

One Year of Using Big Data and Cloud Computing to Improve Reliability at Platte-Clay Electric Cooperative

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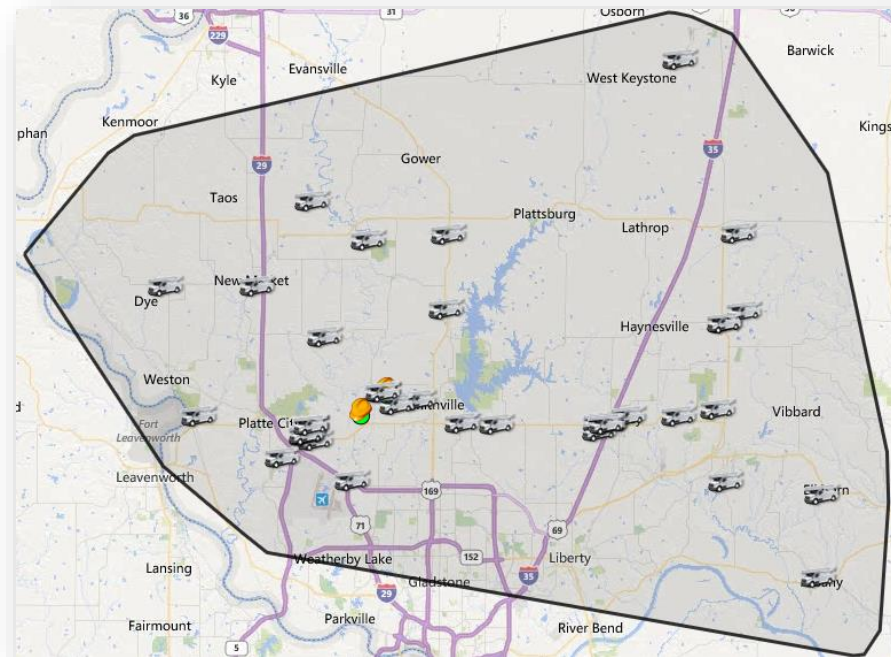


Agenda

- Platte-Clay overview
- Business drivers
- FD&L overview
- Leveraging Cloud Computing and Big Data
- A year in review
- Q&A

Platte Clay Electric Cooperative

- Kearney, Missouri
- 23,000+ meters
- 17 Substations
- Aclara – TWACS AMI
 - 2003-2006 deployment
 - 2017 upgraded communications modules
 - FD&L deployment



FD&L Deployment

- Lead dispatcher engaged in product advisory panel
- Training and product reviews
- Gradual substation rollout
 - 3 -> 8 -> 17
 - Started with heavily loaded substations

The screenshot displays the AclaraONE Fault Detection software interface. The main window is titled 'Fault Detection' and shows a central map with green markers representing faults. The interface includes several panels:

- Map Content Manager:** Lists various components such as Transformers (15,217), Regulator devices (43), Capacitor devices (49), Overhead Lines (80,296), Underground Lines (35,281), Nodes (2), Zero Length Segments (1), AMI Comm. Events (189), and Line Segment Faults (8).
- Device Outages:** A table showing outage details for various devices.
- Segment Outages:** A table showing outage details for line segments.

Actions	Type	Severity	Substation	Phase	ID
<input type="checkbox"/>	Consumer	Unpowered	HOLT	B	2203000
<input type="checkbox"/>	Consumer	Unpowered	SHIRNVILLE	C	98351217
<input type="checkbox"/>	Consumer	Unpowered	OPRICK	B	23806317
<input type="checkbox"/>	Consumer	Unpowered	WESTBOROUGH	C	30514942
<input type="checkbox"/>	Consumer	Unpowered	GREENHILLS	C	13905996
<input type="checkbox"/>	Transformer	Inconclusive			19655_7a
<input type="checkbox"/>	Transformer	Inconclusive			171912_7i

Actions	Severity	Substation	Phase	Time
<input type="checkbox"/>	Unpowered			2019-02-06 16:54:27
<input type="checkbox"/>	Unpowered			2019-02-06 16:54:27
<input type="checkbox"/>	Unpowered			2019-02-06 16:54:27
<input type="checkbox"/>	Unpowered			2019-02-06 16:54:27

