# ncsa eclipse internal training

This tutorial will cover the basic setup and use of Eclipse with forge.ncsa.illinois.edu. At the end of the tutorial, you should be comfortable with the following tasks:

- · start eclipse and view the forge resource manager for your preferred version of MPI
- submit a batch job to forge via eclipse
- build code with eclipse and the c/c++ perspective (we'll ignore fortran for this tutorial, but can show you the perspective for it)
- use TAU to profile a basic GPU code
- use Eclipse to drive TAU performance analysis

Contents.

- eclipse on forge startup, environment, and forge resource manager setup
   add the PTP Contributed Resource Manager Definitions
  - add the PTP Contributed Resource Manager Definitions
     open System Monitoring perspective and select the forge mvapich2 definition
  - start the forge resource manager locally and impress your friends and neighbors
- CUDA code with eclipse
- TAU profiling with eclipse
  - CUDA profiling with TAU is not yet in eclipse, use the command line...
  - Paraprof setup on forge
  - TAU with mpi compute pi example

#### eclipse on forge startup, environment, and forge resource manager setup

To start eclipse on forge ?( locally ), add eclipse (and tau) to your \$HOME/.modules setup. This is also the place where you'd select an alternate MPI implementation if you want to stray from the pack and create confusion in this tutorial from the very beginning (openmpi users step forward). The modules on forge are displayed with the "module avail" command. The prerequisite for running eclipse on forge is X-windows support and ssh X11 forwarding in your ssh client (ssh -Y or ssh -X for linux clients ). Now is the time to find a linux or Mac user with X-windows and ssh (working in pairs) if you don't have that capability on your windows PC:

```
[arnoldg@forge ~]$ echo "module load tau eclipse" >> $HOME/.modules
[arnoldg@forge ~]$ grep -v '^#' .modules
module load tau eclipse
[arnoldg@forge ~]$ eclipse -Xms512m -Xmx512m -XX:PermSize=256m -XX:MaxPermSize=512m &
```

When eclipse first starts, it prompts for a workspace location. It's ok to accept the default of \$HOME/workspace/ if you don't have a directory with that name, or you may select an alternate location.



The first time entering a new workspace, eclipse loads a default screen. To get right into eclipse and skip all the tutorials and help (which you'll come back to next time ?), select the workbench icon.



add the PTP Contributed Resource Manager Definitions

First, you'll add the resource managers plugin from http://download.eclipse.org/tools/ptp/updates/indigo\_5.0.4. Copy the URL into your clipboard and then in eclipse navigate as follows to add the plugin: Help -> Install New Software -> Add (button), then fill in the boxes with the URL. It should look like this:

Install (on forge	e.ncsa.illinois.edu)	
Available Software		
Select a site or enter	r the location of a site.	
Work with: type or se	calact a site	
	Find more software by working with the <u>"Ava</u>	ailable Software Site
type filter text		
Name	Version	
🗌 🛈 There is no si	site selected.	
	Add Repository (on forge.ncsa.illinois.edu)	×
	Name: n://download.eclipse.org/tools/ntn/undates/indigo_5.0.4	Local
	Location: p://download.eclipse.org/tools/ptp/updates/indigo_5.0.4	Archive
	😣 Duplicate location	
Select All	Cancel	ОК
Details		

Click OK and select the item you want to install.

🔲 Install (on forge.ncsa.illinois.edu) 🐂 👘		X	
Available Software			
Check the items that you wish to install.			
		1	
Work with: http://download.eclipse.org/tools/ptp/updates	/indigo_5.0.4 - http://download.eclipse.org/tools/pt	<u>A</u> dd	
Find mo	ore software by working with the <u>"Available Software Sites"</u> p	preferences.	
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🗌 🍫 PTP Common Utilities	5.0.4.201110200938		
🗹 🌆 PTP Contributed Resource Manager Definition	ns 5.0.4.201110200938		
Select All Deselect All 1 item selected			
⊤Details			
Adds resource managers for a number of different system	IS		
		More	
Show only the latest versions of available software	☐ <u>H</u> ide items that are already installed		
☑ Group items by category What is <u>already installed</u> ?			
□ Show only software applicable to target environment			
Contact all undate sites during install to find required a	offuero		
Solution an update sites during instanto into required s	Ultware		
?	< Back Next > Cancel	Finish	

Press Next, and follow the install prompts, then allow eclipse to restart when finished. If the dialog boxes indicate the software is already installed, you don't need to restart eclipse.

