Industry meets SRM

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Diving into the Future

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Today‘s Menu Card

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- New Directions in Web Computing

Entrée

- New Directions in Web Storage

Main Course

- Cloud Storage Efforts

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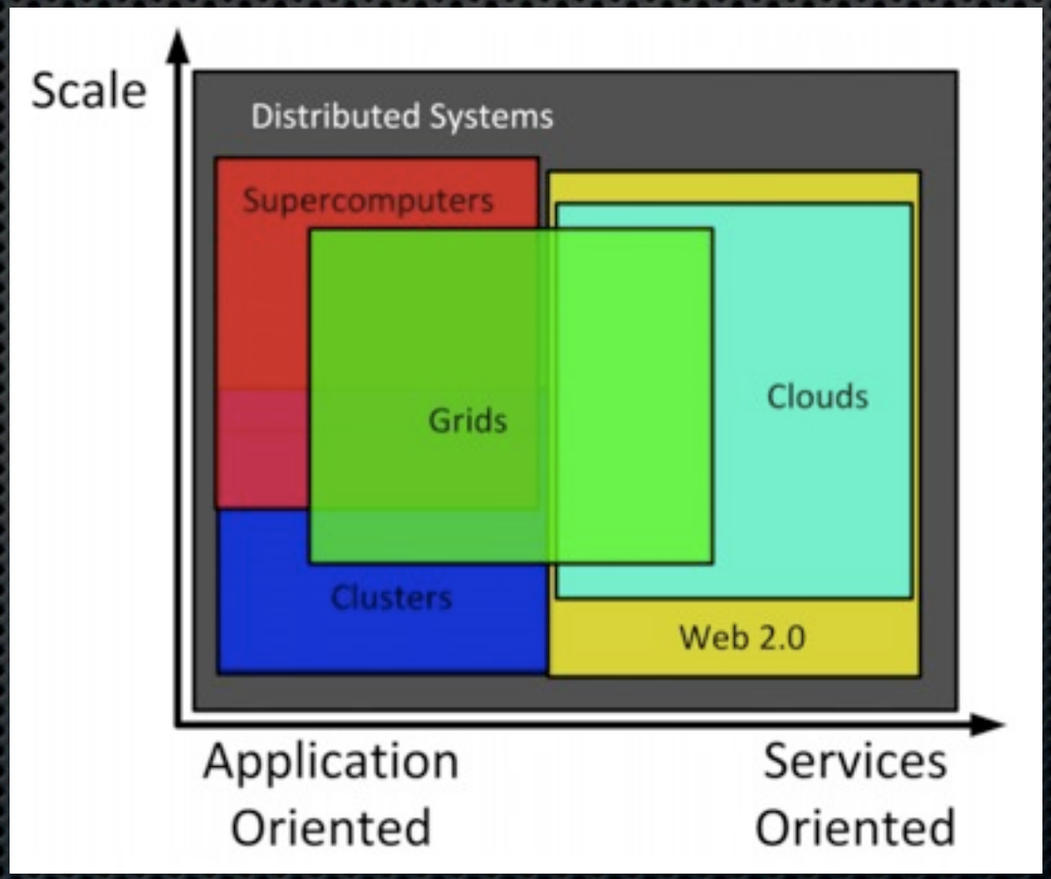
- Cloud Storage and SRM

New Directions in Web Computing

Cloudy Grids

„We now believe that **practical systems** will **inevitably mix** Web 2.0 and **Clouds with Grid**/Web services,…“ (Geoffrey Fox, Community Grids Laboratory, Indiana University)



Cloud Computing and Grid Computing 360-Degree Compared;
Ian Foster, Yong Zhao, Ioan Raicu, Shiyong Lu

