Q&A

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1. Do you see a place for visual light communication (VLC) in terms of integrating smart lighting into existing buildings?
The technology of VLC may well be used to enhance some smart lighting features into existing buildings. However, some care should be taken to make sure the properties of VLC do not fire back. Besides the need to have a well elaborated complex modulation and sensitive receptors at each control node (=luminaire) to make sure the communication paths do not interfere with each other, care should be taken with daylight harvesting, as this technology switches light off and this stops any visual light communication. (I cannot imagine that customers would be happy with installations that flicker and flash to maintain residual communication during the switched off state.)

But of course, when respecting the details, VLC might be applicable to all installations that have a possibly reduced, but continuous ON philosophy during operation, and accept a loss of communication during other times. This is, for example, applicable to windowless aisles, street illumination or the like. I have severe concerns using VLC as a "general tool" to enable smartness to "all kinds of lighting". Besides this general concern, I think we should be very careful with mixing modulation for data communication and dimming, because dimming can also be seen as a modulation technology and changing interference is a troublesome issue when it comes to fault finding missions. While "own dimming" may be kept under control, there is no way to determine beforehand what other modulated light sources are in sight of the receptor. Finally, current RF technology provides many and reliable ways to set up wireless communication that also is acceptable for advanced smart lighting communications.

2. What are the challenges integrating human centric lighting into existing buildings?
There is more than one major obstacle! The main challenge is – as almost always – money. To get human-centric features like colour (temperature) control into a given installation, new luminaries are needed, together with a relatively sophisticated control system. This needs some money but it is very difficult to motivate an investor or building owner for an investment without any or with unclear payback. The tenant's calculation is not much better; the lease is usually shorter than the payback period of a human-centric lighting system.

The second and about equally difficult to overcome obstacle is the immaturity of the existing offerings and the lack of well-accepted standards. Human-centric lighting is difficult to understand, to tender, to bid, to compare and finally also difficult to order, to commission and to hand over (how do I verify that the offered features have been installed and commissioned properly, and that they support the employees in the way needed to pay the money back?).

The third obstacle is that the science behind human-centric lighting is not based on very hard facts. I remember that some years ago the need for (much) smaller lighting investments that were based on comparably hard facts (and that were easy to purchase) have been ignored by more than 85% of the market for more than 10 years. Wilkins[1] showed in the late 1980s that longer-term exposure to 100 Hz flickering light (@60% modulation) has significant adverse effects on health (and employee absenteeism)! Even today, PWM flickering lights are offered that do 100% PWM modulation in the same frequency range: What you cannot see or smell is not a well-received feature and usually ignored.

3. What obstacles exist for a seamless system that incorporates lighting, HVAC, security and access control into existing buildings?
The typical answer shows some technical arguments, like DALI or BACNET not supporting useful number formats vice versa and alike. But this is only the visible part of the story and would not have been technically difficult to overcome. The more difficult story is based on the bidding and responsibility structure: lighting (and its controls) is part of the electrical, whereas HVAC is part of the mechanical tender. Cause or effect does not matter but the knowledge of the engineers (throughout the value chain) on useful features and applicable methods of the "other side" is low to non-existent on both sides. Given this there is no way to plan or implement a real integrated system in the today's executing building industry structures, it is very difficult to get and execute integrated responsibility. Saying this we should note that this is not carved in stone: the IT industry will be happy to push fully IT integrated systems and it is already working on this possibly disruptive "takeover". However, it will not be easy for IT to take over, as costs remain too high compared to actual separated systems and the Simple Network Management Protocol (SNMP) knowledge alone is not sufficient to achieve the details of HVAC efficiency and lighting comfort. Anyway, the IT communication is already at the level of integration (achieved by gateways) and by moving to the final nodes, the integration into a gateway-less and seamlessly integrated system will provide a technical base for a fully integrated system one day.

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4. What do you predict will be the next disruptive technical development in lighting?
Predicting disruptive changes is a high-risk business. For me, a disruptive change is separated from a normal (rapid) change by also causing business models to change. Looking back, the LED change was disruptive only for the lamp manufacturers: the replacement business they lived on is history. Together with that, the concept of a replaceable "lamp" itself is at high risk: Zhaga is doing its best to keep the old spirits up but it is not clear if (and for what size of the market) that will be successful.

The disruptive change for controls is already under way and not so difficult to predict. The internet gets closer to the light points every year (for some 25 years) and the disruption will happen when it finally arrives at the light point (and the various sensors). The reason for the disruption is the nature of online/cloud based services that will be available when the nodes are finally net based: Once controls algorithms and advanced user interfaces can be offered "cloud based", today's business models that integrate hard- soft- and service-ware into one package will change dramatically. Once the offers are separable, other levers are active: cloud software solutions look for a "large installed base"; hardware specialists get rid of complicated software considerations etc; finally, the competition points may change completely, an after market will be established that targets the lifetime and that is maybe larger than today's primary market.

On the lighting market itself the upcoming disruption may be triggered by full embedding of light into the environment, challenging the concept of a "luminaire" and replacing it by "luminous ceiling" or "light emitting tapestry" and the like. But this seems relatively far away and the related business models do not seem to be very challenging to the lighting industry.

Q&A

5. Could you tell us about your role with the OpenAIS consortium to push smart lighting into the IoT world?
OpenAIS is an EU funded research consortium that aims for "lighting integrated building controls". The work is organised in work packages that do the various aspects of this research job. Each work package is headed by one of the consortium partners and I have been appointed, by partner Zumtobel group, to guide the Work Package 2. This package will provide the System Architecture. We decided to use Internet of Things (IoT) methods to achieve our goal, as this new technology covers most of the needs. (The stakeholder requirements have been set by Work Package 1, and it is really worth reading through them, even if you consider yourself a controls specialist.).

We are now concentrating on the lighting performance issues, over and above the IoT frameworks available. This sounds relatively easy but when it comes to the detail, the answers to the questions get tricky. Let me give you some examples: IoT structures support the connection of a device to a (usually cloud-based) server, which uses the data and available methods of the IoT device. This concept fails when it comes to switching large numbers of light points in real time at once or switching lights with missing internet connections. Therefore, OpenAIS Architecture allows both for multicast and for node-to-node communication to close that gap, and it supplies methods for graceful degradation that allows for embedded control to jump in whenever the distant servers are not available. A second major effort is on the extensibility of the system, that finally may drive an after-market, allowing "additional components", "additional control" and "additional services" to happen without major change to the installations. The third focus is on "making commissioning as easy as possible". The original target of "no commissioning necessary" cannot be achieved due to security concerns, since internet to the node really means "exposure of any node to the full aggression of the internet". (See goals and results on www.openais.eu)

Reference

[1] Wilkins et al 1988 (CIBSE Conference) and 1989 (Lighting Research Technology, vol 21), "Sick building syndrome"