Multi-resolution Nested Dust Forecast System Feasibility Study

Karl Benedict (PI)
Earth Data Analysis Center, University of New Mexico
Chowei Yang (Co-I)
Center for Earth Observing and Space Research, George Mason University

Project Background

✦ Public Health Applications

- Public Health Applications in Remote Sensing (PHAiRS - NASA REASoN): 2003-2008
- Adding NASA Earth Science Results to EPHTN via the NM/EPHT System (ENPHASYS - NASA DECISIONS): 2008-2011

✦ Interoperability Development & Testing

- NASA GIO/PHAiRS Project Interoperability and High Performance Computing Test/Demonstration: 2007-2008

Goals

- Work with existing modeling cores (DREAM ETA-8, DREAM NMM)
- Modify model pre- and post-processors to support OGC and REST data transfer
- Develop algorithm for automated generation of dust forecast area(s) of interest
- Evaluate and report on performance characteristics of the nested model system

Integrated System Solution Diagram

Earth System Models

DREAM Eta 4-bin Model
DREAM Eta 8-bin Model
DREAM NMM

Earth Observations

Historic and Current

Terra/Aqua: MODIS
Land Cover, NDVI
SRTM C-Band Elevation Model

Planned Missions

NPP, NPOESS: VIIRS
Land Cover, NDVI

Predictions/ Forecasts

Daily 72-hour low-resolution dust concentration forecasts for a large model domain (i.e. southwestern US)

Daily 72-hour high-resolution dust forecasts for local regions (i.e. 1-degree blocks) for which the low-resolution model run indicates an important dust event

Historic and current full model domain low-resolution hourly $PM_{2.5}$ and PM_{10} dust concentration products for the current day + 48 hours (i.e. 72-hour forecast products)

Historic and current sub-domain high-resolution hourly $PM_{2.5}$ and PM_{10} dust concentration products for important events

Observations, Parameters & Products

Decision Support System

SYRIS,
NM EPHTS

Analyses

Linkage between $PM_{2.5}$ and PM_{10} dust concentrations and measures of public health (i.e. hospital admissions, school absences, etc.)

Location and severity of recent dust events within the model domain

Decisions/Actions

Evaluation and treatment of patients in the context of additional dust concentration information available to clinicians

Alerts to sensitive populations in anticipation of important dust events

Value and Benefits to Society

Timely delivery of improved information about predicted dust events to public health officials, clinicians, and the general public

Enhanced understanding of the linkage between public health measures and modeled dust concentrations

Partnership Area

Inputs	Outputs	Outcomes	Impacts
NASA / UNM / U of A / GMU		New Mexico DOH / CDC / Lubbock HD / Texas R1	

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Systems Integration

Systems Integration

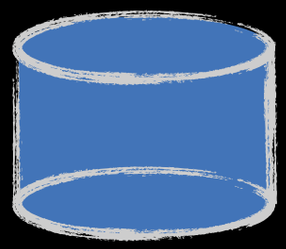
EDAC GMU

Systems Integration

EDAC

GMU

Global Forecast System (GFS) Data



Systems Integration

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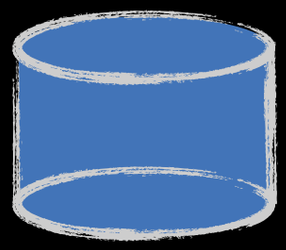
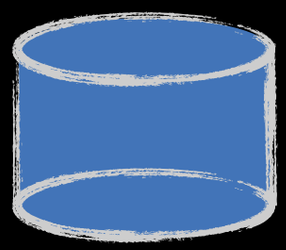
Global Forecast System (GFS) Data



DREAM ETA-8 Bin Data



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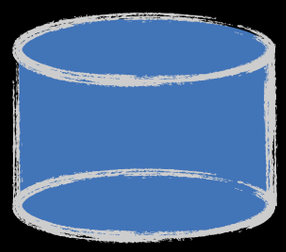

