
BitCtrl Systems GmbH

**QNX6.5.0SP1/6.6.0/7.0 BSP for PHYTEC i.MX6
boards (RDK/MIRA/SEGIN)
Installation and User's Guide**

Version 2.0.0

QNX6.5.0SP1/6.6.0/7.0 BSP for PHYTEC i.MX6 boards (RDK/MIRA/SEGIN)	Version: 2.0.0
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Document History

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January 28, 2015	1.0	Checked against real target, ok	A. Uhlmann
May 11, 2015	1.1	Update for BSP v1.3.2	A. Uhlmann
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March 5, 2020	2.0.0 m2	Started documentation of new major release v2.0	A. Uhlmann
May 11, 2020	2.0.0 rc1	Documentation update for release candidate 1	A. Uhlmann
May 15, 2020	2.0.0	Final documentation for the new v2.0.0 release	A. Uhlmann

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1 PHYTEC i.MX6 QNX Board Support Package (phyFLEX, phyCORE)

1.1 Date and Version of this edition

This document refers to baseline version 2.0, release v2.0.0, date May 15, 2020, of the BSP. This is a new major release that forms a new baseline in itself.

1.2 Target Hardware

The product is targeted at the following hardware

- phyFLEX i.MX6dq, hardware revision C (1362.2) on the Rapid Development Carrier (1364.4)
- phyCORE i.MX6dq (1429.3-5) on the MIRA board (1434.2, 1434.3 and 1434.5)
- phyCORE i.MX6UL (1468.4, 1515.0-1) on the SEGIN board (1472.2)

Depending on your order, you may or may not have the graphics shipped. If not, you do not need to connect DVI monitor/LCD display, mouse and keyboard, and the demo applications will not be available.

1.3 Host OS

Same as documented in [RelNotes].

1.4 References

[phyFLEX] Information about the phyFLEX hardware can be found here:

<http://www.phytec.eu/product/system-on-modules/phyflex-imx-6/>.

[phyCORE] Information about the newer phyCORE hardware can be found here:

<http://www.phytec.eu/product/single-board-computer/phyboard-mira/>.

[phyCORE-UL] Information about the i.MX6UL based phyCORE modules can be

found here: <https://www.phytec.eu/product-eu/system-on-modules/phycore-imx-6ul/>.

[REFBSP] Information about the reference BSP that is used as a foundation for the product can be found here:

<http://community.qnx.com/sf/wiki/do/viewPage/projects.bsp/wiki/FreescaleImx6QSabreSmart>.

[QNX65sp1DOC] The documentation of the QNX Neutrino RTOS v6.5.0SP1 is available here:

http://www.qnx.com/developers/docs/6.5.0SP1.update/index.html#./650_webhelp/momentics/bookset.html.

[QNX660DOC] For QNX6.6.0 documentation, use this link:

http://www.qnx.com/developers/docs/6.6.0_anm11_wf10/#com.qnx.doc.qnxsdp.nav/topic/bookset.html.

[QNX7DOC] For QNX 7 documentation, use this link:

<http://www.qnx.com/developers/docs/7.0.0/#com.qnx.doc.qnxsdp.nav/topic/bookset.html>.

[RelNotes] Release Notes for the BSP (bsp-phyFLEX_i.MX6_RelNotes_15May2020.pdf)

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[I2CMAP] This document is a list of I²C devices with their corresponding addresses.
(I2C-Map_11May2020.pdf)

1.5 Contact and Support

BitCtrl Systems GmbH
Weißenfeller Str. 67
04229 Leipzig
Germany

Use our online form to request the BSP:

<https://www.bitctrl.de/en/contact.html>

For support, use our helpdesk:

<http://www.bitctrl.de/helpdesk/>

2 Background information

Once you have registered via our web site you will be emailed a ZIP archive that contains several projects that you will need to import into your QNX Momentics IDE. You will need to help yourself to an SD card that will be used to transfer the installation built in Momentics to the board. Please use 4 GB SD cards of class 4 or less for phyFLEX-i.MX6 Rapid Development Kit. Some older versions of barebox tend to have problems with faster and/or bigger cards. Smaller cards (2 GB) have different file format which is currently not supported.

For using the phyBOARD MIRA and SEGIN, please use Transcend 4 GB class 10 MicroSDHC cards. Intenso cards 4 GB class 10 are also reported to work, as have Sony 8 GB Class 10 and SanDisk EDGE 16 GB class 10.

