The MITRE Corporation's Center for Advanced Aviation System Development

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Automation to Support Strategic Traffic Flow Management

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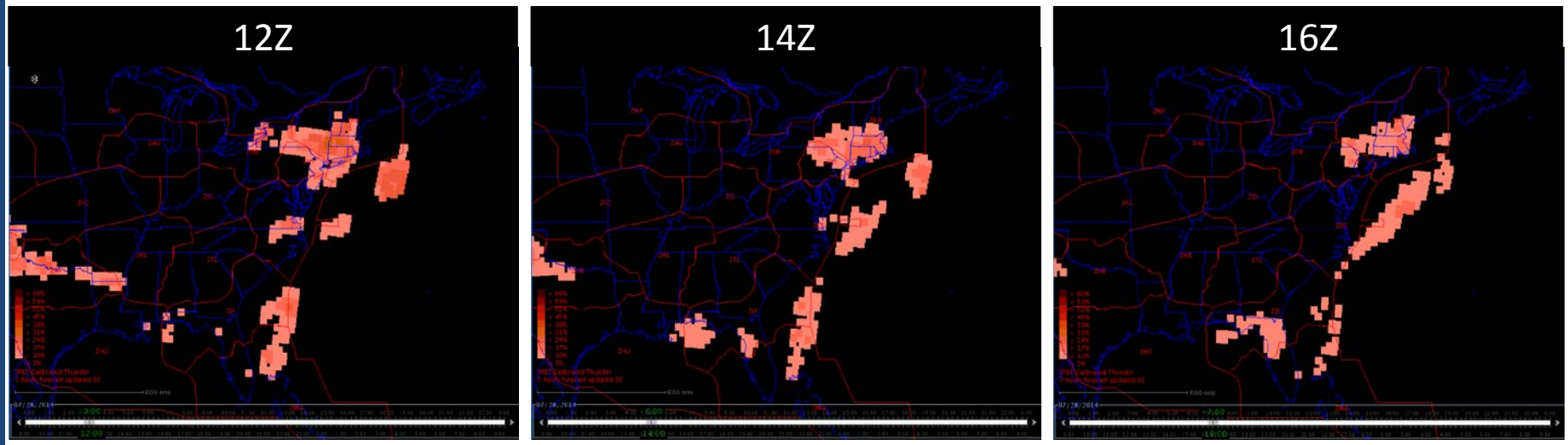
Strategic TFM Planning for Weather

Probabilistic forecasts identify regions of potential weather activity



Short Range Ensemble Forecast (SREF) for 28 July, 2014

What is the range and likelihood of different weather scenarios occurring?

What are the potential scenarios of ATM impacts?

What options are available to mitigate congestion and when do we have to act?

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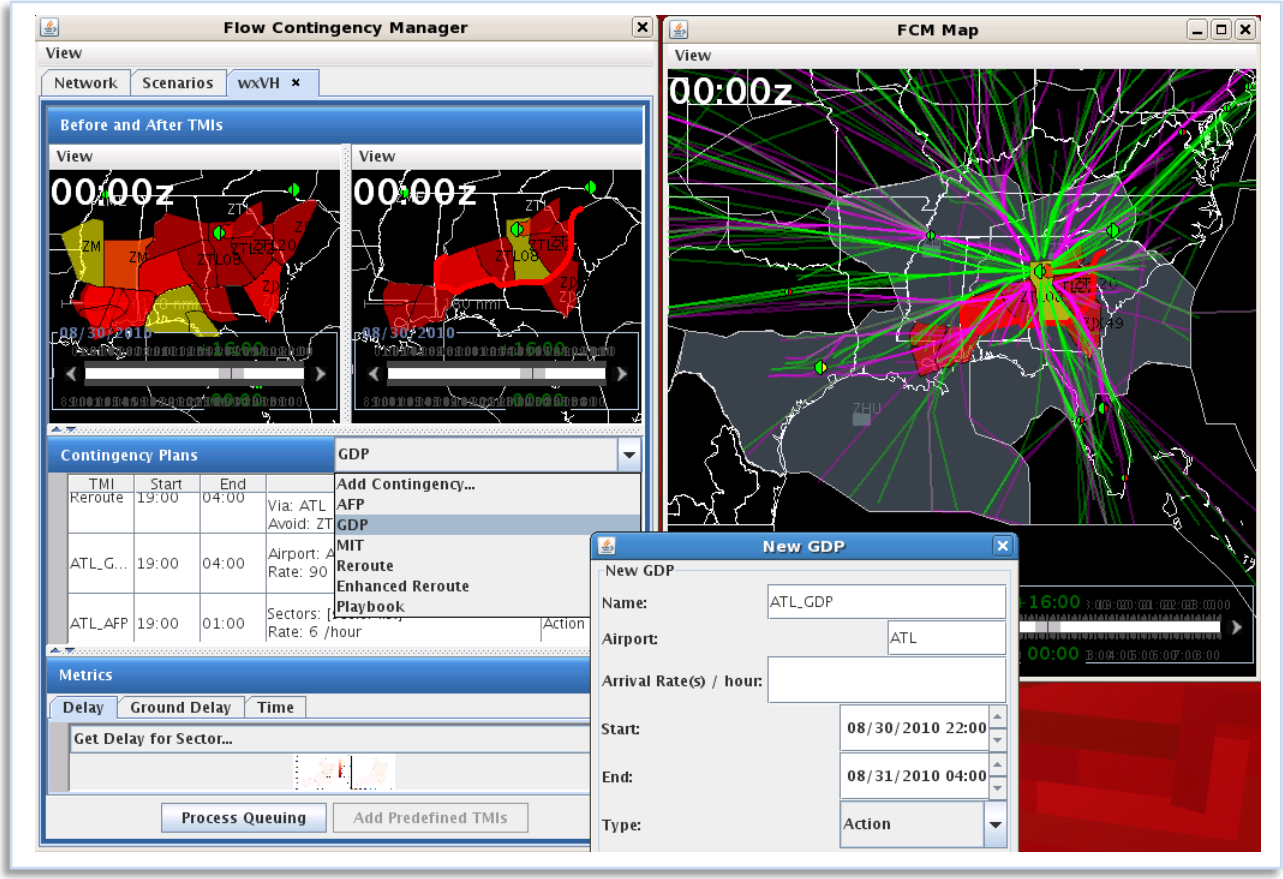
Automation to Assist TFM Planning: Flow Contingency Management (FCM)