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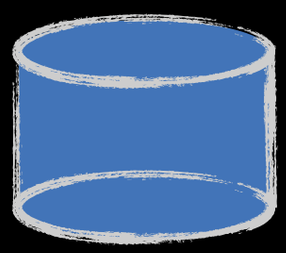
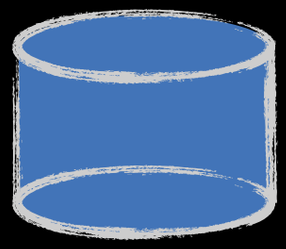


Area of Interest Data and Processing Queue



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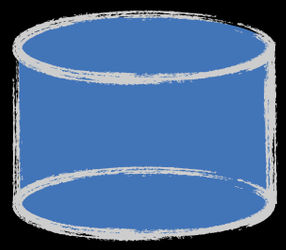

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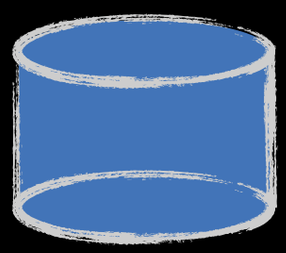

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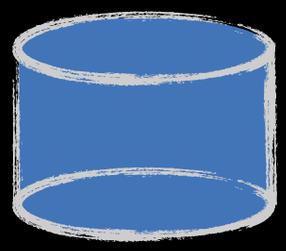
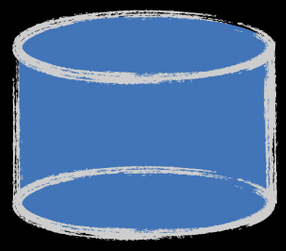


DREAM NMM Data



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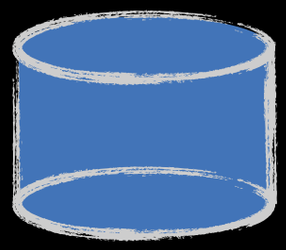

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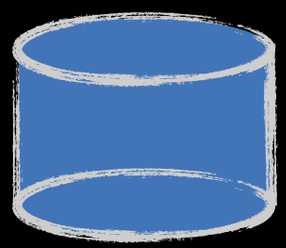

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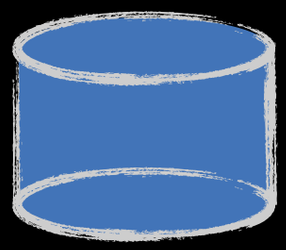

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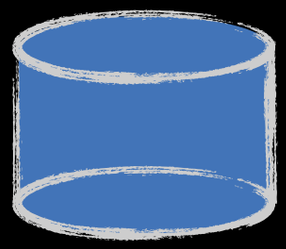

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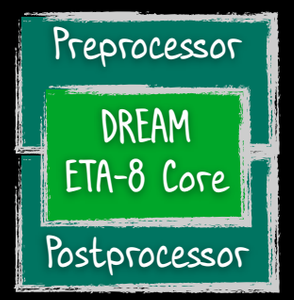

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DREAM ETA-8 Bin Data

Area of Interest Data and Processing Queue

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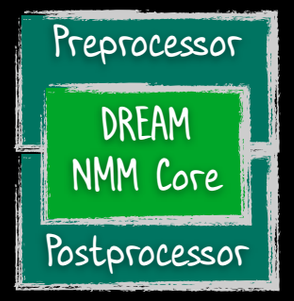

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Global Forecast System (GFS) Data

DREAM ETA-8 Bin Data

AOI Processing

Area of Interest Data and Processing Queue

DREAM NMM Data

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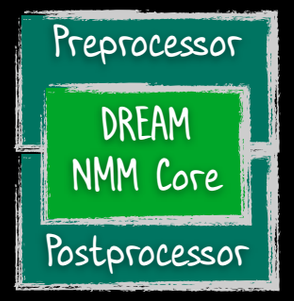

