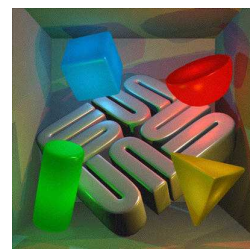




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JavaOne
THE JAVASCRIPT CONFERENCE

The Sun Grid Compute Utility

A Tutorial for Java Developers

Fay Salwen
Peter A. Murray
Uday Subbarayan
Staff Engineers, Sun Grid
Sun Microsystems, Inc.



TS-1109

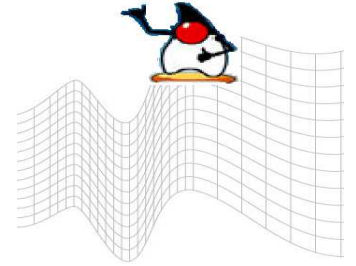
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2006 JavaOneSM Conference | Session TS-1109 |

java.sun.com/javaone/sf

The Sun Grid Compute Utility

A Tutorial for Java Developers



Learn how to leverage
1000s of CPUs on demand.

Agenda

Sun Grid Backgrounder

- What are Grid and Utility computing all about?
- Who are using them and for what?

What is the Sun Grid?

- What makes it so special and why would I want to use it?

How to use the Sun Grid

- Basic concepts

Developing Java Applications for Sun Grid

- How to leverage 1000s of CPUs

Example Applications for Sun Grid

- The best way to get started

Cool tools for Sun Grid

- To make make your life easier

The Sun Grid Compute Utility

Sun Grid Backgrounder

What is the Sun Grid?

How to use the Sun Grid

Developing Java Applications for Sun Grid

Example Applications for Sun Grid

Cool tools for Sun Grid

Q&A

Definitions of a Grid

- No single definition
 - Each company and individual have their own
 - Wikipedia has no less than 7
- Some examples
 - Major DB vendor defines it as—**Pooling all your resources into a central location for optimization**
 - Major HW manufacturer defines it as—**The virtualization of compute and storage resources**
 - One of the largest grid organizations says—**The grid will be defined when the question of what a grid is, no longer exists**

Lowest Common Denominator

- A grid has lots of CPUs, storage, and virtualization
- Everyone says it/they will save you \$\$\$, somehow
- Most vendors/users are afraid of multi tenancy, except with “friendly” users (is there such a thing?)

What Is Grid Computing Used For?

Grid Computing is not new, it has been used for years

Industries

Computing Tasks

Financial Services

Risk and portfolio analysis, Monte Carlo simulations

Energy

Reservoir simulations, seismic processing

Entertainment/Media

Digital content creation, animation, digital asset management

Manufacturing

EDA, MCAD, fluid dynamics, crash-test simulations, aerodynamics modeling

Government/Edu

Weather analysis, nuclear yield simulation

Benefits of Grid Computing

- Grid Computing allows organizations to:
 - Pool systems, manage them as a common resource
 - Increasing utilization
 - Reduce costs
 - Increase agility through dynamic resource allocation



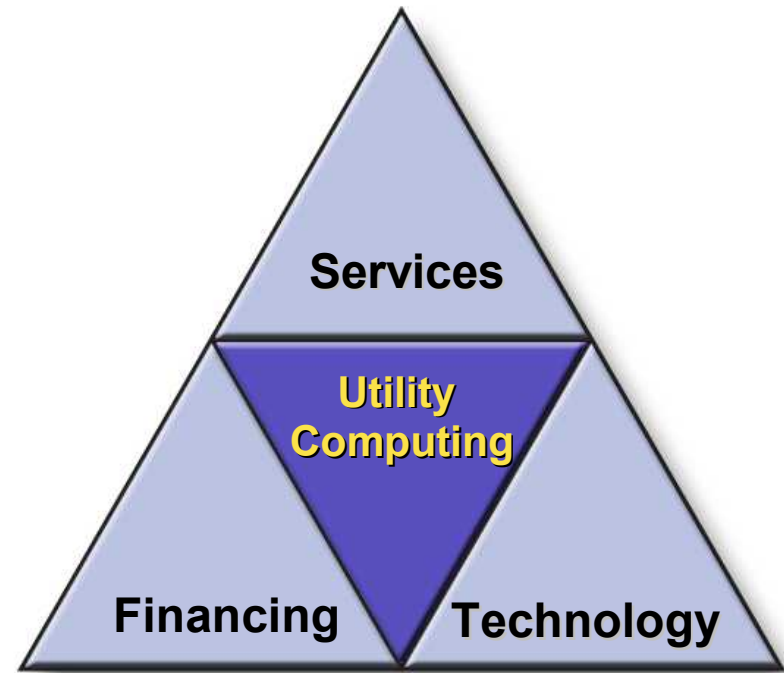
Grid Computing != Utility Computing

Utility Computing (UC)—

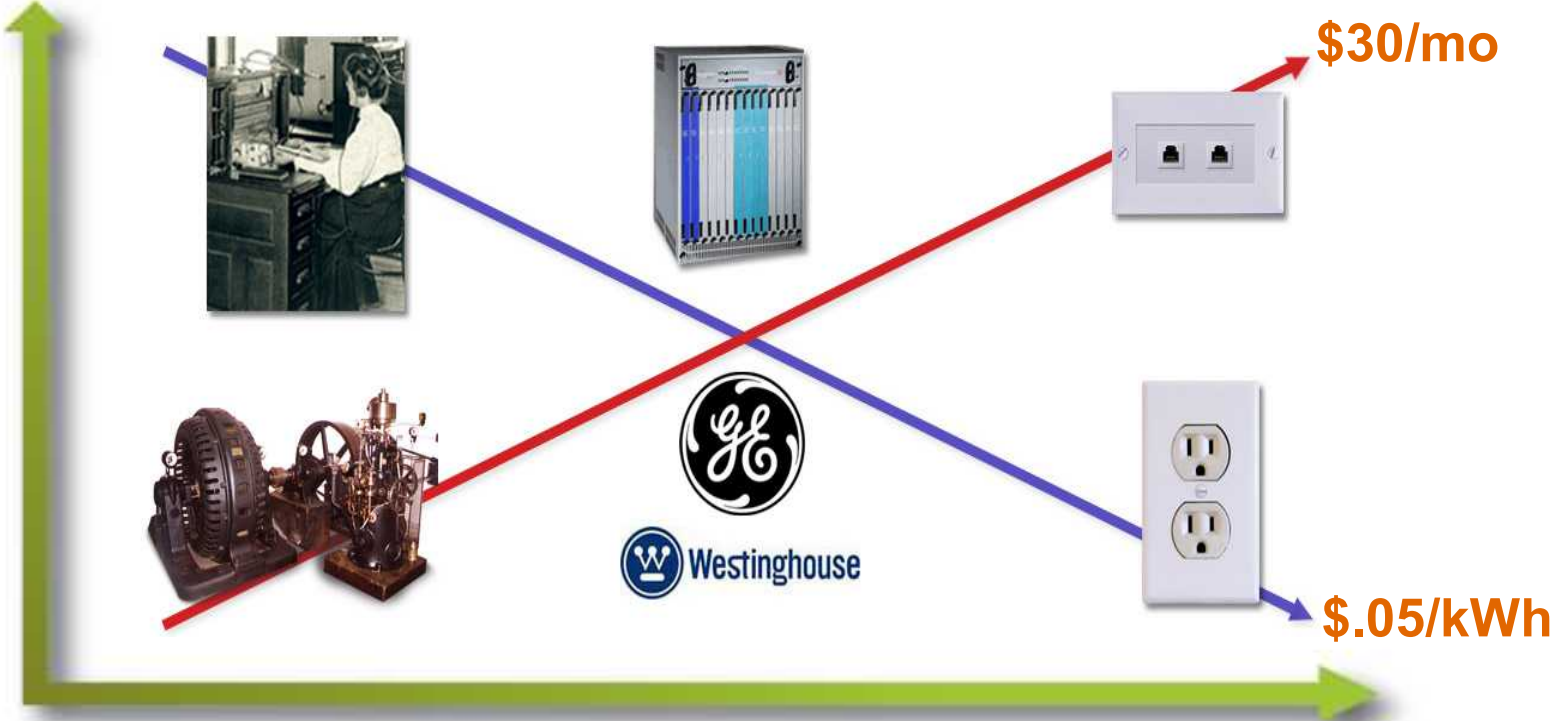
The ability to intelligently match IT resources to business demand on a pay-for-use basis.

