

## **Using Event Processing to Manage Energy Market Operations at ISO New England**

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# Topics Covered

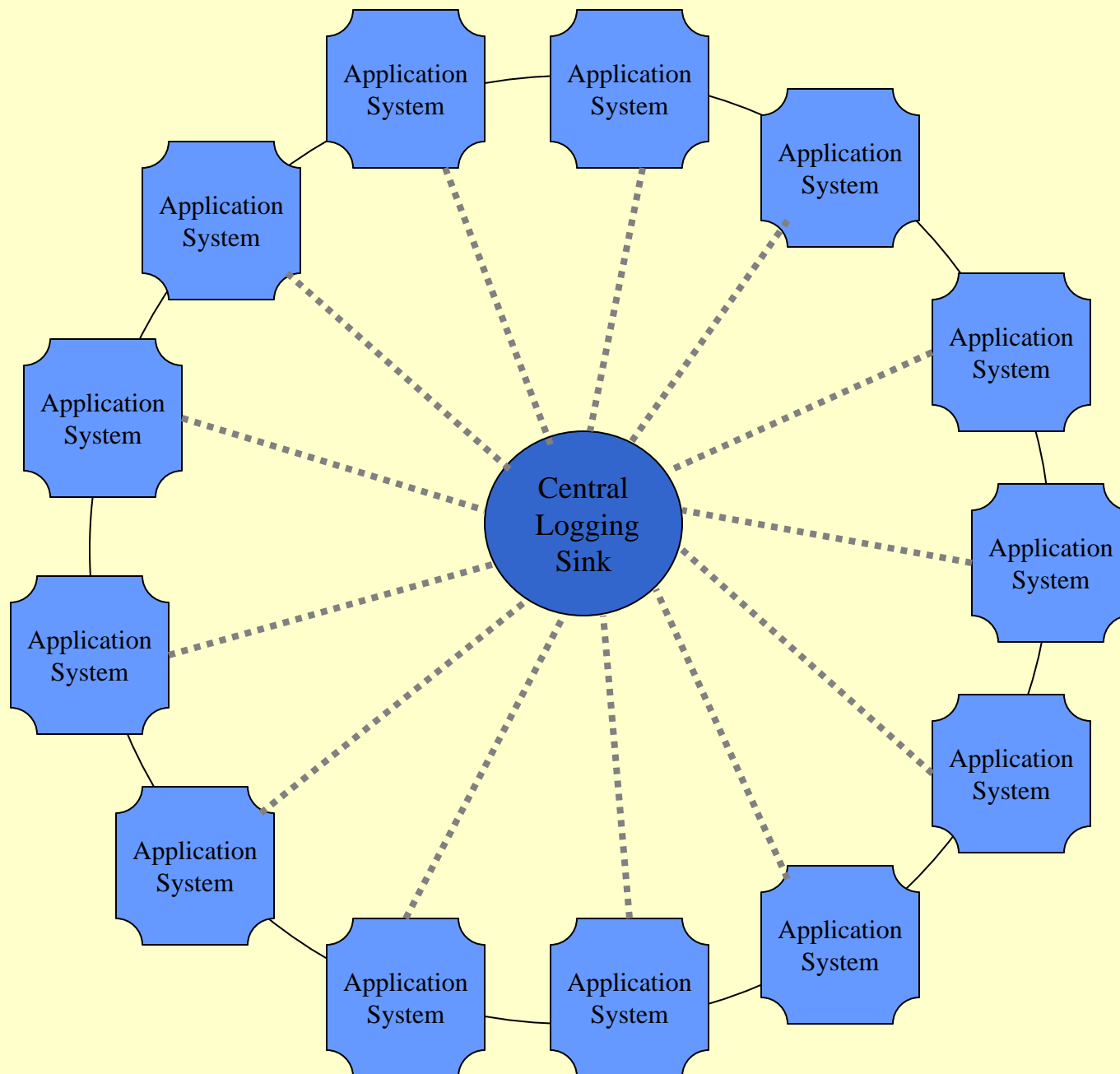
- Brief Introduction to ISO New England
- Two Degrees of Separation System Design
- Complex Event Processing Use Case and Pilot Project
- Benefits
- Lessons Learned

# ISO NE Introduction

- A regional transmission company (RTO) responsible for New England's high voltage electricity grid
- Main Functions:
  - Minute-to-minute reliable operation of New England's bulk electric power system across the region's interstate high-voltage transmission lines
  - Oversight and administration of New England's wholesale electricity marketplace
  - Planning processes that address New England's future electricity needs
- The ISO's responsibility in overseeing the region's wholesale electricity marketplace is to ensure that the markets are fair, transparent, efficient, and competitive.

