PTP Tutorial

Introduction to The Eclipse Parallel Tool Platform

Dennis Castleberry, Hari Krishnan, and Dr. Steven R. Brandt

Center for Computation and Technology
Louisiana State University, Baton Rouge, LA

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Goals

Goals

- The module *Advanced Programming Tools* will teach:
  - Eclipse
  - Installing Eclipse and the JDK
  - Views, Editors, Codes
  - Tools for Static Analysis
  - Tools for Debugging
  - Linux Tools for Eclipse
  - HPC Toolkit Plugin
  - Mojave
- We will use Cactus as an example of an Application Framework.

Eclipse

Eclipse

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- IDE: Integrated Development Environment
- Advanced editing capabilities
- Written in Java for multi-platform support
- open-source
- extensible
- Supports C, C++, Fortran, etc. through "plugins"

Installing the Oracle JDK

Installing the Oracle JDK

Java Platform (JDK) 7

- Goto http://java.sun.com
- Click on "Java SE" under "Top Downloads"
- Click on the "Java Download" button
- Scroll down and get the Java SE 6 JDK (Java Development Kit)

Installing the Oracle JDK

After you run the installer, add the following to your .bashrc

- `export JAVA_HOME=/usr/java/jdk1.6.0_27`
- `export PATH=$JAVA_HOME/bin:$PATH`
- Now source your .bashrc

Installing Eclipse

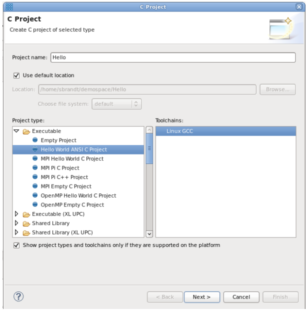
Installing Eclipse

- Goto `http://www.eclipse.org/downloads/`
- Get Eclipse IDE for Parallel Application Developers
- Command: `tar xvf ~/Download/eclipse-parallel-indigo-SR2-incubation-linux-gtk-x86_64.tar.gz`
- Command: `cd eclipse/`
- Command:
  ```
  ./eclipse  -XX:PermSize=256m -XX:MaxPermSize=512m &
  ```
- You'll see a prompt for selecting a workspace. Check the box which says "Use this as the default and do not ask again"

Hello World in C

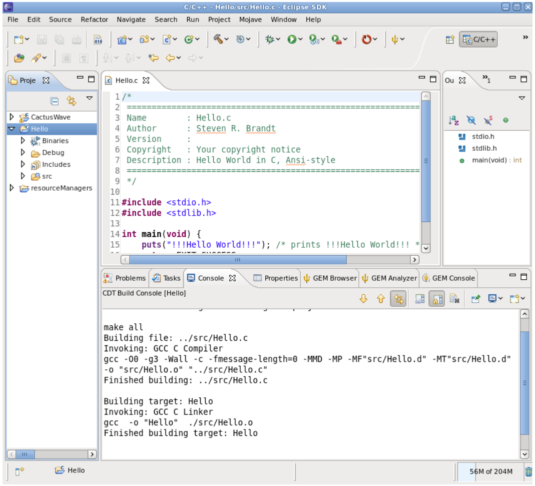
Hello World in C

- File > New > C Project
- Select "Hello World ANSI C Project"
- Fill in project name
- Click "Next"



Hello World in C

"Project > Build Project" builds a project



```
/*
 ============================================================
 Name        : Hello.c
 Author      : Steven R. Brandt
 Version     :
 Copyright   : Your copyright notice
 Description : Hello World in C, Ansi-style
 ============================================================
 */

#include <stdio.h>
#include <stdlib.h>

int main(void) {
    puts("!!!Hello World!!!"); /* prints !!!Hello World!!! *
```

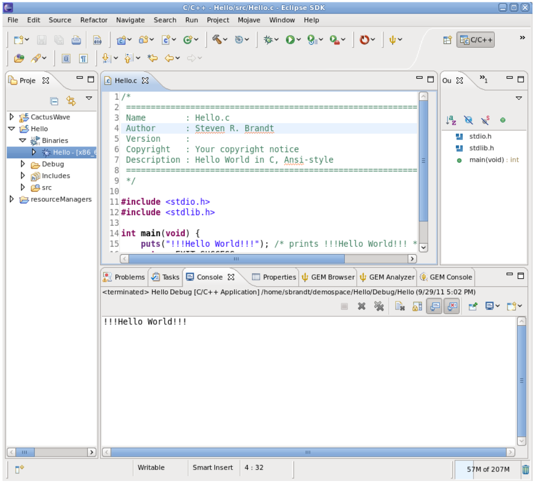
CDT Build Console [Hello]

```
make all
Building file: ../src/Hello.c
Invoking: GCC C Compiler
gcc -O0 -g3 -Wall -c -fmessage-length=0 -MMD -MP -MF"src/Hello.d" -MT"src/Hello.d"
-o "src/Hello.o" "../src/Hello.c"
Finished building: ../src/Hello.c

Building target: Hello
Invoking: GCC C Linker
gcc  -o "Hello"  ./src/Hello.o
Finished building target: Hello
```

Hello World in C

"Run > Run" runs the program


C/C++ - Hello/src/Hello.c - Eclipse SDK
File Edit Source Refactor Navigate Search Run Project Mojave Window Help
C/C++
Proje
CactusWave
Hello
Binaries
Hello - [x86_
Debug
Includes
src
resourceManagers
Hello.c
Ou
stdio.h
stdlib.h
main(void) : int
Problems Tasks Console Properties GEM Browser GEM Analyzer GEM Console
Writable
Smart Insert
4 : 32
57M of 207M

```
/*
 ============================================================
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 ============================================================
 */

#include <stdio.h>
#include <stdlib.h>

int main(void) {
	puts("!!!Hello World!!!"); /* prints !!!Hello World!!! *
```

```
<terminated> Hello Debug [C/C++ Application] /home/sbrandt/demospace/Hello/Debug/Hello (9/29/11 5:02 PM)
!!!Hello World!!!
```

Advanced Editing

Control Sequences

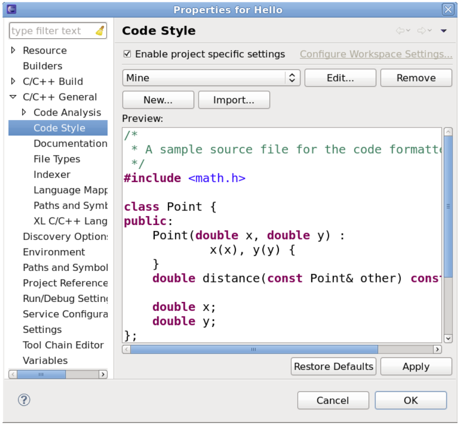
- Find source definition (Ctrl-G to show, F3 to go)
- Alt-$\leftarrow$ navigates to the previous source window
- Shift-Ctrl-G find symbol in workspace
- Ctrl-H to search

Control Sequences

- Alt-Shift-$\leftarrow$ or Alt-Shift-$\rightarrow$ highlights a block
- Correct indentation: highlight region, then Ctrl-I
- Toggle comment: Ctrl-/
- Correct format: highlight region, then Ctrl-Shift-F
- But what is the correct style?

Project Style

- Select a project
- Select: Project > Properties
- Open C/C++ General
- Select "Code Style"



☑ Enable project specific settings

Mine

Preview:

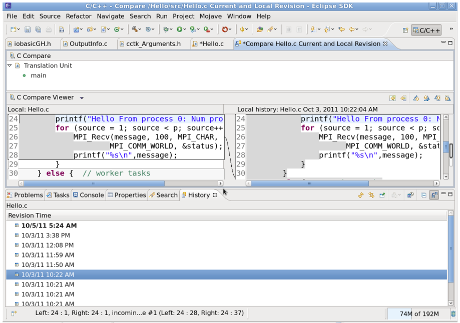
```
/*
 * A sample source file for the code formatte
 */
#include <math.h>

class Point {
public:
    Point(double x, double y) :
            x(x), y(y) {
    }
    double distance(const Point& other) cons

    double x;
    double y;
};
```

Perspective / Editor / View

- A perspective is a collection of views. You can change them by going to `Window > Open Perspective...`
- On the right you see the outline view.
- Click the small x and it will go away.
- To bring it back, use `Window > Open View...` (or Shift-Alt-Q)

History

- The “History” view tracks session edits (Shift-Alt-Q Z)
- It can recover old versions from within the session
- By default, you won’t see edits from a previous session, but if you click the “Link with Editor and Selection” you can see them.
- Old versions stored in `.metadata/.plugins/org.eclipse.core.resources/.history`


C/C++ - Compare /Hello/src/Hello.c Current and Local Revision - Eclipse SDK
File Edit Source Refactor Navigate Search Run Project Mojave Window Help
C/C++
iobasicGH.h
OutputInfo.c
cctk_Arguments.h
*Hello.c
*Compare Hello.c Current and Local Revision
C Compare
Translation Unit
main
C Compare Viewer
Problems
Tasks
Console
Properties
Search
History

Local: Hello.c

```
        printf("Hello From process 0: Num pro
        for (source = 1; source < p; source++
            MPI_Recv(message, 100, MPI_CHAR,
                    MPI_COMM_WORLD, &status);
            printf("%s\n",message);
        }
    } else {  // worker tasks
```

Local history: Hello.c Oct 3, 2011 10:22:04 AM

```
        printf("Hello From process 0: N
        for (source = 1; source < p; so
            MPI_Recv(message, 100, MPI_
                    MPI_COMM_WORLD, &stat
            printf("%s\n",message);
        }
    }
```

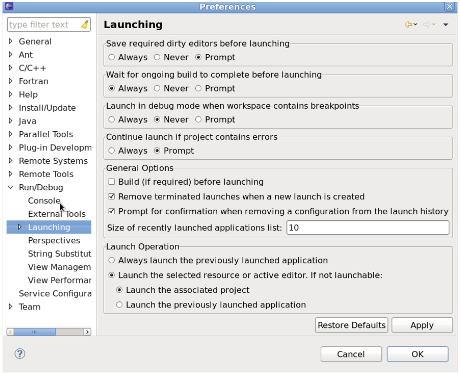
Hello.c

Revision Time
10/5/11 5:24 AM
10/3/11 3:38 PM
10/3/11 12:08 PM
10/3/11 11:59 AM
10/3/11 11:50 AM
10/3/11 10:22 AM
10/3/11 10:21 AM
10/3/11 10:21 AM
10/3/11 10:21 AM

Left: 24 : 1, Right: 24 : 1, incomin...e #1 (Left: 24 : 28, Right: 24 : 37)   74M of 192M

Preferences

- Eclipse rebuilds all open projects before running. Very annoying.
- To turn it off, go to `Window > Preferences`
- Open Run/Debug
- Select Launching
- Uncheck “Build (if required) before launching”



Launching

Save required dirty editors before launching
Always Never [✓ Prompt]

Wait for ongoing build to complete before launching
[✓ Always] Never Prompt

Launch in debug mode when workspace contains breakpoints
Always [✓ Never] Prompt

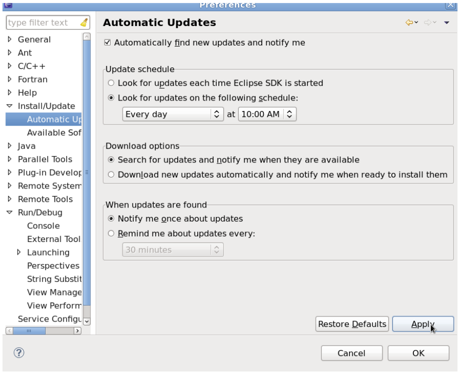
Continue launch if project contains errors
Always [✓ Prompt]

General Options
☐ Build (if required) before launching
☑ Remove terminated launches when a new launch is created
☑ Prompt for confirmation when removing a configuration from the launch history
Size of recently launched applications list: 10

Launch Operation
○ Always launch the previously launched application
● Launch the selected resource or active editor. If not launchable:
● Launch the associated project
○ Launch the previously launched application

Automatic Updates

- Configure automatic updates
- Go to `Window > Preferences`
- Go to `Install/Update > Automatic Updates`



Automatic Updates

[✓] Automatically find new updates and notify me

Update schedule
- ○ Look for updates each time Eclipse SDK is started
- ● Look for updates on the following schedule:

Every day at 10:00 AM

Download options
- ● Search for updates and notify me when they are available
- ○ Download new updates automatically and notify me when ready to install them

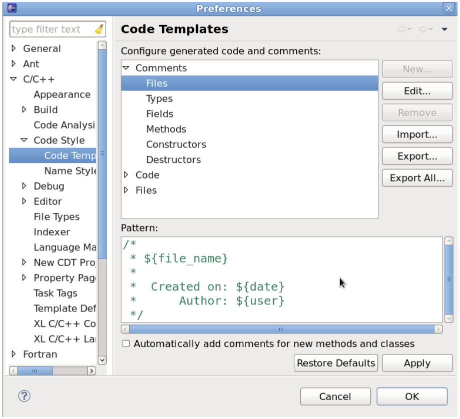
When updates are found
- ● Notify me once about updates
- ○ Remind me about updates every:

30 minutes

Refactorings

- Alt-Shift-R rename variable or function
- Alt-Shift-L extract local variable
- Alt-Shift-M extract method
- Alt-Shift-Z Surround with...

Code Templates



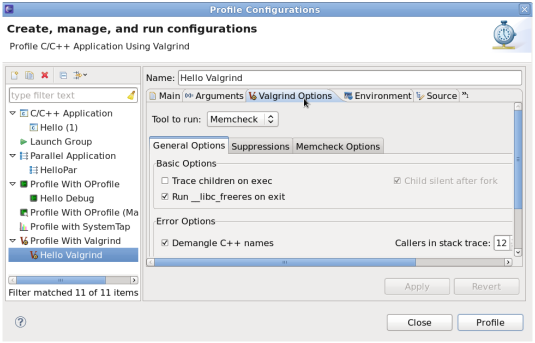
```
/*
 * ${file_name}
 *
 *  Created on: ${date}
 *      Author: ${user}
 */
```

Linux Tools

LinuxTools

- Help > Install New Software...
- Press "Add" set "Name:" to "Linux Tools" and Location to "http://downloads.eclipse.org/technology/linuxtools/update"
- Hit "Next" etc.