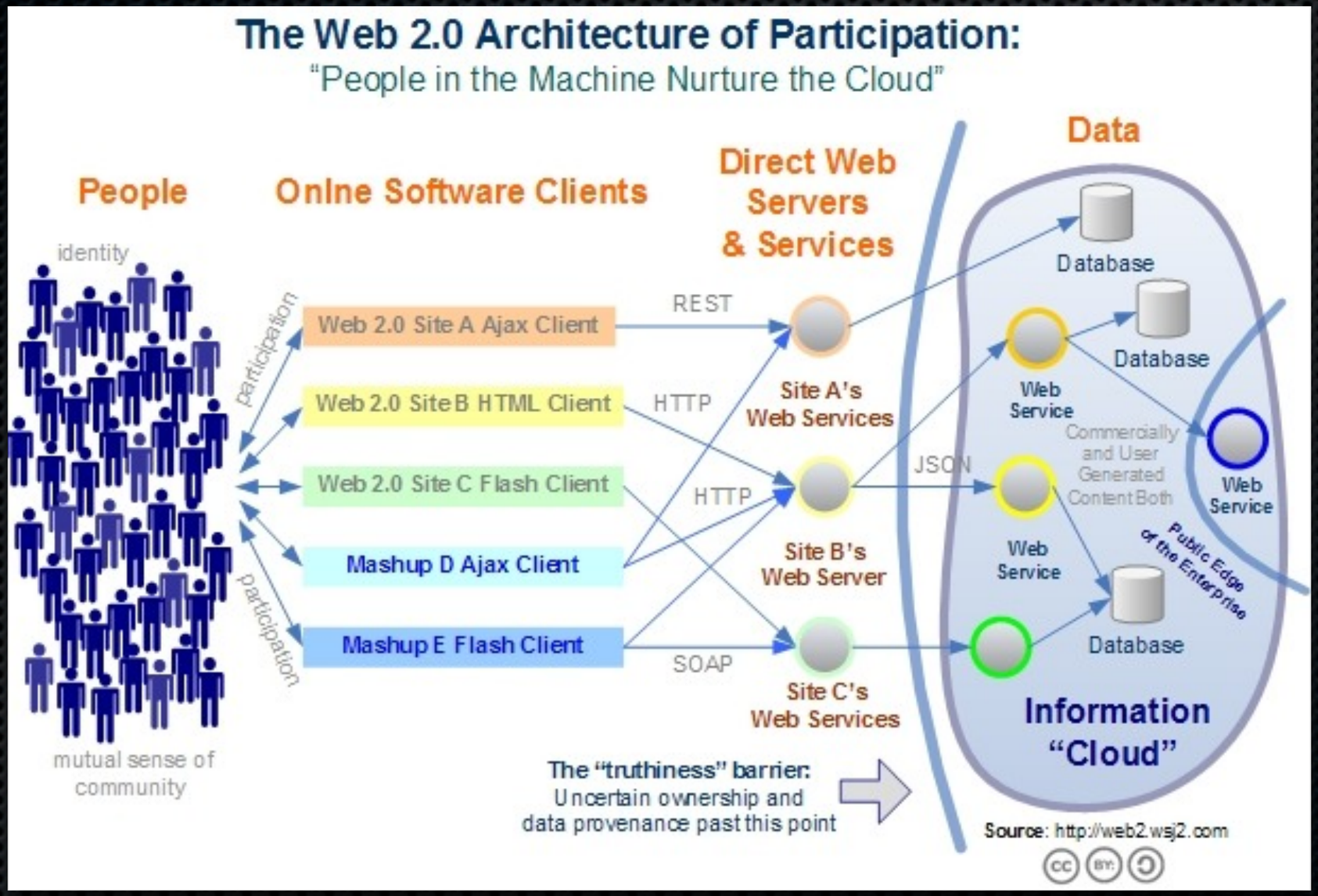
Cloud vs. Grids

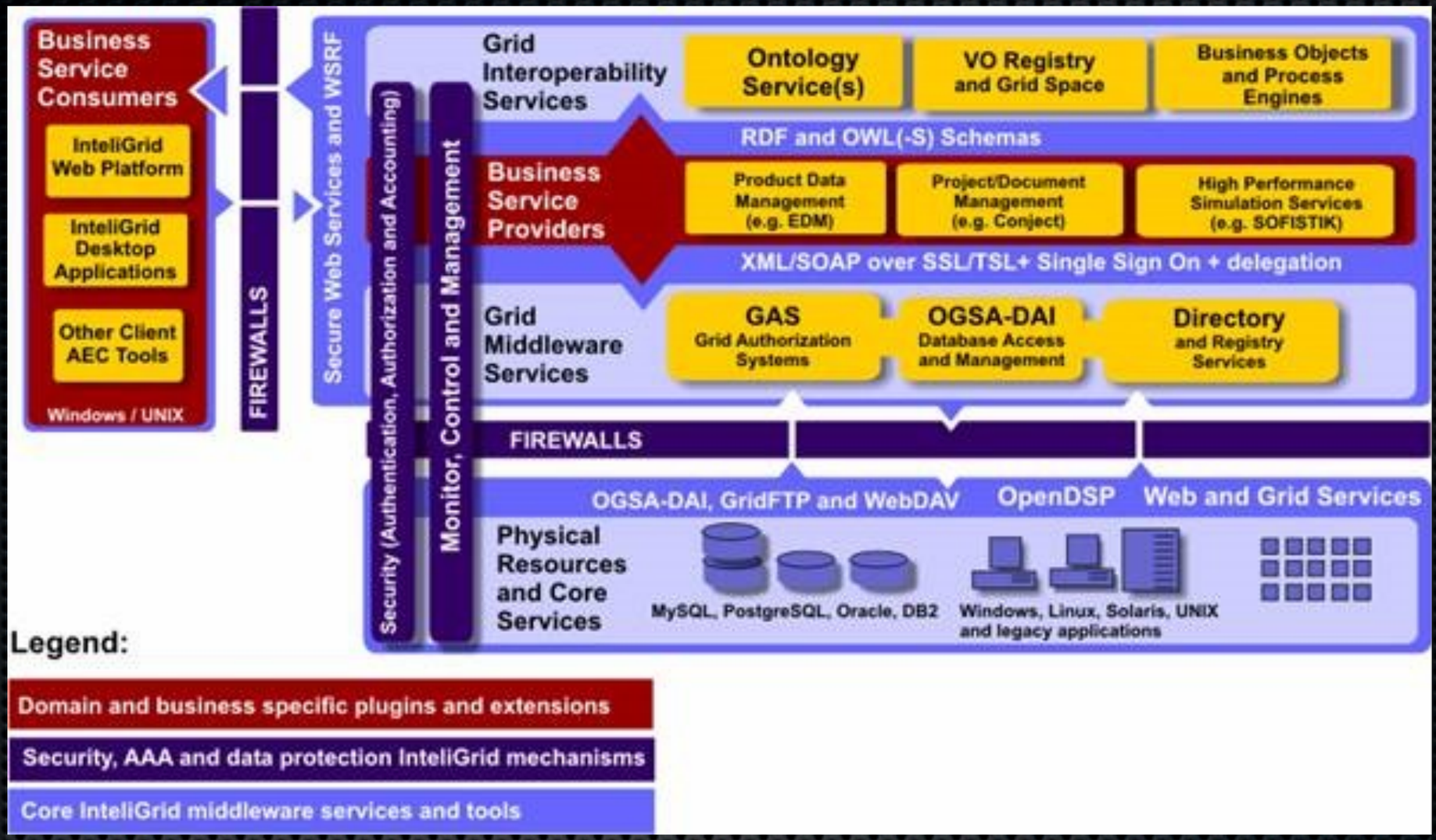
- Cloud: Provide interfaces:
  - syntactically simple,
  - semantically restricted and
  - high-level
- Grid: Level of exposed detail is too great!
  - e.g., Web-Services are just too fine-grained
  - need abstractions to hide levels of detail and provide functionality in a simple way

Web 2.0

- no precise definition, but it is operationally defined by a set of technologies (AJAX etc.)
- developments include cloud systems which supports distinctive Grid features
  - distributed storage and
  - computing
- from the developer's point of view
  - provide much simpler programming, resource allocation, and security models

Web 2.0 Architecture





Sample googled Grid Architecture

Web 2.0

- has commercial site which improves quality
- build portals corresponding to audience
- supports a similar architecture to Web services
- the communicatory nature makes interface information readily available
- it has proven to be a remarkably successful realization of distributed computing concepts