# Two Degrees of Separation Logging and Monitoring System Goals/Objectives

- Create a Logging/Monitoring infrastructure with visibility into distributed, orchestrated business processes
- Enable business users to view “real-time state of a business process”
- Establish a foundation for “fact-based” information gathering and analysis
- Provide correlation of Logged Events to provide administrations with greater “insight”
- Create a **standard log message format and content/semantics** for use by all applications (Common Base Event - CBE)



# EAI Infrastructure

2. Orchestration Server launches Person Update Business Process that contains the following steps:

- 2.1) Log Start Process
- 2.2) Invoke e-Market Person\_Update Service
- 2.3) Log Status of service
- 2.4) Invoke SQL Proc on EES
- 2.5) Log status of SQL Proc
- 2.6) Invoke SQL Proc on SSO
- 2.7) Log status of SQL Proc
- 2.8) Invoke SQL Proc on SMS
- 2.9) Log status of SQL Proc
- 2.10) Log Stop Process

1. CAMS/Rights Sends Person Update Event in CIM format to Orchestration Server

BusinessWorks Orchestration Server  
Subscriber/  
Service Provider

Metadata Management  
CIM Map/Translate  
Service Provider

CENTRAL LOGGING SINK  
Subscriber

Status Info

Messaging Bus

All Log Messages captured in Oracle Database by Central Logging Server.

Publisher  
CAMS (Ext)  
Or  
Rights (Int)

SOAP Service  
E-Market

Adapter  
SQL Proc  
EES

Adapter  
SQL Proc  
ClearTrust  
SSO

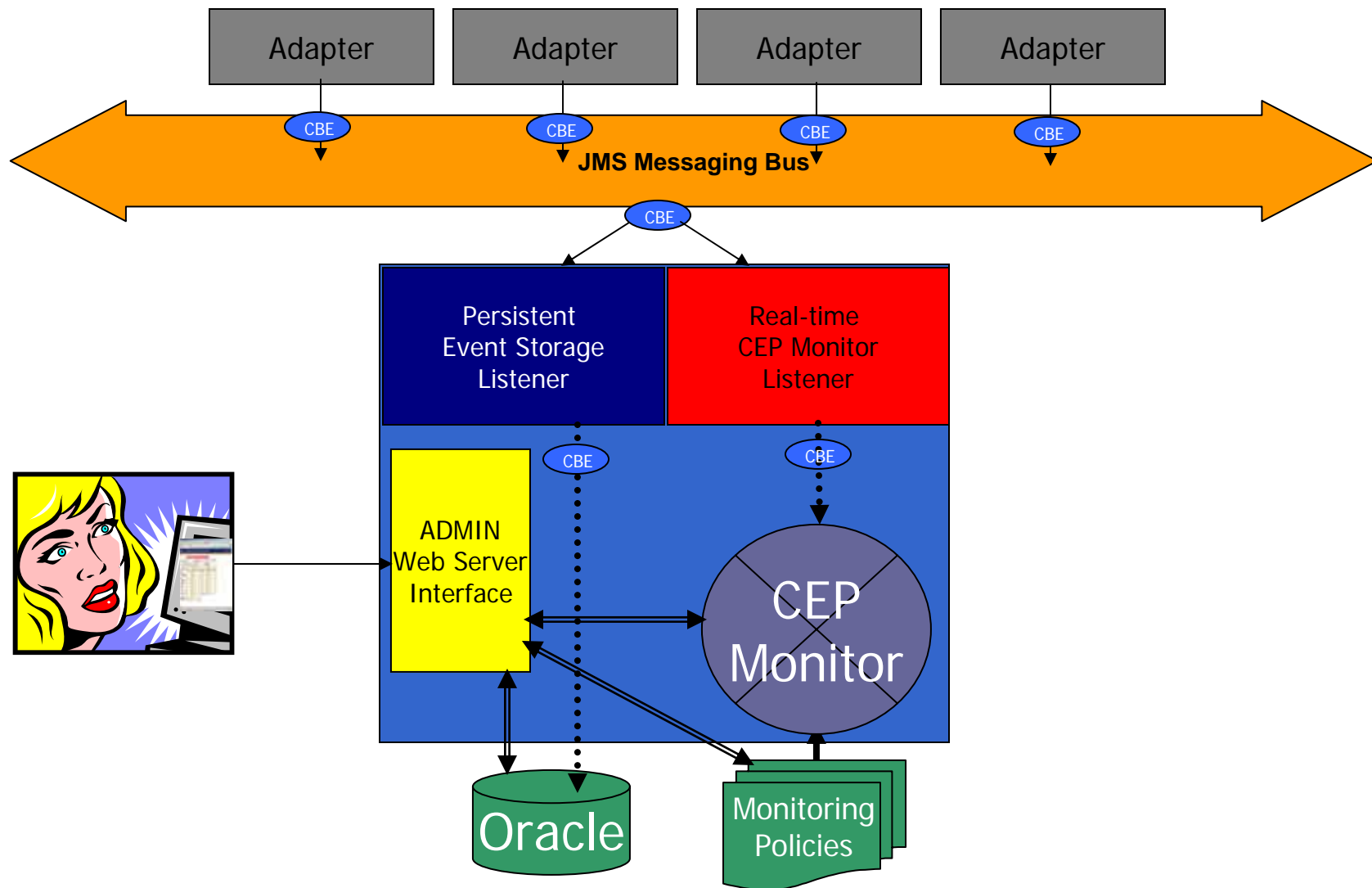
Adapter  
SQL Proc  
SMS  
Security Realm

