



Network Model Manager Requirements Overview

Smart Grid Information Sharing Webcast

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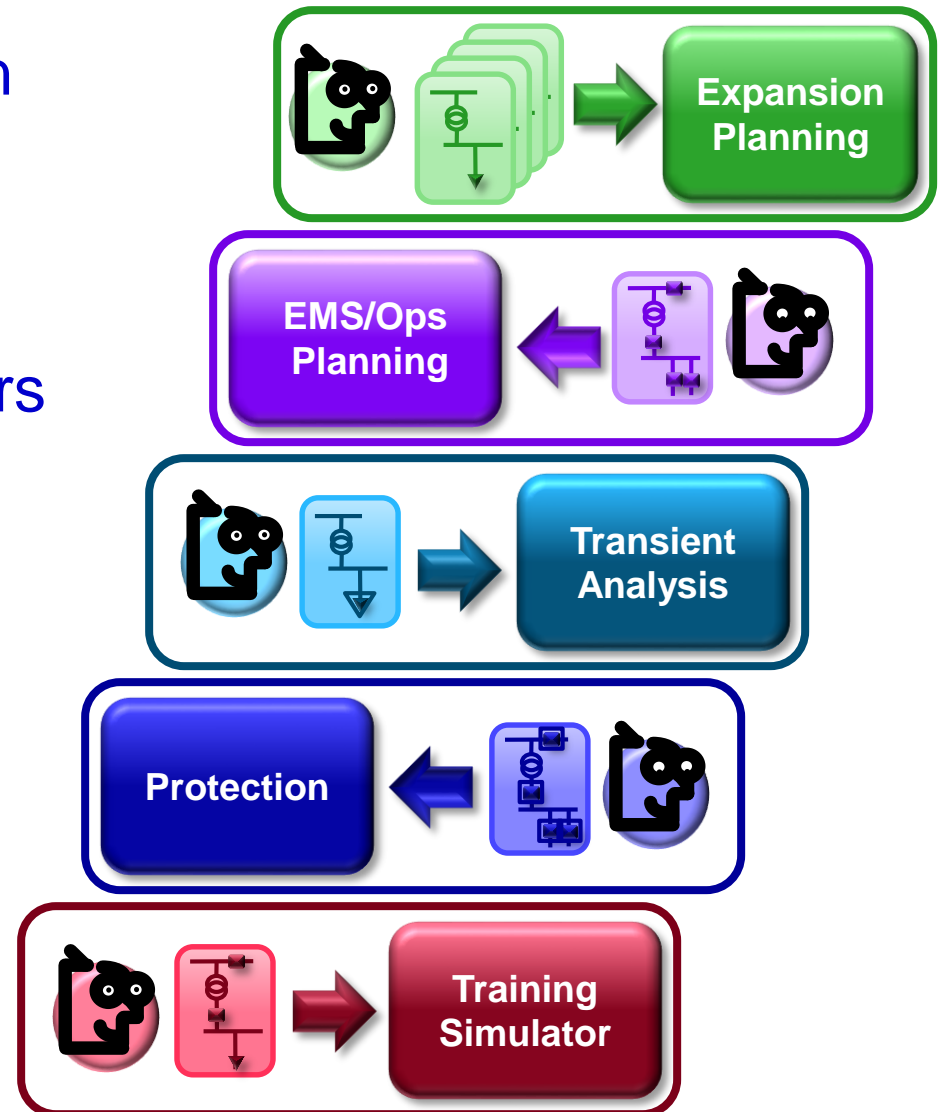
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Transmission Network Model Management In Support of Reliability

- Every tool requires its own network model, in its own format
- Every tool has its own users and maintainers
- **Silos are both technical and organizational**



Transmission Network Model Management

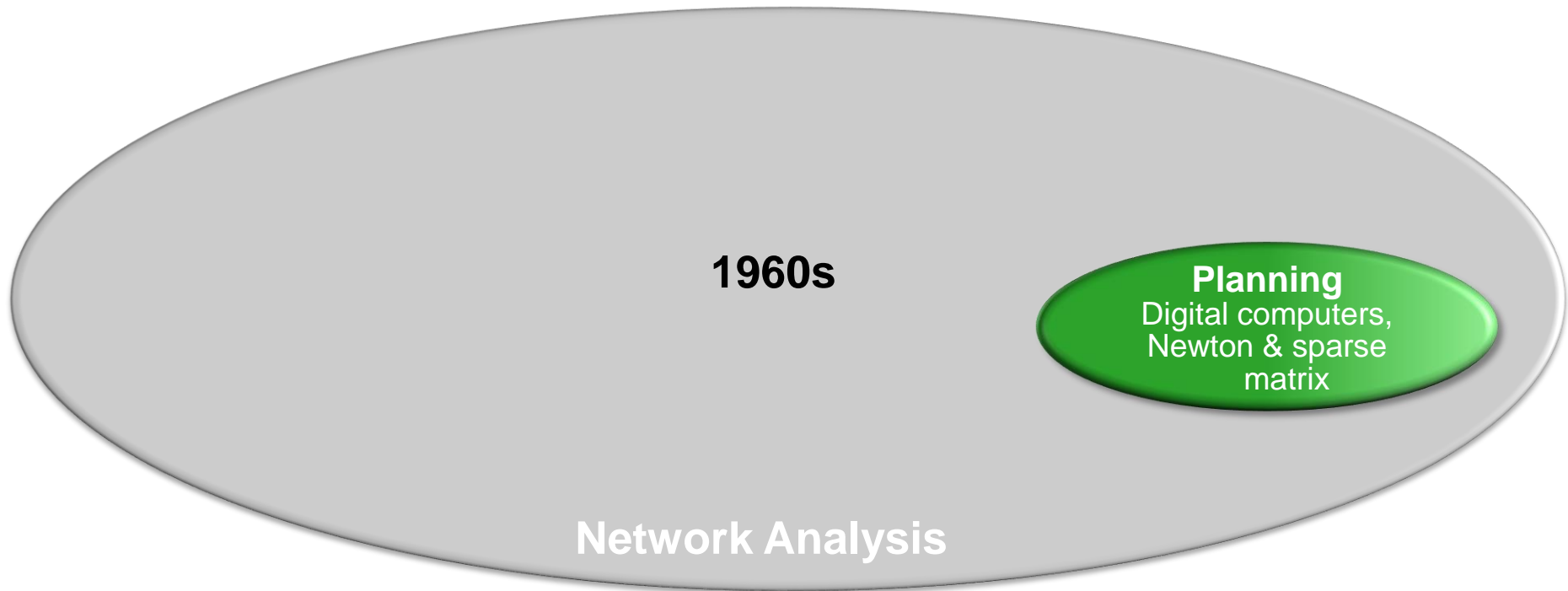
Technical & Organizational Silos

- Silos cause:
 - Duplicate effort
 - Synchronization problems
 - Consistency issues
 - “Trapped” data

**Lots of energy invested in unproductive work
Errors can go unrecognized**

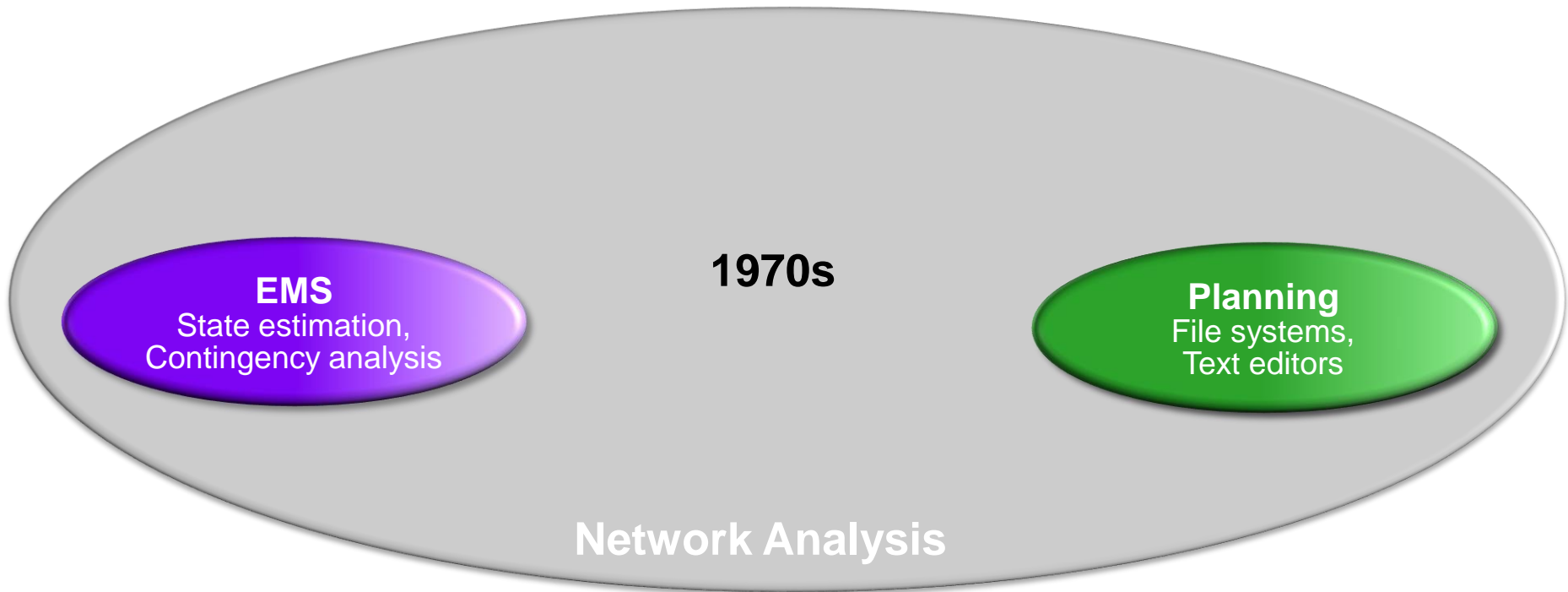
Transmission Network Model Management Background

