HOP Ubibox Gateway

SPECIFICATION DOCUMENT v1.0

What's Inside

Deploy the Internet of Things with Bluetooth Smart-based Applications in Hybrid, Mobile, Personal, Wearable, and Cloud Computing Environments

Connectivity and reliability is critical requirement for maintaining an adaptable network and accomplishing the scale, consolidation, and business continuity demanded by today's advanced applications based on the Internet of Things paradigm. HOP Ubiquitous can help you achieve Internet of Things applications development with an agile, flexible, and efficient way to deploy and optimize application services. In addition, to integrate a wide-range of Smart devices that makes your solutions more personal and ubiquitous.

HOP Bluetooth Smart Devices (HBSD) are intelligent devices based on Bluetooth Low Energy which provide the advanced capability of IoT integration through the newest and most adopted IoT protocol: Lightweight Machine to Machine (LwM2M).

The features of the Bluetooth Low Energy in conjunction with LwM2M allow develop multi-purpose devices with long life cycles such as sensors, actuators, multi-advertisement beacons, and even conjunction of them.

Key benefits

Deploy with increased agility

Quickly and easily extend your products, gateways, and solutions with Bluetooth Smart to delivery services when and where you need it.

A solution for everybody

HOP Ubiquitous has a mission and compromise to make the Internet of Things accessible to everybody, through simple commissioning and bootstrapping mechanisms. Our mobile-driven and cloud computing solutions such as the HOP Engineer App and our coming HOPs Firmware Marketplace, offer a disruptive technology to tune and update your applications over the air through intuitive and users-friendly mechanisms.

Optimize application services more efficiently

Rapidly provision and consolidate application services on your own products and solutions with our flexible modules to extend existing systems (HOP Basic core), and extending your range of products with our HOPs for automation, security, social interactions, mHealth and Smart Cities.

Provide the ultimate in flexibility

Get the most flexible deployment options in the Internet of Things market, with support across all the key platforms and systems, covering from mobile and personal devices such as mobile phones and tables (iOS and Android OS), both private and public cloud (such as FI-WARE and OpenIoT solutions).

HOP Ubiquitous IoT Architecture / IoT Ecosystem

HOP Ubiquitous provides a complete environment from sensors to user real-time application. This environment simplifies the process of manage IoT devices from the cloud and provides several functionalities such as marketing management, virtual processes and raw device management. The components of Homard environment from bottom to top are as follows:

• Hop Core: BLE Device that supports IPv6 connectivity using Glowbal IP. Implements OMA LwM2M stack and it communicates with Homard to perform device operations.

• Ubibox: It is the gateway that communicates the devices with the cloud using IP.

• Homard: LwM2M server allocated in the cloud. Provides a user interface that provides several tools to the end user. Also Homard provides a REST API in order to integrate it in third-party applications such as Fujitsu RunMyProcess.