2.2 E-Market Person Update SOAP service translates CIM message into local data model then interfaces with application. Logging Sensors publish CBE status messages (start/stop, success, fail)

# Complex Event Processing Pilot Project Goals/Objectives

- Fill the “Monitoring/Automated Response gaps” in ISONE’s existing Logging and Monitoring System
- Evaluate COTS software for policy management and complex event processing (AptSoft Director)
- Assess “plug and play” capabilities of AptSoft CEP Director
- Leverage Common Base Event standard and existing investment at ISONE
- Promote the pilot to Industry Consortia, if successful
- Verify the feasibility of CEP for Business Activity Monitoring at ISONE

# Central Logging Sink Architecture





# Example CBE

```
<?xml version="1.0" encoding="UTF-8"?>
```

```
<CommonBaseEvents >
```

```
<CommonBaseEvent
```

```
  version="1.0.1"
```

```
  globalInstanceId="TibcoA_Hourly_Rollup_Service_1105002105a1c01028-7fff"
```

```
  localInstanceId="ORCH-ALL-Settlement_Services-Hourly_Rollup_Service-158000"
```

```
  creationTime="2005-08-10T18:56:49.879Z"
```

```
  severity="20"
```

```
  msg="SUCCESS: Hourly Rollup Complete"
```

```
  priority="10">
```

```
  <contextDataElements
```

```
    name="TRANSACTION_ID" type="DISPLAY:1">
```

```
    <contextValue>12345</contextValue>
```

```
  </contextDataElements>
```

```
  <contextDataElements
```

```
    name="HOUR_NUMBER" type="DISPLAY:2">
```

```
    <contextValue>11</contextValue>
```

```
  </contextDataElements>
```

```
  <sourceComponentId
```

```
    application="Settlement_Services"
```

```
    component="Hourly_Rollup_Service"
```

```
    subComponent="Calculate_Average_LMP.fil_Starter_PD.process"
```

```
    componentIdType="BWProcess"
```

```
    executionEnvironment="EAIPROD"
```

```
    location="TibcoA"
```

```
    locationType="FQHostname"
```

```
    processId="158000"
```

```
    componentType="Java_Activity"/>
```

```
  <situation categoryName="ReportSituation">
```

```
    <ReportSituation reasoningScope="EXTERNAL" reportCategory="STATUS"/>
```

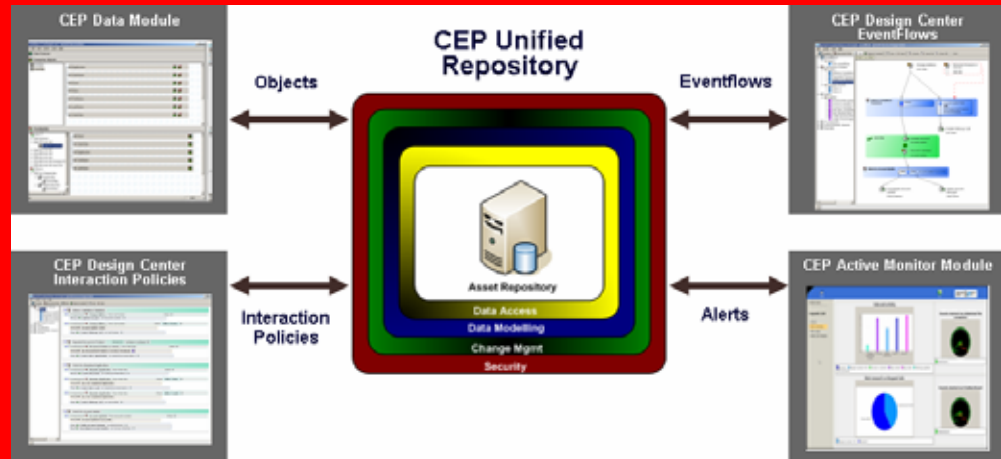
```
  </situation>
```

```
</CommonBaseEvent>
```

```
</CommonBaseEvents>
```