# open System Monitoring perspective and select the forge mvapich2 definition

Under Window -> Open Perspective menu, select the System Monitoring perspective (under Other...) to get started setting up a resource manager to use with forge. The steps that follow will allow you to monitor the system, queues, and submit jobs to forge all from within eclipse. It's beautiful, colorful, powerful, and sometimes runs for hours without crashing. You'll like it.

Open Perspective (on forge.ncsa.illinoi: 🗙
🖏 Java 🗖
💱 Java Browsing
🚼 Java Type Hierarchy
🛼 LTTng
🗱 Parallel Debug
III Parallel Runtime
Image:
👰 Remote C/C++
Remote System Explorer
🔁 Resource
🚟 System Monitoring
🔊 SystemTap Dashboard
SystemTap Graphing
Cancel OK

Right click in the Resource Managers area background , select "Add Resource Managers", and add the entry for forge mvapich2.

	🗖 🗖 🏭 System Monitor 🛿
	(on forge.ncsa.illinois.edu) 🙀
	Choose Resource Manager Type
	Select the type of resource manager to use
	Resource Manager Types:
Active John M. I''' Inactive John	IBM LoadLeveler
	IBM Parallel Environment
	MPICH2
	Open MPI
	Open MPI-Generic-Interactive
	PBS-Generic-Batch
	PBS-Generic-Interactive
	Remote Launch
	SLURM
	edu.illinois.ncsa.forge.pbs.batch.mvapich2
	edu.illinois.ncsa.forge.pbs.batch.openmpi
	edu.utk.nics.keeneland.pbs.batch
	edu.utk.nics.kraken.pbs.batch
	Image: Second

Since we're running locally on forge, leave the Remote Service Provide and Connection Name set to "local". Accept the defaults for the rest of the forge resource manager setup. Normally, you'd setup new ssh connections via remote tools here, but by running locally on forge, that's not necessary. There should now be a forge resource added to the resource managers view.

Sy	stem	Monitor	ing - Ecli	ipse (or	ı forg	e.ncsa.il	linois.edu	1) <sup>1</sup> 8	
<u>F</u> ile	<u>E</u> dit	<u>N</u> avigate	Se <u>a</u> rch	<u>P</u> roject	<u>R</u> un	<u>W</u> indow	<u>H</u> elp		
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📀 Ri	esour	ce Manage	ers 🛛					- 8	
	i edu.il	llinois.ncsa	.forge.pbs	.batch.mv	apicha	2 (LML_JA	AXB)		

## start the forge resource manager locally and impress your friends and neighbors

Right click on the forge.pbs.batch.mvapich2 resource and start it. It should go from grey to green and bring up a display like:

System Monitoring - Eclipse (on forge.ncsa.illinois.edu)	- Di
Elle Edit Navigate Search Project Run Window Help	
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Resource Managers      □     □	🔛 system: forge.ncsa.illinois.edu 🛛 🦳 🗖
<pre>@ edu.illinois.ncsa.forge.pbs.batch.mvapich2 (LML_JAXB)</pre>	
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📮 Console 🕱 📄 Properties 🚼 Problems 🖉 Tasks 🦳 🗖 🗖	
No consoles to display at this time. 🚙 📑 🖓 🛶	
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You can begin exploring the wonderful world of eclipse resource managers from here. Use the Run Configurations under the Run menu if you have an application or job script ready to run on forge.

```
[jlong@forge ~]$ qsub -I -l nodes=2:ppn=4,flags=ADVRES:eclipse  # sample qsub command line showing access to the tutorial reservation
```

# CUDA code with eclipse

Import the code below into a new c++ project (rt click in the open area under c/c++ perspective's Project Explorer pane. Name your project and select the Makefile and Empty Project for it's type, then when the project appears in the pane right click on your project and : Import->General->Filesystem) and bring in the vecadd/ code from your \$HOME. Then follow the steps in the 2nd bullet link (or attached PDF) below.

```
cp -R ~arnoldg/vecadd/ $HOME ; ls $HOME/vecadd/
```

- cdt and cuda makefile projects
- build the project with eclipse ( Project -> Build , or use the hammer icon )

# TAU profiling with eclipse

CUDA profiling with TAU is not yet in eclipse, use the command line...

This URL describes using TAU with cuda code:

http://www.ncsa.illinois.edu/UserInfo/Resources/Software/Tools/TAU/#gpusupport





Note for the bored: the dev/ directory contains trial1.cvp created by computeprof--the Nvidia-CUDA profiler that ships with CUDA. You can visualize it with the computeprof command on forge.

