The Industrial Software Revolution Begins Now

invensys™
WW OPS-11

Wonderware Workflow:
A Plant Engineer's Perspective

Roger Smith
Wonderware Solutions Architect
Session Topics & Objectives

Challenges for Enterprise & Industry
Opportunity & Objectives for Remedy
Workflow & Business Process Management
Applying Wonderware Workflow to the Industrial Space
Building on Wonderware System Platform Infrastructure
Examples of Wonderware Workflow in Action
Real-World Challenges...

Many Data Sources:
- ERP
  - Orders/Finished Goods
  - Raw Materials
- Quality/LIMS
- Ops Management
  - Process Specifications
  - Consume/Produce/WIP
  - Asset Performance/OEE
  - Historian
- Maintenance EAM/CMMS

Many Roles:
- Operations
- Maintenance
- Quality
- Safety
- Environmental
- Supply Chain
- Finance
- Corporate

Many Systems:
- Enterprise Applications
  - ERP, EAM/CMMS, Custom DB
- Automation Applications
  - PLC, DCS, HMI, SCADA, MES
- Desktop Applications
  - Word, Excel, Outlook, Visio
- Web-Based
  - Custom Portal, SharePoint
- Manual – Human Decision
  - Voice, Text, Email
Collaborative Objective: High Performance
The BIGGER Challenge – System to People Collaboration
Collaborative Reality Feels Like This...
Real-World Example: Modeling & Mapping Complex Activities
Challenges Unique to Industry

• Automation systems not connected to other systems in real-time.

• Automation & Information Systems aren’t tightly and methodically connected to human action/reaction.

• Results negatively impact the business:
  – Automated processes become semi-manual.
  – Operation is inconsistent or untimely.
  – Records of action lacking or non-existent.
Industrial Challenges: Operations

Human activities surrounding the process:
- Machine setup, process changeover.
- Manual operation of peripheral components.
- Change in upstream/downstream process.

Unexpected or unpredictable operation:
- Events: Equipment failure, materials outage, waste, spill, emissions
- Cost Variance: Excessive time, energy, labor, materials, rework

Response to alarms detected by Automation System:
- High level, low temperature, no output.
- Safety systems, interlocks, guard systems.

Action Requires Specific Response!
Industrial Challenges: Post-Activity Information

Information captured with process context:

- Time-series process data
- Alarm & Event History
- Utilization/OEE
- Energy Consumption & Intensity
- Genealogy/Traceability
- Asset Health & Runtime Information
- Data Analysis & Dashboards

None of the above report systems “do something”.

Action Requires Specific Response!
Inevitability: The Auditors Cometh...

Internal Audits
• Operation, Quality, Safety, Training
• Materials, Maintenance, Spare Parts

External Audits
• Environmental
• Safety (People, Product, Community)
• Legal/Financial

Auditors ask three key questions:
1. “Do you have a procedure for that?”
2. “Are you following your procedure?”
3. “Can you prove it?”
Solution: Workflow

Model
**Model the Process** – Create Processes, Forms, & Reports

Execute
**Execute the Process** – Manage & Escalate Tasks, Coordinate Resources

Analyze
**Analyze the Process** - Find Bottlenecks, Get Alerts

Improve
**Improve the Process** – Continuous Improvement
Workflow: Criteria for Success

Access to the Right Information:
• Accurate
• Timely
• In Context to the Process

Take the Right Action at the Right Time:
• People
• Procedures
• Systems
  – Process
  – Plant
  – Business
Complex Workflows

- **Transitions**
  - Inhibits the execution of a workflow until a condition is met

- **Conditional Branching**
  - Allows one branch of activities to execute based on the evaluation of an expression

- **Decision Branch**
  - Executes one branch of activities if the evaluation of an expression is true. Executes the alternate branch if the evaluation is false.

- **Loop**
  - Executes a series of activities until a condition is met.