APTSOFT™

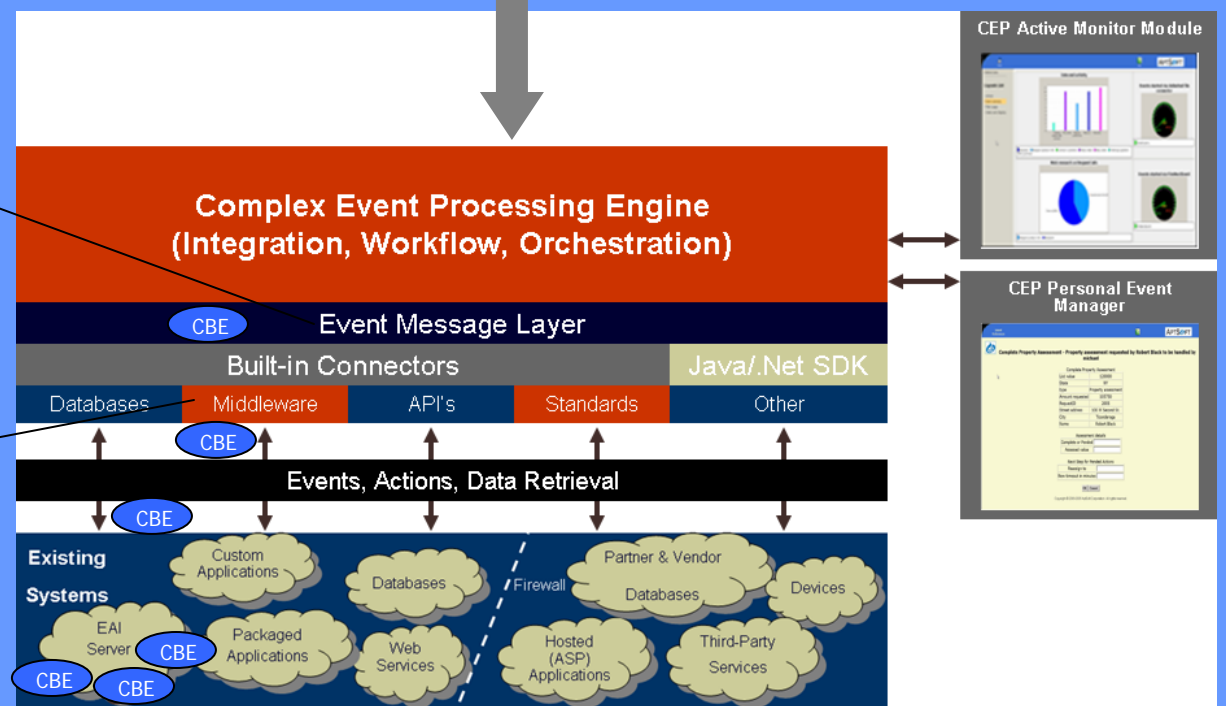
Development  
Environment



JMS  
Messaging  
Bus

APTSOFT™

Execution  
Environment



Real-time  
CEP  
Monitor  
Listener

# Use Case

## Extend Day Ahead Bidding Deadline

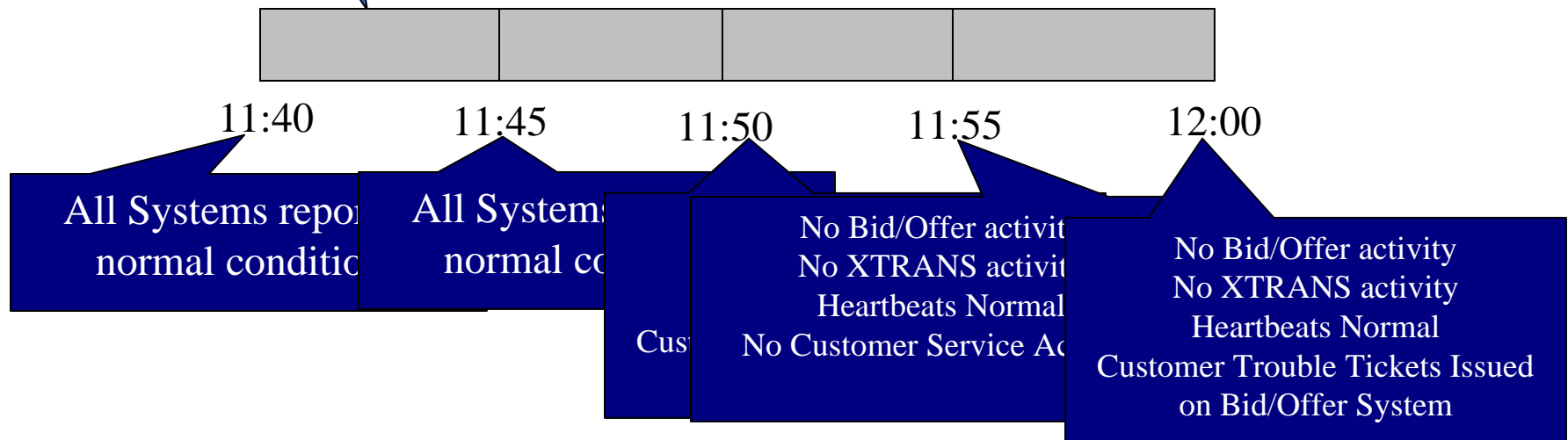
- There are cases when ISONE must extend the day ahead bidding deadline in order to clear the day ahead market
- This decision is based on multiple events and/or non-events
- When things go “wrong” special processes and procedures must be executed to mitigate/resolve the situation

# Monitoring Policy for DAM Closure/Extension

- Nominal Pattern of events supporting Market Closure at 12:00 noon
- Starting at 16:00 on day before closure:
  - Bid/Offer activity within normal range (per 15 minute interval)
  - Healthchecks reporting no anomalous conditions
  - External Transactions activity within normal range
  - Customer Service Activity within normal range
- Simulation covers period from 11:45-12:00

