

# Cloud Computing Revolution

D. Caromel, et al.

## Agenda

1. Background: INRIA, ActiveEon
2. CLOUD Computing
3. ProActive Parallel Suite  
*Programming, Scheduling, Resourcing*
4. Use Cases & Demos:  
Genomics, Engineering, Multi-Disciplinary
5. Conclusion: Cloud Revolution ?



Cloud: Pay as you Go  
Opex vs. Capex

# CLOUD Revolution

- ❑ 1990: PCs
- ❑ 2000: Internet for Companies
- ❑ 2010: Cloud for Companies

Concept: John McCarthy in 1961 originally coin the expression  
“Utility Computing” (Electricity, Water, Gas)

Today: How could we do without Internet and Google Search ?  
In 2020: we will not imagine working without Clouds

Today: We buy Network, Hardware, Software, Services  
Tomorrow: Cloud Services (hiding N, H, S)



# 1. Background



## □ 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!

# 8 INRIA's Research Centres

INRIA Lille  
Nord Europe



**3 800 HC, 217 M Euro**

INRIA Paris  
Rocquencourt



2 900 Scientists

1200 Researchers, Faculty members

1200 Doctoral students

500 Post-Doct & Visiting scientists

1 000 Engineers, Technicians and Staff

INRIA Nancy  
Grand Est



INRIA  
Saclay  
Île-de-France

INRIA Rennes  
Bretagne Atlantique



8 Research Centres in France

68 Associated Teams worldwide

INRIA Grenoble  
Rhône-Alpes



4 000 Scientific Publications / year

230 Active patents

INRIA Bordeaux  
Sud-Ouest



89 Innovative companies created



# Startup Company Born of INRIA



**ACTIVEeon**  
SCALE BEYOND LIMITS

Some Customers:



Some Partners:



❑ Co-developing, Support for [ProActive Parallel Suite](#)

❑ Worldwide Customers: Fr, UK, Boston USA

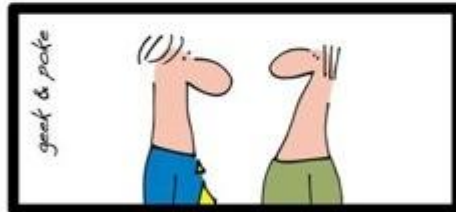




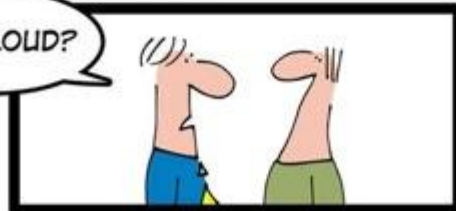
# 2. Cloud Computing

# The CLOUD Solution

MY DAUGHTER SMOKES, MY SON IS IN JAIL AND MY WIFE AND MY GIRLFRIEND HAVE LEFT ME. DO YOU HAVE ANY ADVISE FOR ME?



THE CLOUD?



A GOOD CONSULTANT IS ALWAYS ON DUTY



Source: ScienceDaily



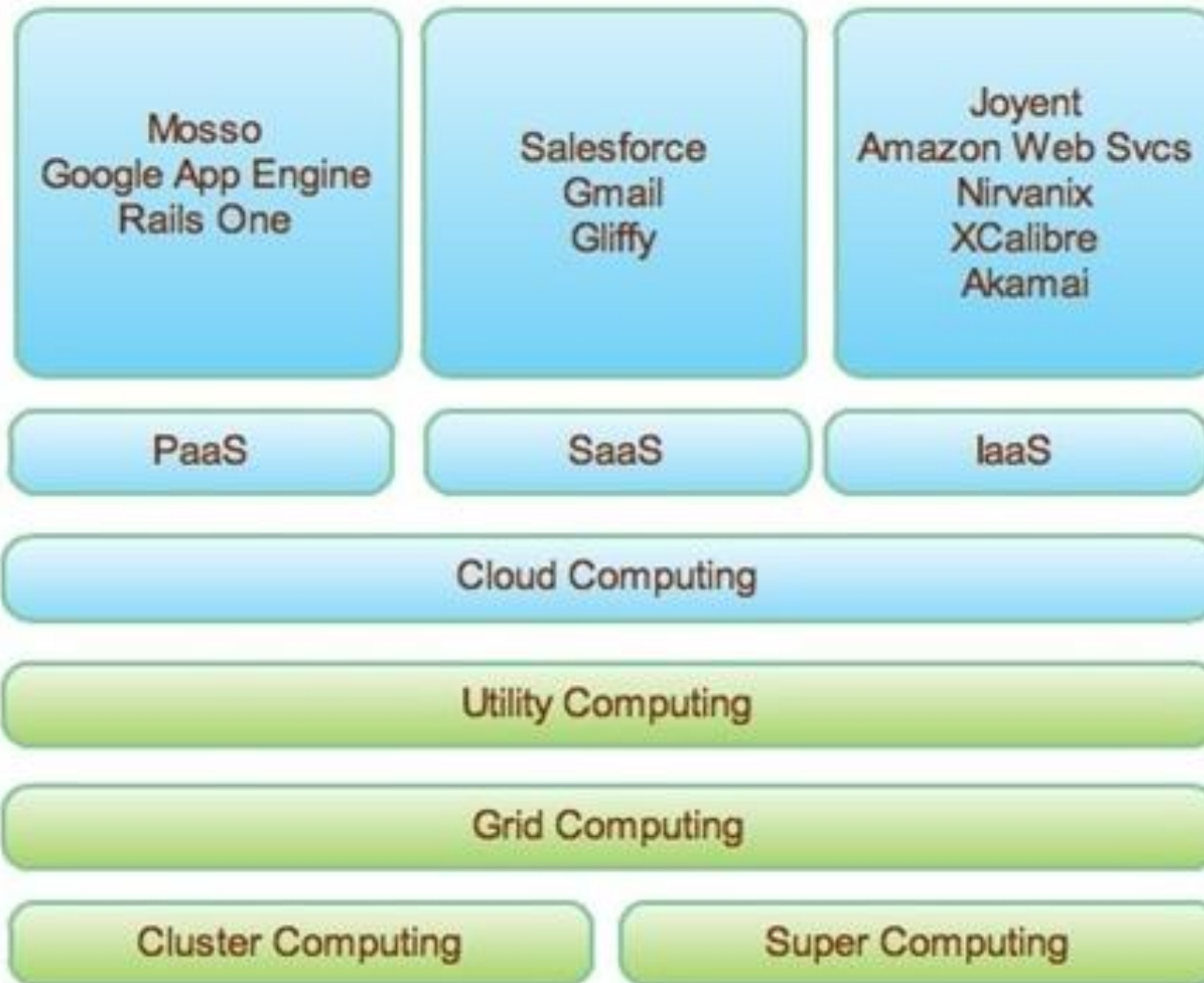
# Clouds: Basic Definition

- ❑ Dynamically scalable, often virtualized resources
- ❑ Provided as a service over the Internet
- ❑ Users need not have knowledge of, expertise in, or control over the technology infrastructure

## XaaS: Anything as a Service

- ❑ Software as a service (SaaS), CRM, ERP
- ❑ Platform as a service (PaaS), Google App Engine
- ❑ Infrastructure as a service (IaaS), Amazon EC2

# Clouds in Picture



# From Grids to Clouds

## □ Grid Computing

- Several administrative Domains
- Virtual Organizations
- Trading not based on Currency

→ (Too) Hard

## □ Cloud solves the issue:

- Pay as you Go

## Distributed, //, & Grid Technologies for Clouds

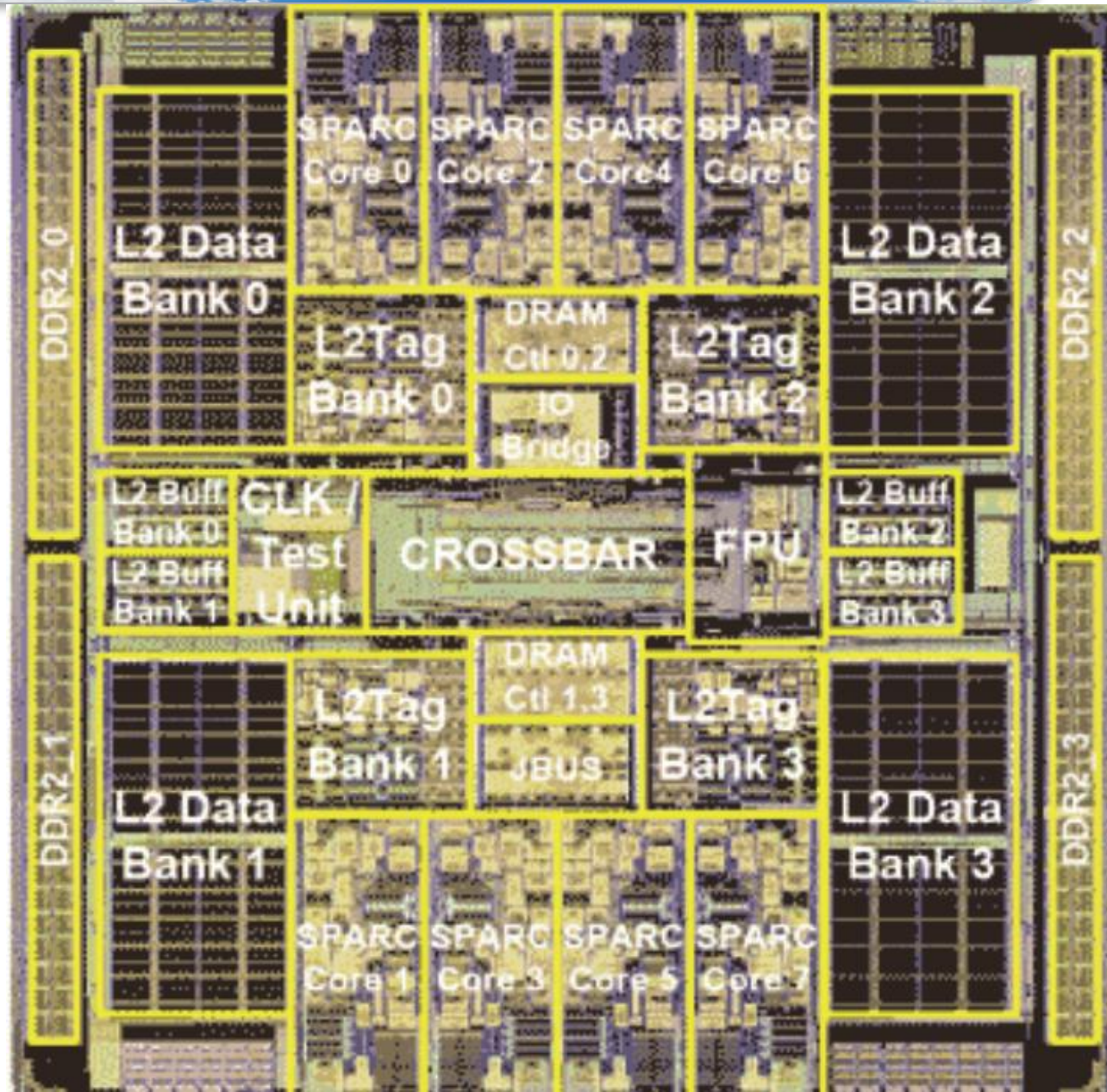




Multi-Core Push

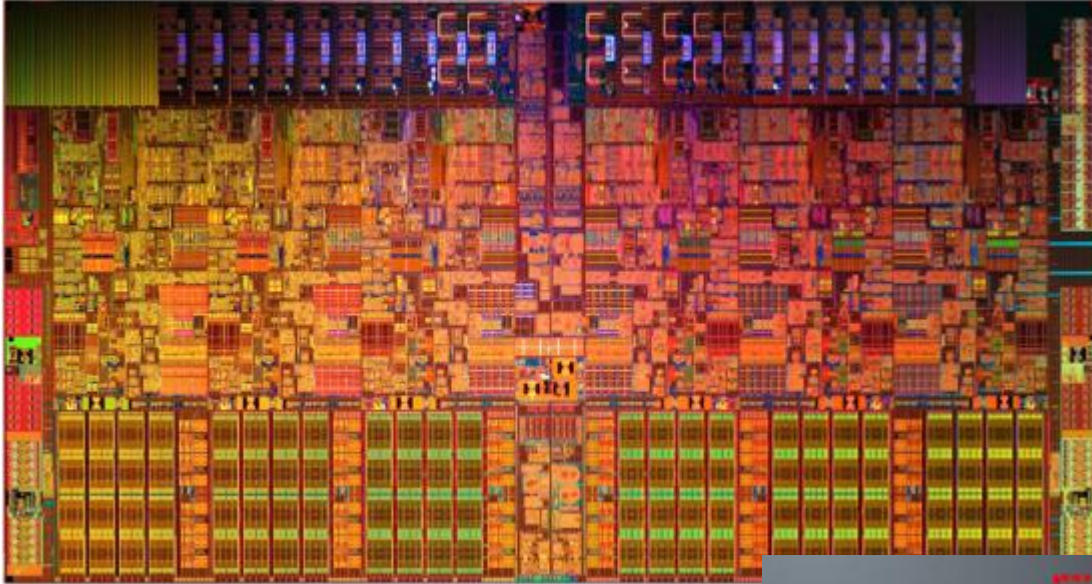
# Symmetrical Multi-Core: 8-ways Niagara II

