KNX IoT and KNX Classic

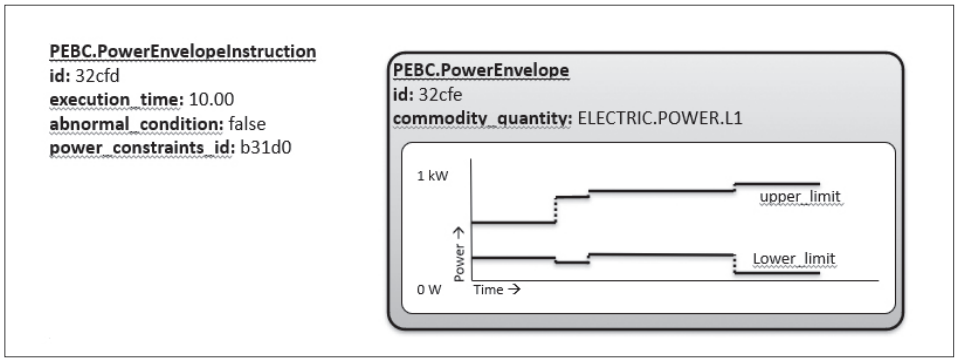
How charging poles and storage batteries are integrated

Energy management via KNX already works today - now energy storage and charging of electric cars are also being integrated.

Joost Demarest, CTO of KNX, explained in his keynote speech at the online event "Smart Energy Management with KNX" how this is done. He also went into detail about a novelty especially for Germany: The so-called control box, which sits behind the smart meter gateway, will soon be KNX-capable; the Forum Netztechnik/Netzbetrieb im VDE (VDE FNN) is already working on the corresponding appendix to the specifications.
But what is energy management in the first place? Wikipedia defines the term as follows: The planning and operation of energy production and consumption with the goals of conserving resources, protecting the climate - at the lowest possible cost.
Homes and buildings play a major role, especially what happens in the home, i.e. from the distributor to the individual consumers in the home. The energy management system is therefore located in the distribution board and controls the individual consumers. "From the very beginning, KNX aimed to implement the control functions from this centre and to use it to address the other KNX-capable devices in the house - from the heating to the ventilation, the air-conditioning technology and the meters to the heat pumps," says Joost Demarest. "That is why KNX is already capable of energy management today. Here is an example: individual room control is one of the most important functions of KNX, and it is primarily through this function that KNX became known to the general public: A central control unit in the room controls the valves in the heat sources and cooling devices. In addition, KNX-capable meters and submeters have been added over the past few years that can perform various power measurements per phase or of the total power and transmit the data via KNX. Load management modules have also been available from various manufacturers since the 1990s. "Even then, 120 different loads could be integrated, have priorities set or send statistical data," Demarest explains. "Load management is checked off with KNX." Now there are also products with their own energy consumption measurement, which can be used to measure various electrical variables at the level of a circuit and to limit consumption to a set level.
Of course, it would also be desirable for data from intelligent meters (smart meters) to be able to transmit and monitor data via KNX. This also already works: for example, one's own PV generation can be measured.
If you want to integrate loads, devices with potential-free contacts can be considered. For example, a charging pole can be switched from full charging to limited charging via a KNX switch, a heat pump or hot water production can

