

# TI-Android-ICS-4.0.3-DevKit-3.0.0 UserGuide



## TI-Android-ICS-4.0.3-DevKit-3.0.0 UserGuide

User Guide - March 30, 2012

### About this manual

This document describes how to install and work with Texas Instruments' Android ICS DevKit release for AM37x platforms running Android. This release package provides a stable Android distribution with integrated SGX (3D graphics accelerated) drivers, TI hardware abstraction for WLAN, Bluetooth and standard applications from Android. The package also includes Linux Android kernel, boot loaders, debug & development tools and documentation to ease development, deployment and execution of Android based systems. The product also forms the basis for all Android application development on AM37x platforms.

This document contains instructions to:

- Install the release
- Set up the hardware
- Use the pre-built binaries in the package
- Run Android on the supported platforms
- Set up the Android debugger “adb” with the hardware platform
- Install and execute Android (out of market) applications on hardware platforms

### Installation

This section describes the list of Software and Hardware requirements to evaluate the DevKit release.

### Hardware Requirements

This release of TI Android ICS 4.0.3 DevKit 3.0.0 is evaluated on the platforms listed below. This package should be easily portable on other platforms on similar TI devices.

| TI Device | Platform Supported                     | Version      | Other Accessories   |
|-----------|--|--------------|---|
| AM37x     |  |              |   |
|           | AM37x Evaluation Module <sup>[1]</sup> | Rev G        | DVI Monitor, USB HUB, USB Keyboard, USB Mouse, Ethernet, UART Cable, Audio Speakers, Camera Module, MMC/SD Card (2GB min) |
|           | BeagleBoard <sup>[2]</sup>             | XM Rev A/B/C | DVI Monitor, USB HUB, USB Keyboard, USB Mouse, Ethernet, UART Cable, Audio Speakers, Camera Module, MMC/SD Card (2GB min) |
|           | Flashboard <sup>[3]</sup>              |              | DVI Monitor, USB HUB, USB Keyboard, USB Mouse, Ethernet, UART Cable, Audio Speakers, MMC/SD Card (2GB min)                |

## Software Host Requirements

The host and target software dependencies and requirements are described below.

### Host PC requirements

If you are an Android application developer or would like to use Android SDK Tools then refer to Android SDK Requirements <sup>[4]</sup> for Host PC requirements.

To evaluate this release we recommend you to have a Linux "Ubuntu 10.04 or above" Host machine, See Ubuntu Linux installation notes <sup>[5]</sup>

## TI Android DevKit Software Release

The TI Android ICS 4.0.3 DevKit 3.0.0 release for AM37x evm, Flashboard and BeagleBoard is available as online download from [http:// software-dl. ti. com/ dsp/ dsp\\_public\\_sw/ sdo\\_tii/ TI\\_Android\\_DevKit/ TI\\_Android\\_ICS\\_4\\_0\\_3\\_DevKit\\_3\\_0\\_0/index\\_FDS.html](http://software-dl.ti.com/dsp/dsp_public_sw/sdo_tii/TI_Android_DevKit/TI_Android_ICS_4_0_3_DevKit_3_0_0/index_FDS.html)

## Setup

This section gives the instructions to quickly prepare an SD Card image and get an experience of TI Android ICS 4.0.3 DevKit 3.0.0 on TI AM37x platforms/devices.

### Getting Pre-built Images

Prebuilt images can be obtained from

- TI\_Android\_ICS\_4\_0\_3\_DevKit\_3\_0\_0 Release Page <sup>[6]</sup>, for the platform you own AM37x EVM, Flashboard or BeagleBoard

Use below commands to untar/uncompress the pre-built image

```
$ tar -xzf <Board name>.tar.gz
$ cd <Board name>
```

The tree structure for pre-built image directory should be as:

```
.
|-- <Board name>
|   |-- START_HERE
|   |-- Boot_Images
|       |-- MLO
|       |-- u-boot.bin
|       |-- boot.scr
|       |-- uImage
|   |-- Filesystem
|       |-- rootfs_<Board name>.tar.bz2
|   |-- Media_Clips
|       |-- Audio
|       |-- Images
|       |-- Video
|   |-- README.txt
|   |-- mkmmc-android.sh
```

## Procedure to populate MMC/SD Card

- Get an SD Card of minimum size 2GBytes (Class4 minimum) and a USB Card reader
- Insert the USB SD Card reader (with SD Card) in your host Linux PC
- Prepare the MMC/SD card with pre-built images:

```
$ cd <Board name>
$ sudo ./mkmmc-android.sh /dev/sd<device>
```

- Above step will create a bootable MMC/SD card which can be used to boot up the device.

## Setting Up Hardware

This DevKit release supports three different platforms AM37x EVM, Beagleboard XM and Flashboard. While they are different devices the hardware setup will almost remain the same.

- Connect the UART port of the platform to the Host PC and have a Terminal software like TeraTerm, Minicom or Hyperterminal.
- Connect the Ethernet
- Connect Audio Speakers
- For Beagle board you need to connect DVI Monitor through HDMI connector.
- Use self powered USB HUB and connect it to USB Host port of the platform, mainly for Beagle. For AM37x evm and Flashboard, the onboard keypad can be used
  - Connect USB keyboard and USB Mouse to the USB HUB for use with Beagle or EVM

### Note:

Beagleboard have no keypad mappings, user is recommended to use USB Keyboard over a self powered USB HUB connected to the Host port of Beagleboard.

- Select Appropriate DIP Switch settings on EVM(s) to boot over MMC/SD

For MMC/SD boot - On AM37x EVM the DIP switch SW4 should be set as shown below

|        |     |    |    |    |     |     |     |     |
|--------|-----|----|----|----|-----|-----|-----|-----|
| Switch | 1   | 2  | 3  | 4  | 5   | 6   | 7   | 8   |
| State  | OFF | ON | ON | ON | OFF | OFF | OFF | OFF |

## Booting Android

- Setup the board/platform
  - Do the DIP switch settings to boot from SD Card, see the DIP switch setting under Setting Up Hardware section.
  - Insert the Micro/SD Card into the Board
  - Switch on the platform
  - Wait for 35sec to get Android up on the UI screen

**NOTE:** For the first time boot the System might take few minutes to boot.

**NOTE:** If your NAND flash is not empty the system might not boot with MMC, in that case do the following with Serial Console / Terminal prompt in u-boot

```
#> mmc init
#> fatload mmc 0 0x82000000 boot.scr
```

```
#> source 0x82000000
```

## Boot Arguments

AM37X:

```
setenv bootargs 'console=ttyO0,115200n8 androidboot.console=ttyO0
mem=256M root=/dev/mmcblk0p2 rw rootfstype=ext4 rootwait init=/init
ip=off omap_vout.vidl_static_vrfb_alloc=y vram=8M omapfb.vram=0:8M'
```

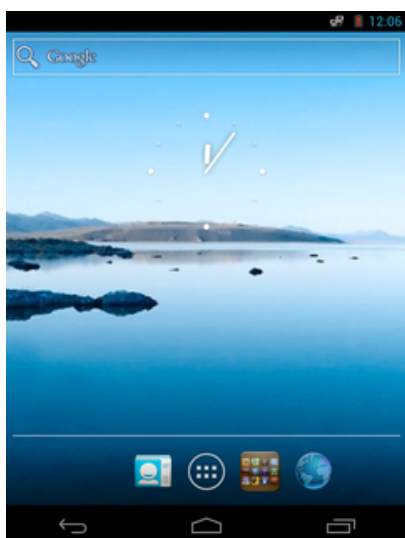
Beagleboard-xm:

```
setenv bootargs 'console=ttyO2,115200n8 androidboot.console=ttyO2
mem=256M root=/dev/mmcblk0p2 rw rootfstype=ext4 rootwait init=/init
ip=off omap_vout.vidl_static_vrfb_alloc=y vram=8M omapfb.vram=0:8M
omapdss.def_disp=dvi omapfb.mode=dvi:1024x768MR-16'
```

Flashboard:

```
setenv bootargs 'console=ttyO2,115200n8 androidboot.console=ttyO2
mem=256M root=/dev/mmcblk0p2 rw rootfstype=ext4 rootwait init=/init
ip=off vram=8M omapfb.vram=0:8M'
```

## Android Home Screen






## Keys mapping

The below table lists the keypad and USB Keyboard mappings to Android UI functionality.

| Functionality | USB Keyboard             | Mouse | Keypad on AM37x EVM | Keypad on Flashboard |
|---------------|--------------------------|-------|---------------------|----------------------|
| Home Screen   |                          |       | R3C2                |                      |
| Left          | Left Arrow               |       | R0C2                | SW5                  |
| Right         | Right Arrow              |       | R2C1                | SW6                  |
| Up            | Up Arrow                 |       | R1C3                |                      |
| Down          | Down Arrow               |       | R2C0                |                      |
| Volume Up     | Volume Up (Multimedia)   |       | R1C2                |                      |
| Volume Down   | Volume Down (Multimedia) |       | R0C1                |                      |
| Power         |                          |       | R0C0                |                      |

|        |                        |                             |      |     |
|--------|------------------------|-----------------------------|------|-----|
| Select | Enter                  | Left / Right / Middle Click | R3C1 | SW3 |
| Back   | Esc, Back (Multimedia) |                             | R2C3 | SW4 |
| Menu   |                        |                             | R3C3 |     |

The below table lists the functions available on the navigation bar on AM37x evm and BeagleBoard display.

| Soft Key  | Feature     | Remarks                                   |
|---|-------------|---|
|  | Back        | Go back to previous screen                |
|  | Home        | Switch to Home screen                     |
|  | Recent Apps | Switch between recently opened Activities |

### UI Navigation

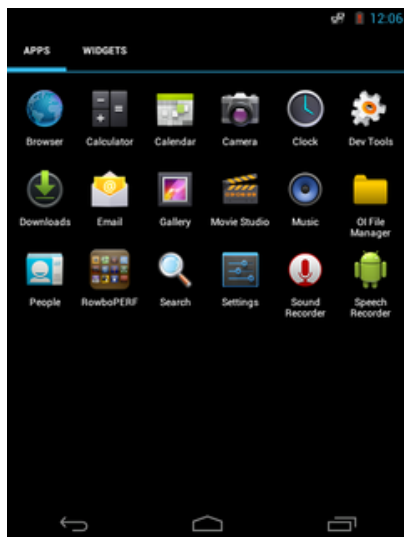
- There are three ways to navigate the UI screen:
  - Matrix Keypad (Not available on BeagleBoard)
  - USB Keyboard
  - USB Mouse

**Note:** The soft keyboard will not appear to enter text/data when USB keyboard is connected

## Out of the Box Demo

### Multimedia Experience

- Using browser and android applications

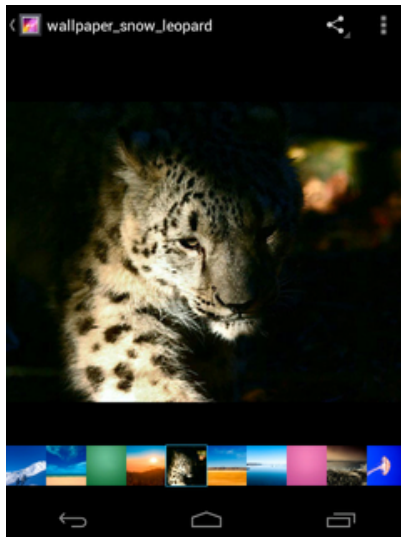


- Image browsing and media playback

### View Image

Select "App Launcher" -> "Gallery" -> "Images". Click any thumbnail to view the image.

