

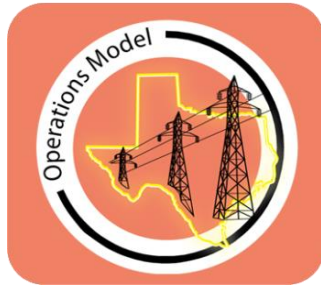
ERCOT's NMMS - Network Model Management in Action

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Project Consultants, LLC

ERCOT NMM

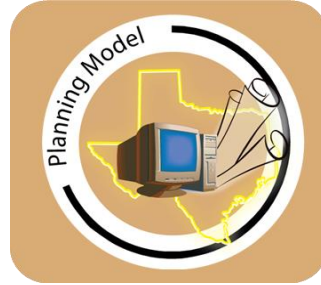
- ▶ The ERCOT System
- ▶ NMMS Overview & Key Functionality
- ▶ Stakeholder Model Update Submissions

ERCOT Models



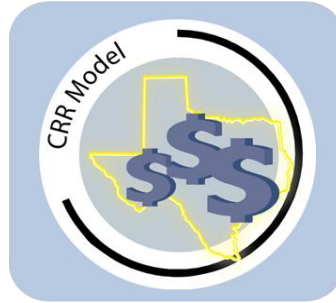
Network Operations Model

- Energy MS
- Market MS
- Steady State Analysis
- State Estimator
- Day Ahead
- Outage Coordination
- Voltage Stability



