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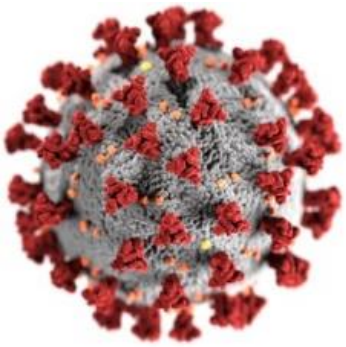
Design Considerations for Smart Buildings

M Lamprecht - Aug 2020



Facilities managers navigating turbulent times during the covid19 pandemic

Questions Designers might be asked:

- What is a smart building?
- What technologies will enable it?
- How to ensure interoperability and data exchange of systems?
- What IT or data security systems do I need to consider?
- How can I connect my systems to the cloud?
- Which vendor?
- What will a smart building look like in the future?
- What do I even do with all this data? Data vs Information

What is a Smart Building

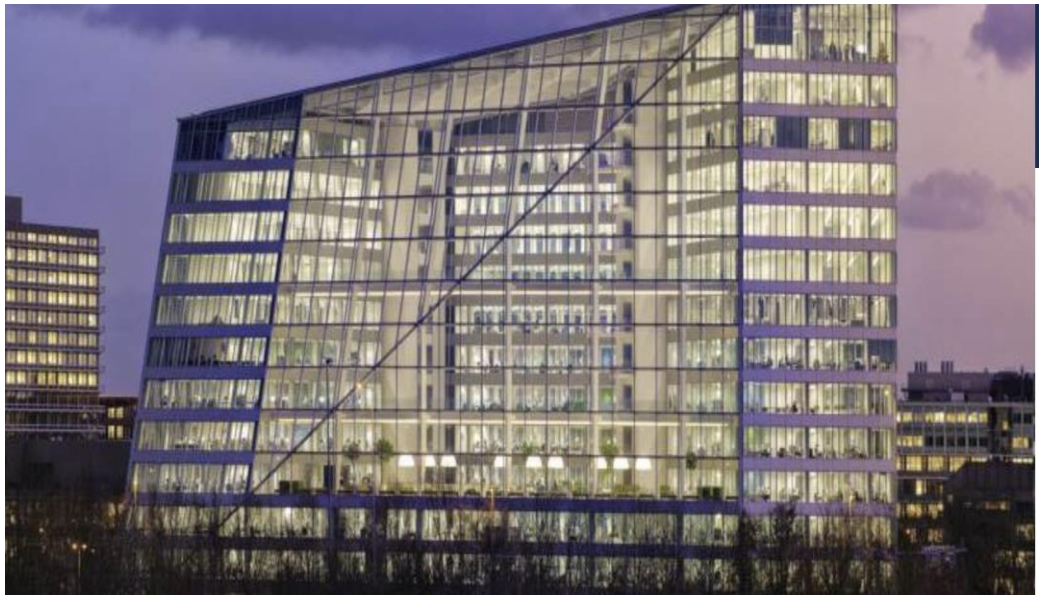
- According to the Building Efficiency Initiative, a smart building is broadly defined as:

a building that delivers useful services that make occupants productive at the lowest cost and environmental impact over the building's life cycle.

- A smart building requires adding intelligence from the start of the design phase to the end of the building's useful life.
- Smart buildings use converged networks during operation to connect a variety of subsystems, which traditionally operate independently, so that these systems can share information to enhance total building performance.
- Smart buildings are characterized by the use of fully integrated systems, that share vital information.
- They use IoT sensors and building automation to control nearly everything.
- A building fitted with a BMS or energy management platform is NOT a smart building.
- A building collecting data and storing it on a server is NOT a smart building.
- A smart building continually "learn and adapt"

The Edge Building (Amsterdam, Holland)

- It knows where you live; it knows what kind of car you drive and will direct you to the most convenient parking spot; it knows your schedule for the day and even how much sugar you like in your coffee.
- No one has an assigned permanent desk space at The Edge. Workspaces are based on your schedule for the day and are assigned as you need them: sitting desk, standing desk, work booth, meeting room, balcony seat, or “concentration room.”
- And when you arrive at these various stations during your day, the building knows your preferences for light and temperature.



Not One Recipe - nor should there be one.