LinuxTools: Valgrind



Create, manage, and run configurations

Profile C/C++ Application Using Valgrind

Name: Hello Valgrind

Tool to run: Memcheck

Basic Options

☐ Trace children on exec

☑ Child silent after fork

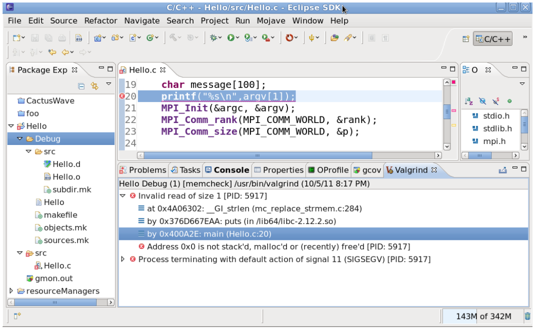
☑ Run __libc_freeres on exit

Error Options

☑ Demangle C++ names

Callers in stack trace: 12

LinuxTools: Valgrind

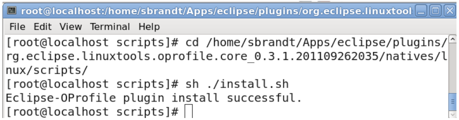

C/C++ - Hello/src/Hello.c - Eclipse SDK
File Edit Source Refactor Navigate Search Project Run Mojave Window Help
Package Exp
CactusWave
foo
Hello
Debug
src
Hello.d
Hello.o
subdir.mk
Hello
makefile
objects.mk
sources.mk
src
Hello.c
gmon.out
resourceManagers
stdio.h
stdlib.h
mpi.h
Problems Tasks Console Properties OProfile gcov Valgrind
143M of 342M

```
    char message[100];
    printf("%s\n",argv[1]);
    MPI_Init(&argc, &argv);
    MPI_Comm_rank(MPI_COMM_WORLD, &rank);
    MPI_Comm_size(MPI_COMM_WORLD, &p);
```

```
Hello Debug (1) [memcheck] /usr/bin/valgrind (10/5/11 8:17 PM)
Invalid read of size 1 [PID: 5917]
    at 0x4A06302: __GI_strlen (mc_replace_strmem.c:284)
    by 0x376D667EAA: puts (in /lib64/libc-2.12.2.so)
    by 0x400A2E: main (Hello.c:20)
    Address 0x0 is not stack'd, malloc'd or (recently) free'd [PID: 5917]
Process terminating with default action of signal 11 (SIGSEGV) [PID: 5917]
```

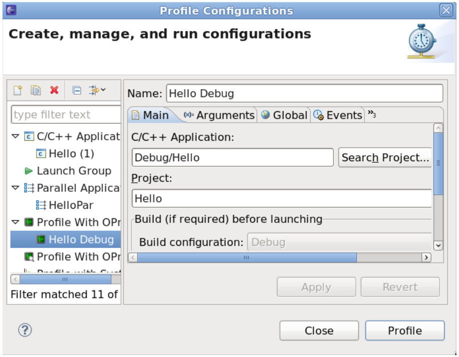
LinuxTools: OProfile Setup

Step 1:



```
root@localhost:/home/sbrandt/Apps/eclipse/plugins/org.eclipse.linuxtool
File  Edit  View  Terminal  Help
[root@localhost scripts]# cd /home/sbrandt/Apps/eclipse/plugins/
rg.eclipse.linuxtools.oprofile.core_0.3.1.201109262035/natives/l
nux/scripts/
[root@localhost scripts]# sh ./install.sh
Eclipse-OProfile plugin install successful.
[root@localhost scripts]#
```

Step 2:



Profile Configurations

Create, manage, and run configurations

type filter text

- C/C++ Applicat
  - Hello (1)
- Launch Group
- Parallel Applica
  - HelloPar
- Profile With OPr
  - Hello Debug
- Profile With OPr

Filter matched 11 of

Name: Hello Debug

Main | Arguments | Global | Events

C/C++ Application: Debug/Hello [Search Project...]

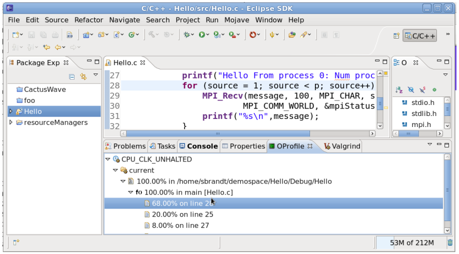
Project: Hello

Build (if required) before launching

Build configuration: Debug

LinuxTools: OProfile

The result of running oprofile is that the oprofile view gives you information about your run. You can click inside the view and see the relevant line in the editor.

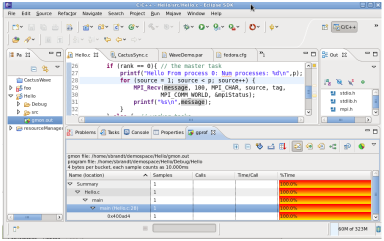


```
27             printf("Hello From process 0: Num proc
28             for (source = 1; source < p; source++)
29                 MPI_Recv(message, 100, MPI_CHAR, s
30                         MPI_COMM_WORLD, &mpiStatus
31                 printf("%s\n",message);
32             }
```

```
CPU_CLK_UNHALTED
  current
    100.00% in /home/sbrandt/demospace/Hello/Debug/Hello
      100.00% in main [Hello.c]
        68.00% on line 28
        20.00% on line 25
        8.00% on line 27
```

LinuxTools: OProfile

- Select Project and right click
- Project Properties > C/C++ Build > Settings > Debugging
- Click on “Generate gprof information (-pg)”
- Compile and run
- Hilight project and hit F5 (refresh)
- Linux Tools can process gmon.out



```
        if (rank == 0){ // the master task
            printf("Hello From process 0: Num processes: %d\n",p);
            for (source = 1; source < p; source++) {
                MPI_Recv(message, 100, MPI_CHAR, source, tag,
                        MPI_COMM_WORLD, &mpiStatus);
                printf("%s\n",message);
            }
```

```
gmon file: /home/sbrandt/demospace/Hello/gmon.out
program file: /home/sbrandt/demospace/Hello/Debug/Hello
4 bytes per bucket, each sample counts as 10.000ms
```

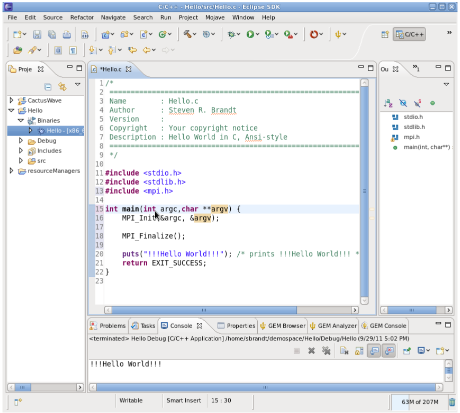
Name (location)	Samples	Calls	Time/Call	%Time
Summary	1			100.0%
Hello.c	1			100.0%
main	1			100.0%
main (Hello.c:28)	1			100.0%
0x400ad4	1			100.0%

Hello World in C+MPI

Hello World in C+MPI

Upgrading the program to use MPI

- Add `#include <mpi.h>`
- Click inside the program type “mpi” then hit Ctrl-space. You’ll see a code completion options. Choose “MPI Init and Finalize” you now have errors in your code. Use the editor to add argc and argv to main.

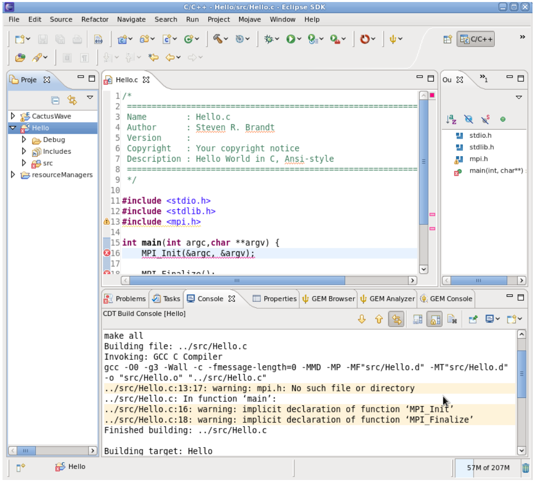


```
/*
 ============================================================
 Name        : Hello.c
 Author      : Steven R. Brandt
 Version     :
 Copyright   : Your copyright notice
 Description : Hello World in C, Ansi-style
 ============================================================
 */

#include <stdio.h>
#include <stdlib.h>
#include <mpi.h>

int main(int argc,char **argv) {
    MPI_Init(&argc, &argv);

    MPI_Finalize();

    puts("!!!Hello World!!!"); /* prints !!!Hello World!!! *
    return EXIT_SUCCESS;
}
```

```
<terminated> Hello Debug [C/C++ Application] /home/sbrandt/demospace/Hello/Debug/Hello (9/29/11 5:02 PM)
!!!Hello World!!!
```

Hello World in C+MPI

Building will now produce errors.


C/C++ - Hello/src/Hello.c - Eclipse SDK
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C/C++
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Includes
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resourceManagers
Hello.c
Ou
stdio.h
stdlib.h
mpi.h
main(int, char**)
Problems Tasks Console Properties GEM Browser GEM Analyzer GEM Console
CDT Build Console [Hello]
Hello
57M of 207M

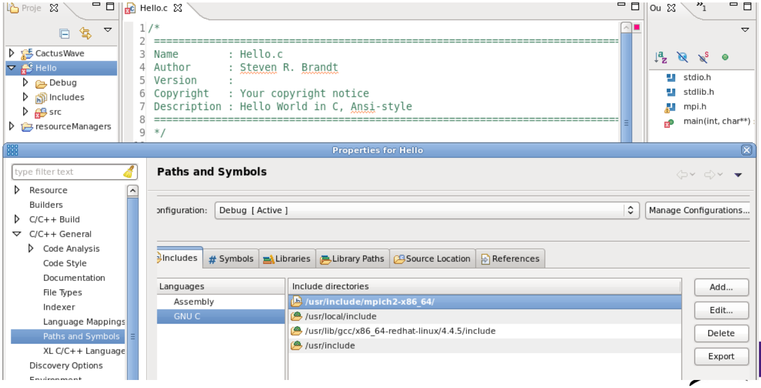
```
1  /*
2   ============================================================
3   Name        : Hello.c
4   Author      : Steven R. Brandt
5   Version     :
6   Copyright   : Your copyright notice
7   Description : Hello World in C, Ansi-style
8   ============================================================
9   */
10
11 #include <stdio.h>
12 #include <stdlib.h>
13 #include <mpi.h>
14
15 int main(int argc,char **argv) {
16     MPI_Init(&argc, &argv);
17
18     MPI_Finalize();
```

```
make all
Building file: ../src/Hello.c
Invoking: GCC C Compiler
gcc -O0 -g3 -Wall -c -fmessage-length=0 -MMD -MP -MF"src/Hello.d" -MT"src/Hello.d"
-o "src/Hello.o" "../src/Hello.c"
../src/Hello.c:13:17: warning: mpi.h: No such file or directory
../src/Hello.c: In function ‘main’:
../src/Hello.c:16: warning: implicit declaration of function ‘MPI_Init’
../src/Hello.c:18: warning: implicit declaration of function ‘MPI_Finalize’
Finished building: ../src/Hello.c

Building target: Hello
```

Hello World in C+MPI

To resolve these errors...

- Right click on the "Hello" project in the project explorer view.
- Select "Properties"
- Open "C/C++ General" and click on "Paths and Symbols"
- Select the C language and click "Add" to add the include.



Proje

- CactusWave
- Hello
  - Debug
  - Includes
  - src
- resourceManagers

Hello.c

```
/*
===========================================================================
Name        : Hello.c
Author      : Steven R. Brandt
Version     :
Copyright   : Your copyright notice
Description : Hello World in C, Ansi-style
===========================================================================
*/
```

Ou

- stdio.h
- stdlib.h
- mpi.h
- main(int, char**)

Properties for Hello

type filter text

- Resource
- Builders
- C/C++ Build
- C/C++ General
  - Code Analysis
  - Code Style
  - Documentation
  - File Types
  - Indexer
  - Language Mappings
  - Paths and Symbols
  - XL C/C++ Language
- Discovery Options
- Environment

Paths and Symbols

onfiguration: Debug [Active]   Manage Configurations...

Includes | # Symbols | Libraries | Library Paths | Source Location | References

Languages	Include directories
Assembly	/usr/include/mpich2-x86_64/
GNU C	/usr/local/include
	/usr/lib/gcc/x86_64-redhat-linux/4.4.5/include
	/usr/include

Add... Edit... Delete Export

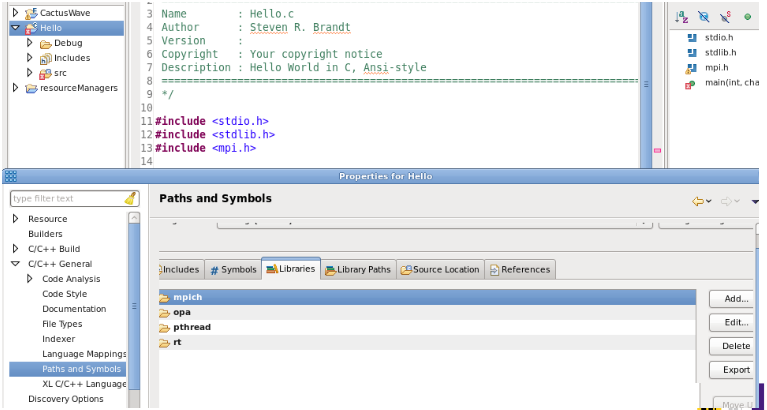
Hello World in C+MPI

How did I know the mpi include path?

- Run `sh -x mpicc test.c`
- Output will contain something like this: + gcc -m64 -O2 -fPIC -Wl,-z,noexecstack test.c -I/usr/include/mpich2-x86_64 -L/usr/lib64/mpich2/lib -L/usr/lib64/mpich2/lib -lmpich -lopa -lpthread -lrt
- Now you can see the include (/usr/include/mpich2-x86_64), the lib dir (/usr/lib64/mpich2/lib), libs, etc.

Hello World in C+MPI

- While you're still in "C/C++ General", click on the "Library Paths" tab and fix that. (In my case, add /usr/lib64/mpich2/lib)
- Next, go to the "Libraries" tab and fix that



```
Name        : Hello.c
Author      : Steven R. Brandt
Version     :
Copyright   : Your copyright notice
Description : Hello World in C, Ansi-style
============================================================================
*/

#include <stdio.h>
#include <stdlib.h>
#include <mpi.h>
```

Properties for Hello

Paths and Symbols

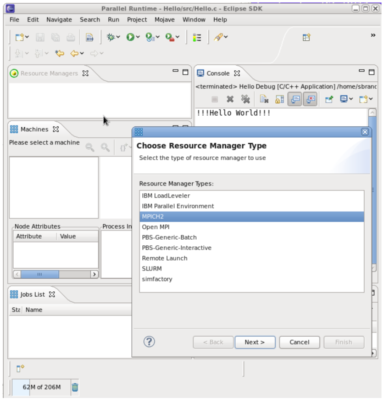
Includes | # Symbols | Libraries | Library Paths | Source Location | References

- mpich
- opa
- pthread
- rt

Hello World in C+MPI

- “Project > Build” should now work again.
- Now we need to set up a parallel run. Click “Window > Open Perspective > Other... > Parallel Runtime”
- Right click inside the “Resource Managers” tab.
- Click on “Add Resource Manager...”
- Choose either MPICH2 or OpenMP, whichever you have on your machine.
- Click Next > Finish.
- In a separate window, type mpdboot to start mpich2
- Right click on the Resource manager and select start.

Hello World in C+MPI



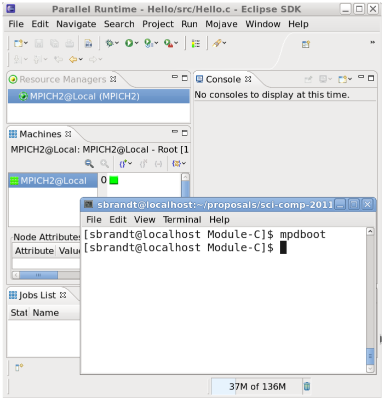
```
<terminated> Hello Debug [C/C++ Application] /home/sbranc
!!!Hello World!!!
```

Choose Resource Manager Type

Select the type of resource manager to use

Resource Manager Types:

- IBM LoadLeveler
- IBM Parallel Environment
- MPICH2
- Open MPI
- PBS-Generic-Batch
- PBS-Generic-Interactive
- Remote Launch
- SLURM
- simfactory


Parallel Runtime - Hello/src/Hello.c - Eclipse SDK
File Edit Navigate Search Project Run Mojave Window Help
Resource Managers
Console
Machines
Node Attributes
Attribute Valu
Jobs List
Stat Name
sbrandt@localhost:~/proposals/sci-comp-2011
File Edit View Terminal Help
37M of 136M

MPICH2@Local (MPICH2)

No consoles to display at this time.