### Paraprof setup on forge

- start paraprof from the ssh command line (not in Eclipse )
- File -> Database Configuration -> accept defaults, confirm new perfdmf database/schema and "Save Configuration"
   Exit paraprof (important because there can not be 2 paraprof processes trying to access your database at the same time...Eclipse will be starting one in the steps that follow)

#### TAU with mpi compute pi example

A requirement for using TAU with eclipse locally is to setup the following directory and symbolic link to work around an Eclipse bug with TAU:

```
$ cd $HOME
$ mkdir -p ./uf/ncsa
$ ln -s $HOME ./uf/ncsa/$USER  # workaround to handle Eclipse/TAU trying to submit jobs with $HOME/$HOME in
pathname
```

Create a new project in eclipse by right clicking in the Project Explorer pane of the c/c++ perspective and choosing the MPI PI C example project with the gcc toolchain. This should create a new project with source files in the src/ directory.

The project will probably need the mpi.h include directory defined and added to all languages/configurations. Build the application when you're done with this step. A Debug/ directory should appear in your project which we'll need later when filling out the Profile Configurations -> Application tab:

•	Properties for mpipic (on forge.ncsa.illinois.edu	)
type filter text 🐣	Paths and Symbols	<b>⇔</b> • ⇒ •
Resource		·
Builders	Configuration: Debug [Active]	Manage Configurations
▷ C/C++ Build		
▷ C/C++ General	Bincludes # Symbols + Librarias = Library Baths   @Source Location	P Poforoncoc
Discovery Options	Add directory path (on forge.ncsa.illinois.edu)	
Environment	Languages Directory:	Add
Paths and Symbols	Assembly //usr/local/mpi/myanich2/myanich2-1 7rc1-intel-12 0 4/inclur	Edit.
Project References	GNU C	
Run/Debug Settings	Add to all configurations Variables	Delete
Service Configurations	Add to all languages Workspace.	Export
Settings	□ ເ∋ Is a workspace path	
Task Repository	File system.	
Task Tags	OK Cancel	htere Deve
Tool Chain Editor		Move Down
▶ Validation	Show built-in Values	
Variables	💣 Import Settings 🖗 Export Settings	
WikiText		
•		Restore Defaults Apply

To profile with TAU, there are a couple steps to follow in the c/c++ perspective. First fill out the TAU settings under the TAU tab for the Profile Configurations. For the first TAU trial use the default settings.

-	Profile Configurations (on forge.ncsa.illinois.edu)
Create, manage, and run co	onfigurations
Build C, C++ or Fortran appl Eclipse via the PTP.	ications with performance analysis tools. Launch parallel programs from within
Image: Second system       Image: Second system         Image: Secon	Name: mpipic     Environment Performance Analysis   Memory Generate MPT Include list     Callpath Profiling   Phase Based Profiling   Memory Profiling   OPARI   OpenMP   Epilog   VampirTrace   PAPI   Select PAPI Counters   Oreset Counters   Native Counters
Filter matched 7 of 8 items	Trace     PDT ○ PDT Instrumentation ⓒ Compiler Instrumentation Select Makefile: Makefile.tau-icpc-mpi     ✓     Apply Revert
?	Close <u>P</u> rofile

Set the Performance Analysis tab to build-only without launch, then Apply and Profile the application which will build a new TAU instrumented version of the code.

#### Profile Configurations (on forge illinois

Profile Configurations (on forge.ncsa.illinois.edu)				
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Image: Second system       Image: Second system         type filter text       Image: Second system         Image: C/C++ Application       Image: Second system         Image: C/C++ Application       Image: Second system         Image: Second system       Image: Second system         Image: S	Name:       mpipic			

While building, watch the console in eclipse for the TAU compile and link commands. These can be useful later if you run TAU outside of Eclipse (or in your larger Makefile to define the compiler and linker commands ):

```
**** Build of configuration Debug_tau-icpc-mpi for project mpipic ****
make all
Building file: ../src/mpipic.c
Invoking: GCC C Compiler
/usr/apps/tools/tau/2.20.3-forge/x86_64/bin/tau_cc.sh -tau_options='-optCompInst ' -tau_makefile=/usr/apps
/tools/tau/2.20.3-forge/x86_64/lib/Makefile.tau-icpc-mpi -T/usr/local/mpi/mvapich2/mvapich2-1.7rcl-intel-12.0.4
/include -00 -g3 -Wall -c -fmessage-length=0 -MMD -MP -MF"src/mpipic.d" -MT"src/mpipic.d" -o "src/mpipic.o" "..
/src/mpipic.c"
Finished building: ../src/mpipic.c
Building target: mpipic
Invoking: GCC C Linker
/usr/apps/tools/tau/2.20.3-forge/x86_64/bin/tau_cc.sh -tau_options='-optCompInst ' -tau_makefile=/usr/apps
/tools/tau/2.20.3-forge/x86_64/bin/tau_cc.sh -tau_options='-optCompInst ' -tau_makefile=/usr/apps
/tools/tau/2.20.3-forge/x86_64/lib/Makefile.tau-icpc-mpi -o "mpipic" ./src/mpipic.o
Finished building target: mpipic
***** Build Finished *****
```

