Managing Large Scale Network Model

for

Energy Management System & Business Management System

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New York Control Area

- 19.2 million people
- Serving New York City
- 2006 load of 162,265 GWH
- 324 active Market Participants
- Record peak of 33,939 MW (8/2/06)
  - Over 485 generating units modeled
- 10,775 miles of high voltage transmission
- 2007 required Installed Capacity 38,966 MW
NYISO Revenue by Market

Year

Million

1999 2000 2001 2002 2003 2004 2005 2006

Energy ICAP TCC Total
Background:


✓ ICCP: 11 Redundant data links (6-12 sec scan)

✓ RTU: Continuous Telemetry – about 100 points (Tie line MW, Large Units MW).

✓ 40 AGC Tie lines to PJM, New England ISO, Ontario Hydro (IMO), Hydro Quebec (HQ).

✓ About 3100 buses, 30/70 split between internal/external.
## Network System Representation

<table>
<thead>
<tr>
<th>Component</th>
<th>Total</th>
<th>Internal</th>
<th>External</th>
</tr>
</thead>
<tbody>
<tr>
<td>Host Control Area</td>
<td>11</td>
<td>1</td>
<td>10</td>
</tr>
<tr>
<td>Load Area</td>
<td>21</td>
<td>11</td>
<td>10</td>
</tr>
<tr>
<td>Substation</td>
<td>2240</td>
<td>400</td>
<td>1840</td>
</tr>
<tr>
<td>Generator</td>
<td>1511</td>
<td>485</td>
<td>1026</td>
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<tr>
<td>Breaker</td>
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<td>612</td>
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<td>Phase Shifter</td>
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<td>17</td>
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<tr>
<td>Compensator</td>
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<td>173</td>
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<tr>
<td>Energy Consumer</td>
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<tr>
<td>SVC</td>
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</tbody>
</table>
Single Model For EMS, BMS & Other Applications:

✓ Energy Management System Applications:

- **SCADA**: There are 20,000 analog points and 12,000 status points. Data is being processed on a 6 sec and 5 min basis.
- **State Estimator (SE)**
- **Area Generation Control (AGC)**
- **Contingency Analysis (CA)**
- **Dispatcher Load Flow (DLF)**
- **Security Monitor (SM)**
- **Topology Confirmation (TC)**
- **Outage Scheduler (OS)**
- **CIM One-Line Station Diagrams**.
Single Model For EMS, BMS & Other Applications:

✓ Business Management System Applications:
  - Security Constrained Unit Commitment (SCUC) for Day-Ahead-Market.
  - Real Time Scheduling (RTS) for Real Time Market.

✓ Other Related Applications:
  - Training Simulator System for System Operators (DTS).
  - PI Historian.
  - Map board Data – Drive the Control Center map board.
Special Generator Model: EMS vs. BMS

Energy Management System:

✓ Model all physical units for EMS and pseudo units for BMS.

✓ Open breakers for all BMS pseudo units within the EMS.

✓ Total individual EMS units measurements and allocate to the BMS pseudo units measurements based on AGC 6 second base points (BMS units)

Business Management System:

✓ Generator status is based on the Bid data.

✓ Thus, generator that has no bid would be out of service.

✓ BMS pseudo units measurements are being used for Performance Tracking.
Demand Respond Program (DRP)

Model large industrial loads as pseudo DRP generators for BMS.

Business Management System (DAM):

✓ Award Day Ahead contracts based on Bids.

Energy Management System:

✓ Open breakers for all pseudo DRP generators.

✓ Industrial loads would be disconnected from the grid in real-time.
Key ID for Data Exchange Between Applications

✓ Equipment PTID: The key that allows all data being exchanged among applications on different platforms is the equipment PTID number.