Planning Model

- Future Year Analysis
- Production Cost Analysis
- Voltage Stability



CRR Model

- Congestion Auction

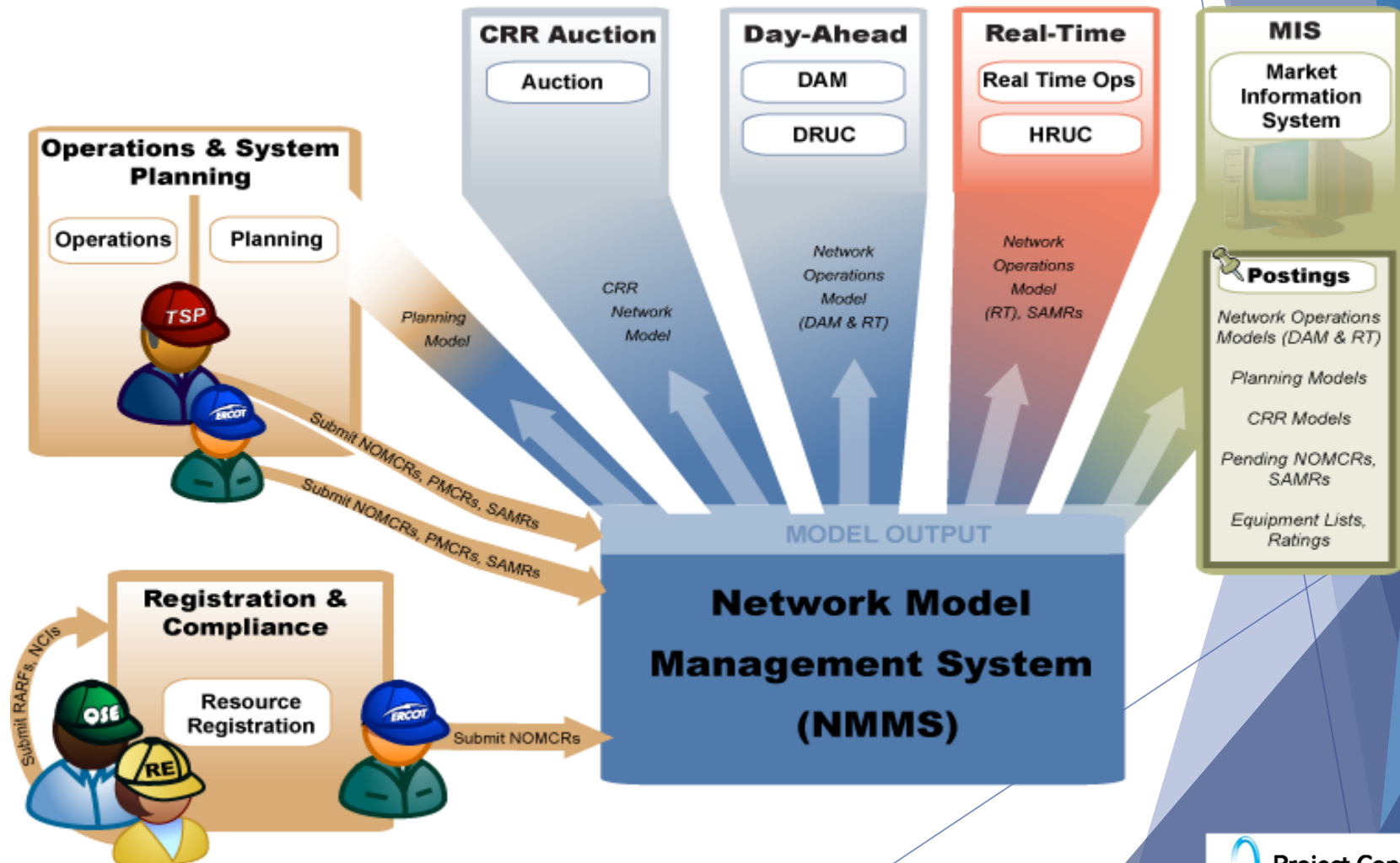


Dynamics Model

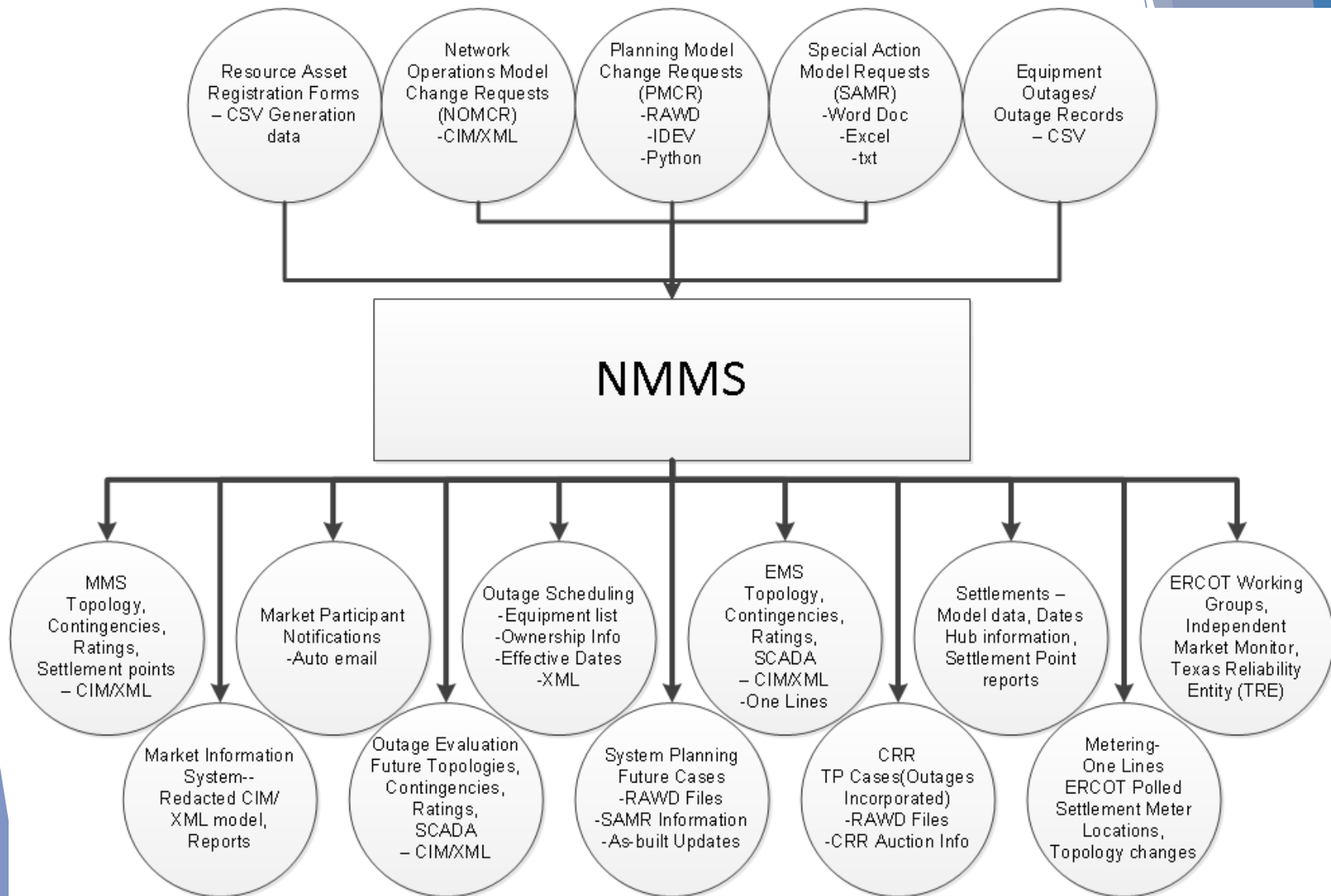
- Stability Analysis

What is NMMS? In Short:

One system manages all model data for up to one year into the future
The Network Model Management System (NMMS)



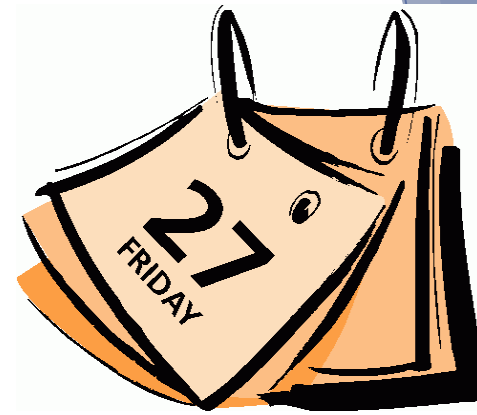
What Does NMMS Do?



NMMS - Key Requirements

- ▶ Time-based modeling
 - ▶ A change that will happen in 5 months can be modeled today.
 - ▶ A model that represents all changes 5 months into the future or from the past can be created today.
- ▶ Generate all models for all processes
 - ▶ Repository for all model information
 - ▶ Both full and incremental CIM files
- ▶ Accept incremental modeling updates.
 - ▶ Submitted by the Market Participants (TSP, QSE, LSE, RE)
 - ▶ QSE, LSE and REs must submit data to an ERCOT representative.