Attributes

- Multi-tenancy
- Standardization
- Scale
- Automation
- Immediate Provisioning
- Granular Costing



The Move From Custom to Utility Models



Customize

Standardize/
Aggregate

Utilize

The Sun Grid Compute Utility

Background/Context

What is the Sun Grid?

How to use the Sun Grid

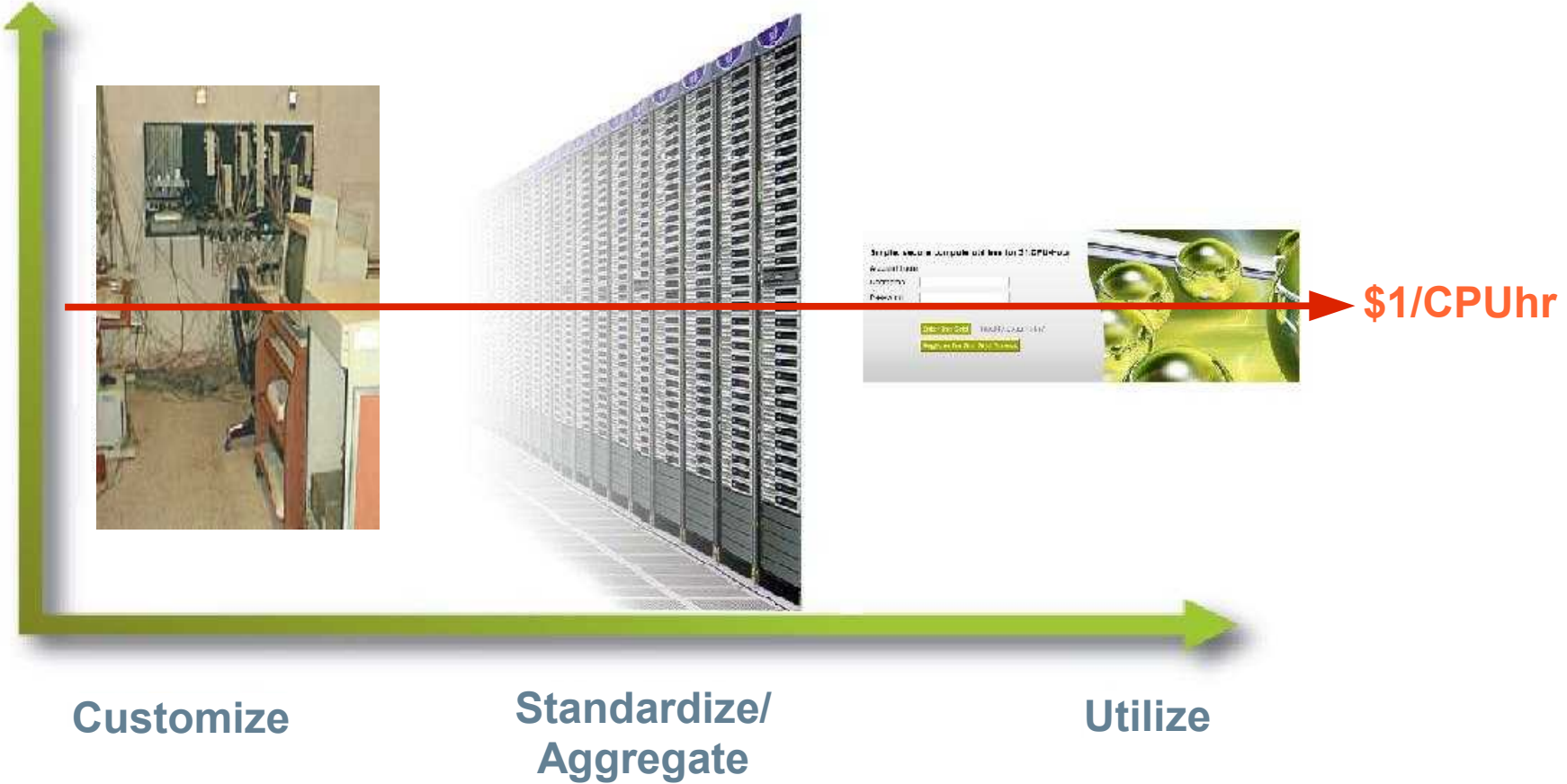
Developing Java Applications for Sun Grid

Example Applications for Sun Grid

Cool tools for Sun Grid

Q&A

The Move to Utility in Grid Computing



What Is Sun Grid Compute Utility?



Grid Technology

- Racks of compute nodes
- High-speed network interconnects
- Shared storage
- Distributed Resource Management (DRM)

Readily available in a...



Utility Model

- Pay-per-use compute power
- Standard pricing—\$1/cpu-hour
- No contract or minimum commitment

Sun Grid Access



- Web-based user interface
- Internet-accessible (www.network.com)
- Available to anybody (US only, at this time)
- No direct Internet access to compute nodes

Access to What?

- Sun Fire V20z™ servers, each containing:
 - Dual 2.4 GHz AMD Opteron™ processors with HyperTransport technology for memory and I/O interface
 - 8 GByte RAM
 - Solaris™ 10 Operating System
- Storage
 - Up to 10 GBytes per user in staging area
 - NFS-mounted home directory in execution environment
- Sun N1™ Grid Engine 6 software
- Grid network infrastructure built on a Gbit/s switched-Ethernet data network

Types of Applications

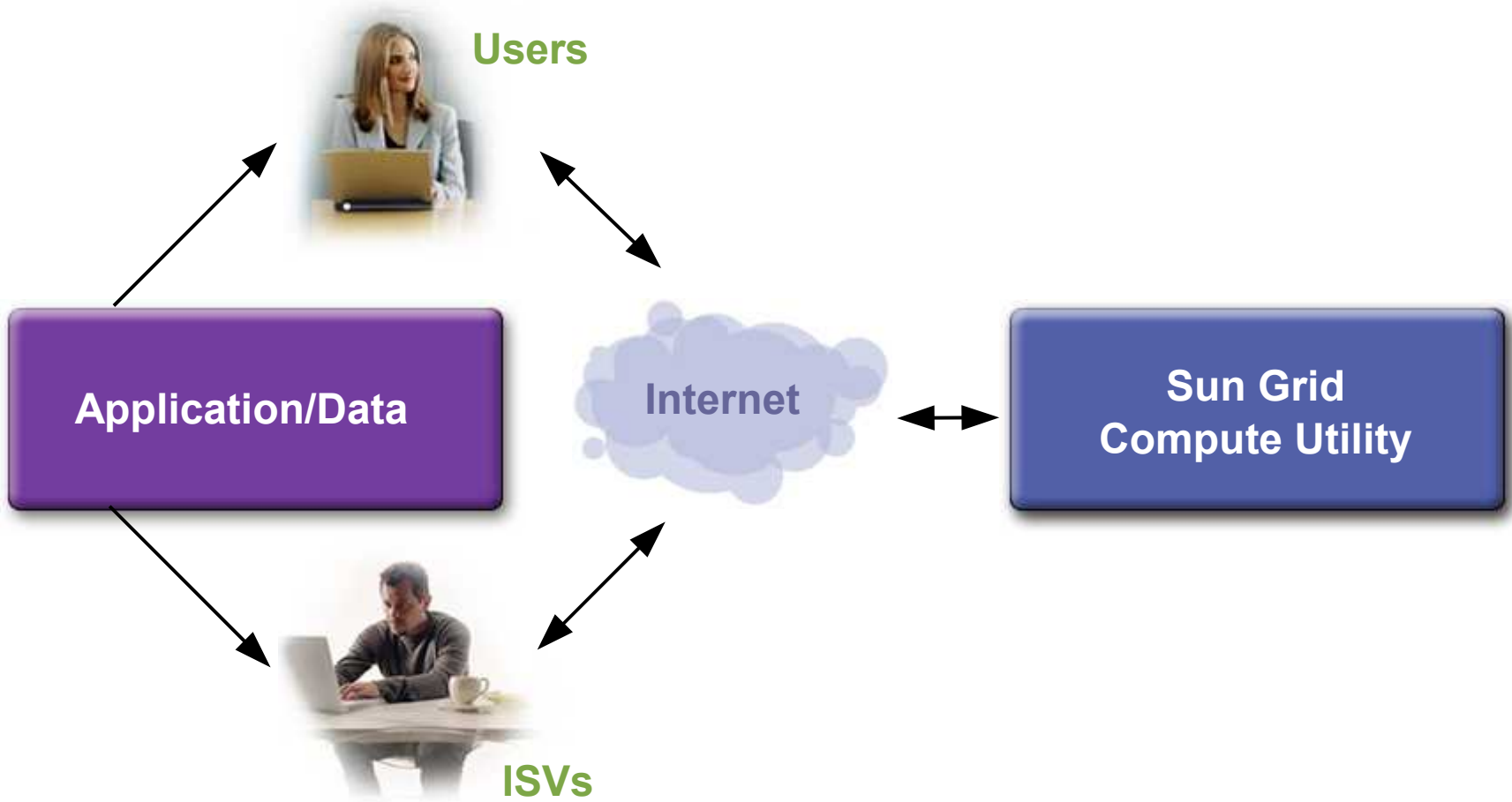
- Batch/Grid
 - Get job done faster
- Data Transformations, such as:
 - Extract Transform Load (ETL)
 - Document processing
- Computations and Simulations, e.g.:
 - Digital media processing (renderings, animations, etc.)
 - Financial calculations
 - Scenario simulations
 - Business Intelligence and Analytics

