Missouri Public Service Commission Smart Grid Technical Conference IEC 61850

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Smart Grid Communication

- Today we monitor:
  - Power plants
  - Transmission lines
  - Transmission substations
- Provides limited distribution feeder information.
- Smart Grid requires communication to extend further into grid:
  - Multiple locations on distribution feeder
  - Customer premise
- One solution may not work for entire service territory

IEC 61850 High Level Overview

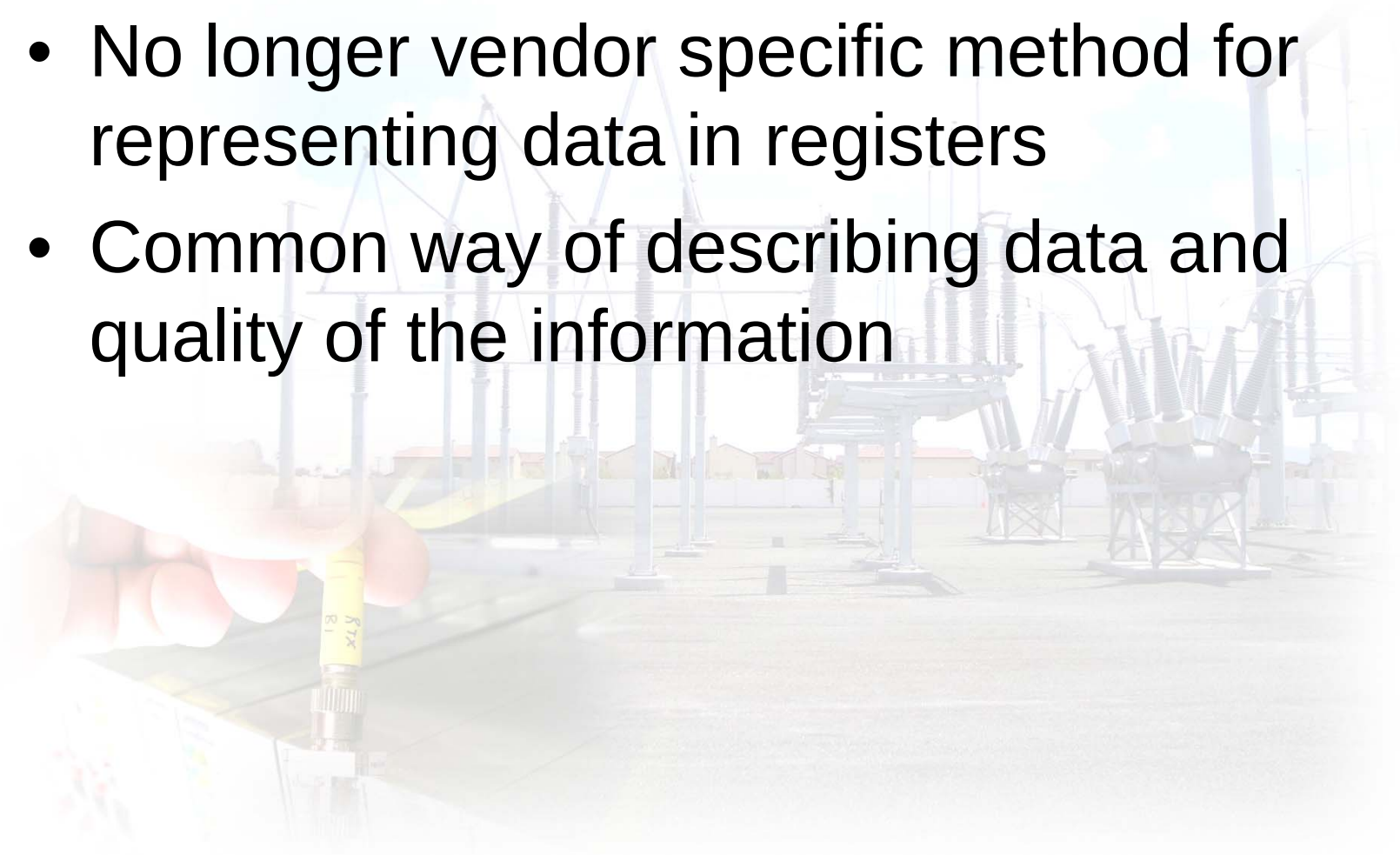
- Information is described in a common way across all devices
- All information is available to all devices
- Information is shared in real time over a common communications bus