Time-Based Modeling



- ▶ Incremental Changes - All model updates are stored as a packet of database modification commands
- ▶ Effective Date - Each incremental change is given an energization date
- ▶ Future Models - Applying dated incremental changes to a base model creates a model representing a future date

PTC: Create NOMCR Screen (Details)

Change Request Form

ERCOT.com | MIS | TML

Hello, MSPBADA2 | Signout

Company ERCOT

Network Model Management System

CreateNOMCR

Project Information

PID # 3 **Project Complete** [View History](#)

Project Name kdt **Created By:** MSPVEDE2 DEC 01, 2008 11:43:09 CST

Project Owner ERCOT **Last Saved By:** MSPBADA2 DEC 01, 2008 11:43:09 CST

Short Description sdsdsg

Full Description

NOMCR Information EDITING

NOMCR ID # 3_1 **Dynamic Rating Changes Only** [View History](#)

NOMCR Status SUBMITTED **Created By:** MSPVEDE2 DEC 01, 2008 11:43:17 CST

Owner Name ERCOT **Last saved By:** MSPBADA2 DEC 08, 2008 14:14:08 CST

Assigned To

* **NOMCR Name**

* **Energyization Date**

* **Short Description**

Full Description

This is an interim update, please complete the information below or change energization Date

* **Description of change for interim**

* **Reason for interim update**

Dependency

* **Dependent NOMCRs** None 0 Attached

* **Dependent SAMRs** None 0 Attached

* **Associated PMCR** None 0 Attached

Upload

CIM XML

Related Information

Submit NOMCR

[Create / View Comments](#) [Validation Log](#)

File uploaded successfully

PTC: Create NOMCR Screen (Details)

The screenshot displays the 'Create NOMCR' form in the PTC Network Model Manager. The form is organized into several sections:

- Project Information:** Fields for PID # (3), Project Name (kdt), Project Owner (ERCOT), Short Description (sdsdg), and Full Description.
- NOMCR Information (EDITING):** Fields for NOMCR ID # (3_1), NOMCR Status (SUBMITTED), Owner Name (ERCOT), Assigned To, NOMCR Name (sdfgsdfg), Energization Date (12/24/2008), Short Description (sdfgsdfg), and Full Description. A red note indicates: "This is an interim update, please complete the information below or change energization Date".
- Interim Update Fields:** Two text boxes for "Description of change for interim" and "Reason for interim update".
- Dependency:** Sections for "Dependent NOMCRs", "Dependent SAMRs", and "Associated PMCR", each with a "None" radio button, a "Select" button, and a "View" button.
- Upload:** Fields for "CIM XML" and "Related Information" with "Browse", "Import", and "Upload" buttons, and a "Launch Model Editor" button.
- Submit NOMCR:** "Validate IMM data" and "Submit NOMCR" buttons.
- Footer:** "Remove Private Changes", "Withdraw", "Delete", "Cancel", and "Save" buttons.

A status bar at the bottom left shows "File uploaded successfully".

NOMCR Information Section Includes:

- NOMCR Name
- Energization Date
- Description
- Interim Update Information
- View History
- Dynamic Rating Changes Only Option
- (Maybe ICCP Data only)

PTC: Create NOMCR Screen (Details)

Change Request Form | ERCOT.com | MIS | TML | Hello, MSPBADA2 | Signout | Company: ERCOT

Network Model Management System

CreateNOMCR

Project Information [View History](#)

PID #: 3
Project Name: kdt
Project Owner: ERCOT
Short Description: sdsdsg
Full Description: [Text Area]

Project Complete:
Created By: MSPVEDE2 DEC 01, 2008 11:43:09 CST
Last Saved By: MSPBADA2 DEC 01, 2008 11:43:09 CST

NOMCR Information EDITING [View History](#)

NOMCR ID #: 3_1
NOMCR Status: SUBMITTED
Owner Name: ERCOT
Assigned To: [Text Area]

Dynamic Rating Changes Only:

* NOMCR Name: [Text Area]
* Energization Date: 12/24/2008
* Short Description: sdfgsdfg
Full Description: [Text Area]

This is an interim update, please complete the information.
* Description of change for interim: [Text Area]

Dependency

* Dependent NOMCRs	<input checked="" type="checkbox"/> None	Select NOMCRs	0 Attached	View Dependent NOMCRs
* Dependent SAMRs	<input checked="" type="checkbox"/> None	Select SAMRs	0 Attached	View Dependent SAMRs
* Associated PMCR	<input checked="" type="checkbox"/> None	Select PMCR	0 Attached	View Associated PMCR

Upload

CIM XML: [Text Area] Browse Import Launch Model Editor
Related Information: [Text Area] Browse Upload [Text Area] Related Information file names

Submit NOMCR [Create / View Comments](#) [Validation Log](#)

Validate IMM data
Submit NOMCR

Remove Private Changes Withdraw Delete Cancel Save

File uploaded successfully

Dependency Section:

- Dependent NOMCRs
- Dependent SAMRs

PTC: Create NOMCR Screen (Details)

Change Request Form | ERCOT.com | MIS | TML | Hello, MSPBADA2 | Signout | Company: ERCOT

Network Model Management System

CreateNOMCR

Project Information [View History](#)

