Use Case 3: Global Plant Energy Optimization

IMC-AESOP

Use Case Objectives

Demonstration of:

- SOA based cross-layer linking of typical hierarchical control architecture from devices to enterprise systems
- Integration of multi-platform data and event sources to unified information model.
- Cross-layer consistency and uniform representation of on-line and off-line process data, topology information and dynamics / performance models.
- Events propagation, aggregation and management.
- Enterprise-wide Strategic Energy Management (EV storage & Trading)

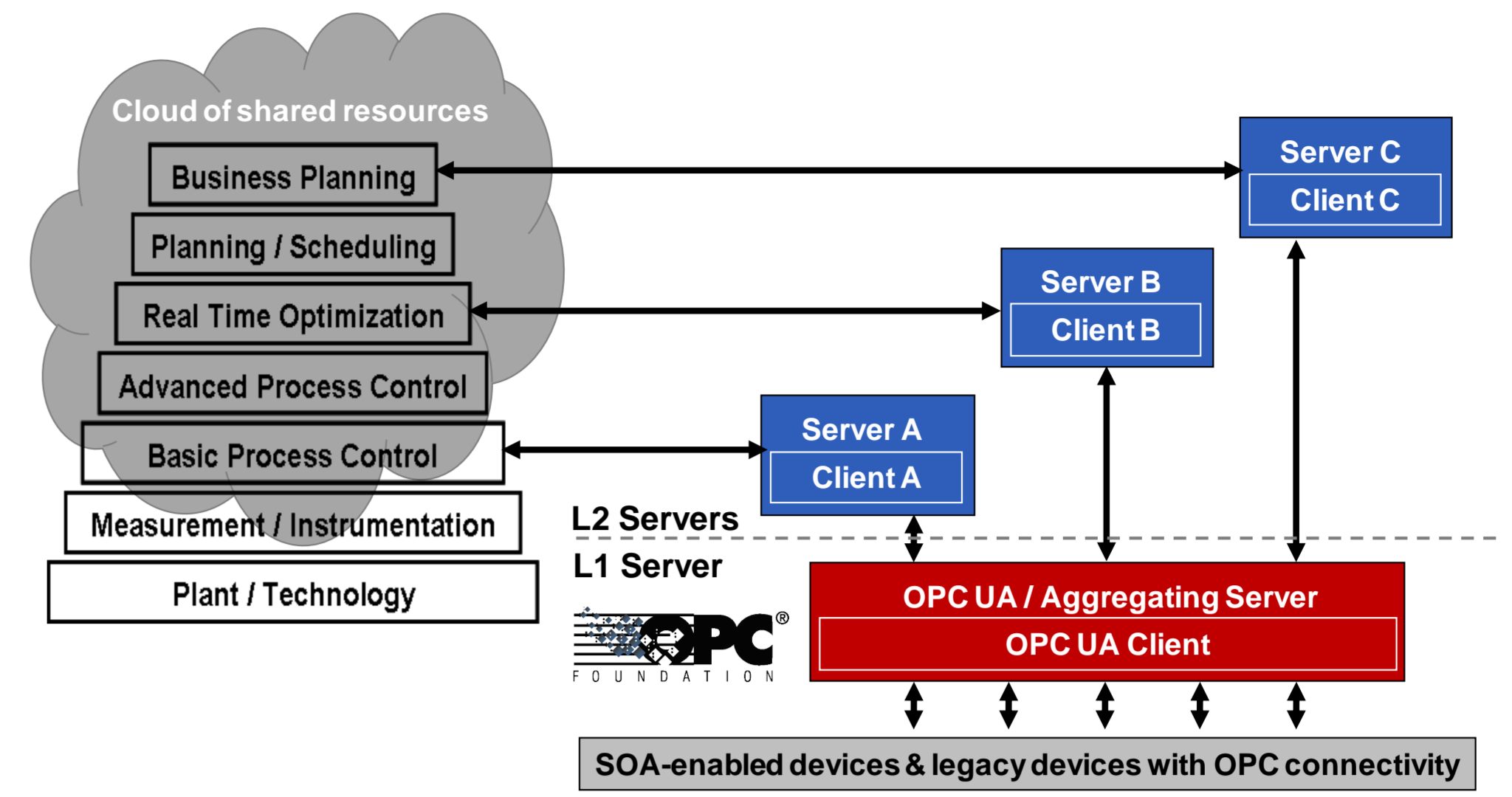Demonstration target: Cogeneration Power Plant

Control and Optimization Tasks

Basic Level - Advanced process control of boilers, provides efficiency curves based on process limits (fans/feeders status).