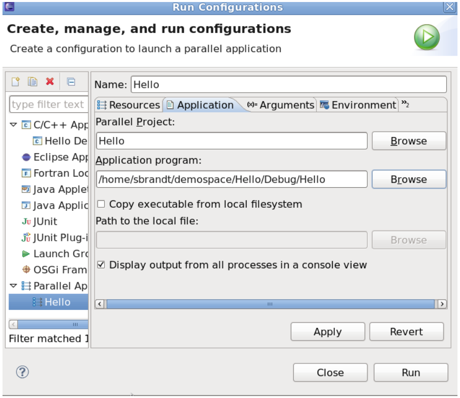
MPICH2@Local: MPICH2@Local - Root [1

MPICH2@Local 0 🟩

```
[sbrandt@localhost Module-C]$ mpdboot
[sbrandt@localhost Module-C]$ 
```

Hello World in C+MPI

- Click `Run > Run Configurations...`
- Right Click on `Parallel Applications` and select `New`
- Select the new application, configure the “Application program.”
- Click “Apply” and “Run”



Run Configurations

Create, manage, and run configurations

Create a configuration to launch a parallel application

type filter text

- C/C++ App
  - Hello De
- Eclipse App
- Fortran Loc
- Java Applet
- Java Applic
- JUnit
- JUnit Plug-i
- Launch Gro
- OSGi Fram
- Parallel Ap
  - Hello

Filter matched 1

Name: Hello

Resources | Application | Arguments | Environment | »2

Parallel Project: Hello [Browse]

Application program: /home/sbrandt/demospace/Hello/Debug/Hello [Browse]

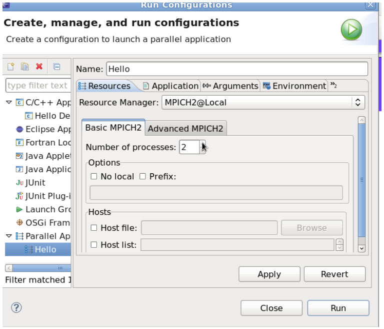
☐ Copy executable from local filesystem

Path to the local file: [Browse]

☑ Display output from all processes in a console view

Hello World in C+MPI

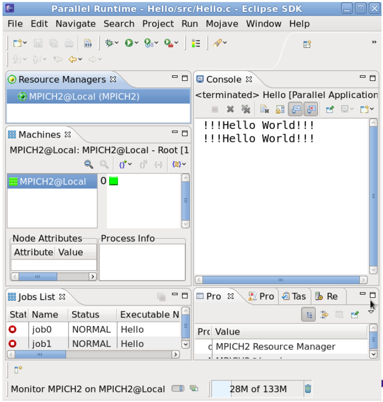
- Click `Run > Run Configurations...`
- Select your parallel application
- Select the "Resources" tab
- Adjust the "Number of processes" to 2
- Click "Apply" and "Run"



Name: Hello

Resource Manager: MPICH2@Local

Number of processes: 2


Parallel Runtime - Hello/src/Hello.c - Eclipse SDK
File Edit Navigate Search Project Run Mojave Window Help
Resource Managers
MPICH2@Local (MPICH2)
Machines
MPICH2@Local: MPICH2@Local - Root [1
MPICH2@Local
0
Node Attributes
Attribute Value
Process Info
Console
Jobs List
Pro
Tas
Re
Prc Value
MPICH2 Resource Manager
Monitor MPICH2 on MPICH2@Local
28M of 133M

```
<terminated> Hello [Parallel Application
!!!Hello World!!!
!!!Hello World!!!
```

Stat	Name	Status	Executable N
●	job0	NORMAL	Hello
●	job1	NORMAL	Hello

Adding Message Passing

Hello World in C+MPI

- Naviagate back to the C/C++ perspective (`Window > Open Perspective > C/C++`)
- Click in the code editor between `MPI_Init` and `MPI_Finalize`.
- Type "mpi" and hit Ctrl-space. Take the "mpisr" code completion. A complete skeleton for doing an MPI send and receive will appear. Fill in the missing variable declarations.

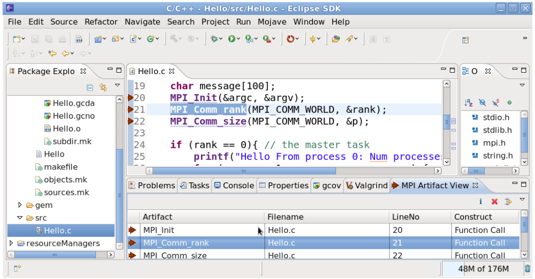
```
    int rank,p,source,dest,tag=66;
    MPI_Status status;
    char message[100];
```

- Alt-P followed by B will build the current project.
- Click on the down arrow and select your run config.

Parallel Analysis Tools

Using Parallel Analysis

- The most basic form of parallel analysis is available through the parallel analysis button
- Select a source file in the package explorer
- Click the down arrow, then choose “Show MPI Artifacts”

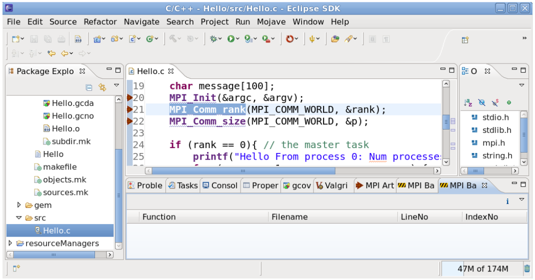


```
19      char message[100];
20      MPI_Init(&argc, &argv);
21      MPI_Comm_rank(MPI_COMM_WORLD, &rank);
22      MPI_Comm_size(MPI_COMM_WORLD, &p);
23
24      if (rank == 0){ // the master task
25          printf("Hello From process 0: Num processe
```

Artifact	Filename	LineNo	Construct
MPI_Init	Hello.c	20	Function Call
MPI_Comm_rank	Hello.c	21	Function Call
MPI_Comm_size	Hello.c	22	Function Call

Using Parallel Analysis

- Select a source file in the package explorer
- Click the down arrow, then choose "MPI Barrier Analysis"



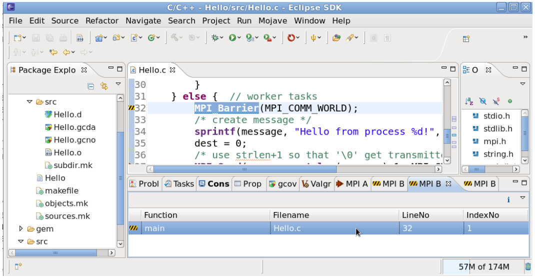
C/C++ - Hello/src/Hello.c - Eclipse SDK

```
    char message[100];
    MPI_Init(&argc, &argv);
    MPI_Comm_rank(MPI_COMM_WORLD, &rank);
    MPI_Comm_size(MPI_COMM_WORLD, &p);

    if (rank == 0){ // the master task
        printf("Hello From process 0: Num processe
```

File Edit Source Refactor Navigate Search Project Run Mojave Window Help
Package Explo
Hello.gcda
Hello.gcno
Hello.o
subdir.mk
Hello
makefile
objects.mk
sources.mk
gem
src
Hello.c
resourceManagers
Hello.c
stdio.h
stdlib.h
mpi.h
string.h
Proble Tasks Consol Proper gcov Valgri MPI Art MPI Ba MPI Ba
Function Filename LineNo IndexNo
47M of 174M

Using Parallel Analysis

- Now introduce a barrier error
- Select a source file in the package explorer
- Click the down arrow, then choose “MPI Barrier Analysis”



```
30         }
31     } else {  // worker tasks
32         MPI_Barrier(MPI_COMM_WORLD);
33         /* create message */
34         sprintf(message, "Hello from process %d!",
35         dest = 0;
36         /* use strlen+1 so that '\0' get transmitt
```

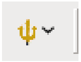
Function	Filename	LineNo	IndexNo
main	Hello.c	32	1

Using GEM

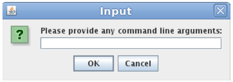
- To use the GEM tools, you must first install isp
- Isp is a tool from University of Utah to analyze C-language (not C++) programs and discover MPI errors.
- It contains a compiler (ispcc), a tool to run a program (isp), and a viewer. This tool may be used outside of Eclipse.
- Installation of isp follows the familiar pattern of configure / make / make install. Make sure the ispcc command is in your path when you start Eclipse.
- Download page: `http://www.cs.utah.edu/formal_verification/ISP-release/`

Using GEM

- To run GEM in Eclipse, click the trident.



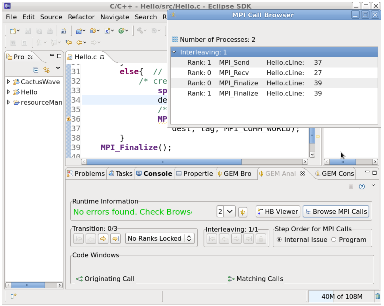
- You will be prompted for command line arguments. Click “OK”.



Input

Please provide any command line arguments:

- GEM will now analyze your code. Click the “GEM Analyzer” tab, then “Browse MPI Calls.”



C/C++ - Hello/src/Hello.c - Eclipse SDK

MPI Call Browser

Number of Processes: 2

Interleaving: 1

```
Rank: 1   MPI_Send      Hello.cLine:   37
Rank: 0   MPI_Recv      Hello.cLine:   27
Rank: 0   MPI_Finalize  Hello.cLine:   39
Rank: 1   MPI_Finalize  Hello.cLine:   39
```

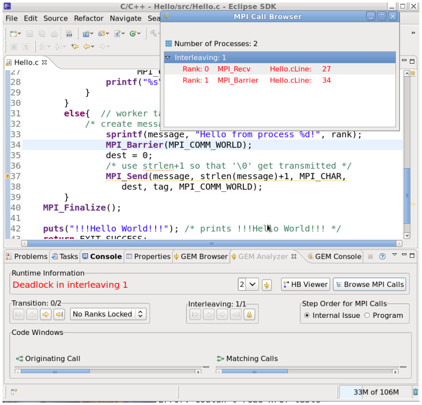
```
        else{   //
            /* cre
                sp
                de
                /*
                MP
                dest, tag, MPI_COMM_WORLD);
        }
    MPI_Finalize();
```

Runtime Information

No errors found. Check Brows

Using GEM

- Now let's introduce an error. A call to `MPI_Barrier()` just before the call to `MPI_Send()`
- Save the file. Build the project. Run GEM. Deadlock detected.


C/C++ - Hello/src/Hello.c - Eclipse SDK
File Edit Source Refactor Navigate
MPI Call Browser
Hello.c
Problems Tasks Console Properties GEM Browser GEM Analyzer GEM Console
HB Viewer
Browse MPI Calls
Code Windows
Originating Call
Matching Calls
33M of 106M

Number of Processes: 2

Interleaving: 1

```
Rank: 0   MPI_Recv      Hello.cLine:   27
Rank: 1   MPI_Barrier   Hello.cLine:   34
```

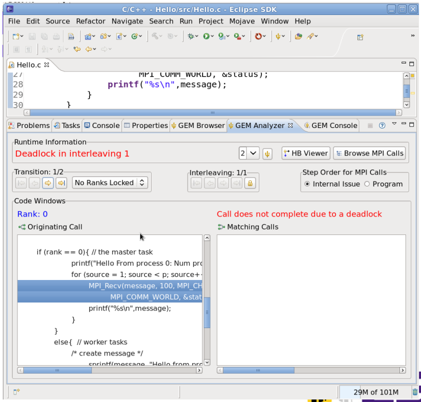
```
                printf("%s\
            }
        }
        else{  // worker ta
            /* create messa
                sprintf(message, "Hello from process %d!", rank);
                MPI_Barrier(MPI_COMM_WORLD);
                dest = 0;
                /* use strlen+1 so that '\0' get transmitted */
                MPI_Send(message, strlen(message)+1, MPI_CHAR,
                   dest, tag, MPI_COMM_WORLD);
        }
    MPI_Finalize();

    puts("!!!Hello World!!!"); /* prints !!!Hello World!!! */
```

Runtime Information: Deadlock in interleaving 1

Transition: 0/2 — No Ranks Locked

Interleaving: 1/1

Step Order for MPI Calls: [✓ Internal Issue] Program


C/C++ - Hello/src/Hello.c - Eclipse SDK
File Edit Source Refactor Navigate Search Run Project Mojave Window Help
Hello.c
Problems Tasks Console Properties GEM Browser GEM Analyzer GEM Console
HB Viewer
Browse MPI Calls
Code Windows
Originating Call
Matching Calls
29M of 101M

```
                MPI_COMM_WORLD, &status);
            printf("%s\n",message);
        }
    }
```

Runtime Information: Deadlock in interleaving 1

Transition: 1/2 — No Ranks Locked

Interleaving: 1/1

Step Order for MPI Calls: [✓ Internal Issue] Program

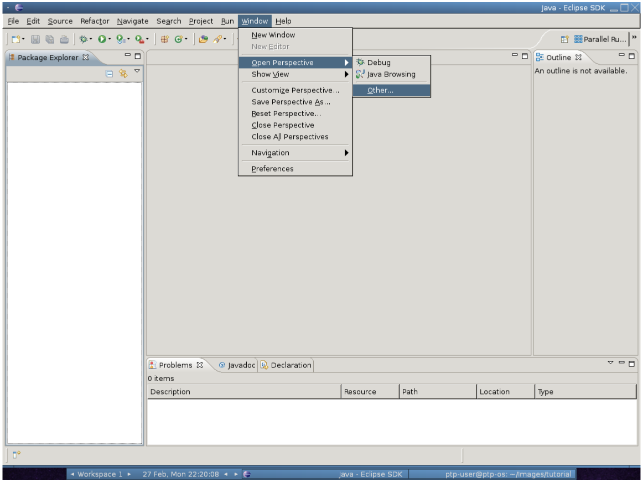
Rank: 0

Call does not complete due to a deadlock

```
    if (rank == 0){ // the master task
        printf("Hello From process 0: Num prc
        for (source = 1; source < p; source+
            MPI_Recv(message, 100, MPI_CH
                MPI_COMM_WORLD, &stat
            printf("%s\n",message);
        }
    }
    else{  // worker tasks
        /* create message */
```

Remote Project

To change perspective, go to *Window* → *Open Perspective* → *Other. . .*

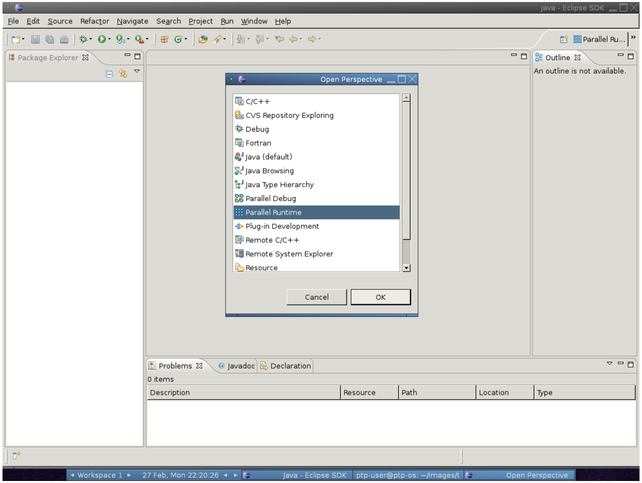


An outline is not available.

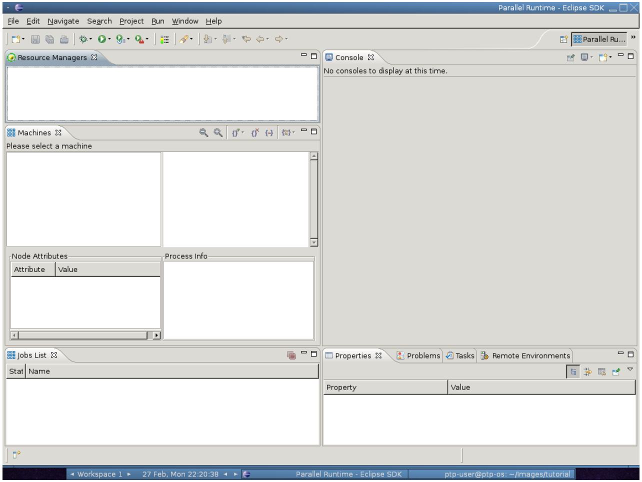
0 items

Description	Resource	Path	Location	Type

Select *Parallel Runtime*.



