User-level Grid monitoring with Inca 2

Shava Smallen

ssmallen@sdsc.edu

June 25, 2007

TeraGrid

- Origins: national supercomputer centers, funded by the NSF

- 9 TeraGrid sites, 18 resources

- Mix of Architectures:
  - ia64, ia32: LINUX
  - Cray XT3
  - Alpha: True 64
  - SGI SMPs

- Connected via dedicated multi-Gbps links

- 1000s of CPUs, > 250 teraflops

- > 30 petabytes of online and archival data storage

- Coordinated user environment across heterogeneous resources
  - CTSS (Coordinated TeraGrid Software & Services)

User-level Grid monitoring

- Testing and performance measurement from a generic, impartial user's perspective in order to detect and fix Grid infrastructure problems before the user's notice them.

- User-level Grid monitoring system:
    - Runs from a standard user account
    - Executes using a standard GSI credential
    - Uses tests that are developed and configured based on user documentation
    - Verifies user-accessible Grid access points
    - Centrally manages monitoring configuration
    - Automates periodic execution of tests
    - Easily updates and maintains monitoring deployment

Inca

- Provides user-level monitoring of Grid functionality and performance
- Features:
    - Collects wide variety of monitoring results
    - Captures context of monitoring result as it executes
    - Eases the writing and deploying of new tests or benchmarks
    - Supports sharing of tests and benchmarks
    - Stores and archives monitoring results
    - Securely manages short-term proxies
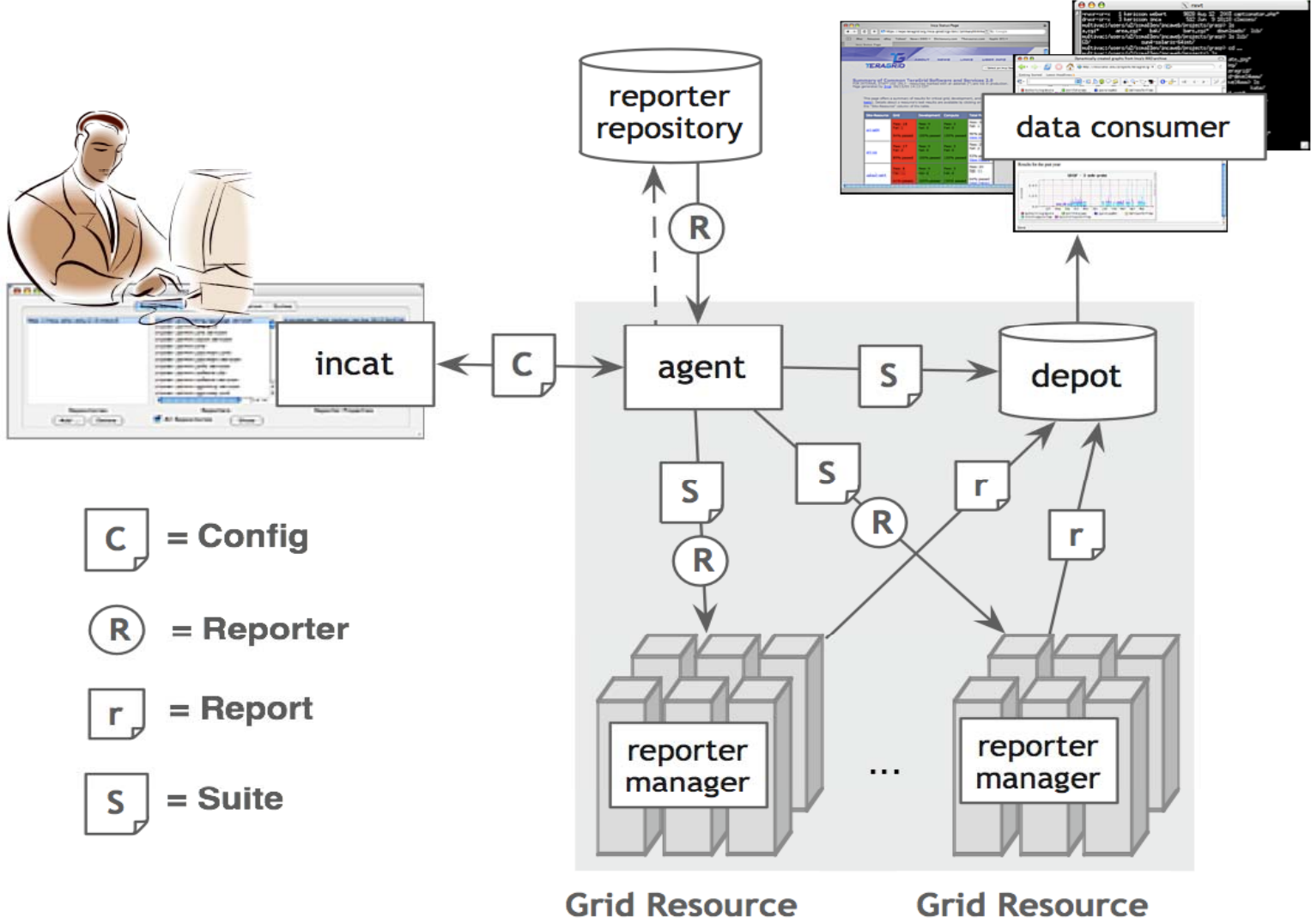   - Measures system impact of tests and benchmarks