Unit level – Headers pressure control by boilers and turbines allocation. Requires efficiency curves and constraints (e.g. number of running boilers/turbines), and provides optimal allocation curves for overall unit and consumption/generation characteristics.
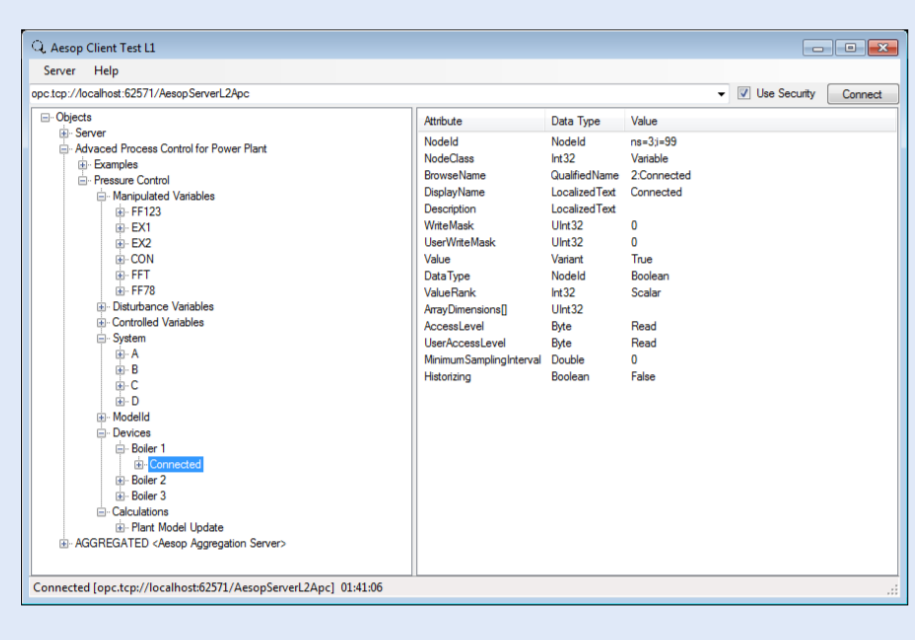
Plant level – plant operation planning. Provides constraints for planning and unit characteristics for optimal production / consumption. Plant level optimization works with what-if scenarios.

Global level – simultaneous optimization of multiple power plants based on plant and market conditions (real-time pricing).
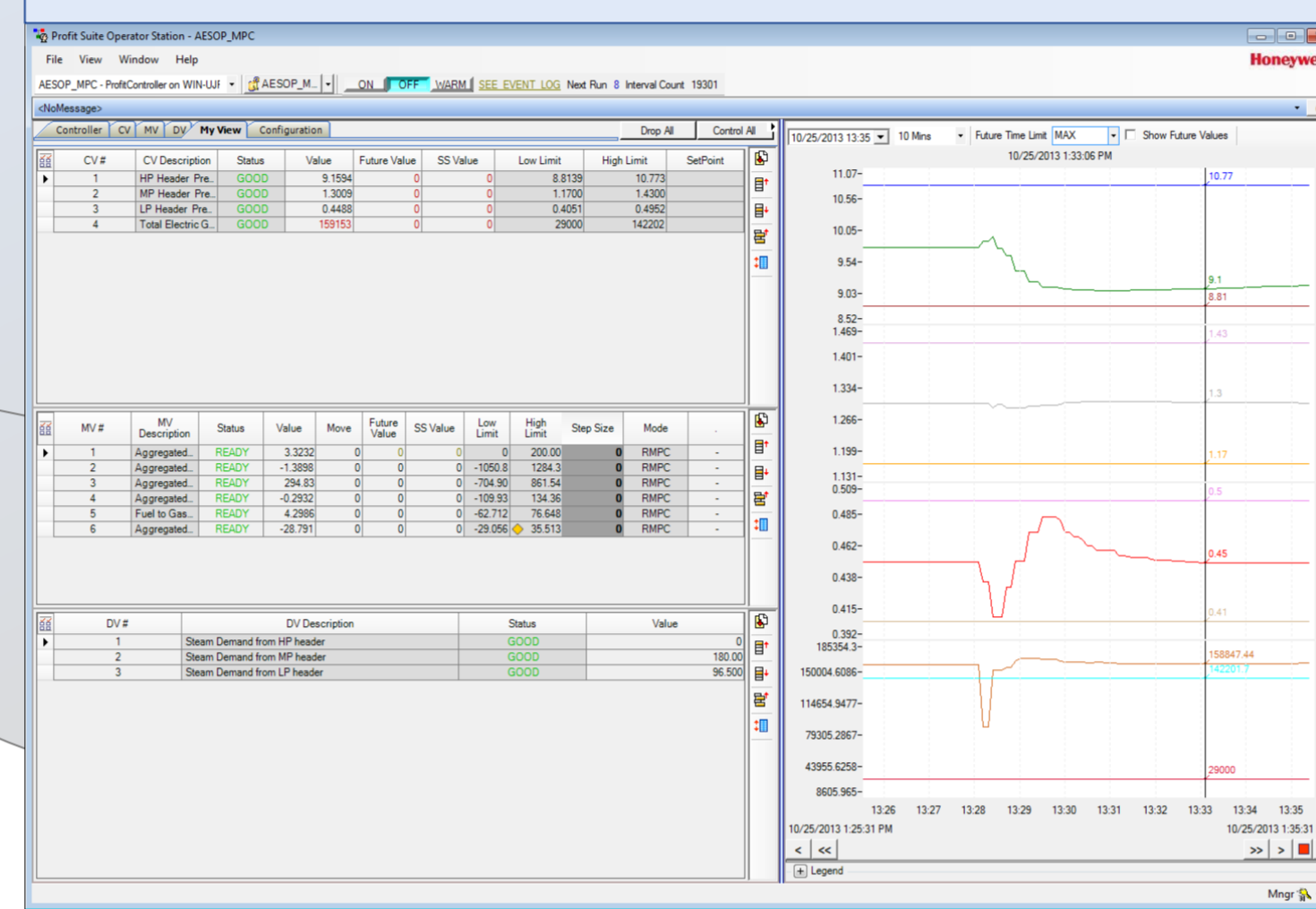
Chained L2 Servers