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



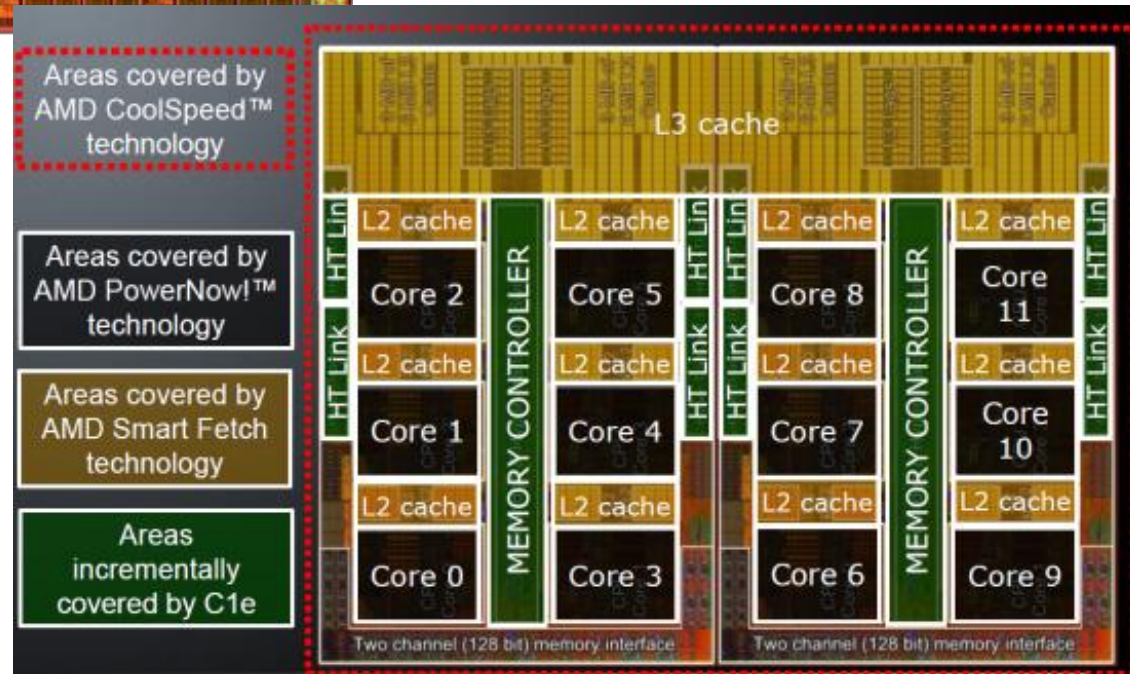


# Today Off The Shelf Multi-Cores, 3 GHz



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

Intel Xeon 5670,  
6 cores





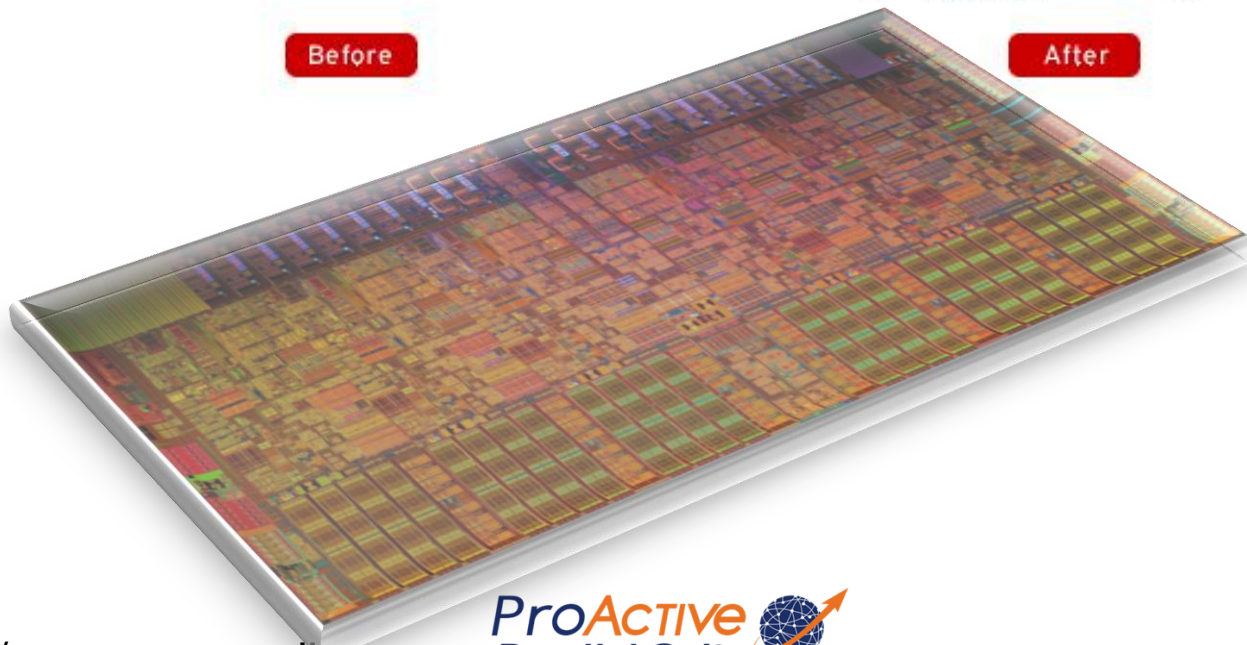
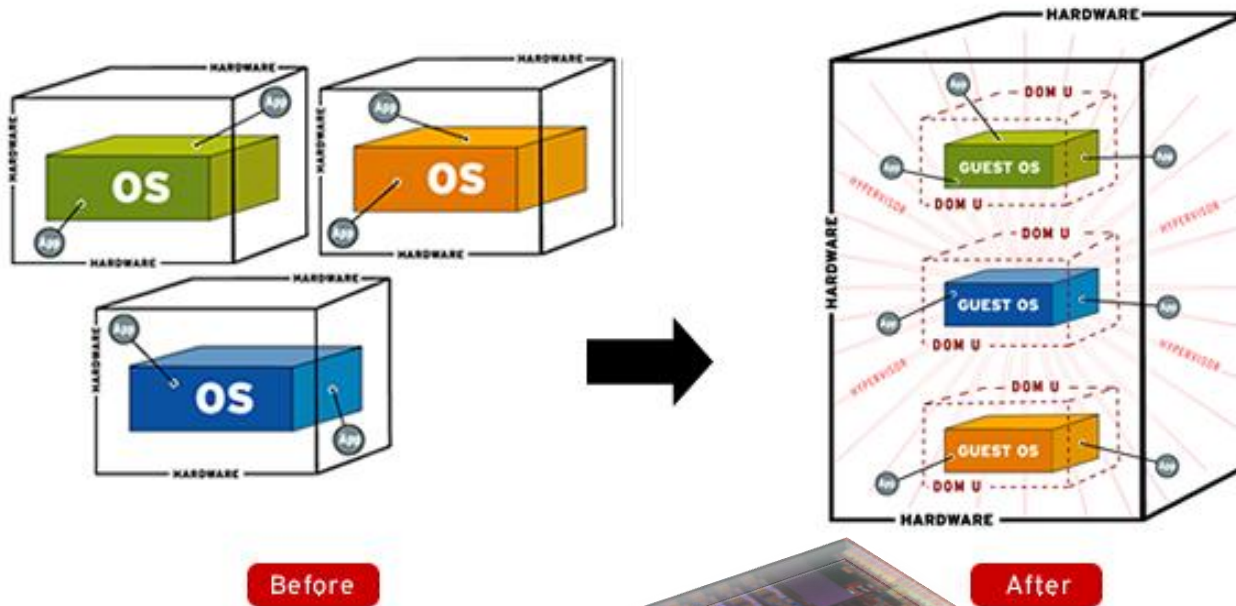
# Multi-Cores: A Few Key Points

- ❑ Moore's Law rephrased:  
Nb. of Cores double every 18 to 24 months
  
- ❑ Key expected Milestones: Cores per Chips (OTS)
  - 2012: 32 to 64
  - 2014: 64 to 128
  
- ❑ 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



# Virtualization

# Virtualization

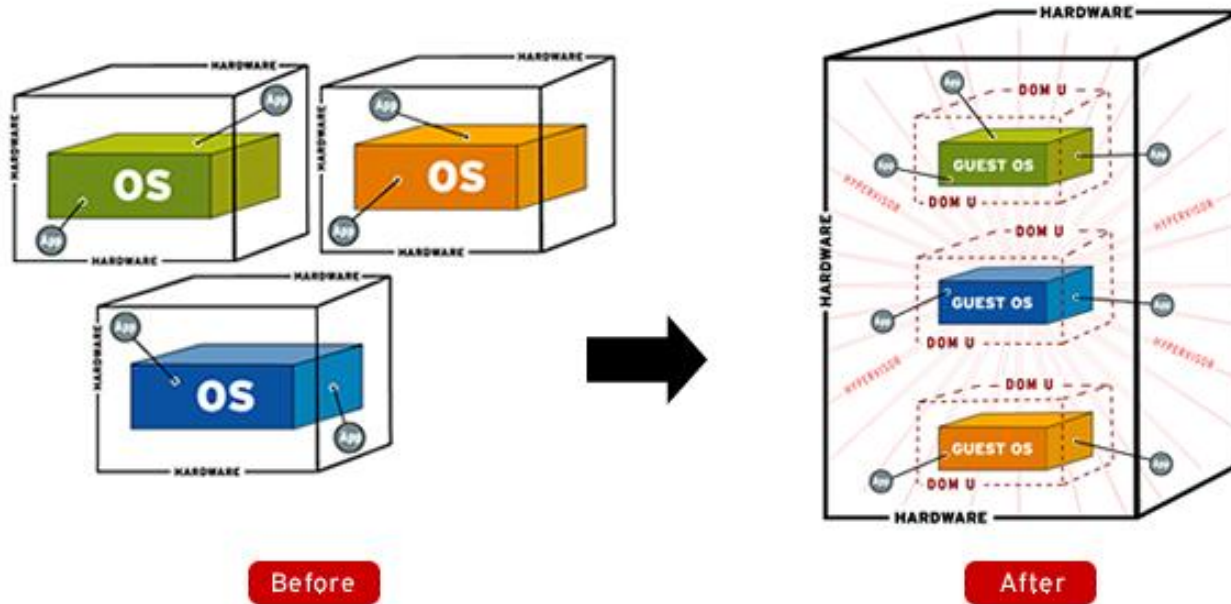




# Virtualization



# Virtualization



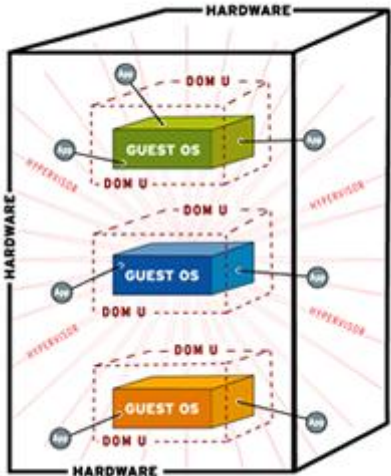


# What we Used to do as Syst. Admin.





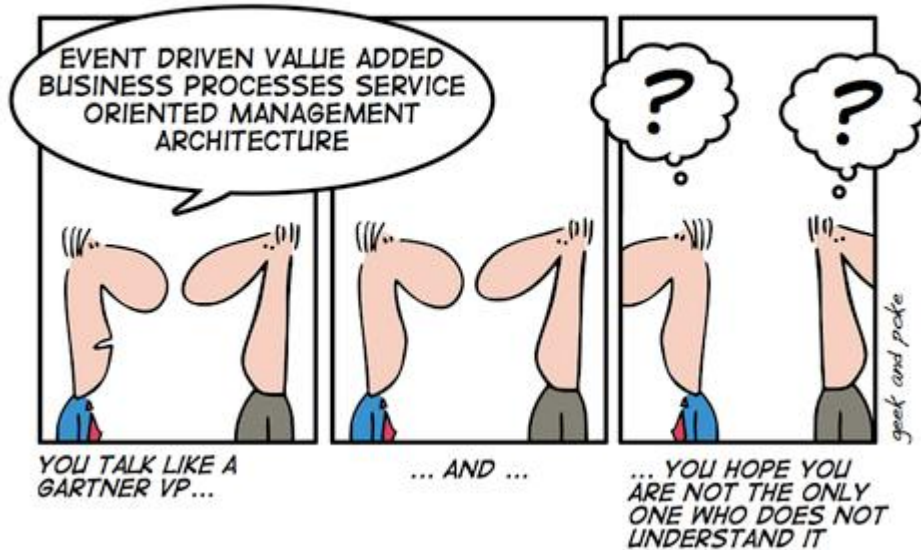
# With Virtualization + Software Appliance





# Attitude and Behavior Shifts: CIO Nightmare

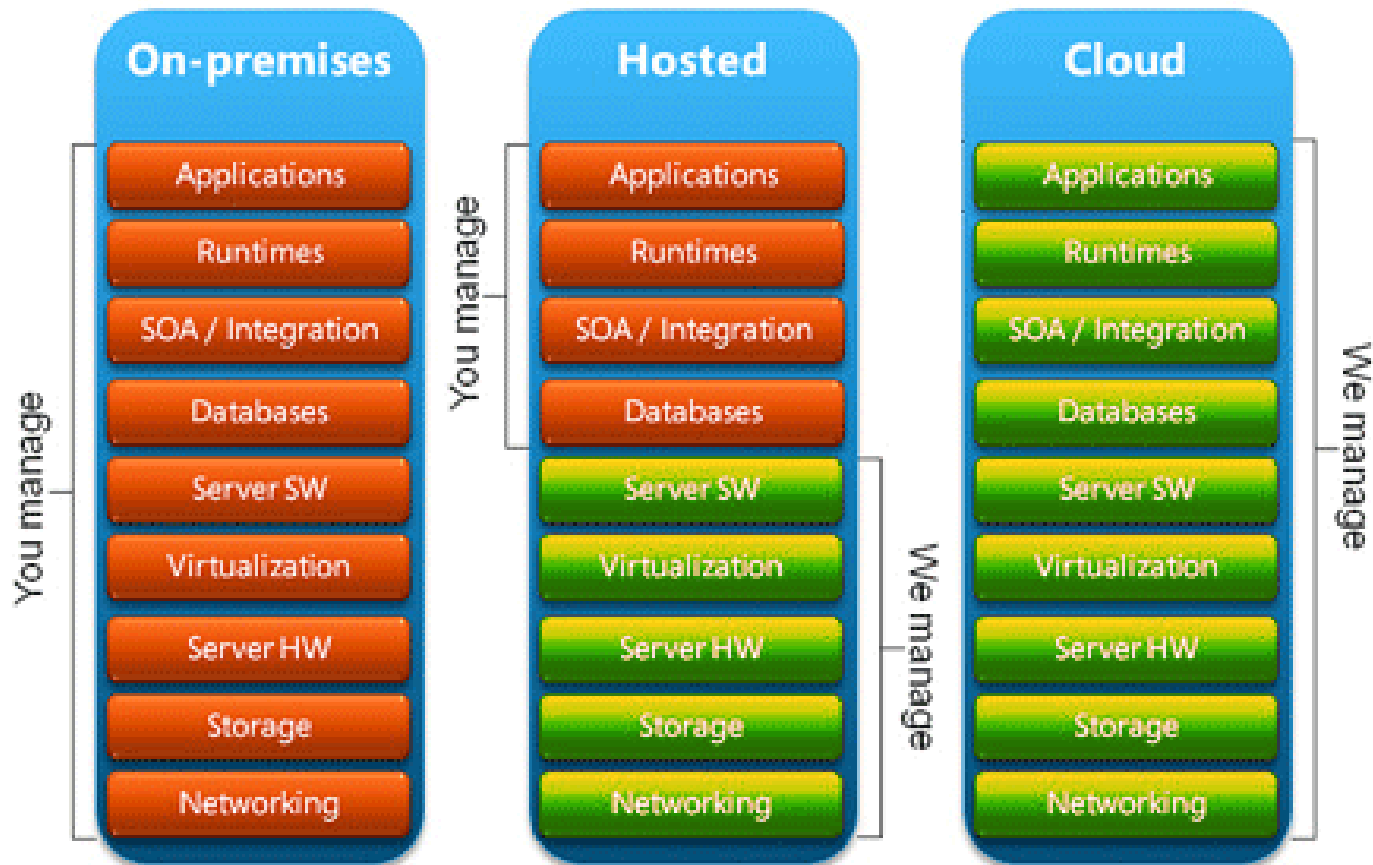
HOW DO YOU KNOW YOU'RE A CIO?