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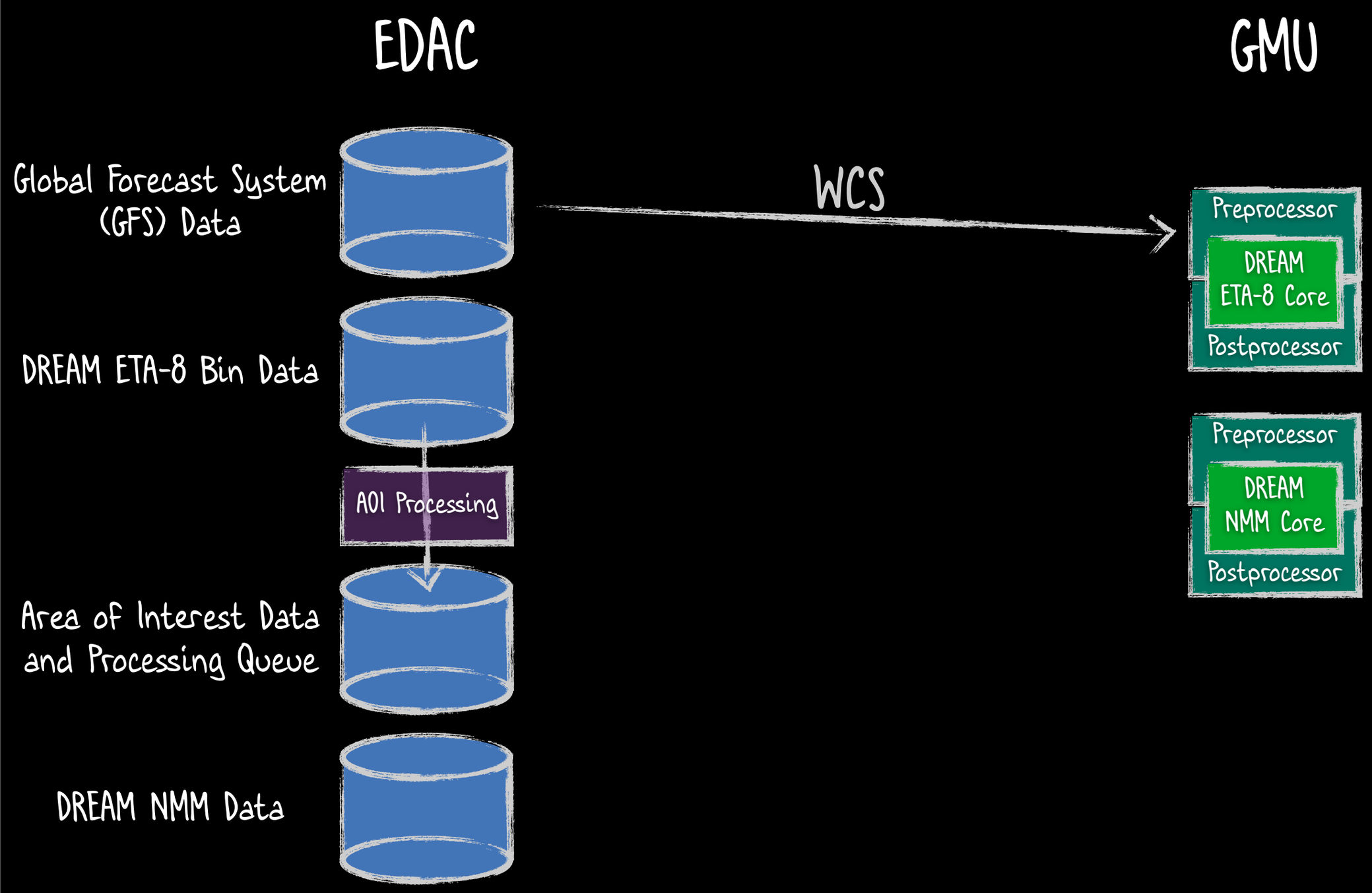

