IBMS Specification

Specification & Design Guideline for Integrated Intelligent Building Management System

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Specification for Integrated Intelligent Building Management System

INDEX

1 Introduction

What is IBMS? - Why is IBMS an advantage? - Purpose and scope of this document.

IBMS stands for “Integrated Building Management System”. An Integrated Building Management System is a single, comprehensive building management system for HVAC, lighting, security, fire and other systems.

The Building Management System (BMS) can be defined as the system installed in buildings that controls and monitors the building’s mechanical and electrical equipment, such as heating, cooling, ventilation, and lighting. These systems typically represent 70% of a building's energy usage. Obviously, the role of BMS is crucial in management of the building’s energy demand.

Beyond controlling the internal environment of the building, the IBMS (“Integrated Building Management System”) covers also access control, intruder alarms, video surveillance, monitoring of fire alarm system and other systems as applicable. IBMS can be referred to as the Integrated BMS and Security System; the single, uniform system for building management.

Application of full IBMS brings the benefits of better indoor comfort, energy efficiency, safety and security, and most importantly, better management of all the systems under the unified system. IBMS supports efficient functional system integration and provides maximum flexibility to support any future changes in the building use.

This document describes the essentials of IBMS comprising the following elements:

- Building Automation System (BMS)
- Lighting Control System
- Access Control & Intruder Alarm System
- Video Surveillance System
- Monitoring & Control Software: The Building Operating System (BOS), providing the comprehensive monitoring & integration platform for IBMS

2 System Architecture

2.1 Overall Architecture of IBMS

The Integrated Building Management System (IBMS) shall incorporate industry standard operating systems, communication networks and protocols. The system shall be designed to be completely modular in structure and freely expandable at any stage.

To ensure fault tolerant operation and robust system design, the system shall incorporate distributed control techniques and apply principles of distributed intelligence whenever applicable.

The overall system architecture comprises the following logical layers:

- Management Layer for system monitoring and management
- Control Layer for intelligence of the system
- Field Layer for industry standard sensors, actuators, peripherals etc.

Each layer of the system shall operate independently of the next level up, in order to allow for fault tolerant system functionality. Most importantly, the Control Layer shall operate independently without support from the Management Layer.

It shall be possible to integrate BMS systems with security systems as specified in this document. The system shall enable remote monitoring, connectivity and value-adding services.

The system shall incorporate integrated BMS and Security Systems as described in this document.

2.2 Principles of System Integration

To create comprehensive IBMS and to provide uniform view to all systems, the monitoring & control software shall utilize the generic Building Operating System (BOS) platform that supports integration and interoperability of building systems. Sub-systems to be monitored shall be integrated on software level through the Building Operating System (BOS) platform.

The Building Operating System (BOS) expands through drivers to existing and future industry standard protocols, including e.g. BACnet, LonWorks, Modbus, M-Bus, OPC, Ethernet TCP/IP and Internet communication technologies.

3 Building Automation / Building Management System

3.1 General

Building Automation System (BAS/BMS) comprises the control and monitoring functionality of mechanical (heating, ventilation and air conditioning) and electrical systems in a building. The core functionality of Building Automation keeps the building climate within a specified range, provides lighting based on schedule and/or occupancy, monitors system performance and device failures, and provides notifications to building engineering staff.

The typical scope of BAS/BMS contains control and monitoring of mechanical and electrical systems, including cooling/heating system, ventilation system, pumps, tanks, lifts, lighting controls and often also consumption metering.

To achieve full benefits of functionally integrated BMS, the Lighting Control System shall be implemented as part of Building Automation / Building Management System, using smart controllers that shall be connected to the same field bus as BMS controllers.

The BMS controllers and the Unit controllers shall be connected to the monitoring and control software through the BOS platform.

To create comprehensive IBMS and to provide uniform view to all systems, Building Automation / Building Management System shall be integrated with security and safety systems through the Building Operating System (BOS) platform.

3.2 BMS Controllers

The mechanical and electrical systems shall be controlled and monitored by smart BMS controllers connected to an industry standard field bus. The BMS controllers shall provide for capability of control and monitoring of all mechanical and electrical systems, including cooling/heating system, ventilation system, pumps, tanks, lifts, and lighting controls at the minimum but not limited to above mentioned systems.

