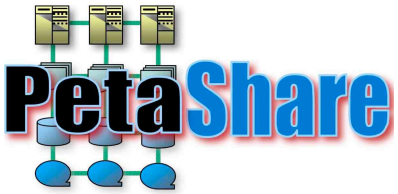


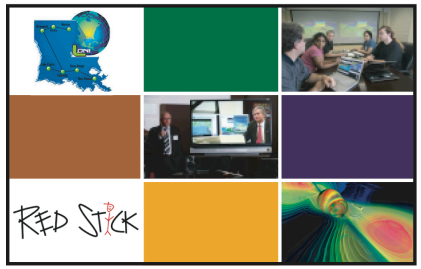
Louisiana Institute
Cyberinfrastructure Development Efforts

Tevfik Kosar

Department of Computer Science & CCT
Louisiana State University

October 31, 2008

CENTER FOR COMPUTATION
& TECHNOLOGY



Statewide Cyberinfrastructure Efforts

- Scheduling, data
- Visualization
- Web Services
- HPC Interfaces & API

- Distributed data management
- Storage, data archival & retrieval

PetaShare

CENTER FOR SECURE CYBERSPACE

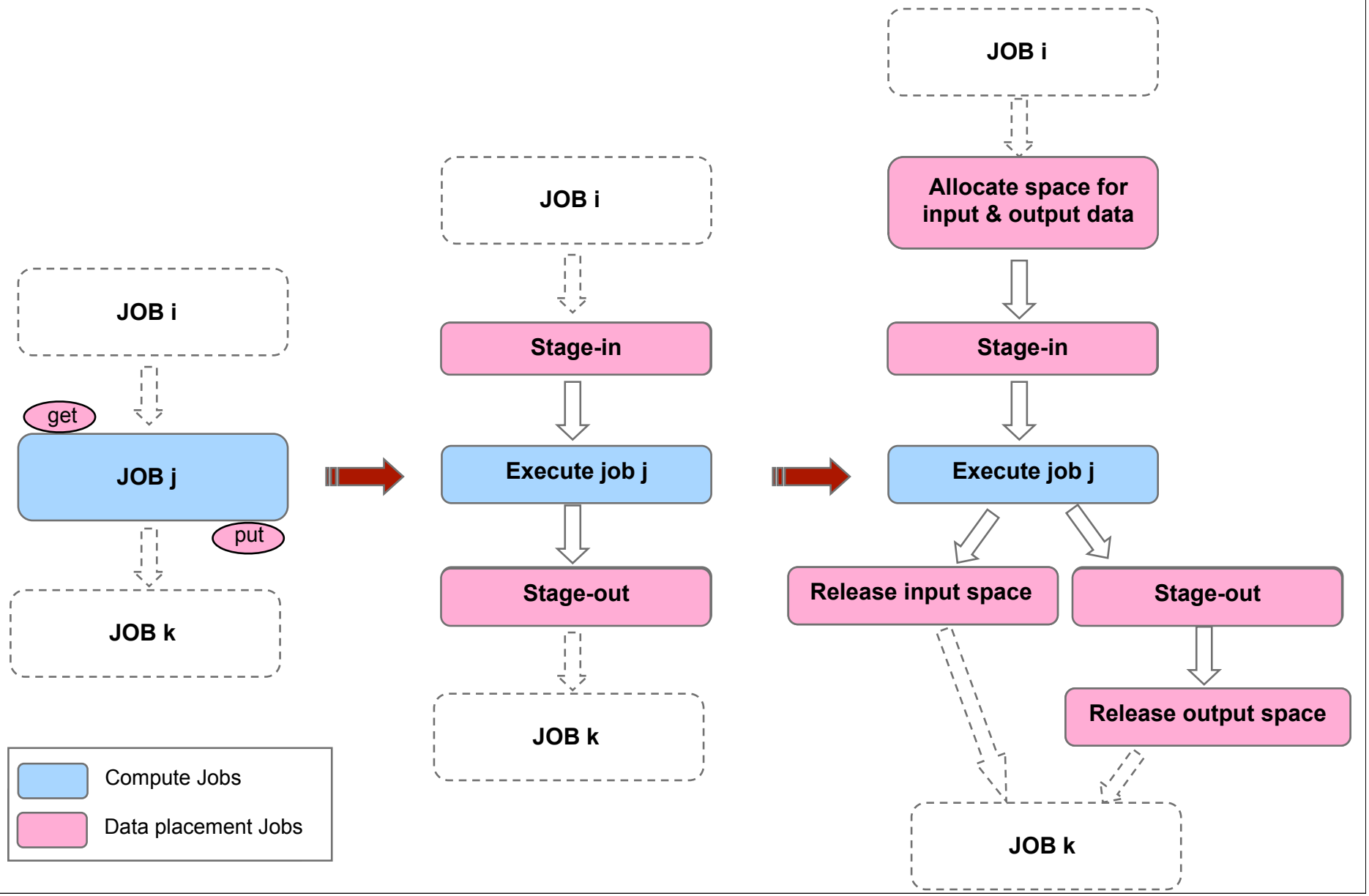
- Sensor Networks
- Cyber Security

Today's Talk

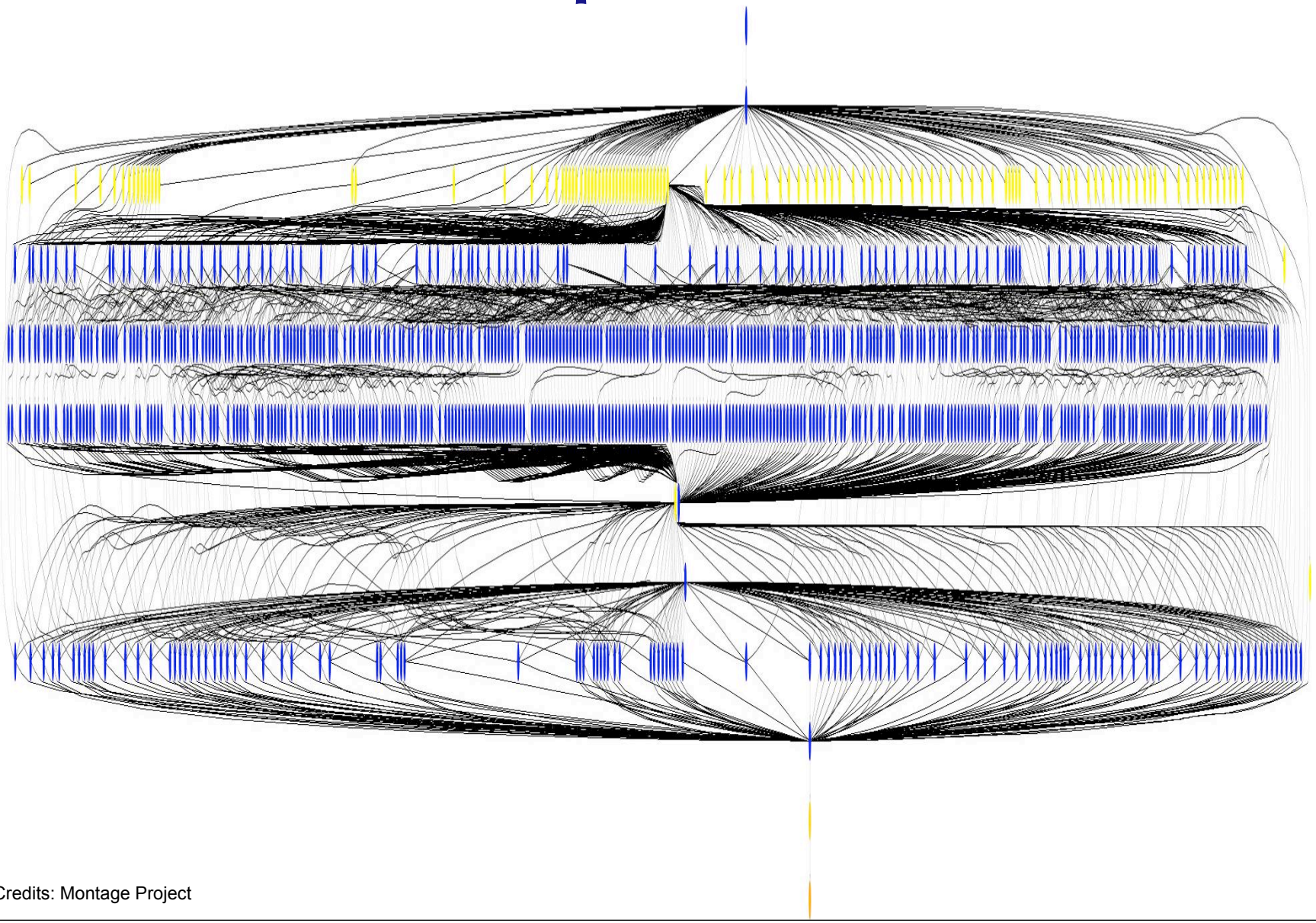
- End-to-end Workflow Management
- Data Scheduling
- Distributed Data Storage