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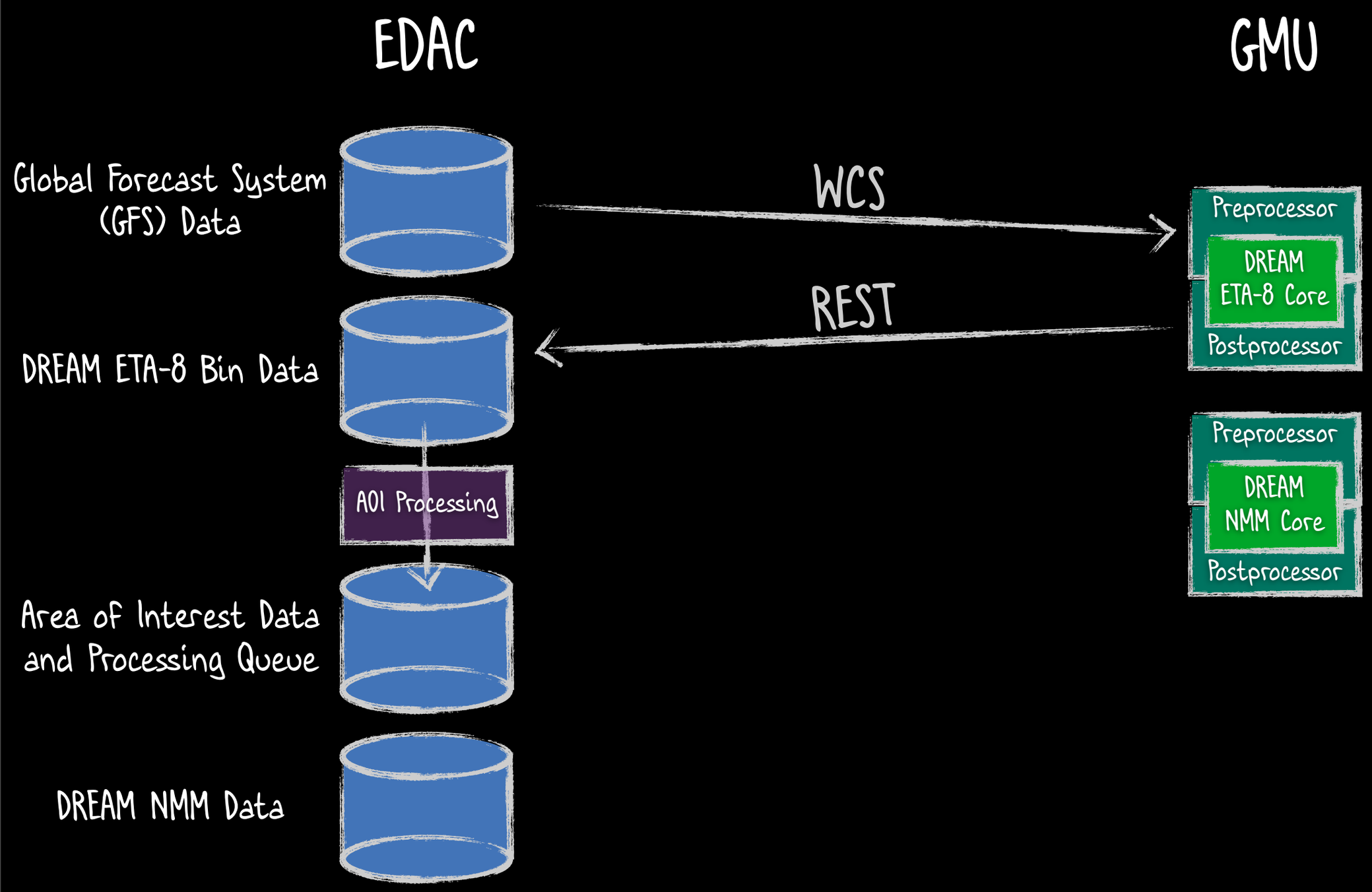

