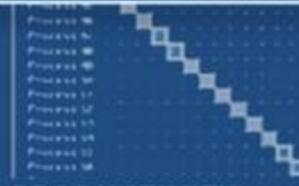




SOFTWARE

- + 19.56 updatex
- + 399.70 updateien
- + 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

- 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
```

- Load Periscope and Score-P modules:

```
% module use /lrz/sys/smuc_tools/modules
% module load UNITE
% module load periscope
% module load scorep
```

Installation Checklist

Benchmark Instrumentation

Periscope Online Analysis

Performance Properties Exploration

- Change directory to the prepared NPB3.3 folder:

```
% cd $HOME/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
```

- Open the BT-MZ Makefile with an editor:

```
% vi BT-MZ/Makefile
```

- Comment out the MAIN definitions that are not for Score-P:

```
#MAIN = bt_epik
MAIN = bt_scorep
#MAIN = bt
```

- Take note of the Score-P Online Access phase definition in the prepared BT benchmark. Open the file `BT-MZ/bt_scorep.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, "OA_Phase", 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 bt-mz CLASS=B NPROCS=4
```

Installation Checklist

Benchmark Instrumentation

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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
```

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

```
% psc_frontend --apprun=./bt-mz_B.4 --strategy=OMP  
--mpinumprocs=4 --ompnumthreads=4 --phase="OA_phase"
```

```
[psc_frontend][DBG0:fe] Agent network UP and RUNNING. Starting search.
```

```
NAS Parallel Benchmarks 3.3 -- BT Benchmark
```

```
[...]
```

```
Time step 200
```

```
BT Benchmark Completed.
```

```
-----  
End Periscope run! Search took 60.5 seconds (33.3 seconds for startup)
```

Installation Checklist

Program Instrumentation

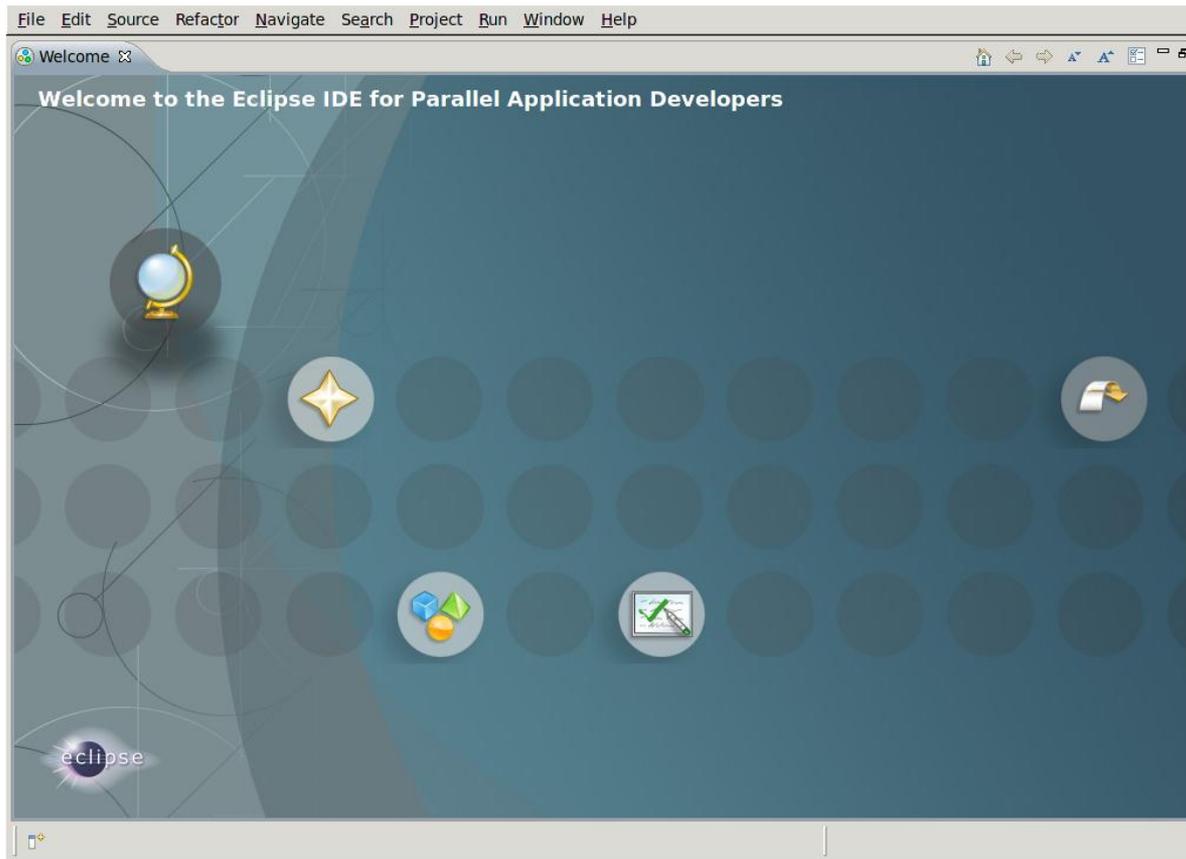
Periscope Online Analysis

Performance Properties Exploration

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