BMS controllers shall include the full intelligence for system functionality and to be capable of operating independently without interference from any master controllers or management applications.

BMS controllers shall support distributed intelligence and centralized system designs alike. It shall be possible to distribute BMS controllers at electrical switchboards or cabinets close to the controlled system to minimize cabling.

To achieve better fault tolerance and robust functionality, systems with centralized master/zone controllers shall not be accepted. Each controller shall be capable to function in a stand-alone manner and able to communicate with other controllers without any master controllers.

Each BMS controller shall contain a 32-bit processor and standard field bus connectivity. Communication between BMS controllers shall be event based, peer-to-peer real time communication. The field bus topology shall be flexible supporting at least bus, star and free topologies.

Any failure problem in communication bus should not affect the operation of the controller.

BMS controllers shall be capable of using both 24VAC and 24VDC as operating voltage. BMS controllers shall support user friendly operation and maintenance by having clearly visible LED:s in the front panel to indicate status of the controller and status of its I/O points.

Each BMS controller involved in process controls shall contain flexible I/O points (each controller including a set of universal inputs and outputs, optimally 10 I/O in each) with freely configurable software functions. Each controller shall be capable of handling I/O point belonging to different systems to enable flexible distribution of I/O points throughout the whole system.

The I/O points shall support the following features.

UI (Universal Input):

- DI: Digital input, potential free contact
- AI: Analog input, standard measurements 0-10 VDC (or 4-20 mA), PT1000 or Ni1000-LG

UO (Universal Output):

- DO: Digital output, open collector
- AO: Analog output, 0-10 VDC control

It shall also be possible to receive impulses to BMS controllers from electricity, water and energy (BTU) meters to enable consumption metering as part of BMS. Metering devices shall provide impulse outputs to be connected to BMS controllers.

The BMS controllers shall include freely configurable software functions to implement complex engineering system process controls. These functions shall include PID controllers and thermostat (ON/OFF controller) functions for implementing the control loops used in process controls, as well as sequencing functionality for sets of devices controlled in sequence (e.g. pumps, fans). Logical functions (for example AND and OR logical gates) shall be integral part of the configurable software in the BMS controllers.

BMS controllers with scheduler objects for time schedulers must have a RTC (Real-Time Clock) included in hardware level. It shall utilize an automatically recharging energy source (for example supercap). No battery based RTC solutions shall be approved. Time shall be kept for at least 72 hours while the primary power supply of the controller is unavailable.

The BMS controllers shall have detachable, numbered connection strips for easy installation. The BMS controllers shall support mounting in DIN rail. Manufacturing of BMS controllers shall comply with ISO-9001 and ISO-14001 standards.

Configuration of BMS controllers shall be done through a graphical system configuration tool, which shall be compatible with the Building Operating System (BOS). The tool shall produce a BOS compatible XML document, which can be used as such as part of the configuration of the BOS.

3.3 Room Automation and Unit Controllers

The BMS system shall contain a selection of Unit Controllers applicable for Room Automation and Unit Controls. The Unit Controllers shall communicate on a standard field bus.

Unit Controllers for Room Automation shall be used as autonomous controllers containing the control functionality for rooms and zones. Each Room Automation controller for shall be capable of controlling temperature, air quality (CO2) and lighting in the room or zone.

Unit Controllers for Unit Controls shall be used as autonomous controllers containing the control functionality for Fan Coil Units and Split Units.

The FCU controller shall automatically change the FCU motor speed based on temperature deviation. The FCU controller shall regulate the cooling valve to meet the desired temperature conditions.

The Split Unit controller shall automatically change the fan speed of the indoor unit based on temperature deviation. The Split Unit controller shall regulate the compressor to meet the desired temperature conditions.

Unit Controllers shall communicate on standard field bus and shall be integrated with BMS system to enable energy optimization and reporting.

