

ProActive Hybrid Workflows with CPUs and GPUs and various Use Cases

D. Caromel, et al.

Agenda

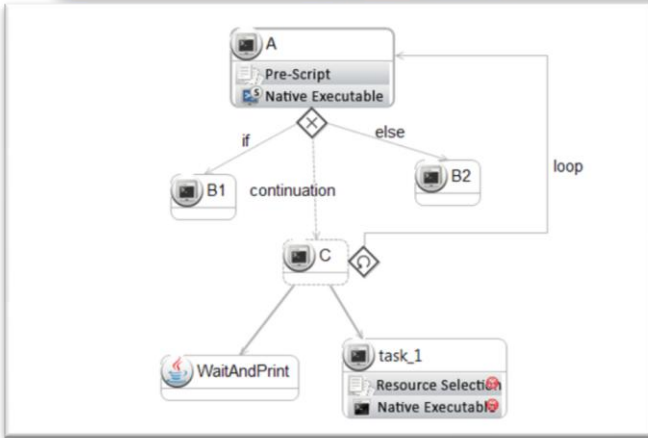
1. Background: INRIA, ActiveEon
2. Multi-Core and Virtualization
3. ProActive Parallel Suite
Programming, Scheduling, Resourcing
4. Use Cases & Demos (PACA Grid)
5. Conclusion



Cloud Computing Revolution ?



Workflow Execution Studio Editor and Visualization Parallel Programming in Java

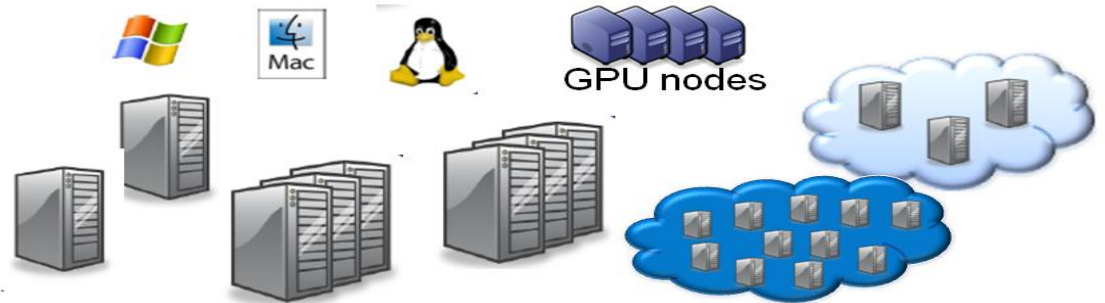
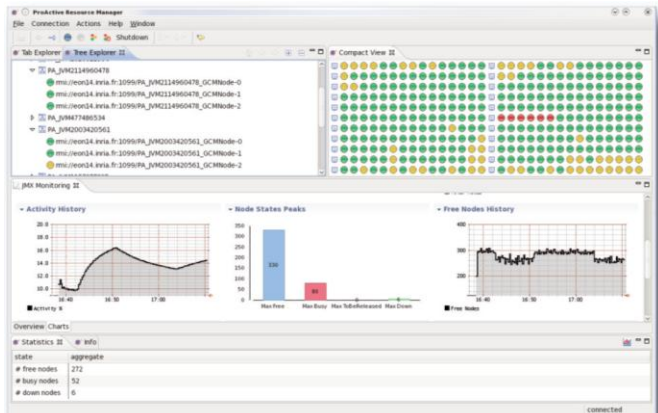


Portal, Multi-Application & Multi-Tenant Enterprise Orchestration

ID	State	User	Progress	Priority
2002	Running	border	1/3	Normal
2001	Running	border	1/3	Normal
2000	Running	border	1/3	Normal
2099	Running	border	1/3	Normal
2062	Killed	border	1/3	Normal
2010	Running	madsen	3/4	Normal
2000	Killed	madsen	3/4	Normal
2095	Finished	reaper	3/3	Normal

User	Jobs	Connected at	Last submit	Hostname
garen	0	03/16 11:17:25		4649
madsen	29	03/16 12:59:30	03/16 05:38:23	4659
border	66	03/16 04:55:39	03/16 04:17:22	4690
lobbe	1	03/17 11:35:02	03/17 11:38:11	4722
border	0	03/17 03:54:45		4722
watcher	0	03/16 02:47:14		4876
demo	0	03/16 08:33:57		4876

Physical and Virtual Machines Management



INRIA OASIS Team Composition (35)

□ Researchers (5):

- D. Caromel (UNSA, Det. INRIA)
- E. Madelaine (INRIA)
- F. Baude (UNSA)
- F. Huet (UNSA)
- L. Henrio (CNRS)

□ PhDs (11):

- Antonio Cansado (INRIA, Conic)
- Brian Amedro (SCS-Agos)
- Cristian Ruz (INRIA, Conicyt)
- Elton Mathias (INRIA-Cordi)
- Imen Filali (SCS-Agos / FP7 SO)
- Marcela Rivera (INRIA, Conicyt)
- Muhammad Khan (STIC-Asia)
- Paul Naoumenko (INRIA/Région)
- Viet Dung Doan (FP6 Bionets)
- Virginie Contes (SOA4ALL)
- Guilherme Pezzi (AGOS, CIFR)

□ + Visitors + Interns

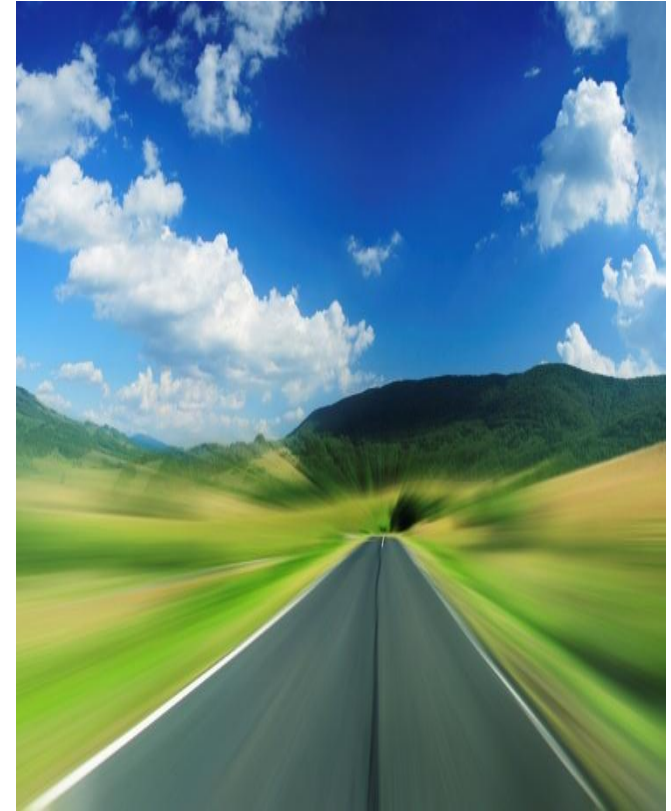


Located in Sophia Antipolis, between
Nice and Cannes,
Visitors Welcome!

- A joint team, about 35 persons
- 2004: First ProActive User Group
- 2011, July: ProActive 5.1, Distributed & Parallel:
From Multi-cores to Enterprise GRIDs & Clouds



Startup Company Born of INRIA



- ❑ Co-developing, Support for [ProActive Parallel Suite](#)
- ❑ Worldwide Customers: Fr, UK, Boston USA

ActiveEon Overview

- ❑ **ActiveEon**, a software company **born of INRIA**, founded in 2007. HQ in the French scientific park Sophia Antipolis
- ❑ **Co developing** with INRIA **ProActive Parallel Suite®**, a Professional Open Source middleware for parallel, distributed, multi-core computing
30 peoples in total
- ❑ Core mission: **Scale Beyond Limits**
- ❑ Providing a **full range of services** for **ProActive Parallel Suite**
- ❑ **Worldwide** customers and production users:

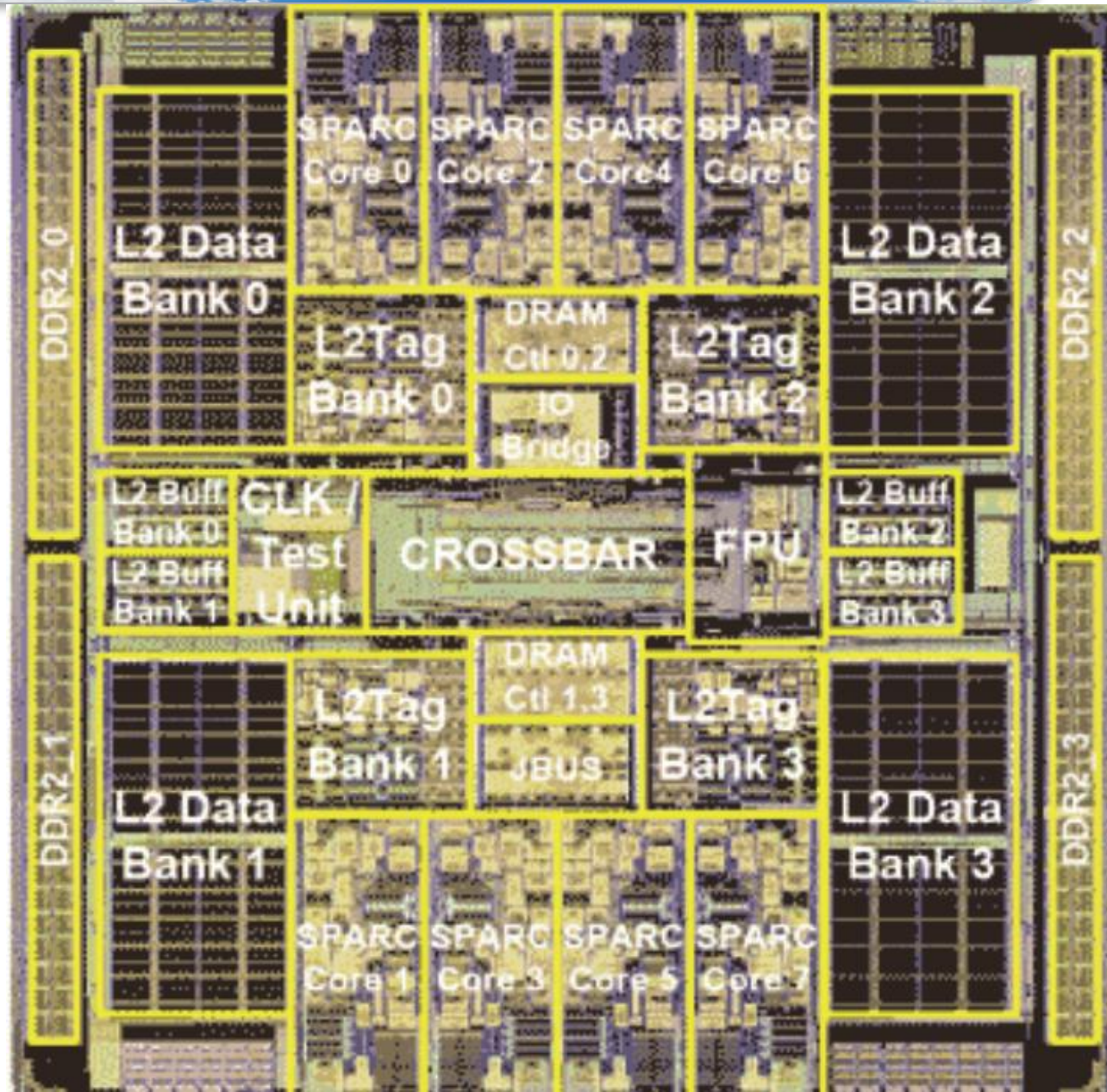




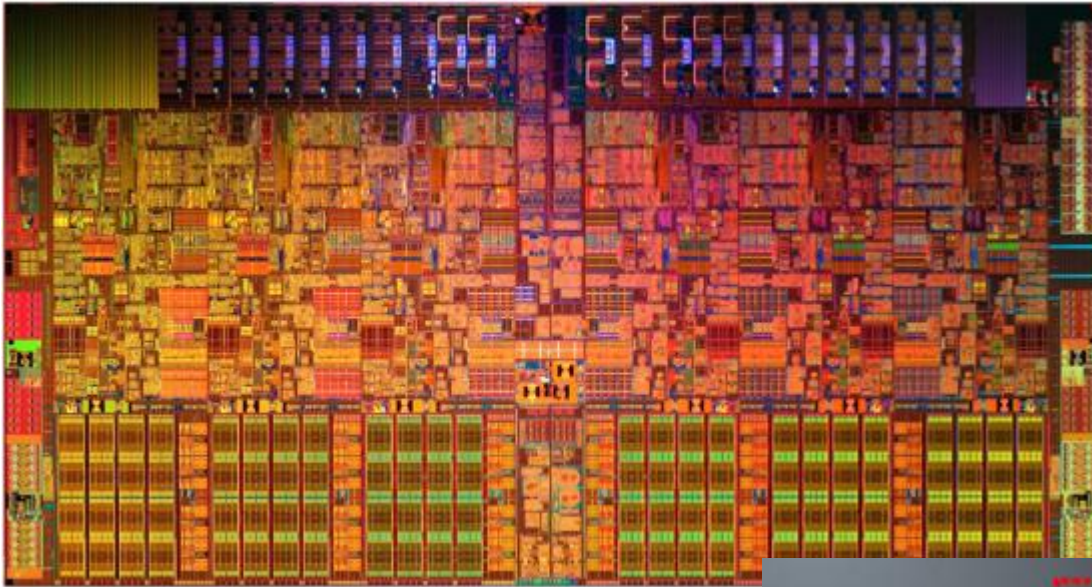
Multi-Core Push

Symmetrical Multi-Core: 8-ways Niagara II

- ❑ 8 cores
- ❑ 4 Native threads per core
- ❑ Linux see 32 cores!

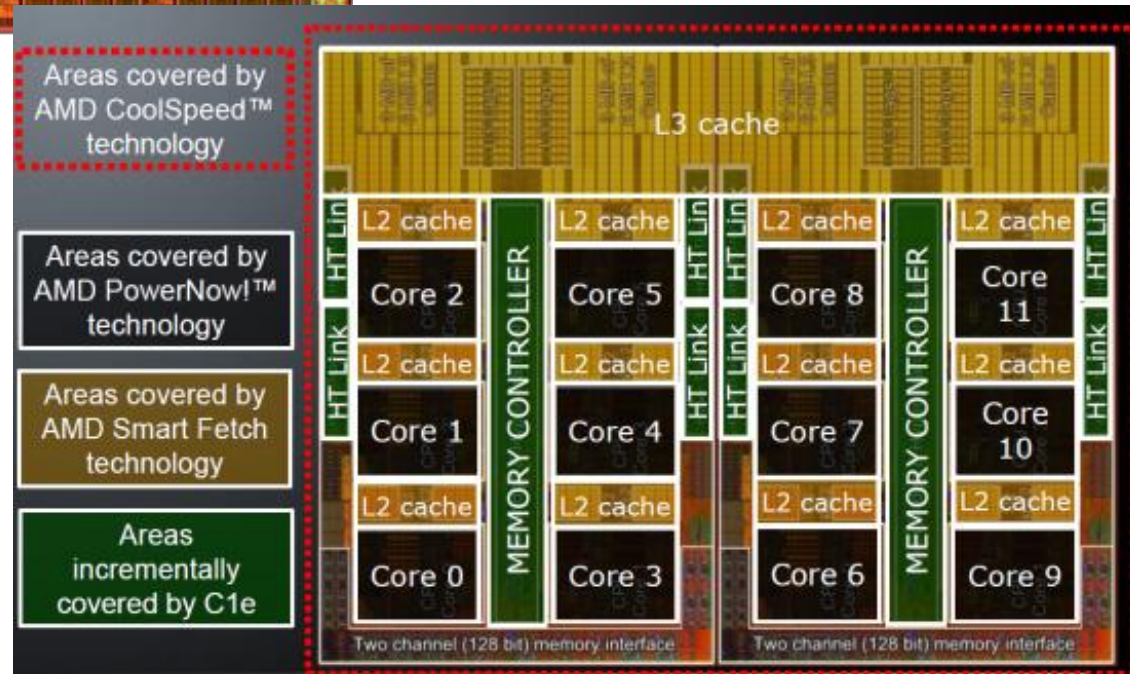


Off The Shelf Multi-Cores, 3 GHz



AMD's Opteron 6174,
"Magny-Cours",
12 cores

Intel Xeon 5670,
6 cores, 10, ... 12



Multi-Cores

A Few Key Points

- ❑ Not Shared Memory (NUMA)
- ❑ Moore's Law rephrased:
 - Nb. of Cores double every 18 to 24 months
- ❑ Key expected Milestones: Cores per Chips (OTS)
 - 2012: 32 to 64
 - 2013: 64 to 128
 - 2015: 128 to 256
- 1 Million Cores Parallel Machines in 2014
- 100 M cores coming in 2020
- ❑ Multi-Cores are NUMA, and turning Heterogeneous (GPU)
They are turning into SoC with NoC: NOT SMP!

A blue background with a white grid pattern, resembling a circuit board or a data visualization. The text is centered in white.

Key Point: Locality will more than ever be Fundamental

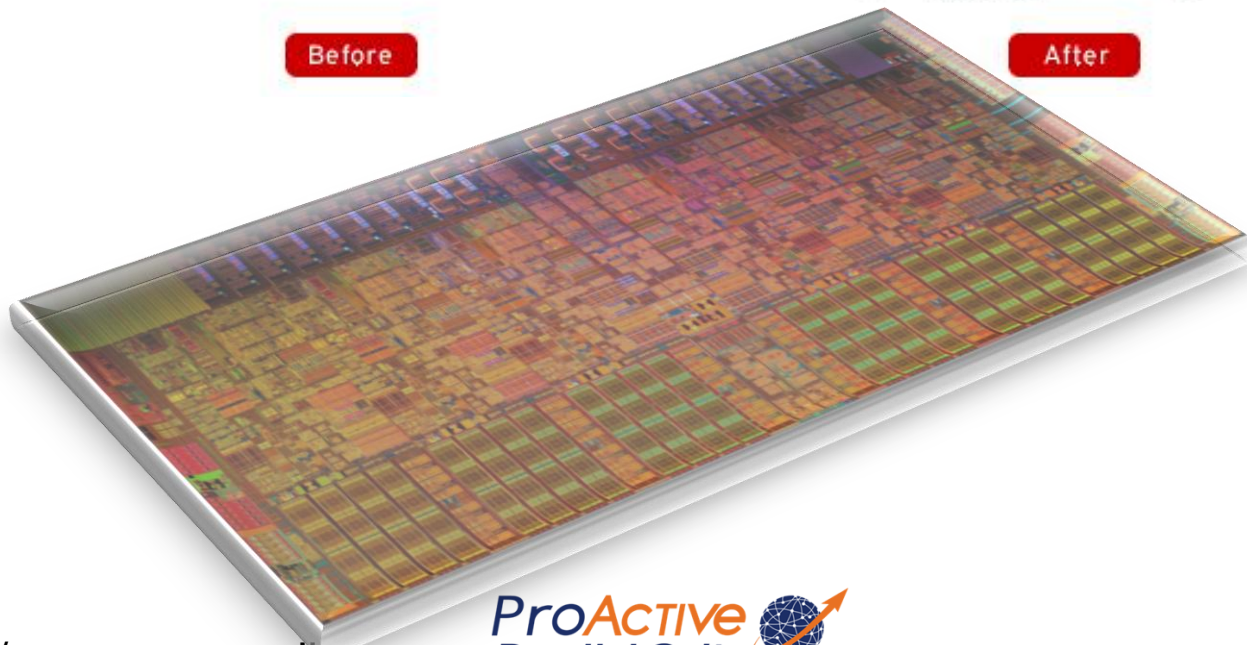
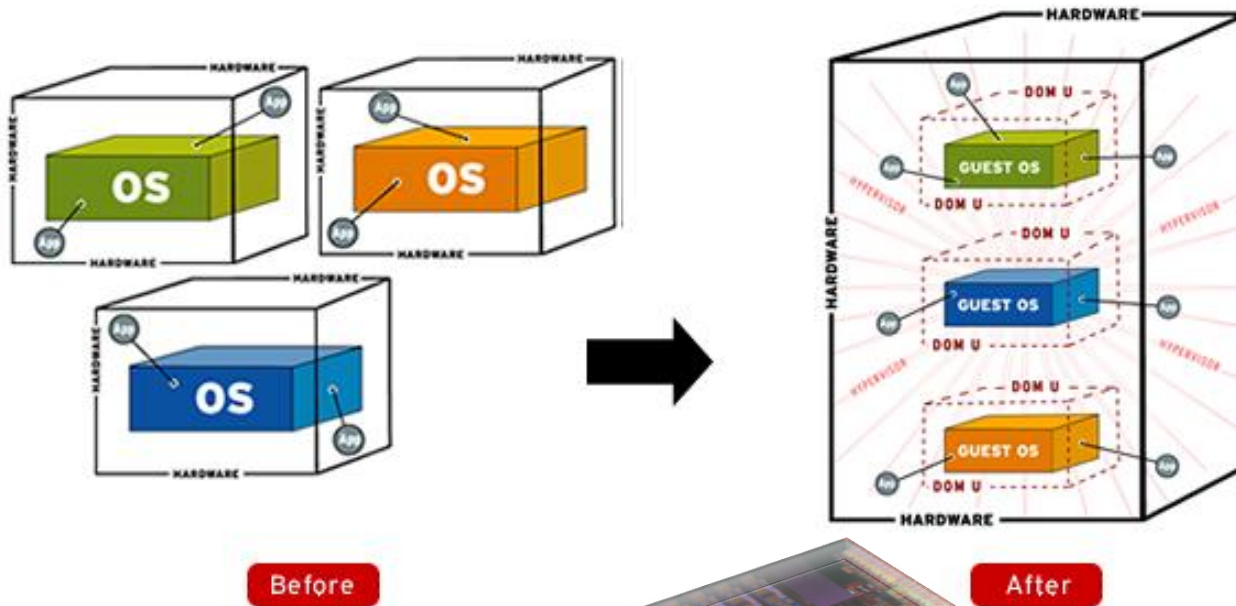
- ❑ Let the programmer control it
- ❑ No global shared memory

