## Revision History

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<th>Date</th>
<th>Description</th>
<th>Author</th>
</tr>
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<tr>
<td>A</td>
<td>12/June/2018</td>
<td>Initial Version</td>
<td>LS</td>
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## Approval Record

<table>
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<tr>
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<th>Name</th>
<th>Date</th>
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<tr>
<td>Reviewed By</td>
<td>KM/MSS</td>
<td>12/June/2018</td>
</tr>
<tr>
<td>Approved By</td>
<td>DR</td>
<td>12/June/2018</td>
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1. INTRODUCTION

This document describes the feature set supported on Debian Linux Software Release Version 1.0 running Debian Buster 10 on the Inforce 6640 development platform. The Inforce 6640 is a SBC based on the 64-bit Qualcomm® Snapdragon™ 820 processor (APQ8096 SoC).

Test Configuration used for Validation

- Development Platform – IFC6640-11-P1
- Camera module – ACC-1H10-00-P3
- MIPI Display Adaptor Card Kit – ACC-1B30

Memory Platform Information

The following has been validated in this release:

- UFS 64GB
- LPDDR4 4GB

There are dedicated partitions in the on-board UFS for each of these files and the important ones are listed below:

<table>
<thead>
<tr>
<th>Partition</th>
<th>Size</th>
<th>Label</th>
</tr>
</thead>
<tbody>
<tr>
<td>/dev/sdb1</td>
<td>3.9M</td>
<td>xbl</td>
</tr>
<tr>
<td>/dev/sde1</td>
<td>512K</td>
<td>rpm</td>
</tr>
<tr>
<td>/dev/sde3</td>
<td>2M</td>
<td>tz</td>
</tr>
<tr>
<td>/dev/sde15</td>
<td>1M</td>
<td>aboot</td>
</tr>
<tr>
<td>/dev/sde17</td>
<td>64M</td>
<td>boot</td>
</tr>
<tr>
<td>/dev/sda7</td>
<td>55.4G</td>
<td>rootfs</td>
</tr>
</tbody>
</table>

It is not recommended to erase or modify any of these partitions except for partition-labeled boot. Modifying may cause the board to no longer boot. If the UFS partitions have been erased or partition table has been corrupted, the system can be recovered by using the instructions provided in the application note called APQ8096_Recovery_of_Bricked_Boards_using_USB_003228_Rev_B.pdf that is available on Inforce Techweb.

The board comes with fastboot support, which means that the APPSBL implements the fastboot protocol. Fastboot is a special bootloader protocol that allows UFS partition to be flashed with new images. By default, the APPSBL will load and execute the boot image from the ‘boot’ partition.

To go to fastboot mode, press the power and Vol– buttons simultaneously on the carrier board before powering on the Inforce 6640 development platform.


Android and Debian Linux images are inter-changeable on this platform. From fastboot mode, use the flashall.bat or flashall.sh script available in the Android release package to flash the prebuilt android binaries.
2. SOFTWARE RELEASE INFORMATION

The following instructions assume that you are working from an Ubuntu 14.04 (or later) host system. The steps for other systems will be similar, and should be easily discerned from what follows.

2.1 BUILD AND RUN IMAGES

A. Package Description

The binaries and sources are packaged into the tarball called:
IFC6640_Debian_Linux_BSP_880562_V1.0

Binaries directory:
This package contains the below pre-built binaries:
- Kernel boot image that includes prebuilt kernel with Inforce's patches applied on 4.14.0 based kernel from Linaro.

NOTE
A separate boot image has been provided for enabling MIPI-DSI display feature.
- alip rootfs image that includes a minimal desktop environment GUI using LXQt.

These binaries can be flashed directly onto your Inforce 6640 platform using the commands in Section G and Section H

Meta-Binaries Directory:
This package contains the meta-binaries from Linaro.

Source Directory:
This package also contains the kernel sources/patches with the necessary tools to build kernel and Apps bootloader images and also to customize the Debian rootfs image.

Users should replace the labels shown below with actual names while executing the different commands in the succeeding sections.