3.4 Field Devices

Field devices shall be connected to BMS controllers using the common industry standards:

- PT-1000 for temperature
- 0-10 V for other sensors and actuators
- Potential free contacts for ON/OFF indications and push buttons
- 24 V relays for ON/OFF controls
- Impulses for consumption metering

To guarantee openness, flexibility and cost-efficient maintenance of systems, the field devices shall not include independent control logic. The subsequent chapters present examples of sensor types.

3.4.1 Temperature Sensors

Temperature sensors shall meet the following requirements:

- Pt1000 type resistance temperature detector
- 24 VAC/DC power supply
- 0-10 VDC output
- Electronics accuracy of +/-0.1% of span

Room type sensors:

- Operating temperature range of 0°C to 50°C

Duct type sensors:

- Operating temperature range of 0°C to 70°C

Outdoor type sensors:

- Operating temperature range of -45°C to 85°C

3.4.2 Relative Humidity Sensors

Humidity sensors shall meet the following requirements:

- 0-10 VDC output proportional to relative humidity range of 0% to 100%

- 2% accuracy
- Reverse voltage protected and output limited

Room type sensors:

- Operating temperature range of 0°C to 50°C

Duct type sensors:

- Operating temperature range of 0°C to 70°C

Outdoor type sensors:

- Operating temperature range of -45°C to 85°C

3.4.3 CO2 Sensors

Carbon dioxide detection sensors shall meet the following requirements:

- 0-10 VDC output, proportional to 0 to 2000 ppm of carbon dioxide concentration
- Standard accuracy to be 3% of reading or 75 ppm, whichever is greater
- Operating temperature of 0°C to 50°C

3.4.4 CO Sensors

Carbon monoxide detection sensors shall meet the following requirements:

- 0-10 VDC output, proportional to 0 to 300 ppm of carbon monoxide concentration
- Standard accuracy to be 5% of reading or 5 ppm, whichever is greater
- Operating temperature of 0°C to 50°C

3.4.5 Differential Pressure Sensors

Air differential pressure sensor shall meet the following requirements:

- Output shall be 0-10VDC output proportional to pressure input range
- Select range as required, taking into consideration pressure drop across filter or coil. Typically 0 to 500pa range for low-pressure commercial duct.
- Operating temperature range of 0°C to 60°C

Water differential pressure sensors shall meet the following requirements:

- Output of 0-10 VDC proportional to the pressure sensed
- Momentary over pressure protection of five times the rated input
- Operating range shall be suitable for the application. Select range such that it covers from zero differential pressure up to a differential static pressure of between 20% to 50% in excess of the maximum static pressure that could be encountered
- Accuracy of better than 1% of full-scale reading

3.4.6 Air Differential Pressure Switches

Air differential pressure switches shall meet the following requirements:

- Field adjustable range from 50pa to max range of device
- Select range as required, taking into consideration pressure drop across filter or coil. Typically 0 to 500pa range for low-pressure commercial duct.
- Temperature range of –40°C to 82°C
- Automatic reset

3.5 Monitoring & Control Software

To create comprehensive IBMS and to provide uniform view to all systems, the monitoring & control software for BAS/BMS shall utilize the generic Building Operating System (BOS) platform that supports integration and interoperability of building systems.

The Building Operating System (BOS) shall contain a full set of features and functionalities in order to serve as the Monitoring & Control Software (SCADA) for the BMS system.

Detailed requirements for the BOS platform are described in chapter “Monitoring & Control Software” of this specification.

4 Lighting Control System

4.1 General

Lighting Control System comprises control functionality of lighting systems in a building, indoor and outdoor alike. Lighting control systems serve to provide the right amount of light where and when it is needed.

To achieve full benefits of functionally integrated BMS, the Lighting Control System shall be implemented as part of Building Automation / Building Management System, using smart controllers that shall be connected to the same field bus as BMS controllers.

4.2 Controllers

The Lighting Control System shall be controlled and monitored by smart controllers connected to an industry standard field bus. The controllers shall be connected to the same field bus as BMS controllers.

The controllers shall support lighting controls based on push-button controls, illumination, time schedules and based on occupancy, with a definable off delay. The controllers shall support definition of lighting scenes and lighting groups. The lighting groups and scenes shall be flexible to modify at all times.

