Intel® Smart Home Development Acceleration Platform (Intel® SHDAP) Software Development Kit (SDK)

Release 1.2

Quick Start Guide

March 2017

Revision 2.0

Intel Confidential
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| March 2017      | 2.0      | Updated for Production Release 1.1  
|                 |          | • Updated Section 3.1 and 3.3 (ZigBee Firmware version upgrade) 
|                 |          | • Updated Section 5.4 due to ZigBee Firmware version change 
|                 |          | • Updated Section 11.1 and Section 11.2 of reserved uid and gid |
| February 2017   | 1.9      | Updated Section 1.3 Intel Premier Support (IPS) hyperlink |
| January 2017    | 1.8      | Updated for Production Release 1.1  
|                 |          | • Updated Sections 3.1 and 3.3 |
| December 2016   | 1.7      | Updated for Experimental Release 1.0.1 |
| November 2016   | 1.6      | Updated for Production Release 1.0 |
| October 2016    | 1.5      | Updated for Pre-Release 0.82 |
| August 2016     | 1.4      | Updated for Pre-Release 0.81 |
| June 2016       | 1.3      | Updated for Pre-Release 0.8 |
| May 2016        | 1.2      | Updated for Pre-Release 0.6 |
| May 2016        | 1.1      | Updated for Pre-Release 0.51 |
| April 2016      | 1.0      | Intel® SHDAP SDK Pre Release 0.5 |
1.0 Introduction

The Intel® Smart Home Development Acceleration Platform (Intel® SHDAP) SDK Quick Start Guide provides required details for setting up the development environment. It covers the following areas:

- Features supported in this release
- System requirements
- Accessing Intel SHDAP SDK packages and documents
- Setting up the development environment
- Installing the SDK on the Intel SHDAP Gateway

1.1 Terminology

Table 1. Terminology

<table>
<thead>
<tr>
<th>Term</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>AP</td>
<td>Access Point</td>
</tr>
<tr>
<td>API</td>
<td>Application Programming Interface</td>
</tr>
<tr>
<td>APK</td>
<td>Android* Application Package File</td>
</tr>
<tr>
<td>BSP</td>
<td>Board Support Package</td>
</tr>
<tr>
<td>DHCP</td>
<td>Dynamic Host Configuration Protocol</td>
</tr>
<tr>
<td>Gateway</td>
<td>Controller to control End devices/Smart Things</td>
</tr>
<tr>
<td>GW</td>
<td>Gateway</td>
</tr>
<tr>
<td>IDE</td>
<td>Integrated Development Environment</td>
</tr>
<tr>
<td>Intel® SHDAP</td>
<td>Intel® Smart Home Development Acceleration Platform</td>
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<tr>
<td>IoT</td>
<td>Internet of Things</td>
</tr>
<tr>
<td>LAN</td>
<td>Local Area Network</td>
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<td>OIC</td>
<td>Open Interconnect Consortium</td>
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<td>Ostro™ OS</td>
<td>Yocto Project-Based Metadata and Source Code for IoT devices. Refer to <a href="https://ostroproject.org/">https://ostroproject.org/</a></td>
</tr>
<tr>
<td>SDK</td>
<td>Software Development Kit</td>
</tr>
<tr>
<td>SSH</td>
<td>Secure Socket Shell</td>
</tr>
<tr>
<td>Things / End Devices</td>
<td>General term for smart home sensors and actuators</td>
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<tr>
<td>USB</td>
<td>Universal Serial Bus</td>
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1.2 Reference Documents

Table 2. Reference Documents

<table>
<thead>
<tr>
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<td>Intel® Smart Home Development Acceleration Platform (Intel® SHDAP)</td>
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<td>Software Development Kit (SDK) Quick Start Guide</td>
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<td>Software Development Kit (SDK) Z-Wave Interface Guide</td>
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<tr>
<td>Application Guide</td>
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<td>Getting Started with the Intel® XDK</td>
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<tr>
<td>Single Image Build Guide</td>
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1.3 Customer Support

Contact Intel using the Intel® Premier Support tool for technical support, including answers to questions not addressed in this document. Contact your Intel representative to set up the Intel Premier Support account.