✓ PTID number: a unique ID that was assigned to each piece of the network model facility and Control Area related definitions.
EMS To BMS Data Exchange in Real-Time

EMS to BMS Applications:

- Contingency Definitions; Contingency Group.
- Security & Monitor flags.
- Transmission facility dynamic ratings (RTS only).
- Internal generators current loading.
- External generators schedules.
- Load pattern for all loads.
- Outage Schedule data.
- Regulation & Spinning, 10 & 30 Min reserve requirements.
BMS To EMS Data Exchange in Real-Time

✓ For AGC:

- 5 min generator base points from Real-time Dispatch (RTD).
- Normal low, high & Emergency high generator operating limits.
- Regulating and emergency response ramp rate.
- Generator regulation flag.
- 10-Min and 30-Min for spinning and non spinning control flag.

✓ For Contingency Analysis & Security Monitor:

- Contingency violations identified by the Real-Time Dispatch application (RTD).
Data Source for Model Update

✓ Generator:
  - *MPs request directly through NYISO Customer Relation department*

✓ Other Equipments:
  - *Internal Control Area: Transmission Owner’s Data Coordinator*
    - Power System facility to be changed
    - One-line diagrams
    - Metering information
    - Equipment related data such as ratings, impedances.
    - The effective date of the changes.
  - *External Control Area:*
    - Contact the External Control Areas directly.
Network Model Exchange: CIM XML File

✓ Provided the standard CIM-XML to other ISOs for reliability purposes only.

✓ Provided the standard CIM-XML to other TOs.

✓ CIM-XML extension is being used for the BMS application.

✓ The NYISO has not yet to import data to CIM database from CIM-XML file.

✓ External Control Area network model updates are being requested on an as needed basis.
Network Model Exchange: CIM XML File

✓ To support the BMS applications such as RTS & SCUC.

✓ Following items are part of the CIM Extension.
  - Interface (Branch Group) definition.
  - Interface incremental limits for outage conditions.
  - Special flags for monitoring and securing for different types of facilities.
  - Limit logic types.
  - Equipment outage priority for different applications.
  - Phase shifter optimization flags.
ABB’s CIM Data Engineering Toolkit

- To maintain & Update network model for all applications.
- Oracle based program.
- Graphical editing environment to manage data in CIM-based format.
- Automatic diagram generation, multi-users and versioned editing.
- Import and Export full & incremental CIM/XML data.
- Support SCADA data definitions.
- Seasonal and dynamic ratings.
- PI historian definitions.
- Data for Control Center Map Board.
Network Model Data Update

✓ Update all network model data directly in CIM database.
✓ Standard data for EMS applications.
✓ Special data for BMS applications.
✓ Data for DTS system – Simulator.
✓ Data for SCADA system.
✓ Transmission Owner Ratings – Define/update equipment seasonal ratings.
✓ Definition for PI historian.
Ranger Run-Time Generation

✔ Export data for EMS system - It takes about 4 and ½ hours.
✔ Export data for BMS (XML file) - 1 hour.
✔ Database generation – 3 hours.
✔ Review database generation log file.
✔ Correct all identified errors in CIM and re-start the entire process again.
✔ Load database to Development System for unit testing.
✔ Development system has live-data identical to Production System.
Database Validation & Verification

- SCADA data - verify and validate all newly defined measurements.
- AGC - Area Generation Control.
- SE - State Estimator
- DLF - Dispatcher Load Flow
- CA - Contingency analysis
- SM - Security Monitor.
- RTS - Real-Time Scheduling Systems.
- SCUC – Security Constrained Unit Commitment.
- All zonal ties and zonal generators for load Forecast
- PI – Verify and validate all new PI tags.
- Verify to ensure that TCC receive the latest model.
- CIM and Station one-line diagrams.
**Additional Database Validation & Verification**

- Move new database to QA for System Integration testing (Bid-to-Bill).
- Inform other departments being impacted by the new database.
- Obtain approval permission for deployment to Production System.
- Network Model is being updated on a monthly basis.
Any Questions?
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