SmartGrid Applied Systems
For Oncor Electric Delivery
Session 1.2.2
Networks and Grids

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Oncor Electric Delivery
Dallas, Texas   USA
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Agenda

• Who’s doing SmartGrid
• Oncor’s Implementation
• The Future
Recent Headlines

• California proposes Smart Grid
• Pennsylvania should chose advanced meters over rate caps
• Hawaii has opportunity to implement Smart Grid
• NERC -- grid improvements without building new transmission lines
• Choosing between BPL and WiFi for the Smart Grid.
Oncor Electric Delivery, a subsidiary of TXU Corp., has selected a joint solution from Siemens Power Transmission & Distribution, Inc. and Intergraph to integrate its outage, mobile workforce and distribution management systems.

By selecting Siemens’ Distribution Management System, including its Spectrum Power SCADA and Spectrum Power DNA products, and InService, Intergraph’s outage management system, Oncor will fully integrate the operational environment for the power grid. The SmartGrid Software System will integrate data, equipment, and associated process changes brought about by existing investments in advanced metering infrastructure (AMI), broadband over powerline (BPL), and distribution automation (DA). This SmartGrid enables software applications to monitor and maintain a stable and healthy distribution network, alerting operators immediately when problems arise and taking automated corrective action. Oncor has also begun migration of its mobile workforce management system to Intergraph’s InService mobile workforce management solution including oneMobile.

The InService suite of applications will provide a single integrated graphical user environment into the operational network, providing equipment monitoring, supervisory control and management of the field resources and equipment. Operators will no longer have to manage multiple network models and software applications.

The Spectrum Power Distribution Network applications will augment the Intergraph outage and work management capabilities to include automated fault assessment/management, load and voltage analysis, restoration optimization, and VAr management. The existing Oncor Spectrum Power SCADA system will be extended to provide distribution automation switch and capacitor bank information from the distribution system. Combined with the outage and mobile work management systems, Oncor will establish a full distribution management system capability for its operations staff.

The Oncor Smart Grid Software System is a phased project, with mobile workforce management system implementation occurring first, followed by outage management with mobile computing, DMS, and SCADA. Siemens and Intergraph are implementing commercial off-the-shelf software solutions, enabling other utilities to take advantage of the SmartGrid vision.

“We are deploying the latest technology with a view toward meeting the needs of the complex market Oncor serves. Deploying smart and distributed technology in the power distribution grid is key to ensuring reliability for electric utilities,” said Kevin Sullivan, vice president and general manager of Siemens Power Transmission & Distribution, Inc’s Energy Management & Automation division. “Siemens is confident that this partnership with Intergraph will result in an implementation at Oncor that will set a new benchmark for this industry.” Sullivan noted further, “Information and automation-enabled grid assets lead to more efficient operation, increased maintenance planning optimization, better cost-to-value ratios for operation & maintenance, and ultimately better consumer satisfaction via better outage management and performance. These developments will foster a new era of grid communities where the ‘smart grid’ achieves an enviable level of performance.”
Agenda

• Who’s doing SmartGrid
• Oncor’s Implementation
• The Future
Oncor’s Implementation

- Who is TXU / Oncor?
- Business Drivers
- The Procurement Process
- Oncor’s SmartGrid Initiative
- The Applications
- The Architecture / Environment
- Enterprise Integration
- Lessons Learned
As a part of a strategy to position itself as a top performing electric utility in the nation, Oncor is making technology investments in a SmartGrid Applied System to integrate the data, equipment and associated process change brought about by the investment in Advanced Metering Infrastructure (AMI), Broadband over Power Line (BPL), and Distribution Automation (DA).
Business Drivers

• Implementation of New Applications and Technology
  – Advanced Metering Infrastructure (AMI)
  – Broadband on Power Line (BPL)
  – Distribution Automation (DA)
  – TMS/SCADA