**RELEASE DIRECTORY** : path to IFC6640_Debian_Linux_BSP_880562_V1.0
**RELEASE** : 4.14-ifc6640-v1.0
**INITRD** : initrd.img
**ROOTFS** : rootfs-ifc6640-v1.0

B. Setting up build environment

```bash
$ cd <RELEASE DIRECTORY>/source/build-tools
$ tar -xvf gcc-linaro-6.3.1-2017.02-x86_64_aarch64-linux-gnu.tar.xz
$ unzip skales.zip
$sudo dpkg -i android-tools-fsutils_4.2.2+git20130218-3ubuntu41+linaro1_amd64.deb
```
Ensure following packages are installed by running the below commands:
$sudo apt-get install device-tree-compiler
$sudo apt-get install libfdt-dev

C. Fetch Kernel Sources

To build the kernel image, follow the steps listed below from your Ubuntu host machine:

The kernel sources are available within the source folder of:
IFC6640_Debian_Linux_BSP_880562_V1.0 package as debian-<RELEASE>.bundle

Kernel source can be fetched in either of the two methods listed below.

Method 1:
$git clone debian-<RELEASE>.bundle -b debian-<RELEASE>

Then follow instructions from Section D onwards.

NOTE

This procedure doesn't require an internet connection since the bundle is part of the release package.

Method 2:
$git clone https://git.linaro.org/landing-teams/working/qualcomm/kernel.git kernel -b release/qcomlt-4.14
$cd kernel/
$git checkout -b -<RELEASE>
$git am .. /patches/kernel-patches/*.patch

Then follow instructions from Section D onwards

For DSI display:

Apply DSI patches on top of Camera patches
$git am .. /patches/dsi-patches/*.patch

Then follow instructions from Section D onwards.

D. Perform the Kernel Build

To generate the image, dtb, and modules, issue the following commands:
$export ARCH=arm64
$export CROSS_COMPILE=<RELEASE DIRECTROY>/source/build-tools/gcc-linaro-6.3.1-2017.02-x86_64-aarch64-linux-gnu/bin/aarch64-linux-gnu-
$make defconfig distro.config
$make -j4 Image dtbs modules KERNELRELEASE=<RELEASE>
$make KERNELRELEASE=<RELEASE> modules_install INSTALL_MOD_PATH=../
$tar -cvf <RELEASE>.tar ../lib/modules/<RELEASE>
$<RELEASE DIRECTROY>/source/build-tools/skales/dtbTool -o dt.img -s 4096
arch/arm64/boot/dts/qcom/
E. Pack the Kernel Boot Image

```bash
$export cmdline="root=/dev/disk/by-partlabel/rootfs rw rootwait console=tty0 console=ttyMSM0,115200n8 log_buf_len=4M"

$< RELEASE DIRECTORY>/source/build-tools/skales/mkbootimg --kernel arch/arm64/boot/Image --ramdisk <RELEASE DIRECTORY>/source/initrd.img --output boot=<RELEASE>.img --dt dt.img --pagesize 4096 --base 0x80000000 --cmdline "$cmdline"
```

This will create the boot image. It can be flashed unto the Inforce 6640 board’s “boot” partition.

F. Userdata Modification (Adding Modules)

```bash
$cd <RELEASE DIRECTORY>/binaries
$gunzip <ROOTFS>.img.gz
$simg2img <ROOTFS>.img <ROOTFS>.img.raw
$sudo su
$mkdir rootfs
$mount -o loop <ROOTFS>.img.raw rootfs
$tar -xf debian-<RELEASE>/<RELEASE>.tar -C rootfs/
```

(This is applicable for build method 1)

**OR**

```bash
$tar -xf ../source/kernel/<RELEASE>.tar -C rootfs
```

(This is applicable for build method 2)

$exit

```bash
$sudo make_ext4fs -o -L rootfs -l 55G -s <ROOTFS>.img rootfs/
$sudo umount rootfs
$rm -rf rootfs <ROOTFS>.img.raw
```

G. Flashing bootloaders

```bash
$cd <RELEASE DIRECTORY>/meta-binaries
$sudo ./flashall
```

H. Flashing the Images

From fastboot mode, enter the following commands:

```bash
$cd <RELEASE DIRECTORY>/binaries

$fastboot flash boot boot=<RELEASE>.img OR
$fastboot flash boot boot=<RELEASE>-dsi.img //If MIPI-DSI display feature is required.
$gunzip <ROOTFS>.img.gz
$fastboot flash rootfs <ROOTFS>.img
$fastboot reboot
```
The platform shall reboot into Linaro. The LXQt-based image is expected to provide a desktop-like experience, as such it is recommended to use a HDMI monitor, as well as USB, Keyboard, and Mouse.