Instead Change Agents that challenge old views and are receptive to innovation or can innovate themselves are required.

E.g. Façades are prime to go beyond a single purpose and serve multiple purposes leading to smart buildings and opportunities to environmental collaboration.

Some considerations …

Owners, operators and occupants expect more from the built environment. Rightfully so.

Technology continues to evolve rapidly and there are a lot of tools, systems and services available to end-users. Confusion.

Buzzwords like “internet of things,” “smart” and “open solution” are used, but overwhelm owners and leave them unsure of which technologies or sensors to choose. Uncertainty

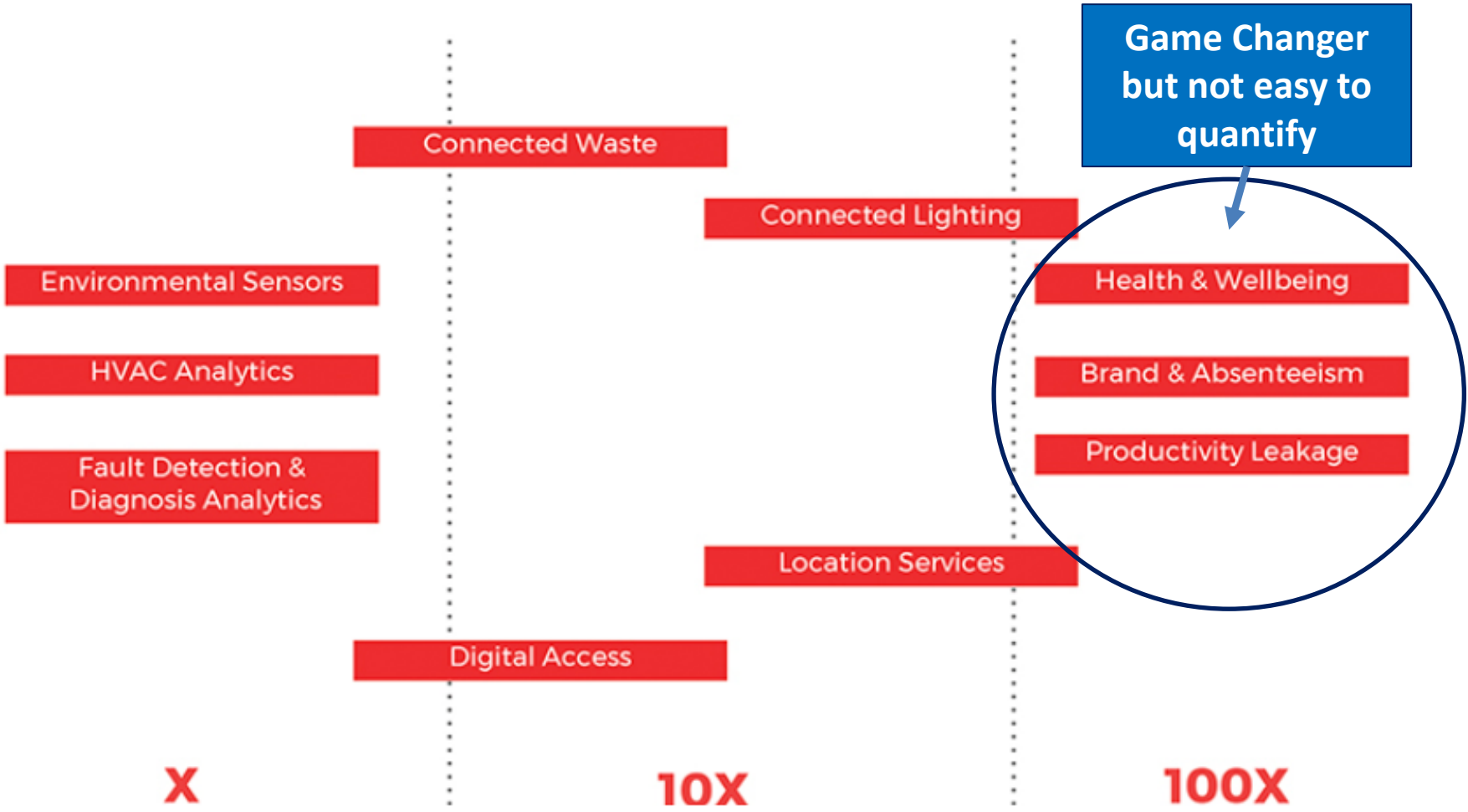
In Selecting Technology consider…

What problems are you trying to solve?

