conga-QKIT/IoT

Starter Kit for congatec Qseven IoT Gateway Development

Software User's Guide

Revision 1.2

Revision History

Revision	Date (yyyy.mm.dd)	Author	Changes
1.0	2015.08.06	AEM	• Official release
1.1	2015.09.22	AEM	• Corrected the configure error in the GUI based project of section 4.1 "Configure the Project".
1.2	2016.05.17	BEU	• Updated all sections to Wind River IDP XT 3.1 • Removed section 3 "Wind River Host Tools"

Preface

This user's guide provides information on how to set up and deploy the Wind River Intelligent Device Platform on the conga-QKIT/IoT. It is one of four documents that should be referred to when designing an IoT based application for the conga-QKIT/IoT. The other reference documents that should be used include the following:

conga-QKIT/IoT Hardware Quick Start Guide

Intel's IoT Design Guide

Wind River Intelligent Device Platform XT (available at www.windriver.com)

The conga-QKIT/IoT hardware and software documents can be found on the congatec AG website at www.congatec.com/conga-qkitiot. For the list of sources of information, see section 6.

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Notes call attention to important information that should be observed.

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Contents

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congatec AG technicians and engineers are committed to providing the best possible technical support for our customers so that our products can be easily used and implemented. We request that you first visit our website at www.congatec.com for the latest documentation, utilities and drivers, which have been made available to assist you. If you still require assistance after visiting our website then contact our technical support department by email at support@congatec.com

Terminology

Term	Description
PCI Express (PCIe)	Peripheral Component Interface Express – next-generation high speed Serialized I/O bus
PCI Express Lane	One PCI Express Lane is a set of 4 signals that contains two differential lines for transmitting and two differential lines for Receiving. Clocking information is embedded into the data stream.
IoT	Internet of Things
TDP	Thermal Design Power
PCI Express Mini Card	PCI Express Mini Card add-in card is a small size unique form factor optimized for mobile computing platforms.
eMMC	Embedded Multi Media Card is a non-volatile memory system, which frees the processor from low level flash memory management.
SDIO card	SDIO (Secure Digital Input Output) is a non-volatile memory card format developed for use in portable devices.
USB	Universal Serial Bus
SATA	Serial AT Attachment: serial-interface standard for hard disks
HDA	High Definition Audio
HDMI	High Definition Multimedia Interface. HDMI supports standard, enhanced, or high-definition video, plus multi-channel digital audio on a single cable.
BSP	Board Support Package
IDP	Intelligent Device Platform
SPI Bus	Serial Peripheral Interface is a synchronous serial data link standard named by Motorola that operates in full duplex mode.
GbE	Gigabit Ethernet
LVDS	Low-Voltage Differential Signaling

1 INTRODUCTION

1.1 Internet of Things (IoT) concept

The concept of Internet of Things is very broad. It however involves the connection and communication of devices in an intelligent way. This concept encompasses every aspect of our lives, extending internet connectivity and device to device interaction beyond common devices like desktops, laptops, smartphones and tablets.

A thing, in the Internet of Things, can be a heart monitoring device, an automobile with built-in sensors, an animal with a biochip transponder, any natural or man-made object that has been provided the ability to transfer data over a network. Simply put, anything that can be connected and communicate in an intelligent way. When these devices connect and interact, huge volumes of data are streamed through the network. The generated data can be analyzed to optimize activities between the devices, improve efficiency and also solve specific business problems.

1.2 Wind River Intelligent Device Platform

Wind River Intelligent Device Platform XT is a scalable, sustainable, and secure development environment that simplifies the development, integration, and deployment of IoT gateways. It is based on Wind River industry-leading operating systems, which are standards-compliant and fully tested.

The platform provides device security, smart connectivity, rich network options, and device management. The platform also includes ready-to-use components built exclusively for developing IoT gateway applications.