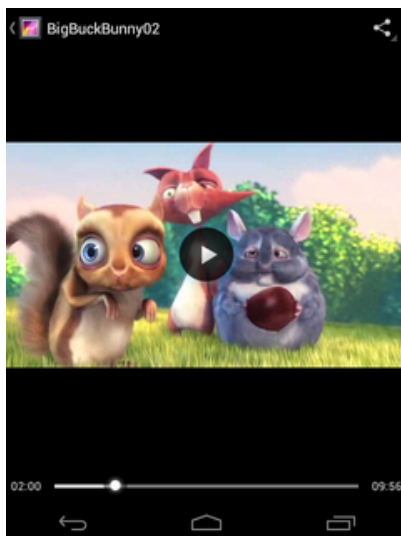
Double click the image to zoom in/out. Slide the image to view next image.



### Play Video

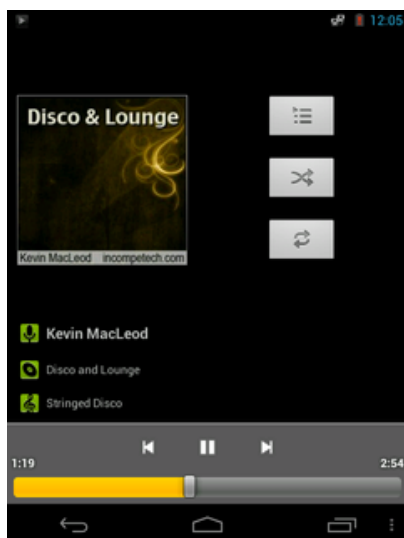
Select "App Launcher" -> "Gallery" -> "Video". Click any thumbnail to play the video.

You can use the UI controls to Pause/Play/Seek the video. To stop playback and exit press the back key button.



## Play Music

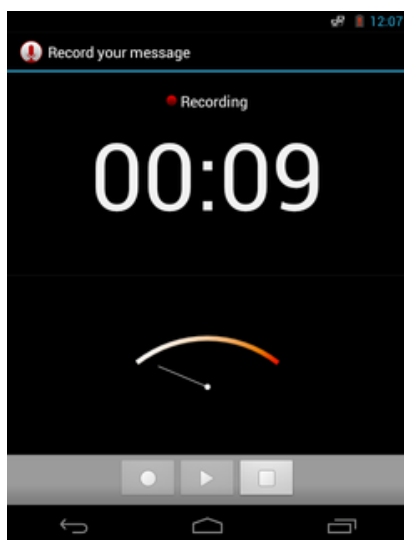
Select "App Launcher" -> "Music" -> "<Artist>" -> "<song-name>" to experience the music.



## Record Sound

Select "App Launcher" -> "Sound Recorder". Press Record button to start recording audio. Press Stop button to stop recording.

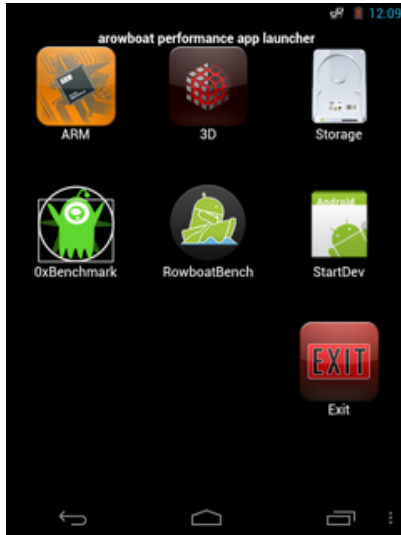
Playback the recorded audio by pressing Play button on Sound Recorder GUI.



## Control Volume

- There are two ways to control volume:
  - Using volume up/down keys
  - Select "App Launcher" -> "Settings" -> "Sound" -> "Volumes"

## TI RowboPerf Experience



### Running 2D/3D Demo

Select "RowboPERF" -> "3D" -> "Chameleon" or "App Launcher" -> "RowboPERF" -> "3D" -> "Chameleon" to view 3D demo.

Select "RowboPERF" -> "RowboatBench" -> "2D Tests" -> "Run" to view 2D demo.

Select "RowboPERF" -> "0xBenchmark" -> "2D" -> "Run" to view 2D demo.

### Running CPU Benchmark

Select "RowboPERF" -> "ARM" -> "Dhrystone" to get CPU dhrystone values.

Refer to RowboPERF User Guide for more details.

## Browser Experience





## Ethernet Configuration

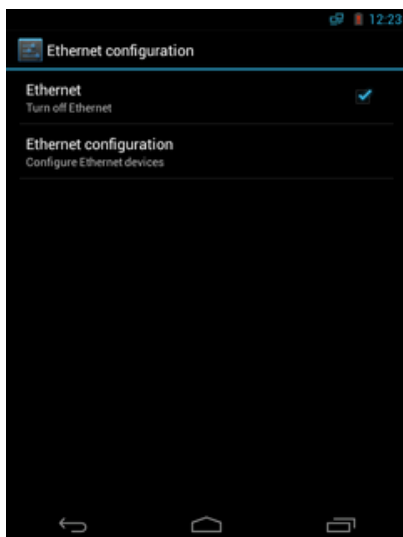
Ethernet is configured by default for DHCP. Use below command to verify Ethernet configuration

```
# netcfg
e.g.
lo          UP                127.0.0.1/8    0x00000049 00:00:00:00:00:00
sit0       DOWN            0.0.0.0/0     0x00000080 00:00:00:00:00:00
eth0       UP              172.24.191.26/22 0x00001043 96:cd:df:8b:c6:2b
```

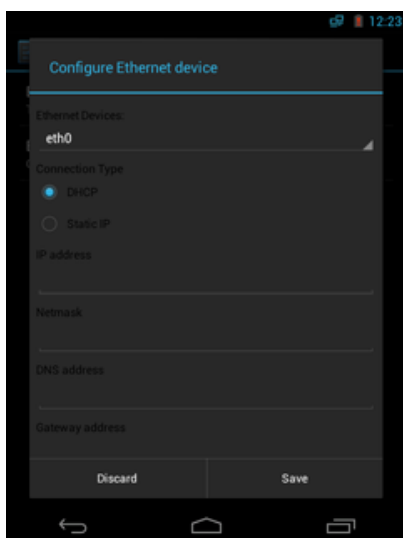
You can configure ethernet from the Settings menu.



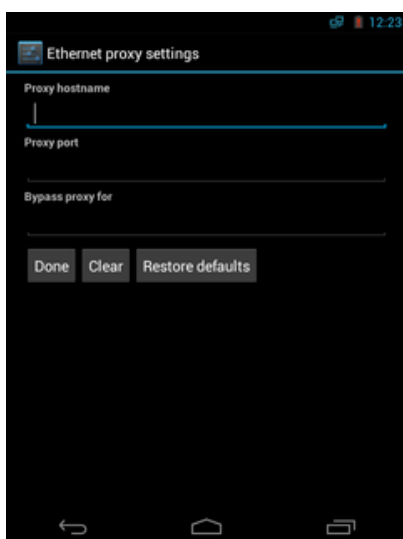
- Select **Ethernet configuration**. Here you can enable/disable ethernet and perform any additional configuration.



- Choose between DHCP and static IP based on your network configuration



- **Optional** If you need to set up proxy, configure this from **Ethernet proxy settings**:



## Camera Support

Ti Android ICS 4.0.3 Devkit 3.0.0 supports camera sensor mt9v113 for beagleboard-xm and camera sensor mt9t111 for AM37x evm



### Feature supported:

- Image Capture
  1. Go to "App Launcher" -> "Camera"
  2. Click on camera capture. By default images will get stored at - */sdcard/DCIM*

**Note:** Video recording is not supported

## Other Display Features

### Using LCD output

On AM37x EVM and Flashboard the on board LCD is used as output device by default.

### Using DVI Monitor

For enabling the DVI output, append the boot arguments with following text:

```
omapdss.def_disp=dvi omapfb.mode=dvi:1024x768MR-16
```

BeagleBoard uses DVI output over HDMI port by default. It is possible to output display over DVI on AM37x evm and Flashboard with a change in the bootargs as follows:

#### AM37x evm

```
setenv bootargs 'console=ttyO0,115200n8 androidboot.console=ttyO0
mem=256M root=/dev/mmcb1k0p2 rw rootfstype=ext4 rootwait init=/init
ip=off omap_vout.vidl_static_vrfb_alloc=y vram=8M omapfb.vram=0:8M
omapdss.def_disp=dvi omapfb.mode=dvi:1024x768MR-16'
```

#### Flashboard

```
setenv bootargs 'console=ttyO2,115200n8 androidboot.console=ttyO2
mem=256M root=/dev/mmcb1k0p2 rw rootfstype=ext4 rootwait init=/init
ip=off omap_vout.vidl_static_vrfb_alloc=y vram=8M omapfb.vram=0:8M
omapdss.def_disp=dvi omapfb.mode=dvi:1024x768MR-16'
```

### Enable FPS logs in Logcat

To print the FPS in logcat dump, type this command on the console before starting playback:

```
# setprop debug.video.showfps 1
```

To disable the prints, type:

```
# setprop debug.video.showfps 0
```

## Wireless

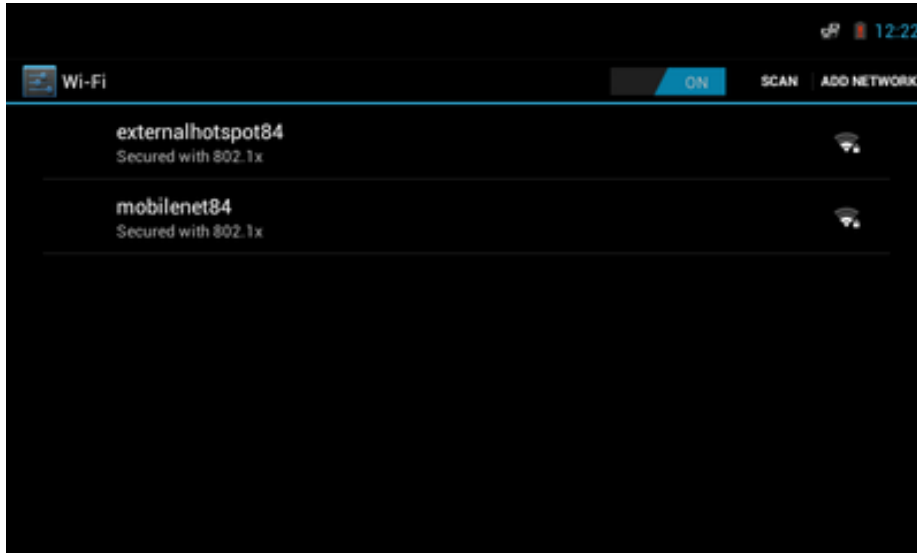
AM37x EVM and Flashboard supports Wi-Fi and Bluetooth on Android.

