Software Defined Building: Building Automation of the Next Generation

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Overview

1. What are the driving factors for digital buildings?
2. The digital building – Technology of today?
3. Software is the new hardware
4. Light out of the network
5. Security due to decentral structure
World Market for Smart Buildings in bn US$ 

<table>
<thead>
<tr>
<th>Year</th>
<th>Value (bn US$)</th>
</tr>
</thead>
<tbody>
<tr>
<td>2015</td>
<td>7.2</td>
</tr>
<tr>
<td>2016</td>
<td>10.0</td>
</tr>
<tr>
<td>2017</td>
<td>13.8</td>
</tr>
<tr>
<td>2018</td>
<td>19.0</td>
</tr>
<tr>
<td>2019</td>
<td>26.3</td>
</tr>
<tr>
<td>2020</td>
<td>36.4</td>
</tr>
</tbody>
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Growth 38% p.a.

Source: Smart Building Markets Global Forecast to 2020, marketsandmarkets.com
The Smart City
as a driver for Smart Building

- Spreading of sensor technology in industry, commercial and consumer market
- Protection of environment and resources
- Development of automation of lighting, heating, climatisation and ventilation
- New infrastructure platforms and services
- Energy efficiency
- Urbanisation
- Internet / Cloud
- Comfort
- Security (digital and physical)

- New mobility, working worlds
- Interaction of things, buildings, humans and machines
- Increased demand for security due to higher risk potential
What are the drivers for Digital Buildings?

- ECONOMIC EFFICIENCY
- SECURITY
- COMFORT
- FLEXIBILITY
Energy Consumption

and the optimization opportunity

• Worldwide, buildings account for 40% of total energy consumption and contribute a corresponding % to overall carbon emissions
• In the US alone, businesses spend about US$100 bn on energy for their offices every year
• Smarter buildings could save (in the US) US$20-25 bn in annual energy costs.
Energy Consumption

Deutsche Gesellschaft für Nachhaltiges Bauen (German Society for sustainable building)
Certificates in Platin, Gold, Silver and Bronze.
40 criteria for sustainability out of 6 fields
• Ecology
• Economy
• Social, cultural and funct. aspects
• Technology
• Processes
• Location
Assessment Criteria
(German Society for Sustainable Building)

ECO1.1 Building related cost over life cycle
Target is a reasonable and consciously use of the economic resources economic resources during the whole life cycle of a building.

ECO2.1 Flexibility and conversion of use
Target is to design the building as flexible as possible and to reach a maximum conversion capability.

TEC1.4 Ability to adapt of technical systems
Target is to plan the technical systems in a building in that way that it is possible to adapt them with minimal efforts to changed terms of use or respectively technical innovations.

SOC1.5 Influence of the user
Target is to offer the user a maximum influence for the room conditioning in terms of ventilation, sun screens, temperature and lighting
The Digital Building today

Separate systems for different applications

- Separate networks for data and building automation
- Time-consuming planning, commissioning, maintenance, adaptation
- Security not existing
The convergence of the IT and building automations systems

Traditional solution: Individual networks

Future solution: Intelligent IP standard network
Smart Building Systems

**Decentral architecture**
- Room based control
- Central monitoring

**Simple installation**
- Room by room

**High reliability**
- Room operates partially autonomous
The digital Building of the Future
One network for all applications

- Secured isolated data streams
- Simple and quick provisioning of new services
Flexibility

Evolution of the light switch

Simple light switch
- only hardware
- fixed cabling

Digital light switch
- system solution
- programmable comfort functions

Smart Building System
- networked and virtual
- function defined by software
SOFTWARE determinates function and added value

HARDWARE is commodity

SOFTWARE is the new HARDWARE
Economic Efficiency
with the example Lighting

Base Innovation 1
LED technology as efficiency engine

Base Innovation 2
Power supply out of the data network
Energy consumption Offices Germany

- Total energy consumption lighting DE: 13,3 TWh
- Lighting: 45% of the total electric power consumption and 13% of the total energy balance

Efficiency of Light Sources

LED is unbeatable

Source: OSRAM
Smart Lighting System
Light provided by the network

Smart Lightiing

Smart Engine
Smart Sensor
Core Switch

Twisted Pair PoE+

Smart Lighting Controller

LED Panel

User

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BICS MIDDLE EAST & AFRICA
Smart Lighting System
Light provided by the network
Smart Lighting System
Light provided by the network

Smart Lighting

- Smart Director App
- Central Smart Lighting Controller
- AC/DC Power Supply: 54 VDC
- Sensor Bus
- LAN
- Twisted Pair (max. 50W)
- LED Panel
- Tunable White LED Panel
- LED Downlight
Smart Lighting System
Light provided by the network

In combination with sensors, light becomes smart
- Automated dimming of light level saves energy
- Presence detection to power down if room is not used
- Follow-Me in corridors, emergency path lighting
- Network authorization to enable light