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3 Installing hardware

For using phyFLEX Rapid Development Kit:

1. Power off the board.
2. Setup the board with serial connection as described in the documentation of the Rapid Development Kit.
3. Connect the board via Ethernet cable to your QNX Momentics development machine (directly via cross-over cable or via switch). Use RJ45 port on top of the Rapid Development Kit (labeled ETH0 / POE).
4. Connect a DVI monitor to the DVI port or connect LCD display to display port.
5. Connect USB mouse and keyboard to USB ports next to DVI port.
6. Connect ETM0700G0DH6 LVDS display to board, if you have one

For using the phyBOARD MIRA Imaging Kit:

1. Power off the board.
2. Setup the board with serial connection as described in the documentation of the Kit.
3. Connect the board via Ethernet cable to your QNX Momentics development machine (directly via cross-over cable or via switch).
4. Connect a HDMI display to the HDMI port, or use a HDMI-2-DVI converter to connect a standard DVI monitor.
5. Connect USB mouse and keyboard to USB ports next to HDMI port.
6. Connect ETM0700G0DH6 LCD display or Mitsubishi AA084SC01 LVDS display to board, if you have one

For using the phyBOARD SEGIN Kit

1. Power off the board
2. Setup the board with serial connection as described in the documentation of the Kit.
3. Connect Ethernet cable to the RJ-45 jack next to the USB port. This will appear as `fec0` device inside QNX and have IP address 192.168.3.17 after installation. The other port is enabled by default, too, and will appear as `fec1` inside QNX with static IP 192.168.2.17 assigned to it.
4. Connect ETM0700G0DH6 LCD display to board, if you have one.

If you have been delivered a source code archive, please proceed to chapter 4.

If you have been delivered a binary-only archive, please extract the archive to an empty SD-card such that the root of the card contains the folder "setup", the various IFS and .install/.info files. Then proceed directly to chapter 5 "Install Barebox and QNX on the PHYTEC hardware".

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4 Set up source tree (QNX Momentics IDE and command line)

4.1 Setup source tree using the QNX Momentics IDE (MS Windows)

Important: If you are using QNX 6.5 and want to use Screen graphics, be sure to install the QNX Screen package for QNX 6.5, which can be downloaded here: <http://www.qnx.com/download/feature.html?programid=27697>.

1. Import the BSP source package(s) by using "Import" → "Existing projects into workspace".
2. Import the reference BSP for the Sabrelite platform for the corresponding QNX version:
 - a. For QNX **6.5**, use "BSP_freescale-imx6q-sabresmart_br-650_be-650sp1_SVN830879_JBN564.zip" (released May 25, 2017).
 - i. **Important:** If you intend to build and use the ETFS NAND flash driver yourself be sure to import the updated ETFS libraries/headers into the "prebuilt" directory. You will get these patches directly from QSS.
 - ii. The System Builder project "bsp-freescale-mx6q-sabrelite" which may get created automatically can be deleted.
 - iii. Additionally, extract the patches "BSP_freescale-imx6q-sabresmart_br-650_be-650sp1_PATCHES_JBN564.zip":
 1. Extract patches/armle-v7 to prebuilt/
 2. Extract patches/usr to prebuilt/
 - b. For QNX **6.6**, use "BSP_freescale-imx6q-sabresmart_br-660_be-660_SVN850002_JBN1126.zip" (released January 31, 2018).
 - i. Import the BSP using the QNX BSP import wizard. The IDE tries to set the project name to "bsp-nxp-mx6q-sabresmart-SDP6.6". Before you click finish, change this to "bsp-nxp-mx6q-sabresmart", otherwise the build will fail!
 - ii. Additionally, extract the patches "BSP_freescale-imx6q-sabresmart_br-660_be-660_SVN850002_JBN1126.zip":
 1. Extract patches/armle-v7 to prebuilt/
 2. Extract patches/usr to prebuilt/
 - c. For QNX **7.0**, use the SabreSMART BSP "QNX® SDP 7.0 NXP i.MX6x SABRE Platform for Smart Devices".
 - i. The BSP must first be installed via the QNX Software Center. The result is a ZIP archive in ~/qnx700/bsp named "BSP_nxp-imx6q-sabresmart_br-mainline_be-700_SVN848889_JBN11.zip". The SVN and JBN numbers might be higher, but that's the version the BSP has been validated against.
 - ii. This ZIP archive must then be imported into the IDE using "Import -> QNX -> Board Support Package".
 - iii. In this reference BSP, the following change must be applied:
 1. Open the file /bsp-nxp-mx6q-sabresmart/src/hardware/devc/common.mk
 2. Locate the line `LIBS+=io-char drv`
 3. Change it to `LIBS+=io-char drv r smmu`

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Hint: We can provide you with ready-to-use versions of the SabreSMART BSP for your platform.

