



SOFTWARE

- + 19.56 updateX
- + 399.70 updateEN
- + 0.00 gene
- + 0.00 <<iteration loop>>
- + 447.52 genBC



PRODUCTIVITY

FAST SOLUTIONS

- PAPI_L1_ICM
- PAPI_L2_DCM
- PAPI_L2_ICM
- PAPI_L1_TCM

Periscope

Score-P Online Access Tutorial Exercise

NPB-MZ-MPI/BT

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Installation Checklist

Benchmark Instrumentation

Periscope Online Analysis

Performance Properties Exploration

Installation Checklist



- Login using X-forwarding:

```
% ssh -X <your_account>@juropa.fz-juelich.de
```

- Load Periscope and Score-P modules:

```
% module load UNITE/1.1
% module load periscope
% module load scorep
```

- Confirm that the configuration file `.periscope` is in the home directory. Copy it if missing:

```
% cp $PERISCOPE_ROOT/etc/periscope.sample $HOME/.periscope
```

- It should look like:

```
MACHINE = localhost
SITE = LiveDVD
REGSERVICE_HOST = localhost
REGSERVICE_PORT = 50027
REGSERVICE_HOST_INIT = localhost
REGSERVICE_PORT_INIT = 50001
APPL_BASEPORT = 51000
AGENT_BASEPORT = 50002
```

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Benchmark Instrumentation



- Copy and change directory to the prepared NPB3.3 folder:

```
% cp -r ~train001/tutorial $WORK  
% cd $WORK/tutorial/NPB3.3-MZ-MPI
```

- Open the make configuration file with an editor:

```
% vi config/make.def
```

- Uncomment the MPIF77 definition for Score-P:

```
# Alternative variants to perform instrumentation  
#MPIF77 = psc_instrument mpif77  
#MPIF77 = scalasca -instrument mpif77  
#MPIF77 = tau_f90.sh  
#MPIF77 = vtf77 -vt:hyb -vt:f77 mpif77  
MPIF77 = scorep --user mpif77
```

Benchmark Instrumentation



- Take note of the Score-P Online Access phase definition in the prepared BT benchmark. Open the file [BT-MZ/bt_scorep_user.F](#) and move to line 219:

```
if (mod(step, 20) .eq. 0 .or. step .eq. 1) then
    if (myid .eq. root) write(6, 200) step
    if (myid .eq. root) call flush(6)
200    format(' Time step ', i4)
    endif

    SCOREP_USER_OA_PHASE_BEGIN(OA_Phase,"ITERATION",SCOREP_USER_REGION_TYPE_COMMON)
```

- Make sure that the suite file defines the correct benchmark to build:

```
% cat config/suite.def
<comments>
bt-mz      B          4
```

- Build the benchmark:

```
% make suite
```

Installation Checklist

Benchmark Instrumentation

Periscope Online Analysis

Performance Properties Exploration

- Periscope is started via its frontend. It automatically starts application and hierarchy of analysis agents.
- Run `psc_frontend --help` for brief usage information

```
% psc_frontend --help
Usage: psc_frontend <options>
  [--help]                      (displays this help message)
  [--quiet]                     (do not display debug messages)
  [--registry=host:port]        (address of the registry service, optional)
  [--port=n]                    (local port number, optional)
  [--maxfan=n]                  (max. number of child agents, default=4)
  [--timeout=secs]              (timeout for startup of agent hierarchy)
  [--delay=n]                   (search delay in phase executions)
  [--appname=name]
  [--apprun=commandline]
  [--mpinumprocs=number of MPI processes]
  [--ompnumthreads=number of OpenMP threads]
...
  [--strategy=name]
  [--sir=name]
  [--phase=(FileID,RFL) ]
  [--debug=level]
```

- Change to the `bin.scorep` directory:

```
% cd bin.scorep
```

- Copy the JUROPA script:

```
% cp ../../jobs/juropa/periscope.msub .
```

- Run Periscope by executing `psc_frontend` with the following command and options:

```
% psc_frontend --apprun=$EXE --mpinumprocs=$PROCS --  
ompnumthreads=$OMP_NUM_THREADS --force-localhost --phase="ITERATION" --  
strategy=OMP
```

