Eandis IEC61850

Next steps

27 September 2017
Eandis in the Energy market

Regulator
CREG / VREG

Producers
Electricity

Import Natural Gas

Elia

Distribution
Grid Operator

Fluxys

Suppliers

Customers
Eandis Network: TS -> SS -> DS

- Elia
- 225 Transformer stations
- 770 Switching substations
- 300,000 LV feeders
- 2,500,000 Customers
- 28,500 Distribution Substations
- 14,000 Customer Substations

IEC 61850 Europe - Amsterdam

27 September 2017
## Introduction Eandis and substation concept

<table>
<thead>
<tr>
<th>HV/MV primary substation - TS</th>
<th>MV secondary substation - SS</th>
</tr>
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<tbody>
<tr>
<td>Double busbar cubicle</td>
<td>Single busbar cubicle</td>
</tr>
<tr>
<td>2 or 3 busbar linear sections</td>
<td>2 to 4 busbar sections in O-shape</td>
</tr>
<tr>
<td>Always involving ELIA</td>
<td>Rarely involving other DNO(‘s)</td>
</tr>
<tr>
<td>Possibly involving other DNO(‘s)</td>
<td></td>
</tr>
</tbody>
</table>

All position indications, measurements, alarms and control signals implemented using classical wiring (no experience with substation protocols, eg 103)
Decentralised production systems

> 1 MVA or when N-1 situation is not guaranteed
Protection IED in Distribution substations

- 2014: concept and contracts
- 2015: engineering and rollout
Implementation of UFLS using IEC61850

- **Legacy Transformer Substations: no IEC61850**
  - Trip transformer CBR in case of frequency drop
  - Partial clearing of feeders before reclosing transformer CBR

- **Under Frequency Load Shedding with IEC61850**
  - Partial clearing of feeders
  - Prioritairy feeders → no zero pass through
Implementation of UFLS using IEC61850

- Automated script determining the group setting for every feeder in the transformer substation
  - GROUP 1: non-priority feeders (passif feeders)
  - GROUP 0: priority feeders (e.g. hospital)
- Script runs periodically (every month)
- UFLS setting group is send using the IEC60870-5-104
Implementation of UFLS using IEC61850

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Implementation of UFLS using IEC61850

- **Commissioning & maintenance aspects**

  - **Reducing the risk of unwanted Trips**
    - Arming principle of DSO function
    - VT – IED’ s have under frequency criteria
    - Send pick up through GOOSE
    - Interface IED is armed on pick up

  - **Possibility to test UFLS in live substation**
    - Implementation of generic BLOCK UFLS GOOSE signal
    - Function key on interface IED sets BLOCK signal high
    - “Live” feeder IED’ s will ignore the Trip signal
    - Using key on Feeder IED you are able to test UFLS TRIP
Implementation of UFLS using IEC61850

- DSO pick up @ 49,8 Hz
- TSO pick up @ 49 Hz
  - TSO → DSO: 10 ms (*high speed relay*)
- Processing time IED: 6 ms
- DSO- SAS reaction time: 44 ms (*incl. CBR’s*)
Added value UFLS using IEC61850

- **Flexible and selective solution**
  - Priority of feeders can change in time
  - no zero pass through Prio Feeders

- **Reaction time E2E: 44 ms (incl. CBR trip)**
  - Total time Trip TSO → Trip DSO: 54 ms

- **Need to implement GGIO GOOSE message(s)**
  - For commissioning and maintenance purposes
  - Should be integrated in test mode
Transition to IEC61850: take the plunge

- **2011: POC (multi vendor)**
  - Multivendor works
  - Many different toolings: too complex on DSO scale

- **2012: European Tender**
  - Single sourcing (IED, RTU, Switch)

- **2013 – 2017: IEC61850**
  - 75 x MV secondary substations
  - 12 x HV/MV primary substations
  - 145 x Dec. production units
  - 35 x Distr. Substations with OC

- What’s next?
Existing substations Eandis

- **Single vendor (IED and RTU)**
- **IEC61850 Ed. 1**
- **Client server implemented for reporting**
- **Dynamic datasets possible**
- **Engineering process**
  - Only 2 configuration tools required (RTU / IED)
  - No .scd transfer between tools necessary
- **GOOSE implemented for interlocking and protection schemes**
- **Conventional VT and CT**
IEC61850: research topics for Eandis

- Interoperability with installed base
- IEC61850 Ed. 1 vs Ed. 2
- Engineering process
- Dynamic vs Static datasets
- Single vs Multi vendor
- Inter-substation
- Sampled values
- Non-conventional sensors
“In theory, theory and practice are the same. In practice, they are not.”

Albert Einstein
Expanding existing substation

- Case 1: Integrating new IED’s in existing substation

**Interoperability with installed base**
- 3 different IED vendors
- Interlocking using GOOSE
- Engineering process (GOOSE)
- Ed1 vs Ed 2
- Dynamic / static datasets
Greenfield conditions

- **Case 2: New IED on new RTU**

![Diagram showing IED and RTU connections]

**Greenfield (RTU – IED)**
- 3 IED vendors
- 4 RTU vendors
- MMS communication
- Engineering process (MMS)
- Dynamic / static datasets
Challenges for Eandis & industry

- **Dynamic datasets**
  - Nice feature for future data needs
  - However not widespread on market
  - Issues with association process
    - need for flexible RTU (/IED) vendor
    - Conformance testing

- **Datamodel specification**
  - How to impose Top down datamodel on vendors
    - Every vendor has own LD/LN hierarchy
    - Readability: user-specific “Prefix” to LN name

- **Engineering process**
  - Trying to avoid need for SCT tool for every project
Challenges for Eandis & industry

• Combination of generations of equipment
  ➢ Single sourcing → multi source environment

• Implementing ed. 2 not possible installed substation
  ➢ IED’s have to be multi – edition

• Put specific functions of IED in ‘test mode’:
  ➢ Not possible now: so specific GGIO GOOSE messages!
  ➢ Industry has to implement more advanced test modes

• “Semi Automated” Asset management:
  ➢ E.g. firm versions
  ➢ Protection thresholds

• future use cases @ DSO?
  ➢ Inter substation GOOSE
  ➢ Sampled values
  ➢ Control room to substation IEC61850
Conclusion: Integrating IEC61850 @ Eandis

Key success factors @ Eandis:

- **Standardisation** (Prim. & Sec. equipment)
- Time & resources to gain expertise
- In house engineering
- Involvement from decision makers to adopters
- Good, easy to use software tools
- Firmware freeze
- **KISS**: Keep It Simple Stupid
Werken in opdracht van eandis

altijd in uw buurt