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USING SPRINGCARD PC/SC COUPLERS WITH ANDROID

Getting Started and Development Guide

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Contents

1. INTRODUCTION

1.1. ABSTRACT

SpringCard offers a free software solution to support its **USB PC/SC Couplers** on an Android tablet.

The solution is made of

- **SpringCard PC/SC Service for Android**, a freeware application that installs from Google Play,
- **SpringCard PC/SC Library for Android**, an open-source library that makes it easy for application developers to communicate through the Service with contactless cards and NFC/RFID tags activated by a **SpringCard PC/SC coupler**.

This explains the software architecture and shows how-to get started developing with the Service and the Library.

Furthermore, SpringCard provides also a PC/SC Demo application. Tips and hints are provided to re-compile the Demo application, and/or retrieve useful pieces of software code and include them into your own project.

1.2. SUPPORTED PRODUCTS

At the time of writing, this document refers to all **SpringCard USB PC/SC Couplers** in the CSB6, and H663 groups, namely:

- **SpringCard** Prox'N'Roll PC/SC,
- **SpringCard** Prox'N'Roll PC/SC HSP, TwistyWriter HSP, CrazyWriter HSP, CSB HSP.

Please note that the SpringCard PC/SC Service for Android and its companion Library provide support for the readers' contactless (NFC/RFID) slot only.
Using the SAM or smartcard slots of TwistyWriter HSP, CrazyWriter HSP or CSB HSP is out of the scope of this free software suite. Don't hesitate to contact us should you need a custom version to support all the slots of your SpringCard coupler.

1.3. AUDIENCE

This manual is designed for use by application developers. It assumes that the reader has expert knowledge of Android development and a basic knowledge of PC/SC and/or of the ISO 7816-4 standard for smartcards.

1.4. USEFUL LINKS

- PC/SC workgroup: http://www.pcscworkgroup.com
- Using a PC/SC reader (and card) in a Java environment thanks to the **javax.smartcardio** package: http://docs.oracle.com/javase/7/docs/jre/api/security/smartcardio/spec/javax/smartcardio/package-summary.html
- USB CCID specification: http://www.usb.org/developers/docs/devclass_docs/DWG_Smart-Card_CCID_Rev110.pdf

1.5. SUPPORT AND UPDATES

All Android-related information and material will be centralized under the tag 'Android' in SpringCard Tech Zone:

http://tech.springcard.com/tags/android

Useful related materials (product datasheets, application notes, sample software, HOWTOs and FAQs…) are available at SpringCard's web site:

www.springcard.com

Updated versions of this document and others are posted on this web site as soon as they are available.

For technical support enquiries, please refer to SpringCard support page, on the web at

www.springcard.com/support

2. QUICKSTART: TESTING YOUR SPRINGCARD READER WITH YOUR ANDROID DEVICE

SpringCard USB PC/SC Couplers, as the name says, are USB devices. To use them, the host system (aka the computer -or tablet) must be a fully-compliant USB host.

This feature is included in the system since Android 3.1, but not supported by every hardware running the system. Unfortunately, there is no reliable software-only solution to check whether a given Android device is a fully-compliant USB host, or not.

Therefore, before starting a long journey into Android development and debugging, it is important to try both **SpringCard PC/SC Service for Android** with its Demo application on your very device, just to make sure the hardware and the system software stack are OK.

2.1. REQUIREMENTS

To test your SpringCard PC/SC coupler with your Android device, you'll need

- A **SpringCard PC/SC Coupler**. It the following pages, we'll be using a **SpringCard Prox'N'Roll PC/SC HSP**, but everything will work identically with any other device based on the CSB6 or H663 core.
- An **Android tablet** running *(theoretically)* Android version ≥ 3.1. We've tested the solution only with Android 5.0 and 5.1 on a Nexus 7 (2013) and a Nexus 9 (2014), so the behaviour with earlier version could be different.
- A **USB adapter** (USB micro B/Male to USB A/Female) in case your tablet doesn't feature a USB A/Female port.