- Submit the job script:

```
% msub periscope.msub
```

Installation Checklist

Program Instrumentation

Periscope Online Analysis

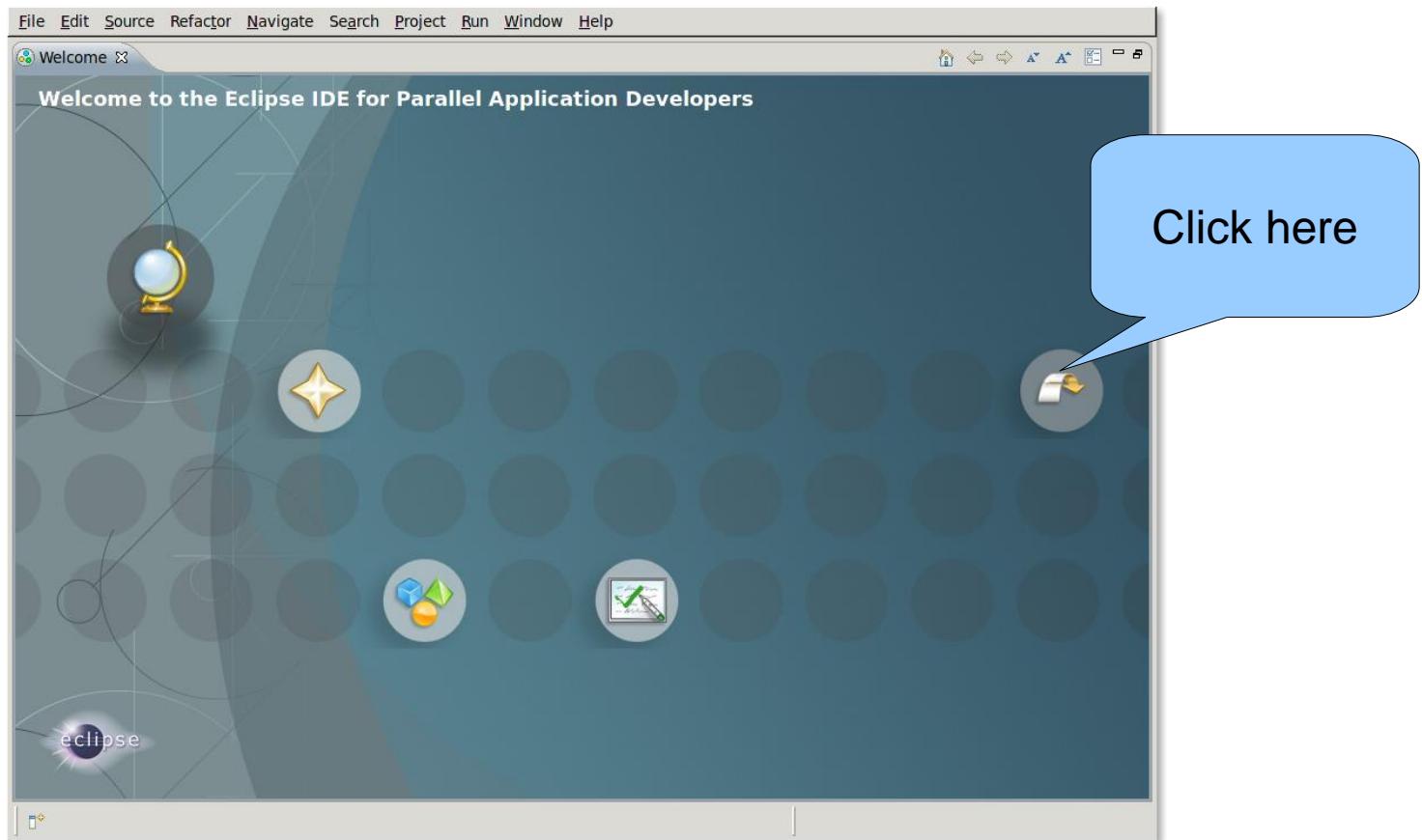
