

ERCOT's NMMS - Network Model Management in Action

**Margaret E. Goodrich
Project Consultants, LLC**

ERCOT NMM

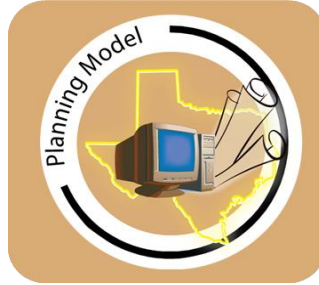
- ▶ The ERCOT System
- ▶ NMMS Overview & Key Functionality
- ▶ Stakeholder Model Update Submissions

ERCOT Models



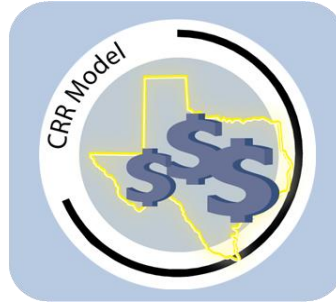
Network Operations Model

- 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

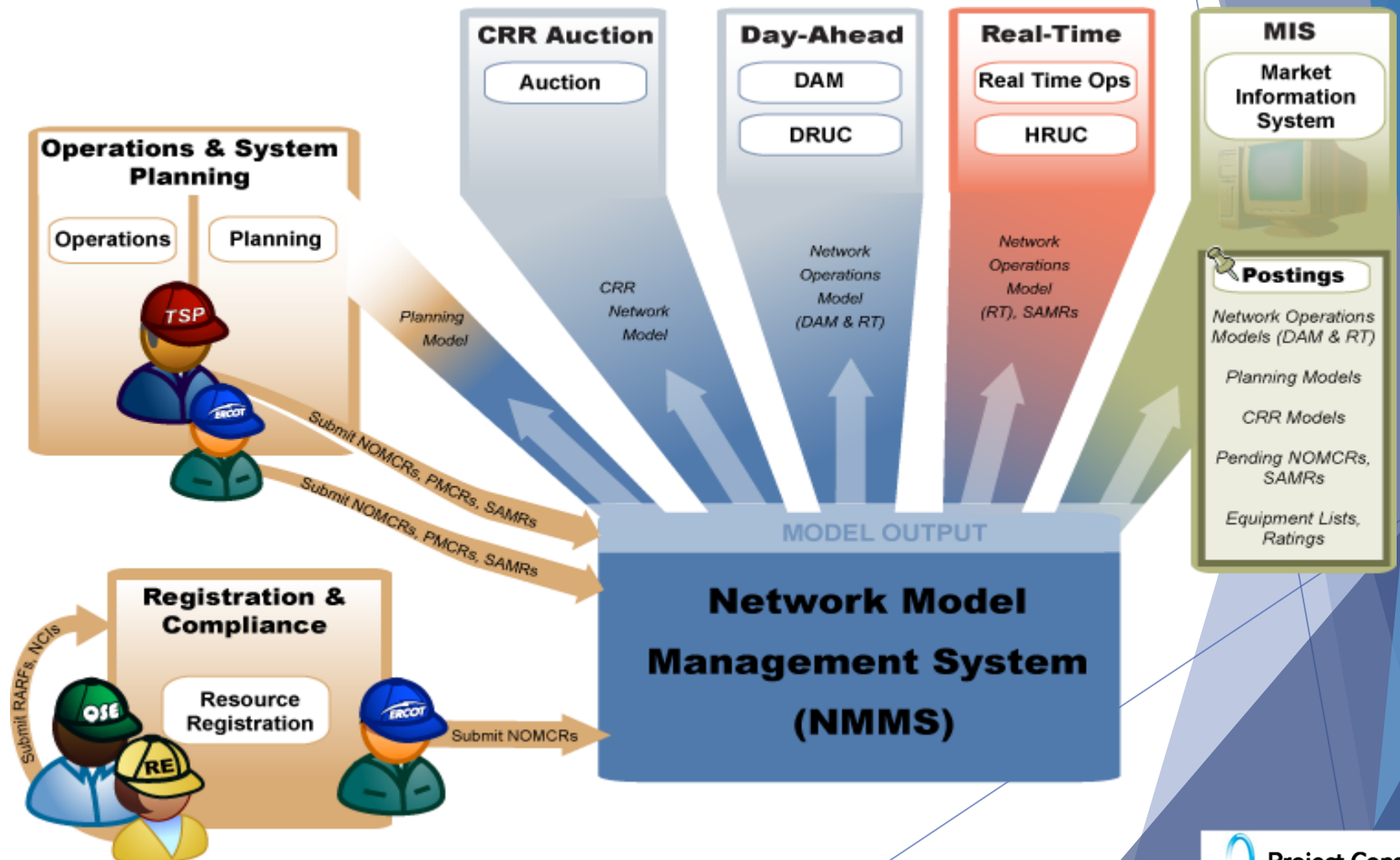


Dynamics Model

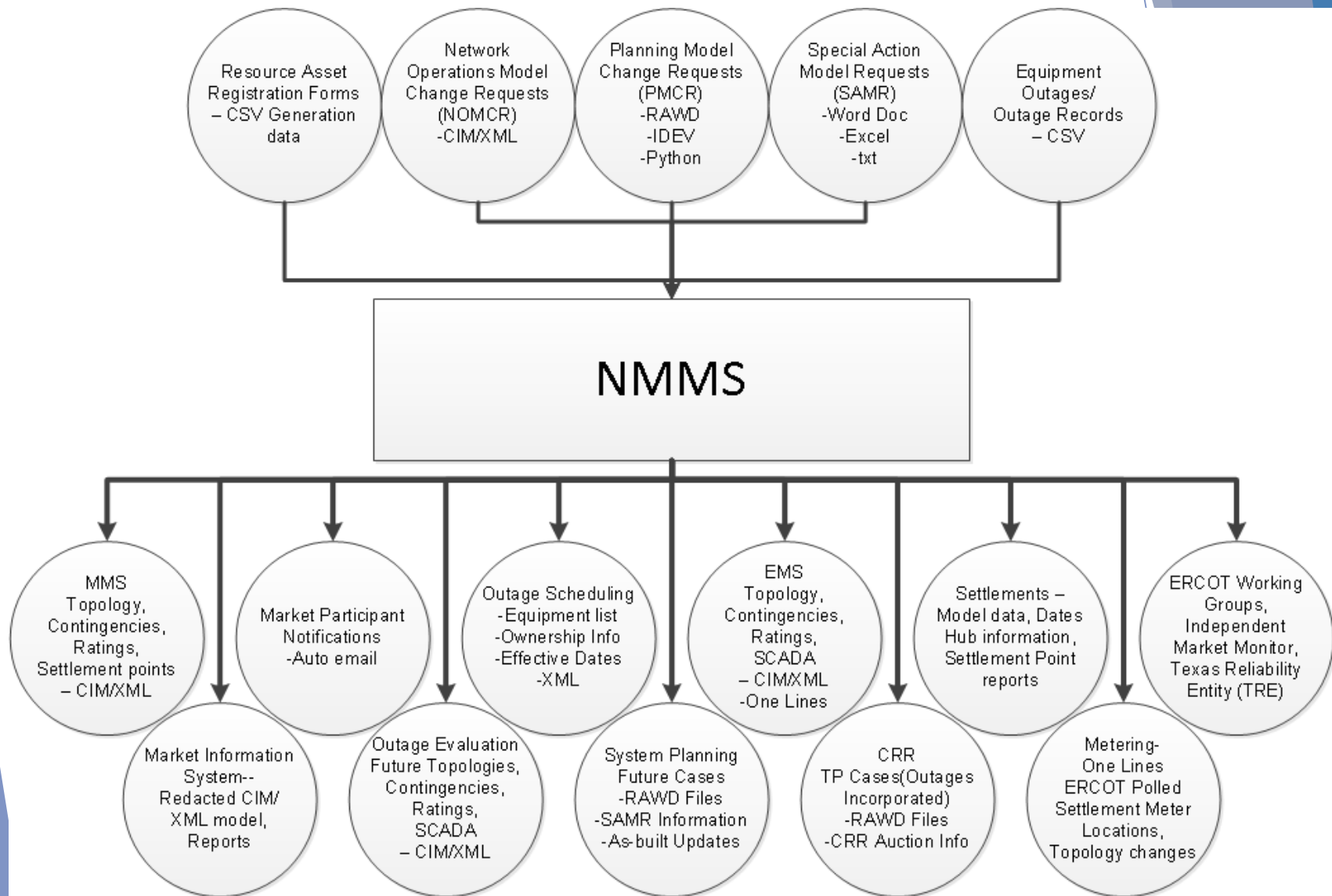
- Stability Analysis

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)



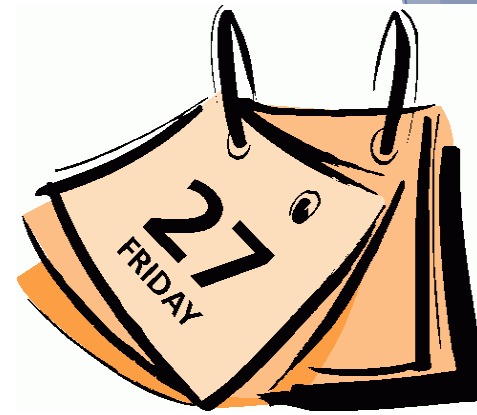
What Does NMMS Do?



