Bosch IoT Remote Manager

Device Management and Monitoring for IoT

Version 7.1
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Chapter 1 – About Bosch IoT Remote Manager

In line with our vision **We connect everyThing**, we bring the possibilities of IoT closer to a wider audience. With our ready to use platform Bosch IoT Suite, administrators and developers have all the capabilities they need to manage and build sophisticated IoT applications from top to bottom. They can quickly build, implement, and operate cloud-based and highly scalable IoT applications, which is demonstrated in over 250 international projects already realized.

An essential part of Bosch IoT Suite is its device management service provided by Bosch IoT Remote Manager. It runs on different clouds - Bosch IoT Cloud, Amazon Web Services, Microsoft Azure, and Huawei Cloud (in China), and is also available for on-premises installation.

Bosch IoT Remote Manager is all about remote provisioning, monitoring, and managing 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 a flexible rule engine.

*Figure 1. A realized use case for IoT device management.*
Chapter 2 – Facts and Figures

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

- [Documentation of Bosch IoT Remote Manager on-premises](#)
- [Documentation of Bosch IoT Remote Manager as a cloud service](#)

Free trial

- [Register for a free trial version of Bosch IoT Remote Manager on-premises](#)
- [Subscribe for a one-month free trial of Bosch IoT Remote Manager as a cloud service](#)
## Chapter 3 – Use Cases

### 3.1 Device Management

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

- Device configuration
- Firmware update
- Device monitoring
- Diagnostics and troubleshooting
- Backup & restore of device configuration

![Diagram of device management use case](image)

*Figure 2. A graphical representation of the device management use case.*

### 3.2 Software Management (Application Provisioning)

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

The key elements for software management consist of:

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

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 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 Bosch IoT Remote Manager.

![Figure 5. A representation of the complete software functionality.](image)

Bosch IoT Remote Manager is a modular platform. Each module (package) can be enabled/disabled for a particular setup depending on the functionality required by the customer. Furthermore, the modules are customizable and hence the system can fit each customer specific device management scenario.

Following are short descriptions of all the modules depicted in the graphic.

### 4.1 Device Inventory

- **Device State Storage**
  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 specified criteria e.g. location, business unit, functionality, etc.

- **Device Searching and Filtering**
  Search for a particular device or set of devices matching specified criteria, based on the information that 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 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 commands to devices connected to Bosch IoT Remote Manager for the execution of management / control “actions”. An action is any command supported by the target device, for example 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**
  A mass management operation allows the execution of a set of management actions over a statically or dynamically defined set of devices registered in Bosch IoT Remote Manager. 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 connects again.

- **Rule-based Automation**
  Bosch IoT Remote Manager provides powerful and flexible Management Rule Engine, which allows automatic execution of specified actions upon occurrence of certain 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**
  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 raising notifications about device, application or system malfunctions, which require operator / administrator attention or reaction.

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

**4.5 Initial Device Provisioning**
The initial provisioning supports capabilities for easy discovery of OSGi devices and providing custom optional features to managed devices. It provides a light OSGi device provisioning and configuration mechanism which enables full customization on behalf of system integrators.
The initial provisioning involves downloading a Management Agent Loader whose only task is to select the management agent which is most suitable for the particular OSGi device among the management agents 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 devices through the Management Console is easy with the “Register New OSGi Device” wizard.

**4.6 Remote Access Services**
The Remote Access Services allow external applications to access devices remotely and securely using the existing Gateway Software Protocol connection between the device and Bosch IoT Remote Manager.
The following set of services is available out-of-the-box:
- **HTTP Tunnel**
  Allows external applications (including normal web browsers) to make HTTPS requests to the connected devices / gateways via Bosch IoT Remote Manager.
- **Secure Communication Tunnel**
  Allows establishing of end-to-end TLS connection between remote applications and devices via Bosch IoT Remote Manager. End-to-end means that encryption is handled by the end peers and even 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 Bosch IoT Remote Manager.
- **Remote Events Service**
  A mechanism which allows remote applications to subscribe to and receive events originating from OSGi-based devices / gateways through 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 Bosch IoT Remote Manager.
- **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 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

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, network communication protocols, and management interfaces supported by the device. The interface to the devices of a particular type is provided by a 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 Bosch IoT Remote Manager. The following device types / protocols adapters are supported off-the-shelf:

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

- **TR-069 devices**
  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**
  Bosch IoT Remote Manager supports management of devices over the OMA-DM protocol, defined by the Open Mobile Alliance and 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 the management of devices based on JavaME.

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

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

- **LWM2M protocol adapter**
  A management solution for LWM2M-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 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
Bosch IoT Remote Manager provides WebSocket-based API for event push notifications.

4.10 Certificate Management
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 Bosch IoT Remote Manager - e.g. for the Gateway Software Protocol, for the HTTP server, for backend API access, and for user authentication.

4.11 User Management
A functionality for the management of users and groups which can access Bosch IoT Remote Manager and their access permissions.

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

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

User Access Control
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

Bosch IoT Remote Manager provides system operators / administrators with powerful interactive **graphical user interface** for performing of system administration and remote device management and monitoring tasks.

A detailed description for all possible system and device management tasks is found in the User Guide sections of the online documentation.

*Figure 6. A Bosch IoT Remote Manager instance initial dashboard.*
Chapter 5 – The Bosch IoT Remote Manager – Gateway Scenario

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

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

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

![Figure 7. An end-to-end scenario for connecting and remote management of a variety of edge devices.](image)

In this scenario, there are five major components:

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

  Connect a number of edge devices. An edge device is a virtual or physical object that can be connected to the Internet.

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

  Incorporate all types of devices using an IoT gateway. An IoT gateway is a physical device or software program that serves as the connection point between the cloud and controllers, sensors and intelligent devices.

- **Backend Server** – running 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 assists 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. Bosch IoT Remote Manager enables access to third-party systems easily and out-of-the-box.
Chapter 6 – Part of Bosch IoT Suite

**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.

Bosch IoT Suite connects devices in different ways. They can be directly connected to the cloud via Bosch IoT Hub and Bosch IoT Remote Manager. Alternatively, 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**.

*Figure 8. The Bosch IoT Suite complete offering.*
Chapter 7 – System Requirements

The system requirements described in this chapter apply to the on-premises version of Bosch IoT Remote Manager.

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

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

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)
- MQTT-enabled devices
- LwM2M-enabled devices
Chapter 8 – Contact us

Your feedback helps us 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 Bosch IoT Suite

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