Lighting is part of the IT and a basic module of the Digital Building

Power-over-Ethernet
54V max. 30W
Smart Lighting System

Light is activated if presence is detected

Smart Director App → Smart Engine → Smart Sensor

- LAN Cable PoE+ 54V/30W
- LED Panel 30W
Smart Lighting System
Automatic dimming for constant ambient light

Smart Engine
Smart Director App
Smart Sensor
LAN Cable PoE+ 54V/30W
LED Panel 30W

Ambient Light Control
Smart Office System
Distributed Architecture

- Central Office
- Micro Switch
- Automation Gateway
- IP phone
- PC
- Smartphone / Tablet
- User Area

- Blinds Control
- Climate Unit
- Heat Valve
- Light Switch
Smart Office System
Distributed Architecture

Simple planning and installation
- Room by room
- No master plan required

Reliability
- Local failure has only local affect
- Local function in case of central failure

Integration in central Control Systems
- On Demand
- Open interfaces
In year 2020 more 25% of identified attacks in enterprises will involve IoT

Gartner, 2016

256 Days
average to identify while data breaches

25 Bn
IoT Devices

38%
increase in the number of detected security incidents

48%
of incidents involved a malicious or criminal attack

6.7 m
Average costs of each data breach

Source:
Gartner – Predicts 2016: Security of Internet of Things
Cost of Data Breach Study: Global Analysis Benchmark research sponsored by IBM Independently conducted by Ponemon Institute LLC
Security

IT Security of the Building Network

- Secured **Standard Protocols** (encrypted, e.g. HTTPS)
- Port based **Access Control**
- Tiered **User Levels**
- Central **Security Management**
Advantages of Smart Building
with example of the flexible Smart Office Concept

**Economic Efficiency**
- Energy savings: Lighting, heating, air conditioning only active when work place is in use
- Energy savings through consequent integration
  - Sensors
  - Dynamic linkage with control technology
- Prevent the waste of energy:
  - Open windows disable both heating and climatization
  - Automatic deactivation of lighting in abandoned rooms
- Optimized utilization of room capacity through dynamic allocation of workplace and meeting areas
- Beyond core times, automatic change into 'sleeping-mode'
Advantages of Smart Building with example of the flexible Smart Office Concept

Security
- Work place is protected (data wise and physical) against abuse
- Workplace activation requires authorisation of the allocated user; automatic deactivation in case of absence
- Detection of unauthorised behaviour causes an alarm, e.g. if user enters a prohibited area
- IT security levels for Building Automation Systems as part of IP technology include
  - secured transmission protocols,
  - port based security,
  - IP Source guard,
  - secure management, etc.
Advantages of Smart Building
with example of the flexible Smart Office Concept

Flexibility and Comfort
- Individual configuration of the work place by the user
- Dynamic creating of user groups
- Both building and room identify their user(s)
- Interaction of various systems: building access control, alarm system, HVAC control, Lighting control, building operating system etc.
- Automation of processes:
  IF user passes slip road THEN automatic parking lot assignment, elevator request, dynamic allocation of working place, activation and configuration of both workplace and indoor climate
Advantages of Smart Building
with example of the flexible Smart Office Concept

**Reduced maintenance efforts**
- Automated Fault Detection help reduce the downtime and O&M costs
- Alarm management - timely and targeted interventions in case of faulty or under-performing building equipment
- Automated Diagnostics – easy detection of erratic situations, fast resolution or workarounds in case of known problems
Smart Building Solution

Services
- Streaming
- Internet
- E-Mail
- VOIP
- Interfaces to third party systems
- System control
- System Configuration
- Customised views
- Alarm Server
- OPC Server
- SNMP

Management

Cloud

Network Infrastructure Backbone

230 V AC

Smart Engine

Industrial Gigabit Ethernet Ring Switch

Processing / Automation
- Smart Director App
- Software PLC (IEC 61131-3)
- Interfaces
  - Configuration / visualisation
  - Automation control
  - MODbus RTU/IP
  - BACnet IP
  - IP 500

Field I/O level – measuring / controlling

Conventional Sensors/Actors connected over Smart IO Controller

PoE+ powered local control panel

Lighting Controller

LED Light

Loudspeaker
Smart Office System

- LED Panel
- Smart Sensor
- LED Downlight
- Window Blind System
- Smart Audio System
- Air Conditioning
- VoIP Telephone
- Micro Switch
- Micro Access Point

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BICSI Middle East & Africa
Advantages of Smart Building
with example of the flexible Smart Office Concept

- Work place is assigned to the user dynamically
- Network access and user specific functions are activated

Economic Efficiency
- Energy savings: Lighting, Heating, Air Conditioning
  only active when work place is in use

Security
- IT security levels for Building Automation Systems as part of IP technology
  include secured transmission protocols & port based security

Flexibility and Comfort
- Individual configuration of the work place by the user
- Dynamic creating of user groups
Thank You!

Smart Buildings cut costs and emissions, improve the value of the real estate, and strengthen the corporate image.