ELECTRICAL DISTRIBUTION DESIGN

Integrated System Model: Design Plan

Design Overview and Use Cases for Real Time Analysis & Control Software

Version 1.1

8/15/2011

This document defines a conceptual plan for the architectural design, functionality and interactivity of the Integrated System Model working in conjunction with a Smart-Grid Implementation.

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Introduction

When incorporated for an active role in the smart grid implementation, the Integrated System Model applications will

- Significantly enhance the operator's monitoring and analysis capabilities,
- Assist operator in optimizing field configurations and resources for existing conditions,
- Actively interface with controls of automated field devices in response to emergency situations and off-design conditions.

To achieve these objectives, the model must be properly maintained to accurately represent applicable configurations of the existing distribution system. Accordingly, before addressing the detailed monitoring and control missions, the supporting architecture and process for maintaining the model should be reviewed.

The ISM applications, as shown in Figure 1, can be conveniently grouped by their primary function.

1. Model Maintenance
2. Monitoring/Analysis
3. Real Time Control Action/Assistance

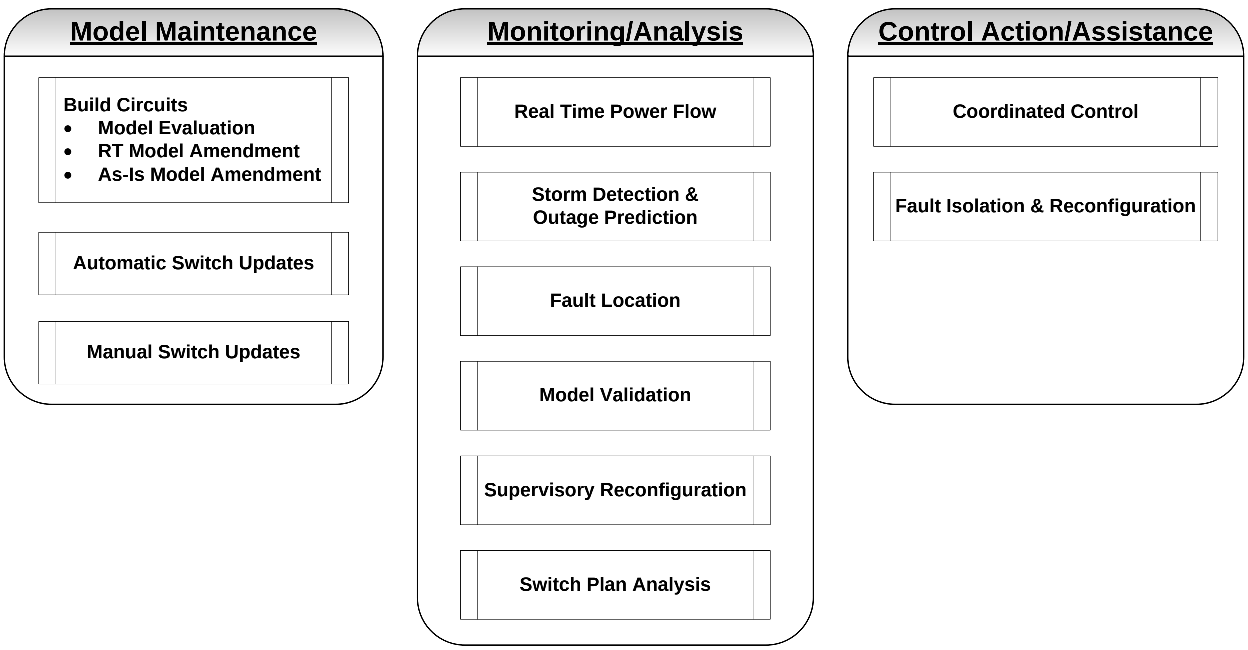


Figure 1: ISM Applications by Primary Function

Some of these applications run continuously or are automatically initiated based on external conditions, while others are only run upon request from an operator. Some are completely standalone applications, but others are coupled with associates, either directly resulting from or leading to the run of a related application. The interrelationships between the ISM applications are defined in Table 1.

Application	Primary Function	Predecessors/Upstream	Peers/Parallel	Successors/Downstream
Build Circuits	Model Maintenance	Mapping Input	Model Evaluation Model Validation	RT Model Amendment As-Is Model Amendment
Switching Updates - Automatic	Model Maintenance	Fault Isolation & Reconfiguration Field Events (SCADA) Operator Input		
Switching Updates - Manual	Model Maintenance	Operator Input		
Fault Location	Monitoring/Analysis	Field-Fault Event	Fault Isolation & Reconfiguration	
Model Validation	Monitoring/Analysis	Continuous	Build Circuits Coordinated Control Fault Isolation & Reconfiguration	
Outage Prediction	Monitoring/Analysis	Operator Request Storm Detection		
Real Time Power Flow (Selective Results View)	Monitoring/Analysis	Continuous (Operator Request)		
Storm Detection	Monitoring/Analysis	Continuous		Outage Prediction
Supervisory Reconfiguration	Monitoring/Analysis	Operator Request		Automatic Switch Updates Manual Switch Updates
Switch Plan Analysis	Monitoring/Analysis	Operator Request		Automatic Switch Updates Manual Switch Updates
Coordinated Control	Real Time Control Action/Assist		Model Validation	
Fault Isolation & Reconfiguration	Real Time Control Action/Assist	Field-Fault Event	Fault Location Model Validation	Automatic Switch Updates

Table 1: Interrelationships between ISM Applications

For each ***Application***, the table lists its ***Primary Function***, trigger events or applications that can initiate it (i.e. ***Predecessors/Upstream***), related applications that may be running or sharing data with it (i.e. ***Peers/Parallel***), and applications that may be launched as a result of it (i.e. ***Successors/Downstream***).

System Architecture

The overall system architecture supporting the ISM implementation is shown in Figure 2, which illustrates the client/server connectivity and interfaces between the supporting network platforms. In addition, the architectural diagram indicates the host environment for the various applications and their relational deployment.