- Network Analysis landscape since 1960s



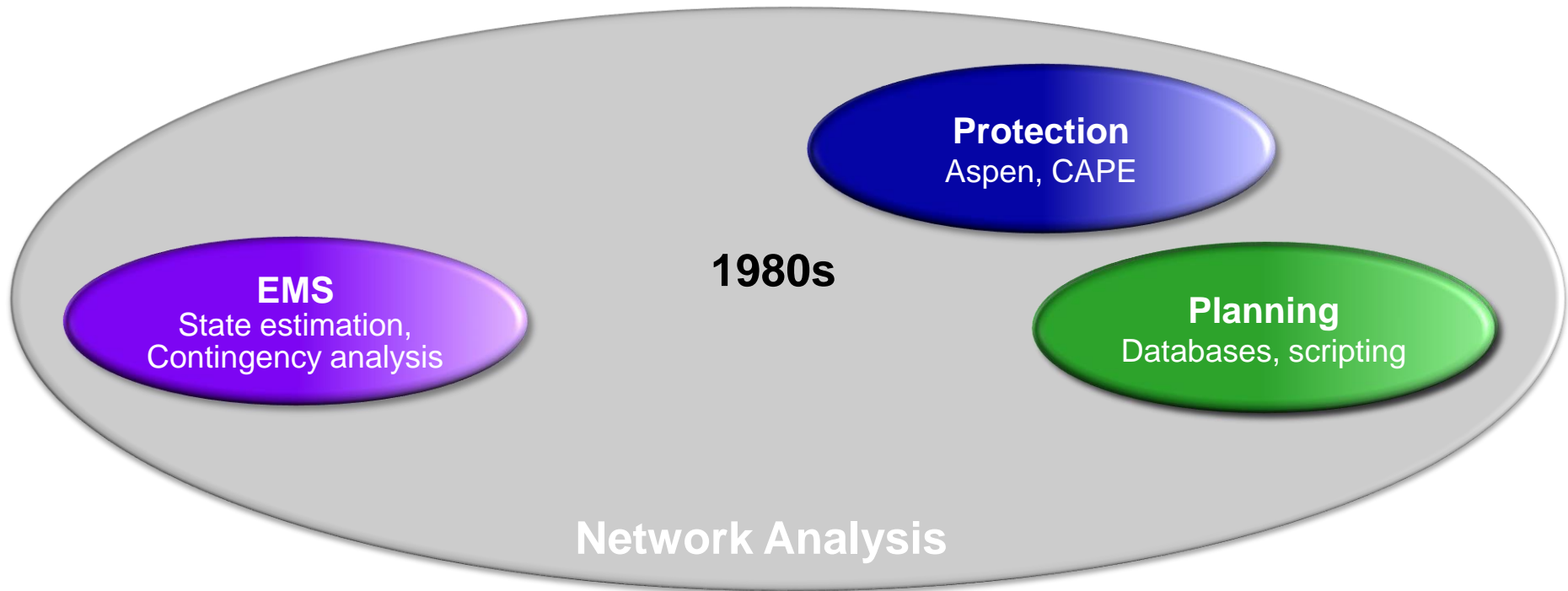
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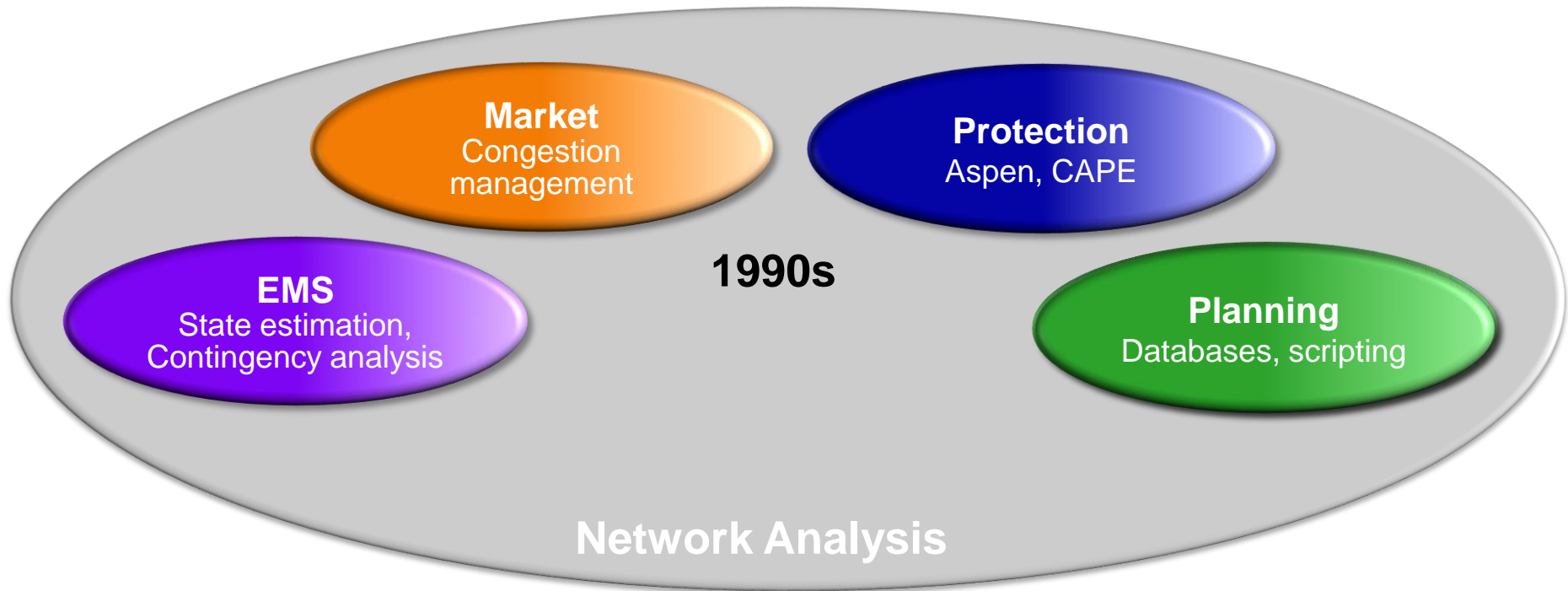
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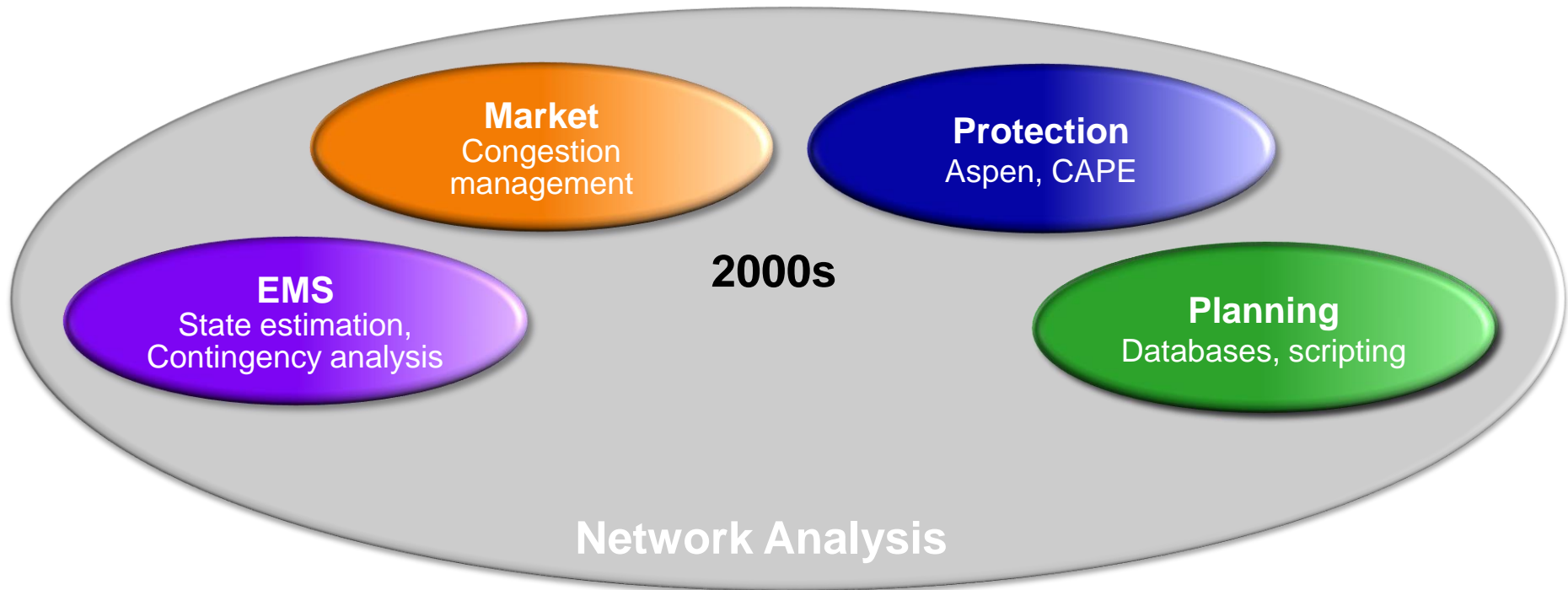
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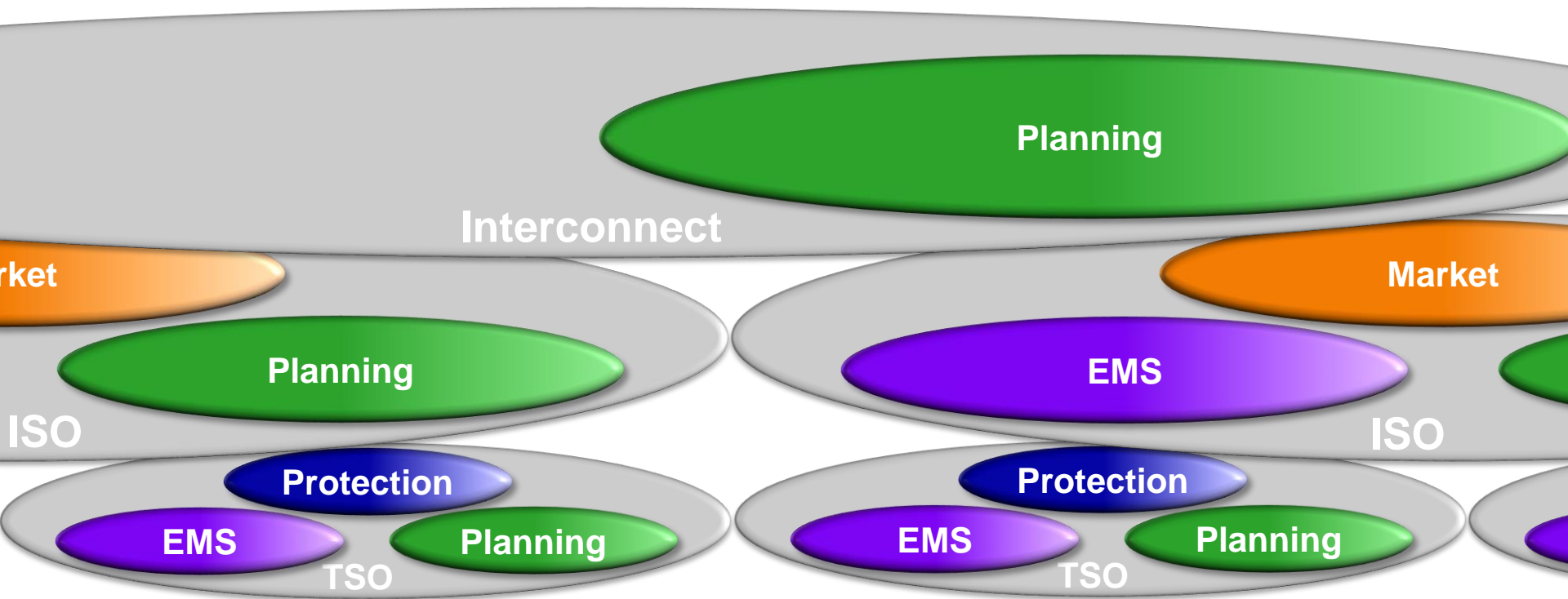
Transmission Network Model Management Background