*At user choice **PGAS**: Partitioned Global Address Space*

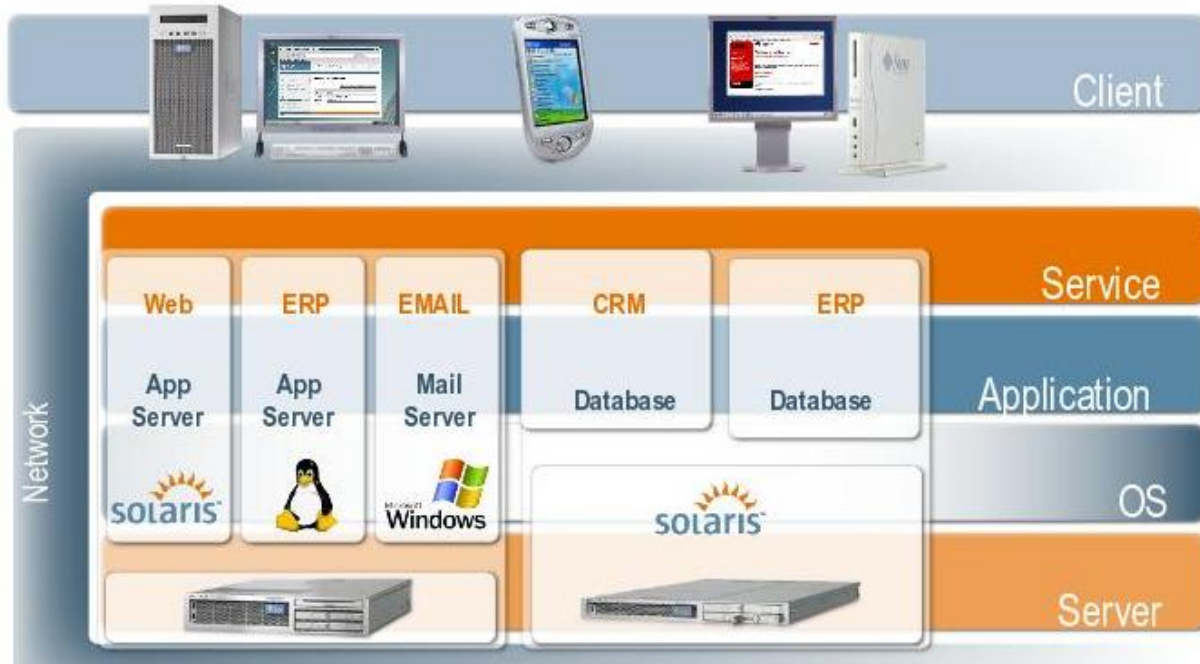


Virtualization

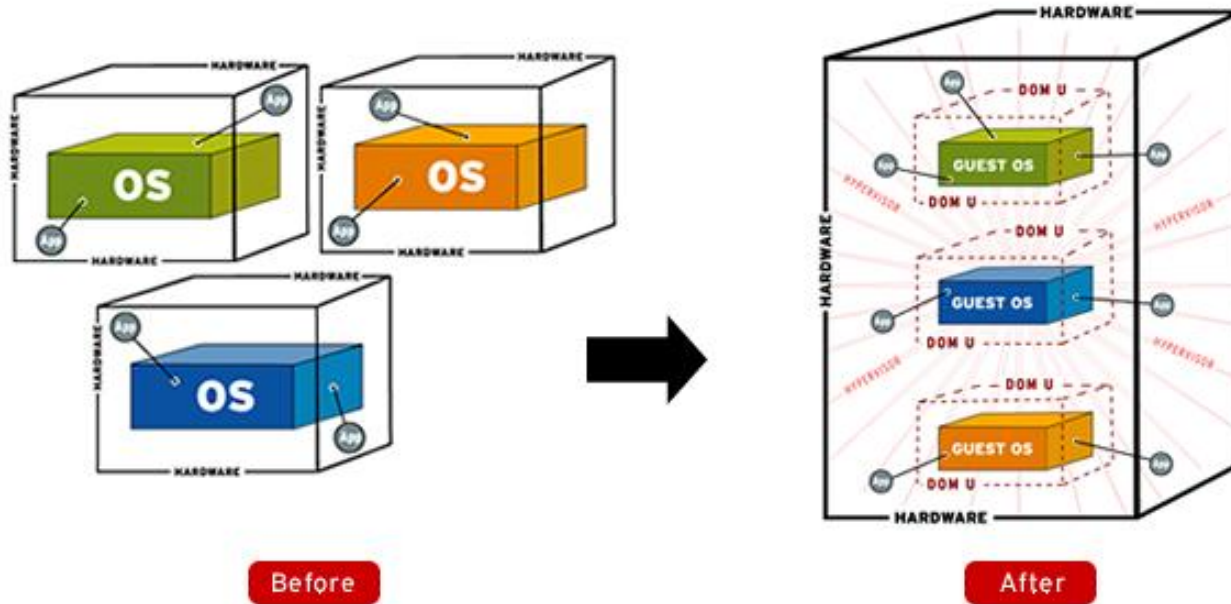
Virtualization



Virtualization



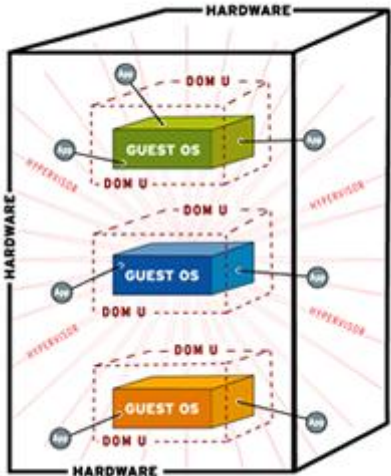
Virtualization



What we Used to do as Syst. Admin.



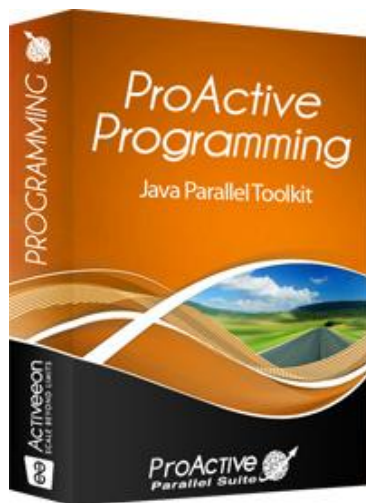
With Virtualization + Software Appliance



ProActive Parallel Suite

ProActive Parallel Suite

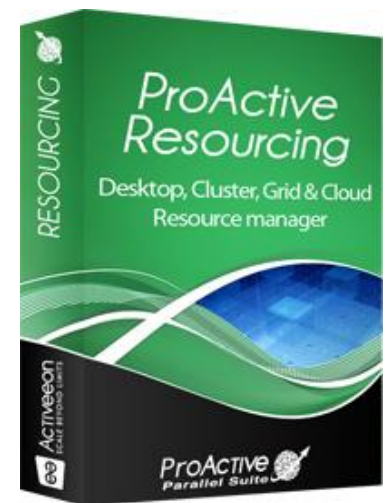
- ❑ Professional Open Source middleware for parallel, distributed, multi-core, Grid and Cloud computing
- ❑ Composed of three modules:



Java
Programming Library

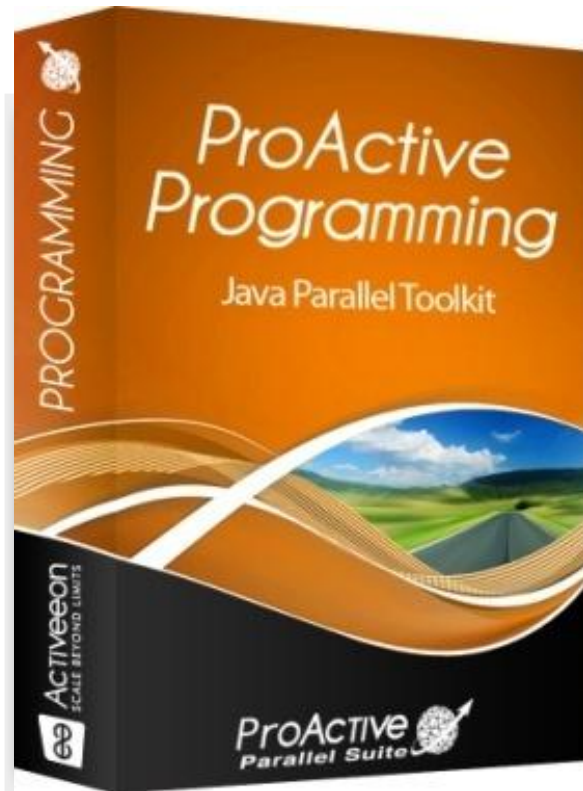


Multiplatform
Job scheduler



Global
resource manager

ProActive Parallel Suite

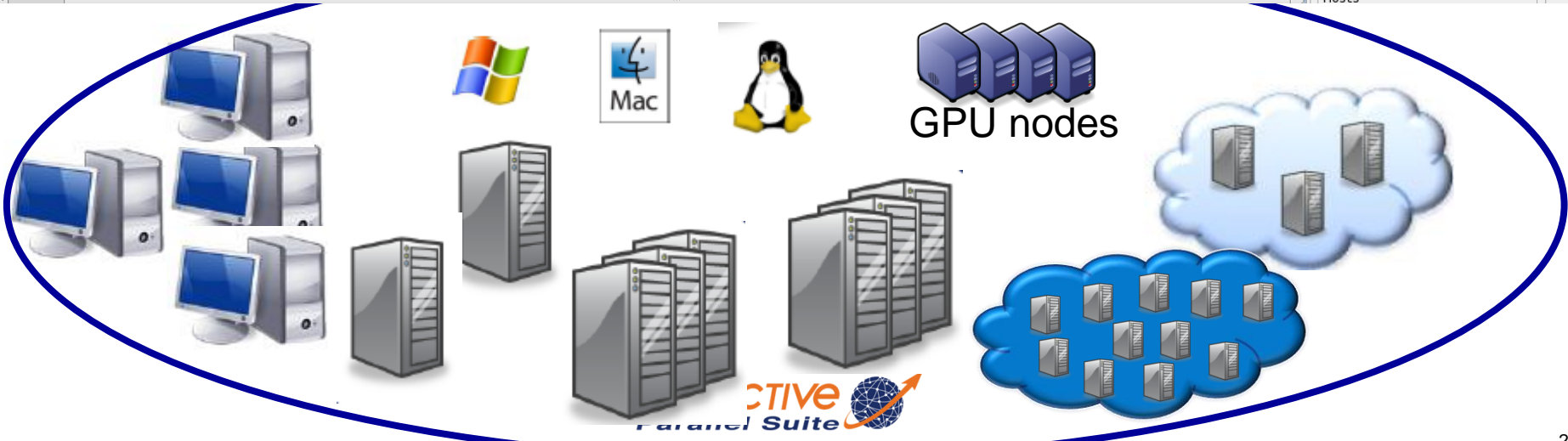
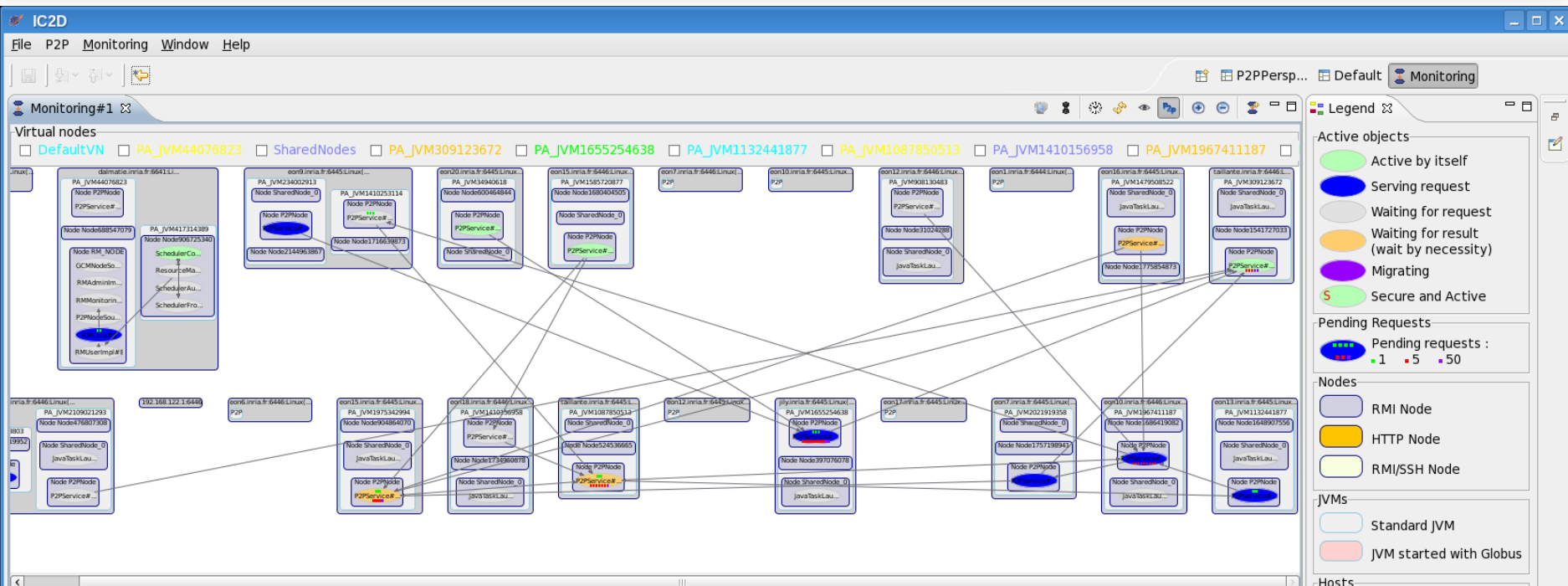


- Workflows in Java
- Master/Workers
- SPMD
- Components
- ...

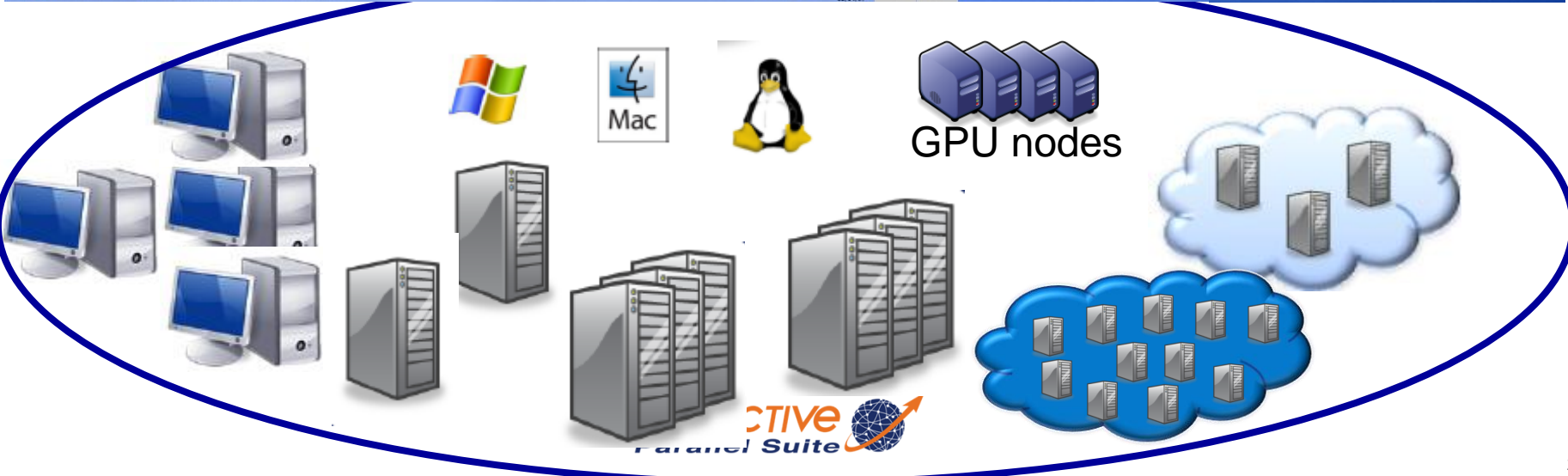
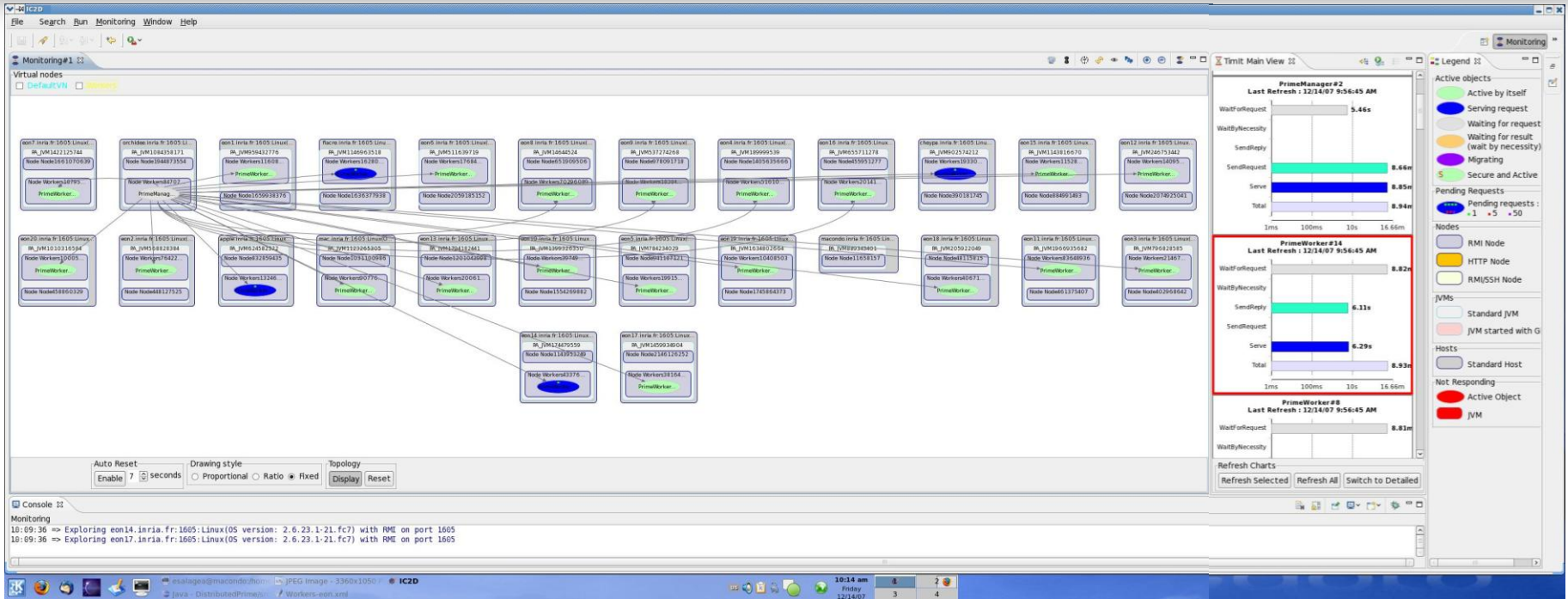
Core API
Active Objects
Asynchrony
Futures
Groups
Mobile Agents
MOP / AOP

