Major Event Management Application Note

mPrest

CONNECTING THE DOTS

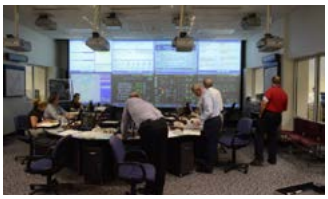
Background

Power utilities continue to make significant investments in their transmission and distribution infrastructures, many of which are aimed at enhancing resiliency and preventing outages. Thanks to these ongoing efforts, utilities can effectively deal with a wide range of routine events, such as planned maintenance, equipment failures and the like. Wildfires, hurricanes and other natural disasters, however, pose a more difficult challenge for utilities' existing systems and processes due to their large scale and widespread impact.

Unfortunately, climate change appears to be creating more volatility in our weather patterns, which are expected to become even more severe in the future. In the wake of recurring wildfires in California and major hurricanes on the Gulf and East coasts, new expectations are emerging related to the utilities' readiness level to deal with major events as well as the magnitude of destruction caused by these events.

While severe major events are rare, they can inflict serious damage to the utilities' brand and reputation. Prolonged outages cause severe inconveniences to consumers, and in extreme cases can even cost lives. While most consumers understand that outages are inevitable in major event scenarios, they also expect a quick response and fast restoration of power during and following such an event. If this doesn't happen, they are likely to complain and even look for an alternative.

Inefficient major event handling may also adversely affect a utility's share price and its relationship with regulators. Accordingly, the ability to model/forecast the extent, location and progress of damages in a major event, minimize its effects, and optimally manage the utility's response in real time has become essential.



The Challenge: Improving Preparedness, Situational Awareness and Event Management

For many utilities, normal event management and restoration processes rely on several not fully interconnected systems. This approach may be adequate for handling day to day events, but tend to break down when the outage and workload volumes increase to the excessive levels experienced in major events. This breakdown often results in utilities becoming reliant on a series of manual processes and isolated applications which consume valuable resources and slow the recovery process.

The first step in ensuring a timely and effective response to major events is preparedness. Utilities need to understand where and how potential events and scenarios are likely to begin and propagate, and estimate their effects on the utility's assets, processes and customers. Weather forecasting and simulation tools can present various possible scenarios for analysis that can help utilities plan in advance. For example, removal of vegetation and other obstacles from the power grid to decrease the damage in the event of a wildfire, should be prioritized in areas that the simulation pointed out as high risk areas.

Effective situational awareness and optimized event management are critical, as they enable decision makers to understand the complex web of priorities, resources readiness and locations, and levels of damage. This ensures that resources and equipment are deployed in ways that will produce the greatest benefit and restore power to critical facilities and customers in the fastest possible manner.

In extreme situations, shortening restoration of power by even a few days can literally be the difference between life and death. Beyond saving lives, restoring power to the affected communities and businesses (e.g., gas stations, supermarkets, banks) translates into major improvements in citizens' quality of life. Minimizing the recovery effort also saves utilities substantial amounts on crew costs, thus providing a sound economic business case for an investment in an optimized major event management application.