What is your system set-up strategy?

How robust are the data capabilities?

What ROI can you expect?



Energy and water costs are only a fraction of total annual operating costs. At $x per square foot for energy and water costs, lease costs are roughly 10 times more per square foot and employee costs are roughly 100 times more. Courtesy: WSP USA

3-30-300 Rule

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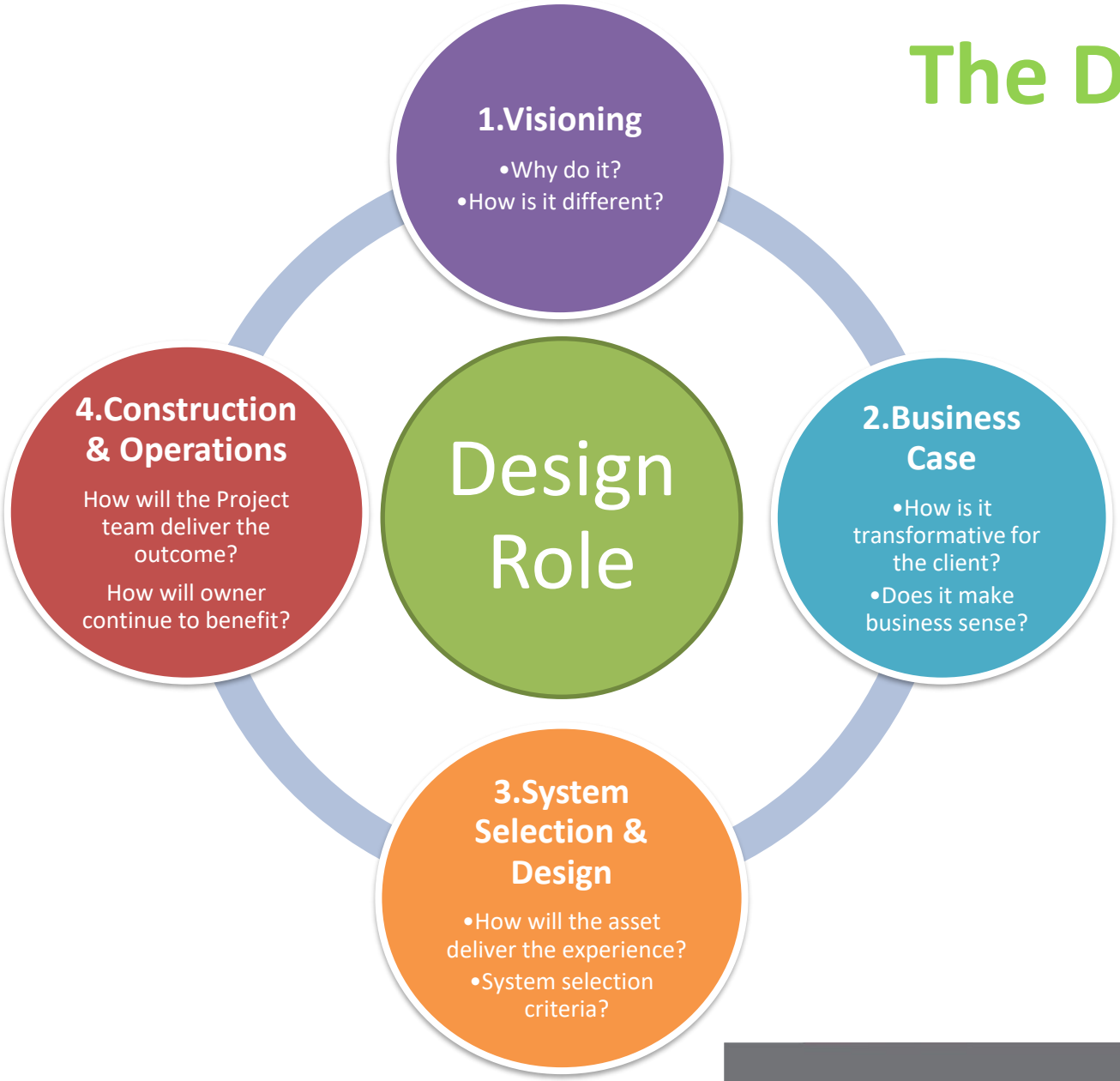
The Designer Role



The smart building consultant's/designer role is evolving to:

- Guide conceptual visioning.
- Develop the foundations to support integrated building systems.
- Select systems to meet the owner's operational and organisation goals.