3. Open the toplevel makefile of the reference BSP (bsp-freescale-mx6q-sabrelite-src/Makefile) and modify it like this: In the make target "install", behind the line \$(MAKE) -Csrc put the keyword "install" (if not already there).
4. Optional: Edit various files under "bsp-PHYTEC-phyFLEX-i.MX6-src/prebuilt/etc" to suit your needs.
5. Right-click on the project "bsp-PHYTEC-phyFLEX-i.MX6-releng" and choose "Make Targets → Build". A dialog appears that allows you to select the carrier you want to build the installation image for, e.g. "RDK-SD" or "MIRA-SD". This will build all sources and can take quite a while. After that, the subfolder "RDK-SD" (or whatever you chose) will contain a lot of files, e.g. the folder "target" and beneath folder "setup".
6. Insert the SD card into your Windows machine (using any USB Card Reader). Copy the contents (!) of the "target" subdirectory to the root directory of the SD card. Safely remove it. To be more clear, the root directory of the SD card must contain the folder "setup", various *.ifs files and the .install script.

4.2 Setup source tree for command line builds (Linux)

In order to build the BSP from the command line (e.g. also on a build server), you need to install QNX Momentics on that host first. Aside the base installation, QNX Screen support, i.MX6 graphics support as well as the SabreSMART BSP must be installed via QNX Software Center, identical to the procedure outlined above under Windows. Next, follow these steps:

1. Create an empty directory that will host all sources, e.g. "PHYTEC-BSP_v2.0.0" or similar.
2. Change into this directory.
3. Extract the BSP source package(s) by using "unzip" into this directory.
4. Create a new directory named "bsp-nxp-mx6q-sabresmart".
5. Change into this directory.
6. Extract the reference BSP into this folder (e.g. "BSP_nxp-imx6q-sabresmart_br-mainline_be-700_SVN848889_JBN11.zip" for QNX 7).
7. Apply any changes to the reference BSP as described above.
8. Change to the release engineering project folder "bsp-PHYTEC-phyFLEX-i.MX6-releng"
9. Issue the make command for your particular target, as follows:

Target	Build command line
Rapid Development Kit (RDK)	
SD	make
ETFS	make CARRIER_TARGET=RDK-ETFS CARRIER_IFS=bsp-PHYTEC-phyFLEX-i.MX6.ifs CARRIER_PROD_IFS=bsp-PHYTEC-phyFLEX-i.MX6-ETFS_prod.ifs RDK-ETFS
MIRA Single-board computer (SBC)	
SD	make CARRIER_TARGET=MIRA-SD CARRIER_IFS=bsp-PHYTEC-phyCORE-i.MX6.ifs CARRIER_PROD_IFS=bsp-PHYTEC-phyCORE-i.MX6_prod.ifs SYSTEM_BUILDER_PROJECT=bsp-PHYTEC-phyCORE-i.MX6 MIRA-SD
EMMC	make CARRIER_TARGET=MIRA-EMMC CARRIER_IFS=bsp-PHYTEC-phyCORE-i.MX6.ifs CARRIER_PROD_IFS=bsp-PHYTEC-phyCORE-i.MX6-eMMC_prod.ifs

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	SYSTEM_BUILDER_PROJECT=bsp-PHYTEC-phyCORE-i.MX6 MIRA-EMMC
	SEGIN Single-board computer (SBC) with i.MX6UL
SD	make CARRIER_TARGET=SEGIN-SD CARRIER_IFS=bsp-PHYTEC-phyCORE-i.MX6UL.ifs CARRIER_PROD_IFS=bsp-PHYTEC-phyCORE_s-i.MX6ulx_prod.ifs SYSTEM_BUILDER_PROJECT=bsp-PHYTEC-phyCORE-i.MX6 SEGIN-SD

Table 1: Build command lines

- After building, go to the target folder "RDK-SD/target" (or "MIRA-EMMC/target", or whatever you built).
- Copy all files to the root directory of the SD card installation media, including .info and .install. These are not shown by default. Alternatively, you can create a ZIP archive like this: `zip -r ~/some_meaningful_name.zip .info .install *.ifs setup/`. This archive can then be transferred to some other machine for extracting to the SD card installation media.