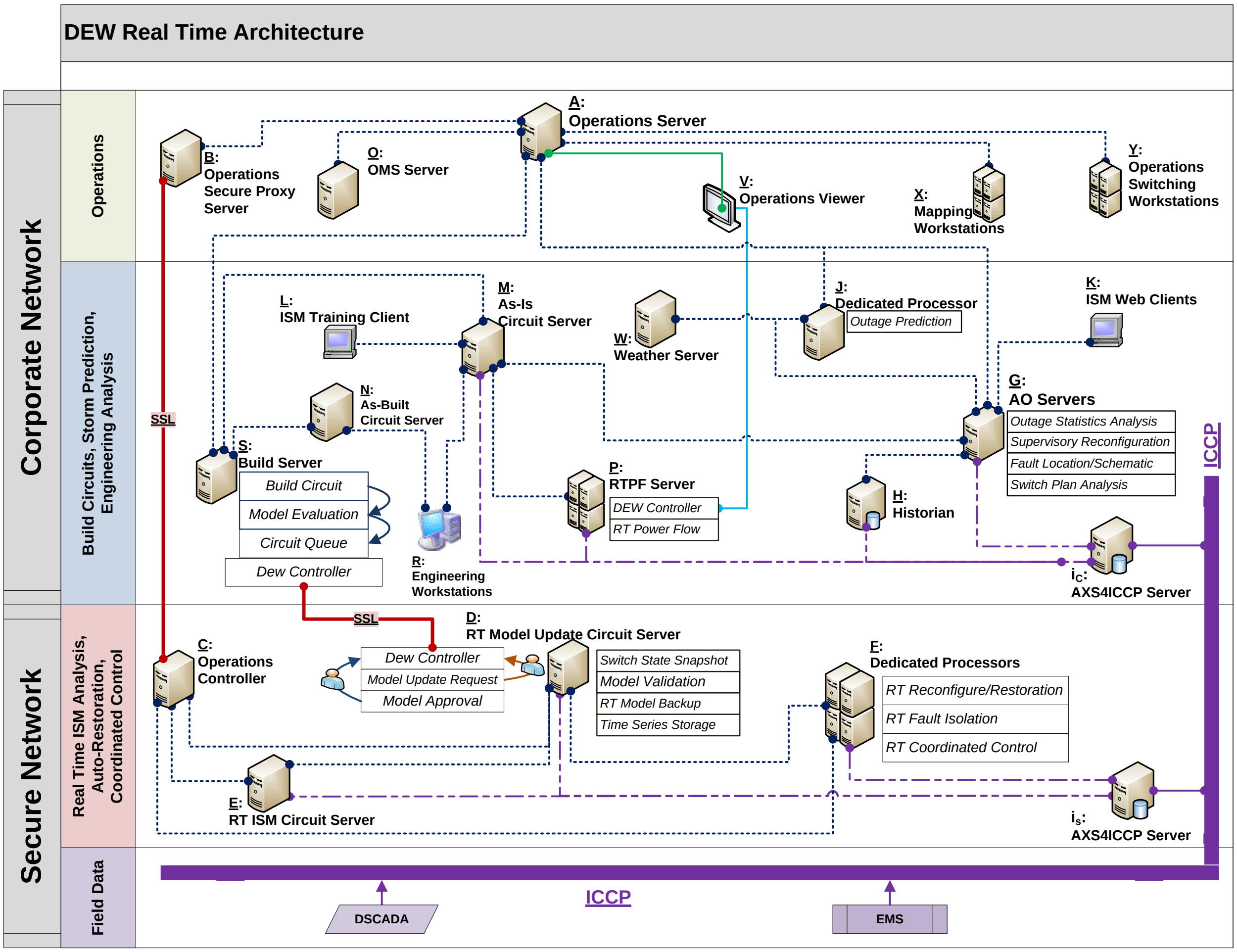
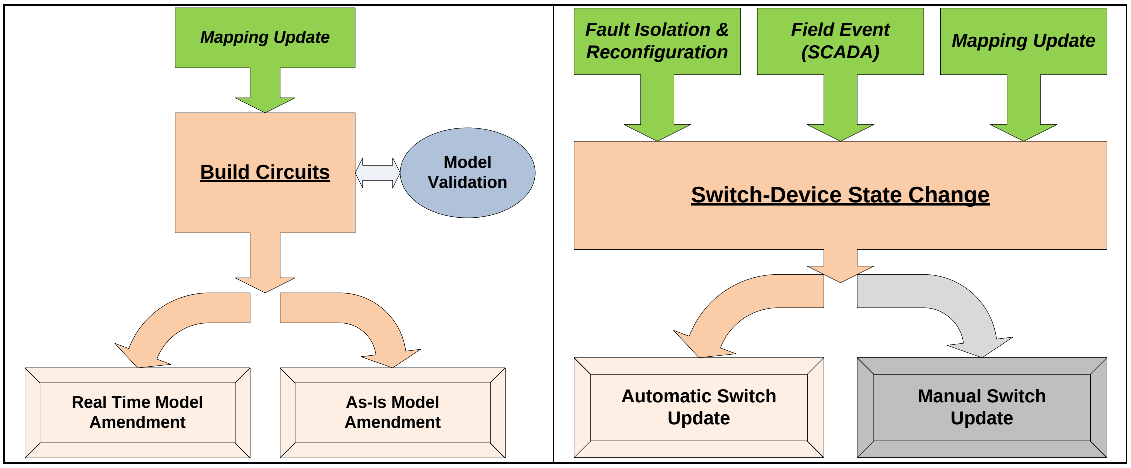


Figure 2: ISM Architecture

Use Case: **Building/Maintaining the ISM Configurations**



Summary:
To maximize benefits of the ISM, the model must be properly maintained to reflect changes in system topology, equipment installations, and active configurations. To assure that the model accurately reflects the latest design and existing conditions, an automatic update of the ISM must be completed every time a distribution map is changed in Operations or a switch state is changed in the field.
Build Circuits processes model updates, based on new mapping input, to define the configurations required for both the As-Built model (i.e. design configuration) and the As-Is model (i.e. existing field configuration). The Build Circuits process utilizes the Model Validation process, in parallel, to verify that the proposed mapping update is compatible with resulting model expectations. The ensuing (Real Time and As-Is) Model Amendment processes define the final field-configuration updates required to amend the applicable configurations to match the existing field implementation. While the Build Circuits process addresses design-mapping updates to the model and the field deviations present when the update occurs, the Automatic Switch Update and Manual Switch Update processes define how switching device state changes, as they occur in the field, are propagated to the appropriate, active ISM configurations.