PID # 3 **Project Complete**
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Short Description sdsdgd
Full Description

NOMCR Information **EDITING** [View History](#)

NOMCR ID # 3_1 **Dynamic Rating Changes Only**
NOMCR Status SUBMITTED **Created By:** MSPVEDE2 DEC 01, 2008 11:43:17 CST
Owner Name ERCOT **Last saved By:** MSPBADA2 DEC 08, 2008 14:14:08 CST
Assigned To
*** NOMCR Name**
*** Energization Date**
*** Short Description**
Full Description

This is an interim update, please complete the information below or change energization Date
*** Description of change for interim** *** Reason for interim update**

Dependency

* Dependent NOMCRs	<input checked="" type="checkbox"/> None	<input type="button" value="Select NOMCRs"/>	0 Attached	<input type="button" value="View Dependent NOMCRs"/>
* Dependent SAMRs	<input checked="" type="checkbox"/> None	<input type="button" value="Select SAMRs"/>	0 Attached	<input type="button" value="View Dependent SAMRs"/>
* Associated PMCR	<input checked="" type="checkbox"/> None	<input type="button" value="Select PMCR"/>	0 Attached	<input type="button" value="View Associated PMCR"/>

Upload

CIM XML
Related Information

Submit NOMCR

[Create / View Comments](#) [Validation Log](#)

File uploaded successfully

Upload Section:

- CIM XML Import
- Related Information
- Launch Model Editor(IMM)

PTC: Create NOMCR Screen (Details)

Change Request Form

ERCOT.com | MIS | TML

Hello, MSPBADA2 | Signout

Company ERCOT

Network Model Management System

CreateNOMCR

Project Information

PID # 3
Project Name kdt
Project Owner ERCOT
Short Description sdsdg
Full Description

Project Complete [View History](#)

Created By: MSPVEDE2 DEC 01, 2008 11:43:09 CST
Last Saved By: MSPBADA2 DEC 01, 2008 11:43:09 CST

NOMCR Information EDITING

NOMCR ID # 3_1
NOMCR Status SUBMITTED
Owner Name ERCOT
Assigned To

* NOMCR Name
* Energization Date
* Short Description
Full Description

This is an interim update, please complete the information below

* Description of change for interim

Dependency

* Dependent NOMCRs None 0 Attached
* Dependent SAMRs None 0 Attached
* Associated PMCR None 0 Attached

Upload

CIM XML
Related Information

Submit NOMCR

File uploaded successfully

- Submit NOMCR Section:**
- Validate IMM Data
 - Submit NOMCR
 - Validation Log
 - Create View Comments
 - Remove Private Changes
 - Withdraw
 - Delete
 - Save

PTC's Case Builder

- **Model Generator** in PTC's Case Builder is used to
 - Build a model for a target build date (one day prior to next model load)

Model Information

Model Id

* Model Name

Model Date

* Description

Model Building and Validation

Generate Model files

os-profile_05
 settlementsbi
 redacted_05
 mis_sps_050

List of NOMCRs

ChangeRequest_ID	Status	Owner	
<input type="checkbox"/> 6682_2	APPROVED FOR TESTING	CPS ENERGY (TDSP)	Reconfigur
<input type="checkbox"/> 6682_3	APPROVED FOR TESTING	CPS ENERGY (TDSP)	Reconfigu
<input type="checkbox"/> 8286_1	APPROVED FOR TESTING	ERCOT	SAL
<input type="checkbox"/> 9917_1	APPROVED FOR TESTING	RAYBURN COUNTRY CO OP DBA RAYBURN ELECTRIC (TDSP)	
<input type="checkbox"/> 10001_1	APPROVED FOR TESTING	LCRA TRANSMISSION SERVICES CORPORATION	

Exporting a Model

- **Test Model Generator** in PTC's Case Builder is used to
 - Build a model for a target build date (one day prior to next model load)
 - Export CIM/XML profiles from the model that is built.

Project Tracker and Coordinator
ERCOT.com | MIS | TML | Hello, NMAGO | Company ERCOT

Network Model Management System

Project Summary | **Case Builder** | Archive Summary | Name Service | Notices

Test Model Generator | Production Model Generator | CRR/Planning Model Generator | Historical Model Generator

Model Information

Model Id: 665 [Create Model]

* Model Name: CIM_07_1_1_04112011

Model Date: 4/11/2011

* Description: CIM_07_1_1_04112011

Existing Models

Model Name	Model Id	Model Date	Model Type	Model Status	Model Creator	Description
CIM_10_1_1_07112011	667	7/11/2011	TEST	SAVED	WHU	CIM_10_1_1_07112011
CIM_09_1_1_06082011	666	6/8/2011	TEST	SAVED	WHU	CIM_09_1_1_06082011
CIM_07_1_1_04112011	665	4/11/2011	TEST	SAVED	WHU	CIM_07_1_1_04112011

Model Building and Validation

[Build Model] [Load TNA] [Erase Model]

Generate Model files

D:\Models\2011\April\7.1.1\NonDeliverables\665_CIM_07_1_1_04112011

[Browse]

[Generate RDF file w/o outages] [Generate RDF file with outages]

complete_05
 ems_mms_05
 settlezones
 os-profile_05

Included NOMCRs

ChangeRequest_ID	Project Name
10447_1	Validation Update 7_1
10425_1	LCRA Dynamic line rating update 138kv Phase 2
10303_1	REG2NMMS Synch Edate 04022011 1 Company Delete
9716_1	Line 6360_E Ratings Change
9519_1	SAMR 9353_1 SCSES RARF Update