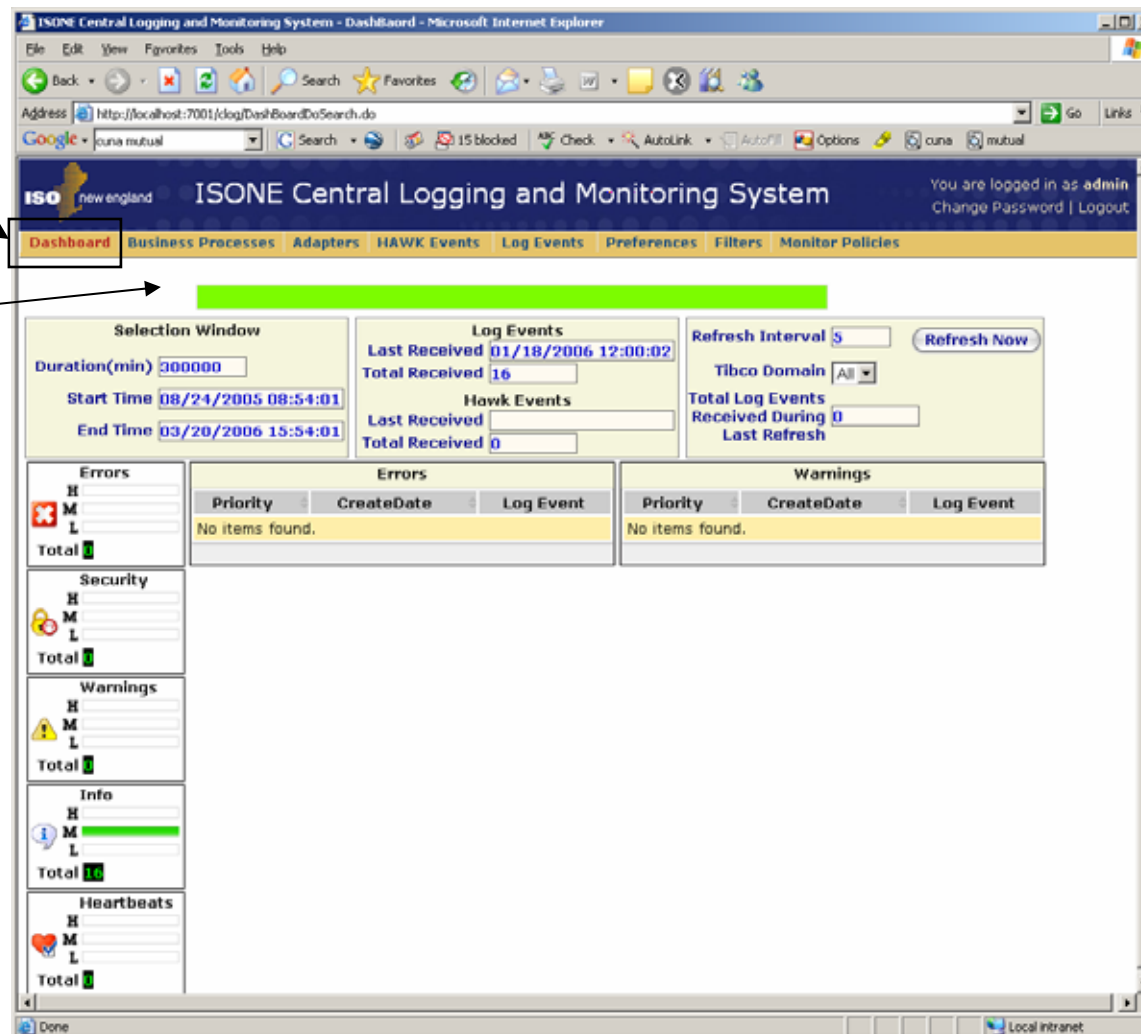
# Day Ahead (DA) Market Timeline

Murphy was alive and well on  
January 18, 2006  
At 11:42:18 AM!  
Forcing ISONE to extend the  
trading deadline in DAM



