The Bosch IoT Remote Manager

Device Management and Monitoring for IoT

Version 7.0
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Chapter 1 – About the Bosch IoT Remote Manager

Our company vision is “We connect everything”. We leverage the Internet of Things (IoT) to differentiate and continually increase the real value of our offerings to customers. Bosch offerings help open up the possibilities of the IoT to a wider audience and in the process increase overall market diversity and robustness in the medium to long term.

The Bosch IoT Remote Manager is all about remotely provision, monitor, and manage IoT device fleets. It enables device manufacturers and service providers to:

- **Stay in touch with their devices.** Improve customer satisfaction by real-time monitoring of the state of the IoT devices and edge services enabled by them.
- **Remain under control.** Efficiently perform bulk management and maintenance actions over device fleets - from a single integrated cloud service.
- **Simplify operations and support.** Reduce costs, by automating complex device management and service provisioning tasks with the help of flexible rule engine.

The Bosch IoT Remote Manager provides you with a proven and future-rich solution to address device management throughout the whole device life cycle. It enables you to configure, monitor, update, diagnose, and provision your gateways, sensors and devices remotely. It supports multiple device management protocols out-of-the-box.

By combining it with other cloud services of the Bosch IoT Suite, the Bosch IoT Remote Manager allows customers to grow from prototyping to operating as full-scale IoT-enabled enterprises.
Chapter 2 – Facts and Figures

The Bosch IoT Remote Manager is responsible for device configuration, monitoring, and remote maintenance. It handles both directly connected devices as well as devices connected through a gateway.

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Further information

Free trial
Free account registration: [https://www.bosch-iot-suite.com/remote-manager/](https://www.bosch-iot-suite.com/remote-manager/)
Chapter 3 – Use Cases

3.1 Device Management

The Bosch IoT Remote Manager enables operators (support engineers, device administrators) of the device manufacturers and service providers to perform centralized remote maintenance of the IoT devices deployed in the field. It provides rich GUI, API and scripting tools, through which technical users and third party applications can perform the following operations:

- Remote configuration of the devices,
- Firmware update,
- Device monitoring,
- Diagnostic and troubleshooting,
- Backup & restore of the device configuration.

3.2 Software Management (Application Provisioning)

The Bosch IoT Remote Manager provides powerful features for delivery and lifecycle management of applications and software components to the target devices, thus allowing realization of use cases for automatic and on-demand provisioning of value-added applications to the smart devices – either pushed by the service provider or requested by the end users.

The key elements for software management consists of:

- Software repository
- Application and life-cycle management
- System and application software components update
- Software dependency management
- Software compatibility management.
3.3 IoT Application Platform

The Bosch IoT Remote Manager can also act as an IoT application platform – by providing a rich set of services and APIs for the realization of custom IoT applications. Some of the basic services provided for this purpose include:

- Device data collection,
- Real-time readings,
- Historical data,
- Remote device control,
- Remote network access to devices.
Chapter 4 – Features at a Glance

The core functionality and the feature enhancements implemented in the Bosch IoT Remote Manager.

4.1 Device Inventory

- **Device State Storage**
  The Bosch IoT Remote Manager collects, retrieves and stores configuration and status information about each managed device. All changes in the state of the device are automatically reflected in the Bosch IoT Remote Manager database (aka Digital Shadow).

- **Device Groups**
  Provide means of hierarchical organization of devices by some particular criteria e.g. for location, business unit, functionality, etc.

- **Device Searching and Filtering**
  Search for a particular device or a set of devices matching specified criteria, based on the information that the Bosch IoT Remote Manager keeps in the Device Inventory.
  You can search and filter devices by:
  - ID,
  - online status,
  - device capabilities (e.g. HW, OS, OSGi parameters, etc.),
  - available software components, their runtime status and configuration, including device’s additionally associated custom properties.
4.2 Collecting Historical Device Data

- **Device State History**
  The History feature allows collection of device state and sensor reading values for extended periods. It provides means for enabling/disabling history recording for defined devices/parameters as well as for retrieving the recorded data.

- **Device State Statistics**
  Provides features for aggregating of the historical device data, such as keeping average, min and max values for specified periods.

4.3 Command and Control

- **Instant Action Execution**
  Means for sending command for execution of management/control "action" to a device connected to the The Bosch IoT Remote Manager. Action is any command, supported by the target device. Examples: change of configuration setting(s), firmware update, application/software component install/update, reboot, factory reset, turn-on/off of a binary switch, etc.