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 | Logout

Company: ERCOT

Network Model Management System

CreateNOMCR

Project Information

PID #

3

Project Name

kdt

Project Owner

ERCOT

Short Description

sdsdsg

Full Description

Project Complete

☐

Created By:

MSPVEDE2

DEC 01, 2008 11:43:09 CST

Last Saved By:

MSPBADA2

DEC 01, 2008 11:43:09 CST

View History

NOMCR Information

EDITING

NOMCR ID #

3_1

NOMCR Status

SUBMITTED

Owner Name

ERCOT

Assigned To

Created By:

MSPVEDE2

DEC 01, 2008 11:43:17 CST

Last saved By:

MSPBADA2

DEC 08, 2008 14:14:08 CST

Dynamic Rating Changes Only

☐

View History

* 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

☒ None

Select NOMCRs

0 Attached

View Dependent NOMCRs

* Dependent SAMRs

☒ None

Select SAMRs

0 Attached

View Dependent SAMRs

* Associated PMCR

☒ None

Select PMCR

0 Attached

View Associated PMCR

Upload

CIM XML

Browse

Import

Launch Model Editor

Related Information

Browse

Upload

Submit NOMCR

Validate IMM data

Submit NOMCR

Create / View Comments

Validation Log

Remove Private Changes

Withdraw

Delete

Cancel

Save

File uploaded successfully

PTC: Create NOMCR Screen (Details)

The screenshot displays the 'Create NOMCR' screen in the PTC Network Model Manager. The interface is divided 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 box highlights this section.
- Dependency:** Sections for Dependent NOMCRs, Dependent SAMRs, and Associated PMCR, each with a 'None' checkbox, a 'Select' button, and a 'View' button.
- Upload:** Fields for CIM XML and Related Information, with 'Browse', 'Import', and 'Upload' buttons.
- Submit NOMCR:** Buttons for 'Validate IMM data', 'Submit NOMCR', 'Remove Private Changes', 'Withdraw', 'Delete', 'Cancel', and 'Save'.

A status bar at the bottom indicates '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

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

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

[View History](#)

NOMCR Information EDITING

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

NOMCR Name sdfgsdfg
Energization Date 12/24/2008
Short Description sdfgsdfg
Full Description

Description of change for interim

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 **Browse** **Import** **Launch Model Editor**

Related Information **Browse** **Upload** Related Information file names

Submit NOMCR

Validate IMM data **Submit NOMCR**

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

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

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

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

[View History](#)

NOMCR Information EDITING

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

Dynamic Rating Changes Only ☐
Created By: MSPVEDE2 DEC 01, 2008 11:43:17 CST
Last saved By: MSPBADA2 DEC 08, 2008 14:14:08 CST

[View History](#)

*** NOMCR Name** sdfgsdfig
*** Energization Date** 12/24/2008
*** Short Description** sdfgsdfig
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 [Select NOMCRs](#) 0 Attached [View Dependent NOMCRs](#)
*** Dependent SAMRs** ☒ None [Select SAMRs](#) 0 Attached [View Dependent SAMRs](#)
*** Associated PMCR** ☒ None [Select PMCR](#) 0 Attached [View Associated PMCR](#)

Upload

CIM XML [Browse](#) [Import](#)
Related Information [Browse](#) [Upload](#) Related information file names

Submit NOMCR

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

[Remove Private Changes](#) [Withdraw](#) [Delete](#) [Cancel](#) [Save](#)

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: sdfgsdfg
* Energization Date: 12/24/2008
* Short Description: sdfgsdfg
Full Description:

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

Dependency

* Dependent NOMCRs: ☒ None [Select NOMCRs](#) 0 Attached [View Dependencies](#)
* Dependent SAMRs: ☒ None [Select SAMRs](#) 0 Attached [View Dependencies](#)
* Associated PMCR: ☒ None [Select PMCR](#) 0 Attached [View Associations](#)

