

NFC-connected Phone as a User Interface? There's an App For That! – Hands On

Class 1: Introduction to the Project and Development Environment

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This Week's Agenda

- 9/23 Introduction to the Project and Development Environment
- 9/24 An NFC Primer and Introducing the NXP NTAG
- 9/25 Building an Android Application from Scratch
- 9/26 Adding NFC Capability and Communications to Our App
- 9/27 Putting it All Together

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Why NFC and Android?

- IoT devices, particularly in consumer markets, are driven by cost concerns. This limits how much user interface (UI) can be provided
- Many applications need infrequent or even one-time interface (for example, commissioning of an IoT device such as a light switch)
- So – how do we move the UI off-device?

And Now There is an App for That



- With the availability of durable cases for phones and tablets, there is a move to more apps to interface to industrial controls, often mimicking the original operator panel

Communications Options

- Cellular (3G/4G/5G)
- WiFi
- Bluetooth
- NFC (Near Field Communication)
- Proprietary (via adding an external interface via USB or the above)

Various OS Opportunities

- Windows 10
- Android
- iOS
- Plus there is the option of using a browser in any of the above

An Example from Pro Audio



- Allen & Heath remote audio mixer app
- Duplicates front panel functions of a hybrid analog / digital mixer board
- Uses wifi

Using an App for IIoT

- Advantages
 - Essentially zero HW development cost
 - Can make field replacement quicker (and remote)
 - Depending on design, no sole source
 - Handset can be locked to the HW for exclusive control
- Disadvantages
 - Harder to lock down hardware selection than using proprietary hardware
 - Possible certification issues
 - Less control over usage

Question 1: What kind of certification might we need?

How do we develop an app?

- Hire a developer or service
- Use a “quick and easy” platform
- Develop yourself with an app platform

Outsourcing

- Insist on examples like your application
- Caveat Emptor
- Write an ironclad SOW

Quick Development

- There are many platforms that are ‘fill in the blank’
- Usually ongoing costs
- May not support your technologies (e.g. NFC)
- May be easier path for multi-platform and/or Play/iTunes registration

Serious Android Development

- Android Studio
- Visual Studio
- Some others (OS)

What is Android?

The Android operating system is a multi-user Linux system in which each app is a different user.

By default, the system assigns each app a unique Linux user ID (the ID is used only by the system and is unknown to the app).

The system sets permissions for all the files in an app so that only the user ID assigned to that app can access them.

Each process has its own virtual machine (VM), so an app's code runs in isolation from other apps.

Question 2: What is a common name for a program that manages multiple VMs?

By default, every app runs in its own Linux process. The Android system starts the process when any of the app's components need to be executed, and then shuts down the process when it's no longer needed or when the system must recover memory for other apps.

- The Android system implements the principle of least privilege.
- Each app, by default, has access only to the components that it requires to do its work and no more.
- This creates a very secure environment in which an app cannot access parts of the system for which it is not given permission.

However, there are ways for an app to share data with other apps and for an app to access system services:

- It's possible to arrange for two apps to share the same Linux user ID, in which case they are able to access each other's files. To conserve system resources, apps with the same user ID can also arrange to run in the same Linux process and share the same VM. The apps must also be signed with the same certificate.
- An app can request permission to access device data such as the user's contacts, SMS messages, the mountable storage (SD card), camera, and Bluetooth. The user has to explicitly grant these permissions.

Near Field Communication

- In a nutshell, NFC is a series of low-frequency, low-power communication protocols that allow two devices to talk over a very short distance
- In one mode, this can be a totally passive unit RFID communication with a device (such as a phone) and an unpowered 'card' such as a hotel room keycard.
- We can simulate the keycard in our embedded application in order to 'talk' to our device from a phone application
- More on NFC tomorrow!

Our Toolkit

- We will use Android Development System from developer.android.com – my examples will be in Windows but there are versions for Mac and Linux.
- We will use an old Android phone with NFC capability (use of your primary phone for development is not recommended)
- We will also use the NXP NTAG Explorer Kit (more on this tomorrow)

developer.android.com

android studio

Android Studio provides the fastest tools for building apps on every type of Android device.