Performance Properties Exploration

Starting Periscope GUI

- Start [Eclipse](#) with Periscope GUI from console

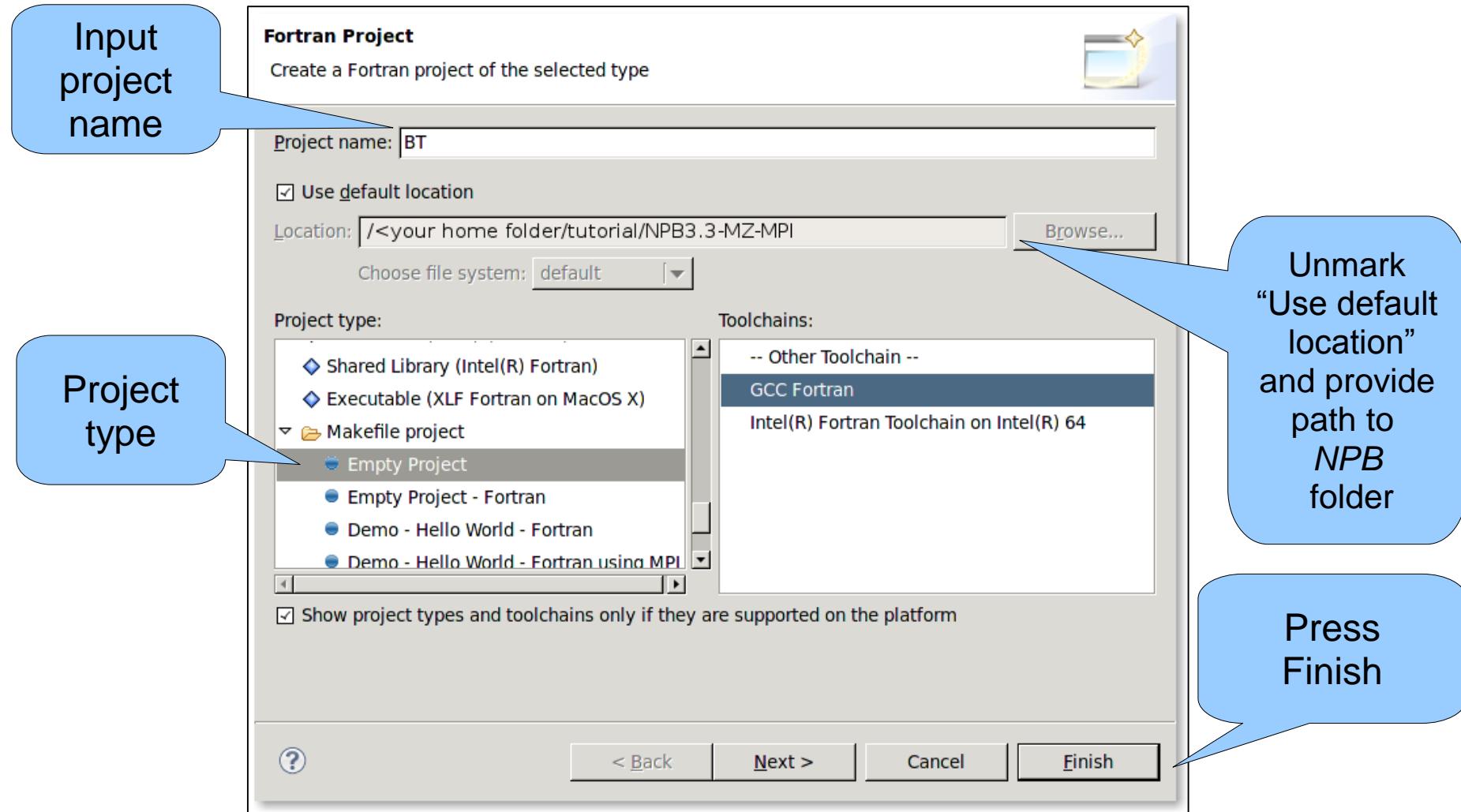
```
% eclipse
```