Be aware that the PC/SC Coupler will takes its power from the USB host, i.e. from the tablet. On most today's tablets, the battery is reloaded through a USB micro B/Female port, which is also the one we use to connect the Coupler.
As a consequence, it is impossible to keep the tablet powered while working with a USB device such as a SpringCard PC/SC Coupler.
If you're designing a kiosk or unattended solution which shall run 24/7, choose your tablet carefully; it must provide a mean to be externaly-powered even with a USB device is attached.

2.2. INSTALLING THE APPLICATIONS

2.2.1. SpringCard USB PC/SC Service

Install the **SpringCard USB PC/SC Service** package from Google Play Store.

Direct link:

https://play.google.com/store/apps/details?id=com.springcard.android_usb_pcsc.service

2.2.2. SpringCard USB PC/SC Demo application

Install the **SpringCard USB PC/SC Demo** package from Google Play Store.

Direct link:

https://play.google.com/store/apps/details?id=com.springcard.springcardpcscdemo

2.3. CONNECTING A COUPLER TO YOUR ANDROID TABLET

Ensure your Android tablet has enough battery to power the reader.

Connect your reader using a Micro USB B/Male to USB2.0 A/Female adapter:

(1) Android device

(2) USB device (Prox'N'Roll HSP)

The coupler is powered but not active (on Prox'N'Roll: LEDs blink yellow) and the Android system prompts to choose the application that will handle the newly connected USB device.

Select “SpringCard USB PCSC Service” and click the “Always” option.

Once done, the system activates the coupler (on Prox'N'Roll: smooth blue LED pulses).

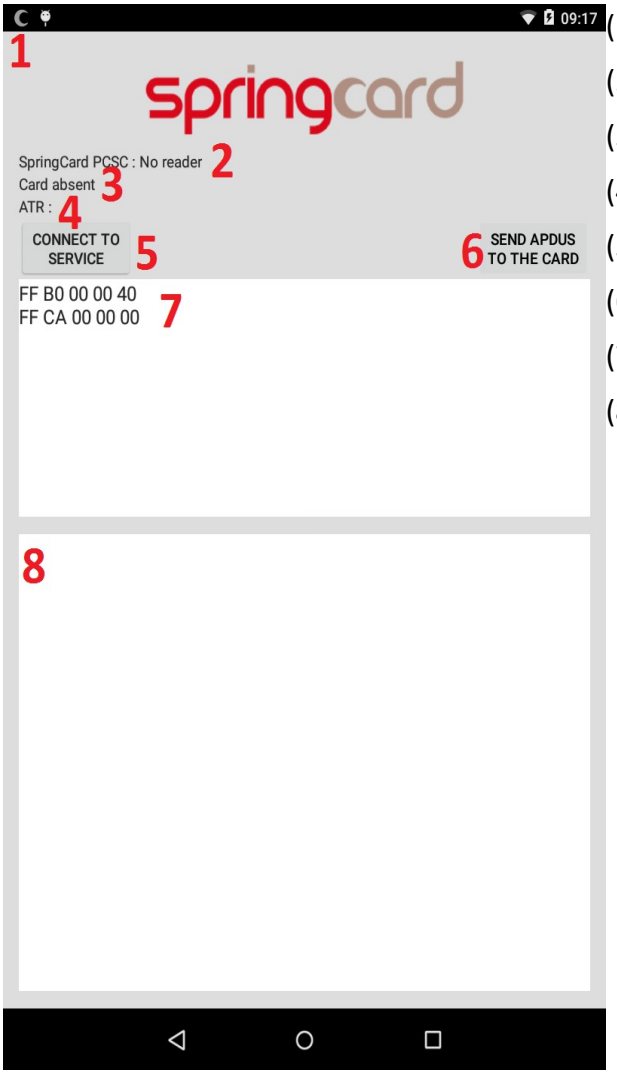
Troubleshooting:

If all coupler's LEDs stay OFF and nothing happen on the tablet's screen

- maybe the adapter cable is broken
- maybe the Android tablet doesn't feature the USB host hardware or software stack.

2.4. THE USB SPRINGCARD PC/SC DEMO APPLICATION

This application is no more than a basic interface to exchange APDUs with a contactless smartcard, or to the coupler's embedded interpreter.



