PI System Users Group Meeting - Düsseldorf January 20th 2011

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- IEC-Capabilities of the Bachmann M1 controller system
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A short introduction to IEC61400-25

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General issue
Remote access to energy ressources

- Complex, distributed structure
- Variety of devices and brands
  - protection relais
  - Cuircuit breakers
- Demands
  - Remote Communication
  - data aquisition
  - Operation and monitoring from control room

Commonly used legacy solutions

- Modbus
- IEC60870-5-101 (serial)
- IEC60870-5-104 (TCP)
  - Used for many different applications, e. g. tunnel lighting
  - Drawback: Compatibility between manufacturers
- DNP3

Improvements introduced by the IEC61850

- First released 1995
- Physical media: Ethernet
- Transport layer: MMS (ISO 9506)

- Improvements:

- Object oriented representation of devices
  - Predefined Structures for different types of devices
  - Predefined Object and data directories

- Data access via named attributes
  - Semantic of data is unified between manufacturers

- Selection of services to access data

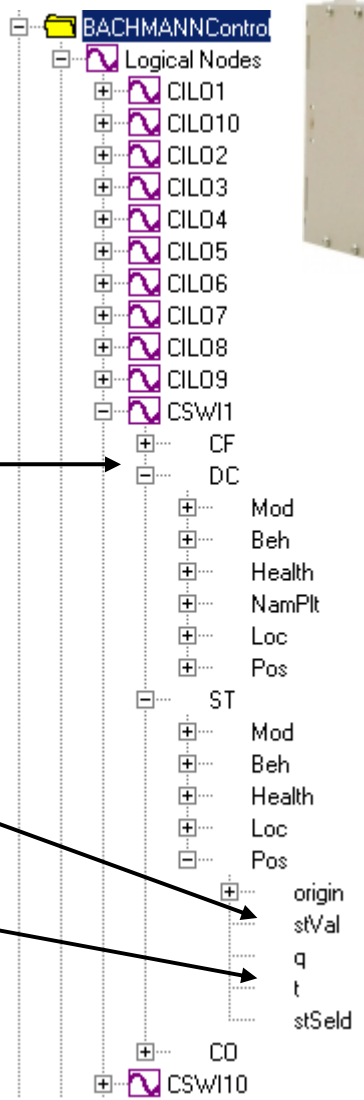
- Unified configuration
  - Standardized description in xml (ICD, SCL)
  - self-descripting, online browsing of data directory

Example: IEC61580 Data directory of a switch

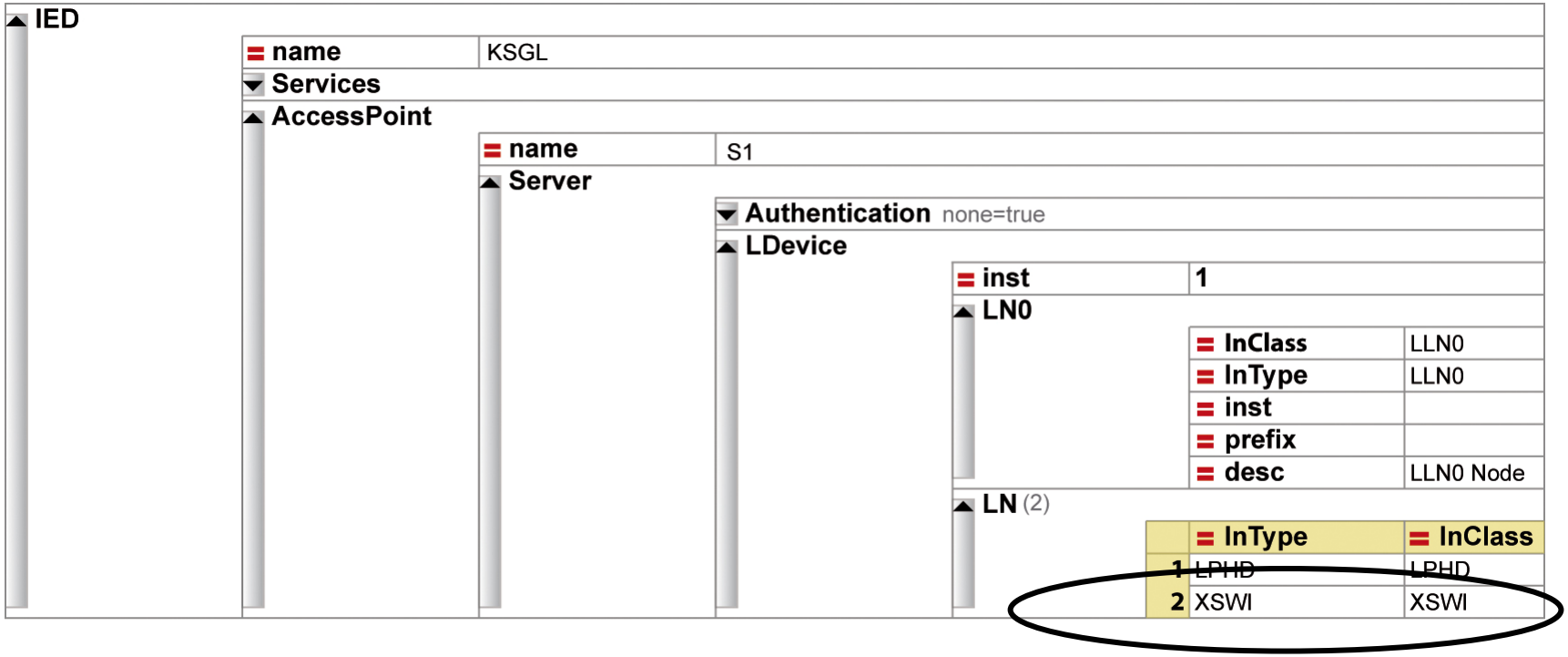
Meta-information about data:
Description, configuration

