

The communication and system architecture was developed based on above SLD as shown in Figure 2.

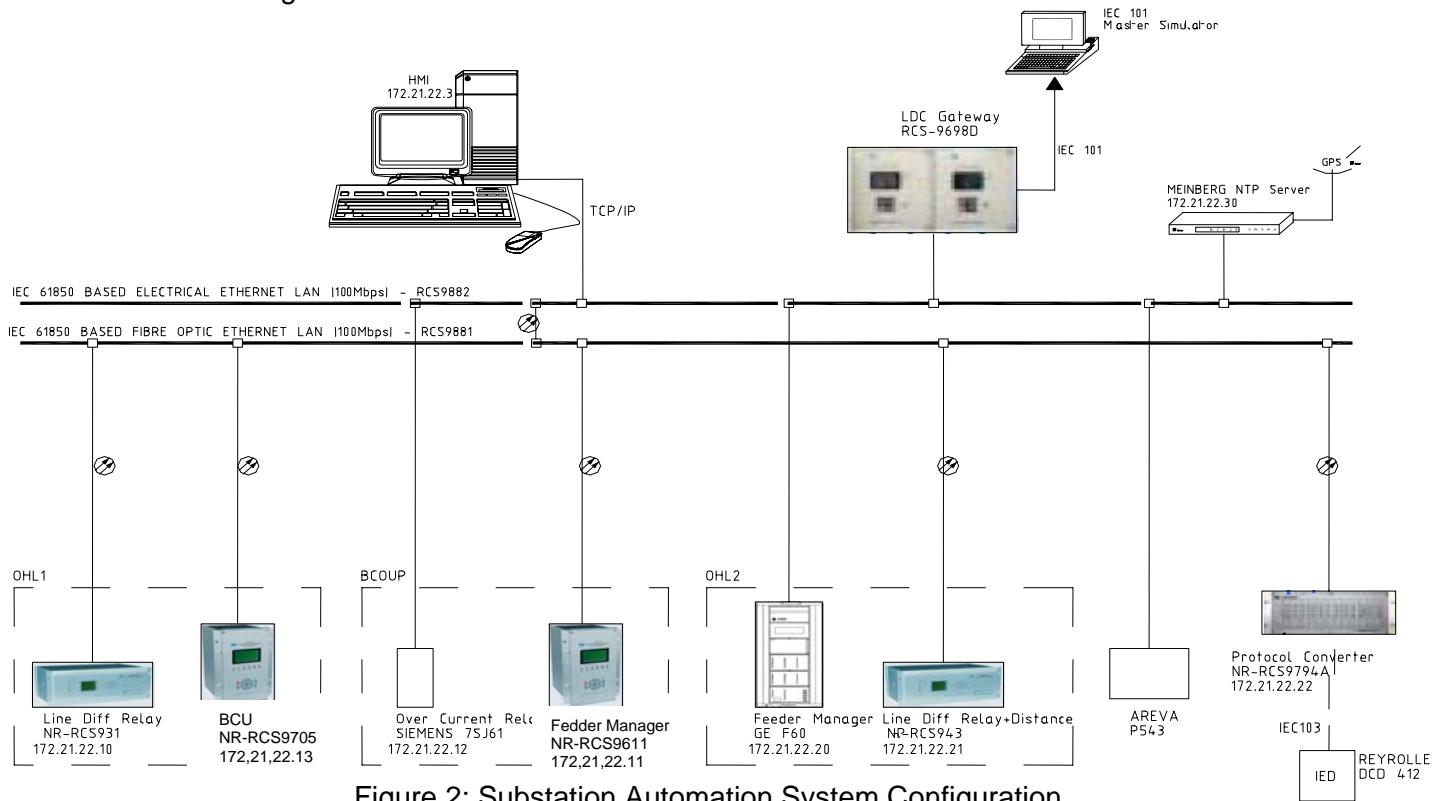


Figure 2: Substation Automation System Configuration

It was decided to use multi vendor IEDs for the SAS configuration. This has enabled us to test the interoperability capability of this new standard.

The NR RCS 9705 BCU and the NR RCS 931 was used as line differential protection for the configuration in overhead line 1 (OHL1).

In bus coupler bay (BCOUP) the IED from NR RCS9611 was used as feeder manager (FM) and Siemens 7SJ61 over current relay used for protection function.

The IED from GE Multilin the F60 was used as feeder manager (FM) and NR RCS943 was used as Line Differential protection in overhead line 2 (OHL2).

The HMI make was Zenon from Austria and the NTP server was from Meinberg, Germany.

An IED from Reyrolle UK was connected through NR protocol converter to test out legacy systems.

Demonstration to TNB

A presentation was made to about 20 people from Engineering, Protection, Telecontrol and Asset Management Departments of TNB. Most of them were quite knowledgeable in IEC 61850 and had experimented with IEC 61850 tools and IEDs.