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2.0 Getting Started

2.1 Accessing Intel® SHDAP SDK

Download the Intel® SHDAP SDK from: http://software.intel.com/smart-home-dap-sdk

Request for access at: https://software.intel.com/en-us/smart-home-dap-sdk-support
3.0 **Functionality Supported in This Release**

Functionality supported in this release:

- Intel® SHDAP Services
  - Things Abstraction Layer
  - Protocol Plug-in Manager
  - Rule Engine (API Runtime)
  - Message Broker

- Interfaces supported:
  - ZigBee*
  - Z-Wave*
  - Wi-Fi*
  - Ethernet
  - Bluetooth® low energy (LE) wireless technology

- Logging

- Intel SHDAP SDK security features

- Event-based rules
  - Create rules
  - Modify rules
  - Delete rules
  - Enable/disable rules

- Creating device aliases

- Creating device groups

- Gateway on-boarding (Wi-Fi configuration)

- Sample applications showcasing
  - Working with devices: scan, pair, operate, remove
  - Simple rule creation and execution
  - Using message broker services
  - Multiple User Applications
  - HTML5 application supporting
    - Scan and pair devices
    - Create groups and assign devices to groups
    - List rules
  - Data aggregation using AWS* IoT Cloud Service

- Integration with Wind River® Helix Device Cloud, a device management platform for the Internet of Things (IoT)

- Integration with Intel® XDK
3.1 Changes in This Release

- Update to Sensor/Zone type information in SDK API: The sensor/zone type convention for IAS clusters is updated and streamlined to be consistent (oic.d.sensor.<sensor_zone_type>)
- Integration of ZigBee Firmware v1.0.10 from MMB*
- Support for remote shell login from HDC portal
- Update of the Node.JS packages used in the Microsoft* Azure Cloud Connector Sample Application

3.2 SDK Package Details

The Intel SHDAP SDK package, *intel_shdap_sdk_kit.tar.gz*, contains the following modules:

- **Intel SHDAP SDK Installation Script** [*install_intel_shdap_sdk.sh*]: The installation script installs the Intel® SHDAP SDK, required libraries, and dependencies on the Gateway device.
- **Intel SHDAP SDK** [*intel_shdap_sdk.tar.gz*]: The SDK package consists of Intel® SHDAP SDK modules, APIs, and runtime libraries.
- **Intel SHDAP SDK Sample Application** [*intel_shdap_sdk_sample_apps.tar.gz*]: This package contains sample applications that demonstrate SDK features and functionalities such as usage of connectivity modules (initiating scan, pair, read, and write) and Rule Engine APIs.
- **Z-Wave Plug-in for Intel SHDAP** [*intel_Z-Wave_plugin_shdap_sdk.tar.gz*]: Z-Wave plug-in for Intel SHDAP, to develop and test Z-Wave applications. This plug-in depends on Sigma Designs* Z-Wave library to run / use.
- **Intel SHDAP SDK Z-Wave Setup (Build) Tools** [*intel_sdk_Z-Wave_Setup.tar.gz*]: Sigma Designs Z-Wave SDK build scripts and patch files.
- **Intel SHDAP ZigBee* Firmware Image** [*MMB_RapidHA_FW_Image_1.0.10.tar.gz*]: ZigBee Firmware Image for Intel SHDAP Gateway platform.
- **Wind River Helix Device Cloud Agent** [*intel_shdap_hdc_agent.tar.gz*]: This package contains the Wind River Helix Device Cloud Agent related agent, installer, and dependent packages.
- **Intel® XDK** [*intel_shdap_XDK.tar.gz*]: This package contains the Intel XDK (IDE).
- **Intel SHDAP SDK Open Source Software Dependencies** [*intel_shdap_sdk_dep_modules.tar.gz*]: This package contains all the open-source modules and frameworks that are required to use the Intel® SHDAP SDK development framework. Refer to *Intel_SHDAP_SDK_Open_Source_Modules.pdf* for a complete list of open-source modules.
• **Intel SHDAP SDK Layer** [*intel_shdap_sdk_customer_package.tar.gz*]: This package contains the additional meta-shdap layer and required patch files for building production Ostro BSP integrated with Intel SHDAP SDK.
3.3 Intel® SHDAP SDK Configuration