- **Mass Management Operations**
  Mass management operation allows execution of a set of management actions over statically or dynamically defined set of devices registered in the Bosch IoT Remote Manager. The Bosch IoT Remote Manager maintains a persistent queue for management/control commands sent to a device. If the device is not currently connected – these commands are sent when the device becomes connected again.

- **Rule-based Automation**
  The Bosch IoT Remote Manager provides powerful and flexible Management Rule Engine, which allows automatic execution of specified actions upon occurrence of some events/conditions. For example (but not limited to) actions related to change of the device state.

- **Scripting Language for Operations/Rules Definition**
  Mass management operations and rules are defined using Groovy scripting language, which provides the ability to create very flexible and complex management actions and rules. Still, actions that are more trivial are performed via the convenient GUI tools of the Management Console.

4.4 Device Diagnostic & Maintenance

- **Retrieving Device Logs**
  The Bosch IoT Remote Manager provides remote interface for retrieving log messages generated on the managed devices – for diagnostic and trouble-shooting purposes. Both automatic and on-demand retrieval of the device logs is supported.

- **Alert Service**
  A mechanism for rising notifications about device, application or system malfunctions, which require operator/administrator attention/reaction.

- **Remote File Transfer to/from Devices**
  A generic mechanism for transferring files/directories between devices and a backend file storage, including ability to synchronize content of file directories.
• **Backup & Restore of Device Configuration**
  A mechanism, which allows obtaining snapshot of the device configuration, which can be later used to restore the state of device to a previous (stable) configuration. This feature can also be used to replicate configuration of one device to another.

### 4.5 Initial Device Provisioning

Our initial provisioning supports capabilities for easy discovery of OSGi devices and providing custom optional features to the managed devices. It provides a light OSGi device provisioning and configuration mechanism, enabling full customization on behalf of system integrators.

The initial provisioning involves downloading a Management Agent Loader, which is a "fake" management agent. Its task is only to select the very best for the specifics of the OSGi device real management agent among those available on the backend.

Our implementation is capable of contacting vendor-independent backend management systems and performing flexible initial provisioning according to a set of configuration properties.

Registering new device through Management Console is easy by using the "Register New OSGi Device" wizard.

### 4.6 Remote Access Services

Represent a set of services allowing external applications to access remotely and securely the devices via the Bosch IoT Remote Manager – using the existing Bosch IoT Messaging connection between the device and the Bosch IoT Remote Manager.

- **HTTP Tunnel**
  Allows external applications (including normal web browsers) to make HTTPS requests to the connected devices/gateways via the Bosch IoT Remote Manager.

- **Secure Communication Tunnel**
  Allows establishing of end-to-end TLS connection between remote applications and the devices via the Bosch IoT Remote Manager. End-to-end means that encryption is handled by the end peers and even the Bosch IoT Remote Manager cannot intercept the data transmitted through it.

- **JSON-RPC Tunnel**
  JSON-RPC Tunnel allows external applications to make remote JSON-RPC calls to gateways or OSGi devices via the Bosch IoT Remote Manager.

- **Remote Event Service**
  A mechanism, which allows remote application to subscribe to and receive events originating from OSGi based devices/gateways – through the Bosch IoT Remote Manager.

### 4.7 Software Management

- **Software Repository**
  Software Repository is a software/content database, which maintains meta-information and content files of the software components (applications, system modules/drivers, firmware update files, etc.) which can be remotely provisioned on the target devices through the Bosch IoT Remote Manager.
The Bosch IoT Remote Manager 7.0 – Device Management and Monitoring for IoT

- **Software Dependency and Compatibility Management**
  Automatic and/or manual defining of dependency and compatibility relations between software components and their different versions, which can be used by the Bosch IoT Remote Manager to automatically determine the suitable set of software modules for each device – considering the device capabilities.

- **Service Application Management**
  Supports logical grouping of a set of software components (e.g. OSGi bundles, Deployment Packages), additional resources, and content files. Provides the ability to provision and manage their lifecycle (update, start/stop, uninstall) as a whole application, handling issues like dependency and compatibility resolving, sharing of components between applications, etc.