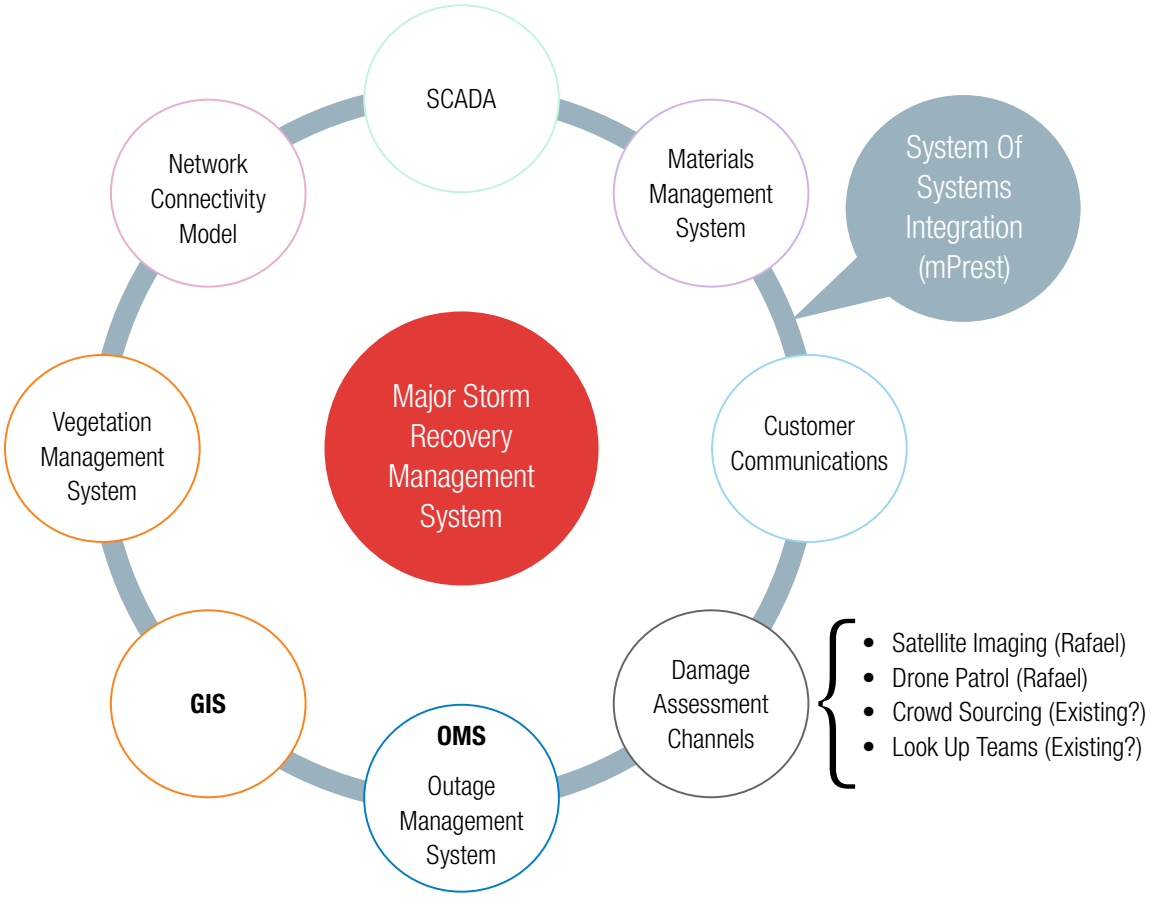
Introducing mPrest's Major Event Management Application

mPrest's automated situational awareness, visualization and decision support solution allows utilities to improve readiness, prioritize resources, and enhance safety and restoration efforts related to wildfires, storms and other major events. Leveraging weather forecasts and asset information, our Major Event Management application provides clear visibility into transmission/distribution systems and critical facilities affected by an event. By enabling real-time, cross-domain situational awareness and streamlined event management, this application helps utilities create an optimal restoration plan that accelerates recovery times and reduces restoration costs.

System of Systems Approach for Unmatched Situational Awareness

mPrest's Major Event Management application uses a System of Systems (SoS) approach creates a single situational awareness picture to support decision makers in managing the event and prioritizing restoration efforts. mPrest correlates and integrates data from existing utility systems (e.g., SCADA, Outage management, GIS, CRM, Asset Health Management, Inventory Management) as well as external systems (e.g., weather, emergency services, etc.), enabling more accurate and timely flows of information. mPrest's SoS approach enables the connection and integration of disparate IT/OT systems, regardless of vintage, language/protocol, format, or vendor, without having to re-create databases or replace existing systems.

By augmenting utilities' existing systems and processes, mPrest's application allows teams to focus on restoration efforts rather than on assembling, processing and communicating information manually. For example, decision makers can take into account factors that impact other first responders and public safety personnel, while also providing consistent information regarding progress and estimated times to restore by area for public communications.



