Signing Android Applications

Applications to be tested on the Emulator must be signed using the secure cabinet: “debug.keystore”.
It should contain a key named: “androiddebugkey”.

NOTE
The public/private Android key container –called *debug.keystore*- is saved in the following folder (assuming r1.5)

Windows XP:
C:\Documents and Settings\Administrator\.android\debug.keystore
Default phone memory image and SD card:
C:\Documents and Settings\Administrator\.android\avd\AvdApi3Id3MatosSDcard.avd\userdata-qwmu.img
C:\Documents and Settings\Administrator\.android\avd\AvdApi3Id3MatosSDcard.avd\userdat.img (???)

Windows Vista:	C:\Users\Administrator\.android\
Mac OS	/Userstheuser/.android/debug.keystore

Eclipse IDE points to the default debug.keystore file. If you want to check it or change it to a custom keystore, follow the sequence : **Window | Preferences | Android | Build**. Under “Default debug keystore” you will find the reference:

C:\Documents and Settings\Administrator\.android\debug.keystore

If needed click on *Browse* and move to the appropriated folder holding the custom keystore.

Mac OS users: Should follow the sequence **Eclipse| Preferences | Android | Build.**

CAUTION:

THIS MATERIAL WORKS WELL WHEN EXECUTING FROM THE JAVA SDK ***/BIN*** *SUBDIRECTORY. WHEN EXECUTING FROM OTHER PLACES IT MAY GIVE SILLY ERRORS (MOST LIKELY RELATED TO PROBLEMS WITH DOS PATH, JAVAPATH AND ALL THAT NON-SENSE).*

Signing / Publishing Android Applications.

Before anything is signed you need to provide *naming/versioning* information into the application code. To do that you should define two special entries (*versionCode*, vesionName) in the Manifest file. The following example shows the use of `android:versionCode` and `android:versionName` attributes.

```
<?xml version="1.0" encoding="utf-8"?>
<manifest xmlns:android="http://schemas.android.com/apk/res/android"
package="com.example.package.name"

   android:versionCode="2"
   android:versionName="1.1">

<application android:icon="@drawable/icon" android:label="@string/app_name">
...
</application>
</manifest>
```

STEP1. Create a Keystore

Keystores are used to support a secure computing environment. A ***keystore*** file is a cryptographic database file that contains matching sets of both *public* keys and *private* keys. The container, as well as each set of key values is password protected. The private key is kept secret, while the public key can be given to anybody. When two parties want to securely communicate the sender must encrypt the message using the well known recipient's public key. Incoming messages (encrypted with the recipient's public key) can only be decrypted with the corresponding private key (which is known by the receiving side). The keys are related in a non-trivial mathematical way, and the private key cannot be practically derived from the public key.

To create a *keystore* you should use the ***keytool*** program which is part of the Java SDK. Make sure your PATH environment variable allows access to the most current Java-SDK.

Example:
Suppose we want to sign an application called: *IAMOK1.APK*. Assume *naming/versioning* has already been taken care of by inserting proper attributes in the application's manifest. To be able to sign this app (and other future apps) we need to first obtain a set of <private/public> keys.

In this example we will create a vault or keystore called "***debug.keystore***" (this is the default name expected by the Eclipse environment. To see or change the (Eclipse) path do: Windows > Preferences > Android (expand+) > Build. Two boxes point to the default vault and optional custom made keystore).

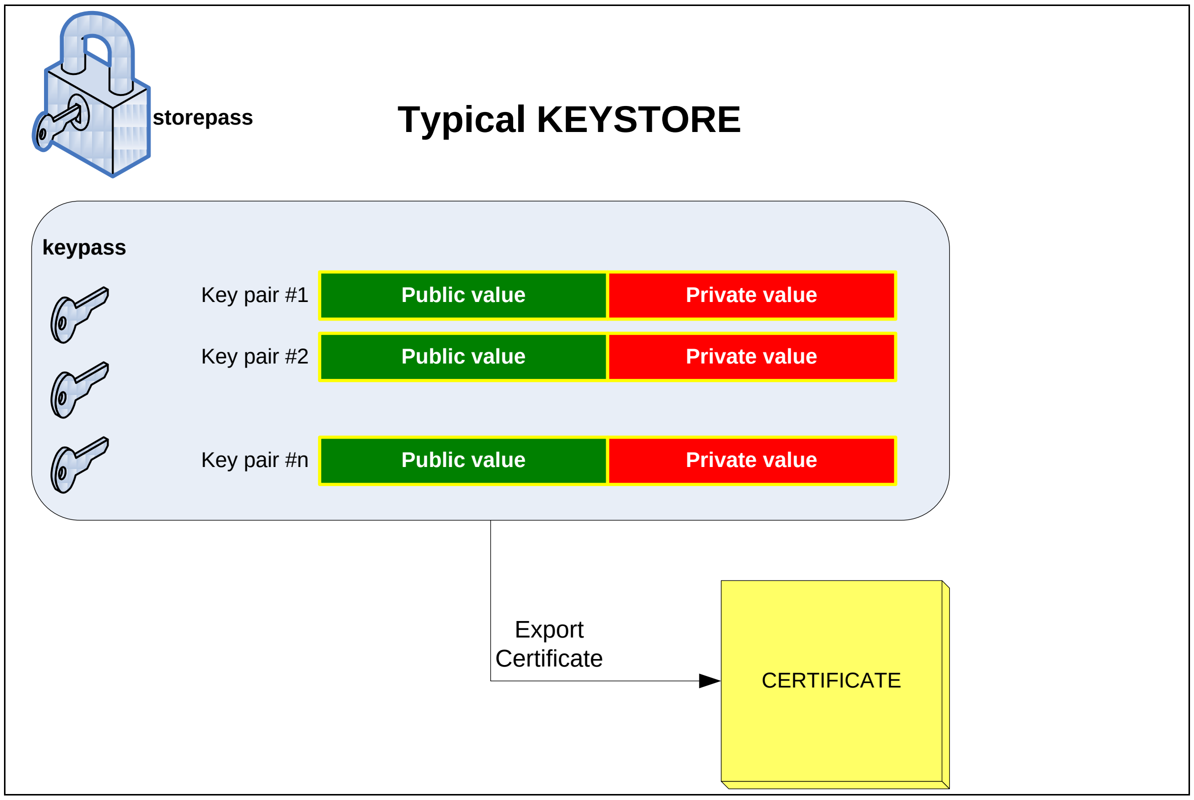
The key to open the *debug.keystore* container is "android". Inside we will create and store a public key called "androiddebugkey". For simplicity we choose the password to the public portion for this key entry to be "android". The corresponding private key will be created using the RSA algorithm and we will request 10000 days of longevity. The command call should be entered in a single line; in our example we break into several lines to enhance readability.

```
keytool -genkey -v
      -keystore     debug.keystore
      -alias        androiddebugkey
       -keyalg      RSA
      -validity     10000
      -storepass    android
      -keypass      android
```

During this process you will be prompted to enter personal information such as name, affiliation, location, etc. This will appear in connection to the secure self-signed certificate to be created. In our example we see the following dialog

```
What is your first and last name?
  [Unknown]:  victor matos
What is the name of your organizational unit?
  [Unknown]:  cis department
What is the name of your organization?
  [Unknown]:  cleveland state university
What is the name of your City or Locality?
  [Unknown]:  cleveland
What is the name of your State or Province?
  [Unknown]:  ohio
What is the two-letter country code for this unit?
  [Unknown]:  us
Is CN=victor matos, OU=cis department, O=cleveland state university, L=cleveland, ST=ohio, C=us correct?
  [no]:  yes

Generating 1,024 bit RSA key pair and self-signed certificate (SHA1withRSA) with a validity of 10,000 days
        for: CN=victor matos, OU=cis department, O=cleveland state university, L=cleveland, ST=ohio, C=us
[Storing debug.keystore]
```

At the end of this process a file called *debug.keystore* should have been created in you file system.