FCM aims to provides a *scientific* methodology for strategic TFM decision-making

Developing a common understanding of the problem among stakeholders

Providing a quantitative analysis of potential plans *prior* to implementation

Enabling fact-based discussions for strategic planning development



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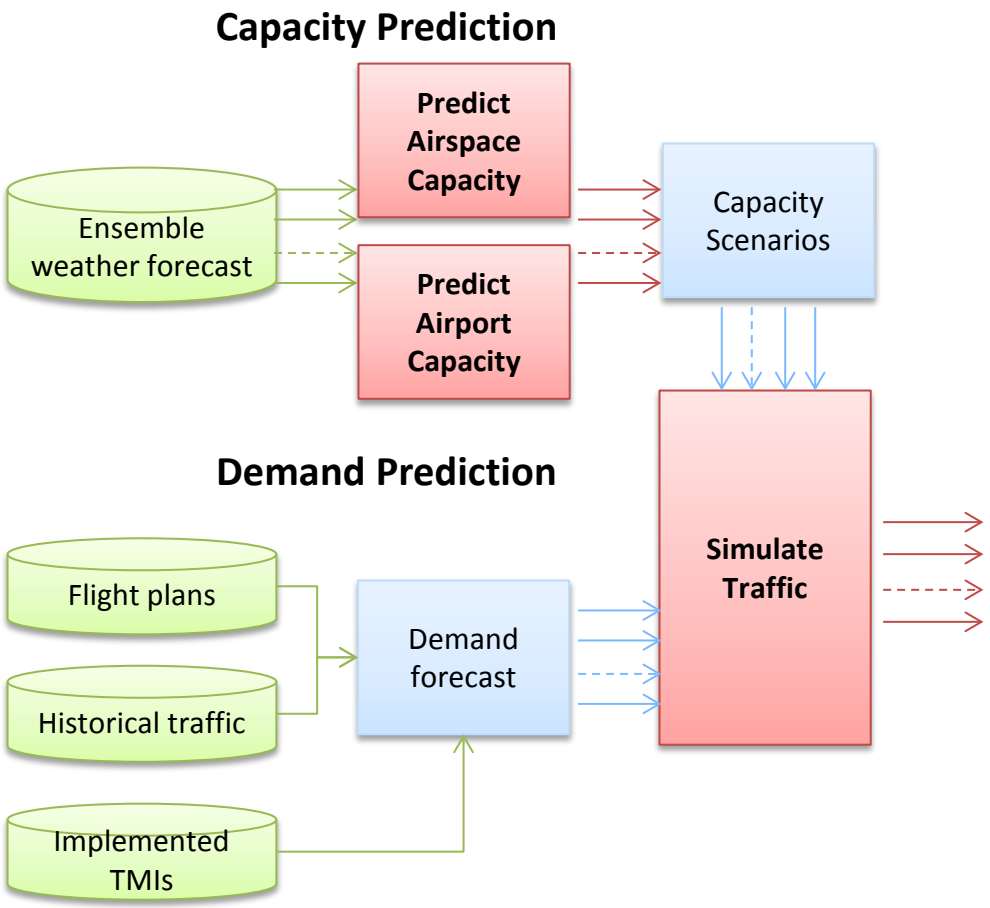
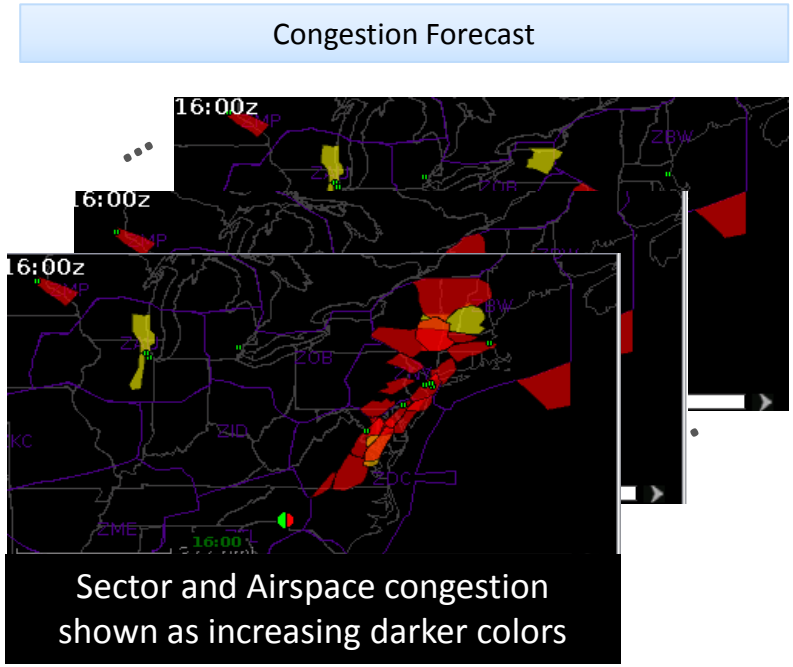
FCM Capabilities

