Future Embedded Lighting Control: Requirements and Solutions for an IoT based Architecture

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//Personalia

- Dr. Walter Werner (PhD), Dornbirn, Austria
- Leading the work- package "system architecture" of the OpenAIS project, contracted by Zumtobel.
- 25+ Years experience in lighting and building controls
- Creator and head of Zumtobel's LUXMATE System (1991 - 2002)
- Now self- employed as a consultant, focussed on innovation business and business innovation.

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// Content:

- What does „going IoT“ really mean?
- What additional requirements are linked to the full internet connection of a luminaire?
- Lighting has tight timing requirements (action to light change). How can they be met?
- How to set up such a system?
- What happens to the system when the internet connection breaks?
- How will such systems integrate into Building Management and Automation?
- How can heritage systems like DALI be integrated?
- Will the business models for lighting controls change?

//What is "IoT" ?

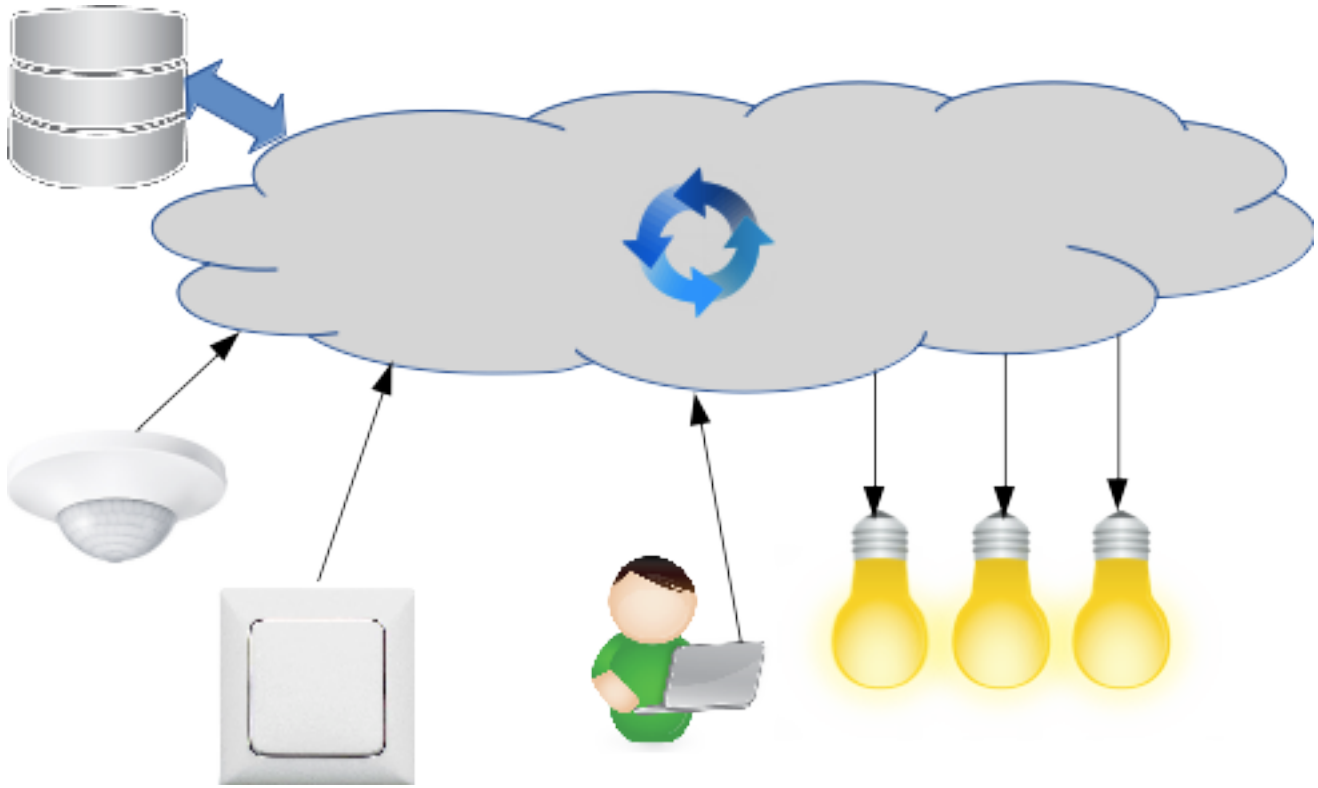
- IoT stands for "Internet of Things", and the wording as such is not very helpful in the first place.
- Most simple definition would be: "Internet to all the things", and this already comes close:
- The consequence is twofold:
  - Many many "nodes" on the network
  - The "things" have only minimal computing power and often restricted communication speed.
- Therefore "IoT" provides technology to connect to really many nodes (IPv6), and to allow for very restricted devices.

