Fault Detection of TeraGrid Resources Using Inca

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Motivation

❑Submission 10,000's of jobs may only require 25 minutes but processing required a day to a week

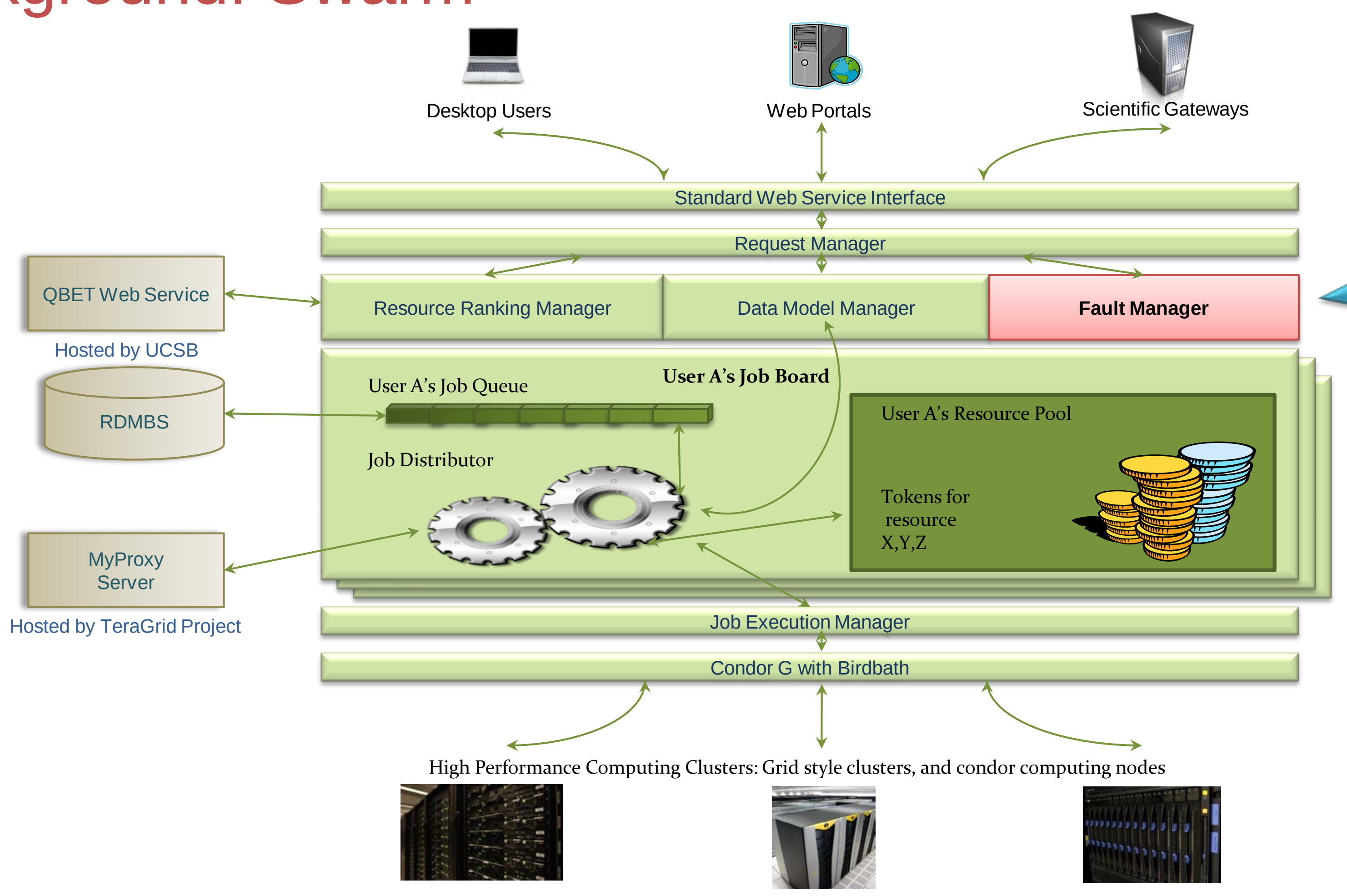
❑Some jobs might fail during processing or in queue
- ▪Resource down
- ▪Resource up but Gram service down

❑No mechanism to automatically recover the failure

❑User has to manually check the status periodically and decide if job failed and re-assign job to other machine

❑Problems:
- ▪Solution inefficient: time consuming and cost of human resource
- ▪Hard to identify remaining jobs since huge submission

Background: Swarm



Swarm Features Include

❑Schedule tens of thousands of jobs over distributed clusters

❑A monitoring framework for large scale jobs

❑User based job scheduling

❑Ranking resources based on predicted wait times

❑Standard Web Service interface for web applications

❑Extensible design for the domain specific software logics

Challenges

❑Target failures: i)TeraGrid resource down for service
ii)TeraGrid resource up but gram job down

❑Down time varies between an hour and a week

❑Maintenance of resource is specific to the organization. Each organization plans down time in site-specify ways