Export Model

Future Model Creation

▶ Creating an Operations Model

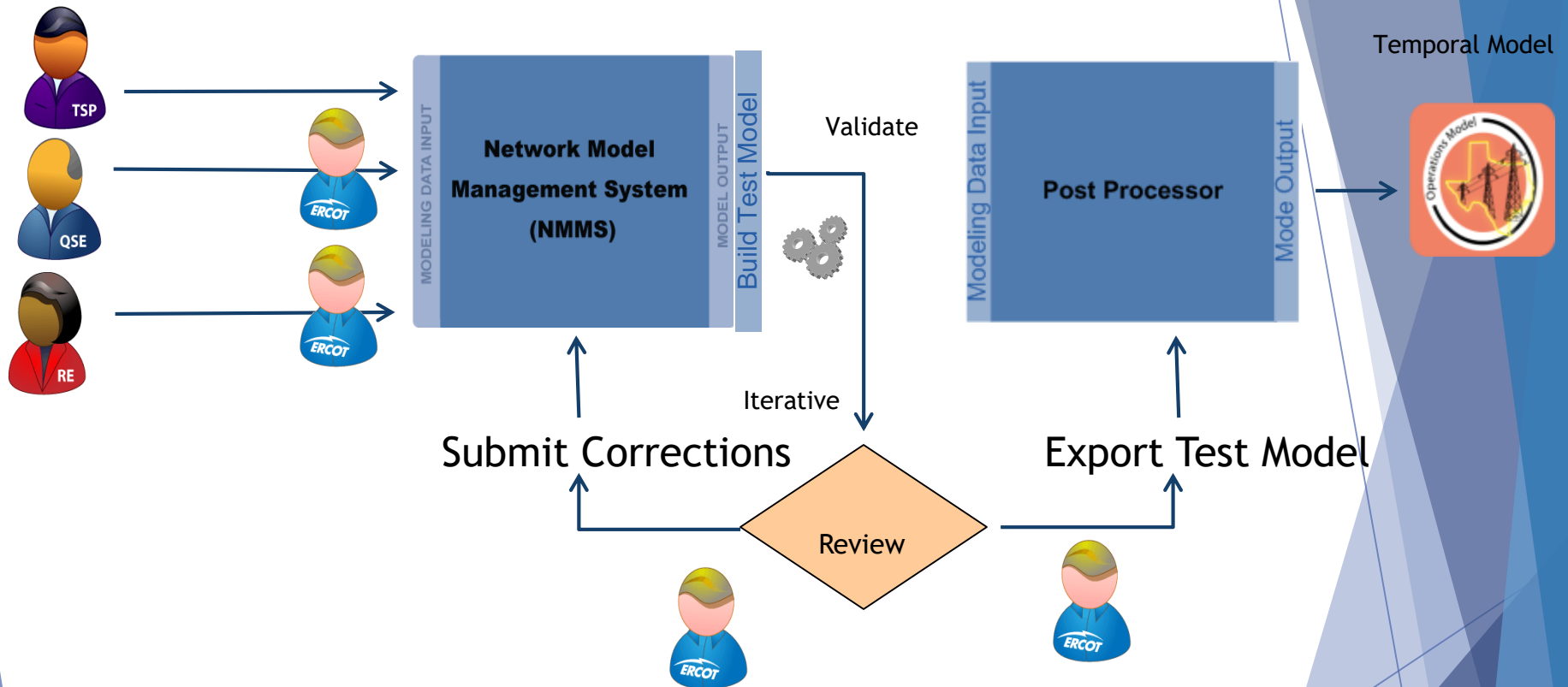
- ▶ The model is created by applying all the incremental changes that occur between the current and future dates to the base model

▶ Creating a Planning Model

- ▶ An Operational model is created for the future date
- ▶ This model is passed through a “topology processor” to change the breaker/switch model into a bus/branch Planning model
- ▶ Planning incremental changes are then applied to the model to make it reflect the future date

