# Big Data: Driving Value-Added Solutions Through the Convergence of Advance Metering Infrastructure, Geographic Information Systems, and Distribution Reliability Systems

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Overview

- Minnesota Power
  - 144,000 electric customers across 26,000 square miles in Northern MN
- Superior Water, Light and Power
  - ~15,000 electric customers in Superior WI
  - ~10,000 water customers in Superior WI
  - ~12,000 gas customers in Superior and Douglas County WI

MINNESOTA POWER
SERVICE TERRITORY

GIS
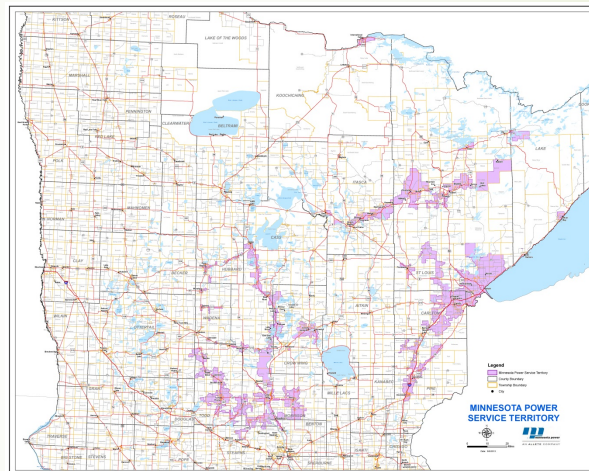
- Geographic Information System
  - Data + Location
  - Capture, store, manipulate, and interpret, react
- Answer geographic questions to solve business challenges
  - Which customers will be out of water during a hydrant replacement?
- GIS grows as business/need grows
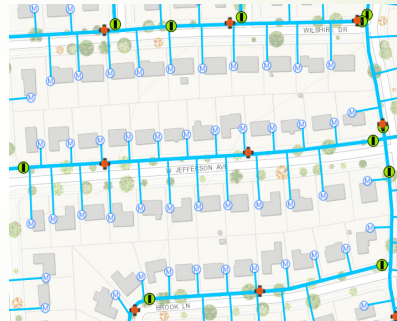 - Different questions, more data, better analysis

Image Source: http://www.vancecounty.org/departments/planning-and-development/gis-geographic-information-system/


GIS

How GIS Works

GIS technology applies geographic science with tools for understanding and collaboration. It helps people reach a common goal: to gain actionable intelligence from all types of data.
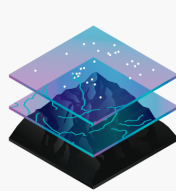

Maps

Maps are the geographic container for the data layers and analytics you want to work with. GIS maps are easily shared and embedded in apps, and accessible by virtually everyone, everywhere.
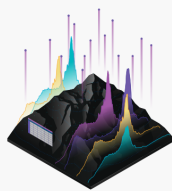
Data

GIS integrates many different kinds of data layers using spatial location. Most data has a geographic component. GIS data includes imagery, features, and basemaps linked to spreadsheets and tables.
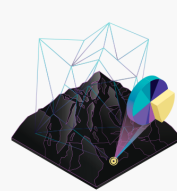
Analysis

Spatial analysis lets you evaluate suitability and capability, estimate and predict, interpret and understand, and much more, lending new perspectives to your insight and decision-making.

Apps

Apps provide focused user experiences for getting work done and bringing GIS to life for everyone. GIS apps work virtually everywhere: on your mobile phones, tablets, in web browsers, and on desktops.