ProActive Programming: Active Objects

ProActive Programming View



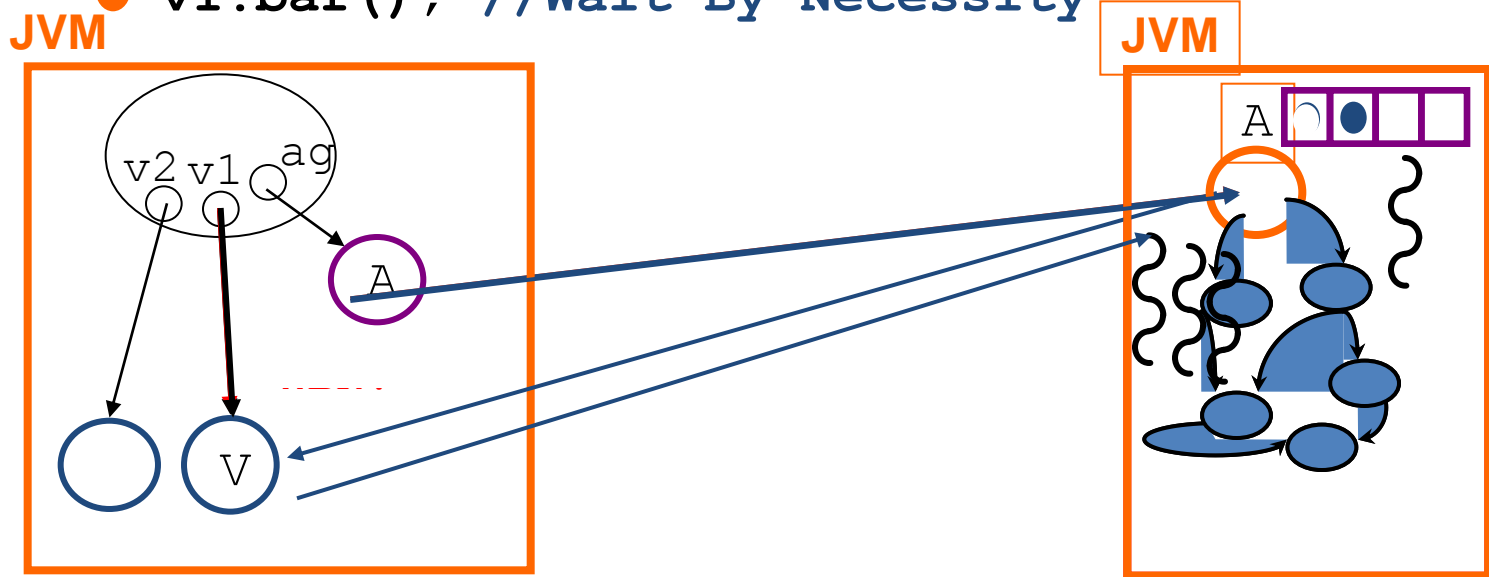
ProActive Programming View



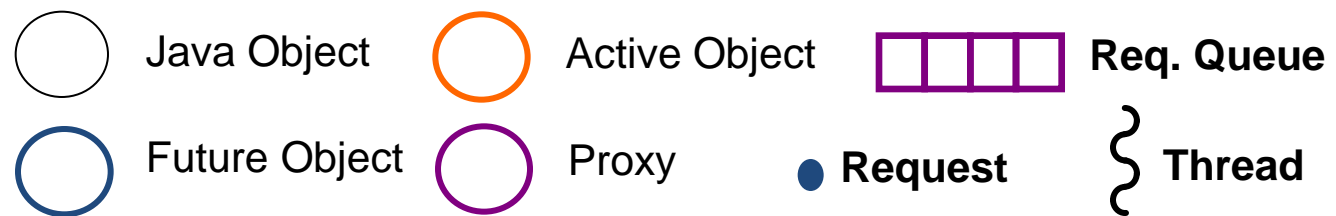
ProActive: Active objects

```

● A ag = newActive ("A", [...], VirtualNode)
● V v1 = ag.foo (param);
● V v2 = ag.bar (param);
...
● v1.bar (); //Wait-By-Necessity
    
```



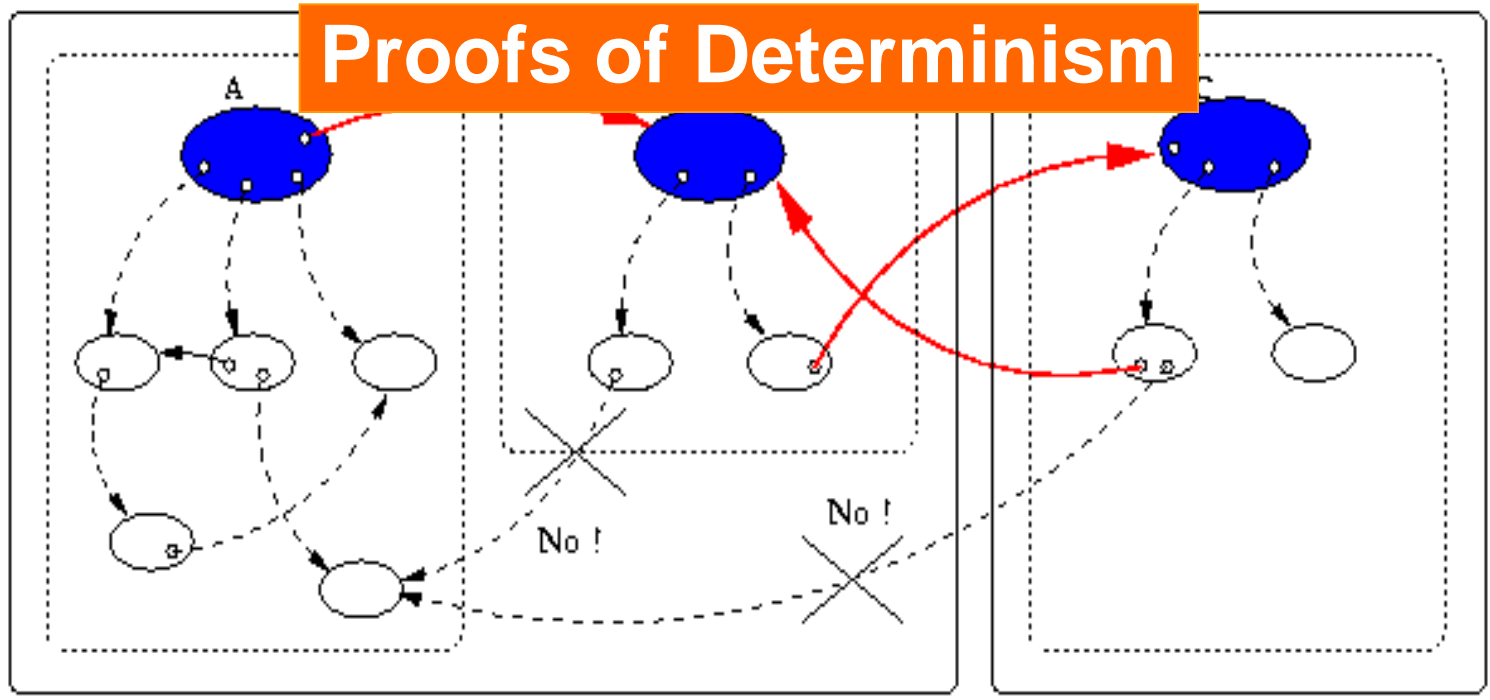
Wait-By-Necessity
is a
Dataflow
Synchronization



Standard system at Runtime: No Sharing

NoC: Network On Chip

Proofs of Determinism



- Active Object
- Passive Object
- Synchronous Call
- Asynchronous Call
- Sub System
- Address Space

ASP: Asynchronous Sequential Processes

$$\frac{(a, \sigma) \rightarrow_S (a', \sigma')}{\alpha[a; \sigma; \iota; F; R; f] \parallel P \longrightarrow \alpha[a'; \sigma'; \iota; F; R; f] \parallel P} \text{ (LOCAL)}$$

Local

$$\frac{\begin{array}{l} \gamma \text{ fresh activity} \quad \iota' \notin \text{dom}(\sigma) \quad \sigma' = \{\iota' \mapsto AO(\gamma)\} :: \sigma \\ \sigma_\gamma = \text{copy}(\iota'', \sigma) \quad \text{Service} = (\text{if } m_j = \emptyset \text{ then } \text{FifoService} \text{ else } \iota''.m_j()) \end{array}}{\alpha[\mathcal{R}[\text{Active}(\iota'', m_j)]; \sigma; \iota; F; R; f] \parallel P \longrightarrow \alpha[\mathcal{R}[\iota']; \sigma'; \iota; F; R; f] \parallel \gamma[\text{Service}; \sigma_\gamma; \iota''; \emptyset; \emptyset; \emptyset] \parallel P} \text{ (NEWACT)}$$

Creating an Activity

$$\frac{\begin{array}{l} \sigma_\alpha(\iota) = AO(\beta) \quad \iota'' \notin \text{dom}(\sigma_\beta) \quad f_i^{\alpha \rightarrow \beta} \text{ new future} \quad \iota_f \notin \text{dom}(\sigma_\alpha) \\ \sigma'_\beta = \text{Copy\&Merge}(\sigma_\alpha, \iota' ; \sigma_\beta, \iota'') \quad \sigma'_\alpha = \{\iota_f \mapsto \text{fut}(f_i^{\alpha \rightarrow \beta})\} :: \sigma_\alpha \end{array}}{\alpha[\mathcal{R}[\iota.m_j(\iota')]; \sigma_\alpha; \iota_\alpha; F_\alpha; R_\alpha; f_\alpha] \parallel \beta[a_\beta; \sigma_\beta; \iota_\beta; F_\beta; R_\beta; f_\beta] \parallel P \longrightarrow \alpha[\mathcal{R}[\iota_f]; \sigma'_\alpha; \iota_\alpha; F_\alpha; R_\alpha; f_\alpha] \parallel \beta[a_\beta; \sigma'_\beta; \iota_\beta; F_\beta; R_\beta :: [m_j; \iota''; f_i^{\alpha \rightarrow \beta}]; f_\beta] \parallel P} \text{ (REQUEST)}$$

Sending a Request

$$\frac{R = R' :: [m_j; \iota_r; f'] :: R'' \quad m_j \in M \quad \forall m \in M, m \notin R'}{\alpha[\mathcal{R}[\text{Serve}(M)]; \sigma; \iota; F; R; f] \parallel P \longrightarrow \alpha[\iota.m_j(\iota_r) \uparrow f, \mathcal{R}[\Box]; \sigma; \iota; F; R' :: R''; f'] \parallel P} \text{ (SERVE)}$$

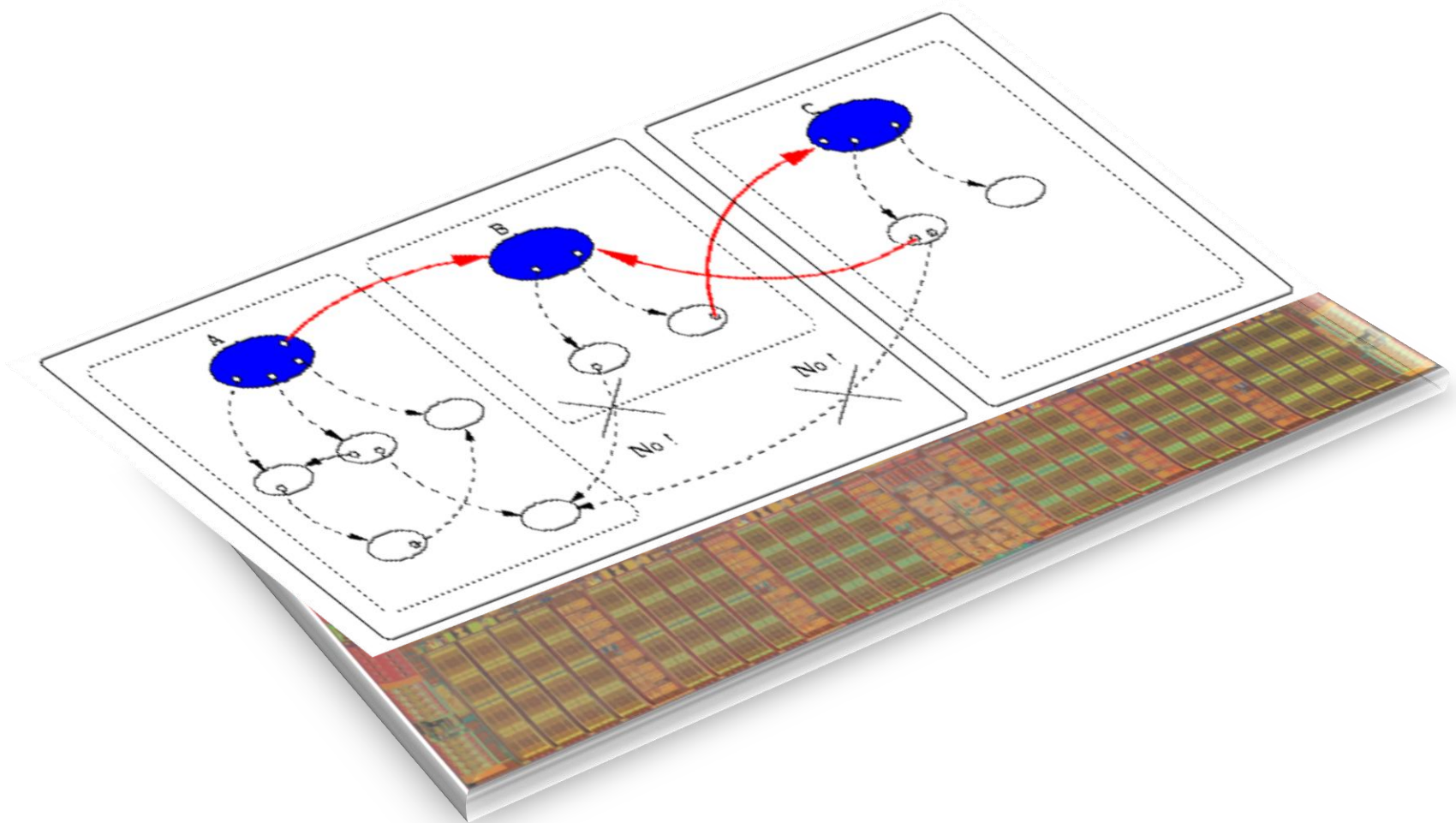
Service

$$\frac{\iota' \notin \text{dom}(\sigma) \quad F' = F :: \{f \mapsto \iota'\} \quad \sigma' = \text{Copy\&Merge}(\sigma, \iota ; \sigma, \iota')}{\alpha[\iota \uparrow (f', a); \sigma; \iota; F; R; f] \parallel P \longrightarrow \alpha[a; \sigma'; \iota; F'; R; f'] \parallel P} \text{ (ENDSERVICE)}$$

$$\frac{\sigma_\alpha(\iota) = \text{fut}(f_i^{\gamma \rightarrow \beta}) \quad F_\beta(f_i^{\gamma \rightarrow \beta}) = \iota_f \quad \sigma'_\alpha = \text{Copy\&Merge}(\sigma_\beta, \iota_f ; \sigma_\alpha, \iota)}{\alpha[a_\alpha; \sigma_\alpha; \iota_\alpha; F_\alpha; R_\alpha; f_\alpha] \parallel \beta[a_\beta; \sigma_\beta; \iota_\beta; F_\beta; R_\beta; f_\beta] \parallel P \longrightarrow \alpha[a_\alpha; \sigma'_\alpha; \iota_\alpha; F_\alpha; R_\alpha; f_\alpha] \parallel \beta[a_\beta; \sigma_\beta; \iota_\beta; F_\beta; R_\beta; f_\beta] \parallel P} \text{ (REPLY)}$$