- ❑ Technology is getting too complex ... even for CIO (not for CTO)
- ❑ No longer want to buy rack of servers or storage or network device
- ❑ Want to buy Services
- ❑ Want to Pay per Use

- ❑ CBA Australian bank Group Executive and CIO, Michael Harte, announced their move to cloud computing.
- ❑ *“We will never buy another data center”*

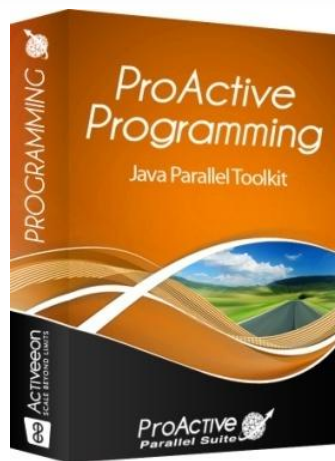
# Administration Burden



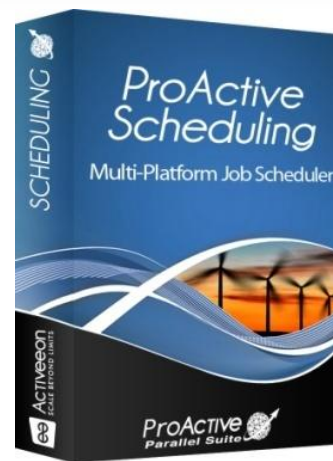
# 3. ProActive Parallel Suite



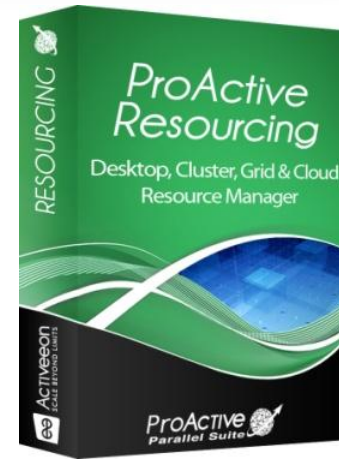
# Cloud Solution: ProActive Parallel Suite



Java Parallel Toolkit



Multi-Platform Job Scheduler



Resource Manager

**amaDEUS**  
Your technology partner

**Used in Production Today:**  
**50 Cores → 300 Cores 2010**

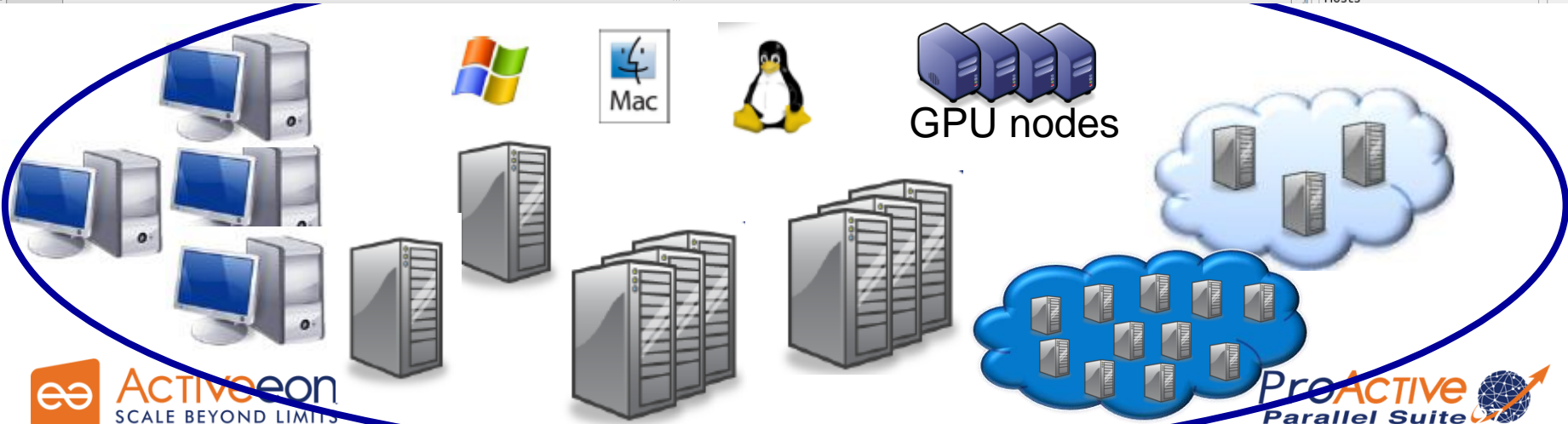
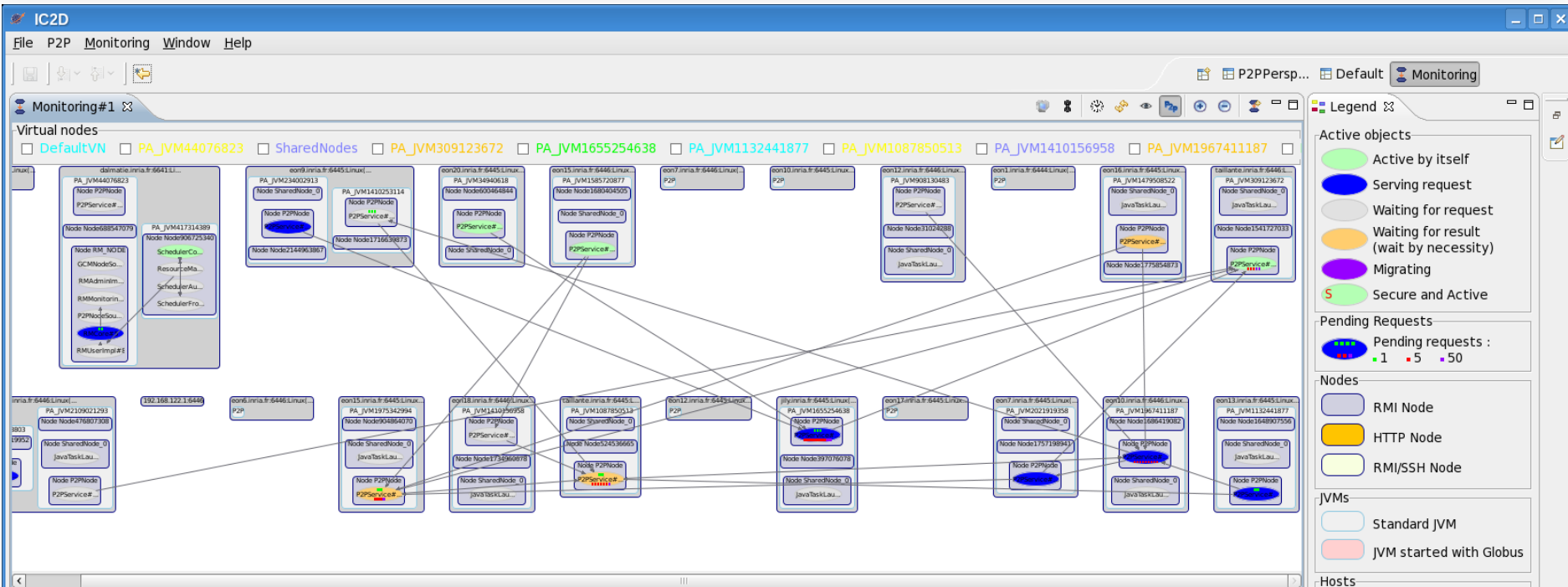
Strong Differentiation:

- ❑ Java Parallel Programming + Integration +
- ❑ Portability: Linux, Windows, Mac +
- ❑ Versatility: Desktops, Cluster, Grid, Clouds = Perfect Flexibility



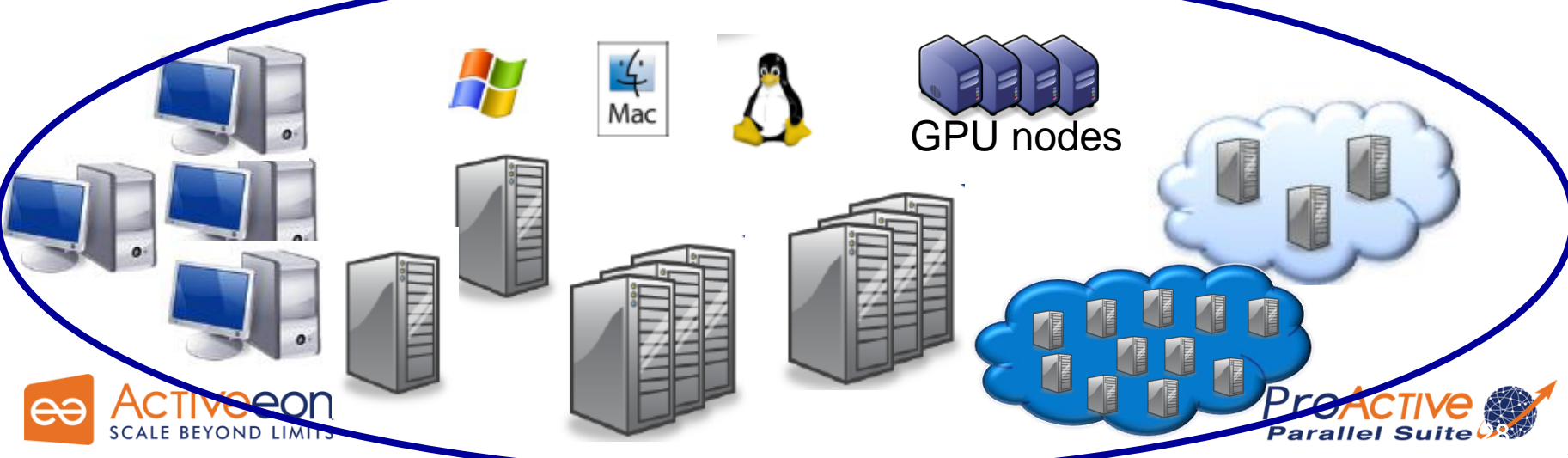
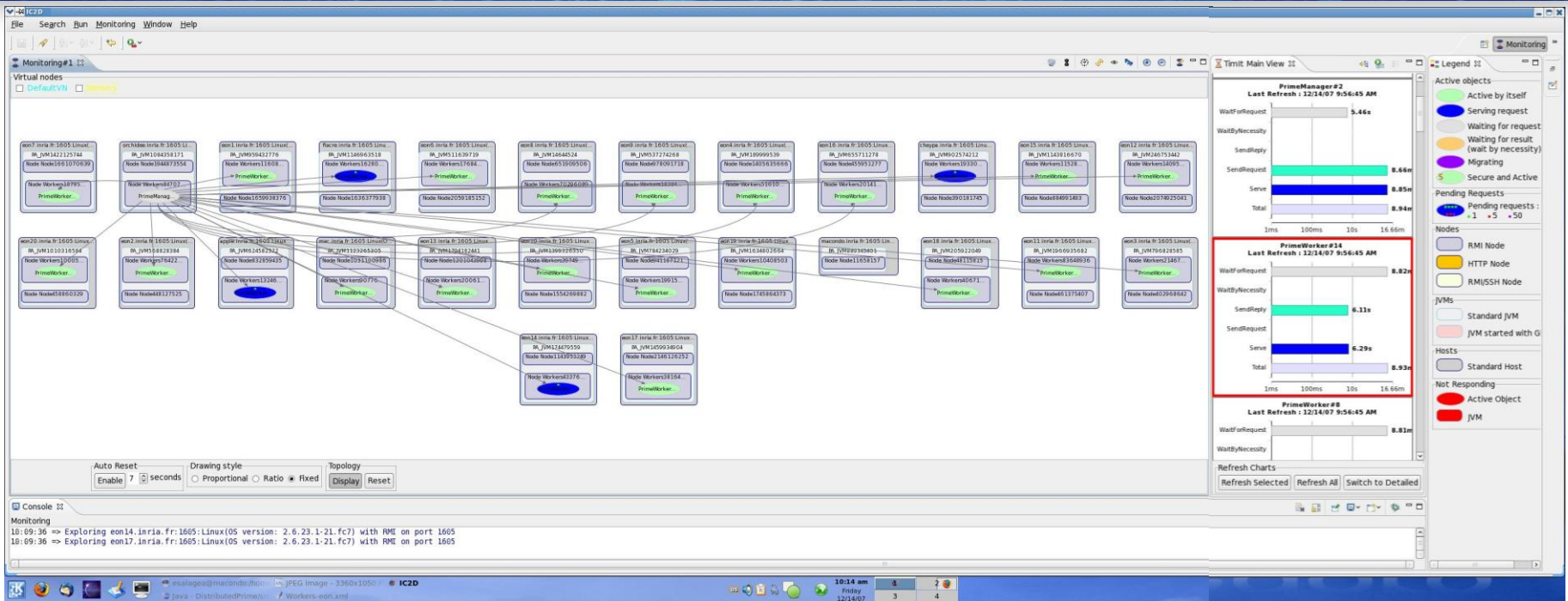
# ProActive Programming: Active Objects