- Or by double-click on Eclipse pictogram on the Desktop



Creating Fortran Project

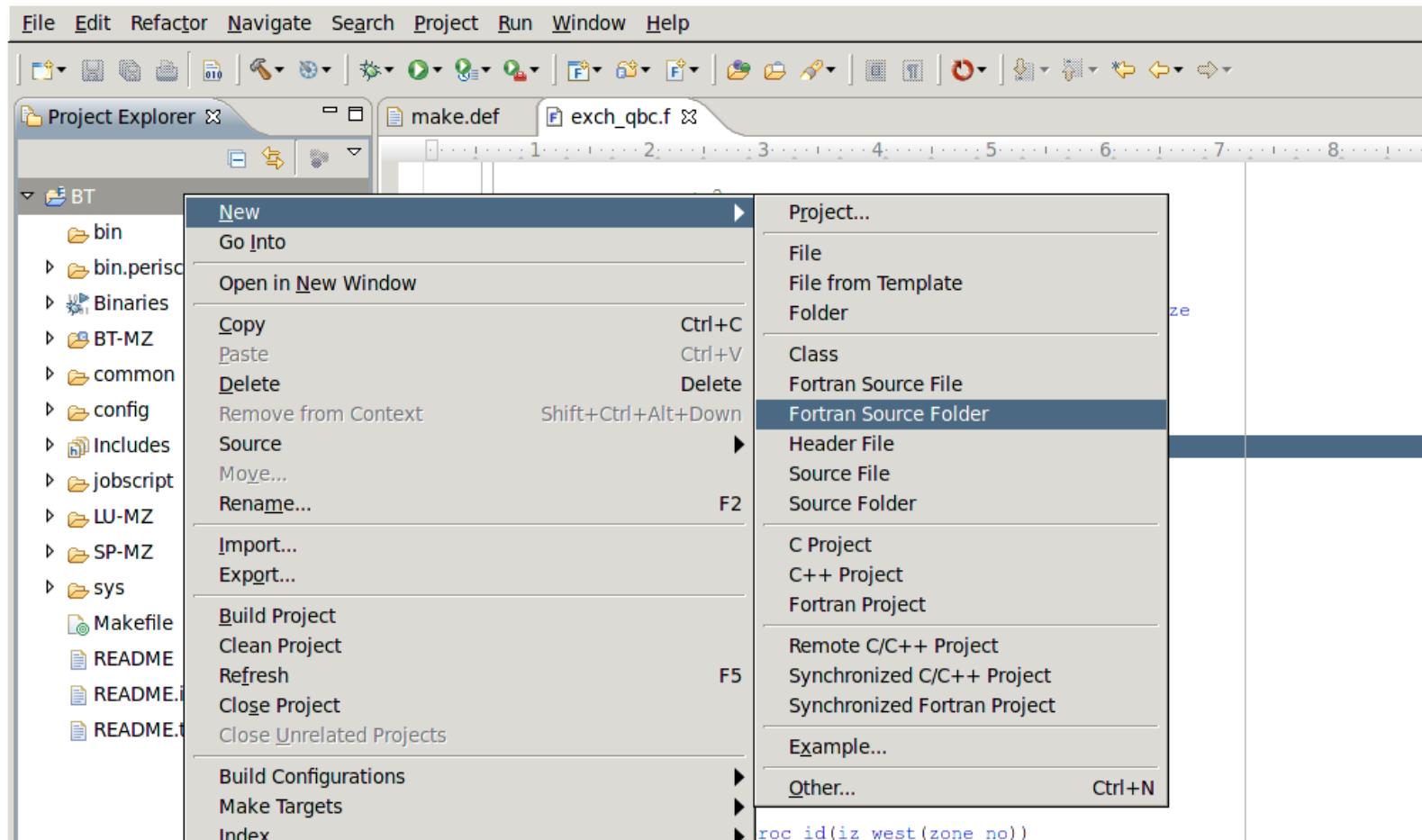
- File->New->Project... → Fortran->Fortran Project