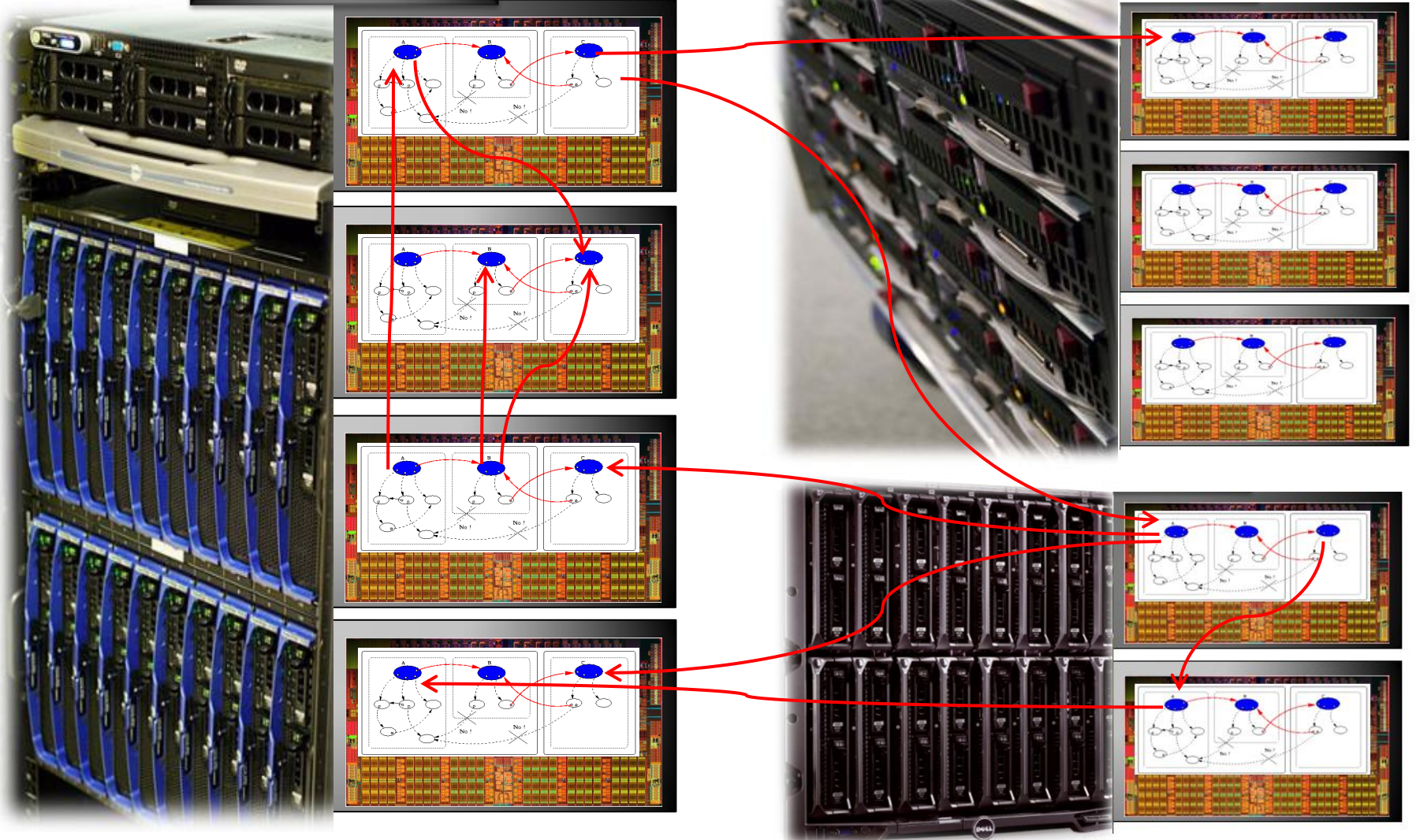
Sending a Reply

Distributed Objects On Chip



Distributed Objects On Chip, Boards, Clouds

Bi-Socket Board

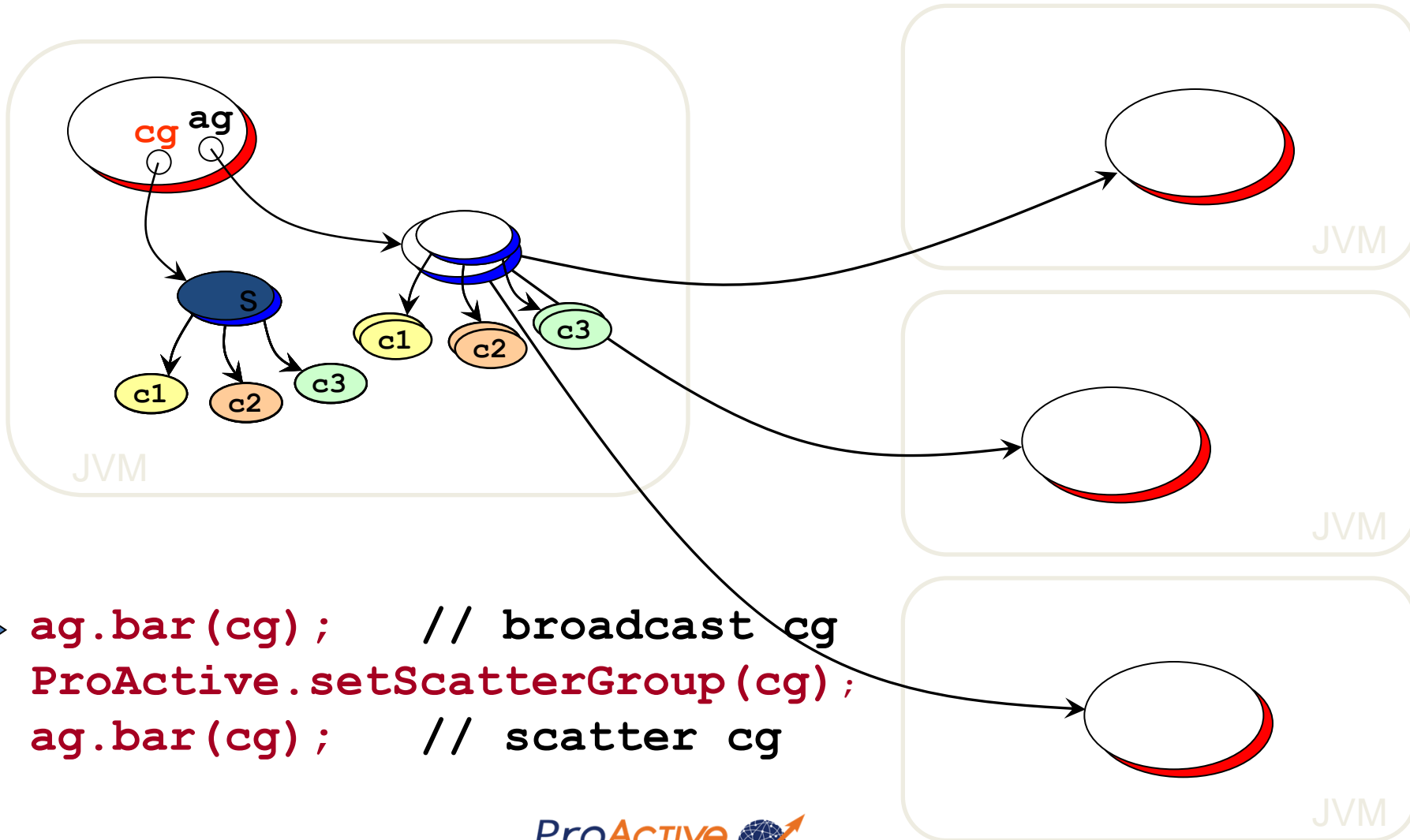


TYPED ASYNCHRONOUS GROUPS

Broadcast and Scatter

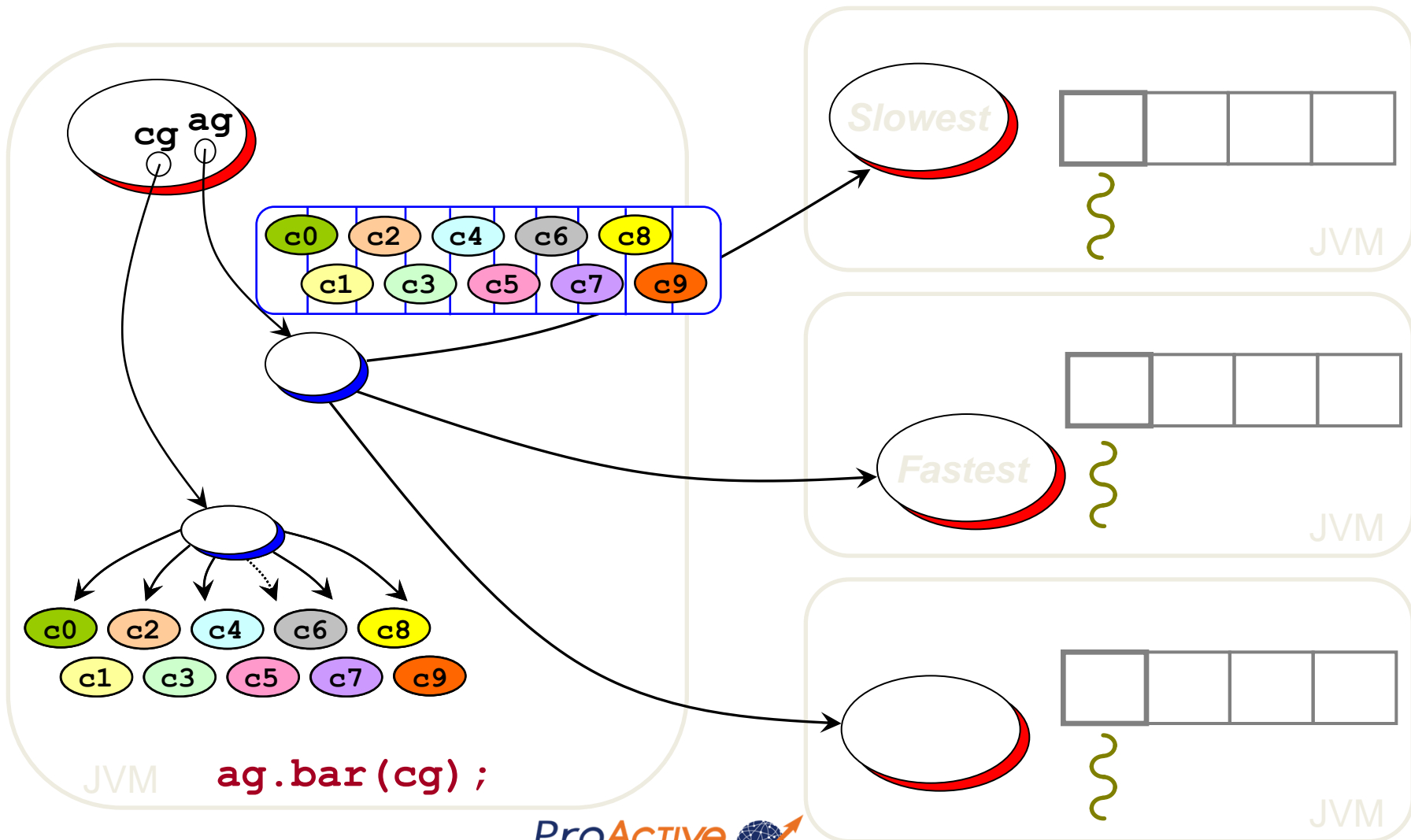
Broadcast is the default behavior

Use a group as parameter, Scattered depends on rankings



```
ag.bar (cg) ; // broadcast cg  
ProActive.setScatterGroup (cg) ;  
ag.bar (cg) ; // scatter cg
```


Dynamic Dispatch Group



Object-Oriented SPMD

Key Point

- ❑ **“MPI and programming languages from the 60’s will not make it”**
 - **Jack Dongarra, 2/13/2009,**
 - **Wake Forest University talk**
- ❑ **“It is time to get ride of MPI”**
 - **Alan Edelman, MIT, 06/16/2010,**
 - **ScilabTec’10 Users’ Day**

OO SPMD: Object-Oriented SPMD

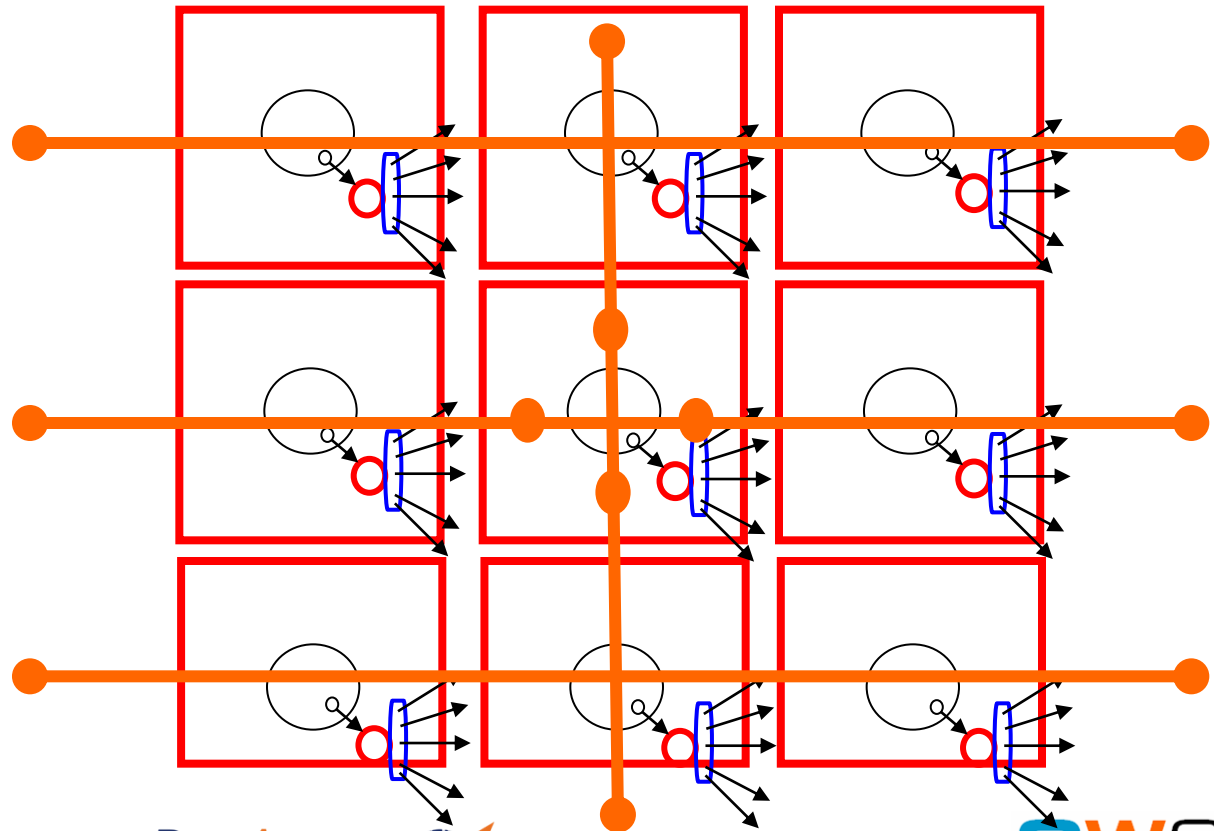
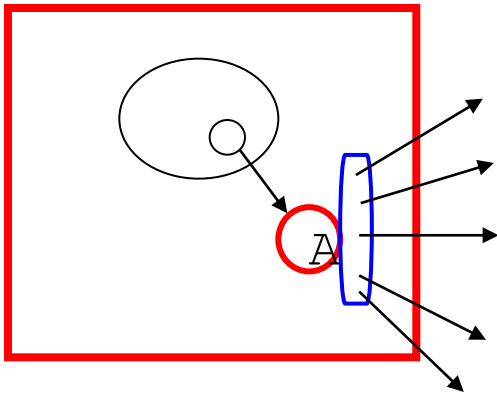
● A ag = `newSPMDGroup ("A", [...], VirtualNode)`

// In each member

● `myGroup.barrier ("2D"); // Global Barrier`

● `myGroup.barrier ("vertical"); // Any Barrier`

● `myGroup.barrier ("north", "south", "east", "west");`



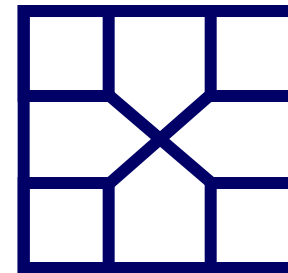
NAS Parallel Benchmarks

- Experimented on 3D ElectroMagnetism, and Nasa Benchmarks
- **Designed by NASA to evaluate benefits of high performance systems**
- **Strongly based on CFD**
- **5 benchmarks (kernels) to test different aspects of a system**
- **2 categories or focus variations:**
 - **communication intensive and computation intensive**

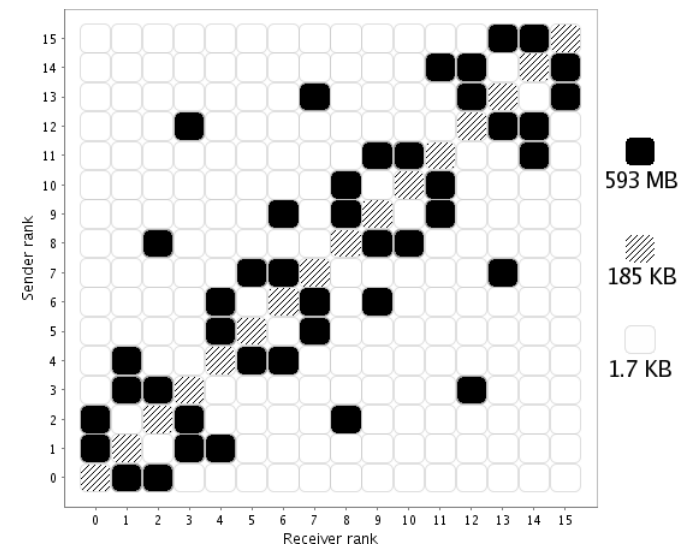
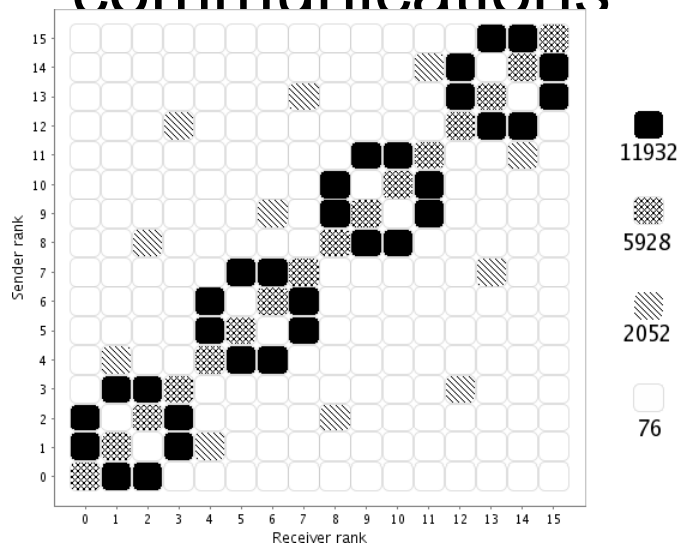


Communication Intensive CG Kernel (Conjugate Gradient)

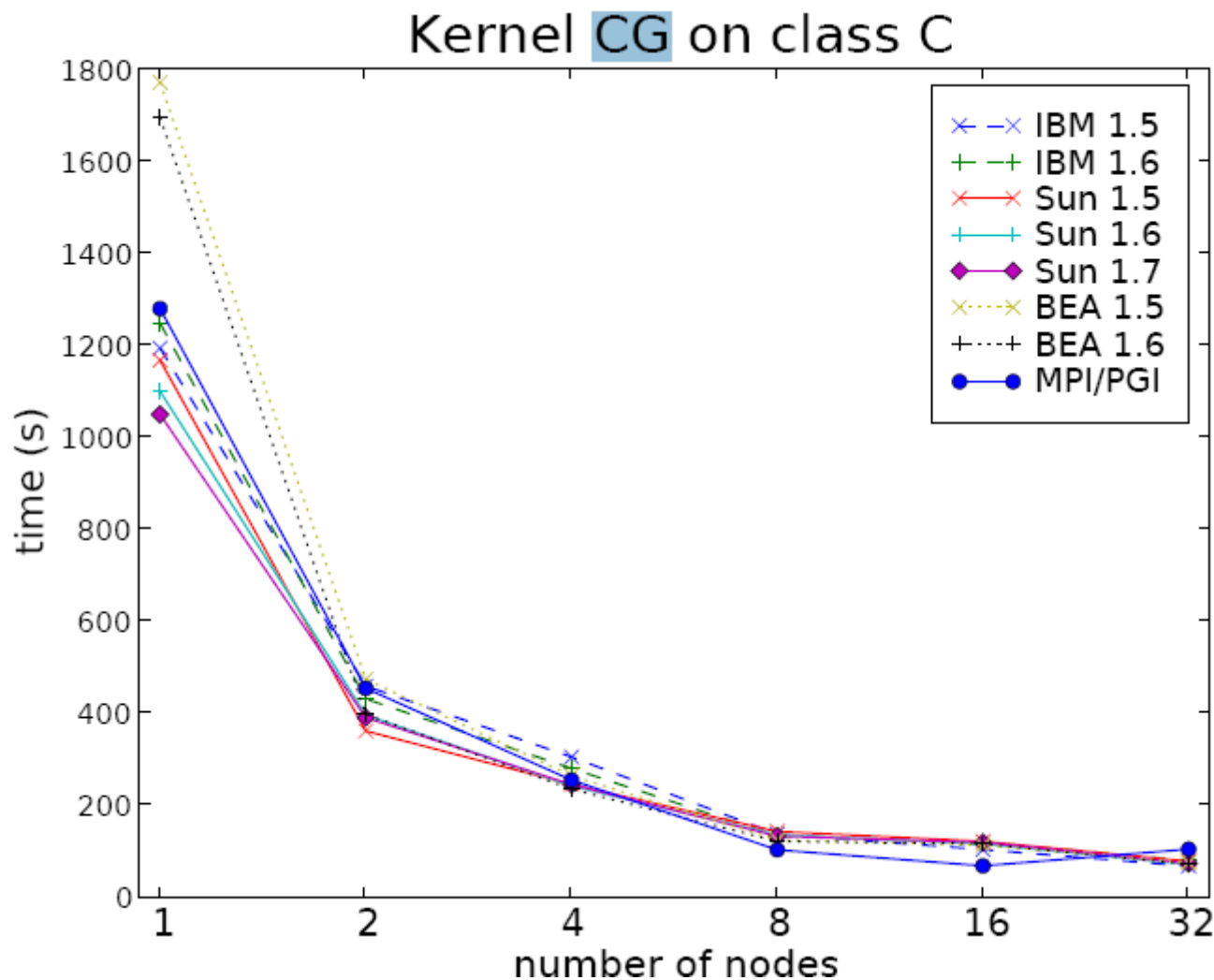
- ❑ Floating point operations
- ❑ Eigen value computation
- ❑ High number of unstructured communications



- 12000 calls/node
- 570 MB sent/node
- 1 min 32
- 65 % comms/WT



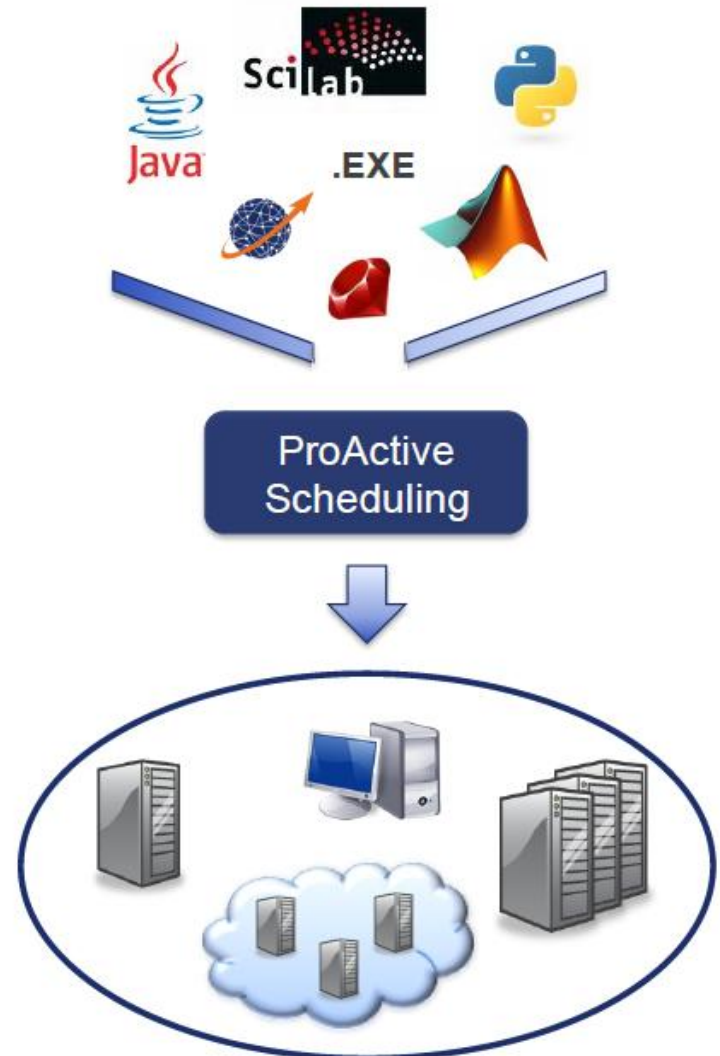
Communication Intensive CG Kernel (Conjugate Gradient)



← Comparable Performances

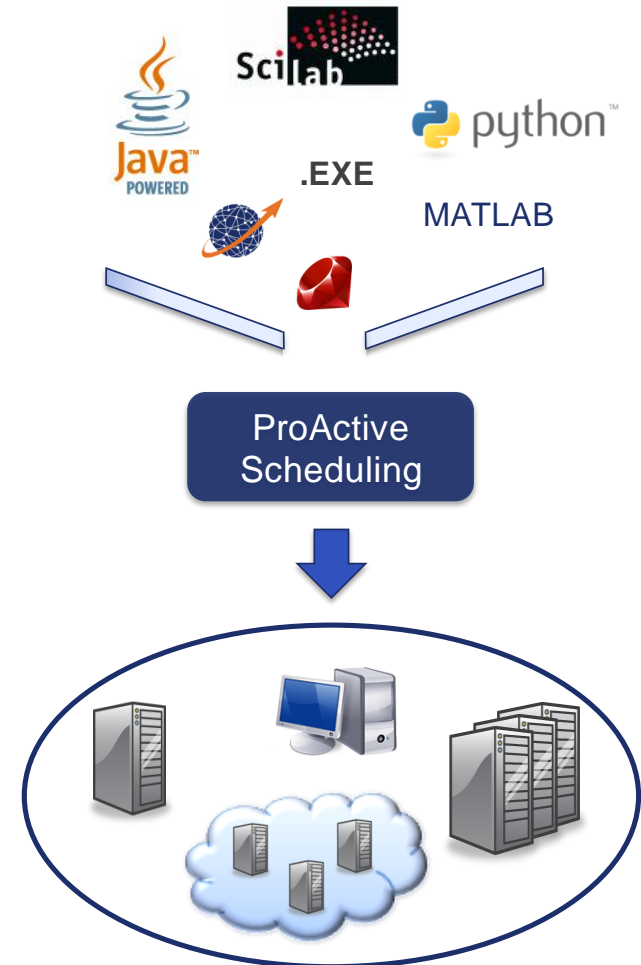
Scheduling and Workflow Orchestration

ProActive Scheduling



ProActive Scheduling

- ❑ Job Scheduling
- ❑ Optimize:
 - workload distribution
 - computing resources usage
 - software licences
- ❑ Straightforward **batch, jobs and workflow** construction
- ❑ Any kind of jobs supported:
 - Java, Applications and Scripts
- ❑ Data management with automatic transfer



ProActive Scheduling Big Picture

The screenshot displays the ProActive Scheduler interface with three main panels: Pending (674), Running (60), and Finished (31). The 'Job Info' panel is expanded for job 2008, showing its tasks and their status.

