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Integrated Building Information Service through Building Services Gateway

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BSG related systems, components and technologies

Building technical systems
- Air conditioning
- Water supply
- Heating
- Cooling
- Lighting
- Electricity
- Tele
- Data
- Antenna system

Building automation (BACS)
- Safety and security
- Fire alarm system
- Smoke control system
- Fire extinguishing system
- Access control
- Elevators
- Special systems
- Domestic appliances
- Entertainment

Building field busses (wire and wireless)
- Physical networks: twisted pair, tele, electrical, wireless

Sensor technologies
- Data transfer & GW: proprietary, IP, Lon, Konnex, BACnet, ...

Building Service Gateway (BSG):
- based on integrated BIM & BACS data

Users:
- Building information
- Terminal devices:
  - Applications for efficient, economical, high performance, productive buildings and related new life cycle services

Internet, 3G, Web services

Life cycle
- BIM
  - Up-to-date building information

DB, CAD, IFC
BSG related applications

• The goal is to make possible to develop applications supporting efficient, economical, high performance, productive buildings and related new life cycle services
  • Building performance contracting
    • Measure, monitor, and verify building/floor/space/system/component level performance
      • guaranteed temperature, CO2 and illuminance levels etc.
  • Online commissioning
  • Energy management services
    • ESCo (Energy Service Company)
    • Measure, monitor, and verify building/floor/space/system/component level energy savings
      • Guaranteed energy savings
      • Energy efficiency of heating, lighting, air conditioning, ...
  • Building predictive maintenance
  • Location based application
    • space geometry, components location, space and component BIM and BACS information
    • user location
  • Ambient intelligence based applications
    • Services for people inside or near the building
  • ...
BSG related information

• BSG will enable standard based access to integrated real-time (BACS) and static (BIM) building information

• Examples of BACS related information
  • real time values (temperatures, energy consumption, etc.)
  • status information (on, off)
  • historical data
  • controls
  • alarms

• Examples of BIM related information
  • site, building, structures, spaces
  • building elements (walls, doors, roofs, stairs, openings, …)
  • relations between building elements
  • HVAC (fans, heat exchangers, valves, etc.), control (sensors, controllers, actuators, meters, etc.), electrical, fire protection and sanitary elements etc.
  • systems (piping, ducting etc.)
  • network topology (element connectivity), service history etc.
  • actors, work plans, costing, time series, constrains (requirements, rules)
  • geometry, drafting
I3CON building information systems architecture
based on Service Oriented Architecture (SOA)

- SOA approach has been adapted also in the main standards (BACnet Web services and oBIX) for interfacing building automation systems with higher level building management and enterprise systems
- Well-defined services enable different applications to utilize the information provided by different systems without knowing details of these systems and technologies behind the service interface
BSG related systems and connections
BSG – Implementation Requirements

- The main SOA related implementation requirement for BSG is
  - BSG must support BACS and BIM Web services
- Main contribution is focused to
  - standard based building automation web service technologies like **BACnet Web services**, open Building Information Exchange, **oBIX**, OPC UA
  - BIM web service technologies

<table>
<thead>
<tr>
<th>BACnet web service (addendum c to ANSI/ASHRAE 135-2004)</th>
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<tbody>
<tr>
<td>CString getValue(CString options, CString path)</td>
</tr>
<tr>
<td>CString[] getValues(CString options, CString paths[])</td>
</tr>
<tr>
<td>CString[] getRelativeValues(CString options, CString basePath, CString paths[])</td>
</tr>
<tr>
<td>CString[] getArray(CString options, CString path)</td>
</tr>
<tr>
<td>CString[] getArrayRange(CString options, CString path, unsigned index, unsigned count)</td>
</tr>
<tr>
<td>CString getArraySize(CString options, CString path)</td>
</tr>
<tr>
<td>CString setValue(CString options, CString path, CString Value)</td>
</tr>
<tr>
<td>CString[] setValues(CString options, CString paths[], CString values[])</td>
</tr>
<tr>
<td>CString[] getHistoryPeriodic(CString options, CString path, CDateTime start, double interval, unsigned count, CString resampleMethod)</td>
</tr>
<tr>
<td>CString getDefaultLocale(CString options)</td>
</tr>
<tr>
<td>CString[] getSupportedLocales(CString options)</td>
</tr>
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</table>
Other implementation requirements for BSG are as follows. It must be

- scalable, IP and Web services based
- accessible from a wide range of different kind of clients and terminals like personal computer, PDA and mobile phone
General use case model of BSG service

- BSG services will combine the needed information from/to BIM and BACS using Web services interfaces so that the integration of BIM and BACS data seems seamless to the end user.
- At the first stage BSG will support mainly building life cycle and FM services like space related services, location based services, building lifecycle performance metrics reporting, new value driven services and for advanced use of simulation during the building's lifecycles.
## Example of BSG low level services

<table>
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<tr>
<th>BSG basic services</th>
<th>Description</th>
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| **CString getInstanceByID**  
(CString instanceID, CString scope, CString[] moreInfo, revision) | **Description:**  
- this method returns the instance by given BIM or BACS ID  
**Parameters:**  
- `instanceID` is instance ID in BIM or BACS system  
- `scope` is BIM or BACS  
- `moreInfo` is XML string including possible option BIM WS parameter strings, used BACS standard name etc.  
- `revision` is instance BIM or BACS revision number (optional)  
**Return values:**  
- BIM or BACS instance (ifcXML or BACS xml string)  
**Error messages:** |
| **CString[] getInstancesByType**  
(CString instanceType, CString scope) | **Description:**  
- this method returns all the instances by given BIM or BACS type (example `ifcFan`)  
**Parameters:**  
- `instanceType` is instance type in BIM or BACS data model  
- `scope` is BIM, BACS or ALL  
**Return values:**  
- List of BIM or BACS instances (ifcXML and/or BACS xml string)  
**Error messages:** |
Conclusion 1/2

- A preliminary BSG concept has been introduced
- Further development will be done during the I3CON project
- The main results covered in this paper are
  - I3CON information systems architecture
  - BSG overview
  - BIM and BACS integration overview
  - basics of BSG Web services
- The potential impacts of BSG are based on its enabling real time, integrative building information services for
  - operations & maintenance and enterprise level applications
    - for efficiency, economy and safety & security of building
    - productivity of occupants’ activities
- Quantitative figures on saving potentials are difficult to estimate because the effects are indirect
Conclusion 2/2

• Examples of BSG related services are
  • building performance contracting (guaranteed temperature, CO2 and illuminance levels etc.)
  • energy management services (ESCo - Energy Service Company, etc.)
  • online commissioning
  • building predictive maintenance service
  • location related information services
  • ambient intelligence based applications developed for people inside the building

• A major challenge for BSG is
  • specification and implementation based on standard data models without non-standard model extensions
  • the performance of BIM side interface of BSG