Upload

CIM XML: [Browse](#)
Related Information: [Browse](#)

Submit NOMCR

[Validate IMM data](#)
[Submit NOMCR](#)

[Remove Private Changes](#) [Withdraw](#) [Delete](#) [Cancel](#) [Save](#)

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)

The screenshot displays the 'Project Tracker and Coordinator' web application. The top navigation bar includes the ERCOT logo, user information (Hello, NIMAGO), and company name (Company ERCOT). The main menu has tabs for 'Project Summary', 'Case Builder', 'Archive Summary', 'Name Service', and 'Notices'. The 'Case Builder' tab is active, showing sub-tabs for 'Test Model Generator', 'Production Model Generator', 'CRR/Planning Model Generator', and 'Historical Model Generator'. The 'Test Model Generator' sub-tab is selected.

The 'Model Information' section is highlighted with a red box and contains the following fields:

- Model Id: [Empty field] [Cancel Create]
- Model Name: [CIM_07_1_1_04112011]
- Model Date: [4/11/2011] [Select NOMCRs]
- Description: [CIM_07_1_1_04112011]

The 'Model Building and Validation' section contains the following buttons:

- Build Model
- Load TNA
- Erase Model

A red text label 'Build Model' is positioned to the right of the 'Build Model' button.

The 'Generate Model files' section includes a 'Browse' button and two buttons: 'Generate RDF file w/o outages' and 'Generate RDF file with outages'.

The 'List of NOMCRs' section features a 'Load OS' button, a 'Select All' button, a 'Clear All' button, and a 'Filter' button. Below these buttons is a table with the following data:

| 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) | Reconfigur |
| <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

* Model Name:

Model Date:

* Description:

Existing Models

Select Column | Select Operatr | Type in data

| 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

Generate Model files

☒ complete_05
☐ ems_mms_05
☒ settlezones
☒ os-profile_05

Included NOMCRs

Select Column | Select Operatr | Type in data

| ChangeRequest_ID | Project_Name | |
|------------------|--|-------------------|
| 10447_1 | Validation Update 7_1 | Val |
| 10425_1 | LCRA Dynamic line rating update 138kv Phase 2 | LCRA Dynamic li |
| 10303_1 | REG2NMMS Synch Edate 04022011 1 Company Delete | REG2NMMS Synch |
| 9716_1 | Line 6360_E Ratings Change | Ratings upgrade t |
| 9519_1 | SAMR 9353_1 SCSES RARF Update | SAMR 935 |

Export Model

Future Model Creation

▶ Creating an Operations Model

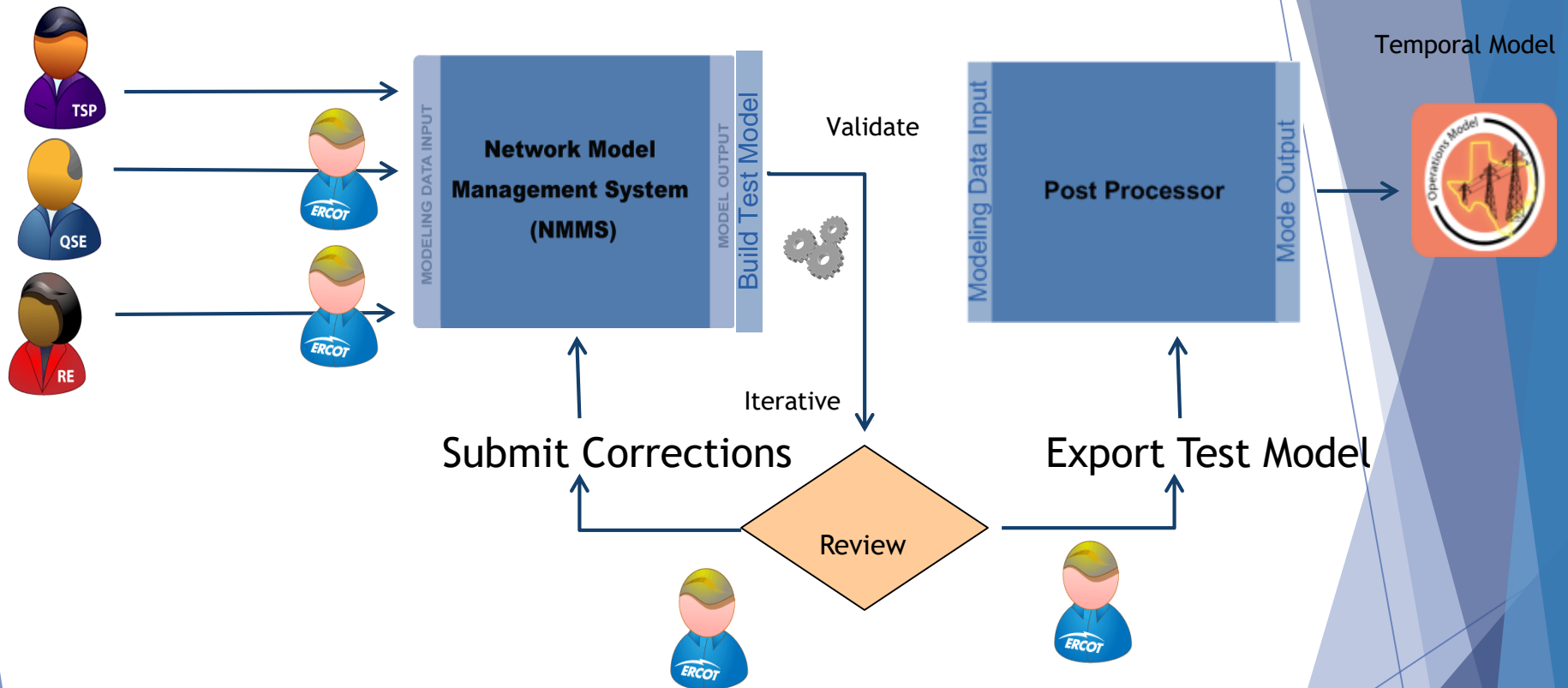
- ▶ The model is created by applying all the incremental changes that occur between the current and future dates to the base model

