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Shareable Components Services and Universal Language Translator (ULTRA) Installation on an Android Phone

by Christian Schlesiger

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14. ABSTRACT

This report contains instructions for installing Shareable Components Android services along with the Universal Language Translator (ULTRA) application on an Android device. Shareable Components contain discrete software technologies for manipulating foreign languages, including speech recognition, text translation, and speech synthesis. The ULTRA application is a client to these services that creates a specific workflow for a Speech-to-Speech system where a user may speak sentences in one language and have the system translate and play back the translation in another language.

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1. Introduction

This document contains instructions for installing Shareable Components and the Universal Language Translator (ULTRA) application on an Android phone. The ULTRA application is a Speech-to-Speech translation system designed to use back-end Android services to recognize speech, translate it to a foreign language, and then synthesize that translation into speech in the other language.

The application is designed to be used in the field to assist in communication with foreign nationals when other means of translation are not available.

All recordings and transcriptions are saved on the device for later retrieval, reporting, and analysis.

The installation process consists of placing all of the installation files and scripts onto a computer in a single folder. The destination phone is configured and then connected to the computer by a USB cable. The installation script is executed at a command prompt or terminal window on the computer, which then installs and copies all the relevant files and applications onto the phone. The phone can then be disconnected and is ready to use. The installation process can be repeated from the computer for multiple phones as needed.

The following definitions are essential to understanding how the system functions:

- Automatic Speech Recognition (ASR): software that recognizes recorded speech and converts it into readable text

- Machine Translation (MT): software that translates text from one language into another

- Text-to-Speech (TTS): software that synthesizes spoken speech given written text

2. Requirements

The following equipment is required for installation:

- A laptop/desktop computer running Windows, Linux, or MacOs with a USB port available

- An Android phone. The system has been tested on a Samsung Galaxy S7/S10/S20/S21. Other phone models and manufacturers should be compatible with the software with no modification as long as they are running Android 8 or later.

- o   NOTE: The phone will be put in developer mode during the installation, but it will not be rooted or otherwise modified.
- A USB cable to connect the phone to the computer
- Shareable Components installation .apk files for ASR, MT, and TTS; all three are required for ULTRA.
- Language sets for each of the ASR, MT, and TTS services installed
- ULTRA installation .apk file
- ULTRA language pack configurations that match the language sets installed
- The installation scripts

3.   Set Up Android Debug Bridge

The Android Debug Bridge (ADB) is the only software required to be installed on the computer that will be used to do the Android installations. The ADB application is included as part of the Android SDK [Software Development Kit] Platform-Tools installation, which is a part of the Android Studio package. It is not necessary to install Android Studio. The platform tools can be installed independently.

The latest version should be retrieved from the website at

https://developer.android.com/studio/releases/platform-tools

Download the SDK platform tools appropriate to your computer's operating system using the links on the previous page. This will download a zip file to the computer.

Create a folder that will house all the installation files. For the purposes of this document, we will use the following path. You may use whatever path you wish:

- Windows: `C:\SCInstall`
- Linux/Mac: `~/SCInstall`

Unzip the SDK platform tools into this folder and you should end up with a new subfolder:

- Windows: `C:\SCInstall\platform-tools`
- Linux/Mac: `~/SCInstall/platform-tools`

Open up a command prompt (Windows) or terminal window (Linux/Mac) and navigate to the SCInstall folder. We will use this command prompt throughout the rest of the document.

Next, we will put the platform tools folder into the path so the adb command can be executed from this folder without fully qualified or relative paths, in the event the SDK platform tools are placed in another location (the host system has Android Studio installed already, which includes the platform tools).

At the command prompt, type the following command (modified for your path as needed for your system):

- Windows: `set PATH=%PATH%;C:\SCInstall\platform-tools`

- Linux/Mac: `export PATH=$PATH:~/SCInstall/platform-tools`

Test that adb can be found by running the following command from the SCInstall folder:

```
adb --version
```

The output should be something like this:

```
Android Debug Bridge version 1.0.41
Version 29.0.6-6198805
Installed as C:\SCInstall\platform-tools\adb.exe
```

If you close the command prompt or terminal, you must rerun the above instructions to set the path on any new command prompt you open. Alternatively, you can set the path permanently by editing your system configuration appropriately.

4. Copy the Installation Files

Obtain the desired installation files and copy them all into the SCInstall folder. The files should be as follows, where "x.x.x" refers to some version number in the filename such as "1.0.2". It is not necessary to unzip any of the archives. The script will take care of that when it needs to.