Building will create a new directory named similar to the TAU makefile from the TAU tab options. Once the instrumented application is built, then fill out the Profile Configuration tabs for the Application and Arguments to point to that executable and directory:

Select application to execute (on forge.ncsa.illinois.edu)					
📝 🖣 🗁 arnold	g eclipse_tmp mpipic Debug_tau-icpc-mpi				
Places	Name 🗸	Size	Modified		
🔍 Search	🗁 src		13:16		
🛞 Recently Used	🗋 makefile	1.1 KB	13:16		
🛅 arnoldg	📑 mpipic	3.2 MB	13:16		
👩 File System	Diects.mk	231 bytes	13:16		
	🗋 sources.mk	392 bytes	13:16		

The Arguments tab should be adjusted to point to that directory (deselect the default directory box and browse the path ).

•	Select working directory (on forge.ncsa.illinois.edu)		<u>ا</u>
📝 🖣 🛅 arnolda	g eclipse_tmp mpipic Debug_tau-icpc-mpi	c	Create Fo <u>l</u> der
Places	Name	Size	Modified 🔺
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🛞 Recently Used	makefile	1.1 KB	13:16
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👩 File System	Dipects.mk	231 bytes	13:16
	sources.mk	392 bytes	13:16
S File System	sources.mk	392 bytes	13:16

Then in the Performance Analysis tab, allow TAU to profile for this run by deselecting the build-only box:

\$	Profile Configurations (on forge.ncsa.illinois.edu)				
Create, manage, and run co	Create, manage, and run configurations				
Build C, C++ or Fortran appl Eclipse via the PTP.	ications with performance analysis tools. Launch parallel programs from within				
▶ 🖬 🗶 🖻	Name: mpipic				
type filter text 🛛 🐣	🗈 Application 🕪 Arguments 📧 Environment Performance Analysis 🛛 🛷 TAU 🍡				
▷ C/C++ Application	Tool Selection				
▶ Launch Group	Select Tool: TAU 💌				
	Add Workflow XML File Bemove Workflow XML File				
😫 mpipic					
Profile With OProfile	Build the instrumented executable but do not launch it				
R Profile With OProfile (	Select existing performance data to analyze with the selected tool				
Verofile With Valgrind					

You will need to fill out the Resources tab to describe the job you want to run. Select a queue (debug), Number of Nodes (1:ppn=4,flags=ADVRES: eclipse), Mpirun command (mpirun\_rsh), Number of cores (should be nodes\*ppn or 4), and wall time (ten minutes = 00:10:00). Finally, once the program runs, use TAU. Allow TAU to run in the background if the dialog box persists while the job is submitted.

TAU: ParaProf: node 3 - Applica	ation 0, Experiment 0, Trial 0. 📃 🗆 🛛	
File Options Windows Help		
Metric: TIME Value: Exclusive Units: seconds		
0.553 0.106 0.035 0.005 4.7E-4 2.3E-4 1.2E-4	calc_pi {{/uf/ncsa/arnoldg/eclipse_tmp/mpipic/Debug MPI_Init() .TAU application MPI_Finalize()   main {{/uf/ncsa/arnoldg/eclipse_tmp/mpipic/Debug_   MPI_Bcast() MPI_Bend()	eriment 0, Trial 0.
2.7E-5 1.0E-6 1.0E-6	MPI_Reduce()   MPI_Comm_rank()   MPI_Comm_size()	pid
	olems 🕗 Lasks 🖳 Console 🔲 Properties 🚡 Ren	Tote Enviro
	U	ising Database: Default Launch ParaProf   🏠 🖕 🔿 🎽
n 🚭 🔻	ipipic	
▼ (≥	▶ icpc-mpi	
	2011-10-25_13:20:11	

Homework questions.

How could you use Eclipse with TAU and a Makefile project ?

Can you manipulate jobs (cancel ) in the Systems Monitoring perspective ?

Does the Systems Monitoring perspective support more than one running resource manager ?