After a short introduction, Marketing Head of NR, Mr. Xu Long gave a Corporate Presentation on NR and their products used in the test system.

Mr. Wang Shu Chao, NR, then presented the NR experience on engineering and commissioning of substations based on IEC 61850. The wealth of experience and the knowledge exhibited was well received.

iTECH then presented the changes in attitudes and paperwork that need to be incorporated by the utility in specifying, approving, testing and commissioning of IEC 61850 based substations.

The actual Demo system set up was then presented by iTECH, Mr. Sivakumar and his team of Sabai, Kao Keong and Kumaran where the full miniature s/s set up was demonstrated. Interoperability between multi-vendor devices, Integration of Legacy devices, Application of GOOSE messages were all actually demonstrated to the satisfaction of the audience.



Finally a hands-on demonstration of usage of NR SCL tool in engineering the IEC 61850 based substation (picture above). The ease of usage and the flexibility of the tool was very impressive especially compared to other vendor tools.

The Demonstration was an unqualified success in the interest generated.

Success Stories

Even though this is the first IEC 61850 system for iTECH, a number of targets were successfully accomplished and a number of theories tested.

- a. The newly developed IEC 61850 driver in the HMI was successfully tested with IEDs from all vendors. The driver behaved correctly and was able to communicate to all the vendor devices.
- b. IEC103 to IEC61850 conversion of the data went through without any problem. The analogue values, Digital Values were recorded by the HMI correctly. This would help integrate Legacy systems.
- c. Engineering and transmission of GOOSE messages was successfully demonstrated by using these messages for station-wide interlocking as shown in Figure 3 (below). GOOSE messages were also picked up by the HMI. This would help in reducing Panel and inter Panel wiring.
- d. Evaluation of SCL tools. Of the three tools studied, the NR tool seems the most useful by far. An English translated tool is being developed.
- e. Study and testing of RCS 9698 Gateway was successfully done. SBO Command and data were transmitted successfully to the IEC 101 Master simulator (SAT Protocol test System) to NR BCU RCS 9705 via NR RTU RCS 9698.
- f. Time synchronization was achieved with all IEDs using Meinburg NTP server. 1 millisecond accuracy is being tested.
- g. Engineering, testing and setting of relays from NR, Siemens, Reyrolle and Areva was successfully learnt by iTECH engineers.
- h. IEC 61850 engineering from SSD to detailed engineering was understood.

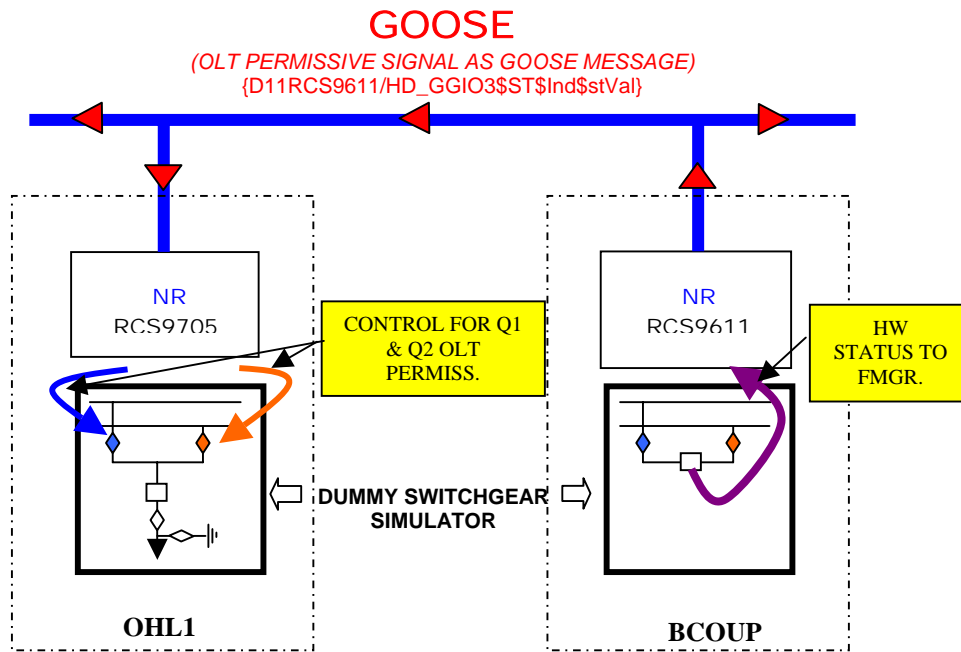


Figure 3: GOOSE Message Implementation

Lessons Learnt

There are still much training/studies needed to completely engineer a substation with IEC61850. What has really been learnt is that there is much more to be learned!