- Flat architecture of System of Systems - mapping "raw" information of L1 server to information model of individual layers hosted by individual L2 servers
- Data / dynamic models / performance models, etc.
- Reacts to events generated by L1 server, process changes are propagated to all control and optimization layers to guarantee cross -layer consistency
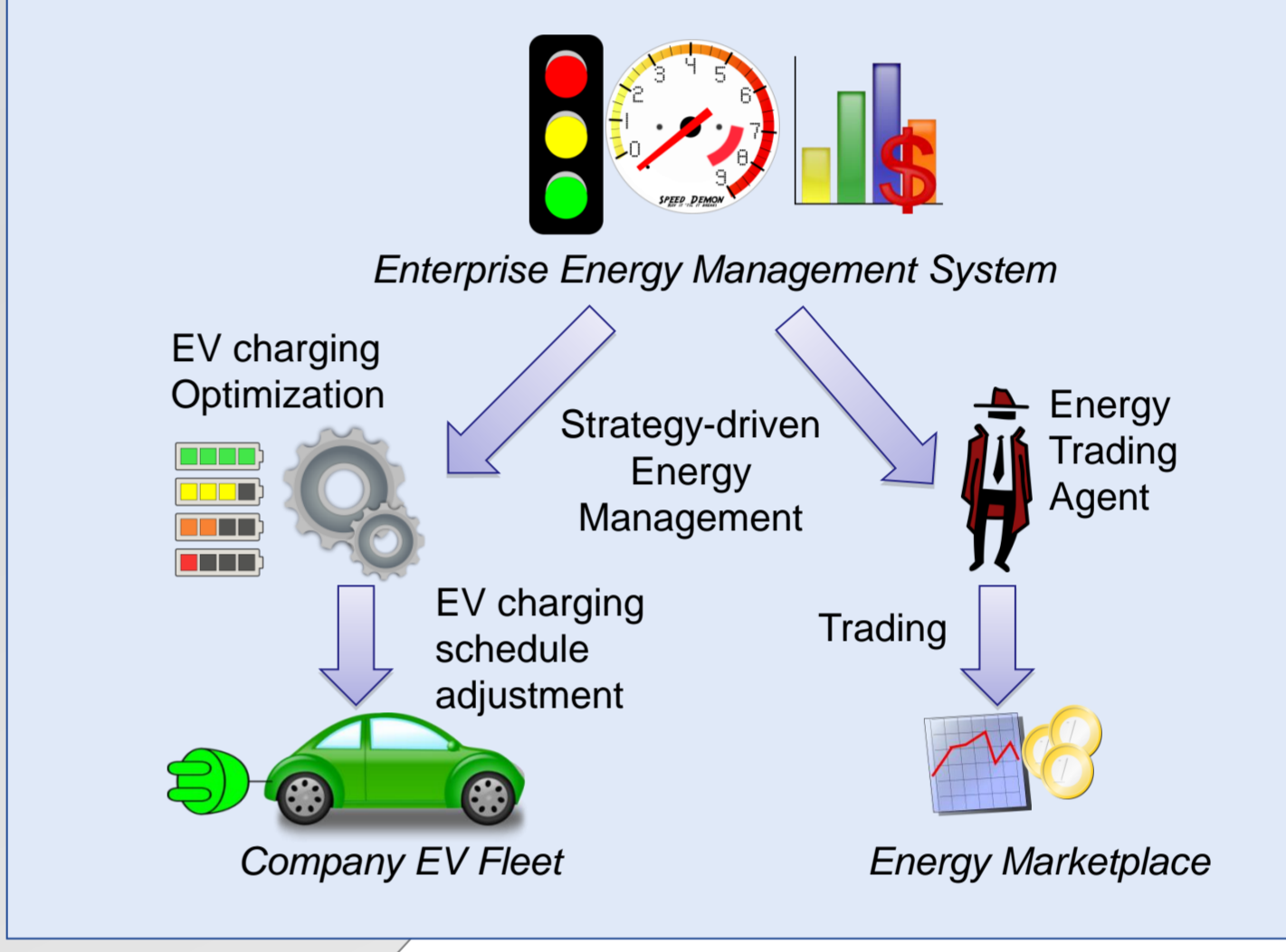
Data

