Implementing a Workflow Solution Leveraging SCADA and Cityworks

GE Intelligent Platforms
What is Cityworks?

Cityworks empowers GIS to manage both physical infrastructure and land-focused asset management. Organizations allocate considerable resources toward developing and maintaining their GIS. Cityworks capitalizes on this valuable resource. Cityworks and Esri ArcGIS combine to make the perfect platform for designing and creating GIS-centric public asset management solutions.

Service requests, work orders, inspections, and projects are used to track citizen concerns and all types of work activities—cyclical or reactive—with their associated costs. Map layers can be created to display information such as all open requests, pavement condition, all repaired potholes for a given time period, etc. Reports of all types can be generated on the fly using various search parameters or set up as customized templates. Cityworks empowers staff at all levels—field workers, call takers, and administration—to get the information they need.
Waterford Township
Use Case
Waterford Township DPW Assets

360 Miles of Water Main and Appurtenances
19 Production Wells
2 Elevated and 1 Ground Storage Tanks
13 Iron Filtration Plants
1 High Service Pumping Station
355 Miles of Sanitary Sewer
63 Sewer Lift Stations
15 Township Buildings
5 Township Cemeteries
230 Vehicle Fleet
Project Objectives

• Electronic Standard Operating Procedures (eSOP) - Provide method for capturing real-time events and documenting best practice processes to resolve them while codifying institutional knowledge

• Provide a workflow component for SCADA – Auto task generation

• Integration of SCADA workflows with Cityworks (CMMS) via Work Order API to further leverage business platforms and capture labor and material used to resolve issues
Project Overview

**SCADA**
Facilitates efficient monitoring, control and optimization of water and sewer operations.

Alarms generated are large proportion of CMMS work orders

No eSOP procedures and not linked directly to SCADA

**Workflow**

Event Based, Process-Centric

- Manual task automation
- Digitized eSOP
- Alarm Response Management
- Direct Integration with SCADA and CMMS
- Service Oriented Architecture – Key to Integration
Project Overview

Cityworks

• Work Order API provides developers a supported set of web services to generate work orders in Cityworks.

• Utilizing the inherent Cityworks business logic, data values sent to the service can trigger both routine and emergency work orders.

• The web services follow the JSON (Java Script) standard making them language independent and able to support requests generated from a variety of environments including .Net and Java.
Project Items

Phase I
Automated workflows based on SCADA condition events
• Pump number of starts
• Pump runtimes
• Standalone workflow to document Sanitary Sewer Overflow (SSO) reporting process

Automated workflow based on time event
• Site Inspection – 5-7 inspections per day as part of a 2 week cycle

Incorporation of Cityworks Work Order API for automatic work order generation

Phase II
• Integration of Document Management System (OnBase)
• Development of additional workflows by internal staff
Workflow Overview

Workflow is made up of four main components

• Equipment Model – Models site/equipment and linkage of SCADA values
• Events – Conditional expressions or time based events that trigger workflows
• Workflow Templates – Configured Templates that contain automated process and manual steps
• Schedules – Combines events with workflow templates to initiate workflows

These components create a process driven workflow for managing by exception
Workflow Template

Configured steps and processes that are executed automatically and/or with user interaction

Steps can be modified by workflow authors and services can be added by administrator
Workflow Template

Workflow presents pre-configured services that can be added as a method

<table>
<thead>
<tr>
<th>Name</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>Create a Work Order</td>
<td>Provides search capabilities against the directory</td>
</tr>
<tr>
<td>Get a Domain List</td>
<td>Provides access to information in the Equipment management</td>
</tr>
<tr>
<td>Get a Entity Type List</td>
<td></td>
</tr>
<tr>
<td>Get a Module List</td>
<td></td>
</tr>
<tr>
<td>Get a Work Order Template List</td>
<td></td>
</tr>
<tr>
<td>Get an Authentication Token</td>
<td></td>
</tr>
<tr>
<td>Parse Authentication Response String</td>
<td></td>
</tr>
<tr>
<td>Parse Domain List Response String</td>
<td></td>
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<tr>
<td>Parse Entity Type List Response String</td>
<td></td>
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<tr>
<td>Parse Module List Response String</td>
<td></td>
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<tr>
<td>Parse Work Order Creation Response String</td>
<td></td>
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<tr>
<td>Parse Work Order Template List Response String</td>
<td></td>
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<tr>
<td>Request Authentication</td>
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<tr>
<td>Request Domain List</td>
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<td>Request Entity Type List</td>
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<td>Request Work Order Template List</td>
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<td>IDbConnector</td>
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<tr>
<td>IDirectorySearch</td>
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<tr>
<td>IEquipment</td>
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</tbody>
</table>
Workflow Schedule

Combines workflow template with events, either conditional or time based to determine if a workflow should be generated.

Select Workflow
This is the Workflow that will run either when an event fires or when manually triggered.

Browse... Pump Station

Pump Station - Schedule by Event
The selected Workflow will be run when this event fires.
Browse... Delete 2-1 Anoka - Pump Starts

Workflow Instance Management
This section indicates the status of your workflow and its resources, as well as the number of these resources currently running. This information is displayed in the Status and Workflow Instances sections.