Major Event Management Key Features

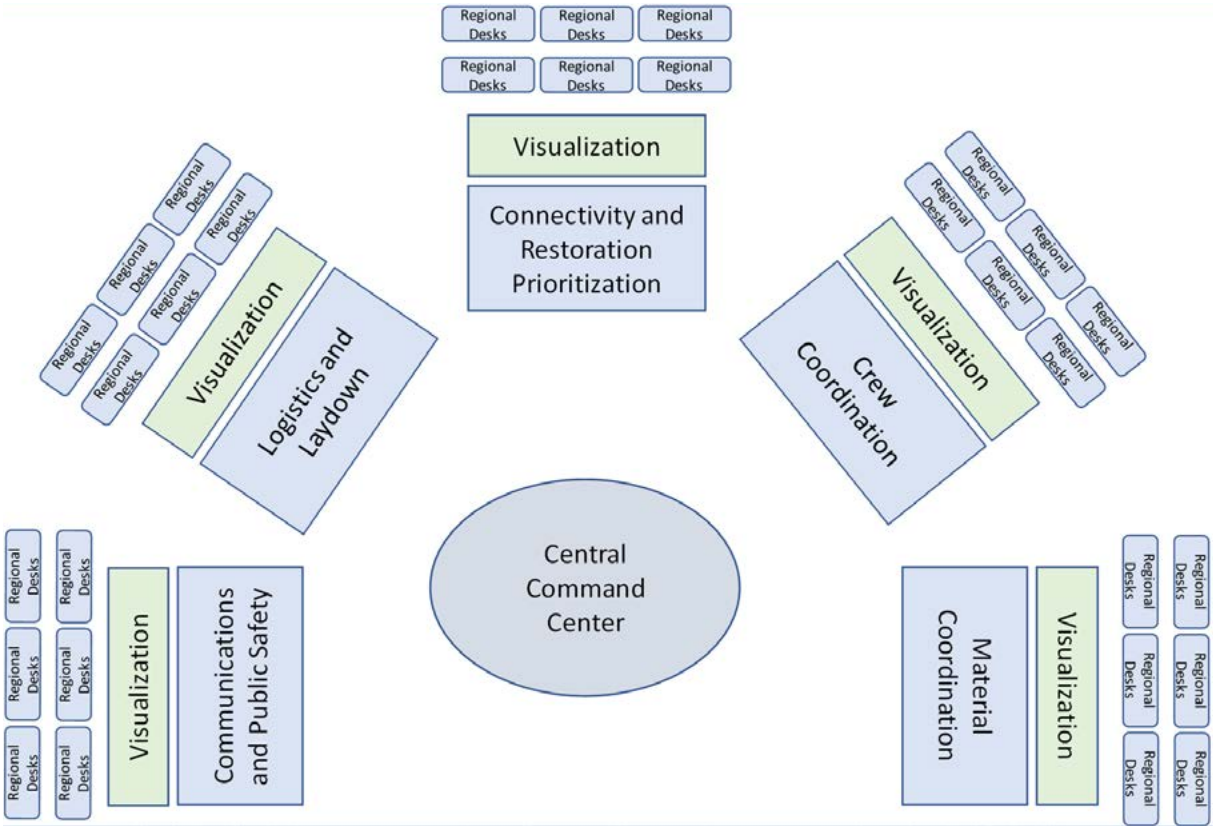
Predictive analytics (forecasting)

Damage mitigation starts prior to the event by leveraging predictive assessments from the analytics layer. This facilitates decisions related to pre-positioning of materials and crews, developing effective SOP (Standard of Operations) flows per scenario, as well as identifying potential resource gaps in material, equipment, crew types, and supporting infrastructure.

Based on the event's intensity, forecasted wind speeds, insight into the vulnerability and criticality of the effected distribution system and other parameters, the application predicts damage levels, possible directions, scenarios and dependencies, and recommends potential SOPs. Utilizing internal and external data, these predictive capabilities allow utilities to maximize preparedness.

The application then creates a de-energizing plan for proactively taking endangered facilities out of service with minimum impact on areas outside the "danger path." By monitoring the event and accurately forecasting the fire's progress, the utility can significantly narrow down the area and duration of the de-energizing action, thus reducing the impact on consumers, saving costs and shortening grid restoration times.