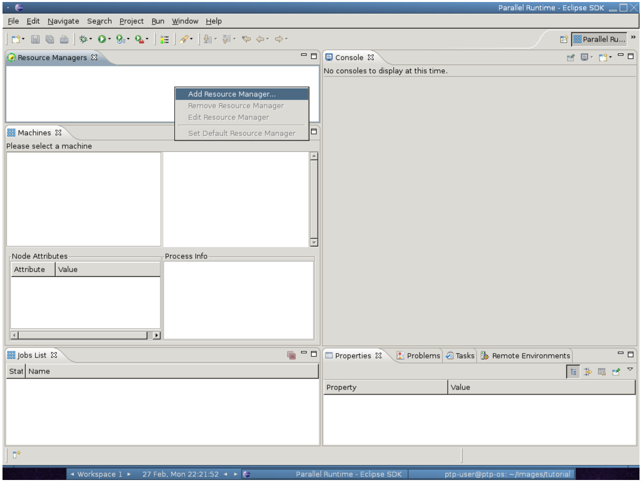
The perspective is now open.



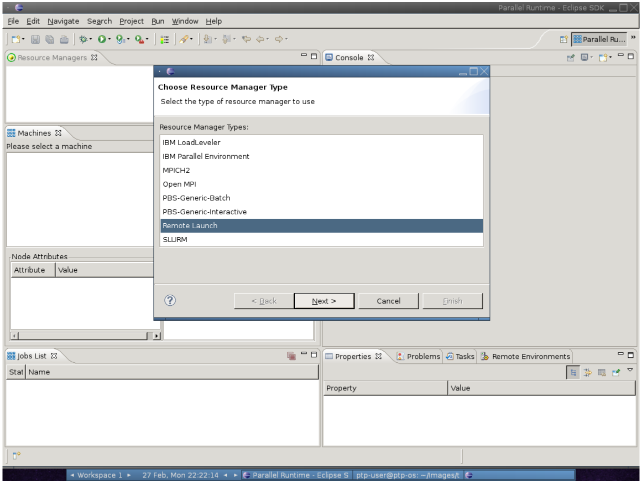
No consoles to display at this time.

Please select a machine

Right-click in the white space under the *Resource Managers* tab and select the *Add Resource Manager* menu item.



Add a *Remote Launch*.



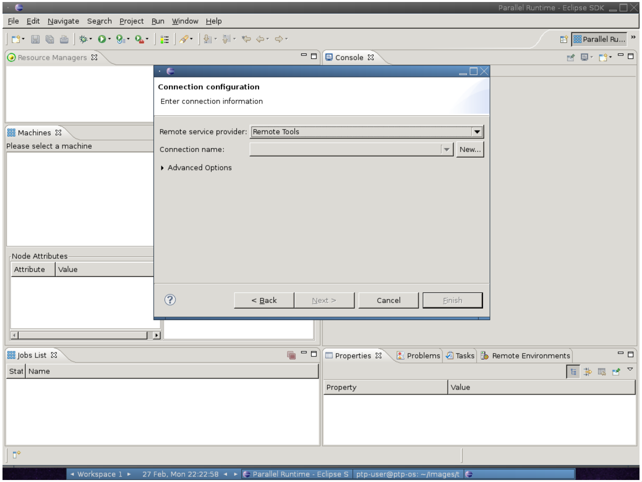
Choose Resource Manager Type

Select the type of resource manager to use

Resource Manager Types:

IBM LoadLeveler
IBM Parallel Environment
MPICH2
Open MPI
PBS-Generic-Batch
PBS-Generic-Interactive
Remote Launch
SLURM

Select *Remote Tools* for *Remote service provider* and click *New* to configure a new connection.



Connection configuration

Enter connection information

Remote service provider: Remote Tools

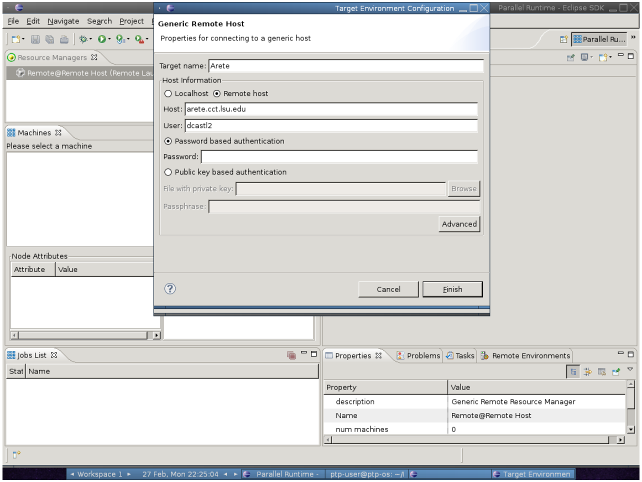
Connection name:

New...

Advanced Options

< Back   Next >   Cancel   Finish

For the connection configuration, enter the hostname and credentials. Click *Finish* until finished.



Target Environment Configuration

Generic Remote Host

Properties for connecting to a generic host

Target name: Arete

Host Information

○ Localhost [✓ ● Remote host]

Host: arete.cct.lsu.edu

User: dcastl2

[✓ ● Password based authentication]

Password:

○ Public key based authentication

File with private key: Browse

Passphrase:

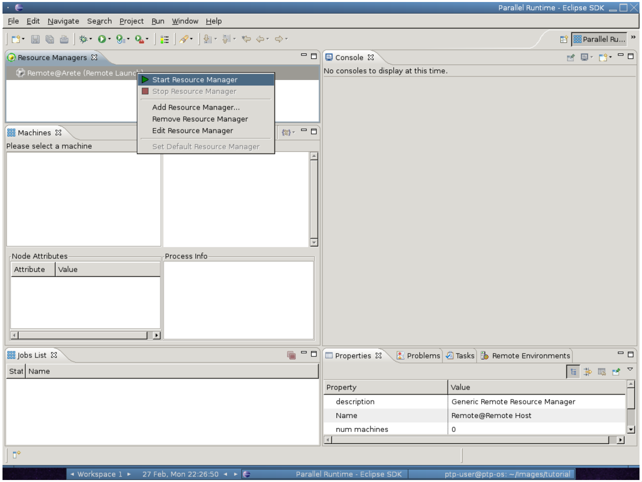
Advanced

Cancel Finish

File Edit Navigate Search Project
Resource Managers
Remote@Remote Host (Remote Lau
Machines
Please select a machine
Node Attributes
Attribute Value
Jobs List
Stat Name
Parallel Ru...
Parallel Runtime - Eclipse SDK
Properties Problems Tasks Remote Environments

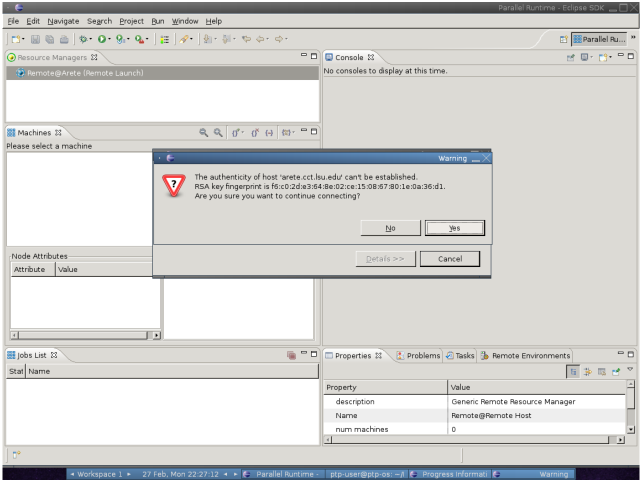
Property	Value
description	Generic Remote Resource Manager
Name	Remote@Remote Host
num machines	0

Back in the parallel runtime perspective, right-click the new RM and select *Start Resource Manager*.



Property	Value
description	Generic Remote Resource Manager
Name	Remote@Remote Host
num machines	0

You may be asked if you'd like to continue connecting; hit *Yes*.



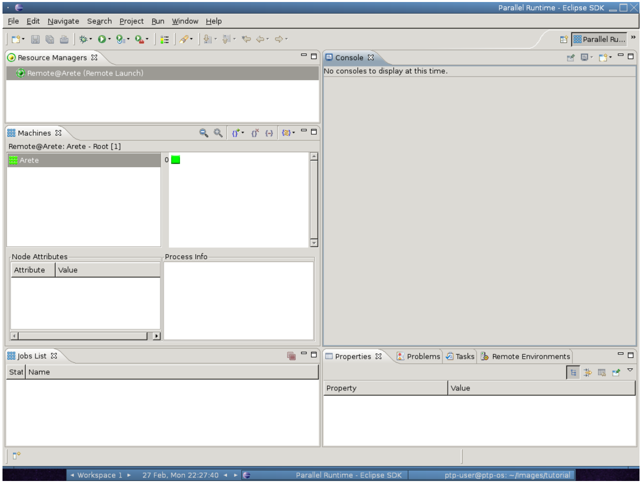
No consoles to display at this time.

Please select a machine

The authenticity of host 'arete.cct.lsu.edu' can't be established.
RSA key fingerprint is f6:c0:2d:e3:64:8e:02:ce:15:08:67:80:1e:0a:36:d1.
Are you sure you want to continue connecting?

Property	Value
description	Generic Remote Resource Manager
Name	Remote@Remote Host
num machines	0

The RM is now started.



Remote@Arete (Remote Launch)

No consoles to display at this time.

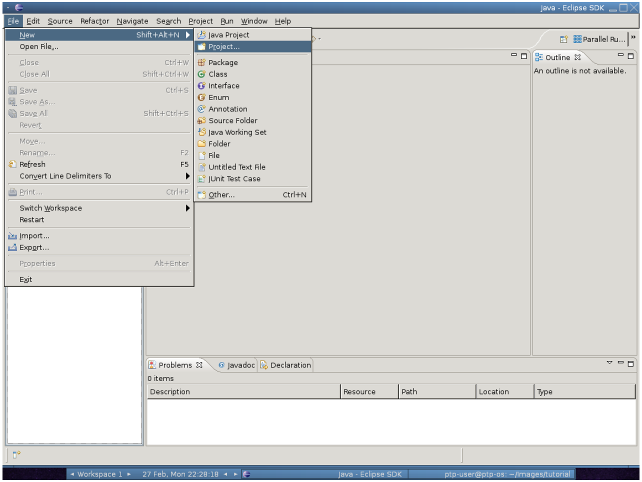
Remote@Arete: Arete - Root [1]

Arete

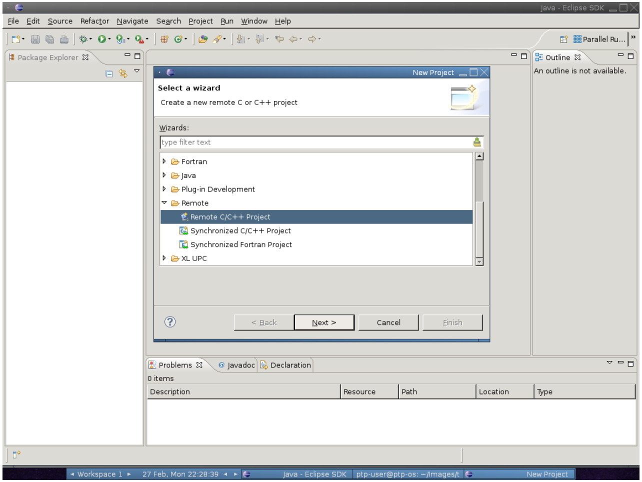
0 🟩

Remote Project

File → New → Project. . .



Select *Remote C/C++ Project*.



New Project

Select a wizard

Create a new remote C or C++ project

Wizards:

type filter text

- Fortran
- Java
- Plug-in Development
- Remote
  - Remote C/C++ Project
  - Synchronized C/C++ Project
  - Synchronized Fortran Project
- XL UPC

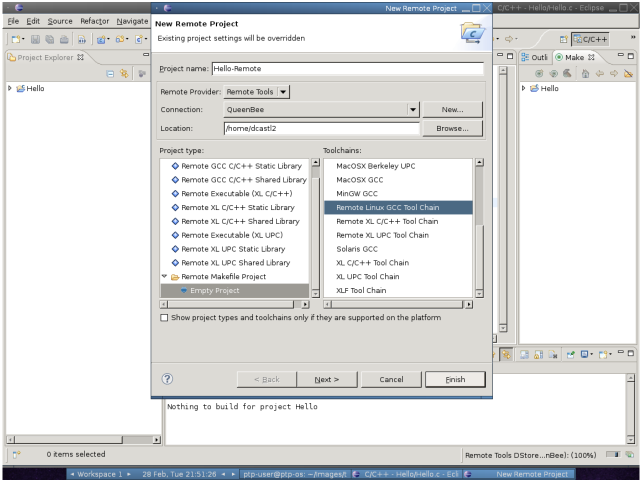
< Back | Next > | Cancel | Finish

An outline is not available.

0 items

Description	Resource	Path	Location	Type

Configure as shown below, then click *Finish*.


New Remote Project

Existing project settings will be overridden

Project name: Hello-Remote

Remote Provider: Remote Tools

Connection: QueenBee

Location: /home/dcastl2

Project type:
- Remote GCC C/C++ Static Library
- Remote GCC C/C++ Shared Library
- Remote Executable (XL C/C++)
- Remote XL C/C++ Static Library
- Remote XL C/C++ Shared Library
- Remote Executable (XL UPC)
- Remote XL UPC Static Library
- Remote XL UPC Shared Library
- Remote Makefile Project
  - Empty Project

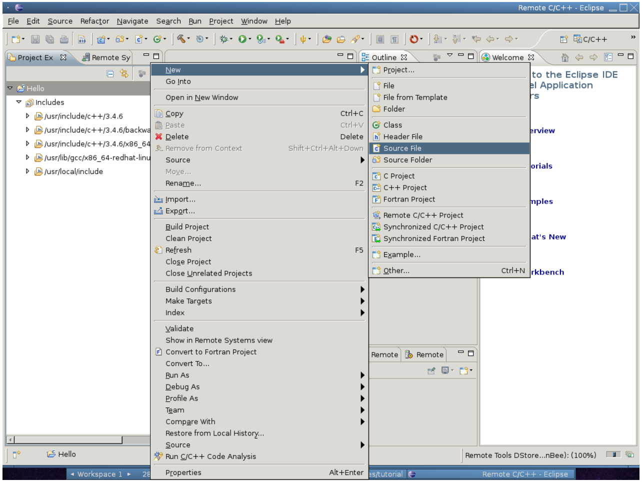
Toolchains:
- MacOSX Berkeley UPC
- MacOSX GCC
- MinGW GCC
- Remote Linux GCC Tool Chain
- Remote XL C/C++ Tool Chain
- Remote XL UPC Tool Chain
- Solaris GCC
- XL C/C++ Tool Chain
- XL UPC Tool Chain
- XLF Tool Chain

☐ Show project types and toolchains only if they are supported on the platform

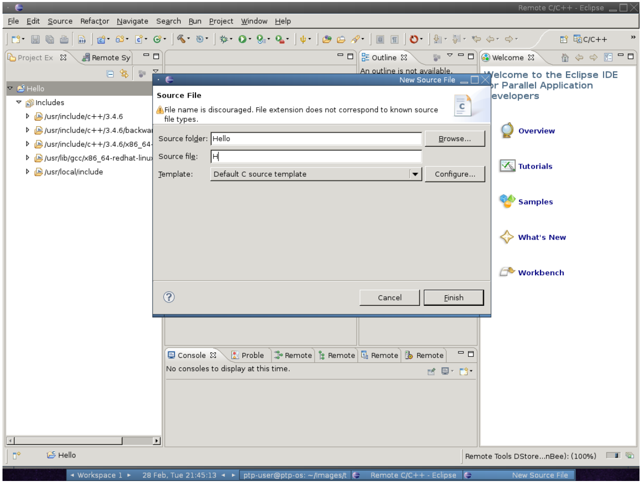
```
Nothing to build for project Hello
```

C/C++ - Hello/Hello.c - Eclipse
File Edit Source Refactor Navigate
Project Explorer
Hello
New...
Browse...
< Back
Next >
Cancel
Finish
C/C++
Outli
Make
0 items selected
Remote Tools DStore...nBee): (100%)
Workspace 1
28 Feb, Tue 21:51:26
ptp-user@ptp-os: ~/images/t
C/C++ - Hello/Hello.c - Ecli
New Remote Project

Create a new source file by right-clicking on the project name, then *New* → *Source File*.



