On the path to open intelligent buildings

Open integrated systems guarantee an optimal and cost-efficient implementation of all requirements within the area of building technology.
For architects and planners, an open system offers, amongst other things, scope to achieve extraordinary solutions and ideas and thus the possibility to impart the desired profile to every building. The reduction in investment costs and the flexibility involved in the design, according to needs, form the decisive benefits for building owners and investors. To the building administrator and facility manager, open technology brings unlimited possibilities for adaptation to changes in user needs at any time, as well as seamless expansion and completion of its objects.
The operator or user ultimately receives, by means of an open system, the basis for operational optimisation, energy savings and cost control, as well as for a comprehensive facility management.
Decisive is, however, the building itself and in this respect open, integrated systems ensure that the value of the real-estate not only increases considerably, but also that it remains at this level in the future.

The Ideal Situation

The implementation of open, intelligent buildings demands a re-think at the planning stage, away from thoughts of device separation, closed loops, components and node lists, and towards considerations of functionality and relationships between systems.
In this way, the lighting control can be connected to the blind control, that is, dependent on the position of the sun, the blind slats are adjusted automatically and by means of measuring light intensity, the degree of artificial light can be readjusted. Or different lighting scenarios may be foreseen in which the individual systems adjust themselves according to the other. Thus at the push of a button, for example, in a video presentation room, the blind will roll down and the lighting will dim without extensive cabling, controllers or programming being necessary.
In planning practice, that means that, from now on, we are only speaking about functionality and it is here that our main task lies.
Which functions should be implemented in a building?
How should a single room be regulated?
Which connections must be visualised?
What should happen, when, and how?
This is comparable to the creation of an event-oriented computer programme where programming schedules are put together. During this process it is important to know which functional building blocks are needed.
The planning procedure just described is not very widespread at present. It presents, however, the optimal interplay between individual systems in a building to form a comprehensive solution.

The Reality

In the following, possible forms of planning are described whereby the cases a) and b) are still linked to the usual procedure still in use today.

In order to create a call for tenders or to make a correct assessment, various types of systems can be chosen. Which model is most suitable for which equipment, cannot be answered in general terms, but must be examined in each individual case.

Device Separation

Various devices are normally planned, implemented, installed and set into operation by various companies. The following cases are possible:

a) The functions of the individual devices are implemented through independent LON-equipment and no exchange of information between the equipment is planned.

   Advantages:
   – Logical and physical freedom for retroaction.
   – No coordination necessary during the planning and projecting of LON equipment.
   – System integration, diagnosis and service independent from other devices, freedom for retroaction and clear allocation of responsibility.
   – Separation today is primarily between electrical, HVAC and security equipment.

   Note:
   In security technology and systems, such as fire protection, dampers) and fire warning equipment, freedom for retroaction is very often a necessary feature.

b) For every device within a piece of LON equipment, individual segments are planned that are connected to each other by routers and in this way, information exchange is made possible.

   Advantages:
   – Exchange of information between the devices and thus higher functionality than in case a) possible
   – Multiple use of bus devices possible.
   – The exchange of data between the segments is however limited to a minimum by the required functionality.

c) Different devices are operated in a piece of LON equipment in a common segment (and domain).

   Advantages:
   – Reduced cabling
   – Reduced devices
   – More easily expandable (bus cable usable in the whole building for all devices).

Case c) corresponds to the ideal planning scenario described above, namely of a functional, open and intelligent building.

Planning

The System Integrator

In cases b) and c), somebody responsible for the coordination between the devices is necessary in the planning and implementation phase. Following the award of contract for the individual devices, a person responsible for the installation needs to be appointed. This person then serves as contact person for the operator with respect to expansions, service and maintenance, even after completion of the work. This person is also known as a system integrator.
The task of the system integrator is to plan LON networks (implementation of routers, bridges, repeaters, the backbone, the structure of the LON network etc.) and to bring the desired functionality into the network and thus into the building. For this purpose, he selects the various LON components that he then functionally connects to each other with the aid of a binding tool. In order to maintain the openness of the whole LON system, it is vital that a so-called ”open tool” is used so that no dependence on the particular system integrator is built up.

The Binding Tool

The Interoperability Principle:

1) Devices in an open network are interoperable when devices from various manufacturers can be installed without the need for additional development and adaptation.

2) Tools are interoperable when interoperable devices can be installed, configured and maintained simultaneously or one after the other from any point across the network.