Location Strategy

Location Enablement	Constituent Engagement	Decision Support	Field Mobility	Analytics	Location Data Management
Discover, use, make, and share maps at work – anywhere, anytime	Facilitate and manage communication with stakeholders	Inform execs and management with maps and location intelligence	Get authoritative information into and out of the field	Describe, predict, and improve business performance	Collect and organize location data about your assets and resources

- Esri
  - Privately owned GIS technology company
- System of Record
  - storing your authoritative data
- System of Engagement
  - a system that manages and promotes user collaboration and interaction
- System of Insight
  - organizing, transforming, and analyzing your data

Issues facing utility

- Legacy workflows
- Staffing turn-over
- Quantity of information
- Speed of information
- Multiple systems
  - Different storage formats
  - Different schemas

- Need to make decisions faster and with fewer resources

Use Cases

- Outage Management System
- Outage Center
- Maintenance/Trouble Collection
- Street Lights
- Damage Claims
- Vehicle Tracking
- Power Quality

Outage Management System

- Uses the GIS connectivity model along with AMI and Customer information to predict outage location and customer's affected.
- First MP OMS was 2006
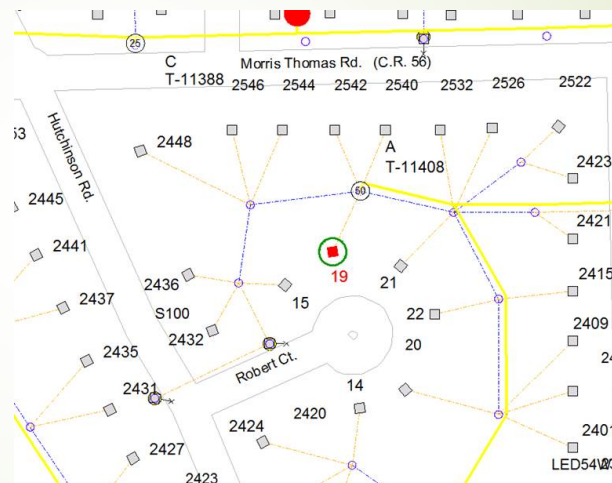
Outage Management System – Pros/Cons

- Pros
  - Prediction engine helps identify which devices operated based on connectivity model and AMI/Customer Call-in data.
  - Real-time view into events across our system
- Cons
  - Switching status must be kept up to date.
  - System changes must be captured in a timely manner.
  - Reliability data appears worse
  - Garbage in garbage out
    - Phasing

Public Outage Map

- Receive OMS data back into GIS
- Replaced 3rd party application
  - More accurately reflect outage information
  - Leverage existing GIS infrastructure

Outage Center
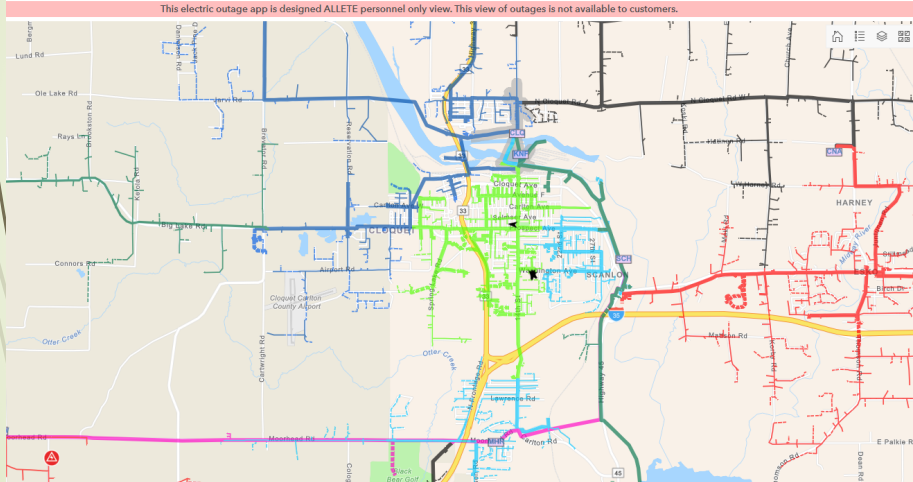
Outage Center

- Allows internal users access to detailed outage information
  - Customer call details
  - Outage points
  - Automated Vehicle Locations (AVL)
- Supports multiple departments uses
  - Service Dispatch
  - Line Crew
  - Corporate Communications

# Maintenance/Trouble Collection

- Created to let anyone in the company identify an issue on the system.
- A service request is generated from the app and resolved from our work management system.