// "Internet" Requirements for Lighting Controls

- When connected to the internet, a variety of requirements unknown to lighting controls materialize:
- 1) System integrity
  - Parametrization by authorized users only
  - No general keys, double secure any updates
- 2) Data privacy
  - Make sure communication patterns do not disclose usage patterns
- 3) Operational integrity
  - Make sure only lighting commands that origin from authorized switches and apps are accepted.

// How IoT Systems Work Today

- Devices talk to a (preprogrammed) cloud service
- Use of IPv6, UDP, CoAP and DTLS technology

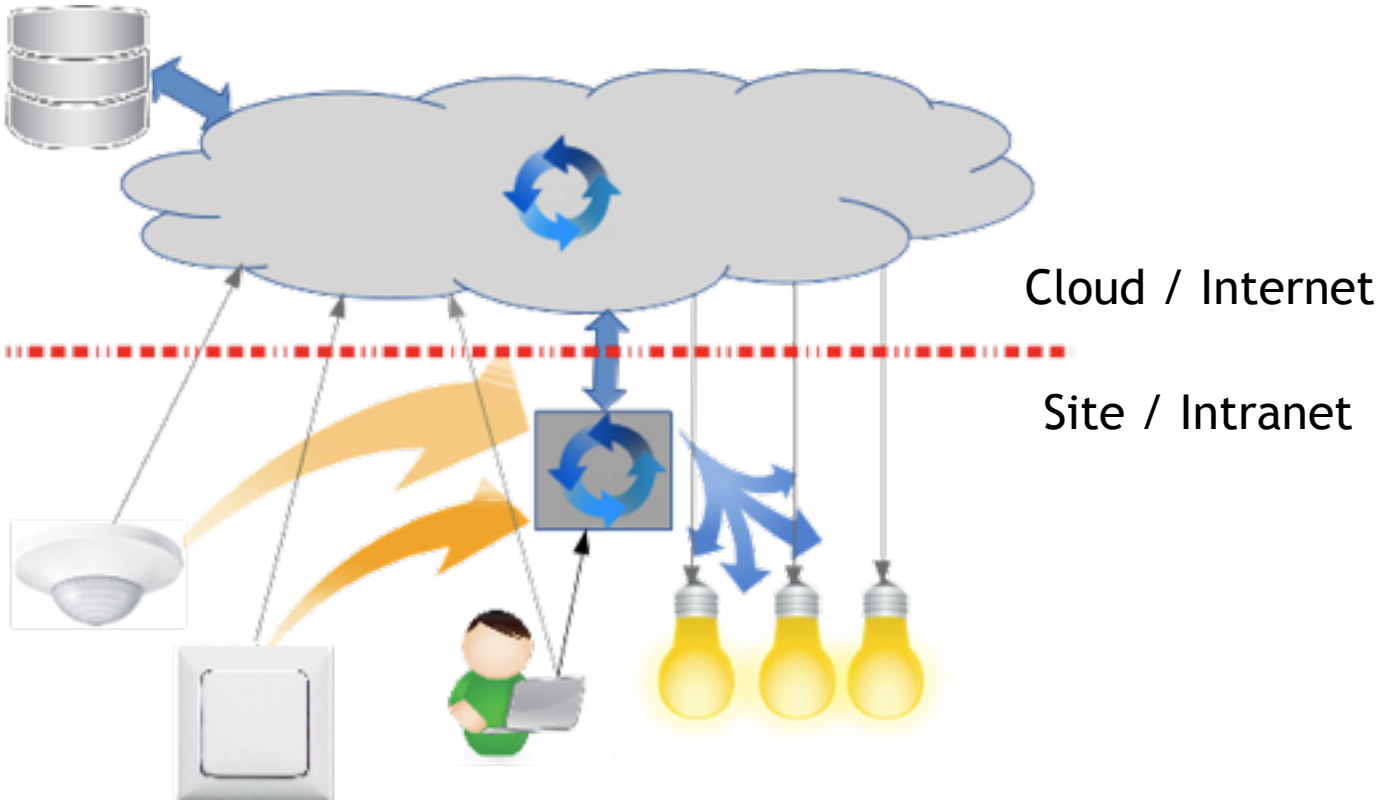


// Lighting Requirements for "Internet based Control"

- When internet technology is used for lighting control, some additional requirements need to be covered to achieve decent lighting control:
  - Internet communication is structural "point-to-point", e.g. one browser asks one server, and the server provides an answer to this browser only.
  - Lighting controls in professional environment is structural "some-to-many", e.g. some light switches (in parallel) switch many light points.
  - Lights should go on or off immediately, the delay between the switch press and the light action should be shorter than half a second. (For dimming controls shorter than a quarter of a second)

// A Solution for an IoT based Lighting Control

- Add control objects local to the site
- Use multicast from sensors to control objects
- Use multicast from control objects to actuators



// Stability Considerations

- The use of site- local control objects for each group of actuators ensures reliable operation independent from the availability of the wider internet.
- The use of multicast, application layer security and symmetric keys allows for fast (re-)action also with larger sets of actuators in restricted networks.
- Keeping the direct cloud interface available supports cloud based services including elaborated user interfaces and provides "full app freedom".
- For local user access the smart mobile devices connect to the control objects to access the actuator settings, avoiding authentication efforts in restricted devices.

// Setting the System Up

- The main challenge is to know which light point is where in the building