# ProActive Programming View





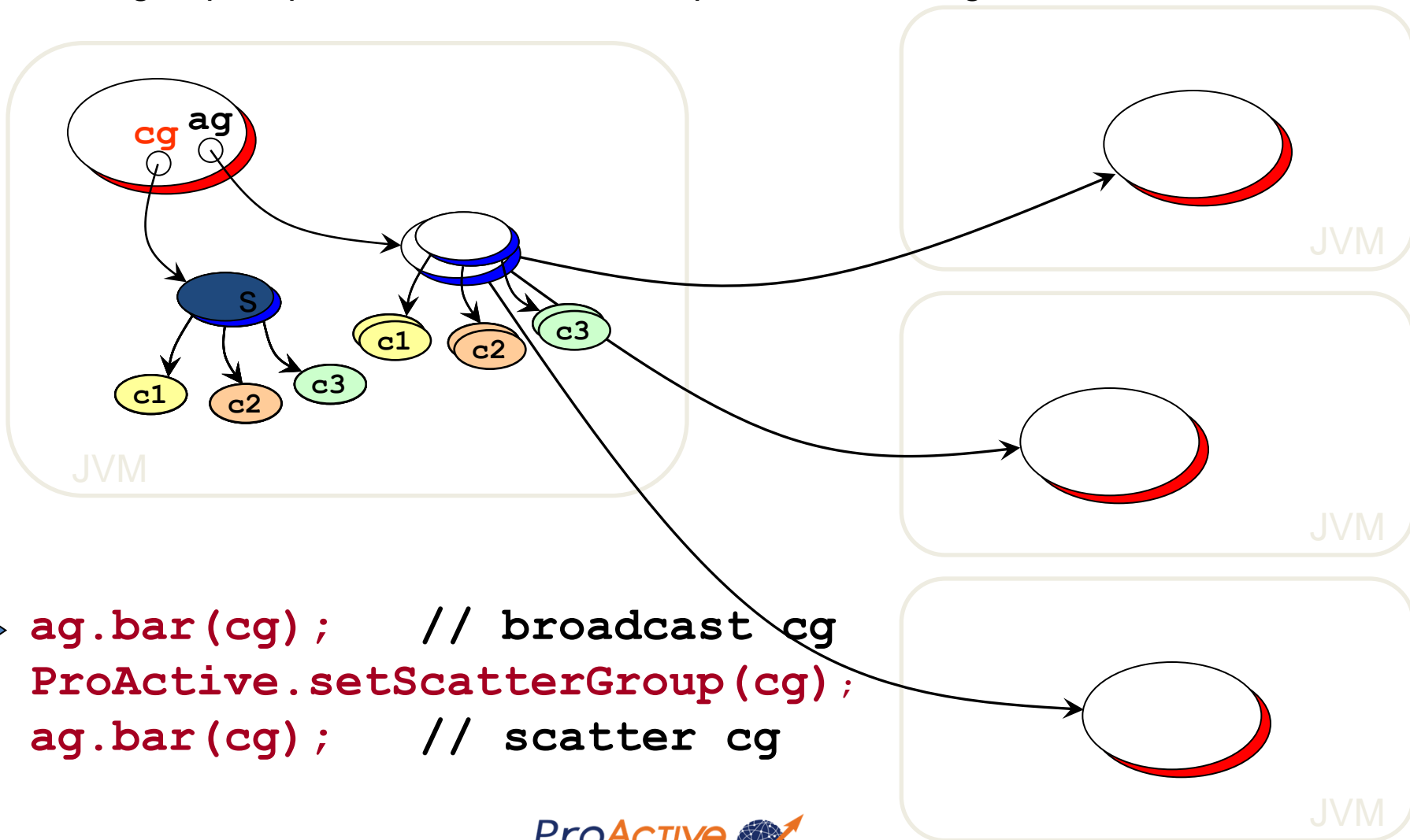
# ProActive Programming View



# Broadcast and Scatter

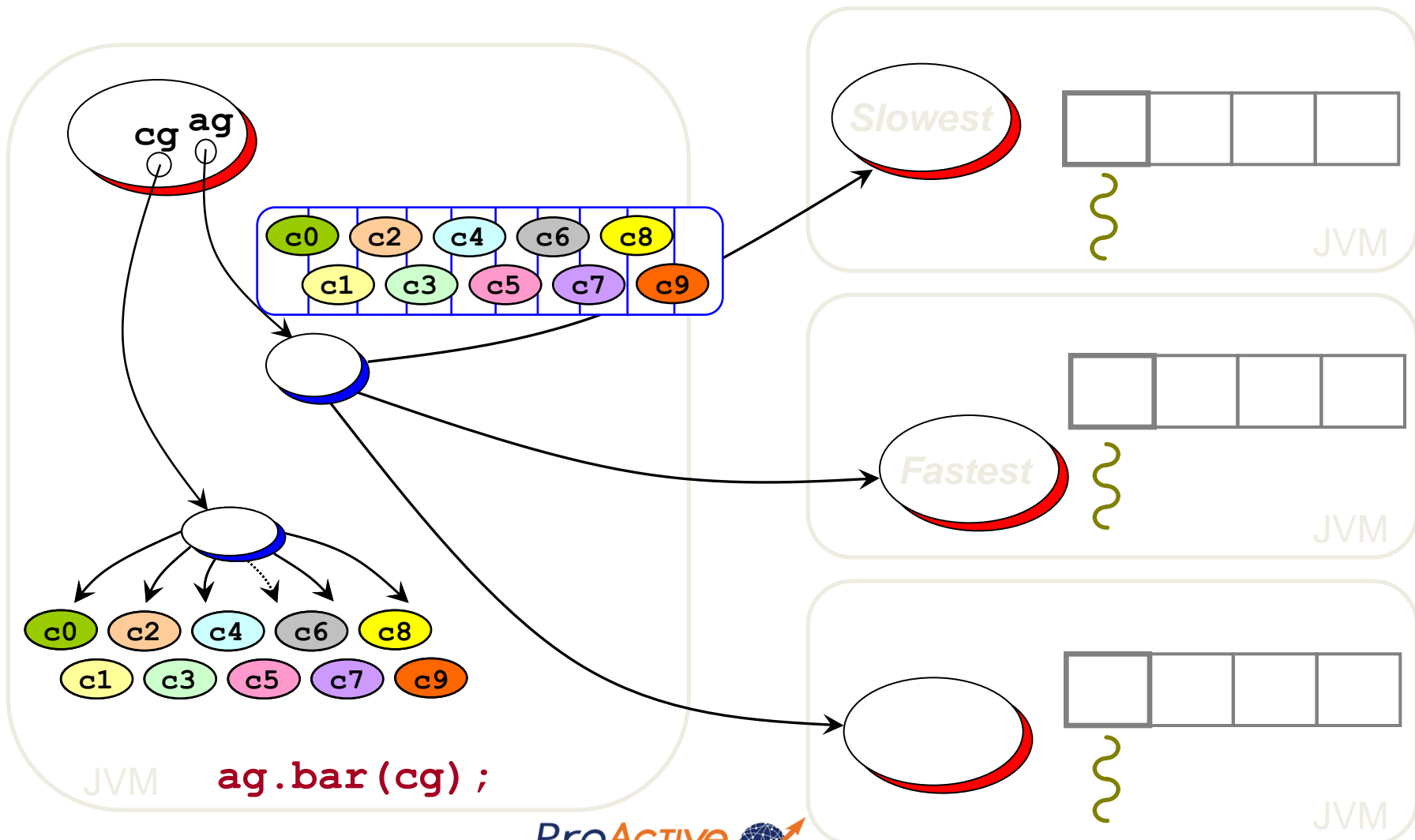
Broadcast is the default behavior

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





# IC2D: Optimizing

The screenshot displays the Eclipse IDE interface with two main views: the Monitoring View on the left and the Job Monitoring View on the right.

**Monitoring View:** This view shows a hierarchical tree of virtual nodes. The top-level node is 'Virtual nodes', which is expanded to show 'Renderer', 'DefaultVN', 'Dispatcher', and 'User'. The 'Renderer' node is selected. Below this, a diagram shows a network of nodes connected by arrows. The nodes include 'DinnerLayout#2', 'Table#3', 'Philosopher#4', 'Philosopher#5', 'Philosopher#6', 'Philosopher#7', and 'Philosopher#8'. These are connected to a central set of nodes: 'Node Renderer-127...', 'Node Dispatcher-5...', 'Node User1602644...', and 'Node Renderer1307...'. Below this central set, there are three more nodes: 'Node Renderer1174...', 'Node Renderer-151...', and 'Node Node-4551863...'. The 'Node Node-4551863...' node is highlighted in red. At the bottom of the Monitoring View, there are checkboxes for 'Display topology', 'Proportional', 'Ratio', 'Filaire', and 'Monitoring enable', along with a 'Reset Topology' button.

**Job Monitoring View:** This view shows a tree of job monitoring information. The root node is 'DefaultVN (JOB-1357457629...)'. It is expanded to show 'bebita.inria.fr:1099:OS un', which is further expanded to show 'PA\_JVM1357457629\_'. This node is expanded to show 'Node Node6056249...'. This node is expanded to show 'DinnerLayout#2', 'Table#3 (JOB-1357457629...)', 'Philosopher#4 (JOB-1357457629...)', 'Philosopher#5 (JOB-1357457629...)', 'Philosopher#6 (JOB-1357457629...)', 'Philosopher#7 (JOB-1357457629...)', and 'Philosopher#8 (JOB-1357457629...)'. Below this, there are other job monitoring nodes: 'sidonie.inria.fr:1099:OS un', 'Dispatcher (JOB--1672076495)', 'User (JOB--294719007)', 'bebita.inria.fr:1099:OS un', 'PA\_JVM-294719007\_1', 'Node User1602644', 'C3DUser#13 (JOB-1672076495)', 'Renderer (JOB--1672076495)', 'bebita.inria.fr:1099:OS un', and 'PA\_JVM-1631909824\_1'.

**Console:** The console at the bottom shows the following message: '15:09:15 => NodeObject id=Node-455186381 already monitored, check for new active objects'.

# IC2D

IC2D Monitoring Window Help

Virtual nodes: DefaultVN, matrixNode

orchidee.inria.fr:4001:Li...

PA\_JVM1820960857  
Node Node-632703901

Node matrixNode15...

OctTree#2

Domain#3

Domain#4

Domain#5

Domain#6

Maestro#7

BioMaestro#8

PA\_JVM1949849146  
Node Node-2003411204  
Displayer#1

PA\_JVM1370729570  
Node Node557274178

Auto Reset: Enable 7 seconds

Drawing style:  Proportional  Ratio  Fixed

Topology:

Legend

Active objects

- Active by itself
- Serving request
- Waiting for request
- Waiting for result (wait by necessity)
- Migrating
- Secure and Active

Pending Requests

- Pending requests: 1 (green), 5 (red), 50 (blue)

Nodes

- RMI Node
- HTTP Node
- RMI/SSH Node

JVMs

- Standard JVM
- JVM started with Globus

Timer Tree View

Name	Time [ms]	Total [%]	Invocations	Parent [%]
Domain#5				
Total	142212.28	100.00	1	0.00
WaitForRequest	21627.76	15.21	2056	15.21
Serve	120543.91	84.76	5352	84.76
SendReply	0.00	0.00	0	0.00
WaitByNecessity	17050.55	11.99	5340	14.14
SendRequest	101773.58	71.56	16054	84.43
Domain#4				
Total	142228.27	100.00	1	0.00
WaitForRequest	21249.88	14.94	2114	14.94
Serve	120936.36	85.03	5353	85.03
SendReply	0.00	0.00	0	0.00
GroupOneWayCall	0.00	0.00	0	0.00
GroupAsyncCall	0.00	0.00	0	0.00
WaitByNecessity	16765.29	11.79	5348	13.86
SendRequest	102320.24	71.94	16057	84.61
Serialization	1101.89	0.77	5352	1.08
LocalCopy	2471.16	1.74	10705	2.42
BeforeSerializati	20631.26	14.51	5352	20.16

Timt View

Domain#4 Snapshot time: 18/10/07 16:20:45

Operation	Time
GroupAsyncCall	1.28m
GroupOneWayCall	1.10s
AfterSerialization	20.63s
BeforeSerialization	2.47s
LocalCopy	21.24s
WaitForRequest	16.76s
WaitByNecessity	1.70m
SendReply	2.01m
SendRequest	2.37m
Serve	2.37m
Total	2.37m

Domain#5 Snapshot time: 18/10/07 16:20:45

Refresh Charts: Refresh Selected, Refresh All, Switch To Basic

Time Line View Console

BigMaestro#8

Maestro#7

Domain#6

Domain#5

Domain#4

Domain#3

OctTree#2

0ms 082.894ms 165.788ms 248.682ms 331.576ms 414.470ms 497.364ms 580.258ms 663.152ms 746.4

Java - Domain.java - Eclipse Terminal - Konsole TimtIC2D\_Output - Konque emacs@orchidee.inria.fr emacs@orchidee.inria.fr <2 ProActive N-Body