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The Process

Developing a Vision

- Vision
- Goals
- 3-30-300 rule
- Employee Happiness – Key to ROI
- Non – Financials such as core values; Corporate Sustainability – ESG score etc.
- Define Metrics
- Financial modelling of metrics

Smart Design

- Ability of systems to share data between them
- Converged Network –[next slide]
- Tight integration with IT departments required.
- Available and Accessible data
- Storage outside systems required.

System Selection

Choosing systems based on:

- **Cost**
- **Flexibility**
- **Control and Convenience**
- **Meaningful feedback**
- **Real time metrics**
- **Security**

Common tagging and coms protocols:

- **Ashrae**
- **GBC**
- **ISO etc**

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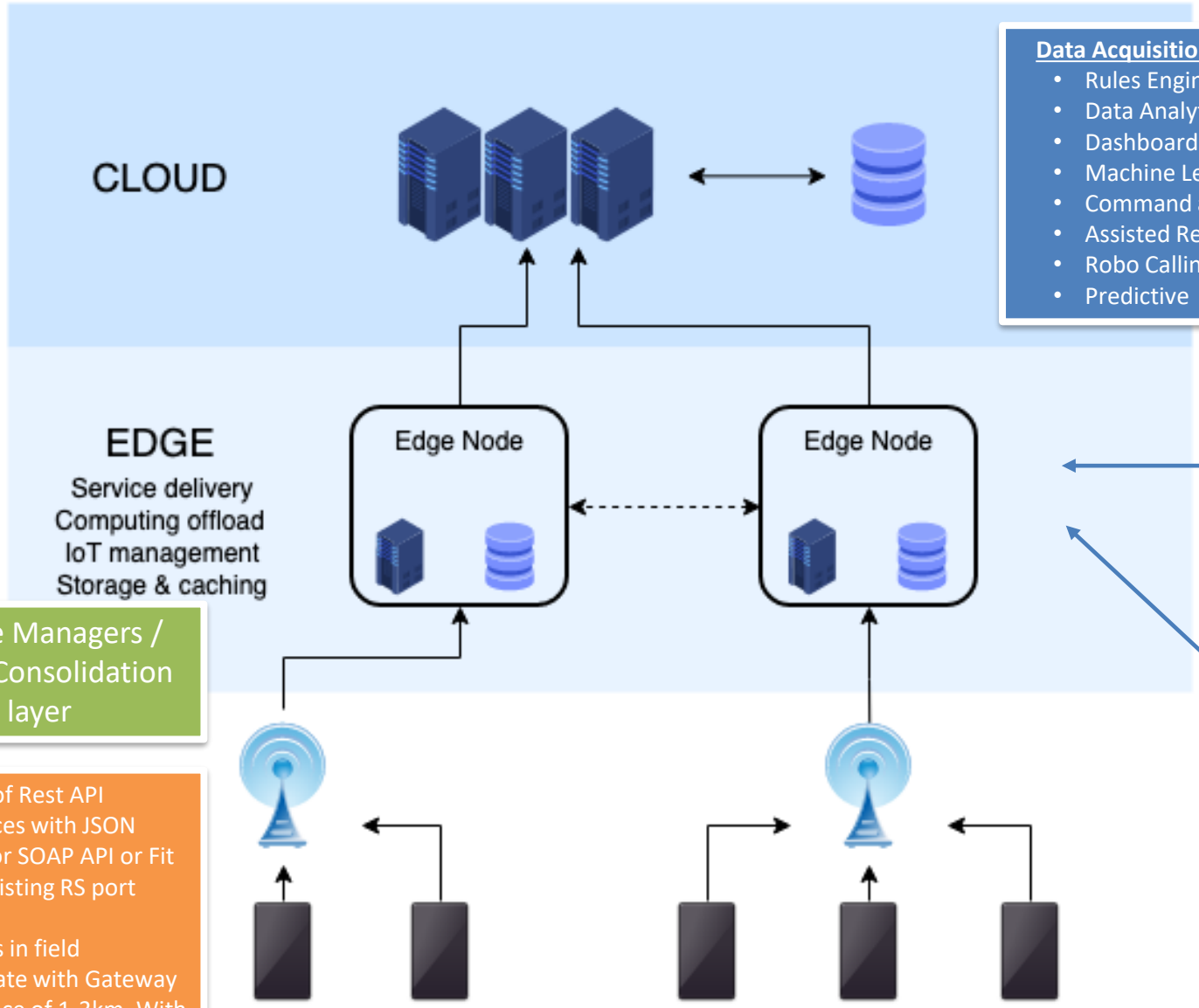