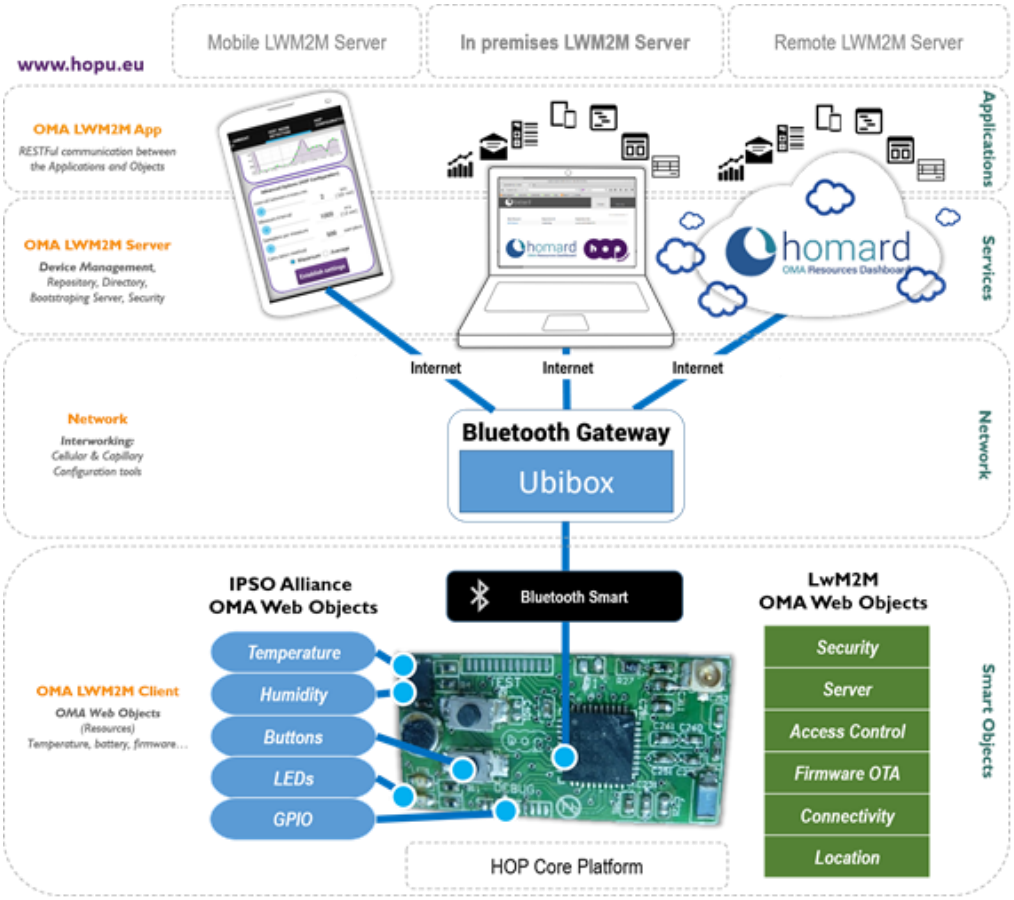

Figure 1. Hop Ubiquitous ecosystem.

This document will focus on Ubibox. Hop Devices specification can be found in its datasheet document.

Ubibox launcher checks for firmware updates at startup

Ubibox Gateway

Ubibox hardware is composed of two parts. On one hand it is the motherboard with an internal flash memory. This memory contains the operative system and Ubibox binaries. On the other hand it is the BLE transceiver that provides BLE connectivity to the motherboard. Ubibox motherboard provides Ethernet connectivity and mini-usb power supply. Ubibox features are the following:

- AM335x 1GHz ARM® Cortex-A8
- 512MB DDR3 RAM
- 4GB 8-bit eMMC on-board flash storage
- NEON floating-point accelerator
- 2x PRU 32-bit microcontrollers

The following section will explain how Ubibox operates with the BLE devices.

Ubibox operating modes

Ubibox is the gateway between Hop Core (HOP devices and sensors) and Homard. It has two working modes: direct and proxy. Direct mode is related with Hop core. Hop core has been implemented to support IP and OMA LwM2M allowing to make direct communications using IP. Proxy mode is for third-party BLE devices. Ubibox creates a virtual OMA LwM2M client for these devices interconnecting with Homard in the same way that direct mode.
One important thing about Ubibox is the connection slots. Ubibox has 3 connection slots that can be used for any device. Each connection consumes one connection slot and it is released upon completion of the connection. For that there are two connection types depending of the user requirements. Ubibox supports two connection types, on one hand it is UDP mode (U) that creates a connection with the BLE device and keeps it in time. Ubibox supports up to 3 U connections simultaneously. On the other hand it is UDP Queue mode (UQ). UQ devices creates intermittent connections depending of the status of the device. UQ devices can be in two status: connectable and sleeping. The periodic connection maintenance can be configured using Homard. The connectable status can be reach through sensor events or periodic connection maintenance. The following image shows the differences between the connection types.