Quantify TFM Impact





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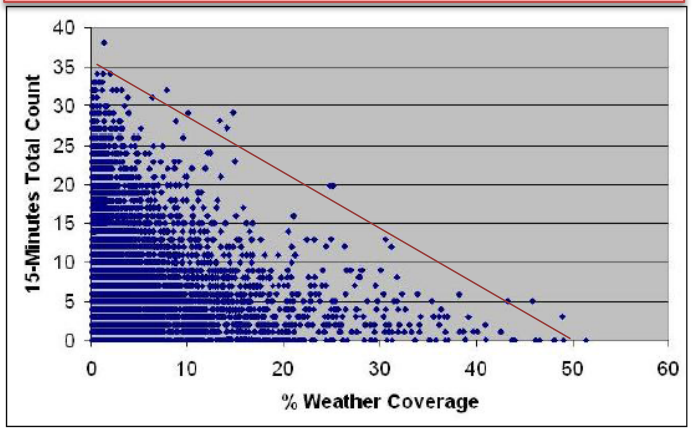
Quantify TFM Impact

Predict Capacities

Ensemble weather forecast

Predict Airspace Capacity



Source: Song, et al (2009)

Predict Airport Capacity
Joint MITRE/WSU Research

Demand

Staffing, Time-of-day, maintenance, operator's choice, etc...

Wind Speed and Direction

Runway Configuration Selection
LAT: Strategic (Hours to Days)

Visibility, ceiling (meteorological conditions or MC)

Tactical TRACON operations (spacing, scheduling of runway use, airspace traffic patterns)
LAT: Tactical (Couple of hours)

Convective Weather

Airport or Approach Closure
LAT: Tactical (Minutes to an hour)