End-to-end Workflows

Data-aware Workflows

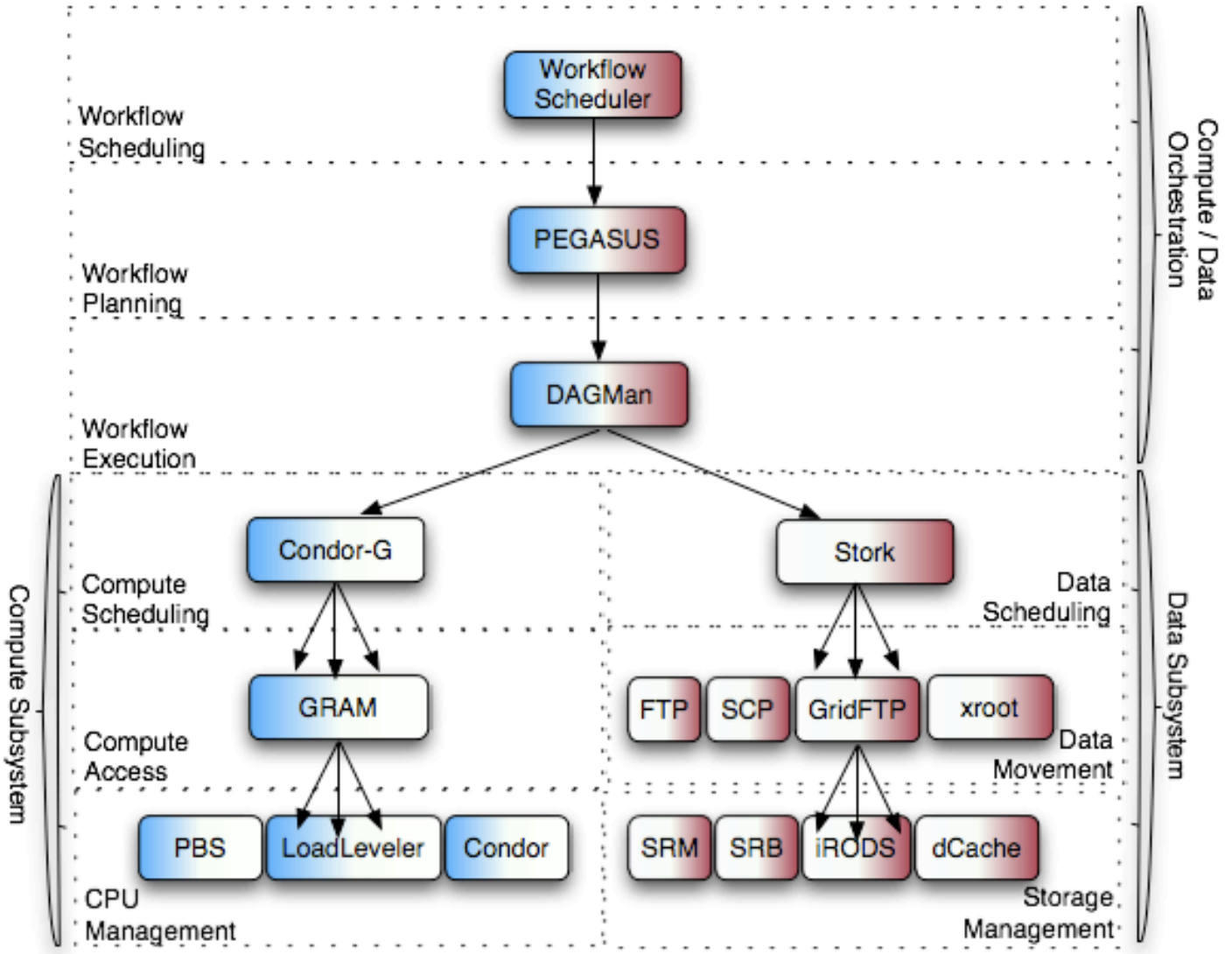


A Less Simpler Workflow

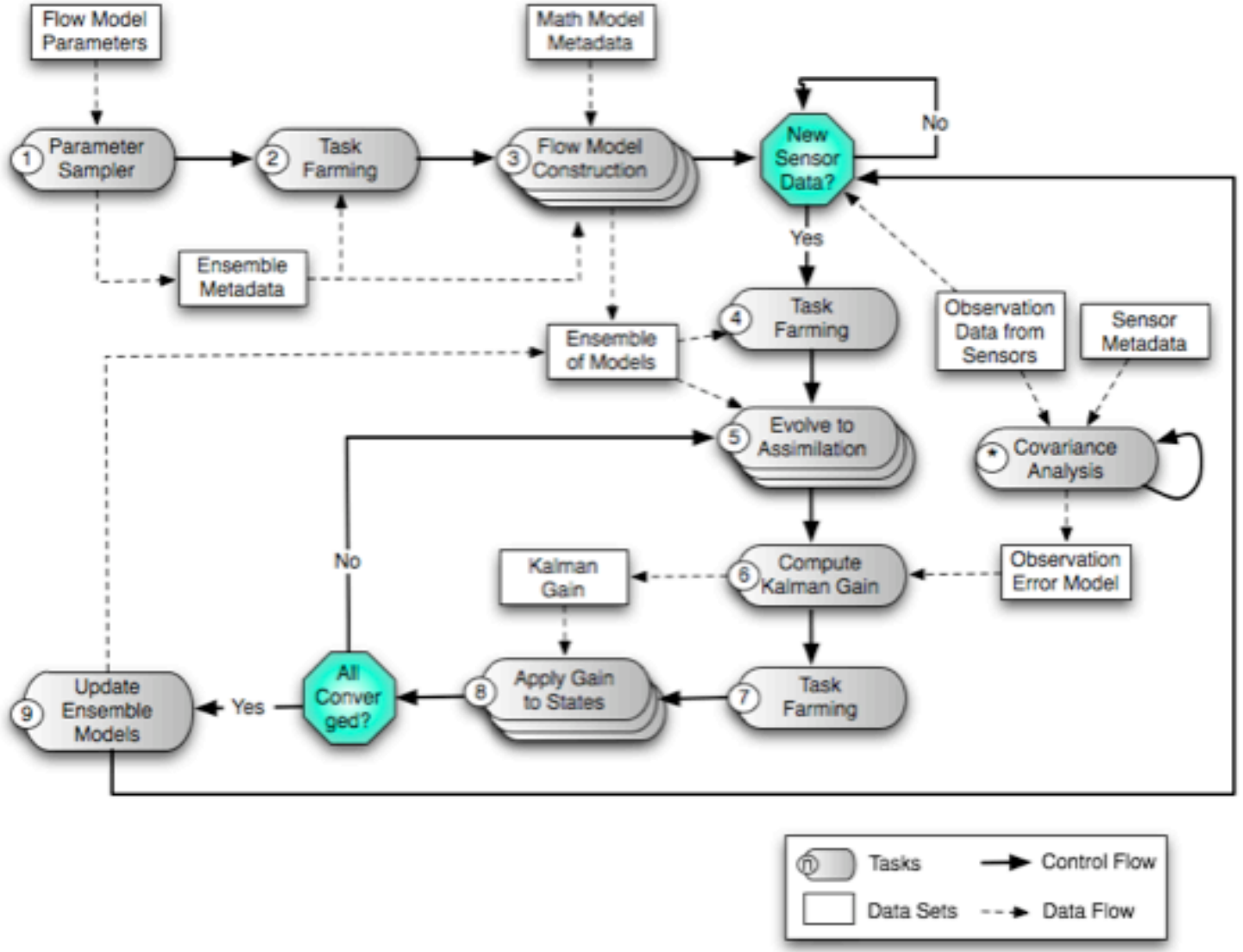


Credits: Montage Project

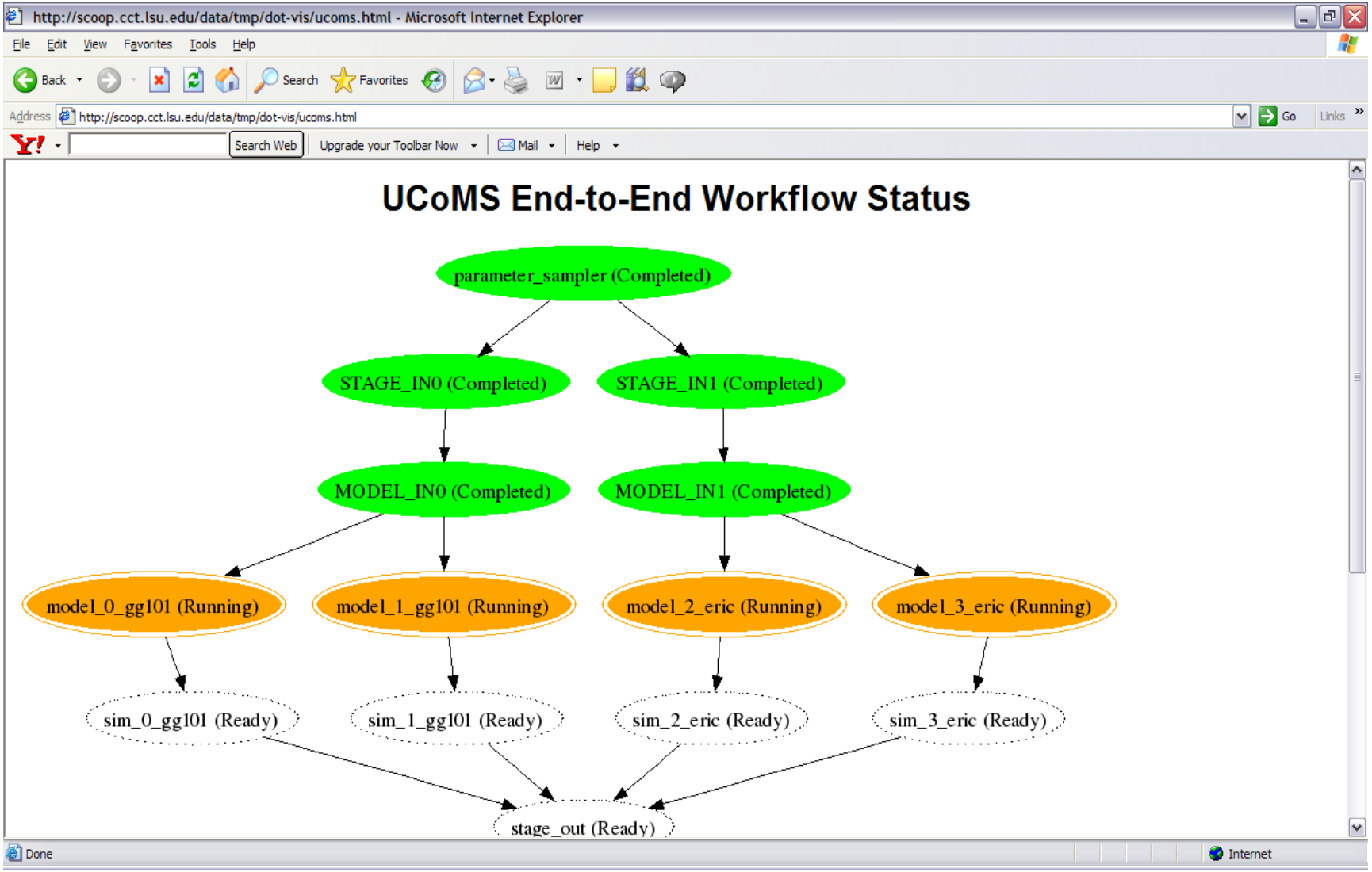
Separation of CPU & IO



UCoMS Workflow

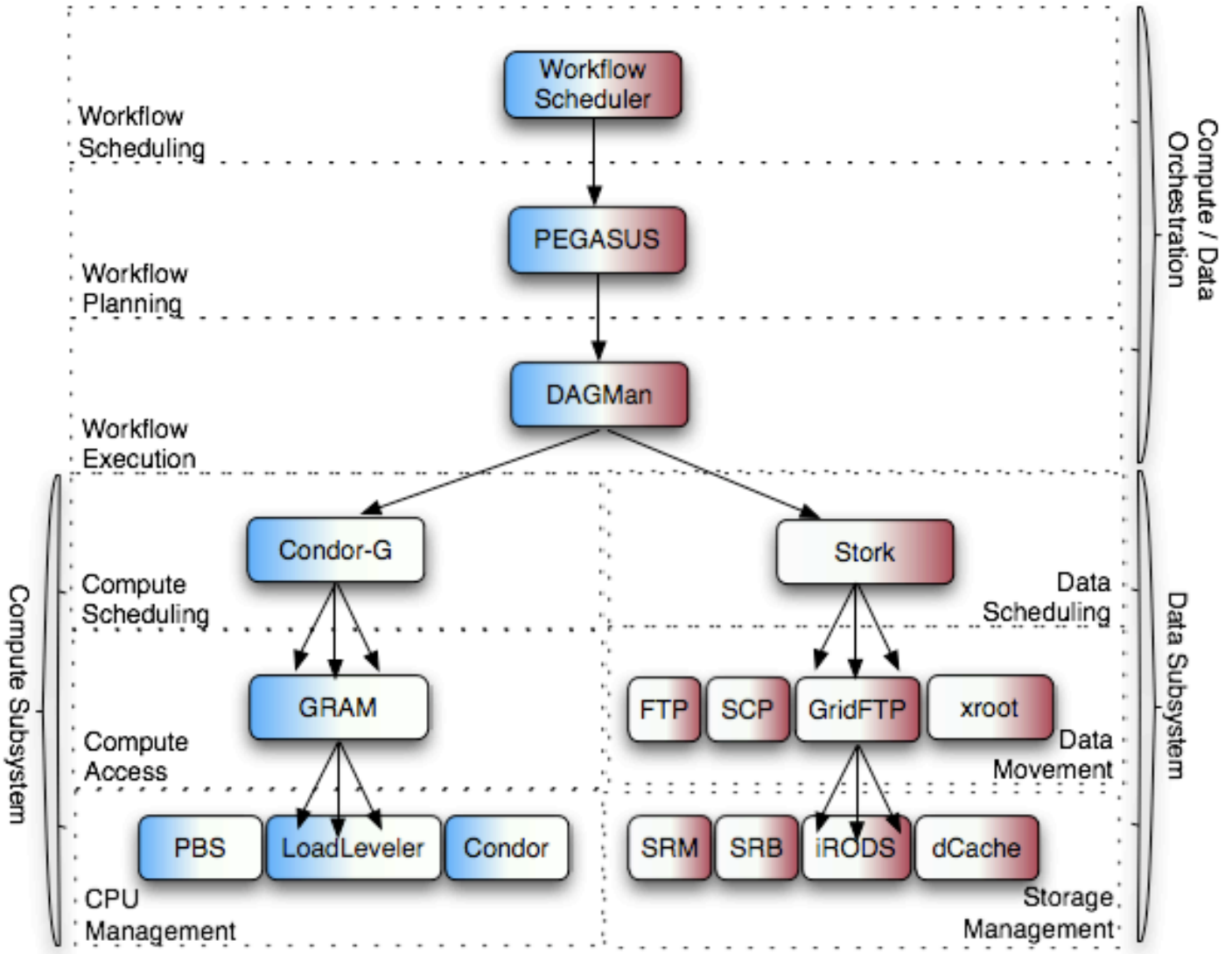


Monitoring Workflows via WEB



Data Scheduling