IEC 61850 High Level Overview

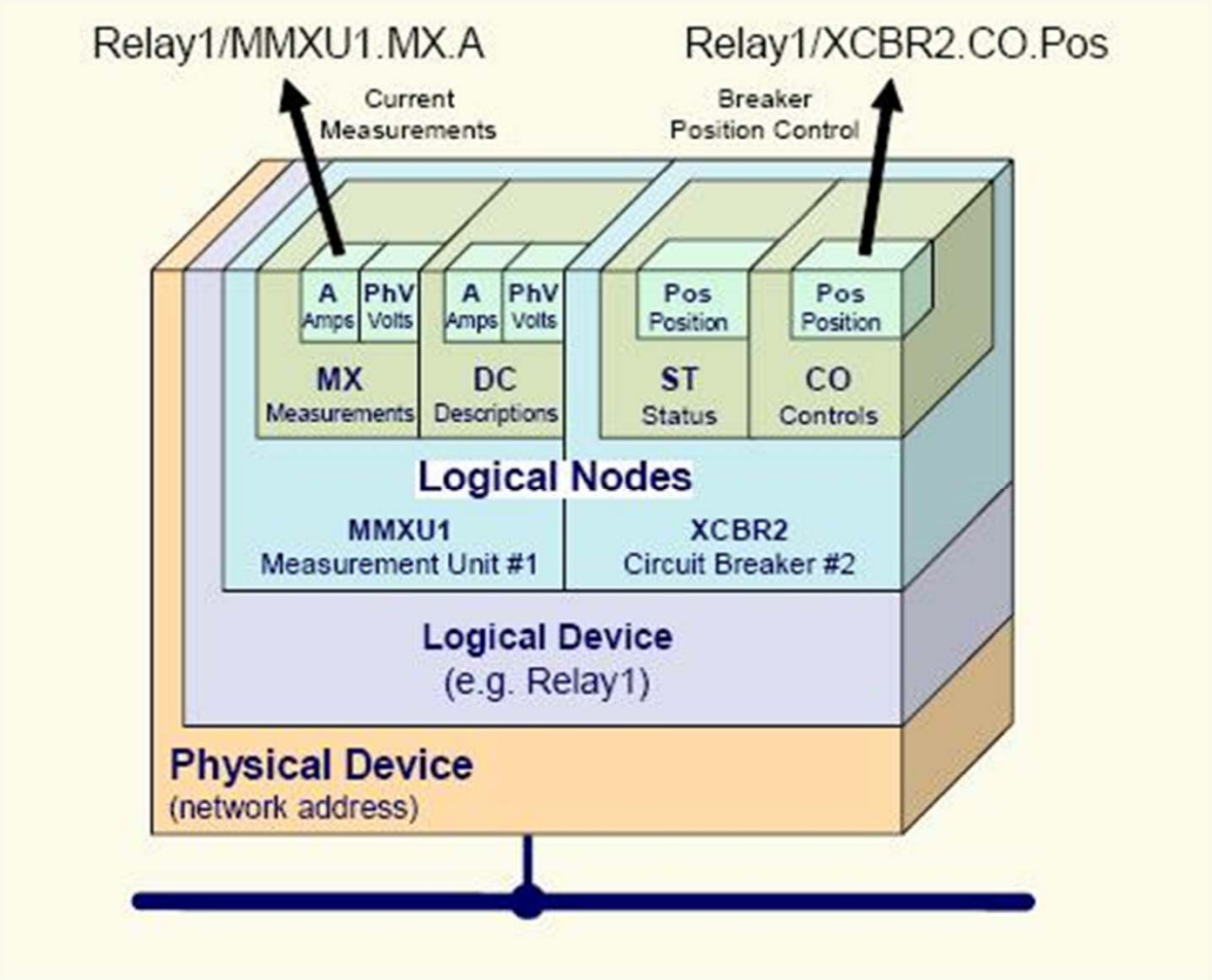
- Common Information Model (CIM)
- Substation Configuration Language (SCL)
- Object oriented communications protocols