**Note:** BeagleBoard doesn't support wireless (Wi-Fi and Bluetooth) module.

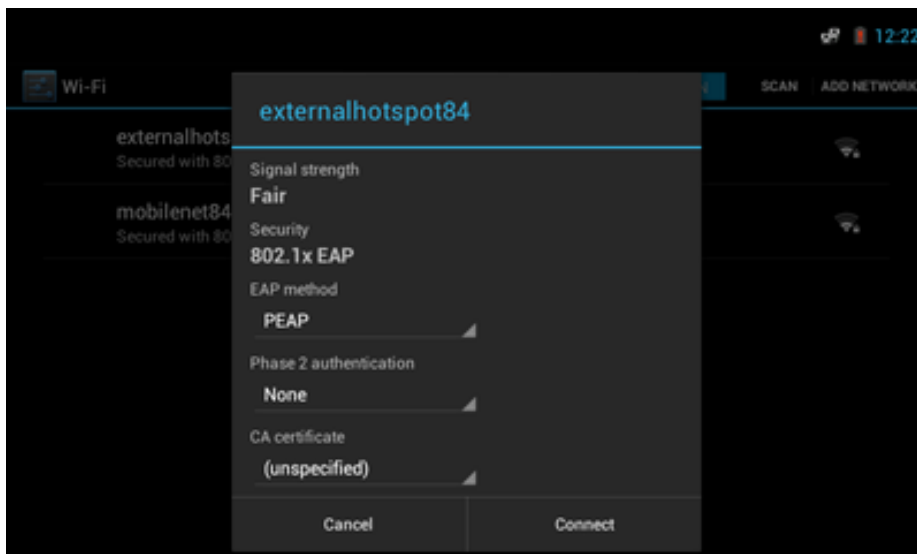
## Wi-Fi

### Enabling Wi-Fi

- To turn on Wi-Fi, browse to "App Launcher" -> "Settings" -> "Wi-Fi".
- Enable Wi-Fi by sliding the ON/OFF tab to the ON position and wait for few seconds.
- The device scans for the available APs and displays them.



- Connect to desired AP by clicking on its name and enter required details (username/key etc) and click Connect



- The following appears on console

```
[ 1270.525207] wl1271: loaded
[ 1271.494323] wl1271: firmware booted (Rev 6.3.6.0.79_2)
[ 1271.499694] wl1271: Driver version: R4_SP2_03_00
[ 1336.340881] cfg80211: Calling CRDA for country: IN
[ 1336.379425] cfg80211: Regulatory domain changed to country: IN
[ 1336.385559] cfg80211:      (start_freq - end_freq @ bandwidth), (max_antenna_gain, max_eirp)
[ 1336.394287] cfg80211:      (2402000 KHz - 2482000 KHz @ 40000 KHz), (N/A, 2000 mBm)
[ 1336.402160] cfg80211:      (5170000 KHz - 5250000 KHz @ 40000 KHz), (N/A, 2000 mBm)
[ 1336.410064] cfg80211:      (5250000 KHz - 5330000 KHz @ 40000 KHz), (N/A, 2000 mBm)
[ 1336.417968] cfg80211:      (5735000 KHz - 5835000 KHz @ 40000 KHz), (N/A, 2000 mBm)
[ 1340.068145] wl1271: Association completed.
```

- when successfully connected, you will see status as connected under the respective AP name

### Disabling Wi-Fi

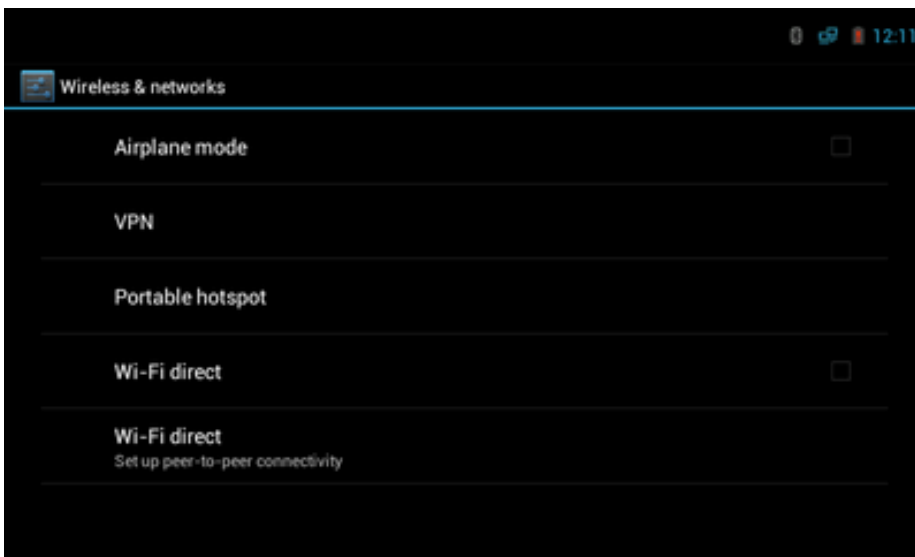
- To turn off Wi-Fi, browse to "App Launcher" -> "Settings" -> "Wi-Fi".
- Disable Wi-Fi by sliding the ON/OFF tab to the OFF position.
- Following message appears on console and the Wi-Fi status is shown as OFF.

```
[ 1459.324127] cfg80211: Calling CRDA to update world regulatory domain
[ 1459.381622] cfg80211: World regulatory domain updated:
[ 1459.386993] cfg80211:      (start_freq - end_freq @ bandwidth), (max_antenna_gain, max_eirp)
[ 1459.395721] cfg80211:      (2402000 KHz - 2472000 KHz @ 40000 KHz), (300 mBi, 2000 mBm)
[ 1459.403991] cfg80211:      (2457000 KHz - 2482000 KHz @ 20000 KHz), (300 mBi, 2000 mBm)
[ 1459.412261] cfg80211:      (2474000 KHz - 2494000 KHz @ 20000 KHz), (300 mBi, 2000 mBm)
[ 1459.420501] cfg80211:      (5170000 KHz - 5250000 KHz @ 40000 KHz), (300 mBi, 2000 mBm)
[ 1459.428741] cfg80211:      (5735000 KHz - 5835000 KHz @ 40000 KHz), (300 mBi, 2000 mBm)
[ 1459.438476] wl1271: down
```

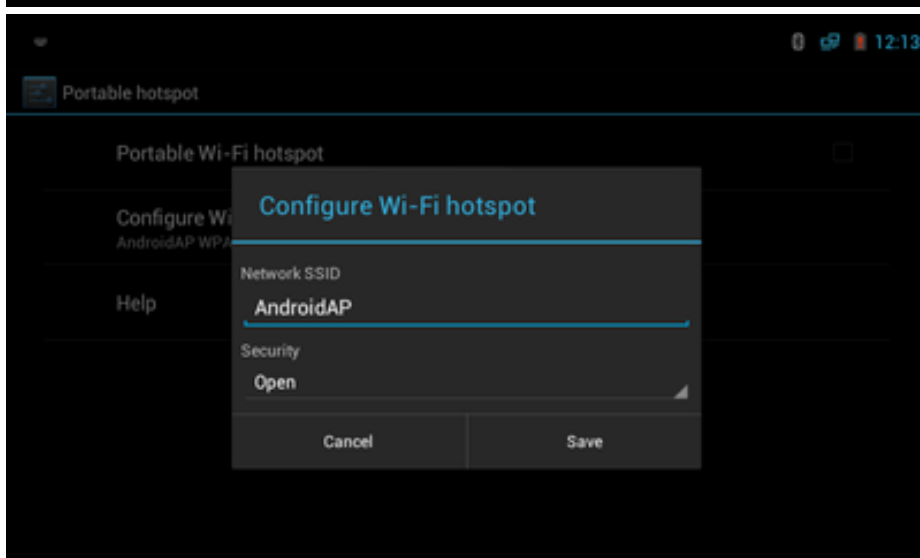
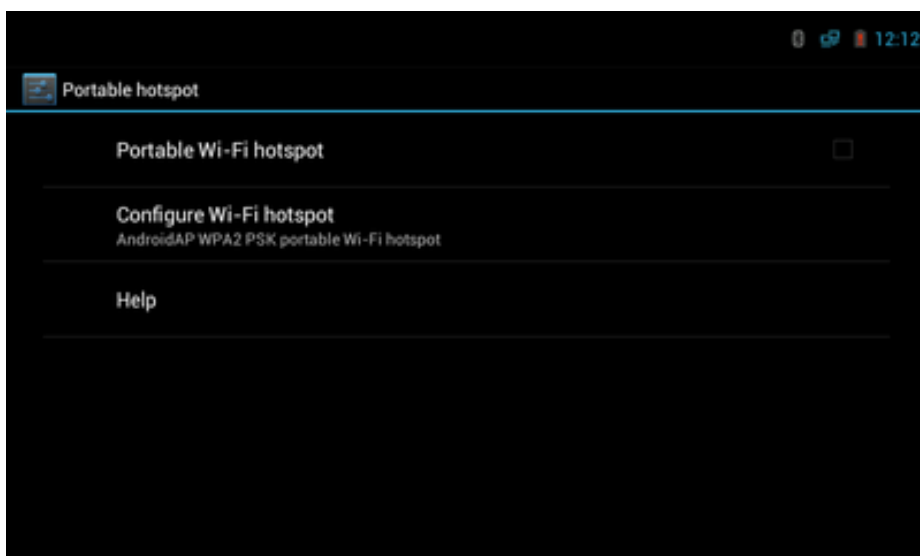
### Wi-Fi Hostspot (SoftAP)

TI-Android-ICS-4.0.3-DevKit-3.0.0 supports Wi-Fi hotspot (SoftAP) feature with TI WL1271 Wireless module.