Events

Advanced Process Control

- Honeywell Profit Suite controller (RMPCT)
- Requires dynamic model consistent with current process
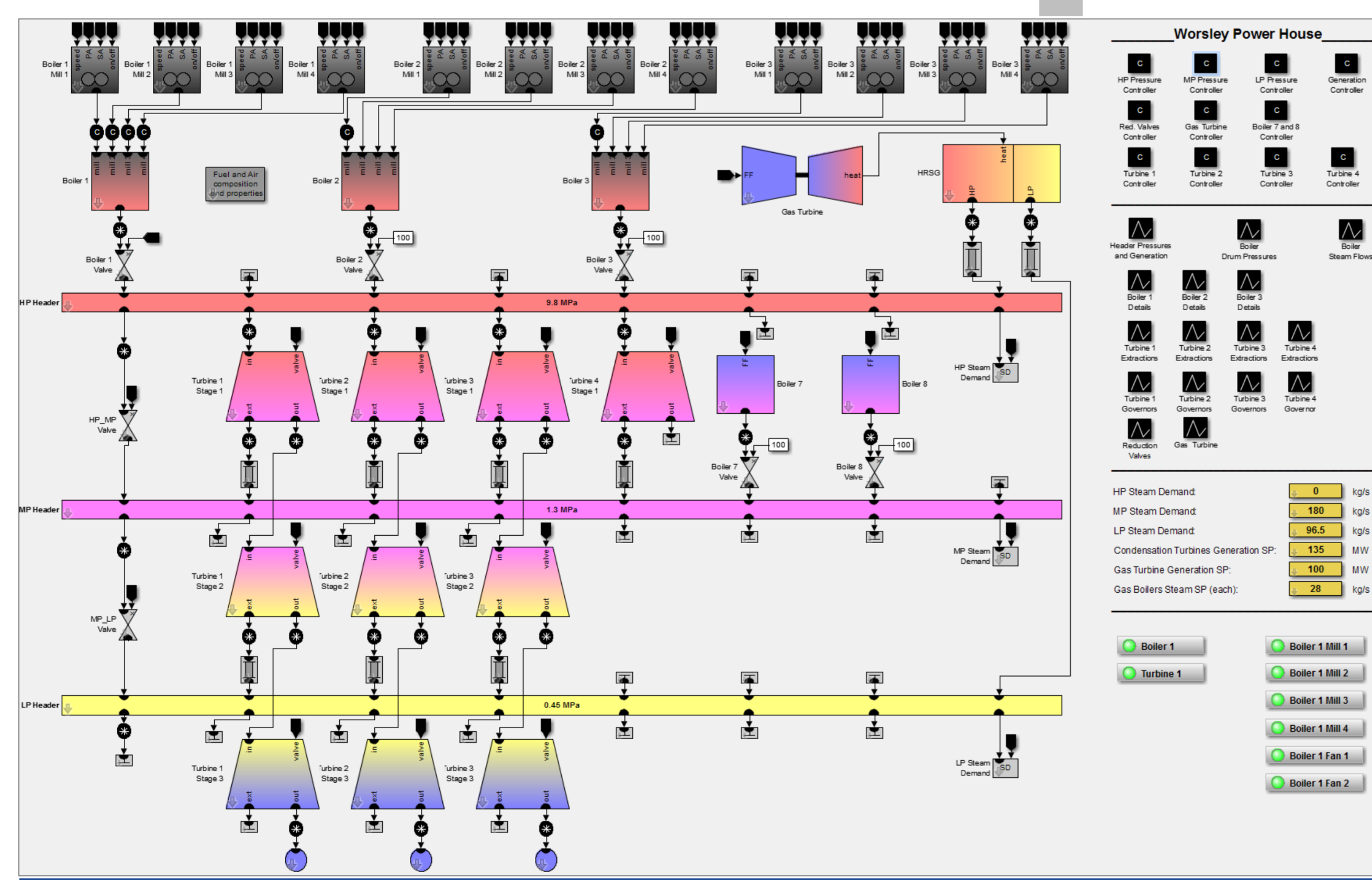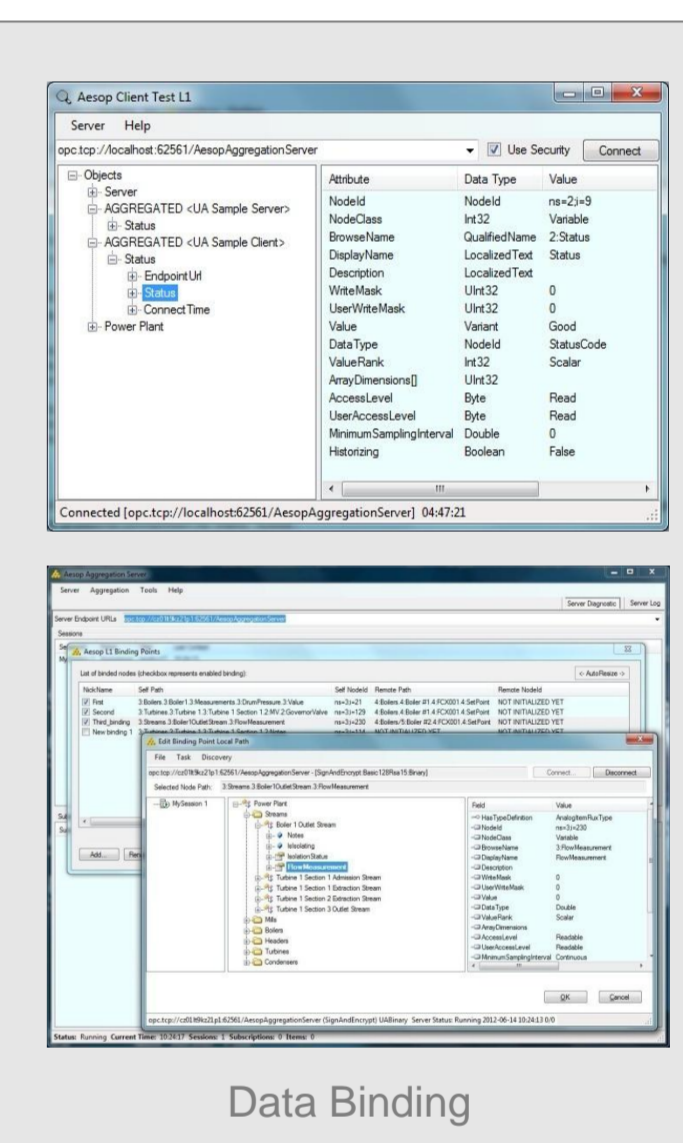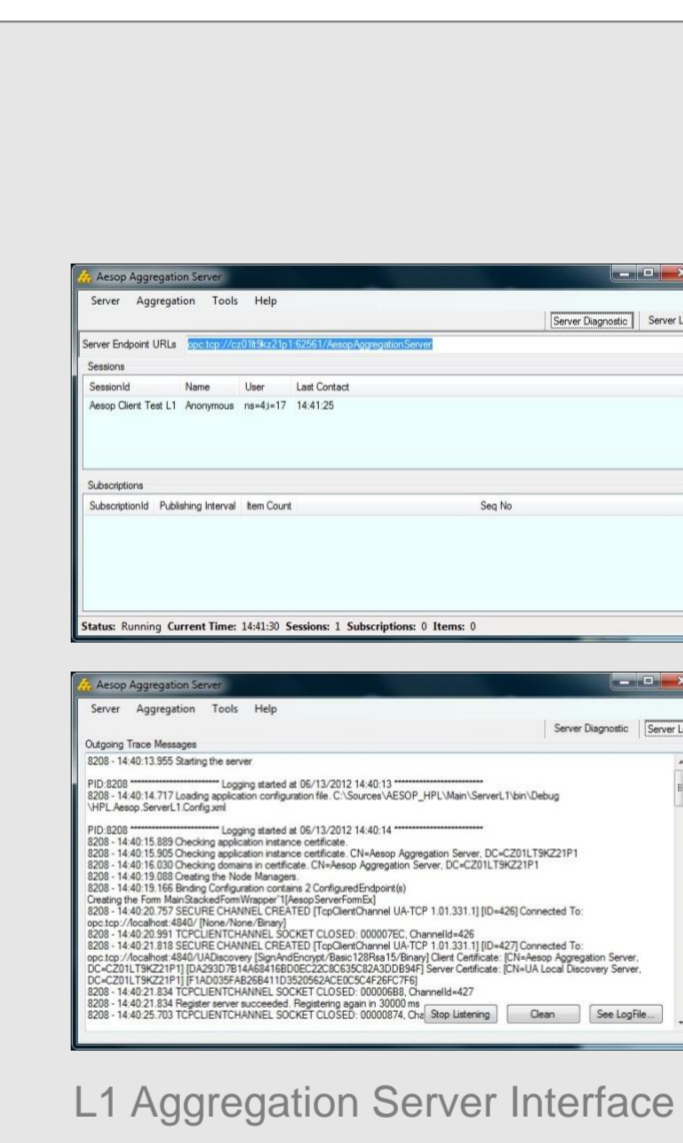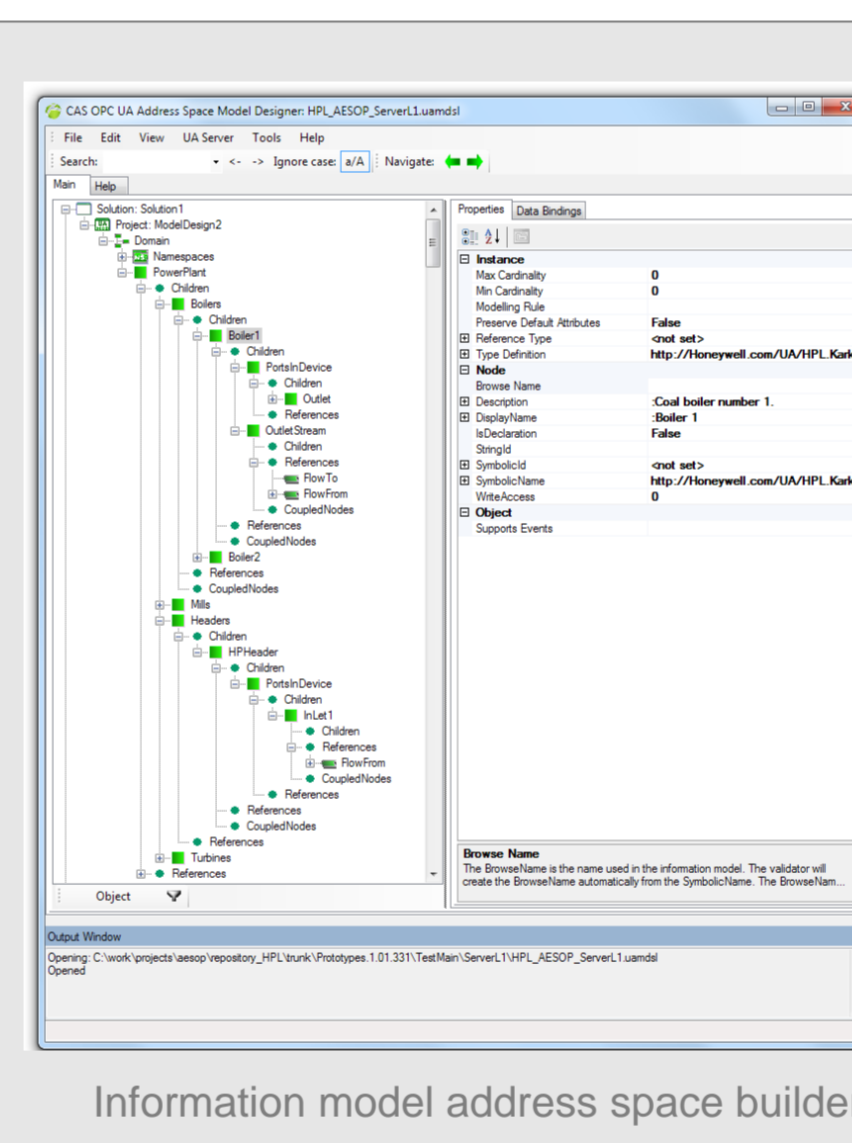