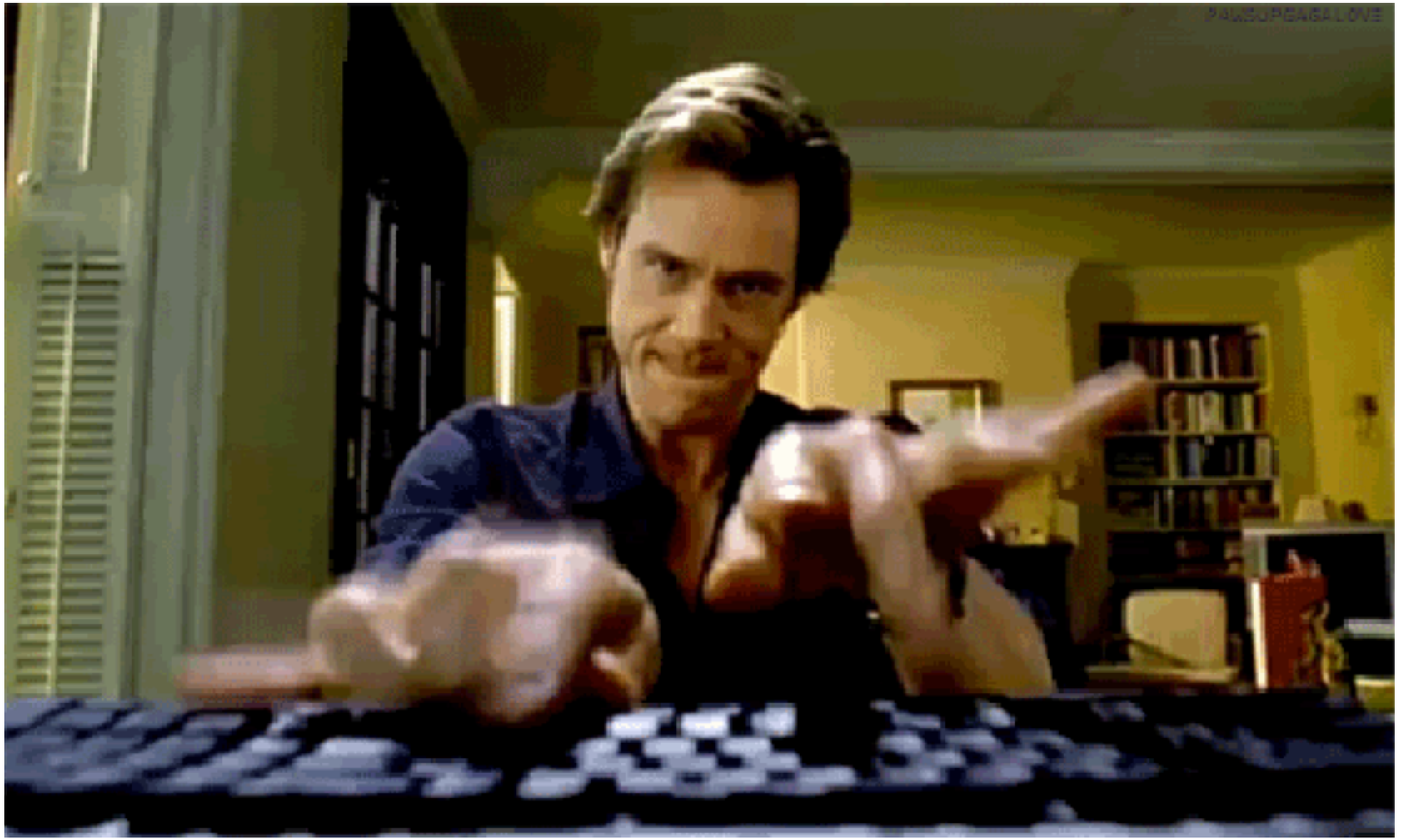
What's NNNNNew in Android Security?

Android Security
Symposium 2017

Scott Alexander-Bown
@ScottyAB



At a glance

Slides/Links
https://goo.gl/sL5z7U

- ☐ Direct boot
- ☐ Android Keystore (Key Attestation)
- ☐ ‘Securer’ networking
- ☐ Misc system and app differences
- ☐ SafetyNet

