
SPATIAL

May 2012
Oracle Spatial User Conference

ORACLE

SPATIAL

# Oracle Spatial User Conference

May 23, 2012

Ronald Reagan Building and International Trade Center

Washington, DC  USA



# Dan Guatto, P. Eng.

COO & Vice President of Engineering
and Operations
Burlington Hydro

# Geoff Cameron

Executive Vice President
Intelligent Networks
AGSI


# Deploying a Smart Grid Network at Burlington Hydro

Oracle Spatial User Conference 2012

# Burlington Hydro GO360Networks Enterprise Solution

Burlington hydro inc.

OVERVIEW

- Centrally managed, authoritative database for all electric network and asset data in Oracle SDO geometry format
- Incorporates 7 corporate systems and 8 departmental systems that were previously silo databases; enable enterprise access and workflow
- Supports Business Functions, Departments, Constituents

CHALLENGES / OPPORTUNITIES

- Need for extreme high performance on spatial queries including Live Operations and Mobile, scalability for Smart Grid Data, and security for mission critical data
- Need to integrate multiple disparate data sets
- Source data over 30% of facility data incorrect; no nodal network connectivity existed
- 5.8 Billion AMI records relating to Geospatial Meters

SOLUTIONS

- Oracle Standard Edition One
  - Locator
- Oracle Fusion Middleware
  - MapViewer, WebLogic future (currently OC4j)

RESULTS

- Reduced asset management reports from months to minutes with significantly enhanced accuracy
- Consolidation of raster, vector, network data in a 7 GB sized central repository with live links to TB sized Smart grid databases
- Enterprise wide adoption of geospatial technology
- Created a common single system of record for the network and all business related asset information
- Citywide network connectivity model of electrical distribution system, sites and customers
- Enhanced data accuracy and timeliness for real-time business decision making purposes and capital planning


# Program Agenda

- Burlington Hydro Utility Overview
- BHI`s Smart Grid Initiatives
- How GO360 Open Architecture Oracle Spatial Foundation Addresses BHI Needs
- BHI`s Smart Grid Challenges
- Enterprise GeoSolution Examples at BHI
- Network design, Asset Management, Mobile etc.
- GO360 Smart Grid Solution Examples at BHI and Neighbouring Utilities


# Burlington Hydro Background

## Customers Served

- Over **60,000** Residential Customers
- Over **5,500** Commercial and Industrial Customers

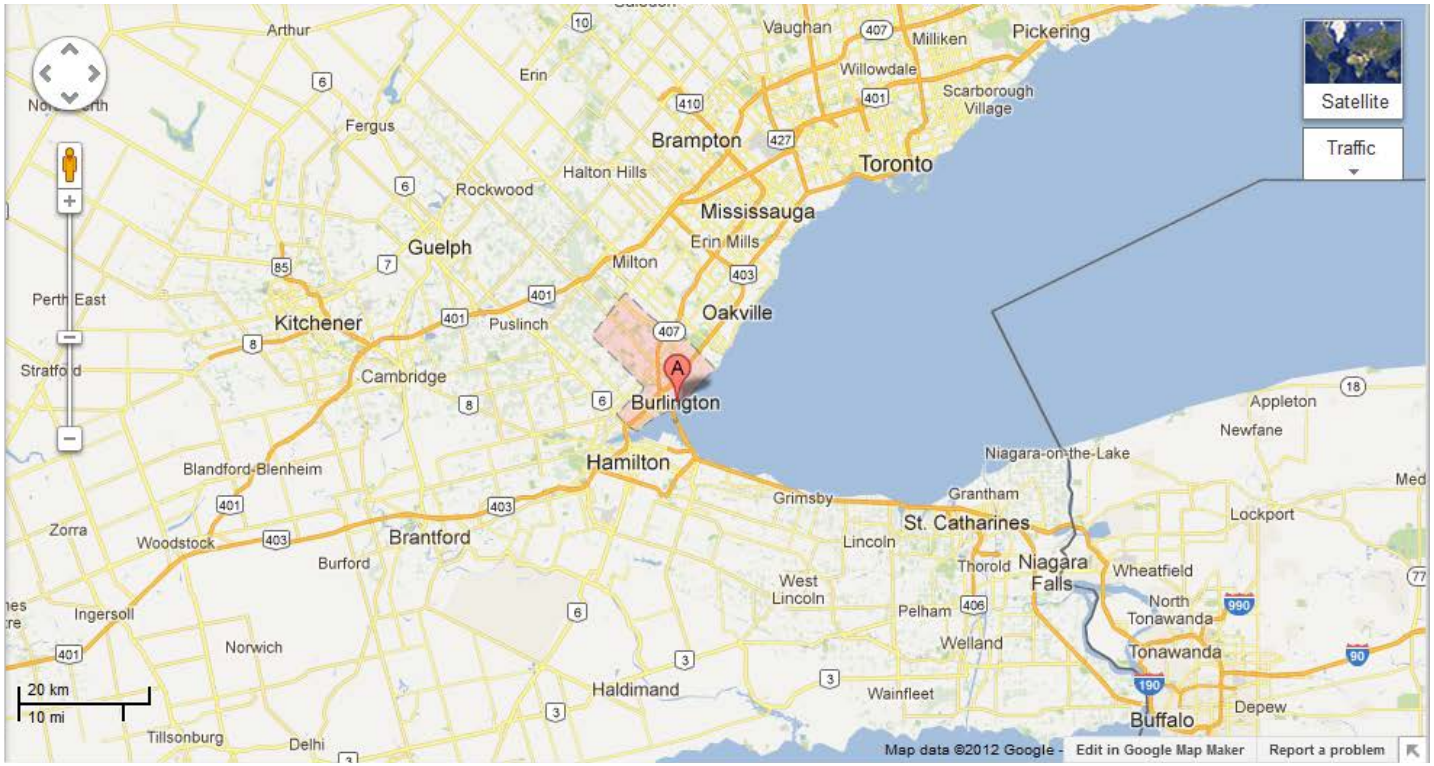
## Assets

- **32** Substations
- **1,600** kilometres of Low Voltage Distribution Lines
- **93** Full Time Employees

Oracle Spatial
User Conference
2012

ORACLE

# Burlington Hydro Background




# Burlington Hydro Background



- **GridSmartCity™ Initiatives**
  - Smart Automated Distribution Switching (Self Healing, High Reliability)
  - 65,000 Smart Meters deployed with Time-of-Use Billing
  - Distributed Renewable Generation is spreading
  - Electric Vehicle Charging Stations
  - Factory Ride-Through Systems
  - Battery-Based Electricity Storage as a deployable grid resource


# BHI Smart Grid
# Enterprise Approach “Why Go360”

## Smart Grid has Focused Open Architecture as a Main Requirement for Utility I.T.

Multitude of Smart Devices and Integrated Systems

- AMI, SCADA, Smart Switches, Power Line Monitors etc.
- MDMR, CIS, ERP, Engineering Analysis etc
  - Proprietary GIS Systems Integration Very Costly and Inflexible
  - All BHI Data stored Directly in Oracle / Oracle Spatial
- Integration Effort Fast and Utilize Existing I.T. Resources


# BHI Smart Grid
# Enterprise Approach "Why GO360"

## Real-Time Bi-Directional Communications

- Advance Distribution Management Systems, Outage Management, Mobile etc.

## "Big Data"

- Medium Size Utilities Generating Billions of Transactions / Records per Year
- Store, Access and Scale Quickly and Cost Effectively


# Go360Networks: Applications Through Integration Facilitating Complete Lifecycle Asset Management

## Go360 Provides Enterprise Utility Specific Solutions

Oracle Spatial Database

- SOA Architecture.
- Live Data Updates and Bi-Directional Communications


# Go360Networks: Applications Through Integration Facilitating Complete Lifecycle Asset Management

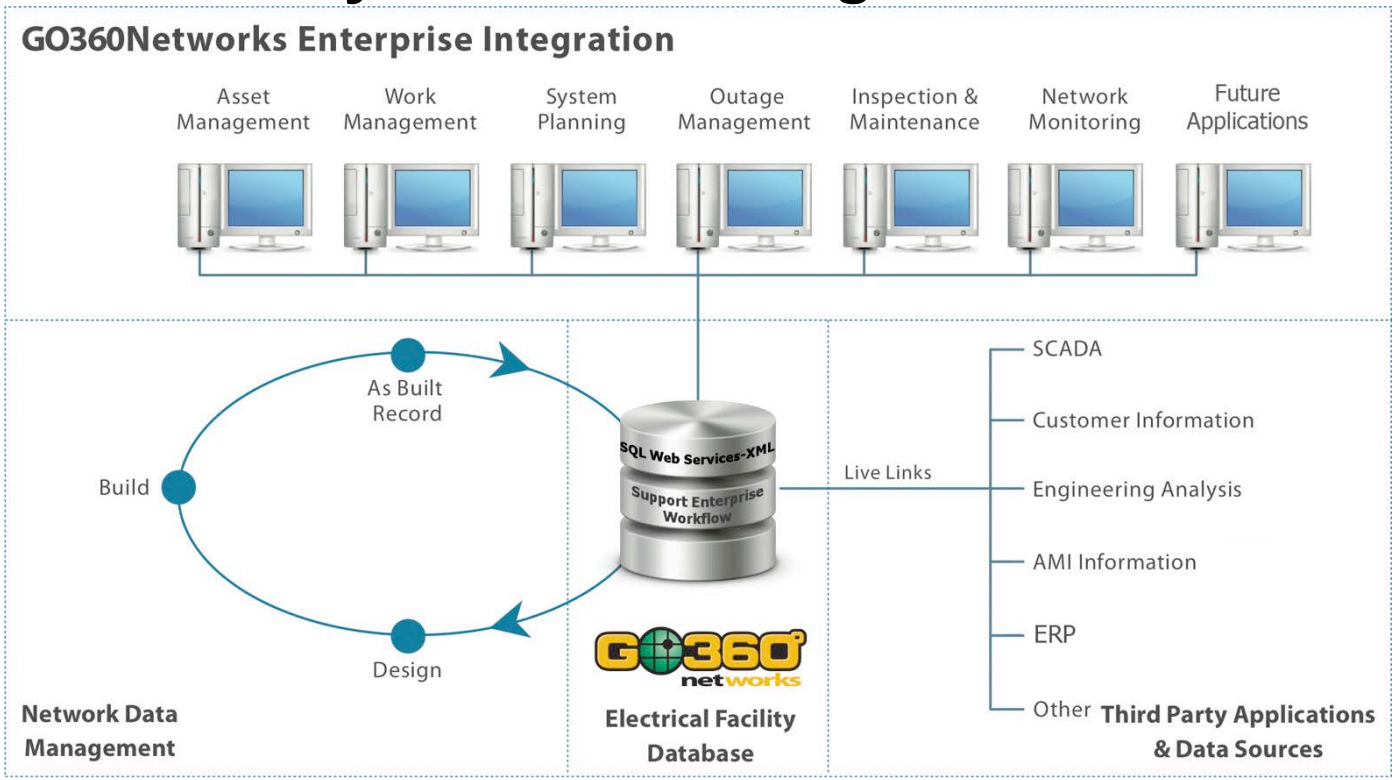
## GO360 Provides Enterprise Utility Specific Solutions