```
% module load eclipse/3.7.2-psc-gui  
% eclipse
```

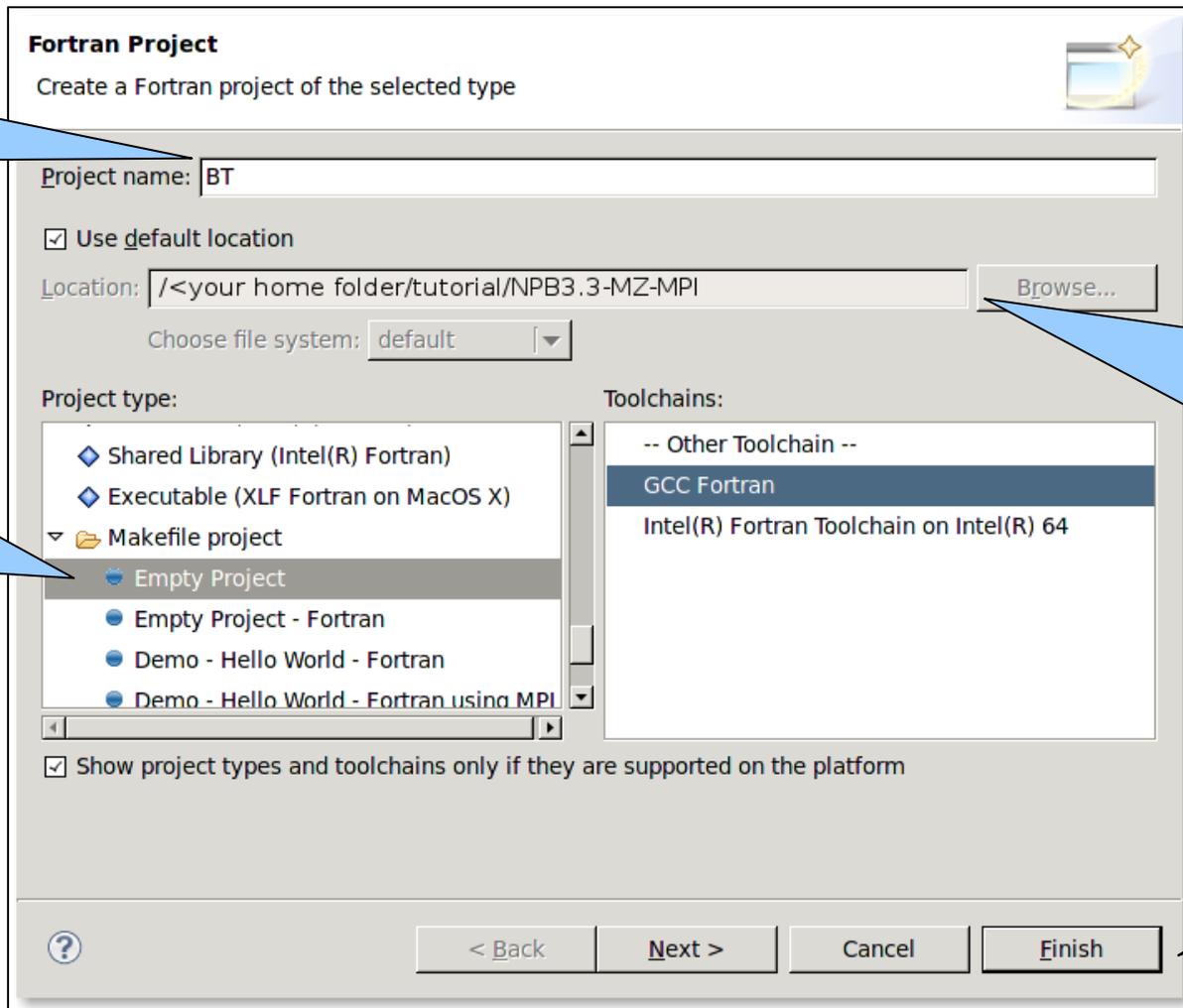
- Or by double-click on Eclipse pictogram on the Desktop



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

Input project name

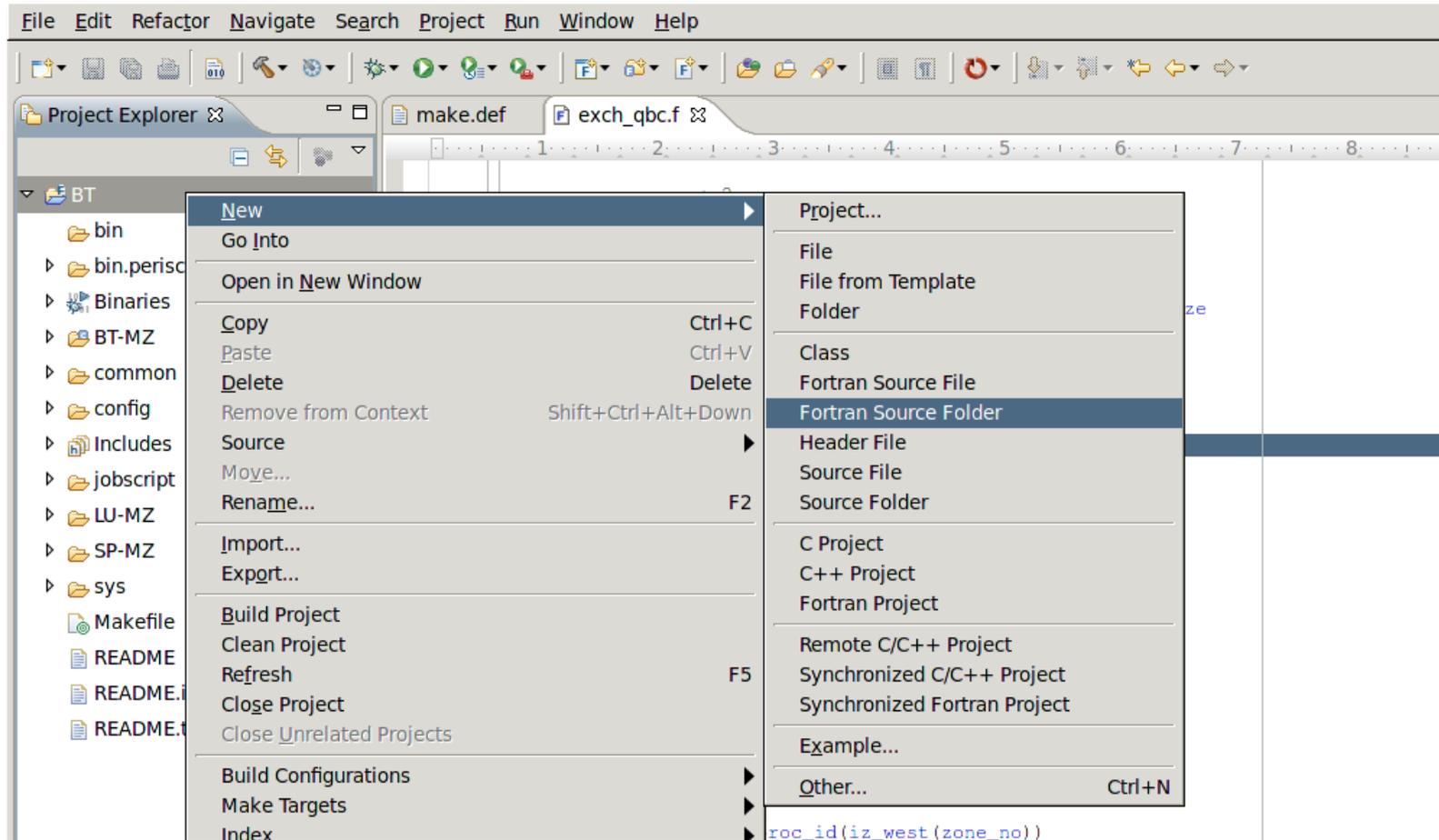
Project type



Unmark "Use default location" and provide path to BT folder

Press Finish

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



- Choose BT-MZ as a source folder

Source folder

  Exclusion patterns of 1 source folder(s) updated to solve nesting.

Project name:

Folder name:

Update exclusion filters in other source folders to solve nesting.



Loading properties



File Edit Refactor Navigate Search Project Run Window Help

Project Explorer

- BT
 - bin
 - bin.periscope
 - bt-mz_B.4
 - bt-mz_B.4.sir
 - DebugOut
 - nbp_btzmz_358118.oe
 - nbp_btzmz_358124.oe
 - properties_MPI_43987.psc