Joost Demarest

be controlled via the existing smart grid contact - depending on the available energy.
Since sonnen became a member of the KNX Association, energy storage units can now also be integrated into the KNX world. In addition, with the e-charge II from ise, for example, a device is now available to integrate the charging stations of various manufacturers (ABB, ABL, KEBA, Mennekes, Mobility Made by Stöhr) into KNX. This allows all essential information regarding the charging process to be transmitted and further processed via KNX. Whether heating control, cooling, smart metering and sub-metering, load management and peak shaving, energy storage, PV systems, electric cars or heat pumps - all these devices and functions can be integrated into KNX. Demarest concludes: "We can already cover a wide range of energy management functions via KNX Classic."
The question is, how can energy management via KNX be realised in practical terms? There are many different possibilities: Energy management can be integrated into the devices, of which there is a large variety available from different manufacturers. However, it can also run in the visualisation software, in the central display unit with advanced logic functions, in the central building server or in a combination of all of these. Apps are also available so that control can be carried out via the Internet. Trained KNX partners implement this.
But now the innovation comes in the form of the new EN50491-12-2 standard, which is part of a series of standards. The first part EN50491-12-1 already exists. The focus is now on the Custom Energy Manager (CEM). Various resource managers (RM) are assigned to this. An RM can be a product, several products or an entire Home and Building Electronic System Solutions (HBES). An HBES can be KNX, but other systems can also be considered. The RM tells the CEM about energy flexibility: what re-



Power envelope based control

sources are available, who needs energy right now or who can supply how much energy. For example, an RM could represent a complete HVAC system that informs the CEM of the current energy demand or supply. The exchange of information between CEM and RM is standardised, but independent of the protocol used. The CEM is practically the conductor who makes the orchestra of consumers and producers in the house play together harmoniously and brings the energy flexibilities in line.

The five control types for energy flexibility

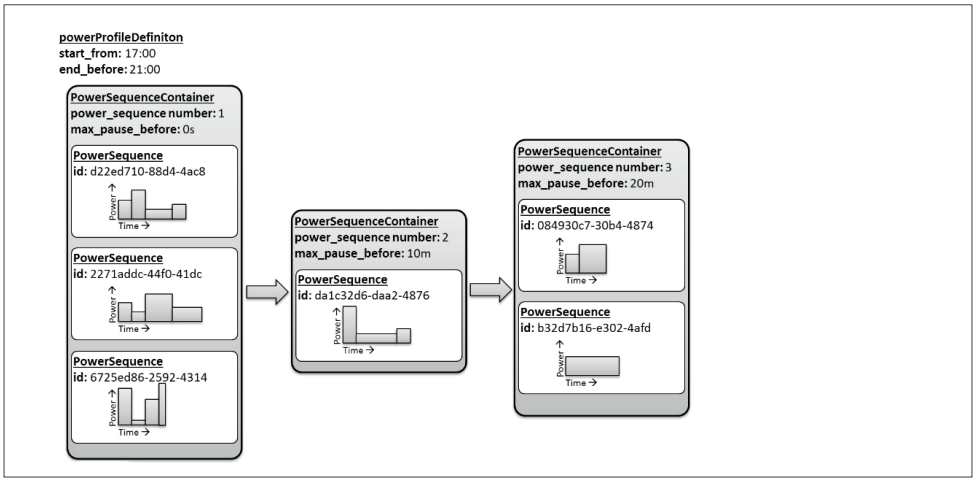
So what is meant by energy flexibility? Depending on what is intended in the application, how everything is to be controlled, EN50491-12-2 provides for five so-called control types:

Power Envelope Based Control

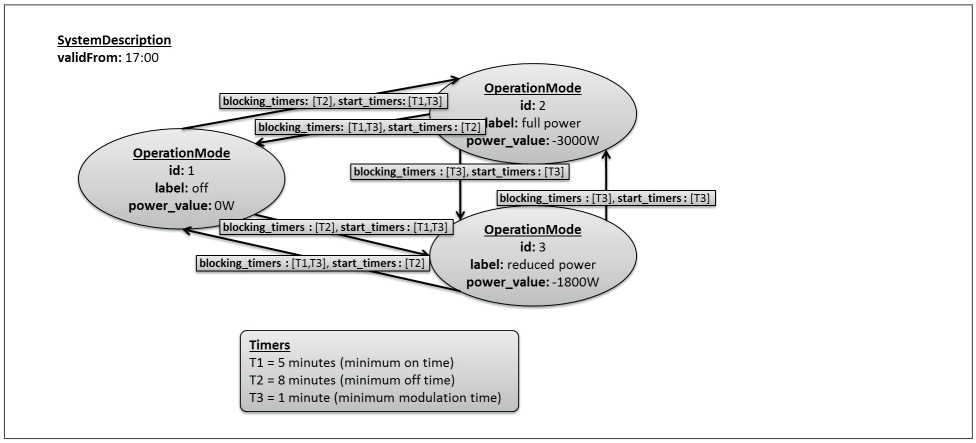
Here, the CEM ensures that the RMs remain within set performance limits, which can vary over time. The CEM adjusts the power envelope to the power prediction of the RMs and it controls the RMs to meet the specified power limits. For example, it commands the heat pump to supply less energy over a certain period of time. The RM in turn gives the predictions to the CEM of what a unit is capable of doing. The CEM aligns these predictions with the given performance envelope, so there is an interaction between the CEM and RM over time.