Capacity
AAR/ADR

Capacity Scenarios

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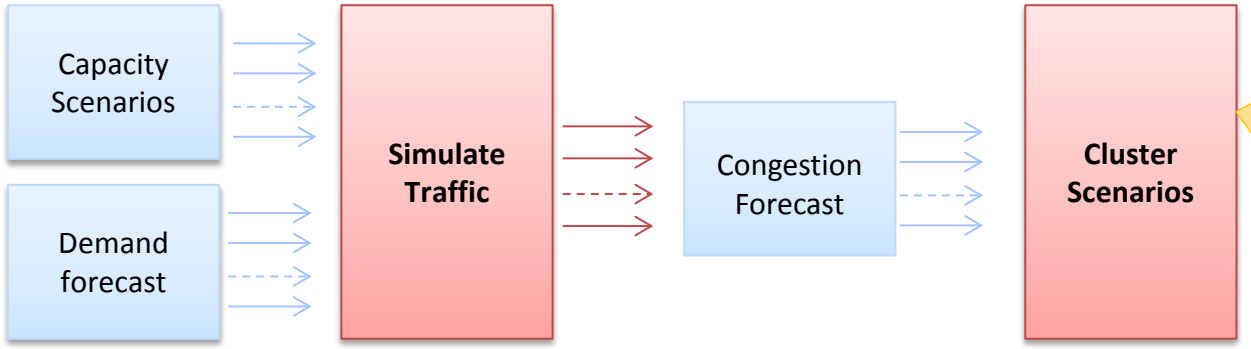
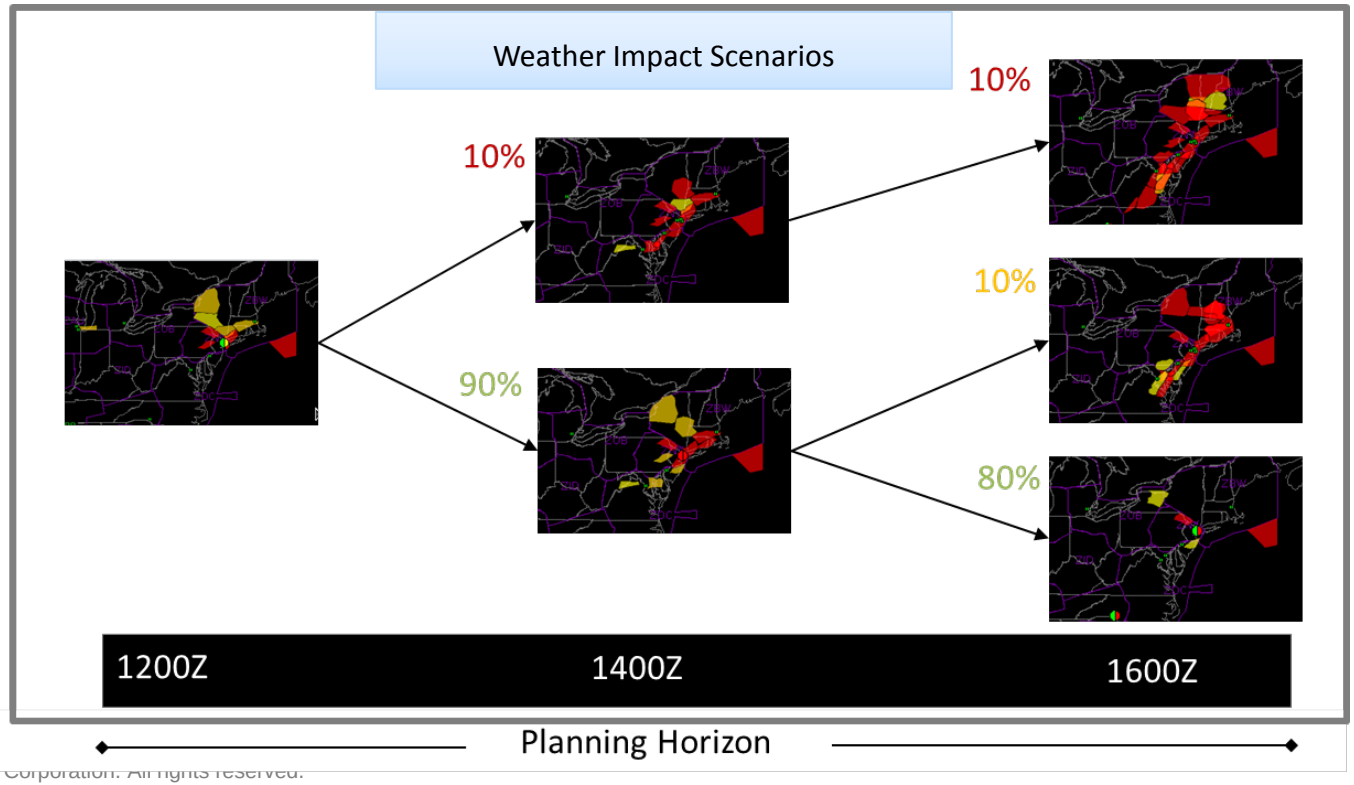
Quantify TFM Impact

Generate Weather Impact Scenarios



Clustering Process

- Identify critical forecast features
- Evaluate scenarios for similarities
- Cluster scenarios on diverging features over forecast time