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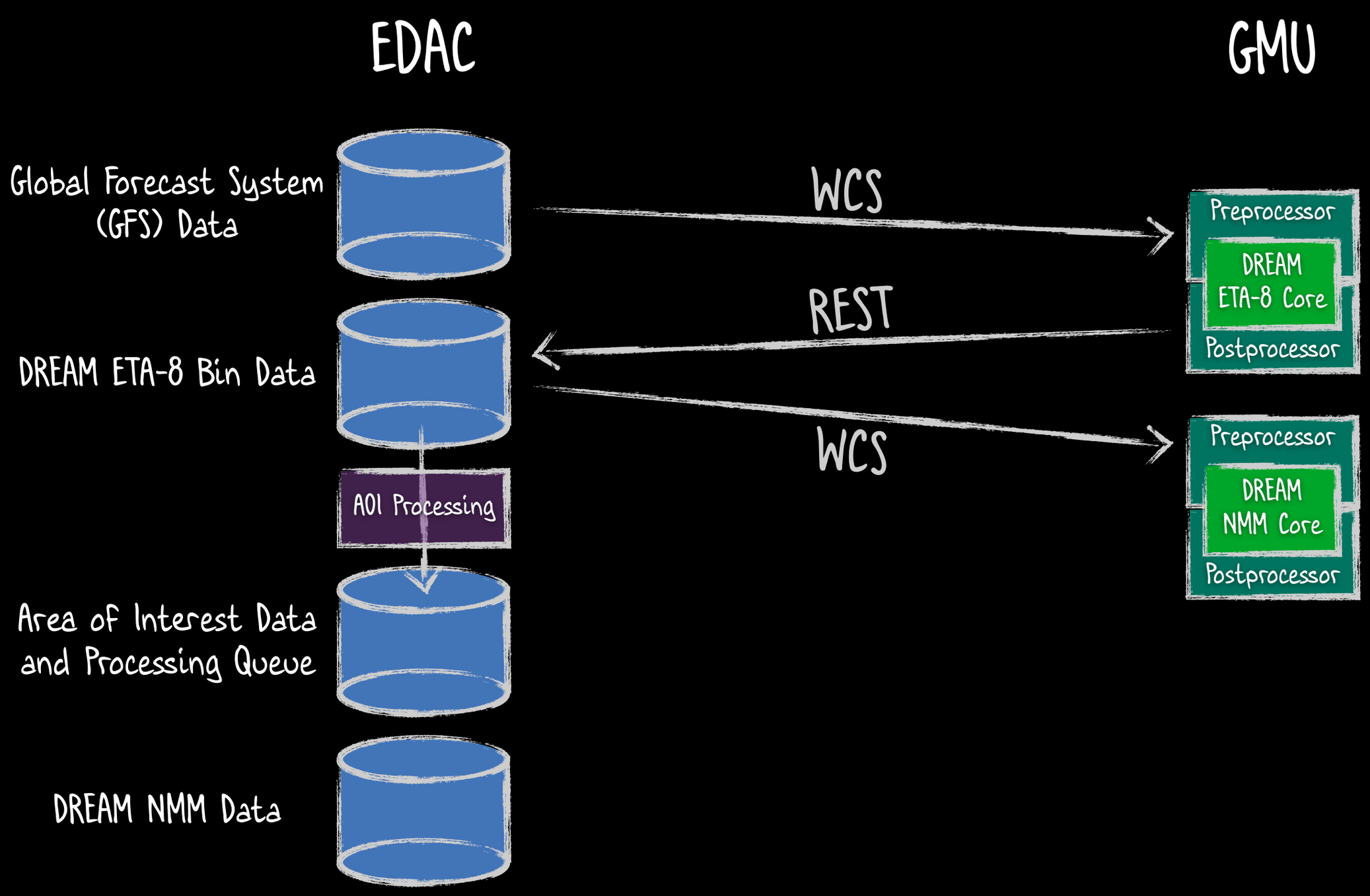