Who Is Interested?

- Individuals/businesses:
 - With variable loads
 - Where **Time = \$**
 - That are small (e.g., start-ups)
- Anyone who wants to:
 - Avoid having to purchase and manage HW/SW
 - Avoid having to scale for the maximum
 - Get cycles when they need them
 - Pay a known cost
- Independent Software Vendors (ISVs)



Sun Grid Usage and ISV Model



The Sun Grid Compute Utility

Background/Context

What is the Sun Grid?

How to use the Sun Grid

Developing Java Applications for Sun Grid

Example Applications for Sun Grid

Cool tools for Sun Grid

Q&A

Login

Sun Grid Compute Utility - Mozilla Firefox

File Edit View Go Bookmarks Yahoo! Tools Help

http://www.network.com/

Java Solaris Communities Partners My Sun Sun Store United States Worldwide

Welcome to Sun Grid

POWER UP YOUR BUSINESS WITH
SUN GRID COMPUTE UTILITY
Access the secure compute power you need, when you need it, easily through the Internet for just \$1/CPU-hr. Pilot US only. Register today »

Use the Sun Grid in three easy steps. View the demo »

1 UPLOAD
Your Application

[Enter the Grid »](#)

Sun Grid Resources

- About Sun Grid
- Sun Grid Developer Community
- Utility Computing

Sun Grid Launch

- View Executive Video
- View Customer Testimonials
- Become a Sun Grid Channel Partner

Test Drive the Sun Grid! Register for a Sun Grid account to test drive Cepstral's text-to-speech translator. This sample application accepts your text input and creates a spoken-word .mp3 audio file. Download the file, and publish your own podcast! Registration required. [Test Drive the Sun Grid!](#)

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Done 4.210s Adblock

Sun Grid - Mozilla Firefox

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https://www.sungrid.net/GridPortal/GridPortal/StartAction.do?acx

Java Solaris Communities Partners My Sun Sun Store United States Worldwide

Products Downloads Services & Solutions Support Training Research Search

Welcome to Sun Grid

Simple, secure compute utilities for \$1/CPU-Hour

Account Login

Username:

Password:

Offer Code:

[Enter the Grid](#) [Trouble Logging In?](#)

New to Sun Grid?

[Request Account](#)

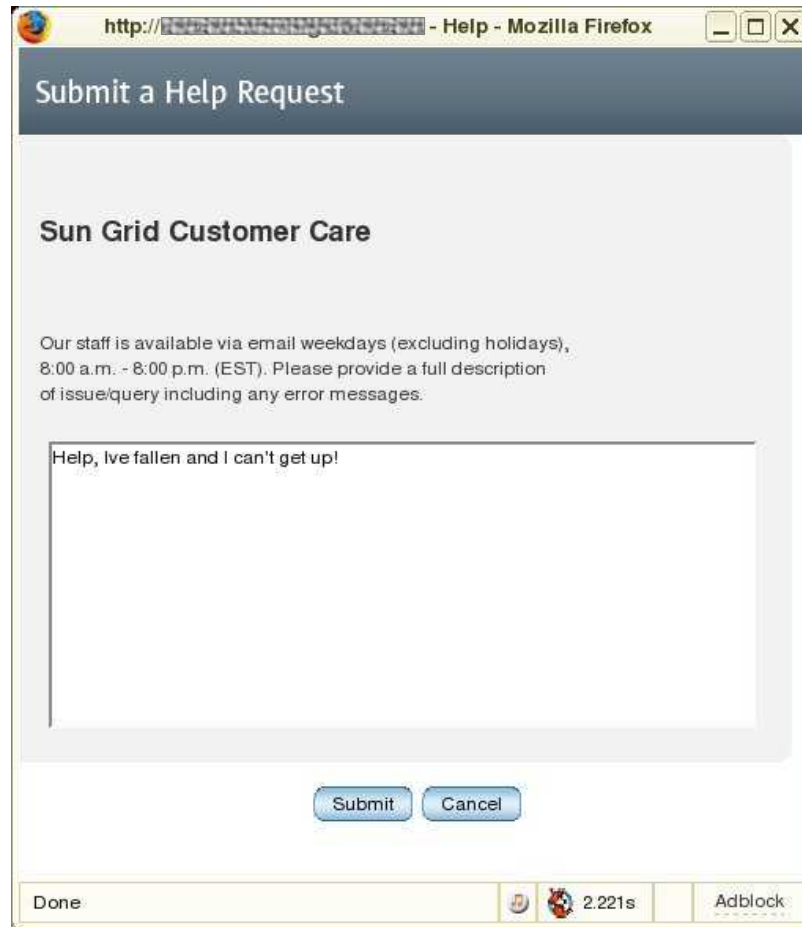
[Learn More about the Sun Grid](#)

The Sun Grid is optimized for the following browsers: Firefox, Internet Explorer, Mozilla, and Safari. Note that popups and cookies must be enabled to use the Sun Grid. The Sun Grid is currently available to users located within the United States. For help, please contact sungrid-help@sun.com. For documentation please see [Compute Utility FAQs](#).

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Done www.sungrid.net 0.200s Adblock

Help!



http://[redacted] - Help - Mozilla Firefox

Submit a Help Request

Sun Grid Customer Care

Our staff is available via email weekdays (excluding holidays), 8:00 a.m. - 8:00 p.m. (EST). Please provide a full description of issue/query including any error messages.

Help, ive fallen and I can't get up!

Submit Cancel

Done | 2.221s | Adblock

The Code

```
% vi HelloWorld.java
```

```
/**
 * This is the hello world application for JavaOne 2006
 * The code is simple, to eliminate java as a point of confusion
 */
class HelloWorld
{
    public static void main(String args[])
    {
        System.out.println("Hello JavaOne 2006 from the SunGrid ");
        System.out.println("where you get a supercomputer for a $1.00");
    }
}
```

```
% javac HelloWorld.java
```

```
% vi helloworld.bash
```

```
#Script file to run the HelloWorld Java Application
#!/bin/sh
java HelloWorld
```

```
% zip HelloWorld.zip HelloWorld.class helloworld.bash
```

Upload a Resource

The screenshot shows the Sun Grid Compute Utility web interface in Mozilla Firefox. The main window displays the 'Resources' section with a table and buttons for 'Create', 'View Details', 'Edit', and 'Delete'. A 'Create Resource' dialog box is open, containing the following fields and text:

- Name: HelloWorld * Required. Enter your Resource name.
- Description: JavaOne2006 Demo
- Type: Application
- Notes: This is the zip'ed file which has the HelloWorld.class, helloworld.bash and any other supporting files you might want to put here. This is created with the following command: zip HelloWrold.zip HelloWorld.class helloworld.bash
- File: /home/petem/Desktop/J [Browse...] * Required. Select the resource file to upload.