Separation of CPU & IO



Traditional Schedulers

- Traditional schedulers not aware of characteristics and semantics of data placement jobs

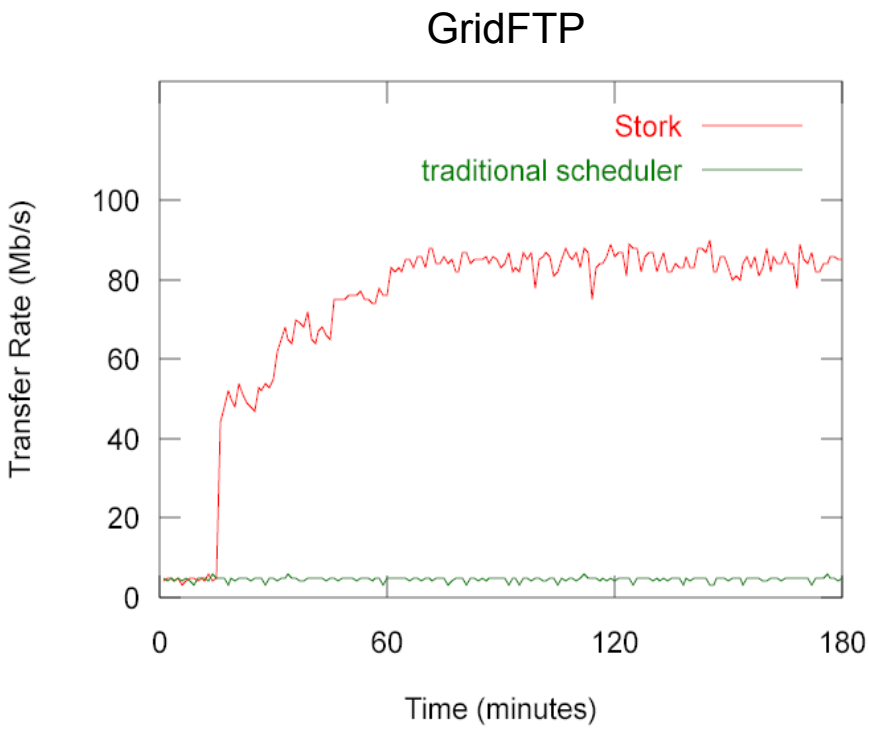
```
Executable = genome.exe

Arguments  = a b c d
```

```
Executable = globus-url-copy
Arguments  = gsiftp://host1/f1
             gsiftp://host2/f2
```

Any difference?