▶ 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

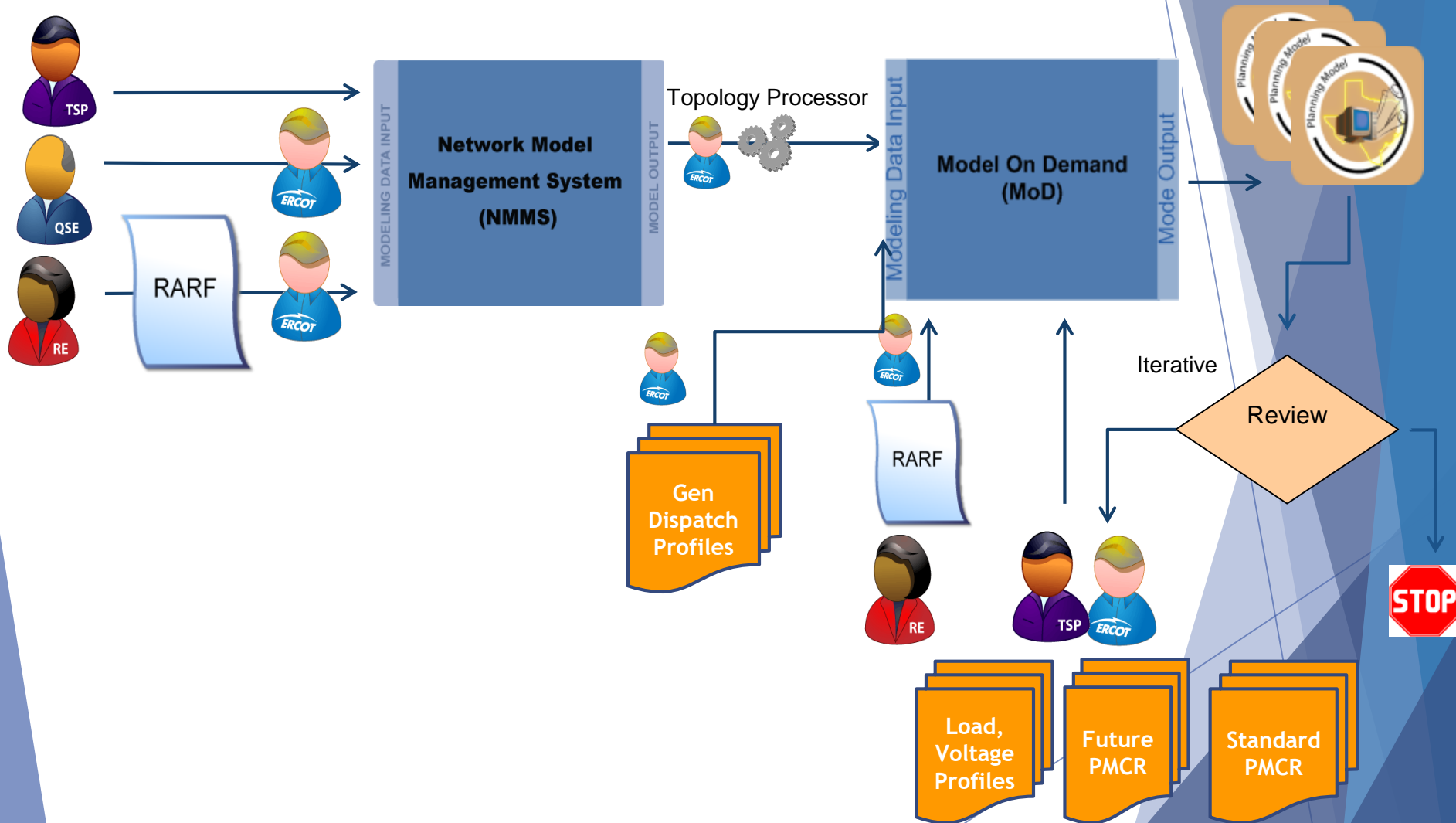
▶ Consistent Data - Converting an Operational model guarantees consistency