Power Profile Based Control

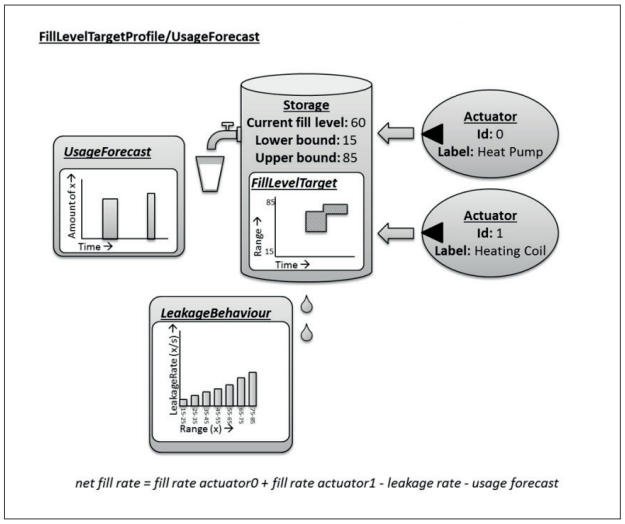
This type of control is intended for appliances that are to start at a specific time, such as a washing machine. It communicates via the RM when it can start, how long it has



Power profil based control



Operation mode based control



Fill-rate based control

to run and when it can be interrupted if necessary (Power Sequence Containers). The CEM then determines the time sequence in which the Power Sequence Containers are started so that the entire process can be completed at the specified time.

Operation Mode Based Control

This type of control is applied to units that can assume different operating states. Because the CEM knows the units and knows which operating modes they can adopt. It controls them in such a way that the specifications are adhered to and they work optimally within this framework. For example, it can command a charging station to charge at full power for a certain period of time, but then change the operating state.