@ScottyAB

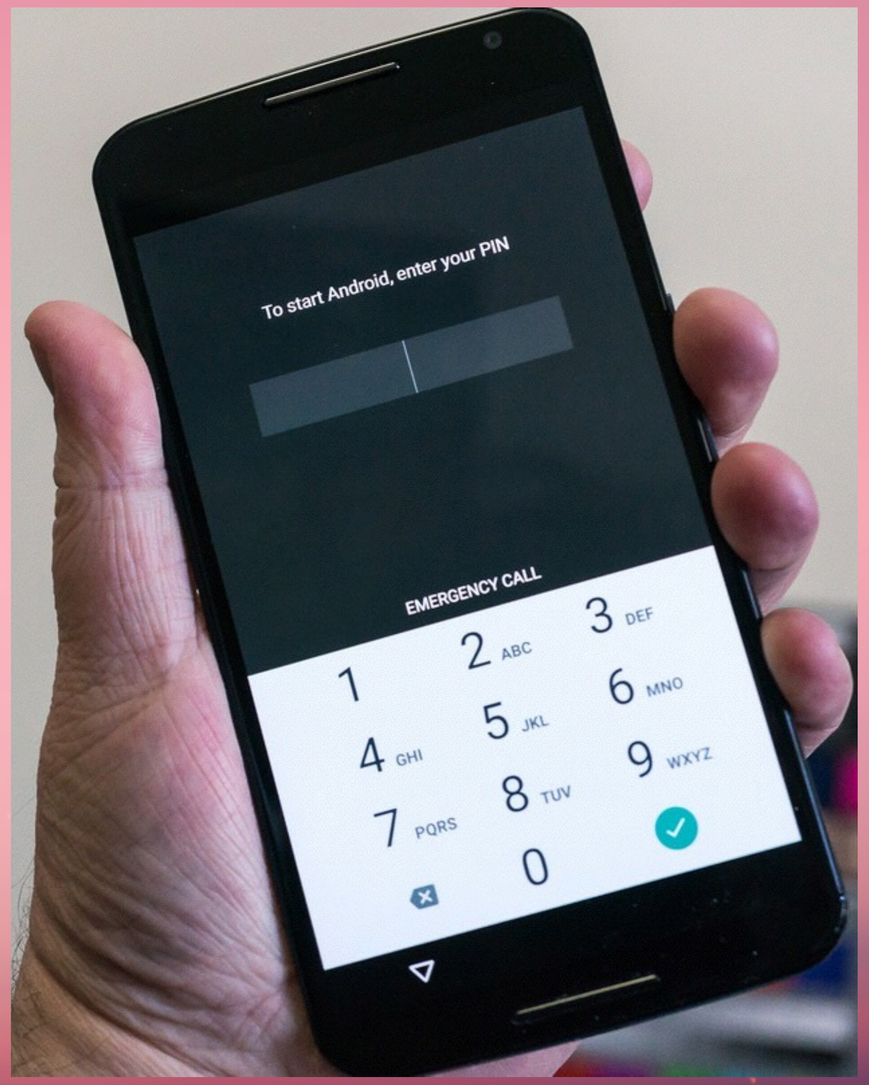
Terms

6.0 - M - API 23 - Marshmallow

7.0 - N - API 24 - Nougat

7.1 - N (MR1) - API 25 - Nougat

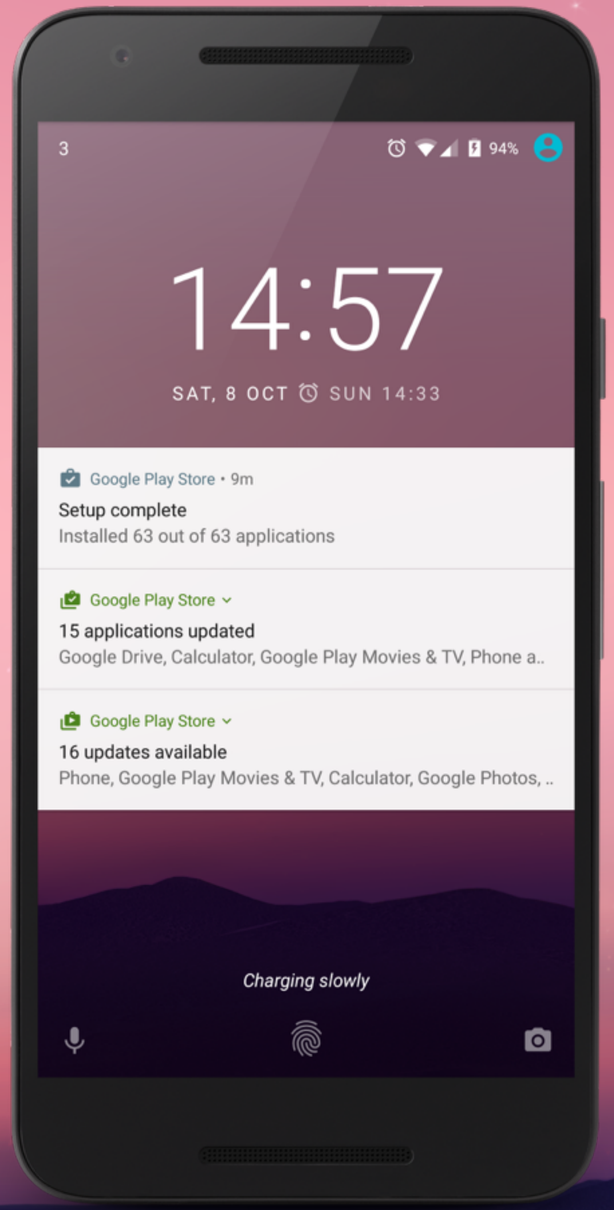

Direct Boot



Booting encrypted device pre-7.0

- ☐ Boot halted for pin/password
- ☐ Device encrypted with same key
- ☐ Android used block-level encryption

@ScottyAB

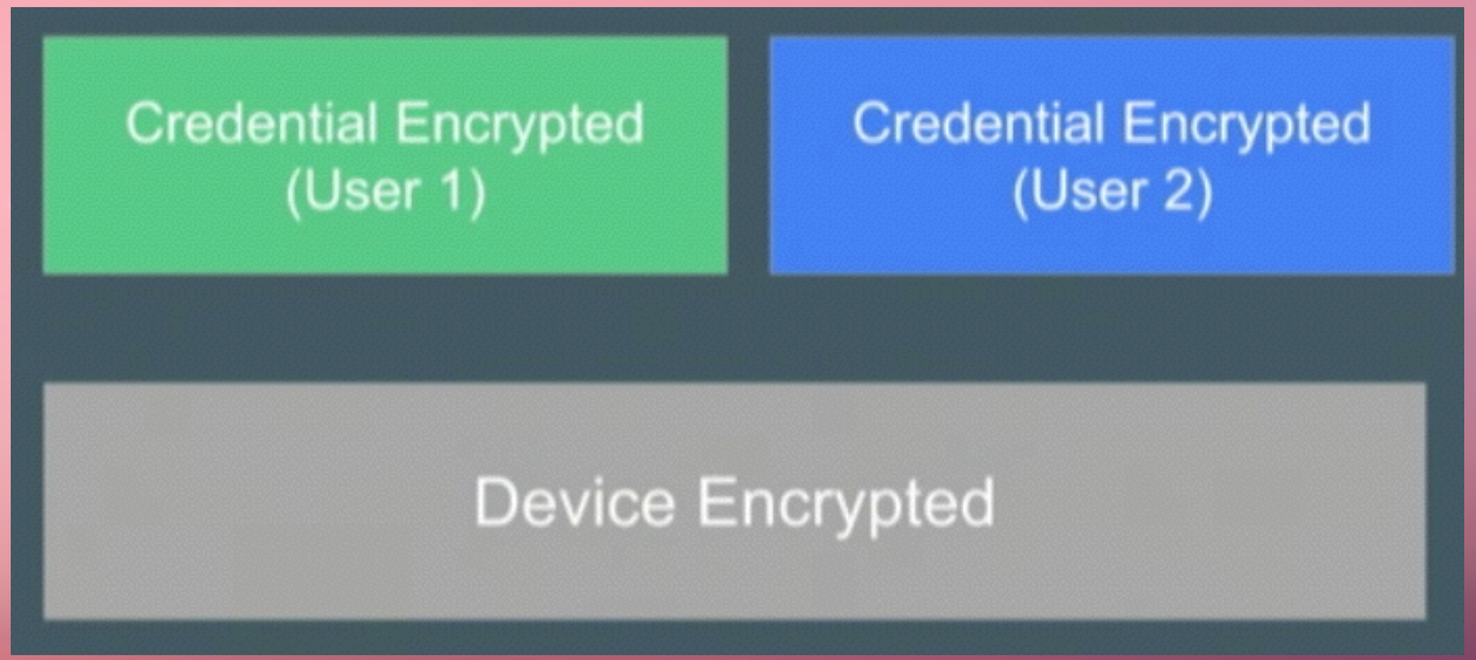


Direct Boot mode

- ☐ Boot direct to lock screen
- ☐ Calls, SMS & Alarms work
- ☐ And your app too!