Common Information Model

- No longer vendor specific method for representing data in registers
- Common way of describing data and quality of the information



IEC 61850 Objects



GOOSE

- Event coordination protocol
- One way – devices advertise know information
- Any other devise subscribes to channel
- Unconfirmed
- Status updates sent when event occurs
- User defined data in each message
- LEAN and FAST (tripping)

Manufacture Message Specification (MMS)

- Metering/Status/Control protocol
- Object oriented standardized information per device type
- Time stamp and quality information with each object
- Polled or report by exception
- Derivative of UCA

Sampled Values (SV)

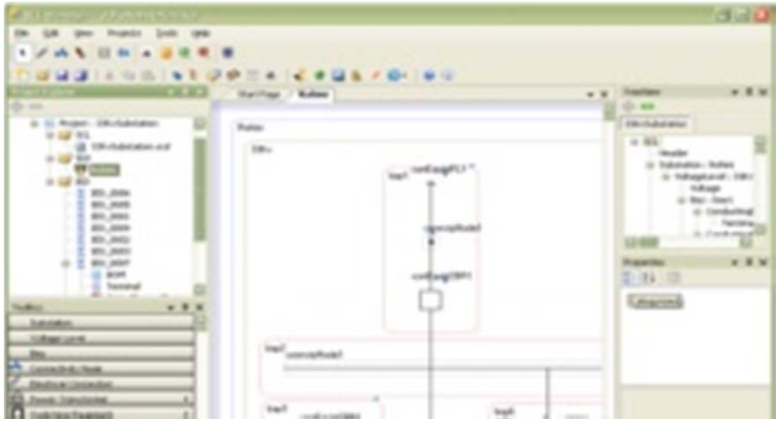
- Process Bus
- Real-time transfer of currents and voltages
- Same transport model as GOOSE
- Constant period between messages
- 80 to 256 samples per second