- **Queuing**
  - Manages tasks efficiently
Workflow Platform

Types of Workflows
- Application Specific
- Workflow Platform

Solution Focus
- One Window
- Intuitive Forms
- Human Workflows
- 100% browser based
- Integration with existing applications

“Every Stakeholder that needs to be involved, gets involved”
How Can We Do That?
Wonderware System Platform is:

Collection of software components that provides:

- Data Acquisition, contextualization, and aggregation
- Supervisory Control
- Historization
- Visualization & Annunciation
- Reporting
- Unified Development Environment
- Extensible Container for Advanced Applications
Wonderware System Platform: Core Component Overview

Wonderware Clients
- InTouch (Visualization)
- Historian Client (Analysis Client)
- Information Server (Web Reporting Client)

Wonderware System Platform
- Application Server
- Historian
- Information Server

Device Integration Products
- 3rd Party Data Sources
- Software Applications
- 3rd Party Controllers
One Platform for Enterprise Control

Enterprise Integration

Common Services
- Global Naming
- Security
- Manage/Deploy
- Messaging
- Alarm\Events
- High Availability

Application Models
- Plant Model
- Templates
- Standards
- Operations
- Security
- Intelligence

Presentation
- HMI
- Web
- Report
- Analyze

Functions
- Supervisory Control
- Performance OEE
- Historian
- Production MES
- Energy Mgmt
- Workflow BPM
- Maintenance CBM
- Intelligence EMI

Device Integration

Field Devices
Wonderware Workflow Components

Wonderware Workflow Software

- Enterprise Console
- Process Designer
- BAM Reports
- Form Designer

Connectors:
- System Platform Connector
- IntelaTrac Connector
- MES Connector
- Historian Connector
- Information Server Connector
- OPC UA Client Connector
- Share Point Connector
- BizTalk Connector
- SAP Connector
- MES Connector
- SAP Connector

Other Connectors:
- IntelaTrac Connector
- Information Server Connector
- OPC UA Client Connector
System Platform Connector Components

Automation Object
- $WorkflowGateway Object

Script Function Library
- Workflow Toolbox
- Workflows Tab

.NET Controls
- BAM
- Fill Form
- Inbox
- List Form
- List View
- Workflow Status
IDE: Workflow Object Integration
Deploy New or Modified Workflow
Would you please come into my office...

OK
After the barrel falls off…

... What happens next?
Example: Hazardous Spill Response

Kevin opens his inbox and fills the form with relevant information and submits the form. (System ensures information is complete)

Did Kevin take action?

Yes

Supervisor Approval received

Supervisor is notified to review the form submitted by Kevin and approve as appropriate

Supervisor Approval received

App Server updated with contextual information and Documents are posted to comply to legal regulations

Workflow Ends

Escalation sent to Kevin and Supervisor is Alerted
Workflow Runtime Execution

Details for step Invoke Submittal Form - EPI Process - Windows Internet Explorer

<table>
<thead>
<tr>
<th>Step Details</th>
</tr>
</thead>
<tbody>
<tr>
<td>Message type</td>
</tr>
<tr>
<td>Action started</td>
</tr>
<tr>
<td>Action event</td>
</tr>
<tr>
<td>Action event</td>
</tr>
<tr>
<td>Action event</td>
</tr>
<tr>
<td>Action event</td>
</tr>
<tr>
<td>Action event</td>
</tr>
<tr>
<td>Action event</td>
</tr>
<tr>
<td>Action event</td>
</tr>
<tr>
<td>Action event</td>
</tr>
</tbody>
</table>
Example: Lockout / Tagout Process

1. Issue Identified by Control System or Operator
2. Notify Maintenance / Servicing Crew
3. Lockout Tag Required
   - Yes: Notification to affected employees indicating maintenance.
   - No: Workflow Ends
4. Machine Shutdown and lockout tags implemented
5. Perform Maintenance
6. Complete notification sent to supervisor and affected employees
7. Tag update
8. Restore Machine
   - Visible in SCADA display

Workflow Ends
Example: Energy Peak Demand Avoidance

Monitor the Real-time Demand
Detect **impending** deviation

notifications are sent to
those who will be impacted
by a load shedding event.
Kevin has to explicitly
authorize halting further
production to avoid
demand charges

Did Kevin take
action?

Yes

No

Production Leads are
notified to not start new
orders and put current
orders on hold

Lead Ack
received

Lead Ack
received

Audit trail is updated with all
actions and a snapshot of current
energy demand is captured.

Workflow is triggered

Supervisor Screen
(Action Needed)

Escalation sent to
Plant Manager
HR Alerted

Workflow Ends

The INDUSTRIAL SOFTWARE
REVOLUTION BEGINS NOW

Slide 36
Complex Example: Pipeline Break

1. **Online Monitoring System**
   - SCADA detects ‘Main Break’
     - Notify Lab Personnel
     - Notify Police Personnel
     - Notify Utility Maintenance Crew
     - Activate alternate flow
     - Close Valve for Faulty Line
   - Collaboration with Lab