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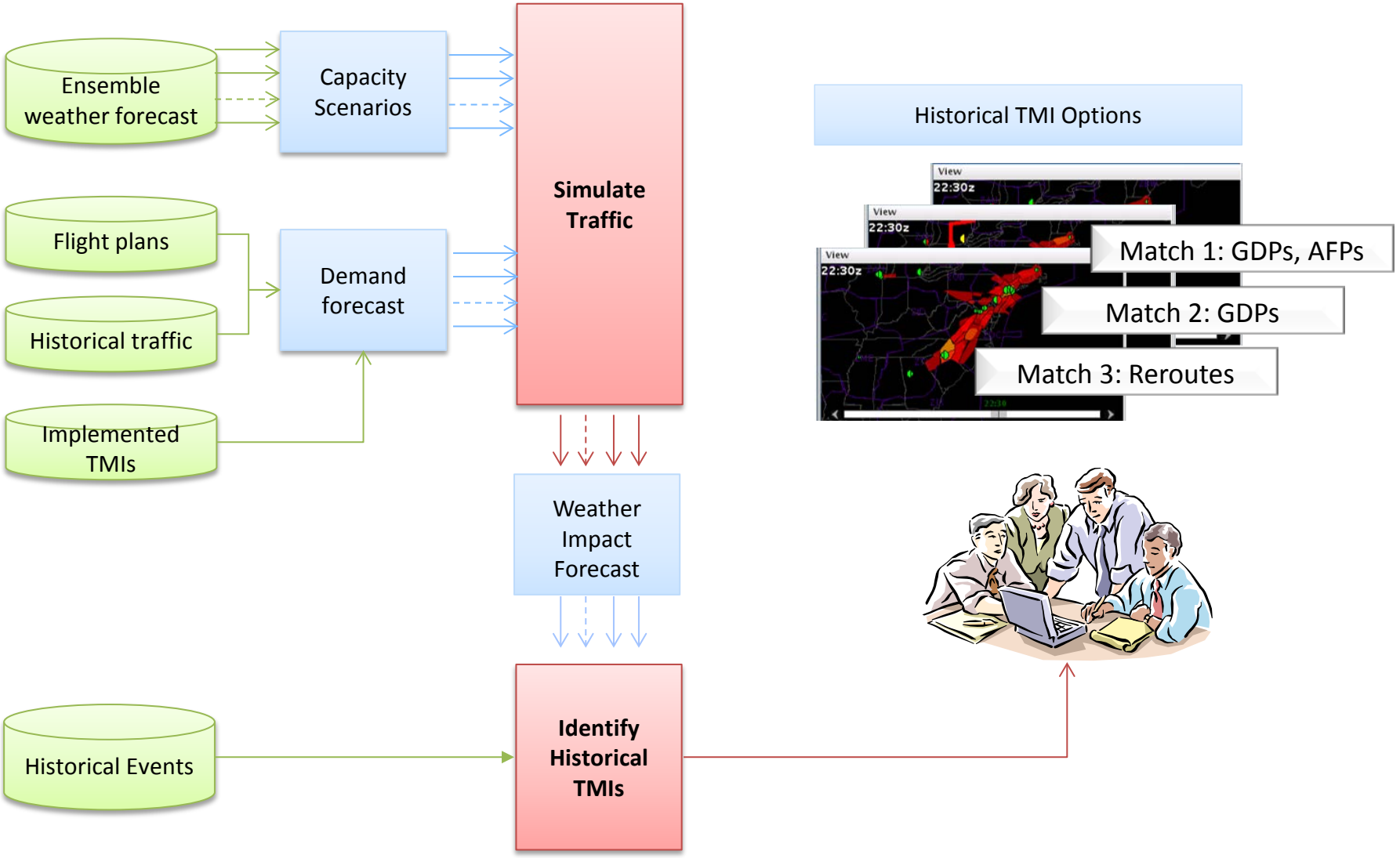
FCM Capabilities