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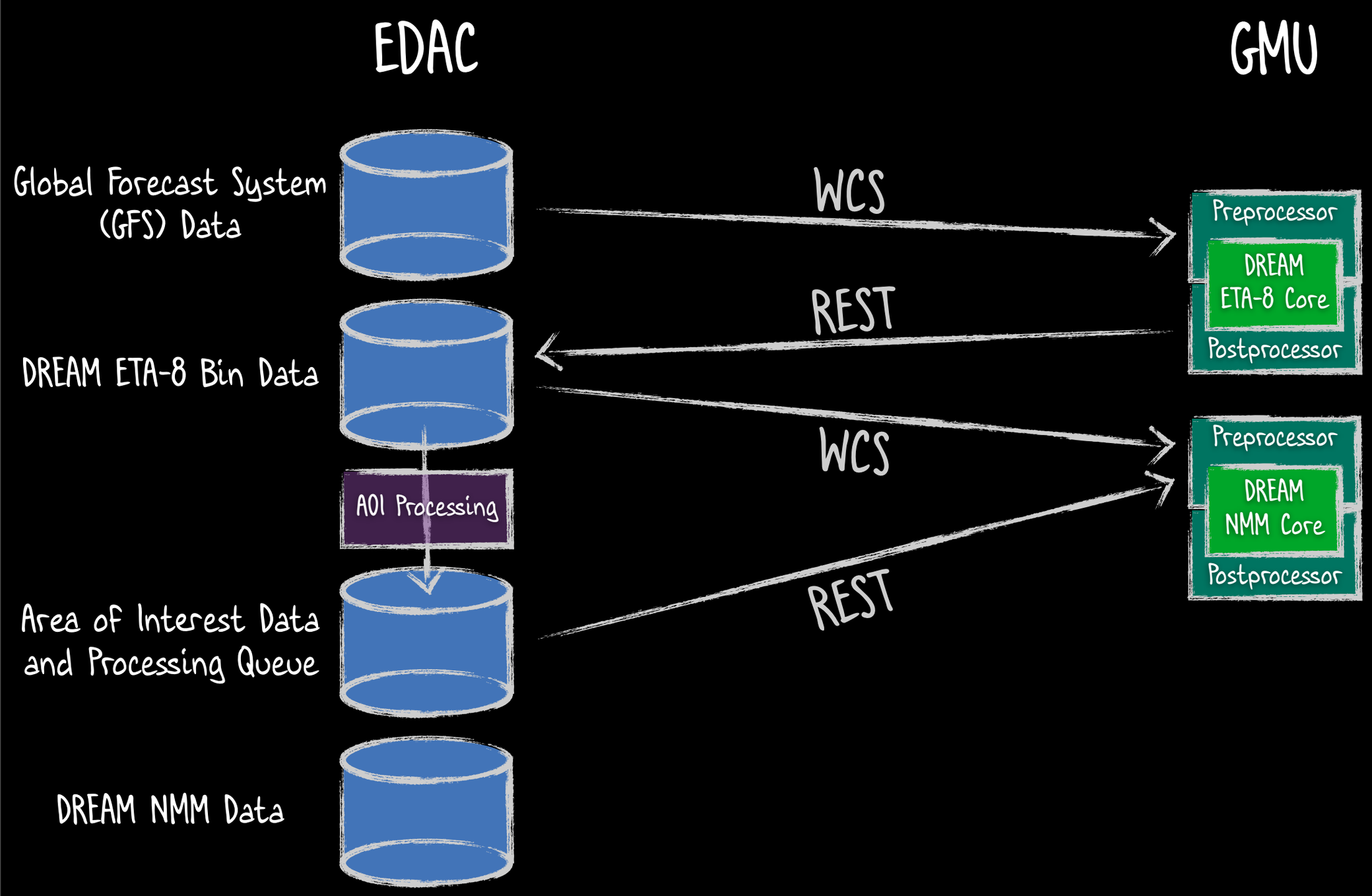