1.3 conga-QKIT/IoT

The conga-QKIT/IoT, a congatec Qseven IoT Development KIT, provides manufacturers and developers with a standardized platform for creating interoperable products that can discover, connect and communicate directly with other devices, systems and services in an intelligent way, regardless of brand. With the integration of the WindRiver IDP XT, the conga-QKIT/IoT provides outstanding software for the development and deployment of safe, secure and reliable intelligent devices.

The conga-QKIT/IoT contains amongst other components, the conga-QA3/E3827 module and a fully featured Qseven IoT carrier board. The conga-QA3/E3827 module features the Intel Atom E3827 dual core processor with 1.75 GHz frequency, high definition graphics, 2GB dual channel DDR3L-1333 memory and onboard 4GB eMMC.

With maximum 8W TDP processor, the conga-QKIT/IoT offers an Ultra Low Power board with high computing performance and outstanding graphics.

2 Development Host System

This section describes the requirements of the host system. A Linux based host system is recommended to develop software for the conga-QKIT/IoT. The host system can either be a dedicated system or a virtual machine that boots and runs Linux OS. The target system is the conga-QKIT/IoT.

2.1 Host System Requirements

2.1.1 Minimum Hardware Requirements

- Intel® Core™ 3rd Generation i5 processor, Quad Core and Intel Hyper-Threading technology
- 150 GB free disk space
- 4 GB RAM capacity
- Network connection

2.1.2 Recommended Hardware

- Intel® Core™ 5th Generation i7 processor, Octa-core and Hyper-Threading technology
- 200 GB free disk space
- 8 GB RAM
- 3 Mbps network connection

2.1.3 Required Software

64 bit Ubuntu Desktop 14.04 LTS (Dedicated or Virtual Machine) is recommended. Refer to Wind River release notes for a list of supported OS.

Required set up for a Virtual Machine:

1. Allocate appropriate RAM and disk space to the Virtual machine and set up the storage for dynamic allocation.
2. Configure the Virtual Box Manager:
   a. Assign all available CPU cores in Settings -> System -> Processor -> Processor(s)

b. Select "User Host I/O Cache" in Settings -> Storage -> Attributes

3. Install Guest Additions.

4. Create a shared folder.

2.1.4 Additional Requirements

Swap Partition:

Create a swap partition the same size as your RAM memory.

Network Interface:

1. Determine the name of your network interface with the command "ifconfig".

2. If the network interface name is not "eth0", edit the net.rules file:

```
$ nano /etc/udev/rules.d/net.rules
NAME = "eth0"
```

3. Save the file and reboot the host system to implement the changes.

Note

The Ethernet interface used for network connectivity on the host system must be named "eth0" for the Wind River Software installation.

3 Configure & Build Wind River IDP Image

This section explains how to configure and build an Intelligent Device Platform XT runtime file system and operating system for the conga-QKIT/IoT. The congatec BSP provides platform modifications and features for the conga-QKIT/IoT to build a reliable QKIT image. The build process can take several hours to complete, depending on the computing power of your build machine and the speed of the internet connection.

3.1 Configure the Project

1. Set up the Wind River build environment
   ```
   $ $HOME/WindRiver/wrenv.sh -p wrlinux-7
   //The wrenv.sh script sets all the Wind River related environment variables including the path to the configure command.
   ```
2. Create a new project subdirectory
   ```
   $ mkdir $HOME/Project/layers
   ```
3. Unpack the git bundle
   ```
   $ cp meta-cg-idp.*.bundle ~
   ```
4. Clone conga-QKIT/IoT BSP to the subdirectory
   ```
   $ cd $HOME/Project/layers
   $ git clone $HOME/meta-cg-idp.*.bundle meta-cg-idp
   ```
5. Change to the $HOME/Project directory
   ```
   $ cd $HOME/Project
   ```
6. Set up the Wind River IDP XT build for a GUI or headless project.

Note

Contact the congatec support team to receive the QKIT BSP (meta-cg-idp layer).