### 4.8 Device Type and Protocol Adapters

The Bosch IoT Remote Manager employs a general abstraction for device representation and manipulation, which is applicable for management and monitoring of any device type, regardless of the concrete device capabilities, the network communication protocols, and the management interfaces supported by the device. The interface to the devices of a particular type is provided by set of plugins (adapters), which adapt the concrete device management interface (e.g. OMA DM, TR-069, etc) supported by the devices to the common device model of the Bosch IoT Remote Manager. The following device types/protocols adapters are supported off-the-shelf:

- **OSGi devices (over Bosch IoT Messaging Protocol)**
  Devices (typically gateways) running OSGi compliant frameworks, including gateways running Bosch IoT Gateway Software. The OSGi agent of the Bosch IoT Remote Manager communicates with the backend over an efficient binary protocol called Bosch IoT Messaging protocol, which supports bi-directional message exchange between the devices and the Bosch IoT Remote Manager over permanent connection.

- **TR069 devices**
  The Bosch IoT Remote Manager supports configuration and firmware update of customer devices (CPEs) over TR-069 protocol, standardized by the Broadband Forum. The supported standards include TR-069 Amendment 6 and TR-157 Amendment 3 (including Software Module Management).

- **OMA-DM devices**
  The Bosch IoT Remote Manager supports management of devices over the OMA-DM protocol, defined by Open Mobile Alliance. A protocol widely used in the mobile devices and automotive industry. Supported standards include SCOMO and FUMO, which allows software components management and firmware update of the target devices.

- **JavaME devices**
  For management of devices based on Java ME.

- **REST-based device adapter**
  Connecting and managing remote devices over RESTful HTTP protocol

- **MQTT device adapter**
  A management solution for MQTT-enabled devices.

### 4.9 Bosch IoT Remote Manager APIs

- **Java (Remote Access Client)**
  This API is in the form of a Java library providing any external Java based application/system with remote interface to the Bosch IoT Remote Manager.
**REST**
To provide a universal access to its functionality and to avoid the requirement of using proprietary Java APIs, the system exports Web Services for its main services such as device management, user management, access to the Software Repository, etc.

**WebSocket**
The Bosch IoT Remote Manager provides WebSocket based API for event push notifications.

### 4.10 Certificate Management

The Bosch IoT Remote Manager includes a common certificate management module, which maintains private keys and certificates, as well as trusted certificates.

There are different certificates (own and trusted) specified for the different interfaces of the Bosch IoT Remote Manager - e.g. for Bosch IoT Message service, for the HTTP server, for backend API access, and for user authentication.

### 4.11 User Management

Functionality for management of users and groups that can access the Bosch IoT Remote Manager system and their access permissions.

- **User Account Management**
The Bosch IoT Remote Manager includes functionality for creating of user accounts and user groups and for assigning the access rights on a user and/or user group level. The user accounts are used for getting access to the Bosch IoT Remote Manager through the GUI console applications and for accessing the APIs of the Bosch IoT Remote Manager.

- **User Authentication**
The Bosch IoT Remote Manager supports basic (username/password based) and secure (based on personal user certificates) authentication methods.

- **User Access Control**
The Bosch IoT Remote Manager restricts access to the management actions on devices by means of "user groups". In addition users may have "general view/management rights", or "view/management rights limited on specific nodes".
4.12 Management Console - GUI

The Bosch IoT Remote Manager provides system operators/administrators with powerful interactive GUI for performing of system administration and remote device management and monitoring tasks.
Chapter 5 – The Bosch IoT Remote Manager – Gateway Scenario

Some of the main strengths of the Bosch IoT Remote Manager are achieved when it is used in combination with gateways running the Bosch IoT Gateway Software stack.

The Bosch IoT Gateway Software provides connectivity to numerous device classes over large set of non-IP and IP-based device protocols.

The combination of the Bosch IoT Remote Manager and the Bosch IoT Gateway Software enables remote monitoring, data collection, and control of all these device classes.

In this scenario, there are five major components:

- **Edge Devices** – sensors, actuators, appliances or a group of devices (e.g. multi-sensor devices)

We define the edge devices as a virtual or physical object that can be connected to the Internet.

- **IoT Gateway** – running Bosch IoT Gateway Software Runtime

Incorporate all types of devices using an IoT gateway. An IoT gateway is an IoT device that lets legacy industrial devices report data using the Internet, as well as enabling technologies or systems with disparate protocols interact with one another.

- **Backend Server** – running the Bosch IoT Remote Manager

Remotely manage all types of devices and realize IoT use cases. Through the Bosch IoT Remote Manager GUI the system operator is able to perform remote administration and monitoring of devices running in different physical locations.

