



Network and Grid Monitoring

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GRIDs – Basic Concepts

- Distributed Systems
 - Large scale
 - Spanning administrative domains
 - Heterogeneous
- Provide *processing* and *services*
- Very complex jobs
 - Workflows including data staging
 - Interaction of many components



Networks for GRIDs

- Basic underlying infrastructure
- Provide data transfer capability
- Usually not directly exposed
 - Except for data transfer planning

Network Information for GRIDs

- Availability and quality of paths
 - Network capacity prediction
 - Monitoring of actual data transfers
 - Fulfillment of SLA (implicit/explicit)
- Failover
 - Implicit
 - Explicit – new search for appropriate path

Network Capacity Prediction

- How/when I can transfer amount X of data from A to B ?
- I have two sets of sites: $\{A, B, C, \dots\}$ (data sources) and $\{X, Y, Z, \dots\}$ (using data). Find me one node from the first and one node from the second set such that the transfer of data will be the fastest.

Network Monitoring Role

- The Network Capacity prediction needs a network monitoring data
 - Flow and flow patterns are needed
- NRENs collect this data to some extent only
 - And usually do not provide it to third parties

Network Weather Service (NWS)

- Collects information about flows through network
- Provides interface for predicted link/path capacity
- Challenges
 - Completeness of the information
 - Is deployed as a NREN service?
 - Unpredicted reaction of NWS users
 - Their reaction synchronized if not under control
 - Prediction is hard/impossible

Monitoring of Data Transfers

- Purpose:
 - Check the SLA
 - Provide data for prediction improvement
 - Look for patterns
- Identification of a particular flow
- Authorization to use such service
- Authorization to access data
 - At the end of data transfer
 - In real time
- Not (yet) commonly available



CESNET Systems

- G3 system
 - Infrastructure monitoring
 - SNMP based
 - High detail (e.g. history of virtual port related data)
- FTAS (Flow-based Traffic Analysis System)
 - Aggregate and individual flow information
 - Both IPv4 and IPv6 supported
 - Heavily used for security related incidents
 - DoS and DDoS attacks
- None currently used by the Grid community

Grid Information and Monitoring Services

- Almost every Grid component relies on some external information
- Information provides every Grid element
 - Distributed producers
- Distributed Use
- Classical separation
 - Grid Information services
 - Grid Monitoring services

Grid Information Services

- “Static” information about elements
 - Number of CPUs
 - GPS location of nodes
 - Users and their affiliation
 - *Actual length of a queue*
 - *Number of free CPUs*
- Usually does not check itself

Grid Monitoring

- Infrastructure/status monitoring
 - Nodes
 - Services
 - May be distributed/duplicated/migrating
 - Jobs and their workflows
- Application monitoring
 - Infrastructure part
 - Particular application oriented part

Grid infrastructure monitoring

- Structure of service
 - Centralized
 - Easier to deploy
 - Scalability problems
 - Distributed/Hierarchical
 - Higher overhead
 - Reliability of monitoring components

Grid infrastructure monitoring

Nodes

- Monitor properties of nodes
 - Configuration
 - Services associated with nodes
 - Examples:
 - Job acceptance
 - Compiler availability
- Could run complex checks
 - Checkout a CVS and compile a program

Example of Node Monitoring

Testbed status

Generated: Tuesday, September 14, 2004 5:45:06 AM UTC

Test results

no.	machine	Store	Serve	GRIS	Gatekeeper	mercury2	mercury2.3.1	FTP	CA	imapfile	GS1SSH	gridlab.conf	softwa
1	skort.cs.muni.cz	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK
2	litchi.zib.de	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK
3	frage1.man.poznan.pl	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK
4	fs0.dns2.cs.vu.nl	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK
5	elitero.pcz.pl	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK
6	packcs-e0.scai.fraunhofer.de	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK
7	onyx3.zib.de	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK
8	peyoka.aei.mpg.de	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK
9	pr0.tycc.szaki.hu	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK
10	helix.beyc.bsu.edu	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK
11	quater3.zib.de	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK
12	htrnoss.lrz-muenchen.de	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK
13	priority.uni-paderborn.de	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK
14	bouscat.cs.cf.ac.uk	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK
15	sn0000.lrz-muenchen.de	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK
16	grade.man.poznan.pl	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK

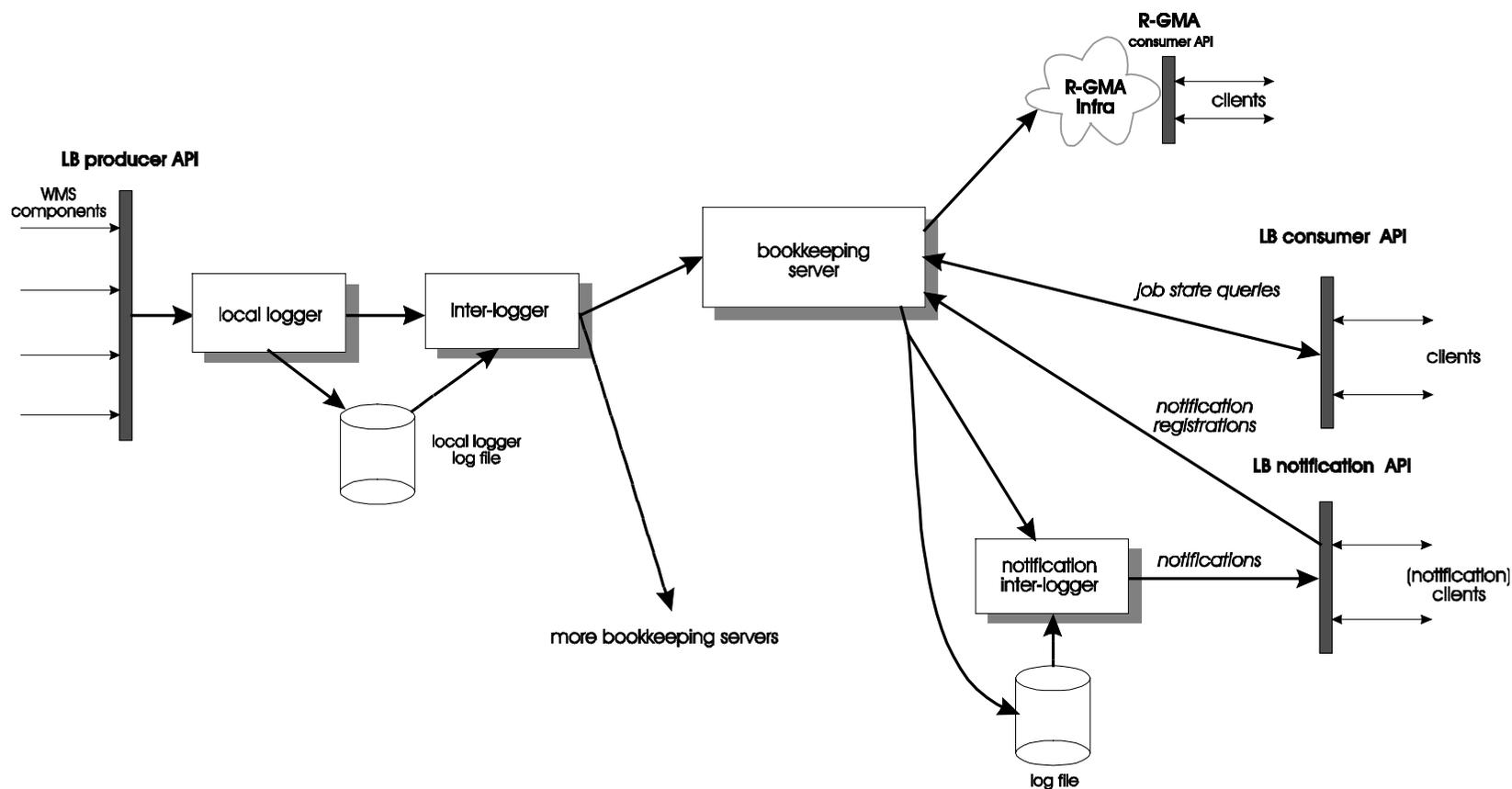
Grid infrastructure monitoring Services

- General Grid services
- Service discovery
 - Where the service run now
- Redundancy
 - Check the service or all its copies?
- Grid monitoring itself a service

Grid infrastructure monitoring Jobs

- Information about job flows through the Grid middleware
 - Distributed gathering of monitoring data
 - Must be somewhere completed
- Complex jobs/workflows
- EGEE Logging and Bookkeeping (LB)
 - Collects events triggered by job flow through the middleware
 - Computes job states on the fly
 - Provides user access to the job states

LB Service Architecture



Middleware instrumentation

- Idea to collect data from running middleware
 - Similar to the LB service, but more general
- Large number of sources
 - Distributed collection and processing
- SNMP à SGMP?



Monitoring information dissemination

- Many places/services look for the data
- Streams of data
 - Monitoring data discovery
 - What is available where
- Events
 - Subscription/Notification
- Cross organizational data flow
 - Sharing monitoring data

Privacy/Security Considerations

- Potentially sensitive data collected
 - When/where to aggregate
 - Access authorization
- Extended use of mutual authentication of monitoring elements
- Not always required
 - Provision of alternate less secure (faster/low overhead) monitoring infrastructure

NRENs and GRIDs

- Role for NRENs
 - Provide information about the network
 - What is available where
 - Provide information and monitoring services for Grids
- In some aspects analogy to PERT/PACE
- Major challenges
 - Grids are multi-NRENs
 - (Much) more “users”
 - Privacy/Security
 - Heterogeneity of monitored elements
 - Portal and service access to the collected data



Questions?