Oracle Spatial Database

- Enterprise Access for utility Specific Applications
  - Network Design and Connectivity Model Management
  - Asset Management
  - Mobile with Real-Time Bi-Directional Information Updates
    - Tablets, iPhone, Android, Blackberry etc.
  - Outage Management (OMS)
  - Distribution Management Solution (DMS)
  - Smart Grid Analytics
  - Executive Dashboards

Oracle Spatial
User Conference
2012
ORACLE

# Go360Networks: Applications Through Integration Facilitating Complete Lifecycle Asset Management

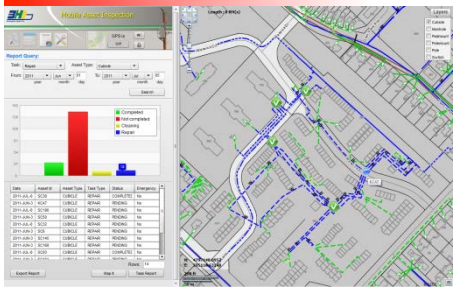


Oracle Spatial User Conference 2012

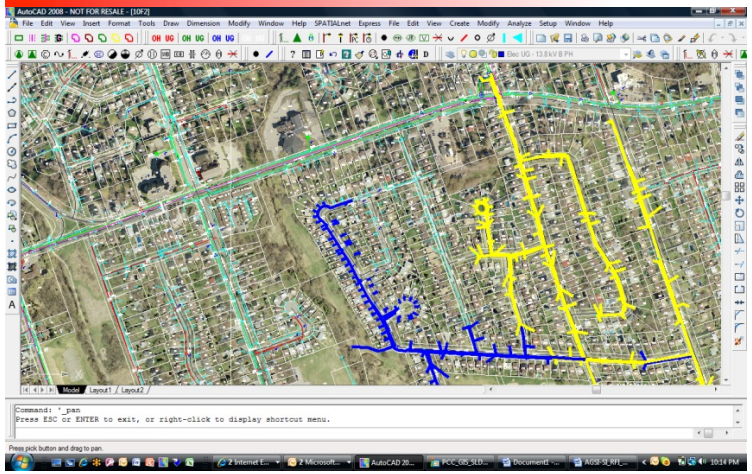
# Integrated and Accessible Solutions For Your Business Users From a Single Common Database

## Executive Dashboards

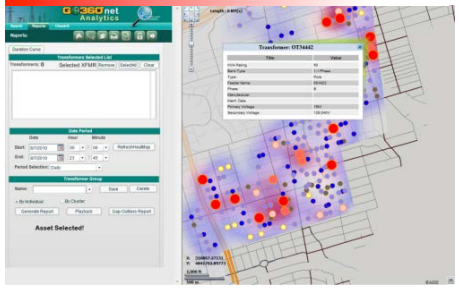

## Asset Management



## Network Design / Connectivity Model




## Smart Grid Analytics




## Mobile

The image part with relationship ID rId4 was not found in the file.


# Burlington Hydro I.T. Systems History

- Legacy CableCad Environment
  - Internally Maintained Land Base
    - Parcels, Address Points, Cad Layers and Text
- Daffron ERP: Billing, Work Orders, Transformers Assets, Time Reporting etc.
- Dromey DESS: Engineering Analysis
- Asset Condition Assessment DB: Nameplate, Condition and Photo Data
- SCADA
- GridSmartCity™ Infrastructure (Phase 2): e.g. Smart Switching, AMI, EV Fleet Implementations, EV Charging Stations, Renewable Energy etc.


# BHI Consultant Recommendations Prior to Implementing GO360

- Move from Stand Alone to Enterprise Integration
- Functionally Rich Design Solution
  - Productivity Enhancements e.g. AutoCAD Integration
  - Streamline Business Data Ownership, Use and Entry Processes
- Mobile Workforce
- CableCad Data Conversion
- System & Data Integration introducing Enhanced Geospatial Functions
- Support Smart Meter / Smart Grid Initiatives
- Focus on Real-Time (Leverage Investment AMI Network)
- Vision of Enterprise Access and Use for Data and Technology

"Two of the main factors affecting GIS today are the move towards using Internet technology to be able to serve GIS data to a much broader user base and efforts by the Open Geospatial Consortium (OGC) to promote interoperability. BHI needs to implement a new GIS that will fit its technology vision and provide the benefits of today's GIS to BHI operations."

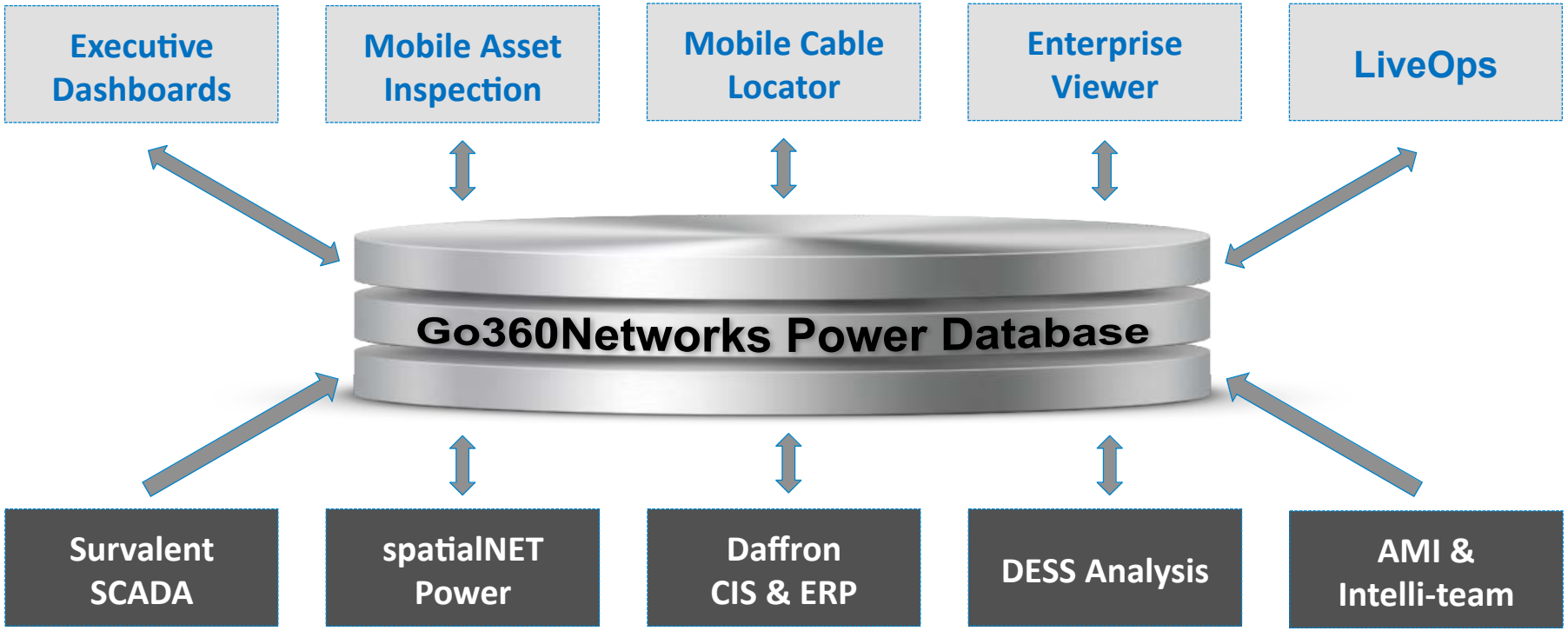
**BHI Independent Consultant**


# Initial BHI Targeted Implementation

- **Main Conduit for Information Corporate Wide**
  - **Engineering**
  - **Operations / Control Room**
  - **Customer Service**
  - **Mobile**
  - **Finance**
  - **HR**
- **Productivity Enhancement**
  - **Access to High Quality Information in Real-Time**
  - **Improve Work Capabilities i.e. Combine separate tasks into a seamless workflow**
  - **Streamline Data Update into a Single Process through Automation**
- **Timing Was Good – Tied in Regulatory Asset Inspection and Data Collection Initiatives**