Inca Architecture

C = Config

R = Reporter

r = Report

S = Suite

reporter repository

data consumer

incat

agent

depot

reporter manager

reporter manager

Grid Resource
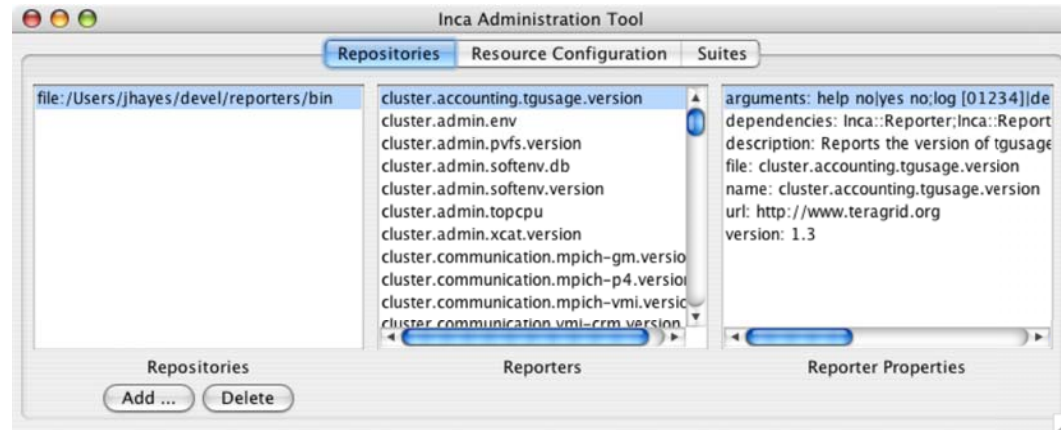
Grid Resource

inca

SDSC

TeraGrid

Collecting Monitoring Data

- Reporters
  - Executable program that measures some aspect of the system or installed software
  - Requirements:
    - Supports specific command-line options
    - Writes XML (Inca Reporter schema) to stdout
  - Supports multiple types of data
  - Extensive library support for perl scripts
  - Most reporters < 30 lines of code
  - Independent of other Inca components

Sharing Reporters

- Repositories: collection of reporters available via a URL

  - Supports package dependencies (Perl modules, Makefile, autoconf)

Screenshot of a repository using Inca GUI tool

  - Packages versioned to allow for automatic updates

  - Inca repository contains 157 reporters

    - Version, unit test, performance benchmark reporters
    - Grid middleware and tools, compilers, math libraries, data tools, and viz tool

SDSC

Centralized configuration and deployment

- Incat
  - GUI interface to enable a large number of monitoring results to be collected with a minimum of effort
  - Configure the reporters to execute on a set of resources
  - Configuration stored in a XML file and sent to Agent
- Agent
  - Implements the configuration specified by Inca administrator
  - Stages and launches a reporter manager on each resource
  - Sends package and configuration updates

SDSC

Storing data

- Depot
  - Stores configuration information and monitoring results
  - Uses relational database backend via Hibernate
  - Provides full archiving of reporter output
  - Supports SQL queries and provides predefined queries for latest monitoring results, report instance, and report history
  - Supports notifications

SDSC

Displaying and publishing data

- Data Consumer
  - Web application that queries and displays monitoring data
  - Packaged with Jetty
  - JSP tags to query data and format using XSL