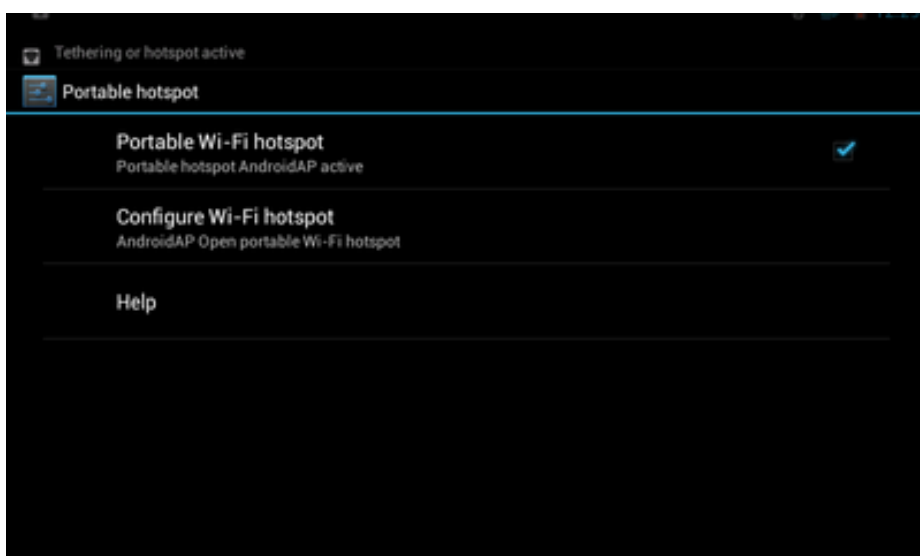
- To turn on Wi-Fi hotspot, browse to "App Launcher" -> "Settings" -> "More..." -> "Portable hotspot"



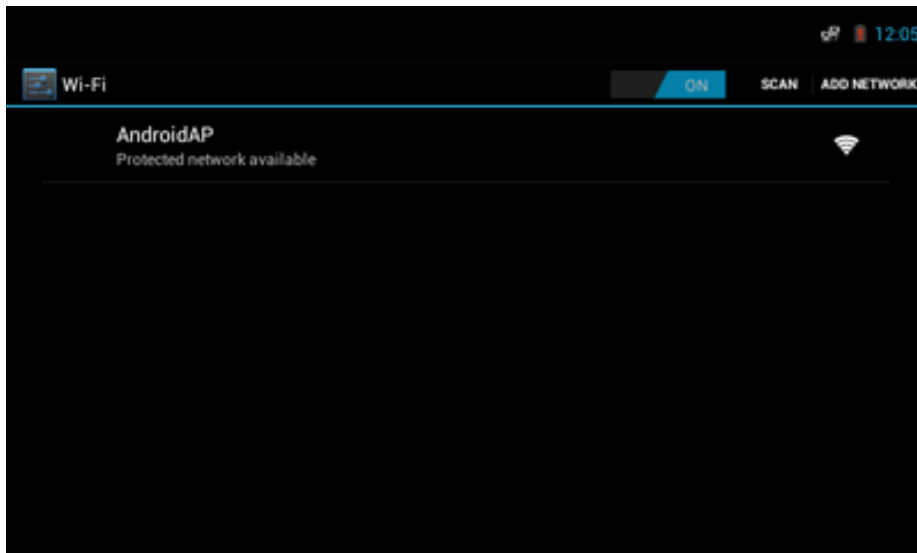
- Click "Configure Wi-Fi hotspot" to configure the hotspot settings..



- Click the checkbox next to "Portable Wi-Fi hotspot" to start hotspot. You will see the message "Tethering or hotspot active" in the notification bar once the hotspot is fully functional.



- The following screenshot shows the hotspot being detected from another evm.

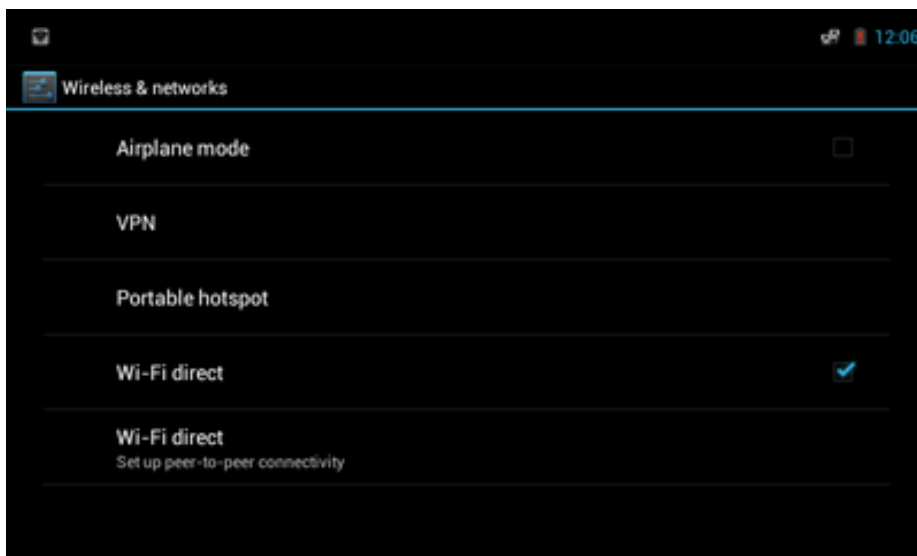


**Note:** Tethering with another network interface like ethernet is not currently supported in this DevKit release

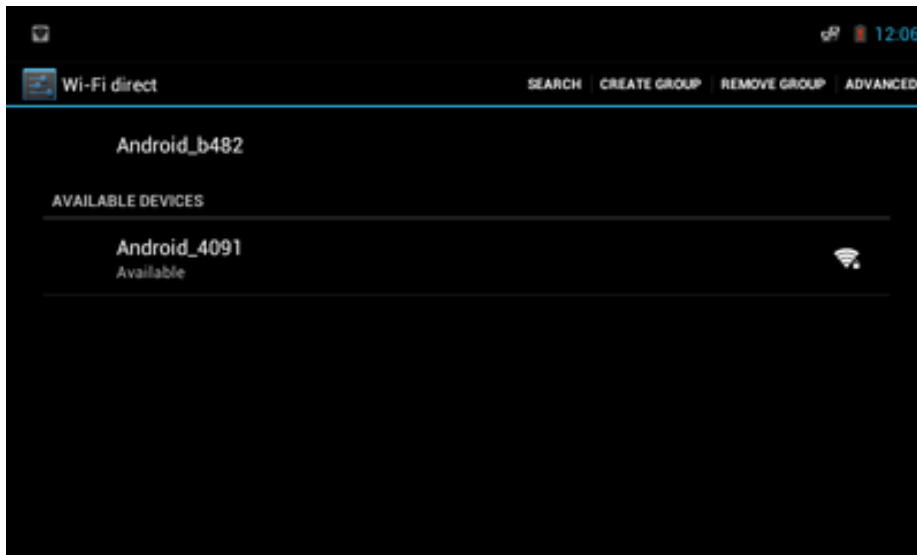
### Wi-Fi Direct

TI-Android-ICS-4.0.3-DevKit-3.0.0 supports Wi-Fi Direct with TI WL1271 Wireless module.

- To turn on Wi-Fi direct, browse to "App Launcher" -> "Settings" -> "More..."
- Click checkbox next to "Wi-Fi direct".



- After Wi-Fi direct is enabled, click "Wi-Fi direct: Set up peer-to-peer connections". This window shows any nearby devices with Wi-Fi direct enabled.



**Note:** Wi-Fi station mode or SoftAP/hotspot mode, if enabled, shall be disabled when Wi-Fi direct is active. The earlier state is restored when Wi-Fi direct is disabled

### Changing WLAN MAC address

The devices loaded with TI-Android-ICS-4.0.3-DevKit-3.0.0 will have the same MAC address which is encoded in wl1271-nvs.bin file. This may result in Wi-Fi not operating correctly when multiple devices are simultaneously in use. For optimum results, we recommend to modify the MAC address to ensure unique MAC for the devices before use

To change the MAC address, perform the following on the serial console of device:

- First get the current MAC address for WLAN:

```
root@android:/ # calibrator get nvs_mac /system/etc/firmware/ti-connectivity/wl1271-nvs.bin
```

- Then update the MAC address for WLAN:

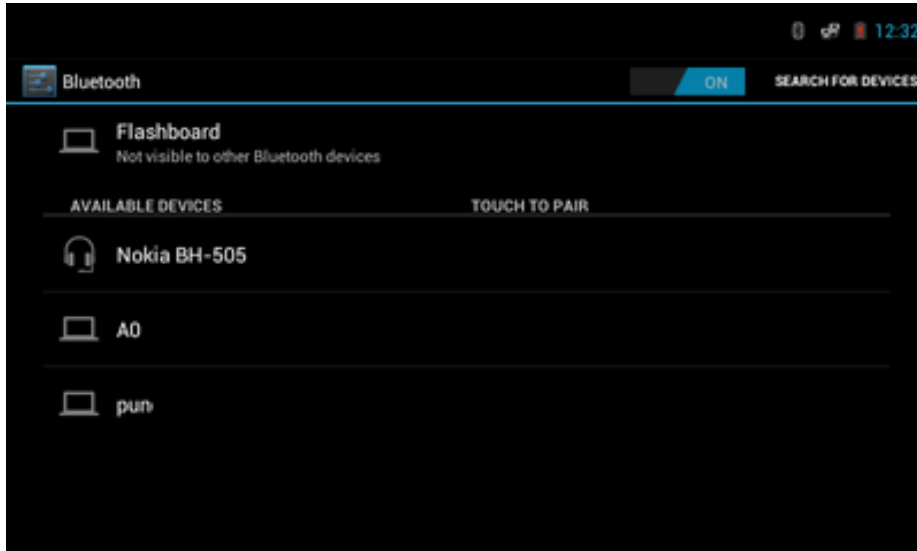
```
root@android:/ # calibrator set nvs_mac /system/etc/firmware/ti-connectivity/wl1271-nvs.bin <MAC Address>
```



## Bluetooth

### Enabling Bluetooth

- To turn on Bluetooth, browse to "App Launcher" -> "Settings" -> "Bluetooth".
- Enable Bluetooth by sliding the ON/OFF tab to the ON position and wait for few seconds.
- Bluetooth icon appears on taskbar.
- When BT is enabled the status shows Turning Bluetooth ON and lists out the available Bluetooth devices.