Each of the Shareable Components services has an installation file that places the main code of the service on the device. Language sets for each service contain model, vocabulary, and configuration files that are installed separately for each language that is available for that service. Similarly, the ULTRA application has an installation file and separate language pack installations. Lastly, it is necessary to put the installation scripts in the same folder as all the installation files.

Kaldi ASR Android Service

- shareable-asr-kaldi-x.x.x.apk

3

Kaldi ASR Language Sets

- shareable-asr-kaldi-chain2-libyan-arabic-vx.x.x.zip

- shareable-asr-kaldi-chain-english-vx.x.x.zip

- shareable-asr-kaldi-chain2-african-french-vx.x.x.zip

Open NMT TF-Lite MT Android Service

- shareable-mt-opennmttf-x.x.x.apk

Open NMT TF-Lite MT Language Sets

- shareable-mt-opennmttf-african-french-vx.x.x.zip

- shareable-mt-opennmttf-libyan-arabic-vx.x.x.zip

FastSpeech2 MBM TF-Lite TTS Android Service

- shareable-tts-fs2mbm-x.x.x.apk

FastSpeech2 MBM TF-Lite TTS Language Sets

- shareable-tts-fs2mbm-tflite-libyan-arabic-vx.x.x.zip

ULTRA Application

- ultra-x.x.x.apk

ULTRA Language Pack Configurations

- ultra-language-pack-african-french-vx.x.x.zip

- ultra-language-pack-libyan-arabic-vx.x.x.zip

Installation Scripts

- shareable-services-install.sh

- shareable-services-install.bat

- ultra-install.sh

- ultra-install.bat

5. Set Up Android Phone – Galaxy S7/S10/S20/S21+

The following settings must be configured on the phone prior to installation.

### 5.1 Set the Default TTS Engine

On Samsung phones, the default TTS engine is Samsung's own engine. This needs to be changed to the Google TTS engine, which supports a larger set of languages and voices. If the installation is being run on a phone other than Samsung, check the default TTS engine and set it to Google.

On the phone, go to Settings, then to General Management where Language and Keyboard are set (Fig. 1).
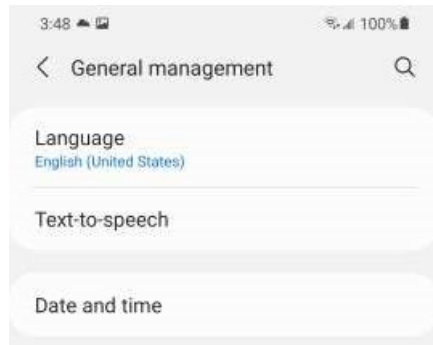
Fig. 1   Top portion of the General Management settings screen

Tap on the Text-to-Speech setting to get to this screen (Fig. 2):
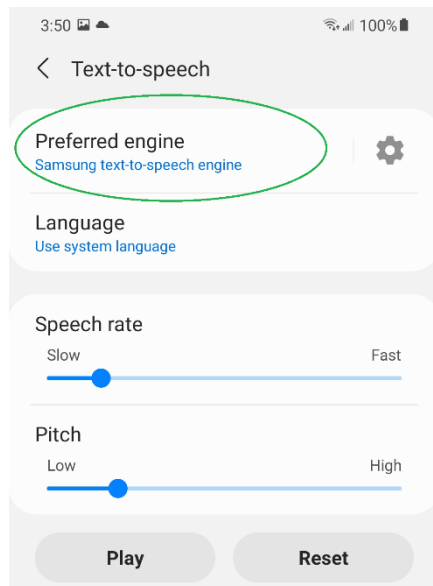
Fig. 2   Text-to-Speech settings screen with Preferred Engine highlighted

Select Preferred Engine to get a dialog to switch between engines, then select Speech Services by Google (Fig. 3). Do not tap on the Gear icon, as that will allow you to change the options for the current preferred engine. To change the Preferred Engine, you must tap on the Preferred Engine text itself.
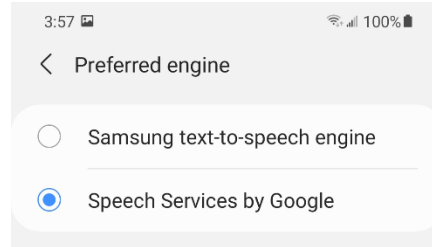

Fig. 3   Preferred Engine selection screen

5.2 Set the Phone in Developer Mode

Developer mode is a special option to allow the phone to receive application installations outside of the Google Play Store and to allow a remote debugging tool like the Android Debug Bridge to send files and communicate with the device. This mode must be enabled for the installation but can be disabled again after the phone has been set up.