STEP2. Verify the keystore – See your MD5 fingerprint

For peace-of-mind you should verify the quality of your keystore. This process is also used in displaying the vault's *fingerprint.* The certificate's fingerprint value will be used in other validation procedures such as obtaining a Google's *android:apiKey* (required for an Android application that wants to get access to the Google-Map Service).

In our example we enter the following command (one line)

```
keytool -list -keystore debug.keystore
```

in this example it returns:

```
Enter keystore password:

Keystore type: JKS
Keystore provider: SUN

Your keystore contains 1 entry

androiddebugkey, Jan 22, 2009, PrivateKeyEntry,

Certificate fingerprint (MD5): 7E:E2:C2:12:FB:58:8E:EF:2A:BF:EB:85:49:6A:84:52
```

This output indicates that the keystore has *one* entry in the <public,private> collection of keys. In this case the public key is **androiddebugkey** and it has its corresponding matching (non-displayable) *PrivateKeyEntry* for which a certificate has been made.

Certificates
A public key certificate (also known as a *digital certificate* or *identity certificate*) is an electronic document which uses a digital signature (fingerprint) to bind together a public key with an identity — information such as the name of a person or an organization, their address, and so forth. The certificate can be used to verify that a public key belongs to an individual.

The output above shows the fingerprint associated to the public key. You may optionally create a *Certificate File* which summarizes information about a single public key. This is useful in SSL exchange (such as when using Google Maps API). If you choose to create the certificate enter the following command:

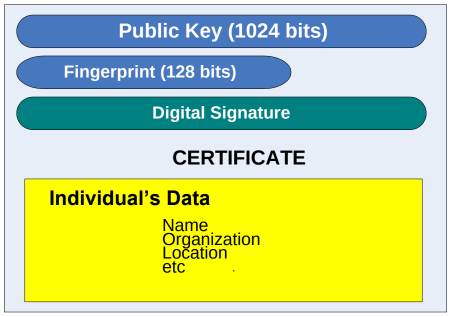
```
keytool     -exportcert -v
            -alias androiddebugkey
            -keystore debug.keystore > MyAndroidDebugCertificate2019.crt


Enter keystore password:  android
```

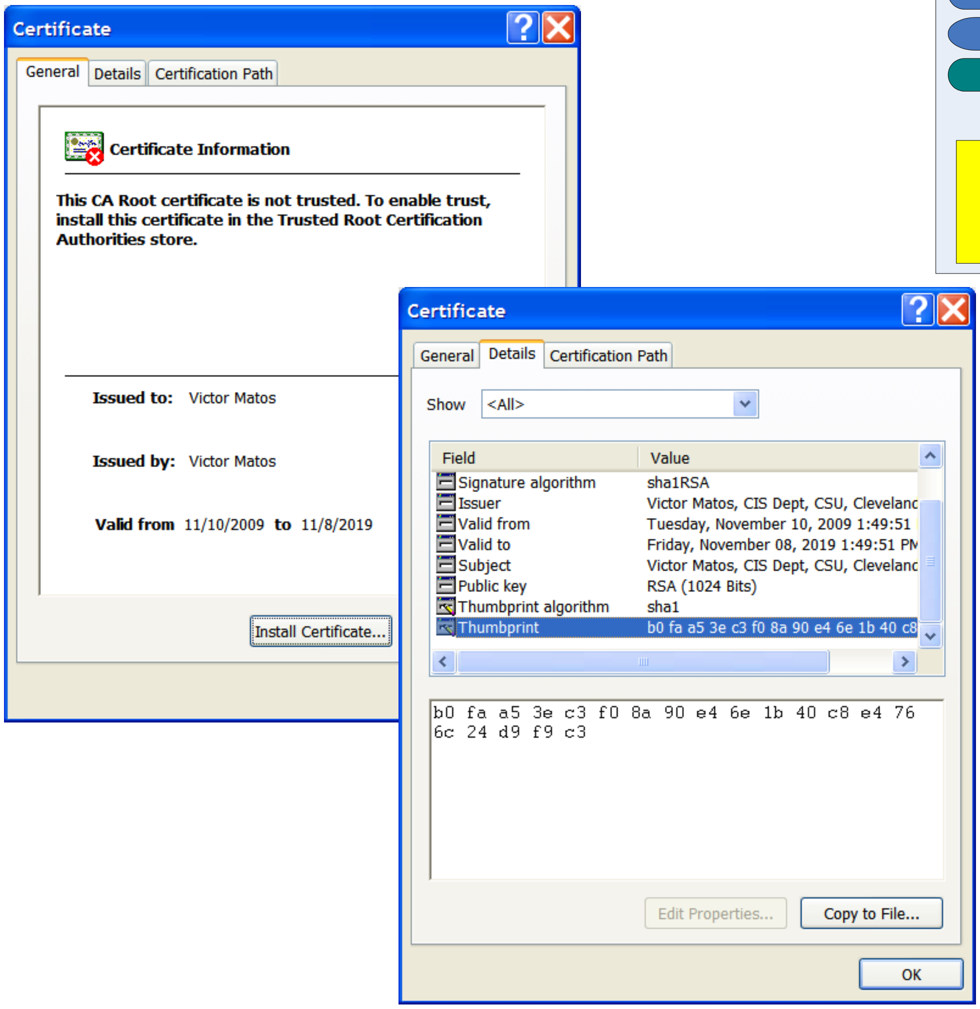
Inspect contents of the optional certificate file using the following command

```
    keytool -printcert -v -file myAndroidDebugCertificate2019.crt
```

You should see output like this

```
Owner: CN=Victor Matos, OU=CIS Dept, O=CSU, L=Cleveland, ST=Ohio, C=US
Issuer: CN=Victor Matos, OU=CIS Dept, O=CSU, L=Cleveland, ST=Ohio, C=US
Serial number: 4af9b5cf
Valid from: Tue Nov 10 13:49:51 EST 2009 until: Fri Nov 08 13:49:51 EST 2019
Certificate fingerprints:
         MD5:  71:73:97:14:13:13:FB:E5:38:A9:B3:9C:61:9C:56:F1
         SHA1: B0:FA:A5:3E:C3:F0:8A:90:E4:6E:1B:40:C8:E4:76:6C:24:D9:F9:C3
         Signature algorithm name: SHA1withRSA
         Version: 3
```





This CA Root certificate is not trusted. To enable trust, install this certificate in the Trusted Root Certification Authorities store.