Add BT-MZ as a Source Folder



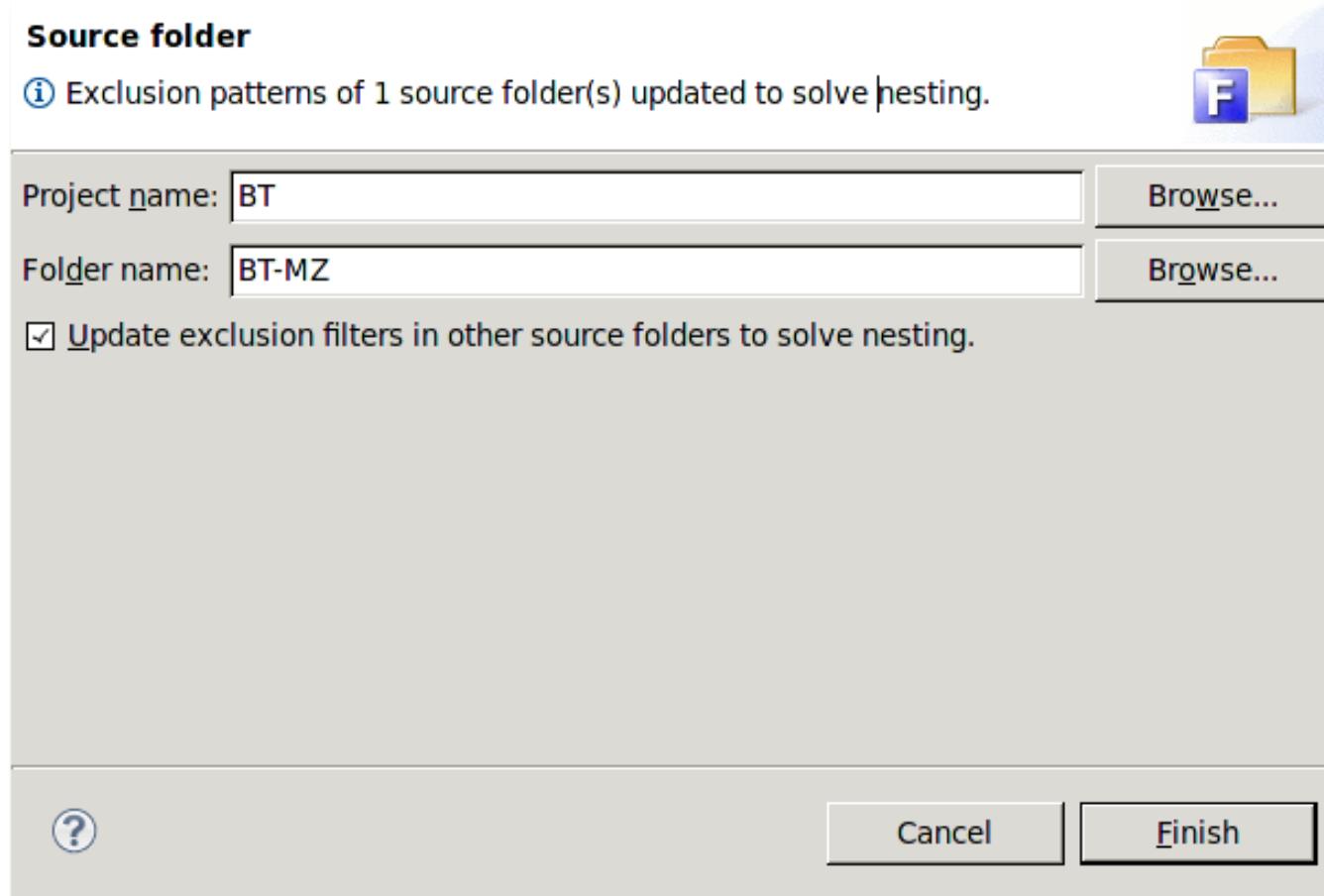
- Right-click -> File-> New -> Fortran Source Folder