Oracle Spatial
User Conference
2012
ORACLE

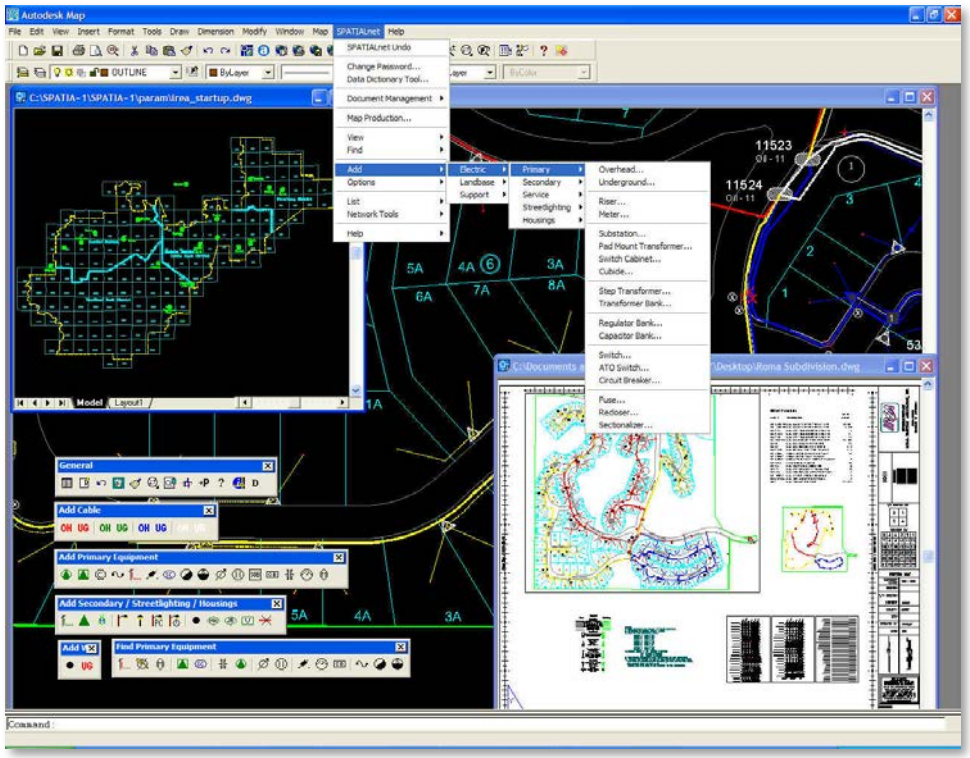
# Go360Networks
# Current Implementation at BHI



Oracle Spatial
User Conference
2012

# SpatialNET Power – Robust Design And Network Management

**Includes Robust Job Management, Versioning & Conflict Resolution Capabilities**

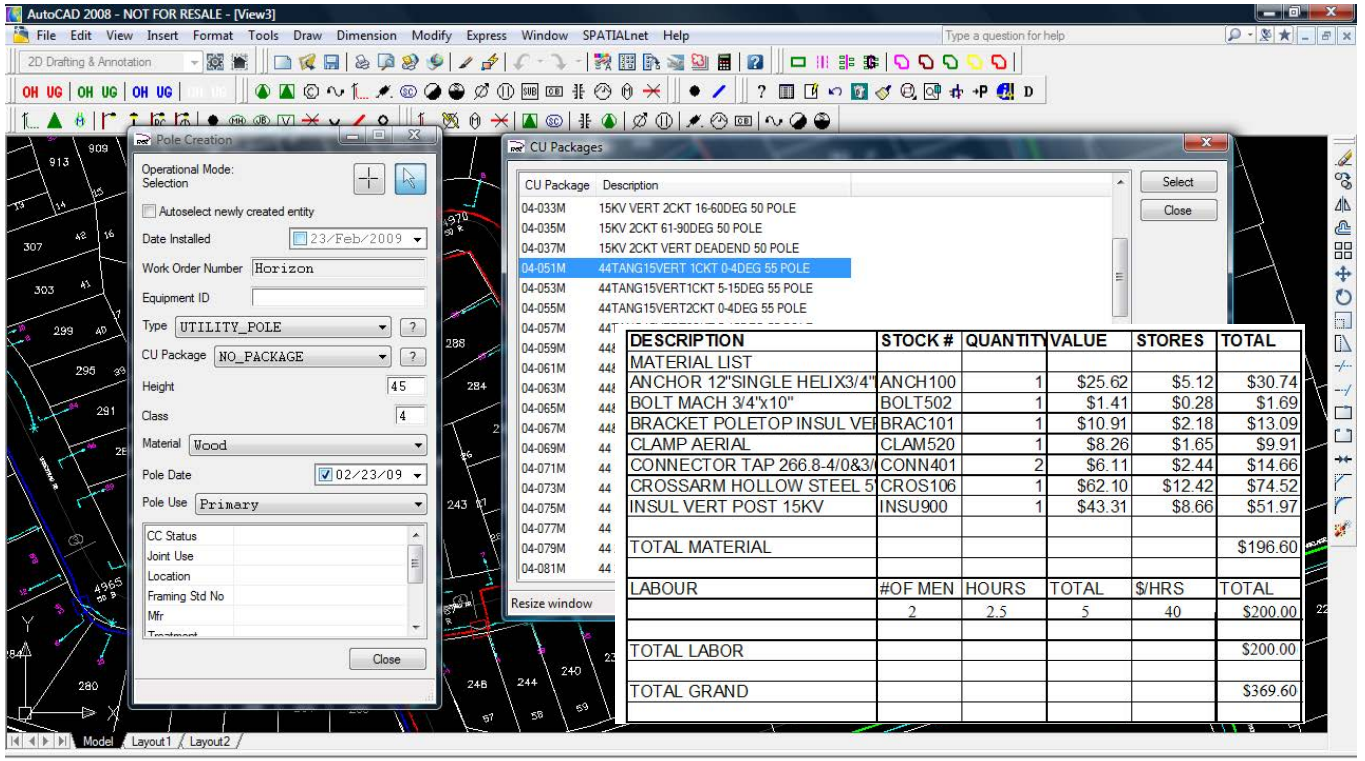



# BHI Project Implementation

- **spatialNET Power**
  - **Distribution Design and Network Topology**
    - **AutoCAD Partner Solution – ACAD Interface for Editing and Design**
    - **Direct Read / Write to Oracle Spatial**
    - **spatialNET Engine for:**
      - **Job Management / Versioning etc.**
      - **Automated Connectivity on the Fly**
      - **Engineering Standards and Bill of Materials**
      - **Map Production**
      - **Spatial and Attribute Queries**
      - **On-Board Table and Attribute Configuration**
      - **Integration 3rd Party Systems e.g. Dromey DESS, DWG, Multi-Speak etc.**

Oracle Spatial
User Conference
2012

# Network Design with Engineering Standards Job Estimating, "What Ifs" and Asset Tracking (2204 Compliancy)




| DESCRIPTION | STOCK # | QUANTITY | VALUE | STORES | TOTAL |
|---|---|---|---|---|---|
| MATERIAL LIST | | | | | |
| ANCHOR 12"SINGLE HELIX3/4" | ANCH100 | 1 | $25.62 | $5.12 | $30.74 |
| BOLT MACH 3/4"x10" | BOLT502 | 1 | $1.41 | $0.28 | $1.69 |
| BRACKET POLETOP INSUL VE | BRAC101 | 1 | $10.91 | $2.18 | $13.09 |
| CLAMP AERIAL | CLAM520 | 1 | $8.26 | $1.65 | $9.91 |
| CONNECTOR TAP 266.8-4/0&3/ | CONN401 | 2 | $6.11 | $2.44 | $14.66 |
| CROSSARM HOLLOW STEEL 5' | CROS106 | 1 | $62.10 | $12.42 | $74.52 |
| INSUL VERT POST 15KV | INSU900 | 1 | $43.31 | $8.66 | $51.97 |
| | | | | | |
| TOTAL MATERIAL | | | | | $196.60 |
| | | | | | |
| LABOUR | #OF MEN | HOURS | TOTAL | $/HRS | TOTAL |
| | 2 | 2.5 | 5 | 40 | $200.00 |
| | | | | | |
| TOTAL LABOR | | | | | $200.00 |
| | | | | | |
| TOTAL GRAND | | | | | $369.60 |

Oracle Spatial
User Conference
2012

ORACLE

# BHI spatialNET Power
# 7cm Ortho Imagery Example

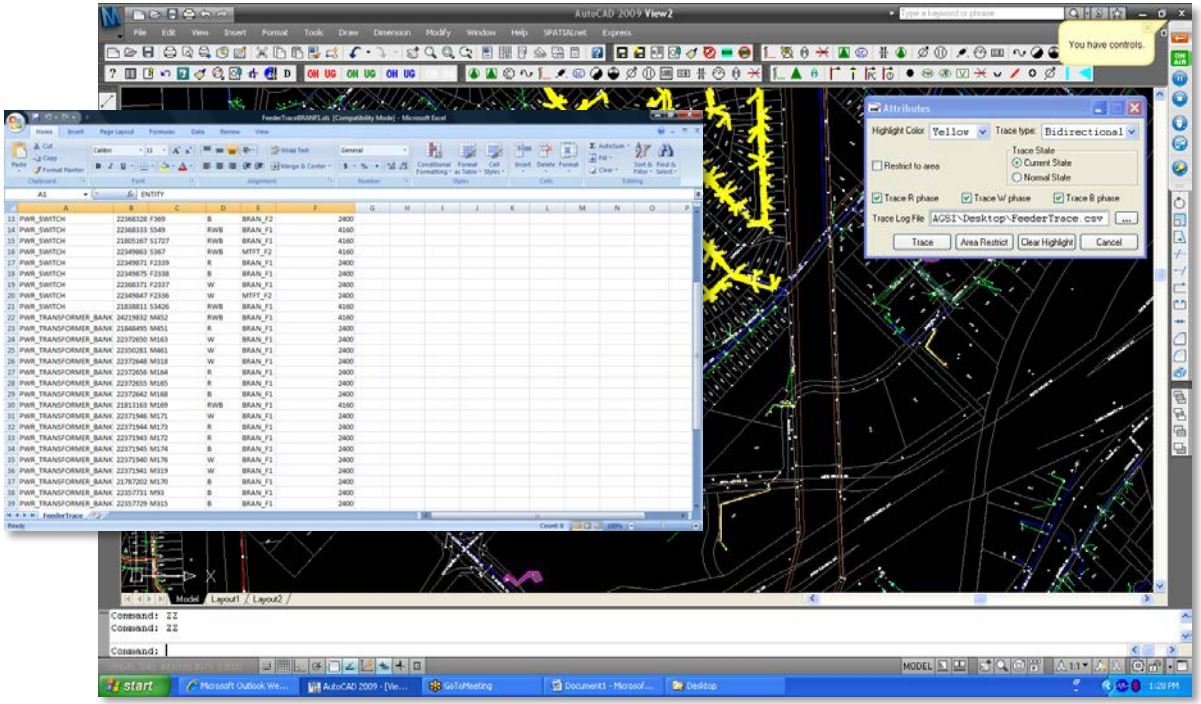
The image part with relationship ID rId4 was not found in the file.