Issued to: Victor Matos

Issued by: Victor Matos

Valid from 11/10/2009 to 11/8/2019

Field	Value
Signature algorithm	sha1RSA
Issuer	Victor Matos, CIS Dept, CSU, Clevelanc
Valid from	Tuesday, November 10, 2009 1:49:51
Valid to	Friday, November 08, 2019 1:49:51 PM
Subject	Victor Matos, CIS Dept, CSU, Clevelanc
Public key	RSA (1024 Bits)
Thumbprint algorithm	sha1
Thumbprint	b0 fa a5 3e c3 f0 8a 90 e4 6e 1b 40 c8

```
b0 fa a5 3e c3 f0 8a 90 e4 6e 1b 40 c8 e4 76
6c 24 d9 f9 c3
```

STEP3. Signing Your Android Apk

In order to distribute your application it must be first processed by the ***jarsigner*** program which is part of the Java SDK.

*The **jarsigner** tool is used in Android for two purposes: (1) to sign Java bytecode (.APK) files, and (2) to verify the signatures and integrity of signed .APK files. Archived APK files contain class files, images, sounds, and other digital data in a single file for faster and easier distribution. When processed by jarsigner an .APK files will also contain a META-INF/MANIFEST.MF file.*

*A **digital signature** is a string of bits that is computed from some data (the APK being "signed") and the private key of an entity. In order for an entity's signature to be generated for a file, the entity must first have a public/private key pair associated with it, and also one or more certificates authenticating its public key.*

*A **certificate** is a digitally signed statement from one entity, saying that the public key of some other entity has a particular value.*
*jarsigner uses key and certificate information from a **keystore** to generate digital signatures for APK files.*
jarsigner uses an entity's private key to generate a signature. The signed APK file contains, among other things, a copy of the certificate from the keystore for the public key corresponding to the private key used to sign the file.
jarsigner can verify the digital signature of the signed JAR file using the certificate inside it (in its signature block file).

In our example we use the following command (it must be a single-line command). It asks jarsigner to open the keystore known as "**debug.keystore**" using the keypass "**android**". Inside the vault it should look for the public key "**androiddebugkey**" and obtain its corresponding private value using the keypass "**android**". Finally, all this information will be use to sign the Android application known as "**IamOk1.apk**" (the following command should be written on only one line).

```
jarsigner   -verbose
            -keystore debug.keystore
            -storepass android
            -keypass android
             IamOk1.apk
            androiddebugkey
```

After executing the command you will see something like the lines below indicating the aplication's apk now contains a secure digital signature agreeable to the Android emulator (or device)

```
   adding: META-INF/VMATOSKE.SF
   adding: META-INF/VMATOSKE.RSA
  signing: res/drawable/btn_dropdown_down.9.png
  signing: res/drawable/icon.png
  signing: res/drawable/picture_emergency.png
  signing: res/layout/main.xml
  signing: res/layout/mycontacts_layout.xml
  signing: AndroidManifest.xml
  signing: resources.arsc
  signing: classes.dex
```

STEP4. Verifying Signature on the Android Application

```
jarsigner -verify -verbose -certs IamOk1.apk
```

You will see something like:

```
         401 Mon Oct 19 16:16:30 EDT 2009 META-INF/MANIFEST.MF
         541 Thu Nov 12 09:48:10 EST 2009 META-INF/ANDROIDD.SF
         925 Thu Nov 12 09:48:10 EST 2009 META-INF/ANDROIDD.RSA
         454 Mon Oct 19 16:16:30 EDT 2009 META-INF/CERT.SF
         776 Mon Oct 19 16:16:30 EDT 2009 META-INF/CERT.RSA
sm      3366 Mon Oct 19 15:11:08 EDT 2009 res/drawable/icon.png
      X.509, CN=Victor Matos, OU=CIS Dept, O=CSU, L=Cleveland, ST=Ohio, C=US
      [certificate is valid from 11/10/09 1:49 PM to 11/8/19 1:49 PM]

      X.509, CN=Android Debug, O=Android, C=US
      [certificate expired on 11/4/09 10:23 PM]

sm       916 Mon Oct 19 16:16:30 EDT 2009 res/layout/main.xml

      X.509, CN=Victor Matos, OU=CIS Dept, O=CSU, L=Cleveland, ST=Ohio, C=US
      [certificate is valid from 11/10/09 1:49 PM to 11/8/19 1:49 PM]

      X.509, CN=Android Debug, O=Android, C=US
      [certificate expired on 11/4/09 10:23 PM]

sm      1416 Mon Oct 19 16:16:30 EDT 2009 AndroidManifest.xml

      X.509, CN=Victor Matos, OU=CIS Dept, O=CSU, L=Cleveland, ST=Ohio, C=US
      [certificate is valid from 11/10/09 1:49 PM to 11/8/19 1:49 PM]

      X.509, CN=Android Debug, O=Android, C=US
      [certificate expired on 11/4/09 10:23 PM]

sm      1156 Mon Oct 19 15:11:08 EDT 2009 resources.arsc

      X.509, CN=Victor Matos, OU=CIS Dept, O=CSU, L=Cleveland, ST=Ohio, C=US
      [certificate is valid from 11/10/09 1:49 PM to 11/8/19 1:49 PM]

      X.509, CN=Android Debug, O=Android, C=US
      [certificate expired on 11/4/09 10:23 PM]

sm      4388 Mon Oct 19 16:16:30 EDT 2009 classes.dex

      X.509, CN=Victor Matos, OU=CIS Dept, O=CSU, L=Cleveland, ST=Ohio, C=US
      [certificate is valid from 11/10/09 1:49 PM to 11/8/19 1:49 PM]

      X.509, CN=Android Debug, O=Android, C=US
      [certificate expired on 11/4/09 10:23 PM]


  s = signature was verified
  m = entry is listed in manifest
  k = at least one certificate was found in keystore
  i = at least one certificate was found in identity scope

jar verified.
```

STEP5. Install your signed APK application in the Android Emulator (or device).

Use the Android-Debug-Bridge program available in the Android-SDK.

```
adb install IamOk1.apk
```

You will see something like:

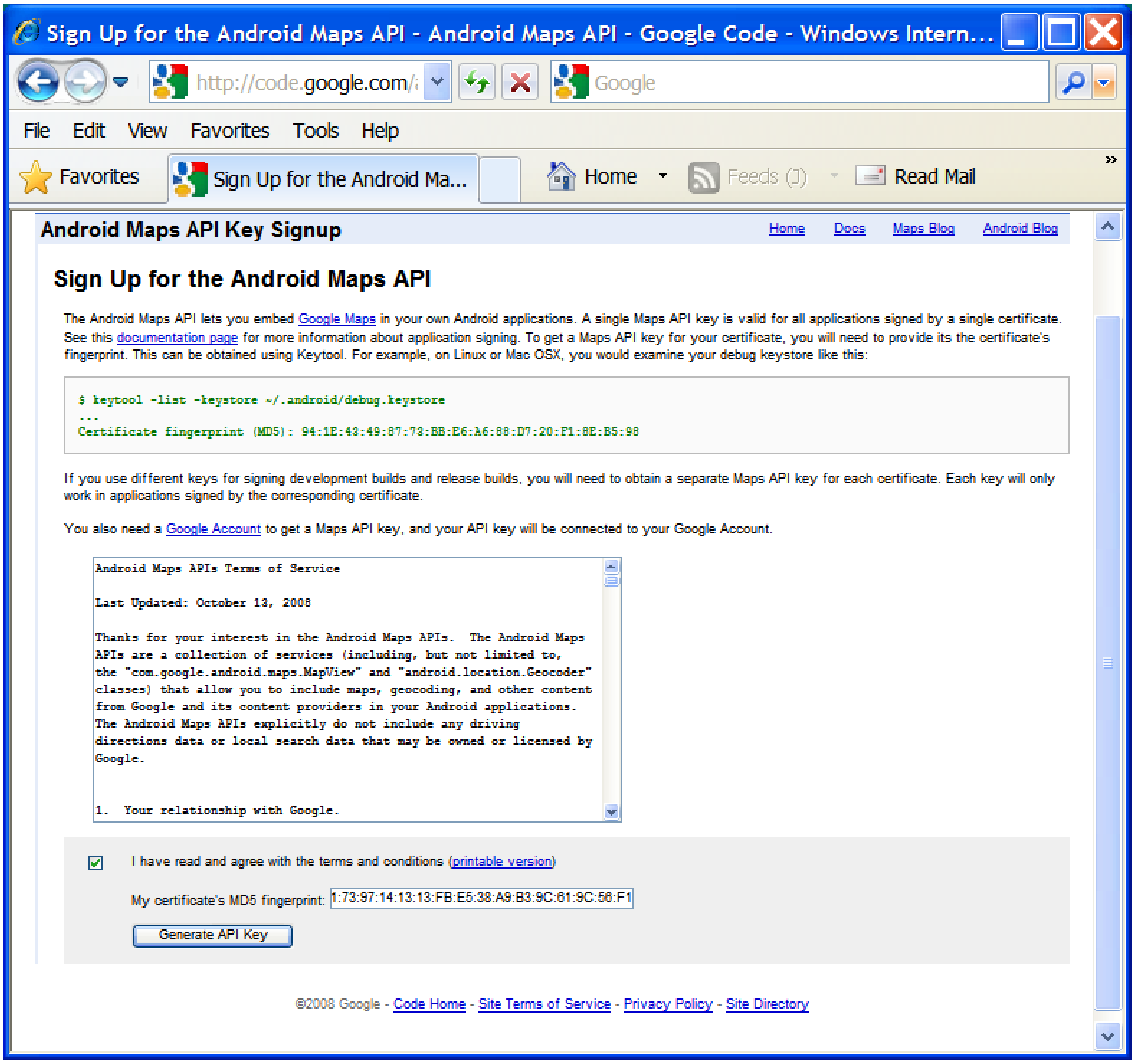
```
763 KB/s (0 bytes in 24441.000s)
         pkg: /data/local/tmp/IamOk1.apk
Success
```

At this point you should be ready to try the application.

Step6. Android Maps API Key Signup

1. We assume you are a registered *Google developer* or at least have a *gmail* account. Therefore you know your *username/password* credentials. If you do not have them you will have an opportunity to do so in the next steps.

2. Now you go into the "**Sign Up for the Android Maps API**" process. Contact Google at http://code.google.com/android/maps-api-signup.html. Accept the service agreement and paste the MD5 fingerprint value obtained earlier. Click on *Generate API key* button:


Sign Up for the Android Maps API - Android Maps API - Google Code - Windows Intern...
http://code.google.com/
Google
File Edit View Favorites Tools Help
Favorites
Sign Up for the Android Ma...
Home
Feeds (J)
Read Mail
Home Docs Maps Blog Android Blog

Android Maps API Key Signup

Sign Up for the Android Maps API

The Android Maps API lets you embed Google Maps in your own Android applications. A single Maps API key is valid for all applications signed by a single certificate. See this documentation page for more information about application signing. To get a Maps API key for your certificate, you will need to provide its the certificate's fingerprint. This can be obtained using Keytool. For example, on Linux or Mac OSX, you would examine your debug keystore like this:

```
$ keytool -list -keystore ~/.android/debug.keystore
...
Certificate fingerprint (MD5): 94:1E:43:49:87:73:BB:E6:A6:88:D7:20:F1:8E:B5:98
```

If you use different keys for signing development builds and release builds, you will need to obtain a separate Maps API key for each certificate. Each key will only work in applications signed by the corresponding certificate.

You also need a Google Account to get a Maps API key, and your API key will be connected to your Google Account.

```
Android Maps APIs Terms of Service

Last Updated: October 13, 2008

Thanks for your interest in the Android Maps APIs.  The Android Maps
APIs are a collection of services (including, but not limited to,
the "com.google.android.maps.MapView" and "android.location.Geocoder"
classes) that allow you to include maps, geocoding, and other content
from Google and its content providers in your Android applications.
The Android Maps APIs explicitly do not include any driving
directions data or local search data that may be owned or licensed by
Google.


1.  Your relationship with Google.
```

☑ I have read and agree with the terms and conditions (printable version)

My certificate's MD5 fingerprint: 1:73:97:14:13:13:FB:E5:38:A9:B3:9C:61:9C:56:F1

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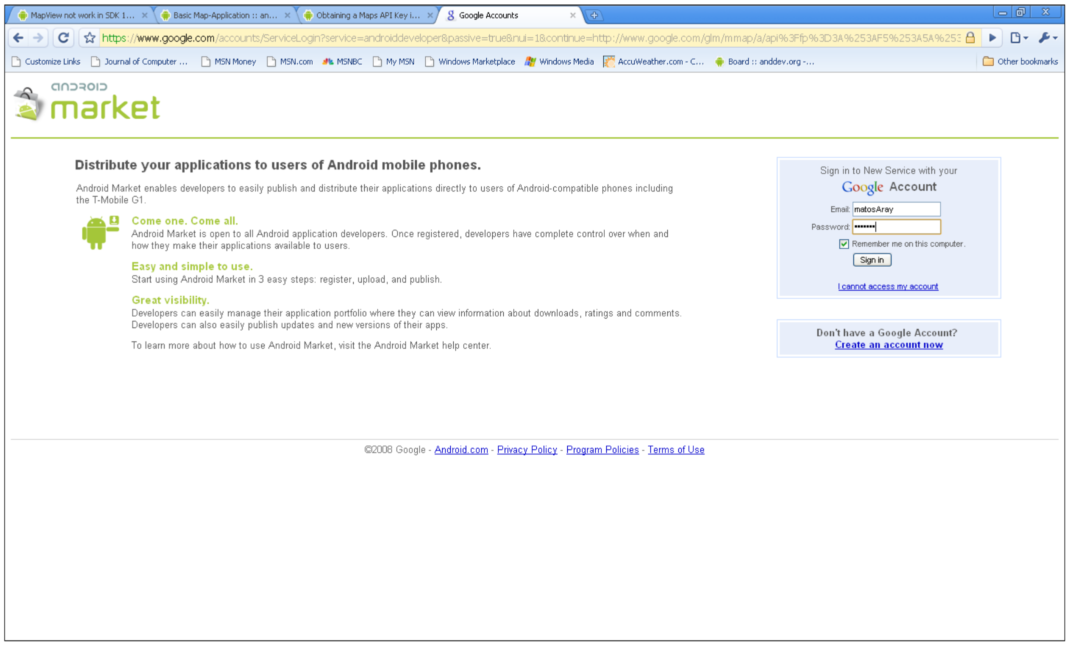
3. The first time you try this, you will be prompted to enter your Google/Gmail login credentials (*username/password*).



https://www.google.com/accounts/ServiceLogin?service=androiddeveloper&passive=true&nui=1&continue=http://www.google.com/glm/mmap/a/api%3Ffp%3D3A%253AF5%253A5A%253

Distribute your applications to users of Android mobile phones.