Data Acquisition and Analysis Platform

- Rules Engine
- Data Analytics
- Dashboards
- Machine Learning
- Command and Control
- Assisted Reality
- Robo Calling
- Predictive

Sometimes referred to as Fog computing

Multi-Agent Systems and Subsystems

Device Managers / Signal Consolidation layer

Make use of Rest API (Webservices with JSON Scripting) or SOAP API or Fit Node to existing RS port

IoT Sensors in field communicate with Gateway over distance of 1-3km. With Booster antenna up to 7km 433 MHz, , 868 MHz, 1019 MHZ

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MULTI-AGENT SYSTEMS THAT COULD BE AT PLAY

According to the characteristics that influence the condition of Intelligent Buildings, the following subsystems of “Agents” could be considered:

Green Building:

- Control multiagent subsystem for energy saving.
- Energy production multiagent subsystem.
- Water consumption control multiagent subsystem
- Gas emission control multiagent subsystem.
- Wastewater emission control multiagent subsystem.

Comfort:

- Thermal Comfort control multiagent subsystem.
- Control subsystem Ventilation and
- Air Conditioning Control multiagent subsystem.
- Control multiagent subsystem Lighting.
- Control multiagent subsystem Access.
- Noise control multiagent subsystem.
- Lifts control multiagent subsystem.

Efficiency for Work:

- Signaling control multiagent subsystem.
- Directory control multiagent subsystem.
- Parking control multiagent subsystem

Healthy Buildings:

- Drinking water control multiagent subsystem.
- Elevator ventilation control multiagent subsystem.
- Cleaning control multiagent subsystem.
- Waste management control multiagent subsystem.
- Pest control multiagent subsystem.
- Pool filtration control multiagent subsystem.

Cultural Elements:

- Activities advertising facilitator multiagent subsystem.

High Technology Image:

- Broadband Internet facilitator multiagent subsystem.
- Multiagent Subsystem of Control of Electrical Services,
- Facilitator multiagent subsystem Automation of Offices.
- Intelligent Control multiagent Subsystem.
- Automation multiagent subsystem.
- Multiagent subsystem for the control of Mobile Phone Coverage.
- Advanced Parking Facilities multiagent Subsystem

Security and Structure:

- Fire protection multiagent subsystem.
- Electrical safety multiagent subsystem.
- Lift reliability multiagent subsystem.
- Multiagent subsystem of public notices.
- Exhaust plan multiagent subsystem.
- Essential electrical energy multiagent subsystem.
- Security management multiagent subsystem.
- Earthquake monitoring multiagent subsystem.
- Structural monitoring multiagent subsystem.
- Terrorist attack precaution multiagent subsystem
- Security and Surveillance multiagent Subsystem.

MAS Continued

Codes, standards, guidelines to consider

- It's a bit of the wild west with regard to smart buildings, with everyone claiming they have the best single solution.
- Owners are best served if they are not pigeonholed into one solution where they are held hostage with licensing agreements and proprietary solutions that others cannot bid on.

Some aspects to consider are:

- ANSI/BICSI-007-2017: Information Communication Technology Design and Implementation Practices for Intelligent Buildings and Premises.
- ASHRAE Standard 135: BACnet — A Data Communication Protocol For Building Automation and Control Networks.
- Brick Schema: Uniform Metadata Schema for Buildings.
- EN ISO 16484-1 Building Automation and Control Systems.
- ISO/IEC 18598-2016: Information technology — automated infrastructure management systems — requirements, data exchange and applications.
- Project Haystack: Standardized Semantic Data Models.
- Telecommunications Industry Association Smart Building Program.