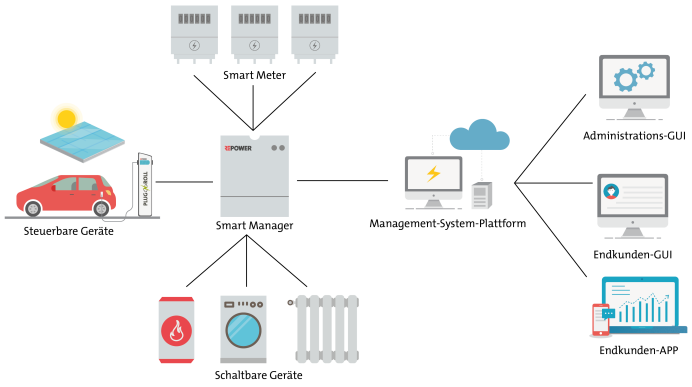
Network Surveillance in an IoT environment

Master thesis

Project Background

Noser Engineering AG is working together with EVUlution AG to design a new manageable power distribution solution to handle arising challenges in power networks over the next decades.

SMARTPOWER allows network operators to provide their customers real-time data about their power consumption and production (e.g. photovoltaic) as well as manageability of their connected devices. The goal of the system is network stability and prevention of peaks in demand.



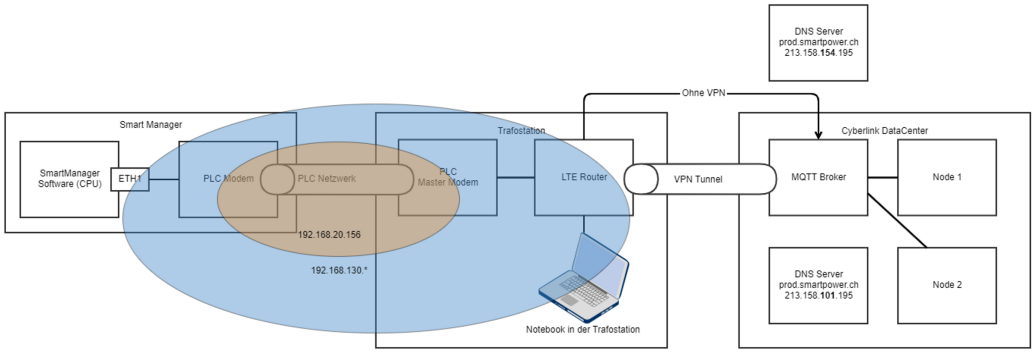
The main components are `Smart Managers` and a `Management Platform`. A `Smart Manager` is installed in a building and offers several functionalities such as reading out values from smart meters, connection to the `Management Platform` and executing predefined rules upon events. The `Management Platform` is hosted at some server and has several endpoints for administration and visualization of data.

Project

A `SMARTPOWER` network consists of several distinct networking devices which are required to ensure that each sensor can send its values to the management server. Currently, only a coarse grained monitoring system tracks correct functioning of those devices. To ensure a high availability of each sensor it is necessary to monitor all components and links. With that information, it is possible to take appropriate measures to fulfill the service level agreements.

The goal of this thesis is to determine suitable monitoring mechanisms which are able to locate the reason for an unavailability of a specific network component. The results then need to be verified with a proof of concept in a prototype network.

Technical network overview



The network is based on different physical layers using different protocols. In the figure above a network using G.hn power line communication (PLC) is depicted. Each `Smart Manager` consists of a computing unit and an network adapter, connected to a PLC modem using an ethernet connection. The PLC modem is part of a meshed network using mac address routing. It connects to the PLC master modem over potentially several hops (peers or repeaters). The PLC master modem is connected to a uplink in a transformer station, where a VPN connection to the `Management Platform` is established. Power networks offer some redundant links to mask failures, therefore it is possible during runtime that paths in the PLC network might change as well. Distinguishing between such changes and real device failures is a difficult task.

Key challenge

The key challenge of this project is a monitoring that focuses on the key components within the network (Smart Manager, Repeater, Modem) and allows creating an embedded network visualization of the current network state. The cloud and embedded worlds have to be united conceptually and technologically using C/C++ programming for the devices and .NET programming for server-side code.