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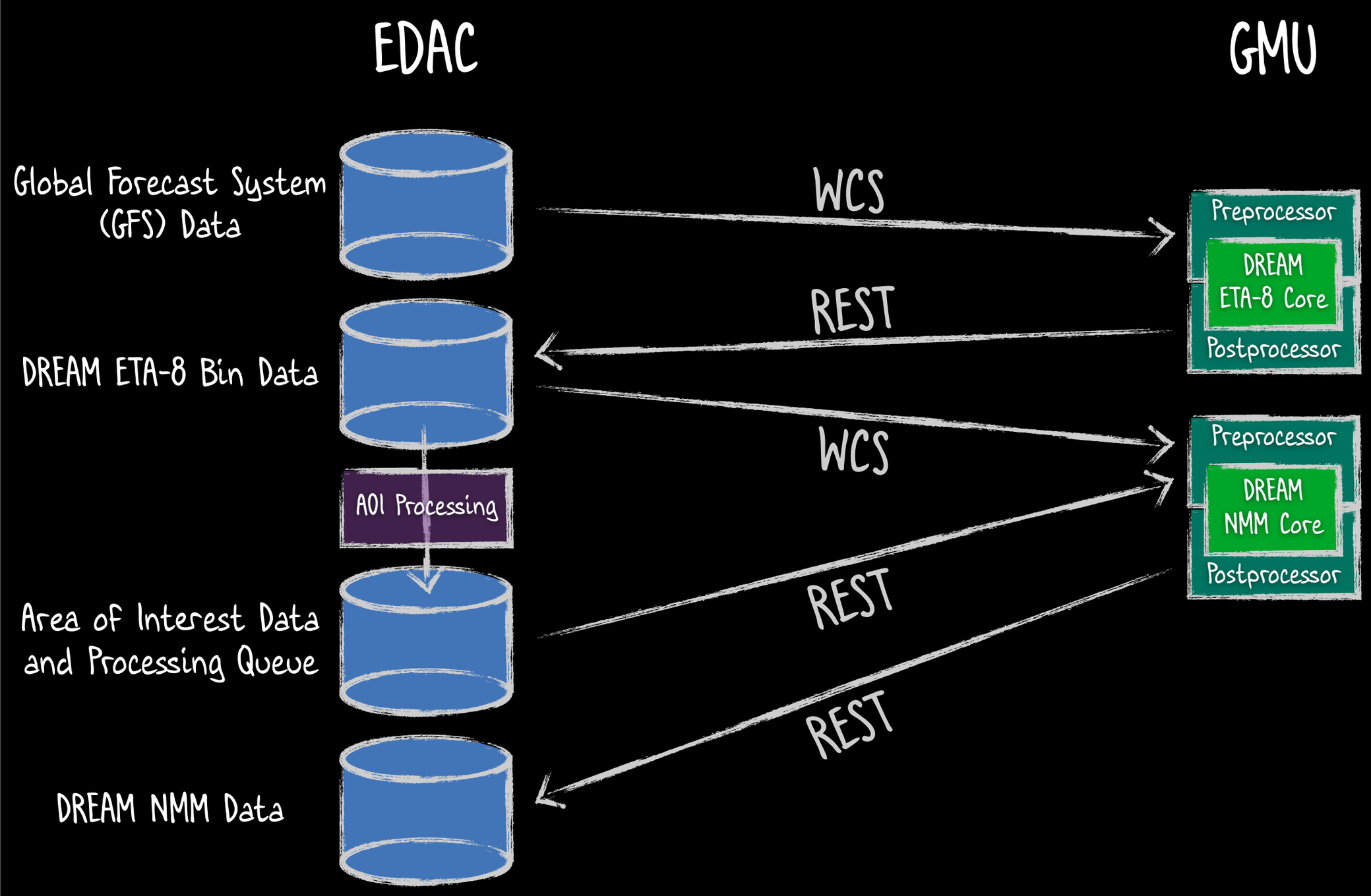

Systems Integration

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Global Forecast System (GFS) Data