Detailed Narrative:
The Operations Center's "*Send Circuits*" process works with the DEW Build Circuits process to build the ISM from the latest Operations data. The Operations batch program can be scheduled to run every evening, sending circuits that have been revised by the Mappers to DEW, which then integrates the revised circuit into the ISM. This (Send Circuit) process can also be initiated manually by the operator to accommodate situations that require an immediate circuit update of the ISM. In either case, only authorized personnel can make changes to the maps that will ultimately update the ISM.

Operations must also systematically inform DEW when a switch state change has been initiated from within the Operations group, as this represents manual change that is not typically communicated by the SCADA system. Additionally, the new design configuration of a circuit update must be amended with the existing field configurations of the automatic (SCADA operable) devices to ensure accuracy of the As-Is and Real Time model definitions.

Reference Process Document: BuildCktsProcess.pdf

Primary Actors: Operator, DEW

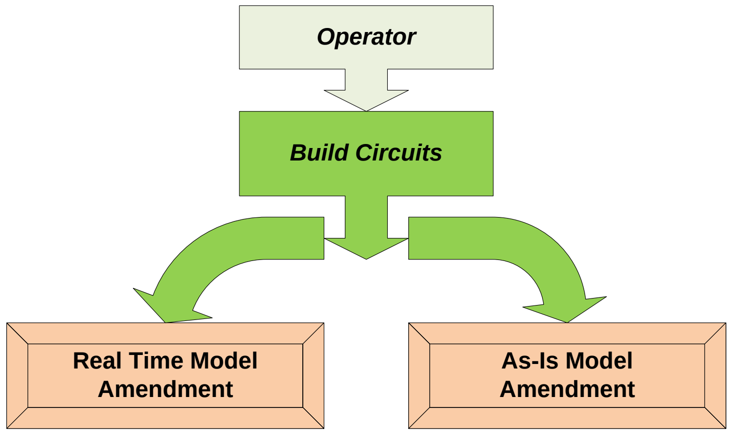
Primary Scenario (Build Circuits):

1. Operator, or scheduled runtime, initiates retrieval of circuit update and runs the Send Circuits application to begin the Build Circuits process.
2. Model is evaluated by the Build Circuits process to verify integration consistency, before being stored in circuit queue.
3. Operator requests the model update.
4. Operator reviews the update and approves for release.
5. Build Circuits process updates the applicable ISM configurations.

Secondary Maintenance Scenarios (Switching Device Updates):

- Real Time / As-Is Model Amendments
- Automatic Switch Update Process
- Manual Switch Update Process

Use Case: **Real Time / As-Is Model Amendments**



Summary:
While the Automatic and Manual Switching Update processes ensure that as field variations occur to the design (i.e. "*As-Built*") configuration, they are systematically propogated to the apppropriate active models; those processes do not retroactively incorporate any pre-existing field variations into a new model update. For a Build Circuits model update to complete deployment into the Real Time and As-Is environments of the ISM, the design configuration must be revised to incorporate existing field deviations, both from the automatically monitored (SCADA/ICCP) devices and from the manually maintained devices. These revisions are accomplished with the Real Time and As-Is Model Amendment subprocesses, which are contained within the Build Circuits process. Both subprocesses employ basically the same operations to produce identical output models, but occur in separate network environments, i.e. "Corporate" vs. "Secure".

Detailed Narrative:
The Real Time and As-Is Model Amendment processes amend the design (i.e. "*As-Built*") configurations of model updates to ensure that the As-Is and Real-Time models being deployed maintain any existing field variations that were previously indentified. The process sequence can be generally described here to apply to both environments, with network specific details distinguished in the scenario descriptions. Upon receiving an update for the design-build model, DEW retrieves the existing field configurations for all switchable devices, getting the automatic switch states from its ICCP connection and the manually maintained switch states from Operations. DEW then revises the Real Time and As-Is models to match existing field conditions. DEW then validates the revised configurations by repeating the switching configuration retrieval to verify correspondence between applicable models data and existing switch configuration data in the field. The amendment process continues until it achieves successful validation.

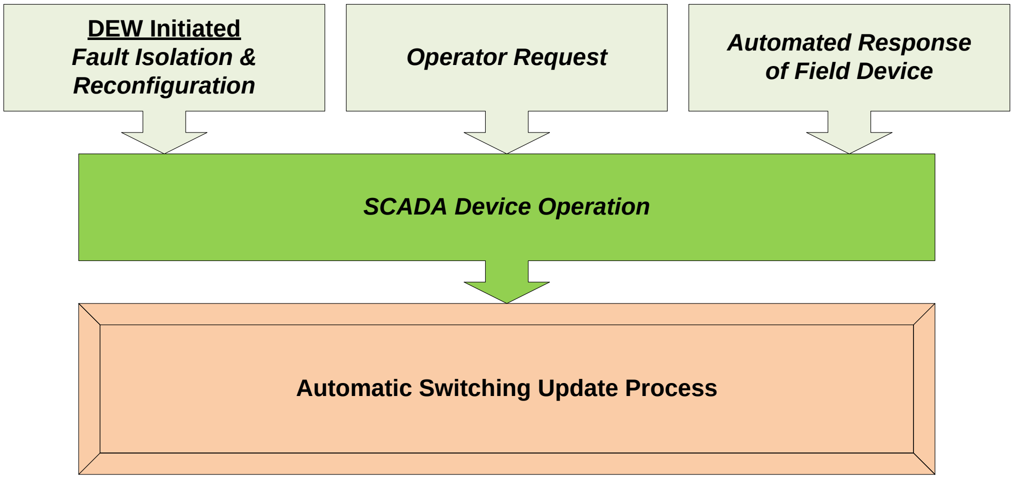
Reference Process Document: ModelAmendmentsProcess.pdf

Primary Actor: DEW

Primary Scenario for As-Is Model Amendment:

1. Operator processes model update through the Build Circuits process.
2. Build Circuits process executes Real Time and As-Is Model Amendment subroutines, which determine and implement the existing switch configurations for the applicable models.

Use Case: **Automatic Switching Updates**



Summary:
The Automatic Switching Updates process is the automated system response by DEW that updates the applicable models with configurational state changes of automatic (i.e. SCADA monitored) switchable devices and sends an update notifications to the operator. Automatic Switches may change states as a result of a running real time DEW application (i.e. Fault Isolation & Reconfiguration), field events (i.e. breaker or recloser operation), or operator requests. After receiving communication of the switch state change through its ICCP interface, DEW propagates the configuration update to the appropriate (i.e. Real-Time / As-Is) model configurations, then notifies the operator of the updated configuration.