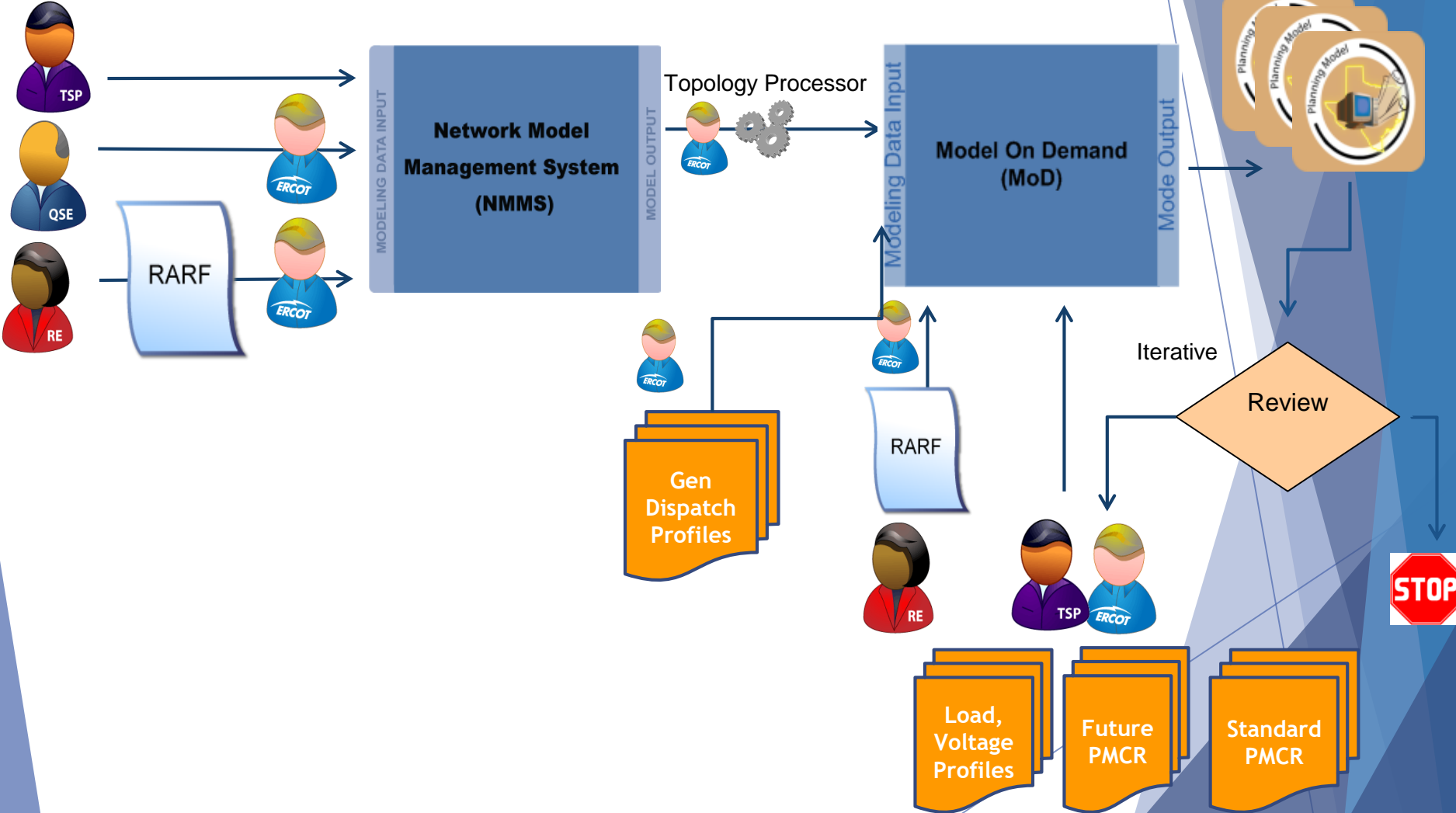
▶ Consistent Data - Converting an Operational model guarantees consistency