# Central Logging Dashboard

No anomalies reported on any event during timeframe.



# Central Logging Log Events

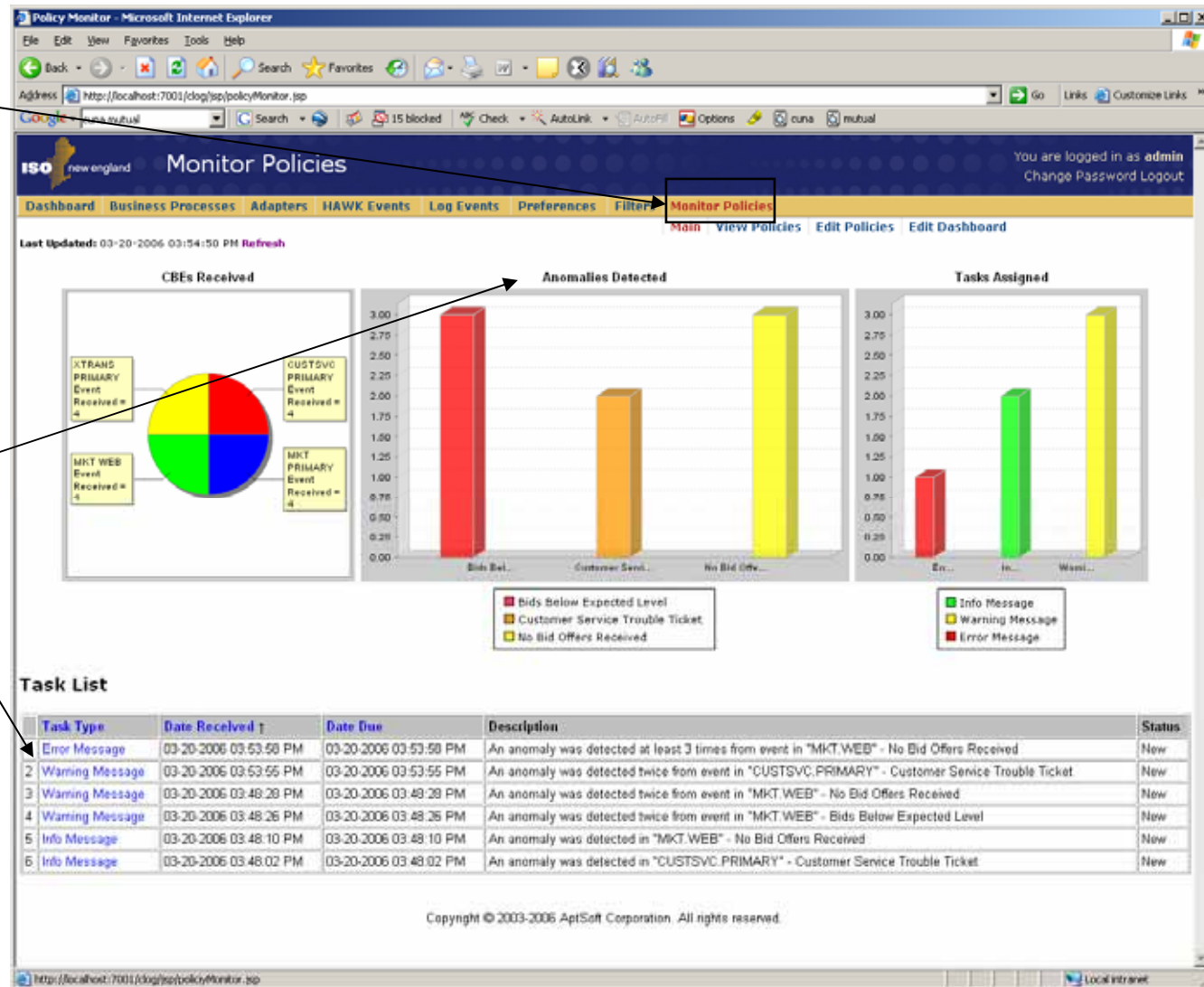
No anomalies reported on any event during timeframe.