ERCOT Network Model Build Process

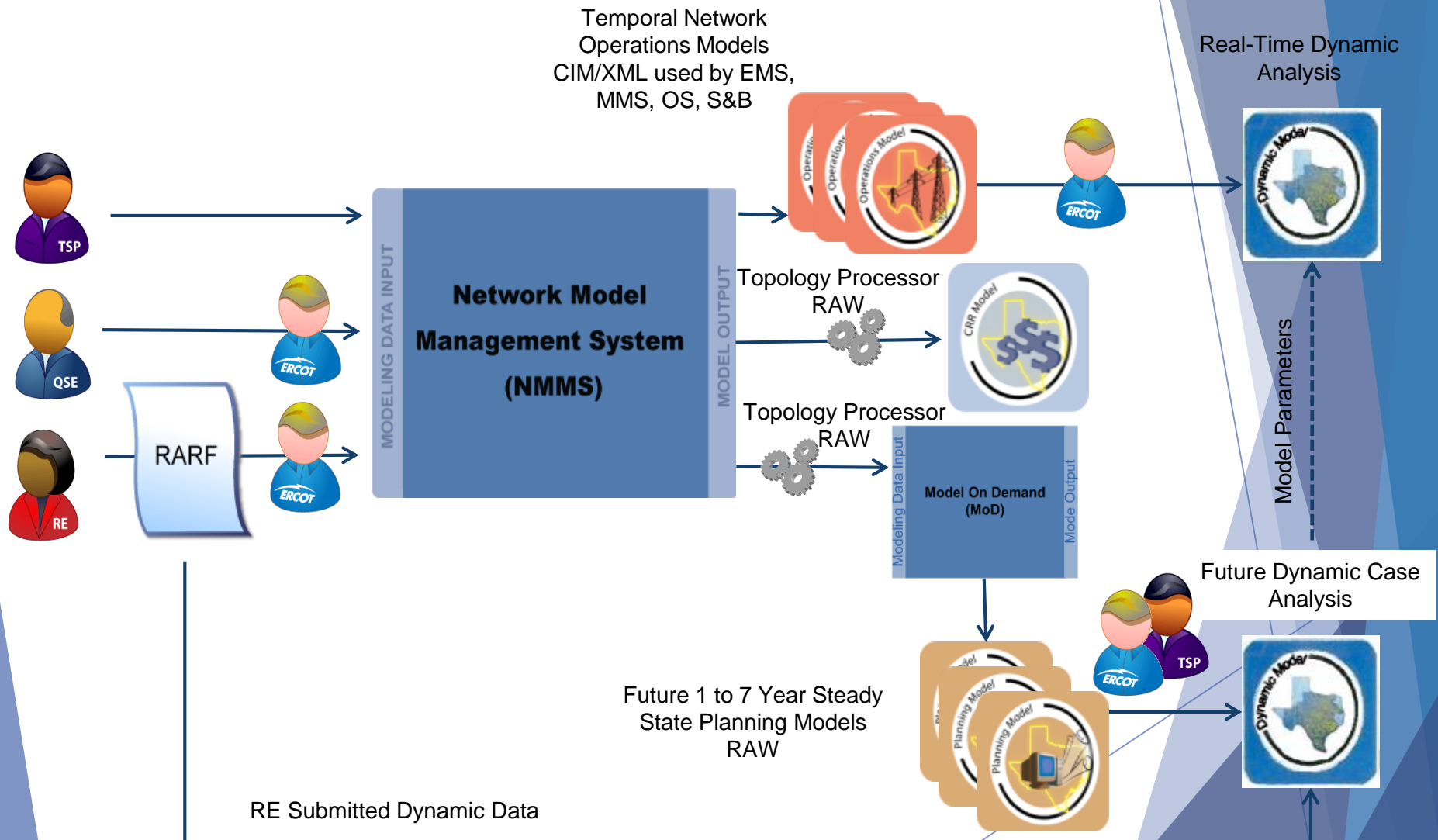


- All activities are executed in a Test Model Development environment