Buttons for 'UpLoad' and 'Cancel' are visible at the bottom of the dialog. An 'Upload Progress' window is also shown, displaying:

- Progress bar: 36%
- Upload speed: 0Kb/sec
- Loaded: 1Kb/2Kb
- Waiting ...
- 1.000s
- AdBlock

The Resource Exists!

MySunGrid - Mozilla Firefox

File Edit View Go Bookmarks Tools Help

http://[redacted]GridPortal/GridPortal/transfer_control.jsp

Vonage Citi Chase Health Java Desktop Sun Java Finance Grid News SO8SDK Blingo Zones

REFRESH LOG OUT HELP

Welcome: Peter Murray

Sun Grid Compute Utility

Account balance (CPU-Hours): 150
Storage used (%): 0
[Buy Additional CPU-Hours](#)

Sun Microsystems, Inc.

Resources Jobs Runs My Account Reference

Resources

<input checked="" type="checkbox"/>	Name	Size (MB)	Type	Source File	Description	Owner
<input type="checkbox"/>	cepstral-scripts	0		cepstral-scripts.zip		Sun Grid
<input type="checkbox"/>	HelloWorld	0		HelloWrold.zip		Peter Murray

Create View Details Edit Delete

Total Resources Size (MB): 0.000
Account Storage limit (MB): 1250

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Done

Confirmed

Loaded Resource 'HelloWorld' to the SunGrid.

OK

Done 3.698s Adblock

Create a Job

The screenshot shows the Sun Grid Compute Utility interface in a Mozilla Firefox browser. The main window displays the 'Jobs' section with a table of existing jobs and a 'Create' button. An overlay window titled 'Create Job' is open, showing the following form fields:

- Name:** javaOne2006-HelloWorld * Required. Enter your Job name.
- Description:** [Empty text box]
- Notes:** This is a sample app which just does a hello world java applicaiton for JavaOne 2006
A supercomputer for a buck.
- Executable:** helloworld.bash * Required. Enter your Job executable program/script name.
- Parameters:** [Empty text box]
- Resources:** HelloWorld (selected in dropdown) Path: [Empty text box]

Buttons for 'Create' and 'Cancel' are visible at the bottom of the 'Create Job' form.

Job Exists!

MySunGrid - Mozilla Firefox

File Edit View Go Bookmarks Tools Help

http://.../GridPortal/GridPortal/transfer_control.jsp

Vonage Citi Chase Health Java Desktop Sun Java Finance Grid News SO8SDK Blingo Zones

REFRESH LOG OUT HELP

Welcome: Peter Murray

Sun Grid Compute Utility

Account balance (CPU-Hours): 150
Storage used (%): 0
[Buy Additional CPU-Hours](#)

Sun Microsystems, Inc.

Resources Jobs Runs My Account Reference

Jobs

<input type="checkbox"/>	Name	Executable	Parameters	Description	Owner
<input type="checkbox"/>	Host Name	/bin/hostname		get the name of this host	Sun Grid
<input type="checkbox"/>	JavaOne2006-HelloWorld	helloworld.bash			Peter Murray

Create View Details Edit Delete Run Now

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Done

Confirmed

Job 'JavaOne2006-HelloWorld' Created

OK

Done 1.883s AdBlock

Run It



Run Status Pending/Started

MySunGrid - Mozilla Firefox

http://[redacted]/GridPortal/GridPortal/transfer_control.jsp

Welcome: Peter Murray

Sun Grid Compute Utility

Account balance (CPU-Hours): 150
Storage used (%): 0
[Buy Additional CPU-Hours](#)

RESOURCES | JOBS | **RUNS** | MY ACCOUNT | REFERENCE

<input type="checkbox"/>	Number	Job Name	Status	CPU-Hrs Used	CPU-Hrs Billed	Started When	Finished When	Output size
<input type="checkbox"/>	216	JavaOne2006-HelloWorld	Pending	0	0			0

Cancel | View Details | Delete | Download Output | **UpdateStatus**

Total Runs Output Size (MB): 0.000
Account Storage limit (MB): 1250

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Sun Grid Job Run Status

Reply | Reply to All | Forward | Print | Delete | Junk | Not Junk | Previous | Next

From: Sun Grid Customer Care <sungrid-notifications@sun.com>
To: Peter.Murray@Sun.COM
Subject: Sun Grid Job Run Status
Date: Thu, 30 Mar 2006 19:06:13 +0000 (GMT+00:00) (14:06 EST)

Your Sun Grid job run 'JavaOne2006-HelloWorld_216' started at time 2006-03-30 19:06:13.619.
If you have any questions, please contact Sun Grid Customer Care (sungrid-help@sun.com)



Run Finished

MySunGrid - Mozilla Firefox

File Edit View Go Bookmarks Tools Help

http://[redacted]GridPortal/GridPortal/MyRunsAction.do

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WELCOME: Peter Murray

Sun Grid Compute Utility

Account balance (CPU-Hours): 149
Storage used (%): 0
[Buy Additional CPU-Hours](#)

RESOURCES | JOBS | **RUNS** | MY ACCOUNT | REFERENCE

<input checked="" type="checkbox"/>	Number	Job Name	Status	CPU-Hrs Used	CPU-Hrs Billed	Started When	Finished When	Output size
<input type="checkbox"/>	216	JavaOne2006-HelloWorld	Succeeded	0.000	1	2006-03-30 19:06:13.0	2006-03-30 19:06:43.0	1230

Cancel View Details Delete Download Output **UpdateStatus**

Total Runs Output Size (MB): 0.001
Account Storage limit (MB): 1250

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Sun Grid Job Run Status

File Edit View Message

Reply Reply to All Forward Print Delete Junk Not Junk Previous Next

From: Sun Grid Customer Care <sungrid-notifications@sun.com>
To: Peter.Murray@Sun.COM
Subject: Sun Grid Job Run Status
Date: Thu, 30 Mar 2006 19:06:43 +0000 (GMT+00:00) (14:06 EST)

Your Sun Grid job run 'JavaOne2006-HelloWorld_216' finished (Succeeded) at time 2006-03-30 19:06:43.61.
If you have any questions, please contact Sun Grid Customer Care (sungrid-help@sun.com)



Run Details



View Run Details

Number:	216
Job Name	JavaOne2006-HelloWorld
submitted when:	2006-03-30 19:05:45.0
Started when:	2006-03-30 19:06:13.0
Finished when:	2006-03-30 19:06:43.0
Status:	Succeeded
CPU-Hours used:	0.000
CPU-Hours billed:	1
CPU-Hours redeemed (paid):	1
Memory used:	0.000
I/O used:	0.000
Output size (bytes):	1230
Output CheckSum:	9f4934398oda1d04054747a547b7e2cd
Created when:	2006-03-30 19:05:45.0
Updated when:	2006-03-30 19:05:45.0
Owner:	[REDACTED]
Owner Name:	Peter Murray

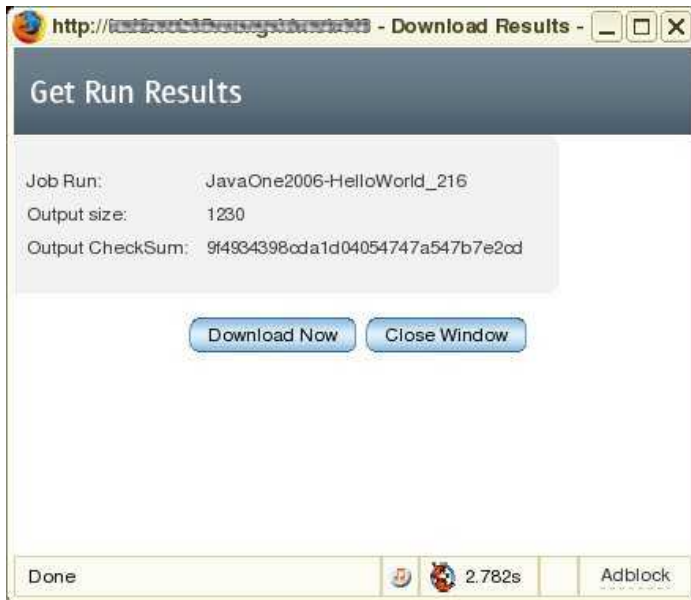
	Resource Name	Resource Description
	HelloWorld	