Pending (674)

Id	State	User	Priority	Name
1996	Pending	jl	Normal	job_with_dep
1997	Pending	jl	Normal	job_with_dep
1998	Pending	jl	Normal	job_with_dep
1999	Pending	jl	Normal	job_with_dep
2000	Pending	jl	Normal	job_with_dep
2001	Pending	jl	Normal	job_with_dep
2002	Pending	jl	Normal	job_with_dep
2003	Pending	jl	Normal	job_with_dep
2004	Pending	jl	Normal	job_with_dep
2005	Pending	jl	Normal	job_with_dep
2006	Pending	jl	Normal	job_with_dep
2007	Pending	jl	Normal	job_with_dep
2008	Pending	jl	Normal	job_with_dep
2009	Pending	jl	Normal	job_with_dep
2010	Pending	jl	Normal	job_with_dep

Running (60)

Id	State	Progress	# Finished	User	Priority
1313	Running	[Progress Bar]	4/8	user1	Normal
1314	Running	[Progress Bar]	4/8	user1	Normal
1315	Running	[Progress Bar]	7/8	admin	Normal
1316	Running	[Progress Bar]	4/8	user1	Normal
1317	Running	[Progress Bar]	7/8	admin	Normal
1318	Running	[Progress Bar]	4/8	user1	Normal
1319	Running	[Progress Bar]	7/8	admin	Normal
1320	Running	[Progress Bar]	3/8	user1	Normal
1321	Running	[Progress Bar]	7/8	admin	Normal
1322	Running	[Progress Bar]	3/8	user1	Normal
1323	Running	[Progress Bar]	7/8	admin	Normal
1324	Running	[Progress Bar]	2/8	user1	Normal
1325	Running	[Progress Bar]	2/8	user1	Normal
1326	Running	[Progress Bar]	2/8	user1	Normal
1327	Running	[Progress Bar]	2/8	user1	Normal

Finished (31)

Id	State	User	Priority	Name
010	Finished	jl	Low	job_proActive
008	Finished	jl	Low	job_proActive
005	Finished	jl	Low	job_proActive
001	Finished	jl	Low	job_proActive
006	Finished	jl	Low	job_proActive
004	Finished	jl	Low	job_proActive
003	Finished	jl	Low	job_proActive
009	Finished	jl	Low	job_proActive
007	Finished	jl	Low	job_proActive
002	Finished	jl	Low	job_proActive
245	Finished	user1	Normal	job_with_dep
246	Finished	user1	Normal	job_with_dep
247	Finished	user1	Normal	job_with_dep
252	Finished	admin	Normal	job_with_dep
253	Finished	admin	Normal	job_with_dep

Job Info (Job 2008)

Job 2008 has 8 tasks

Id	State	Name	Host name	Start time	Finished time	Re-run	Description
200800	Submitted	task4	n/a	Not yet	Not yet	0/2	This task will sleep 5s
200800	Submitted	task2	n/a	Not yet	Not yet	0/1	This task will sleep 10s
200800	Submitted	task6	n/a	Not yet	Not yet	0/1	This task will sleep 8s
200800	Submitted	task1	n/a	Not yet	Not yet	0/2	This task will sleep 6s
200800	Submitted	task5	n/a	Not yet	Not yet	0/1	This task will sleep 2s
200800	Submitted	task7	n/a	Not yet	Not yet	0/2	This task will sleep 6s
200800	Submitted	task3	n/a	Not yet	Not yet	0/1	This task will sleep 4s
200800	Submitted	task8	n/a	Not yet	Not yet	0/1	This task will sleep 6s

Result Preview

Property	Value
Id	2008
State	Pending
Name	job_with_dep
Priority	Normal
Pending tasks number	0
Running tasks number	0
Finished tasks number	0
Total tasks number	8
Submitted time	09:40:06 03/12/08
Started time	Not yet
Finished time	Not yet



RESO

ProActive Orchestration Portal

File Edit View Favorites Tools Help

★ Favorites | ★ Suggested Sites | Web Slice Gallery

ProActive Scheduler Portal

Home RSS Mail Print Page Safety Tools ?

Portal Admin Help Submit job Logout demo



Jobs list

My jobs Finished Pending Running < Previous 1 - 50 Next >

Id	State	User	Progress	Priority
2602	Running	lbordier	1 / 3	Normal
2601	Running	lbordier	1 / 3	Normal
2600	Running	lbordier	1 / 3	Normal
2599	Running	lbordier	1 / 3	Normal
2562	Killed	lbordier	1 / 3	Normal
2610	Running	madelain	3 / 4	Normal
2608	Killed	madelain	3 / 4	Normal
2595	Finished	rameur	3 / 3	Normal

Use filters to restrict the number of jobs currently displayed.
Filters apply only to the current page.
Use The <Previous and Next> controls to view more results.

Match All Match Any Match None

Id contains

Clear Apply

Details

User	Jobs	Connected at	Last submit	Hostname
gperetti	0	03/16 11:17:25		4649
madelain	29	03/16 12:59:30	03/18 05:38:23	4659
lbordier	66	03/16 04:55:39	03/18 04:17:22	4690
cdeibe	1	03/17 11:35:02	03/17 11:38:11	4722
lbordier	0	03/17 01:54:45		4729
watcher	0	03/18 02:47:14		4876
demo	0	03/18 08:33:57		4876

Job Info	Output	Result Preview
Job Id: 2599		
State: Running		
Name: TEST_CY_0029		
Priority: Normal		
User: lbordier		
Pending tasks: 1		
Running tasks: 1		
Finished tasks: 1		
Total tasks: 3		

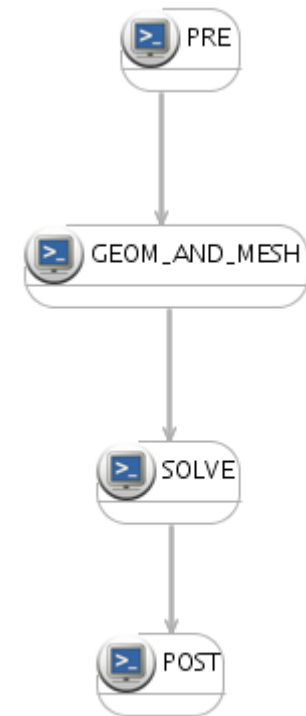
Done

Internet | Protected Mode: On

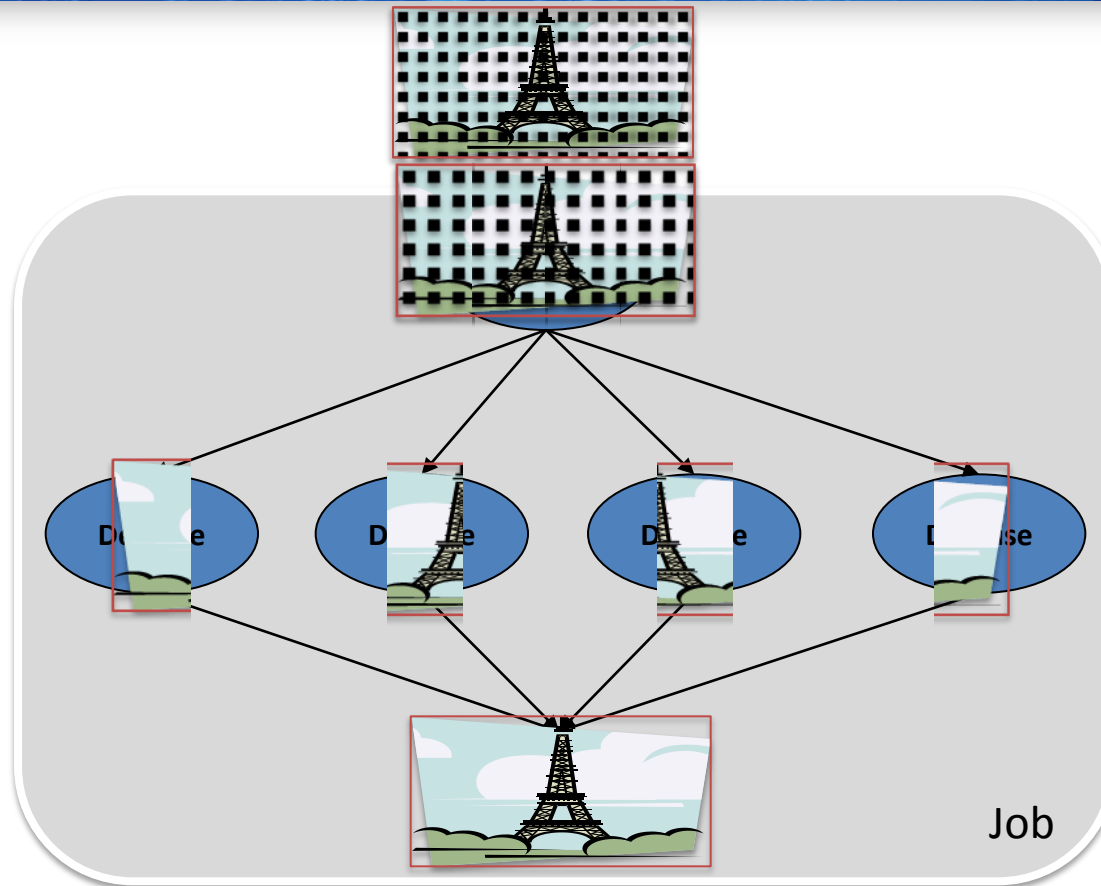
100%

ProActive Scheduling & Orchestration

- ❑ Provides highly configurable scheduling policies
- ❑ Self-healing with automatic restart from latest valid point
- ❑ Hardware and software fault tolerant mechanism for task execution
- ❑ Graphical interface and command line client
- ❑ Seamless integration with third-party application
 - Java, Web Service and C/C++
- ❑ Accounting per user



Workflow Example : Picture Denoising



- with **selection** on native executable availability (ImageMagik, GREYstoration)
 - Multi-platform selection and command generation
- with file transfer in pre/post scripts

Workflow Studio

The screenshot displays the Eclipse Workflow Studio interface. The main window shows a workflow diagram with the following structure:

- Pre_computation
- Computation_setup (child of Pre_computation)
- Test_case_speed_1 (child of Computation_setup)
- Test_case_speed_2 (child of Computation_setup)
- Post_processing_speed_1 (child of Test_case_speed_1)
- Post_processing_speed_2 (child of Test_case_speed_1)
- Post_processing_speed_3 (child of Test_case_speed_1)
- Test_case_speed_3 (child of Test_case_speed_1)
- Test_case_speed_4 (child of Test_case_speed_2)
- Post_processing_speed_4 (child of Test_case_speed_4)

The left sidebar shows the Project Explorer with the following structure:

- myWorkflow
 - OMD2
 - OMD2_modified
 - img
 - cas2_template_geom_and_mesh_distant.job.c
 - cas2_template_geom_and_mesh_distant.xml
 - cas2_template_geom_distant.job_diagram
 - cas2_template_geom_distant.xml
 - job_static_workflow_kepsilon.job_diagram
 - job_static_workflow_kepsilon.xml
- workflow
 - default.job_diagram
 - default.xml
 - default.taipan
 - default.taipan_diagram

The right sidebar shows the Palette with the following categories:

- Task
 - Java Task
 - Native Task
 - pre/post/clean
 - InputFiles
 - Output Files
 - Resource Selection
- Flow Controls
 - if
 - loop
 - replicate
- Flow Connectors
 - Flow Connection
 - if-then branch
 - if-else branch
 - if-join branch
 - loop connection

The bottom section shows the Job Properties dialog:

Job Properties

Job	Project Name		Max number of executions for tasks	
Rulers & Grid	Job Name	job_Finemarine_1Host	Cancel Job On Error Policy	Cancel job as soon as one task fails
Appearance	Job Description		If an error occurs restart task	anywhere
	Input Space URL:		Job Priority	Normal
	Output Space URL:			
	Log File	\${LOGS}/job_finemarine107Core2Host.log		

Buttons: generic information, job classpath, job variables



Studio Demonstration



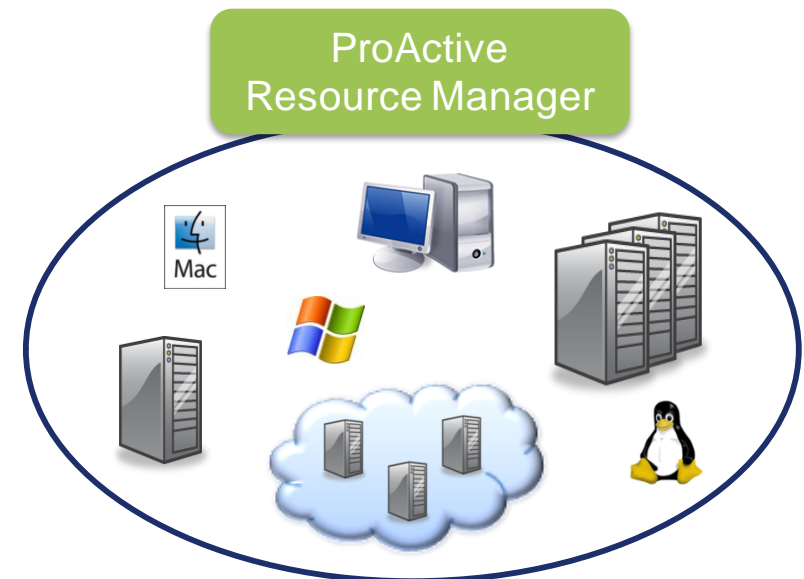
Heterogeneous Resource Management

ProActive Resourcing



ProActive Resourcing

- ❑ **Virtualizes** organizations' existing infrastructure for a heightened computing power
- ❑ Enables **business driven** computing resources acquisitions
 - Elastic computing platform
- ❑ Reaps the benefits from **Clouds**, e.g. Amazon EC2, and latest hardware architecture
- ❑ **Aggregates** and leverages any type of resources
- ❑ Manage your **virtual machines**
 - VMWare, Xen, KVM, Hyper-V, ...
- ❑ Accounting per resource provider



Resource Manager GUI

The screenshot displays the ProActive Resource Manager interface. At the top, there is a menu bar with 'File', 'Connection', 'Actions', 'Help', and 'Window'. Below the menu is a toolbar with various icons, including a 'Shutdown' button. The main area is divided into several sections:

- Tree Explorer:** Shows a hierarchical view of resources. The selected node is 'PA_JVM1252018564' under 'eon14.inria.fr'. Other nodes include 'PA_JVM406472916' and 'PA_JVM1861646533'.
- Compact View:** A grid of colored circles representing the status of various nodes. The colors range from green (active) to red (inactive) and yellow (warning).
- JMX Monitoring:** Contains three charts:
 - Activity/Inactivity:** A pie chart showing 'Activity(15.53%)' in blue and 'Inactivity(84.47%)' in red.
 - Node States:** A bar chart showing the count of nodes in different states: Total (330), Free (266), Busy (40), ToBeReleased (0), and Down (24).
 - Total Nodes History:** A line chart showing the total number of nodes over time, with a legend for 'Total Nodes'.
- Statistics:** A table with the following data:

state	aggregate
# free nodes	266
# busy nodes	40
# down nodes	24

The status bar at the bottom right indicates 'connected'.

Topology with the ProActive Resourcing

The screenshot displays the ProActive Resource Manager GUI. The main window is titled "ProActive Resource Manager GUI" and has a menu bar with "ResourceManager", "Admin", "Window", and "Help". Below the menu bar is a "Tab Explorer" showing "Topology View (beta)".

The central area shows a network topology diagram with nodes and edges. Nodes are labeled with names like "styx.inria.fr", "tranquilly.inria.fr", "pendule.inria.fr", "nubik.inria.fr", "loy.inria.fr", "ecops.inria.fr", "deephought.inria.fr", "stx-sophia.inria.fr", "calpira.inria.fr", "eion1.inria.fr", "eion2.inria.fr", "eion3.inria.fr", "eion4.inria.fr", "eion5.inria.fr", "eion6.inria.fr", "eion7.inria.fr", "eion8.inria.fr", "eion9.inria.fr", "eion10.inria.fr", "eion11.inria.fr", "eion12.inria.fr", "eion13.inria.fr", "eion14.inria.fr", "eion15.inria.fr", "eion16.inria.fr", "eion17.inria.fr", "eion18.inria.fr", "eion19.inria.fr", "eion20.inria.fr", "eion21.inria.fr", "eion22.inria.fr", "eion23.inria.fr", "eion24.inria.fr", "eion25.inria.fr", "eion26.inria.fr", "eion27.inria.fr", "eion28.inria.fr", "eion29.inria.fr", "eion30.inria.fr", "eion31.inria.fr", "eion32.inria.fr", "eion33.inria.fr", "eion34.inria.fr", "eion35.inria.fr", "eion36.inria.fr", "eion37.inria.fr", "eion38.inria.fr", "eion39.inria.fr", "eion40.inria.fr", "eion41.inria.fr", "eion42.inria.fr", "eion43.inria.fr", "eion44.inria.fr", "eion45.inria.fr", "eion46.inria.fr", "eion47.inria.fr", "eion48.inria.fr", "eion49.inria.fr", "eion50.inria.fr", "eion51.inria.fr", "eion52.inria.fr", "eion53.inria.fr", "eion54.inria.fr", "eion55.inria.fr", "eion56.inria.fr", "eion57.inria.fr", "eion58.inria.fr", "eion59.inria.fr", "eion60.inria.fr", "eion61.inria.fr", "eion62.inria.fr", "eion63.inria.fr", "eion64.inria.fr", "eion65.inria.fr", "eion66.inria.fr", "eion67.inria.fr", "eion68.inria.fr", "eion69.inria.fr", "eion70.inria.fr", "eion71.inria.fr", "eion72.inria.fr", "eion73.inria.fr", "eion74.inria.fr", "eion75.inria.fr", "eion76.inria.fr", "eion77.inria.fr", "eion78.inria.fr", "eion79.inria.fr", "eion80.inria.fr", "eion81.inria.fr", "eion82.inria.fr", "eion83.inria.fr", "eion84.inria.fr", "eion85.inria.fr", "eion86.inria.fr", "eion87.inria.fr", "eion88.inria.fr", "eion89.inria.fr", "eion90.inria.fr", "eion91.inria.fr", "eion92.inria.fr", "eion93.inria.fr", "eion94.inria.fr", "eion95.inria.fr", "eion96.inria.fr", "eion97.inria.fr", "eion98.inria.fr", "eion99.inria.fr", "eion100.inria.fr".

On the right side, there is a "Tree Explorer" showing a hierarchical view of the resources. The tree structure is as follows:

- deploying//ssh_dyn3/SSH-ssh_dyn3-188
- deploying//ssh_dyn3/SSH-ssh_dyn3-194
- eion14.inria.fr
- cheypa.inria.fr
- segfault.inria.fr
- pendule.inria.fr
- eion8.inria.fr
- eion3.inria.fr
- eion1.inria.fr
 - rmi://eion1.inria.fr:6613/PA_JVM112148903
 - rmi://eion1.inria.fr:6613/SSH-ssh_dyn3-1
 - rmi://eion1.inria.fr:6613/PA_JVM935097679
 - rmi://eion1.inria.fr:6613/SSH-ssh_dyn3-
 - rmi://eion1.inria.fr:6613/PA_JVM634441905
 - rmi://eion1.inria.fr:6613/SSH-ssh_dyn3-
- eion9.inria.fr
- eion4.inria.fr
- ank.inria.fr
- srv-oasis.inria.fr
- deephought.inria.fr
- eion6.inria.fr
- eion15.inria.fr
- saturn.inria.fr
- eion16.inria.fr
- huenchula.inria.fr
- styx.inria.fr
- srv-sophia.inria.fr
- eion2.inria.fr
- cobreloa.inria.fr
- groasis.inria.fr
- eion10.inria.fr
- kisscool.inria.fr
- eion20.inria.fr
- jilyinria.fr
- bego.inria.fr
- bound.inria.fr

Below the topology view, there is a "Compact View" showing a grid of colored circles representing nodes. The colors correspond to the node status: black (Deploying), blue (Lost), green (Configuring), yellow (Free), orange (Busy), and red (Down).