Detailed Narrative:
Any change of state for distribution switching equipment monitored by EMS or the SCADA system must be immediately communicated to the As-Is model configurations in DEW and to the applicable Operations systems. DEW receives state changes from applicable field devices via server connections to ICCP in both the secure and corporate network domains. These servers then push the changed status to the appropriate models in each network. In addition, the Operations Controller is notified of the change and sends the update notice to the Operations Server, via secure socket and the Operations Secure Proxy Server. Upon receiving notification, the Operations server will immediately update the feature to indicate that the switch state has changed. A signal will be sent to each user so that if they are displaying this switch on their screen, they will immediately see the change in state.

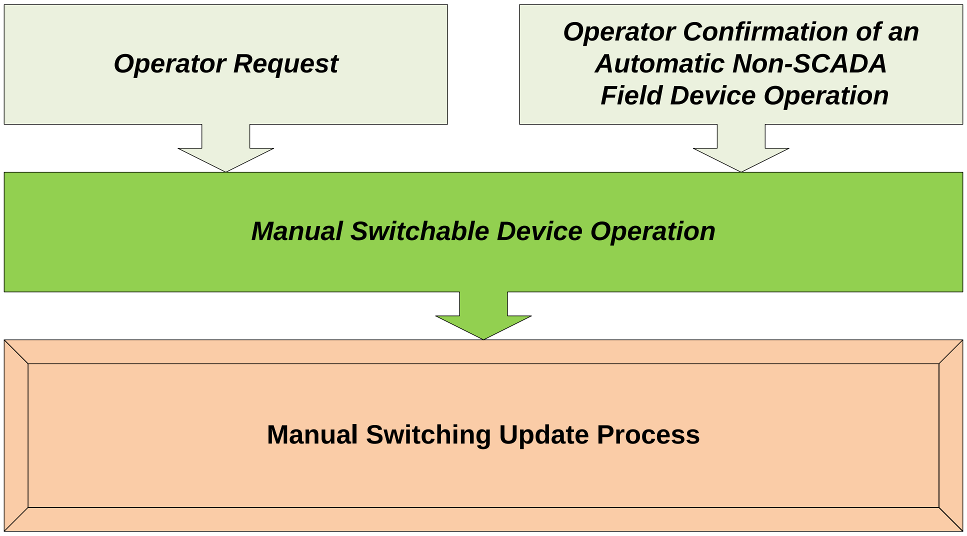
Reference Process Document: AutoSwitchOpsProcess.pdf

Primary Actors: DEW / Operator

Primary Scenario:

1. SCADA-monitored switchable device operates (as a result of program control, operator request, or automated response).
2. Automatic Switching Update process updates the applicable (Real-Time / As-Is) models to reflect change in existing configuration.
3. Operator receives notification of the configuration change from the Automatic Switching Update process, where the notification is in the form of alarm/events.
4. The Automatic Switching Update process initiates a change in the appropriate Operations model switch status.

Use Case: **Manual Switching Updates**



<u>Summary:</u>

The ***Manual Switching Updates*** process is the operator-initiated response required to update the applicable models in DEW with configurational state changes of manual (i.e. not monitored by system) switchable devices in the field. ***Manual*** switching updates occur when a switching device in the field has changed states and the switch status update must be communicated manually to the system by the Operations Controller. Once initiated, the switch update is systematically propagated by DEW to the appropriate (i.e. Real-Time / As-Is) model configurations.

<u>Detailed Narrative:</u>

The Operator determines that a non-automated switching device has changed states, requiring a manual update to the DEW "***Existing***" model configurations. The operator submits the switching update to DEW, which then propagates the configuration change to the applicable models.

<u>Reference Process Document</u>: ManualSwitchOpsProcess.pdf

Primary Actors: Operator, DEW

Primary Scenario:

Manual Switching Operation

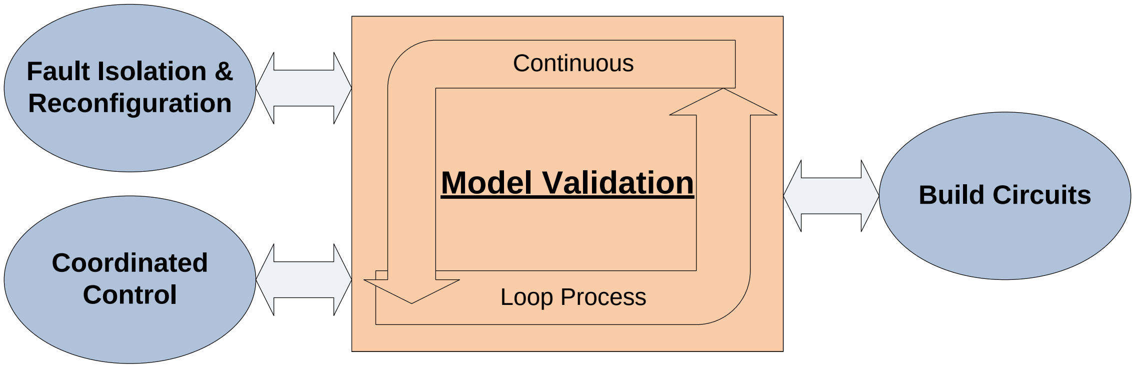
1. Operator implements a manual switching device state change.
2. Operator submits the switch update to DEW.
3. Manual Switching Update process updates applicable models (as-is, real-time) to reflect the change in model configuration.

Secondary Scenario:

Automatic Non-SCADA Switching Device Operation

1. Operator confirms that an automated, Non-SCADA switching device has changed states.
2. Operator submits the switch update to DEW.
3. Manual Switching Update process updates applicable models (as-is, real-time) to reflect the change in model configuration.

Use Case: **Model Validation**



Summary:
Model Validation is a continuously running, real time DEW process that compares results from real time model applications with correlated field data to determine whether model results and reported field conditions agree within acceptability criteria. The process repeats at set time intervals to recheck for discrepancies, automatically running without an external trigger event. Under normal (i.e. satisfactory) conditions, there are no follow-on actions directly resulting from the process. If a discrepancy is found by the process, then it is communicated to the operator and to the appropriate parallel processes.