Oracle Spatial
User Conference
2012

ORACLE

# BHI spatialNET Power Examples

## Network Connectivity Trace and Equipment Report




# Enterprise Go360Networks Web

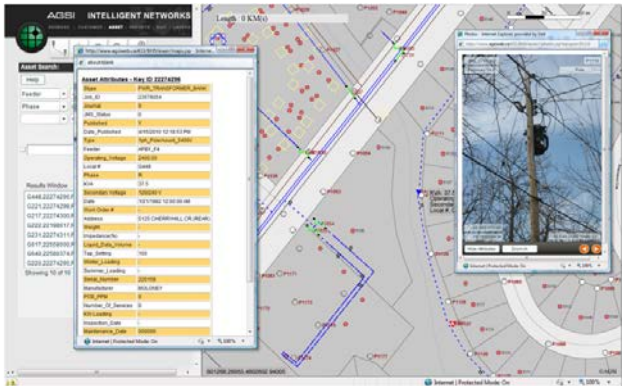
## Current BHI Solution Implementation

- **Direct "Live" Read / Write to SPATIALnet Power**
- **Attribute and SPATIAL Asset Queries and Reporting**
  - **Canned and Ad Hoc SQL Queries**
  - **Multiple Spatial Queries (by Fence, Grid, Buffer, Network trace)**
- **Customer Account Information Maintenance**
  - **Integration CIS and ERP (equipment nameplate and fincials)**
- **Available to Internal and Contract Staff including Mobile Solutions**
- **Operations**
  - **Outage Management with SCADA, Self Healing Switch and AMI Integration**
  - **Outage Statistic Reporting CAIDI, SAIDI, SAIFI – Pinpointing Cause of Problem Spatially for Accurate Reports**
- **Executive Dashboards**
  - **HR, Engineering, Financials, CIS, Call Centre, Scorecard**

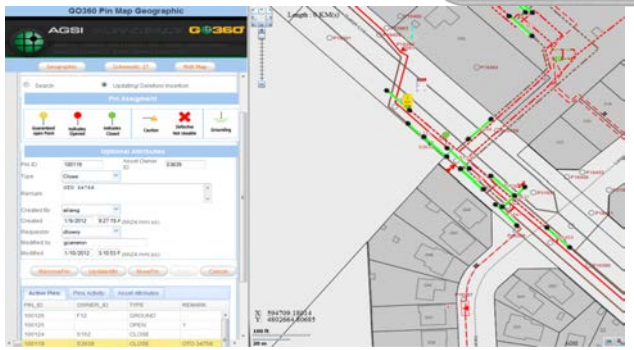
Oracle Spatial
User Conference
2012

ORACLE

# GO360Networks Live Applications Integration and Deployment at BHI Examples



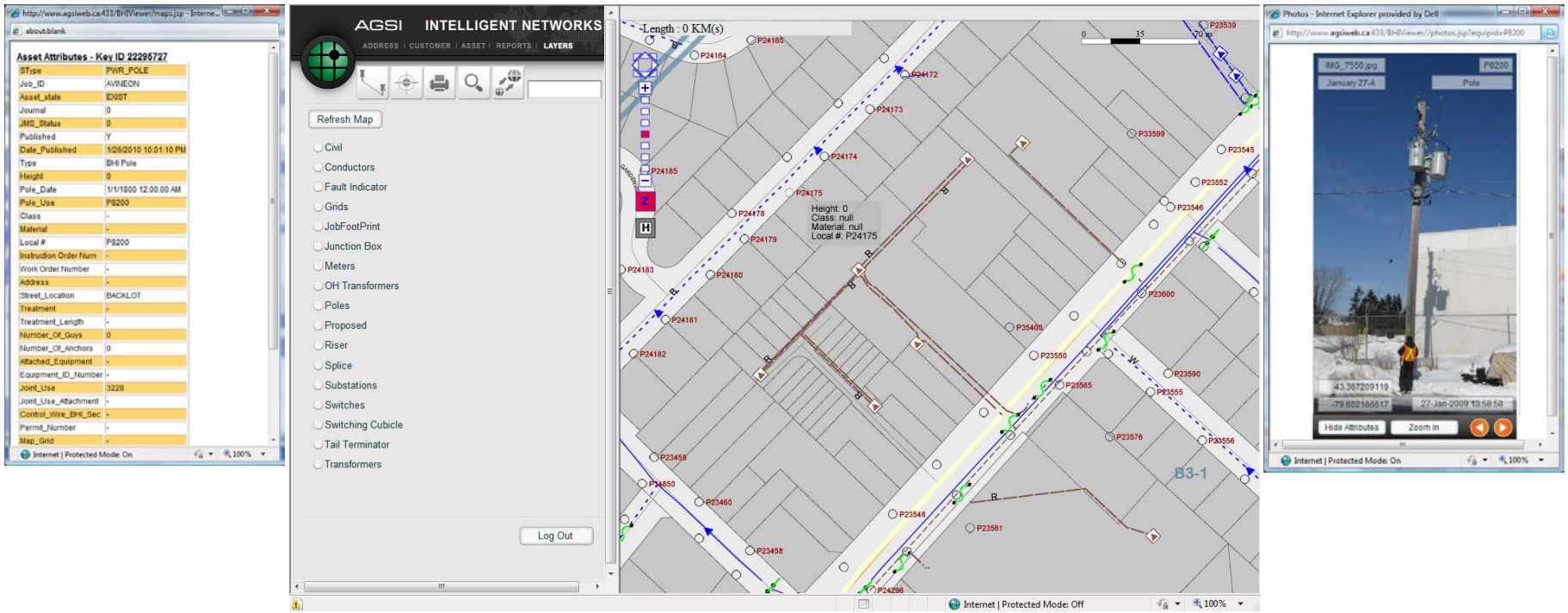



Oracle Spatial User Conference 2012

ORACLE

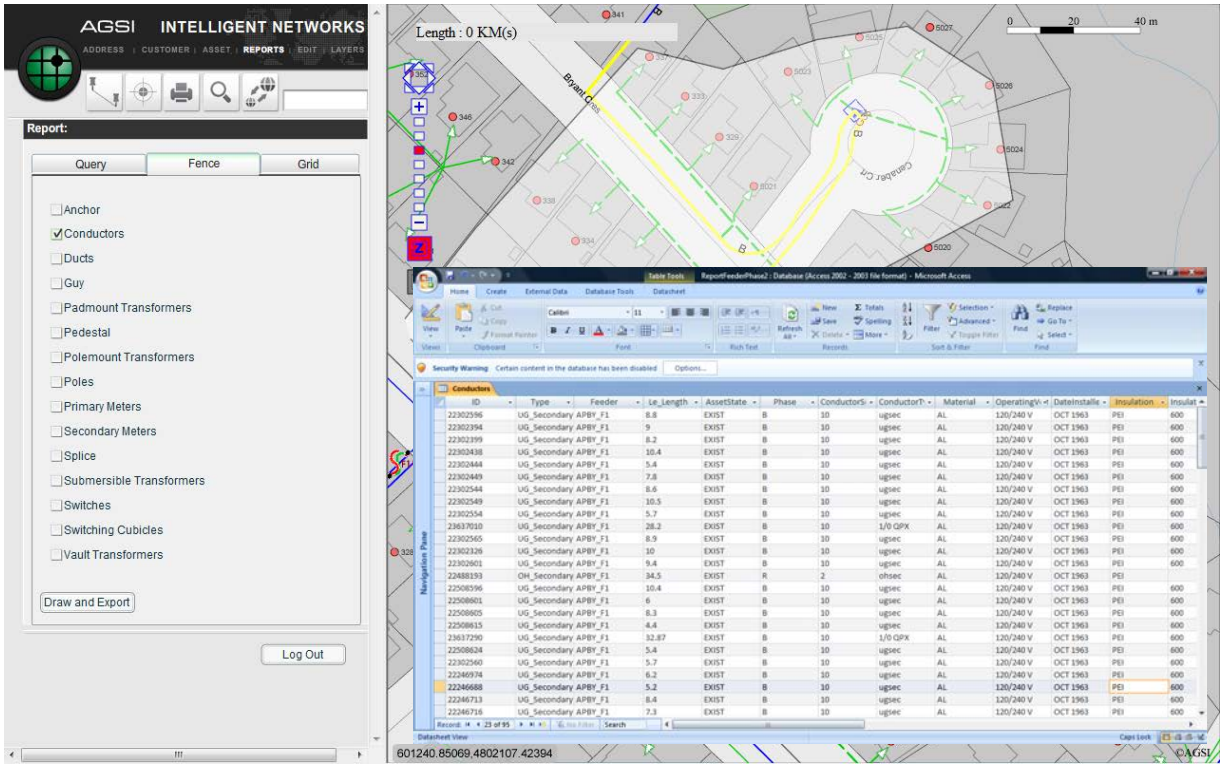
# Go360net: Live Access Via The Web Supporting Asset Management And Operations