- Web services
  - Query data from depot and return as XML

Inca in Use: TeraGrid

- Currently monitoring all 18 allocated TeraGrid resources
  - Monitoring of CTSSv3
  - Monitoring of CTSSv4 (in progress)
  - Grid jobs (Globus gatekeeper logs)
  - CA certificate and CRL checking (notify if 2 weeks from expiration)
  - Resource registration in MDS

ctssv3

Page loaded: 05-29-2007 06:30 PM (PDT)

n/a	does not apply to resource		test
	missing (not yet executed)	pkgWait	wai
pass	passed	incaWait	wai
error	error	incaErr	inca

- ant
- blas
- compiler-gcc
- compiler-intel
- compiler-xlc
- condor-g
- gridshell
- gsissh
- gsissh
- gt4
- gt4-gr
- gt4-gr

APPS	
ant	anl-ia64
version: 1.6.5	1.6.5
ant-unit	pass
blas	anl-ia64
blas-level1	pass
blas-level2	pass
blas-level3	pass
condor-g	anl-ia64
version: >=6.7.18	6.7.18
condorg-condorq	pass

Details for "all2all:gram_to_gatekeeper.bigred.iu.teragrid.org" series

Result:	
completed	

Reporter details:	
reporter name	grid.middleware.globus.unit.gatekeeper (click name for more info)
reporter version	3

Execution information:	
ran at	06-23-2007 02:57 AM (PDT)
age	10 hours 46 minutes
cron	?=57 ?=4 * * *
ran on (hostname)	tg-login1.uc.teragrid.org
memory usage (MB)	19.1406
cpu time (secs)	0.800782
wall clock time (secs)	1.16846

Input parameters:	
help	no
host	gatekeeper.bigred.iu.teragrid.org
log	3
verbose	1
version	no

Command used to execute the reporter:

```
% bash -l -c 'set -a; cd /home/inca/inca2install-ia64; cp ~/.soft.v
&& soft-msc ~/.soft.v3.$$ && source ~/.soft.v3.$$.cache.sh && expo
PERL5LIB=/home/inca/inca2install-ia64/var/reporter-
packages/lib/perl:${HOME}/inca/install-ia64/lib/perl &&/home/inca/i
ia64/var/reporter-packages/bin/grid.middleware.globus.unit.gatekeep
-host="gatekeeper.bigred.iu.teragrid.org" -log="3" -verbose="1" -ve
-f ~/.soft.v3.$$*';
```