Intel SHDAP SDK Release 1.2 Configuration:

<table>
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<th>Details</th>
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<td>Intel® Quark™ SoC X1020</td>
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<tr>
<td>GW Device</td>
<td>ZE250 IoT Gateway</td>
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<tr>
<td>SDK</td>
<td>Intel SHDAP SDK v1.2</td>
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<table>
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<tr>
<th>Software</th>
<th>Details</th>
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<td>Ostro™ OS</td>
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<td>BIOS</td>
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<tr>
<td>BSP</td>
<td>Flash_01020105</td>
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<tr>
<td></td>
<td>BSP-0.0.0.012</td>
</tr>
<tr>
<td>MMB Networks*</td>
<td>RapidHA 1.2 Serial protocol (version 1.4.0)</td>
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<td>ZigBee Firmware</td>
<td>1.0.10</td>
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<td>Z-Wave Serial API Version</td>
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<tr>
<td>Z-Ware C API Library Version</td>
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</tr>
<tr>
<td>Intel® XDK</td>
<td>v3641</td>
</tr>
</tbody>
</table>

3.4 External Dependencies

Intel SHDAP SDK supports the Z-Wave functionality provided by Sigma Designs.

Instructions to enable the Z-Wave interface are documented in: Intel® SHDAP Software Development Kit (SDK) Z-Wave Interface Guide.

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4.0 System Requirements

- Development system: Intel® Core™ i5 processor (or above)
- OS: Ubuntu* / Windows* 7.0 and above
- Smart Home gateway: Intel® SHDAP GW device: ZE250 IoT Gateway (http://www.cybertan.com.tw/Products/ZE250.html)
- Cables:
  - Micro-USB (Type AB) to connect to GW device from PC
  - LAN cable
- Tools:
  - PuTTY (www.putty.org) or WinSCP (https://winscp.net/)
- Network requirements:
  - Network, Wi-Fi, and LAN with DHCP and Internet access, without proxy
5.0 Installing Intel® SHDAP SDK

This section details the process to install and configure Intel® Smart Home Development Acceleration Platform (Intel® SHDAP) SDK.

The flow is as shown:

5.1 Installing Ostro™ OS

Intel SHDAP SDK Release 1.1 is based on the Ostro™ OS version 1.00.19b1. The Smart Home Gateway device should be upgraded to this OS version before SDK installation.

Note: Install the Intel SHDAP SDK on the abovementioned Ostro OS version to avoid SDK conflicts.
The required Ostro OS, along with OS upgrade instructions, are at:

**Document:**
ake_user_guide_1.6.docx&dirname=doc

**Ostro OS image:**
http://www.cybertan.com.tw:8080/download/download.jsp?newfilename=ostro-image-
swupd-intel-quark-1.00.19b1-development.zip&dirname=fw

**BSP:**
http://www.cybertan.com.tw:8080/download/download.jsp?newfilename=BSP-
0.0.0.012.zip&dirname=bsp

## 5.2 Configure PC and Smart Home Gateway Device

### 5.2.1 Configure Serial Port Access

The device drivers used to connect to the Intel® Galileo board can be used to connect
to the Smart Home gateway also via serial port, using the micro-USB interface on the
gateway.

Serial port connection is recommended for initial board setup such as configuring SSH
keys for auto-login and to obtain the IP address of the board for SSH connection to the
board.

If connected through serial terminal and trying to run application.js, make sure the
board is assigned with the IP address (LAN / Wi-Fi). This is required for adding ZigBee
devices.

#### 5.2.1.1 Windows* OS

Download the [Intel® Galileo board Firmware Updater for Windows* OS](http://www.cybertan.com.tw:8080/download/downloadlist.jsp) and
install/configure it as mentioned in Intel_Homelake_User_Guide_1.x.doc downloadable from

#### 5.2.1.2 Linux* OS (Recommended)

On an Ubuntu* OS Development PC:

1. Get the USB port where the gateway is plugged in, using the `dmesg` command.
2. Use the `putty` serial interface option to connect to the abovementioned USB port
   with baud rate set to **115200**. Execute the `putty` command as `root` (or with the `sudo`
   option).
5.2.2 **Configure SSH Access**

Follow these steps to set up the secure SSH connection between your Ubuntu system and the gateway device for SSH access and auto-login.