**NOTE**

*Run the below command on the LXQt terminal to update the system.*

```
$ sudo apt-get update
$ sudo apt-get upgrade
$ sudo apt-get install v4l-utils
$ sudo apt-get install gstreamer1.0-gl
$ sudo apt-get install gstreamer1.0-plugins
```
3. FEATURES OF THE RELEASE

NOTE
Boot the board by pressing the POWER button. Connect the micro USB cable once the board has booted. If this sequence is not followed, the board will not function correctly.

3.1 FEATURES SUPPORTED IN THIS RELEASE

1. **Operating System**: This release is based on Linaro’s Debian based Build that provides developers with a desktop like environment using Debian and the LXQt desktop.
   - **Linux Kernel**: 4.14
   - **Debian Linux**: 10 (aka Buster)
2. **CPU Frequency**: This release supports the maximum frequency capabilities of the CPU organized as two clusters i.e. Gold@2.15GHz each and Silver@1.593 GHz.
3. **Display**
   - **HDMI**: This release supports HDMI display up to and including 4K@60 fps full-screen resolution.
   - **DSI**: This release supports DSI display feature. ACC-1B30 accessory (available from https://www.inforcecomputing.com/products/accessories) has been validated in this release.

   **NOTE**
   It is possible to boot the system with only DSI display connected or with only HDMI connected or with both displays connected.

   The system boots up with the MIPI-DSI display chosen as the primary display when the ‘boot-
   <RELEASE>-dsi.img’ has been flashed. The orientation of the HDMI display would thus be in Portrait mode. To change this orientation to Landscape mode (full screen rendered), use the following command:
   ```
   $xrandr --output HDMI-1 --primary --mode <required resolution>.
   
   The required resolution can be any of the standard resolutions viz., 640p/720p/1080p
   ```
4. **Audio**: This release was validated for HDMI audio.
5. **USB 3.0**: This release is validated for the USB 3.0 host mode on USB type A port. Below is the USB class tested in this release.
   - **Mass Storage**: This release is validated for USB pen drive (Auto mount).
   - **Camera**: This release is validated for USB camera preview.

   **NOTE**
Please connect the USB camera after the system has booted. Please ensure that the gstreamer packages are installed (using commands from the NOTE in Section H). To enable preview from the USB camera, issue the command:
gst-launch-1.0 v4l2src device=/dev/video0 ! gimagesink

To capture an image in JPG format, use the command:
gst-launch-1.0 v4l2src device=/dev/video0 num-buffers=1 ! 'video/x-raw,width=1280,height=800' ! jpegenc ! filesink location=usb01.jpg

To capture a video in H264 compression, use the command:
gst-launch-1.0 -e v4l2src device=/dev/video0 ! video/x-raw,width=1280,height=800,framerate=10/1 ! videoconvert ! v4l2h264enc ! h264parse ! mp4mux ! filesink location=/home/linaro/video.mp4
The supported resolutions are 1280x800, 1280x720, 960x544, 800x600, 800x448 and 640x480.

To play the recorded video, use the command:
gst-launch-1.0 playbin uri=file:///home/linaro/video.mp4

The video node could be different. Check the video node using the command:
v4l2-ctl --list-devices
And change accordingly in the gst-launch-1.0 commands above.

The USB camera can work concurrently with the MIPI-CSI camera.

6. **Gigabit Ethernet:** This release supports Gigabit Ethernet.

7. **Serial UART:** This release supports serial UART.

8. **Wi-Fi:** This release was validated for Wi-Fi client functionality.

9. **Bluetooth:** Bluetooth has been validated in this release.

   $sudo apt-get update
   $sudo apt-get install blueman

   - From UI open bluetooth manager, go to Menu→Preferences →Bluetooth Manager
   - Change the adapter preferences as desired and click Search Icon to discover nearby bluetooth devices.