@ScottyAB

File based encryption



@ScottyAB

Direct Boot aware <receiver />

```
<receiver
    android:name=".directboot.MyDirectBootAwareReceiver"
    android:directBootAware="true">
    <intent-filter>
        <action
android:name="android.intent.action.ACTION_LOCKED_BOOT_COMPLETED" />
    </intent-filter>
</receiver>
```

Direct Boot aware <receiver />

```
<receiver
    android:name=".directboot.MyDirectBootAwareReceiver"
    android:directBootAware="true">
    <intent-filter>
        <action
android:name="android.intent.action.ACTION_LOCKED_BOOT_COMPLETED" />
    </intent-filter>
</receiver>
```

@ScottyAB

Accessing device encrypted storage

```
@Override
public void onReceive(Context context, Intent intent) {

    Context directBootContext =
ContextCompat.createDeviceProtectedStorageContext(context);

    if (directBootContext != null) {
        SharedPreferences sharedPreferences =
PreferenceManager.getDefaultSharedPreferences(directBootContext);

        String token = sharedPreferences.getString(READ_ONLY_OAUTH_TOKEN, null);

        //do read only API lookup
        ///...
    }
}
```

@ScottyAB

Accessing device encrypted storage

```
@Override
public void onReceive(Context context, Intent intent) {

    Context directBootContext =
ContextCompat.createDeviceProtectedStorageContext(context);

    if (directBootContext != null) {
        SharedPreferences sharedPreferences =
PreferenceManager.getDefaultSharedPreferences(directBootContext);

        String token = sharedPreferences.getString(READ_ONLY_OAUTH_TOKEN, null);

        //do read only API lookup
        ///...
    }
}
```

@ScottyAB

Accessing device encrypted storage

```
@Override
public void onReceive(Context context, Intent intent) {

    Context directBootContext =
ContextCompat.createDeviceProtectedStorageContext(context);

    if (directBootContext != null) {
        SharedPreferences sharedPreferences =
PreferenceManager.getDefaultSharedPreferences(directBootContext);

        String token = sharedPreferences.getString(READ_ONLY_OAUTH_TOKEN, null);

        //do read only API lookup
        ///...
    }
}
```

@ScottyAB

Direct Boot, so what is it good for?

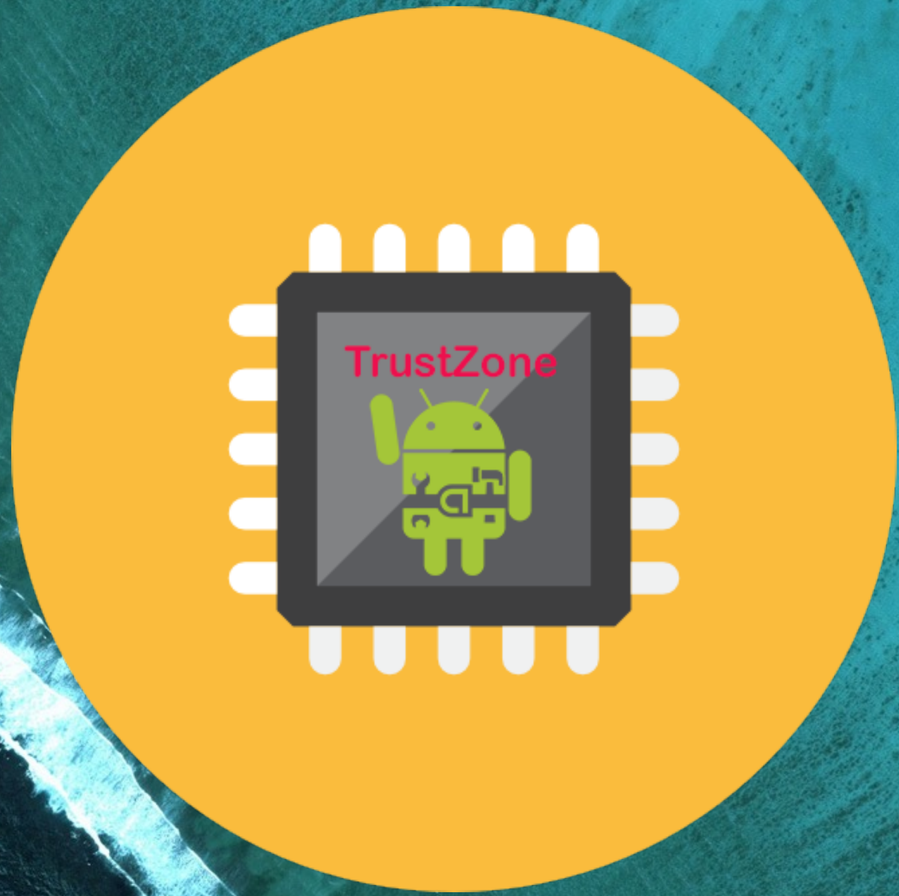
- ☐ Messaging apps, important user notifications.
- ☐ Already using a BootCompleted listener?
- ☐ Device encrypted storage for limited scope API tokens i.e Readonly