The system shall contain separate interface relays for on/off controls, in order to be able to change the interface relays without having to replace the controller. It

shall be possible to control the lights on/off also direct from the interface relay for e.g. testing purposes.

Controllers shall include the full intelligence for system functionality and to be capable of operating independently without interference from any master controllers or management applications.

Controllers shall support distributed intelligence and centralized system designs alike. It shall be possible to distribute controllers at electrical switchboards or cabinets close to the controlled system to minimize cabling.

To achieve better fault tolerance and robust functionality, systems with centralized master/zone controllers shall not be accepted. Each controller shall be capable to function in a stand-alone manner and able to communicate with other controllers without any master controllers.

Each controller shall contain a 32-bit processor and standard field bus connectivity. Communication between controllers shall be event based, peer-to-peer real time communication. The field bus topology shall be flexible supporting at least bus, star and free topologies.

Any failure problem in communication bus should not affect the operation of the controller.

Controllers shall be capable of using both 24VAC and 24VDC as operating voltage. Controllers shall support user friendly operation and maintenance by having clearly visible LED:s in the front panel to indicate status of the controller and status of its I/O points.

Each controller shall contain flexible I/O points (each controller including a set of universal inputs and outputs, optimally 10 I/O in each) with freely configurable software functions. Each controller shall be capable of handling I/O point belonging to different systems to enable flexible distribution of I/O points throughout the whole system.

The I/O points shall support the following features.

UI (Universal Input):

- DI: Digital input, potential free contact
- AI: Analog input, standard measurements 0-10 VDC (or 4-20 mA), PT1000 or Ni1000-LG

UO (Universal Output):

- DO: Digital output, open collector
- AO: Analog output, 0-10 VDC control

The controllers shall have detachable, numbered connection strips for easy installation. The controllers shall support mounting in DIN rail. Manufacturing of controllers shall comply with ISO-9001 and ISO-14001 standards.

Configuration of controllers shall be done through a graphical system configuration tool, which shall be compatible with the Building Operating System (BOS). The tool shall produce a BOS compatible XML document, which can be used as such as part of the configuration of the BOS.

The controllers shall be connected to the monitoring and control software through the BOS platform.

4.3 Monitoring & Control Software

To create comprehensive IBMS and to provide uniform view to all systems, the monitoring & control software for Lighting Control System shall utilize the generic Building Operating System (BOS) platform that supports integration and interoperability of building systems.

The Building Operating System (BOS) shall contain a full set of features and functionalities in order to serve as the Monitoring & Control Software (SCADA) for the Lighting Control system.

Detailed requirements for the BOS platform are described in chapter “Monitoring & Control Software“ of this specification.

5 Access Control & Intruder Alarm System

5.1 General

The Access Control and Intruder Alarm System controls physical access to premises and detects unauthorized access. The Access Control and Intruder Alarm System shall be implemented as one unified system as described in this section.

Access Control and Intruder Alarm System shall be implemented with smart Network Controllers and Interface Panels.

Users can be classified so that they have access only to the spaces they are allowed to enter according to programmed time schedules.

Intruder alarm system shall include perimeter protection and indoor surveillance. Monitored doors and windows shall be equipped with magnetic contacts. Movement detectors used in indoor surveillance shall be sensitive enough for presence detection of a single person, so that they can also be used for lighting controls and air-conditioning controls.

The Access Control and Intruder Alarm System shall use the Building Operating System (BOS) platform as the Security Management System. It shall be possible to integrate the Access Control and Intruder Alarm System with BMS through the Building Operating System (BOS) platform.

To create comprehensive IBMS and to provide uniform view to all systems, Access Control and Intruder Alarm System shall be integrated with Building

Automation / Building Management System and Video Surveillance System through the BOS platform.

5.2 Controllers and Interface Panels

The access control and intruder alarm system shall be controlled and monitored by smart Network Controllers and Interface Panels. Access control and intruder alarm system shall function independently without Management Layer. To achieve this, system shall support distributed intelligence located in Network Controllers or Interface Panels. The controllers shall include the full intelligence for system functionality and to be capable of operating independently without interference from management applications.