using the latest available Production data snapshot.

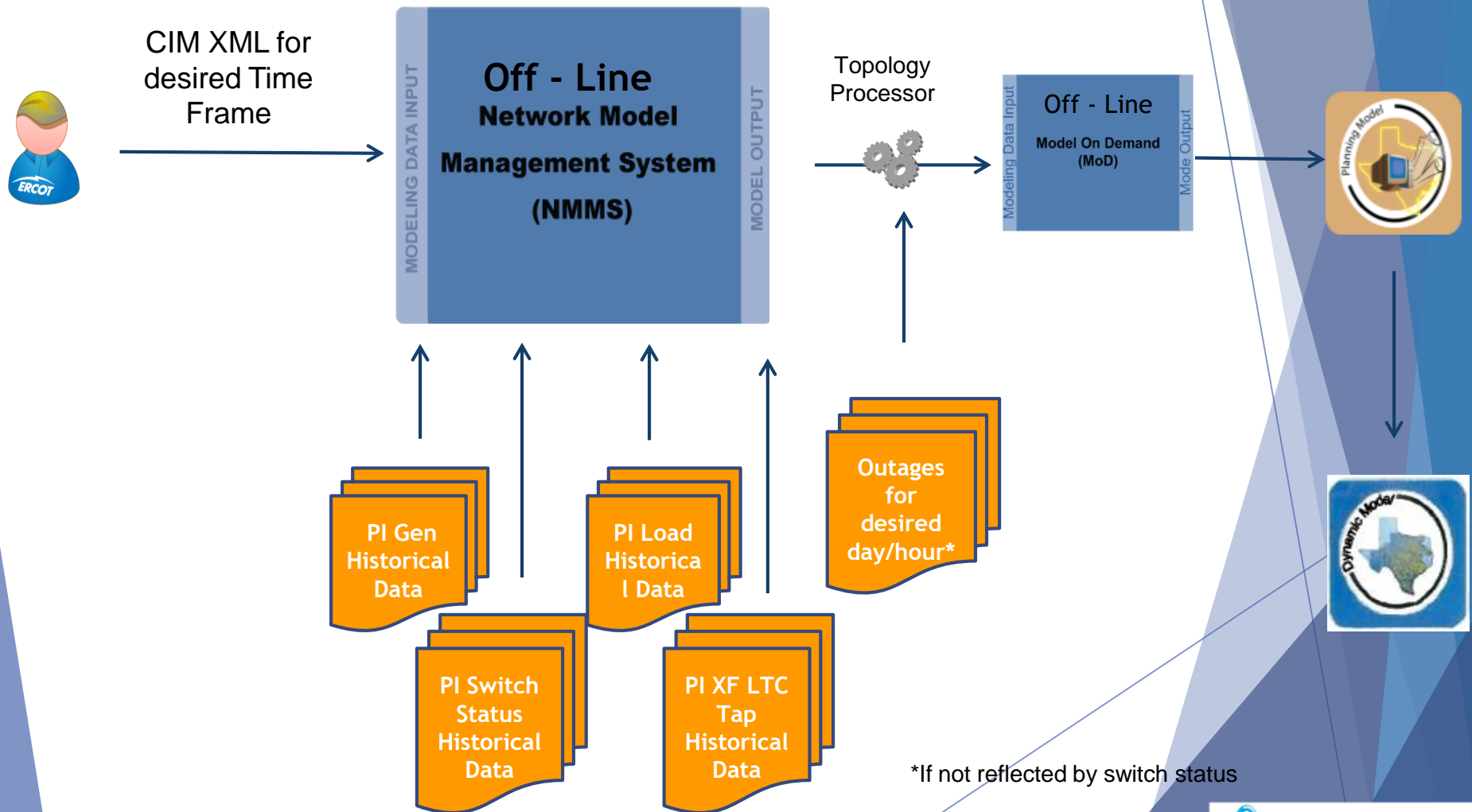
ERCOT Steady State Planning Model Creation Process