```
nr = nr + 2
qoffset = qoffset + m_size
tag = tag + num_procs
end do
else if (c_size .lt. 0) then
write(*,*) 'error: integer overflow', myid, ip, c_size
call mpi_abort(MPI_COMM_WORLD, 1, ierror)
stop
endif

if (nr .gt. 0) then
call mpi_waitall(nr, requests, statuses, ierror)
endif
```

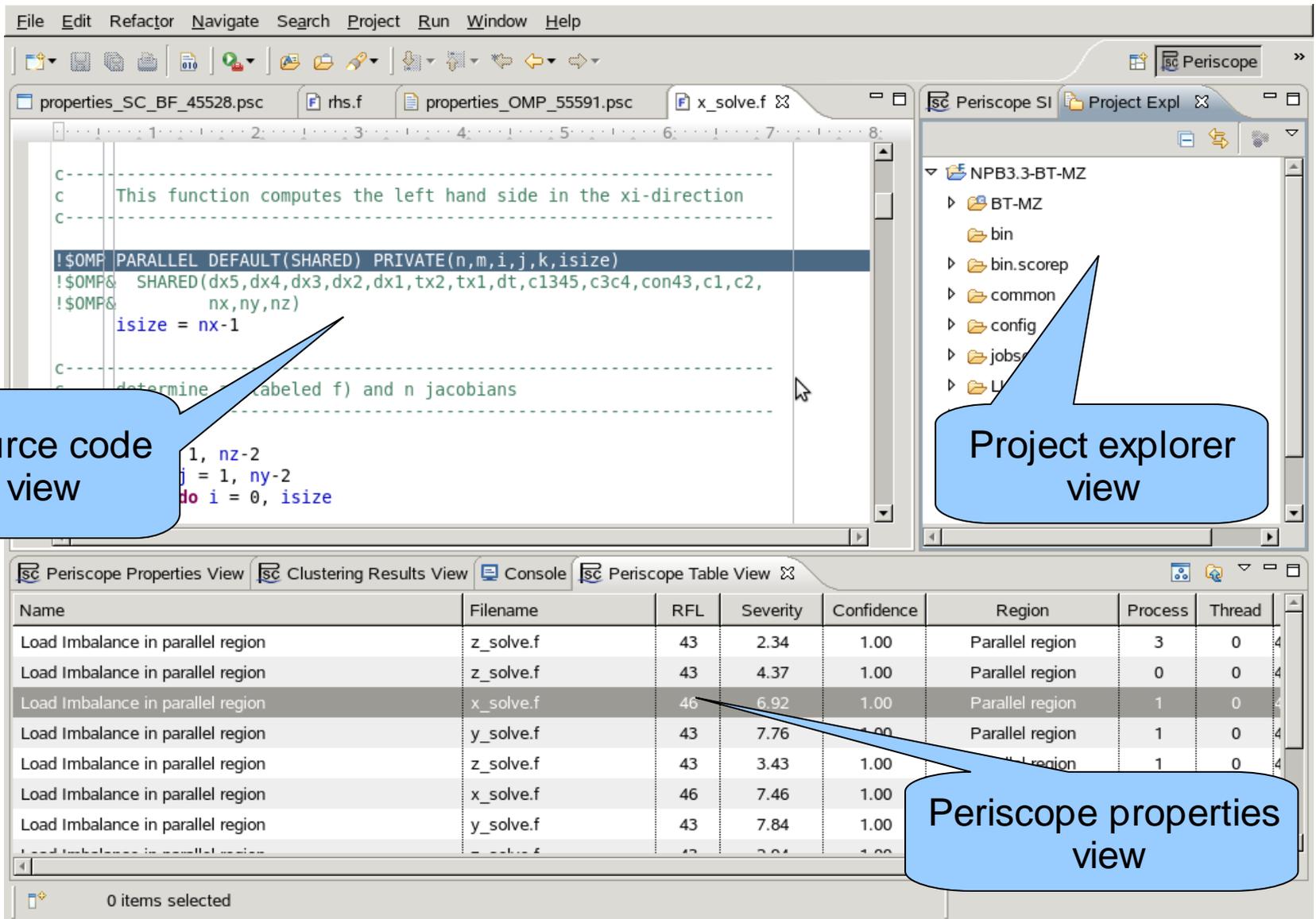
Context Menu:

- New
- Open F3
- Open With
- Copy Ctrl+C
- Paste Ctrl+V
- Delete Delete
- Remove from Context Shift+Ctrl+Alt+Down
- Mark as Landmark Shift+Ctrl+Alt+Up
- Move...
- Rename... F2
- Import...
- Export...
- Refresh F5
- Make Targets
- Validate
- Show in Remote Systems view
- Clean Selected File(s)
- Build Selected File(s)
- Run As
- Debug As
- Profile As
- Team
- Compare With
- Replace With
- Run C/C++ Code Analysis
- Periscope
 - Load all properties
 - Load properties above a severity
 - Load and cluster properties
- Properties Alt+Enter

Periscope Table View

name	RFL	Severity	Percentage	Region	Process
h_qbc.f	121	11.16	1.00	Call region	3
h_qbc.f	121	11.71	1.00	Call region	2
h_qbc.f	121	11.45	1.00	Call region	1
h_qbc.f	121	11.45	1.00	Call region	3

Expand BT project,
search for *.psc
and
Right click->Periscope->
Load all properties