The Network Controllers shall be connected to the Security Management System through the BOS platform.

5.2.1 Network Controller

The Network Controller shall contain the full intelligence for system functionality, with access control processing for up to 32 interface panels. Each controller shall contain a 32-bit processor running the Linux Operating System. The Network Controller shall make all online door decisions, input monitoring and output control for connected interface panels.

The Network Controllers shall connect with BOS Software through industry standard TCP/IP protocol, over 10/100 Mbps Ethernet or over Internet.

The controller shall be capable of processing real time commands received from the BOS Software.

The Network Controller shall connect with Interface Panels through two independent RS-485 networks, each network having two sets of input connections for optimum system topology. This architecture minimizes the impact on corporate LANs by using only one TCP/IP address for every 32 interface panels and by handling low-level transactions on the RS-485 network. The controller shall have event buffer of 99,999 events for offline transactions.

Each Network Controller shall contain two on-board inputs and outputs for local input point monitoring and auxiliary output control.

5.2.2 Interface Panels

Interface Panels shall contain at least the following types:

- Interface Panel to connect with two readers through Wiegand interface
- Interface Panel to connect with 16 supervised input circuits
- Interface Panel to connect with 12 relay controllable devices

Interface Panels shall connect with the Network Controller through a high speed RS-485 network.

5.3 Field Devices

The proximity readers shall use Wiegand interface to connect with the Interface Panel.

Field devices shall be connected to Interface Panels using common industry standards.

5.4 Monitoring & Control Software (Security Management System)

To create comprehensive IBMS and to provide uniform view to all systems, the monitoring & control software for Access Control and Intruder Alarm System shall utilize the generic Building Operating System (BOS) platform that supports integration and interoperability of building systems.

The Building Operating System (BOS) shall contain a full set of features and functionalities in order to serve as the Security Management System for the Access Control and Intruder Alarm System.

Detailed requirements for the BOS platform are described in chapter “Monitoring & Control Software” of this specification.

6 Video Surveillance System

6.1 General

Video surveillance shall be implemented with a fully IP based Network Video Recording (NVR) system. The system shall be capable of running on Linux operating system.

It shall be possible to integrate Video Surveillance with BMS using Building Operating System (BOS) as the integration platform.

6.2 NVR integration with Monitoring & Control Software

To create comprehensive IBMS and to provide uniform view to all systems, Video Surveillance System shall be integrated with Building Automation / Building Management System and Access Control and Intruder Alarm System through the BOS platform.

The system shall start recording video stream upon triggering from intruder alarm system, access control system, or any other system integrated to BOS.

The integrated system shall be used through the video surveillance system’s own User Interface Client and also through the integrated user interface of the BMS system.

In addition to the software based user interface, it shall be possible to additionally expand the operator workstation with hardware based keypad and joystick interfaced with the system.

6.3 Cameras

The system shall include compliant IP cameras for video surveillance.

7 Monitoring & Control Software

7.1 General

The monitoring & control software shall be based on the generic Building Operating System (BOS) software platform that contains the full set of features and functionalities to serve as the Monitoring & Control Software (SCADA) for the fully featured IBMS system, and supports integration and interoperability of various building systems. The BOS software platform shall consist of the BOS Server and User Interface applications.

The BOS Server shall be a genuinely scalable solution, based on modern software architecture and technologies, and its core applications shall be implemented using industry standard Java technology. The software shall be capable of running on both Windows and Linux operating systems.

The BOS Server shall support industry standard operating systems, networks and protocols. The system shall support industry standard protocols, including at least BACnet, LonWorks, Modbus, M-Bus, OPC, Ethernet TCP/IP and Internet communication technologies. These protocols shall be supported on software level without need for external gateways.

Web UI application and Client UI application shall both be supported as User Interface applications. The BOS platform shall support a true Client-Server architecture, enabling the server application to be run separately from the client application. Whenever required, it shall also be possible to run both applications on the same computer. Client connections to the server must utilize TCP/IP network (e.g. LAN, Internet). The server application shall be able to handle many simultaneous client connections from a number of workstations. The BOS platform shall allow for usage through a standard Internet browser.