Web 2.0 and Grids

- it is recommend to replace many Grid components with their Web 2.0 equivalents:
  - mash-ups could replace workflow,
  - start pages with gadgets and widgets could replace portlets,
  - user generated registries (discovered by standard web search engines) could replace UDDI,
  - and so on

New Directions in Web Storage

Data Intensive (Science) Applications

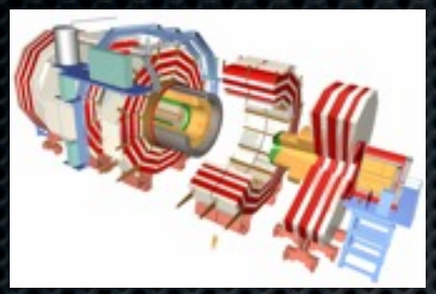
- data starts on some disk/sensor/instrument and needs to be partitioned
- filtering data of interest and (re)formatting it
- decomposition of data could require iterative steps between communicating processes or could be pleasing parallel
- workflow links above steps with multiple instances of filtering/reducing
- filters are “Maps” or “Reductions” in MapReduce

LHC in the clouds

- classic eScience
- several people have shown, that commercial clouds are perfect for this
- ship the data into the cloud
- no parallel computing necessary
- each node of the cloud analysis part of the data and ships the answers back
- reduction operation to summarize the statistics of this analysis -> physics

“File/Data Repository” Parallelism

Instruments

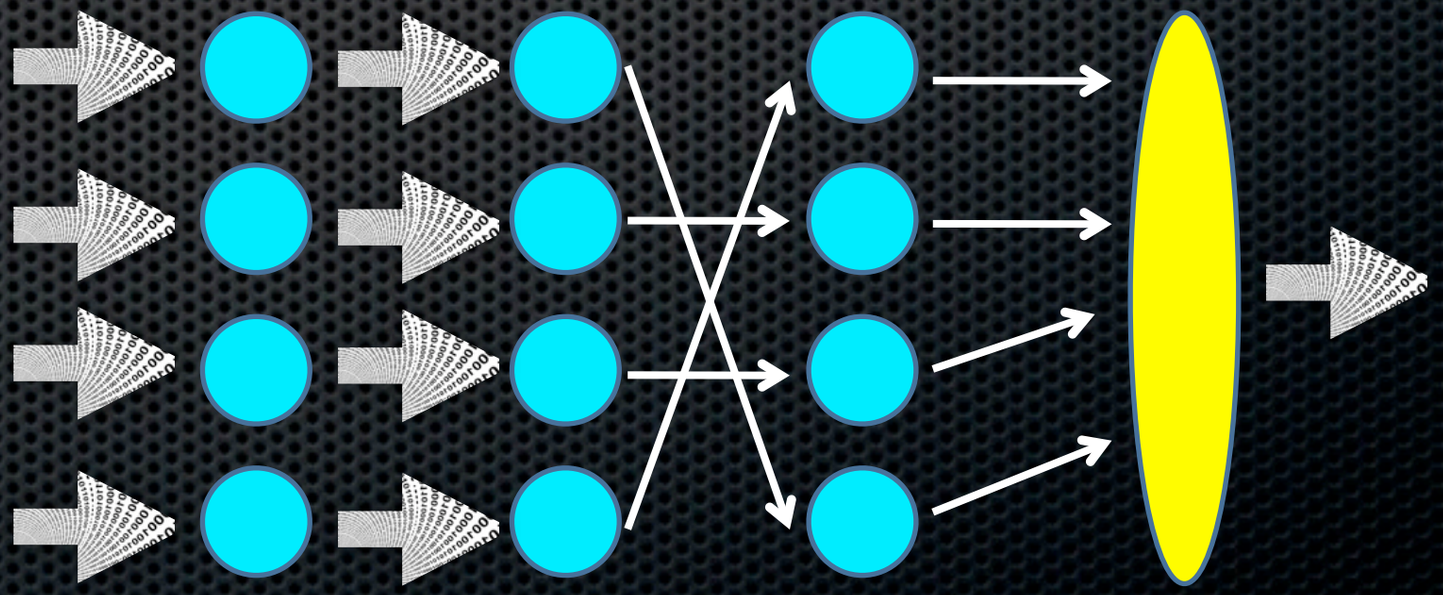


Map = (data parallel) computation reading and writing data
Reduce = Collective/Consolidation phase e.g. forming multiple global sums as in histogram