- Select the desired device to pair with.
- A popup dialog with pin will appear.
- Click Pair button to confirm pairing.
- Verify that the desired device shows the same pin. click OK. And then the device gets listed under the paired devices category.

**Note:** When pairing with Bluetooth headset, pin may not be displayed. Android attempts to pair automatically with Bluetooth headsets. Pin dialog will be shown only if auto-pairing fails.

### Disabling Bluetooth

- To turn off Bluetooth, browse to "App Launcher" -> "Settings" -> "Bluetooth".
- Disable Bluetooth by sliding the ON/OFF tab to the OFF position.

### Bluetooth Object Push profile

Using Bluetooth, it is possible to send / receive files (pictures, media files etc).

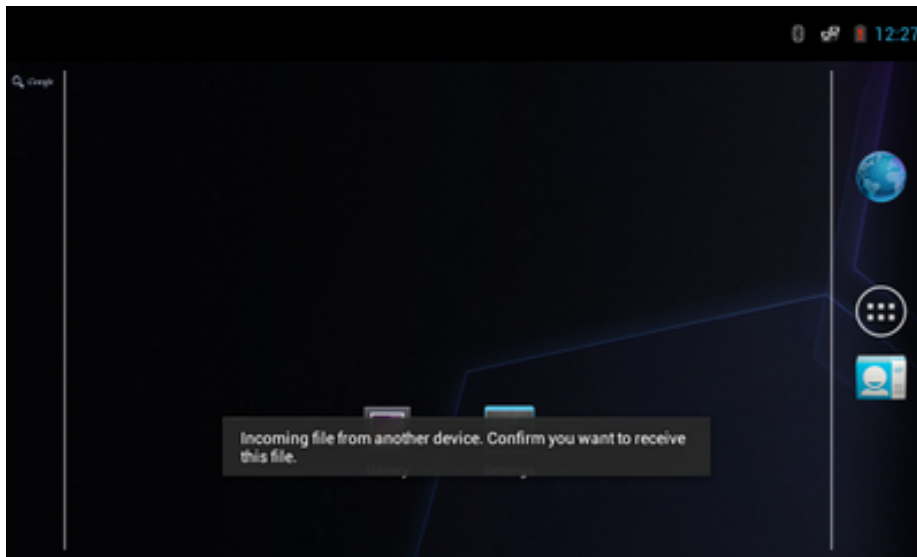
### Sending files

**Note:** 'Share using Bluetooth' is not enabled by default in the Gallery app. You need to install a third party application like BlueFTP to enable the sharing option

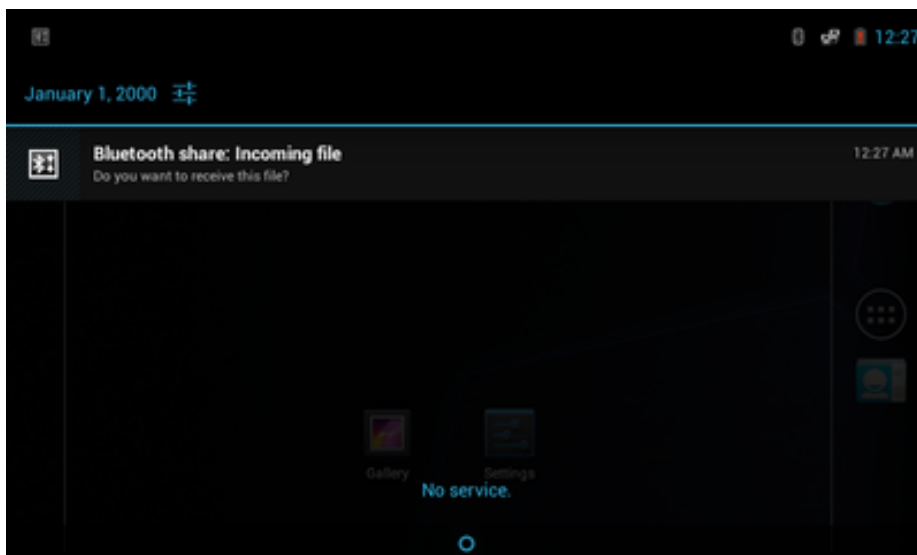
- browse to "App Launcher" -> "Gallery" -> "Images".
- Select a picture to share.
- Click share icon (top bar), select bluetooth from the options
- select paired BT device to send to.
- The BT device will prompt to accept. Accept incoming file at the other device.
- Once download finishes, check file.

## Receiving files

- On paired device (e.g. phone), select send via Bluetooth, click on Flashboard (or omap3evm).
- On evm, notification appears about incoming connection.



- Open the task bar and select "Bluetooth share: Incoming file".

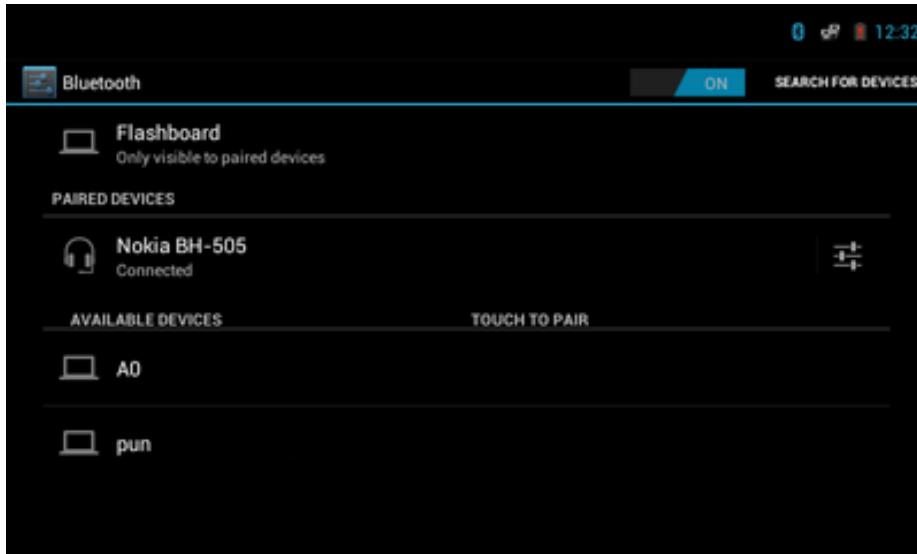


- A pop up appears asking for confirmation. On popup click Accept.
- Once download completes, check file.

## Bluetooth A2DP

You can listen to Media audio on Bluetooth A2DP headset.

- Pair A2DP capable bluetooth headset with device. Android uses the stereo headset icon to denote A2DP headset.
- After pairing succeeds, the status is updated to 'Connected'.



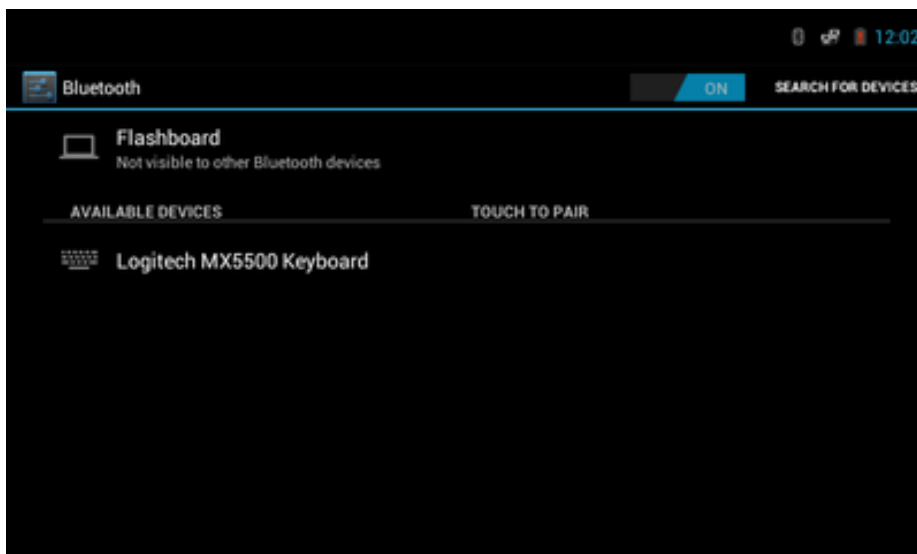
- Open Music player and play any audio clip.
- Audio will be heard on the Bluetooth headset.

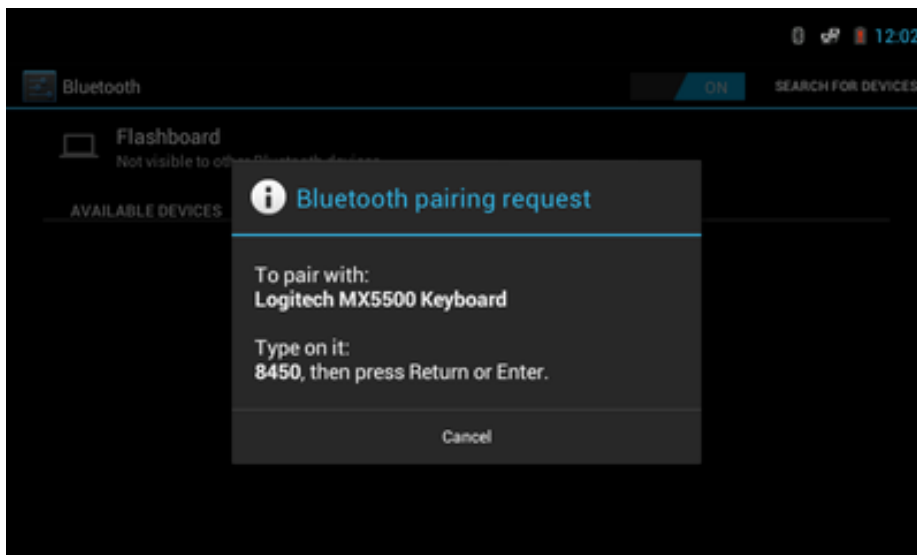
## Bluetooth HID

You can connect to Bluetooth keyboard or mouse.