Android Keystore

Android 4.3

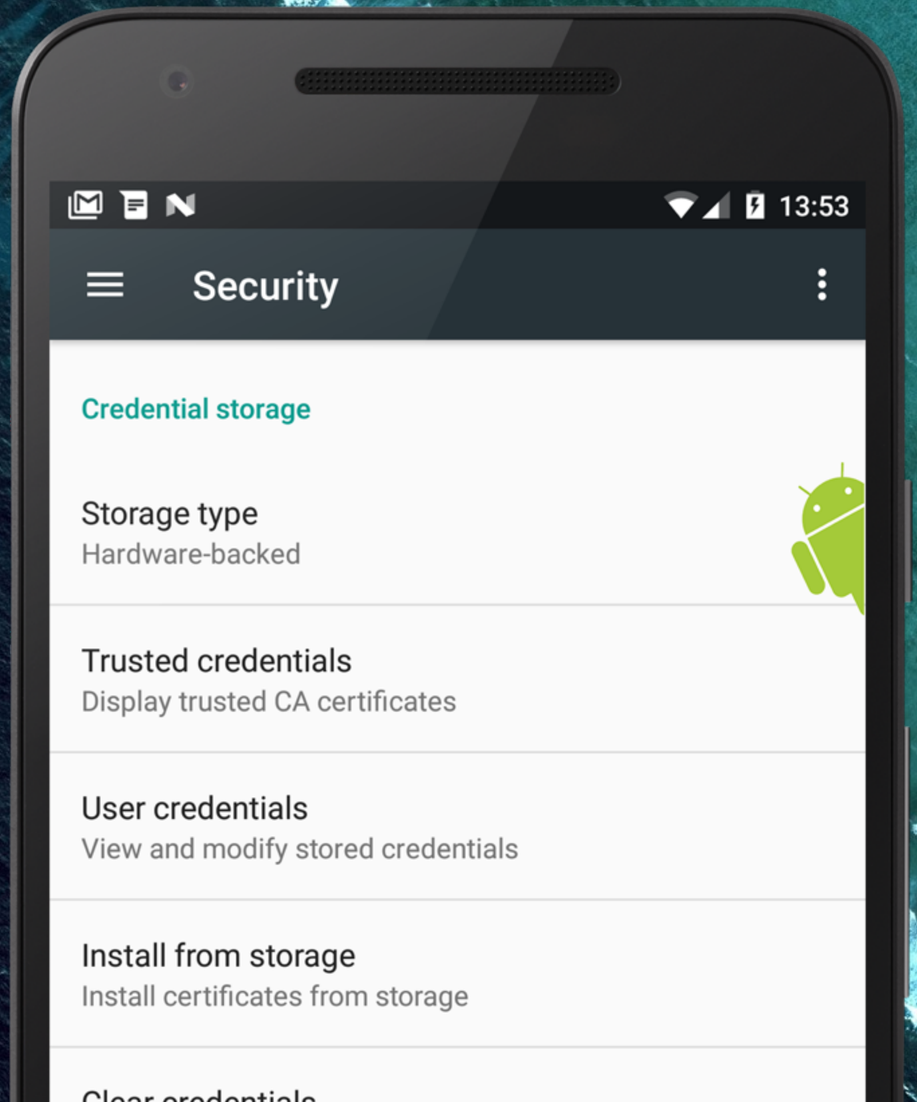
@ScottyAB

What is the KeyStore?



@ScottyAB

What's new?



- ☐ Android M introduced broader range of capabilities.
- ☐ N+ must be hardware backed (new devices)
- ☐ Time sensitive (Android M)

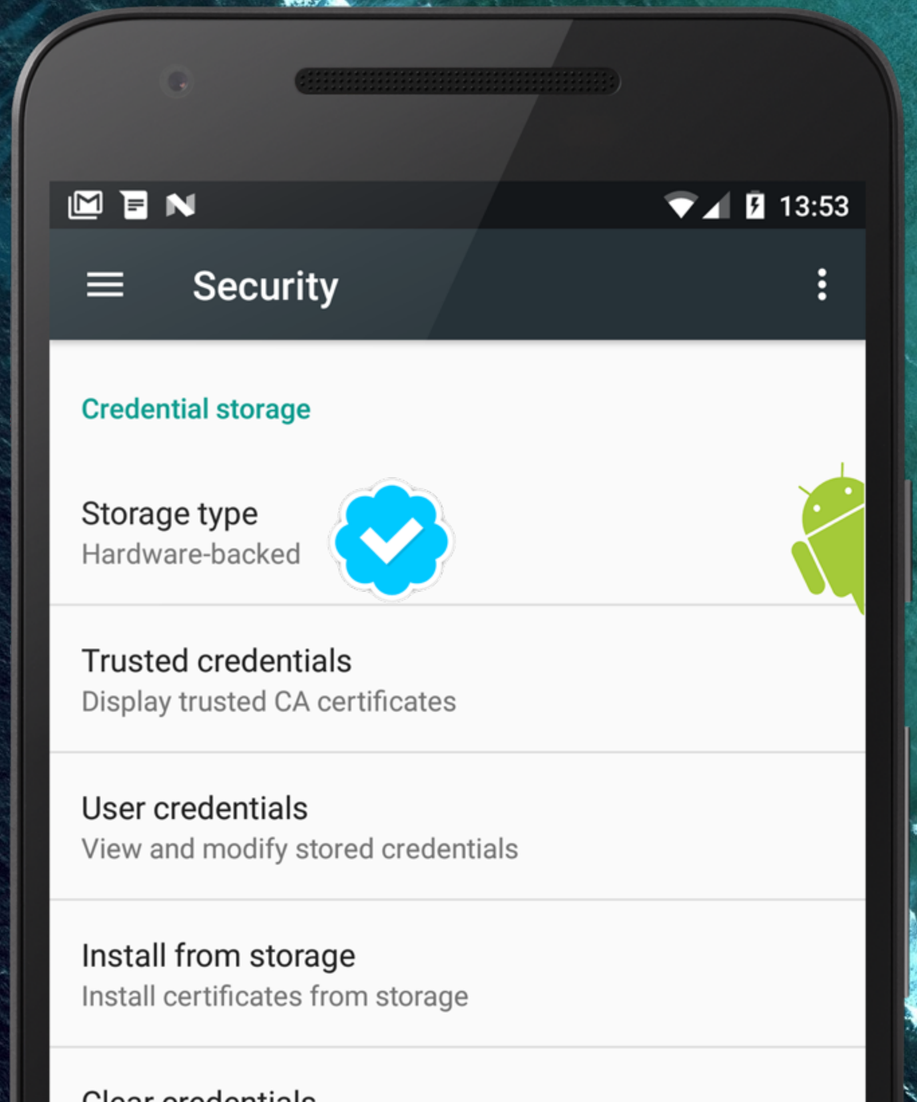
@ScottyAB

is the Keystore hardware backed?

```
// deprecated
KeyChain.isBoundKeyAlgorithm(“RSA”);

// Recommended alternative
PrivateKey key = ...; // private key from KeyChain

KeyFactory keyFactory = KeyFactory.getInstance(key.getAlgorithm(),
“AndroidKeyStore");

KeyInfo keyInfo = keyFactory.getKeySpec(key, KeyInfo.class);
 if (keyInfo.isInsideSecureHardware()) {
     // The key is bound to the secure hardware of this Android
```

@ScottyAB

Key Attestation



- ☐ verify key is stored in hardware-backed keystore
- ☐ N+ (New hardware)
- ☐ Special key is baked into the firmware

@ScottyAB

Code

- `keyStore.getCertificateChain(alias)`
- Send cert chain to your server
- validate the cert chain (on your server!)

Android Security: The Forgetful Keystore

Written on February 15, 2015

Updated 13/06/2016

You've just moved in to a new house and have been given the master key for the front door. You only have one of these
you know you need to keep it safe. Your really paranoid so you hire an armed guard, whose sole job is to protect this ke
fact, this is all he has been trained to do and has a catchy slogan of "need to protect a key, its what I was born to do!". Y


<network-security-config>
@ScottyAB

Securer Networking

- ☐ Custom trust store / anchors
- ☐ Debug only Overrides CA
- ☐ Block non https traffic
- ☐ Limit the certs you trust

minSdkVersion=24?