The parallel processes associated with *Model Validation* are ***Build Circuits***, ***Coordinated Control***, and ***Fault Isolation & Reconfiguration***. The Build Circuits process is a model maintenance activity, which interacts only during model updates to determine whether the model update meets expectations with existing field conditions. Coordinated Control is an automated real time operation, which continually interacts with Model Validation to validate a circuit's submission for programmable control operations. Fault Isolation & Reconfiguration is an automated, externally triggered, real time operation that uses Model Validation to determine whether an applicable circuit is set as controllable, and subsequently available for automated switching/reconfiguration operations. For more details on the associated processes, refer to the **Build Circuits**, **Coordinated Control**, and **Fault Isolation & Reconfiguration** topics.

Detailed Narrative:
DEW continually receives field data from SCADA/ICCP devices and EMS, then incorporates into the existing model/solution to validate that existing measurements/conditions reasonably match model predictions. Should the validation fail, DEW attempts to isolate the suspected source (e.g. nonresponsive component or uncontrollable circuit) in the model, to omit the suspect components or sections for subsequent validation runs. DEW also sends notification of any validation failures to the Operations Center, which maintains the appropriate alarm status.

Reference Process Document: ModelValidationProcess.pdf

Primary Actors: DEW / Operator

Primary Scenario:

Circuit validation for Automated Processes (Coordinated Control, Fault Isolation & Reconfiguration) -

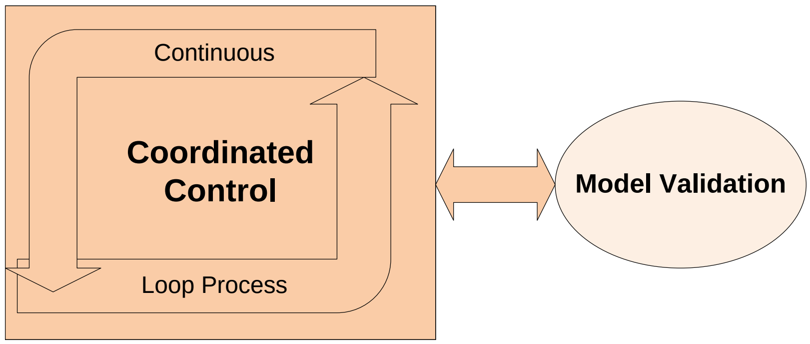
1. Model Validation process determines whether the active model reasonably corresponds with existing field data.
2. If a circuit does not pass validation criteria, Model Validation removes the circuit from automated processes and DEW sends validation failure/alarm notification to Operations.
3. If a circuit does not pass validation criteria, operator initiates investigation of validation errors to determine root cause and appropriate corrective actions.
4. Process repeats continuously.

Secondary Scenario:

Circuit validation for model updates from Build Circuits Process -

1. Model Validation process determines whether the proposed circuit update reasonably corresponds with the as-designed model (power flow obtains reasonable result).
2. Model Validation process determines whether the proposed circuit update reasonably corresponds to the as-is model with recent SCADA data (power flow results reasonably match recent SCADA data).
3. If a circuit update does not pass validation criteria, Build Circuits process rejects the update from the circuit queue and sends validation failure/alarm notification to Operations.
4. If a circuit update does not pass validation criteria, Operator initiates investigation of validation errors to determine root cause and appropriate follow-up actions.

Use Case: **Coordinated Control**



<u>Summary:</u>

Coordinated Control is a continuously running, real time operation that functions to automatically adjust field device settings to achieve the target objective, which may be specified as maximizing a circuit's operating efficiency (via loss reduction), maximizing the circuit capacity, or as voltage conservation (i.e. minimizing operating voltages to lowest acceptable levels). The Coordinated Control application optimizes each ***validated*** circuit individually, based on model calculations for the circuit. The circuits are validated for Coordinated Control using the **<u>Model Validation</u>** process.

<u>Detailed Narrative:</u>
The DEW real time system receives system parameters such as phase current loadings and bus voltages from the area substation via an interface into the Energy Management System (EMS) and from field devices such as line re-closers, capacitor banks, regulators and sensors from SCADA. DEW then applies these real time values to the ISM and uses them to scale estimated loads. A power flow is then run on the ISM using the real time values and scaled loads.
The power flow results from the existing circuit data are then compared with those from the prior run to determine if a significant change has occurred in the circuit. If such a change has occurred and the circuit has not been locked out or flagged as uncontrollable, then the Coordinated Control process is initiated. Before attempting to determine an updated control scheme, the application compares successive iterations of the power flow results to determine when the observed change has stabilized. After stabilization, the application runs to determine the optimized control settings for the active target objective, i.e. either maximizing efficiency or maximizing capacity. The application concludes by automatically sending the updated control settings to the SCADA devices, via ICCP.

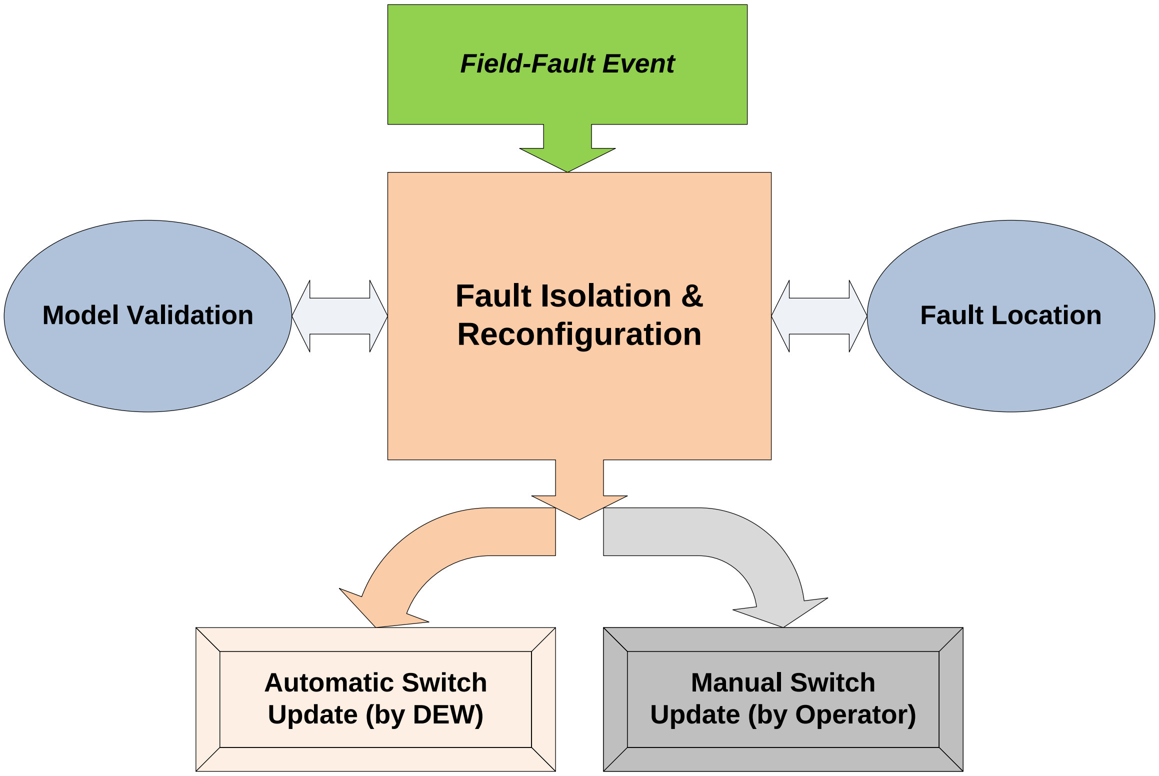
<u>Reference Process Document</u>: CoordinatedControlProcess.pdf