106-03-30 19

Done

Done 1.692s Adblock

Get the Output




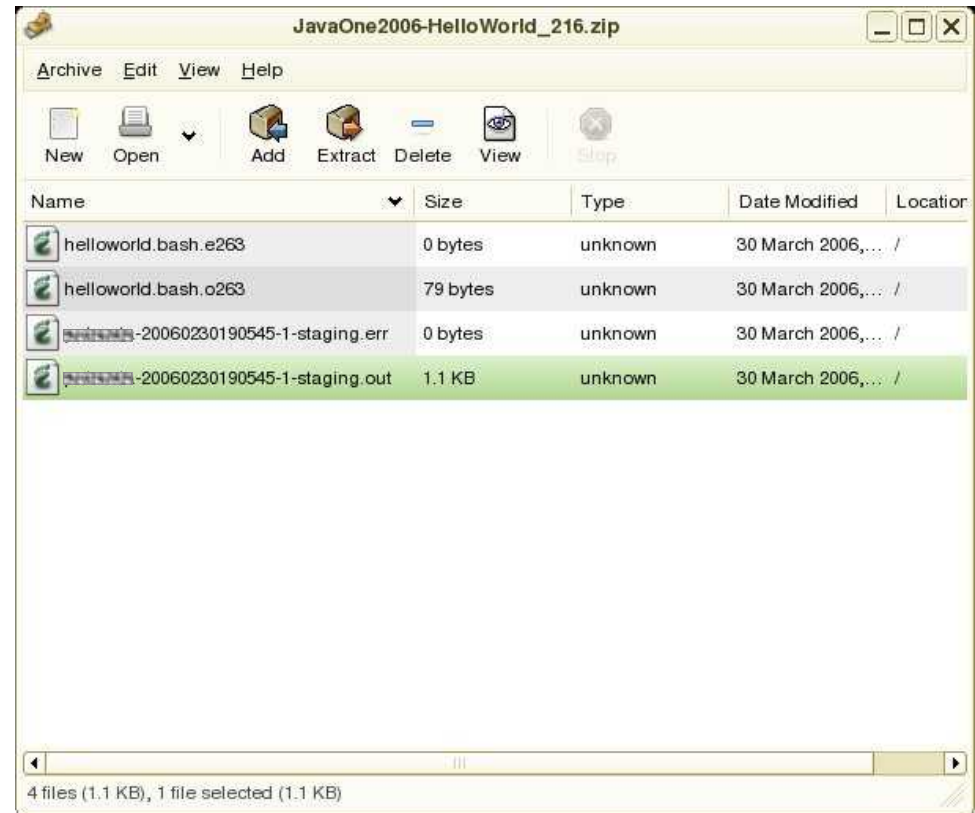
http://... - Download Results -

Get Run Results

Job Run: JavaOne2006-HelloWorld_216
 Output size: 1230
 Output CheckSum: 9f49343980da1d04054747a547b7e2cd

[Download Now](#) [Close Window](#)

Done  2.782s [Adblock](#)



JavaOne2006-HelloWorld_216.zip

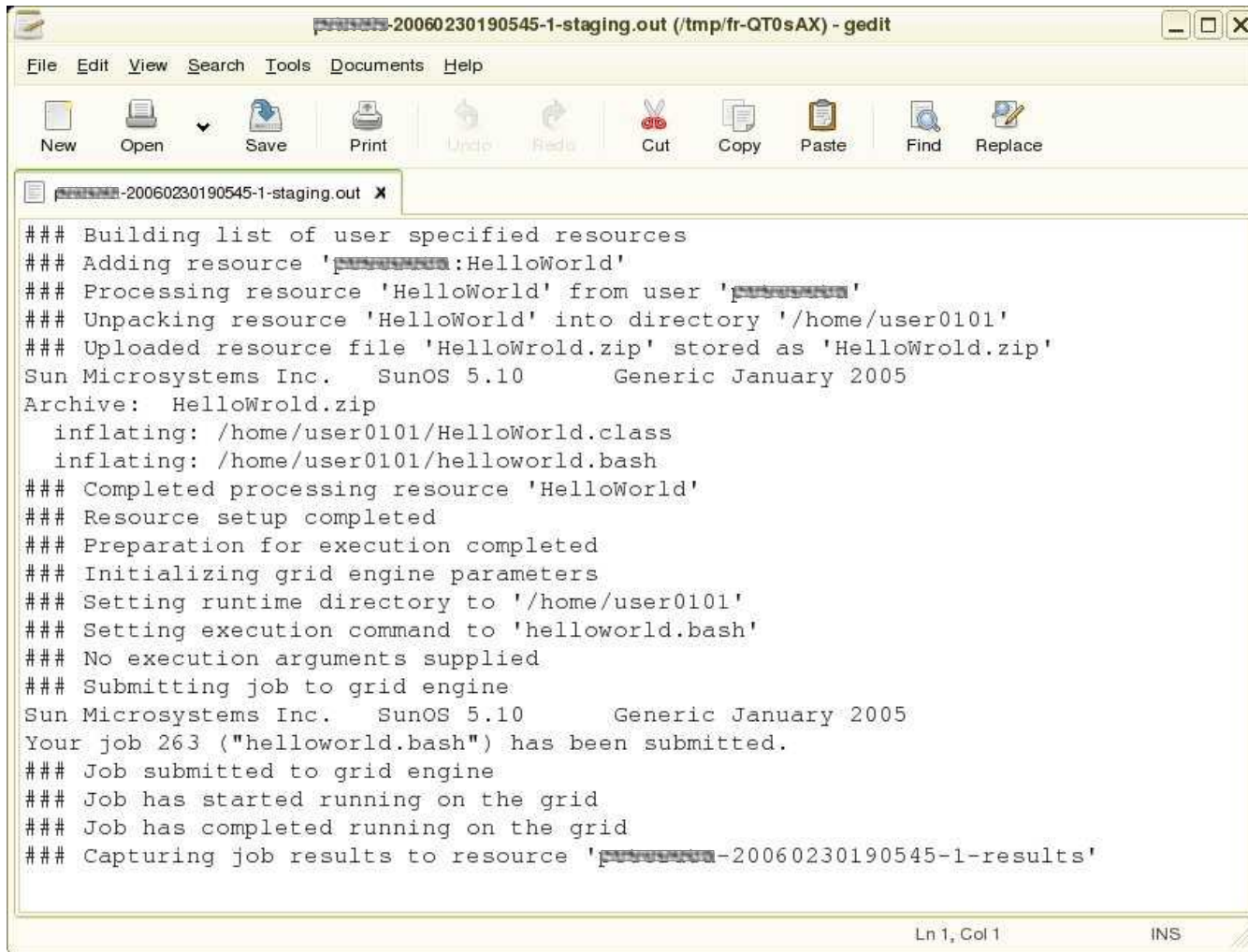
Archive Edit View Help

New Open Add Extract Delete View Stop

Name	Size	Type	Date Modified	Location
helloworld.bash.e263	0 bytes	unknown	30 March 2006,...	/
helloworld.bash.o263	79 bytes	unknown	30 March 2006,...	/
...-20060230190545-1-staging.err	0 bytes	unknown	30 March 2006,...	/
...-20060230190545-1-staging.out	1.1 KB	unknown	30 March 2006,...	/

4 files (1.1 KB), 1 file selected (1.1 KB)

What Comes Back?



```

### Building list of user specified resources
### Adding resource 'XXXXXXXXXX:HelloWorld'
### Processing resource 'HelloWorld' from user 'XXXXXXXXXX'
### Unpacking resource 'HelloWorld' into directory '/home/user0101'
### Uploaded resource file 'HelloWrold.zip' stored as 'HelloWrold.zip'
Sun Microsystems Inc.  SunOS 5.10      Generic January 2005
Archive:  HelloWrold.zip
  inflating: /home/user0101/HelloWorld.class
  inflating: /home/user0101/helloworld.bash
### Completed processing resource 'HelloWorld'
### Resource setup completed
### Preparation for execution completed
### Initializing grid engine parameters
### Setting runtime directory to '/home/user0101'
### Setting execution command to 'helloworld.bash'
### No execution arguments supplied
### Submitting job to grid engine
Sun Microsystems Inc.  SunOS 5.10      Generic January 2005
Your job 263 ("helloworld.bash") has been submitted.
### Job submitted to grid engine
### Job has started running on the grid
### Job has completed running on the grid
### Capturing job results to resource 'XXXXXXXXXX-20060230190545-1-results'
  
```


StdOut



The Sun Grid Compute Utility

Background/Context

What is the Sun Grid?