CWAC-NetSecurity by Mark Murphy

https://github.com/commonsguy/cwac-netsecurity

@ScottyAB

Configuring CAs for Debugging

- ☐ Self signed certs in development
- ☐ Only enabled when android:debuggable=true
- ☐ Safer that conditional code

Configuring CAs for Debugging

```
<network-security-config>
  <debug-overrides>
      <trust-anchors>
        <certificates src="@raw/debug_cert" />
      </trust-anchors>
  </debug-overrides>
</network-security-config>
```

@ScottyAB

Manifest

```
<application
    android:icon="@mipmap/ic_launcher"
    android:label="@string/app_name"
    android:networkSecurityConfig=
“@xml/network_security_config_debug_ca" />
```

Manifest

```
<application
    android:icon="@mipmap/ic_launcher"
    android:label="@string/app_name"
    android:networkSecurityConfig=
“@xml/network_security_config_debug_ca" />
```

@ScottyAB

User certs not trusted by default*

*Running on API 24+ and targeting API 24+

PORTSWIGGER
WEB SECURITY

mitmproxy

@ScottyAB

Trusting user installed certs

```
<network-security-config>
    <debug-overrides>
        <trust-anchors>
            <certificates src="user" />
        </trust-anchors>
    </debug-overrides>
 </network-security-config>
```

Gist: https://goo.gl/KN1QLp

@ScottyAB

Pinning Certificates

- SSL pinning lets apps limit the set of certificates they accept
- Pin a hash of the SubjectPublicKeyInfo of the X.509 certificate.

@ScottyAB

SSL Pinning

```
<network-security-config>
  <domain-config>
     <domain>scottyab.com</domain>
      <pin-set expiration="2018-03-08">
        <pin digest="SHA-256">7HIpactkIAq2Y49…Y=</pin>
        <!-- backup pin -->
        <pin digest="SHA-256">fwza0LRMXouZHR…E=</pin>
      </pin-set>
  </domain-config>
</network-security-config>
```

@ScottyAB

How to get the Pin?

SSL Pin Generator

Is a simple Java base util to generate SSL pins based on a certificate's Subject Public Key Info as described on Adam Langley's Weblog (a.k.a Public Key pinning). Pins are base-64 SHA-1 [default] hashes, consistent with the format Chromium uses for static certificates. See Chromium's pinsets for hostnames that are pinned in that browser.

I created this mainly to be compatible with okhttp 2.1+, but later added the option to specific which hashing algorithm can be used to make this compatible with Android's `<network-security-config>`

Usage

Warning you should ensure you run this on a trusted network

Download the jar here or clone and compile the class.

Simply pass to hostname with optionally port, and algorithm to the jar. `$ java -jar generatePins.jar <your hostname:port"> algorithm`

https://goo.gl/mupcRk

Default

How to get the Pin?

```
$ openssl s_client -servername scottyab.com
-connect scottyab.com:443 | openssl x509 -
pubkey -noout | openssl rsa -pubin -outform
der | openssl dgst -sha256 -binary | openssl
enc -base64
```

Thanks to John Kozyrakis @ikoz

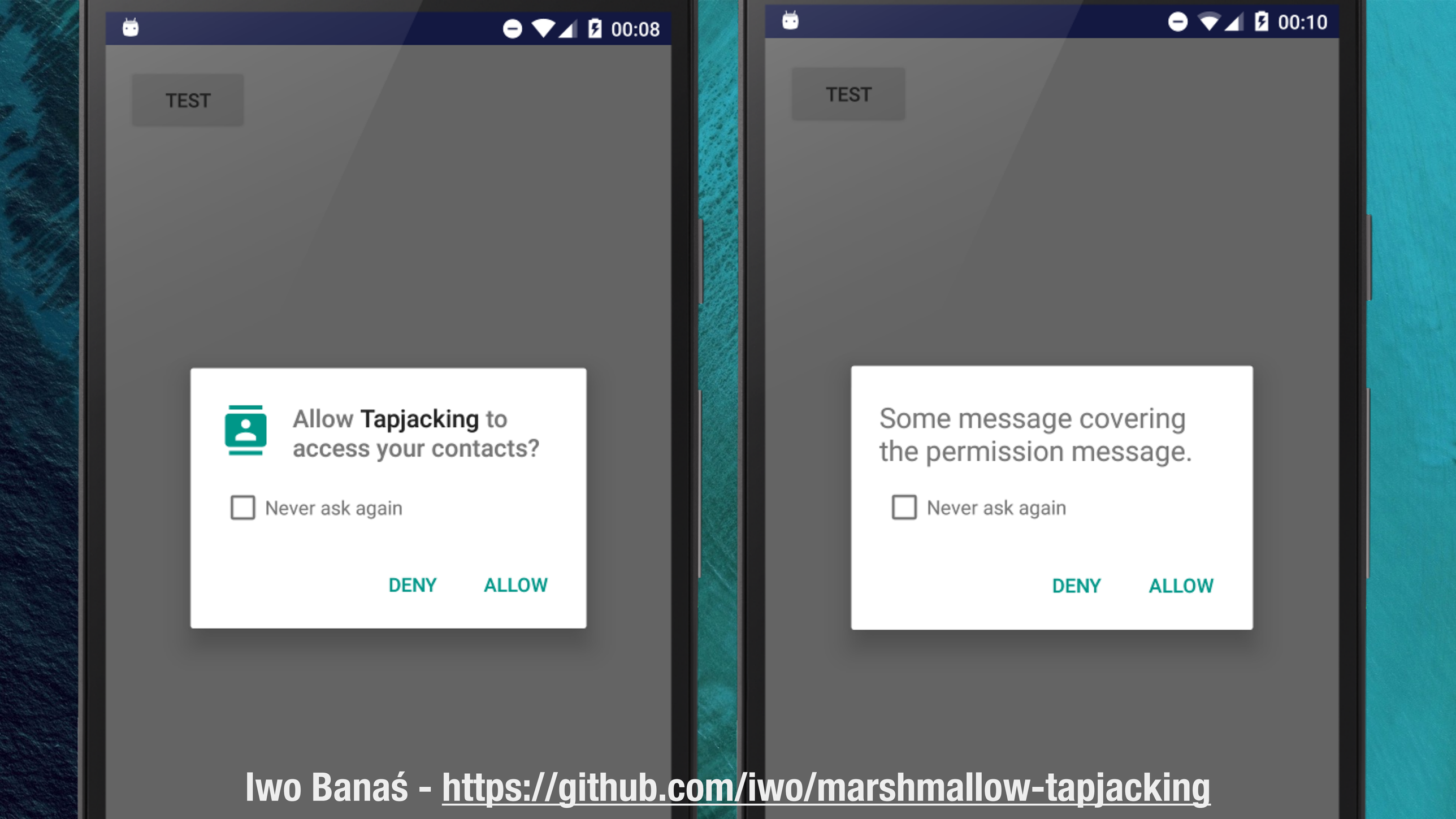

Misc
NEW
@ScottyAB

Under the hood

- The media stack and platform hardening
- Kernel hardening (with error correction)

