SASensor Open Platform

Summary

Locamation develops automation solutions for smart grids. Recently they have devised a new concept called “OpenPlatform”. The Open Platform is an initiative to allow 3rd party applications to run on Locamation’s software product “called SASensor”. SASensor is a substation automation platform within the Medium Voltage (MV) and Low Voltage (LV) substations and is continuously measuring and monitoring the electricity flow within the substation/transformer. All measured data is made available through the OpenPlatform to the 3rd party application. OpenPlatform is Locamation’s initiative to test new applications, speed up research and development by collaborating with 3rd party developers and research institutions. It provides their customers an innovative platform that can cope with new emerging ideas and functions resulting from the advances within smart grids.

Open Platform V2

Open Platform V2 eliminates the risks involved by allowing third party software to run on ARTOS (The real time operating system of SASensor) without hindering or risking the correct operation of sensitive (protection) applications.
With the advances in processor architecture (multicore processing) and the addition of virtualization technology (VTx) to intel-based processors, it is now possible to execute various operating systems on the same computer. Support for this technology in the form of a Linux hypervisor (KVM) allows us to run both Linux and ARTOS on the same hardware and on different cpu-cores. This feature implies that third party applications can run on the Linux-client next to ARTOS. In order to exchange real-time data between ARTOS and the Linux-client we have to develop a real time data (RTD) bridge between the two systems. The availability of a dedicated shared-memory drivers (Nahhani driver: http://www.linux-kvm.org/wiki/images/e/e8/0.11.Nahanni-CamMacdonell.pdf and http://abhijeet-dev.net/content/ivshmem-qemu-kvm-interrupts), makes this approach look feasible.

Features of the Open Platform V2:

- Uses KVM to create 2 virtual computers with Linux and ARTOS operating systems.
- The Linux computer is the Open platform for 3rd party applications.
- The ARTOS system is responsible for providing measurement data and a suite of standardized communication protocols to the control center.
- Real time data is exchanged through shared memory between the Linux and the Artos system.
- Support for standardized communication protocols (IEC61850-SV, DNP3, IEC60810-104, IEC60810-101, etc.).
- Cyber security.

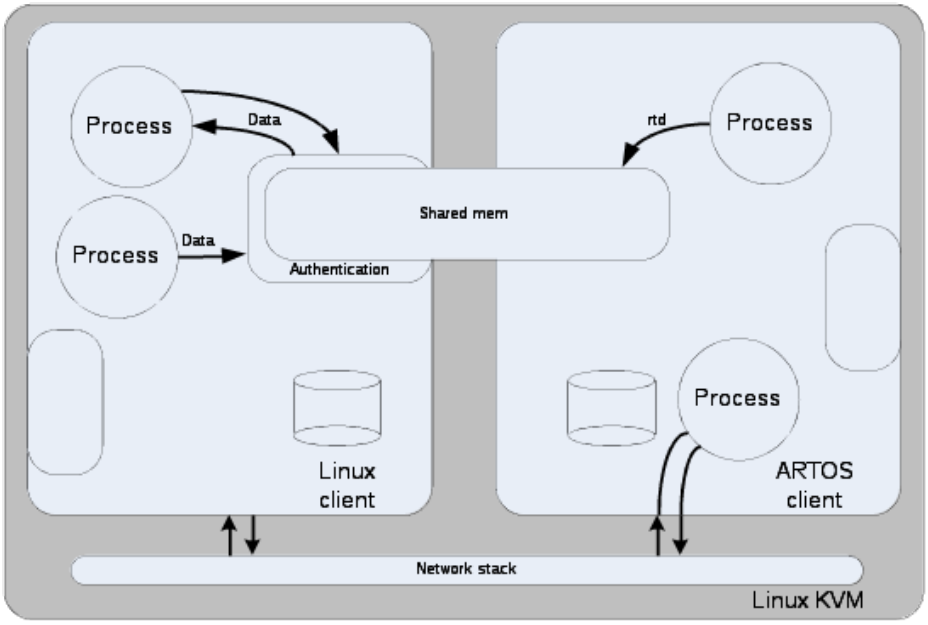

Figure 2: schematic diagram of the Open Platform concept

The assignment

Locamation would like to test this concept in the field test of Lochem (IN4Energy project) as a first run of the Open Platform V2. Lochem is part of a national field test, testing the impact of high penetration of PV panels and electric cars within the low voltage grid. This environment is an ideal test-case for smart-grid technology. Within this field test, both transformers and households provide measurement data such as power consumption and voltages.

Within the CAES chair, a demand side management methodology for smart grids, called Triana, has been development. Triana consists of three steps: forecasting the flexibility within the grid, finding a (optimal) planning exploiting this flexibility and lastly ensuring the made planning is achieved. Triana uses a hierarchical approach, where coordination between a central controller and individual controllers located in the grid is used. Models of both household energy flows and the low voltage grid are available. The latter can be used for load-flow calculations to do a state estimation of the low voltage network.

Within this assignment you have to research the best architecture to apply Triana on top of OpenPlatform v2. Besides the research within the underlying hardware/software layer, a scalable solution is required for the coordination with the controllers present within the grid.
A proof of concept implementation is a load shedding optimization that would reduce the peak-load emerging from charging multiple electrical cars at the same time. The Triana methodology and measurement data are to be used to resolve congestion and voltage problems.

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