• Existing Systems at End-of-Life
  – Mobile Data - Resource Management (RM)
  – Computer Aided Trouble System (CATS)

• Oncor needs a system to collect and process the data from these disparate systems to enhance the operational environment and the decisions made by Operations personnel
The Procurement Process

• Technology Environment
  – Past technology procured and implemented in silos
  – Today silo systems not acceptable due to corporate integration requirements

• Procurement Process
  – Found no single vendor with capability to meet all the requirements
  – Forced creative thinking
  – A teaming arrangement only way to meet requirements
  – Intergraph & Siemens really listened to Oncor and were willing to team
  – Proposed a system integrating both companies technologies
  – Agreed to make the resulting system a commercial offering
Oncor’s - SmartGrid Applied Systems

• Mobile Workforce Management - MWM
• Outage Management Systems/DSCADA - OMS
• Distribution Management System/DNA - DMS

Smart Switches
MWM Components

- InService Dispatcher
- I/AutoDispatch
- Mobile TC
- Reports
- I/NetViewer - I/NetDispatcher
InService Dispatcher

InService Dispatcher (IDispatcher) provides full dispatching capabilities on a color dual-screen workstation.

Interactive intelligent mapping is combined with crew management, dispatching, and monitoring functions.

With InService Dispatcher, the dispatcher can dispatch techs more effectively, monitor techs and jobs, and control the operation of all service vehicles.

Because visual information is so easily assimilated, the dispatchers can make their decisions quickly, accurately, and with confidence they have the best information available.
IDispatcher Work Station
I/AutoDispatch

Is used for bulk assignments for the current day’s work based on a configurable set of rules -
[such as priority of jobs, travel distance, scheduled shifts for techs, cost of travel, service, waiting, and overtime and tech equipment and capabilities]

It honors any pre-assignment of work (typically from a long-term scheduling engine).

Provides an option to “rebalance” the workload.

Will recommend assignments based on the defined parameters, including priority of jobs and scheduled appointment times.

Will also warn the dispatcher of any appointments in risk of being missed.
• Green events mean that they are new, un-assigned and have not been manually looked at by the dispatcher at all.

• Blue events mean that they are un-assigned events that the dispatch has manually looked at or reviewed at least once.

• Red events mean that the event has been dispatched/assigned to at least one field unit.

• The red highlighted line is auto dispatch showing the route for Burgess to take to hit the assigned red events and the additional events that could be added to Burgess’ to do list.
Mobile TC

- GPS tracking in the trucks
- Job assignments with geographic and electrical facility information
  - On the map
  - In the laptop
- Job/Ticket update & closure
- Messaging
- More information relayed to field
- Real-time feedback for customers (in I/Netview & I/Dispatch & INetDispatch)
- Timely ticket completion information
- Better tracking for workforce safety
- Easily increase individual users access
Reports

- Robust reporting capabilities with information geared toward different levels within the utility
- Web based availability
- Executive summaries
- Spatial reporting & executive dashboards
- Crew & dispatcher performance
- Ability to write custom reports

Benefits
- Productivity analysis of dispatchers and crews
- Flexible search criteria for reports
- Geospatial analysis
- Ability to identify areas of potential improvement
MWM Dashboard

- Total Orders by Crew
- # of Events by Day
- Most Common Events
- Summary Lists of Events
- Maps showing Crews
- Live Weather Feeds
- KPIs
SmartGrid Applied Systems
Schedule

Mobile Workforce Management

Outage Management Systems/DSCADA

Distribution Management System/DNA

Smart Switches
Operating Model Visualization

• Operational Tasks
  – Navigation
    – Map
    – Tools & Commands
    – Monitors – Crews, Alarms, etc.
  – Work Flow Processing
    – Outage Visualization
    – Coordination with Crew
    – Manual Switching
    – Operational Tagging
    – X & J Switch
    – Trouble Call Closure