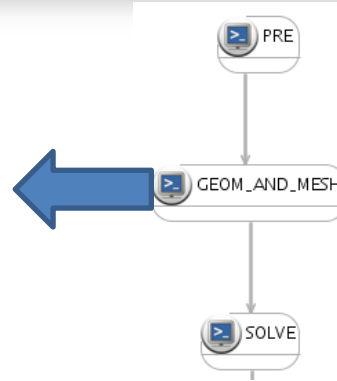
At the bottom, there is a "Statistics" table:

Node Status	Count
Deploying	0
Lost	24
Configuring	0
Free	84
Busy	100
Down	3
Total	187

The bottom right corner shows the status "connected".

Private, Public & Hybrid Clouds

Enterprise
Private
Hybrid
Cloud



Application
and
Workflow
Acceleration

Static Policy
LSF

Timing Policy
12/24
Desktops

Dynamic Workload
Policy
On Burst



Dedicated resources

On premise

Desktops

External Data Center, Amazon EC2,
Azure

ProActive: Security for your Enterprise Cloud platform

- ❑ User Authentication (LDAP or Files)
- ❑ Authentication and encryptions of network communications using SSH, SSL and PKI
- ❑ Secure communication routing through Firewall and NAT configuration of LAN network

Use Cases and Demonstration on a Production Platform

The ProActive PACA Grid Platform (4)

Total:

- ❑ 1 368 Cores
- ❑ 480 CUDA Cores
- ❑ 30TB Storage

**Publically Available Today
for Production**



Use Case 1: CPU + GPU Workflow

Workflow ProActive for CPU and GPU

The screenshot displays the ProActive Workflow Studio 0.9.1 (beta) interface. The main workspace shows a workflow diagram with three tasks: Split, GPU, and Merge, connected in a linear sequence. Each task has options for 'Selection-Script' and 'Native Executable'. The 'Project Explorer' on the left shows a tree view of project files, including 'branchingExample', 'GPU-Denoising', 'MapReduce', and 'OSCi'. The 'Palette' on the right contains various workflow components like 'Task', 'Flow Controls', and 'Flow Connectors'. The 'Properties' panel at the bottom shows 'Job Properties' for a job named 'Video Denoising', with a description 'Split, Denoise (GPGPU) and Merge a video'.

Job Properties

Job	Project Name	GPU	Max number of executions
Generic Info	Job Name	Video Denoising	Cancel Job On Error Policy
Job Classpath	Job Description	Split, Denoise (GPGPU) and Merge a video	If an error occurs restart ta



CPU + GPU
Workflow

Live Demo

CPU + GPU ProActive Workflows

- ❑ Resource selection for each Task of a ProActive Workflow
- ❑ Selection of Host with GPU capacity
- ❑ Data Transfer to the GPU Host
- ❑ Configuration of GPU Capacity at the level of Admin (Number of GPU Nodes, size)
- ❑ Freedom to request one or several GPU capacities for one GPU program
- ❑ Global Scheduling (Multi-Tenant, Multi-Application) of GPU Tasks

Use Case 2: OMD2

Distributed Multi-Disciplinary Optimizations with Remote Visualization

OMD2

Open Source Interfaces For Distributed Multi-Disciplinary Optimisations



OMD2 :

Open Source Interfaces For Distributed Multi-Disciplinaires Optimisations

OMD2 OPTIMISATION
MULTI
DISCIPLINAIRE
DISTRIBUÉE



Laboratoire Roberval
Unité de recherche en mécanique



Ecole Nationale
Supérieure des Mines
SAINT-ETIENNE

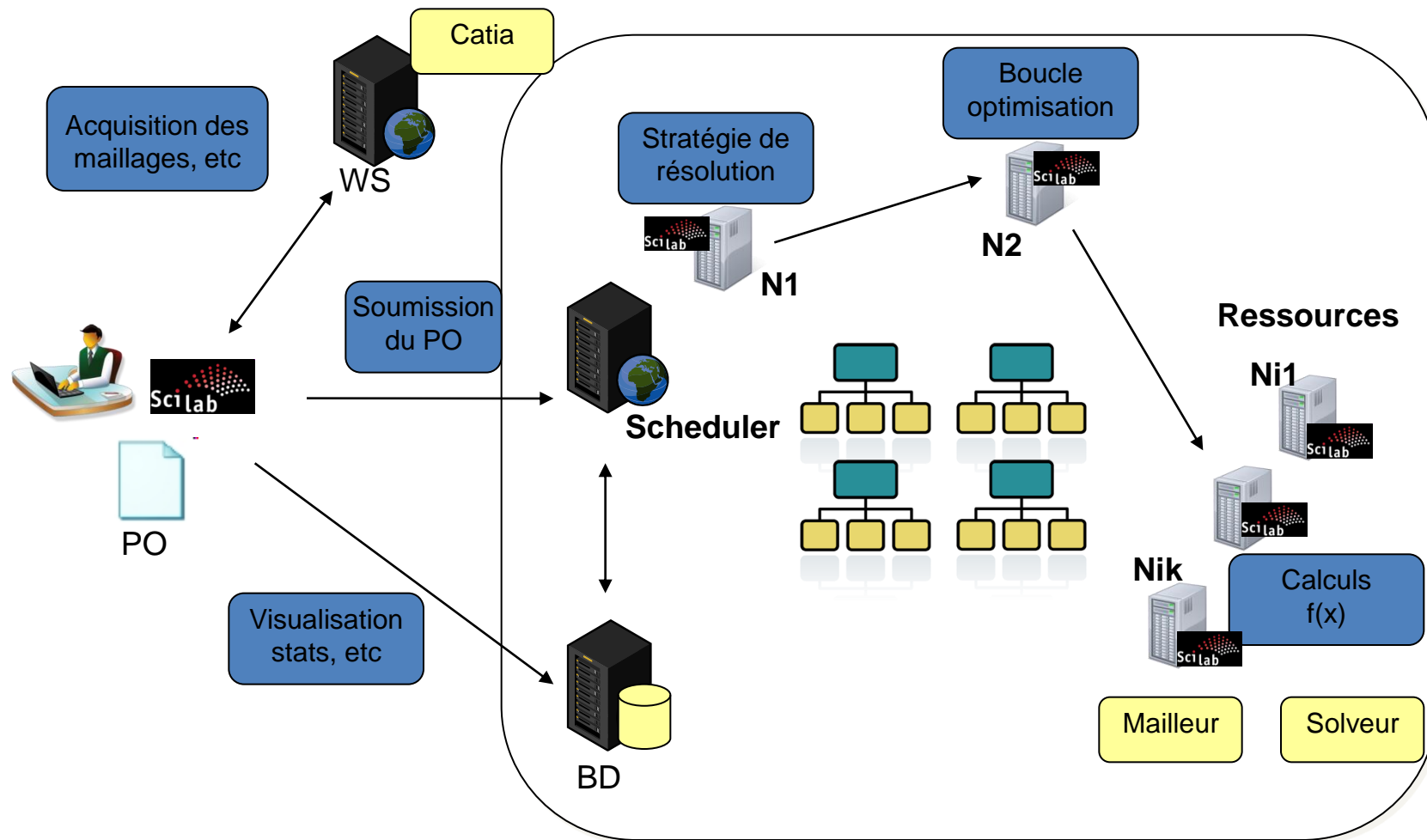
INSTITUT NATIONAL
DE RECHERCHE
EN INFORMATIQUE
ET EN AUTOMATIQUE



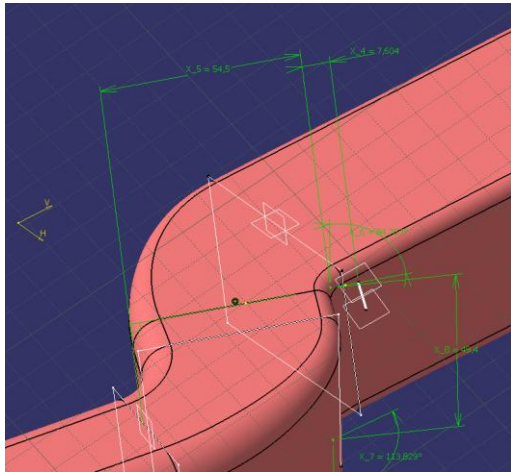
INRIA



Distributed Workflow

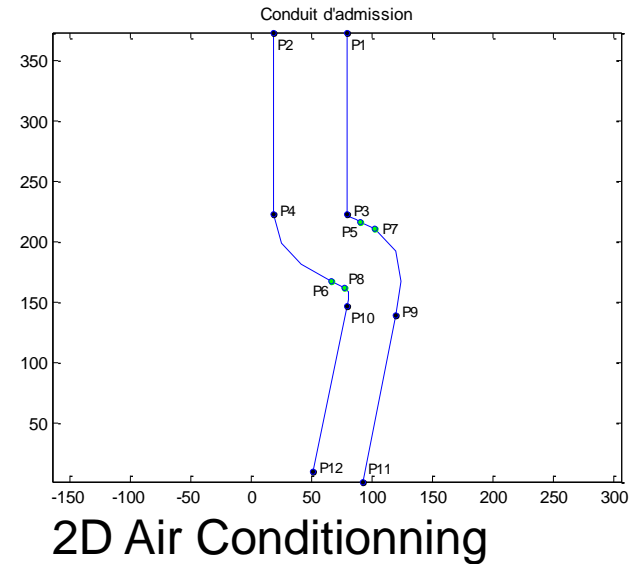
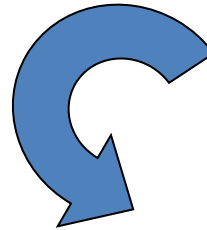


Coupling Mechanics, Aerodynamics ...



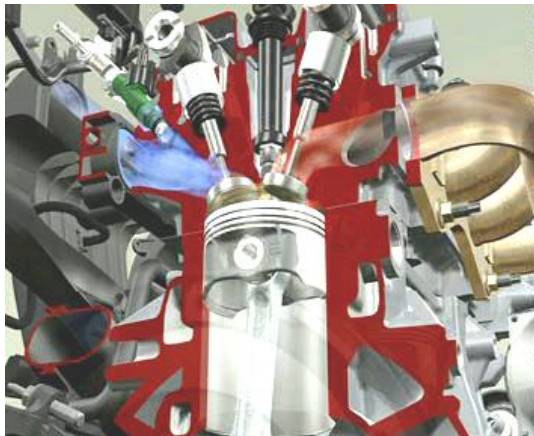
3D Air Conditionning

10min
CPU



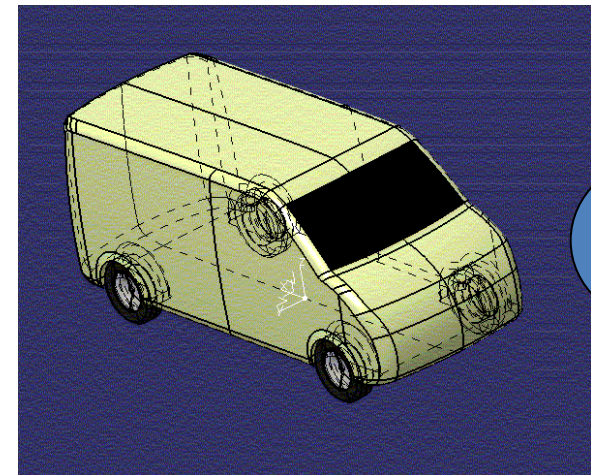
2D Air Conditionning

<1min
CPU



Cylinder Head

100h
CPU



External
Aerodynamic

1000h
CPU

ProActive OMD2 Demo



1000 Cores
Production
Cloud Portal

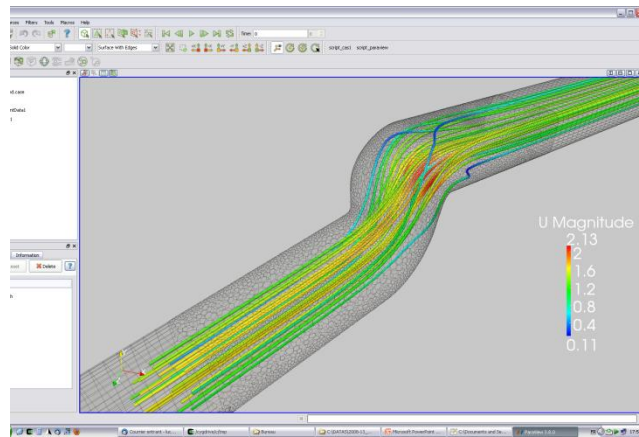
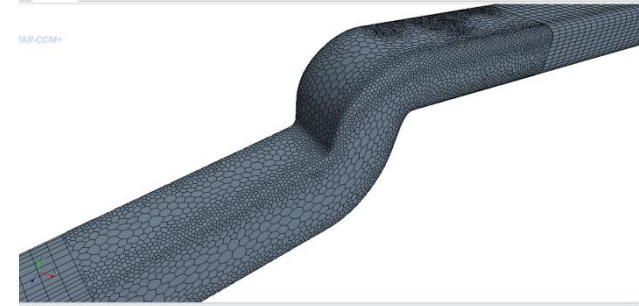
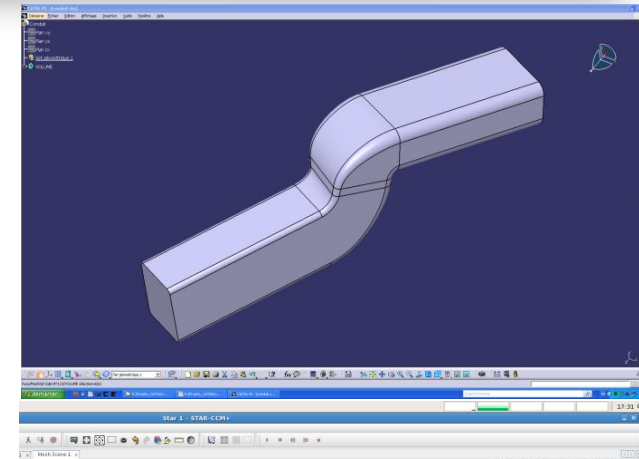
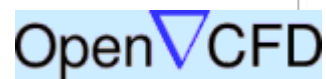
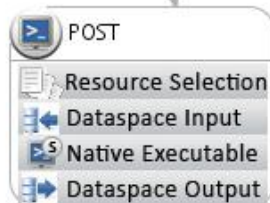
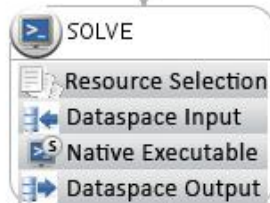
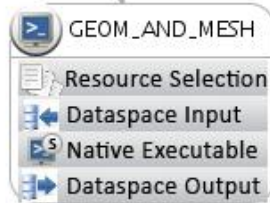
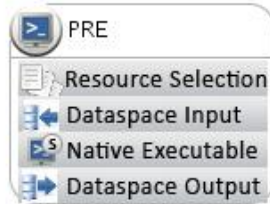




Demonstration



Engineering Optimizations: Renault UC



Use Case 3: Map Reduce

ProActive MapReduce (CO, SP2, Task 2.1)

- ❑ Same APIs as Hadoop
(Easy switch from Hadoop to ProActive)
- ❑ Does not requires an HDFS File System
- ❑ Runs on general purpose, Multi-tenant, Multi-Applications Grids and Clouds
- ❑ Available as PaaS in Java

Workflow ProActive MapReduce

The screenshot displays the ProActive Workflow Studio 0.9.1 (beta) interface. The main workspace shows a vertical workflow diagram with the following tasks: SplitterPATask, MapperPATask, MapperJoinPATask, ReducerPATask, and ReducerJoinPATask. The SplitterPATask and MapperJoinPATask tasks have a green double-pause icon next to them. The Project Explorer on the left shows a tree view of the project files, including MapReduce, MapReduce_job.png, MapReduce_job.pws, MapReduce_job.xml, and several Pic_copyrighter_step files. The Outline view at the bottom left shows a small thumbnail of the workflow diagram. The Palette on the right contains various task and flow control elements. The Properties view at the bottom right shows the Job Properties for the current workflow.

Job Properties

Job	Project Name	ProActiveMapReduce	Max number of executions for tasks	1
Generic Info	Job Name	mapreduce taskflow job	Cancel Job On Error Policy	Cancel job as soon as one task fails
Job Classpath	Job Description	ProActive MapReduce	If an error occurs restart task	anywhere

Map Reduce Demo

ProActive MapReduce vs. Hadoop+HDFS

File Size	Sequential	Hadoop	PA MapReduce	Speedup
0.7 GB	5m 04s	1m 17s	1m 05s	4.6
4.3 GB	25m 31s	2m 30s	2m 20s	10.9
7.3 GB	46m 00s	3m 31s	3m 30s	13.1
20 GB	2h 07m 00s	8m 30s	7m 09s	17.8
50 GB	5h 19m 00s	21m 05s	25m 11s	12.7
100 GB	10h 38m 00s	43m 23s	58m 42s	10.9

- ❑ Data available in a NAS (General purpose storage)
- ❑ Transfer to HDFS for Hadoop
- ❑ Used directly without copy for ProActive
- ❑ Use Case of Map/Reduce on fresh data
- ❑ Different ProActive Map/Reduce configuration for recurrent MR on in place Data (e.g. ProActive HDFS interface)

Use Case 4: BioTechs

IPMC Use Case and Collaboration

SOLID
machine from
AB Applied Biosystems

ProActive
Parallel Suite



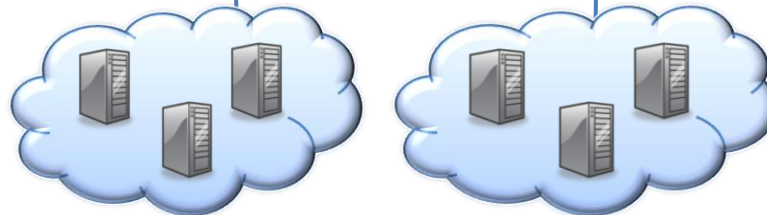
PBS

Cluster



Desktops

**Nodes
can be
dynamically
added!**

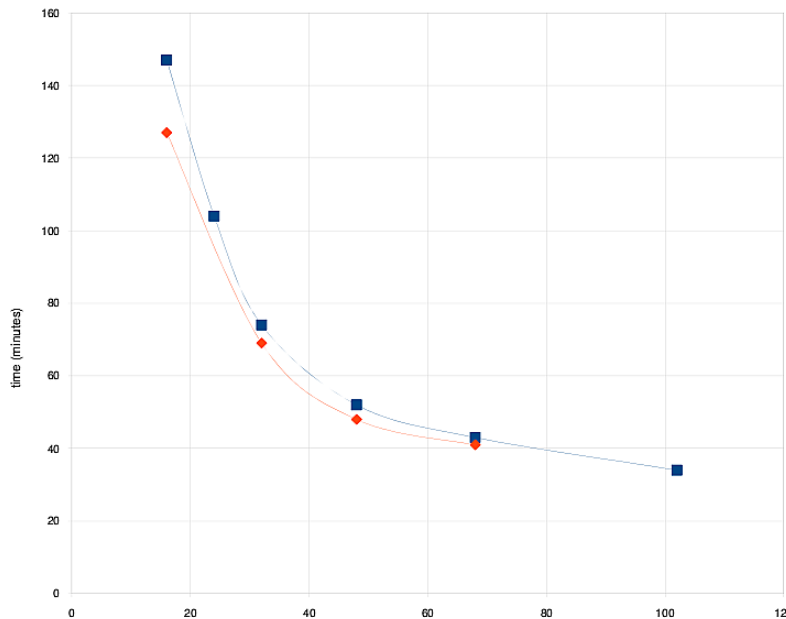


EC2

Clouds

Benchmarks

- ❑ The distributed version with ProActive of Mapreads has been tested on the INRIA cluster with two settings: the Reads file is split in either 30 or 10 slices
- ❑ Use Case: Matching 31 millions Sequences with the Human Genome (M=2, L=25)



4 Time FASTER from 20 to 100
Speed Up of 80 / Th.
Sequential : 50 h → 35 mn

EC2 only test: nearly the same
performances as the local
SOLiD cluster (+10%)

**For only \$3,2/hour, EC2 has nearly the same perf. as
the local SOLiD cluster (16 cores, for 2H30)**

Use Case 5: Hydrodynamic with K-Epsilon and FineMarine

K-EPSILON
HYDRODYNAMIC & AERODYNAMIC

Hydrodynamic Optimization: Workflow generated from a GUI

The screenshot displays the Eclipse IDE interface for a workflow project. The main window shows a job diagram with the following structure:

- Pre_computation (Start)
- Computation_setup (Parent of all other tasks)
- Test_case_speed_1 (Child of Computation_setup)
- Test_case_speed_2 (Child of Computation_setup)
- Post_processing_speed_1 (Child of Test_case_speed_1)
- Post_processing_speed_2 (Child of Test_case_speed_1)
- Post_processing_speed_3 (Child of Test_case_speed_1)
- Test_case_speed_3 (Child of Test_case_speed_1)
- Test_case_speed_4 (Child of Test_case_speed_2)
- Post_processing_speed_4 (Child of Test_case_speed_4)

The Job Properties panel at the bottom shows the following configuration:

Property	Value
Project Name	
Job Name	job_Finemarine_1Host
Job Description	
Input Space URL:	
Output Space URL:	
Log File	\${LOGS}/job_finemarine107Core2Host.log
Max number of executions for tasks	
Cancel Job On Error Policy	Cancel job as soon as one task fails
If an error occurs restart task	anywhere
Job Priority	Normal

Additional buttons in the Job Properties panel include: generic information, job classpath, and job variables.