Android Market enables developers to easily publish and distribute their applications directly to users of Android-compatible phones including the T-Mobile G1.

Come one. Come all.
Android Market is open to all Android application developers. Once registered, developers have complete control over when and how they make their applications available to users.

Easy and simple to use.
Start using Android Market in 3 easy steps: register, upload, and publish.

Great visibility.
Developers can easily manage their application portfolio where they can view information about downloads, ratings and comments. Developers can also easily publish updates and new versions of their apps.

To learn more about how to use Android Market, visit the Android Market help center.

Sign in to New Service with your
Google Account

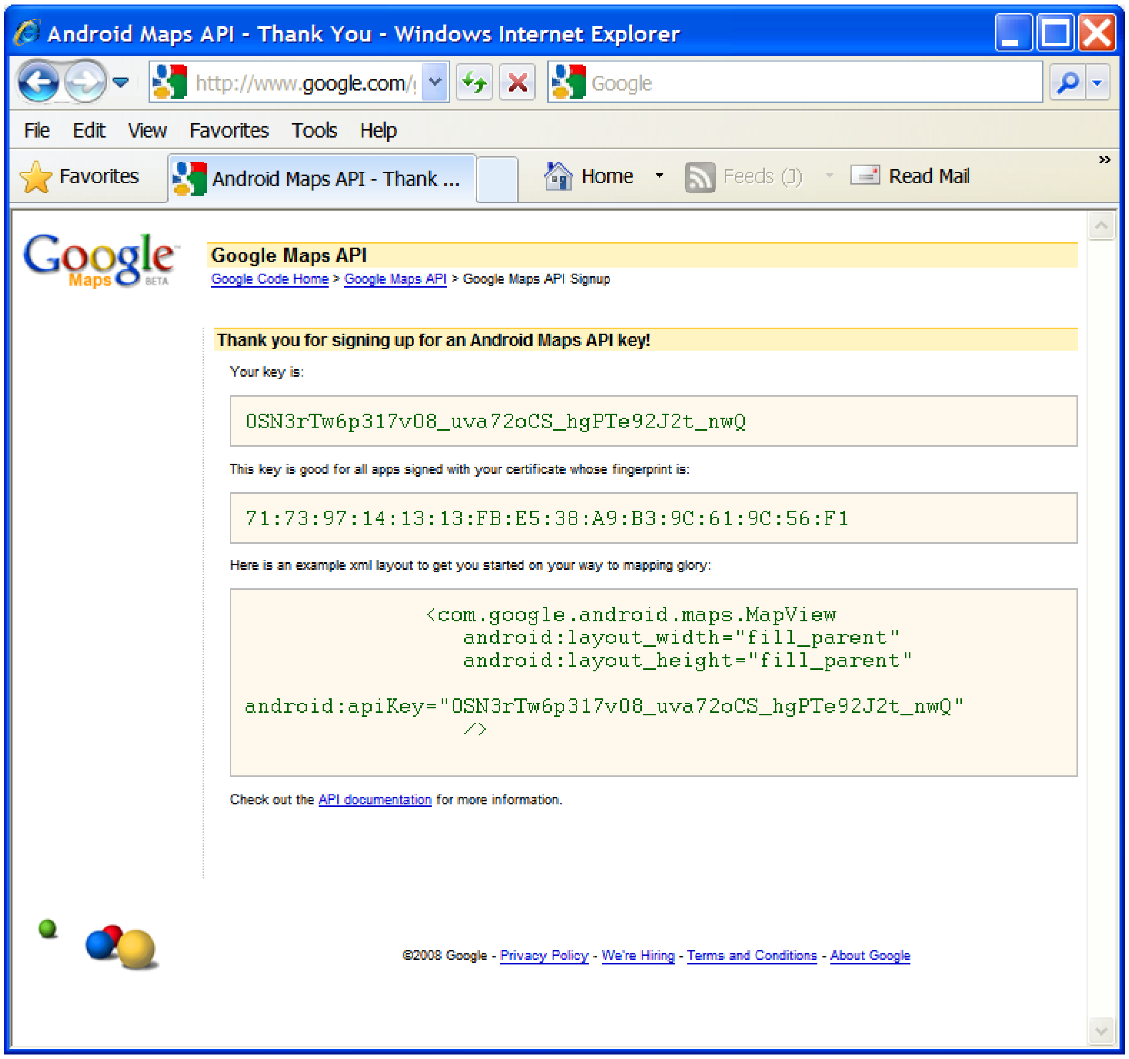
Email: matosAray
Password: •••••••
[✓] Remember me on this computer.
Sign in

I cannot access my account

Don't have a Google Account?
Create an account now

©2008 Google - Android.com - Privacy Policy - Program Policies - Terms of Use

4. Assuming everything went well you will see a screen like the following.


Android Maps API - Thank You - Windows Internet Explorer
http://www.google.com/
Google
File Edit View Favorites Tools Help
Favorites
Android Maps API - Thank ...
Home
Feeds (J)
Read Mail

Google Maps API

Google Code Home > Google Maps API > Google Maps API Signup

Thank you for signing up for an Android Maps API key!

Your key is:

```
0SN3rTw6p317v08_uva72oCS_hgPTe92J2t_nwQ
```

This key is good for all apps signed with your certificate whose fingerprint is:

```
71:73:97:14:13:13:FB:E5:38:A9:B3:9C:61:9C:56:F1
```

Here is an example xml layout to get you started on your way to mapping glory:

```
               <com.google.android.maps.MapView
                  android:layout_width="fill_parent"
                  android:layout_height="fill_parent"

android:apiKey="0SN3rTw6p317v08_uva72oCS_hgPTe92J2t_nwQ"
                  />
```

Check out the API documentation for more information.

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In this example the apikey value is

```
0SN3rTw6p317v08_uva72oCS_hgPTe92J2t_nwQ
```

(this is valid for any applications generated under the fingerprint `71:73:97:14:13:13:FB:E5:38:A9:B3:9C:61:9C:56:F1`)

When using a **MapView** attach the following signed fragment of xml to the layout/main.xml

```
<com.google.android.maps.MapView
  android:layout_width="fill_parent"
  android:layout_height="fill_parent"
  android:apiKey="0SN3rTw6p317v08_uva72oCS_hgPTe92J2t_nwQ"
  />
```

Personal Notes for Room BU342

SDK1.5 uses the folder: **C:\Documents and Settings\Administrator\.android** for hosting *certificate* and *debug.keystore*. The instructions to create the *fingerprint* and *ApiKey* are similar to the above for SDK1.0 except for the use of the sub-directory.