Name the file.


Remote C/C++ - Eclipse
File Edit Source Refactor Navigate Search Run Project Window Help
C/C++
Project Ex
Remote Sy
Hello
Includes
/usr/include/c++/3.4.6
/usr/include/c++/3.4.6/backwa
/usr/include/c++/3.4.6/x86_64
/usr/lib/gcc/x86_64-redhat-linu
/usr/local/include
Outline
An outline is not available.
Welcome
Welcome to the Eclipse IDE for Parallel Application Developers
Overview
Tutorials
Samples
What's New
Workbench
Console
Proble
Remote
Remote
Remote
Remote
Hello
Remote Tools DStore...nBee): (100%)
Workspace 1
28 Feb, Tue 21:45:13
ptp-user@ptp-os: ~/images/t
Remote C/C++ - Eclipse
New Source File

New Source File

Source File

File name is discouraged. File extension does not correspond to known source file types.

Source folder: Hello Browse...

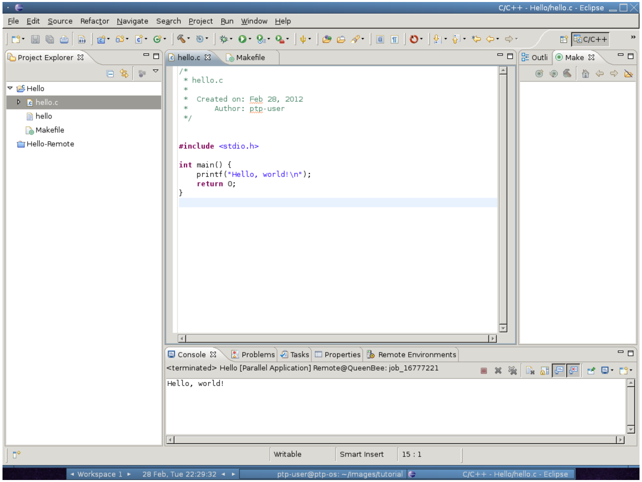
Source file: H

Template: Default C source template Configure...

Cancel Finish

No consoles to display at this time.

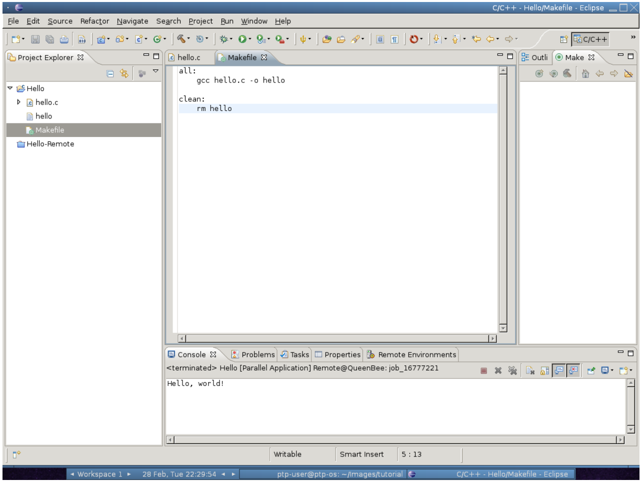
Type a simple Hello, World program into the editor.



```
/*
 * hello.c
 *
 *  Created on: Feb 28, 2012
 *      Author: ptp-user
 */

#include <stdio.h>

int main() {
    printf("Hello, world!\n");
    return 0;
}
```

```
<terminated> Hello [Parallel Application] Remote@QueenBee: job_16777221
Hello, world!
```

Create a new makefile by right-clicking on the project name, then *New* → *File*. Fill in the makefile as follows.



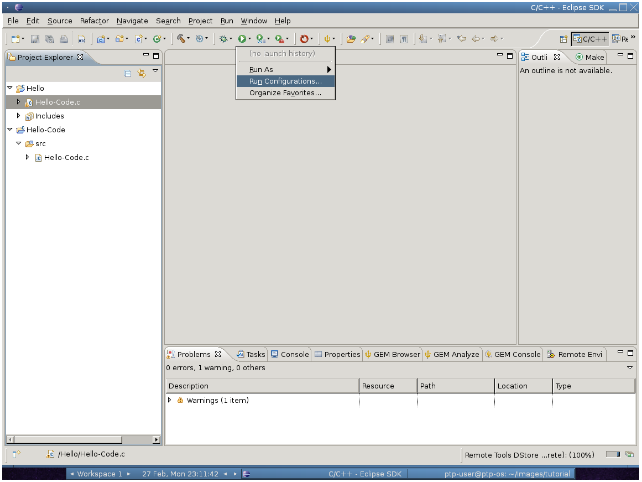
```
all:
    gcc hello.c -o hello

clean:
    rm hello
```

<terminated> Hello [Parallel Application] Remote@QueenBee: job_16777221

```
Hello, world!
```

Remote Project

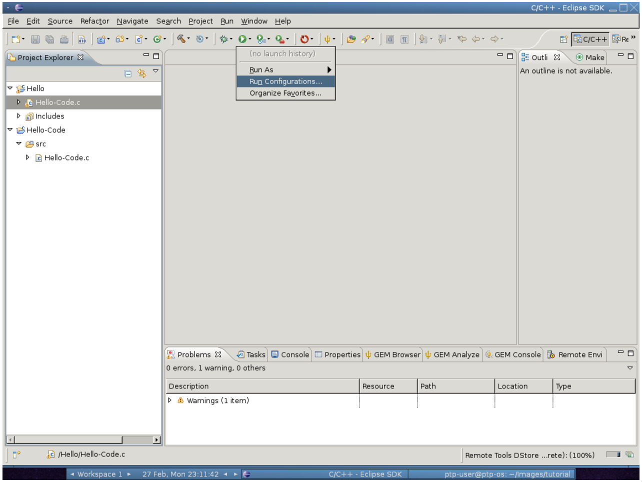
Before you attempt to run, you need to *Build* using the hammer symbol.



An outline is not available.

0 errors, 1 warning, 0 others

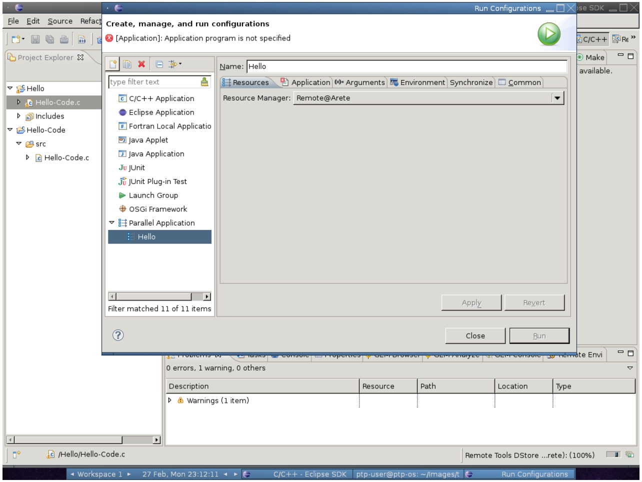
Click on the drop-down arrow next to the green arrow and click *Run Configurations. . .* .



An outline is not available.

0 errors, 1 warning, 0 others

Click the blank page with the plus sign to create a new configuration. Set the resource manager to the one you created earlier.



Create, manage, and run configurations

[Application]: Application program is not specified

Name: Hello

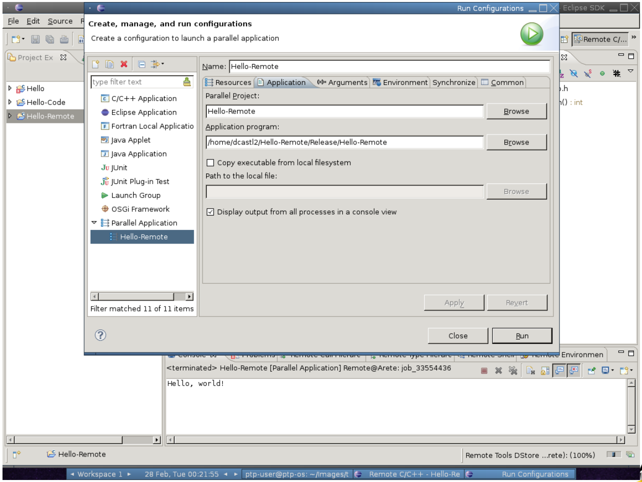
Resource Manager: Remote@Arete

Filter matched 11 of 11 items

0 errors, 1 warning, 0 others

Description	Resource	Path	Location	Type
Warnings (1 item)				

Select the *Application* tab to complete the configuration. For *Application program*, hit browse and select the location on the remote machine where the executable will reside.



Name: Hello-Remote

Parallel Project: Hello-Remote

Application program: /home/dcastl2/Hello-Remote/Release/Hello-Remote

☐ Copy executable from local filesystem

Path to the local file:

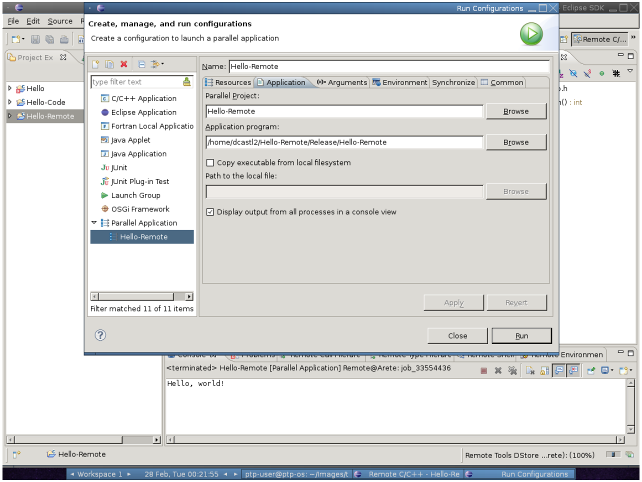
☑ Display output from all processes in a console view

<terminated> Hello-Remote [Parallel Application] Remote@Arete: job_33554436

```
Hello, world!
```

Remote Tools DStore ...rete): (100%)

Hit *Run*. The application will run remotely.



Create, manage, and run configurations

Create a configuration to launch a parallel application

Name: Hello-Remote

Parallel Project: Hello-Remote

Application program: /home/dcastl2/Hello-Remote/Release/Hello-Remote

☐ Copy executable from local filesystem

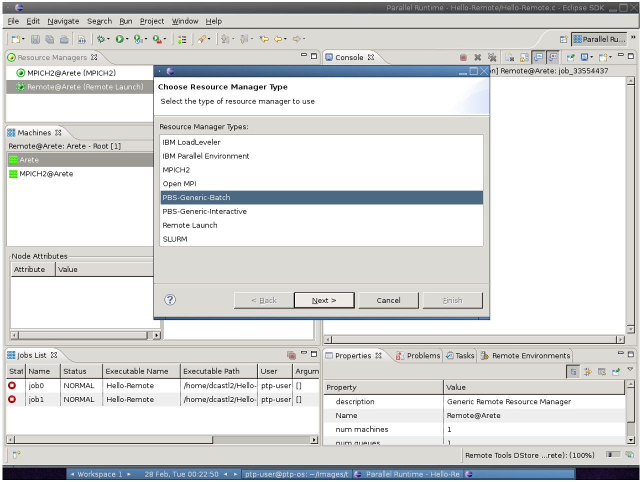
Path to the local file:

☑ Display output from all processes in a console view

Filter matched 11 of 11 items

```
<terminated> Hello-Remote [Parallel Application] Remote@Arete: job_33554436
Hello, world!
```

Follow the steps for creating a new resource manager, except select *PBS-Generic-Batch* this time.


Choose Resource Manager Type

Select the type of resource manager to use

Resource Manager Types:

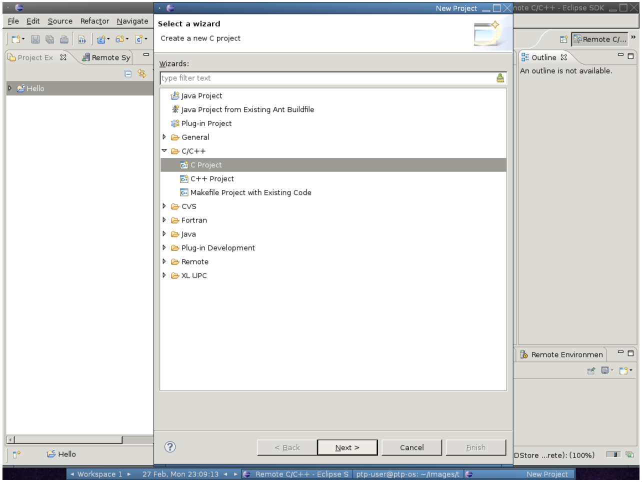
- IBM LoadLeveler
- IBM Parallel Environment
- MPICH2
- Open MPI
- PBS-Generic-Batch
- PBS-Generic-Interactive
- Remote Launch
- SLURM

Stat	Name	Status	Executable Name	Executable Path	User	Argum
●	job0	NORMAL	Hello-Remote	/home/dcastl2/Hello-	ptp-user	[]
●	job1	NORMAL	Hello-Remote	/home/dcastl2/Hello-	ptp-user	[]

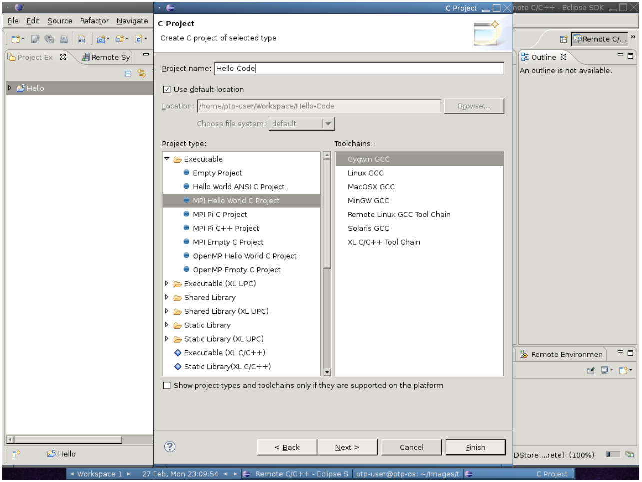
Property	Value
description	Generic Remote Resource Manager
Name	Remote@Arete
num machines	1
num queues	1

Parallel Runtime - Hello-Remote/Hello-Remote.c - Eclipse SDK
File Edit Navigate Search Run Project Window Help
Resource Managers
MPICH2@Arete (MPICH2)
Remote@Arete (Remote Launch)
Machines
Remote@Arete: Arete - Root [1]
Arete
MPICH2@Arete
Node Attributes
Attribute Value
Console
n] Remote@Arete: job_33554437
< Back
Next >
Cancel
Finish
Jobs List
Properties Problems Tasks Remote Environments
Remote Tools DStore ...rete): (100%)
Workspace 1
28 Feb, Tue 00:22:50
ptp-user@ptp-os: ~/images/t
Parallel Runtime - Hello-Re

To get a parallel Hello, World code to execute remotely, open another project. . .



Let's make an MPI Hello World project and copy the code and makefile.