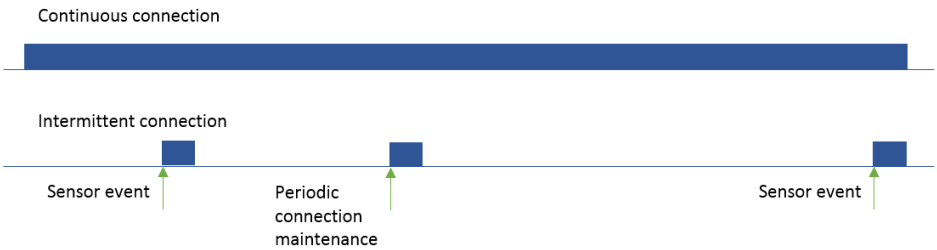

Figure 2. Ubibox connection types.

Ubibox BLE Devices Access Control

BLE Devices access control is the procedure by which the list of valid devices is recovered from Homard server by Ubibox. This procedure is launched at started and set the internal device whitelist. The whitelist will be used to filter the scan responses and connect only the devices allowed by HOPU servers. The Ubibox whitelist can be listed using its OMA resource. The Access Control is also managed by the bootstrap server, which redirects sensors to the Open Stack-based instance that manages individually the sensors from an organization (it offers also the opportunity for on-premised deployment of homard instances).

Ubibox BLE Performance

In this section it is explained Ubibox connection performance and learn how to configure the periodic connection maintenance to reach the number of devices connected simultaneously UQ desired. As was mentioned on previous section, Ubibox can connection 3 U devices simultaneously, but for UQ devices depends on the periodic connection maintenance. The periodic connection maintenance depends of the number of Ubibox deployed and the number of UQ devices required.

For example, if we have 1 Ubibox and only UQ devices the graphic is as follows:

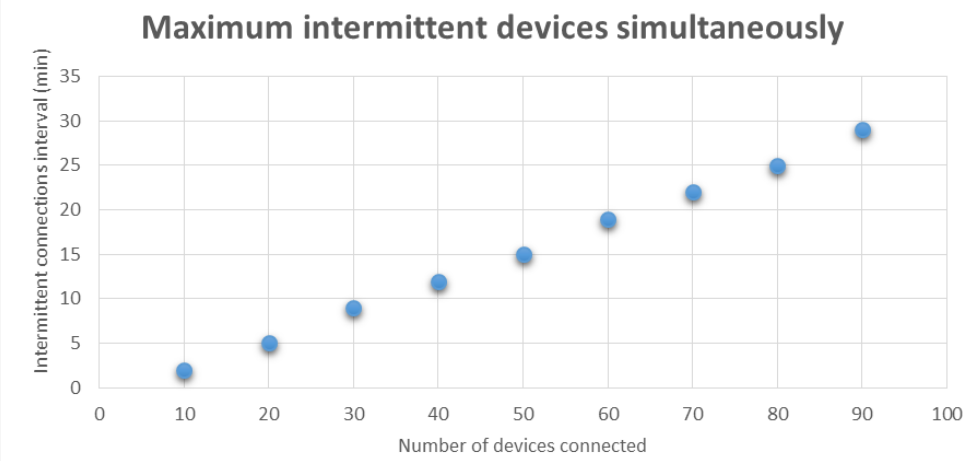

Figure 3.Required periodic connection maintenance depending of the number of UQ devices to connect with 1 Ubibox.

This means that to manage 30 UQ devices, the periodic connection maintenance must be ~10 minutes.