Conventional & Interruptable X-Chat [2.4.0]: vbodnart @ Inbox - Mozilla Thunderbird KCalc emacs@orchidee.inria.fr <3 IC2D

16:23 2007-10-18

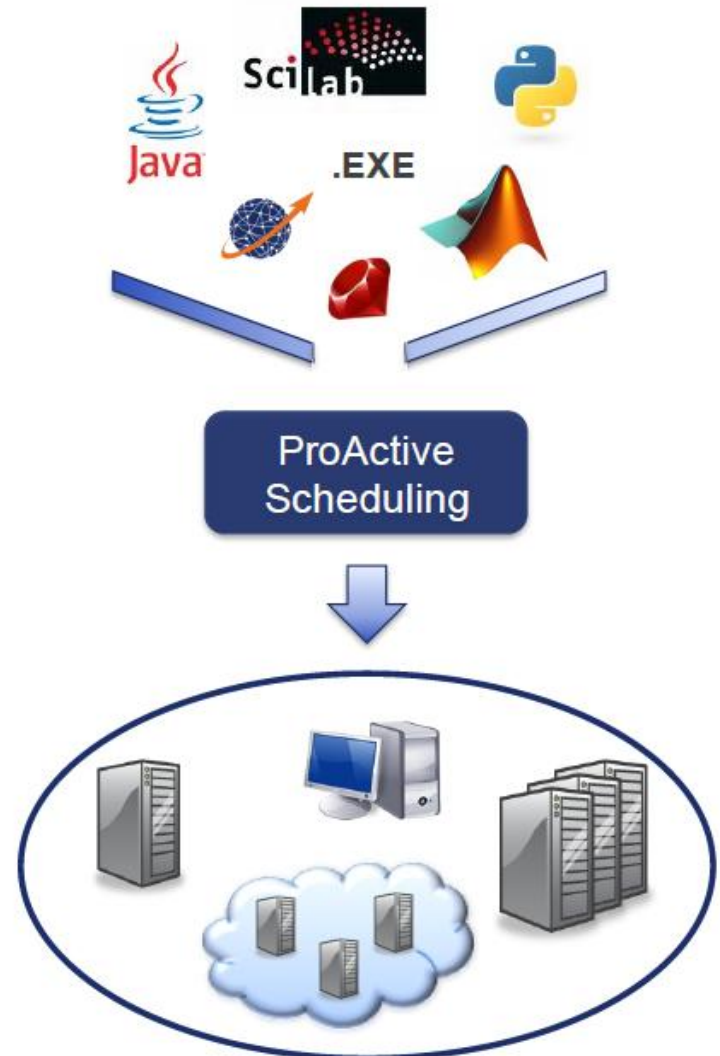


# Video 1: IC2D Optimizing Monitoring, Debugging, Optimizing



# Scheduling & Resourcing

# ProActive Scheduling





# ProActive Scheduling Big Picture

ProActive Scheduler

File Window Help

Scheduler

Jobs

Pending (674) Running (60) Finished (31)

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

Id	State	Progress	# Finished	User	Prior
1313	Running	<div style="width: 25%;"></div>	4/8	user1	Norr
1314	Running	<div style="width: 25%;"></div>	4/8	user1	Norr
1315	Running	<div style="width: 25%;"></div>	7/8	admin	Norr
1316	Running	<div style="width: 25%;"></div>	4/8	user1	Norr
1317	Running	<div style="width: 25%;"></div>	7/8	admin	Norr
1318	Running	<div style="width: 25%;"></div>	4/8	user1	Norr
1319	Running	<div style="width: 25%;"></div>	7/8	admin	Norr
1320	Running	<div style="width: 25%;"></div>	3/8	user1	Norr
1321	Running	<div style="width: 25%;"></div>	7/8	admin	Norr
1322	Running	<div style="width: 25%;"></div>	3/8	user1	Norr
1323	Running	<div style="width: 25%;"></div>	7/8	admin	Norr
1324	Running	<div style="width: 25%;"></div>	2/8	user1	Norr
1325	Running	<div style="width: 25%;"></div>	2/8	user1	Norr
1326	Running	<div style="width: 25%;"></div>	2/8	user1	Norr
1327	Running	<div style="width: 25%;"></div>	2/8	user1	Norr

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

RESUMED

Console Tasks

Job Info Result Preview

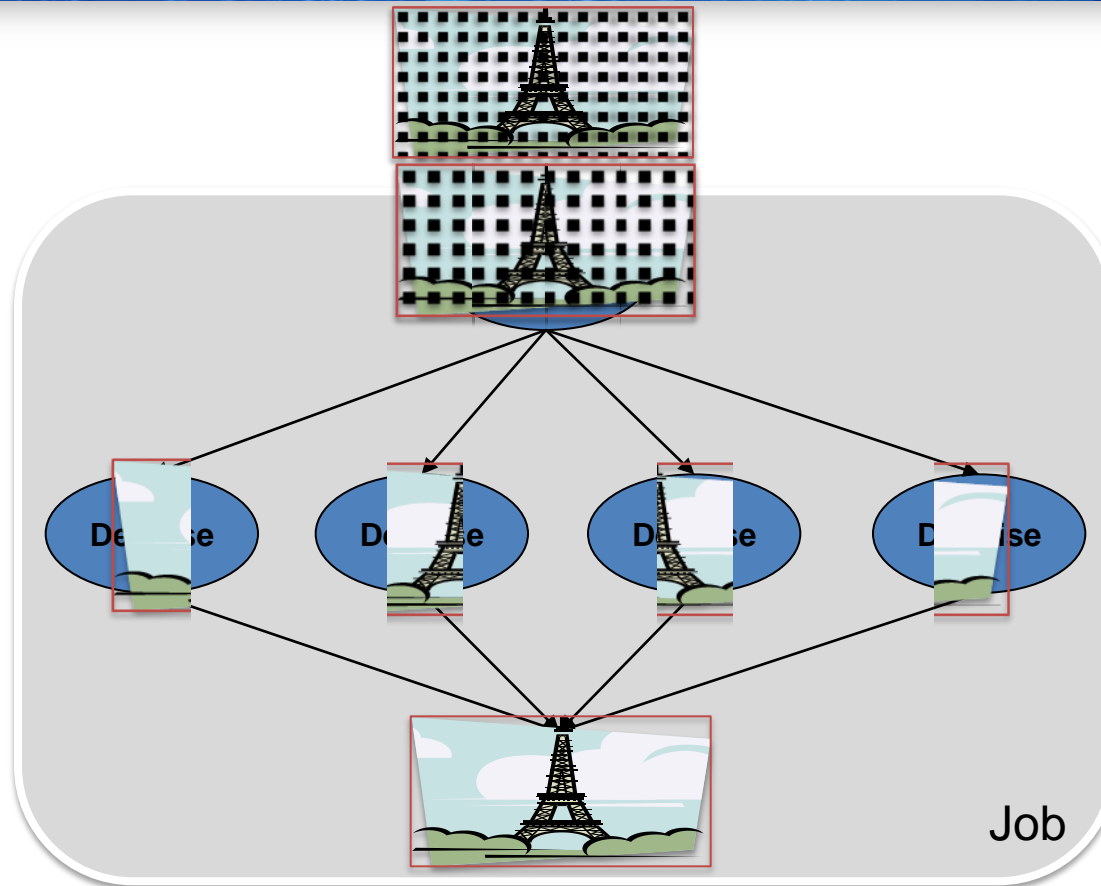
Job 2008 has 8 tasks

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

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

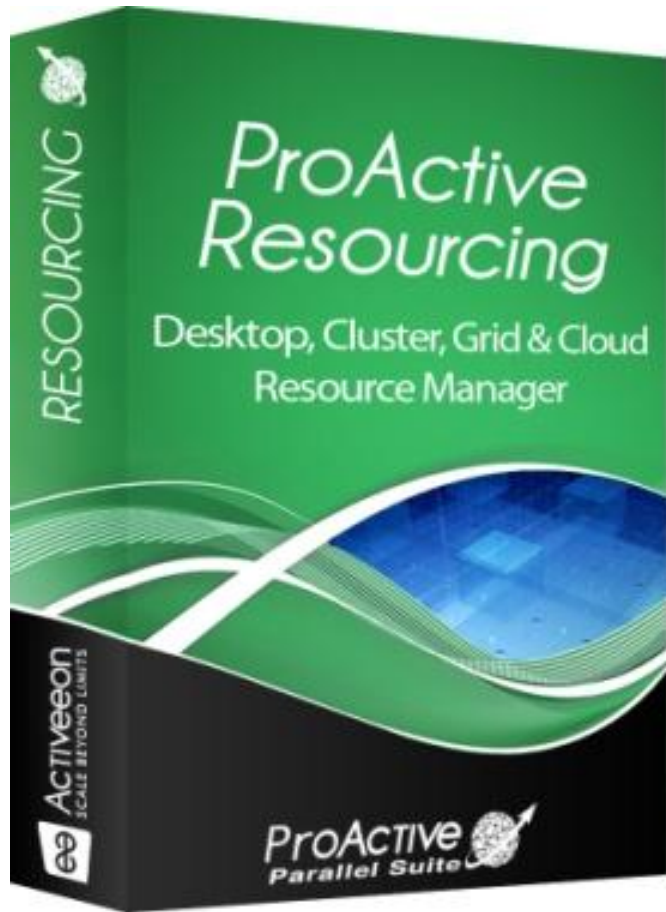
RES

# 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

# ProActive Resourcing





# RESOURCING User Interface

The screenshot displays the ProActive Resource Manager (PA) User Interface. The main window is titled "ProActive Resource Manager" and includes a menu bar (File, Connection, Actions, Help, Window) and a toolbar with a "Shutdown" button. The interface is divided into several panes:

- Tree Explorer:** Shows a hierarchical view of resources. The tree structure is as follows:
  - PA\_JVM2114960478
    - rmi://eon14.inria.fr:1099/PA\_JVM2114960478\_GCMNode-0
    - rmi://eon14.inria.fr:1099/PA\_JVM2114960478\_GCMNode-1
    - rmi://eon14.inria.fr:1099/PA\_JVM2114960478\_GCMNode-2
  - PA\_JVM477486534
  - PA\_JVM2003420561
    - rmi://eon14.inria.fr:1099/PA\_JVM2003420561\_GCMNode-0
    - rmi://eon14.inria.fr:1099/PA\_JVM2003420561\_GCMNode-1
    - rmi://eon14.inria.fr:1099/PA\_JVM2003420561\_GCMNode-2
- Compact View:** A grid of colored circles representing the state of individual nodes. Most nodes are green, indicating they are free. Some nodes are yellow, and a few are red, indicating they are busy or down.
- JMX Monitoring:** Contains three charts:
  - Activity History:** A line graph showing activity levels over time, with a peak around 16:50.
  - Node States Peaks:** A bar chart showing the maximum number of nodes in different states: Max Free (330), Max Busy (80), Max ToBeReleased (0), and Max Down (0).
  - Free Nodes History:** A line graph showing the number of free nodes over time, fluctuating between approximately 250 and 350.
- Overview/Charts:** A section with tabs for "Statistics" and "Info".
- Statistics Table:** A table showing the current state of the system:

state	aggregate
# free nodes	272
# busy nodes	52
# down nodes	6
- Status:** A "connected" indicator in the bottom right corner.