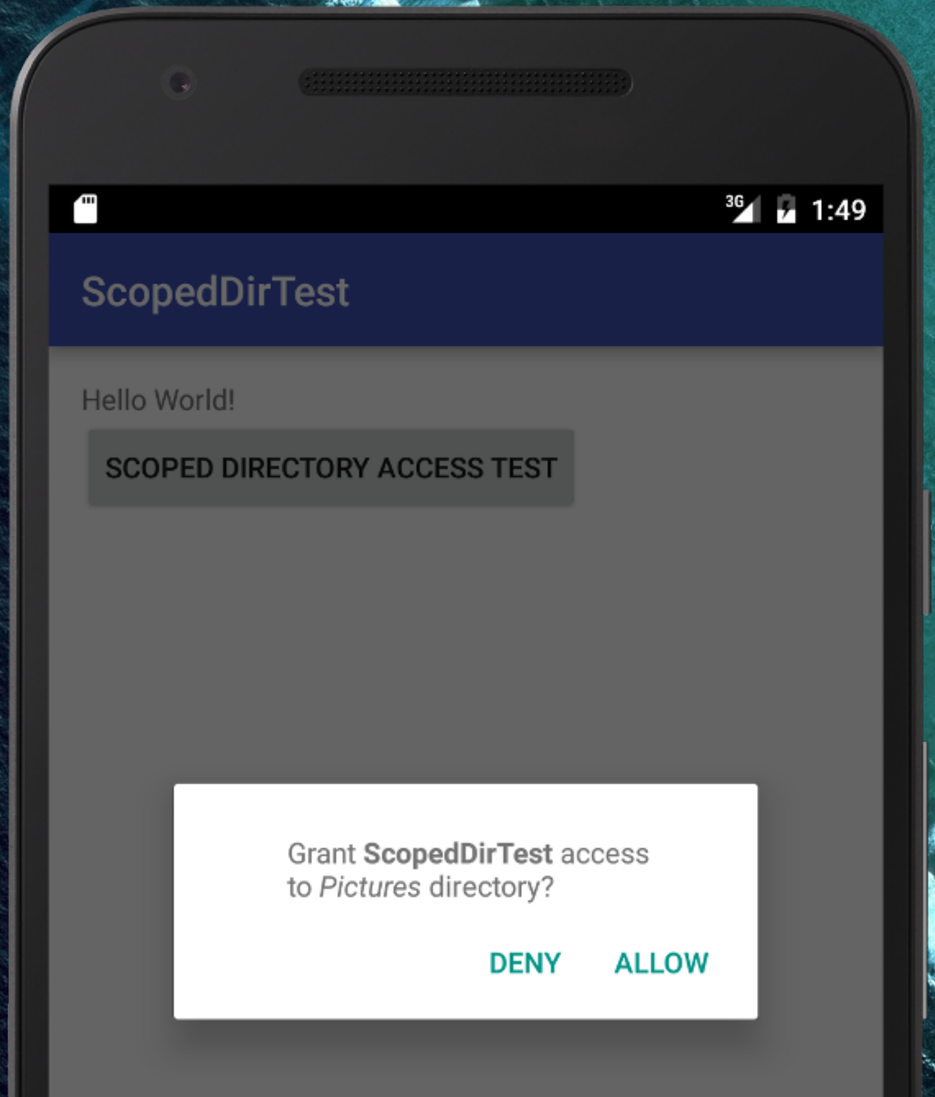
@ScottyAB


Seamless OTA updates
@ScottyAB



Iwo Banaś - https://github.com/iwo/marshmallow-tapjacking

Scoped directory access



- Storage Access Framework
- `Environment.DIRECTORY_MOVIES`
- Remember to call `takePersistableUriPermission()`

@ScottyAB

App data directory

- App data directory now user only 700 permissions
- Sharing files is explicitly opt-in
- Use FileProvider (support-lib)
- content:// URI instead of file://
- Training article “Sharing Files”

@ScottyAB

APK signing schema v1

- Problems
- Deleting files
- adding files to meta-inf
- DOS app

@ScottyAB

APK signing schema v2

- Faster
- More Secure
- You’re already using both?
- zipalign before (not after)

@ScottyAB

Access to Hardware Identifier

wifiManager.getConnectionInfo().getMacAddress()

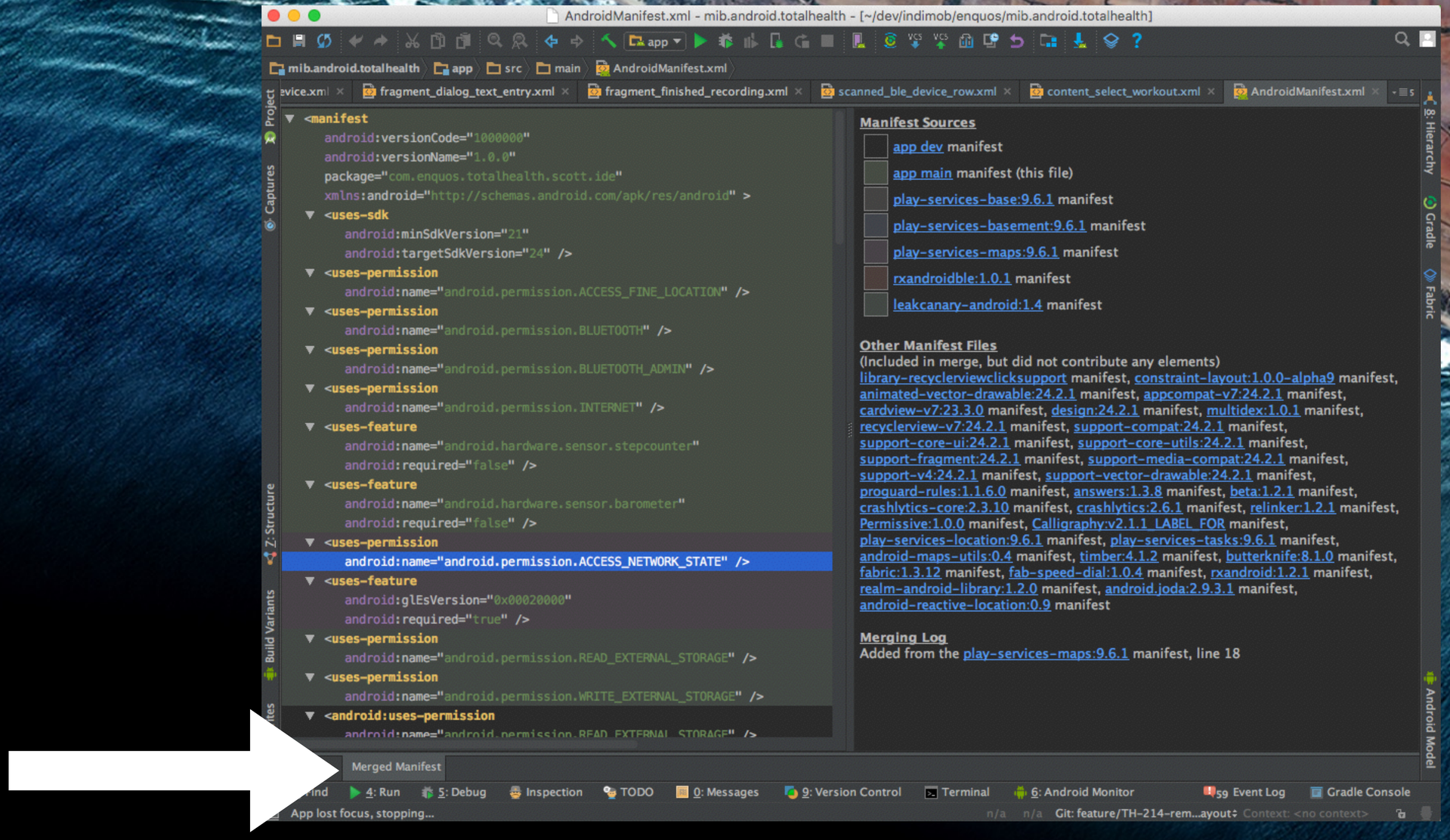
BluetoothAdapter.*getDefaultAdapter*().getAddress()

```
D/MAC: Device:Pixel, SDK:25
D/MAC: via WifiManager: 02:00:00:00:00:00
D/MAC: via BluetoothAdapter: 02:00:00:00:00:00
D/MAC: via NetworkInterface: AC:37:43:
```