Leverage Historical TMIs



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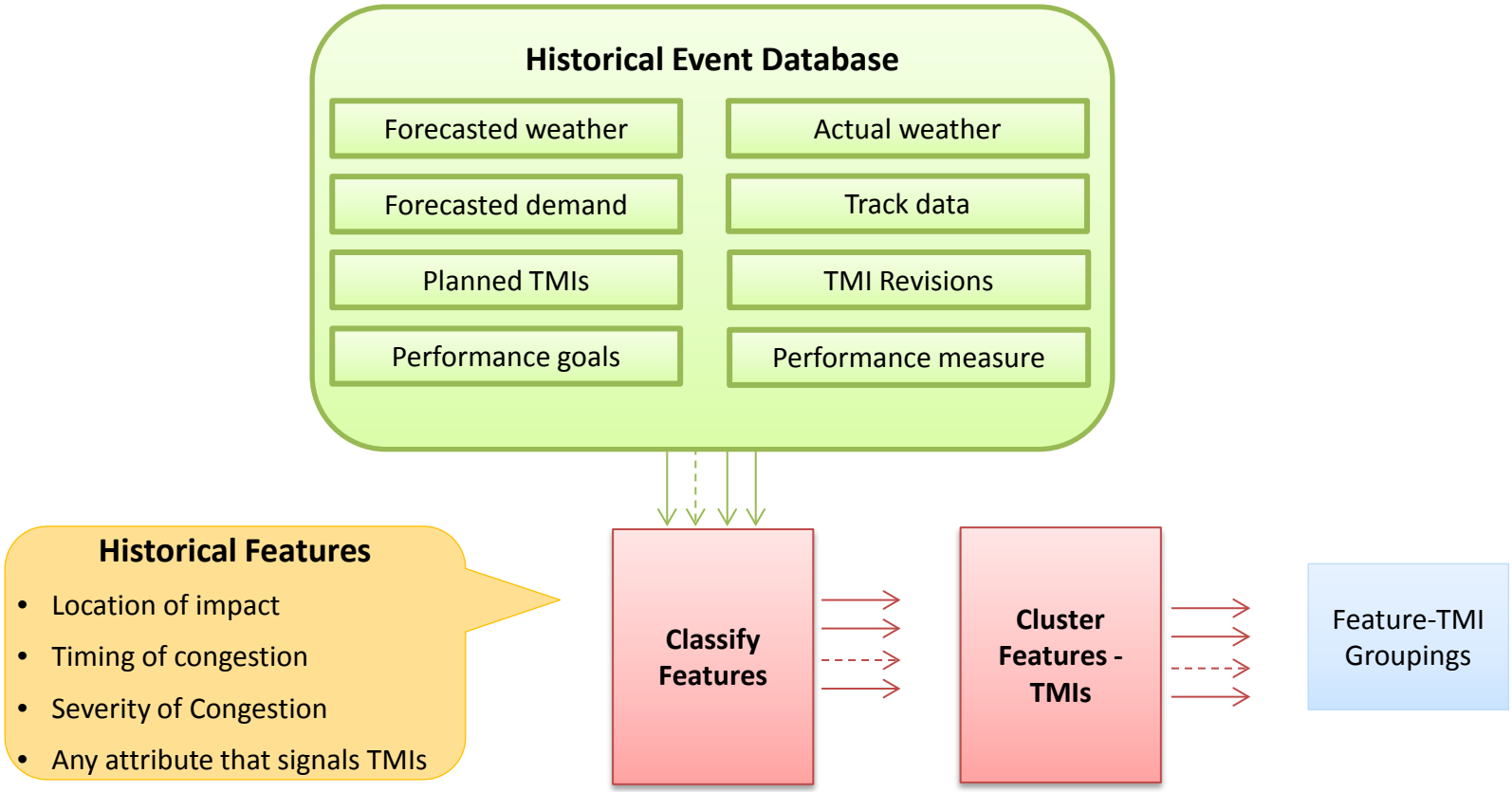
Leverage Historical TMIs

Classify Similar Events



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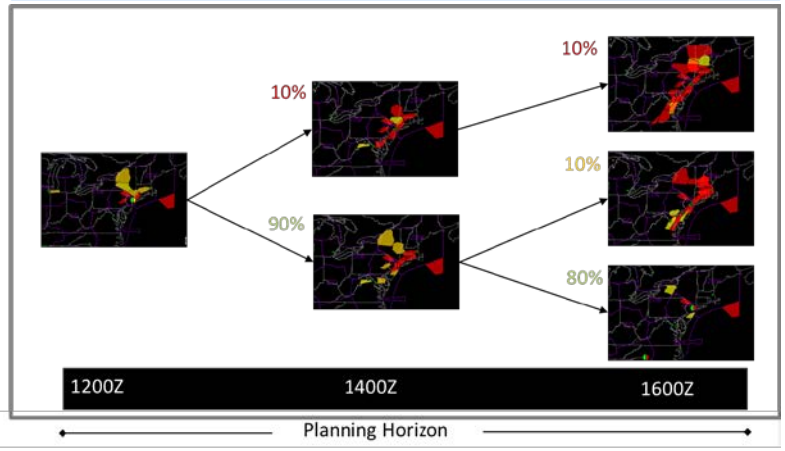
Leverage Historical TMIs

Identify Historical TMI Options

Weather Impact Scenarios



Classify Features

Identify Historical TMIs

Feature-TMI Groupings

Historical Options Set

Evaluation by automation

Direct evaluation

Historic Options Set

Restriction	Start Time	Duration	Rate
Ground Delay	15:00-23:00	2-6 hours	25-40 /hr
Meter Point	15:00-23:00	2-4 hours	10-40 /hr
Reroute	17:00-20:00	2-8 hours	