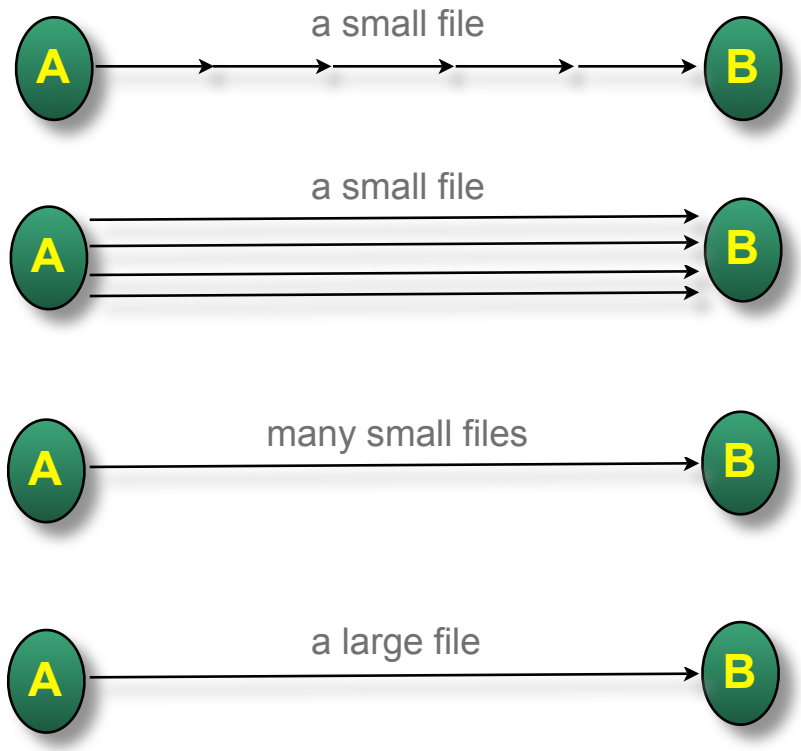
Data-Aware Schedulers

- Type of a job?
  - transfer, allocate, release, locate..
- Priority, order?
- Protocol to use?
- Second vs Third party?
- Available storage space?
- Best concurrency level?
- Reasons for failure?
- Best network parameters?
  - tcp buffer size
  - I/O block size
  - # of parallel streams