Based on levels of predicted damage and expected resource availabilities, the application then estimates expected restoration times and provides initial assessments to communities and customers so that they can begin their own planning efforts.



Field assessment tools

During the actual event, the assessment module begins to use GIS, connectivity models and AMI data (as available) to identify which parts of the system remain energized and which parts of the system are without power. This enables the operations personnel to prioritize damage assessment efforts based on visual indications of outage impacts. This includes an indication of the location of critical customers and facilities (hospitals, shelter locations, first responder facilities, fueling facilities, and other types of locations that are important to visualize and track). Damage assessment teams in the field can use handheld tablets or smartphones to document damage and forward to a central location for review by qualified assessors.

Equipment and inventory requirements

As the assessment efforts progress, beginning with pre-event predictions of potential damage based on forecasted wind speeds and direction, rainfall, outdoor temperature, etc., the application provides an early supply/demand view of required equipment and materials for restoration. Then, after data from actual damage assessment begins to emerge, the product tracks the growing inventory needs against volumes and locations and begins to identify optimal sourcing locations to support specific restoration efforts. Based on the projected needs, the application identifies potential shortfalls against known inventory stock.

Crew Management

Major Event Management tracks crew requirements (electric and vegetation) by repair location. It also enables the operators to identify crew capabilities by standard type, thus facilitating the integration of external crews where needed. The application can track the location and availability of specialized equipment using either GIS vehicle tracking or through the linkage of specialty equipment to specific restoration efforts and tracking the completion of such efforts.

Decision Support, Visualization and Optimization

In addition to situational awareness, mPrest provides a wide range of visualized analysis and decision support capabilities, including simulations for enhanced preparedness. This enables utilities to estimate the cost of total recovery given the level of assessed damage, the known costs of equipment and materials and the labor costs of internal and external crews. It also provides scenario analysis, showing impact of changes to crew numbers, and damage assessment assumed accuracy.

Optimized Event Management

mPrest's SoS approach helps to streamline event management by integrating and correlating all relevant data from myriad systems (e.g., SCADA, GIS, Asset Management, Crew Management, etc.) and sensors. A powerful set of tools enables operators and decision-makers to manage incident response activities such as Standard Operating Procedures (SOPs), escalations, communication systems, automatic emergency actions and more.

Once an event is underway, the application receives notifications and alerts from connected systems and sensors, calculates operational statuses and performs continuous evaluation of the current situation on the ground. Using operator-defined rules and SOPs, the module automatically performs specific sets of actions and procedures (e.g., de-energize a particular area or circuit). Users can modify or create new SOPs via a simple "drag and drop" rule engine interface, allowing rules and procedures to be easily defined without the need for programming assistance.

Sample Major Event Scenario Flows

Below are two sample scenarios demonstrating how utilities can leverage the advanced capabilities of mPrest's Major Event Management application to enhance the effectiveness and efficiency of their event management and restoration efforts.