DOWNLOAD ANDROID STUDIO

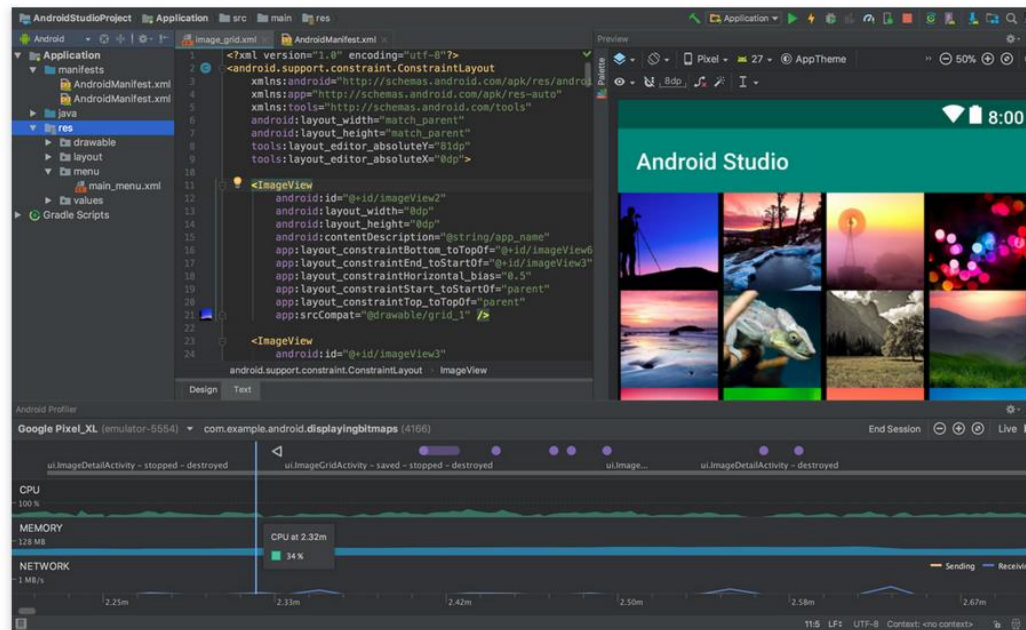
3.5 for Windows 64-bit (710 MB)

PREVIEW RELEASES

3.5 RC 3 (723 MB) 3.6 Canary 11 (766 MB)

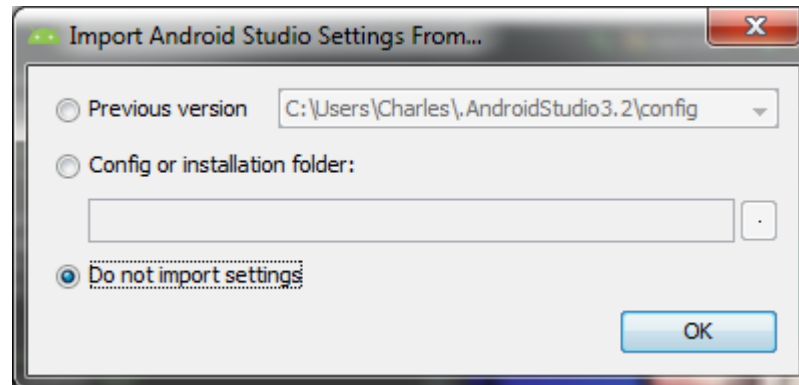
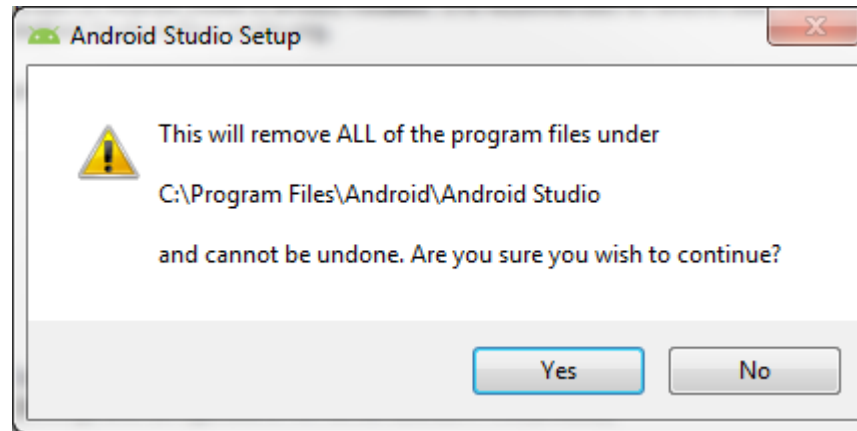
DOWNLOAD OPTIONS