# Clusters to Grids to Clouds: e.g. on Amazon EC2

# Private, Public & Hybrid Clouds



ProActive Scheduler

ProActive Resource Manager

**“ Cloud Bursting! ”**

Static Policy

LSF

Timing Policy  
12/24

Desktops

Dynamic Workload Policy

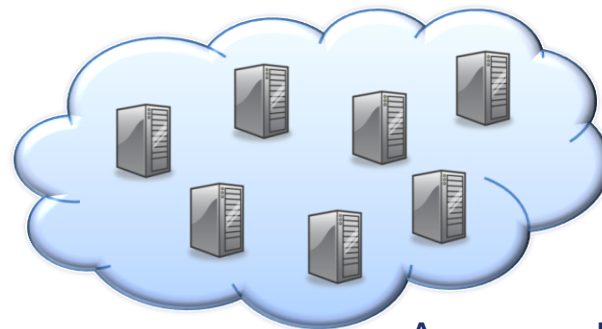
EC2



Dedicated resources



Desktops



Amazon EC2

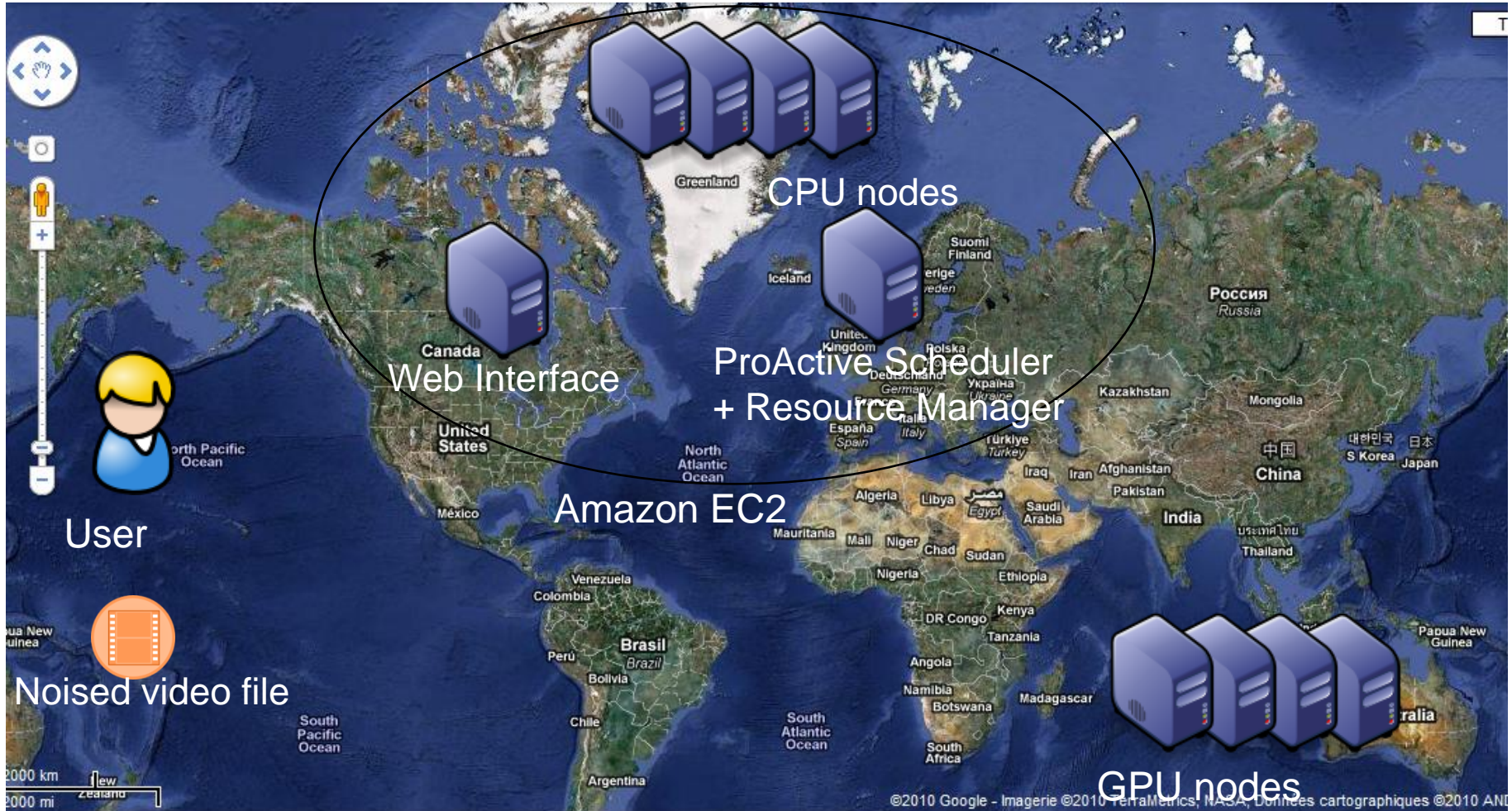


# *Cloud Seeding with ProActive*

- ❑ Amazon EC2 Execution
- ❑ *Cloud Seeding* strategy to mix heterogeneous computing resources :
  - External GPU resources