Usually it is required to add one or two U devices as actuators depending of the required deployment. Ubibox can manage 3 simultaneous connections so if there are two U devices, this means that the Ubibox has just 1 connection slot to manage UQ devices. For 1 Ubibox with 2 U devices using connections slots, the required periodic connection maintenance is as follows:

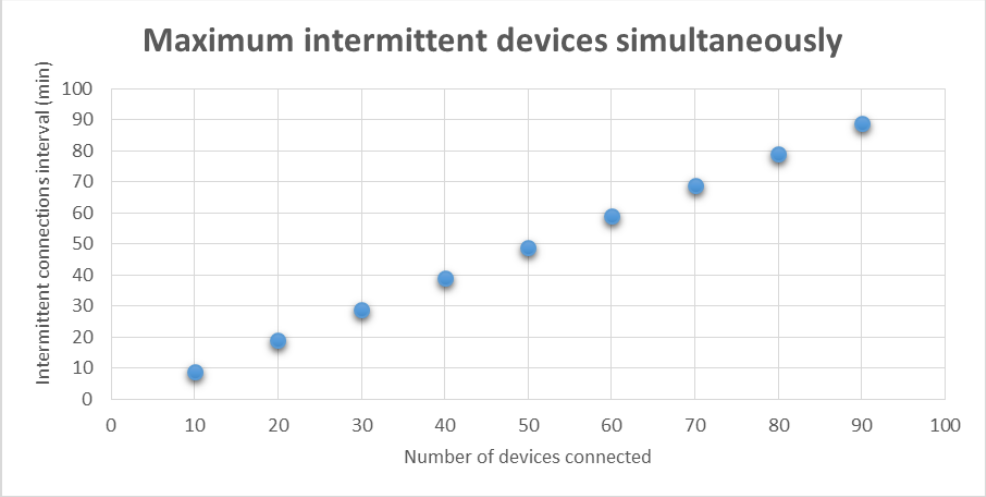

Figure 4. Required periodic connection maintenance depending of the number of UQ devices to connect with 1 Ubibox and 2 U devices.

In this case, to manage 30 UQ devices and 2 U devices the periodic connection maintenance for UQ devices have to be 30 minutes.

To solve this, we can add more Ubibox in the deployment increasing the number of available slots. The following graphic shows the previous scenario with 2 Ubibox:

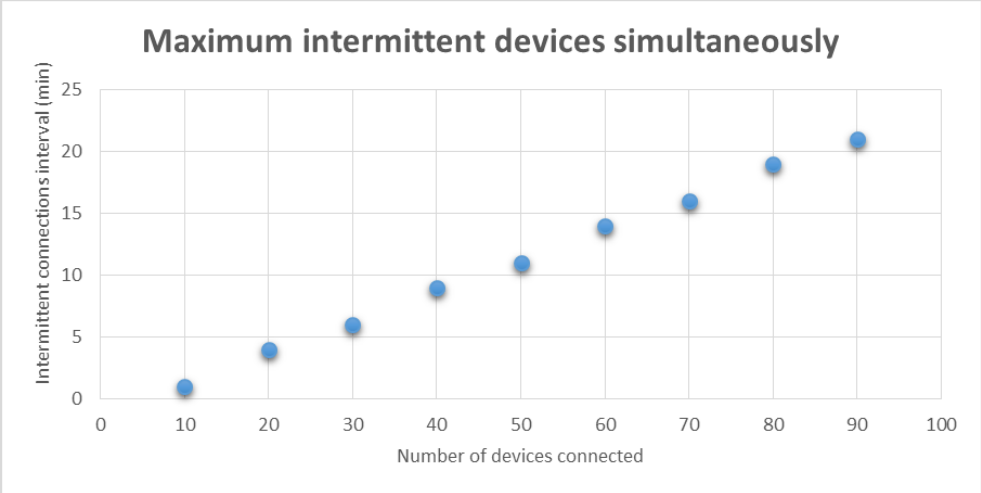

Figure 5. Required periodic connection maintenance depending of the number of UQ devices to connect with 2 Ubibox and 2 U devices.

In this scenario, the periodic connection maintenance time for 30 UQ devices have to be ~5 minutes. This is because with 2 Ubibox and two U devices there are 4 connection slots free to use with UQ devices.

Note that the periodic connection maintenance time is the minimum required. The user can increase this time to increase the devices lifetime. This does not mean that devices cannot connect early, because the events produced by BLE device sensors can awaken at any time.

More Information

For more information you can contact with jara@hopu.eu

Version history

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