DREAM ETA-8 Bin Data

AOI Processing

Area of Interest Data and Processing Queue

DREAM NMM Data

WMS, WCS, WFS

Preprocessor
DREAM
ETA-8 Core
Postprocessor

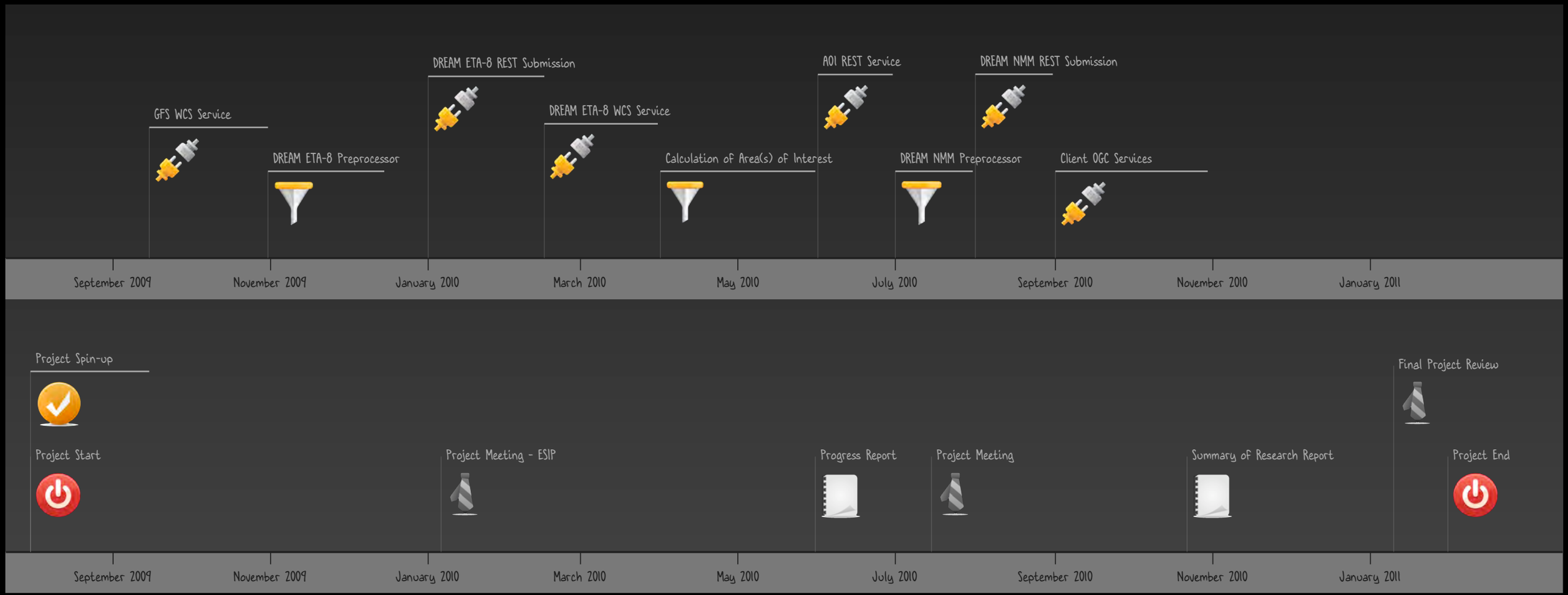
Preprocessor
DREAM
NMM Core
Postprocessor

Users

Feasibility Testing

- ✦ Systems Integration
  - ✓ Model pre- and post-processor implementation
  - ✓ Data management and storage
  - ✓ Appropriateness of implemented service standards
- ✦ Performance
  - ✓ Comparison of performance (time-to-delivery) of nested model vs. dedicated large domain/ high-resolution model runs

Timeline


GFS WCS Service
DREAM ETA-8 Preprocessor
DREAM ETA-8 REST Submission
DREAM ETA-8 WCS Service
Calculation of Area(s) of Interest
AOI REST Service
DREAM NMM REST Submission
DREAM NMM Preprocessor
Client OGC Services
September 2009
November 2009
January 2010
March 2010
May 2010
July 2010
September 2010
November 2010
January 2011
Project Spin-up
Project Start
Project Meeting - ESIP
Progress Report
Project Meeting
Summary of Research Report
Final Project Review
Project End
September 2009
November 2009
January 2010
March 2010
May 2010
July 2010
September 2010
November 2010
January 2011

Contact Information

Karl Benedict
kbene@edac.unm.edu
(505) 277-3622 x 234
MSC01 1110, 1 University of New Mexico
Albuquerque, NM 87131

Chowei Yang
cyang3@gmu.edu