- Every light point has its ID, and the corresponding location is documented in one of these ways:
  - Preprogrammed light points are labelled and placed accordingly.
  - Light points are preprogrammed when mounted and placed (e.g. using NFC)
  - Randomly placed light points are searched (using wink) to document their location.
  - Randomly placed light points communicate their ID using a beacon technology (e.g. VLC) that is picked up to document the location.
- Groups are programmed to create room and zonal control using the location information by powerful commissioning tools, that also deploy the encryption keys for the groups.

// Integration Issues

- Full integration of heritage lighting control (e.g. DALI) can be achieved through gateways.
  - "Full integration" means: The tools and apps of the IoT system can be applied to the integrated part seamlessly (and without users knowing about it)

- Integration into future Building Management (e.g. BACNET/IoT or KNX/IoT etc.) can be achieved through
  - suitable cloud services
  - suitable interfaces at control object level
  - suitable interfaces at device level

// Strategic Issues

- Is this really different from today's lighting control?
- Is a new technology really helpful for an already well resolved task? Does IoT provide more "smartness"?

- The answer depends on the point of view, minimum two aspects should be considered:
  - Cloud services are able to provide features far beyond today's imagination at lower cost for large amounts of devices.
  - Control objects (and with them the system functionality) are software only, and may be replaced over the lifetime of the system at relatively low cost, and also provided by third parties to better support the customer.

- This will result in a change in business models, and hopefully in a wider acceptance of smart lighting worldwide!

// IoT Lighting Controls by the OpenAIS Consortium

- The first operating real system will be presented in autumn 2017, provided by the consortium:

- More results and details at www.openais.eu/en/results

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Thank you

www.openais.eu

Open Architectures for Intelligent Solid State Lighting Systems

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Questions?

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