<u>Primary Actor:</u> DEW

<u>Primary Scenario:</u>

1. Coordinated Control process determines that a significant change has occurred in a ***controllable*** and ***validated*** circuit, where new control settings would result in improvements to the specified target objective.
2. Coordinated Control process sends updated control settings to field (SCADA) devices.

Use Case: **Fault Isolation & Reconfiguration**



Summary:
Fault Isolation & Reconfiguration is a real time operation that functions to automatically respond to a fault event in the field by operating SCADA devices to localize the isolation and minimize the outage area. The process includes running the *Reconfiguration/Restoration* application to optimize the switching configuration with the isolated fault to maximize the recovery of dropped loads. The Fault Isolation & Reconfiguration process inherently activates the ***Automatic Switch Update*** process by DEW to perform its configuration updates. Also, using output from Fault Isolation & Reconfiguration, the operator may opt for additional switching changes, which result in model configuration updates using the ***Manual Switch Update*** process.

Associated processes running parallel with Fault Isolation & Reconfiguration are ***Model Validation*** and ***Fault Location*** processes. The ***Model Validation*** process is an independent recurring process that continually validates model agreement with existing field conditions. It maintains the status indicating whether circuits are controllable. If a circuit is not set as controllable, then DEW cannot perform the automatic switching operations. The ***Fault Location*** process is a complementary field-monitoring process that simultaneously initiates with Fault Isolation & Reconfiguration to notify the operator of the fault occurrence and provide locational details. For more details on the associated processes, refer to the Fault Isolation & Reconfiguration and Model Validation topics.

Detailed Narrative:
When a faulted line section of a ***controllable*** circuit is removed from service by a recloser or SCADA operable distribution switch, the real time DEW system on the secure network will receive this information and initiate the Fault Isolation sequence. After running the Fault Isolation application, DEW sends control commands via ICCP, updating the isolation switching configuration to minimize the outage area for the given fault occurrence. After issuing the isolation command set, DEW awaits return of field data (via ICCP) that confirms successful isolation implementation. Receiving this acknowledgement, DEW proceeds with Reconfiguration/Restoration execution and sends the restoration command set, which updates switching configuration to maximize recovery of dropped loads for the existing isolation.
If the successful isolation acknowledgement is not received by DEW, then it flags unresponsive devices as "Inoperable", sends an alarm message to Operations, and retries the Fault Isolation routine to determine whether another isolation improvement is available, given the known inoperable devices.

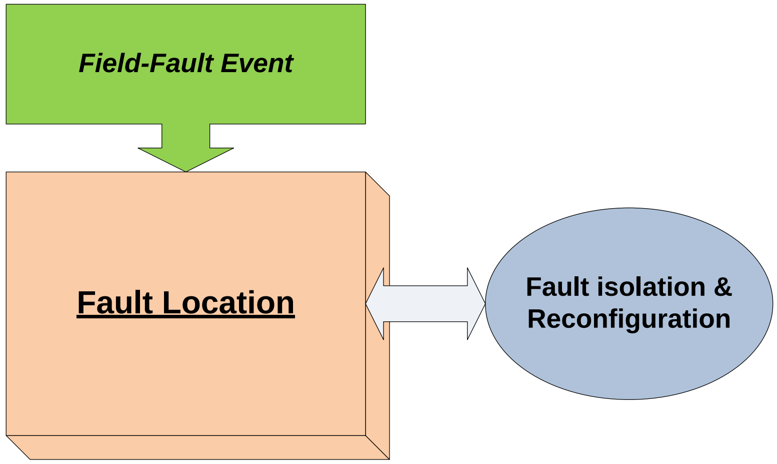
Reference Process Document: RT_FaultIsolationProcess.pdf

Primary Actor: Operator

Primary Scenario:

1. Fault event occurs in field, which results in the state-change of a controllable device, i.e.breaker or recloser lockout.
2. DEW determines whether fault occurred in a controllable circuit, based on results from *Model Validation* process.
3. For controllable circuits, DEW determines and operates the appropriate fault isolation devices.
4. For controllable circuits, automated devices for reconfiguration are operated by DEW.
5. DEW determines probable locations for the fault event, from the *Fault Location* process.
6. Operator receives Fault Notification/Alarm indicating the fault occurrence and providing details for retrieving fault location, automated response actions, and follow-up opportunities for improvement via manual switching changes.
7. Operator may then choose to:
    a. Retrieve/Review the automated response actions by the Fault Isolation & Reconfiguration process.
    b. Retrieve/Review/Implement additional configuration improvement opportunities found by the Fault Isolation & Reconfiguration process, which require manual switching device operations.

Use Case: **Fault Location**



Summary:
Fault Location is a monitoring/analysis application that notifies the operator of a fault occurrence and identifies probable fault locations based on the field/fault data received. Upon receiving fault data from the field via ICCP, DEW automatically runs Fault Location to generate a reduced schematic, which illustrates the most probable sites for the fault occurrence. The operator is automatically notified of the fault occurrence and may then retrieve the fault schematic to determine the most likely locations for the actual fault condition.
Concurrently with the Fault Location application, the fault data simultaneously triggers DEW to initiate the real time ***Fault Isolation & Reconfiguration*** process, which independently proceeds to localize the fault and minimize outaged areas. See the ***Fault Isolation & Reconfiguration*** topic for related details.