MAPS - UPGRADING

if you already have an ApiKey obtained for SDK1.0 then the (old) *keystore* is saved in the folder:

C:\Documents and Settings\Administrator\Local Settings\Application Data\Android

You do not need to obtain a new key !!!

Copy all the OLD files into the NEW destination in which SDK1.5 expects to see the keystore, the new destination is

C:\Documents and Settings\Administrator\.android

In my case:

LAPTOP	**android:apiKey="0SN3rTw6p317v08_uva72oCS_hgPTe92J2t_nwQ"**

Note: SDK1.5
If you do not have a previous Google-maps apiKey then follow the instructions from the beginning of these notes, remember that under SDK1.5 the *keystore* file is saved in the folder: C:\Documents and Settings\Administrator\.android

Appendix A. Visual Tool to Create and Print a Certificate.

The following steps are optional. You could create the debug.keystore, obtain a fingerprint, sign Android applications, and request a Google ***android:apikey*** *using the instructions given above.*

However, you may also use **KeyTool IUI** to generate and print the needed fingerprint.

- A graphical version of KeyTool software is available at: http://yellowcat1.free.fr/index_ktl.html.
- Download *ktl214.rar* (or latest Windows version), unpack the file, and execute the batch file: *run_ktl.bat*.

The process to create the fingerprint is as follows:

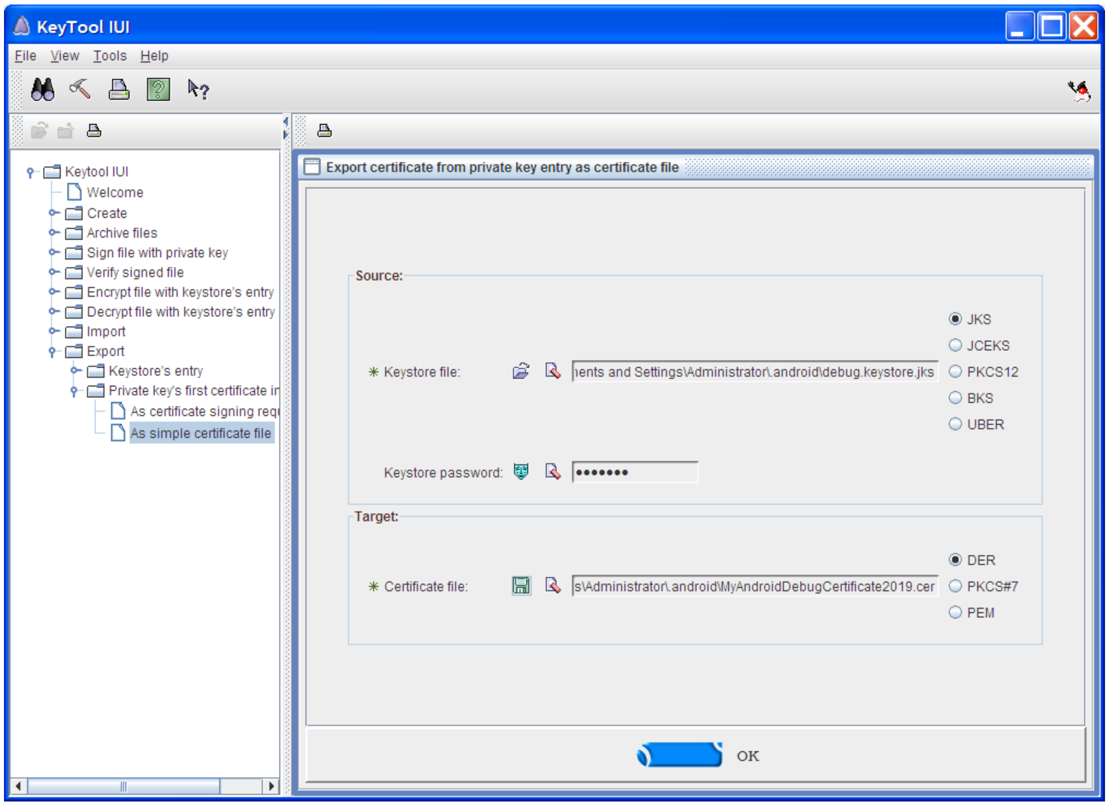
1. Go to folder
   C:\Documents and Settings\Administrator\.android

2. Make a copy of the file: debug.keystore and save it as
   debug.keystore.jks

3. Run KeyTool IUI
   Export | Private Keys's first certificate in chain | As Simple certificate file

4. On the screen enter
   SOURCE
   Keystore file: C:\Documents and Settings\Administrator\Local Settings\Application Data\Android\ ***debug.keystore.jks***
   keystore passwd: ***android***

   TARGET
   Certificate file: ***MyAndroidDebugCertificate2019***


KeyTool IUI
File View Tools Help
Keytool IUI
Welcome
Create
Archive files
Sign file with private key
Verify signed file
Encrypt file with keystore's entry
Decrypt file with keystore's entry
Import
Export
Keystore's entry
Private key's first certificate in
As certificate signing req
As simple certificate file
OK

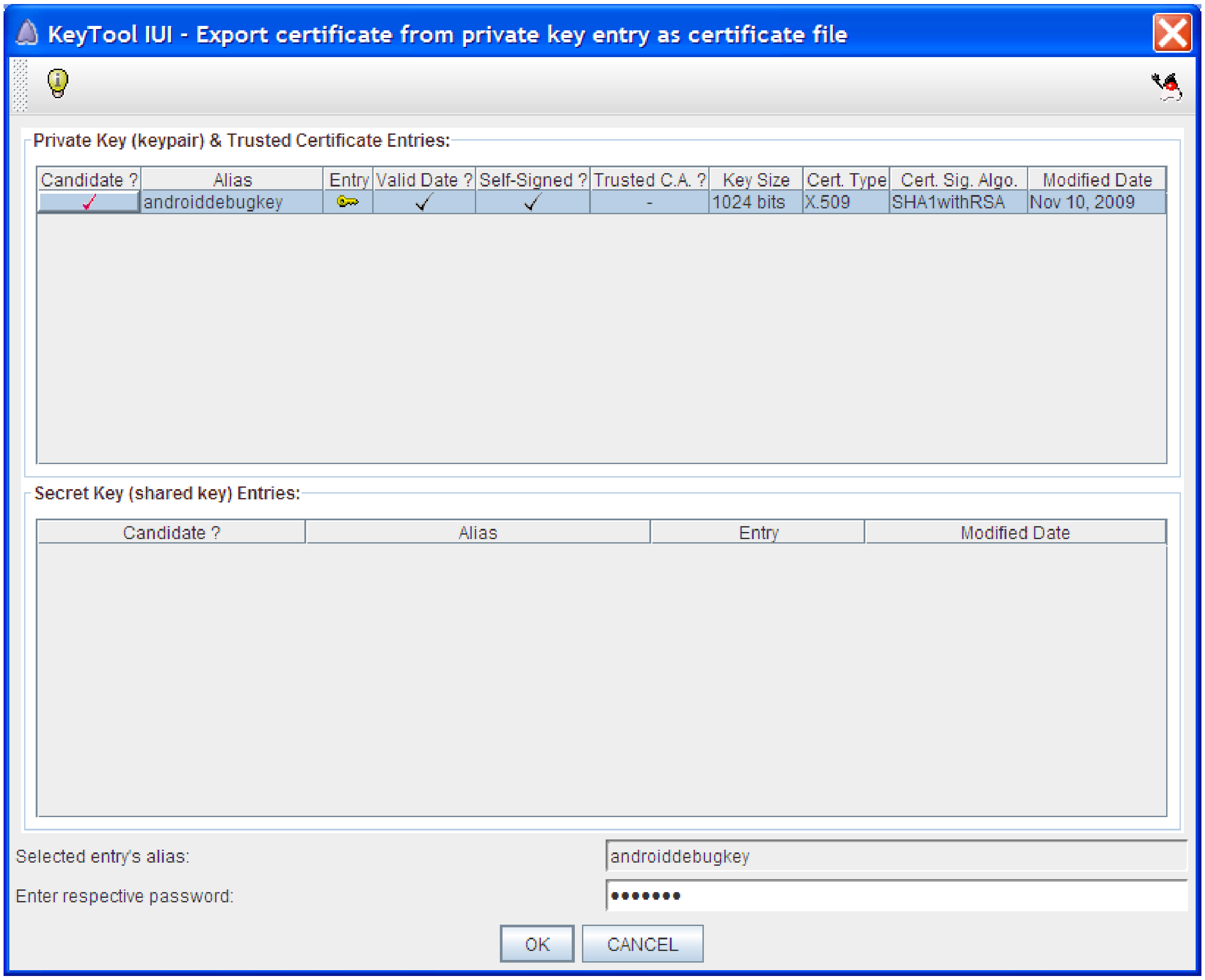
Export certificate from private key entry as certificate file