5 Install Barebox and QNX on the PHYTEC hardware

- If you have a different carrier for runtime: Make sure boot switch of RDK matches your carrier's settings.
- Insert the card
 - On phyFLEX: into slot 2 (the right one when the kit is viewed from top).
 - On MIRA/SEGIN: into the MicroSDHC slot
- Boot the development kit, but stop autoboot by pressing a key.
- Make sure you have the latest Barebox installed. It should be 18.1.0 or later.
- SD-Card is auto-mounted, check: `ls -l /mnt/mmc`, this should show the root directory of the MicroSD card.
- Install boot file and launch QNX: `/mnt/mmc/.install` (On MIRA and SEGIN, the script has a command-line option `-m` to tell the boot media (nand, mmc, emmc))
- On the QNX prompt, check and set the date and save it to battery-backed clock using `rtc -s hw /dev/i2c2`.
- On the QNX prompt, issue: `/dos/setup/qnx/install-qnx`
- The script asks you to confirm the SD card erase. Under QNX6.6 and QNX 7, you will get a warning "volume at /dos/ will be unmounted". It is safe to ignore it.
- Wait while root file system is extracted (can take several minutes depending on speed of SD card).
- Reboot board when prompted by entering `shutdown` on the prompt. Now QNX should boot automatically from SD card.
- After boot, you can create or remove additional cookie files in the directory `/etc/system/config` in order to control which drivers will be launched. Cookies supported are: `useaps, usecamera, useexti2c, usepci, usepushbtn, useumass, useusbser, usehdmionly, uselvdonly, uselcdonly, useaudio, use100Mbit, useip6, usespinor, usesata, useextmmcsd, useuart3, useqconn, useham`. See chapter 10.1 for details.
- You can now also install additional tools packages if you have received them. They usually reside in `/usr/local/bin`, although this is not a strict requirement, as long as it is in the PATH environment variable: `tar -C /usr/local/bin -xzf /tmp/bsptools_<date>.tgz`.

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6 Using QNX Screen

6.1 Configure QNX Screen on target

The graphics configuration and a default calibration file for the touch screen are already present on the system, along with the display drivers

```
/etc/system/config/scaling.conf
/usr/lib/graphics/iMX6X/graphics-LVDS.conf
/usr/lib/graphics/iMX6X/graphics-DUAL.conf
/usr/lib/graphics/iMX6X/graphics-HDMI.conf
/usr/lib/graphics/iMX6X/libwfdcfg-imx6x-etm0700g0dh6.so
/usr/lib/graphics/iMX6X/libwfdcfg-imx6x-rdk_dual.so
/lib/libmtouch-etmDDDDGx.so
```

First, tell rc.devices to launch QNX Screen next time you boot:

```
rm /etc/system/config/noscreen
```

After that, you need to tell the BSP the desired display configuration. It can be one of the following: dual-mode, LVDS only, LCD only or HDMI only. The default is “HDMI only” since the installer has no idea about an LVDS display being present or not. Use the script `switch_display.sh` to toggle around the four modes. The script will simply touch or remove the corresponding cookie files (see chapter 10.1).

The effect is as follows:

- If the file `usehdmionly` exists, only HDMI output is active.
- If the file `uselvdsonly` exists, only the LVDS (RDK) or LCD (MIRA) outputs are active.
- If neither file exists, this means “Dual-Display” configuration, the primary display is the LVDS/LCD display, the secondary display is HDMI.
- Cookie `uselcdonly` has no effect yet.

On the MIRA board, you can also use the Mitsubishi AA084SC01 display. Call `make-aa084sc01.sh` once to enable it. Use `make-aa084sc01.sh -r` to revert back to LCD display.

REBOOT. After the next boot, the selected display(s) should be usable. The primary display should display a static splash screen, or is simply blacked out. Try to run some OpenGL applications: `gles2-gears`, `gles2-maze` or `gles2-gears -display=2` (Our default `rc.apps` script does exactly that).

If that works, you can try to install a Qt5 runtime environment, if it has not automatically been installed by the installer.