- Network Analysis landscape since 1960s
 - More and more silos



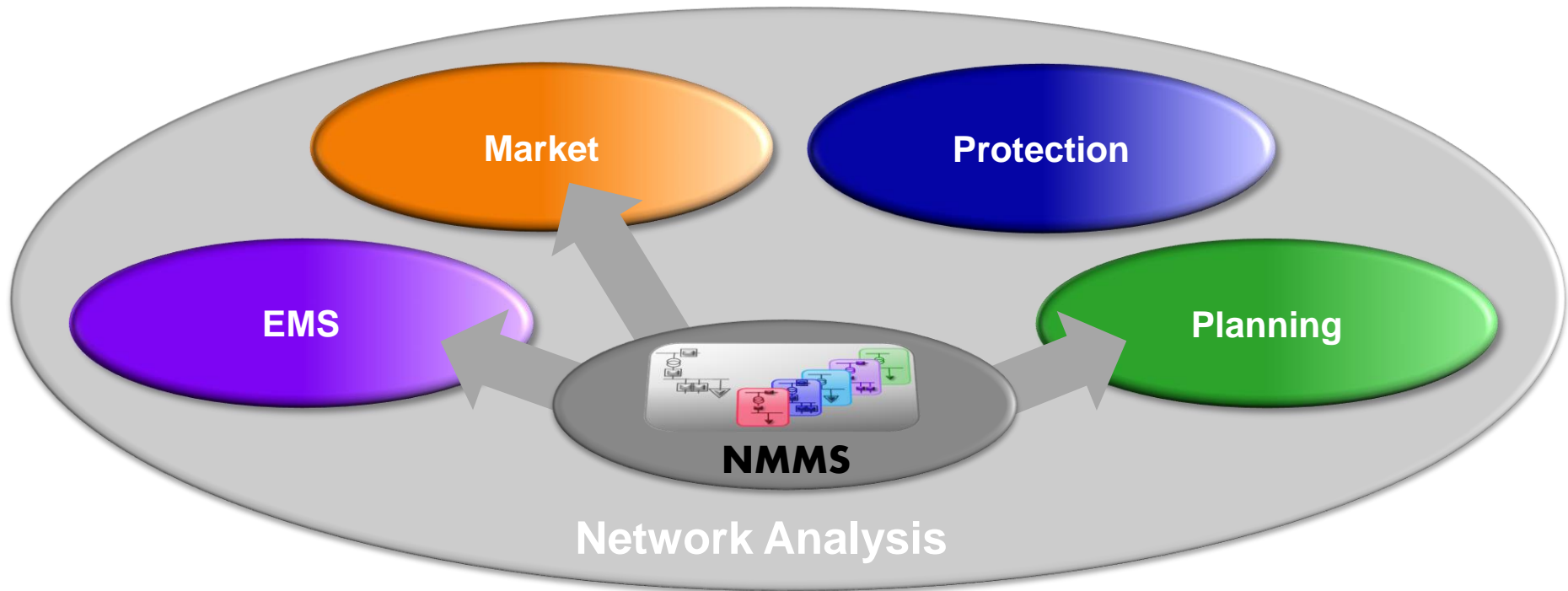
Transmission Network Model Management Industry Landscape

- Silos at multiple levels – TSO, ISO, Interconnect



Transmission Network Model Management Encouraging Developments

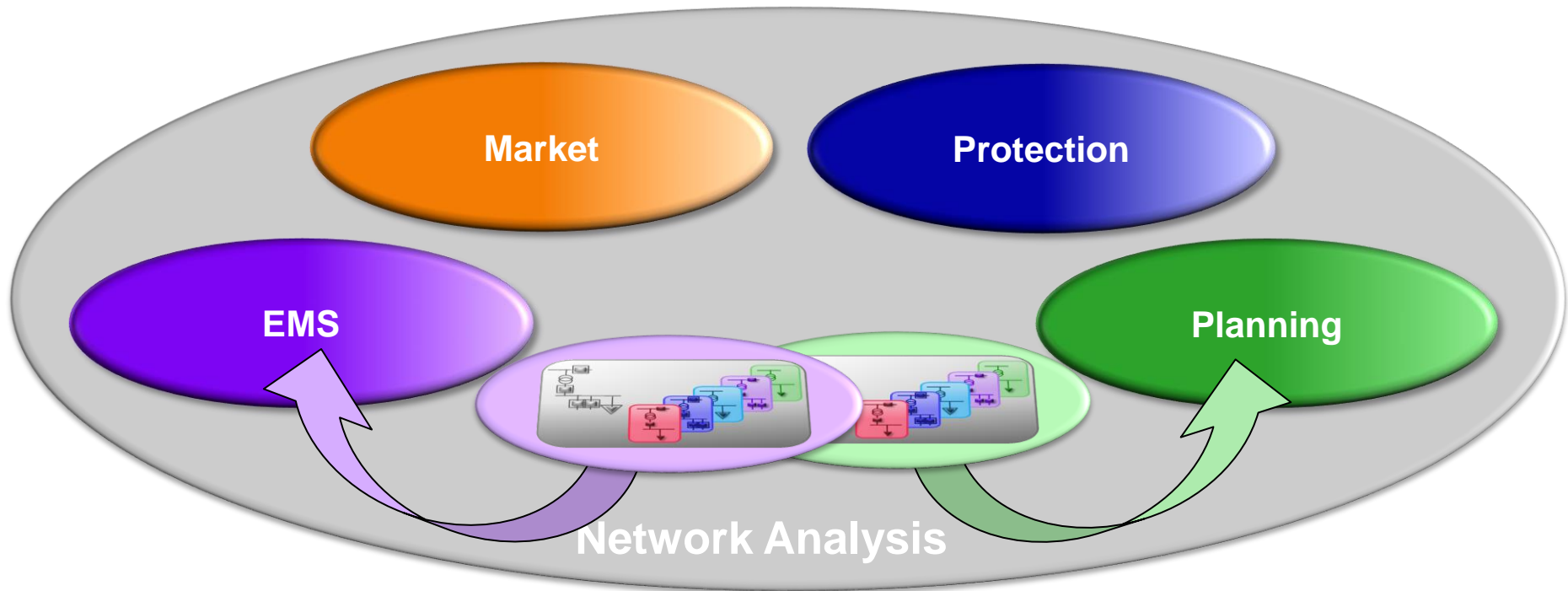
- Consolidated model management
 - ERCOT model management implementation



Transmission Network Model Management

Encouraging Developments

- Consolidated model management
 - ERCOT model management implementation
 - Product configuration tools