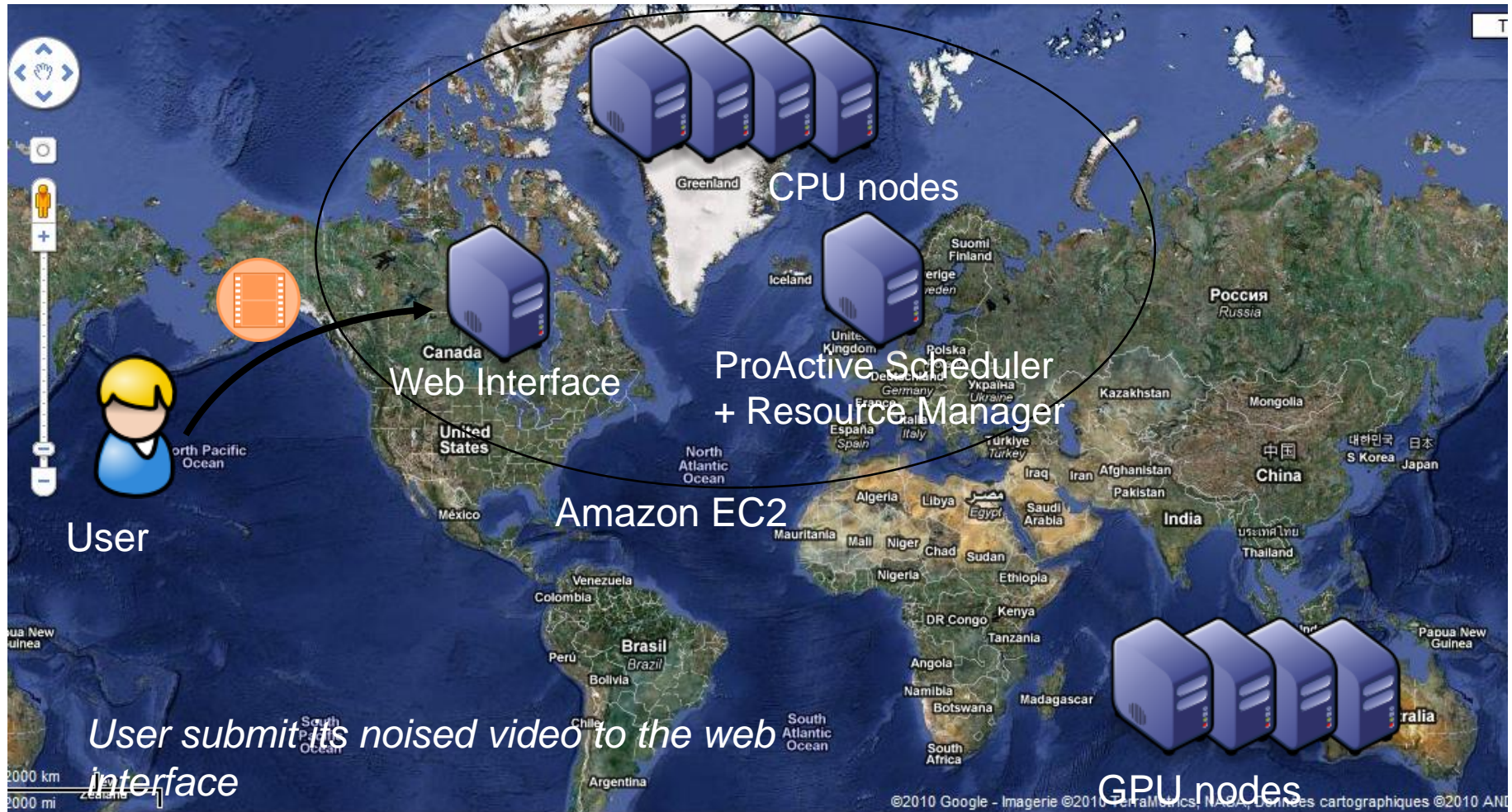
*“ Cloud Seeding ”*

# Cloud Seeding with ProActive



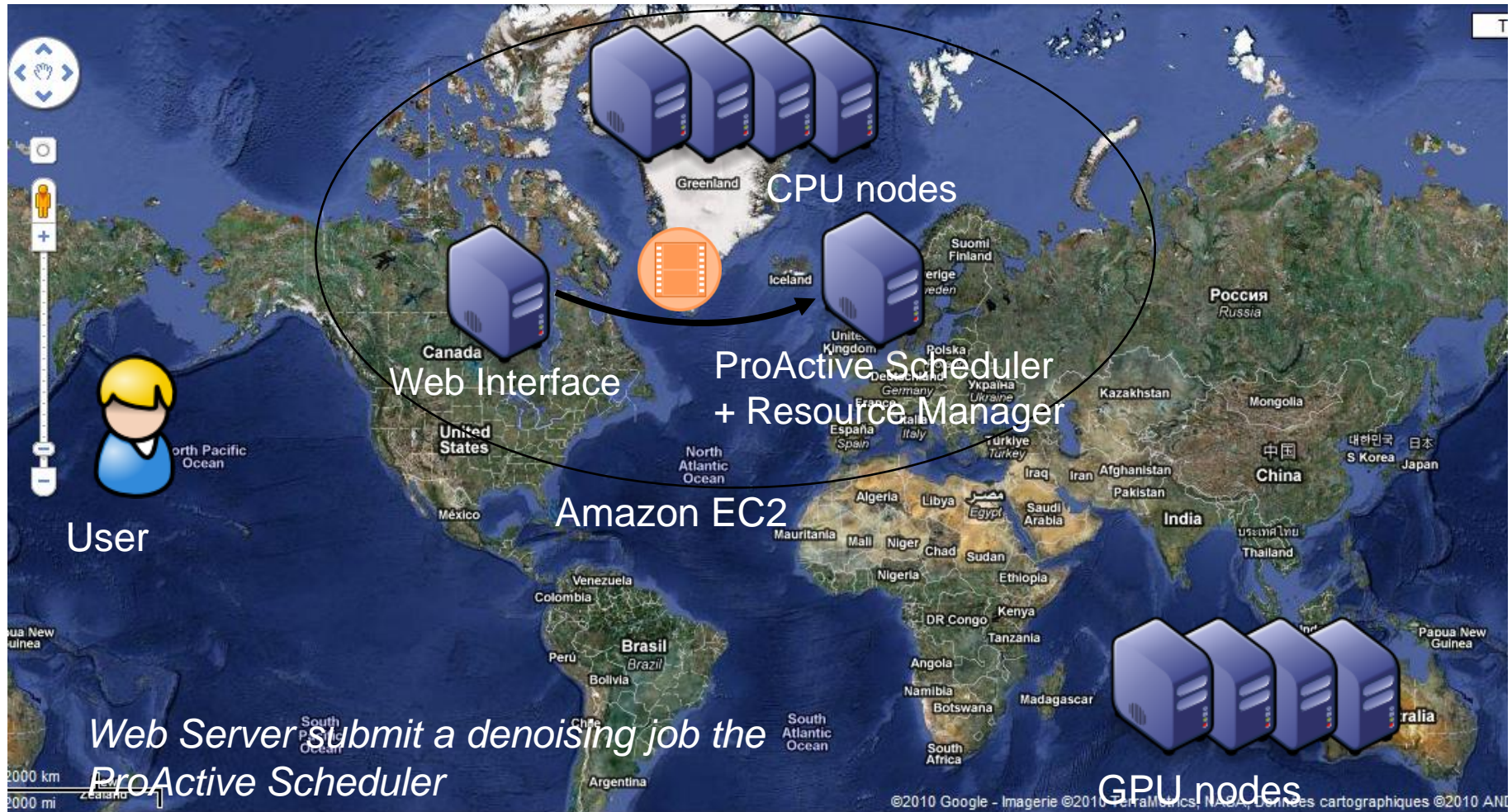


# Cloud Seeding with ProActive



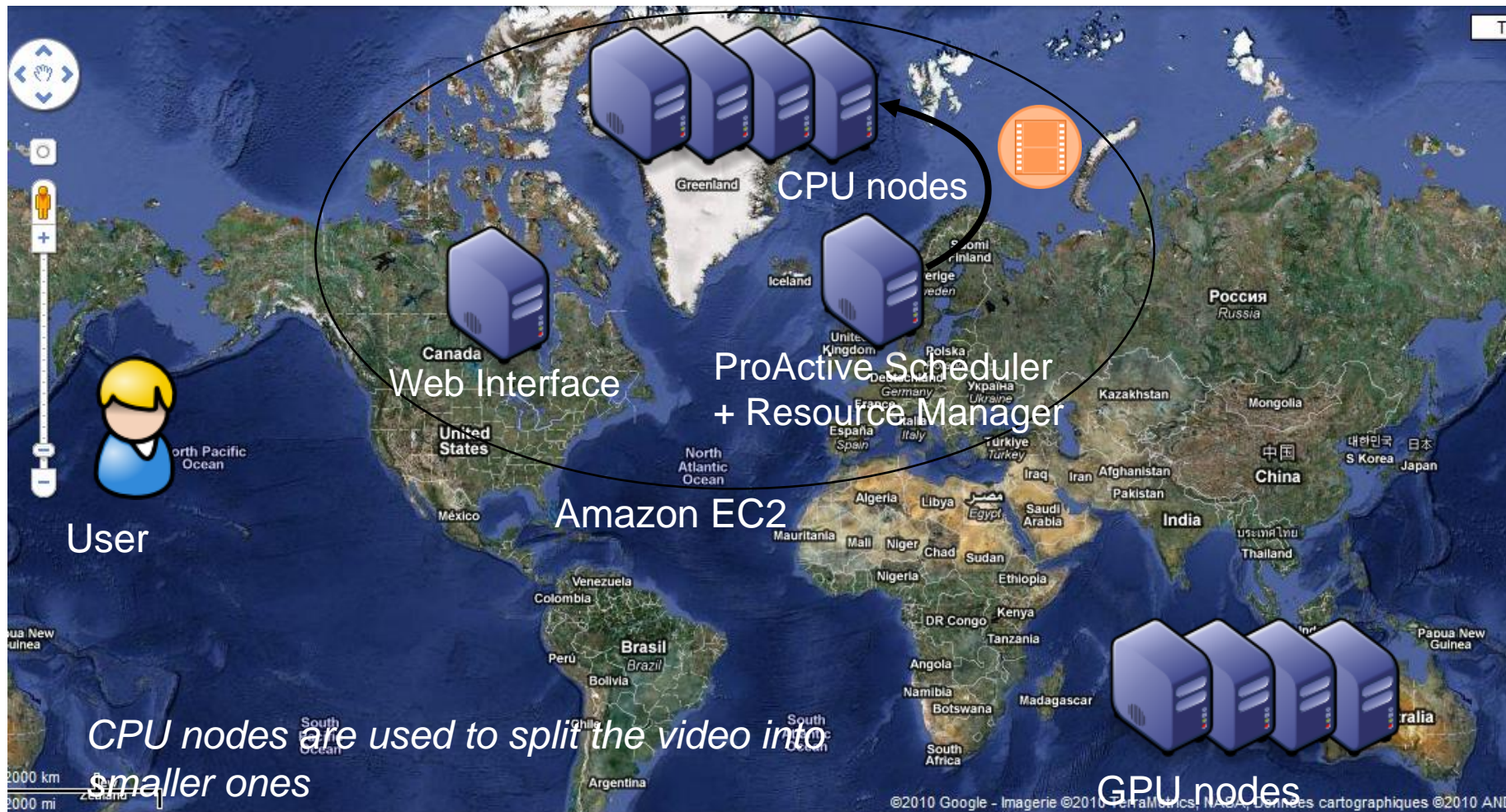


# Cloud Seeding with ProActive



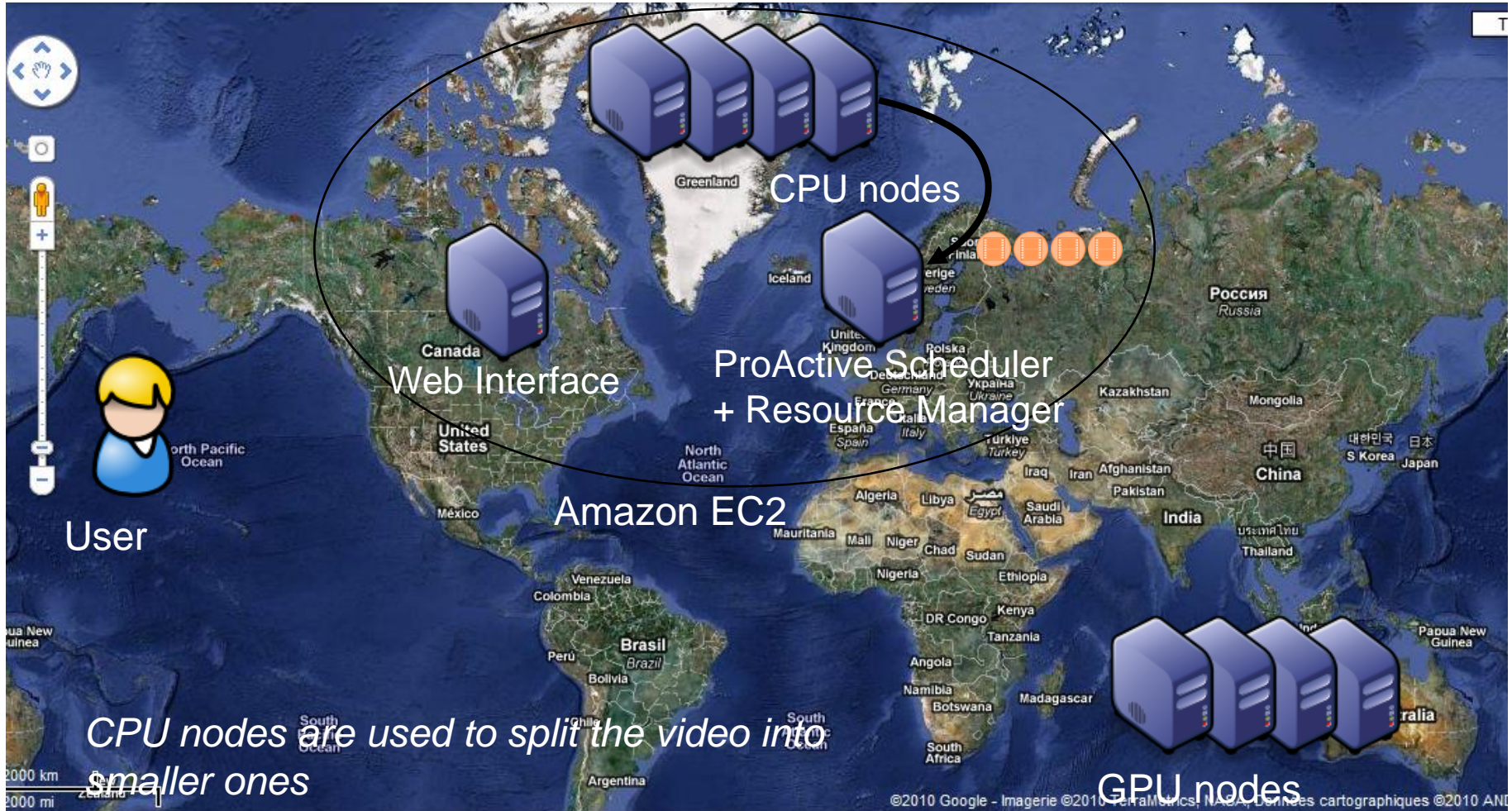


# Cloud Seeding with ProActive



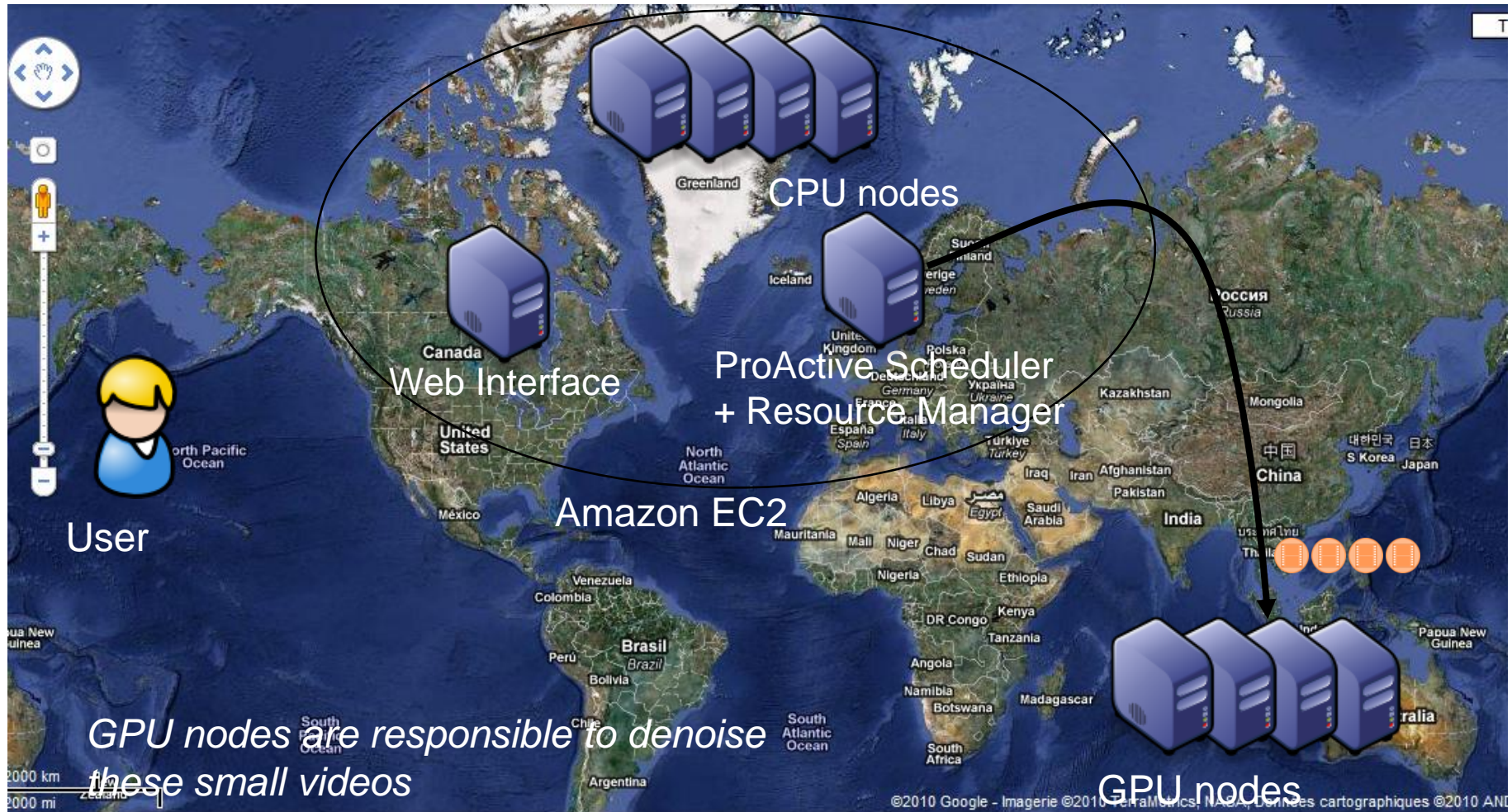


# Cloud Seeding with ProActive



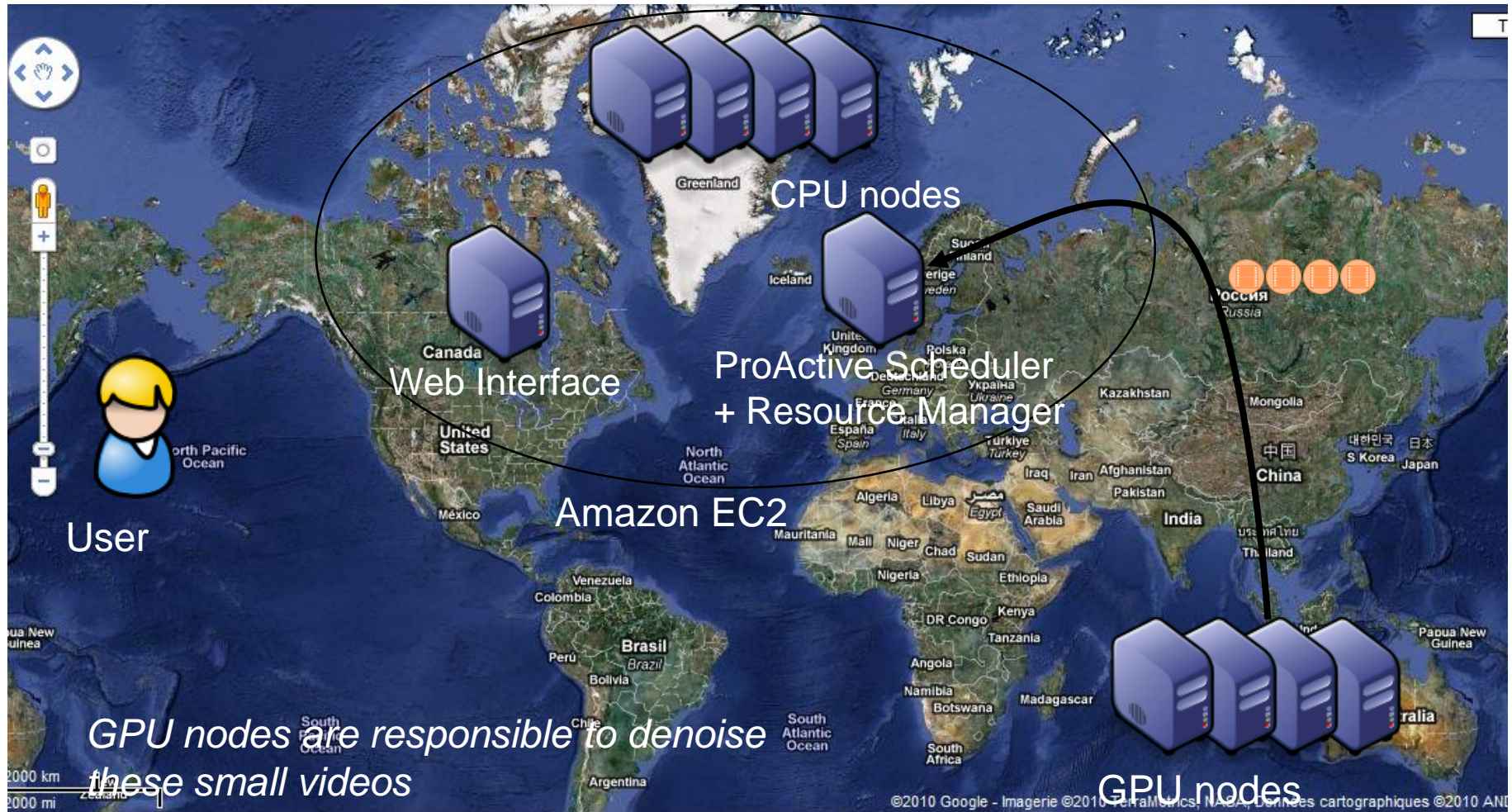


# Cloud Seeding with ProActive



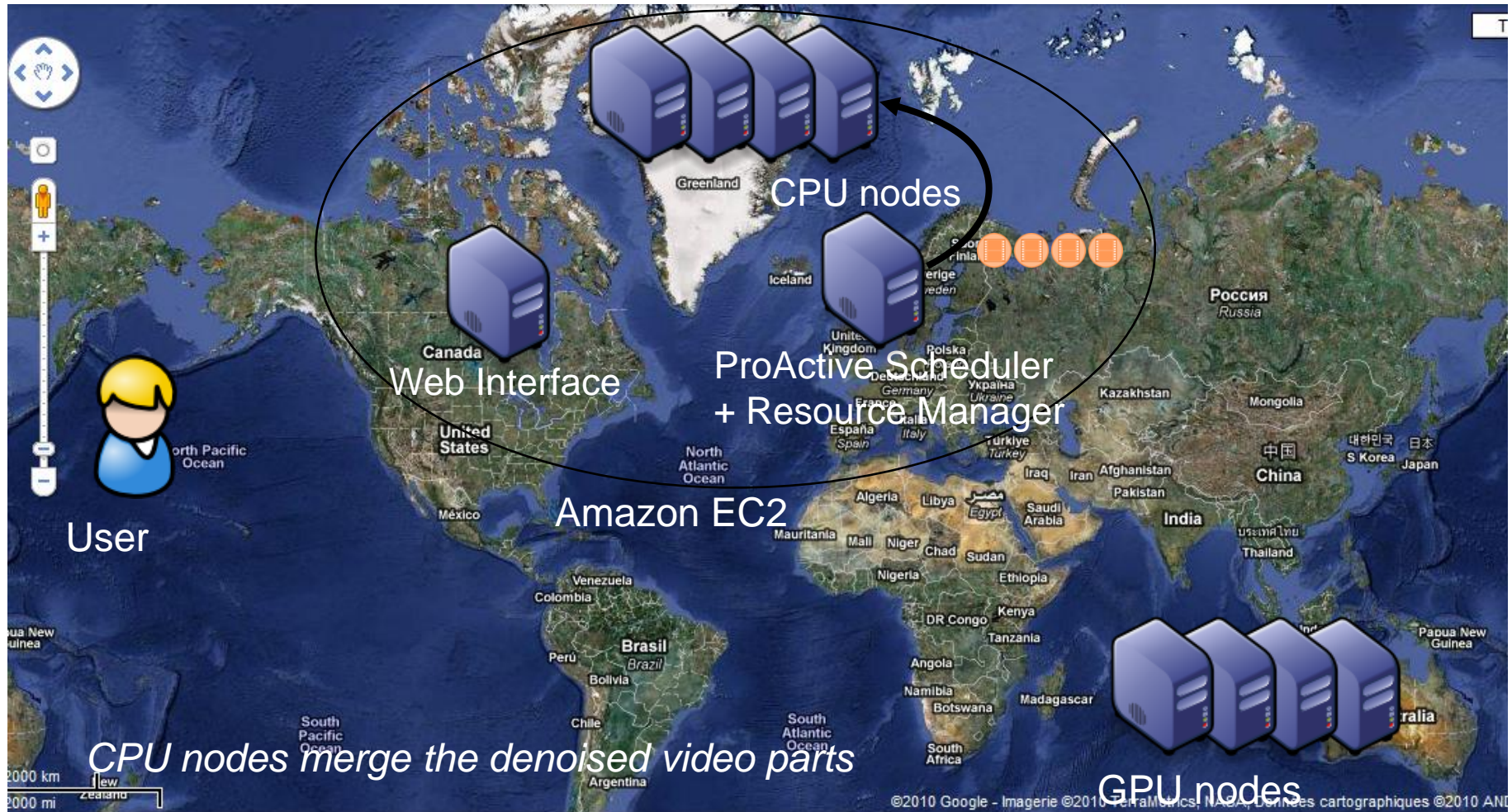


# Cloud Seeding with ProActive



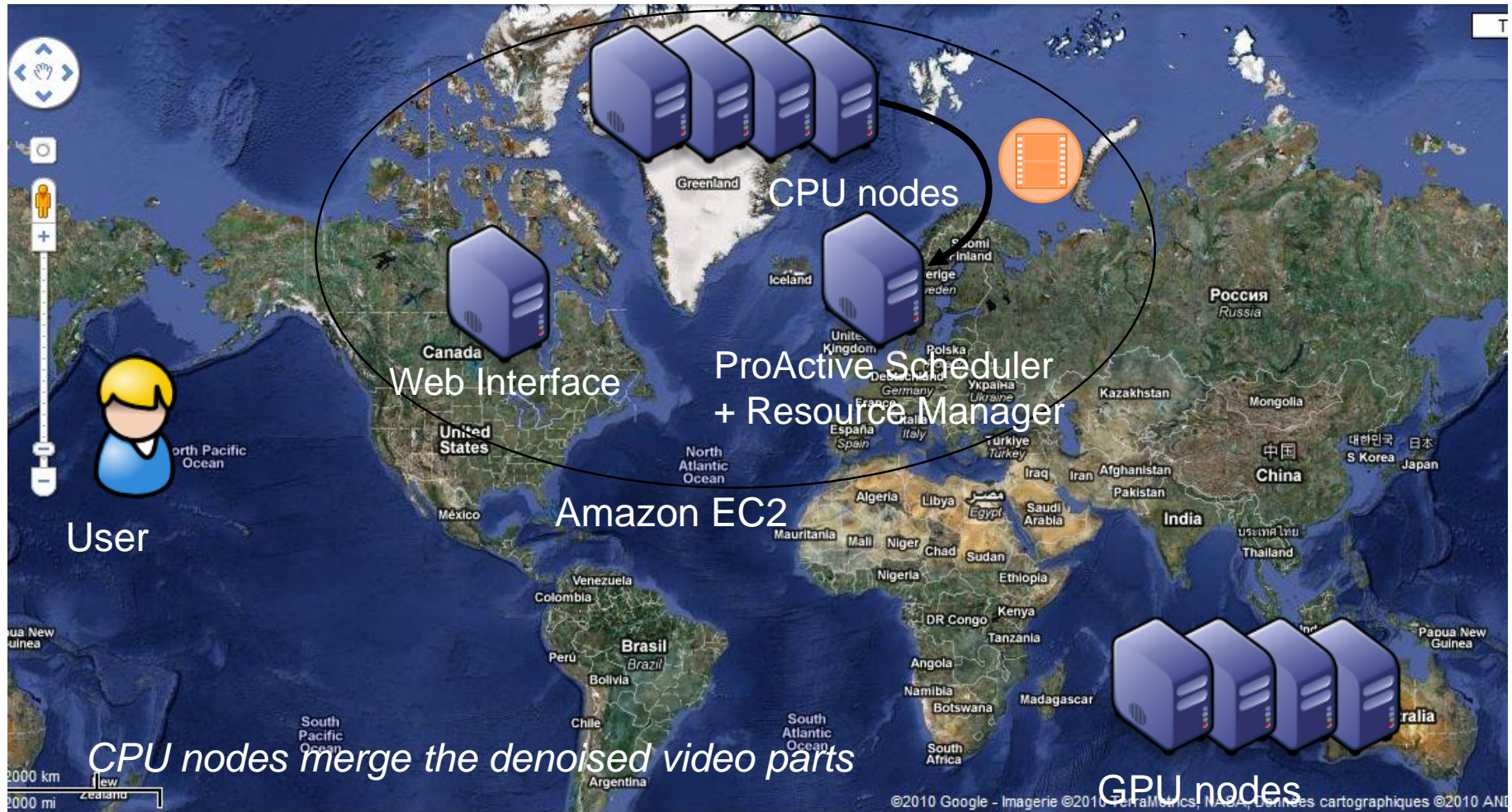


# Cloud Seeding with ProActive



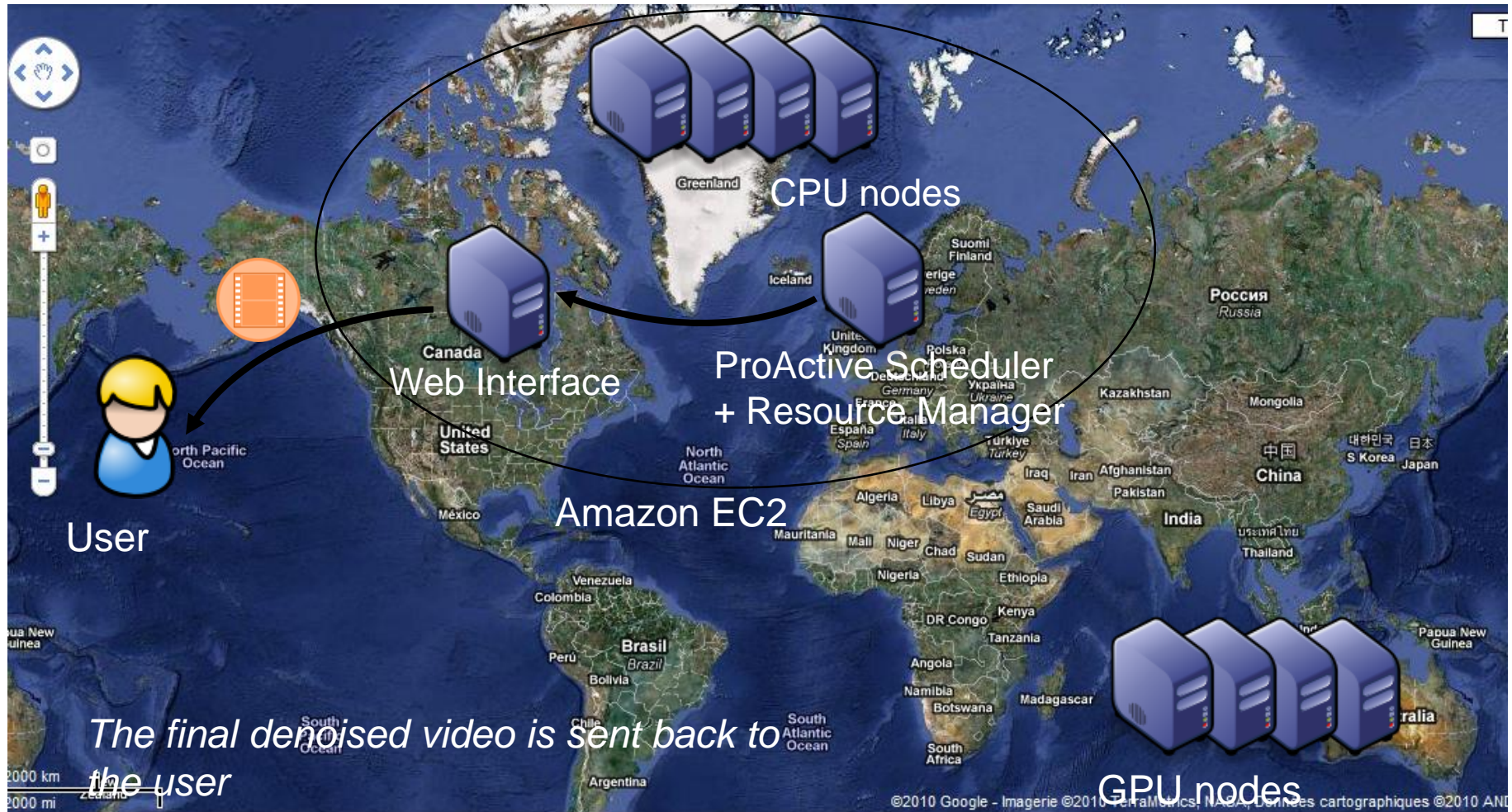