Service Request Dashboard
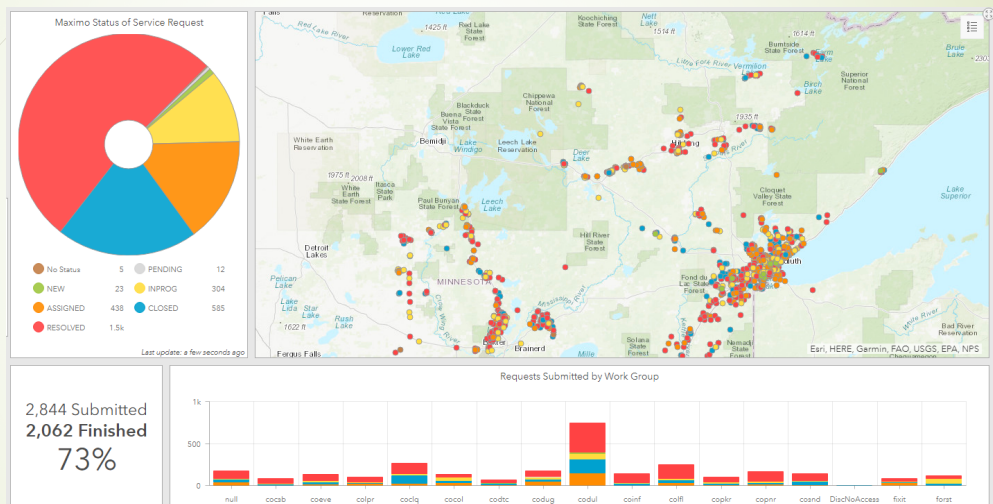
Maintenance/Trouble – Pros/Cons