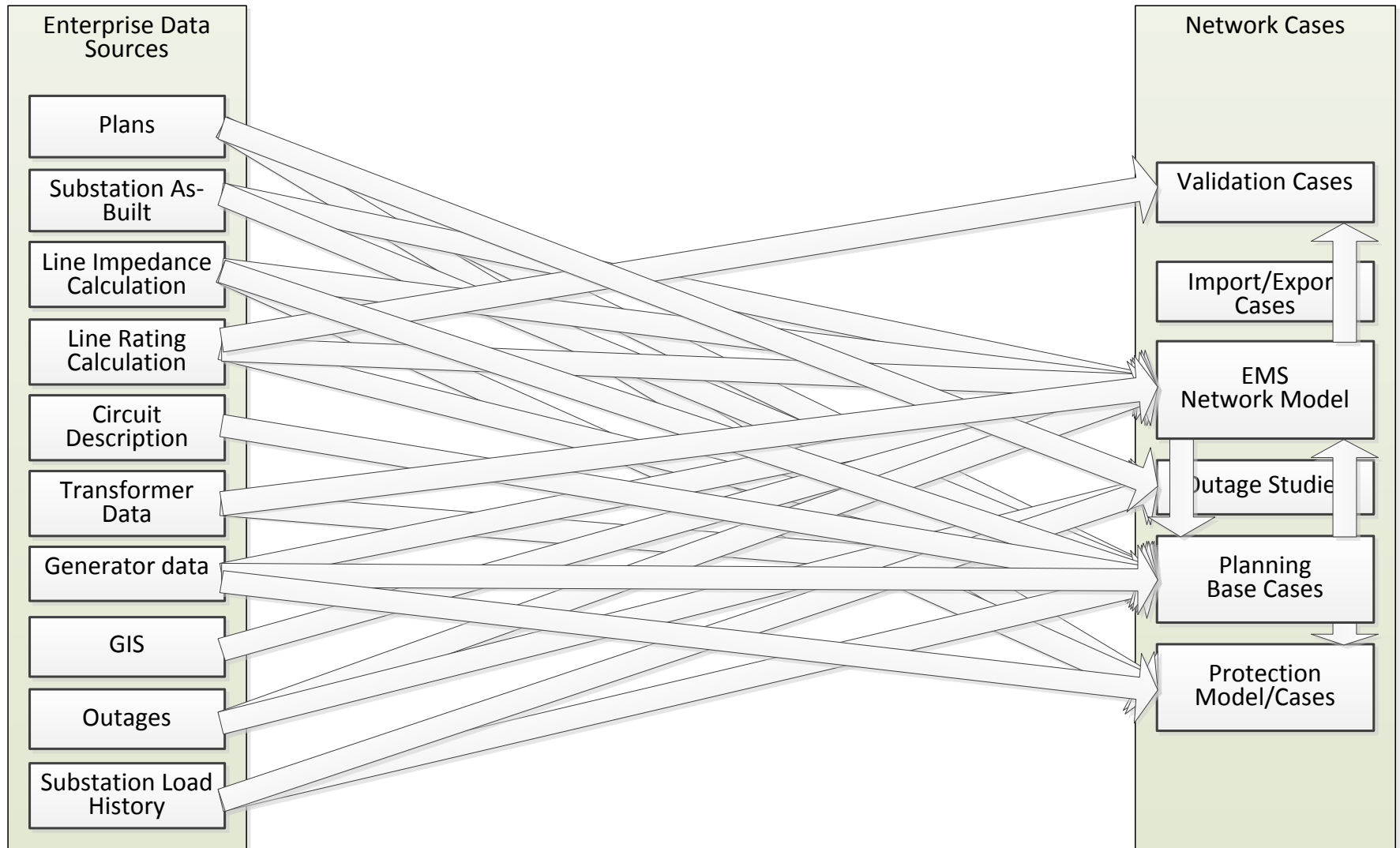
Transmission Network Model Management Support from the CIM

- Common Information Model (CIM) as foundation
 - Began as operational model in early 1990s
 - Support EMS components from different vendors
 - Became IEC Standard in mid-1990s
 - Understood as basis for semantic model for enterprise integration
 - Network model interoperability tests started in 2000 – more than 15 to-date
 - Planning (bus/branch) model added in 2008
 - Dynamics (transient behavior) model added in 2013
 - Projects, outage and contingency modeling are current topics
 - Now nearly robust enough to truly support NMM tool integration