Gist: https://goo.gl/ZRDe2g

@ScottyAB

Permissions required by libraries.



@ScottyAB

SafetyNet API

SafetyNetApi.attest(..)

- ☐ Read device?
- ☐ Vulnerable?
- ☐ Rooted?

@ScottyAB

https://github.com/scottyab/safetynethelper

README.md

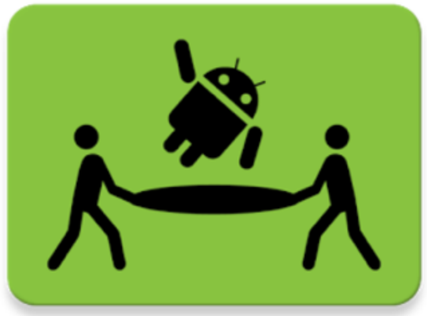
SafetyNet `attest()` Helper

SafetyNet Helper wraps the Google Play Services SafetyNet.API and verifies Safety Net API response with the Android Device Verification API. The SafetyNet.API analyses the device your app is running on to test its software/hardware configuration matches that of a device that has passed the Android Compatibility Test Suite (CTS). Note this is a client only validation, it's recommended to include server side validation.

Rooted devices seem to cause `ctsProfileMatch=false`.

Recommend reading the developers guide to getting started with SafetyNet

play.google.com/store/apps/details?id=com.scottyab.safetynet.sample



SafetyNet Helper Sample

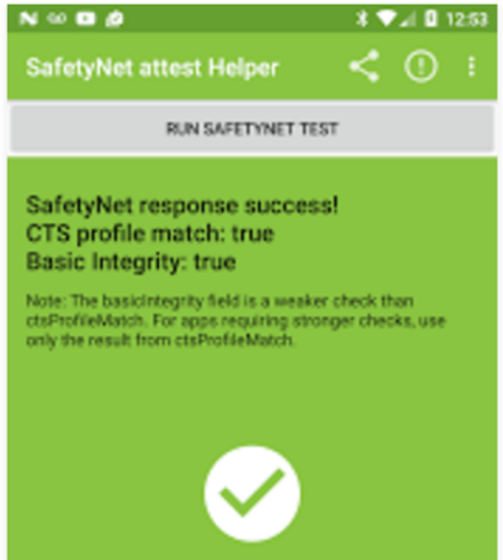
Scott Alexander-Bown **Tools**

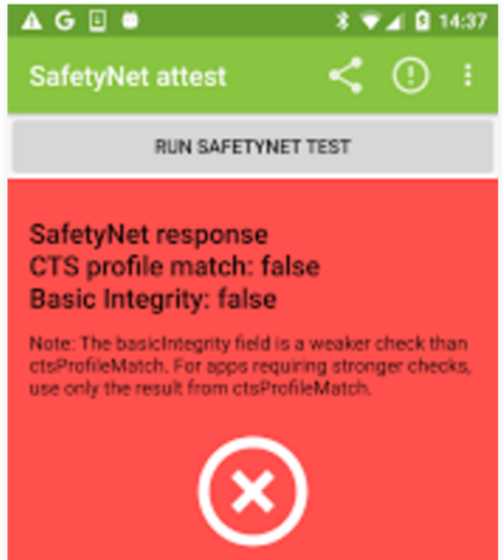
★★★★★ 402

PEGI 3

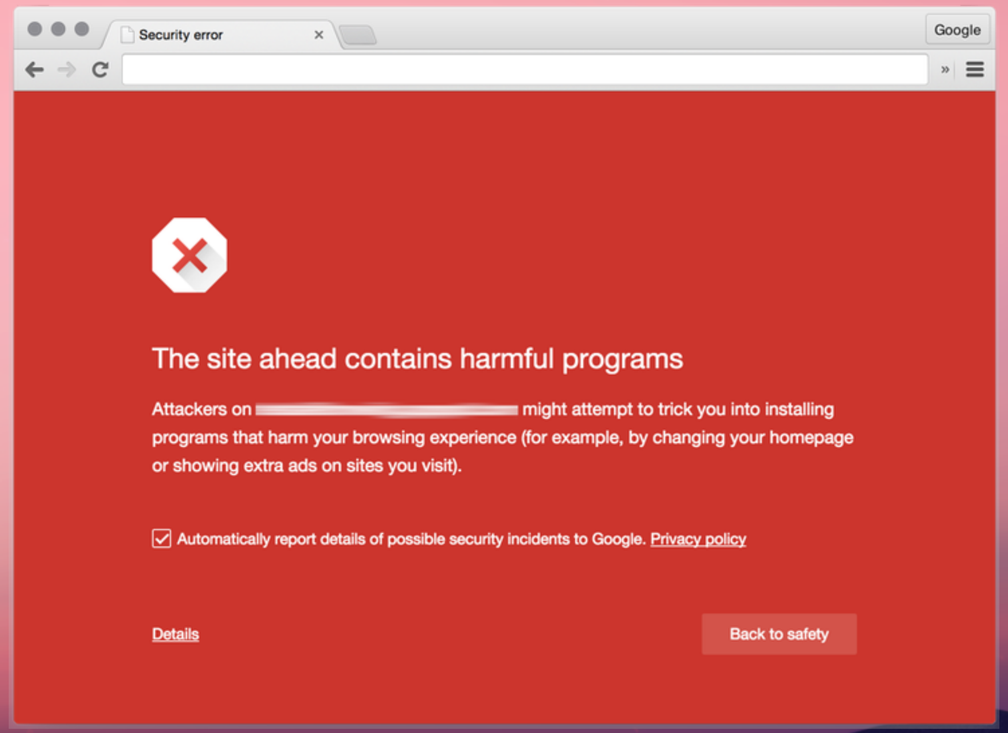
This app is compatible with some of your devices.