Business Drivers



for your HOME

for your BUSINESS

about ME

Report an Outage

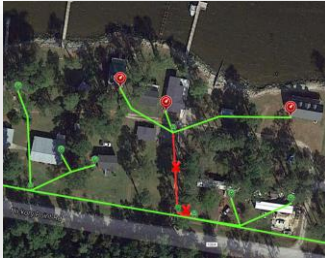
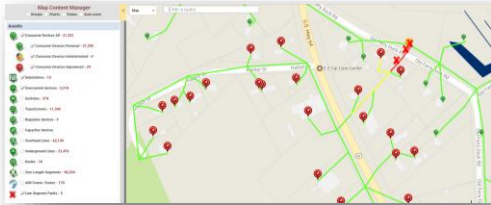
To report an outage, call MED at 615.893.5515. Our phones are answered 24 hours a day, seven days a week.

Please have the following information available when you call:

- Your name and address
- Type of electrical problem you're experiencing
- Time you first noticed the problem
- Cause of problem, if obvious (i.e. fallen tree over power lines, lightning strike, etc.)
- Areas affected, if known

- Relying on customer 'no power' calls
- Bedroom community where high percentage of residences not home during the day
 - Outages that could be handled during the day weren't reported
- Reliability, safety, customer service, and financial impact

Solution



Fault Detection and Localization (FD&L)

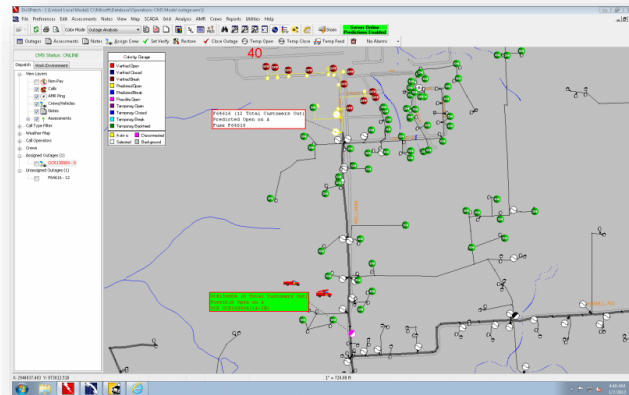
- FD&L automatically detects and displays outages, identifies outage locations, and verifies restorations
- Nested outages are detected and reported ensuring that the dispatched crew can confirm the extent of any remaining outages soon after resolving the main outage

FD&L Improves the value of an Outage Management System

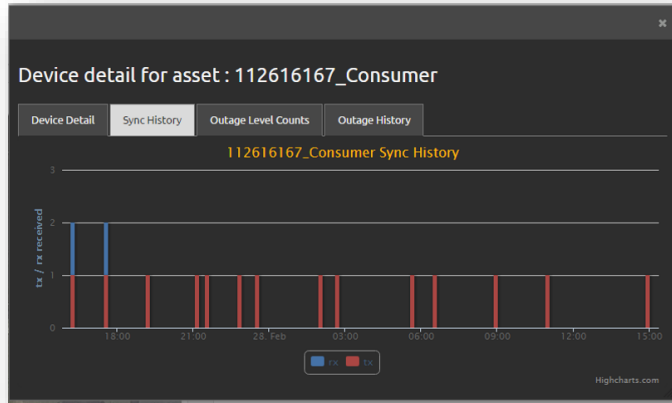
Function	Without FD&L	With FD&L
Is there an outage?	Unaware unless members call to report the outage	Automatic detection
Where is the outage?	Location accuracy is related to the number of members that call	Accurate and reliable identification of each meter associated with the outage
Was the outage completely restored?	Requires multiple steps and additional pinging to verify	Automatic verification of restoration and identification of stranded members (if applicable)

Integration with OMS

- 'No power' messages
- Power restoration messages
- MultiSpeak



How Does it Work?



- Continuously collects and processes TWACS meter communication data
- Leverages AMI jobs (daily shift, interval reads, voltage, blink counts, etc.) and electric distribution network topology
- Verify restorations

Demonstration

Map Content Manager

- Transformers - 15,217
- Regulator devices - 43
- Capacitor devices - 69
- Overhead Lines - 40,296
- Underground Lines - 35,281
- Nodes - 2
- Zero Length Segments - 1
- AMI Comm. Events - 189
- Line Segment Faults - 8