- Started as distribution only and has expanded to multiple areas
- Pros
  - Brings issues to light and visibility to work
  - Eliminates lost paperwork
  - Fast
  - Collects all needed information
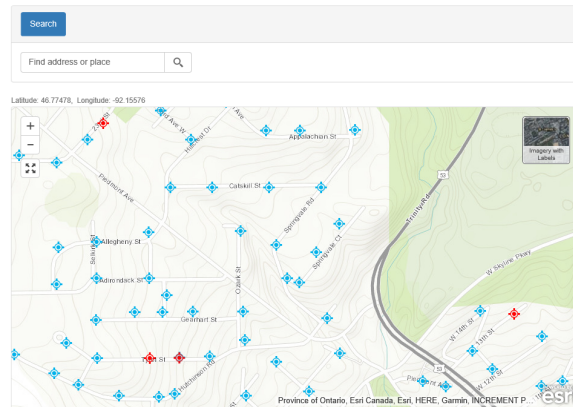 - Integrated with work order system
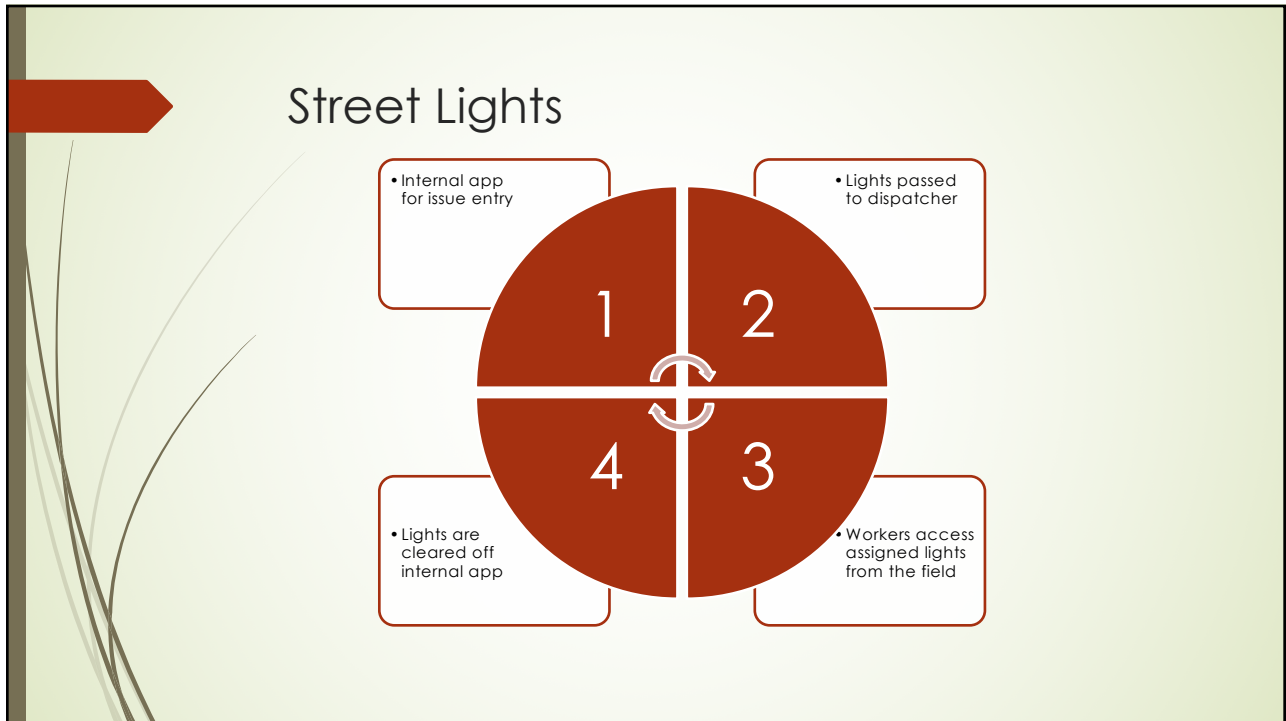- Cons
  - Subjective data
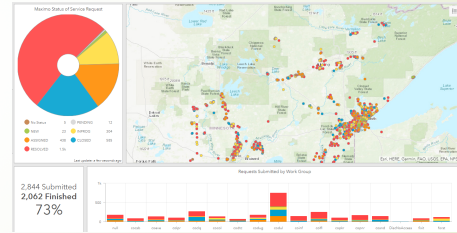
Street Lights

Minnesota Power Light Outage Reporter

1. Select Location

Specify the location for this entry by zooming in to see current lights and clicking/tapping the map. Green symbols denote Area lights. Blue symbols denote Streetlights.

Search

Find address or place

Latitude: 46.77478, Longitude: -92.15576

2. Enter Light and Contact Information

Street Lights

- Internal app for issue entry

1

- Lights passed to dispatcher

2

4

3

- Lights are cleared off internal app

- Workers access assigned lights from the field

Damage Claims

- Used to enter damage to our facilities
- Connected to Work Order System
  - Automatically generates work order
  - Collects pictures and information to process the damage claim correctly

Survey123 for ArcGIS

Damage Claims

Entered By *

Nature of Incident *
- Overhead
- Underground

Responding Authority
Cass County Sheriff, Duluth PD, Deputy Name, etc

Accident Report or Case No.

Responsible Party
Who did the damage?

Responsible Party's Mailing Address

Vehicle Tracking

Vehicle Tracking – Pros/Cons

- Pros
  - Allows crews to see nearby resources
  - Greater ability to alert on statuses
- Cons
  - Big Brother
  - Data attributes currently limited

Future Use Cases

- Power Quality/Voltage Alarms
- Momentary Outages leading to equipment failing
- Mobile Designer
- Vegetation Management

