The Latin American Grid WRF Portal

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Motivation

- Meteorological researchers suggest hurricane modeling improvements by incorporating ensemble forecasting and model coupling
- Ensemble/couple based forecast requires a scale out of computing resources achievable through Grid infrastructure
- Ensemble/couple model will generate an order of magnitude more data for researchers to manage and study

Challenges

- Address various User Community Needs
  - Diverse Targeted audience (meteorologists, homeowner, business owner, emergency response community) have different level of expectation and expertise for interpreting the output of a hurricane forecast.
- Can we achieve improvements in performance by scaling out using Grid computing middleware?
- WRF designed for Cluster architecture not Grid.
- Globus challenges include steep learning curve, reliability and performance issues.
- Addressing communication latency over Grid nodes
- Realization of a cyber infrastructure that facilitates the investigation of model data and collaboration among researchers.

Goals & Objectives

- LA Grid WRF Portal to provide a Comprehensive User Interface
- Data Input Selection & Ingest
- Model Parameter Settings
- Automate WRF simulation runs to support ensembles
- Output Management and Organization
- Visualization for Forecast Data
- Optimize WRF Model runs (Grid enhanced version)
- Parallelize pre & post aspects of WRF runs
- Efficient Resource Allocation for WRF visualization and GIS data sets
- Visualization (Meteorologists/ER Teams/Business Continuity Managers)
  - Interactive Visualizations
  - JPEGs, GIFs overlaid on Maps
  - Zoom In/Zoom out, & Navigability
  - Runtime update of visualizations (Driven by Model Parameters)
- Non-Interactive Visualizations
- Static Granularity MPEGs for WRF runs

WRF Background

- Computational Expensive Process
- WRF Statistics
  - 455,000 lines of code (40,000 lines generated at compile time)
  - Simple 7 x 7 grid @ 4 km resolution (~1.5 Hours on single-node; ~30 mins on 8 nodes)
  - Installation, Compilation and Run requires
    - NetCDF library, Script & Compiler Installation Configurations
      - Edit input file for input model parameters

Project Road Map

- WRF Portal 0.5 - Meteorologists in prediction phase
  - Auto-configuration of single WRF simulations
  - Simple Visualization Output (2-D Track, Wind Intensity)
- WRF Portal 1.0 - Meteorologists/sophisticated end-users in prediction & impact phases
  - Ensemble Orchestration (scripting) & Simple Visualizations
  - Data Extraction based on geographical areas, time frame and parameter variation etc.
- WRF Portal 2.0 - End-users in impact & recovery phases (Static)
  - End-user driven Simulations based on expected views and requirements
  - Ensemble Orchestration & Integration of simulation and visualization via job flow management
  - Customized views targeted at each end-user community
- WRF Portal 3.0 - End-users in impact & recovery phases (Static)
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WRF Portal Prototype

- New Ensemble
  - Ensemble Name: [Input]
  - Name List File: [Browse]
  - Model [Create Ensemble]

Portal Prototypical Architecture

- Ensemble Queue
  - Ensemble Run WRF 01
  - Ensemble Run WRF 02
  - Ensemble Run WRF 03
  - Ensemble Run WRF 04
  - Ensemble Run WRF 05

- Ensemble Results: Ensemble Run WRF 05
  - Run Information
    - Date: 01/01/01
    - Time: 12:00
    - Wind Speed: 30 mph
    - Temperature: 60°F
    - Humidity: 80%

- Visualization
  - Interactive Visualization
  - Zoom In/Zoom Out

- Output
  - NetCDF files
  - GIS/Weather Input Data Sets
  - Ensemble Run Configurations

- Meta-Scheduler

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