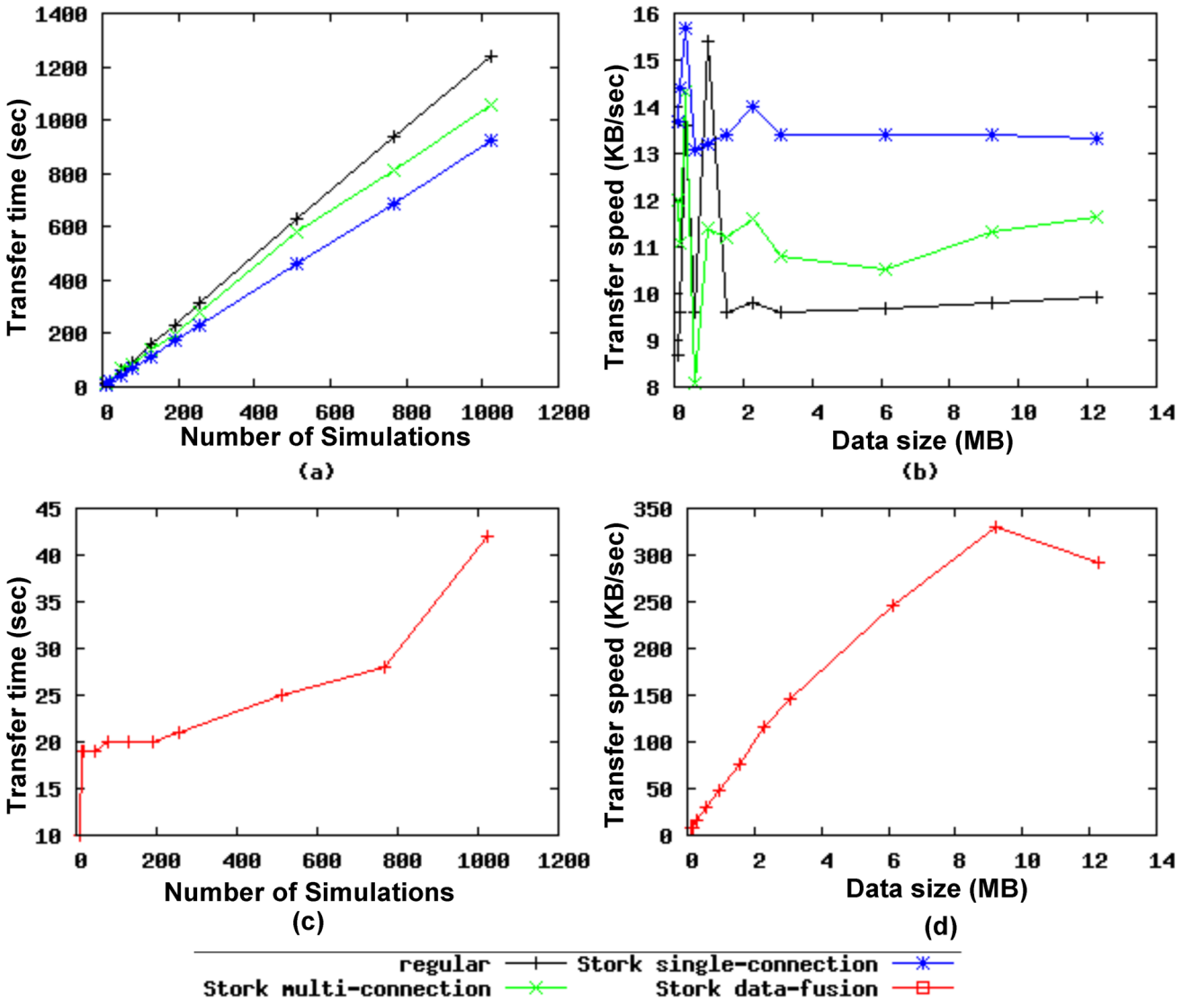


Stork Transfer Methods

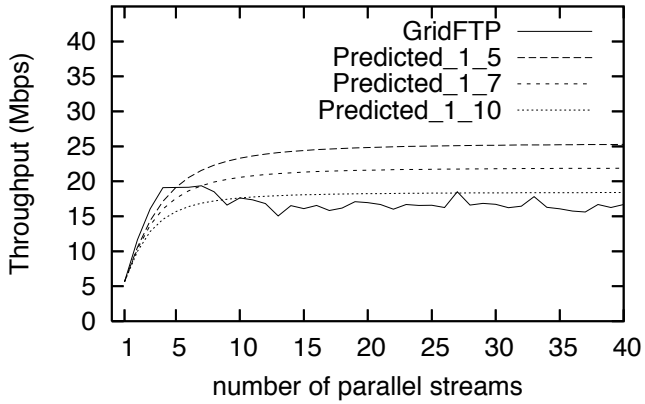
- regular:
  - one connection per file, serial transfer
- multi-connection:
  - one connection per file, concurrent transfer
- single-connection:
  - one connection for all transfers
- data-fusion:
  - merge small files into larger chunks