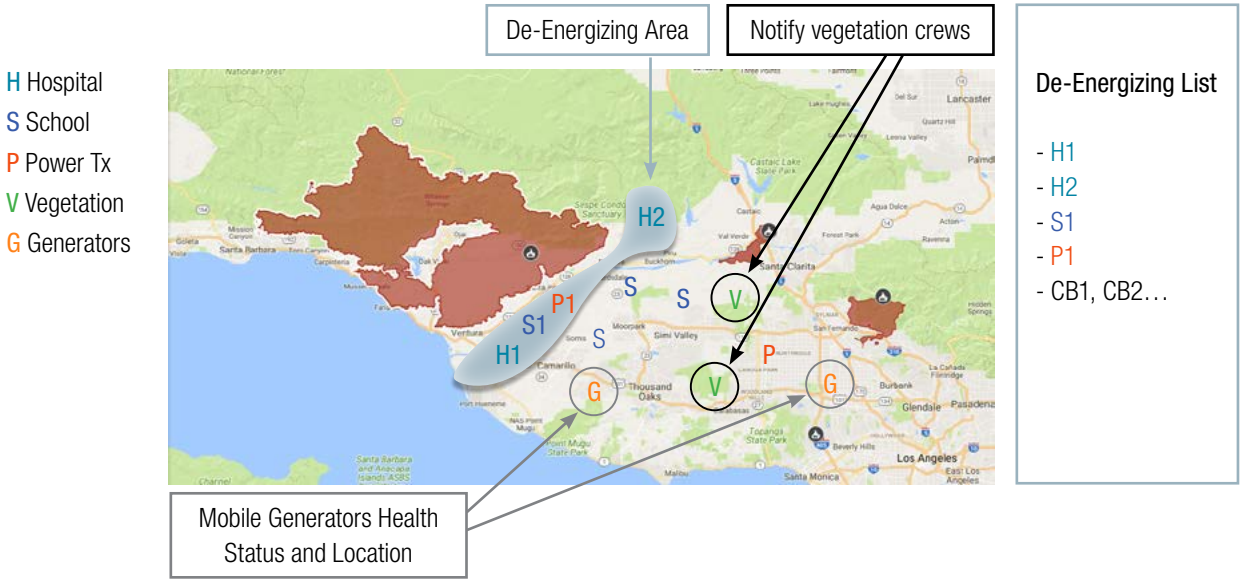
Major Storm

Preparedness Actions (Pre-Storm):

1. Leverage detailed weather forecasts and asset condition information to estimate or project damage locations and volumes and translate these into material and crew requirements
2. Assess projected crew requirements and secure foreign crews to augment company and contract crews already committed

Event Management Actions (During and Post-Storm):

1. Monitor and gather outage condition information through SCADA, AMI and other means
2. Confirm volumes and locations of outages and adjust projections as appropriate
3. Confirm and refine resources and materials needed to respond based on updated outage volumes and types
4. Mobilize detailed data gathering (human and technological, including customer supplied information) to ensure that all damage points are identified in detail. Data needs to be correlated to circuit and to geography for effective coordination of recovery
5. Use collected data to identify specific materials and crew resources needed for each specific location
6. Assign crews and materials based on priorities. Provide crews with electronic maps and information regarding the nature of the needed repairs in their assigned locations (noting that these can be changed during the process to reflect shifting priorities).
7. Identify lines that are ready for clean-up, inspection, and restoration in whole or in part
8. Based on understanding of the damage and typical time to repair, estimate and communicate restoration times. Estimates are verified and refined as crew progress is tracked.



Wildfire

Preparedness Actions (Pre-Event):

1. Leverage previous history and simulation tools to plan in advance for various possible wildfire scenarios
2. Identify high-risk areas based on weather and time of year and remove vegetation and other obstacles from the power grid to decrease the damage in the event of a wildfire outbreak

Event Management Actions (During and Post-Event):

3. Utility receives notification/alarm of wildfire incident from relevant authorities
4. Based on fire's location, forecasted wind speeds and weather, as well as insight into the current vulnerability of the distribution system, the product predicts fire's future movement
5. Identify grid assets in the fire's future path (lines, transformers, substation, breakers, feeders, etc.) as well as identifying critical facilities in the vicinity (hospitals, schools, etc.)
6. Predict grid damage levels by circuit and builds de-energizing plan advising Operations on what facilities need to be taken out of service on a proactive basis considering:
   - **a.** Fire event and risk – ignition prevention and facilities damage
   - **b.** Critical facilities (hospital, fire, police, city centers, etc.) – avoiding premature de-energization if not absolutely necessary
   - **c.** Critical utility assets (substations, work-yards, material inventories, crew centers) with respect to fire risk and proactive de-energization

The selection of the de-energizing area and assets within that area can be performed manually or automatically based on pre-defined logic related to the fire's location and movement.

7. Assign restoration crews and materials based on location and damage assessment, together with electronic maps and information regarding the nature of the needed repairs.
8. Leverage real-time and field data inputs to create an optimal restoration plan that accelerates recovery times and reduces restoration costs
9. Based on understanding of the damage and typical time to repair, estimate and communicate restoration times. Estimates are verified and refined as crew progress is tracked.

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