The screenshot displays the Periscope GUI interface. The top menu bar includes File, Edit, Refactor, Navigate, Search, Project, Run, Window, and Help. The main workspace is divided into three panes:

- Source code view:** Shows the source code for `x_solve.f`. A callout bubble points to the code:

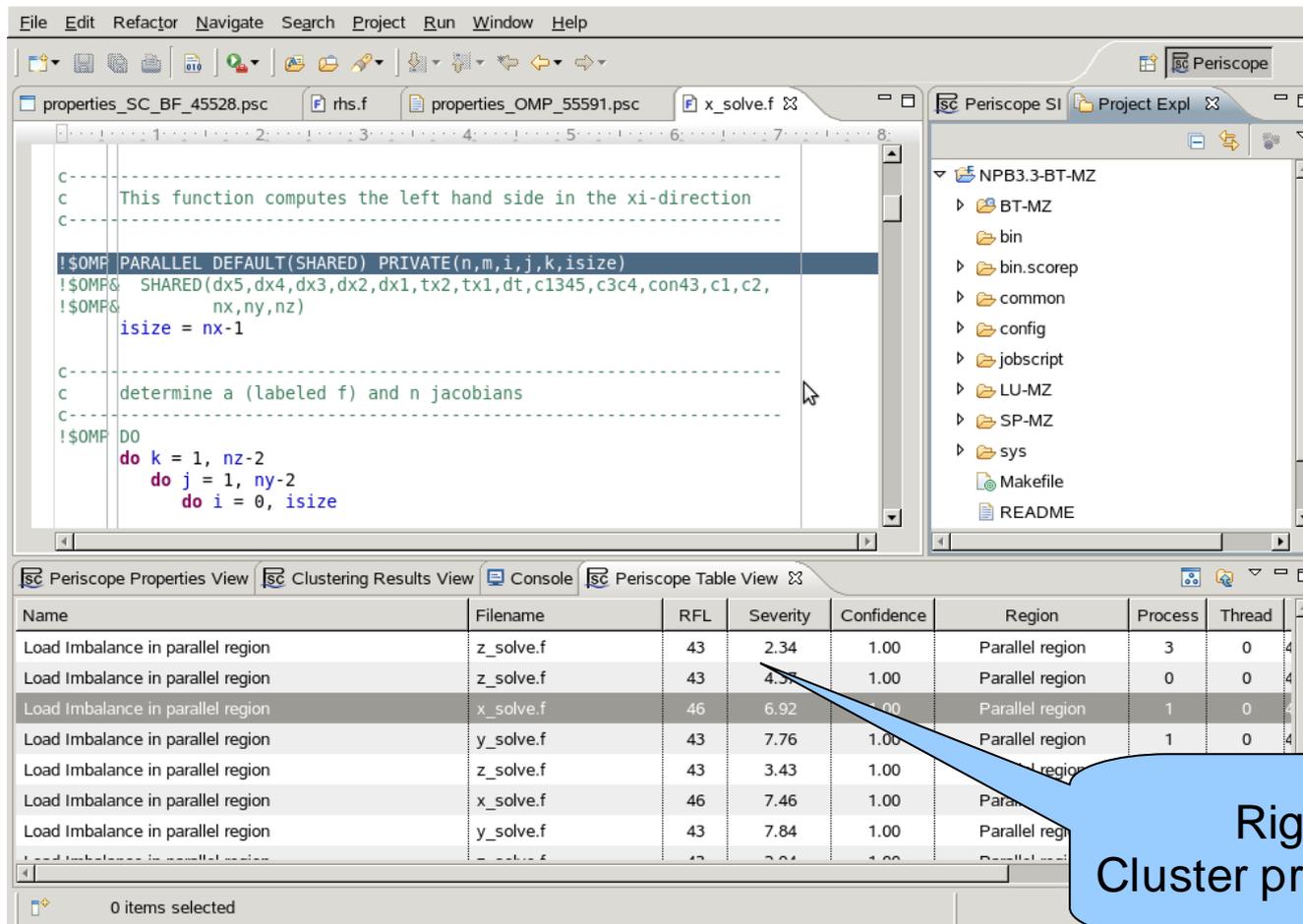
```
!$OMP PARALLEL DEFAULT(SHARED) PRIVATE(n,m,i,j,k, isize)
!$OMP SHARED(dx5,dx4,dx3,dx2,dx1,tx2,tx1,dt,c1345,c3c4,con43,c1,c2,
!$OMP nx,ny,nz)
isize = nx-1
```
- Project explorer view:** Shows a tree view of the project structure for `NPB3.3-BT-MZ`, including subdirectories like `bin`, `bin.scorep`, `common`, `config`, `jobs`, and `U`.
- Periscope properties view:** A table showing analysis results. A callout bubble points to the row for `x_solve.f`.

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	4.37	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	1	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	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).

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



The screenshot shows an IDE with a code editor and a 'Periscope Properties View' table. The code editor displays a function with OpenMP directives. The table below shows clustering results for 'Load Imbalance in parallel region' across various files.

```
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,  
!$OMP& nx, ny, nz)  
isize = nx-1  
C-----  
C determine a (labeled f) and n jacobians  
C-----  
!$OMP DO  
do k = 1, nz-2  
do j = 1, ny-2  
do i = 0, isize
```

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	1	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	1	0

0 items selected

Right-click->
Cluster properties by type

Properties clustering



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		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			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			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		
call: MPI_WAIT (x_solve.f:71)	x_solve.f	71	92.40	1.00	Regions		
Excessive MPI time in receive due to late send	x_solve.f	71			Types		Clustering squared error: 0.12/0.50
Cluster 1	x_solve.f	71	92.60		14		
Cluster 2	x_solve.f	71	92.34		2 5 6		
Excessive MPI communication time (6)	x_solve.f	71			Types		Clustering squared error: 0.13/0.50
Cluster 1	x_solve.f	71	92.36				
Cluster 2	x_solve.f	71	92.62				

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

Severity value of the Cluster 1

Region and property where clustering performed

Processes belonging To the Cluster1