• Real Time Monitoring and Control
  – Real Time Information Display
  – Feeder Breakers
  – DA Switches
  – Cap Banks
  – Operating Panels
  – TMS / SmartGrid Tags w/Comments
  – Control Tagging
Operating Model Visualization

- **Navigation**
  - Map
    - Feeders
    - Substation
    - Symbology
Operating Model Visualization

- **Navigation**
  - Map
    - Airport
    - **Feeders**
    - Substation
    - Symbology
Operating Model Visualization

- Navigation
  - Map
    - Airport
    - Feeders
    - Substation
    - Symbology
Outage Visualization

- Call arrives through the IVR system
- Job is created and shows up on the map and in the pending events monitor under the new tab
- Job is rolled up as more outage calls come in and TA predicts where the problem is on the network
- Job is assigned to a mobile unit from the operations center through the InService GUI
- Mobile unit works the job and closes it through the MobileTC application
- Information can be passed real time back to an external system upon closure of the job or a status change
Outage Visualization
Advanced Metering Systems

• Data Collection Systems – PLC, BPL, RF & other traditional systems along with a Meter Data Mgmt System

• OMS/DMS -
  – AMI outage notifications to OMS
  – OMS pinging AMI to verify outage (automatically done for single outage)
  – OMS pinging AMI to verify restoration as part of the customer callback verification process
SmartGrid Applied Systems
Schedule

Mobile Workforce Management

Outage Management Systems/DSCADA

Distribution Management System/DNA

Smart Switches
Network Applications

• Distribution System Power Flow (DSPF)

• Fault Location (FLOC)

• Fault Isolation and Service Restoration (FISR)

• Volt/VAr Control (VVC)

• Optimal Feeder Reconfiguration/Large Area Restoration (OFR/LAR)

• Distribution Short Circuit Calculation (SCC)

• Optimal Capacitor Placement (OCP)
SmartGrid Systems

• Challenges
  – Unlike any existing system
  – Broad scope of work and massive development
  – Complex mix of vendors and technologies

• Payoffs
  – Better resource management tool
  – Better accounting of System Average Interruption Duration Index (SAIDI)
  – System can be upgraded and expanded as required
SmartGrid Functional Overview

Intergraph GIS
- Asset, Engr & Const UI
- GIS (Data & Graphic Engineering)
- Load Profiles
- Engr. Geo Map
- Elect Network Attributes
- Network Topology
- SCADA Points

Intergraph OMS
- Operational UI
  - OMS/WFM • AP • SUPY Control • DNA Output • Geographic • Schematic • Tabular
- OMS Host Topology Processing
- Mobile Workforce Management
- Alarm Processing
- SUPY Control (Manual update, tagging, interlock-check, etc.)

TMS
- Subst Telem & Data Acq
- capacitor & remote operated switch control

Device Control
- SCADA Points

Siemens DSCADA
- Data Acq for Distribution Network
- Engr CFE IDE Mapping
- Engr ICCP1

Siemens DNA
- Applic. UI
  - DSPF
  - FISR (closed loop)
  - FLOC
  - VVC (closed loop)
- Engr ICCP2
- Engr ICCP3

Engr ICCP1

DMS Functionality
User Interfaces
Master User entry point for this data
SmartGrid Dispersed Architecture

West Location
- SmartGrid Primary
- SmartGrid Disaster Recovery
- Transmission Control Center

East Location
- Transmission SCADA
- Corporate HQ

MPLS Core
- Enterprise Network
- Internet

Data Center
- Reporting Systems
- Corporate HQ
- CIS
- GIS
- Other legacy applications
Key Standards

- Enterprise Service Bus
- Reference Data Model - CIM

Graphic by Xtensible Solutions
### SmartGrid Team - Multiple Participants / Roles

