An Urgent Computing Workflow for Realtime Hurricane Forecasts

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Representing the SURA Coastal Ocean Observing and Prediction Program (SCOOP)
NSF DynaCode
SURA Coastal Ocean Observing and Prediction (SCOOP)

- Integrating data from regional observing systems for realtime coastal forecasts in SE
- Coastal modelers working closely with computer scientists to couple models, provide data solutions, deploy ensembles of models on the Grid, assemble realtime results with GIS technologies.
- Three scenarios: event-driven ensemble prediction, retrospective analysis, 24/7 forecasts

University of Alabama at Huntsville, University of Florida, GoMOOS, Louisiana State University, University of Miami, University of Maryland, University of North Carolina, Texas A&M, Virginia Inst of Marine Sciences
Urgent Coastal Scenarios

- Emergency preparedness
- Oilspill behaviour
- Sea rescue
- Military operations
- Hypoxia “Dead Zone”
- Algae blooms
- Hurricane forecasts
SCOOP Ensemble Modeling

- Wind Forcing
  - NCEP
  - MM5
  - NCAR
  - or Regional Archives
  - or Synthetic Wind Ensembles

- Select region and time range

- Transform and transport data

- Wave and/or Surge Models
  - ADCirc
  - EICirc
  - WAM
  - SWAN

- Ensemble of models run across distributed resources

- Result Dissemination
  - Archive
  - Verification
  - Visualization
    - Analysis, storage, cataloging, visualization of output

Ensemble wind fields from varied and distributed sources
Configure Ensembles

Selected storm: 2005/12 (120 hours)

Ensemble run state selection (Priority Level)

Setting these values will decide what level of priority you want to allocate to your jobs when they run on the supercomputers. At each priority level, you can select how many of your ensemble members you want to run at that level. Later, under ensemble member configuration, you prioritize your individual ensembles relative to what you have allocated here. Ensemble members with greatest priority go into the Emergency list (until it fills up), then to the Urgent list, and lastly to the Normal list. By default, all go to the Normal list.

- **Emergency** jobs will run immediately, clearing the computer for your use, and terminating other scientists' jobs without warning.
- **Urgent** jobs are put on a special VIP list, and will run as soon as any resources become available.
- **Normal** jobs are added to the supercomputer's general list of jobs, without any special consideration or additional cost.

Ensemble member configuration

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<th>Track</th>
<th>Priority</th>
<th>Model</th>
<th>Forcing</th>
<th>Region</th>
<th>Config</th>
<th>Hot Start</th>
<th>Comment</th>
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Urgency & Priority

• Urgency Level:
  – *Emergency*: run on-demand (e.g. preemption)
  – *Urgent*: run in priority queue (e.g. next to run)
  – *Normal*: best effort, e.g. guess best queue

• Priority:
  – Order in which jobs should be completed
What is SPRUCE

- SPRUCE is a specialized software system that provides computational resources quickly for time critical emergency decision support applications.
- Developed by University of Chicago and ANL.
- The system provides the users with the “right of way” tokens, which when activated provides users with higher priority to access the resource.
SPRUCE User Workflow

Fig. 1. SPRUCE workflow and token activation
Handling Urgent Job Submission

Fig. 6. Resource provider architecture
SCOOP Workflow

User Requests/Scheduler → Dagman → Submit file → GRAM → Job Manager → Local Job Queues → Resource

SCOOP Job Submission Process
SCOOP Work Flow with SPRUCE

User Requests → Dagman → Submit file → GRAM
  |          RSL parameter          |
  |            Condor-g             |
SCOOP Job Submission Process

authenticate Token with a filter → SPRUCE Job Manager → Job Queues → Resource
Why use SPRUCE?

- Token based authentication is simple and less time consuming when compared to signed certificates or proxies.
- Access control can be given dynamically to any user during an urgent situation with the tokens.
- The resources on which the user is given access can be controlled by the administrator by specifying the list of resources during the token activation.
- The queues on which the job is being submitted need not be selected manually. The appropriate queue is selected depending on the policies implemented at the resource.
Credits

• Entire SCOOP team.
• Special thanks to Suman Nadella for her support all over the project.
• For More Information:
  – http://scoop.sura.org