- Allows control and optimization for dynamic multivariable processes with systematic constraints handling
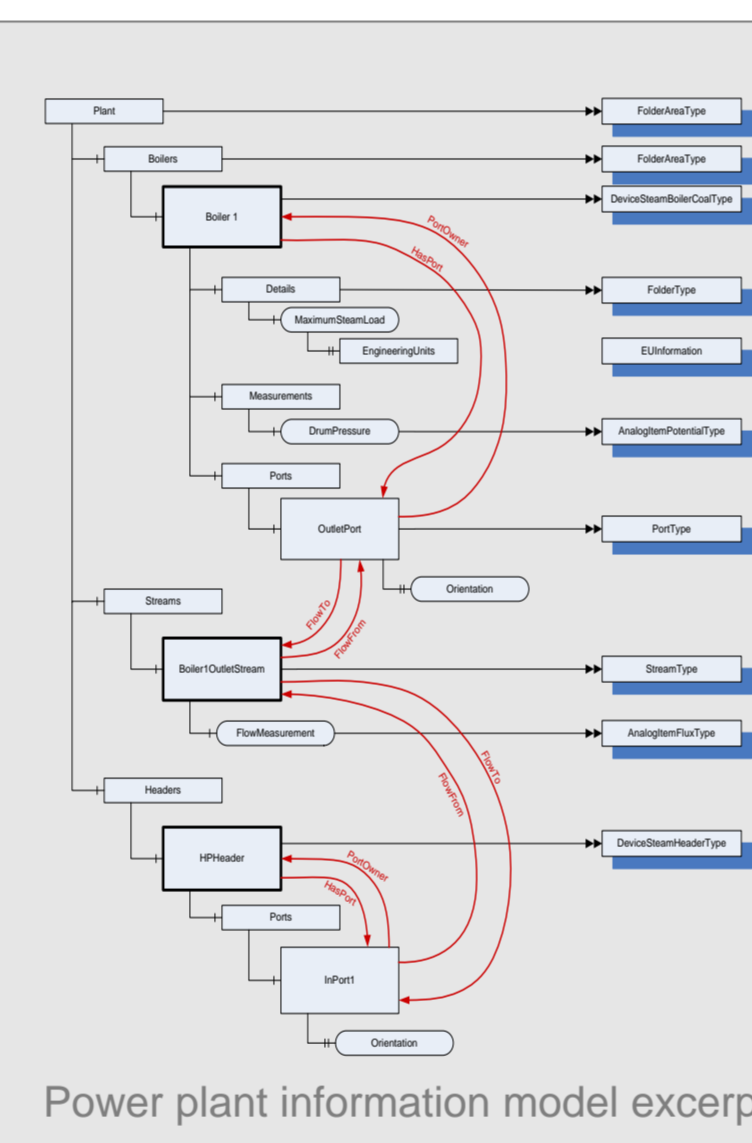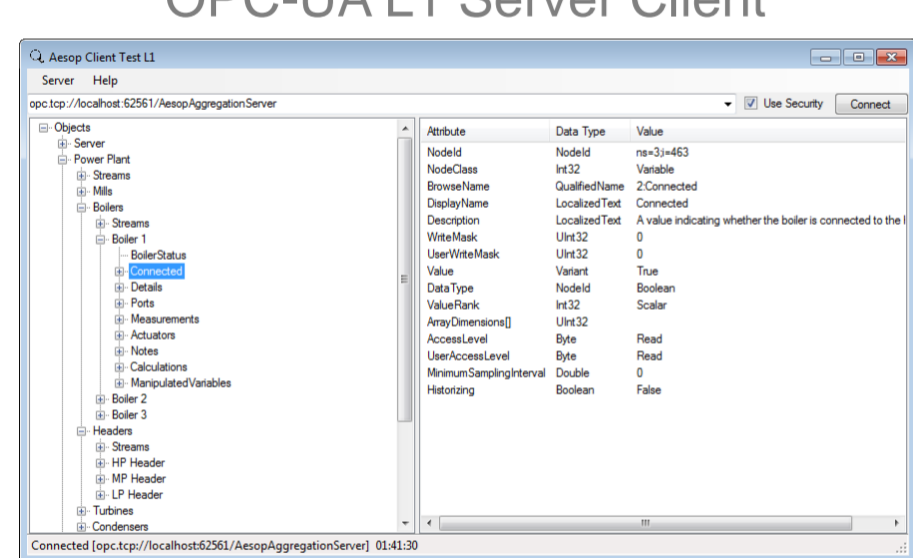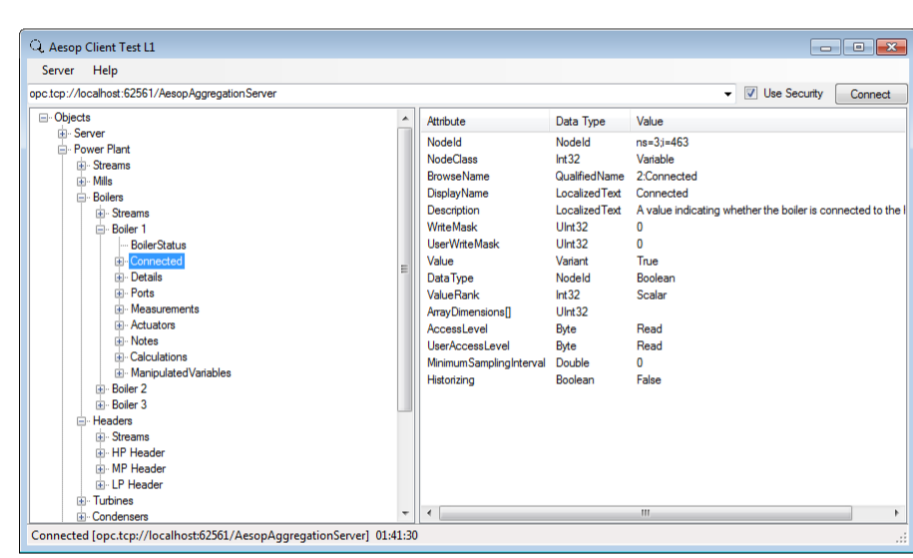
Adaptive Enterprise Energy Management