2. **Check for contamination**
   - Compare with the permissible standards
     - Yes
     - Implement ‘Boil Water’ Ordinance
     - Initiate Consequence Management Plan
     - Lift the ordinance
     - Normal
     - High
     - Repair pipeline
     - Flush Pipeline
   - Check for contamination
   - Yes
     - Lift the ordinance
     - Normal
   - No
     - High
     - Repair pipeline
     - Flush Pipeline

3. **Complex Example: Pipeline Break**
   - Implement ‘Boil Water’ Ordinance
   - Initiate Consequence Management Plan
   - Lift the ordinance
Workflow Process Designer & Activities
Workflow Activities
Beyond Automation: Workflow Examples

- Energy: Peak/Demand Response
- Quality: HACCP, Recall, Sampling/Testing
- Safety: LOTO, Hot Work Permit, Confined Space Entry
- Operations: Training, Execution, Exceptions, Alarms, Cleaning
- Maintenance: Shutdown, Repair/Replace, Startup, Auto W.O.
- Engineering: Plant Shutdown/Startup, Critical Asset Procedures
- R&D: New Product Development & Testing
- Supply Chain: Inventory Reconciliation, Materials Staging
Real-World Challenges

Real-World Opportunity!

Many Data Sources:
- ERP
  - Orders/Finished Goods
  - Raw Materials
- Quality/LIMS
- Ops Management
  - Process Specifications
  - Consume/Produce/WIP
  - Asset Performance/OEE
  - Historian
- Maintenance EAM/CMMS

Many Roles:
- Operations
- Maintenance
- Quality
- Safety
- Environmental
- Supply Chain
- Finance
- Corporate

Many Systems:
- Enterprise Applications
  - ERP, EAM/CMMS, Custom DB
- Automation Applications
  - PLC, DCS, HMI, SCADA, MES
- Desktop Applications
  - Word, Excel, Outlook, Visio
- Web-Based
  - Custom Portal, SharePoint
- Manual – Human Decision
  - Voice, Text, Email
Highlights: Wonderware Workflow 2012

Business Value
• Enable Operational Improvements
• Improve Procedural Quality, Consistency
• Adhere to and enforce Regulatory Compliance

Key Capabilities
• Digitally Capture, Institutionalize Best Practices
• Preconfigured Workflows
• Business to Mfg. Connectivity (human-centered)
THE INDUSTRIAL SOFTWARE REVOLUTION BEGINS NOW

invensys
Architecture / Topology

Workflow Engine
Task Scheduler
Communication Service

Central Configuration Site location
Enterprise Console information
Global configuration settings

Repositories

Skelta Server 1
Skelta Server n

Skelta Farm DB

Skelta Datasource 1
Skelta Datasource n

Skelta Client 1
Skelta Client n

Farm DB

Datasource 1
Datasource n

Repository 1
Repository n
Wonderware Workflow Software can be reused and embedded in a custom ASP.NET application. These same controls are used in Skelta Enterprise Console, the ArchestrA IDE and ArchestrA Graphics.

Skelta Enterprise Console is a web-based interface that allows authorized users to build workflow-driven applications. It also allows users to participate in these applications.

Skelta Repository contains workflow definitions, queues, calendars, settings, workflow execution data and Business Activity Monitoring (BAM) data.

Forms Engine is responsible for every activity starting from the time a form is opened till a form is closed. It captures all the real-time user inputs, processes the inputs and displays this information in terms of controls, business logic and usability.

The Integration Layer acts as an interface between Skelta BPM.NET and third-party applications.

Web Services - Skelta BPM.NET provides out-of-the-box activities that can be used to call a third-party Web Service from a workflow. Examples include Workflow Engine Services, Task Scheduler Services, Skelta Communication Services, Skelta Advanced Server Service.

Supports the following Security & Directory Services:
1.) Active Directory
2.) Lightweight Directory Access Protocol (LDAP)
4.) Any User Directory
5.) .NET Role Provider
6.) ArchestrA Security

Delivery Channels are interfaces for users to interact with workflows. Skelta BPM.NET provides multiple delivery channels which include: Browser, Messenger Services, Mobile Phones, Email, MS Outlook, Desktop Applications.

The Skelta Object Access allows reuse of third-party .NET objects. It allows registration of third-party object assemblies.

The Enterprise Event Bus handles third-party events that trigger workflows. Third-party events can include updating SharePoint lists, updating files and receiving e-mails.

Microsoft Integration - Skelta BPM.NET integrates with the following Microsoft applications: 1.) Exchange 2.) SharePoint 3.) Word 4.) InfoPath 5.) SQL 6.) BizTalk 7.) Visio