Add BT-MZ as a Source Folder

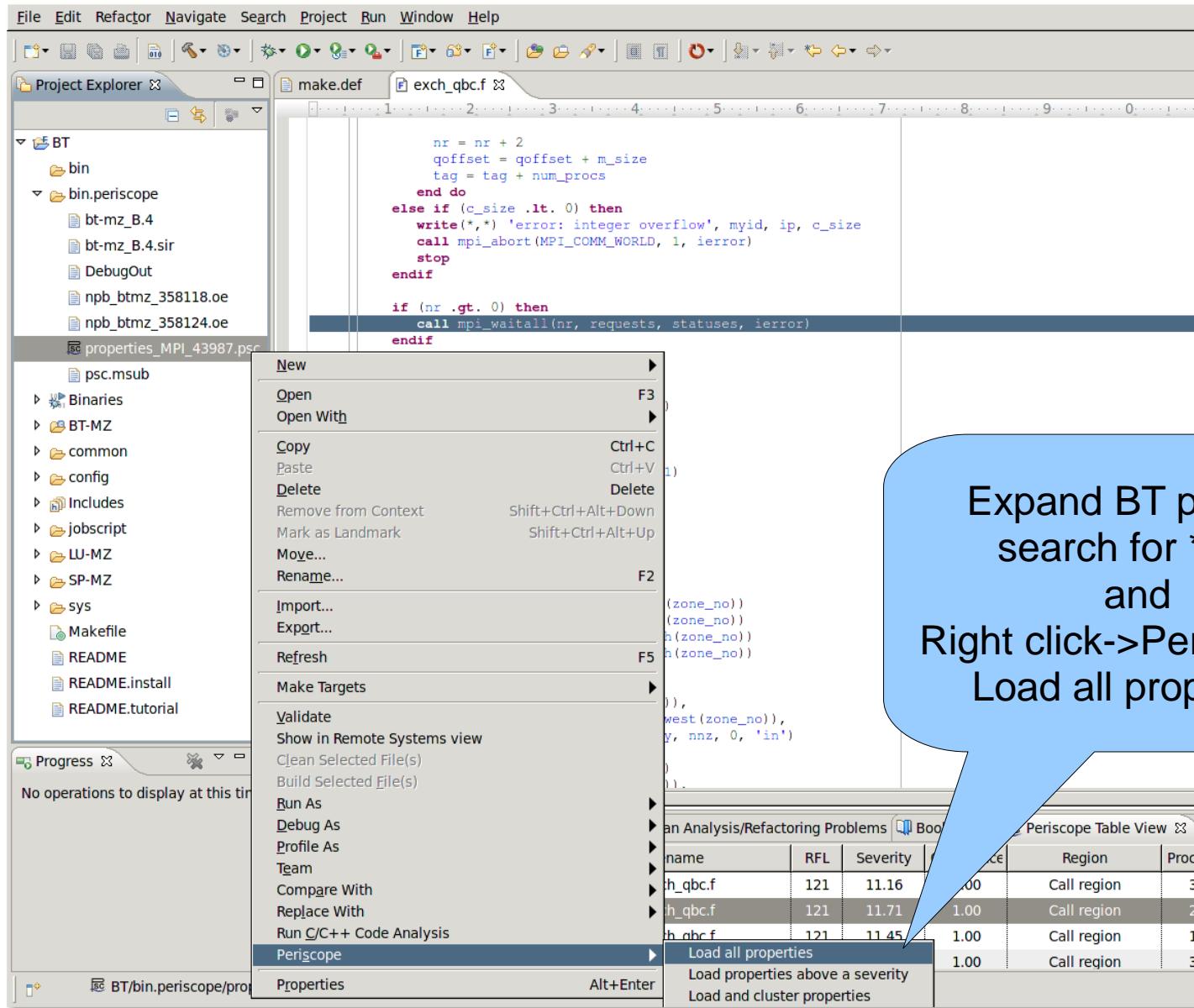


- Choose BT-MZ as a source folder



Loading properties

VI-HPS



Periscope GUI

VI-HPS

The screenshot displays the Periscope GUI interface with three main components:

- Source code view:** Shows a code editor with several files open. A callout bubble points to the code for the `x_solve.f` file, which contains OpenMP parallel code for computing the left-hand side in the xi-direction.
- Project explorer view:** Shows the project structure for "NPB3.3-BT-MZ". A callout bubble points to the "bin" folder.
- Periscope properties view:** Shows a table of performance analysis results. A callout bubble points to the row for "Load Imbalance in parallel region" in the `x_solve.f` file.

Source code view

```
C
c      This function computes the left hand side in the xi-direction
c
!$OMP PARALLEL DEFAULT(SHARED) PRIVATE(n,m,i,j,k, isize)
!$OMP&  SHARED(dx5,dx4,dx3,dx2,dx1,tx2,tx1,dt,c1345,c3c4,con43,c1,c2,
!$OMP&
           nx,ny,nz)
    isize = nx-1
c
c determine n-labeled f) and n jacobians
c
1, nz-2
j = 1, ny-2
do i = 0, isize
```

Project explorer view

- NPB3.3-BT-MZ
 - BT-MZ
 - bin
 - bin.scorep
 - common
 - config
 - jobs
 - Li

Periscope properties view

Name	Filename	RFL	Severity	Confidence	Region	Process	Thread
Load Imbalance in parallel region	<code>z_solve.f</code>	43	2.34	1.00	Parallel region	3	0
Load Imbalance in parallel region	<code>z_solve.f</code>	43	4.37	1.00	Parallel region	0	0
Load Imbalance in parallel region	<code>x_solve.f</code>	46	6.92	1.00	Parallel region	1	0
Load Imbalance in parallel region	<code>y_solve.f</code>	43	7.76	1.00	Parallel region	1	0
Load Imbalance in parallel region	<code>z_solve.f</code>	43	3.43	1.00	Parallel region	1	0
Load Imbalance in parallel region	<code>x_solve.f</code>	46	7.46	1.00	Parallel region	1	0
Load Imbalance in parallel region	<code>y_solve.f</code>	43	7.84	1.00	Parallel region	1	0

0 items selected

- Multi-functional table is used in the GUI for Eclipse for the visualization of bottlenecks
 - Multiple criteria sorting algorithm
 - Complex categorization utility
 - Searching engine using Regular Expressions
 - Filtering operations
 - Direct navigation from the bottlenecks to their precise source location using the default IDE editor for that source file type (e.g. CDT/Photran editor).