<table>
<thead>
<tr>
<th></th>
<th>Company</th>
<th>Role</th>
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<tbody>
<tr>
<td>1</td>
<td>Oncor</td>
<td>Solution owner / end user</td>
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<tr>
<td>2</td>
<td>Intergraph</td>
<td>MWM / OMS / Solution GUI / Data Transformation</td>
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<tr>
<td>3</td>
<td>Siemens</td>
<td>DSCADA / DNA</td>
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<tr>
<td>4</td>
<td>Capgemini Energy</td>
<td>Legacy System Integration / Hardware / Solution Maint.</td>
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<tr>
<td>5</td>
<td>Triencon Services</td>
<td>Oncor consultant for Solution Architecture</td>
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<tr>
<td>6</td>
<td>Avineon</td>
<td>Oncor data analysis &amp; data transformation</td>
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<tr>
<td>7</td>
<td>Alcatel-Lucent</td>
<td>WAN Upgrades / LAN Infrastructure</td>
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<tr>
<td>8</td>
<td>Pericient</td>
<td>ESB Framework &amp; Application Connection to ESB</td>
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<tr>
<td>9</td>
<td>Xtensible Solutions</td>
<td>Solution CIM configuration &amp; extension / MDI / EIM</td>
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<tr>
<td>10</td>
<td>Capgemini</td>
<td>Program &amp; Project Mgt / Integration Architecture / SME</td>
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<td>11</td>
<td>Ventyx (MDSI)</td>
<td>Existing MWM system (RM)</td>
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<tr>
<td>12</td>
<td>Hewlett Packard</td>
<td>Hardware vendor for existing MWM system</td>
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<tr>
<td>13</td>
<td>Enspiria Solutions</td>
<td>Vendor Selection &amp; Scoping Consultant</td>
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</tbody>
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With multiple partners comes complexity and coordination challenges.
Lessons Learned

• Core foundational data issues critical
• Networks just don’t happen
• Change management essential
• Dedicated PMO Office

• We haven’t learned all the lessons yet!
Smart Grid is an Incremental Investment
Agenda

- Who’s doing SmartGrid
- What is a “SmartGrid”
- Oncor’s Implementation
- The Future
Smart Grid Applied Solutions Program: Combined Elements of Smart Grid

**Enterprise/Back Office Integration**

- Energy Management System (EMS)
- Distributed Control System (EMS)
- Substation Automation (EMS)
- Feeder Automation (EMS)
- Asset Performance Management (EMS)
- AMI
- MDMS

**DMS with DSM**

- DMS
- EMS
- Satellite
- Fiber
- Data Concentrators
- Breakers
- Cap Banks
- Transformers
- Tiered Controls
- Generation Planning
- Common Modeling
- Historically Data Information
- Reclosers
- Distributed Control System
- BPL
- µWave
- PLC, WIFI, WIMAX
- BPL
- Manual
- Dist Network Application
- Dist Training Simulator
- Energy Market Management (P)
- Gen Optimization
- SCADA
- Auto Gen Control
- Demand Side Mgmt (Utility)
- Auto Meter Reading
- Environ
- Transmission Distribution
- Consumer Generation

**Analysis**

- Energy Market Mgmt (O)
- Trans Network Application
- Outage Mgmt Sys
- Mobile Work Mgmt
- Energy Market Mgmt (O)
- Trans Network Application
- Outage Mgmt Sys
- Mobile Work Mgmt

**Control**

- Distributed Control System (EMS)
- EMS
- Feeder Automation (EMS)
- Asset Performance Management (EMS)
- AMI
- MDMS

**Communications**

- In Plant (LAN)
- Microwave, Fiber…
- BPL, PLC, WiFi

**Apparatus & Device**

- RTUs, Data Concentrators
- GTs, CCP, ST, WP
- Breakers
- Cap Banks
- Transformers
- Tiered Controls
- Generation Planning
- Common Modeling
- Historically Data Information
- Reclosers
- Distributed Control System
- BPL
- µWave
- PLC, WIFI, WIMAX
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**Enterprise**

- Generation Planning
- Energy Market Mgmt (O)
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