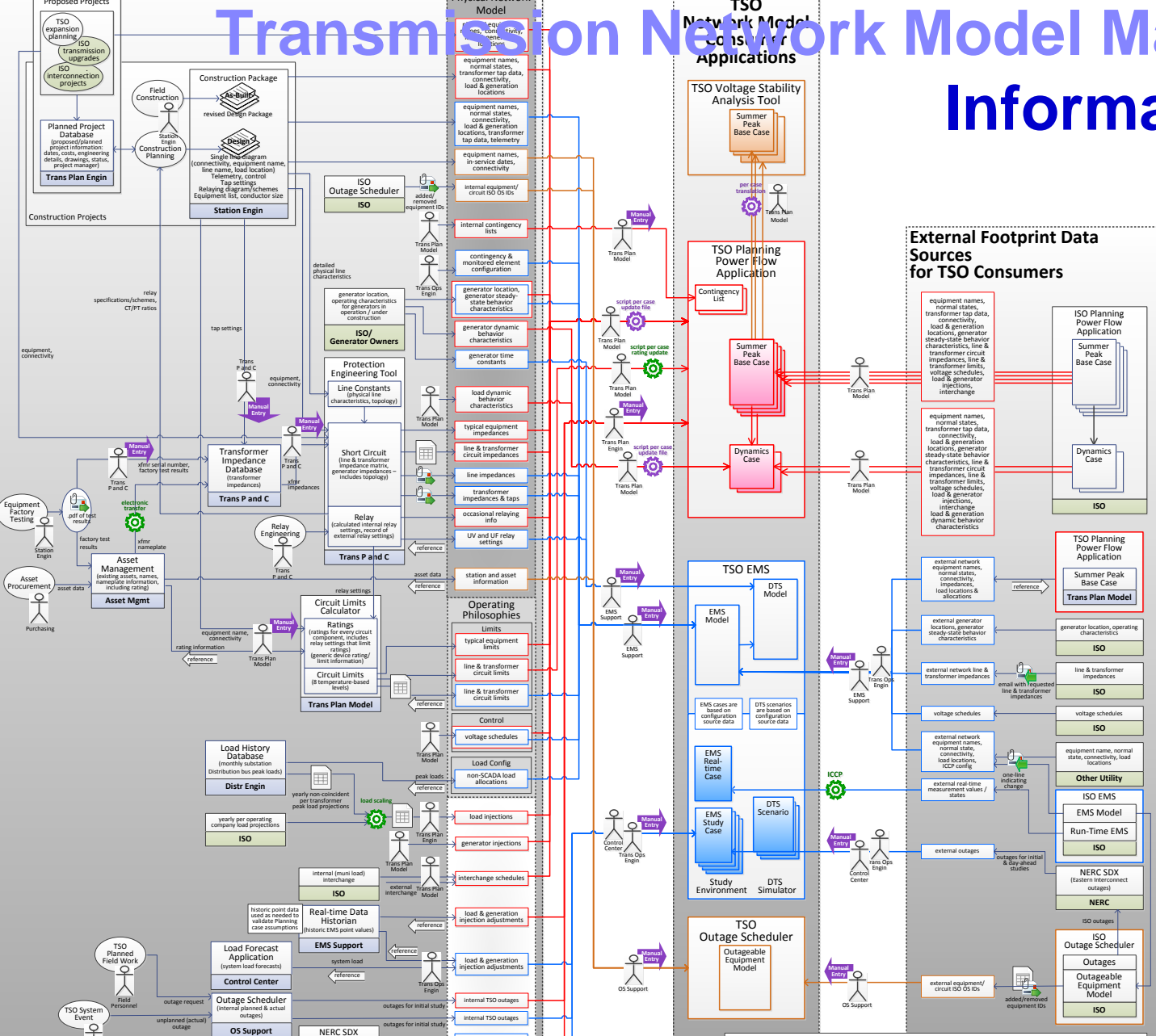
Transmission Network Model Management

Existing Situation



TSO Footprint Enterprise Data Sources for TSO Consumers

Transmission Network Model Management Information Flows

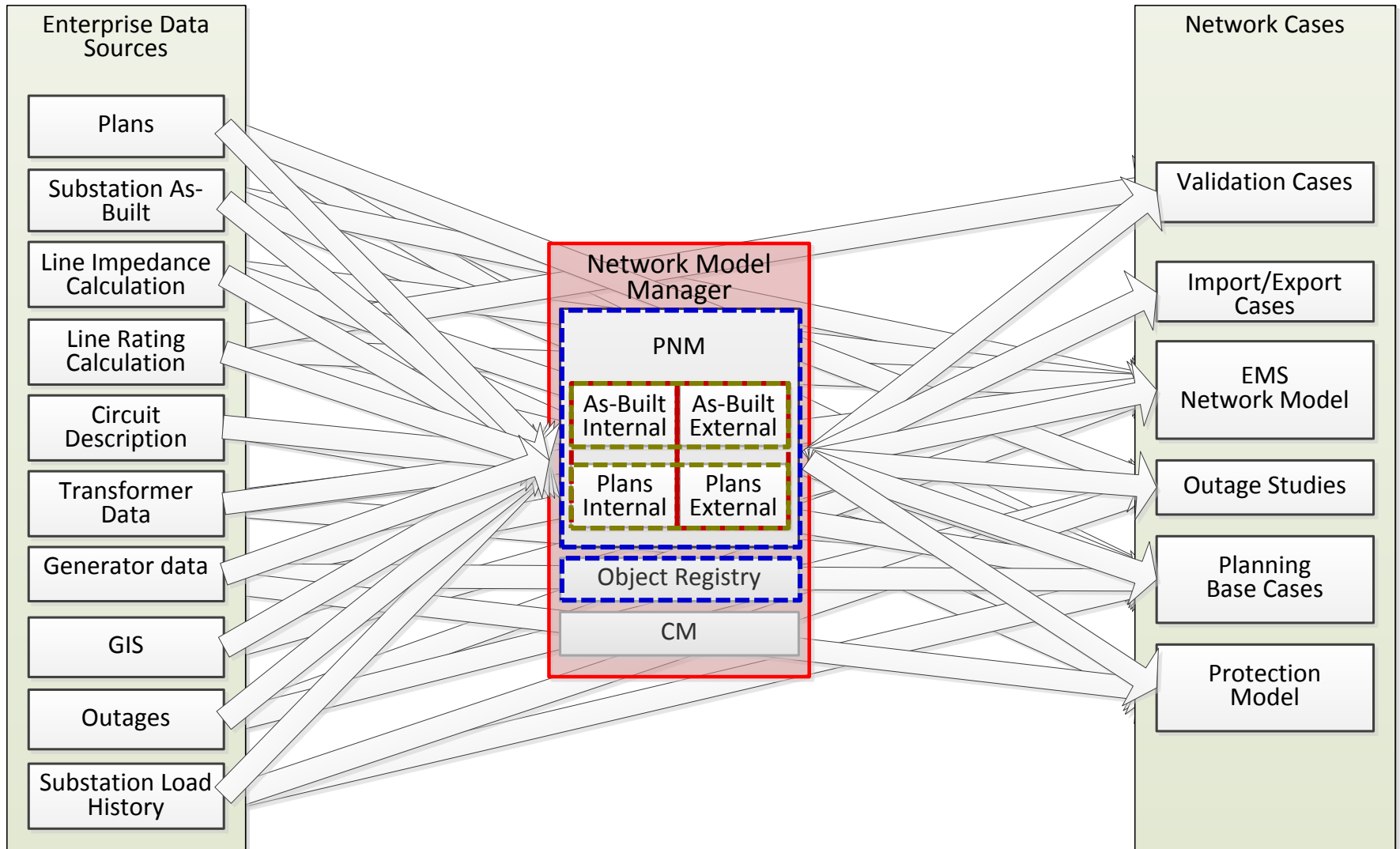


Key

- Application/System/Database Source
- TSO Data Owner
- Application/System/Database Source
- Non-TSO Data Owner
- Actor assisting w/ information flow
- Manual Entry
- Manual information flow
- process details
- Partially automated information flow
- process details
- Automated information flow

Transmission Network Model Management

The NMM Vision



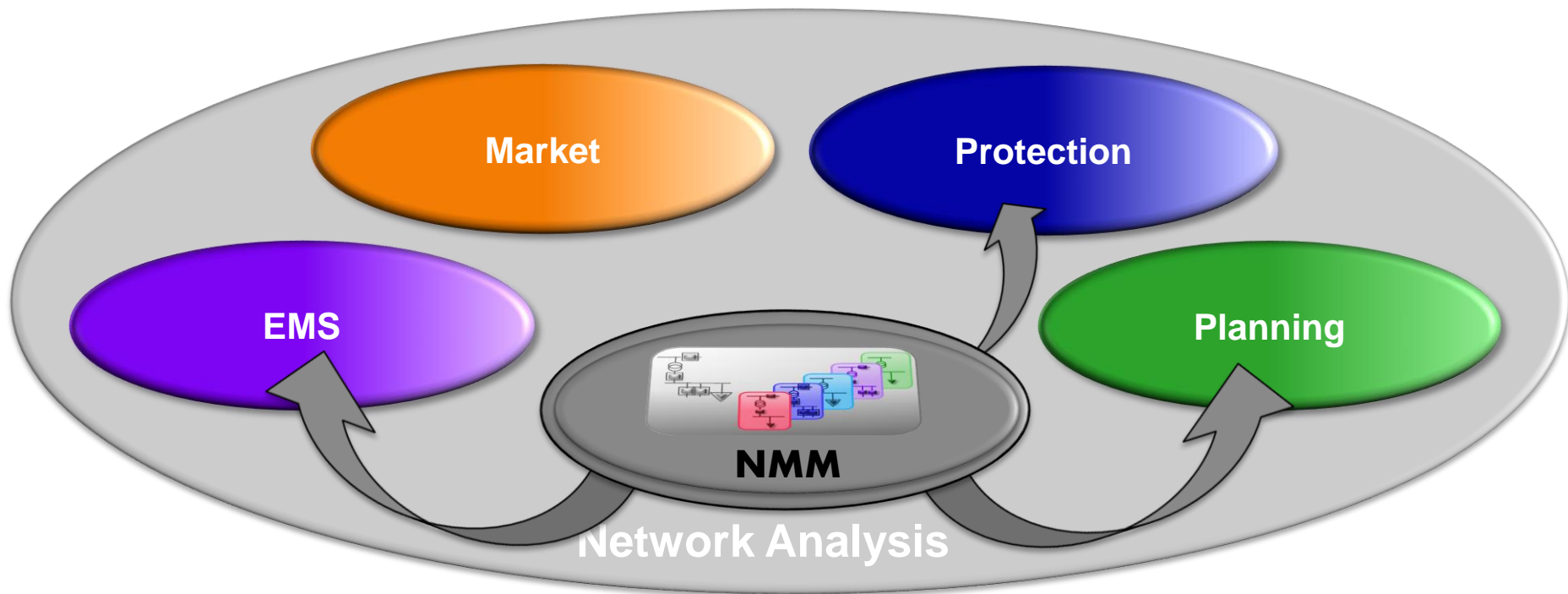
Transmission Network Model Management

Current EPRI Work

- 2013 Integrated Network Model Management supplemental
 - “Deep-dive” supplemental with FE and AEP
 - Understanding of existing practices and potential benefits of consolidated approach
 - ⇒ Supplemental still open
- 2013 161B Deliverable – a Do-It-Yourself Guide
 - *Network Model Manager and Repository: A Guide to Exploring the Potential of Centralized Network Model Management for the Interested Utility*, PID 3002000609
 - ⇒ Documents “deep-dive” process

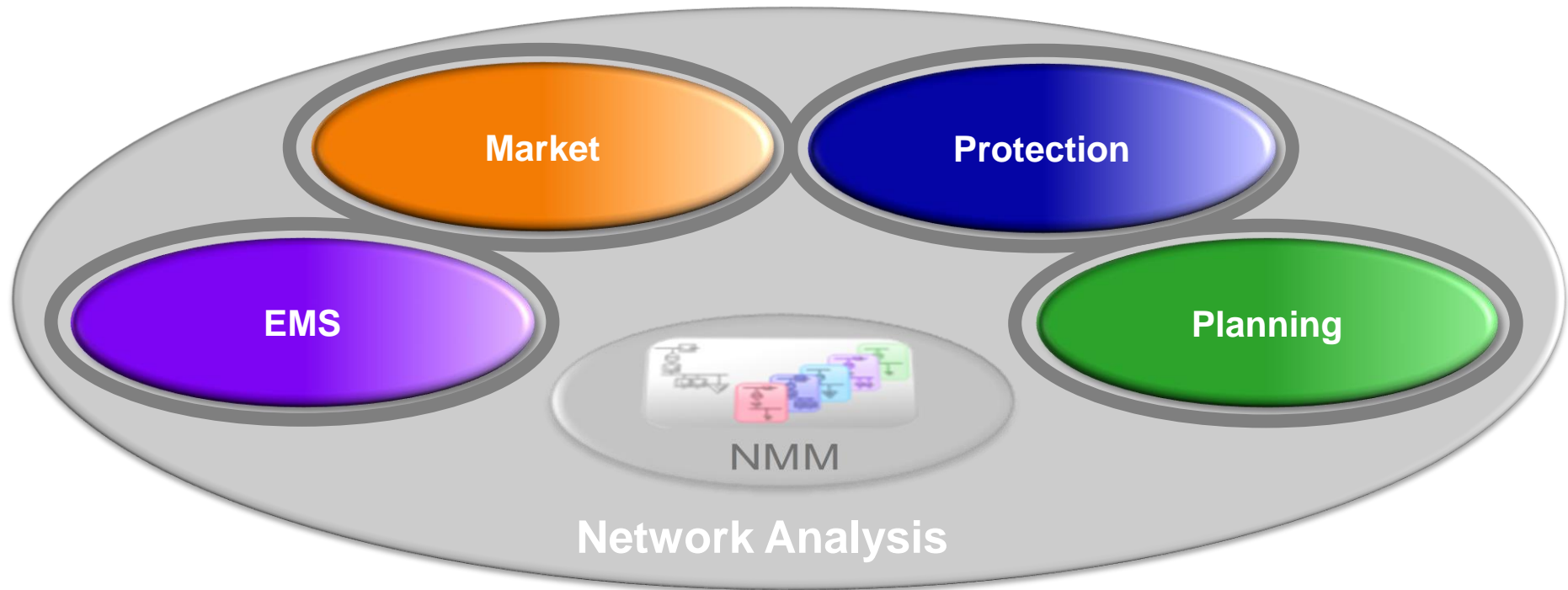
NMM Requirements Overview

- Consolidated model management
 - Utilities ready to implement
 - Real NMM product market niche



NMM Requirements Overview

- Consolidated model management
 - Utilities ready to implement
 - Real NMM product market niche
 - Silos get in the way