Communication via Messages/Files

Map_1 Map_2 Map_3 **Reduce**

Disks



Computers/Disks

Portals /Users

LHC Data Analysis Examples

- file parallel over events
  - Map 1:
    - process raw event data into “events with physics parameters”
  - Map 2:
    - process physics into histograms
  - Reduce 2:
    - add together separate histogram counts

Cloud Storage Efforts

Problem: Diversity

- terminologies
- authentication methods
- access Control
- location specification
- parallel Uploads/Downloads
- error codes

Lessons Learned

- things get complex fast
  - authentication
  - connection pooling
  - composite objects
  - multi-access concurrency
- developers prefer HTTP
- developers prefer a layered approach
  - quick and easy to get something basic working
  - add on more advanced capabilities as needed

Facts from Industry

- globally distributed nodes under a single namespace
- working with multiple clouds
- fully redundant infrastructure with integrated load balancing
- SAS 70 (auditing standard) compliant network, physical security, encryption and SSL
- policy enabled file replication and geo-distribution
- multi-tenant file system with full directory structure and child account

Information Infrastructure Goals

- logical-physical Independence
  - any processing on any processing node
  - any communications on any communications node
  - any storage on any storage node
  - completely dynamic logical-to-physical mapping
  - any node is usable; any node is disposable
- unlimited Scalability
  - fungibility of all resources within a class
  - transparent scaling across resource pools
- foundation standardization
  - communications standards, processing and storage standards

Cloud Efforts

- OGF:
  - Cloud Computing Interface Working Group (OCCI)
- SNIA:
  - Cloud Storage Technical Working Group
- Collaboration:
  - periodic joined meetings

OGF OCCI

- developing a new API for interfacing “IaaS” Cloud computing facilities that will allow for:
  - consumers to interact with cloud computing infrastructure on an ad-hoc basis (e.g. deploy, start, stop, restart)
  - integrators to offer advanced management services
  - aggregators to offer a single common interface to multiple providers
  - providers to offer a standard interface that is compatible with available tools
  - vendors of grids/clouds to offer standard interfaces for dynamically scalable service delivery in their products

Cloud Storage TWG

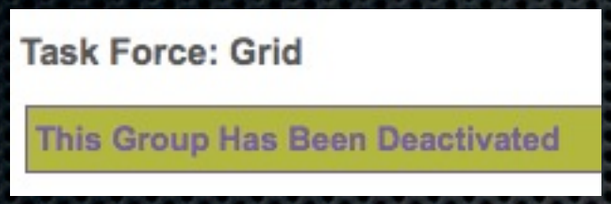
- identify, develop and coordinate systems standards for Cloud Storage
- produces a comprehensive set of specifications and drives consistency of interface standards and messages across the various Cloud Storage related efforts
- documents system-level requirements and share these with other Cloud Storage standards organizations

SNIA Cloud Storage TWG

- use Cases
  - description of the various offerings that might be considered „Cloud Storage“
  - e.g. Web facing applications, Consumer Clouds, Backup to the Cloud, Archive to the Cloud, Cloud Databases etc.
- reference model
  - abstract model of cloud storage related services and the interface to them that are candidates for standardization
- taxonomy
  - common terms and definitions for Cloud Storage