Detailed Narrative:
When a faulted line section is removed from service by a recloser or SCADA operable distribution switch, DEW receives the fault information from the field via its ICCP interface and initiates the Fault Location process. After running the Fault Location application to determine the most likely fault locations for producing the associated fault data, DEW notifies the operator (at Operations Viewer) of the fault occurrence and the available fault schematic, which illustrates probable locations for the existing fault condition. Operator may then request to retrieve the fault schematic for further review.

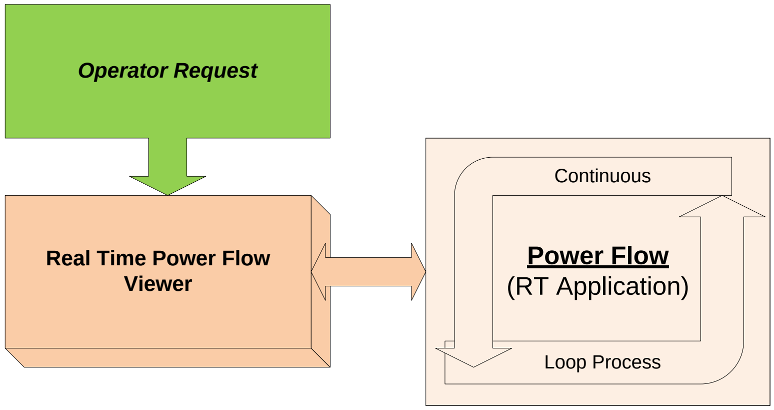
Reference Process Document: FaultLocationProcess.pdf

Primary Actors: Operator

Primary Scenario:

1. Fault event occurs in field, which results in the state-change of a controllable device, i.e.breaker or recloser lockout.
2. DEW initiates ***Fault Isolation & Reconfiguration*** to run in parallel with ***Fault Location***.
3. The Fault Location process determines probable locations for the fault condition, based on the corresponding field data, and generates the fault schematic.
4. Operator receives the Fault Schematic availability notification
5. Operator may then retrieve the Fault Schematic for review.

Use Case: Viewing Real Time Power Flow Results



Summary:
The Real Time Power Flow application continuously runs on the RTPF Server to determine the load flow results throughout the entire system model, based on existing field measurements and conditions. The RTPF View function enables the operator to select specific circuits/components of interest for monitoring the results in real time.

Detailed Narrative:

Preface:
The DEW real time system receives system parameters such as phase current loadings and bus voltages from the area substation via an interface into the Energy Management System (EMS) and from field devices such as line reclosers, capacitor banks, regulators and sensors from Distribution SCADA system (SCADA). DEW applies these real time values to the ISM and uses them to scale estimated loads. A power flow is then run on the ISM using the real time values and scaled loads. DEW calculates appropriate system parameters for all components in the distribution system and maintains real time results for displaying the existing model solution.

Viewing RTPF Results:
The Operator selects the monitoring locations and parameters of interest from the Operations Viewer workstation. Each Operator can subscribe to view load flow results for any number of features. As long as the user is subscribed, the requested results will appear on the screen in the form of Volts, Amps, Power, or Reactive Power depending on the user's setting. The user can unsubscribe from these results at any time, which only terminates the display monitoring for the applicable operator.

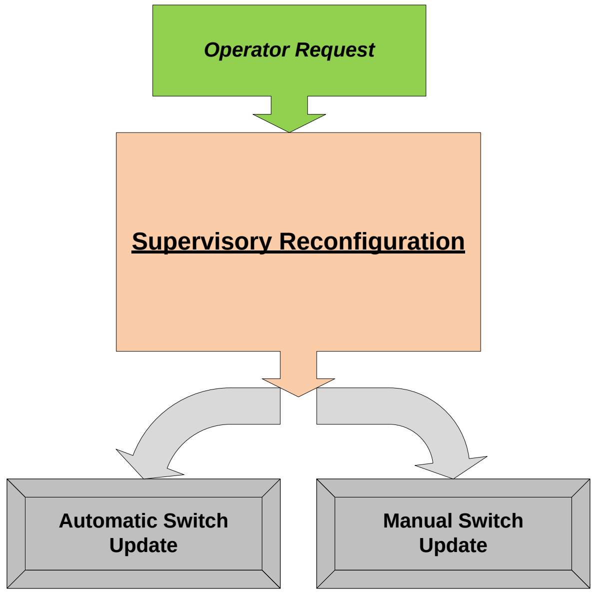
Reference Process Document: RTPF_ViewProcess.pdf

Primary Actor: Operator

Primary Scenario:

1. Operator selects desired components for viewing Power Flow results.
2. Operator views Power Flow updates for the selected components.
3. Operator terminates viewing for selected components.

Use Case: **Supervisory Reconfiguration**



Summary:
Supervisory Reconfiguration enables an operator to submit a circuit and the level of adjacents to be considered for manual reconfiguration. The application evaluates the submission and determines potential reconfiguration (switching) scenarios that could improve the load management for existing field conditions. After running Supervisory Reconfiguration, the Operator may choose to implement switching changes, which result in model configuration updates using the Automatic or Manual Switch Update processes.

Detailed Narrative:
The Operator identifies a target feeder for improved load management, along with the level of adjacents allowed for reconfiguration. DEW receives the request and pulls the applicable circuits (in the 'As-Is' state). DEW then runs the Supervisory Reconfiguration application to determine switching alternatives that could improve the load management situation and stores the results with a corresponding detailed schematic. DEW sends the results and the schematic name to the requesting Operator, who can then retrieve the detailed schematic and manually implement the optimized reconfiguration.