Oracle Spatial User Conference 2012

ORACLE

# Associated Asset Report e.g. Age and Proximity to Other Planned Work



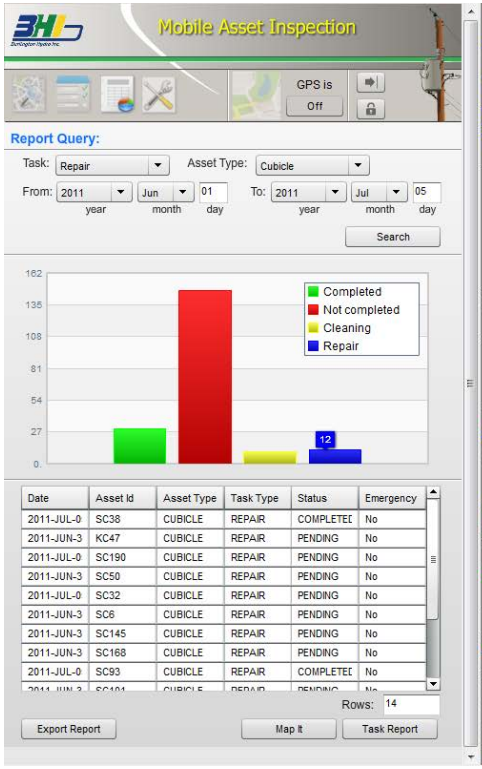
Oracle Spatial
User Conference
2012

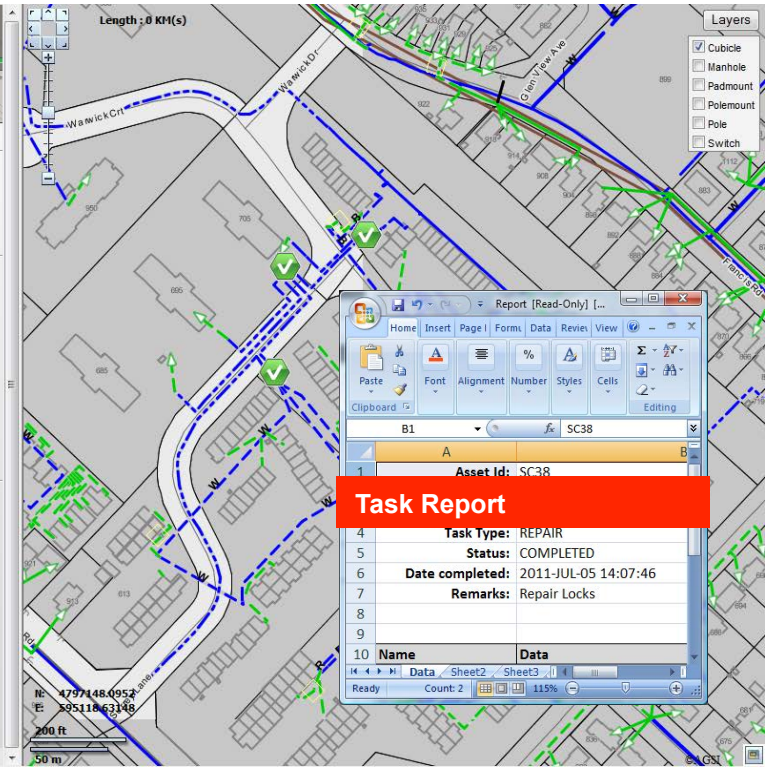
# Mobile Solutions:
# Field Asset Inspection Example

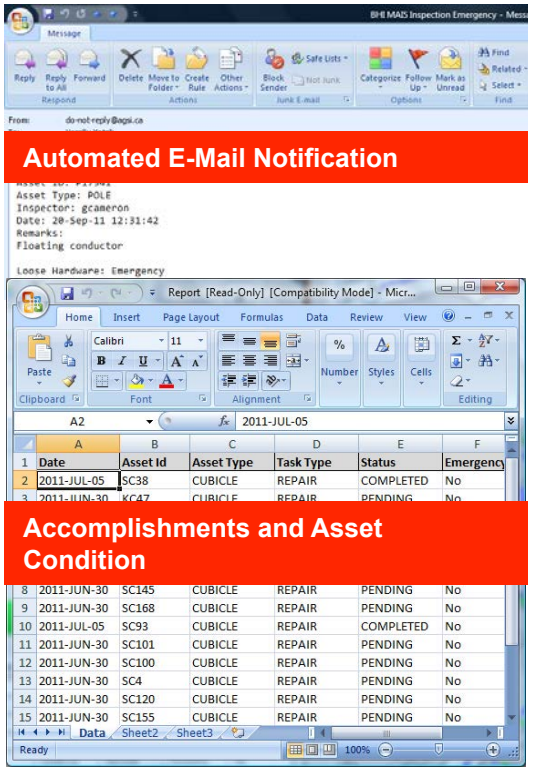
The image part with relationship ID rId4 was not found in the file.

Oracle Spatial User Conference 2012

# Analysis and Work & Accomplishment Reporting



Oracle Spatial
User Conference
2012

ORACLE

# New GO360 Mobile Form Factors

## Android, BlackBerry, iOS, Windows

- **Devices**
  - **Blackberry**
  - **iPhone**
  - **Android phones**
  - **Tablets (iPad, Playbook, Toughbook, etc.)**
  - **Wall Maps**
- **Includes all functionality**
  - **Query**
  - **GPS**
  - **Edit**
  - **Thematic's**
  - **Live Ops**