- Enterprise-wide strategic energy management
- Optimization of Electric Vehicle fleet charging
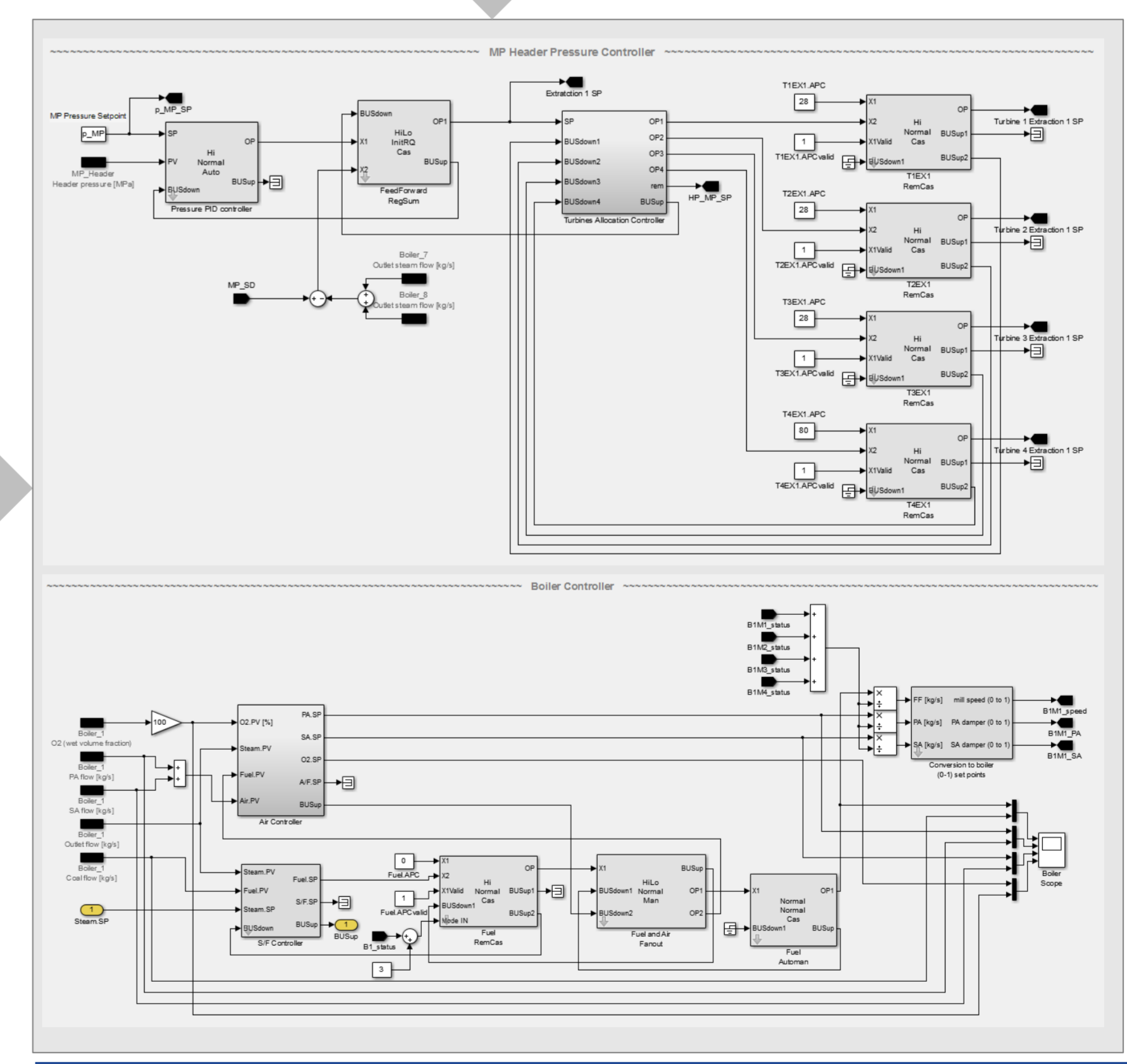- Trading of electricity in local energy markets

Enterprise Energy Management System

EV charging Optimization

Strategy-driven Energy Management

Energy Trading Agent

EV charging schedule adjustment

Trading

Company EV Fleet

Energy Marketplace

IMC-AESOP Service Cloud

Data

Events

Aggregating L1 Server

- Contains low level process **information model** with raw and preprocessed data and system topology information
- Object oriented OPC-UA information model
- Handles low level events and generates events for L2 servers
- Unified gateway to SCADA / DCS for upper layers
- Parallel aggregating servers for large scale systems

OPC-UA L1 Server Client

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Power plant information model excerpt

Information model address space builder

L1 Aggregation Server Interface

Data Binding

OPC-DA — Process Values

OPC-DA — Set Points Control Signals

Process Values Manipulated Variables

Power Plant Simulator

Complex system of boilers, header, turbines, etc. Power plant simulator is realized in Matlab Simulink using Honeywell Power plant library. The simulator is based on Worsley Alumina Power Plant (Australia). The simulator is hidden for the information model behind standard OPC-DA connectivity.

Basic Process Control

Implements basic and backup control strategy on the lowest level using Honeywell Experion DCS implemented in Simulink.

Honeywell

SAP RESEARCH