C Project

Create C project of selected type

Project name: Hello-Code

[✓] Use default location

Location: /home/ptp-user/workspace/Hello-Code

Choose file system: default

Project type:

- Executable
  - Empty Project
  - Hello World ANSI C Project
  - MPI Hello World C Project
  - MPI Pi C Project
  - MPI Pi C++ Project
  - MPI Empty C Project
  - OpenMP Hello World C Project
  - OpenMP Empty C Project
- Executable (XL UPC)
- Shared Library
- Shared Library (XL UPC)
- Static Library
- Static Library (XL UPC)
- Executable (XL C/C++)
- Static Library(XL C/C++)

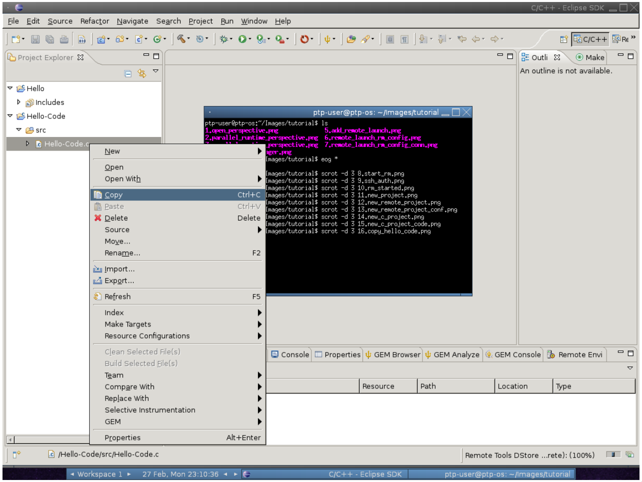
Toolchains:

- Cygwin GCC
- Linux GCC
- MacOSX GCC
- MinGW GCC
- Remote Linux GCC Tool Chain
- Solaris GCC
- XL C/C++ Tool Chain

[ ] Show project types and toolchains only if they are supported on the platform

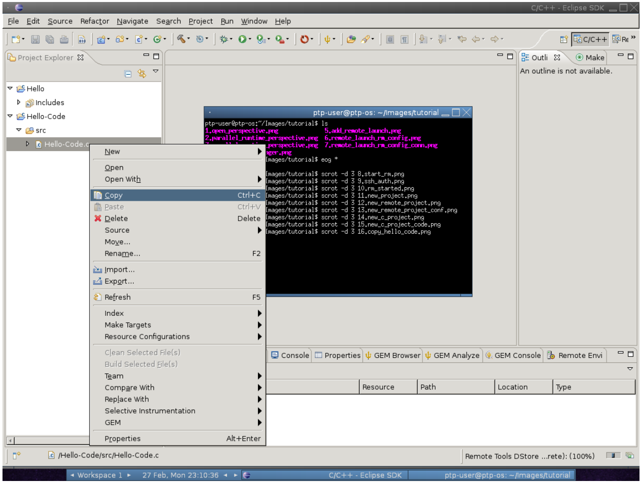
< Back | Next > | Cancel | Finish

Once the project is created, right-click on the source and select *Copy*, then paste it under the existing remote launch project.



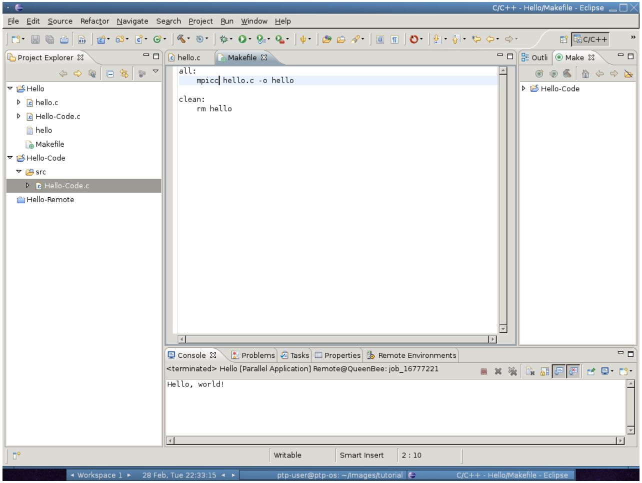
```
ptp-user@ptp-os:~/Images/tutorial$ ls
1.open_perspective.png                 5.add_remote_launch.png
2.parallel_runtime_perspective.png     6.remote_launch_rm_config.png
                  _perspective.png     7.remote_launch_rm_config_conn.png
                  ager.png
                  Images/tutorial$ eog *

                  Images/tutorial$ scrot -d 3 8.start_rm.png
                  Images/tutorial$ scrot -d 3 9.ssh_auth.png
                  Images/tutorial$ scrot -d 3 10.rm_started.png
                  Images/tutorial$ scrot -d 3 11.new_project.png
                  Images/tutorial$ scrot -d 3 12.new_remote_project.png
                  Images/tutorial$ scrot -d 3 13.new_remote_project_conf.png
                  Images/tutorial$ scrot -d 3 14.new_c_project.png
                  Images/tutorial$ scrot -d 3 15.new_c_project_code.png
                  Images/tutorial$ scrot -d 3 16.copy_hello_code.png
```

Do the same for the makefile.



```
ptp-user@ptp-os:~/Images/tutorial$ ls
1.open_perspective.png                5.add_remote_launch.png
2.parallel_runtime_perspective.png   6.remote_launch_rm_config.png
                    _perspective.png  7.remote_launch_rm_config_conn.png
                 ager.png
                 Images/tutorial$ eog *

                 Images/tutorial$ scrot -d 3 8.start_rm.png
                 Images/tutorial$ scrot -d 3 9.ssh_auth.png
                 Images/tutorial$ scrot -d 3 10.rm_started.png
                 Images/tutorial$ scrot -d 3 11.new_project.png
                 Images/tutorial$ scrot -d 3 12.new_remote_project.png
                 Images/tutorial$ scrot -d 3 13.new_remote_project_conf.png
                 Images/tutorial$ scrot -d 3 14.new_c_project.png
                 Images/tutorial$ scrot -d 3 15.new_c_project_code.png
                 Images/tutorial$ scrot -d 3 16.copy_hello_code.png
```

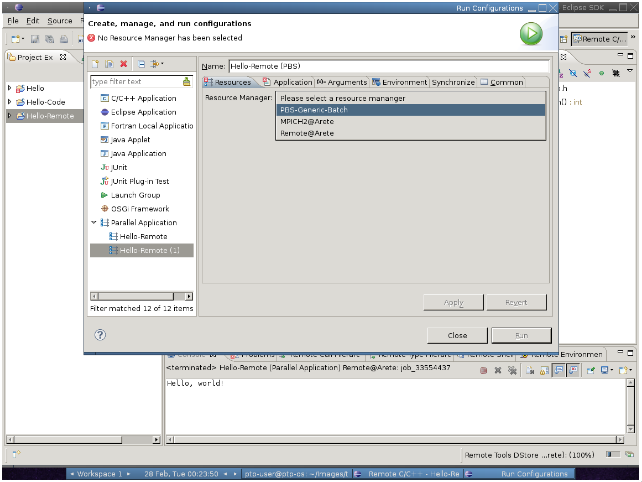
Edit the makefile.



```
all:
    mpicc hello.c -o hello

clean:
    rm hello
```

```
<terminated> Hello [Parallel Application] Remote@QueenBee: job_16777221
Hello, world!
```

Create a corresponding run configuration for the project, except specify this as the new resource manager.


Create, manage, and run configurations

No Resource Manager has been selected

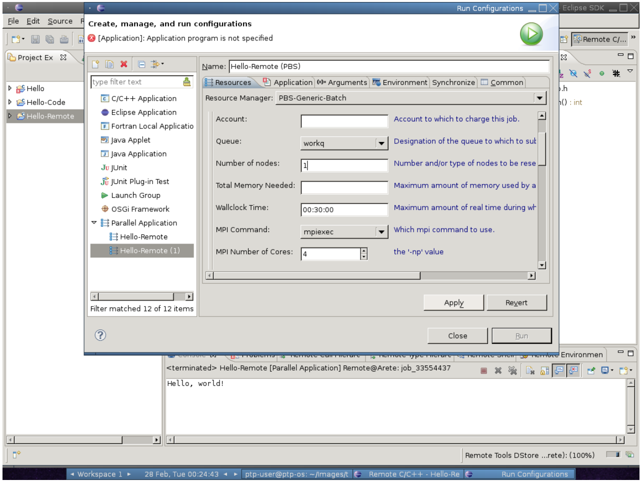
Name: Hello-Remote (PBS)

Resource Manager: Please select a resource mananger
PBS-Generic-Batch
MPICH2@Arete
Remote@Arete

Filter matched 12 of 12 items

```
<terminated> Hello-Remote [Parallel Application] Remote@Arete: job_33554437
Hello, world!
```

Under the *Application* tab, fill in the fields.



Create, manage, and run configurations

[Application]: Application program is not specified

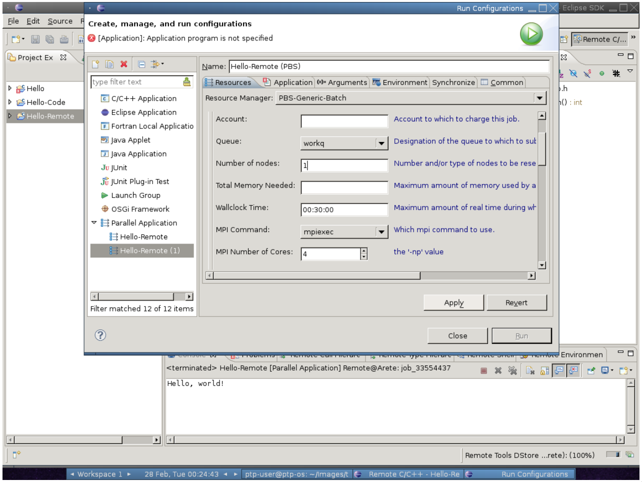
Name: Hello-Remote (PBS)

Resource Manager: PBS-Generic-Batch

Account:		Account to which to charge this job.
Queue:	workq	Designation of the queue to which to sub
Number of nodes:	1	Number and/or type of nodes to be rese
Total Memory Needed:		Maximum amount of memory used by a
Wallclock Time:	00:30:00	Maximum amount of real time during wh
MPI Command:	mpiexec	Which mpi command to use.
MPI Number of Cores:	4	the '-np' value

```
<terminated> Hello-Remote [Parallel Application] Remote@Arete: job_33554437
Hello, world!
```

Hit *Run*. Then, switch to the *System Monitoring* perspective, right-click on the now-inactive job, and click *Show output*. The output will be shown.



Create, manage, and run configurations

[Application]: Application program is not specified

Filter matched 12 of 12 items

Name: Hello-Remote (PBS)

Resource Manager: PBS-Generic-Batch

Account: | Account to which to charge this job.

Queue: workq | Designation of the queue to which to sub

Number of nodes: 1 | Number and/or type of nodes to be rese

Total Memory Needed: | Maximum amount of memory used by a

Wallclock Time: 00:30:00 | Maximum amount of real time during wh

MPI Command: mpiexec | Which mpi command to use.

MPI Number of Cores: 4 | the '-np' value

```
<terminated> Hello-Remote [Parallel Application] Remote@Arete: job_33554437
Hello, world!
```

Synchronized Project

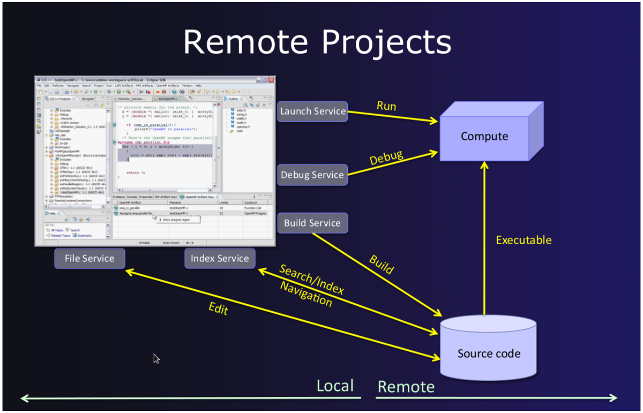
Synchronized Project

Project Types

- **Local Project** : Source is located on local machine and build happens locally
- **Remote**: Source is located on remote machine and build happens remotely
- **Synchronized=Local+Remote**

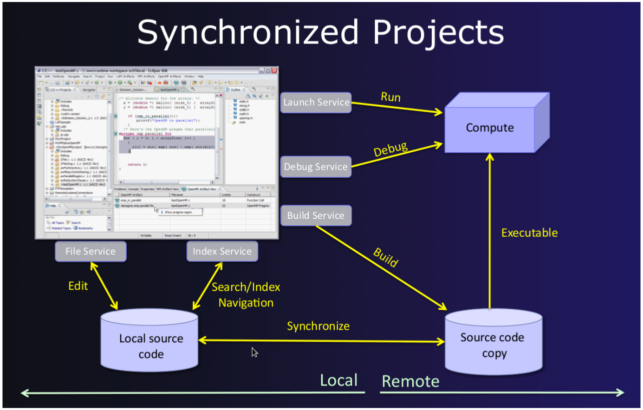
Remote Project

Remote Project Process Layout



Synchronized Project

Synchronized Project Layout

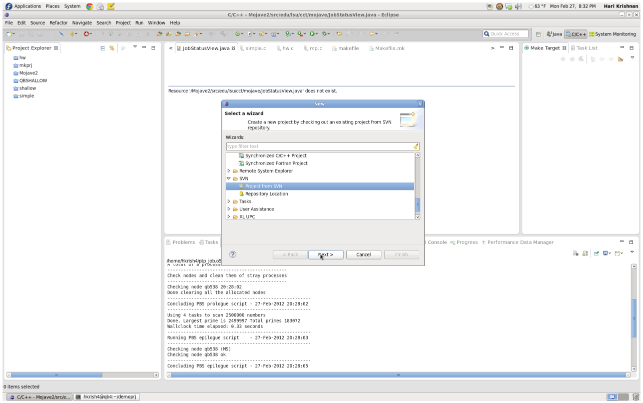


Demo

- Checkout a project from SVN.
- Building a default Makefile project.
- Building a custom Makefile Project by changing the command to build application.
- Launching the application locally.
- Converting the project into synchronized project.
- Building and launching the project remotely using the cluster resource manager.

SVN Source to checkout

Select File → New → Others



Resource '/Mojave2/src/edu/lsu/cct/mojave/JobStatusView.java' does not exist.

New

Select a wizard

Create a new project by checking out an existing project from SVN repository.

Wizards:

type filter text

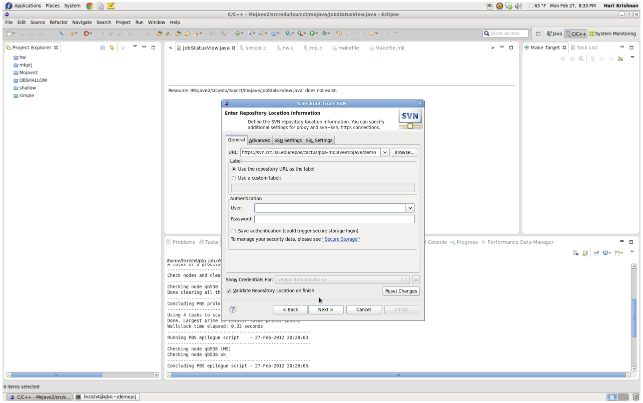
- Synchronized C/C++ Project
- Synchronized Fortran Project
- Remote System Explorer
- SVN
  - Project from SVN
  - Repository Location
- Tasks
- User Assistance
- XL UPC

< Back | Next > | Cancel | Finish

```
/home/hkrish4/ptp_job.o5
-------------------------------------------
Check nodes and clean them of stray processes
-------------------------------------------
Checking node qb538 20:28:02
Done clearing all the allocated nodes
----------------------------------------------------------
Concluding PBS prologue script - 27-Feb-2012 20:28:02
----------------------------------------------------------
Using 4 tasks to scan 2500000 numbers
Done. Largest prime is 2499997 Total primes 183072
Wallclock time elapsed: 0.33 seconds
----------------------------------------------------------
Running PBS epilogue script    - 27-Feb-2012 20:28:03
----------------------------------------------------------
Checking node qb538 (MS)
Checking node qb538 ok
----------------------------------------------------------
Concluding PBS epilogue script - 27-Feb-2012 20:28:05
```

Checkout a project from SVN.

https://svn.cct.lsu.edu/repos/cactus/ppa-mojave/mojave/demo



Resource '/Mojave2/src/edu/lsu/cct/mojave/JobStatusView.java' does not exist.