Properties clustering



- Clustering can effectively summarize displayed properties and identify a similar performance behaviour possibly hidden in the large amount of data

The screenshot shows the VI-HPS integrated development environment. The top menu bar includes File, Edit, Refactor, Navigate, Search, Project, Run, Window, and Help. The toolbar contains various icons for file operations. The code editor window displays Fortran code with several OpenMP directives. The project explorer window on the right shows a directory structure for 'NPB3.3-BT-MZ' containing subfolders like BT-MZ, bin, bin.scorep, common, config, jobscript, LU-MZ, SP-MZ, sys, Makefile, and README. The bottom part of the interface is the 'Periscope Properties View' which lists 'Clustering Results View', 'Console', and 'Periscope Table View'. A table in the 'Periscope Properties View' shows the following data:

Name	Filename	RFL	Severity	Confidence	Region	Process	Thread
Load Imbalance in parallel region	z_solve.f	43	2.34	1.00	Parallel region	3	0
Load Imbalance in parallel region	z_solve.f	43	4.57	1.00	Parallel region	0	0
Load Imbalance in parallel region	x_solve.f	46	6.92	1.00	Parallel region	1	0
Load Imbalance in parallel region	y_solve.f	43	7.76	1.00	Parallel region	1	0
Load Imbalance in parallel region	z_solve.f	43	3.43	1.00	Parallel region	0	0
Load Imbalance in parallel region	x_solve.f	46	7.46	1.00	Parallel region	1	0
Load Imbalance in parallel region	y_solve.f	43	7.84	1.00	Parallel region	0	0

0 items selected

A blue callout bubble in the bottom right corner points to the 'Periscope Properties View' tab with the text: 'Right-click-> Cluster properties by type'.

Properties clustering

VI-HPS

File Edit Refactor Navigate Search Project Run Window Help

Problems Console Fortran Declaration Periscope Properties View Clustering Results View

Name	Filename	RFL	Severity	Confidence	Processes	Threads	Clustering Error
call: MPI_WAIT (8) (y_solve.f:70)	y_solve.f	70	92.35	1.00	Regions Group		
Excessive MPI time in receive due to late send					Types Group		Clustering squared error: 0.13/0.50
Cluster 1					8 9		
Cluster 2					10 11		
Excessive MPI communication time (4)					Types Group		Clustering squared error: 0.17/0.50
Cluster 1	y_solve.f	70	92.45		10 11		
Cluster 2	y_solve.f	70	92.28		8 9		
call: MPI_WAITALL (12) (copy_faces.f:216)	copy_faces.f	216	93.01	1.00	Regions Group		
Excessive MPI time in receive due to late send	copy_faces.f	216	92.98		Types Group		Clustering squared error: 0.11/0.50
Cluster 1	copy_faces.f	216	92.98		3 12 13		
Cluster 2	copy_faces.f	216	93.04		1 7		
Excessive MPI communication time (6)	copy_faces.f	216	92.98		Types Group		Clustering squared error: 0.11/0.50
Cluster 1	copy_faces.f	216	92.98		3 1		
Cluster 2	copy_faces.f	216	93.04		1 4		
call: MPI_WAIT (12) (x_solve.f:71)	x_solve.f	71	92.40	1.00	Regions Group		
Excessive MPI time in receive due to late send	x_solve.f	71	92.60		Types Group		Clustering squared error: 0.12/0.50
Cluster 1	x_solve.f	71	92.34		1 4		
Cluster 2	x_solve.f	71	92.36		2 5 6		
Excessive MPI communication time (6)	x_solve.f	71	92.62		Types Group		Clustering squared error: 0.13/0.50

Severity value of the Cluster 1

Region and property where clustering performed

Processes belonging To the Cluster1

Filter: Search: RE 0 Loaded - 21 Shown - 1 Selected -