10. **Hardware Accelerated Video Encode and Decode:** These features are validated in this release using File stream/Camera Input. Please ensure that the gstreamer packages are installed (using commands from the NOTE in Section H)

The gstreamer documentation can be found at http://gstreamer.freedesktop.org/documentation/.

For more information on using the gstreamer features through command-line application (gst-launch-1.0) click on:
http://wiki.oz9aec.net/index.php/Gstreamer_cheat_sheet#Encoding_and_Muxing

![NOTE]
Use **gst-launch-1.0** instead of **gst-launch** in the gstreamer cheat sheet.
Using Filestream: Issue the following command to test the pipeline using gstreamer's video test source `videotestsrc`:

To encode:
```
gst-launch-1.0 videotestsrc ! video/x-raw,format=NV12,width=1920,height=1080,framerate=30/1,profile=high ! v4l2h264enc ! queue ! filesink location=/home/linaro/enc.h264
```

To decode:
```
gst-launch-1.0 playbin uri=file:///home/linaro/enc.h264
```

Using input from camera sensor: This is validated for OV5640 camera sensor using ACC1H10 accessory available at: https://www.inforcecomputing.com/products/accessories

To configure the pipeline:
```
./cam-pipeline-config-encode.sh
```

To encode:
```
./cam-encode.sh
```

To decode:
```
gst-launch-1.0 playbin uri=file:///home/linaro/enc.h264
```

NOTE
The camera script files are provided under source/camera-scripts folder in the release package.

11. MIPI-CSI camera: This release validates the rendering of preview images through the ACC1H10 camera module accessory. The release package includes:

- OV5640 camera sensor driver
- QC MSM camera sub-system (CSIPHY, CSID, ISPIF, VFE)
- QC Camera control interface (CCI) driver

Please ensure that the gstreamer packages are installed (using commands from the NOTE in Section H). To ensure the sensor is properly connected, inspect the output of the following command:
```
$media-ctl -d /dev/media0 -p //Confirm if the media node corresponds to the // MIPI camera. If not, change it.
```

If there are no errors, the output would be as shown below:
```
entity 226: ov5640 3-003b (1 pad, 1 link)
    type V4L2 subdev subtype Sensor flags 0
device node name /dev/v4l-subdev19
    pad0: Source
[fmt:UYVY8_2X8/2592x1944 field:none colorspace:srgb]
```
This release is validated for below resolutions:
- 2592x1944
- 1920x1080
- 1280x720

Configure the pipeline: link the hardware blocks in the camera pipeline and set their formats:
To do this push the `camera_configure_ov5640.sh` script file which is provided in the release BSP package under `source/camera-scripts` folder to target board.

```
$./camera_configure_ov5640.sh
```

Use Gstreamer to show a live preview from the camera by pushing the `camera_preview.sh` provided in the release BSP package under `source/camera-scripts` folder to the target board using the command:

```
$./camera_preview.sh
```