1. Stay connected to the gateway device via serial port.
2. If your computer has been previously set up for secure SSH connection, the SSH Keys are located in `~/.ssh/id_rsa.pub`. If not, follow the subsequent procedure to create them.

   ```sh
   $ cd ~/.ssh
   $ ssh-keygen -t rsa
   ``

3. Copy the public key string in the text file `".ssh/id_rsa.pub"` and append this key string to the `/home/root/.ssh/authorized_keys` text file in the gateway device. Save the changes made to the `/home/root/.ssh/authorized_keys` text file.
4. Execute the following command on the Ubuntu system to register the key.

   ```sh
   $ ssh-add .ssh/id_rsa
   ``

   **Note:** If the above command fails with the message “*Could not open a connection to your authentication agent*”, try starting the ssh-agent before executing the ssh-add command.

   ```sh
   $ eval `ssh-agent -s`
   $ ssh-add
   ``

5. Log on to the gateway device using its IP as shown in the following example. The session is authorized automatically without a password prompt.

   ```sh
   $ ssh root@<gateway ip address>
   ```

5.3 **BIOS**

Execute the following command to confirm the BIOS version is up to date.

![BIOS Version](attachment:image)

The required BIOS image files along with BIOS upgrade instructions are at:


Document: Intel_HomeLake_user_guide_1.6.docx

BIOS: Flash_01020105.cap

5.4 **ZigBee* Firmware Upgrade**

1. Refer to the required ZigBee* firmware version in Section 3.3.
2. Go to the `/usr/share/zigbee_test` directory.
3. Execute the Python* script as follows to read the EUID:

   $ python mz100_read_eui64.py -p /dev/ttyS0

   **Note:** If the token is displayed as “ffffffffffffffff”, follow Step 4 to upgrade the firmware and then read the EUID. The token “ffffffffffffffff” is displayed only if you are using the gateway for the first time. If you are using an earlier version of Intel SHDAP, follow step 4 to upgrade the firmware to the latest version mentioned in Section 3.3.

4. Upgrade the firmware using command:

   $ python mz100_serial_upgrade.py -p /dev/ttyS0 -f homelake_rapidha_coordinator_v1.0.10_UART2.img

5. Read the EUID using the command:

   $ python mz100_read_eui64.py -p /dev/ttyS0

   A valid token other than “ffffffffffffffff” displayed shows that the firmware is upgraded.

### 5.5 SDK Installation

After downloading the SDK packages, Intel recommends keeping those packages in the /home/root/Intel/ folder.

1. Copy the SDK Package files onto the gateway device in the previously mentioned path and execute the installer script `install_intel_shdap_sdk.sh` shown as follows:

   $ sh install_intel_shdap_sdk.sh

2. During the script execution, the user is prompted to set passwords for the system users (*shdap* and *app* accounts).

   Intel® SHDAP SDK main working directory is at: /home/shdap/Intel/shdap_sdk/.

   Intel® SHDAP SDK common libraries and tools are installed at: /home/root/Intel/.

3. Once the SDK is installed to the abovementioned folders, the installer script prints the following message on the console: “**SDK Installed Successfully!!!**”

### 5.6 Launch Sample Application

Intel® SHDAP SDK *node.js* sample application serves as a reference application for a developer to develop innovative smart home applications and use cases.

To run the sample application, logon as "**app**" user.

$ ssh app@<IP address>

Start application.js to execute the connectivity sample application:

$ node application.js
Refer to the Intel® SHDAP SDK Developer Guide for details on the various functionalities supported by this sample application and for details on the other sample applications bundled in this SDK.

§
6.0 Z-Wave* Interface

Intel® SHDAP SDK supports Z-Wave* functionality provided by Sigma Designs.

Refer to the instructions in the following document to enable Z-Wave functionality.

7.0  Helix Device Cloud Manageability Application

Intel® SHDAP SDK supports remote manageability of gateway devices using Wind River* Helix Device Cloud Manageability Application. Refer to the instructions in the following document to install and use the application.

**Helix Device Cloud Manageability Application Guide**: Intel® SHDAP Software Development Kit (SDK) Helix Device Cloud Manageability Application Guide

§
8.0 Intel® XDK Setup

Intel® XDK, part of the Intel® IoT Developer Kit, enables you to create and run Node.js* applications directly on Intel-based IoT platforms. Intel® XDK provides templates for creating applications and offers the possibility of remotely debugging your application and running it from your own desktop.

8.1 Intel® XDK Installation

Use the script `XDK_installer.sh` to install the required rpms and patch the system files.

Intel XDK depends on the following modules: OpenSSH, mdns-dev, mdns-dbgh, mdns-544-r1, node-js-npm, and xdk-daemon.

8.1.1 Intel® XDK Services

To use Intel XDK, start the Intel XDK Service as a "root" user on the gateway device:

```
$ systemctl start mdns.service
$ systemctl daemon-reload
$ systemctl restart xdk-daemon
```

8.1.2 Verify Intel® XDK Daemon

Make sure that the Intel® XDK daemon is running and active on the gateway:

```
$ systemctl status xdk-daemon -l
```

8.2 Intel® XDK Configuration on PC


Once installation is complete, perform the following configuration on the PC.
8.2.1 Configure SSH Keys for Intel® XDK

Generate SSH Keys on the system where Intel XDK is running:

1. Use puttygen to generate both public and private keys.
2. Save the public keys on the smart home gateway device at: `~/.ssh/authorized_keys`
3. Save the private keys on the PC system.

**Note:** Only secure SSH key connections to the smart home gateway device is supported. Connecting IoT devices securely with a user name and password as described in the *Intel XDK* guide does not apply to the smart home gateway device.
### Devices Supported

<table>
<thead>
<tr>
<th>Device Type</th>
<th>Manufacturer</th>
<th>Protocol</th>
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<td>AEON labs Door/Window Sensor</td>
<td>Z-Wave*</td>
</tr>
<tr>
<td>Door/Window Sensor</td>
<td>Schlage</td>
<td>Z-Wave</td>
</tr>
<tr>
<td>Multi-Sensor</td>
<td>AEON labs Multi-Sensor</td>
<td>Z-Wave</td>
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<td>Lock</td>
<td>Schlage</td>
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<td>Electrical Outlet</td>
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</tr>
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<td>Water Sensor</td>
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<td>ECOLINK</td>
<td>Z-Wave</td>
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<td>Smoke Sensor</td>
<td>First Alert</td>
<td>Z-Wave</td>
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<td>Shock and Vibration Sensor</td>
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<td>Z-Wave</td>
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<td>Philips 456210 Hue A19 Bulb Starter Kit 2nd Generation</td>
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<td>Yale</td>
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<td>Cree</td>
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<td>Smart outlet</td>
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<td>Quirky-GE</td>
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<td>Smart Energy Plug</td>
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<td>ZigBee</td>
</tr>
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10.0 Wi-Fi Setup

Sections 10.1–10.3 show steps to connect to a wireless network using DHCP.

10.1 Enable/Disable WLAN Radio

```
root@intel-quark:~# connmanctl
connmanctl> enable wifi
Enabled wifi
connmanctl> disable wifi
Disabled wifi
connmanctl> enable wifi
Enabled wifi
connmanctl>
root@intel-quark:~# ifconfig
Wlp1s0  Link encap:Ethernet  HWaddr 80:A5:89:4D:12:A7
        UP BROADCAST MULTICAST  MTU:1500  Metric:1
        RX packets:413437 errors:0 dropped:63927 overruns:0 frame:0
        TX packets:19 errors:0 dropped:1 overruns:0 carrier:0
        collisions:0 txqueuelen:1000
        RX bytes:888 (888.0 B)  TX bytes:2103 (2.0 K)
        Interrupt:20
```

10.2 Scan for Wi-Fi Networks

```
root@intel-quark:~# connmanctl
connmanctl> scan wifi
Scan completed for wifi
connmanctl> services

  *AR Wired          ethernet_000000000000_cable
  MES-LAB-SED-2.4GHz  wifii_80a5894d12a7_4d45532d4c4142dd35442dd32e347487a_managed_ps
  AVE2-T184-guest    wifii_80a5894d12a7_41564532d54318342d6775657374_managed_home
  Smart-Home         wifii_80a5894d12a7_536d172742d466f6d05_managed_ps
```

Note: To connect to a secure Wi-Fi network, register the agent to handle user requests.