Installed





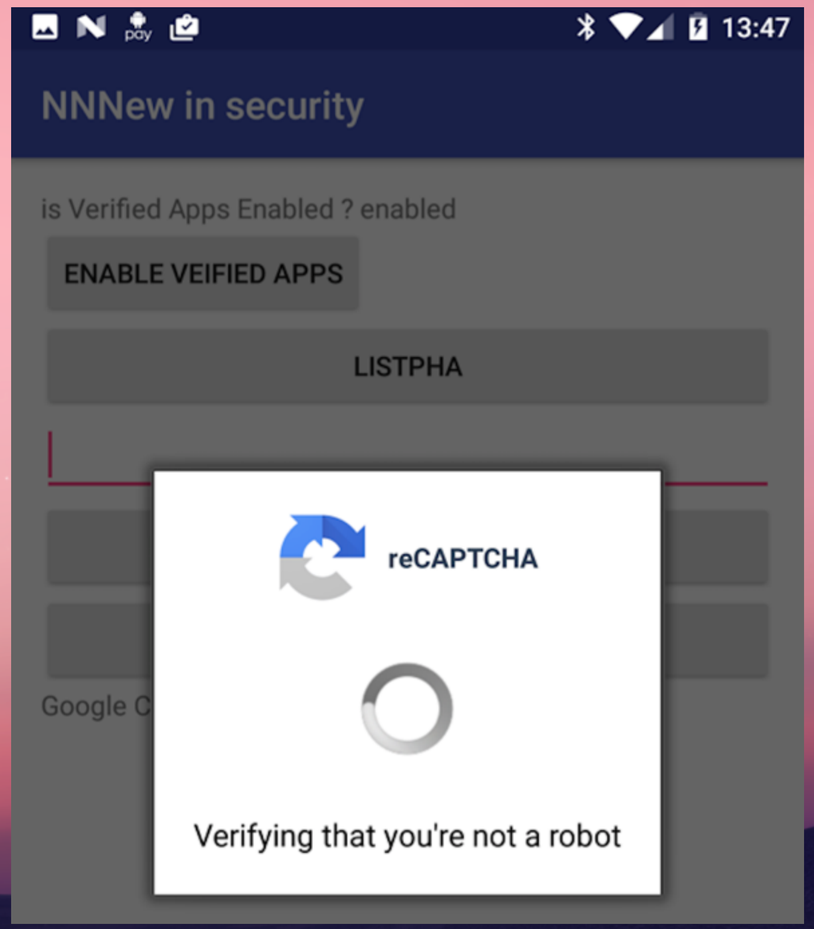
SafetyNetApi.lookupUri(..)



- ☐ Social Engineering
- ☐ Potentially Harmful Apps

@ScottyAB

SafetyNetApi - Misc



- ☐ Check Verified Apps status
- ☐ Enable Verified Apps
- ☐ List installed Potentially Harmful Apps (PHA)
- ☐ reCAPTCHA Integration

@ScottyAB

Recap

- ☐ Direct boot
- ☐ Android Keystore (Key Attestation)
- ☐ ‘Securer’ networking
- ☐ Misc system and app differences
- ☐ SafetyNet

@ScottyAB

Slides/Links
https://goo.gl/sL5z7U

Thanks for listening

Shout outs:
@commonsguy
@ikoz
+AdrianLudwig
@doriancussen
@niallscott
@trionkidnapper
@subsymbolics

Scott Alexander-Bown
@ScottyAB
hello@scottyab.com

Resources

- https://www.blackhat.com/ldn-15/summit.html#what-can-you-do-to-an-apk-without-its-private-key-except-repacking
- https://doridori.github.io/android-security-the-forgetful-keystore/#sthash.hFHQpV3A.5WcUVfYk.dpbs
- http://android-developers.blogspot.co.uk/2016/09/security-enhancements-in-nougat.html
- https://developer.android.com/about/versions/nougat/android-7.0.html#apk_signature_v2
- https://blog.stylingandroid.com/nougat-direct-boot/
- SafetyNet Helper library https://github.com/scottyab/safetynethelper
- Security patch date util - https://gist.github.com/scottyab/77bac6600986eb6a619e07a3d0abae3f
- *Adrian Ludwig's Google IO talk - What's new in Android Security (M &N) - https://www.youtube.com/watch?v=XZzLjllizYs

@ScottyAB

Training / Developer Docs

- https://developer.android.com/training/articles/security-key-attestation.html
- https://developer.android.com/training/articles/scoped-directory-access.html#accessing
- https://developer.android.com/training/articles/user-data-permissions.html#tenets_of_working_with_android_permissions
- https://developer.android.com/training/articles/direct-boot.html

@ScottyAB

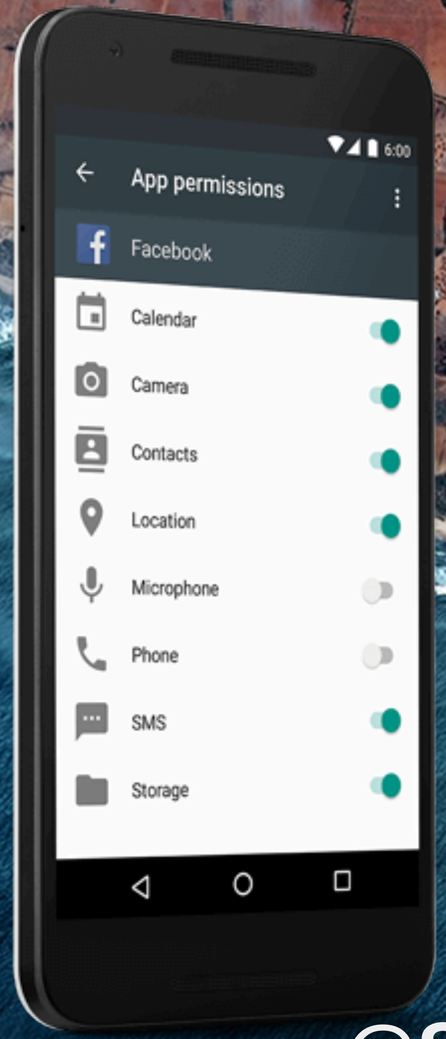
Runtime Permissions

- Permissions that users “get”
- Control on specific permissions
- Easy for users
- Updates don’t require approval

@ScottyAB

Tips of Working with Android Permissions

- ☐ Only use the permissions necessary for your app to work
- ☐ Be transparent
- ☐ Make system accesses explicit
- ☐ Context, Context, Context!



@ScottyAB