Status information:
Position of the switch contact

Position value with quality, timestamp, and additional information



Example: IEC61850 device and node hierarchy



IEC61850 Data access services

- Read data
  - Polling mode
    Single access to attributes or structures
  - Report mode
    Automatic transmission from Device to subscriptors
- Different "Functional constraints" for different data → more than read-only and read-write
  - Configuration (CF)
  - Description (DC)
  - Status (ST)
  - Set-point (SP)
  - Control (CO)
- Filetransfer, sampled values

IEC61850 Control model: How to operate a device

- Different control models
  - One-stage operaton
    - Direct operate
  - Two-stage operation
    - Select before operate
    - Operate
- Result of operation: Status change via report

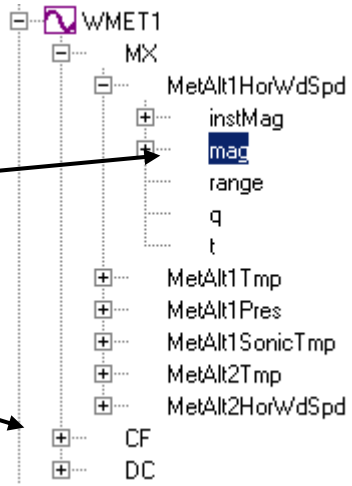
What is IEC61400-25 compared to 61850

- The IEC61400 is the collection of wind turbine standards
- All required extensions to 61850 for wind turbines are in 61400-25

- additional object definitions
  - WMET – meteorological data
  - WTRM - Transmission
  - WROT – Rotor
  - … some more

Measurement Value in MX

Units and scaling factors in CF



What is IEC61400-25 compared to 61850

- More transport protocols additionally to MMS
  - Webservices, 60870 and some more
  - As 61850 only supports MMS,
    most 61400-25 implementations also use MMS
- All basic concepts of communication and data representation
  is to be found in 61850!

Integration of IEC61850 & IEC61400-25 on the realtime controller

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Changes in the wind turbine market

- Increasing demands on data acessability
- Proprietary access is disadvantage for turbine's owner
- Heterogenous structure of stakeholders
  - Manufacturer
  - Owner
  - Park operator
  - Grid operator
  - 3rd Party service technician

  → different needs for data access
- totally installed capacity of wind power becomes relevant for grids
  → scenarious become more complex
- Legal changes – e. g. Germany‘s EEG