Fill Rate Based Control

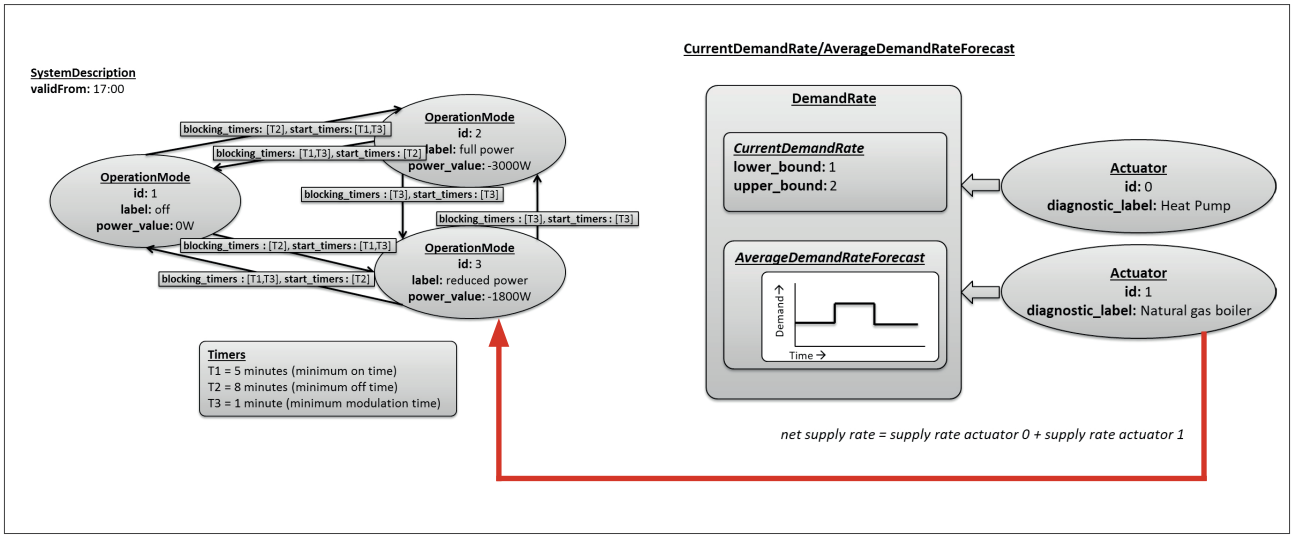
This type of control is suitable for devices that store or buffer energy. The RMs inform about their current as well as their minimum and maximum filling quantities and whether they may be fallen short of or exceeded. The unit can also tell you when it wants to be recharged. The RMs also communicate their leakage behaviour to the CEM. A hot water tank loses heat over time, even if no hot water is drawn from it. Because it is also known what is consumed on average on a weekday, it is possible to calculate how much energy is needed to refill the storage. Filling it is in turn modelled: This is the task of one or more actuators linked to the RM. They are modelled in the same way as the units in the Operation Mode Based Control type. Only the effect they have on the filling level needs to be added. Based on this information, the CEM sends the commands and indicates the desired operating mode of the actuator and the time for the transition.

Demand Driven Based Control

This type of control was created for units that are flexible in terms of the type of energy used, but cannot store or buffer energy. A hybrid heat pump that can generate energy via electricity or gas is one example. It can communicate how high its needs are or in what range its needs are or will be soon. The operating modes of the actuators indicate how much can be produced in that mode. The CEM combines the operating modes of the actuators to meet the demand.