The screenshot displays the ISONE Central Logging and Monitoring System interface. The top navigation bar includes links for Dashboard, Business Processes, Adapters, HAWK Events, Log Events (highlighted), Preferences, Filters, and Monitor Policies. The user is logged in as 'admin'. The interface features search filters for Start Time, Stop Time, Tibco Domain, Host Name, Business Domain, Business SubDomain, Severities, Priorities, and Categories. A 'Refresh Now' button is also present. Below the filters is a table titled 'Selected Events' with columns for Severity, Priority, Category, CreateDate, Application, Process Service, Activity, Transaction Events, and Log Event. The table lists 14 events, all with a 'Success' severity and 'Medium' priority, categorized as 'STATUS'. Each event includes a 'View' link and a 'Detail' link.

Severity	Priority	Category	CreateDate	Application	Process Service	Activity	Transaction Events	Log Event
Success	Medium	STATUS	01/18/2006 12:00:02	Adapter_CUSTSVCPRIMARY	Report_Activity	Publish_CBE	<a href="#">View</a>	<a href="#">Detail</a>
Success	Medium	STATUS	01/18/2006 12:00:02	Adapter_MKTWEB	Report_Activity	Publish_CBE	<a href="#">View</a>	<a href="#">Detail</a>
Success	Medium	STATUS	01/18/2006 12:00:01	Adapter_MKTPRIMARY	Report_Activity	Publish_CBE	<a href="#">View</a>	<a href="#">Detail</a>
Success	Medium	STATUS	01/18/2006 12:00:00	Adapter_XTRANSPRIMARY	Report_Activity	Publish_CBE	<a href="#">View</a>	<a href="#">Detail</a>
Success	Medium	STATUS	01/18/2006 11:55:01	Adapter_CUSTSVCPRIMARY	Report_Activity	Publish_CBE	<a href="#">View</a>	<a href="#">Detail</a>
Success	Medium	STATUS	01/18/2006 11:55:01	Adapter_MKTWEB	Report_Activity	Publish_CBE	<a href="#">View</a>	<a href="#">Detail</a>
Success	Medium	STATUS	01/18/2006 11:55:00	Adapter_MKTPRIMARY	Report_Activity	Publish_CBE	<a href="#">View</a>	<a href="#">Detail</a>
Success	Medium	STATUS	01/18/2006 11:55:00	Adapter_XTRANSPRIMARY	Report_Activity	Publish_CBE	<a href="#">View</a>	<a href="#">Detail</a>
Success	Medium	STATUS	01/18/2006 11:50:02	Adapter_CUSTSVCPRIMARY	Report_Activity	Publish_CBE	<a href="#">View</a>	<a href="#">Detail</a>
Success	Medium	STATUS	01/18/2006 11:50:02	Adapter_MKTPRIMARY	Report_Activity	Publish_CBE	<a href="#">View</a>	<a href="#">Detail</a>
Success	Medium	STATUS	01/18/2006 11:50:02	Adapter_XTRANSPRIMARY	Report_Activity	Publish_CBE	<a href="#">View</a>	<a href="#">Detail</a>
Success	Medium	STATUS	01/18/2006 11:50:00	Adapter_MKTWEB	Report_Activity	Publish_CBE	<a href="#">View</a>	<a href="#">Detail</a>
Success	Medium	STATUS	01/18/2006 11:45:01	Adapter_CUSTSVCPRIMARY	Report_Activity	Publish_CBE	<a href="#">View</a>	<a href="#">Detail</a>
Success	Medium	STATUS	01/18/2006 11:45:01	Adapter_MKTPRIMARY	Report_Activity	Publish_CBE	<a href="#">View</a>	<a href="#">Detail</a>

# Central Logging Monitor Policies (AptSoft)

AptSoft Identifies anomalies based on Complex Event Processing analysis of the SAME Events during SAME timeframe.