3.1.1 GUI-based Project Setup

Use the following configure command for a GUI based project:

```
$ $WIND_LINUX_CONFIGURE_CLI --enable-board=intel-baytrail-64 --enable-kernel=idp --enable-bootimage=ext3,hdd --enable-patchresolve=noop
--enable-rootfs=idp --enable-addons=wr-idp --with-layer=wr-prosyst-mbs-smarthome-sdk-ia,wr-digi-idigiconnector,wr-wks-oneagent-oma-dm-ia,wr-
wks-oneagent-tr069,sys-version,wr-iot,wr-idp-devkit,meta-cg-idp --with-template=feature/vlan,feature/opc,feature/recovery,feature/opc_
demo,feature/ipsec_vpn,feature/l2tp,feature/ems-test,feature/remote-session,feature/openjdk-bin,feature/online_updates,feature/bluetooth,feature/
pptp_vpn,feature/target-toolchain,feature/graphics_qt,feature/qkit,feature/cg-wdt --with-package=make,git,iasl,libtool,perl,ruby,subversion
,autoconf,automake,curl,conntrack-tools,fuse,igmpproxy,iperf,ipset,libcli,mipv6-daemon-umip,ntfs-3g,ntfsprogs,sshfs-fuse,tftp-hpa,tftp-hpa-
server,tcpdump,vim,qt4-embedded,packagegroup-core-x11-sato-games --enable-reconfig –enable-internet-download
```

3.1.2 Headless Project Setup

Use the following configure command for a headless project:

```
$ $WIND_LINUX_CONFIGURE_CLI --enable-board=intel-baytrail-64 --enable-kernel=idp --enable-bootimage=ext3,hdd --enable-patchresolve=noop
--enable-rootfs=idp --enable-addons=wr-idp --with-layer=wr-prosyst-mbs-smarthome-sdk-ia,wr-digi-idigiconnector,wr-wks-oneagent-oma-dm-ia,wr-
wks-oneagent-tr069,sys-version,wr-iot,wr-idp-devkit,meta-cg-idp --with-template=feature/vlan,feature/opc,feature/recovery,feature/opc_
demo,feature/ipsec_vpn,feature/l2tp,feature/ems-test,feature/remote-session,feature/openjdk-bin,feature/online_updates,feature/bluetooth,feature/
pptp_vpn,feature/target-toolchain,feature/qkit,feature/cg-wdt --with-package=make,git,iasl,libtool,perl,ruby,subversion,autoconf,automake,c
url,conntrack-tools,fuse,igmpproxy,iperf,ipset,libcli,mipv6-daemon-umip,ntfs-3g,ntfsprogs,sshfs-fuse,tftp-hpa,tftp-hpa-server,tcpdump,vim
--enable-reconfig –enable-internet-download
```

3.2 Build the Project

1. Change to the $HOME/Project directory:

   ```
   $ cd $HOME/Project
   ```

2. Build the project:

   ```
   $ make fs
   //The binary image is created in the directory $HOME/Project/bitbake_build/tmp/deploy/images
   ```

Deploy this image to the conga-QKIT/IoT.

4 Deployment

This section describes how to deploy the Wind River IDP image to USB and eMMC storage devices. It also describes various user interfaces for accessing and managing the target device.

4.1 Deploy Image to USB Storage Device

1. Insert a USB storage device to the development machine.
2. Mount the attached USB storage device.
3. Determine the device node name assigned to the USB device:

```
$ lsblk
//Write down the USB device node name. Do not include the partition. For example, if the partition is /dev/sda1, then the node name is /dev/sda
//Other useful commands to view the USB devices attached are "dmesg | tail", "mount", "dh-l" etc.
```

4. Change to the $HOME/Project directory and start the deploy script:

```
SD=/dev/sdX
sudo ./deploy.sh -d "$SD" -y -u -f export/intel-baytrail-64-idp-idp-dist.tar.bz2; sync
```

Note

The USB storage device must have a capacity of at least 4GB.