Source:
Keystore file: ıents and Settings\Administrator\.android\debug.keystore.jks
[✓ JKS] JCEKS PKCS12 BKS UBER
Keystore password: •••••••

Target:
Certificate file: s\Administrator\.android\MyAndroidDebugCertificate2019.cer
[✓ DER] PKCS#7 PEM

5. Click **OK** button

6. Select the first row: *androiddebugkey*. Enter respective password: ***android.*** Click OK button.



KeyTool IUI - Export certificate from private key entry as certificate file

Private Key (keypair) & Trusted Certificate Entries:

Candidate ?	Alias	Entry	Valid Date ?	Self-Signed ?	Trusted C.A. ?	Key Size	Cert. Type	Cert. Sig. Algo.	Modified Date
✓	androiddebugkey		✓	✓	-	1024 bits	X.509	SHA1withRSA	Nov 10, 2009

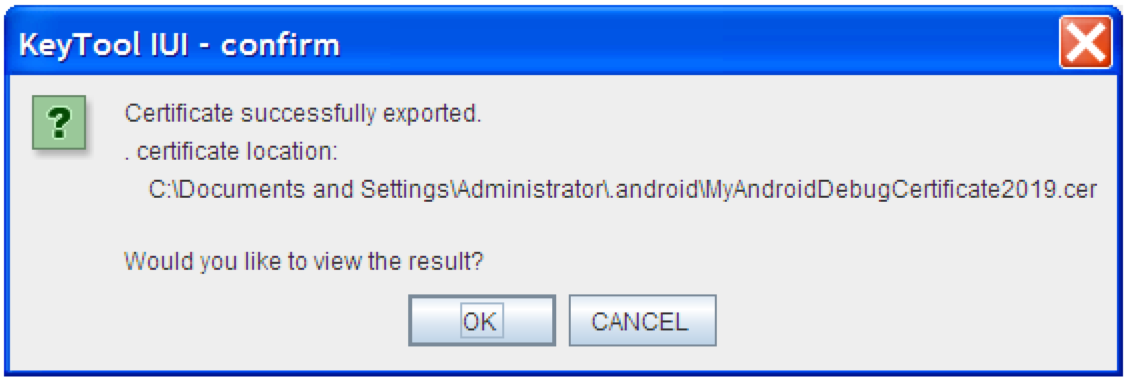
Secret Key (shared key) Entries:

Candidate ?	Alias	Entry	Modified Date

Selected entry's alias: androiddebugkey

Enter respective password: •••••••

7. You will see a messagebox. Click **OK** to see the certificate file.

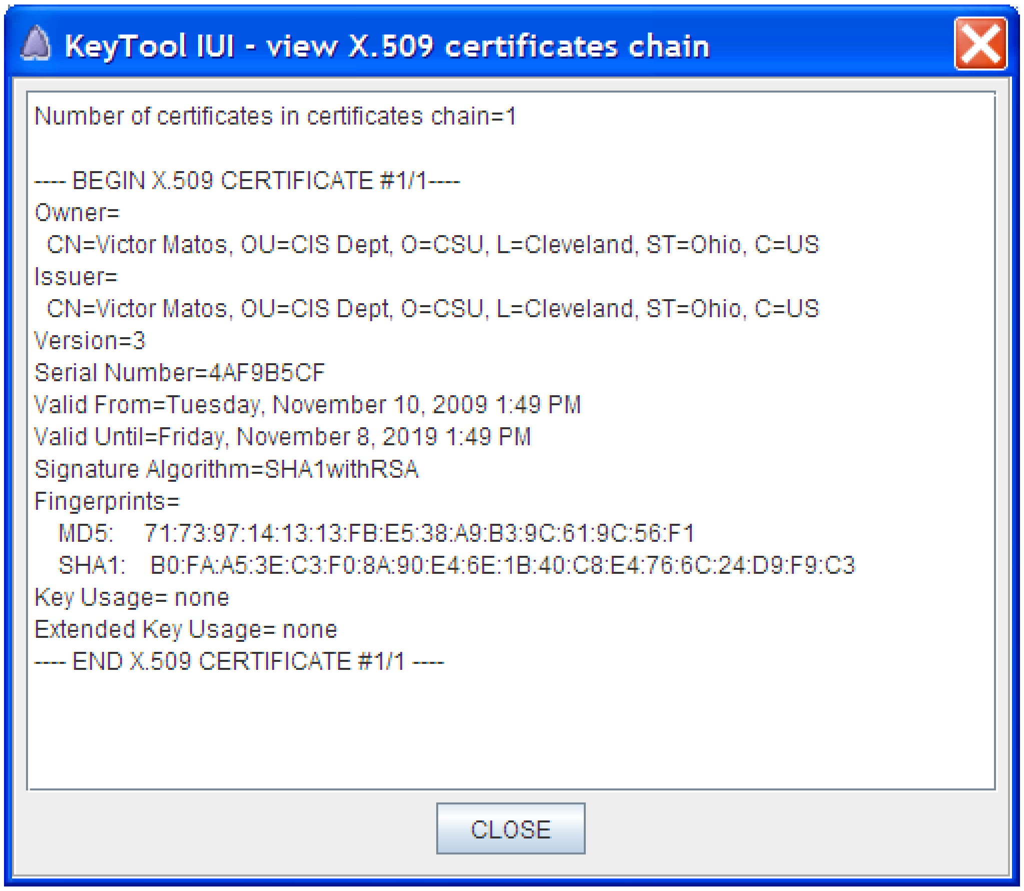


KeyTool IUI - confirm

Certificate successfully exported.
. certificate location:
C:\Documents and Settings\Administrator\.android\MyAndroidDebugCertificate2019.cer

Would you like to view the result?