Device Outages

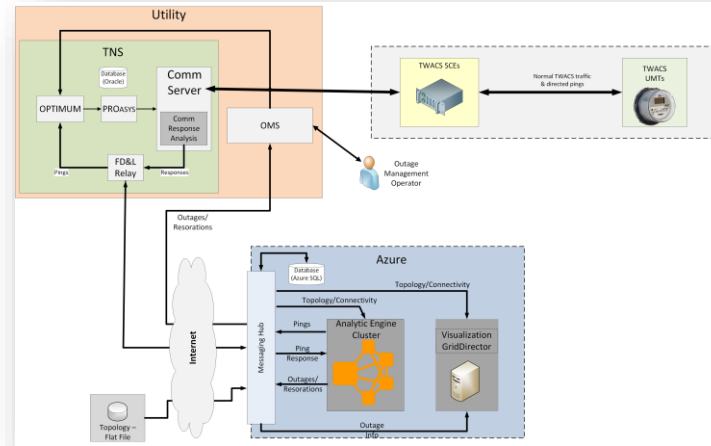
Actions	Type	Severity	Substation	Phase	ID
<input type="checkbox"/>	Consumer	Unpowered	HOLT	B	22039300
<input type="checkbox"/>	Consumer	Unpowered	SMITHVILLE	C	98551217
<input type="checkbox"/>	Consumer	LikelyUnpowered	ORRICK	B	230606311
<input type="checkbox"/>	Consumer	LikelyUnpowered	WESTBRIDGE	C	55514967
<input type="checkbox"/>	Consumer	LikelyUnpowered	GREENBRIAR	C	230606981
<input type="checkbox"/>	Transformer	Inconclusive			T9650_Tra
<input type="checkbox"/>	Transformer	Inconclusive			T17019_Tr

Segment Outages

Actions	Severity	Substation	Phase	Time
<input type="checkbox"/>	Unpowered			2019-02-06 16:54:27
<input type="checkbox"/>	Unpowered			2019-02-06 16:54:27
<input type="checkbox"/>	Unpowered			2019-02-06 16:54:27
<input type="checkbox"/>	Unpowered			2019-02-06 16:54:27

Cloud-based Architecture

- Analytic Engine
- Big data
 - Volume, velocity
 - Predictive
- Scalability



Big Data

- Process a million outage detection events per day per client
- An event has one of three states:
 - We heard the meter's message
 - We didn't hear the meter's message
 - An event preempted our attempt to talk to the meter

Scale

- Every 9 seconds, the state of every meter, as well as every node (transformer, overcurrent device, switch) and every line segment in the system is computed
- Leverages fault tolerant distributed Spark clusters for processing
- Multiple communications paths between components provide by the cloud infrastructure
- Integration of map, street views and weather overlays
- Abundant storage for data logging in the cloud

Microsoft Azure Cloud

- HD Insight
 - Built on Apache Hadoop for managing meter telemetry
 - Leveraging the power of Apache Spark for near-real-time analysis
- Azure Service Bus
 - Robust messaging infrastructure to securely exchange data with on-premises services

Software as a Service

- Minimize training, IT support and infrastructure
- Automatic FD&L upgrades managed by Aclara
- Operating system upgrades managed by Azure
- Simplifies the acquisition to the utility as no new servers or people are required

FD&L at Platte-Clay

Before FD&L

- Test meters twice a day for power
 - AMI job – ping all meters
- Dispatchers analyzed outage data to determine if accurate
 - Manually intensive

After FD&L

- FD&L constantly scanning system 24/7 for outages and restorations
- Results automatically posted in OMS (Milsoft DisSPatch)

Changes For Dispatchers

- Another source for reporting outages
- Outage description (AMR call)
- Monitor how FD&L responded to each scenario
 - This will eventually end
- Frequently finding electrician/members pulling meters
 - Gives us a chance to address this issue
- Finding problems with meter base connections and part power issues

Interesting Observations

- Frequently finding electrician/members pulling meters
- Identified a failed transformer
- Problematic meter base connections and partial power issues
 - Poor connections
 - Cut line
 - Bad wire

FD&L and Outages 2018

- 722% - FD&L detected outages without notification
 - 51% - PCEC restored power prior to member calling
 - 49% - FD&L 1st to detect, saving an average of 34 minutes

FD&L Benefits

- Sophisticated analytics and automation improves operational efficiencies and with annual savings of \$2-3 per meter per year for a typical utility (25k meters)
- Decrease outage durations
- Improve safety and reduce costs (operational and administrative)
- Increase member satisfaction

Q&A