Real-time capabilities

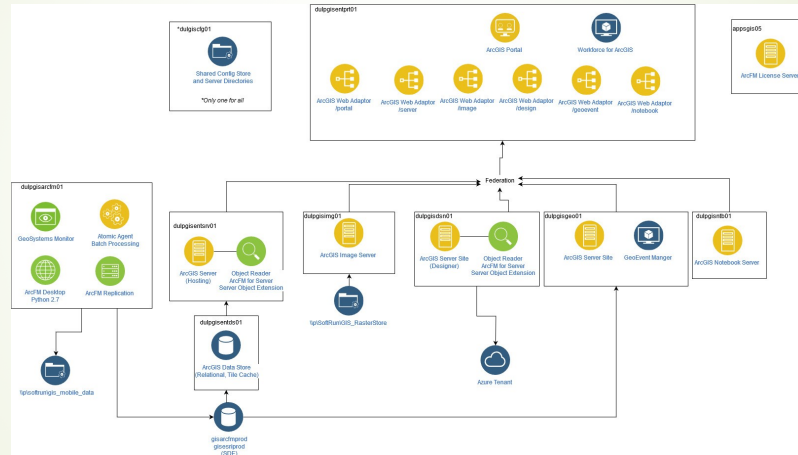### GeoEvent Server

- Listen for events
- Trigger actions
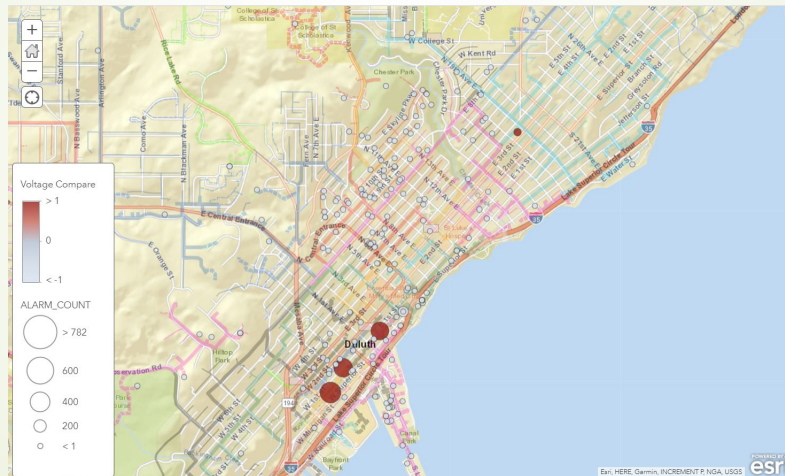 - Text
  - E-mail
  - Map Updates

GeoAnalytics Server

- Perform data analysis/processing
- Highly scalable

Real-time capabilities

Power Quality/Voltage Alarm Processing

Power Quality/Voltage Alarm Processing

- Meters are polled hourly for alarms
- Meters with voltage alarms are broken out by feeder and totaled
- Emails with data and map link sent to supervisor
  - Thresholds configurable
  - 8-10 events per feeder

Power Quality/Voltage Alarm Processing – Pros/Cons

- Pros
  - Real time view of issues on our system
  - Allows engineering to quickly identify problem areas
  - Eliminates spreadsheet filtering to find issues on the system.
- Cons
  - Resource needed to review alert e-mails/maps
  - Filtering needed to remove "bad data"

Momentary Outages

March 13th
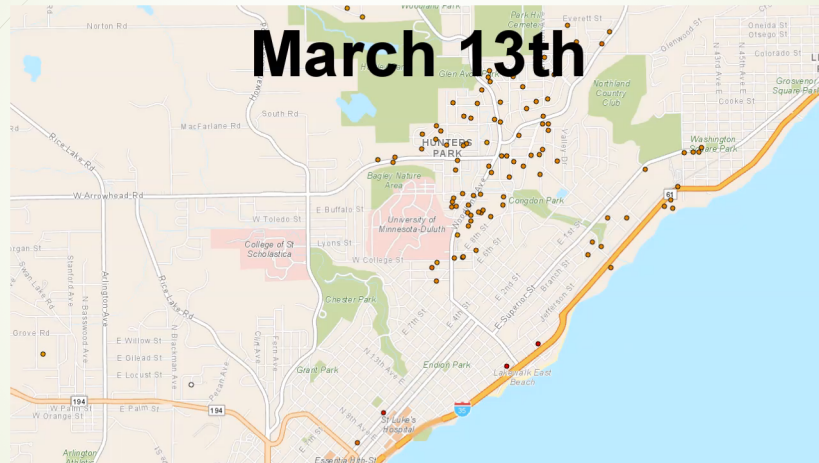
Momentary Outages

- All outages compiled into a new file
- New file is compared to historical outage count file
  - Example
    - Meter 123 had 1 outage in new file
    - Outage count file says meter 123 had 23
    - New count is 24
- Alerts generated on feeders experiencing large numbers of momentary outages