Go to Settings, scroll down, and select About Phone (Fig. 4).
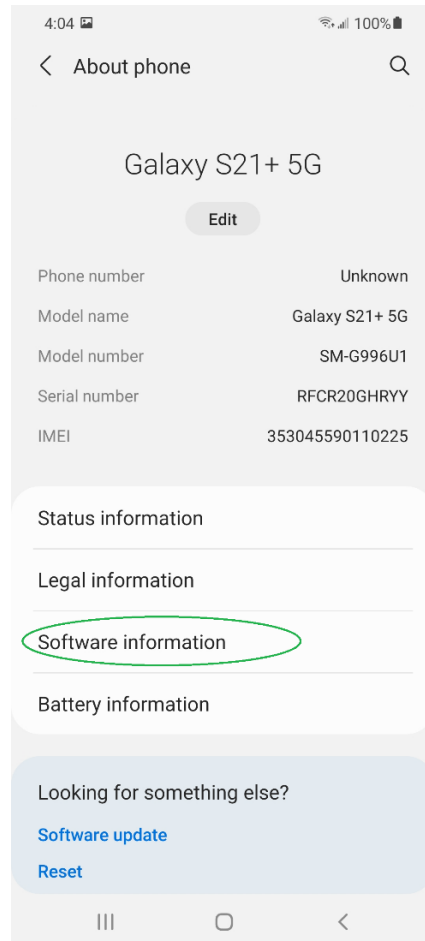
Fig. 4   About Phone settings screen

Tap the Software Information setting to get to the next screen. Under that screen, locate Build Number (Fig. 5). Tap the text Build Number **seven** times to enable Developer Mode. After the third tap, the phone will warn you that you are close to turning on Developer Mode. Continue for the full seven taps required.
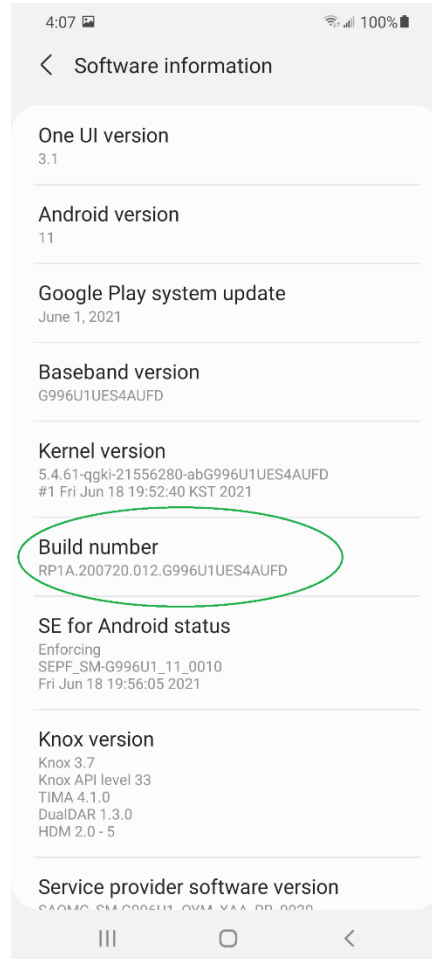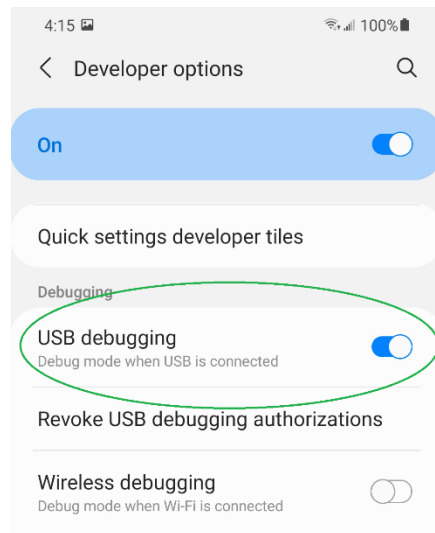