4.2 Deploy Image to Internal eMMC

The conga-QA3 module included in the conga-QKIT/IoT is equipped with an onboard eMMC flash storage sufficient for IDP's partitions.

1. Insert a USB storage device to the development machine.
2. Mount the USB storage device.
3. Determine the device node name assigned to the USB device.

```
$ lsblk
//Write down the USB device node name. Do not include the partition. For example, if the partition is /dev/sda1, the node name is /dev/sda.
//Other useful commands to view the USB devices attached are "dmesg | tail", "mount", "dh-l" etc.
```

4. Copy the targed root file system to the target's /opt directory (/media/wr_usb_boot/opt) as local or network copy:
   - Local copy (on the host system)

     ```
     $ sudo cp bitbake_build/tmp/deploy/images/wrlinux-image-glibc-idp-intel-atom-baytrail.tar.bz2 /media/wr_usb_boot/opt
     $ sudo umount $SD
     $ sync
     ```

   - Network copy (SSH). This requires a network connection and correct SSH configuration.

     ```
     $ scp $HOME/Project/bitbake_build/tmp/deploy/images/wrlinux-image-glibc-idp-intel-atom-baytrail.tar.bz2 root@:"$TARGET_IP"/opt
     ```

5. Install the image with the reset_media script on the conga-QKIT/IoT:
   a. Insert the USB stick in the conga-QKIT/IoT.
   b. After the Wind River Operating System boots, use `ctrl + alt + F4` to enter the command prompt.
   c. For user name and password, type `root`.
   d. Find the current working directory with `pwd`. If the current directory is /root (a directory under root), then go a step back with `cd ..`
   e. Deploy the image to the eMMC:
      ```
      $ /sbin/deploytool -d /dev/mmcblk0 -y -u -f /opt/wrlinux-image-idp-intel-baytrail-64.tar.bz2
      ```
   f. Remove the USB stick and boot from eMMC.

4.3 Access and Manage Target Device

The image provides the following user interfaces for accessing and managing the target device:

- CLI Console:
  - For a headless project, the target presents a command line interface on the DP video output.
  - For a GUI project, use Ctrl+Alt+F4 to enter the command prompt.
- SSH Daemon (running by default)
- LuCI (interface to configure the IDP XT device):
  - For ethernet access, open the URL "https://<*TARGET-IP*>"
  - For wifi access, connect to the access point "IDPDK-*XXXX*", open the URL "https://192.168.1.1", default password is "windriveridp"
  - The default password for LuCI is "root"

5 Deployment Sources of Information

5.1 Industry Specification

The list below provides links to industry specifications that apply to congatec AG modules.

Specification	Link
Qseven® Specification	http://www.qseven-standard.org/
Qseven® Design Guide	http://www.qseven-standard.org/
Low Pin Count Interface Specification, Revision 1.0 (LPC)	http://developer.intel.com/design/chipsets/industry/lpc.htm
Universal Serial Bus (USB) Specification, Revision 2.0	http://www.usb.org/home
Serial ATA Specification, Revision 1.0a	http://www.serialata.org
PCI Express Base Specification, Revision 2.0	http://www.pcisig.com/specifications
Intel® Product Specifications	http://ark.intel.com/

5.2 References

- Intel® Gateway for the Internet of Things DK300 - Early Access Kit Getting Started Guide (544500_Intel_Gateway_for_the_IoT_DK300_EA_GetStarted_Rev1.1.pdf).
- Wind River Linux 5.0/5.0.1 Recommended Development Host Distributions (wrs-idp-documents/Recommended-Hosts-List_5.0.1.pdf).
- Wind River® Intelligent Device Platform XT - Release Note 658852696 (WindRiver/wrlinux-7/docs/docs/extensions/eclipse/plugins/com.windriver.ide.doc.wr_intelligent_device_platform_XT_3.1/wr_idp_xt_release_notes_31/wr_intelligent_device_platform_xt_release_notes_31.pdf).
- congatec QA3 product page (http://www.congatec.com/en/products/qseven/conga-qa3.html).