ERCOT Dynamic Model Creation Process



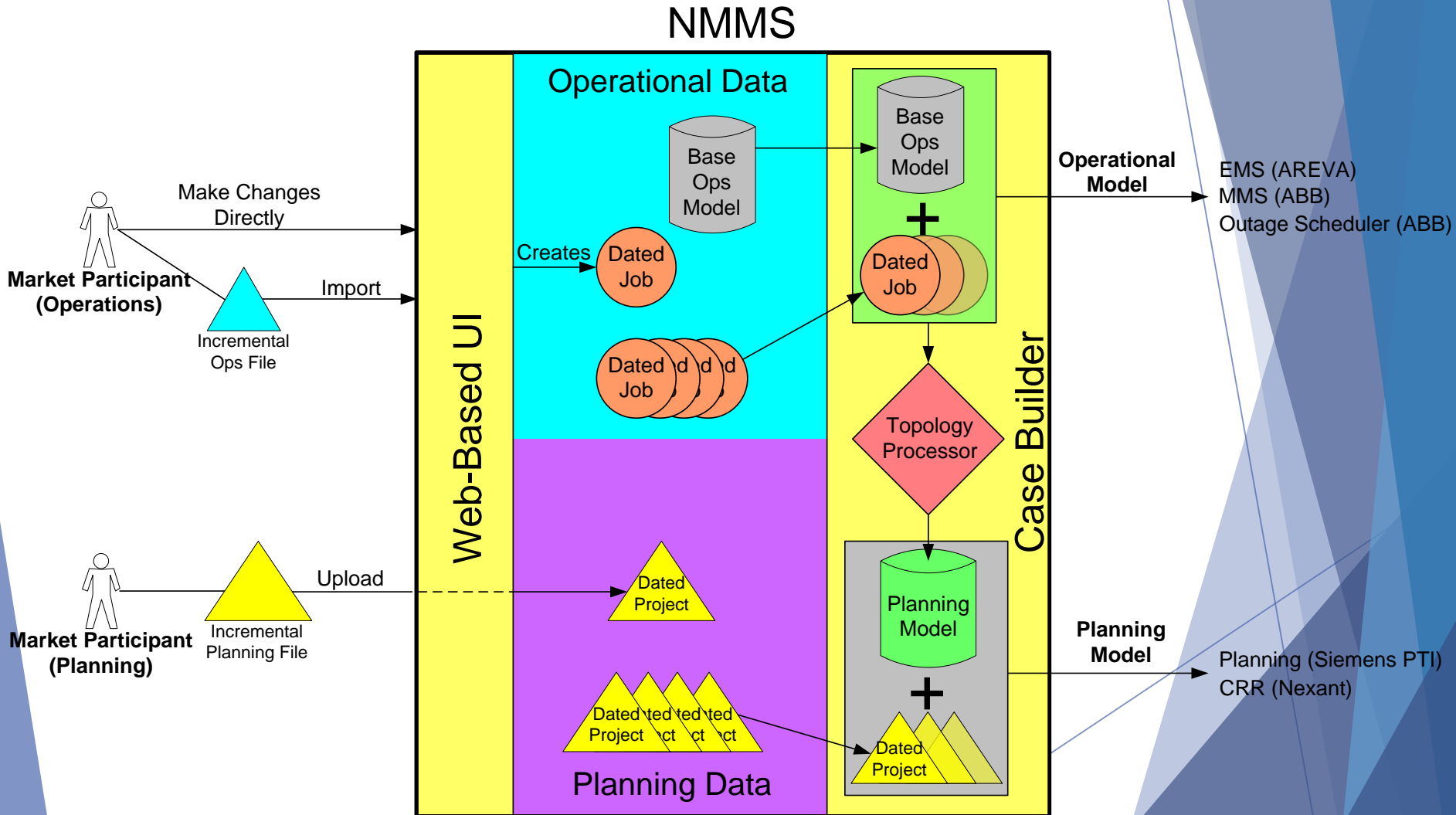
ERCOT Model Re-creation for Validation



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!



Margaret E Goodrich
Project Consultants, LLC
margaret@projectconsultantsusa.com
+1-903-477-7176