ERCOT Network Model Build Process

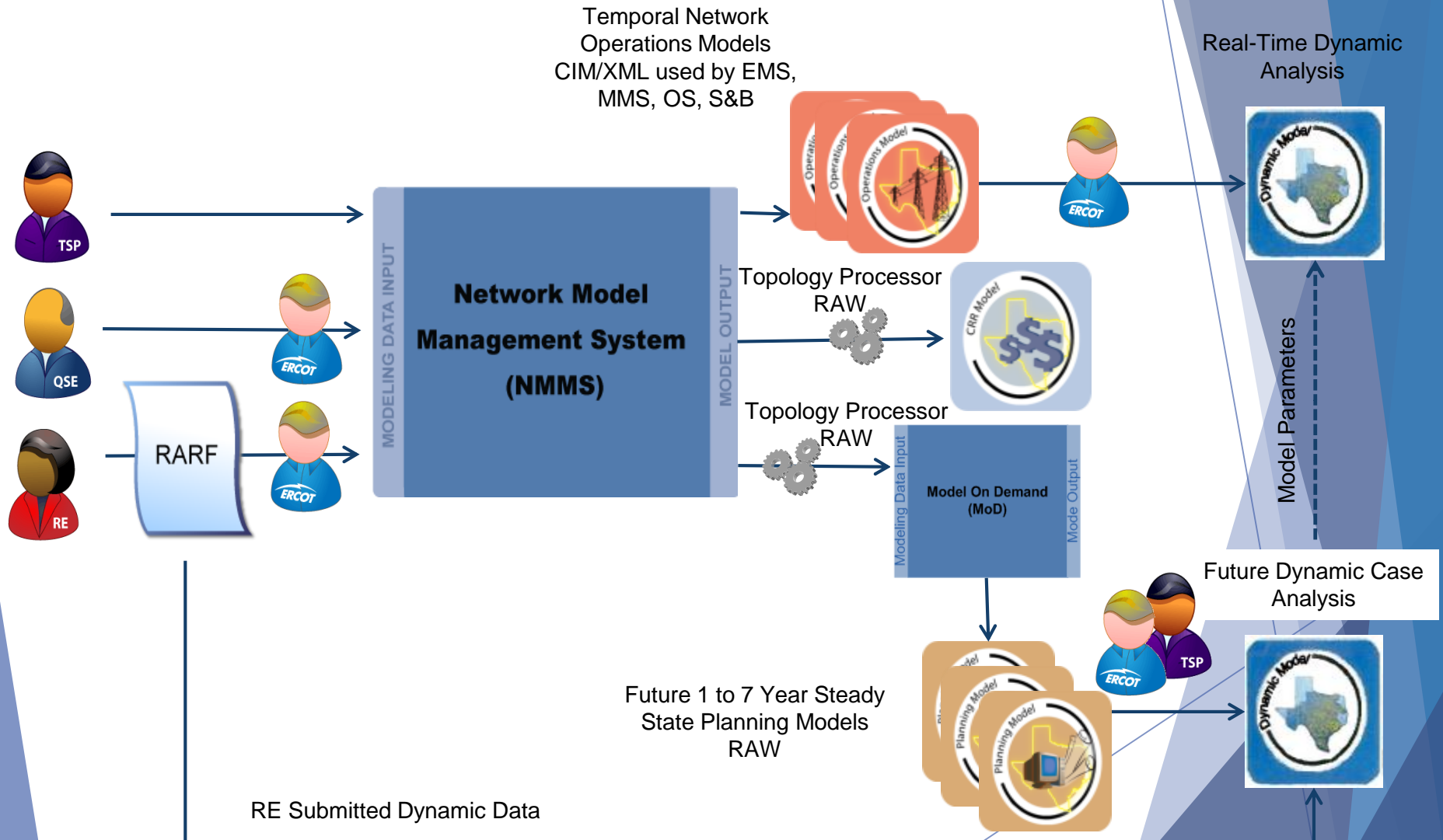


- All activities are executed in a Test Model Development environment using the latest available Production data snapshot.

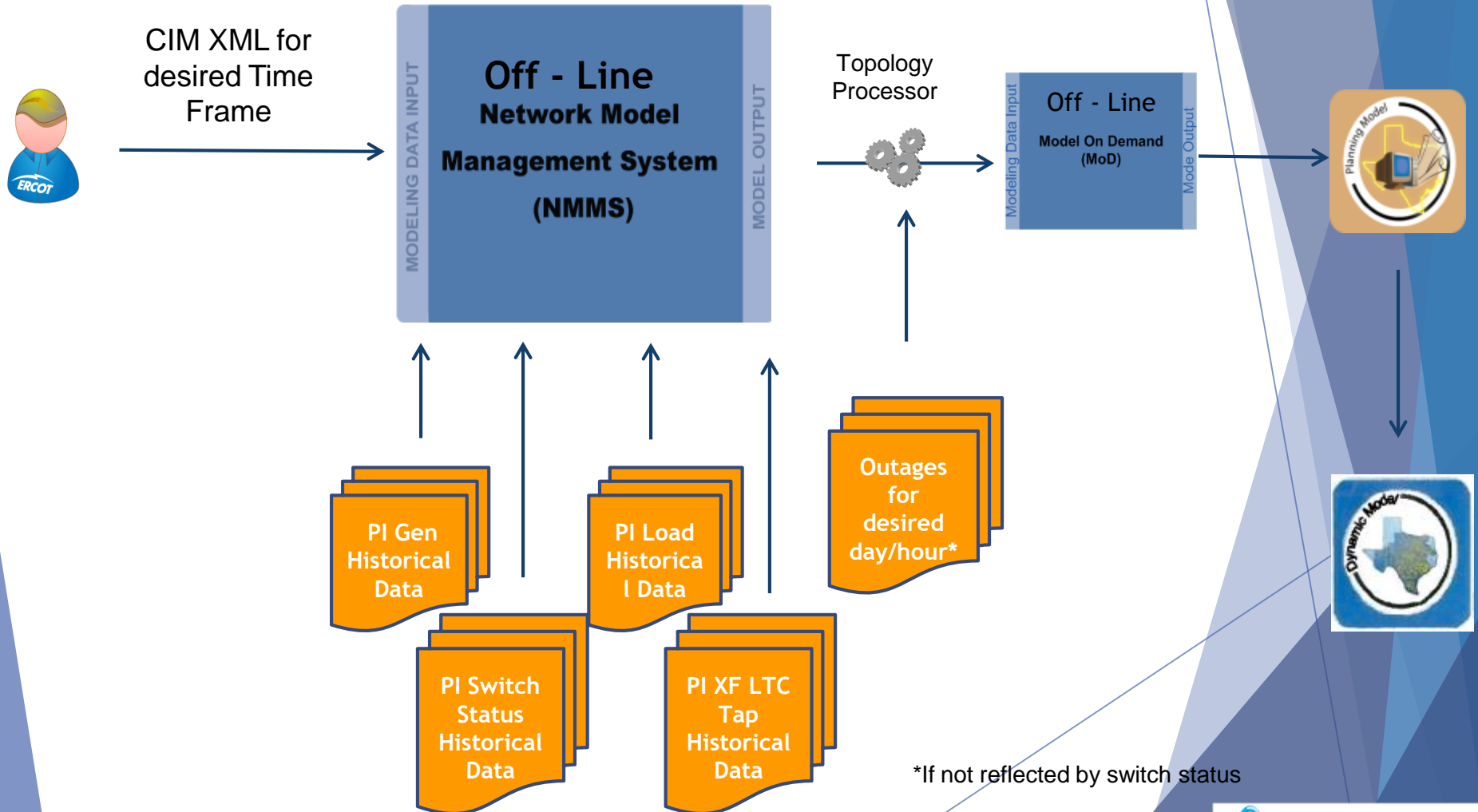
ERCOT Steady State Planning Model Creation Process