LNS-based tools have the advantage that network and project data are stored in standardised formats and so-called device plug-ins can be used. All this data can likewise be read in by another LNS-based tool.
Due to this fact, the LON Nutzer Organisation (German LON User Organisation – LNO) recommends using so-called LNS-based tools as the future standard platform.

The Call for tenders

How to create an optimal, integral call for tenders is unfortunately not general knowledge. It would, nevertheless, be a desirable goal to create norm modules for building technology that simplify the call for tenders and thereby the calculation. In what follows, some elements are listed that should be observed.

Standard of Material

Which materials/components will be implemented, where, and how?
The following points need to be defined:
- Design (planned installation, space requirements etc.)
- Inevitable functionality (behaviour during bus cable outage, breaks in the supply voltage etc.)
- Design (above all in the case of visible elements such as sensing devices, temperature sensors, movement sensors etc.)
- Device regulations (mechanical strength durability, IP Protection, temperature etc.)

Object Description

- How will the building be used and which building types are involved?
- What has which priority (security, aesthetic, comfort etc.)?
- What does the installation concept look like? Can the LON nodes be installed decentrally in the false floor or ceiling, or do they need to be installed centrally? Is a connection between floor and ceiling possible?
- In which areas of the building will the bus be implemented immediately and where at later points in time?
- If the bus devices are to be implemented in a particular area of the building only at a later point in time, the corresponding bus cables should also be laid there too.
- In corridors, a change in the use of space is not to be expected. With respect to the necessary functions, aspects such as emergency lighting need to be given a higher priority than flexibility. In this way, the number of necessary switch groups can be established.
- Should bus devices be planned in outside areas? This can pose problems for bus devices as they are only constructed for a specific temperature range. Such functions can, for example, be implemented by means of connecting conventional devices in the outside area with bus devices for the inside area.

Performance Description

- The functional description relating to the controls/closed loop controls that need to be individually created forms the most central point of a call for tenders. On a particular floor of the building, as few room modules as possible should be created in order to make optimal use of a LON system.
- The functional description should be formulated in as detailed a way as possible, in order to clearly define performance.
- The simple standard saying: “C-programming according to the specifications of electrical planners” guarantees unnecessary discussions after the award of contract. Unknown functionality features cannot be globalised!
- The quantity structure also always requires a detailed functional description. It encompasses the number of nodes, groups in need of controlling (motors, lighting elements etc.) and provides a quick insight into the whole installation.
- The services to be rendered must be presented in a detailed way. System integration is not to be forgotten!!!

Example of a Description:

Sun Protection (Lamellas, blinds)

Offices East façade / West façade:
In the offices and in the corridor on the east side are small windows with motorised lamella blinds. The motors are controlled in groups via the LON nodes located within the false floor. In the offices, two sensors are located on the corresponding service modules for the individual control of the blinds. The manual interventions are oversteered by the façade control.

Motor Control:

In order to avoid electricity peaks, the blind motors should be driven up and down in groups and in time-delay.

Facade Control:

The information necessary for blind control is sent by the weather station to the LON. From there, the blinds are controlled façade by façade. In order to still direct enough light in the offices and corridors when the blinds are being lowered, the lamellas are driven into a working position mode. Aim: More than 150 Lux illumination, without lighting.

Visualisation:
The sun protection control of the outer façades can be manually oversteered by means of visualisation. Manual intervention has second priority.

Interface Analysis

- Who is delivering to whom, when, what and to where?
- How the interfaces are defined is secondary. Important is that they are defined.
- Delivery of material and system integration should stem from the same company (the guarantee question comes into play when the switchgear constructor buys modules and an integrator must programme these/carry out their parameter setting).
- Will the components be pre-programmed and delivered ready for implementation to the building site? (This is preferable, even if the component prices are a little higher, as the effort at the building site and the incalculable costs involved with this can be minimised).
- Does the installer know where which device must be installed?

Example of an interface definition:

In every case, the following are valid:

- Agree upon room functions in good time with the building owner, architects, planners and companies.
- In the functional specifications, the general and detailed functions should be described.
- **Security systems should still be treated, at the moment, as “island solutions”. Connections to whole systems are, however, advisable.**
- A strategy for reliability cannot be avoided in large objects.

Note:
To plan only a few or even only one device with LON technology within a building does not make sense. Rather, a complete approach needs to be categorically chosen.

The LON Nutzer Organisation (German LON User Organisation - LNO) and the LON-Tech Associations regularly hold events for planners during which these points are discussed in detail. In addition, the LNO issues a handbook for planners in which the fundamentals of planning an intelligent building with LON are described. For further information, please visit: www.lno.de, or contact one of our expert advisors.