To capture image run the below script:
```
$./camera_snapshot.sh
```

12. **Wi-Fi Direct**: Wi-Fi Direct has been validated in this release.
- Create `wpa_supplicant.conf` file with the below content and place it in `/etc` on target.
  ```
  #wifi-direct p2p configuration file
  ctrl_interface=/var/run/wpa_supplicant
  device_name=My_P2P_Device_1
  device_type=1-0050F204-1
  
  Ensure wlan interface is *up*.
  
  Check with `ifconfig -a`.
  
  Interface should be either `wlp1s0` or `wlan0`.
  
  Run the below commands
  ```bash
  sudo service wpa_supplicant stop
  sudo wpa_supplicant -D nl80211 -i wlp1s0 -c
  /etc/wpa_supplicant.conf &
  ```
  - If `wpa_supplicant` is initialized successfully then run the below command:
    ```bash
    sudo wpa_cli
    ```
  - The shell starts with interactive mode. Then run the below command:
    ```bash
    $p2p_find
    ```
  - It discovers p2p supported devices. Once a device is discovered the search can be stopped by:
    ```bash
    $p2p_stop
    ```
  - To create connection run:
$p2p_connect <device-mac-address> pbc

- Pop-up will show on other device (if it is an android device mobile) then click connect to create connection.

- If a successful connection is created then wlp1s0 interface is up with some IP address on host side. If IP address is not found then run the below command:
  
  ```
  sudo dhclient wlp1s0
  ```

- On client side interface will be created with a prefix as p2p.
  e.g p2p-<interface name>

- To check the connection run the below command:
  
  ```
  $ping <IP-address>
  ```

**To establish connection between two Inforce boards**

- Create wpa_supplicant.conf file on both boards with the below content and place it in `/etc` on target.

- **On board 1**
  
  ```
  #wifi-direct p2p configuration file
  ctrl_interface=/var/run/wpa_supplicant
  device_name=My_P2P_Device_1
  device_type=1-0050F204-1
  ```

- **On board 2**
  
  ```
  #wifi-direct p2p configuration file
  ctrl_interface=/var/run/wpa_supplicant
  device_name=My_P2P_Device_2
  device_type=1-0050F204-2
  ```

- **On device 1**

  Run the below commands:
  
  ```
  $sudo service wpa_supplicant stop
  $sudo wpa_supplicant -D nl80211 -i wlp1s0 -c /etc/wpa_supplicant.conf &
  ```

  - If wpa_supplicant is initialized successfully run wpa client tool and enable p2p listen mode.
    
    ```
    $sudo wpa_cli
    $p2p_listen
    ```

- **On device 2**

  Run the below commands
  
  ```
  $sudo service wpa_supplicant stop
  $sudo wpa_supplicant -D nl80211 -i wlp1s0 -c /etc/wpa_supplicant.conf &
  ```
• If wpa_supplicant is initialized successfully and run wpa client tool and enable p2p find mode:
  $sudo wpa_cli
  $p2p_find

• On device 2, once device 1 is found run the connect command.
  $p2p_connect <device1-mac-address> pbc

• On device 1, once connect request is received, run the below command.
  $p2p_connect <device2-mac-address> pbc

NOTE

Exit wpa_cli, new network interface p2p-wlp1s0-X is created on each device. The interface can be configured manually or by using dhcp.

On device 1
$ifconfig <interface-name >192.168.1.X
ex:-ifconfig p2p-wlp1s0-0 192.168.1.33

On device 2
$ifconfig <interface-name> 192.168.1.X
ex:-ifconfig p2p-wlp1s0-1 192.168.1.46

To check the connection
$ping 172.0.0.1

Output
PING 172.0.0.1 (172.0.0.1) 56(84) bytes of data.
64 bytes from 172.0.0.1: icmp_seq=1 ttl=64 time=1115 ms

For File Transfer between two boards
scp <file-name> linaro@<boards-ip>:~/home/linaro

For remote login between two boards
ssh linaro@<boards-ip>
## 4. LIMITATIONS/BUGS

The following table describes the known bugs in this release. Future releases will be deployed, as and when these issues are resolved.

<table>
<thead>
<tr>
<th>#</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Suspend/Resume and board shutdown using Power button is not supported in this release.</td>
</tr>
<tr>
<td>2</td>
<td>HDMI hot plug is not supported when HDMI display connected post boot.</td>
</tr>
<tr>
<td>3</td>
<td>HDMI video playback is not smooth for resolutions of 1080p@60fps and above.</td>
</tr>
<tr>
<td>4</td>
<td>Analog audio and Audio recording are not supported.</td>
</tr>
<tr>
<td>5</td>
<td>SDIO (SD card) is not supported.</td>
</tr>
<tr>
<td>6</td>
<td>USB OTG is not working.</td>
</tr>
<tr>
<td>7</td>
<td>GPS is not supported.</td>
</tr>
<tr>
<td>8</td>
<td>Connecting USB camera pre-boot results in HDMI audio not working.</td>
</tr>
<tr>
<td>9</td>
<td>WiFi Direct connection works intermittently and is not consistent.</td>
</tr>
<tr>
<td>10</td>
<td>Low Speed Peripherals' programming is not supported.</td>
</tr>
</tbody>
</table>
5. CONTACT INFORMATION

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