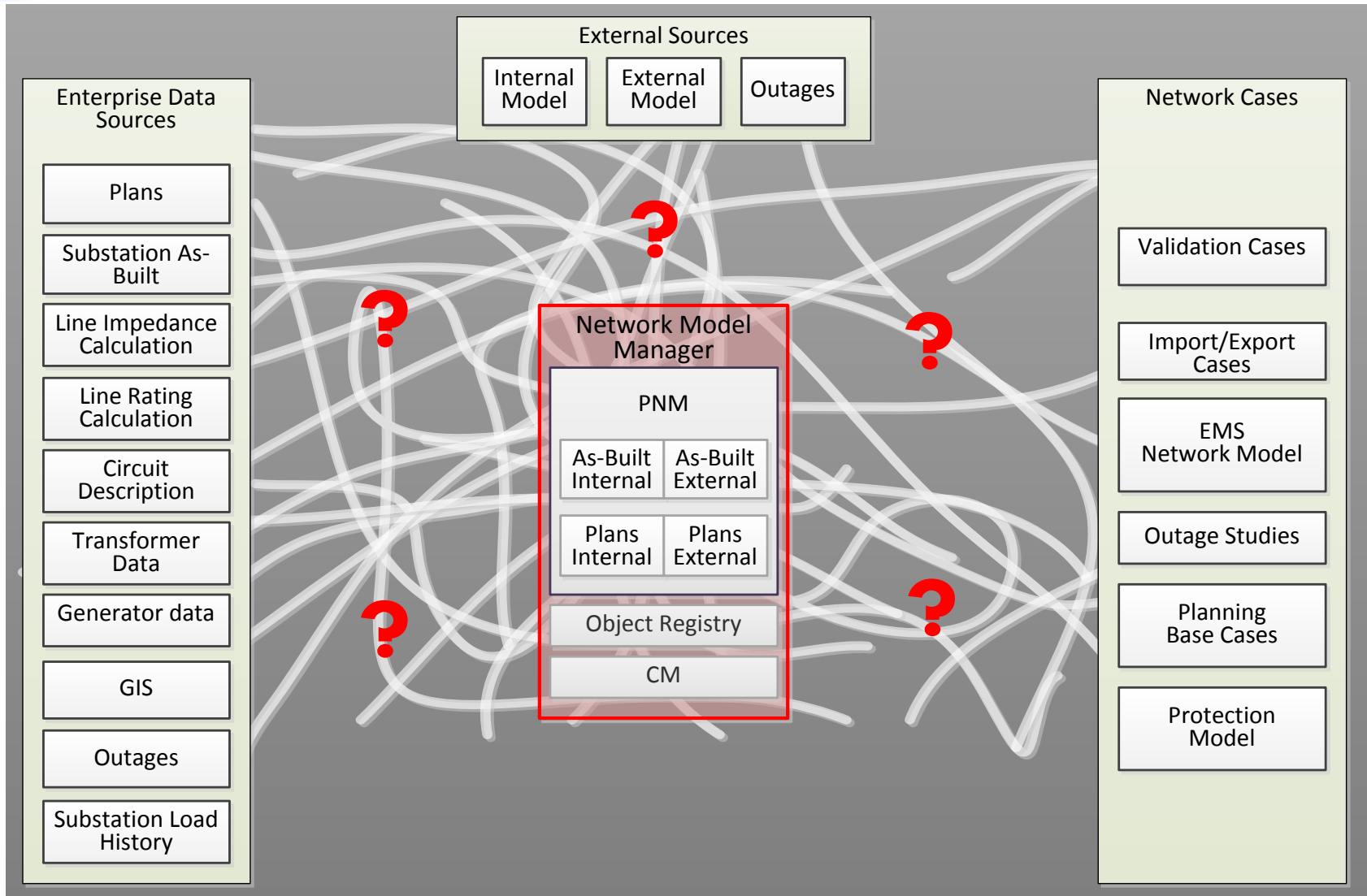
NMM Requirements Overview Project

- 2014 Network Model Manager Requirements Overview supplemental
 - Overview of consolidated model management tool requirements
 - Sponsored and created by 8 utilities and 2 vendors
 - TSOs - AEP, BPA, Électricité de France, NationalGrid UK, Oncor
 - ISOs – ISO-NE, MISO, PJM
 - Vendors – Alstom, Siemens/Siemens PTI
 - Results publicly available for free
 - Influence the industry