How to use the Sun Grid

Developing Java Applications for Sun Grid

Example Applications for Sun Grid

Cool tools for Sun Grid

Q&A

Java Applications for Sun Grid

- Parallel applications
 - Numerous independent jobs (1000s)
 - Run simultaneously
 - Minimal cross-dependencies
- Types of parallel applications
 - HPC applications
 - Large data analysis
- These applications
 - Are self-contained
 - POJOs

Creating a Java Grid Application

- Good candidates for parallel processing
 - Compute intensive
 - Time-consuming loops
 - Need results faster
- How to parallelize an application
 - Break loops down
 - Create independent jobs to run simultaneously
 - Partition data for each job

Communication and Coordination

- Communication
 - MPI (native libraries pre-installed)
 - File system
 - Applications read/write files
 - NFS for sharing data
 - RMI
- Coordination via N1 Grid Engine
 - Jobs may have dependencies
 - One job can wait for another
 - Use `qsub` command with “`hold_jid`” option

Develop and Pre-Test Locally

- Develop the application
 - Write the code using your favorite IDE
 - Include logs for debugging
 - Use application-specific logging mechanism
 - Write logs to the file system
 - Package the Java application as JAR(s)
- Pre-Test the application (optional, but beneficial)
 - Local grid with Solaris 10 and N1GE (open source)
 - Develop and test the execution scripts

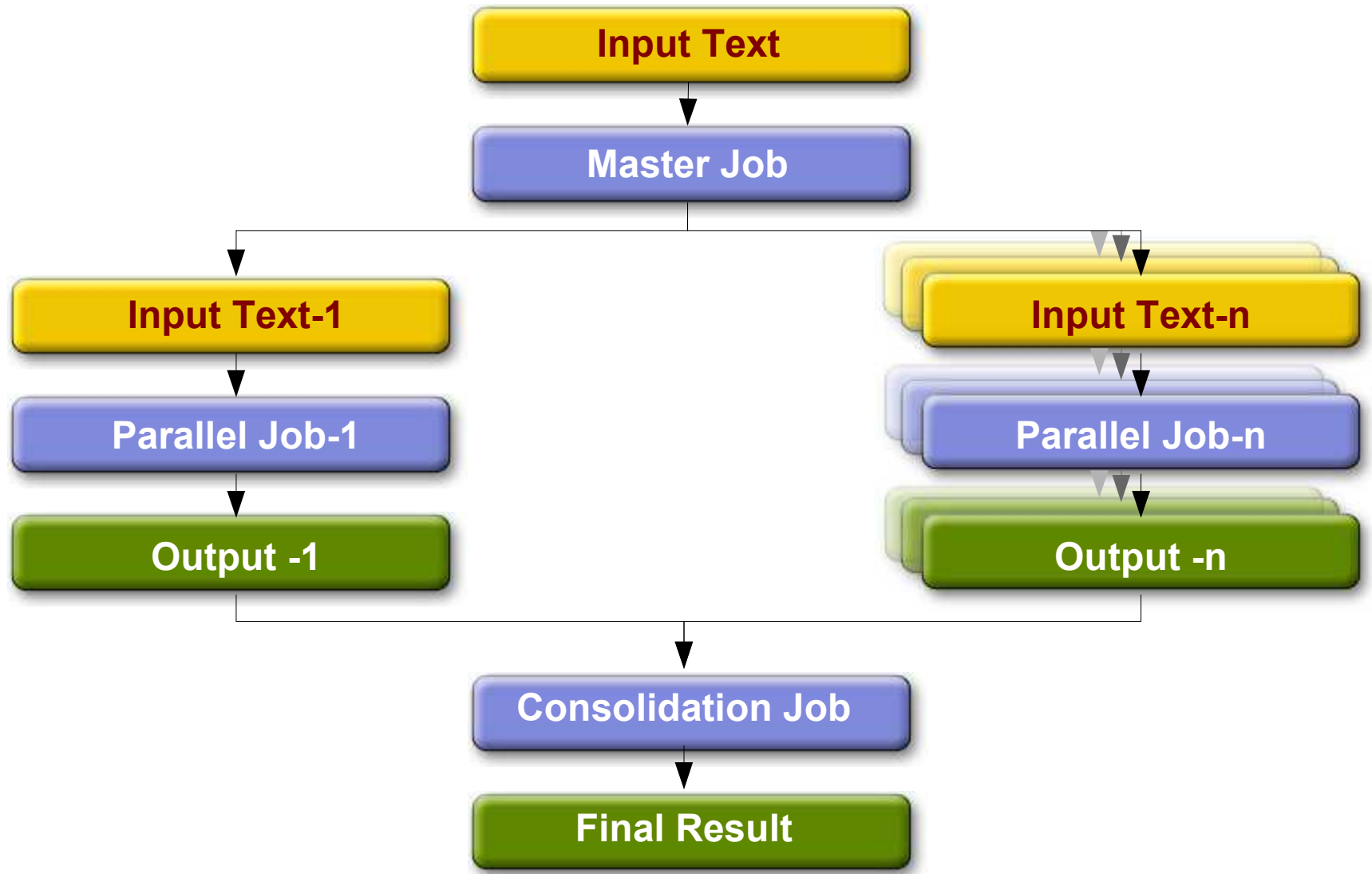
The Sun Grid Compute Utility

- Background/Context
- What is the Sun Grid?
- How to use the Sun Grid
- Developing Java Applications for Sun Grid
- **Example Applications for Sun Grid**
- Cool tools for Sun Grid
- Q&A

File System Example Application

- Credit Card Processor
 - Input file with transaction details for processing
 - Partition processing and consolidate results
 - Demonstrates typical processing model
- Available for download
 - Sun Grid Community
 - <http://example-java-prog.developer.network.com/>
 - Source code and compiled binary

CC Example—Flow of Execution



CC Example—Sun Grid Script

```
#!/usr/bin/bash

let NTASKS=$1
let COUNT=0

qsub -N step1 -b n java_step1.sh $NTASKS

while [ $COUNT -lt $NUMTASKS ] ; do
    let COUNT=COUNT+1
    qsub -N step2 -hold_jid step1 -b n java_step2.sh $COUNT
done

qsub -hold_jid step2 -b n final.sh CreditCardOutput $NTASKS
```

CC Example—More Sun Grid Scripts

<java_step1.sh>

```
#!/usr/bin/bash
```

```
let NUMTASKS=$1
```

```
java -cp ccapp.jar com.sun.sungrid.sample.jog.CreditCardProcessor  
CreditCardInfo.txt $NUMTASKS
```

<java_step2.sh>

```
#!/usr/bin/bash
```

```
let FNUM=$1
```

```
java -cp ccapp.jar com.sun.sungrid.sample.jog.CCParallelJobs  
CreditCardInfo-$FNUM.txt CreditCardOutput-$FNUM.txt
```

CC Example Java Code—Snippet 1

<CreditCardProcessor.java>

```
...
BufferedWriter out;
File file = new File("error.log");
PrintStream log = null;
log=new PrintStream(new FileOutputStream(file,true));
out = new BufferedWriter(new FileWriter("CCAppStatus.txt",true));
out.write("Welcome to SunGrid CreditCard Processor Sample App!");
out.write("This file contains the log");
out.write("Splitting the input file into multiple parts now... ");
out.close();

CCFileReader filereader=new CCFileReader();
filereader.divideFile(args[0], args[1]);
...
```