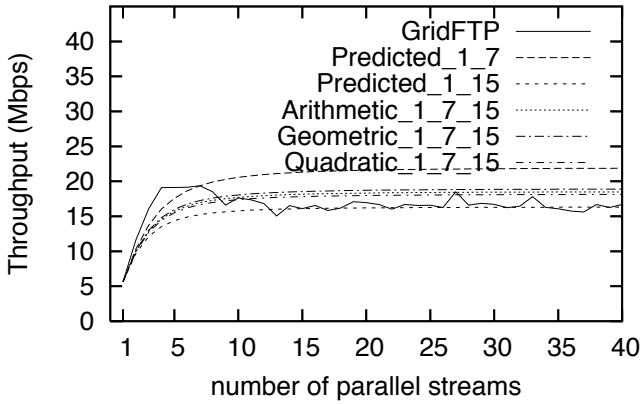
Stork Transfer Results



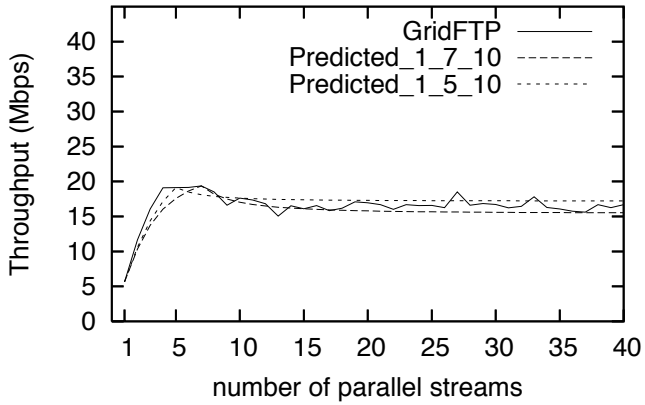
a) Dinda et al Model Prediction Results



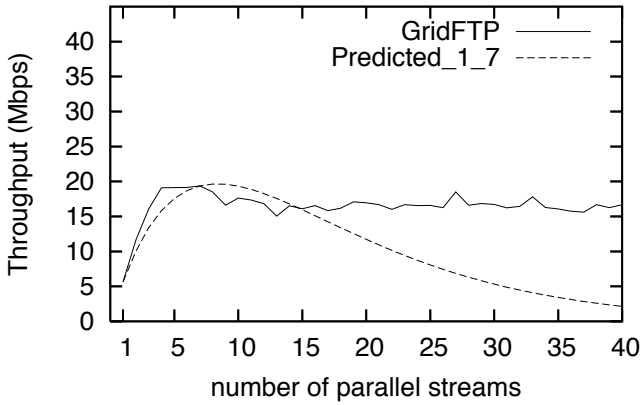
b) Averaging Prediction Results



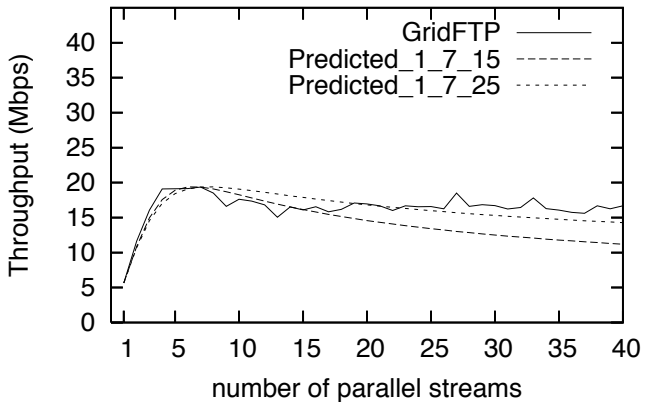
c) Break Function Prediction Results



d) Logarithmic Prediction Results



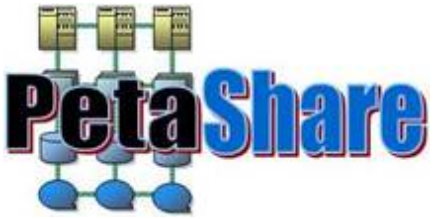
e) Newton's Method Prediction Results



Dynamic Tuning

Based on light-weight prediction

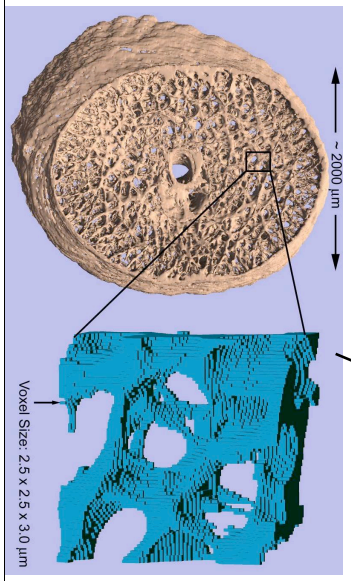
Distributed Storage



- Goal: enable domain scientists to focus on their primary research problem, assured that the underlying infrastructure will manage the low-level data handling issues.
- Novel approach: treat data storage resources and the tasks related to data access as first class entities just like computational resources and compute tasks.
- Key technologies being developed: data-aware storage systems, data-aware schedulers (i.e. Stork), and cross-domain meta-data scheme.
- Provides and additional 250TB disk, and 400TB tape storage

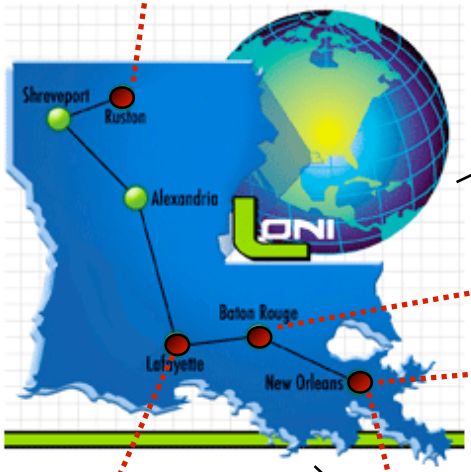
PetaShare

Participating institutions in the PetaShare project, connected through LONI. Sample research of the participating researchers pictured (i.e. biomechanics by Kodiyalam & Wischusen, tangible interaction by Ullmer, coastal studies by Walker, and molecular biology by Bishop).



Sensor Networking
High Energy Physics
Biomedical Data Mining

LaTech

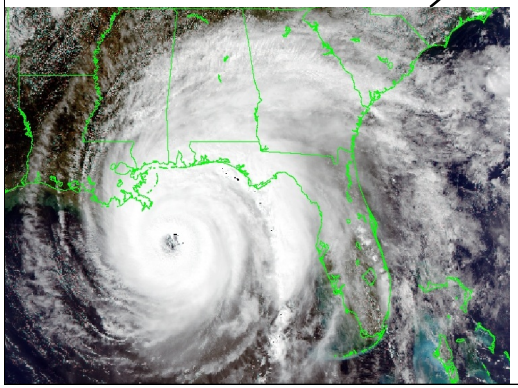


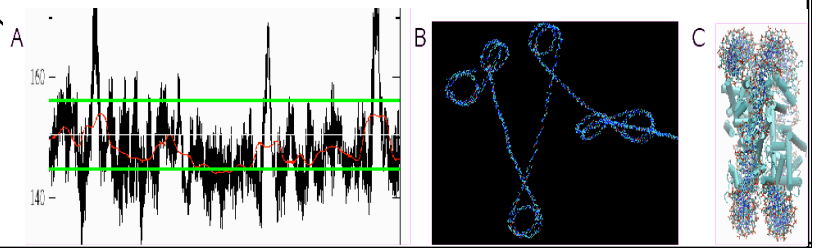
LSU
Coastal Modeling
Petroleum Engineering
Computational Fluid Dynamics
Computational Biology
Numerical Relativity

UNO
Biophysics

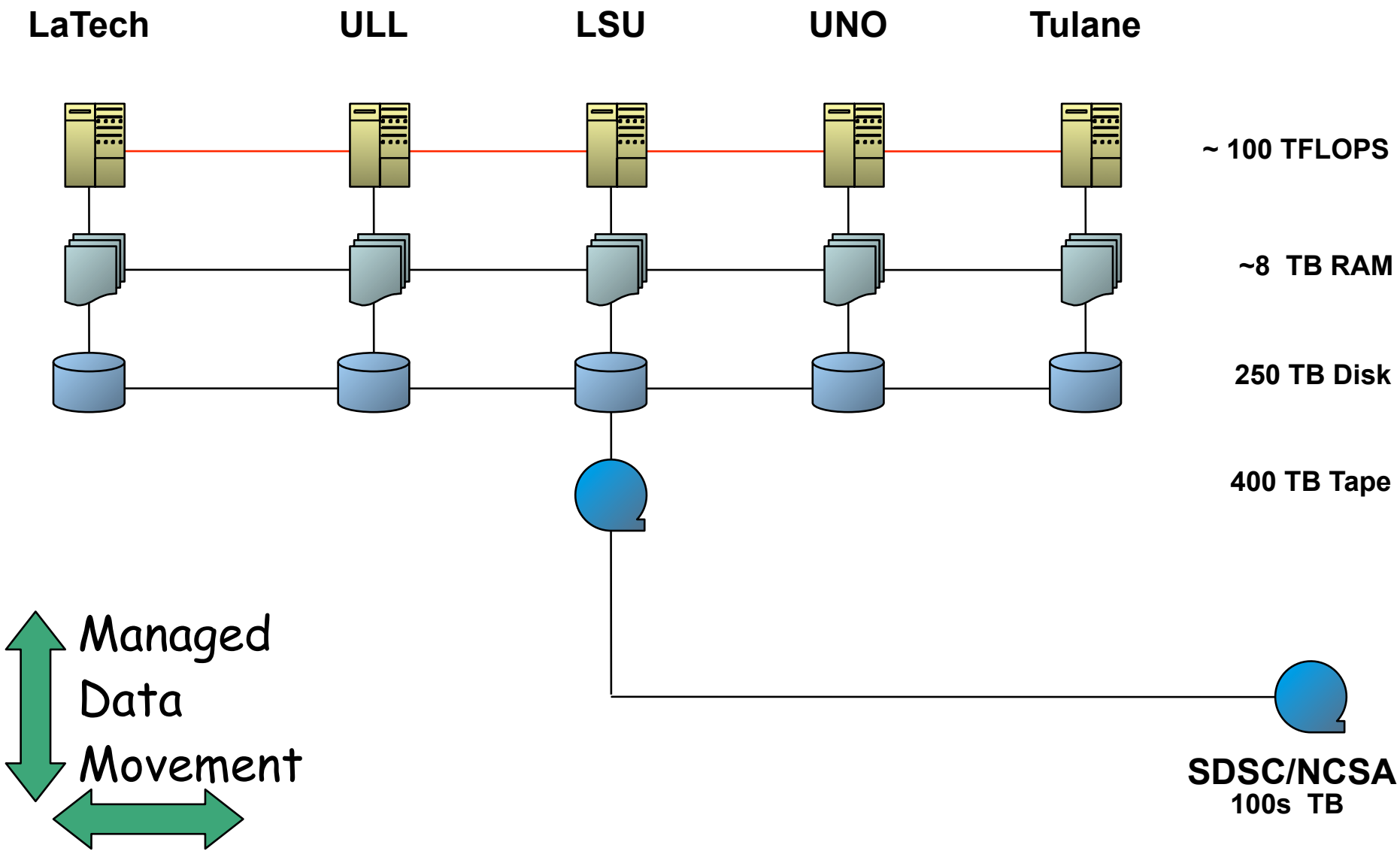
ULL
Geology
Petroleum Engineering
Sensor Networking