ERCOT Dynamic Model Creation Process



ERCOT Model Re-creation for Validation

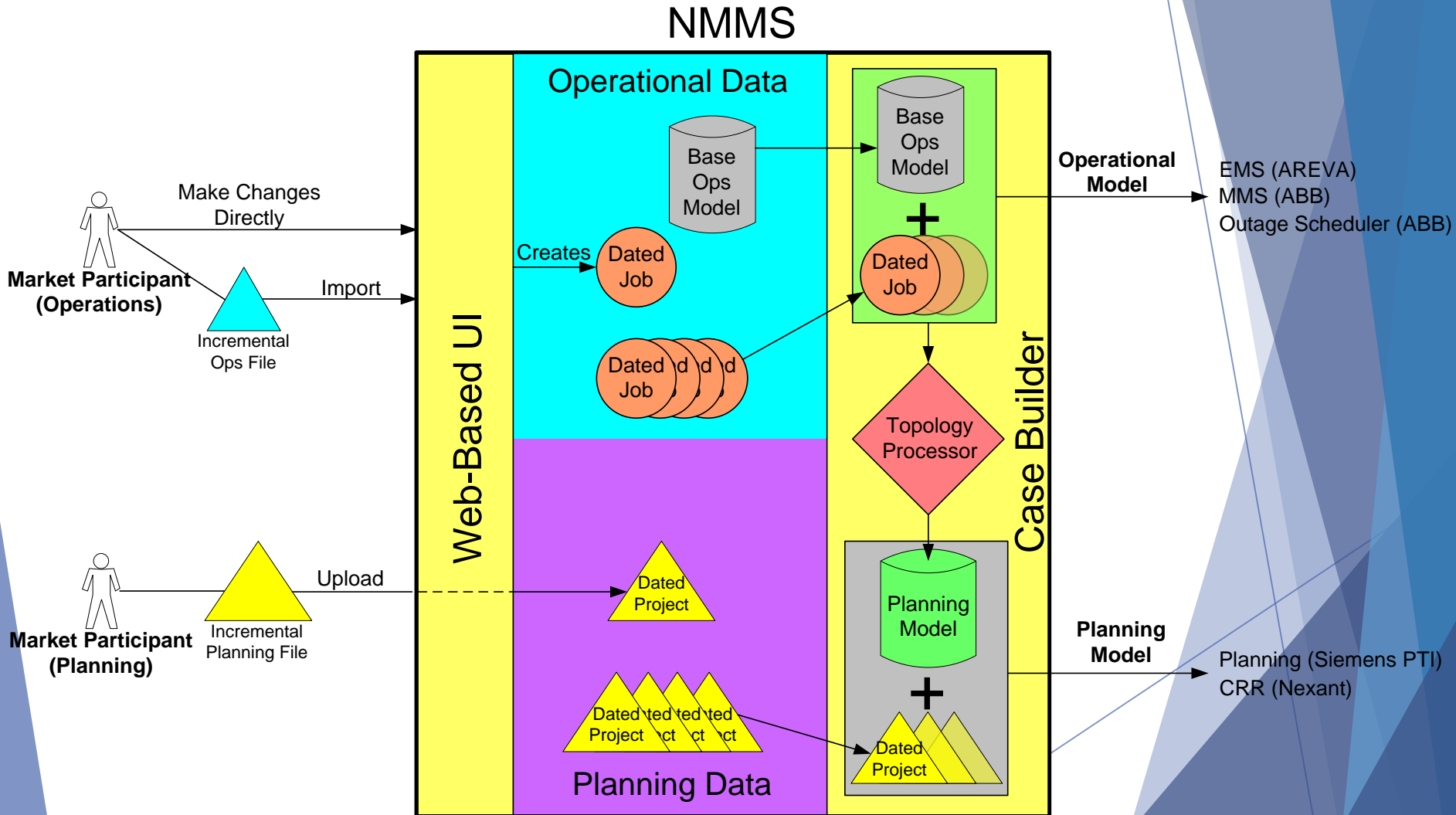


*If not reflected by switch status

Stakeholder Submissions

- ▶ ERCOT Stakeholders include:
 - ▶ Transmission/Distribution Service Provider (TSP)
 - ▶ Qualified Scheduling Entity (QSE)
 - ▶ Resource Entity (RE or Generators)
- ▶ QSEs and REs must submit their data through an ERCOT representative and do not have access to the NMMS directly. The ERCOT network modelers take their data and input it into the NMM system.
- ▶ TSPs may submit their data in one of 2 ways:
 - ▶ Online through the Portal using a One-Line Editor
 - ▶ Submission of CIM/XML incremental instance files per the IEC standards.

NMMS Stakeholder Submissions



Summary

- ▶ The set of requirements faced by ERCOT is not exactly the same as for other ISO/RTOS.
- ▶ ISO/RTO requirements are not the same as TSO requirements.
- ▶ However, there is a lot of overlap and the same underlying design principles can be applied.
- ▶ ERCOT NMMS did not do everything right, but it is a success!
- ▶ It demonstrates that planning, operations and markets can share common modeling source data to their mutual benefit.
- ▶ It demonstrates that a group of entities in an interconnection can coordinate modeling, to everyone's benefit

Thanks!



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