6.2 Installing Qt5 runtime

There are newer versions of Qt5 for QNX out there, but we have tested only 5.1.0 for QNX6.5.

```
# mkdir /opt (in most cases it will already exist)
# tar -C / -xzf /tmp/qt510+icu49_QNX650SP1_bin_<date>.tgz (takes 3 Minutes or so)
# tar -C /usr/local/bin -xzf /tmp/qt5.1-startupdemos.tgz
# animatedtiles
```

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(It will issue a warning about physical screen size)

For QNX6.6, you should install the Qt5.3 Creator on your Windows host and get the Qt5.3 runtime from there (essentially the contents of C:\Qt\Qt5.3.0\5.3\qnx6-armle-v7). You need to set the x-Bit on all *.so* files after transferring them to the target.

We have compiled a downstripped version of the Qt 5.3 runtime environment that you only need to copy to your target and unpack under /opt directory. Please contact us if you want to obtain this archive, which is meant for testing only.

Any newer version of Qt5 will need to be gotten directly off the QT website; QNX support is fully integrated.

For QNX 7.0, we have also tested to build Qt 5.10 under Ubuntu Linux, which is straight forward due to integrated QNX support. It just needs to be extracted to /opt directory on the target after installation. Please contact us if you want to obtain this archive, which is meant for testing only.

6.3 Calibrating the touchscreen

Try to calibrate the touch screen:

```
# calib-touch -recalibrate
```

This should create a file called /etc/system/config/calib.RDK (or calib.MIRA, respectively). However, under QNX6.5 currently the values are not propagated back to scaling.conf, which is what is being read by QNX Screen on startup. So the calibration holds only until the next launch of Screen. That's why we provide a default scaling.conf that is approximately right for the 7" displays of the PHYTEC.

Under QNX6.6 and 7, it is sufficient to call calib-touch once on bootup to load the values back into QNX Screen.

6.4 Controlling power supply to LVDS/LCD displays

The BSP provides the possibility to control the brightness of the connected LVDS or LCD display by means of Pulse-Width modulated signal (PWM). The display can also be turned off completely, if supported by an appropriate control pin. These features can be used through the PPS object "control" in the path

/pps/system/displays/primary or /pps/system/displays/secondary, resp. After initial installation, this PPS object looks like this:

```
root@MIRA in /pps/system/displays/primary # cat control
@control
Brightness:n:1000
OperationMode::MANUAL
PowerMode::ON
root@MIRA in /pps/system/displays/primary #
```

The brightness is given in tenth of percent. To set the display brightness to 20%, do this:

```
root@MIRA in /pps/system/displays/primary # echo Brightness::200 >> control
```

Make sure you use the APPEND operator in order not to overwrite the other attributes.

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To turn off the display, do this:

```
root@MIRA in /pps/system/displays/primary # echo PowerMode::OFF >> control
```

Please note that the display control file only influences the electrical power supply, it has no impact on QNX Screen or other graphics software operation.

7 Building and installing the camera drivers

If you have source for the camera drivers:

- Right-click on project “clko” and choose “Make Targets → Build”. A dialog appears that allows you to select the target, choose “install”.
- Right-click on project “camera-PHYTEC-phyFLEX-i.MX6” and choose “Make Targets → Build”. A dialog appears that allows you to select the target, choose “install”. It takes a while to build the drivers, after that you will get the various binaries under the “install” folder.
- Copy them to the target preserving the directory structure (you can TAR the directory before transferring)

If you have been delivered a pre-compiled archive:

- Copy the file “camera-<Board>-<Version>-QNX<Version>-<Processor>.tgz” to the target, e.g. /tmp
- On a target console, issue “tar -xzf camera*.tgz
- If you have built under Windows, make sure the driver and start scripts are executable (e.g. set the x-Bit).
- Modify the /usr/sbin/devcam-restart script to match camera drivers and command line options.
- Connect your camera and issue “devcam-restart”
- Issue “camtest -r21” → live image should be seen on primary display

On target, issue `touch /etc/system/config/usecamera` to have camera drivers automatically start on boot.