Cloud Storage and SRM

SRM and GRID

- 

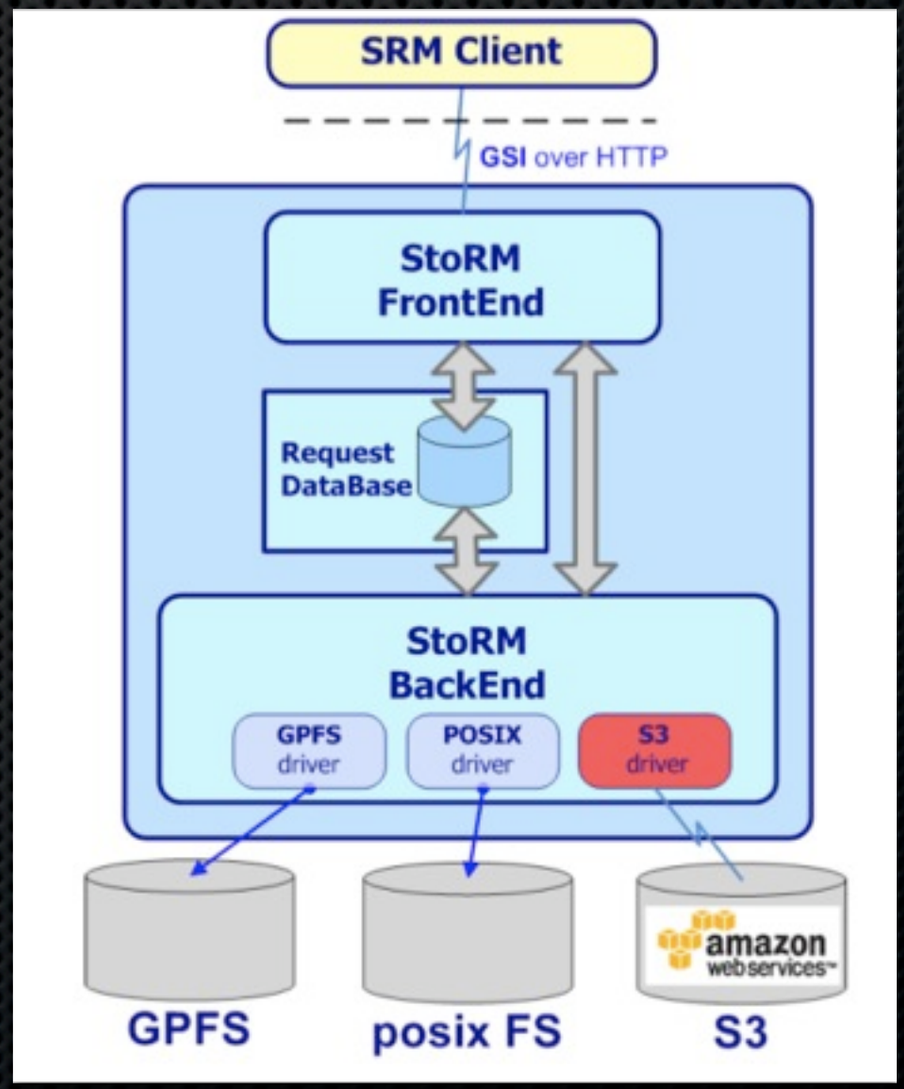
- Storage resource management tools are now maturing and becoming more of a “must have”capability
- efficiently utilize resources and expertise to ensure secure, efficient storage and protection of data
- Freeing IT staff from these complicated tasks allows them to focus on core competencies that drive their business forward

Storage Management Challenges

- How much storage do I have available for my applications?
- How is my storage being used?
- How do I know the storage is not the bottleneck for user response time issues?
- Is the storage infrastructure available and performing as needed?
- How do I monitor and centrally manage my replication services?
- Which files must be backed up, archived and retained for compliance?
- How can I more quickly configure and deploy storage resources?

Cloud Storage and SRM

- StoRM on Amazon Simple Storage Service (S3)
- StoRM translates the Grid authorization rules into the Amazon S3
- plugin for integration of Amazon S3



Towards the Integration of StoRM on Amazon Simple Storage Service (S3), INFN-CNAF, CHEP'07

Benefit from Industry

- similar problems occur in industry enterprise usage
- simplicity and functionality is required to offer scientists a tool to mash-up services in an ease way
- benefit from knowledge exchange
- influence during industry standardization process
- freeing storage resources from maintenance costs in future

Take care about the cloud!

Because the tide turns