(1) Service's notification icon

(2) Reader's product name

(3) Card's presence or not

(4) ATR retrieve from the card

(5) Connect to SpringCard USB PCSC Service

(6) Send APDU command to the card

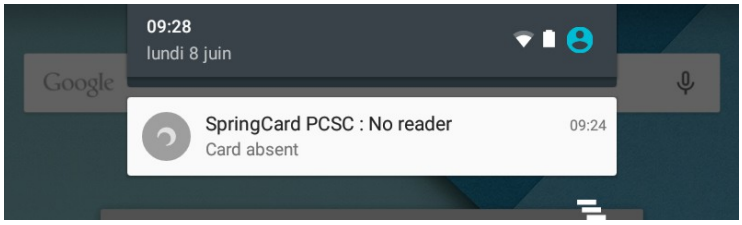
(7) Command list (one per line) to send to the card

(8) Command result log

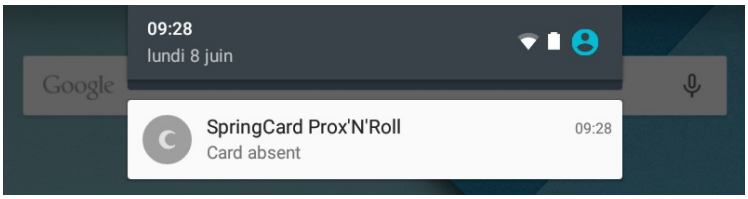
2.5. THE USB SPRINGCARD PC/SC SERVICE

The Service shows its state in the notification bar.

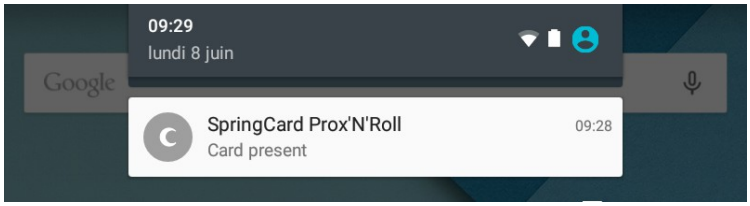
No Coupler connected:



Prox'N'Roll PC/SC Coupler connected to the tablet:

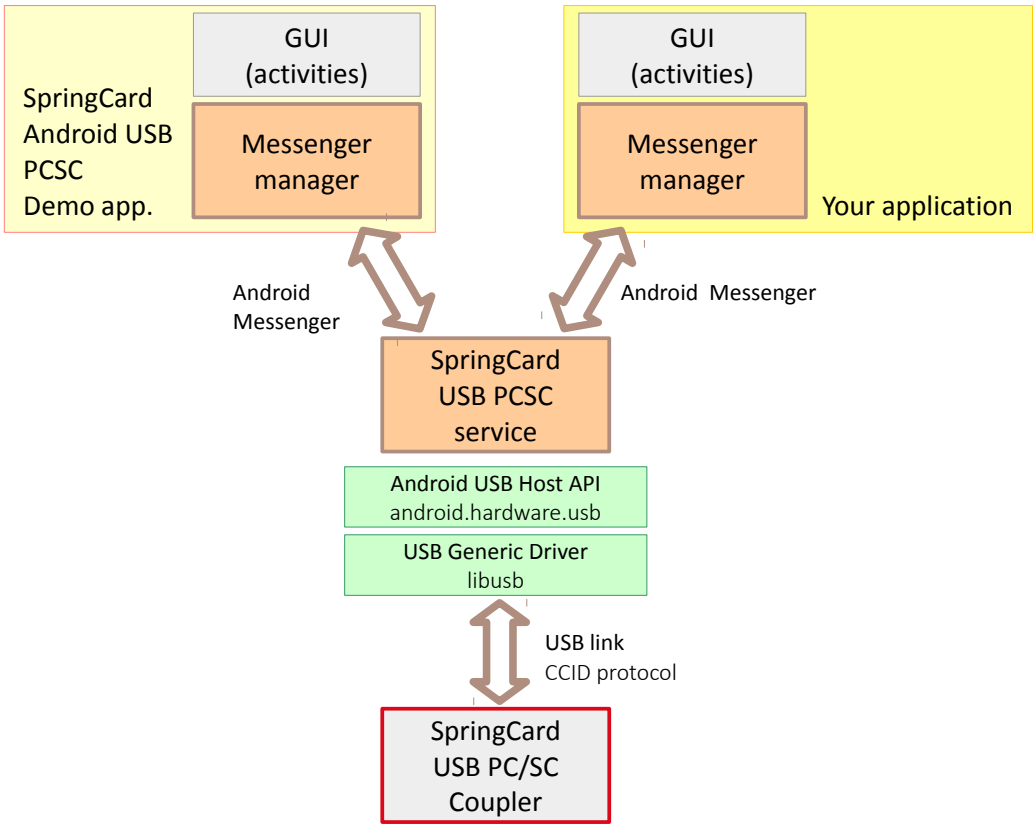


Contactless card, NFC or RFID tag present on the Coupler's antenna:



3. ARCHITECTURE OF SPRINGCARD USB PCSC FOR ANDROID

3.1. OVERALL PICTURE



3.2. THE SPRINGCARD ANDROID USB PC/SC SERVICE FOR ANDROID

- Is responsible of the USB communication between an Android device and SpringCard's PCSC compliant readers.
- Contains a list of compliant readers and will ask the user for relevant access rights.
- Has full access to those readers.

3.3. THE SPRINGCARD ANDROID USB PC/SC LIBRARY FOR ANDROID

- Communicate with the running service using Android's Messenger system only.

4. REBUILDING THE DEMO APPLICATION IN ANDROID STUDIO

4.1. REQUIREMENTS

Nothing is needed to build the demo application, but your must have the **SpringCard Android USB PC/SC Service** running on the Android device you'll be using for debugging and tests.

Download and install Android Studio on your computer: https://developer.android.com/sdk/

4.2. RETRIEVING THE PROJECT FROM GIT HUB

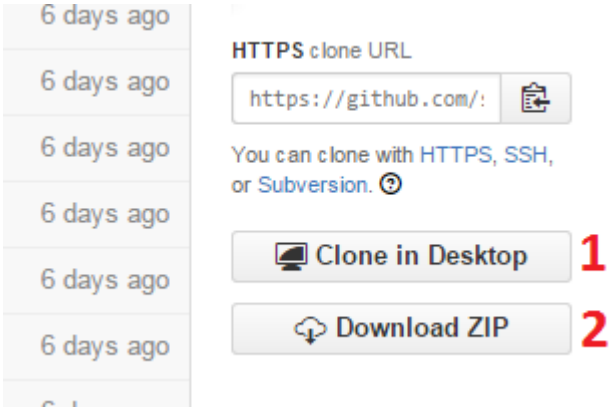
Method 1:

Use GIT to clone the project from GitHub:

```
git clone https://github.com/springcard/springcard.pcsc-android.sdk.git
```