Hydrodynamic Optimization: Execution

The image displays a multi-panel software interface for hydrodynamic optimization. On the left, a workflow diagram shows a sequence of tasks including 'Post_processing_speed' and 'Test_case_speed'. The middle panel shows 'Job Properties' for a project named 'job_Finemarine_1Host'. The right panel features a 3D visualization of a submarine in a fluid flow simulation, with a control panel for 'Quantities' and 'Representations'. The 'Quantities' panel includes options for Pressure, Turbulent Kinetic Energy, Turbulent Frequency, Mass Fraction, Turbulent Viscosity, Velocity, Relative velocity, Solid Data, and Mechanics. The 'Representations' panel includes options for Grid, Plots & Values, Contours & Iso Values, Integrals, and Opacity. The 3D view shows a submarine with a red propeller and a white hull, moving through a blue fluid flow field. The status bar at the bottom indicates that a macro has been executed and provides data for Mass Fraction and Volume.

Applications Places System | cmorandin@node2:/store/workspaces/yroux/simus | Cedric Morandin Tue Sep 21, 11:47 AM

FINE/Marine version 2.2-2 /store/workspaces/yroux/simus/Subof/Subof.1ec

Project Mesh Solver

CFView 8.8-2-3 : Subof_computation_1.cfv

File Edit Geometry Render Quantity Representation Update View Window Preferences Macros

sub_marine
 D1.B1.S12 Mirror
 D1.B1.S13 External
 D1.B1.S14 External
 D1.B1.S15 External
 D1.B1.S16 External
 D1.B1.S17 External
 ISO Mass Fraction=C

Filter (regexp)

Quantities
Pressure (normal stress)
Turbulent Kinetic Energy
Turbulent Frequency
Mass Fraction
Turbulent Viscosity
Velocity
Relative velocity
Solid Data
Mechanics

Representations
Grid
Plots & Values
Contours & Iso Values
Integrals
Opacity
0.58
Lighting & shadows
Material

Macro 'istore/workspaces/yroux/simus/Subof/Subof_computation_1/post_processing.py' has been executed.

Mass Fraction : -6.87489e-21 -> 1
Volume(<- iso): 218.561, Volume(>- iso): 741.107

Hydrodynamic: Remote Steering during execution

The screenshot displays a remote VNC session titled "testVNC@node2.cloud.sophia.inria.fr:0". The main window is "CFView 8.8-2-3 : Subof_computation_1.cfv", showing a 3D model of a submarine with streamlines representing flow. The interface includes a menu bar (File, Edit, Geometry, Render, Quantity, Representation, Update, View, Window, Preferences, Macros) and a toolbar with various icons. A sidebar on the left contains several panels:

- Surfaces:** A list of surfaces including "sub_marine", "D1.B1.S12 Mirror", "D1.B1.S13 External", "D1.B1.S14 External", "D1.B1.S15 External", "D1.B1.S16 External", "D1.B1.S17 External", and "ISO Mass Fraction=0.5 .D1".
- Quantities:** A list of physical quantities such as "Pressure (normal stress)", "Turbulent Kinetic Energy", "Turbulent Frequency", "Mass Fraction", "Turbulent Viscosity", "Velocity", "Relative velocity", "Solid Data", and "Mechanics".
- Representations:** A section for visualizing the simulation, including a "Grid" panel with icons for different grid styles.

A terminal window on the left shows shell commands and their outputs, including file listings and directory navigation. The status bar at the bottom of the CFView window displays "Mass Fraction : -6.87489e-21 -> 1" and coordinates "X: 1.34192 Y: 1.28157 Z: -1.65029".

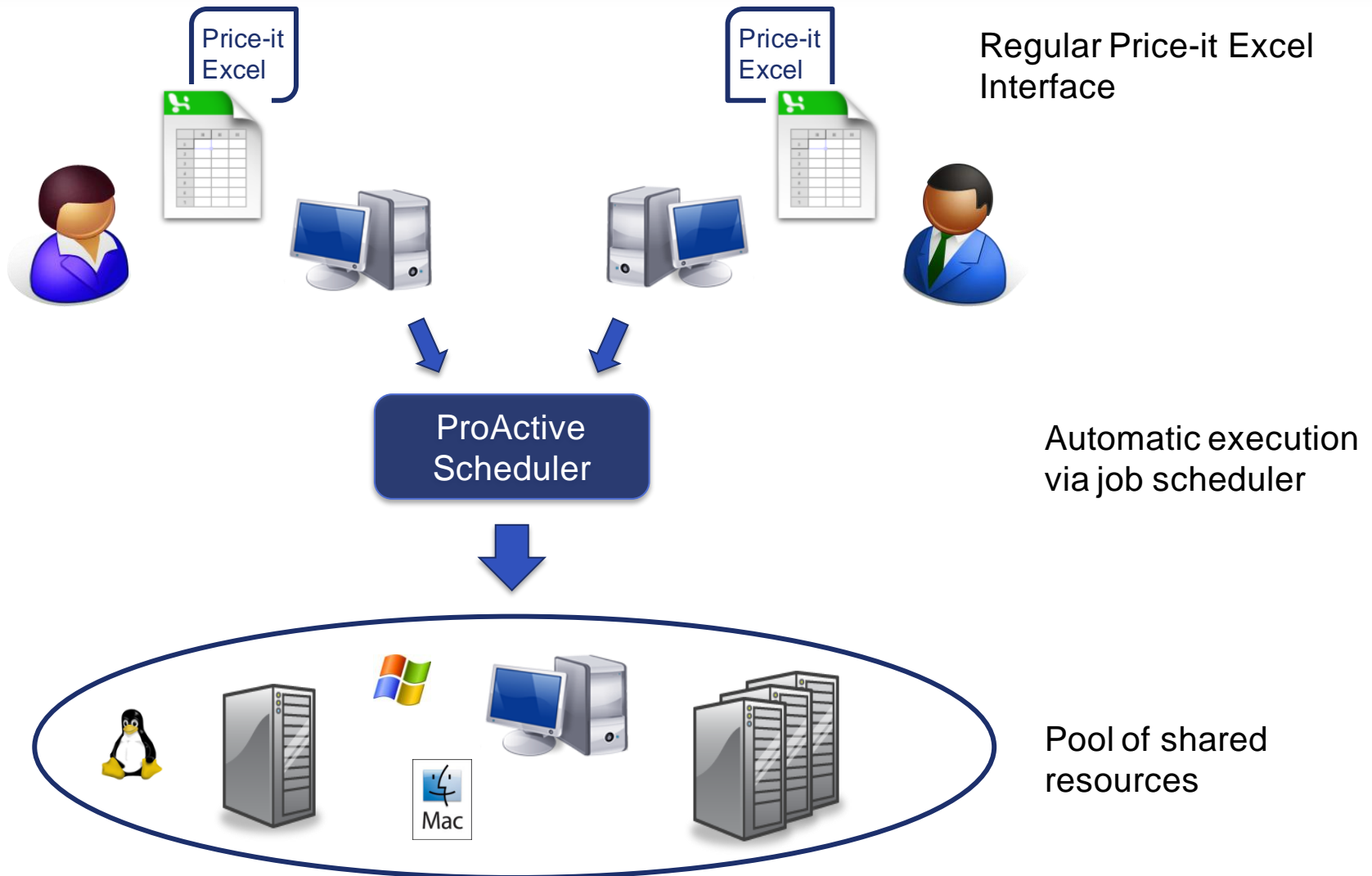


UC 6: Acceleration of Financial Valuations

C++ library developed by Pricing Partners
Pricing solution dedicated to highly complex derivatives,
Greek computation

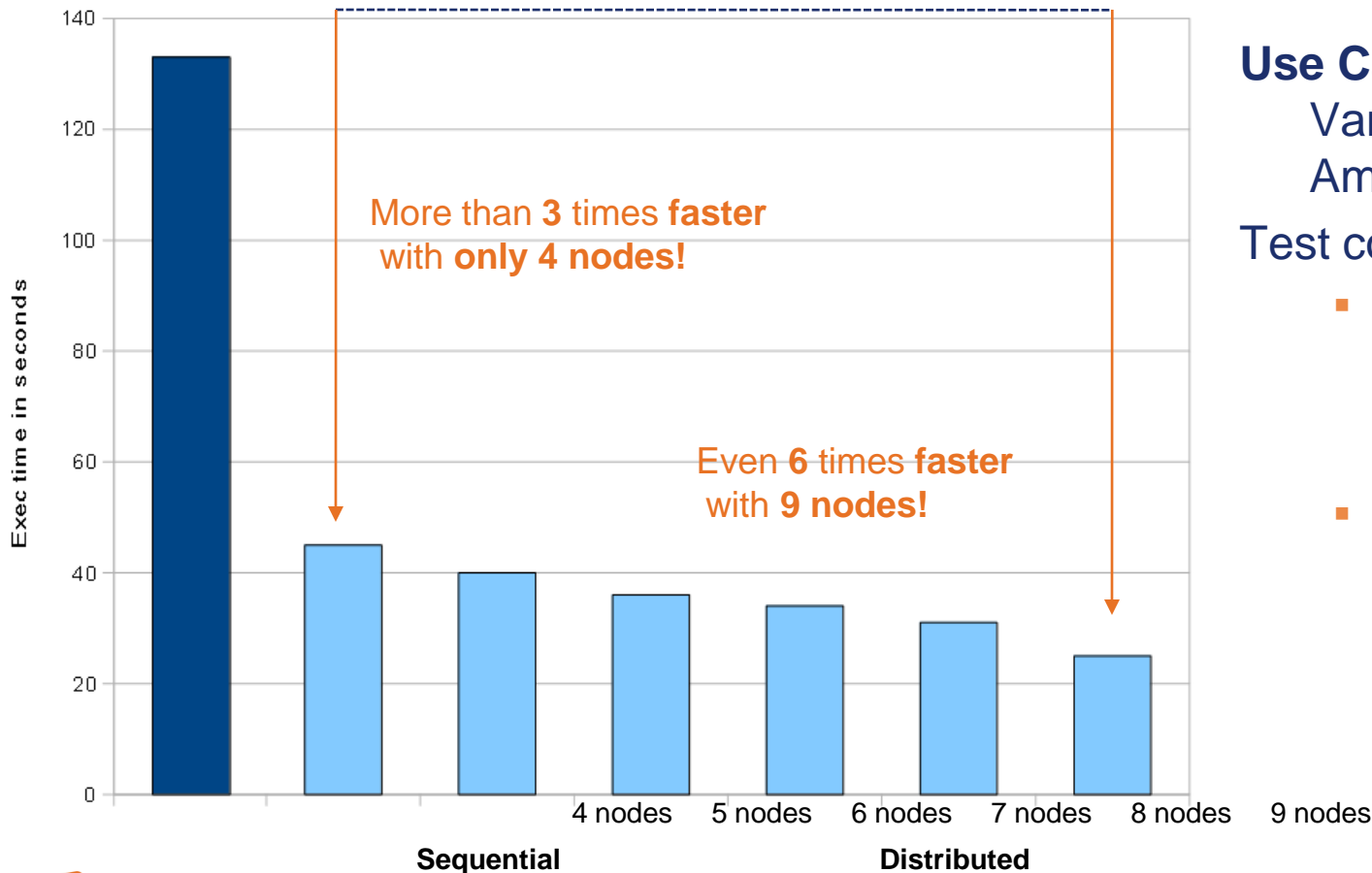
How Does it Work?

Price-it Computing Distribution



Accelerated Price-it Performances

- ❑ **Increased Productivity:** Reduces Price-it Execution Time by 6 or more!



Use Case: Bermuda Vanilla, Model American MC

Test conditions:

- One computation is split in 130 tasks that are distributed
- Each task uses 300ko

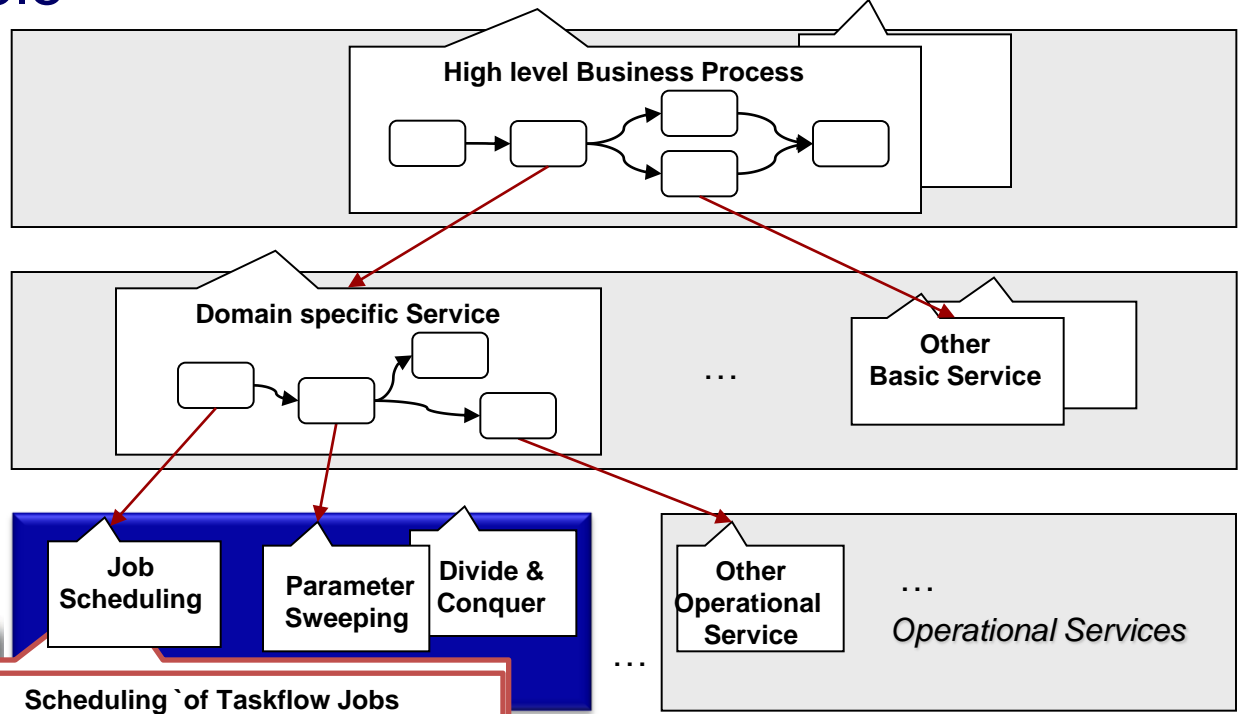
UC 7: IT

SOA Analysis of Web Server Logs

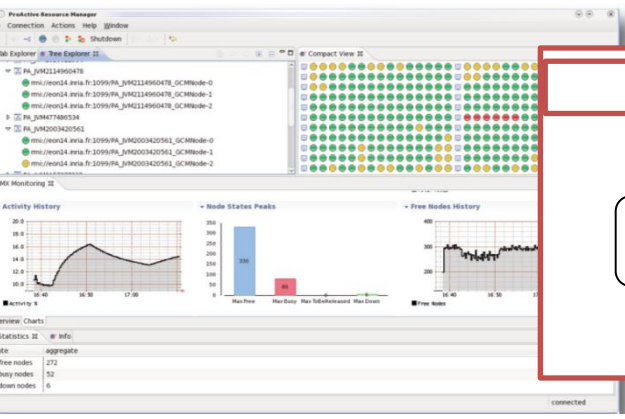


Parallel Services

- Separation: BPEL – Parallel Serv. – Task Flow
- Standards et Portable
- Flexibility



ID	State	User	Priority	Name	Wd	State	#	Finished	User	Pror
1996	Pending	J	Normal	job_wtd_step	2322	Running	1	100%	user1	Normal
1997	Pending	J	Normal	job_wtd_step	1214	Running	1	100%	user1	Normal
1998	Pending	J	Normal	job_wtd_step	1315	Running	1	100%	user1	Normal
1999	Pending	J	Normal	job_wtd_step	1216	Running	1	100%	user1	Normal
2000	Pending	J	Normal	job_wtd_step	1317	Running	1	100%	user1	Normal
2001	Pending	J	Normal	job_wtd_step	1118	Running	1	100%	user1	Normal
2002	Pending	J	Normal	job_wtd_step	1219	Running	1	100%	user1	Normal
2003	Pending	J	Normal	job_wtd_step	1120	Running	1	100%	user1	Normal
2004	Pending	J	Normal	job_wtd_step	1321	Running	1	100%	user1	Normal
2005	Pending	J	Normal	job_wtd_step	1222	Running	1	100%	user1	Normal
2006	Pending	J	Normal	job_wtd_step	1323	Running	1	100%	user1	Normal
2007	Pending	J	Normal	job_wtd_step	1224	Running	1	100%	user1	Normal
2008	Pending	J	Normal	job_wtd_step	1125	Running	1	100%	user1	Normal
2009	Pending	J	Normal	job_wtd_step	1226	Running	1	100%	user1	Normal
2010	Pending	J	Normal	job_wtd_step	1327	Running	1	100%	user1	Normal



Job Scheduling **Parameter Sweeping** **Divide & Conquer**

Scheduling of Taskflow Jobs

Enterprise Grid

AGOS Platform Management

HP- Business Availability Center (HP-BAC)

Tasks Scheduler & Resources manager

- Monitoring of entire platform
- Cover all layers in the scope
- Monitoring dashboard and reports

- Integration with grid
- Indicator on running jobs
- Hypervisor & VM management

HP Business Availability Center - Dashboard

System Status

Legend

Updated: Fri, 2/19/2010, 1:11 PM CET

0 Critical 4 Major 0 Minor 12 Normal 0 Disabled 0 Unknown Total: 16

0 Unclassified Event Status

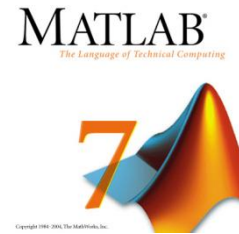
All Systems

System Name	System Type	System Address	Product Name	OS Name
ilo-c3000-1	Management Processor	192.168.1.211	Integrated Lights-Out ...	Embedded
ilo-c3000-2	Management Processor	192.168.1.212	Integrated Lights-Out ...	Embedded
ilo-c3000-5	Management Processor	192.168.1.215	Integrated Lights-Out ...	Embedded
ilo-c3000-6	Management Processor	192.168.1.216	Integrated Lights-Out ...	Embedded
ilo-gront1	Management Processor	192.168.1.222	Integrated Lights-Out ...	Embedded
ilo-wallace	Management Processor	192.168.1.220	Integrated Lights-Out ...	Embedded
lbrn147	Server	192.168.2.213	ProLiant BL680c G5	LINUX
lbrn14	Server	192.168.2.214	ProLiant BL480c G1	LINUX
lbrn16	Server	192.168.2.230	HP-LUX B.11.31	LINUX
lbrn11	Virtual Platform	192.168.2.11	Virtual Platform	LINUX
lbrn16	Server	192.168.2.220	ProLiant DL380 G4	Microsoft(R) Windows(R)...
visor1	Server	192.168.2.211	ProLiant BL480c G1	Linux - XenServer Ente...
visor2	Server	192.168.2.212	ProLiant BL480c G1	Linux - XenServer Ente...
visor5	Server	192.168.2.215	ProLiant BL480c G1	Linux - XenServer Ente...