### Bluetooth Keyboard

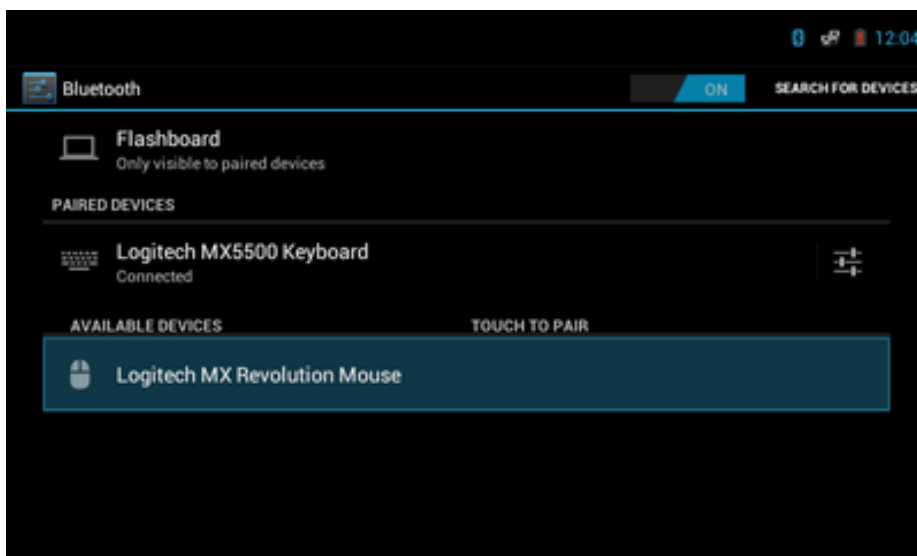
- Pair with the Bluetooth keyboard, by providing the suitable pass-code from the keyboard matching to the code shown on the device.
- After the successful pairing of the keyboard with the device, the keyboard will be listed under the paired devices category.
- The supported functionality of the paired keyboard can be used on the device.
- For disconnecting the keyboard from the device, select the keyboard under paired devices category, and agree to disconnect message.

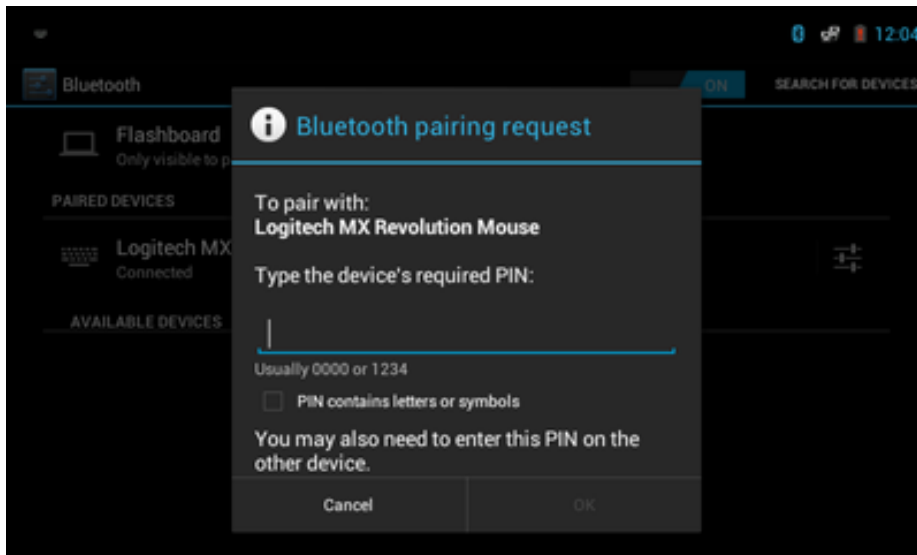




### Bluetooth Mouse

- Pair with the Bluetooth mouse, by providing the suitable pass-code from the device, matching to the supported code of the mouse.
- After the successful pairing of the mouse with the device, the mouse will be listed under the paired devices category.
- The supported functionality of the paired mouse can be used on the device.
- For disconnecting the mouse from the device, select the mouse under paired devices category, and agree to the disconnect message.





### Bluetooth AVRCP

You can control Media playback with Media player keys on Bluetooth headset with AVRCP capabilities.

NOTE: The following steps assume Bluetooth A2DP headset with AVRCP.

- Pair the BT headset
- The following text appears on the debug serial when the pairing is successfully completed. This confirms that AVRCP feature is registered with android

```
[ 3291.281250] input: AVRCP as /devices/virtual/input/input4
```

- Open Music Player and go to playlist view. Check that there are multiple clips in the playlist.
- Press the Play/Pause button on the BT headset - The currently queued clip begins playing on the headset.
- Press the Play/Pause button again on the headset - The currently playing clip is paused.
- Press the Next button on the headset; the next clip in the playlist begins to play on the headset.
- Press the Prev button on the headset; the currently playing clip restarts from the beginning.

### Accelerometer Sensor

TI Android ICS 4.0.3 DevKit 3.0.0 supports the accelerometer sensor on Flashboard.

#### Auto-rotate screen

- Browse to the "App Launcher" -> "Settings" -> "Display".
- Enable the "Auto-rotate screen" feature. Ensure the Check box gets ticked.
- Now hold the device in horizontal or vertical orientation to find the screen getting rotated.

#### Amazed Application



- Launch the Amazed application by browsing to the "App Launcher" -> "Amazed".
- The game starts. Tap the screen to begin.
- Hold the device in different orientation to move the ball to the destination and hence test the accelerometer.

**Note:** The device should be kept vertically for best results

## Power Management

Below are the features supported for AM37x in TI-Android-ICS-4.0.3-DevKit-3.0.0:

- Change of LCD backlights based on Wake Locks and Screen Timeouts (DIM,OFF)
- LCD back light brightness control from Settings Application
- Suspending the device to Memory.The device can be suspended in two ways.
  1. Pressing the POWER key on the keypad.
  2. Allowing the system go to suspend after a screen timeout.
- Prevent Suspend based on Wake Locks.
- System Resume on Key Press
- System Resume on Alarm
- CPU Dynamic Voltage and Frequency Scaling (ondemand, performance, powersave and userspace governors).
- CPU Idle States.
- Enabling system for hitting retention during idle.
- Enabling system for hitting OFF.

## Basic Settings

### Enable PM

By default we have disabled PM with the setting "setprop hw.nopm true" in init.rc.

Replace the line with "setprop hw.nopm false" to enable suspend/resume features.

Remove the selection "App Launcher" -> "Settings" -> "Developer options" -> "Stay awake" if selected already.

### To go in suspend mode

- Press POWER (R0C0) key on the keypad.

### To resume from suspend mode

- Press any button on the keypad.

### To set the Screen Timeout to go suspend

- Select "App Launcher" -> "Settings" -> "Display" -> "Sleep"
- Select one of the options from the list.

### To set set the screen always on preventing suspend

- Select "App Launcher" -> "Settings" -> "Developer options" -> "Stay awake"

### To set Screen Brightness

- Select "App Launcher" -> "Settings" -> "Display" -> "Brightness"

### To set Alarm in Android

- Select "App Launcher" -> "Clock "
- Click "Set alarm" -> "Add Alarm". Set the alarm as per requirements.

Device will be woken up from suspend at Alarm Time.

---

## Advanced Settings

### To Disable Power Management

- Edit init.rc file on the root directory.
- Set the property **hw.nopm** to **true**
- 
- This will prevent POWER key suspend and screen timeout based suspend.

### CPU Idle and OFF mode Settings

CPU Idle feature is enabled by default in the kernel. There are seven power states introduced by CPU Idle. Enable **sleep\_while\_idle** and **enable\_off\_mode** to achieve all the possible idle states. For maximum power reduction set the UART console timeouts as well

```
# echo 1 > /debug/pm_debug/sleep_while_idle
# echo 1 > /debug/pm_debug/enable_off_mode
# echo 5 > /sys/devices/platform/omap/omap_uart.0/sleep_timeout
# echo 5 > /sys/devices/platform/omap/omap_uart.1/sleep_timeout
# echo 5 > /sys/devices/platform/omap/omap_uart.2/sleep_timeout
```

The usage and time count for these different states can be checked via

```
#cat /sys/devices/system/cpu/cpu0/cpuidle/state*/time
#cat /sys/devices/system/cpu/cpu0/cpuidle/state*/usage
```

### Enabling ondemand frequency governor

The ondemand governor enables DVFS(frequency/OPP) transitions based on CPU load.

```
#echo ondemand > /sys/devices/system/cpu/cpu0/cpufreq/scaling_governor
```

### Enabling performance frequency governor

The performance governor keeps the CPU always at the highest frequency.

```
#echo performance > /sys/devices/system/cpu/cpu0/cpufreq/scaling_governor
```

### Enabling powersave frequency governor

The powersave governor keeps the CPU always at the lowest frequency.

```
#echo powersave > /sys/devices/system/cpu/cpu0/cpufreq/scaling_governor
```

### Enabling userspace frequency governor

Once this governor is enabled, DVFS( frequency) transitions will be manually triggered by a userspace application by using the CPUfreq sysfs interface

```
#echo userspace > /sys/devices/system/cpu/cpu0/cpufreq/scaling_governor
```

See all the available operating points

```
#cat /sys/devices/system/cpu/cpu0/cpufreq/scaling_available_frequencies
```

Application can select any of the available frequency from the above

```
#echo <Desired Frequency> > /sys/devices/system/cpu/cpu0/cpufreq/ scaling_setspeed
```

**To minimize the power consumption in runtime**

The maximum power reduction in runtime is achieved when “enable\_off\_mode” and “sleep\_while\_idle” options are enabled and dvfs option is set to “power save”.

**To minimize the power consumption in suspend**

The maximum power reduction in suspend is achieved when “enable\_off\_mode” and “sleep\_while\_idle” options are enabled and UART console timeouts are set.

Please check the power consumption analysis at TI-Android-ICS-4.0.3-DevKit-3.0.0 Performance Benchmark page

**Limitations**

- In BeagleBoard there is no keypad connected to the wake up domain. So wake up is not possible by pressing keys.
- In Suspend, If USB OTG cable is connected, it makes Powerdomain (core\_pwrdom) not entering to sleep State
- Inserting and Removing USB OTG cable continuously after suspend-resume makes system hang sometimes

**NAND Booting****NAND Image flashing from u-boot prompt**

- The default ECC scheme is 1-bit hardware ECC with Kernel/FileSystem ECC layout. Before saving the environment to NAND flash, always select this scheme. This will ensure that U-boot can read the environment from NAND without any ECC mismatch.