Accelerate utility interest
Broaden vendor vision

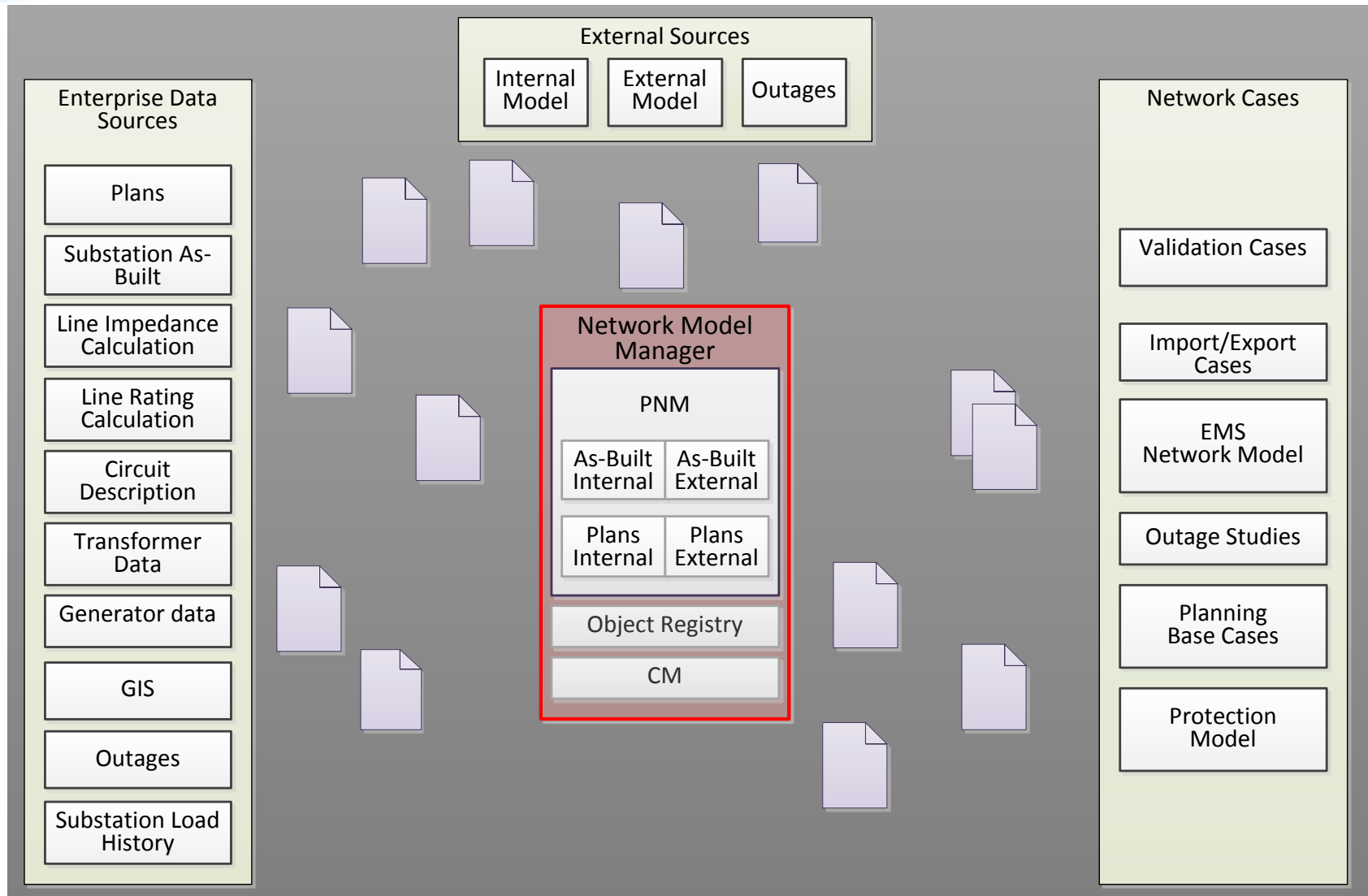
NMM Requirements Overview Project

Use Cases to Identify Requirements



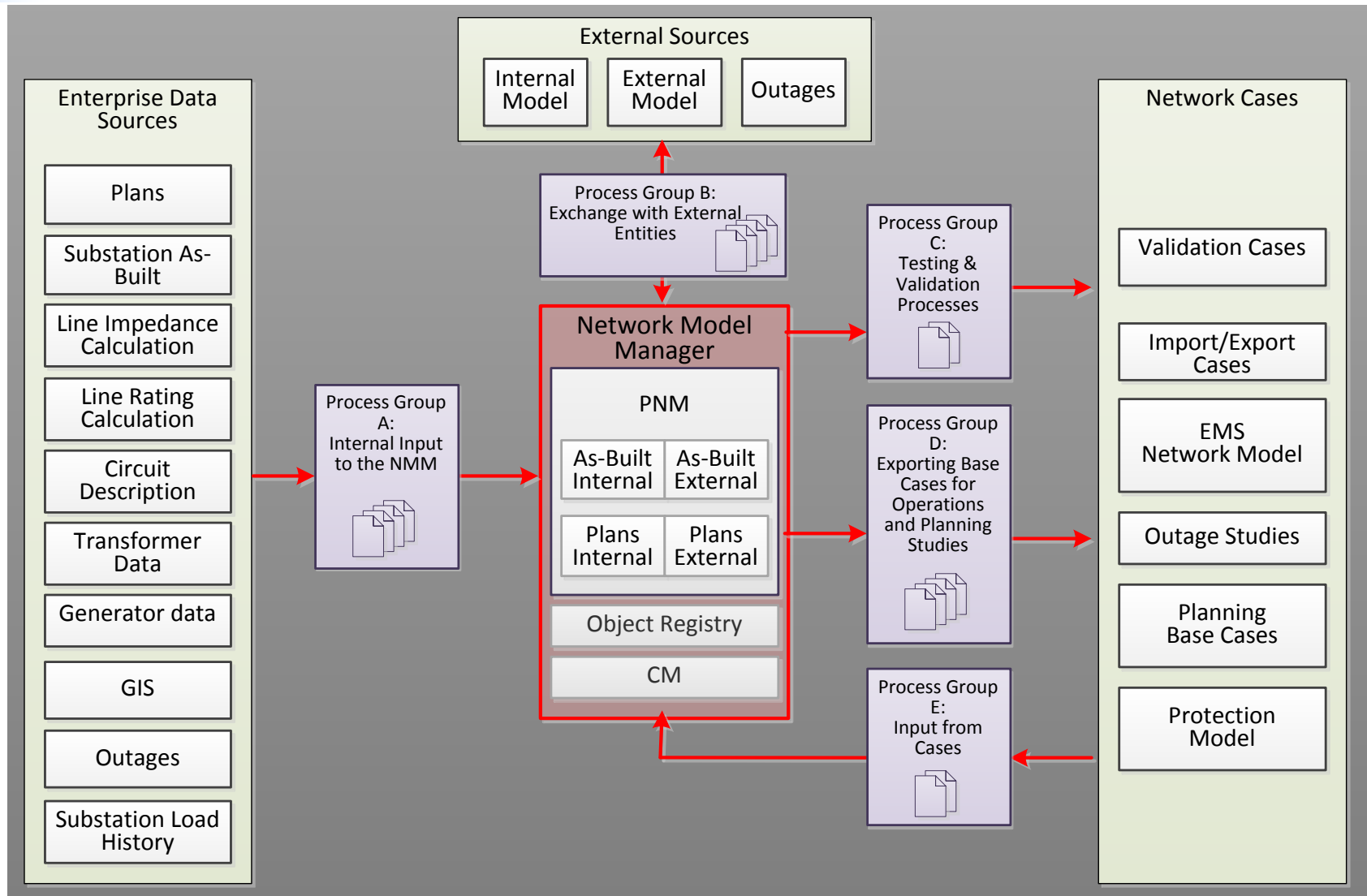
NMM Requirements Overview Project

Use Cases to Identify Requirements



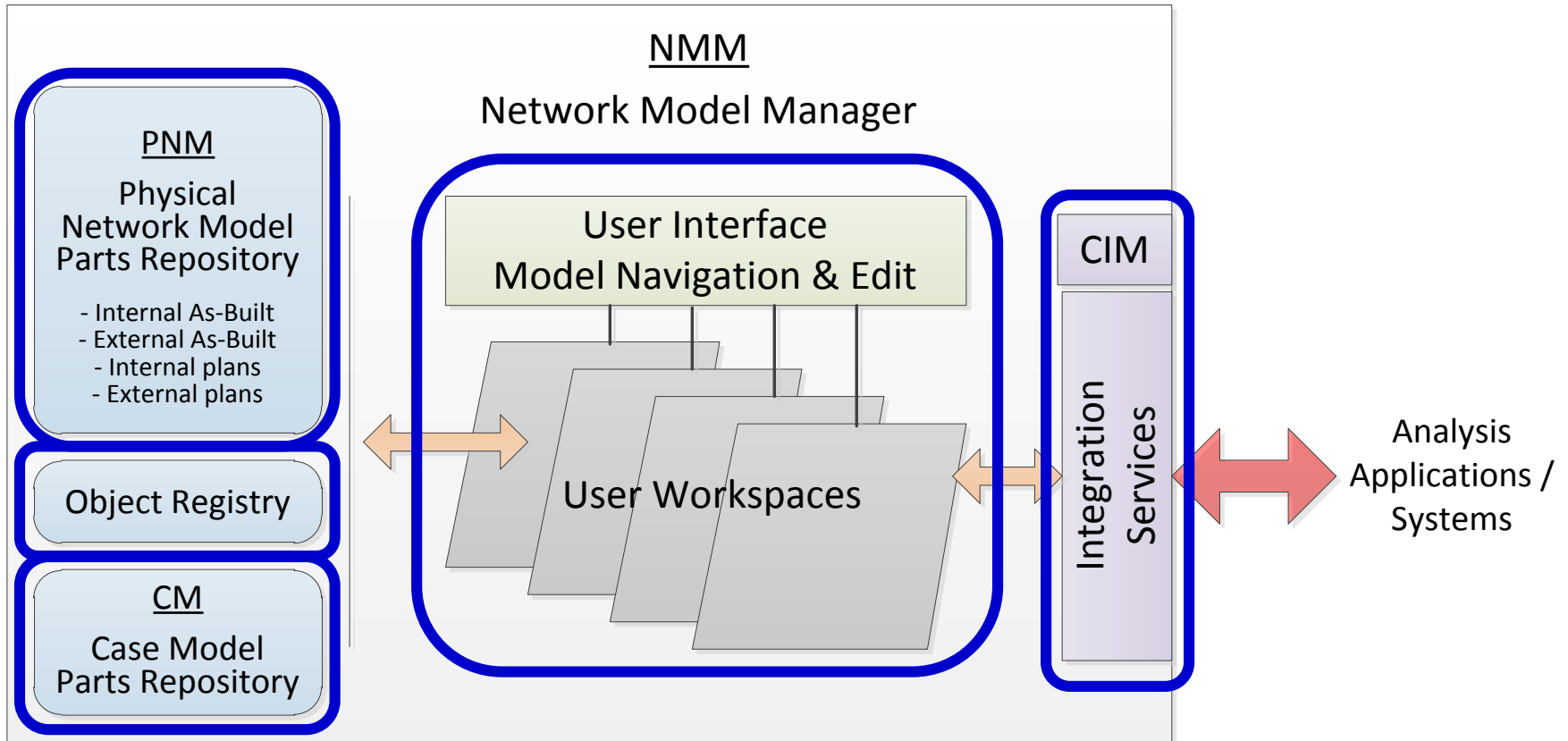
NMM Requirements Overview Project

Use Cases to Identify Requirements



NMM Requirements Overview Project

NMM Functional Overview



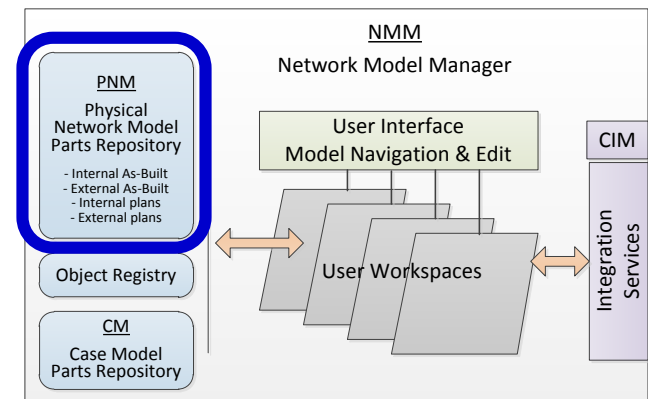
NMM Requirements Overview Project

NMM High-Level Requirements

- Physical Network Model (PNM) Requirements

Provide a secure, permanent store for PN Model Parts

- PN Model Parts directory
- Integrate with Asset Management System
- Integrate with GIS System (and support Distribution Model Parts)
- Include locally-created and imported and PN Model Parts
- Include Model Parts used for assembly
- Maintain versions of PN Model Parts including current baseline
- Maintain projects – sets of changes to PN Model Parts



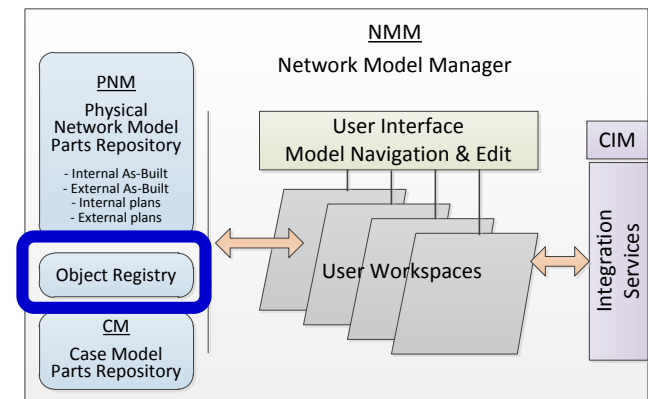
NMM Requirements Overview Project

NMM High-Level Requirements

- Object Registry Requirements

Support object registry services to manage the names of network model Canonical Objects in different contexts

- Primary object registration on Model Part save
- Support for secondary registrations
- Support for object registration/retirement notification
- Generation of name mappings to/from MRID/names



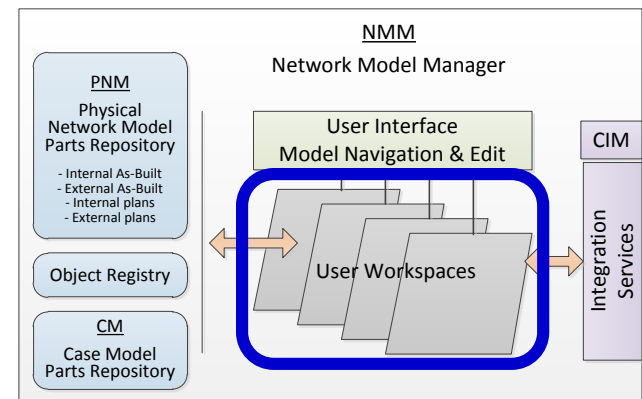
NMM Requirements Overview Project

NMM High-Level Requirements

- Workspaces Requirements

Support multiple Workspaces for carrying out NMM operations in parallel

- Multiple users
- Support for model/case assembly
- Intermediate area for saving work before storage in PNM / CM
- Standard set of functions which operate on Workspace content (selecting, loading, assembling, editing, saving, validating, etc.)
- Extensible with locally-written functions
- Differencing of Model Parts or Workspace content
- Audit trail to present state
- Definition of Procedures for automating actions



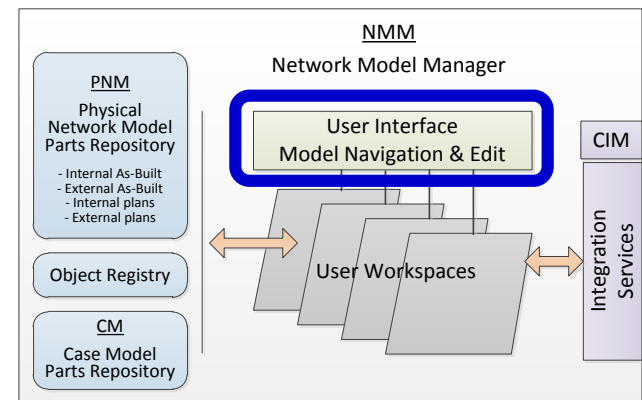
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NMM High-Level Requirements