RELEASE NOTES



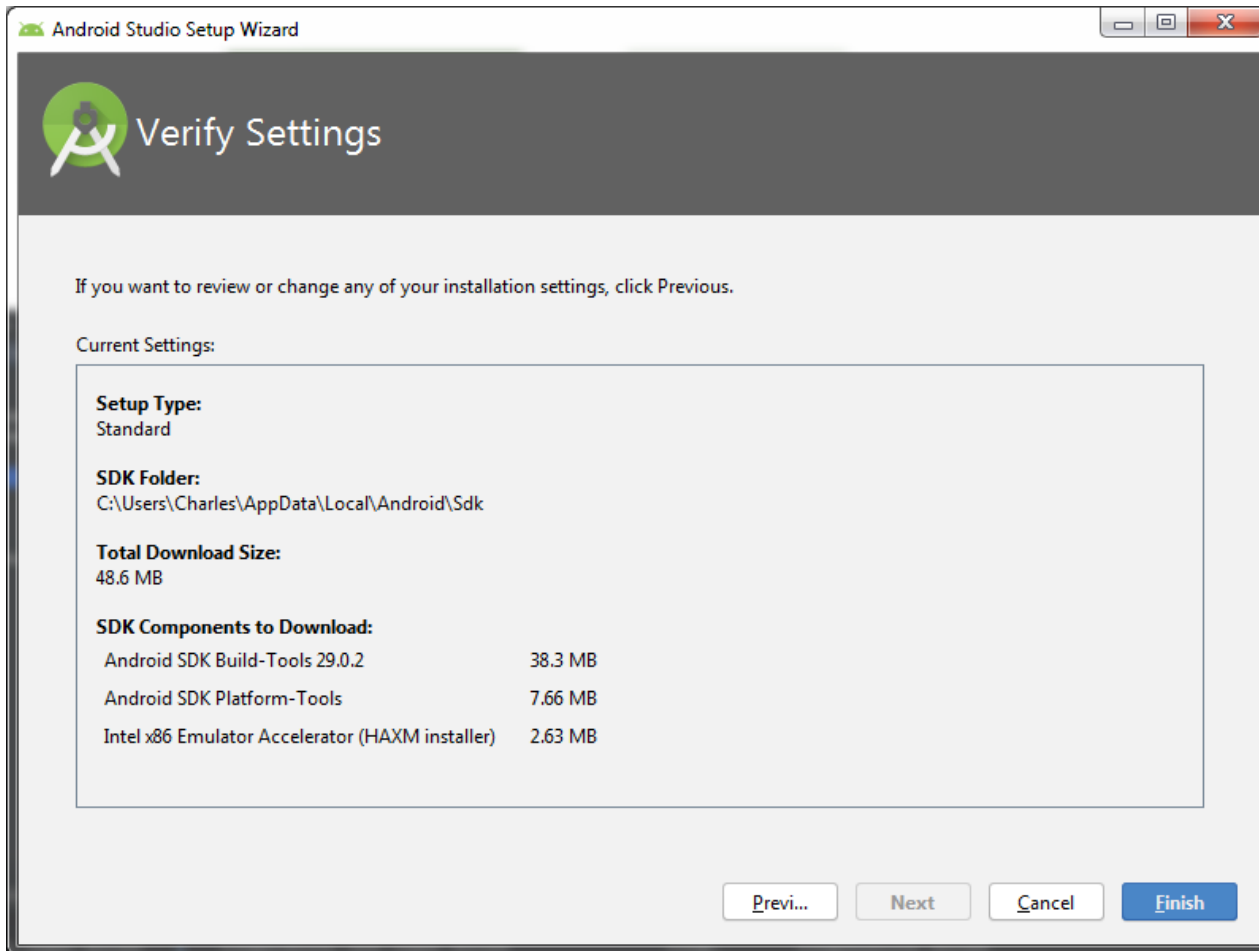
Take all defaults.

Note if you are upgrading!