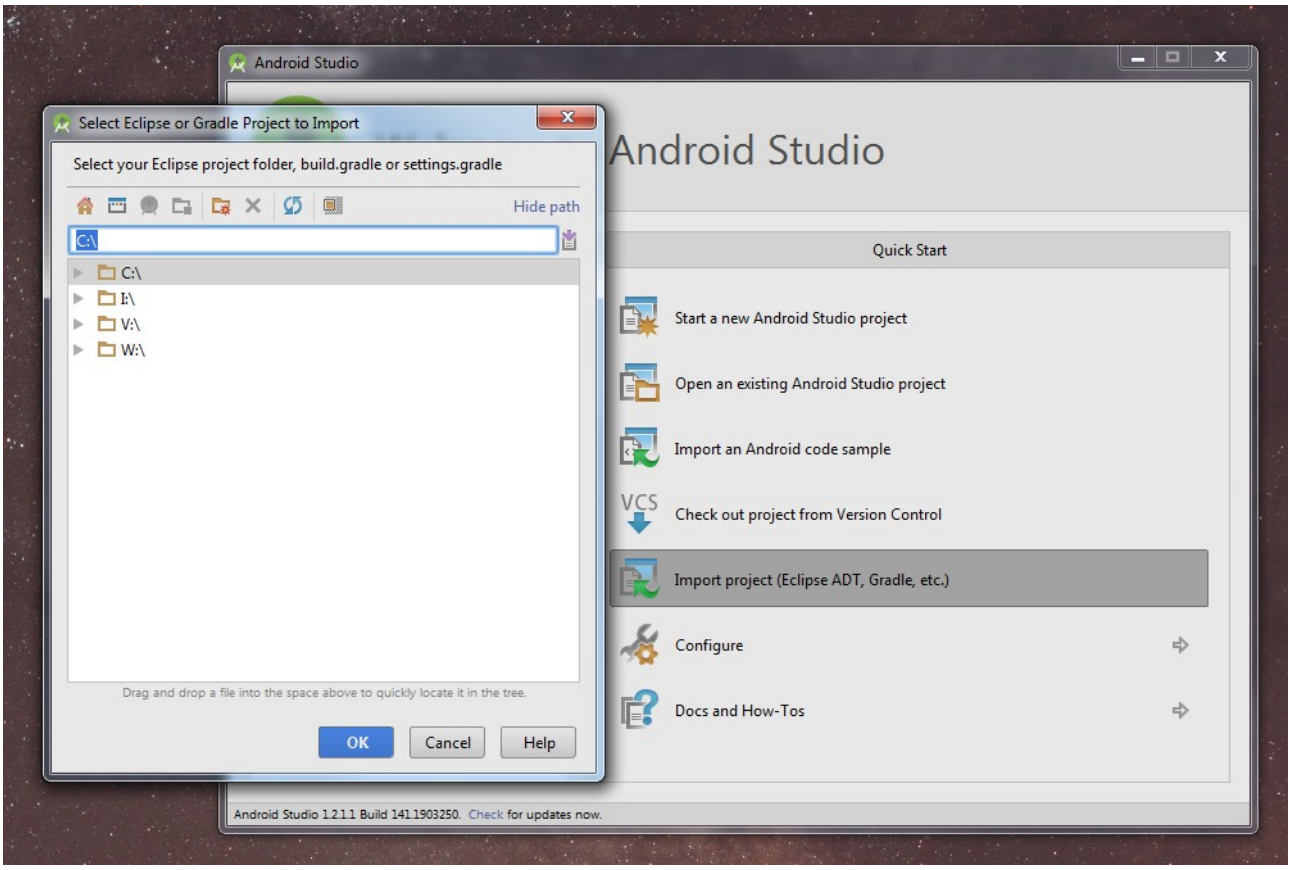
Method 2:

Download a ZIP archive of the project at:
https://github.com/springcard/springcard.pcsc-android.sdk/archive/master.zip



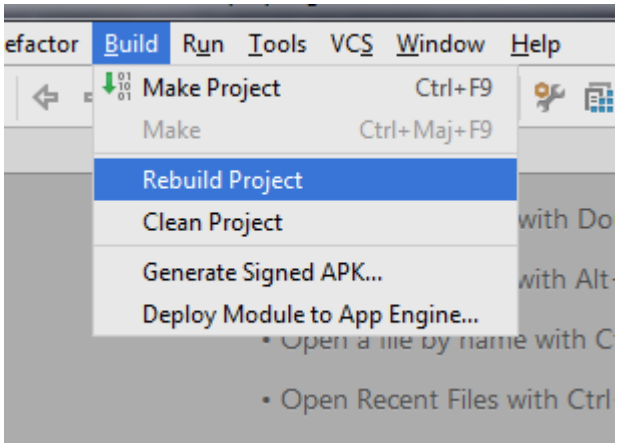
4.3. IMPORTING THE PROJECT IN ANDROID STUDIO

Launch Android Studio and import the project (select the folder where you have extracted the archive):



4.4. COMPILING THE PROJECT

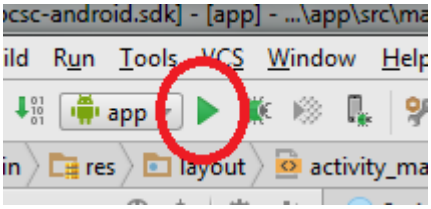
In Android Studio, select menu “Build”, option “Rebuild Project”:



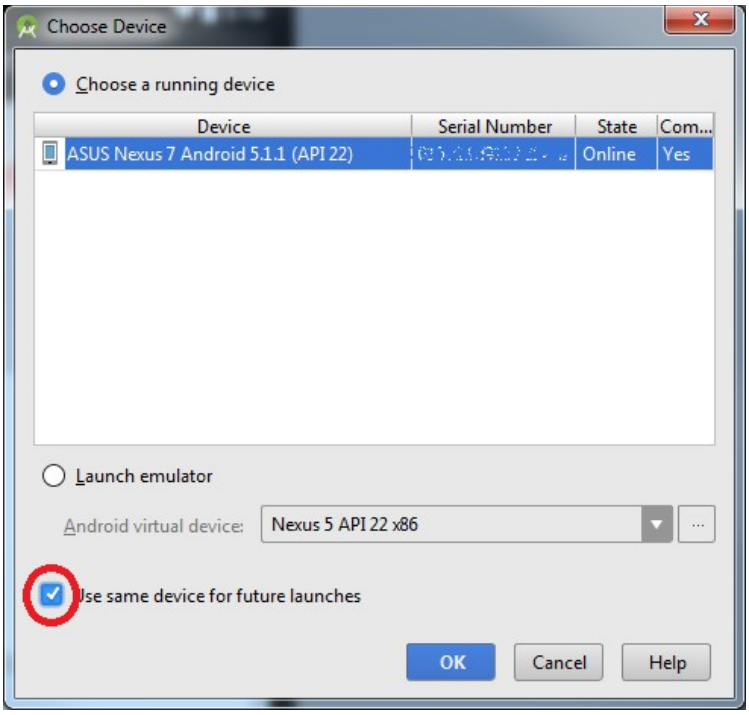
4.5. RUNNING THE PROJECT

Connect a compliant Android device to your computer (using an USB wire or using Wireless network). Your device must be in Developer mode.

Push the “run” button in Android studio:



Select your device from the list (an option is available to remember your choice):



5. DEVELOPING YOUR OWN APPLICATION USING SPRINGCARD USB PC/SC

5.1. ABSTRACT

The **SpringCard USB PC/SC Service** for Android runs in the background.

Any application that wants to communicate with a contactless card or a RFID/NFC tag through a **SpringCard PC/SC Coupler** will be bound to the Service and will communicate with it using Android Messenger sub-system.

All details regarding the Service / Messenger scheme are documented at
http://developer.android.com/guide/components/bound-services.html

Multiple application could bind the Service but only the one which is active in the foreground will receive answers from the Service.

The **SpringCard USB PC/SC Library** for Android is a set of Java files that provides a "high level" interface to the Service, using function calls inspired by the javax.smartcardio package.

5.2. IMPORTING THE LIBRARY (AS SOURCE CODE) INTO YOUR ANDROID STUDIO PROJECT

To be written

5.3. USING THE LIBRARY

In your application's source files, add the following import

```
import com.springcard.android_usb_pcsc.client
```

Your main activity shall provide the **SpringCardPCSC.Client** interface.

```
public class MainActivity
      extends Activity
      implements SpringCardPCSC.Client
```

Then your main activity shall check that the Service is installed, and then bind to the Service.

5.3.1. Is the Service installed?

The static method

```
static bool SpringCardPCSC.isServiceAvailable(Context context)
```

returns **`true`** if the Service is installed, and **`false`** otherwise.

You should instruct the user to install the Service's package if the Service is not installed.

5.3.2. Bind to the Service

The static method

```
static void SpringCardPCSC.bindToService(SpringCardPCSC.Client activity)
```

binds your application to the **SpringCard USB PC/SC Service** for Android. An exception is raised if the Library fails to bind the application to the Service.

From now on, any event that occurs on the Service-side (Coupler connected/removed from the system, card inserted/removed over the Coupler's antenna...) will be notified to the application through one of the callback methods defined within the **SpringCardPCSC.Client** interface.