```
connmanctl> agent on
```

This agent is used by the daemon to call back an application when attention or input is needed. If you're connecting to an (unsecured) open access point, you can skip this step.
10.3 Connect to a Wi-Fi Network

```bash
root@intel-quark-# connmanctl
connmanctl> connect wifi_80a5b94512a7_4dd5532d4c4142d322e3447487a_managed_psk
AVE-SED: 2.4GHz wifi_80a5b94512a7_4156452d5345442d322e3447487a_managed_psk
AVE2-T184-guest wifi_80a5b94512a7_415645322d543138342d6775657374_managed_none
```
11.0 Creating User/Group

11.1 Create a Group

$groupadd <groupname>

For example, $groupadd test

Create any group name other than intel, app, shdap, iotbus, tal, ppm, and rengine.

*Note:* Group IDs 1101–1109 are used by the Intel® SDK installation script.

11.2 Create a User with Unique User ID and Associate with the Group

$useradd -g <groupname> -u <user ID> -m <username>

For example, $useradd -g test -u XXX -m testuser

Create any user name other than shdap and app.

*Note:* User name and User ID should be unique. uid 2001 to 2004 are already in-use by the Intel® SHDAP SDK installation script.

11.3 Set a Password for Created User

$passwd <username>

For example, $passwd testuser
12.0 Known Issues, Workarounds, and Limitations

12.1 Known Issues and Workarounds

- The end devices (Z-Wave*) should always be disconnected through the SDK. If disconnected from the device side, operations on them will not be functional after reconnection.

- Intel observed that a few of the Centralite* devices (Motion Sensor, Door/Window Sensor and Temperature/Humidity Sensor) take a long time to get scanned/added and often were not discovered at all during scanning.

- Occasionally, Intel observes that a device scan has to be attempted multiple times, after adding about 12 devices. If this issue is observed, use the script dissolve_and_form_zigbee_network.sh at /home/shdap/Intel/shdap_sdk/tools to dissolve and form the ZigBee network again. After the network is dissolved and formed, all devices have to be reset before attempting to pair or un-pair them.

12.2 Limitations

12.2.1 ZigBee* Interface

Enabling Devices to Rejoin the Network
Sometimes, the device announce callback is not triggered after completing a pair/un-pair sequence of the end device. Repeat the pair/un-pair sequence again.

Read Attribute
Read attribute reports all attributes corresponding to a particular cluster even though the request is for one attribute.

Notifications
Asynchronous notifications on device events/status changes are not supported on the lights (Philips* Hue Bulb, Philips Hue Strip, OSRAM* Bulb, Cree* Bulb and GE* Bulb).

SDK API
For a multi sensor, supporting multiple zone types / sensor functions in a single device, only one zone type will be displayed during scan/pairing. However all notifications will have appropriate zone types set. This is due to OCF/IoTivity framework limitation in handling multisensory types natively.
12.2.2 Philips® Hue Plug-in

After adding new devices on the Philips Hue Bridge using the Philips Hue application, the scan result shows the existing and new devices.

12.2.3 Z-Wave® Interface

Devices using the Z-Wave® interface usually connect seamlessly during a board reboot. Do a factory reset of the gateway if the devices have problems connecting.

12.2.4 HTML5 Sample Application and Gateway Onboarding Sample Application

Connect the gateway to the Internet to use the HTML5 sample application and Gateway Onboarding sample application. Sometimes, during the Gateway Onboarding process, the Wi-Fi AP names returned may have some control information (for example, “A”) before the AP name. In this case, the Gateway Onboarding application may not work. This limitation will be addressed later.