Fig. 5   Build Number on the Software Information screen

Now that Developer Mode has been turned on, you will see a new option on the main Settings screen called Developer Options, found at the very bottom of the list (Fig. 6).
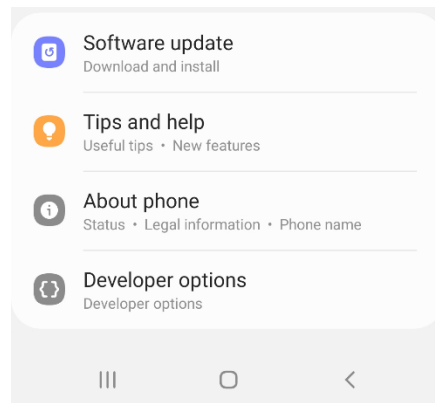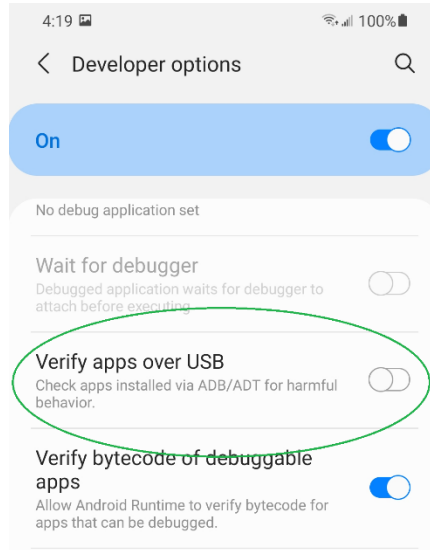

Fig. 6   Developer Options appears at the bottom of the settings screen

In the Developer Options screen, turn on the USB Debugging switch (Fig. 7).

Fig. 7   USB Debugging shown as enabled

Then scroll down farther and turn OFF the option Verify Apps over USB (Fig. 8).

Fig. 8   Verify Apps over USB option shown as off

Once the installation process is complete, these options can be turned off to increase the phone's security.

Exit Settings and return to the home screen. Connect the phone to the computer using a USB cable. Verify that the computer has found the phone by typing the following command into the command prompt or terminal window:

```
adb devices
```

The output should be something like this if adb has successfully communicated with the phone:

```
* daemon not running; starting now at tcp:5037
* daemon started successfully
List of devices attached
RFCR20GHRYY     device
```

6.   Run the Install Scripts

The first script that should be run will install the Shareable Components Android Services. In order, the script will look for the latest version it finds in the folder of the Kaldi ASR, then the OpenNMT MT, and finally the FastSpeech2 TTS.

After installing each application, the script will search for any zip files containing language sets. The script will ask for a yes or no answer as to whether it should install each one it finds. This behavior will allow the script to be run later to update

or install new language sets as needed, while skipping those the user knows is already installed.

To run the script, type this command into the command prompt or terminal window:

- Windows: `shareable-services-install.bat`
- Linux/Mac: `./shareable-services-install.sh`

The installation will take several minutes as it walks through each of the applications and all the associated zip files that it finds.

After the script has completed, the ULTRA application and its language pack configurations should be installed. Much like the first script, it will search the SCInstall folder for the latest version of the ULTRA application available and install it. Then, it will search for all language pack configurations and one-by-one confirm with yes or no questions as to whether they should be installed.

To run the script, type this command into the command prompt or terminal window:

- Windows: `ultra-install.bat`
- Linux/Mac: `./ultra-install.sh`

7.   Post Installation Clean-up

After the scripts have completed, the phone is ready to be used. The phone can be disconnected from the computer by removing the USB cable.

Developer Mode can be turned off if desired. Return to the Settings screen, scroll down, and click Developer Options. At the top of the Developer Options screen is a switch that can be set to "Off" to disable Developer Mode (Fig. 9).
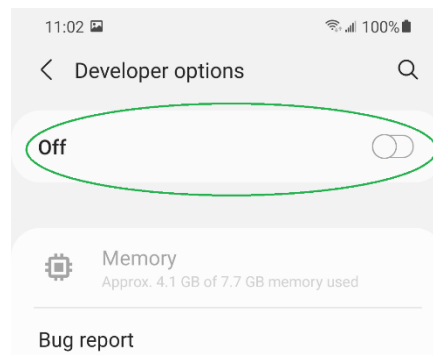
Fig. 9   Turning off Developer Mode

If the computer is no longer going to be used for installs onto Android phones, then the SCInstall folder and all of its contents can safely be deleted.

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List of Symbols, Abbreviations, and Acronyms

ADB	Android Debug Bridge
ASR	automatic speech recognition
MT	machine translation
SDK	Software Development Kit
TTS	text-to-speech
ULTRA	Universal Language Translator
USB	universal serial bus