- **Developer Site** – using the Bosch IoT Gateway Software SDK

Develop your own IoT application and logic. The Bosch IoT Gateway Software SDK provides a friendly toolkit for modeling and emulating runtime images, as well as assist the development and testing of software based on the APIs from the runtime.

- **(Optionally) 3rd Party Backend Systems and Applications**

Integrate easily your own business logic and legacy systems. The Bosch IoT Remote Manager enables access to third party systems easy and out-of-the-box.
The Bosch IoT Suite consists of various cloud-enabled services and software packages that enable fast, easy, and secure development of sustainable applications in the Internet of Things.

The Bosch IoT Suite connects devices in different ways. They can be directly connected to the cloud via the Bosch IoT Hub and the Bosch IoT Remote Manager. Alternatively, the Bosch IoT Gateway Software supports indirect connection of devices via gateways (i.e., for data privacy reasons and many other user cases).

Bosch IoT Things allows connected devices to be integrated into cloud services or other applications. The applications can manage their asset data and share it across the IoT solution.

In order to provide you with a seamless solution in the cloud for building your IoT project, we combine the strengths of our cloud services with our proven Bosch IoT Gateway Software, which features tools for development a powerful Java based SDK that consists of Eclipse plugins, OSGi runtime, and OSGi validator.

We have developed and successfully realized remote management use cases such as:

- Firmware & Software Over-the-Air, Diagnostics, and Fleet Management for Mobility
- Smart Metering for Energy
- Predictive Maintenance, Edge Computing, and Remote Monitoring for Connected Industry
- Home automation for Connected Buildings & Smart Home
Chapter 7 – System Requirements

7.1 Remote Management Server(s)

7.1.1 Hardware Requirements

- **RAM:** 1024 MB minimum. 2048 MB or more recommended
- **Disk space:** 400 MB for the Development Edition. The space for the Production Edition depends on selected components. Recommended free space - at least 500 MB

7.1.2 OS & JVM Requirements

The Bosch IoT Remote Manager Server(s) require a **Java SE VM** equivalent to **Oracle/Sun JDK 1.6** or higher. Any OS equipped with such JVM can be used (Linux, Windows, Solaris, etc.)

7.1.3 Supported Database Systems

- Oracle 9i, 10g, 11g
- MySQL 5.0.x, 5.1.x
- PostgreSQL 9.6.2, 9.6.3
- H2 1.1.11 (Note: H2 is included in the RM development/evaluation configuration. We do not recommend using it on production deployments)
- MongoDB 3.4, 3.5

7.2 OSGi Management Agent

7.2.1 JVM/OS Requirements

- Software components, which are installed on OSGi devices on behalf of the RM require J2ME CDC 1.0/Foundation 1.0 compatible JVM

7.2.2 Supported OSGi Frameworks

- Bosch IoT Gateway Software SDK 6.1 or higher
- Apache Felix 2.0, 3.0.6 and 3.2.0
- Equinox 3.5.1, 3.6.1 and 3.6.2

The Bosch IoT Remote Manager should be compatible with any other OSGi Specifications Release 4 or higher framework.
7.3 Management Console

7.3.1 Hardware

- 1024 MB RAM

7.3.2 JVM

- Java SE VM equivalent to Oracle/Sun JDK 1.6 or higher

7.4 Supported Non-OSGi Devices

- OMA DM devices compatible with OMA DM protocol version 1.1 & 1.2
- TR-069 devices compliant with TR-069 protocol (TR-069, TR-069 Amendment 1, TR-069 Amendment 2 and TR-069 Amendment 3).
Chapter 8 – Contact us

Your feedback helps us to continuously improve our products and services. Please send any questions, comments or suggestions for improvement to support@bosch-si.com.

Learn more:

Bosch IoT Remote Manager

Member of the Bosch IoT Suite

Bosch IoT Suite

https://www.bosch-iot-suite.com/remote-manager/

Europe:
Bosch Software Innovations GmbH
Ullsteinstr. 128
12109 Berlin
GERMANY
Tel. +49 30 726112-0
info-de@bosch-si.com
www.bosch-si.com

Asia:
Bosch Software Innovations
c/o Robert Bosch (SEA) Pte Ltd
11 Bishan Street 21
Singapore 573943
Tel. +65 6571 2220
info-sg@bosch-si.com
www.bosch-si.com