Historical TMI Options

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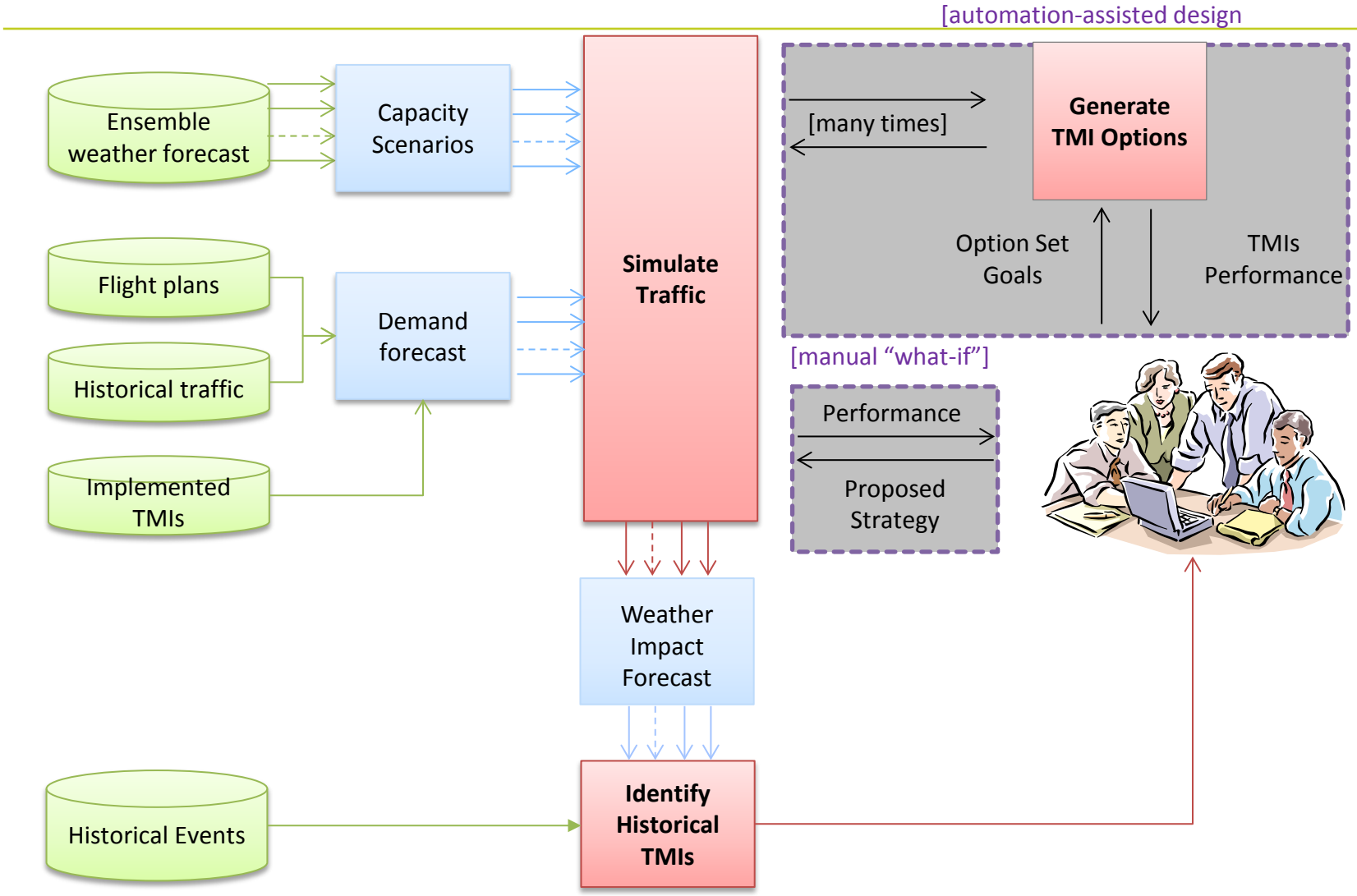
FCM Capabilities