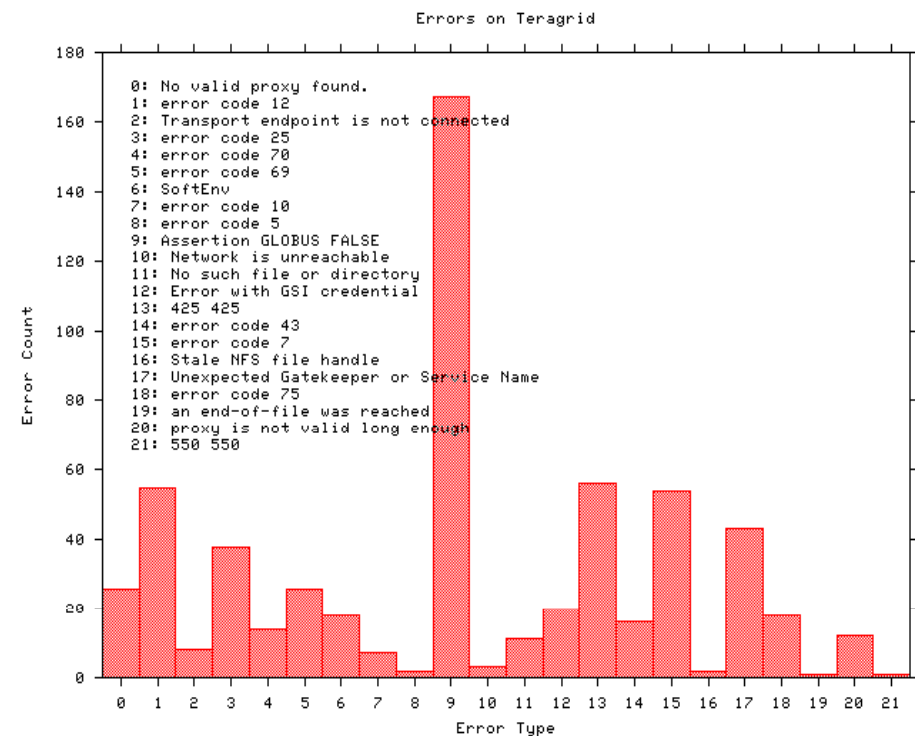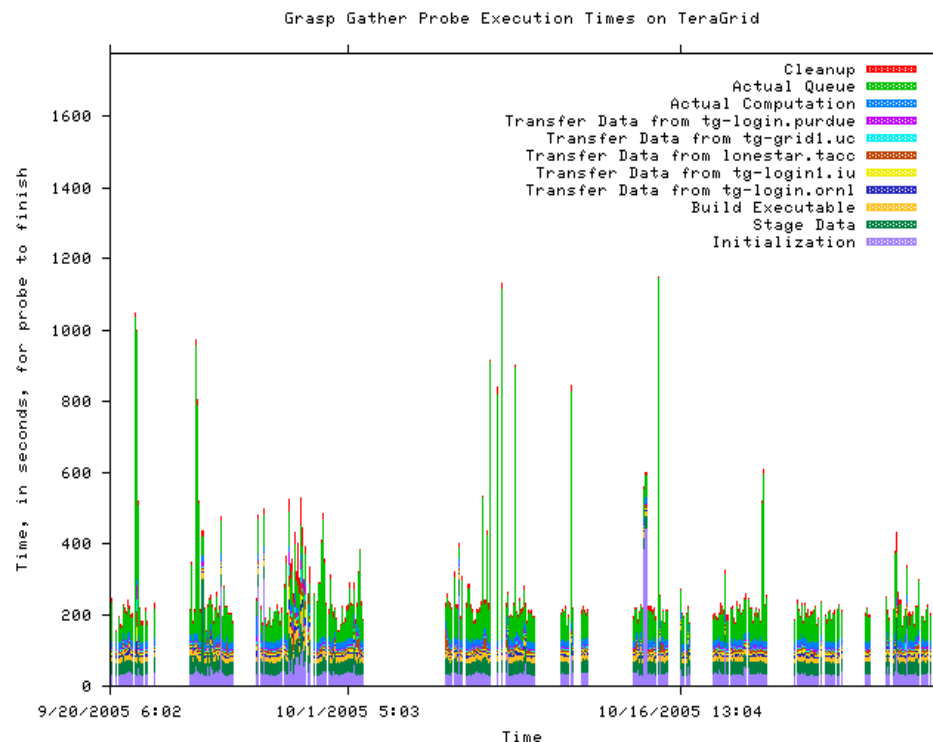**System commands executed by the reporter:**

Note that the reporter may execute other actions in between system commands (e.g., change dire

```
% globusrun -a -r gatekeeper.bigred.iu.teragrid.org
```

SDSC

TeraGrid

Inca in use: Grid Assessment Probes

- Set of probes designed to emulate Grid applications
- Deployed using Inca to GEON and TeraGrid

Software Status

Current software version: 2.03
(available from Inca website)
http://inca.sdsc.edu

Other Inca deployments:

Summary

- User-level Grid monitoring: Testing and performance measurement from an impartial user perspective to detect problems before the users notice them

- Standalone reporter APIs and repositories make it easy to write and share tests and benchmarks (reporters)

- Centralized configuration enables uniform monitoring and makes it easy to deploy Inca monitoring to a set of resources

- Data consumer and web services interface enable publishing and displaying of Inca monitoring data

More Information

Website:
http://inca.sdsc.edu

Supported by:

Announcements:
inca-users@sdsc.edu

Email:
inca@sdsc.edu

Sample Reporter

```perl
use Inca::Reporter::SimpleUnit;
my $reporter = new Inca::Reporter::SimpleUnit(
 name => 'grid.globus.gramPing',
 version => 2,
 description =>  'Checks gatekeeper is accessible from local machine',
 url => 'http://www.globus.org',
 unit_name => 'gramPing'
);
$reporter->addDependency('Inca::Reporter::GridProxy');
$reporter->addArg('host', 'gatekeeper host');
$reporter->processArgv(@ARGV);
my $host = $reporter->argValue('host');
my $out = $reporter->loggedCommand("globusrun -a -r $host", 30);
if (!$out) {
 $reporter->unitFailure("globusrun failed: $!");
} elsif($out !~ /GRAM Authentication test successful/) {
 $reporter->unitFailure("globusrun failed: $out");
} else {
 $reporter->unitSuccess();
}
$reporter->print();
```

Scheduling and Execution

- Reporter manager
  - Manages and schedules the execution of reporters on a single resource
  - Executes under regular user account
  - Monitors reporter system usage and enforces limits
  - Sends monitoring result to a depot