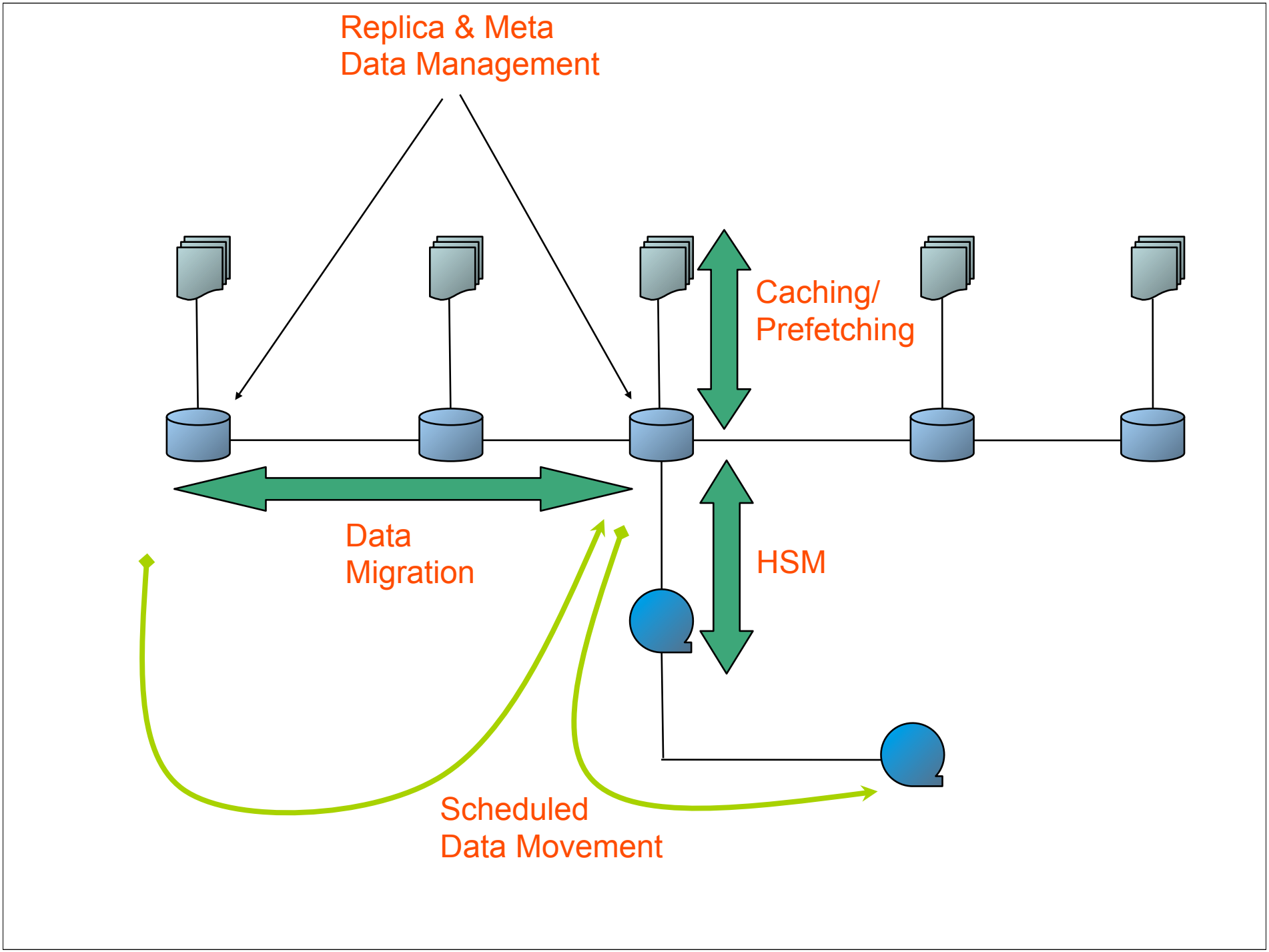
Tulane
Molecular Biology
Computational Electrophysiology