# Central Logging Monitor Tasks (AptSoft)

When AptSoft detects an anomalous pattern, a follow-up task is opened and assigned along with email notification.

http://localhost:7001/director/servlet/ListMyActions?cmd=viewaction&uid=CF0E728E2D6E547776339A - Microsoft Internet Explo...

File Edit View Favorites Tools Help

Back Forward Stop Search Favorites Home

Address http://localhost:7001/director/servlet/ListMyActions?cmd=viewaction&uid=CF0E728E2D6E547776339AA1448F50476\_action=Errc Go Links

Google Search 15 blocked Check AutoLink Options



## Review Common Base Event Message

[Click here to view full message in ISONE Central Logging](#)

contextDataElements	
Value	MKTWEB_1001
Type	DISPLAY:1
Name	TRANSACTION_ID

contextDataElements	
Value	0
Type	DISPLAY:2
Name	BIDS

contextDataElements	
Value	0
Type	DISPLAY:3
Name	OFFERS

CommonBaseEvent	
localInstanceId	MKT-WEB-Adapter_MKTWEB-Report_Activity-10002
msg	BID and OFFER ACTIVITY REPORT
severity	20
creationTime	2006-01-18T17:00:02.635Z
priority	50
globalInstanceId	<a href="#">deva_CBESimulator_120c795_1094c052ee8_-5000</a>
version	1.0.1

Please make a selection:

Resubmit

OK Cancel

Done Local intranet

# Central Logging Monitor Tasks (AptSoft)

A link to the initiating Event is included to speed investigation and resolution. Other information can be included as well.

The screenshot displays a web application interface for monitoring log details. The browser address bar shows the URL: `http://localhost:7001/clog/CbeLogDetail.do?bean.globalInstanceID=deva_CBESimulator_120c795_109d - Microsoft Inter...`. The page title is "Log Details".

The "Log Details" section contains the following fields:

- Business Domain: MKT
- Business SubDomain: WEB
- Version: 1.0.1
- Global Instance Id: deva\_CBESimulator\_120c795\_109dc052ee8\_-5000
- Local Instance Id: MKT-WEB-Adapter\_MKTWEB-Report\_Activity-10002
- Tibco Domain: EAIDEV
- Host Name: deva.iso-ne.com
- Application: Adapter\_MKTWEB
- Process/Service: Report\_Activity
- Activity: Publish\_CBE
- Component Id type: ApplicationAdapter
- Log Message: BID and OFFER ACTIVITY REPORT
- Severity: Success
- Priority: Medium
- Created Date: 01/18/2006 12:00:02
- Scope: EXTERNAL
- Process Id: 10002
- Category: ReportSituation
- Report Category: STATUS
- Component type: BusinessWorks

The "Application Context" section displays a table with the following data:

Name	Value
TRANSACTION_ID	MKTWEB_1001
BIDS	0
OFFERS	0

Below the table, it states: "3 items found, displaying all items." At the bottom right, there is a button labeled "GetMoreDetail".

# Benefits

- Consistent status reporting from across application domains
- Broad oversight of multi-step integration processes
- Ability to respond pro-actively to situations
- Central Logging and Monitoring improves SAS 70 auditability
- Ability to correlate events from across all enterprise applications and activities
- CEP engine enables ISONE to monitor very complex situations and enforce strict rules/guidelines with greater efficiency than existing solution
- Extremely flexible, dynamic, codeless design environment
- Reusability of objects
- Dynamic data retrieval (using CBE) as necessary
- Contextual (timing/sequence) evaluation functions built-in

# Lessons Learned

- Don't need to use ALL of the CBE to reap benefits
- Some tools cannot support XML schema abstract types (e.g. CBE situationType element)
- A common information model is an absolute requirement for cross enterprise logging and monitoring
- Logging and Monitoring can leverage the security, reliability and publish/subscribe capabilities of JMS

# Future Plans

- Promote the development of BAM standards on a broader scale
- Engage Energy industry participants (e.g. Utilities, Grid and Market Operators, Consultants, Software Vendors, Regulators) in supporting/adopting BAM standards

# Summary

- If CEP technologies were available during the California Energy Crisis would it have been possible to:
  - “Get Shorty” before Shorty got them
  - Deflate “Fat Boy”
  - Extinguish “Death Star”
- ISONE sees significant business benefit in a Common Logging Infrastructure using the CBE standard
- The Pilot Project has proven that AptSoft’s CEP monitoring engine delivered the desired results and met the pilot project goals/objectives

# Demonstration

- Aptsoft demonstration of ISO-NE BAM solution

## For More Information:

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