It shall be possible to run the BOS Server as a Windows service or Linux daemon service. It shall be automatically started upon booting of the server computer. The application shall be capable of logging application level events to operating system's system log.

The internal software architecture of the BOS Server shall support service oriented architecture, enabling adding and removing of the BOS services during the life cycle of the project. BOS Server application shall be a software product that is configured for each project. It is not allowed to have a project specific application code, thus it shall not be necessary to compile any server application code for the project.

The BOS Server shall offer an application framework consisting of core services and network interface driver services. The application framework shall start and

monitor all these services. It shall also be possible to develop new services to the framework according to the manufacturer's development API specifications. It shall be possible to support new field bus protocols by implementing new network interface drivers.

The BOS Server shall include a SQL database for centralized storage of system events, trends and logs. The SQL database can be run on the same computer or in a separate computer.

The system shall include centralized alarm dispatching features for all connected systems, using e.g. SMS and email. The system shall support triggering of functions based on the events from the other connected systems.

The BOS Server shall be configurable using a dedicated application, e.g. a Server Manager Tool. It shall be possible configure the Server Application, which is installed to the same computer, or the remotely accessed server using SSH connection. The Server Manager application shall allow for configuration of the services, users and user rights based on the structured data model of the server. It shall be possible to take a backup of the configurations of the server application using the Server Manager Tool. All configuration must be done using the Server Manager application. No manual editing or manipulation of the server application's configuration files is allowed, in order to prevent unwanted error situations that may be visible only during startup.

7.2 Main Features

The BOS platform shall include the following features:

- The systems connected to the BOS shall be monitored with a Graphical User Interface. Web usage and a client application shall be both supported.
- The BOS shall support receiving of real time values, trends, alarms and event logs from the connected systems. Different levels of logs (e.g. warning, error, info) shall be available.
- The BOS shall support modification of set points, time schedules and manual (override) controls in the connected systems.
- BOS shall support an event mapping mechanism for triggering of functions, e.g. starting video recording and turning on lights from events like unauthorised access attempt, or turning 'ON' the Air Conditioning Unit of the room while the employee/person is granted access to the building.
- The BOS shall be modular in structure, consisting of services, which are flexible to add, configure and to update.
- The functionalities of the BOS shall run on the server level autonomously of the user interfaces.
- The BOS shall support multiple operating systems, including Linux and Windows.
- The BOS shall contain an SQL database for storing data.

- The BOS shall contain drivers to industry standard field buses and shall support third party device integrations.
- The BOS shall contain a Data Model describing the structure of the building and the control systems.
- The BOS shall support high-availability systems with a failover server.

7.3 Data Model

The BOS Server shall contain a Data Model describing the structure of the building and the control systems. The data structure of the BOS Server shall be based on XML data model, which includes modeling of building structure, systems and devices in a standard manner.

The data model shall describe the structure of the building and the control systems, including devices and functions. The model shall include two main sections: the first section contains model of the real world (e.g. building structure) and the second models abstract items (e.g. control systems).

The data model shall define at least the following elements:

- Structure of building - floors, spaces, etc.
- Control systems – AHUs, heating system, access control, etc.
- Devices – fans, pumps, doors, cameras, etc.
- Effect areas of devices

The data model shall be transferred to BOS Server as XML files, describing the building structure and the control model. The XML schemas shall define the structure and elements used in these files.

7.4 Database

The BOS Server shall come with an SQL database, which shall include ODBC and JDBC drivers. It shall also be possible to use other database engines, in case there are specific needs by the customer's environment.

7.5 Operating System

The BOS Server shall run on Linux (preferred) or on a Microsoft Windows 8 / Windows 7 / Vista / XP, Windows Server 2012 / 2008 / 2003 operating system.

7.6 Standby Server

Whenever there's a special requirement for High Availability (HA), the system shall be equipped with a failover server. The failover server is normally idle, monitoring the main server, taking over in case the main server fails.