The ECC algorithm supported in this release are:

```
# nandeccl [ hw <hw_type> | sw | bch4_sw | bch8_sw ]
```

Usage:

```
sw          - Set software ECC for NAND
hw <hw_type> - Set hardware ECC for NAND
               <hw_type> - 1 for Kernel/FileSystem ECC layout
                           2 for X-loader/U-boot ECC layout
bch4_sw      - Set 4-bit BCH ECC for NAND
bch8_sw      - Set 8-bit BCH ECC for NAND
```

(hw 1 is set as the default nandeccl)

**Saving Environment Variables**

For example, to set bootargs and save them to the environment, the following commands could be used:

```
OMAP3_EVM # nandeccl hw 1
OMAP3_EVM # setenv nandboot 'nand read 0x82000000 0x280000 0x500000 ;
bootm 0x82000000'
OMAP3_EVM # setenv bootcmd 'run nandboot'
OMAP3_EVM # setenv bootargs 'init=/init console=ttyO0,115200n8 noinitrd
ip=off androidboot.console=ttyO0 rootwait mem=256M
omap_vout.vidl_static_vrfb_alloc=y rw ubi.mtd=4,2048 rootfstype=ubifs
root=ubi0:rootfs rootwait vram=8M omapfb.vram=0:8M'
OMAP3_EVM # saveenv
```



### Flashing x-loader

To flash MLO (x-load.bin.ift) to the NAND Flash, execute the commands listed below:

```
OMAP3_EVM # tftp 0x82000000 MLO
OMAP3_EVM # nand erase 0x0 0x80000
OMAP3_EVM # nandeccl hw 2
OMAP3_EVM # nand write 0x82000000 0x0 0x80000
```

### Flashing U-boot

To flash u-boot.bin to the NAND Flash, execute the commands listed below:

```
OMAP3_EVM # tftp 0x82000000 u-boot.bin
OMAP3_EVM # nand erase 0x80000 0x1C0000
OMAP3_EVM # nandeccl hw 2
OMAP3_EVM # nand write 0x82000000 0x80000 0x1C0000
```

### Flashing Linux kernel

To flash uImage to the NAND Flash execute the commands listed below:

```
OMAP3_EVM # tftp 0x82000000 uImage
OMAP3_EVM # nand erase 0x280000 <kernel image size>
OMAP3_EVM # nandeccl hw 1
OMAP3_EVM # nand write 0x82000000 0x280000 <kernel image size>
```

### Flashing UBI filesystem

To flash UBI image to the NAND Flash execute the commands listed below:

```
OMAP3_EVM # mw.b 0x82000000 0xFF <file system size>
OMAP3_EVM # tftp 0x82000000 <file system image>
OMAP3_EVM # nand erase 0x780000 <file system size>
OMAP3_EVM # nandeccl hw 1
OMAP3_EVM # nand write 0x80000000 0x780000 <file system size>
```

**Note:** The image size should be upward aligned to NAND page size which is 2KiB (i.e. 0x800). For example, if the image size is 0x19B8004 the size to be passed to the NAND write command should be 0x19B8800.

## Fastboot and UBI rootfs

Fastboot flashing utility is for updating the different software components of Android. Here is a guide to reflash the xloader, u-boot, kernel and root-file-system (UBIFS image). This guide assume that Rowboat has been compiled before trying out these instructions.

### Establishing Fastboot connectivity

#### Setup on Device

- Connect serial port to host PC via null modem cable.
- Serial port settings: 115200 8N1, No flow control.
- Connect USB cable between USB OTG port of the board and host PC.
- Apply power to the board.
- Press any key in serial port utility during boot and get U-boot command prompt.
- Run "**fastboot**" on u-boot command prompt (u-boot will echo "fastboot initialized").

### Setup on Linux host

- On command prompt, run

```
$ export ANDROID_ROOT=<rowboat top level directory>
```

```
$ cd $ANDROID_ROOT/out/host/linux-x86/bin
```

```
$ sudo ./fastboot devices
```

if a device number is echoed, fastboot is working.

### Setup on Windows host

- Refer ADB over USB on Windows Machine
- Edit android\_winusb.inf - under section [Google.NTx86], add line as below:

```
%SingleBootLoaderInterface% = USB_Install, USB\VID_0451
```

- Proceed installing, with the difference that device to be selected is "Android Bootloader Interface" instead of "Android ADB Interface".

### Creating ubifs images

- Change the permission of target rootfs else it will give permission denied errors:

```
$ sudo chmod -R 777 android_rootfs_am37x
```

- Clone/download the latest mtd-utils sources and build them:

```
$ git clone git://git.infradead.org/mtd-utils.git
```

```
$ cd mtd-utils
```

```
$ make
```

- Creating ubifs image:

```
$ sudo mkfs.ubifs/mkfs.ubifs -r <path_to_rootfs>/ -m 2048 -e 126976 -c X -o ubifs.img
    where X = 3991 for 512MB NAND and X = 1948 for 256MB NAND flash
```

- Create/Edit ubinize.cfg:

```
[ubifs]
mode=ubi
image=ubifs.img
vol_id=0
vol_size=Y
    where Y=450MiB for 512MB NAND and Y=200MiB for 256MB NAND
vol_type=dynamic
vol_name=rootfs
vol_flags=autoresize
```

- Creating ubi.img to be flashed:

```
$ sudo ubi-utils/ubinize -o ubi.img -O 2048 -m 2048 -p 128KiB -s 512 ubinize.cfg
```

**Important** Use either Fastboot to flash ubi.img over System partition of NAND or do it manually from u-boot prompt.

**Fastboot commands**

```
$ export ANDROID_ROOT=<rowboat_top_level_build_directory>
```

```
$ cd $ANDROID_ROOT/out/host/linux-x86/bin
```

- List connected devices:

```
$ sudo ./fastboot devices
679600029e380000016830c302      fastboot
```

- Update xloader:

```
$ sudo ./fastboot flash xloader <xloader_binay_path>/MLO
sending 'xloader' (18 KB)...
OKAY [ 0.031s]
writing 'xloader'...
OKAY [ 0.259s]
finished. total time: 0.290s
```

- Updating u-boot:

```
$ sudo ./fastboot flash bootloader <uboot_binary_path>/u-boot.bin
sending 'bootloader' (212 KB)...
OKAY [ 0.159s]
writing 'bootloader'...
OKAY [ 0.312s]
finished. total time: 0.471s
```

- Updating kernel:

```
$ sudo ./fastboot flash boot <kernel_image_path>/uImage
sending 'boot' (3260 KB)...
OKAY [ 2.266s]
writing 'boot'...
OKAY [ 1.660s]
finished. total time: 3.926s
```

- Updating filesystem:

```
$ sudo ./fastboot flash system <rootfs_image_path>/ubi.img
sending 'system' (117248 KB)...
OKAY [ 81.792s]
writing 'system'...
OKAY [ 53.123s]
finished. total time: 134.929s
```

- Erasing partition:

```
$ sudo ./fastboot erase <partition name> (eg. xloader)
```

- Display fastboot variable:

```
$ sudo ./fastboot getvar <variable>
```

- Exit fastboot mode in uboot:

```
$ sudo ./fastboot
resuming boot...
OKAY [ 0.001s]
finished. total time: 0.001s continue
```

### Booting with UBIFS rootfs

- Set the bootarguments from u-boot prompt.

```
# setenv nandboot 'echo Booting from nand ...; nand read ${loadaddr} ${boot_nand_offset} ${boot_nand_size}; bootm ${loadaddr}'
```

```
# setenv bootcmd 'run nandboot'
```

```
# setenv bootargs 'init=/init console=ttyO0,115200n8 noinitrd ip=off
androidboot.console=ttyO0 rootwait mem=256M
omap_vout.vidl_static_vrfb_alloc=y rw ubi.mtd=4,2048 rootfstype=ubifs
root=ubi0:rootfs rootdelay=2 vram=8M omapfb.vram=0:8M'
```

## ADB Android Debugger & Downloader

Android Debug Bridge (adb) is a versatile tool lets you manage the state of the Android-powered device. For more information about what is possible with adb, see Android Debug Bridge page at <http://developer.android.com/guide/developing/tools/adb.html>. The ADB tool can be used to

- Download an application from a host machine, install & run it on the target board.
- Start a remote shell in the target instance.
- Debug applications running on the device using the debugging tool DDMS ( Dalvik Debug Monitor Server) which runs on top of adb connection.
- Copy files to and from the board to host machine

### Downloading "ADB" & Host setup

The adb tool is a part of Android SDK package located at <http://developer.android.com/sdk/index.html>. For an overview of how to install and set up the Android SDK, follow download & setup instructions from <http://developer.android.com/sdk/index.html>. Once you install Android SDK, the directory contents look like this.

```
.
|-- SDK Readme.txt
|-- add-ons
|-- google-market_licensing
|-- platform-tools
|   |-- NOTICE.txt
|   |-- aapt
|   |-- adb
|   |-- aidl
|   |-- dexdump
|   |-- dx
|   |-- lib
|   `-- source.properties
|-- platforms
|-- temp
`-- tools
    |-- NOTICE.txt
```

```
|-- adb_has_moved.txt
|-- android
|-- ant
|-- apkbuilder
|-- ddms
|-- dmtracedump
|-- draw9patch
|-- emulator
|-- etcltool
|-- hierarchyviewer
|-- hprof-conv
|-- layoutopt
|-- lib
|-- mksdcard
|-- monkeyrunner
|-- proguard
|-- source.properties
|-- sqlite3
|-- traceview
`-- zipalign
```

The adb tool is located in platform-tools/ directory under the Android SDK installation. Export the platform-tools and tools directory path as shown below.

```
$ export PATH=<android_sdk_path>/platform-tools/:<android_sdk_path>/tools/:$PATH
```

## Connecting Host machine & board through adb

This release of DevKit has been tested for three different methods of connecting a given board with host machine

- adb over USB
- adb over USB Ethernet
- adb over Ethernet

The below sections describe each of these methods and provides necessary instructions for the same.