Generate and Evaluate TMI Plans



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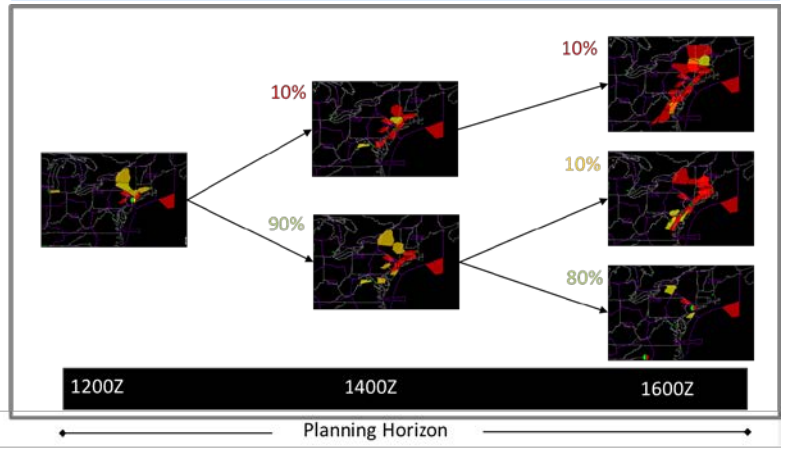
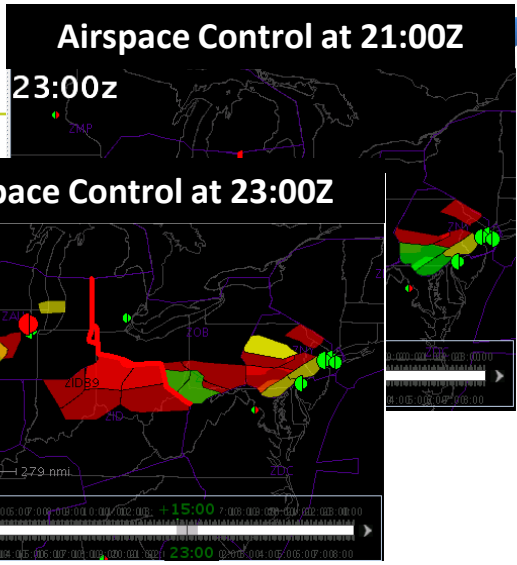
Generate and Evaluate TMI Plans

"What-if" Analysis

Weather Impact Scenarios



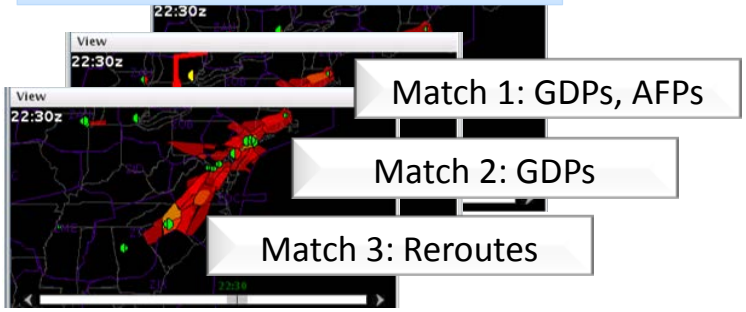
Simulate Traffic



Performance

Proposed Strategy

Historical TMI Options



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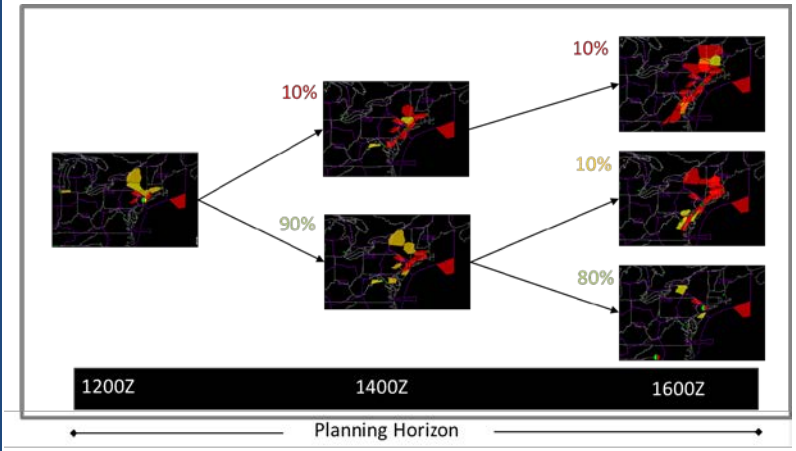
Generate and Evaluate TMI Plans

Design TMI Plan Options

Weather Impact Scenarios



TMI Plan

Proposed Restriction

- Scenario 1 Possible Restrictions
- Scenario 2 Possible Restrictions
- Scenario 3 Possible Restrictions

Historic Options Set

Restriction	Start Time	Duration	Rate
Ground Delay	15:00-23:00	2-6 hours	25-40 /hr
Meter Point	15:00-23:00	2-4 hours	10-40 /hr
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Generate TMI Options

- Select TMI Parameters
- Simulate Traffic
- Evaluate Objectives

TMIs
Performance

Goals

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Discussion

- FCM takes the strategic planning process from *reactive* to *proactive*
  - Analyze problems *before* they start
  - Develop mitigation strategies based on *analytical* evaluation
  - Opportunity to evolve the decision making paradigm
- Automation can help identify problems and develop solutions
  - Quantify capacity impacts
  - Gain insight from historical information
  - Generate and evaluate solutions
- Success means a more efficient, more repeatable, and more transparent TFM system

Thanks!

CAASD

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