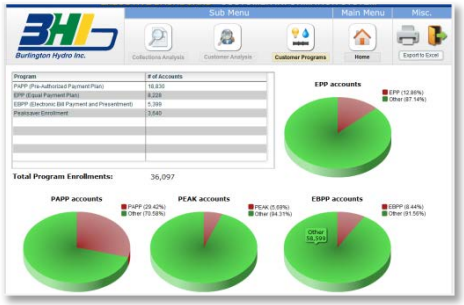
Oracle Spatial
User Conference
2012

ORACLE

# Performance Monitoring Dashboards

## BHI Example

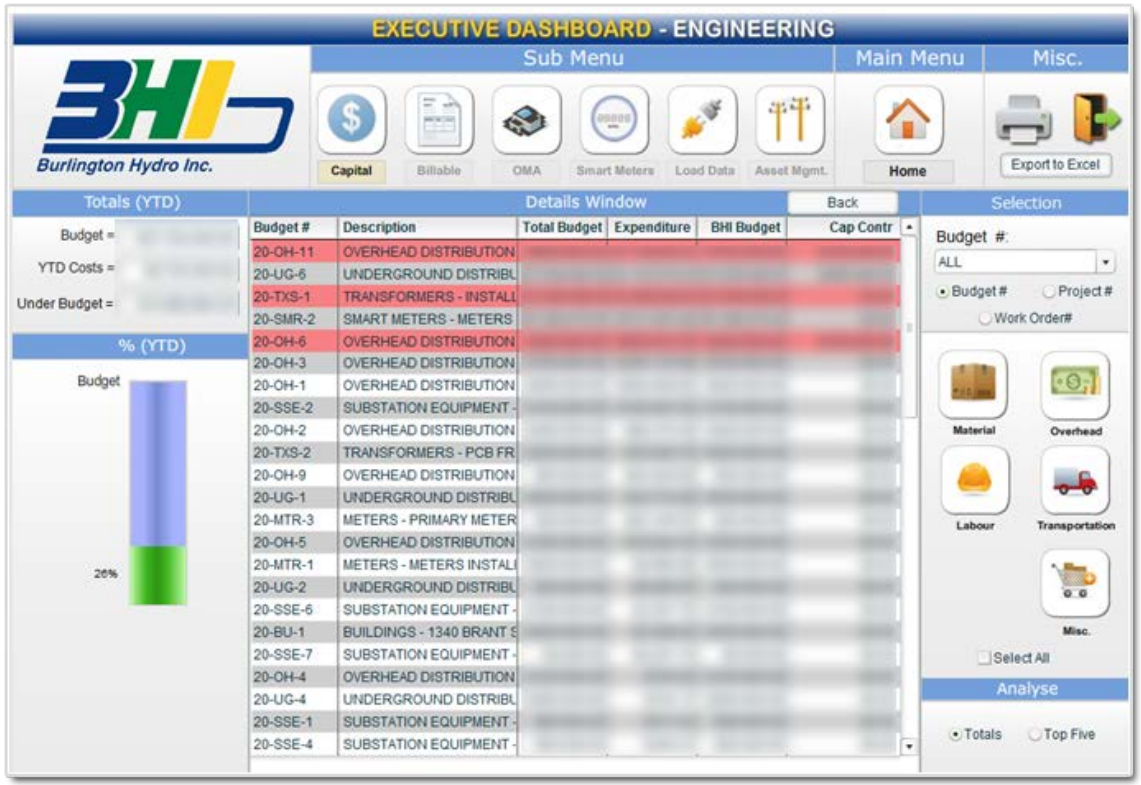



Oracle Spatial
User Conference
2012

ORACLE

# Financials and Drill Downs



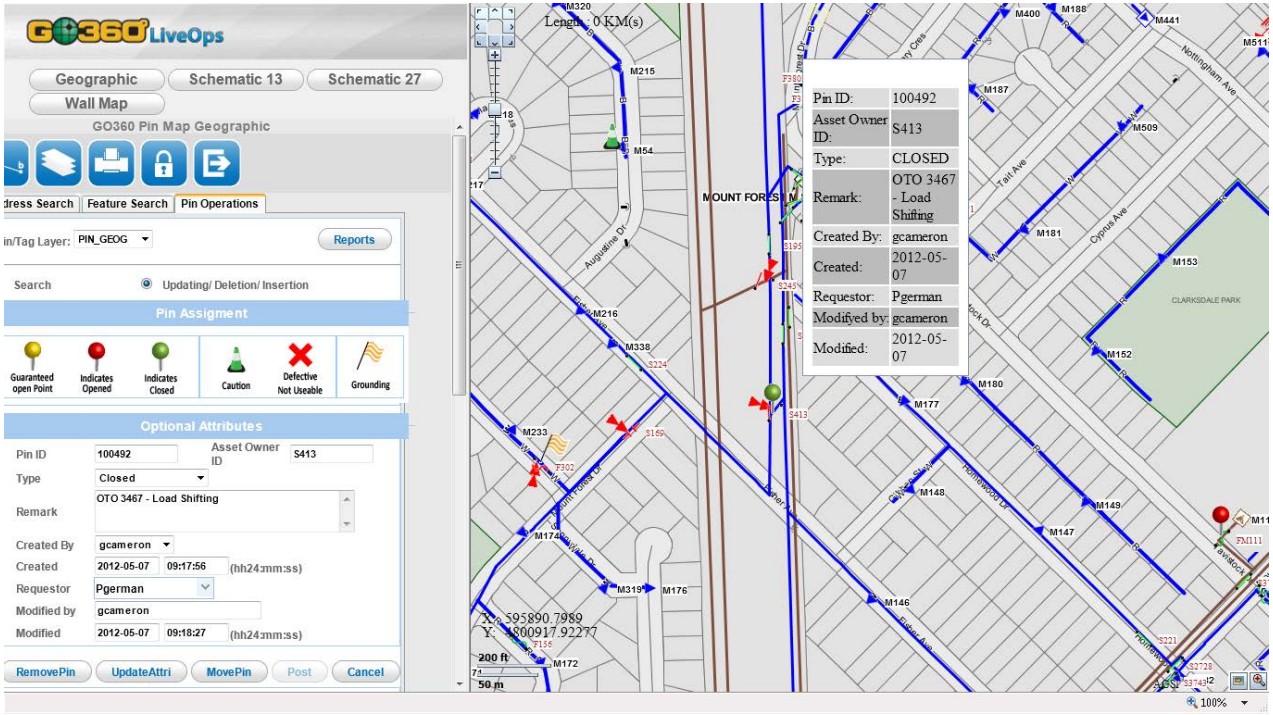

# GO360Networks 2012 Initiatives

- **Automating Network Pinning and Work Protection Tagging**
  - **Includes SCADA Integration**
- **Enhancing GO360 Asset Inspection to include Pole Testing & New Transformer Details**
- **Automating Outage Statistics CAIDI, SAIDI and SAIFI Reporting**
- **Complete OMS (LiveOps)**
  - **Smart Grid Enabled i.e. AMI, Self Healing Switches, other Smart Sensors**
  - **Integrates with Completed Pinning and Tagging**
  - **Manage Outages and Restoration including Crew Management**
  - **Re-configure Network via Engineering Switch Order Management**
- **Full Mobile Field Force Automation**
  - **Live Bi-Directional Communications with Operations including Automated Dispatch and Job Closing**
- **Asset Analytics**

Oracle Spatial User Conference 2012

# GO360LiveOps: Automating Network Pinning and Work Protection Tagging

## Geographic View



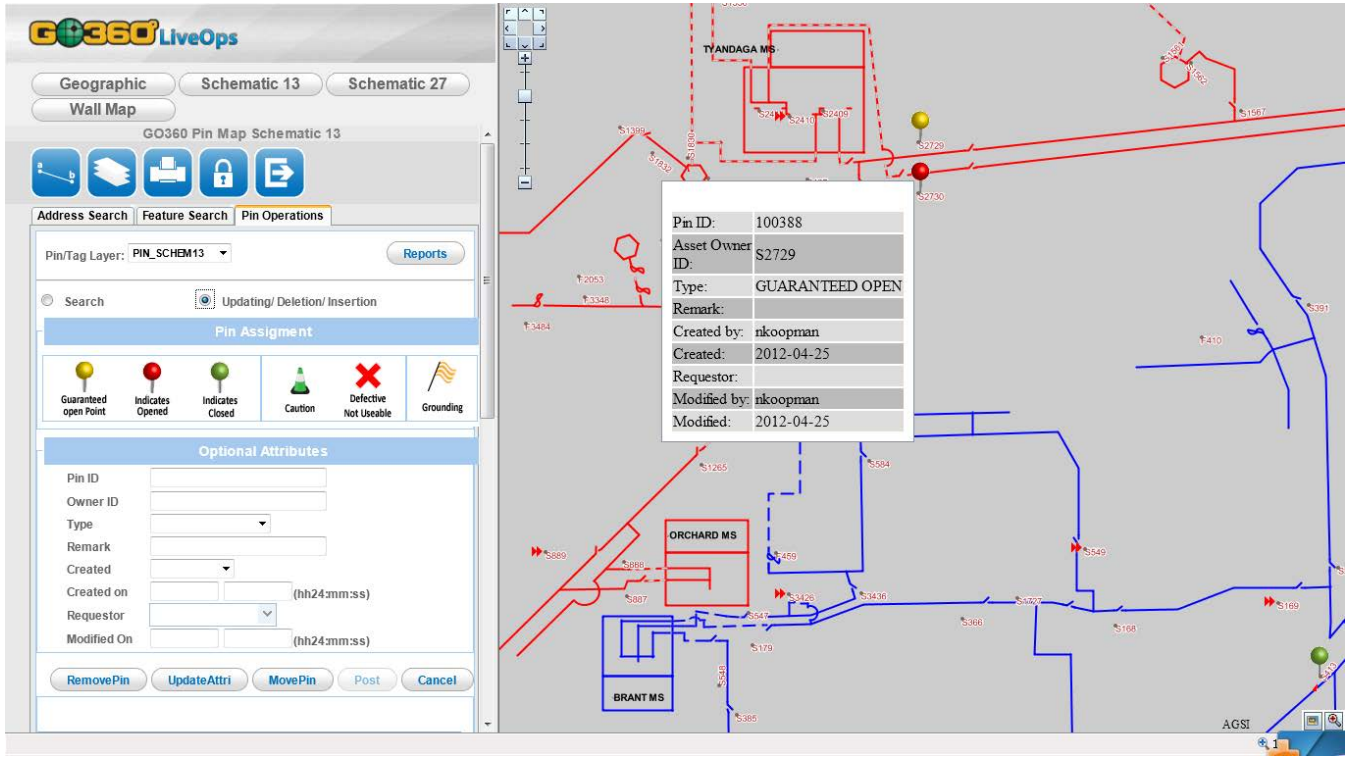

**Allows for:**

- Manual Operator Placement
- Substation SCADA (One Second Reads)
- Intelligent Self-Healing Switches (One Second Reads)

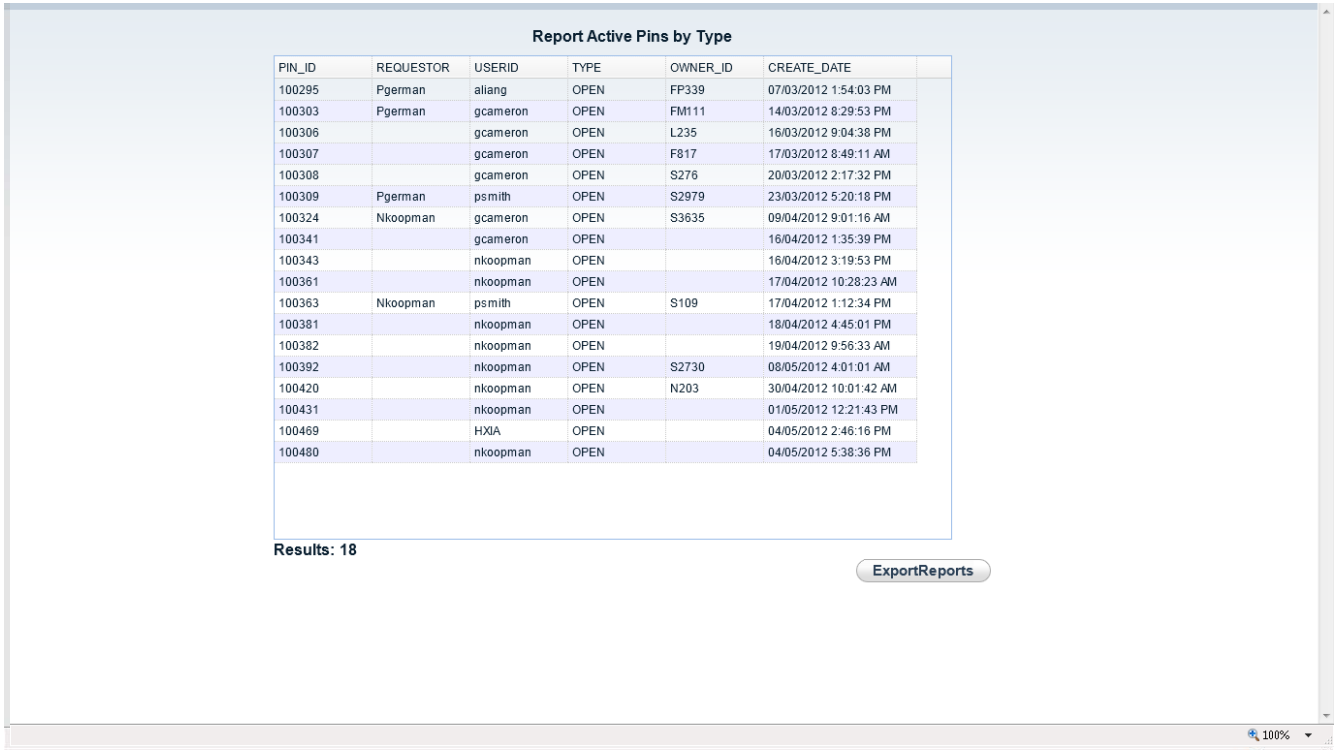
Oracle Spatial
User Conference
2012

# GO360LiveOps

## Schematic View




# GO360LiveOps Reports



**Report Active Pins by Type**

| PIN_ID | REQUESTOR | USERID | TYPE | OWNER_ID | CREATE_DATE |
|---|---|---|---|---|---|
| 100295 | Pgerman | aliang | OPEN | FP339 | 07/03/2012 1:54:03 PM |
| 100303 | Pgerman | gcameron | OPEN | FM111 | 14/03/2012 8:29:53 PM |
| 100306 | | gcameron | OPEN | L235 | 16/03/2012 9:04:38 PM |
| 100307 | | gcameron | OPEN | F817 | 17/03/2012 8:49:11 AM |
| 100308 | | gcameron | OPEN | S276 | 20/03/2012 2:17:32 PM |
| 100309 | Pgerman | psmith | OPEN | S2979 | 23/03/2012 5:20:18 PM |
| 100324 | Nkoopman | gcameron | OPEN | S3635 | 09/04/2012 9:01:16 AM |
| 100341 | | gcameron | OPEN | | 16/04/2012 1:35:39 PM |
| 100343 | | nkoopman | OPEN | | 16/04/2012 3:19:53 PM |
| 100361 | | nkoopman | OPEN | | 17/04/2012 10:28:23 AM |
| 100363 | Nkoopman | psmith | OPEN | S109 | 17/04/2012 1:12:34 PM |
| 100381 | | nkoopman | OPEN | | 18/04/2012 4:45:01 PM |
| 100382 | | nkoopman | OPEN | | 19/04/2012 9:56:33 AM |
| 100392 | | nkoopman | OPEN | S2730 | 08/05/2012 4:01:01 AM |
| 100420 | | nkoopman | OPEN | N203 | 30/04/2012 10:01:42 AM |
| 100431 | | nkoopman | OPEN | | 01/05/2012 12:21:43 PM |
| 100469 | | HXIA | OPEN | | 04/05/2012 2:46:16 PM |
| 100480 | | nkoopman | OPEN | | 04/05/2012 5:38:36 PM |