Infrastructure Overview

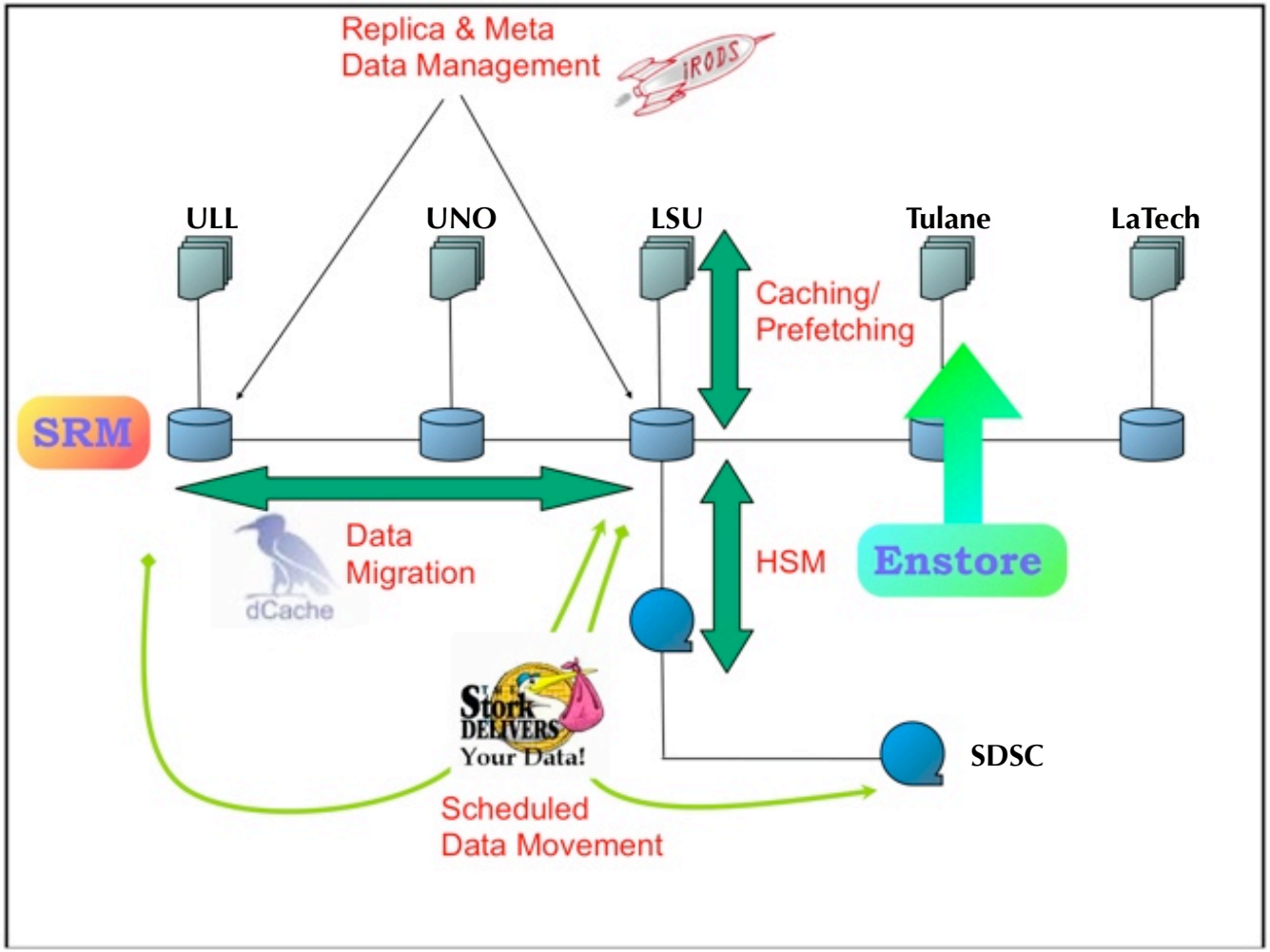



Replica & Meta
Data Management
Caching/
Prefetching
Data
Migration
HSM
Scheduled
Data Movement

PetaShare Core

POSIX interface:
- NO need to change code
- NO relinking
- NO recompiling
- NO privileged access

petashell



user-level virtual FS:
- NO need to change code
- NO relinking
- NO recompiling

petafs

Web interface:

PetaSearch

petashell

- a POSIX compatible shell interface to PetaShare

```
$ petashell

psh% cp /tmp/foo.txt /petashare/tulane/tmp/foo.txt
psh% vi /petashare/tulane/tmp/foo.txt
psh% cp /tmp/foo2.dat /petashare/anysite/tmp/foo2.dat

psh% genome_analysis genome_data -->
psh% genome_analysis /petashare/uno/genome_data

psh% exit
$
```

PetaSearch

Search Keywords: Katrina

In Archives:

- [x] SCOOP
- [x] UCoMS
- [ ] NumRel
- [x] Digital Media
- [ ] ....

- [ ] All Archives

Accepting Allocation Proposals

1) Title of the Project:
2) Short Description of the Project (Approximately 250 words):
3) Project Web Page (if any):
4) Project PI and Affiliation:
5) Other Senior Personnel:
6) If none of the project participants are associated with PetaShare, please specify a PetaShare contact person:
7) Amount of Storage Allocation Asked:
- **In Short Term (first 6 months):**
- **In Long Term (after 6 months):**

8) Preferred Storage Site(s):

[ ] LSU (available)
[ ] UNO (available)
[ ] ULL (soon)
[ ]Tulane (soon)
[ ] LSUHSC (soon)
[ ] LaTech (after May)
[ ] Other _____

9) Check if your application includes any of the following:

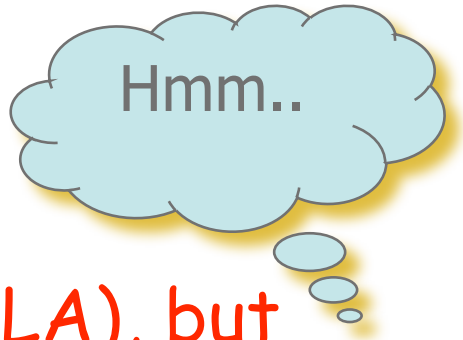
[ ] MPI jobs
[ ] Batch jobs
[ ] Real-time Visualization
[ ] Data Streaming

10) Please specify from which platforms you will be accessing this storage:

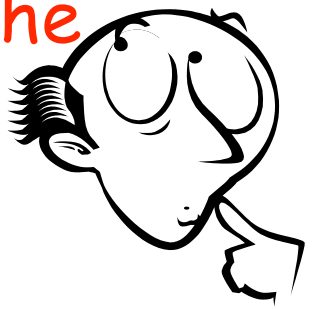
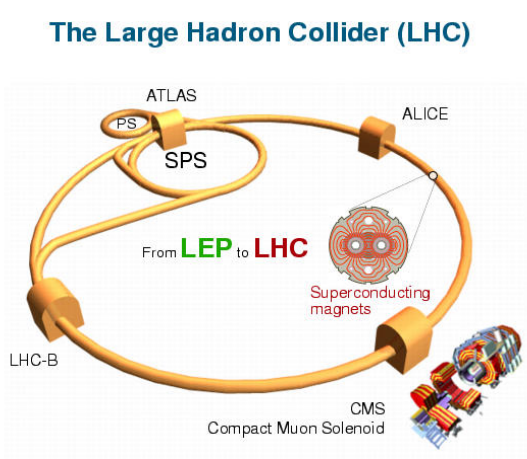
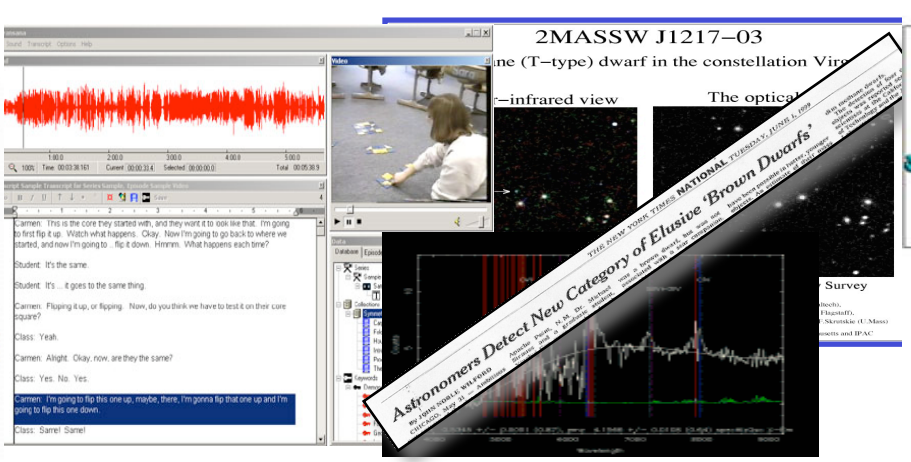
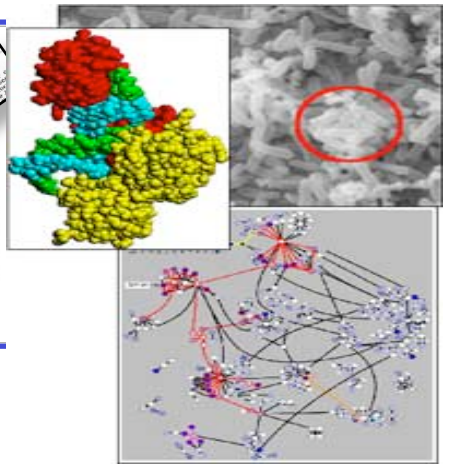
[ ] Linux
[ ] AIX
[ ] Windows
[ ] Other _____

Send an email to: kosar@cct.lsu.edu

PetaShare



A system driven by the local needs (in LA), but has potential to be a generic solution for the broader community!



For more information on **PetaShare**:
http://www.petashare.org