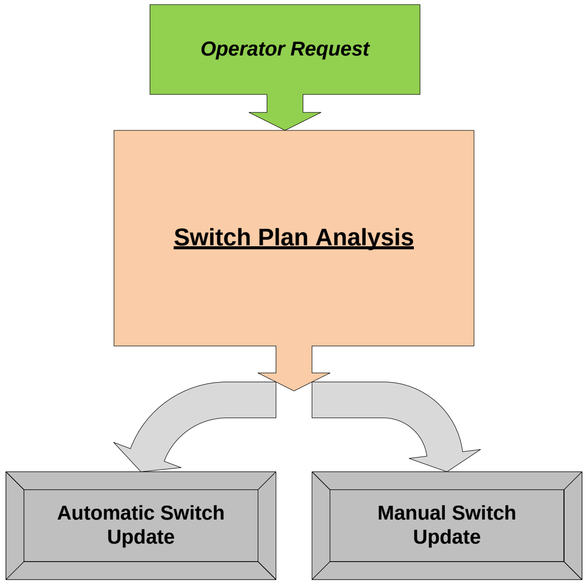
Reference Process Document: SupervisoryReconfigurationProcess.pdf

Primary Actors: Operator, DEW

Primary Scenario:

1. Operator initiates the Supervisory Reconfiguration process, identifying circuit and allowable levels for reconfiguration.
2. Supervisory Reconfiguration process determines reconfiguration options and notifies operator of available results.
3. Operator retrieves results and reviews switching alternatives.
4. Operator implements the desired switching scenario.

Use Case: Switch Plan Analysis



Summary:
Switch Plan Analysis enables the operator to evaluate a planned switching sequence, determining potential system/loading impacts prior to implementation. After running the analysis, the operator may choose to implement the switch plan using Automatic or Manual Switch Update processes.

Detailed Narrative:
The Switch Plan serves as an operational sequence, generally for isolating a section of an electrical circuit, which consists of a series of operations on the network. Typical interactions include opening/closing a switch, or installing a jumper/bell. Switch Plans may be defined for scheduled maintenance of a circuit/feeder section or might be used for emergency procedures. The Switch Plan contains detailed information defining the switching steps needed. The steps are sent via a web service to DEW for analysis. Upon completion, DEW sends back the results via a web service to the Operations server, which then returns the results to the requesting operator. The analysis reports results for each step in the Switch Plan for the As-Is configuration, indicating the number of customers gaining or losing power, the maximum loading on the system, load transfer, low/high voltage conditions, and any overloads, enabling the operator to determine expected impacts from the submitted plan before it is executed.

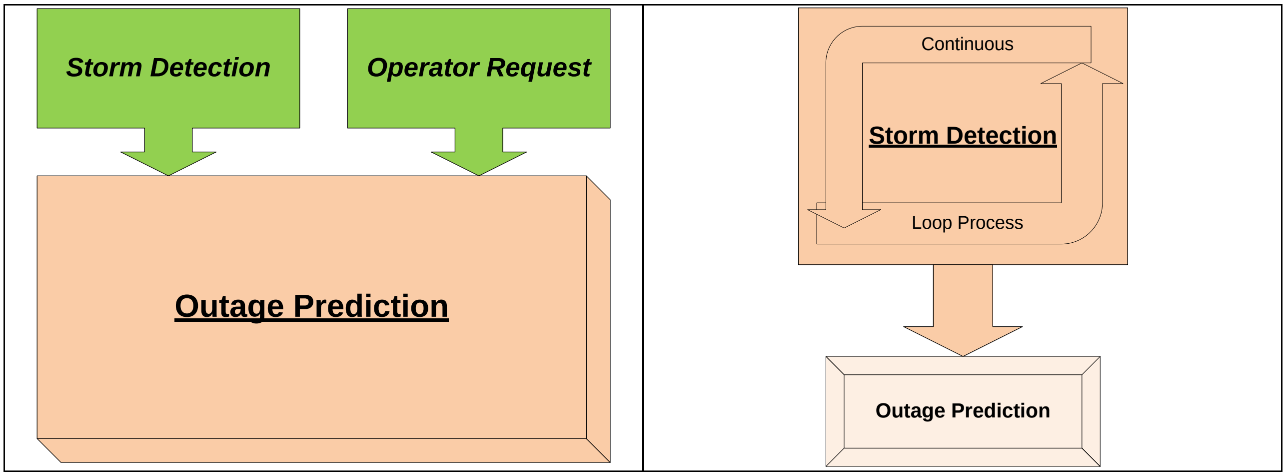
Reference Process Document: SwitchPlanAnalysisProcess.pdf

Primary Actor: Operator

Primary Scenario:

1. Operator submits the desired operational sequence to Switch Plan Analysis.
2. Switch Plan Analysis returns model results with proposed configuration.
3. Operator reviews results of proposed configuration and decides whether to proceed with implementation.

Use Case: Storm Outage Prediction



Summary:
The Outage Prediction process can be initiated directly by operator request or can be automatically activated by the associated Storm Detection process. Storm Outage Prediction uses an empirical outage model, along with real time data from the Weather Station and Outage Management Systems, to predict the incident outlook based on worst-case weather conditions. The incident outlook is continually updated, using the latest weather and outage data to provide revised predictions for the operator.

Detailed Narrative:
Using years of historical data, storms are classified into categories based on temperature, wind speed, and empirical models of cumulative outages for each category of storm. The operator may initiate the request for outage predictions at any time to retrieve incident predictions based on weather and outage conditions. During Storm Detection operation, a computerized "observer" recognizes when the weather conditions and rate of receipt of outages constitute a storm event, automatically notifies the operator of the occurrence and continually updates outage incidence predictions throughout the course of the storm.

Reference Process Document: StormOutagePredictionProcess.pdf

Primary Actor: Operator

Primary Scenario:

1. Operator, or Storm Detection process, initiates the Outage Prediction process.
2. Operator receives prediction for expected total outage incidents, based on latest outage and weather data.
3. The Outage Prediction process continues providing updates to operator until the associated storm event has either timed-out or been manually stopped.

Appendix – Detailed Process Documentation Reference List

Use Case / Application		Reference Process
Building/Maintaining the ISM Configurations	---	BuildCktsProcess.pdf
Real Time / As-Is Model Amendments	---	ModelAmendmentsProcess.pdf
Switching Updates - Automatic	---	AutoSwitchOpsProcess.pdf
Switching Updates - Manual	---	ManualSwitchOpsProcess.pdf
Model Validation	---	ModelValidationProcess.pdf
Coordinated Control	---	CoordinatedControlProcess.pdf
Fault Isolation & Reconfiguration	---	RT_FaultIsolationProcess.pdf
Fault Location	---	FaultLocationProcess.pdf
Viewing Real Time Power Flow Results	---	RTPF_ViewProcess.pdf
Supervisory Reconfiguration	---	SupervisoryReconfigurationProcess.pdf
Switch Plan Analysis	---	SwitchPlanAnalysisProcess.pdf
Storm Detection & Outage Prediction	---	StormOutagePredictionProcess.pdf