### adb over USB

- Make sure that the mini-usb cable is connected between the host usb port and the target's USB OTG port
- Turn on "USB Debugging" on your board. On the board (UI screen)-
  - Browse to "App Launcher" -> "Settings" -> "Developer options".
  - Enable "USB debugging". Select OK for confirmation. Ensure the Check box gets ticked.
- Setup host machine to detect the board. On Ubuntu Linux host machines this is done by adding a rules file to configure device vendor ID of on-board OMAP device.
- For the EVMs and Boards covered here, the vendor ID is "18d1".
  - Log in as root and create this file: **/etc/udev/rules.d/51-android.rules**

```
SUBSYSTEM=="usb", SYSFS{idVendor}=="18d1", MODE="0666"
```

- Execute the following to change the user mode for the rules file.

```
$ chmod a+r /etc/udev/rules.d/51-android.rules
```

**Note:** We recommend to reboot the host after making the above changes.

- Verify the adb connectivity between host and target board

```
$ adb devices
```

If device is connected, then output on screen should list the device, example:

```
List of devices attached
20100720      device
```

### adb over Ethernet

- Make sure Ethernet port on board and host machine are connected to the network
- Check Ethernet configuration for the board

```
# netcfg
lo      UP                127.0.0.1/8    0x00000049 00:00:00:00:00:00
sit0    DOWN            0.0.0.0/0     0x00000080 00:00:00:00:00:00
eth0    UP                172.24.191.26/22 0x00001043 96:cd:df:8b:c6:2b
```

- If Ethernet was not configured, ensure that Ethernet is enabled and configured correctly in Android Settings and reboot. See Ethernet Configuration section for more details.
- Configure the ADB Daemon on target to use an Ethernet connection using setprop as shown below.

```
# setprop service.adb.tcp.port 5555
```

- If network is configured successfully (above steps) then Restart service adbd on the target,

```
# stop adbd
# start adbd
```

- On the host machine use following commands to establish adb connection

```
$ export ADBHOST=<target's ip address>
$ adb kill-server
$ adb start-server
$ adb connect <target_ip_address>:5555
```

- Verify for device connectivity by executing the following command:

```
$ adb devices
```

If connected, find the device name listed

```
List of devices attached
172.24.191.26:5555      device
```

Invoke the shell of the target

```
$ adb shell
```

For more information about adb commands, see Android Debug Bridge page at Android ADB <sup>[7]</sup>

### adb over USB on Windows Machine

Follow the below instructions to get ADB over USB work on a Windows PC

- Download latest Android SDK

(<http://developer.android.com/sdk/index.html>) and uncompress it in a local folder (i.e. c:\android\_sdk).

- Optionally, you may want to add the location of the SDK's primary tools directory to your system PATH. Right-click on My Computer, and select Properties. Under the Advanced tab, hit the Environment Variables button, and in the dialog that comes up, double-click on Path (under System Variables). Add the full path to the tools\ directory to the path.

- Download Android USB Driver

([https://dl-ssl.google.com/android/repository/usb\\_driver\\_r03-windows.zip](https://dl-ssl.google.com/android/repository/usb_driver_r03-windows.zip)) and uncompress it in a local folder (i.e. c:\android\_sdk\usb\_driver)

- Edit (or create and then edit if it doesn't already exist) file in

"%USERPROFILE%\android\adb\_usb.ini":

```
> echo 0x18D1 > "%USERPROFILE%\android\adb_usb.ini"
```

- Edit android\_winusb.inf to match EVM/Beagle vendor and product ids:

Under [Google.NTx86] section add:

```
;TI EVM
%SingleAdbInterface%      = USB_Install, USB\VID_18D1&PID_9018
%CompositeAdbInterface%   = USB_Install, USB\VID_18D1&PID_9018&MI_01
```

**Note:** Be careful to add it under Google.NTx86 and not under Google.NTamd64 unless your machine is AMD 64 bits. If you skip this step you won't be able to later install the driver as windows will reject it.

- Boot the board as normal and wait until shell prompt is available (micro-B USB cable must be disconnected).
- Connect micro-B USB cable between board and Windows PC.
- If it is proceeding as planned, Windows will tell you it found a new hardware asks you to install the driver. Install driver that was downloaded as described in step 3 above:

Answer "No, not this time" to the question about running Windows Update to search for software.

- Choose "Install the hardware that I manually select from a list (Advanced)" this is the 2nd option, then click "Next"
- Select "Show All Devices", then click "Next"
- You are going to see a grayed-out text box with "(Retrieving a list of all devices)", click the "Have Disk..." button
- Browse" to your driver folder (c:\android\_sdk\usb\_driver). It will be looking of a .inf file so select "android\_winusb.inf" and click "Open" then "OK". It's the only file there so you shouldn't go wrong.
- Select "Android ADB Interface" then click the "Next" button.
- A warning will appear, answer "Yes" but read the warning anyway.
- Click the "Close" when the wizard is completed.
- Disconnect and reconnect micro-B USB cable from Board(probably reboot it as well).
- Open command prompt and restart adb server just to make sure it is in a proper state:

```
> adb kill-server
> adb start-server
```

- List the attached devices with "adb devices". It should show your board/device with a random number.

- Type "adb shell". You should see the "#" indicating it works.

## Operations over ADB

The Root File System provided in this DevKit release contain only standard Android components and applications.

To install and run Android application follow steps mentioned below:

### Installing (.apk files) application on Target Platform

- From the host: You can use adb tool for package installation.

```
$ adb install <package>.apk.
```

NOTE: Use -s option with the adb tool, to install the package on external storage.

On successful installation adb tool will report SUCCESS on host terminal, and the application would be listed on the android main menu.

### Un-installing applications (.apk) using adb

- To un-install non-default components (that were installed later)
  - Method 1: On the host machine execute the following

```
$ adb shell pm list packages
$ adb uninstall <package name>
```

- Method 2: On target:

Main menu -> Menu -> Settings -> Applications -> Manage applications -> Find the package Tap on it -> Uninstall -> OK -> OK

- On successful removal, the application would have been removed from the android main menu. All the short-cuts to the application also removed.
- To un-install default components, use the following commands from abd on host machine

```
$ adb shell
# rm /system/app/app.apk
```

On successful removal, the application would have been removed from the android main menu.

### Copy any files to and from the board over ADB

- Using the adb commands "pull" and "push" copy files to and from the board.
- Unlike the install command, which only copies an .apk file to a specific location, the pull and push commands let you copy arbitrary directories and files to any location on the board.
- To copy a file or directory (recursively) from the board, use

```
$ adb pull <remote> <local>
```

- To copy a file or directory (recursively) to the board, use

```
$ adb push <local> <remote>
```

In the commands, <local> and <remote> refer to the paths to the file or directory on your development host (local) and on the target instance (remote).

```
Here's an example:
$ adb push foo.txt /sdcard/foo.txt
```



## Compatibility Test Suite (CTS)

This section describe the procedure to run CTS on any platform.

- Pre-requisites
  - Download and extract the CTS package from here <sup>[8]</sup>
  - Android SDK is installed and **adb** command is in the *\$PATH* . See ADB section above
- Refer to Google CTS Guide <sup>[9]</sup> for information on setting up the host and android device for CTS testing.
- Setup an ADB connection between Host and platform as mentioned in ADB section above.
- Launch the CTS.
  - Change to android-cts directory
  - Start cts

```
android-cts$ ./tools/cts-tradefed
```

- On CTS prompt check the available plans

```
cts-tf > list p
```

- Start a specific Test Plan

```
cts-tf > run cts --plan <test plan name>
```

Once all the tests are executed, the results can be browsed in an browser by opening [android-cts/repository/results/<session-name>/testResult.xml] and use the results to adjust your design.

**Note:** Sometimes when CTS is restarting the board, adb connection to CTS, may not happen automatically. In that case, execute the following command on the console, soon after the board has restarted.

```
# stop adbd;sleep 1;start adbd;
```

## Building Android Sources

Refer to TI Android DevKit Developer Guide at [http://processors.wiki.ti.com/index.php/TI-Android-ICS-4.0.3-DevKit-3.0.0\\_DeveloperGuide](http://processors.wiki.ti.com/index.php/TI-Android-ICS-4.0.3-DevKit-3.0.0_DeveloperGuide) for building Android sources and setting up the platform for booting.







TI provides Android sources for all the supported devices in multiple locations, developers can download the sources from the rowboat repository <sup>[10]</sup> or use the pre-packaged repo in the DevKit TI\_Android\_ICS\_4\_0\_3\_AM37x\_Sources.tar.gz <sup>[11]</sup>.

## SD Card Recommendations


Some brands or models of SD cards are observed with poor performance on AM37x platforms. The symptom could be one or some of the followings.

- the boot-up time is much longer than normal (3x of normal or even longer);
- the reaction of UI operations is unacceptably delayed;
- the Gallery app cannot find the media files to create the albums;
- the video playback is sluggish.

The table below lists the SD cards tested which have no issue on performance.

|  | Brand/Model   | Type       | Class | Capacity |
|--|---------------|------------|-------|----------|
|   | SanDisk       | SDHC       | 4     | 4GB      |
|   | SanDisk Ultra | SDHC       | 4     | 4GB      |
|   | SanDisk Ultra | SD         | 4     | 2GB      |
|   | Sony          | SDHC       | 4     | 4GB      |
|   | Sony          | SD         | 4     | 2GB      |
|  | Sony          | micro SDHC | 4     | 4GB      |

The table below lists the SD cards tested which have **poor** performance.

|   | Brand/Model        | Type       | Class | Capacity |
|---|--------------------|------------|-------|----------|
|   | HP Invent          | SDHC       | 4     | 4GB      |
|   | Kingston           | SDHC       | 4     | 4GB      |
|  | Kingston           | micro SDHC | 4     | 4GB      |
|  | Lexar MULTI-USE    | SDHC       | 4     | 4GB      |
|  | Lexar PLANTINUM II | SDHC       | 6     | 4GB      |
|  | PNY Optima         | SDHC       | 4     | 4GB      |

## Versioning

This release is available from [http://software-dl.ti.com/dsps/dsps\\_public\\_sw/sdo\\_tii/TI\\_Android\\_DevKit/TI\\_Android\\_ICS\\_4\\_0\\_3\\_DevKit\\_3\\_0\\_0/index\\_FDS.html](http://software-dl.ti.com/dsps/dsps_public_sw/sdo_tii/TI_Android_DevKit/TI_Android_ICS_4_0_3_DevKit_3_0_0/index_FDS.html)

The release notes is available at [http://processors.wiki.ti.com/index.php/TI-Android-ICS-4.0.3-DevKit-3.0.0\\_ReleaseNotes](http://processors.wiki.ti.com/index.php/TI-Android-ICS-4.0.3-DevKit-3.0.0_ReleaseNotes)

## Technical Support and Product Updates

For further information or to report any problems, contact <http://e2e.ti.com/android> or <http://support.ti.com>.

For community support join <http://groups.google.com/group/rowboat>

For IRC #rowboat<sup>[12]</sup> on [irc.freenode.net](http://irc.freenode.net)

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