8 Using PCIe (Experimental, QNX 6.6/7.0 only, RDK/MIRA only)

For QNX 6.6, QSS provides an experimental version of its new PCI server on the Foundry 27 web site. We have prepared the environment in the boot sequence that is necessary for the server to run. To enable PCIe on the RDK, follow these steps:

- Obtain archive ‘pci-mx6-JBN35-bin.tgz’ via helpdesk
- Copy it to the target, e.g. to /tmp
- On target, issue: `tar -C / -xvzf /tmp/pci-mx6-JBN35-bin.tgz`
- On target, issue `pci-server -c &`. Use `pci-tool -v` to verify that server is running.
- On target, issue `touch /etc/system/config/usepci` to have PCI server automatically start on boot.

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For QNX 7, you need to install the PCI subsystem via the QNX Software Center. The required drivers will then be included in the image build automatically. In particular, you have to install the package “PCI Older Revision of Libs”.

9 Using CAN driver

Important: Make sure the bus termination is set up correctly! On the MIRA/SEGIN board, use jumper J2 just next to the CAN connector to enable the termination. The CAN connector, X3, is located next to the HDMI port.

If you have obtained an archive file named “dev-can-mx6x-<carrier>-A.B.C-QNX<version>-armle-v7.spk”.

1. Copy that file to the running target, e.g. to /tmp.
2. On the target, issue “sh /tmp/dev-can-mx6x-<carrier>-A.B.C-QNX<version>-armle-v7.spk”
3. After installation, edit /usr/sbin/can-restart to select correct baud rate and CAN ports to use.
4. Issue “can-restart”, or reboot your system to launch CAN driver automatically.
5. Use the demo program to generate and receive some CAN traffic:

```
# qCANv2demo -r0xFF -s0x1F -v
CANv2 driver demo, built Mar  8 2018 18:18:08 $LastChangedRevision: 64738 $
RX cnt   10 TX cnt  143
#
```

In case you have received the CAN driver as source archive and built the BSP yourself and installed it on the board, then the CAN driver is already present and will be launched automatically on boot.

The script /usr/sbin/can-restart sets the baud rate to 100K, edit the script and run it again to operate the driver at different baud rate.

10 Configuration of BSP Boot Sequence

10.1 Cookie Files

In order to avoid having the system initialization scripts be edited to change the boot behavior, or to maintain a multitude of variants of these scripts, the system makes use of a set of small cookie files in the folder /etc/system/config which are queried at script execution time. These cookie files have, for the most part, no contents, the scripts just check for their existence and then decide to take a certain action or not. For example, normally the system launches the driver for port UART3 automatically. In order to achieve that, the (empty) cookie file “useuart3” must be present in the directory /etc/system/config. In order to skip the launch of the driver for UART3 at boot time, simply delete this file.

The following table gives an overview of which cookie files are available, and what they allow to control:

Cookie	Default	What does it control?
useaps	Present	Creation and use of CPU partitions for the system
useaudio	Absent	Automatic start of audio subsystem

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usecamera	Absent	Automatic start of camera drivers, if installed.
useexti2c	Absent	Automatic start of the I2C driver for the external bus.
useham	Absent	Automatic start of the QNX High-Availability Manager as well as the HAM attach daemon, if installed
useip6	Present	Launch the IPv6 stack, otherwise the IPv4 stack. Please note that the SSH daemon requires the IPv6 stack.
usepci	Absent	Automatic start of the PCI subsystem
useqconn	Depends	Automatic start of qconn. The installation routine will ask for this setting.
usesata	Absent	Automatic start of the S-ATA driver and mount of filesystem
useuartN	Absent	Automatic start of driver for UARTN (external serial communication). Possible values for N are 1-6, but be aware that on the phyCORE UART2 and on the phyFLEX UART4 are already in use for the serial debug console so setting this will have no effect. The only value currently supported is N=3.
use100MBit	Present	Determines whether network is set to 100 Mbit or auto-negotiated speed.
uselvdonly	Absent	Use the LVDS display as primary and only output
uselcdonly	Absent	Use the LCD display as primary and only output
usehdmionly	Absent	Use the HDMI display as primary and only output. Note: If neither "uselvdonly" nor "usehdmionly" are present, the system enters dual-display mode.
usepushbtn	Absent	Automatic start of the pushbutton driver(s)
useumass	Absent	Automatic start of USB mass storage daemon in PNP mode
useusbser	Absent	Automatic start of USB-2-Serial converter driver
usespinor	Absent	Automatic start of SPI NOR flash driver with FFS3 file system
useextmmcsd	Absent	Automatic start of driver for external SD/MMC card or device. Not possible on all platforms.