Momentary Outage Processing – Pros/Cons

- Pros
  - Precursor to failing equipment
  - Identifies areas that we dispatch trouble to patrol
  - Can identify vegetation issues
- Cons
  - Slow
    - Large files and feature enhancement
   - 2-3 hours
  - Need resources to review output

Mobile Designer – Designer XI

- Implementing a mobile design tool
- Allow engineers and designers to create GIS features in the field
- Tied to Maximo work orders and compatible units
- Benefits
  - Move mapping to beginning of work order process
  - Allows downstream systems access to map data asap
    - Gopher State One Call & Locating
  - Enforces standards
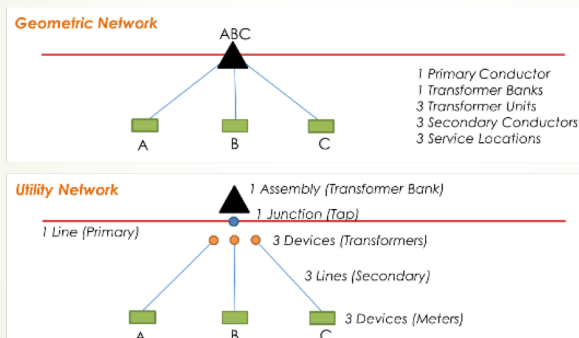 - Work process improvements from design to completion.

Vegetation Management

- Bring digital/mapping solutions to vegetation management
- Digital Bidding
- Progress Tracking
- Historical analysis
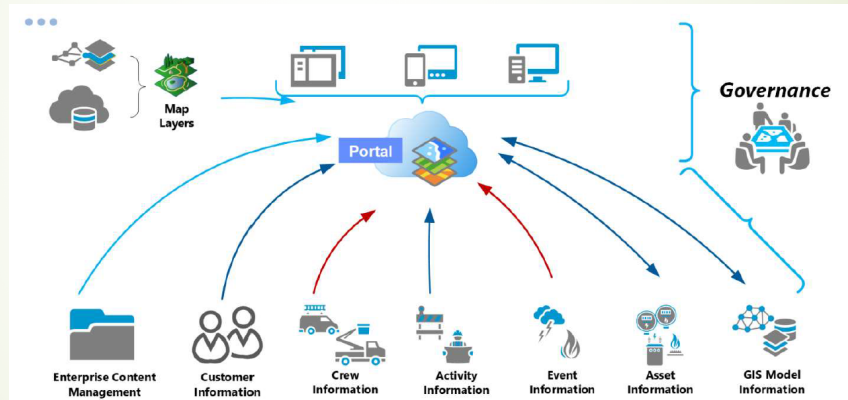- Re-analyzing the methods for planning vegetation clearing
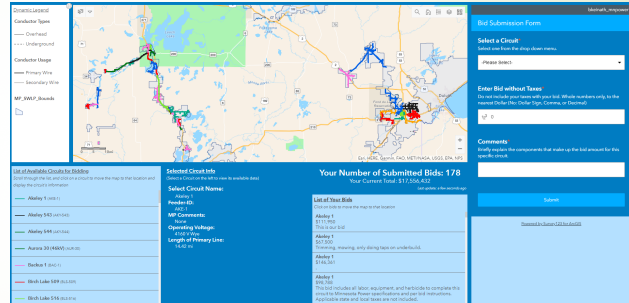
Next steps

- Utility Network Migration

Summary

Questions

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