Checkout from SVN

Enter Repository Location Information

Define the SVN repository location information. You can specify additional settings for proxy and svn+ssh, https connections.

General | Advanced | SSH Settings | SSL Settings

URL: https://svn.cct.lsu.edu/repos/cactus/ppa-mojave/mojave/demo [Browse...]

Label
- [✓] Use the repository URL as the label
- Use a custom label:

Authentication
- User:
- Password:
- ☐ Save authentication (could trigger secure storage login)

To manage your security data, please see "Secure Storage"

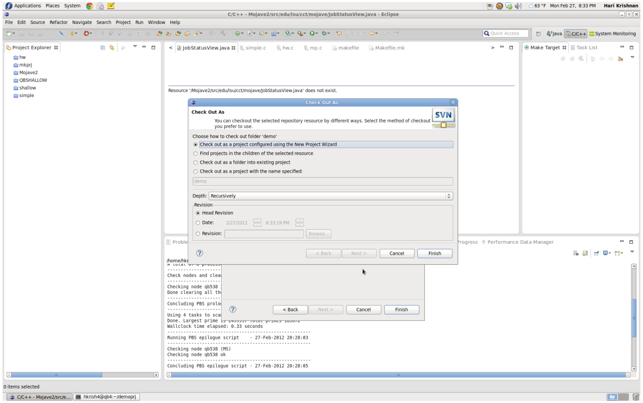
Show Credentials For: <Repository Location>

☑ Validate Repository Location on finish [Reset Changes]

< Back | Next > | Cancel | Finish

```
/home/hkrish4/ptp_job.o5
-------------------
Check nodes and clea
-------------------
Checking node qb538
Done clearing all th
-------------------
Concluding PBS prolo
-------------------
Using 4 tasks to sca
Done. Largest prime
Wallclock time elapsed: 0.33 seconds
------------------------------------------------
Running PBS epilogue script    - 27-Feb-2012 20:28:03
------------------------------------------------
Checking node qb538 (MS)
Checking node qb538 ok
------------------------------------------------
Concluding PBS epilogue script - 27-Feb-2012 20:28:05
```

Checkout files in repo as C project.



Applications Places System
63 °F Mon Feb 27, 8:33 PM Hari Krishnan
File Edit Source Refactor Navigate Search Project Run Window Help
Quick Access
Java C/C++ System Monitoring
Project Explorer
hw
mkprj
Mojave2
QBSHALLOW
shallow
simple
JobStatusView.java simple.c hw.c mp.c makefile Makefile.mk
Make Target Task List
Proble
Progress Performance Data Manager
0 items selected
C/C++ - Mojave2/src/e...
hkrish4@qb4:~/demoprj
< Back Next > Cancel Finish

C/C++ - Mojave2/src/edu/lsu/cct/mojave/JobStatusView.java - Eclipse

Resource '/Mojave2/src/edu/lsu/cct/mojave/JobStatusView.java' does not exist.

Check Out As

You can checkout the selected repository resource by different ways. Select the method of checkout you prefer to use.

Choose how to check out folder 'demo'

- [✓ Check out as a project configured using the New Project Wizard]
- Find projects in the children of the selected resource
- Check out as a folder into existing project
- Check out as a project with the name specified: demo

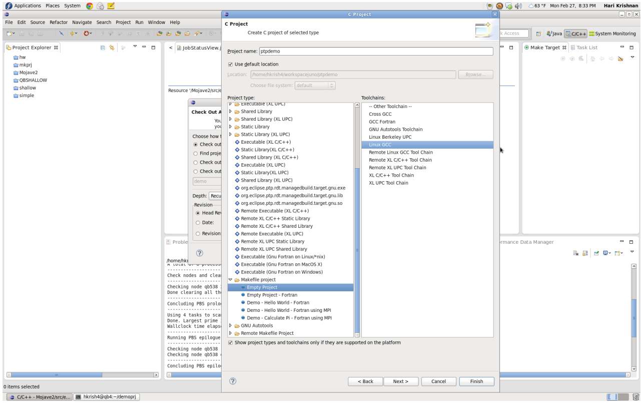
Depth: Recursively

Revision
- [✓ Head Revision]
- Date: 2/27/2012 8:33:19 PM
- Revision: Browse...

< Back Next > Cancel Finish

```
/home/hkr
A total of 8 process
--------------------
Check nodes and clea
--------------------
Checking node qb538
Done clearing all th
--------------------
Concluding PBS prolo
--------------------
Using 4 tasks to sca
Done. Largest prime
Wallclock time elapsed: 0.33 seconds
------------------------------------------------------------
Running PBS epilogue script    - 27-Feb-2012 20:28:03
------------------------------------------------------------
Checking node qb538 (MS)
Checking node qb538 ok
------------------------------------------------------------
Concluding PBS epilogue script - 27-Feb-2012 20:28:05
```

Select empty Makefile project in Wizard.



C Project

Create C project of selected type

Project name: ptpdemo

☑ Use default location

Location: /home/hkrish4/workspacejuno/ptpdemo

Choose file system: default

Project type:

- Executable (XL UPC)
- Shared Library
- Shared Library (XL UPC)
- Static Library
- Static Library (XL UPC)
- Executable (XL C/C++)
- Static Library(XL C/C++)
- Shared Library (XL C/C++)
- Executable (XL UPC)
- Static Library(XL UPC)
- Shared Library (XL UPC)
- org.eclipse.ptp.rdt.managedbuild.target.gnu.exe
- org.eclipse.ptp.rdt.managedbuild.target.gnu.lib
- org.eclipse.ptp.rdt.managedbuild.target.gnu.so
- Remote Executable (XL C/C++)
- Remote XL C/C++ Static Library
- Remote XL C/C++ Shared Library
- Remote Executable (XL UPC)
- Remote XL UPC Static Library
- Remote XL UPC Shared Library
- Executable (Gnu Fortran on Linux/*nix)
- Executable (Gnu Fortran on MacOS X)
- Executable (Gnu Fortran on Windows)
- Makefile project
  - Empty Project
  - Empty Project - Fortran
  - Demo - Hello World - Fortran
  - Demo - Hello World - Fortran using MPI
  - Demo - Calculate Pi - Fortran using MPI
- GNU Autotools
- Remote Makefile Project

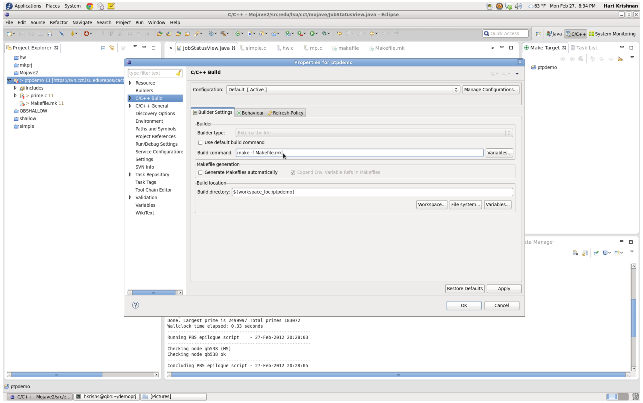
Toolchains:

- -- Other Toolchain --
- Cross GCC
- GCC Fortran
- GNU Autotools Toolchain
- Linux Berkeley UPC
- Linux GCC
- Remote Linux GCC Tool Chain
- Remote XL C/C++ Tool Chain
- Remote XL UPC Tool Chain
- XL C/C++ Tool Chain
- XL UPC Tool Chain

☑ Show project types and toolchains only if they are supported on the platform

Building project with custom command.

Right click on the project and select properties


Properties for ptpdemo

C/C++ Build

Configuration: Default [Active]

Builder Settings

Builder type: External builder

Use default build command: ☐

Build command: make -f Makefile.mk

Generate Makefiles automatically: ☐

Expand Env. Variable Refs in Makefiles: ✓

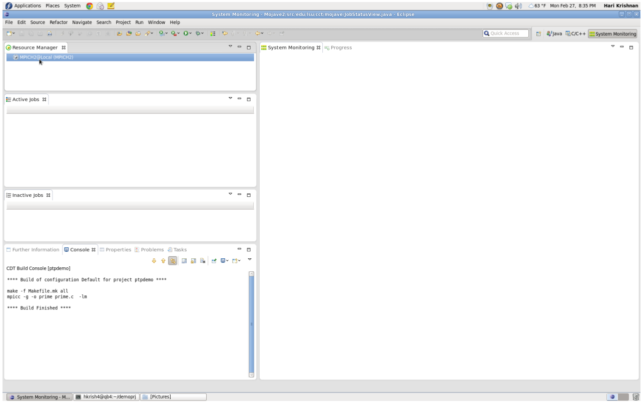
Build directory: ${workspace_loc:/ptpdemo}

```
Done. Largest prime is 2499997 Total primes 183072
Wallclock time elapsed: 0.33 seconds
------------------------------------------------------------
Running PBS epilogue script    - 27-Feb-2012 20:28:03
------------------------------------------------------------
Checking node qb538 (MS)
Checking node qb538 ok
------------------------------------------------------------
Concluding PBS epilogue script - 27-Feb-2012 20:28:05
```

Lauch MPI-Based application on local machine.

- Windows $\rightarrow$ Open Perspective $\rightarrow$ Others $\rightarrow$ System Monitoring.
- In resource manager, right click $\rightarrow$ add resource manager $\rightarrow$ MPICH2.
- Select Local for remote service provider and connection name.
- Start resource manager by right click and click start.

System Monitoring view.



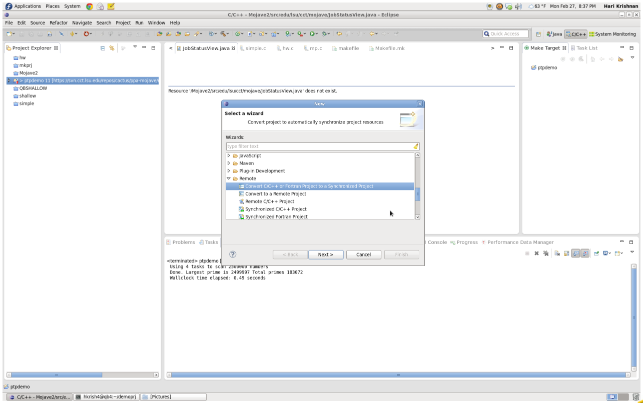
```
CDT Build Console [ptpdemo]

**** Build of configuration Default for project ptpdemo ****

make -f Makefile.mk all
mpicc -g -o prime prime.c  -lm

**** Build Finished ****
```

Steps to launch application.

- Click Run in main menu → Run configuration → Parallel application (right click) → new → name it and choose MPICH2 as resource manager (choose number of process in muliple of 4).
- In application tab, select the project and choose executable.
- Hit run.
- Console shows the output for locally running MPI program.

Converting Local/Team project into Synchronized project

File → New → Others → Remote → convert C/C++ or Fortran project to a Synchronized project


Resource '/Mojave2/src/edu/lsu/cct/mojave/JobStatusView.java' does not exist.

Select a wizard

Convert project to automatically synchronize project resources

Wizards:

- JavaScript
- Maven
- Plug-in Development
- Remote
  - Convert C/C++ or Fortran Project to a Synchronized Project
  - Convert to a Remote Project
  - Remote C/C++ Project
  - Synchronized C/C++ Project
  - Synchronized Fortran Project

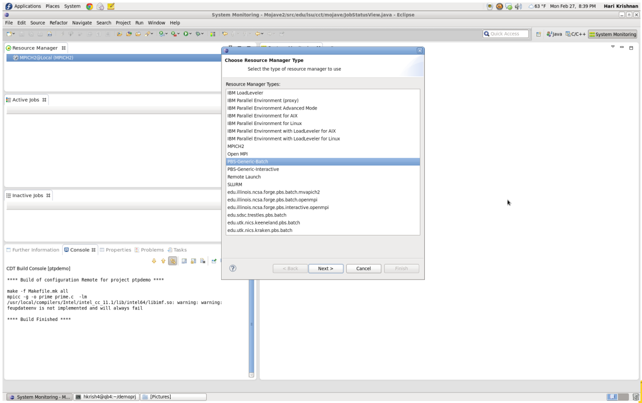
```
<terminated> ptpdemo [
 Using 4 tasks to scan 2500000 numbers
 Done. Largest prime is 2499997 Total primes 183072
 Wallclock time elapsed: 0.49 seconds
```

Converting Local/Team project into Synchronized project

- Click remote tools for remote service provider.
- Icon changes from repo (yellow cylinder) to synchronized (double headed arrow).
- All synchronized projects saves all files before buid and once user saves it locally.
- To sync manually right click on project → synchronization → sync all now.
- To build remotely, right click on project → Build Configuration → Set Active → Remote. Then hit the hammer to build the application on remote machine.

Launch job using PBS on remote machine

In System monitoring perspective, right click on resource manager view → add resource manager → PBS-Generic-Batch and proceed with remote tools on Queenbee machine and start the RM.


Applications Places System
63 °F Mon Feb 27, 8:39 PM Hari Krishnan
System Monitoring - Mojave2/src/edu/lsu/cct/mojave/JobStatusView.java - Eclipse
File Edit Source Refactor Navigate Search Project Run Window Help
Quick Access
Java C/C++ System Monitoring
Resource Manager
MPICH2@Local (MPICH2)
Active Jobs
Inactive Jobs
Further Information Console Properties Problems Tasks
< Back
Next >
Cancel
Finish
System Monitoring - M...
hkrish4@qb4:~/demoprj
[Pictures]

Choose Resource Manager Type

Select the type of resource manager to use

Resource Manager Types:

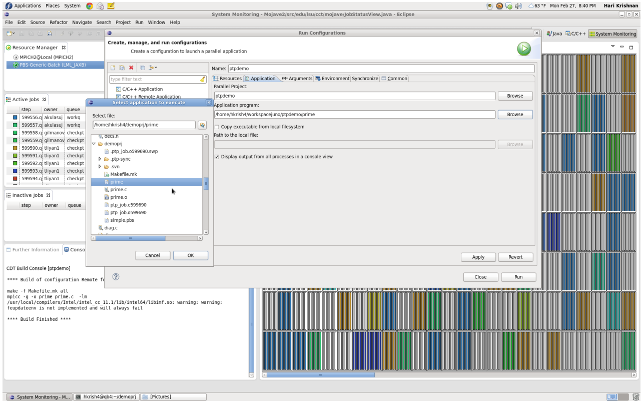
IBM LoadLeveler
IBM Parallel Environment (proxy)
IBM Parallel Environment Advanced Mode
IBM Parallel Environment for AIX
IBM Parallel Environment for Linux
IBM Parallel Environment with LoadLeveler for AIX
IBM Parallel Environment with LoadLeveler for Linux
MPICH2
Open MPI
[✓ PBS-Generic-Batch]
PBS-Generic-Interactive
Remote Launch
SLURM
edu.illinois.ncsa.forge.pbs.batch.mvapich2
edu.illinois.ncsa.forge.pbs.batch.openmpi
edu.illinois.ncsa.forge.pbs.interactive.openmpi
edu.sdsc.trestles.pbs.batch
edu.utk.nics.keeneland.pbs.batch
edu.utk.nics.kraken.pbs.batch

```
CDT Build Console [ptpdemo]

**** Build of configuration Remote for project ptpdemo ****

make -f Makefile.mk all
mpicc -g -o prime prime.c  -lm
/usr/local/compilers/Intel/intel_cc_11.1/lib/intel64/libimf.so: warning: warning:
feupdateenv is not implemented and will always fail

**** Build Finished ****
```

Create a run configuration

- Run → run configurations. Create new configuration for the project under parallel application.
- Select PBS-Generic-Batch for resource manager combo-box.
- Fill account with your allocation name and the queue.
- In number of nodes type number:ppn=8
- In application tab pick the executable from the Queenbee location and hit run.