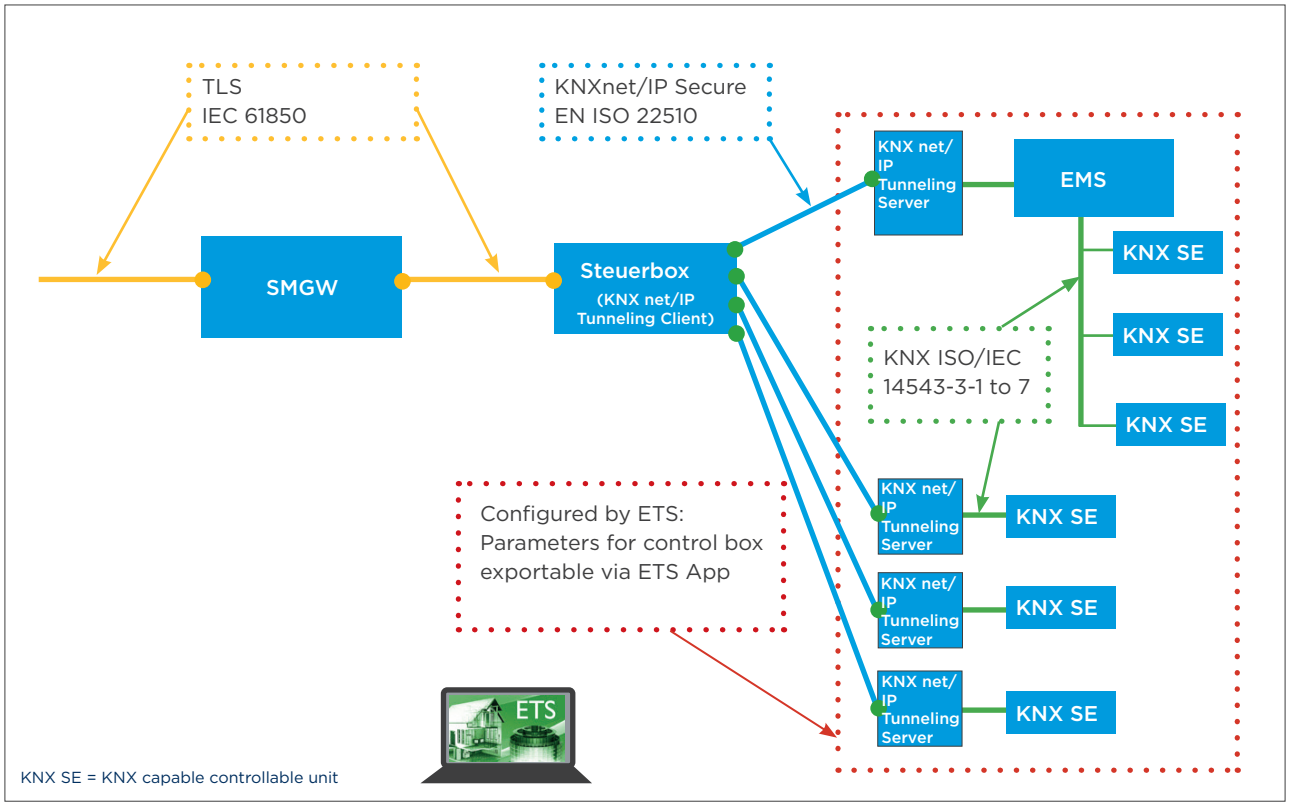
KNX Classic and KNX IoT

So what does this mean for KNX, how can these control types be implemented in the KNX world?
Above all, it is about parameters that change over time. This would definitely be possible via group communication in KNX. But in reality, the 14-byte telegrams would not be sufficient for this; extended frames would have to be used for this. In a typical group communication, however, the CEM always addresses only one unit, almost never



Demand driven based control

several units at the same time. Therefore, Object/Property communication would be more suitable, or even Function Properties. However, this would require the installer to store the individual addresses of the RMs in the CEM, which ETS does not currently support.
Therefore, it would be better to use KNX IoT Point API with JSON or CBOR data structures for the exchange between CEM and RM. "However, KNX Classic can still be used for event-driven communication," explains Joost Demarest. "The exchange of device parameters, however, could then be done via KNX IoT Point API."
And now another novelty for Germany. At this point, the FNN is in charge of the specification of the so-called control box, which sits behind the smart meter gateway (SMGW). The control box allows loads to be switched in the smart home or in smart buildings. Previously, the control boxes were available with four relay contacts. "Annex B to the FNN control box specifications is now being prepared, which will specify how the control box can also be realised with KNX," Joost Dermarest is pleased to say. The control box could then be realised as a KNXnet/IP tunnelling client. The most important thing: The installer can configure the KNX installation as before, nothing changes for him. He only needs to integrate commercially available KNX Secure Tunneling Servers into the system. However, the manufacturer of the control box with KNX interface must provide an ETS app. This ensures that the parameters required by the control box can be exchanged during initial installation or replacement of the control box. "Annex B will be adopted soon, then the manufacturers can develop control boxes accordingly and put them on the market," explains Joost Dermarest.
In this way, KNX and KNX IoT can work together in the future.
For the energy transition to succeed, the home energy management system and home automation must be integrated into one system.
Joost Demarest, CTO of KNX: "For event-driven communication, KNX Classic can still be used. "The exchange of device parameters, however, could then be done via KNX IoT Point API."
The control box allows loads to be switched in the smart home or in smart buildings. Annex B to the FNN control box specifications is now being prepared, which will specify how the control box can also be implemented with KNX.



The control box allows loads to be switched in the smart home or in smart buildings. Annex B to the FNN control box specifications is now being prepared, which will specify how the control box can also be implemented with KNX.