CC Example Java Code—Snippet 2

<CCParallelJobs.java>

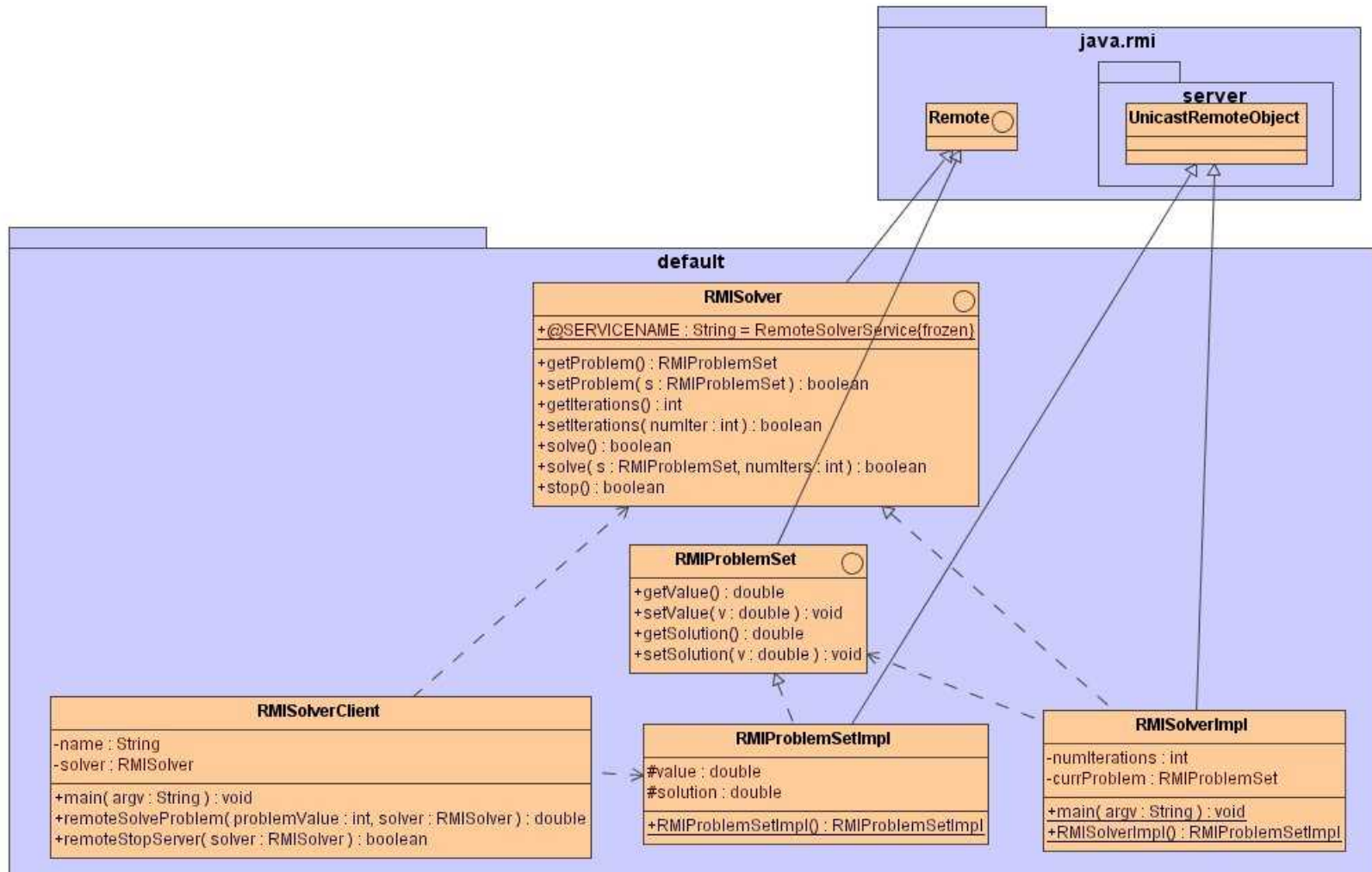
```
...
PrintStream log=new PrintStream(new FileOutputStream(file,true));
BufferedWriter out = new BufferedWriter(new FileWriter(outfilename));
BufferedReader in = new BufferedReader(new FileReader(infilename));

while ((str = in.readLine()) != null) {
    //process
    out.write(" ...");
}
...
```

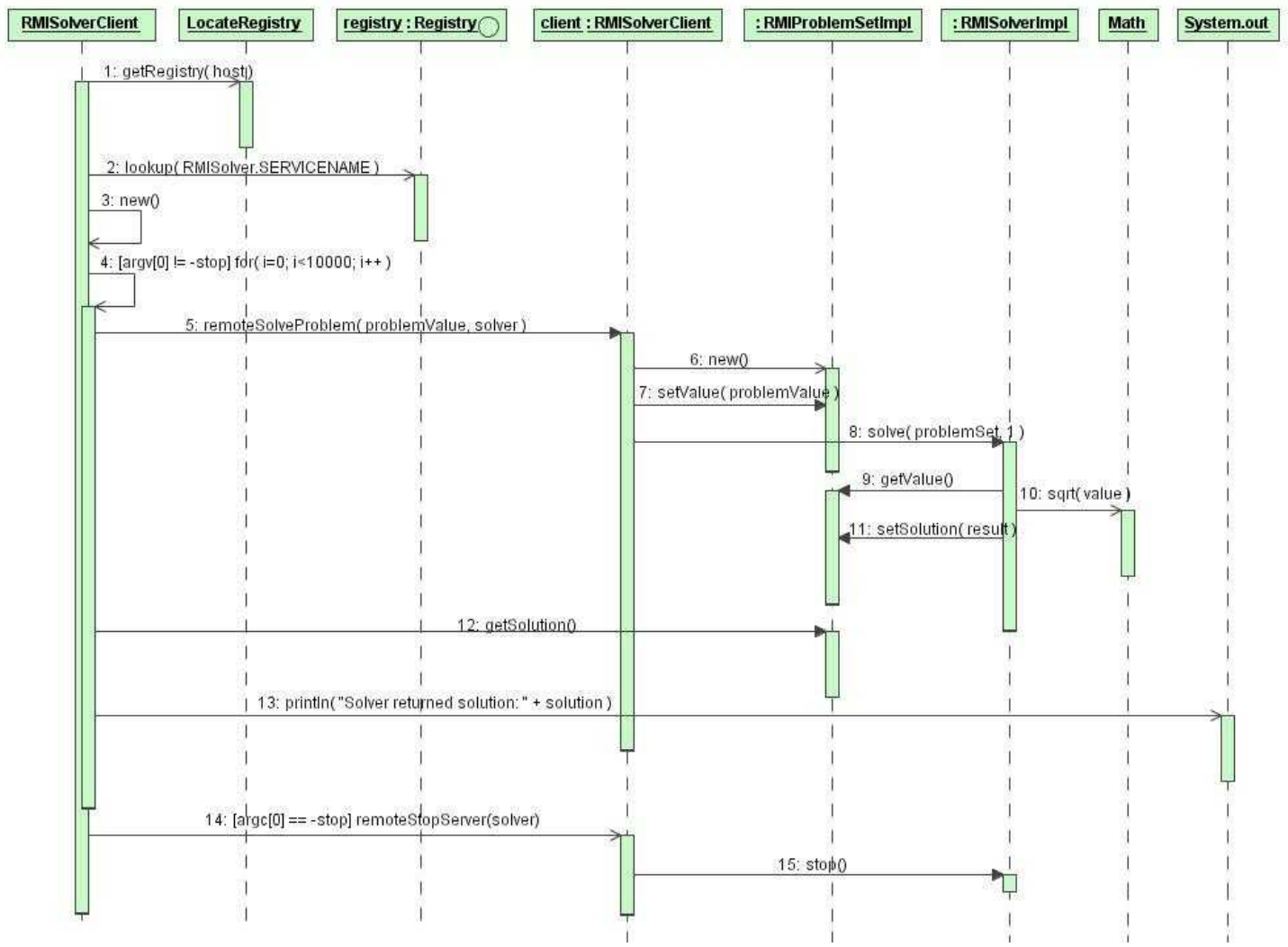
RMI Example Application

- RMISolver
 - Server implements a mathematical solver
 - Clients pass data object to server to be solved
 - Demonstrates approach to locate the server
- Available for download
 - Sun Grid Community
 - <http://examplermiprogram.developer.network.com/>
 - Source code and compiled binary