- User Interface Requirements

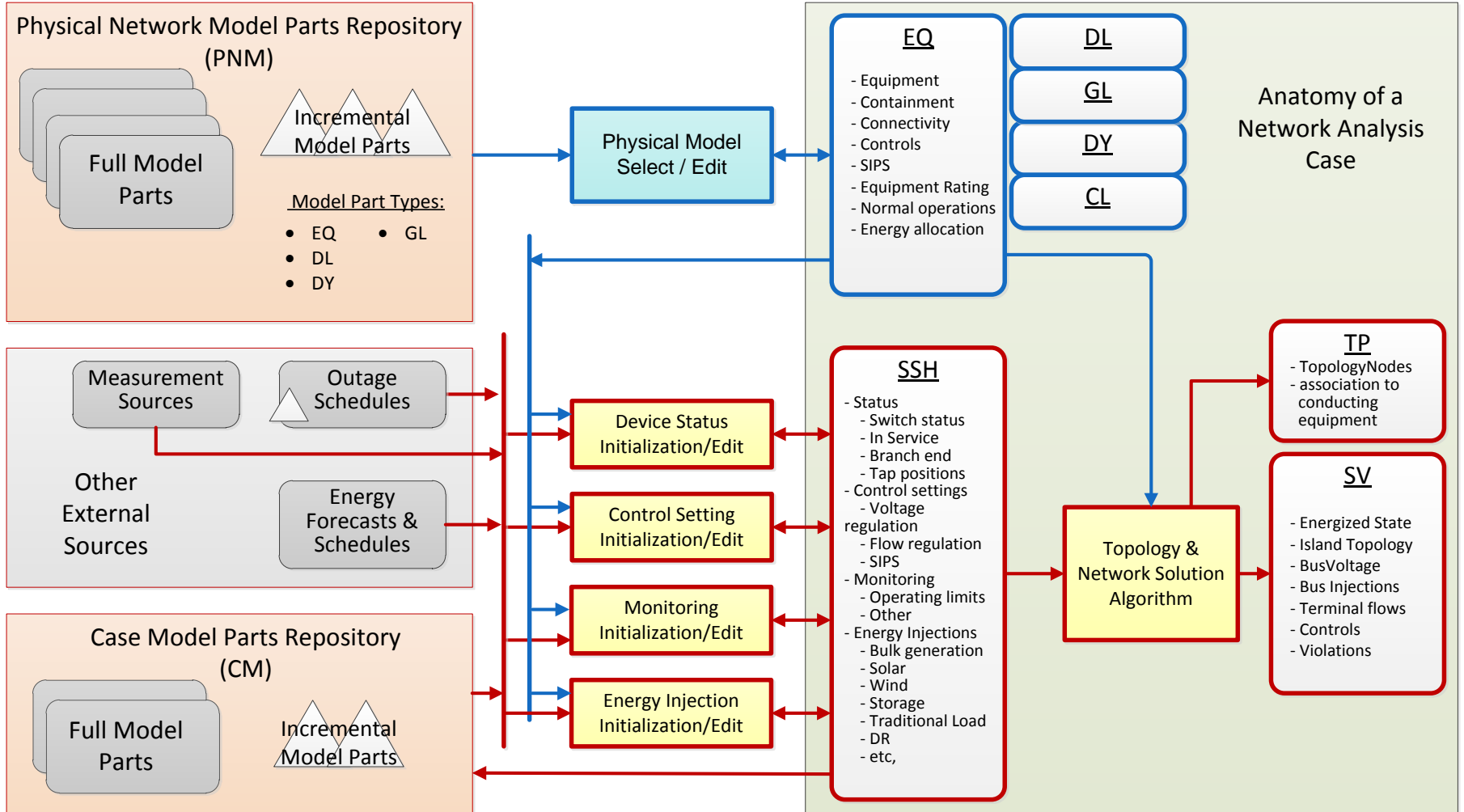
Capability for users to browse and edit NMM content

- Editing via one-lines – “electrical connectivity and schematics shall be created co-operatively and assured consistent”
- Security and access control mechanisms to meet industry requirements – reference recent Energy Sector Control Systems Working Group (ESCSWG) document
- Workspace content save / retrieve



NMM Requirements Overview Project

Anatomy of a Network Analysis Case



NMM Requirements Overview Project

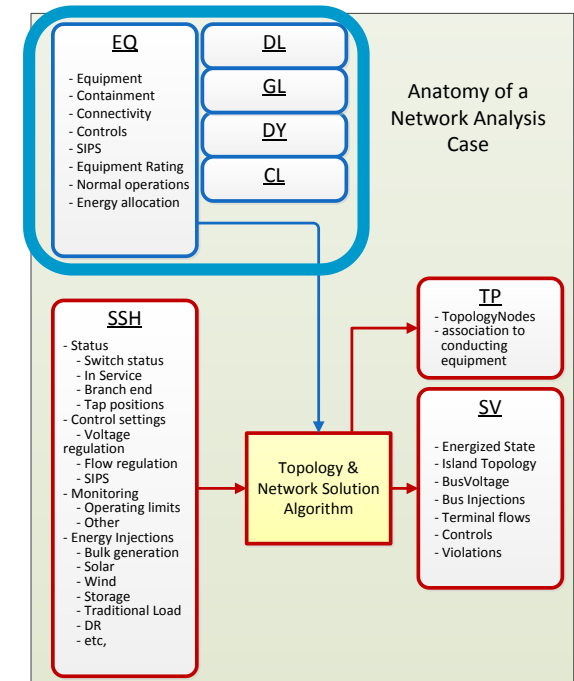
NMM High-Level Requirements

- Model and Case Assembly Requirements

Support the IEC CIM modular concept for assembling network models and network analysis base cases

- Model assembly in Workspace, including

- PN Model Part selection & loading
- Project selection & loading
- Built-in and locally-written services (simplification, etc.)



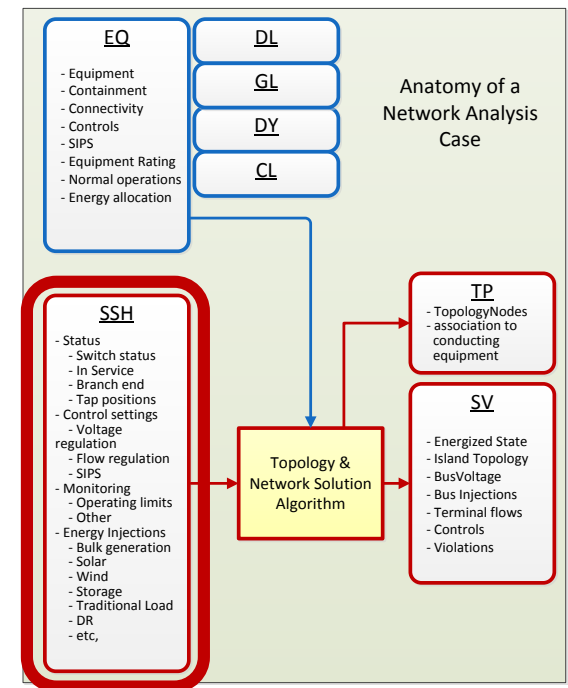
NMM Requirements Overview Project

NMM High-Level Requirements

- Model and Case Assembly Requirements (continued)

Support the IEC CIM modular concept for assembling network models and network analysis base cases

- Case assembly in Workspace, including
 - Addition of Case Model Parts to model assembly
 - SSH Model Part generation via built-in or locally-written services
- Audit trails for assembled models/cases



NMM Requirements Overview Project

NMM High-Level Requirements

- Validation Requirements
 - Support for testing and validation regimen
 - Topology processing service
 - Power flow service



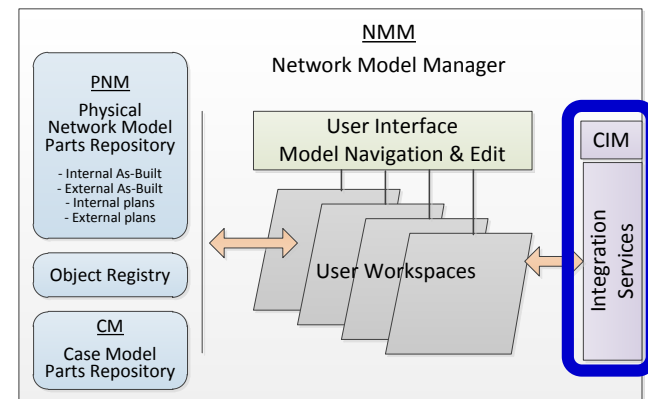
NMM Requirements Overview Project

NMM High-Level Requirements

- Integration Requirements

CIM-based integration services which allow NMM integration without modification of NMM code

- Import / export of Model and Case Parts and Projects
- Workspace export
- Import of CIM-standard data into Workspace
- Interfaces based on IEC CIM information modeling and profiling



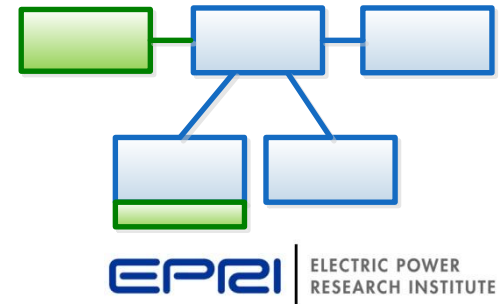
NMM Requirements Overview Project

NMM High-Level Requirements

- Extensibility Requirements

Model-driven data content, CIM-based information exchange definitions extensible to match utility Canonical Data model

- Process for updating Model Part schema and transforming NMM content to new version
- Support for phased implementation and successive schema extensions



NMM Requirements Overview Project Deliverable and Contacts

Network Model Manager Technical Market Requirements: A Transmission Perspective

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