7.7 Integration Interfaces

The BOS Server shall comprise defined interfaces for systems and applications to be connected with the platform. The interfaces shall include interfaces as follows:

- A System Interface to allow different systems to be connected with the BOS Server using Network Interface Drivers and Device Drivers.
- An Enterprise Interface to allow a variety of applications and services to be produced and connected with the BOS platform and accessing all connected systems. The Enterprise Interface shall enable value-adding services that require accessing the connected building systems.

7.7.1 System Interface

The System Interface shall allow any system to be integrated with the BOS Server. The interface shall consist of Network Interface Drivers and Device Drivers.

Network Interface Drivers shall enable communication with external systems and devices utilizing a variety of media and protocols, such as BACnet, LonWorks, Modbus, M-Bus, OPC, Ethernet TCP/IP and Internet communication technologies.

Network Interface Drivers shall be services of the BOS Server to provide general access to different field buses. Other services of the BOS Server (e.g. device drivers) can utilize the access provided by Network Interface Drivers.

The Device Drivers shall allow integration of different systems/devices with the BOS Server.

7.7.2 Enterprise Interface

The Enterprise Interface shall allow different applications to access the BOS Server connected systems and to receive information from connected systems. The interface shall utilize the latest Web Services technology, e.g. REST. All communication shall be implemented in standard XML or JSON format. External applications shall be able to give commands to the connected systems and to receive information via Enterprise Interface to/from all connected systems.

The Enterprise Interface shall include the following main functionality:

- Requesting and modifying Data Point values
- Requesting and modifying alarm events (e.g. acknowledge, comment)
- Requesting history events (trends, logs)

For example, Data Point values can convey the following types of information:

- Measured values of e.g. temperature, humidity, pressure, CO2, CO; i.e. any type of measurement
- Indications of any type from any connected system

- Metering values of water consumption, electricity consumption, energy consumption
- Other similar data to/from connected systems

It shall be possible to integrate any type of external application with connected building systems using the Enterprise Interface. The interface shall allow for getting and modifying any data from connected systems to any 3rd party applications.

Integration using the BOS Server shall allow production of value-adding services for all connected systems in a coherent manner, including but not limited to e.g. the following services:

Alarm monitoring:

- Maintenance alarms
- Intruder alarms
- Fire alarms
- Advanced video monitoring
- All alarms trigger corrective action

Energy optimization and trending:

- Setpoint adjustment
- Control optimization
- Trending
- Preventive maintenance

Remote diagnostics of connected devices:

- Immediate feedback from all devices
- Quick replacement of faulty units
- Regular SW updates

Access rights managment:

- Physical access rights
- Virtual access rights

8 User Interfaces

8.1 General

User Interfaces shall provide access to connected systems through the BOS platform. The User Interfaces shall be available both as a Web Application and as a Java based client application. The client application is recommended for professional usage and central monitoring applications.

8.2 Client User Interface Application

The system shall enable a client-based User Interface for professional usage and for central monitoring of systems. The User Interface client shall allow for at least the following:

- Alarm monitoring and alarm handling by multiple operators
  - Intruder alarms
  - Fire alarms
  - Alarms from electrical and mechanical systems
  - System maintenance alarms
  - Video monitoring
- Remote diagnostics, energy optimization and trending
  - Set point adjustment
  - Control optimization
  - Trending
  - Remote diagnostics of system/devices
  - Preventive maintenance
  - Consumption reports for energy management and billing
- Logs and reporting
- User profile and role management
- Access rights management

The User Interface shall contain system views, floor plan views, trend view, alarm views and event log views. The User Interface shall include an automatically adapting tree structure of the building, building's parts, individual spaces, different systems and parts of systems. The tree structure can be used for navigation through the system.

All systems connected to BOS platform can be accessed through the same graphical User Interface. The User Interface must be available as a Java based client application, which can be installed to unlimited number of remote computers or laptops. The client software shall allow for remote Internet usage of several sites using the same application.

For local and remote web usage, BOS platform installation shall include an embedded web server, which provides information for users accessing the system with a standard web browser.

8.3 Web User Interface Application

The User Interface shall also be available as a Web Application, having the same main features as the Client Applications.