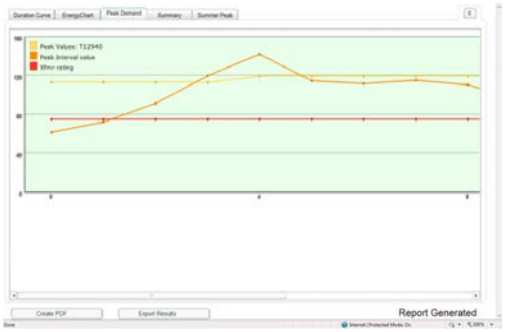
**Results: 18**

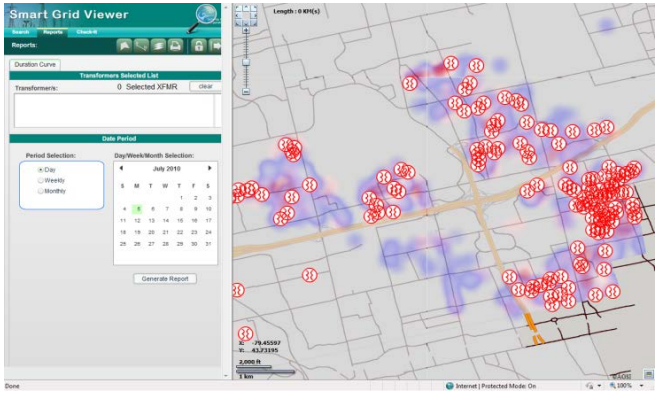
ExportReports

100%

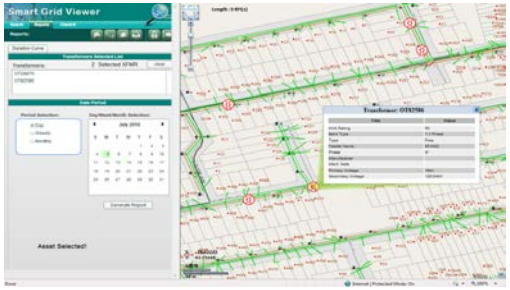
Oracle Spatial
User Conference
2012

# AMI Integration Example – Transformer Monitoring and Analysis



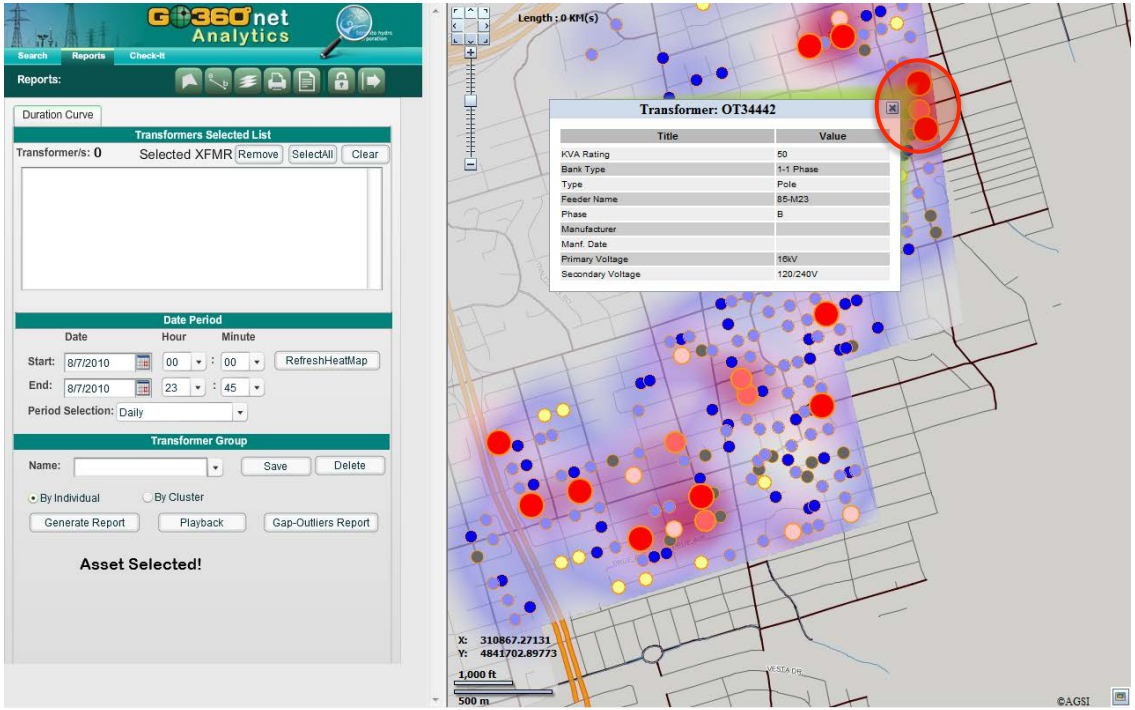





Oracle Spatial User Conference 2012

# Real-Time Smart Grid for Operations and Asset Analytics e.g. Overload Analysis Example

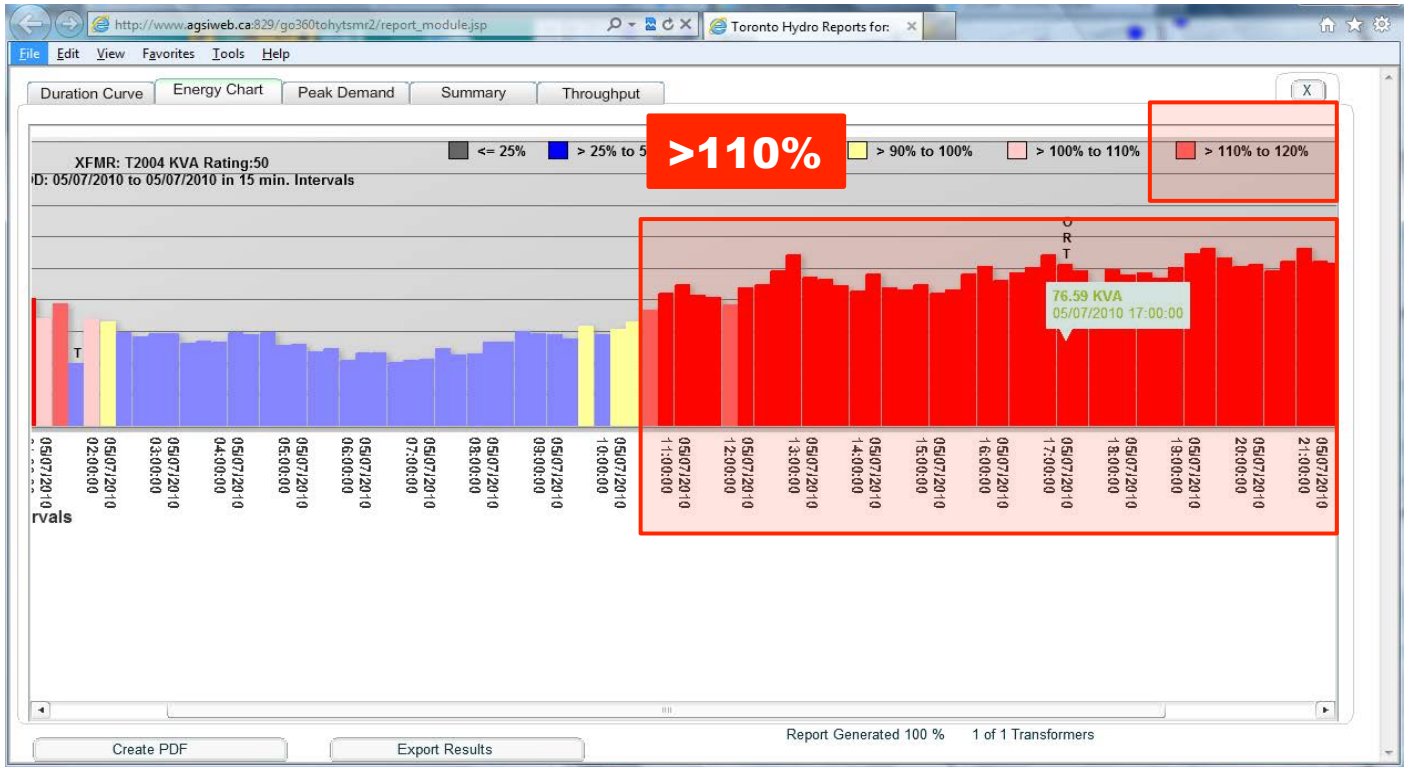
## Detailed Geographic View. Transformer Overloading