8. See the resulting values. For your future convenience copy to a text file (c:\myfingerprint.txt) the **MD5 Fingerprint** value from the .cer file



```
Number of certificates in certificates chain=1

---- BEGIN X.509 CERTIFICATE #1/1----
Owner=
  CN=Victor Matos, OU=CIS Dept, O=CSU, L=Cleveland, ST=Ohio, C=US
Issuer=
  CN=Victor Matos, OU=CIS Dept, O=CSU, L=Cleveland, ST=Ohio, C=US
Version=3
Serial Number=4AF9B5CF
Valid From=Tuesday, November 10, 2009 1:49 PM
Valid Until=Friday, November 8, 2019 1:49 PM
Signature Algorithm=SHA1withRSA
Fingerprints=
    MD5:     71:73:97:14:13:13:FB:E5:38:A9:B3:9C:61:9C:56:F1
    SHA1:    B0:FA:A5:3E:C3:F0:8A:90:E4:6E:1B:40:C8:E4:76:6C:24:D9:F9:C3
Key Usage= none
Extended Key Usage= none
---- END X.509 CERTIFICATE #1/1 ----
```

10. In this example the value MD5 Fingerprint value is=
`71:73:97:14:13:13:FB:E5:38:A9:B3:9C:61:9C:56:F1`

Appendix B. Keytool Command

```
keytool usage:

-certreq     [-v] [-protected]
             [-alias <alias>] [-sigalg <sigalg>]
             [-file <csr_file>] [-keypass <keypass>]
             [-keystore <keystore>] [-storepass <storepass>]
             [-storetype <storetype>] [-providername <name>]
             [-providerclass <provider_class_name> [-providerarg <arg>]] ...
             [-providerpath <pathlist>]

-changealias [-v] [-protected] -alias <alias> -destalias <destalias>
             [-keypass <keypass>]
             [-keystore <keystore>] [-storepass <storepass>]
             [-storetype <storetype>] [-providername <name>]
             [-providerclass <provider_class_name> [-providerarg <arg>]] ...
             [-providerpath <pathlist>]

-delete      [-v] [-protected] -alias <alias>
             [-keystore <keystore>] [-storepass <storepass>]
             [-storetype <storetype>] [-providername <name>]
             [-providerclass <provider_class_name> [-providerarg <arg>]] ...
             [-providerpath <pathlist>]

-exportcert  [-v] [-rfc] [-protected]
             [-alias <alias>] [-file <cert_file>]
             [-keystore <keystore>] [-storepass <storepass>]
             [-storetype <storetype>] [-providername <name>]
             [-providerclass <provider_class_name> [-providerarg <arg>]] ...
             [-providerpath <pathlist>]

-genkeypair  [-v] [-protected]
             [-alias <alias>]
             [-keyalg <keyalg>] [-keysize <keysize>]
             [-sigalg <sigalg>] [-dname <dname>]
             [-validity <valDays>] [-keypass <keypass>]
             [-keystore <keystore>] [-storepass <storepass>]
             [-storetype <storetype>] [-providername <name>]
             [-providerclass <provider_class_name> [-providerarg <arg>]] ...
             [-providerpath <pathlist>]

-genseckey   [-v] [-protected]
             [-alias <alias>] [-keypass <keypass>]
             [-keyalg <keyalg>] [-keysize <keysize>]
             [-keystore <keystore>] [-storepass <storepass>]
             [-storetype <storetype>] [-providername <name>]
             [-providerclass <provider_class_name> [-providerarg <arg>]] ...
             [-providerpath <pathlist>]

-help

-importcert  [-v] [-noprompt] [-trustcacerts] [-protected]
             [-alias <alias>]
             [-file <cert_file>] [-keypass <keypass>]
```

```
            [-keystore <keystore>] [-storepass <storepass>]
            [-storetype <storetype>] [-providername <name>]
            [-providerclass <provider_class_name> [-providerarg <arg>]] ...
            [-providerpath <pathlist>]

-importkeystore [-v]
            [-srckeystore <srckeystore>] [-destkeystore <destkeystore>]
            [-srcstoretype <srcstoretype>] [-deststoretype <deststoretype>]
            [-srcstorepass <srcstorepass>] [-deststorepass <deststorepass>]
            [-srcprotected] [-destprotected]
            [-srcprovidername <srcprovidername>]
            [-destprovidername <destprovidername>]
            [-srcalias <srcalias> [-destalias <destalias>]
              [-srckeypass <srckeypass>] [-destkeypass <destkeypass>]]
            [-noprompt]
            [-providerclass <provider_class_name> [-providerarg <arg>]] ...
            [-providerpath <pathlist>]

-keypasswd   [-v] [-alias <alias>]
            [-keypass <old_keypass>] [-new <new_keypass>]
            [-keystore <keystore>] [-storepass <storepass>]
            [-storetype <storetype>] [-providername <name>]
            [-providerclass <provider_class_name> [-providerarg <arg>]] ...
            [-providerpath <pathlist>]

-list       [-v | -rfc] [-protected]
            [-alias <alias>]
            [-keystore <keystore>] [-storepass <storepass>]
            [-storetype <storetype>] [-providername <name>]
            [-providerclass <provider_class_name> [-providerarg <arg>]] ...
            [-providerpath <pathlist>]

-printcert   [-v] [-file <cert_file>]

-storepasswd [-v] [-new <new_storepass>]
            [-keystore <keystore>] [-storepass <storepass>]
            [-storetype <storetype>] [-providername <name>]
            [-providerclass <provider_class_name> [-providerarg <arg>]] ...
            [-providerpath <pathlist>]
```

Appendix C. Jarsigner Command

```
Usage: jarsigner [options] jar-file alias
       jarsigner -verify [options] jar-file

[-keystore <url>]          keystore location

[-storepass <password>]    password for keystore integrity

[-storetype <type>]        keystore type

[-keypass <password>]      password for private key (if different)

[-sigfile <file>]          name of .SF/.DSA file

[-signedjar <file>]        name of signed JAR file

[-digestalg <algorithm>]   name of digest algorithm

[-sigalg <algorithm>]      name of signature algorithm

[-verify]                  verify a signed JAR file

[-verbose]                 verbose output when signing/verifying

[-certs]                   display certificates when verbose and verifying

[-tsa <url>]               location of the Timestamping Authority

[-tsacert <alias>]         public key certificate for Timestamping Authority

[-altsigner <class>]       class name of an alternative signing mechanism

[-altsignerpath <pathlist>] location of an alternative signing mechanism

[-internalsf]              include the .SF file inside the signature block

[-sectionsonly]            don't compute hash of entire manifest

[-protected]               keystore has protected authentication path

[-providerName <name>]     provider name

[-providerClass <class>    name of cryptographic service provider's
[-providerArg <arg>]] ... master class file and constructor argument
```