Pre-Commercial Demonstration of Direct Non-iterative State Estimator (DNSE+)

Project with Quanta, NYPA & EPG

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Project Objective:
Demonstrate functionality and performance of a production-grade Direct Non-iterative State Estimator (DNSE) integrated with NYPA’s Energy Management System (EMS) and with an enhanced Real Time Dynamic Monitoring System (RTDMS) synchrophasor platform from Electric Power Group (EPG);

Background:
• DNSE started as an idea by Bruce Fardanesh at NYPA several years ago; also patented
• It was further researched as PhD thesis by Tony Jiang
• DNSE+ (+ added to designate SE with additional components around the estimation “engine”)

System Architecture – Functional View

Component Diagram of Proposed Project

Legend:
- Phasor Rate
- SCADA rate or slower

Within project scope
Existing component

Who?

Phasors

SCADA/EMS

Model-less Data Conditioning

RTDMS/ISD Platform

RTDMS

ePDC

IEEE C37.118 in Adapter

DNSE+ (Direct Non-Iterating SE) Engine

DNSE Out Adapter

QT/NYPA

SCADA DATA

DNSE+

Who?

SCADA/EMSSCADA/EMS

Phasors

Legend

Phasor Rate
SCADA rate or slower

Within project scope
Existing component

Who?

SCADA INPUTS

PMU INPUTS

Component Diagram of Proposed Project

System Architecture – Functional View

Legend:
- Phasor Rate
- SCADA rate or slower

Within project scope
Existing component
Anticipated Project End Status

- Successfully demonstrate a DNSE+ at New York Power Authority (NYPA) that will:
  - Use both SCADA and synchrophasor data simultaneously to obtain the complete state of the entire NYPA operating model at rates close to the phasor data rates, and without iterations.
  - Have input/output adapters based on standards (IEC 37.118 for streaming synchrophasor data, ICCP for SCADA exchange and CIM models to export the host utility’s EMS source data base)

- Prove that DNSE+ is a commercially viable application by successful integration with commercial products (EMS and RTDMS)
  - RTDMS will be enhanced as part of the project
  - Show DNSE+ is ready for use at other utilities to address a common need for “clean and trustworthy” operational data for synchrophasor applications
Project Participants

Key team members

Executive Sponsor:
Damir Novosel

Quanta DNSE+
Principal Investigator
Dino Lelic

Department of Energy:
Brian Mollohan

EPG Project Team:
Wayne Schmus
Ashley Wang
Prashant Palayam
Simon Mo

Quanta Project Team:
Boza Avramovic
Yi Hu
Tony Jiang
Vasudev Gharpure

NYPA Project Team:
Bruce Fardanesh
Alan Ettlinger
Ali Iravani
Saman Babaee

NYISO – Project Observer & Advisor
Project team Roles

- **Quanta Technology**
  - Overall project management
  - Overall technical lead; overall system design
  - System integration and FAT lead; Site Acceptance Test support

- **NYPA**
  - End user of developed system
  - System design support
  - Field installation & SAT test lead

- **Electric Power Group**
  - EPG product supplier
  - RTDMS enhancement development
  - System integration & FAT support
  - Field installation & SAT support

- **NYISO**
  - Technical advisor and historical PMU data provider
## Performance Target

<table>
<thead>
<tr>
<th>Decision point</th>
<th>Performance test environment</th>
<th>Success criteria</th>
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</thead>
<tbody>
<tr>
<td>Mid-point of Task 5 (end of 2015)</td>
<td>A mid-range server at QT</td>
<td>Minimum: &lt; 2s</td>
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<tr>
<td></td>
<td></td>
<td>Desired: &lt; 1s</td>
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<tr>
<td>End of Task 6 (July 2016)</td>
<td>NYPA acquired DNSE+ server</td>
<td>Minimum: &lt; 1s</td>
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<tr>
<td></td>
<td></td>
<td>Desired: &lt; 0.1s</td>
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## Project Tasks & Progress

<table>
<thead>
<tr>
<th>Milestone #</th>
<th>Milestone Name</th>
<th>Completion Date</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Project Management Planning</td>
<td>Aug 30, 2014</td>
</tr>
<tr>
<td>2</td>
<td>System Design Completion</td>
<td>Jan 30, 2015</td>
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<tr>
<td>3</td>
<td>DNSE+ implemented*</td>
<td>Jul 30, 2015</td>
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<tr>
<td>4</td>
<td>RTDMS Platform Enhancement completed**</td>
<td>Jul 30, 2015</td>
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<tr>
<td>5</td>
<td>Integration and FAT completion</td>
<td>Dec 30, 2015</td>
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<tr>
<td>6</td>
<td>Field Installation, User training, and SAT completion</td>
<td>Jun 30, 2016</td>
</tr>
<tr>
<td>7</td>
<td>Project completion</td>
<td>Jul 29, 2016</td>
</tr>
</tbody>
</table>

* It has been tested on a small scale system
** Needs to be tested together with DNSE, using data exchange
Current Status of the Project

- Integration of DNSE+ with enhanced RTDMS under way
- Interface for transfer of EMS SCADA data is being developed at NYPA
- PMU data (historical) to be received from NYISO for purpose of testing
Questions