Oracle Spatial
User Conference
2012

# Smart Grid for Operations and Asset Analytics

## Loading Profile at Transformer
## Color Coded by % Overload In 15 min. Intervals



Oracle Spatial User Conference 2012

# Smart Grid for Operations and Asset Analytics

## Transformer Daily Summary Report (July 5, 2010)

| Transformer Number: OT3979 | | | Report Period: 05/07/2010 to 05/07/2010 in 15 min. Intervals |
|---|---|---|---|
| | | | Formula |
| Transformer Rating: | 50.0 | KVA | |
| Peak Demand: | 88.53 | KVA | Peak Interval Reading (kW/15min) * 4 / 0.9 (kVA) |
| Peak Demand: | 79.68 | KWh | Overload: 64% of the time …as reset) |
| Overload: | 64 | % | % of time for which transformeis overloaded |
| Load Factor Rating: | 0.64 | | Ratio of Avg. Demand to Max. Demand |
| Use Factor Rating: | 1.77 | | Ratio of Peak Demand (kVA) to Installed Capacity |
| Outage Count: | 1 | | Derived from AMRDEF daily outage summary values |
| Outage Duration: | 15.0 | Minutes | Loss of Life: 1.11% |
| Loss of Life: | 1.11 | % | As Defined by Appropriate IEEE Standard |
| Coincidence Factor: | 1.0 | | Max. simultaneous demand (in kVA) divided by sum of maximum demands of each device (in kVA) |
| Throughput: | 1227.27 | KWh | |

Oracle Spatial User Conference 2012

# Smart Grid for Operations and Asset Analytics

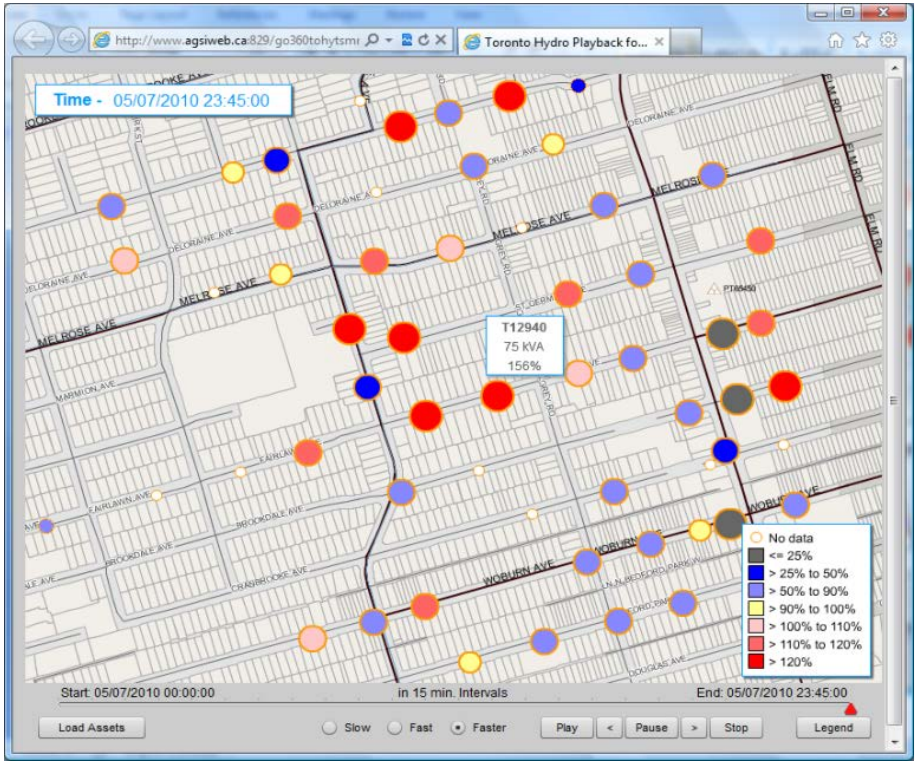
## Transformer Weekly Summary Report (July 5 to July 9, 2010)

| Transformer Number: OT3979 | | | Report Period: 05/07/2010 to 09/07/2010 in 2 hour intervals |
|---|---|---|---|
| | | | Formula |
| Transformer Rating: | 50.0 | KVA | |
| Peak Demand: | 91.93 | KVA | Peak Interval Reading (kW/15min) * 4 / 0.9 (kVA) |
| Peak Demand: | 82.74 | KWh | Overload: 74% of the time ...as reset) |
| Overload: | 74 | % | % of time for which transformeis overloaded |
| Load Factor Rating: | 0.65 | | Ratio of Avg. Demand to Max. Demand |
| Use Factor Rating: | 1.84 | | Ratio of Peak Demand (kVA) to Installed Capacity |
| Outage Count: | 2 | | Derived from AMRDEF daily outage summary values |
| Outage Duration: | 30.0 | Minutes | Loss of Life: 6.7% |
| Loss of Life: | 6.7 | % | As Defined by Appropriate IEEE Standard |
| Coincidence Factor: | 1.0 | | Max. simultaneous demand (in kVA) divided by sum of maximum demands of each device (in kVA) |
| Throughput: | 6481.07 | KWh | |

Oracle Spatial User Conference 2012

# Smart Grid for Real-Time Operations and Asset Analytics

## Time Based Playback Example




**July 5th [Midnight]**

**July 5th [7 AM]**

**July 5th [5 PM]**

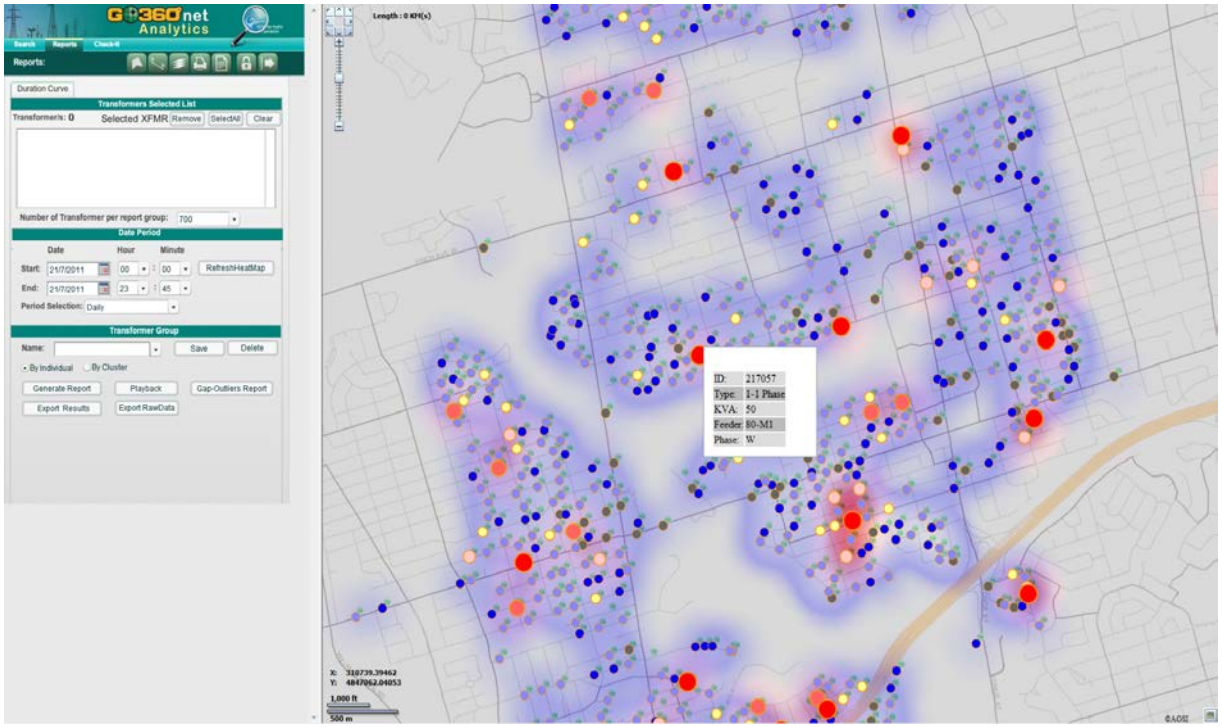
***Temporary Outage Events***

**July 6th [Midnight]**

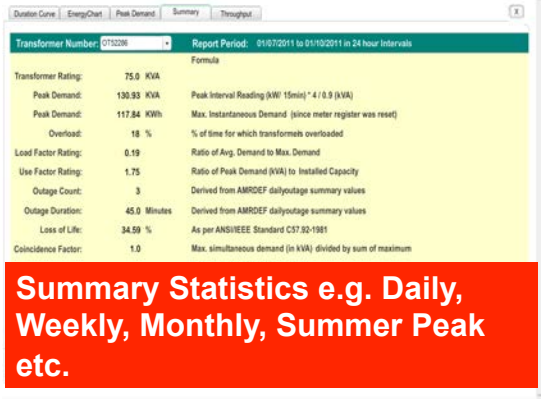
Oracle Spatial User Conference 2012

# AMI Asset Analytics

## Detailed Geographic View of Transformer Overloading




**Loading Profile at Transformer Colour Coded by % Overload**




**Summary Statistics e.g. Daily, Weekly, Monthly, Summer Peak etc.**


# Enterprise Go360Networks on Oracle

## Realizing our Vision

- **One Centrally Maintained Asset Database to Serve Enterprise**
  - **Operations, Mobile Crews, Asset Management, Engineering, System Planning, Asset Inspection, Cable Locates, Executive**
- **Ease of System Integration**
  - **Within a very short period of time able to integrate CIS, ERP, SCADA, Smart Switches, AMI**
- **Live Solutions Enabling Efficient Operations Leveraging Smart Grid**
  - **Automate Operations, Enhanced Reliability, Enhance Asset and Energy Analytics**
- **Available to any Internal and Contract Staff including Mobile Solutions in A Secure Manner**
- **Operations**
  - **Outage Management with SCADA, Self Healing Switch and AMI Integration**
  - **Outage Statistic Reporting CAIDI, SAIDI, SAIFI – Pinpointing Cause of Problem Spatially for Accurate Reports**
- **Executive Dashboards**
  - **HR, Engineering, Financials, CIS, Call Centre, Scorecard**