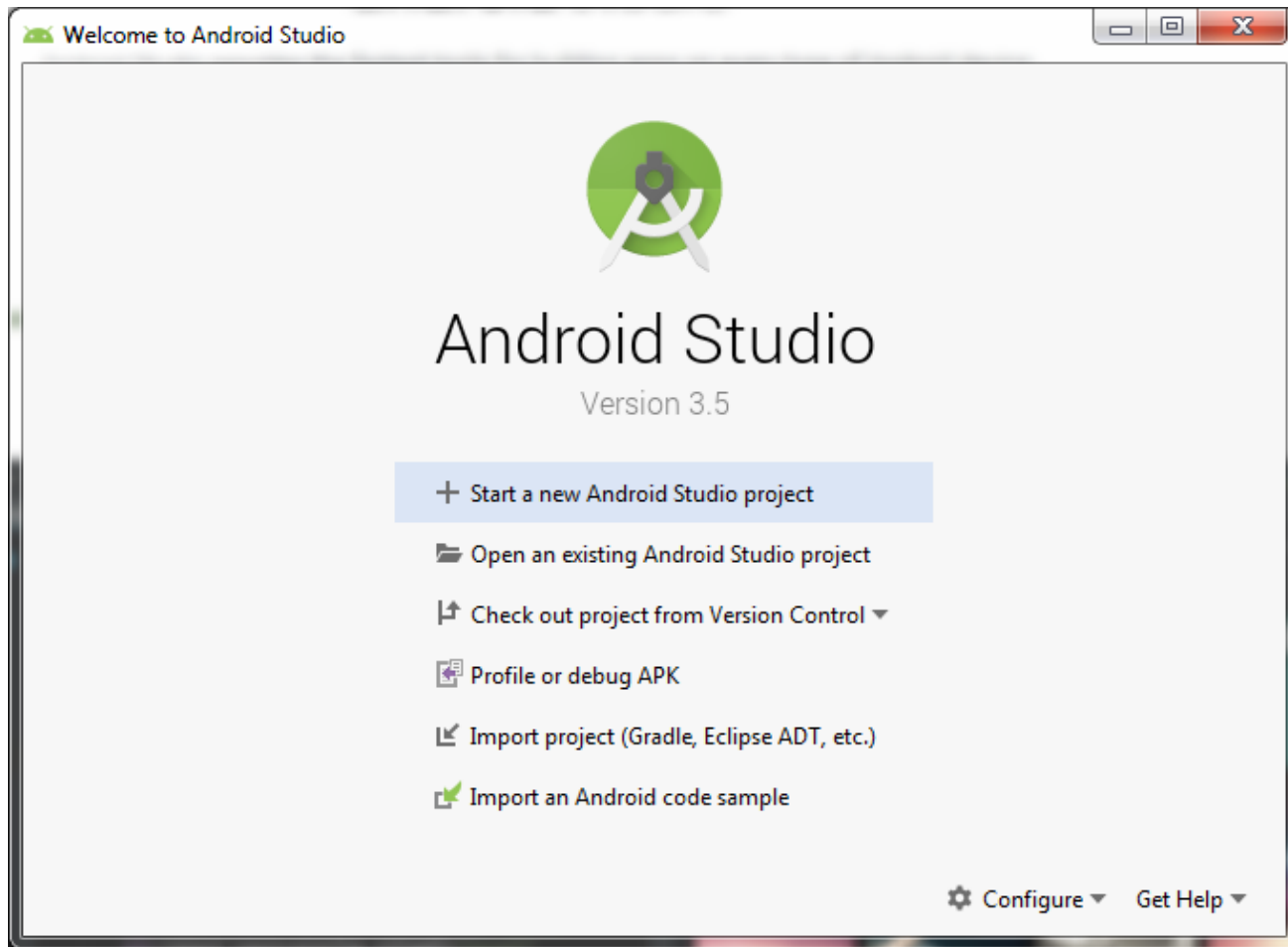


Question 3: Past Experience with Android programming?

Defaults



Now We Are Ready for Wednesday



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Please stick around as I answer your questions!

- Please give me a moment to scroll back through the chat window to find your questions
- I will stay on chat as long as it takes to answer!
- I am available to answer simple questions or to consult (or offer in-house training for your company)

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