application.



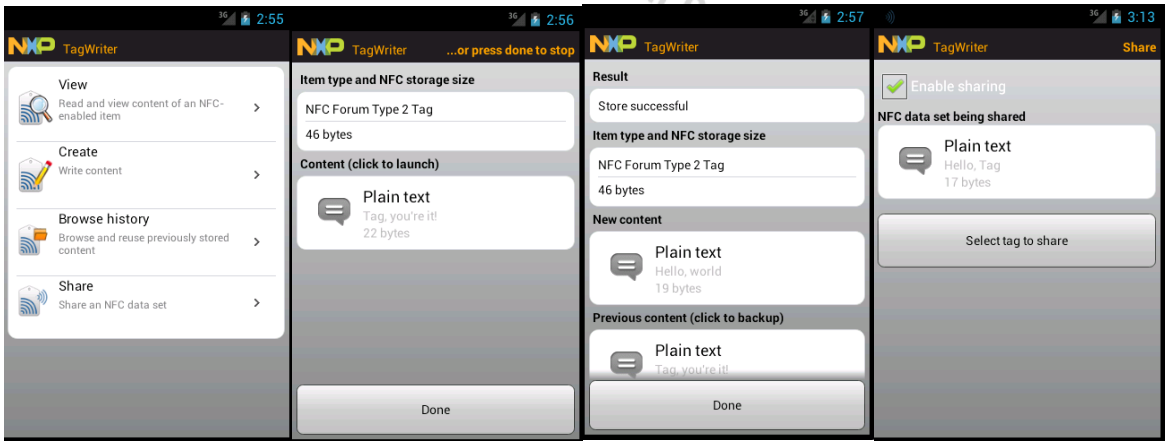
4.2 com.nxp.taginfolite-2.apk

This application is developed by NXP, and allows retrieving all the information of a present tag and share a given tag information. Similar to the above application, this application also returns the information such as NFC technology, manufacture, technology classes, Ndef message information, Memory information, NFC data set information, etc.
The following images are screenshots of this application.



4.3 com.nxp.nfc.tagwriter-1.apk

This application is developed by NXP, which allows reading, formatting, writing a present tag, as well as the P2P exchange.
The following images are screenshots of this application.



4.4 com.example.android.beam

This application is proposed by android Dev guide (http://developer.android.com/guide/topics/nfc/nfc.html), which allows validating the P2P beam exchange.

All the above four applications are employed in our intensive testing cases, we compared the results issue from our new architecture to the results from a Nexus S phone with ICS 4.0.3 embedded to validate OpenNFC new architecture. Similar to the NFC scenario tests, these application use the standard Android NFC API, which calls the NFC service level and then calls OpenNFC native code. These intensive tests validate the compatibility of OpenNFC to standard Android NFC API.