8.4 Graphical Pages

All monitored data shall be displayed on the graphical pages of the User Interface. It shall be possible to display all kinds of data (analogue, digital, soft points) simultaneously.

All changes made by the operator (e.g. set point changes) shall be logged and identified by both operator name and time stamp. All real-time data shall be integrated with schematic view of the system and displayed on graphical pages to enable easy and efficient monitoring of all systems in the building.

The User Interface shall include a template and symbol library that can be used in creation of system schematics and graphical pages. The library shall include a variety of components, including labels, static images, dynamic images and link buttons.

It shall be possible to use bitmap images (jpeg, gif, png, bmp) as background images of the system, e.g. floor plan views of system views. Graphical objects can be arranged in relation with each other (bring front, send back).

Graphical pages shall be arranged as a tree structure. Links shall be created between the pages to ensure easy and fast access to all needed systems during the operation.

Functional components shall be attached with a dialogue, which provides for a more detailed view to the controlled item and allows for changing related parameters in a separate dialogue window.

It shall be possible to launch applications (such as Microsoft Word, Excel, custom help files or any third party applications) from a graphical display. If supported by the application, it shall be possible to launch the application with a specified file opened within the launched application.

8.5 Alarms

The BOS platform shall include an alarm handling mechanism for connected systems.

Alarms shall be displayed in chronological order on the Alarm lists. In addition, it shall be possible to define an optional audible annunciation with user selectable audio file. Alarming points can also include operator instructions as free-form text. Operator can acknowledge alarms either one by one or several at one time.

Alarm lists shall be shown as separate tabs, including Active Alarms, Handled by Me, Handled by Others and Acknowledged Alarms. The operator can accept an alarm into his/her handling process, and the alarm is then removed from the main list of Active Alarms.

The status of alarms shall be indicated with the following colors.

- RED - alarm is activated, unacknowledged
- YELLOW - alarm is inactivated, unacknowledged
- GREEN - alarm is activated, acknowledged
- GREY - alarm is inactivated, acknowledged

Alarm list shall include also the Alarm History Browser feature, which enables queries to system wide alarm database covering all present and past alarms. This feature can be used for trouble-shooting and auditing.

The Alarm list shall include an advanced linking feature. Each alarming point shall be automatically equipped with a link to guide the operator straight into the alarming point in any of the graphical views. The alarming point shall be temporarily highlighted to guide the user to the correct point on the graphical view.

8.6 Trending

The BOS platform shall provide a trending view containing multiple trends on the same graph. The user can define the points to be trended and the trending interval. Analogue values shall be shown as line graphs. Discrete and on/off values shall be shown as bars.

The user can define which of the trended points are shown in the trending view. It shall be possible to export the trend view as CSV file for utilization by external applications.

The trend view shall enable zooming to enable precise investigation. The visible period shall be possible to select freely. Shortcut buttons shall be also available to select predefined periods, e.g. 1h, 12h, 24h. Each line graphs shall be distinguished with colors.

8.7 Event Logs

Event log shall store all control events that are initiated from the graphical User Interface by the operator. Each log event shall include event time, user name, controlled point and value.

It shall be possible to export event logs as CSV file for utilization by external applications.

The log shall also include a link to the controlled point to guide the operator straight into the point in any of the graphical views.

8.8 User Rights Management

The BOS platform shall include a comprehensive user rights management engine for creating and managing users. Each user shall have a user name and a dedicated password for logging into the system.

Each user shall have one or several User Roles with predefined rights for Reading, Writing and Alarm Receiving. Role definitions can be applied on system scale, device scale or on global scale. It shall be possible to define exceptions to the predefined rights for any level of the Data Model.

Typically all users shall share the same User Interface view, but it shall also be possible to define and create a customized User Interface view for each user.

8.9 Operator Workstation Hardware

Ensure that the processor speed of each operator workstation meets the data processing requirements.

Recommended: Intel dual core processor, minimum: 2.8 GHz. Use a color monitor with resolution no less than 1280x720 (HD). The operator workstation shall be equipped with keypad and mouse. Multiple monitors are recommended for IBMS systems with a wide scope and scale.

------END OF SECTION------