HP Business Service Management - Universal CMDB Administration

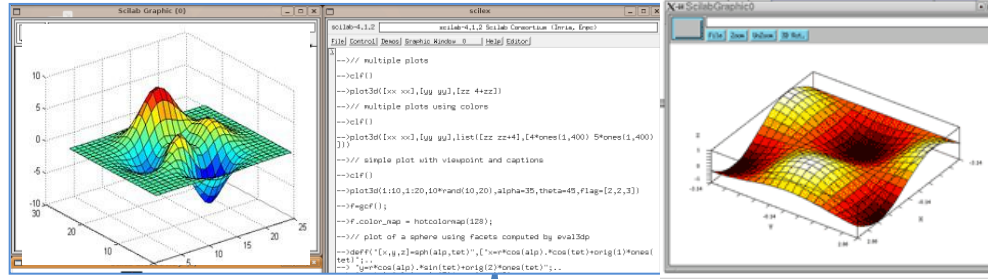
Agos-Pool Overview

Name	CPU Usage	Used Memory	Disks (avg / max KBs)	Network (avg / max KBs)	Address	Uptime
visor1	3% of 4 CPUs	28% of 4 GB	-	9/18	192.168.2.211	59 days 0 hours 54 minutes
vm11	0% of 1 CPU	90% of 256 MB	1/1	0/0	192.168.2.111, 192.168...	15 days 0 hours 20 minutes
vm12	0% of 1 CPU	90% of 256 MB	1/1	0/0	192.168.1.101, 192.16...	15 days 0 hours 20 minutes
vm21	0% of 4 CPUs	-	-	-	-	59 days 0 hours 55 minutes
vm51	0% of 4 CPUs	-	-	0/0	192.168.2.215	59 days 0 hours 54 minutes
vm52	0% of 2 CPUs	-	-	-	-	36 days 20 hours 11 minutes
vm61	0% of 1 CPU	-	-	-	-	36 days 20 hours 8 minutes
vm62	0% of 4 CPUs	-	-	0/0	192.168.2.216	59 days 0 hours 55 minutes
vm63	0% of 1 CPU	-	-	-	-	3 minutes
vm64	0% of 2 CPUs	-	-	-	-	36 days 20 hours 10 minutes



Integration with Scilab and Matlab

Integration with Scilab and Matlab



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Static Policy

LSF

Timing Policy
12/24

Desktops

Dynamic Workload
Policy

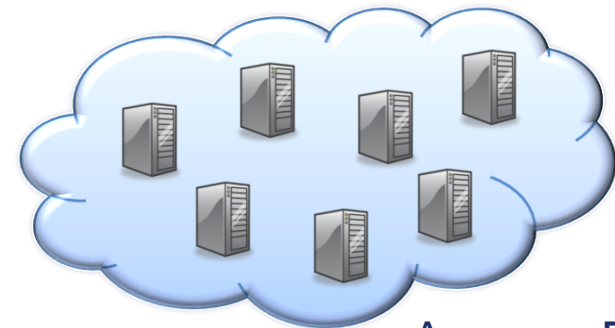
EC2



Dedicated resources



Desktops



Amazon EC2

Interface ProActive ↔ Scilab

```

Console
Fichier Edit Préférences Contrôle Applications ?
-->PAconnect('rmi://shainese.inria.fr:6608');
Connection successful to rmi://shainese.inria.fr:6608
-->res1 = PAsolve( 'cosh', list(1,2,3,4,5,6,7,8,9,10));
-->res1
res1 =
    res1(1)
1.5430806
    res1(2)
3.7621957
    res1(3)
10.067662
    res1(4)
27.308233
    res1(5)
74.209949
    res1(6)
201.71564
    res1(7)
548.31704
    res1(8)
1490.4792
    res1(9)
4051.542
    
```

Scheduler

File Window Help

Jobs

Pending (8) Running (10) Finished (7)

Pending (8)				Running (10)				Finished (7)				
Id	Priority	Name	Description	Id	Task	Priority	Name	Description	Id	Priority	Name	Description
78	Normal	job_2_tasks	2 tasks with variable durations	68	7/8	Normal	job_8_tasks	Simple test of 8 tasks with	61	Normal	job_8_tasks	Simple test of 8 tasks with variat
79	Normal	job_2_tasks	2 tasks with variable durations	69	7/8	Normal	job_8_tasks	Simple test of 8 tasks with	62	Normal	job_8_tasks	Simple test of 8 tasks with variat
80	Normal	job_2_tasks	2 tasks with variable durations	70	6/8	Normal	job_8_tasks	Simple test of 8 tasks with	63	Normal	job_8_tasks	Simple test of 8 tasks with variat
81	Normal	job_2_tasks	2 tasks with variable durations	71	0/1	Normal	job_PI	Calcul de Pi, methode de l	64	Normal	job_8_tasks	Simple test of 8 tasks with variat
82	Normal	job_2_tasks	2 tasks with variable durations	72	0/1	Normal	job_PI	Calcul de Pi, methode de l	65	Normal	job_8_tasks	Simple test of 8 tasks with variat
83	Normal	job_2_tasks	2 tasks with variable durations	73	0/1	Normal	job_PI	Calcul de Pi, methode de l	66	Normal	job_8_tasks	Simple test of 8 tasks with variat
84	Normal	job_2_tasks	2 tasks with variable durations	74	0/1	Normal	job_PI	Calcul de Pi, methode de l	67	Normal	job_8_tasks	Simple test of 8 tasks with variat
85	Normal	job_2_tasks	2 tasks with variable durations	75	0/1	Normal	job_PI	Calcul de Pi, methode de l				
				76	1/2	Normal	job_2_tasks	2 tasks with variable durat				
				77	0/2	Normal	job_2_tasks	2 tasks with variable durat				

Console Tasks

Job 65 has 8 tasks

Id	State	Name	Start time	finished time	Run time limit	Runnable	Description
65001	Finished	task6	08:55:11 07/05/07	08:55:16 07/05/07			
65002	Finished	task5	08:55:13 07/05/07	08:55:21 07/05/07			
65003	Finished	task4	08:55:14 07/05/07	08:55:20 07/05/07			
65004	Finished	task2	08:55:14 07/05/07	08:55:21 07/05/07			
65005	Finished	task8	08:55:15 07/05/07	08:55:35 07/05/07			
65006	Finished	task1	08:55:15 07/05/07	08:55:23 07/05/07			
65007	Finished	task3	08:55:16 07/05/07	08:55:24 07/05/07			
65008	Finished	task7	08:55:17 07/05/07	08:55:22 07/05/07			

Jobs info

Property	Value
Id	65
Name	job_8_tasks
Priority	Normal
Pending tasks number	0
Running tasks number	0
Finished tasks number	8
Total tasks number	8
Submitted time	08:54:55 07/05/07
Started time	08:55:11 07/05/07
Finished time	08:55:35 07/05/07
Pending duration	16s 25ms
Execution duration	24s 622ms

Interface ProActive ↔ Matlab

The image displays two software interfaces side-by-side. On the left is the MATLAB 7.5.0 (R2007b) environment. The Command Window contains the following code:

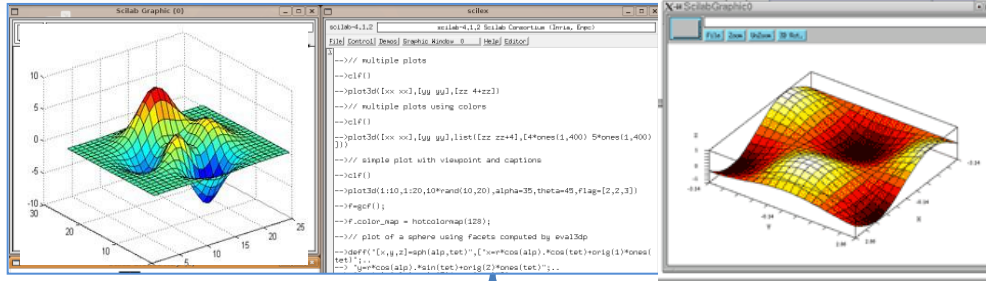
```

class(input)
PAsolve(input, @factoria
ans{10}
PAsolve(input, @factoria
ans{1}
input{1}
PAsolve({1,2,3},@testEmp
clear
PAsolve({1,2,3,4,5,6,7,8
PAsolve({1,2,3,4,5,6,7,8
PAsolve({1,2,3,4,5,6,7,8
PAsolve({1,2,3,4,5,6,7,8
initExample
PAsolve({1,2,3,4,5,6,7,8,9,10,11,12,13,14,15,16,17,18,19,20,21,22,23,24},@factor
initExample
PAsolve({1,2,3,4,5,6,7,8
  
```

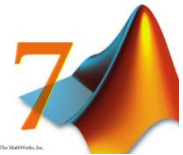
The right window is the ProActive Scheduler. It shows a list of jobs categorized into Pending (10), Running (10), and Finished (128). The Job Info panel for job 116 provides the following details:

Property	Value
Started time	13:43:43 07/23/08
Finished time	13:43:44 07/25/08
Pending duration	1s 58ms
Execution duration	1s 227ms
Total duration	2s 285ms
Description	Set of parallel matlab tasks

Integration with Scilab and Matlab



MATLAB
The Language of Technical Computing



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Static Policy

LSF

**Timing Policy
12/24**

Desktops

**Dynamic
Workload Policy**

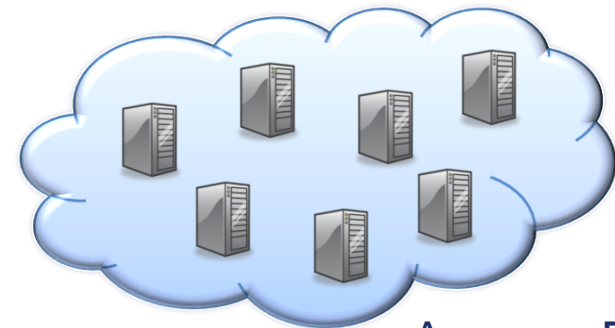
EC2



Dedicated resources

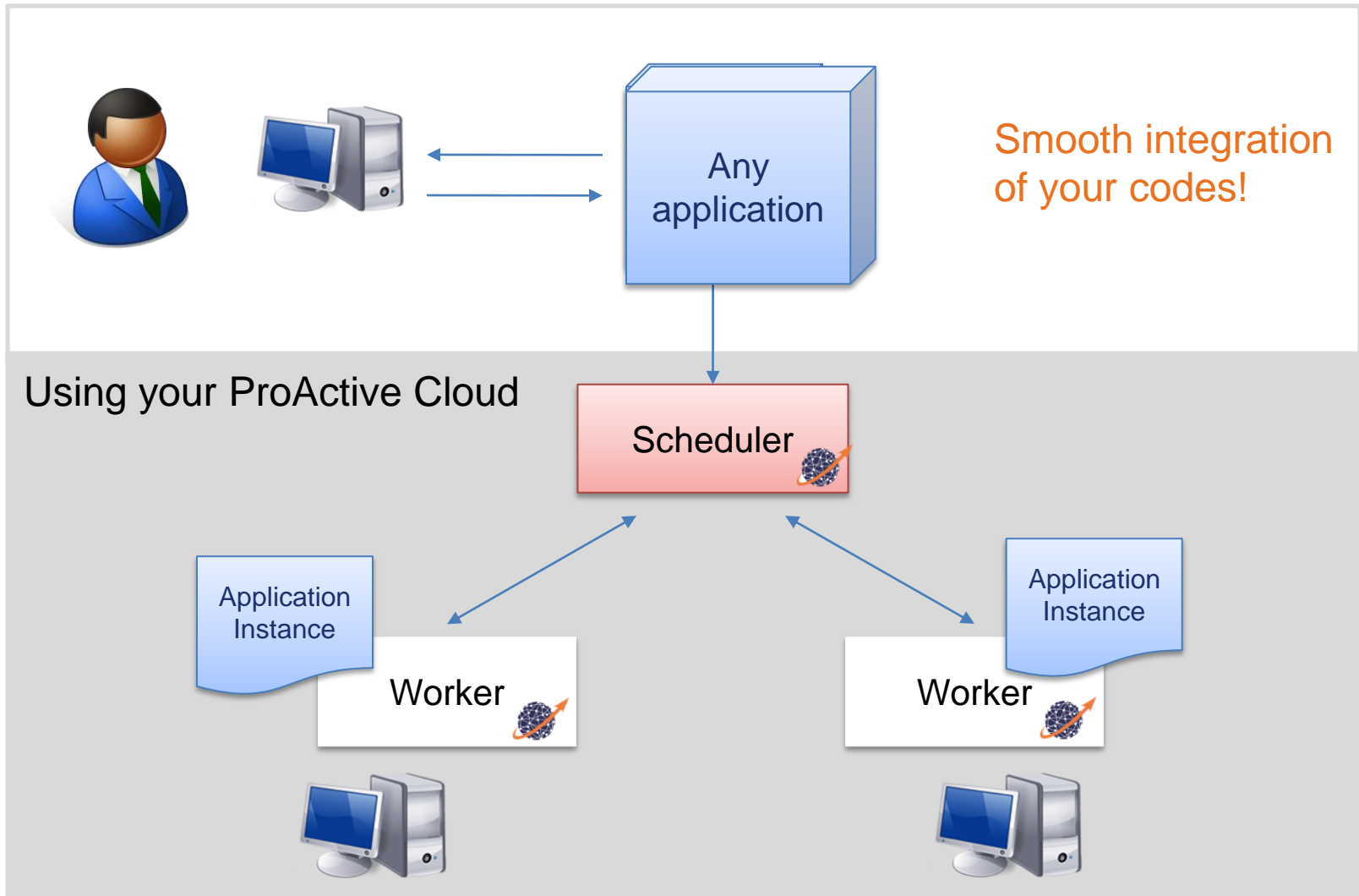


Desktops



Amazon EC2

Integration with Applications



Conclusion

Conclusion



Flexibility

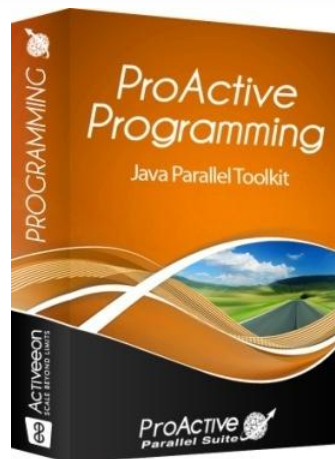
Clutch Power

Portability:

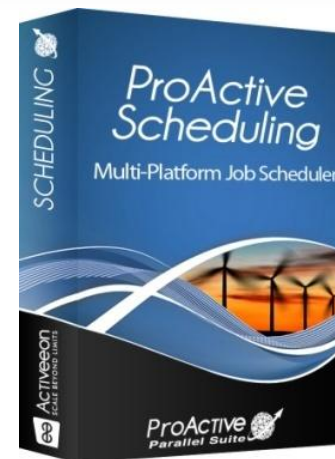
Windows, Linux, Mac

Versatility:

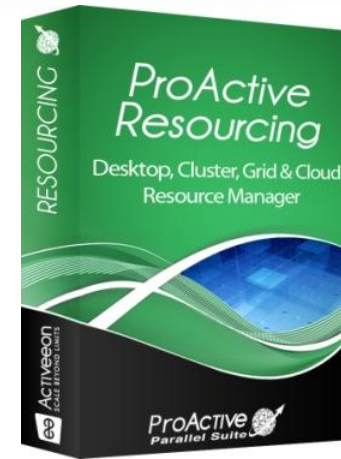
Desktops, Grids, Clouds



Java Parallel Toolkit



Multi-Platform Job Scheduler



Resource Manager

Free Professional
Open Source Software



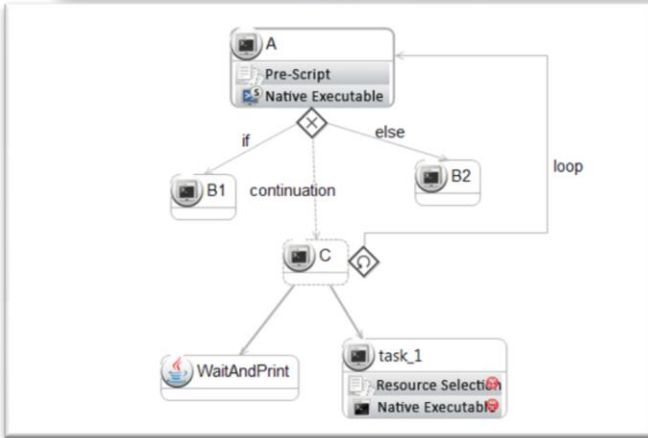
ProActive.inria.fr

Multi-Core: No sharing Parallel Programming Model

Cloud: Smooth transition needed:

Consolidation + Interoperability

Workflow Execution Studio Editor and Visualization Parallel Programming in Java

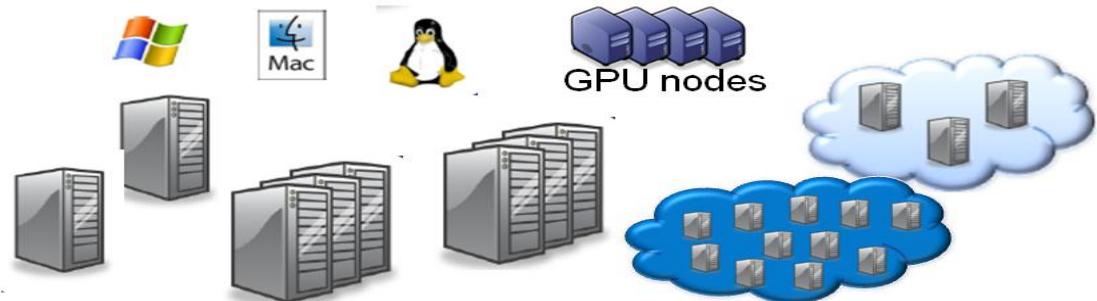
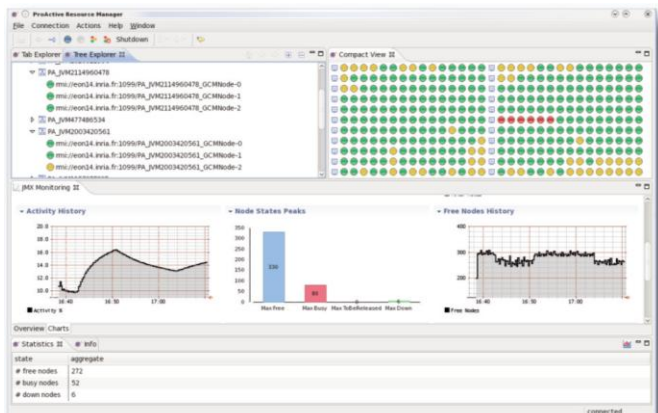


Portal, Multi-Application & Multi-Tenant Enterprise Orchestration

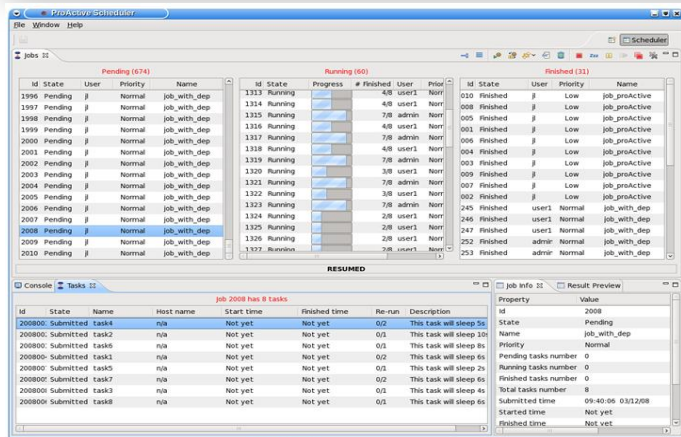
ID	State	User	Progress	Priority
2002	Running	border	1/3	Normal
2001	Running	border	1/3	Normal
2000	Running	border	1/3	Normal
2099	Running	border	1/3	Normal
2062	Killed	border	1/3	Normal
2010	Running	madsen	3/4	Normal
2000	Killed	madsen	3/4	Normal
2095	Finished	rsneer	3/3	Normal

User	Jobs	Connected at	Last submit	Hostname
rsneer	0	03/18 11:17:25		4649
madsen	29	03/18 12:59:30	03/18 05:38:23	4659
border	66	03/18 04:55:39	03/18 04:17:22	4690
colaba	1	03/17 11:35:02	03/17 11:38:11	4722
border	0	03/17 03:54:45		4722
watcher	0	03/18 02:47:14		4876
demo	0	03/18 08:33:57		4876

Physical and Virtual Machines Management



Conclusion



ProActive
Parallel Suite

Computing Portal for
Heterogeneous Resources



Free Professional
Open Source Software

OW2
Consortium



- Portability:
Windows, Linux, Mac
- Versatility:
Desktops, Grids, Clouds

- Infrastructure Management
Dynamic (Local, Remote, Public Cloud)
- Application Acceleration:
APIs: Java, C++, Script, WS REST full

ProActive
Parallel Suite

Industrial (1750) & Cloud Revolution Compared

	Industrial Revolution	Cloud Revolution
Concept	Mechanization and centralization of manufacturing activities	Computing as a Utility Centralization of Data Center, Automation
Technology	Supporting new technos (Mechanic, Tool Machines, etc.)	Distributed Computing Virtualization Multi-Cores Network
Socio Economical Factors	Large new demand was ready to use the new offer. (A change in business attitude & organization)	IT Cost Reduction Pressure CIO Nightmare CEO Out-of-DataCenter CapEx

→ All elements converge for a strong Cloud Revolution

Sources & Inspiration: Simon Wardley (CSC) Scott Stewart



<http://proactive.inria.fr>

