

# Distributed Computing in Kepler

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6th Biennial Ptolemy  
 Miniconference

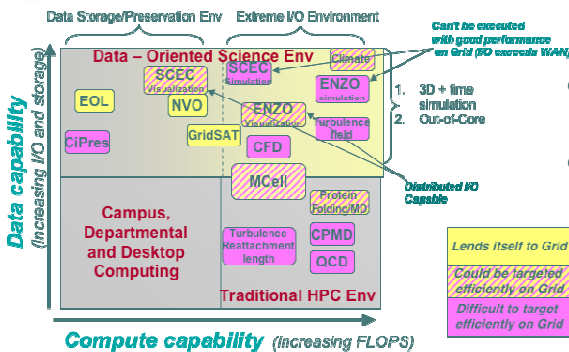
Berkeley, CA  
 May 12, 2005



## Distributed Computation is a Requirement in Scientific Computing



Scientific workflows do scientific computing!



Picture from: Fran BERMAN

- Increasing need for data and compute capabilities
- Data and computation should be combined for success!

- HEC + Data management/integration

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# Kepler and Grid Systems -- Early Efforts --



- o Some Grid actors in place
  - Globus Job Runner, GridFTP-based file access, Proxy Certificate Generator
  - For one job execution! Can be iterated...
- o SRB support
- o Interaction with Nimrod and APST
- o Grid workflow pattern:
  - STAGE FILES -> EXECUTE -> FETCH FILES**
  - Execute==Schedule -> Monitor & Recover

Issues: Data and process provenance, user interaction, reporting and logging



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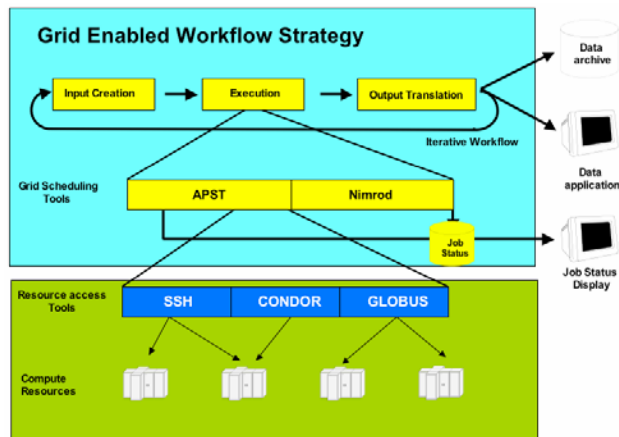
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# NIMROD and APST



GOAL: To use the expertise in scheduling and job maintenance



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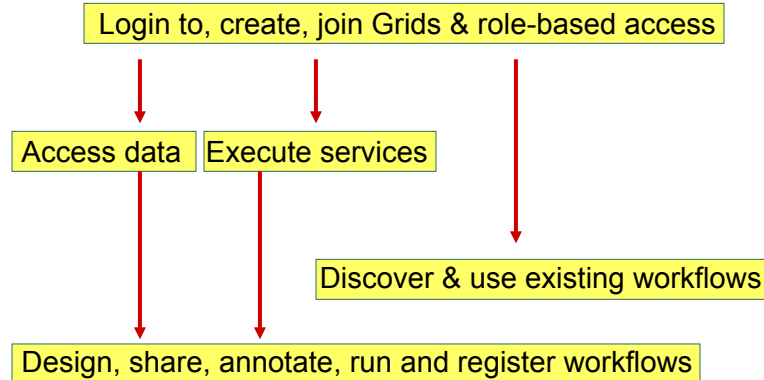
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## Distributed Computing is Team Work



So our distributed computing framework *should support collaborations!*

...as well as it should keep control of *scheduling* and *provenance* information...



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## Goals and Requirements

- Two targets:
  - Distributing execution
    - Users can configure Kepler Grid access and execution parameters
    - Kepler should manage the orchestration of distributed nodes.
    - Kepler will have the ability to do failure recovery
    - Users can be able to detach from the workflow instance after they and then connect again
  - Supporting on the fly online collaborations
    - Users can log into Kepler Grid and form groups
    - Users can specify who can share the execution



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## Peer-to-Peer System Satisfies These Goals



- o A peer-to-peer network:
  - Many or all of the participating hosts act both as client and server in the communication
- o The JXTA framework provides:
  - Peers
  - Peer Groups
  - Pipes
  - Messages
    - Queries and responses for metadata
    - Requests and responses to move workflows and workflow components as .ksw files
    - Data flow messages in executing workflows



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## Creating KeplerGrid using P2P Technology

### Setting up Grid parameters



The screenshot shows the JXTA Configurator application. The 'Basic settings' tab is active, displaying a 'Register as a peer' form with fields for Peer Name, Password, and Verify Password, along with an 'Import Root Certificate File...' button. The 'Relays' tab is also visible, showing 'Relay Settings' with checkboxes for 'Use a relay' and 'Use only configured seed relays', and a 'Relay seed peers' section with a text field and a '+' button. The 'Relay seeding URLs' section contains a text field with the URL 'http://pdx.jstak.com:8080/jstak/relays.cgi?'. The application title bar indicates the URL 'http://shell.jxta.org/index.html'.



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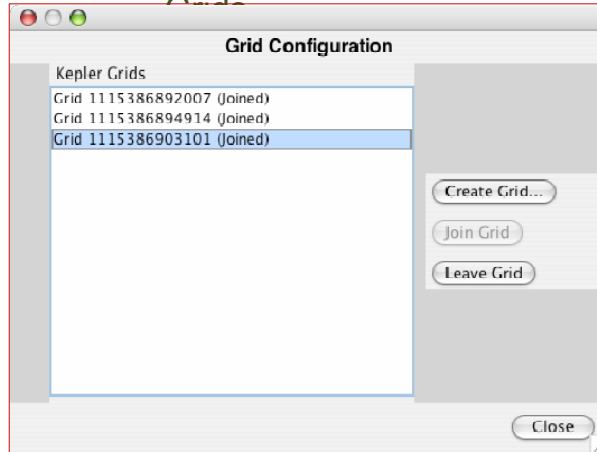
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# Creating KeplerGrid using P2P Technology

## Creating, Joining & Leaving Grids



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# Creating KeplerGrid using P2P Technology

## Distributing Computation on a Specific Grid



- o P2P/JXTA Director
  - Decides on the overall execution schedule
  - Communicates with different nodes (peers) in the Grid
  - Submits *distributable* jobs to remote nodes
  - Can deduce if an actor can run remotely from its metadata
  - Configuration parameters:
    - Group to join
  - Can have multiple models:
    - Using a “master peer” and static scheduling is the current focus

*Work in progress...*



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## Creating KeplerGrid using P2P Technology

### Provenance, Execution Logs and Failure Recovery



- Built in services for handling failures and resubmission
  - Checkpointing
  - Store data where you execute it & send back metadata
  - The “master peer” collects the provenance information



How can we do it without having a global job database?

*Work in progress...*



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## Status of Design and Implementation



- Initial tests with Grid creation, peer registration and discovery
- Start with a basic execution model extending SDF
- Need to explore different execution models
  - More dynamic models seem more suitable
- Big design decisions to think on:
  - What to stage to remote nodes
  - Scalability
  - Detachability
  - Certification and security



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To sum up...



- Just distributing the execution is not enough  
Need to think about the usability of it!
- Need to have sub-services using the JXTA model for
  - peer discovery,
  - data communication,
  - logging,
  - failure recovery.
- Might need more than one domain for different types of distributed workflows



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Questions?..

Thanks!



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