5.3.3. Releasing the service when leaving

Don't forget to un-bind the application from the Service in the application's onDestroy event by calling this static method:

```
static void SpringCardPCSC.unbindService()
```

5.4. NOTIFICATION EVENTS

5.4.1. onTerminalInstalled

Your main activity (which implements the **SpringCardPCSC.Client** interface) implements the following method:

```
void onTerminalInstalled(SpringCardPCSC.CardTerminal terminal)
{
      /* A Coupler has been added to the system */
}
```

This method is invoked by the Library

- when starting, if a Coupler is already attached to the system
- every-time a new Coupler is attached to the system.

Use the methods of the **SpringCardPCSC.CardTerminal** object to retrieve

- the Coupler's name (**getName** method),
- whether there's a Card in the Coupler or not (**isCardPresent** method).

5.4.2. onTerminalRemoved

Your main activity (which implements the **SpringCardPCSC.Client** interface) implements the following method:

```
void onTerminalRemoved(SpringCardPCSC.CardTerminal terminal)
{
	/* A Coupler has been removed from the system */
}
```

This method is invoked by the Library every-time a Coupler is removed from the system.

When this callback is invoked, the application shall suppress any reference it owns to the CardTerminal object. Any copy of the CardTerminal object becomes invalid after return.

5.4.3. onCardInserted

Your main activity (which implements the **SpringCardPCSC.Client** interface) implements the following method:

```
void onCardInserted(SpringCardPCSC.CardTerminal terminal)
{
	/* A Card has been inserted in the Coupler */
}
```

This method is invoked by the Library

- when starting, if a Card is already present in the Coupler
- every-time a new Card is inserted into any Coupler attached to the system.

Use the **CardTerminal.connect** object to open a connection to the Card. You may then retrieve

- the Card's Answer To Reset (**Card.getATR** method),
- the **SpringCardPCSC.CardChannel** object that will be used to exchange APDUs with the card (**Card.getBasicChannel** method).

5.4.4. onCardRemoved

Your main activity (which implements the **SpringCardPCSC.Client** interface) implements the following method:

```
void onCardRemoved(SpringCardPCSC.CardTerminal terminal)
{
	/* A Card has been removed from the Coupler */
}
```

This method is invoked by the Library every-time a Card is removed from any Coupler attached to the system.

When this callback is invoked, the application shall suppress any reference it owns to the Card or CardChannel objects belonging to this CardTerminal. Any copy of these objects becomes invalid after return.

5.5. EXCHANGING APDUS WITH THE CARD

5.5.1. Sending a Command-APDU to the Card

The application communicates with the Card through the CommandAPDU method of a CardChannel object.

To retrieve the CardChannel object, the application shall

- implements the **onCardInserted** method
- when **onCardInserted** is called, retrieve the Card object using the **CardTerminal.connect** method,
- retrieve the CardChannel object using the **Card.getBasicChannel** method.

```
void onCardInserted(SpringCardPCSC.CardTerminal terminal)
{
      SpringCardPCSC.Card card = terminal.connect();
      SpringCardPCSC.CardChannel channel = card.getBasicChannel();
      channel.transmit(new SpringCardPCSC.CommandAPDU("00A404023F00"));
}
```

Observe that the transmit method doesn't return anything. The transmission is done asynchronously, and the callback **onResponseAPDU** is invoked when the Card (finally) answers.

5.5.2. onResponseAPDU - Retrieving the Response-APDU from the Card

Your main activity (which implements the **SpringCardPCSC.Client** interface) implements the following method:

```
void onResponseAPDU(SpringCardPCSC.CardChannel channel,
                    SpringCardPCSC.ResponseAPDU response)
{
      /* The Card has answered */
}
```

If response is null, the Card failed to answer (onCardRemoved will be called immediately afterwards).

6. LICENSE INFORMATION

6.1. SPRINGCARD USB PC/SC SERVICE FOR ANDROID

The **SpringCard USB PC/SC Service** for Android is provided free of charge, but is not an open-source software.

The following license applies:

```
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6.2. SPRINGCARD USB PC/SC LIBRARY FOR ANDROID

The **SpringCard USB PC/SC Library** for Android is an open-source software project.

Note that the license forbids to use this software with products not provided by SpringCard.

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