❑No standard shut down mechanism from TeraGrid

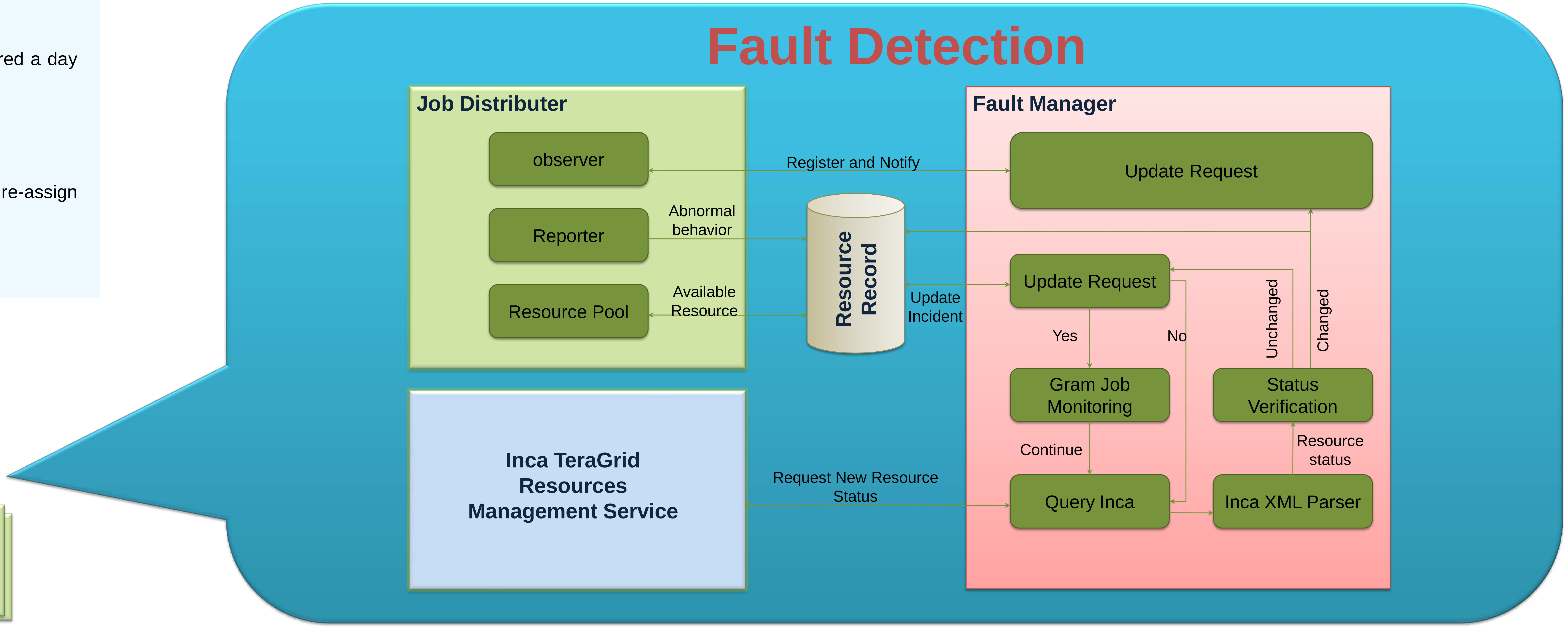
❑Condor job status unclear during down time. Statuses are shown in queue or hold

❑Notification is slow and inefficient through email

❑Unable to implement fault recovery mechanism without reliable information

❑Building self-checking mechanism is not trivial such as network ping, due to resource might up but service down or service might up but execution failed

Fault Detection



Fault Detection I: Fault Manager

❑Using Inca TeraGrid Resources Management Service
- ▪Three operations (RESTful WS interface):
  - ➢Pre-WS-Gram: updated very 3 minutes
  - ➢External-Ping: updated very 5 minutes
  - ➢Pre-WS-Gram batch: updated very 12 hours
- ▪XML handler
- ▪Update incident report
- ▪Monitoring the reported resource
- ▪Periodically query to Inca TeraGrid Resource Portal
- ▪Parsing status information that is encoded in XML
- ▪Detecting changes of status
  - ➢Down (Up -> down)
  - ➢Up (down -> up)
- ▪Notify mechanism: observable & observer design pattern
- ▪Periodical update every 3 minutes

Fault Detection II: Job Distributor

❑Self-Tracking the Job status
- ▪Job Distributed report abnormal behavior to Resource Manager
  - ➢Job in hold status
  - ➢Long waiting in the batch queue
  - ➢Processing time more than user specified
- ▪Notify fault manager

❑Portable for other application with observer

Conclusion

❑We can detect possible system faults in TeraGrid HPC cluster and notify to the other software component within Swarm

❑Inca provides us easy-to-access interface for recent status of TeraGrid HPC clusters

❑Self-detecting scheme detects faults which can happen between Inca's monitoring schedule

❑Inca limitation:
- ▪Periodical update: 3 minutes - 12 hour
- ▪Reliability and accuracy
- ▪Inca service down or traffic busy

❑Network latency problem: Cannot update status from Inca immediately

❑Dependency on Inca XML schema, changes will effect parsing failed

Future Work

❑Fault Tolerance
- ▪Migrate job if machine is down
- ▪Discover new resource for the task
- ▪Implement job clean up when the resource is back

❑Expend to other available service to avoid dependent on single service
- ▪ E.g. GPIR

❑Support for Cloud computing clusters or Condor cluster

❑Develop Web service interface for the resource monitoring