Current Situation for Distribution Automation

- Automation at feeder level often based on localized protection/control applications running on the device without need for communications to other devices.
- Communications often limited to SCADA interface only (trip status, basic measurements, switch commands, control set-points).
- Centralized switch control normally manually supervised, not automated.
- Operation of circuit often not optimal with respect to losses and voltage control.
- Often difficult to make business case.
Intelligent Electronic Device (IED)

SCADA Interface

Alarms, Measurements

Control, Settings

Device Logic

Input/Output

Event Records

Waveform Capture

**IED Characteristics:**

- Contains one or more microprocessors
- Has at least one communications port, usually 2 or 3
- Has a defined data structure
- Transmits requested data in response to a query
- Accepts and executes commands
- May have a user interface (display and selection keys)
IEC 61850 – Not just for Substation Automation

- IEC 61850 is a protocol designed for the electric utility industry… optimizes Ethernet connectivity:
  - Utilizes TCP/IP
  - Plug and play functionality.
  - OPEN Protocol Format - Coopers’ “Reclose Block” status point will be the SAME point as ABB’s, SEL’s, GE’s etc. with IEC61850
  - Utilizes Goose Technology (Generic Object Oriented Substation Event)
61850-Based IEDs

IED becomes an network (and enterprise)-addressable device

TCP/IP Interface

SCADA Interface (alarms, measurements)

Virtual Input

Voltage/Current

Physical Input (switch position, status)

IP: 192.168.2.10

LN1

XCBR

LN2

GGIO

Events, Waveforms

Virtual Output

Physical Output

SW

Configuration Tool

LN = Logical Node
To be able to exchange the device descriptions and system parameters between tools of different manufacturers in a compatible way, IEC 61850-6 defines a substation configuration language (SCL)

- .ICD file - IED Capability Description
- .SSD file - System Specification Description
- .SCD file - Substation Configuration Description
- .CID file - Configured IED Description
DA Open-Architecture Solutions

- **Future Solutions offerings based on Open Standards**
  Nonproprietary solutions for DA using open standards, such as IEC 61850. Utilize protocol conversion technology for converting between various legacy standards and IEC 61850.

- **Support for present/future communications options**
  WiMax (802.16), Broadband over Power Lines, digital cellular, etc.

- **IEDs, Gateways include basic logic for supporting distribution automation applications**
  IEC 61850-based logic using peer-to-peer for basic automation functionality such as loop control, fault location, volt/var control, etc.

- **Scalable solution functionality**
  Can offer basic solutions for just a few feeders, or more complex solutions involving interaction with distribution management system.

- **Configuration tools**
  Tools made available for automating IED and solution configuration.
Automation Justification

Device Level

Applications
- Predictive Maintenance
- Volt/Var Control
- Auto-Restoration
- Fault Location
- Peak Demand Reduction
- Power Quality Mon.

Business Payback
- $ per avoided maint.
- $ per avoided equip. failure
- $ per Reduced SAIDI minutes
- $ per crew dispatch hours
- $ per kWh loss reduction
- $ per kVA peak reduction
- $ penalized for poor power quality
Utility-Side DA Investment Process

Drivers:
- Load Growth
- Aged Assets
- Operating Efficiency
- Reliability
- Crew Efficiency
- Regulatory Req.

Available Technologies

PROJECT IDENTIFICATION PROCESS

Budget $$

Request for Information
Pilot/Product Evaluation
Request for Proposal
Request for Equipment Quote
Vendor-Side DA Investment Process

**Market Input:**
- RFPs, Sales
- Customer Input
- Competitor Activity
- Market Surveys
- Press/Articles

**Tech Input:**
- Standards
- Existing Product Specs
- R&D Prestudy

**Product Management – New Product & Enhancements Identification Process**

**Business Case:**
- NPV, Years to Payback

**R&D Budget $$**

**R&D Team**

**Product Portfolio**

- Other T&D Equipment R&D

**Automation R&D**

**Market Requirement Specification**
Product Roadmap Example

<table>
<thead>
<tr>
<th>New Products</th>
<th>BobCat Rel 3.1</th>
<th>BobCat Rel 3.2</th>
</tr>
</thead>
<tbody>
<tr>
<td>BearCat</td>
<td></td>
<td>WolfCat</td>
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<tr>
<td>Tools</td>
<td>EzSet v2.3</td>
<td>EzSet v3.0</td>
</tr>
<tr>
<td>Solution Offerings</td>
<td>Loop Control 2.1</td>
<td>Loop Control 2.2</td>
</tr>
<tr>
<td>Base Product Enhancement</td>
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</tbody>
</table>

ABB
Market Requirement Specification

Requirements for a new device or new functionality

- Role of Device in Product Portfolio
- Cost Target
- Use Cases
- Protection, Control, Monitoring Functions
- HMI
- Communications
- I/O
- Power
- Compliance Standards
- Configuration Tool
- etc.
Gaps

- Short-term roadmap input for automation-related product offerings.
- Accuracy of business case associated with new automation offerings/functionality (what are customer really going to spend money on).
- How to package cost-effective distribution automation functionality into standardized product offerings.
- Making automation solutions less complex, easier to market and sell.
- Underutilization of pilot activity for proving out concepts.
- More tangible success stories (for management).
- No DA interoperability testbed.
Importance of Pilot Activities

- Demonstrate potential of technology.
- Valuable feedback to host utility and vendors regarding application requirements, product design and functionality.
- Helps build organizational support for future deployment.
- Demonstration of technology before full deployment.
- Quantification of financial benefits possible with new technology.