A workflow whose status is set to Enabled can be used in a live production environment. All resources associated with that workflow must also be enabled. A workflow whose status is set to Disabled cannot be used in a run-time state; however, it can be edited.

Status
Enable or disable your resource by clicking one of the buttons below.
Enable Disable

Workflow Instances
Number of running workflow instances using this resource: 0
Resource disabled - workflow instances that use this resource can no longer be created.
Workflow Deployed

When a workflow is triggered, either manually or automatically as part of a conditional or time based event a series of processes occur:

An email is triggered, notifying appropriate personnel of the workflow and supplying a work order number if generated.
Workflow Deployed

Appropriate users can view details of the workflow and begin processing it.
Workflow Deployed

Information from SCADA is displayed in the workflow, along with specific eSOP information for troubleshooting.

Instructions

Pump #1 Starts: 26  Pump #2 Starts: 16  Pump #3 Starts: 0

If there is no mechanical alternator go to the next step.
Check mechanical alternator:
1. Trip float on/off
2. Trip float 1
3. Is the pump running? Check to ensure Pump 1 is on
4. Turn both floats off
5. Repeat steps 1 - 4 with float 2 and Pump 2 should start
6. Repeat steps 1 - 5
7. If starts do not alternate, replace the alternator and repeat steps 1 - 6 to verify it
8. If it still doesn't work call and email the DPW Electrician.

Enter any comments about work performed.
Workflow In Action

Steps guide users through resolution of the issue

Steps have expiration timers, if steps are not processed in time escalation processes occur (notifications)
Waterford Township ROI Comparison

What it measures: Two (2) simple pro-active continuous monitoring operational tools that increase operator efficiency by allowing them to focus on greater value add activities.

**Pump Runtime Comparison** monitors the pumps at each station by checking to make sure the individual pump runtimes do not vary by more than a certain percentage, in this case 20%. Given the pumps are hydraulically the same, and in most pumping stations this is the case, a large variance in runtimes in a given time period would indicate a problem with the pump that is running longer such as ragging, bad impellor, etc. In Waterford’s case, the application is monitoring this scenario continuously for all 62 sewer pumping stations (approximately 130 pumps).

**Pump Alternation Comparison** monitors the pumps at each station by checking to make sure the individual pumps are alternating as required, which helps to ensure that runtimes for the pumps are equalized maximizing the life of the asset. Alternations varying by more than 3 cycles between the pumps being monitored indicates an alternator or other mechanical problem with the pump not starting or stopping as required. In Waterford’s case, the application is monitoring this scenario continuously for all 62 sewer pumping stations (approximately 130 pumps).

Calculated ROI for the 2 applications above including software purchase and implementation ~ $30,000 was 4 Months
## Workflow- Waterford ROI Calculation

### Workflow ROI Calculation Example for Waterford Township

<table>
<thead>
<tr>
<th>Workflow Type</th>
<th># of Stations</th>
<th>Approx. Avg. Savings Per Station Per Week</th>
<th>Approx. Avg. Savings x 62 Stations Per Week</th>
<th>Approx. Avg. Savings x 52 Weeks Per Year</th>
<th>Total Annual Savings</th>
<th>Total Cost of Software and Implementation</th>
</tr>
</thead>
<tbody>
<tr>
<td>Pump Runtime Comparison</td>
<td>62</td>
<td>$0.129032,26 $5.03 $3.00 $1.25 $0.0541 $12.41</td>
<td>$312.00 $186.00 $77.50 $3.35 $769.23</td>
<td>$16,224.00 $9,672.00 $4,030.00 $174.45 $40,000.00 $70,100.45</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Pump Alternation Comparison</td>
<td>62</td>
<td>$0.064516,13 $2.52 $1.25 $0.65 $0.0271 $4.96</td>
<td>$156.00 $77.50 $40.30 $1.68 $307.69</td>
<td>$8,112.00 $4,030.00 $2,095.60 $87.23 $16,000.00 $30,324.83</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

### Total Annual Savings

- $100,425.28
- $30,000.00

### ROI (Years)

- 0.30
Thank You!

Questions?

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Backup

eSOP

Solution Components
Standalone and Disconnected Platforms
eSOP Solution

Solution components:
✓ Proficy Workflow and Reporting
✓ eSOP Editor – Global Display
✓ eSOP System Configuration – Global Display
✓ eSOP Template – Workflow Template
✓ eSOP Step – Workflow Template Form
✓ Email – Custom Activity
✓ eSOP User Activities
✓ Solution Objects Service Provider

What you will need to have...
✓ One of the supported Workflow Operating Systems
✓ SQL Server 2005 (or greater)
✓ SSRS – SQL Server Reporting Services
✓ SQL Server Business Intelligence Development Studio
✓ Microsoft Office 2007 (or greater)
Standard Models (CIM, ISA95)

One common method to communicate about assets

- ERP
- SCADA
- GIS
- LIMS

Event Information and data

Noru Kitas vienas alus, prašome

Желим Још једно пиво молим

Jeg ønsker en annen øl vennligst

私はもうビールはお願いしたいと思います

SOA
Location Context
ISA-95 Equipment Models