Table 2: System configuration cookie files

10.2 Carrier Information Environment Variable

The system initialization scripts are setup such that they support multiple carrier boards. They can find out on which carrier they are sitting and then take conditional actions, e.g. launch drivers with different parameters depending on the carrier they are sitting on.

The carrier name is stored in a shell environment variable named CARRIER by the boot images, thus it is available during the boot sequence in all scripts.

To make it available also in interactive shell sessions it is stored in /etc/profile.d/board.sh, which gets executed during login.

The board.sh file is created by the installation routine, but can be changed later if the CPU module is installed on one carrier and then moved to a different one.

10.3 The rc.* start scripts

The BSP implements a script-based boot sequence in analogy to the standard QNX boot sequence described in [QNX65sp1DOC], path "QNX Neutrino RTOS -> User's Guide -> Controlling How Neutrino Starts". Even though these scripts are no longer the default for QNX 6.6 and 7, they are very useful and flexible and are used by the BSP across all QNX versions.

The BSP adds an additional script not present in the QNX default: rc.app. That is the

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place where users can launch their own applications. However, all rc.* scripts run in an environment which is to some extent different to the one used by a regular shell login session, and also different from that used by qconn. It is recommended that the auto-launch of applications be tested early in the development process. The following differences must be obeyed:

1. The major difference is that the shell executing rc.* scripts is ending after execing into tinit, and so a hangup signal is sent to all child processes. This means that programs launched here need to be immune against SIGHUP, either by setting it to "ignore" or by catching it and do not exit the program in the handler. Otherwise, the program will terminate apparently without any reason more or less immediately after its launch.
Doing `nohup <cmdline> > /dev/null &` is technically possible, too, but only a last resort if source is not available.
2. In addition, the set of environment variables is different compared to a login session. You can do `set > /tmp/rc-env.txt` in rc.app to be sure what is set.
3. If Adaptive Partitioning is enabled, the rc.app script will run in the APP partition, while an interactive console like SSH is usually run in the Debug partition.

11 Additional drivers

11.1 Using the pushbutton driver

The BSP provides a generic driver for using an i.MX6 GPIO pin as input for a pushbutton. To enable driver launch on start, cookie `usepushbtn` must be present (see chapter 10.1). The BSP provides support for the pushbuttons S2 and S3 on the small PEB-EVAL-01 board (on SEGIN S3 only if soldered jumper is setup properly).

On the RDK, there are no pushbuttons present, but it is easy to use the GPIO connector to connect and setup one.

11.2 External SD/MMC cards

The BSP provides a generic way to configure an additional SD/MMC driver. In case the operating system is installed on the eMMC (or on the right SD-Port on RDK), the card slot is free. Set the cookie file `useextmmcsd`, plug a formatted SD card and reboot the board. DOS partitions will be mounted automatically.

11.3 I2C drivers

Most boards have multiple I2C busses. The corresponding devices `/dev/i2cN` are used as follows:

- 0 - unused
- 1 - On-module peripherals (M24C32 EEPROM, DA9062), not available on phyCORE-i.MX6ULx
- 2 - General Extension bus (RTC, GPIO expanders, STMPE811, ...)
- 3 - Extended I2C bus (Cameras, HDMI DDC or other board-specific use). If

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you want this instance to be loaded, set the cookie file `useexti2c`.

- 4 - Free, Only available on i.MX6ULx SoC

Please note that these logical device indices are the same across SoC modules in order to provide a uniform interface to software. The mapping of those logical devices to the real i.MX6 I2C instances is done via env vars which are setup in the boot image, which by nature is specific to SoC variant *and* carrier and so serves as the single place to configure those things.

11.4 Naming scheme for block drivers

The BSP explicitly configures the device names of block devices. So instead of having `/dev/hd0`, `/dev/hd1` and then always researching which device points to which media, the BSP adopts the following naming scheme:

device	index	Which media
sd	0	First SD/MMC card. If QNX is executing from SD-Card, this will be index 0. If QNX is executing from different media, this will be the index of the external SD card.
sd	1	If QNX is executing from SD-Card, and there is an additional slot available, this will be index 1. Currently, this is only available on the phyFLEX RDK.
emmc	0	If QNX is installed on eMMC chip.
sata	0	External S-ATA disk or SSD drive. i.MX6 has only one port, so there is only index 0.
umass	0-N	USB mass storage devices, if enabled via the <code>useumass</code> cookie.

Table 3: block device naming scheme