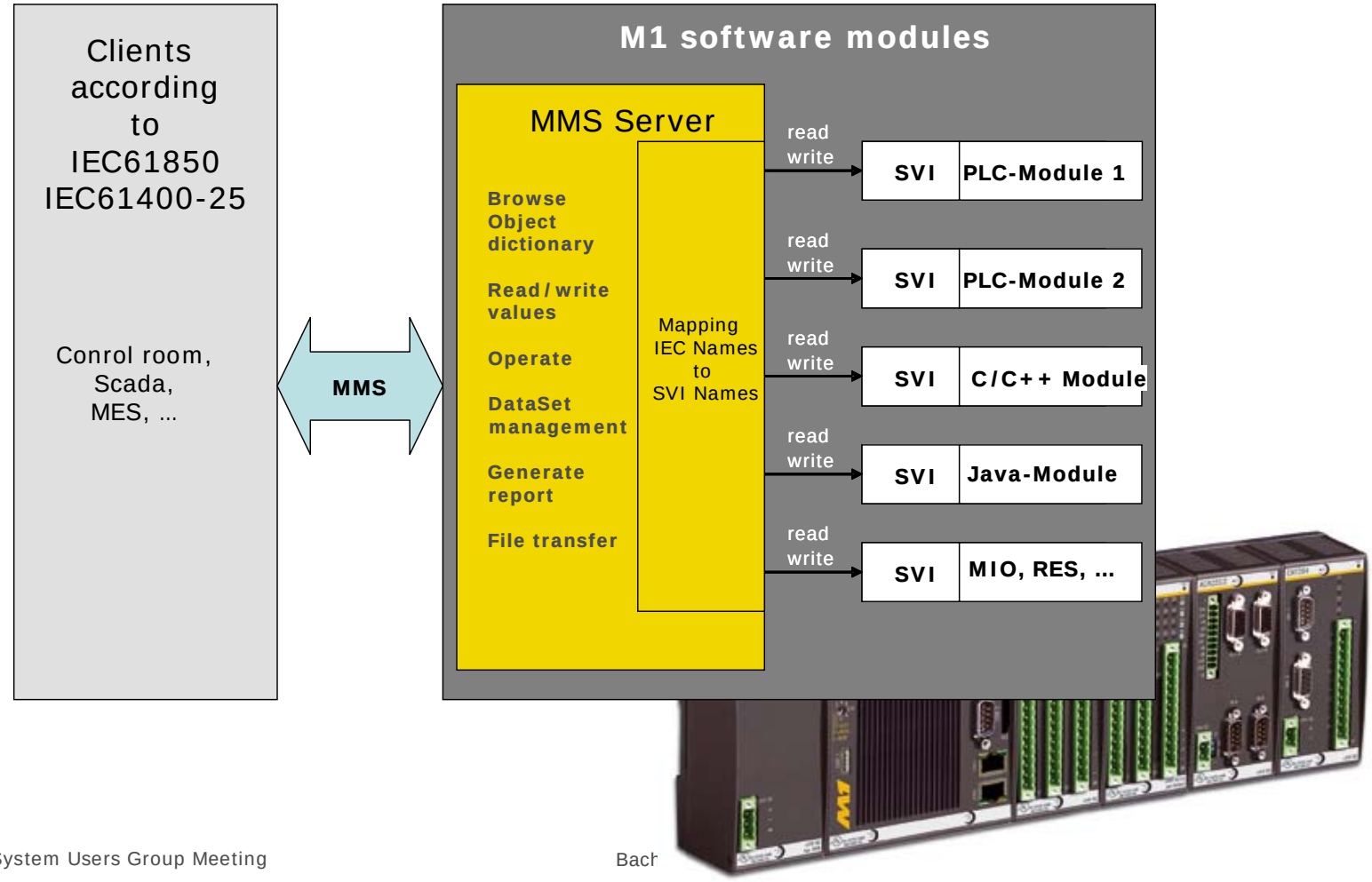
Opportunities given by the controller system

- Controller software represents the whole turbine with all its data
  - Monitoring values
  - Closed loop controllers
  - sampling data
  - Alarms, events, states
  - Condition monitoring
  - Operates executed by controller

- Open system with many opportunities of configuration, flexible combination of standard software products and user programming

- Dedicated hardware components
  - Grid measurment and protection
  - Vibration measurement
  - Functional safety

IEC communication as software module on the controller



IEC communication for the bachmann OEM customer

- Optional software component
- Object dictionary and access rights configured by turbine manufacturer
- Data point connection to turbine application programs
- Go-Live project currently going on with REpower, e.on and OSI/Sisco
- Implementations going on with other turbine manufacturers, currently two customers have it in the field
- Successfully tested at the latest Interop-Workshop 2010 in Sweden

IEC communication for the bachmann OEM customer

- Precise time stamps due to PTP (IEEE 1588) synchronization
- No additional hardware, pure software solution.
  Uses existing ethernet ports of controller CPU
- Traffic can be mixed with legacy protocols
  (Modbus, FTP, OPC, proprietary protocols, …)

Benefits of an integrated solution
Turbine manufacturer‘s view

- Single point of configuration: Program and data access on one robust CPU
  → easier set-up and software updates
- Less misunderstandings about data exchange
  → easier integration into existing wind parks
- No additional PC in the turbine
  → better availabilty
- No Proxy, no communication delay, local report buffer in the controller
  → Faster reaction to set-point changes and operates
- Direct interaction with controller program.
  → Operates can be accepted or denied directly by the turbine software

Benefits of an integrated solution
Turbine owner‘s view

- One scada interface for different turbines
  → Mix of manufacturers can be handled
- Standard client software available
  → No need for gathering proprietary software
- PTP synchronized timestamps on all turbines in the park
  → exact and transparent logging of all events
- Easier Scada integration due to configuration standard
  → faster go-live of new turbines
- Same “language” as substation devices at point of common coupling
  → full integration of all park infrastructure

IEC server and client available on the controller

- MMS-Client allows connecting all IEC-capable standard devices directly to the turbine program
  - Meteorological data (61400-25)
  - Converters (61400-25)
  - Protection relays (61850)
  - Circuit breakers (61850)
  - ...
- Comfortable access to data and reports
- Comparable to classic fieldbus system
- Saves discrete wiring
- Better means of logging with original timestamps

Challenges on first installations

- User dependant visibility of data (Access view) is not covered neither by the standard nor by the stack suppliers
  - Solution is implemented by Bachmann
  - Better support by standard and stacks still required
  - Risk of inconsistent object directories
- Increasing importance of IT security issues
  - Heterogenous roles of stakeholders
  - More “public” access to turbine’s data
- Insufficient declaration of alarm handling
  - Logical Node “WALM” needs better specification
  - Collaboration of Bachmann in the Use61400-25

Thank you for your attention!

- Questions and discussion