Common Information Model

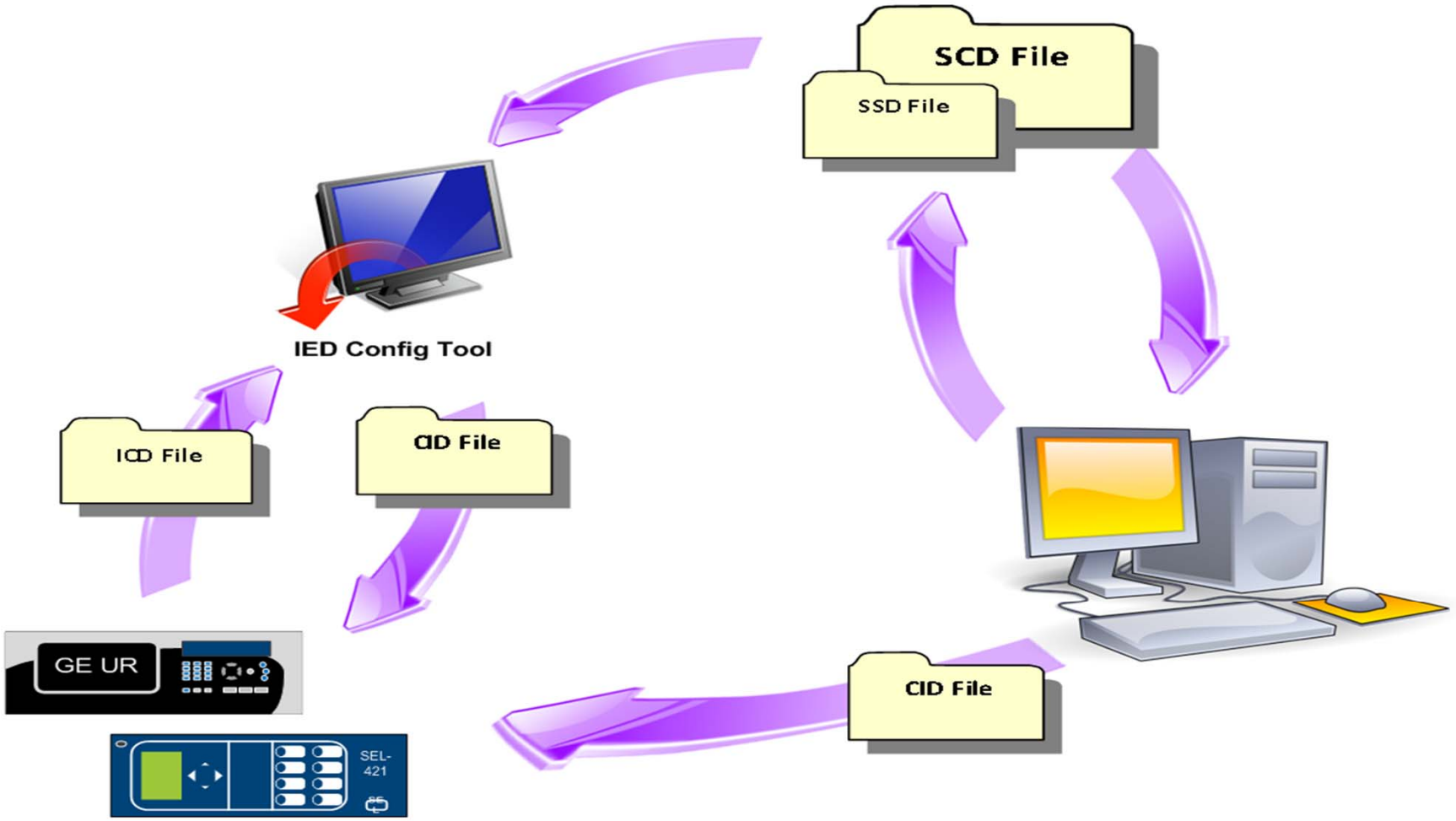
- IED Capability Description (ICD)
- Configured IED Description (CID)
- Substation Configuration Description (SCD)

System Configuration Language (SCL)

- Data architecture
  - Station one-line
  - Control logic
  - Communication
  - Settings come directly from model (ICD)
  - XML based



System Configuration Language (SCL)



Object Oriented Protocols

- Object Oriented Substation Event (GOOSE)
- Manufacture Message Specification (MMS)
- Sampled Values (SV)

IEC 61850 = More Documentation?

- Substation configuration tool
  - Electronic model of substation
  - Validation / what if scenarios
- Decrease wiring/elementary/schematic diagrams
- Net decrease in manually created documentation

IEC 61850 and Security

- Within control house -> CIP compliance methods are well established
- In the substation yard -> It is possible but not as well tested by audits
  - The NERC interpretation to PacifiCorp in February 2009,approved by FERC (Docket No. RM06-22-000) on April 20, 2010 outlines some clarifications to “six sided” physical security for critical cyber assets.

IEC 61850 and Security

- Clarifies that alternative measures to "control" physical access may comprise both physical as well as logical measures.
- Acceptable alternative nonphysical control measures may include, for example, data encryption for protection and circuit monitoring for detection of unauthorized physical access or tampering.

Vendor Interoperability

- It is getting better
- GOOSE and MMS messaging are interoperable
- Configuration methods are not – vendors support the standard to varying degrees
- New generation of devices have IEC 61850 built into hardware architecture from the start

On-going 61850 Development

- IEC 61850-90-1
  - Extensions to IEC-61850 to address inter-substation communication on WAN
  - IEEE 1588v2 Precision Time Protocol (PTP)

IEC 61850 – Additional Developments

- Power Quality
- Weather Forecasting Data
- Hydroelectric Power Plants
- Wind Generation (61400-25)
- High Voltage Switchgear (62271-3)
- Distributed Energy Management