Planning and Managing
Virtual Data Requests
In a Grid Environment

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Driving Concepts
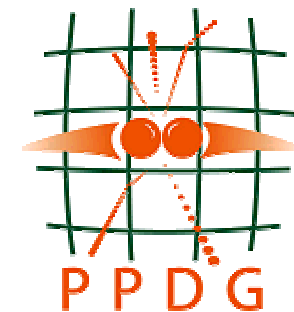
- Virtual Data – Service Requests are in the form " place y = F(x) at location L".
- A common reference Data Grid Architecture.
- Integrated research efforts in the areas of planning algorithms and scheduling policies.
- A framework of networked services connected by reliable, recoverable and bi-directional interfaces.
- Uniform view of processing and data placement activities.
- Job flow management based on Directed Acyclic Graphs (DAGs) of jobs.
- Evaluation of Grid technology via end-to-end implementations of "real-life" services.
- Interoperability with "external" technologies and deployed infrastructure.

Application

= initial solution is operational

DAG (logical)

Planner

DAG (physical)

Executor

Condor-G, DAGMan, Kangaroo

Catalog Services

MCAT; GriPhyN catalogs

Info Services

MDS

Policy/Security

GSI, CAS

Monitoring

MDS

Repl. Mgmt.

GDMP

Reliable Transfer Service

Globus

Compute Resource

GRAM

Storage Resource

GridFTP; GRAM; SRM
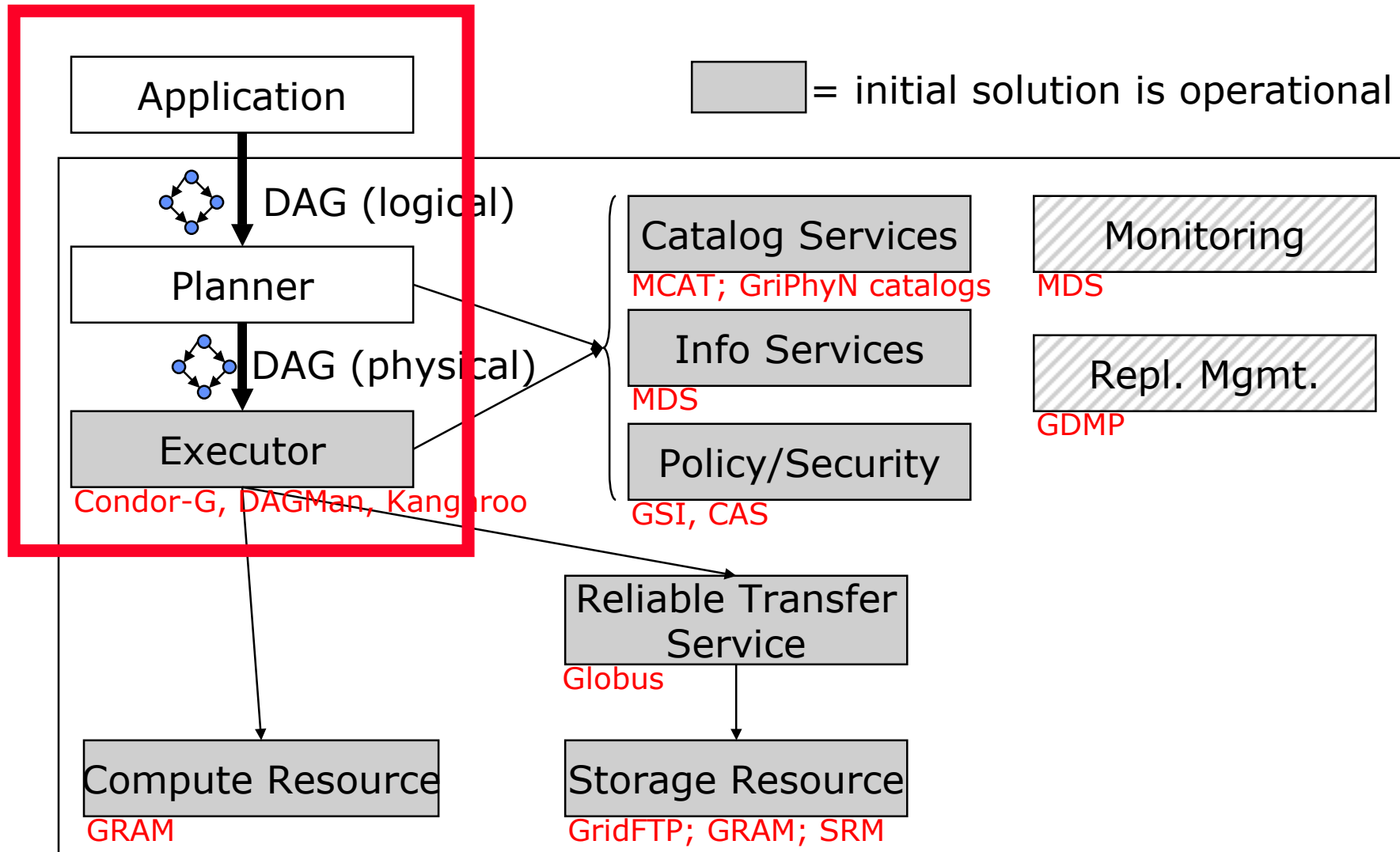
- To do or not to do? (does y exist? what is "cheaper", to retrieve or to materialize?)
- From a request to a logical DAG (Virtual Data Language - VDL)
- From a logical DAG to a physical DAG –
  - Select an execution site, a source for x and a destination for y
  - Build a "job" to allocate space for storing x and y at execution "location" (eager or lazy?)
  - Build a "job" to move x to execution location
  - Build a "job" to run F on x and generate y
  - Build a "job" to move y to destination
  - Build a "job" to free allocated space
- Execute physical DAG

- Collection and retrieval of information – what is where, who can do what, …
- Planning of a physical DAG
    - All jobs at DAG submission time (eager)
    - A job at a time when job is ready to go (lazy) or when resource is available (very lazy)
    - Any combination of the above …
- Execution of a DAG – A DAG Manager dispatches a job when the conditions it waits for are satisfied.
- Scheduling of Data Placement (DaP) and Processing jobs
- Allocation of storage space – Give me a "lot" of X MB for Y days at location Z and call it L
- Transfer files – Move file F (or part of) from A to B and place it in L
- Run job J on machine M

Services (soon) Available

- The Globus Tool Kit – Inter-domain information security and job submission services.
- The Condor system – Intra-domain information, security, job management and resource allocation services.
- Condor-G – Job management services for Globus jobs
- RLS – Logical to physical mapping of file names
- DRM – Data staging services
- VDS – Virtual Data Language, Derivation and Transformation Catalogs
- GridFTP and RFT – file/data movers
- DAGMan – Job flow services

Challenges (near term)

- Integrate existing (generic) services with experiment (specific) software to form a vertically integrated end-to-end Grid enabled "production quality" capability.
- Effectively leverage available technology sources and deployed capabilities.
- Co-manage storage and processing resources.
- Provide a "basic" set of exception handling and error recovery services.
- Avoid "stupid" planning and/or scheduling decisions.
- Interplay of authorization, planning and scheduling.
- Packaging and support.
- Have fun.