Executable from QueenBee.


Applications Places System
System Monitoring - Mojave2/src/edu/lsu/cct/mojave/JobStatusView.java - Eclipse
File Edit Source Refactor Navigate Search Project Run Window Help
63 °F Mon Feb 27, 8:40 PM Hari Krishnan
Run Configurations
Java C/C++ System Monitoring
Resource Manager
MPICH2@Local (MPICH2)
PBS-Generic-Batch (LML_JAXB)
Inactive Jobs
step owner queue
Further Information Conso
type filter text
C/C++ Application
C/C++ Remote Application
Resources Application Arguments Environment Synchronize Common
Apply Revert Close Run
Cancel OK
System Monitoring - M... hkrish4@qb4:~/demoprj [Pictures]

Active Jobs

	step	owner	queue
🟦	599556.q	akulasuj	workq
🟩	599557.q	akulasuj	workq
🟩	599558.q	gilmanov	checkpt
🟩	599559.q	gilmanov	checkpt
🟨	599590.q	tliyan1	checkpt
🟩	599591.q	tliyan1	checkpt
🟩	599592.q	tliyan1	checkpt
🟦	599593.q	tliyan1	checkpt
🟥	599594.q	tliyan1	checkpt

Create, manage, and run configurations

Create a configuration to launch a parallel application

Name: ptpdemo

Parallel Project: ptpdemo

Application program: /home/hkrish4/workspacejuno/ptpdemo/prime

☐ Copy executable from local filesystem

Path to the local file:

☑ Display output from all processes in a console view

Select application to execute

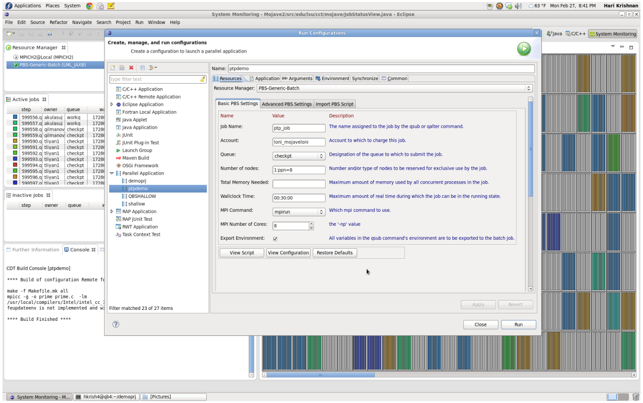
Select file: /home/hkrish4/demoprj/prime

```
decs.h
▽ demoprj
    .ptp_job.o599690.swp
  ▷ .ptp-sync
  ▷ .svn
    Makefile.mk
    prime
    prime.c
    prime.o
    ptp_job.e599690
    ptp_job.o599690
    simple.pbs
diag.c
```

CDT Build Console [ptpdemo]

```
**** Build of configuration Remote fo

make -f Makefile.mk all
mpicc -g -o prime prime.c  -lm
/usr/local/compilers/Intel/intel_cc_11.1/lib/intel64/libimf.so: warning: warning:
feupdateenv is not implemented and will always fail

**** Build Finished ****
```

Sample Run config.


Applications Places System
System Monitoring - Mojave2/src/edu/lsu/cct/mojave/JobStatusView.java - Eclipse
File Edit Source Refactor Navigate Search Project Run Window Help
63 °F Mon Feb 27, 8:41 PM Hari Krishnan
Java C/C++ System Monitoring
Resource Manager
MPICH2@Local (MPICH2)
PBS-Generic-Batch (LML_JAXB)
Further Information
Console
System Monitoring - M...
hkrish4@qb4:~/demoprj
[Pictures]

Active Jobs

	step	owner	queue
🟦	599556.q	akulasuj	workq
🟩	599557.q	akulasuj	workq
🟩	599558.q	gilmanov	checkpt
🟩	599559.q	gilmanov	checkpt
🟧	599590.q	tliyan1	checkpt
🟩	599591.q	tliyan1	checkpt
🟩	599592.q	tliyan1	checkpt
🟦	599593.q	tliyan1	checkpt
🟥	599594.q	tliyan1	checkpt
🟩	599595.q	tliyan1	checkpt
🟧	599596.q	tliyan1	checkpt
🟦	599597.q	tliyan1	checkpt

Inactive Jobs

step	owner	queue

```
CDT Build Console [ptpdemo]

**** Build of configuration Remote fo

make -f Makefile.mk all
mpicc -g -o prime prime.c  -lm
/usr/local/compilers/Intel/intel_cc_1
feupdateenv is not implemented and wi

**** Build Finished ****
```

Run Configurations

Create, manage, and run configurations

Create a configuration to launch a parallel application

type filter text

- C/C++ Application
- C/C++ Remote Application
- Eclipse Application
- Fortran Local Application
- Java Applet
- Java Application
- JUnit
- JUnit Plug-in Test
- Launch Group
- Maven Build
- OSGi Framework
- Parallel Application
  - demoprj
  - ptpdemo
  - QBSHALLOW
  - shallow
- RAP Application
- RAP JUnit Test
- RWT Application
- Task Context Test

Filter matched 23 of 27 items

Name: ptpdemo

Resources | Application | Arguments | Environment | Synchronize | Common

Resource Manager: PBS-Generic-Batch

Basic PBS Settings | Advanced PBS Settings | Import PBS Script

Name	Value	Description
Job Name:	ptp_job	The name assigned to the job by the qsub or qalter command.
Account:	loni_mojaveloni	Account to which to charge this job.
Queue:	checkpt	Designation of the queue to which to submit the job.
Number of nodes:	1:ppn=8	Number and/or type of nodes to be reserved for exclusive use by the job.
Total Memory Needed:		Maximum amount of memory used by all concurrent processes in the job.
Wallclock Time:	00:30:00	Maximum amount of real time during which the job can be in the running state.
MPI Command:	mpirun	Which mpi command to use.
MPI Number of Cores:	8	the '-np' value
Export Environment:	✓	All variables in the qsub command's environment are to be exported to the batch job.

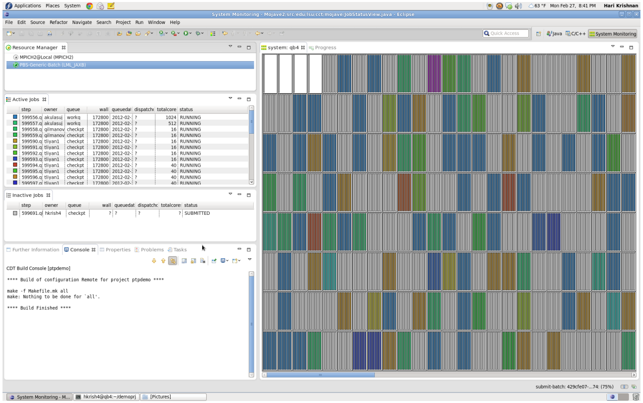
View Script | View Configuration | Restore Defaults

Apply | Revert

Close | Run

Launch and monitor job

Inactive jobs view shows job is submitted.


System Monitoring - Mojave2/src/edu/lsu/cct/mojave/JobStatusView.java - Eclipse
Resource Manager
MPICH2@Local (MPICH2)
PBS-Generic-Batch (LML_JAXB)
system: qb4
Progress
submit-batch: 429cfe07-...74: (75%)

Active Jobs

	step	owner	queue	wall	queuedat	dispatchc	totalcore	status
🟦	599556.q	akulasuj	workq	172800	2012-02-	?	1024	RUNNING
🟩	599557.q	akulasuj	workq	172800	2012-02-	?	512	RUNNING
🟩	599558.q	gilmanov	checkpt	172800	2012-02-	?	16	RUNNING
🟩	599559.q	gilmanov	checkpt	172800	2012-02-	?	16	RUNNING
🟧	599590.q	tliyan1	checkpt	172800	2012-02-	?	16	RUNNING
🟩	599591.q	tliyan1	checkpt	172800	2012-02-	?	16	RUNNING
🟩	599592.q	tliyan1	checkpt	172800	2012-02-	?	16	RUNNING
🟦	599593.q	tliyan1	checkpt	172800	2012-02-	?	16	RUNNING
🟥	599594.q	tliyan1	checkpt	172800	2012-02-	?	40	RUNNING
🟩	599595.q	tliyan1	checkpt	172800	2012-02-	?	40	RUNNING
🟧	599596.q	tliyan1	checkpt	172800	2012-02-	?	40	RUNNING
🟦	599597.q	tliyan1	checkpt	172800	2012-02-	?	40	RUNNING

Inactive Jobs

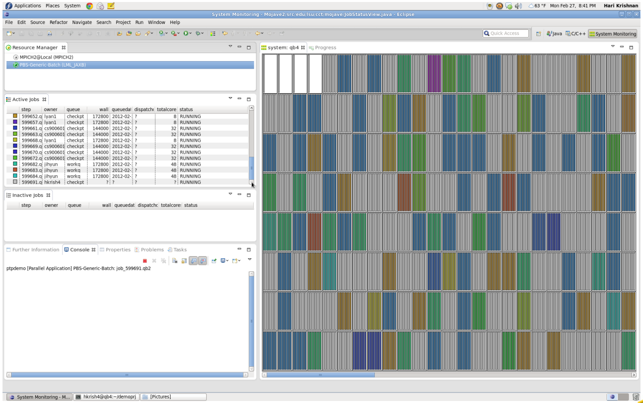
	step	owner	queue	wall	queuedat	dispatchc	totalcore:	status
⬜	599691.q	hkrish4	checkpt	?	?	?	?	SUBMITTED

CDT Build Console [ptpdemo]

```
**** Build of configuration Remote for project ptpdemo ****

make -f Makefile.mk all
make: Nothing to be done for `all'.

**** Build Finished ****
```

Job status and actions

Job moves to Active job view when it is running and right click on job and hit job status to refresh the status of the job.


Applications Places System
63 °F Mon Feb 27, 8:41 PM Hari Krishnan
System Monitoring - Mojave2/src/edu/lsu/cct/mojave/JobStatusView.java - Eclipse
File Edit Source Refactor Navigate Search Project Run Window Help
Quick Access
Java C/C++ System Monitoring
Resource Manager
MPICH2@Local (MPICH2)
PBS-Generic-Batch (LML_JAXB)
system: qb4
Progress
Active Jobs

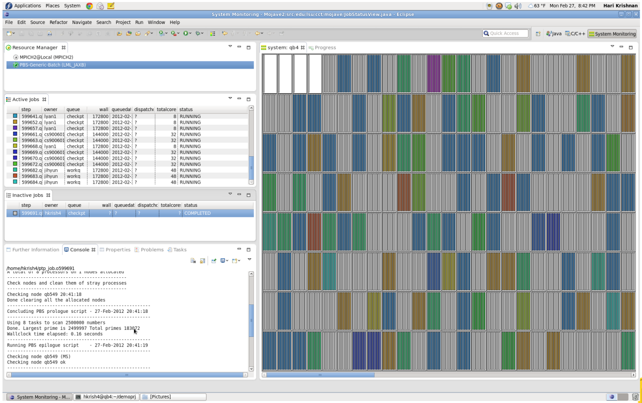
	step	owner	queue	wall	queuedat	dispatch	totalcore	status
🟧	599652.q	lyan1	checkpt	172800	2012-02-	?	8	RUNNING
🟪	599657.q	lyan1	checkpt	172800	2012-02-	?	8	RUNNING
🟦	599661.q	cs900601	checkpt	144000	2012-02-	?	32	RUNNING
🟩	599663.q	cs900601	checkpt	144000	2012-02-	?	32	RUNNING
🟨	599668.q	lyan1	checkpt	172800	2012-02-	?	8	RUNNING
🟦	599669.q	cs900601	checkpt	144000	2012-02-	?	32	RUNNING
🟦	599670.q	cs900601	checkpt	144000	2012-02-	?	32	RUNNING
🟩	599672.q	cs900601	checkpt	144000	2012-02-	?	32	RUNNING
🟩	599682.q	jihyun	workq	172800	2012-02-	?	48	RUNNING
🟥	599683.q	jihyun	workq	172800	2012-02-	?	48	RUNNING
🟦	599684.q	jihyun	workq	172800	2012-02-	?	48	RUNNING
⬜	599691.q	hkrish4	checkpt	?	?	?	?	RUNNING

	step	owner	queue	wall	queuedat	dispatchc	totalcore	status

```
ptpdemo [Parallel Application] PBS-Generic-Batch: job_599691.qb2
```

Read Output back from Queenbee

When the job is completed, it will be shown in inactive jobs view. By right click on the jobs in inactive job, view output/error by clicking get job output/error option



System Monitoring - Mojave2/src/edu/lsu/cct/mojave/JobStatusView.java - Eclipse
File Edit Source Refactor Navigate Search Project Run Window Help
Resource Manager
MPICH2@Local (MPICH2)
PBS-Generic-Batch (LML_JAXB)
system: qb4
Progress
Further Information
Console
Properties
Problems
Tasks
System Monitoring - M...
hkrish4@qb4:~/demoprj
[Pictures]

Active Jobs

	step	owner	queue	wall	queuedat	dispatchd	totalcore	status
🟦	599641.q	lyan1	checkpt	172800	2012-02-	?	8	RUNNING
🟧	599652.q	lyan1	checkpt	172800	2012-02-	?	8	RUNNING
🟪	599657.q	lyan1	checkpt	172800	2012-02-	?	8	RUNNING
🟦	599661.q	cs900601	checkpt	144000	2012-02-	?	32	RUNNING
🟩	599663.q	cs900601	checkpt	144000	2012-02-	?	32	RUNNING
🟨	599668.q	lyan1	checkpt	172800	2012-02-	?	8	RUNNING
🟦	599669.q	cs900601	checkpt	144000	2012-02-	?	32	RUNNING
🟦	599670.q	cs900601	checkpt	144000	2012-02-	?	32	RUNNING
🟩	599672.q	cs900601	checkpt	144000	2012-02-	?	32	RUNNING
🟩	599682.q	jihyun	workq	172800	2012-02-	?	48	RUNNING
🟥	599683.q	jihyun	workq	172800	2012-02-	?	48	RUNNING
🟦	599684.q	jihyun	workq	172800	2012-02-	?	48	RUNNING

Inactive Jobs

	step	owner	queue	wall	queuedat	dispatchc	totalcore	status
⬜	599691.q	hkrish4	checkpt	?	?	?	?	COMPLETED

/home/hkrish4/ptp_job.o599691

```
A total of 8 processors on 1 nodes allocated
---------------------------------------------
Check nodes and clean them of stray processes
---------------------------------------------
Checking node qb549 20:41:18
Done clearing all the allocated nodes
-------------------------------------------------------
Concluding PBS prologue script - 27-Feb-2012 20:41:18
-------------------------------------------------------
Using 8 tasks to scan 2500000 numbers
Done. Largest prime is 2499997 Total primes 183072
Wallclock time elapsed: 0.16 seconds
-------------------------------------------------------
Running PBS epilogue script    - 27-Feb-2012 20:41:19
-------------------------------------------------------
Checking node qb549 (MS)
Checking node qb549 ok
-------------------------------------------------------
```