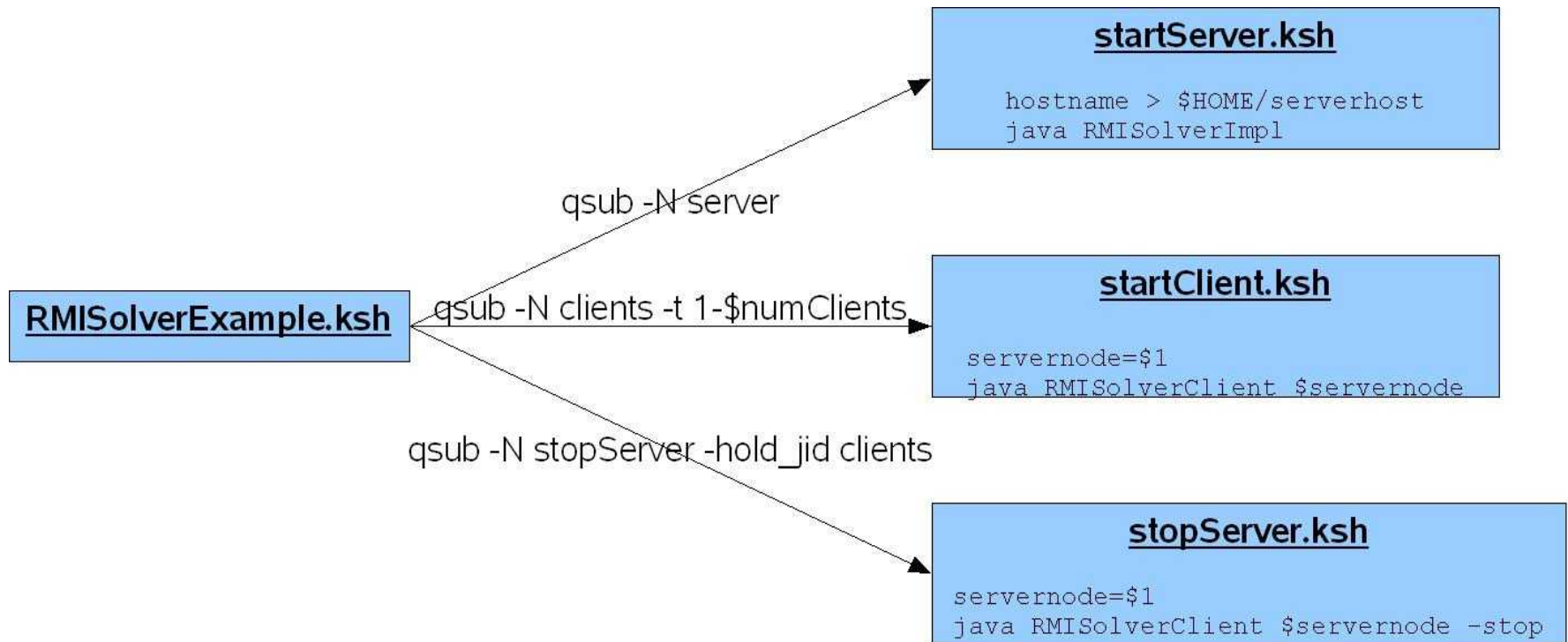
RMISolver Example—Classes



RMI Solver Example—Flow



RMISolver Example—Scripts



RMISolver Example—Main Script

```
svrResp=`qsub -N server startServer.ksh`           # start the server
svrJobId=`echo "$svrResp" | awk '{print $3}'`      # parse out the job id

status="not running"
until [ "$status" == "r" ]
do
    status=`qstat | nawk '/'$svrJobId'/ {print $5}'`
    sleep 10
done                                               # loop until server job is running

filename="$HOME/serverhost"
until test -f $filename
do
    sleep 10
done                                               # loop until the hostname is there

servernode=`cat $filename`                         # fetch the server hostname
rm -f $filename                                    # cleanup the file

qsub -N clients -t 1-$numClients startClient.ksh $servernode    # start the clients
qsub -N stopServer -hold_jid clients stopServer.ksh $servernode # stop the server
```

The Sun Grid Compute Utility

- Background/Context
- What is the Sun Grid?
- How to use the Sun Grid
- Developing Java Applications for Sun Grid
- Example Applications for Sun Grid
- **Cool tools for Sun Grid**
- Q&A

Why Tools for Sun Grid?

- Writing Sun Grid applications can get complex
- In addition to business logic, have to deal with:
 - Application parallelization
 - Infrastructure to distribute code and data
 - Multi-threaded code (maybe)
 - Programming model and application pattern(s)
 - Scripts or DRMAA for N1 Grid Engine
 - Remote debugging

“Compute Server” Project Overview

- Java.net project that eases use of Sun Grid
- Programming model (Master/Worker pattern):
 - Single-threaded tasks executed by workers
 - Single-threaded task generator executed by master, produces output and controls task generation
 - Output processed off-grid
- Developer only has to write:
 - The task class
 - The task generator class
 - The output processing code
- IDE integration

Packaging and Execution Support

- Integrated Ant tasks for project functions:
 - Build Project
 - Debug Project
 - Package Grid Resources
 - Process Grid Output
 - Properties
- Online help within Netbeans:
 - “Compute Server Projects: Compute Server Job Submission” subtopic

Compute Server Developer Experience

- Get SunGrid account
- Write the application-specific code
- Test locally to ensure correctness
- Specify key execution parameters
- Generate package for submission to Sun Grid
- Submit to Sun Grid and download results
- Executes output processing and displays results

IDE Supported Steps

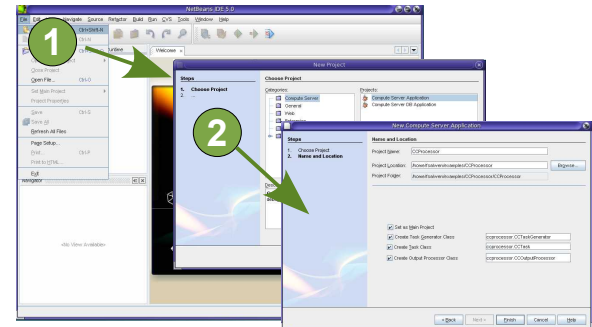
Additional Info

More About Applications and Tools

- Structured approach for decomposition
- Patterns for examples shown here and more
- More on Compute Server, with a demo

- Unfortunately, no time here
- Will be covered in...

- TS-3117: Advanced Sun Grid—Creating Applications for Horizontal Scale
- 4:30pm Today

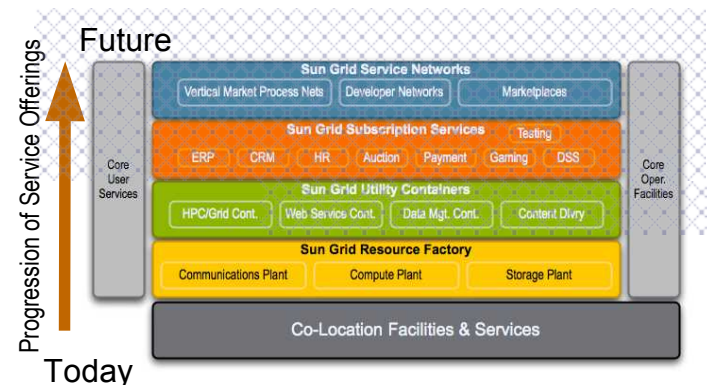


Sun Grid Futures

- Programmatic access
- Support for long-running services
- ISV models
- More...

Unfortunately, no time here

- Will be covered in...
 - BOF-7995: What's Next for Sun Grid?
 - 10:30pm Today



Q&A

<code />

For More Information

JavaOne sessions

TS-3117: Advanced Sun Grid—Creating Applications for Horizontal Scale

BOF-7995: What's Next for Sun Grid?

Java.net Community Corner mini-sessions

Rapid Development of Sun Grid Applications using Compute Server

Sun Grid as a Test-to-Scale facility

Sun Grid developer experience and API development

<http://www.network.com>

<http://developer.network.com>

<http://computeserver.dev.java.net>

<http://gridengine.sunsource.net>

<http://www.sun.com/service/crs>



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The Sun Grid Compute Utility

A Tutorial for Java Developers

Fay Salwen
Peter A. Murray
Uday Subbarayan
Staff Engineers, Sun Grid
Sun Microsystems, Inc.

TS-1109