# Cloud Seeding with ProActive





# Cloud Seeding with ProActive



# Use Cases: Genomics - Sequencing



# IPMC Use Case and Collaboration

**SOLID**  
machine from  
**AB Applied Biosystems**

**ProActive**  
Parallel Suite

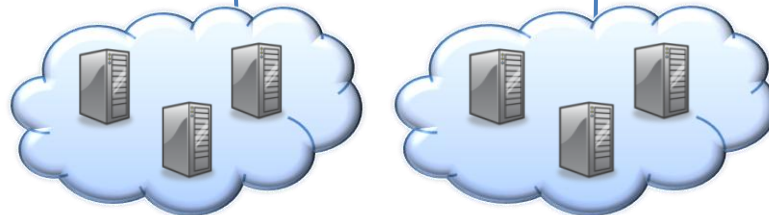


*Cluster*



*Desktops*

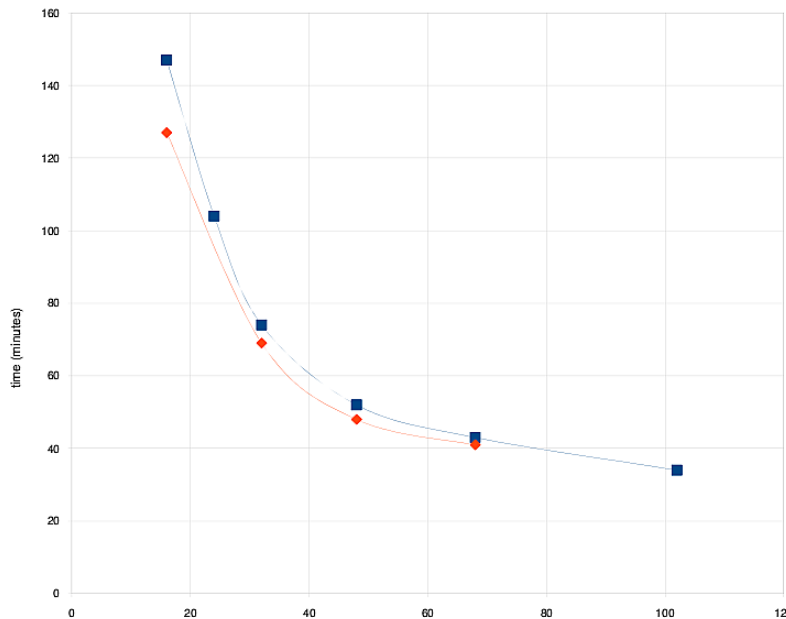
**Nodes  
can be  
dynamically  
added!**



*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%)

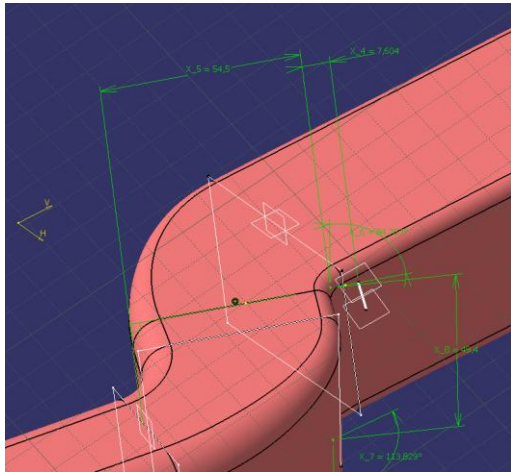
**For only \$3,2/hour, EC2 has nearly the same perf. as  
the local SOLiD cluster (16 cores, for 2H30)**

# Use Case: OMD2

## Distributed Multi-Disciplinary Optimizations

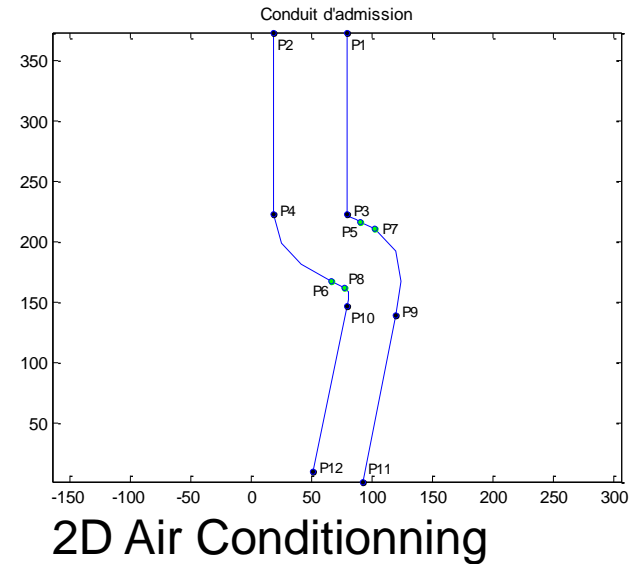
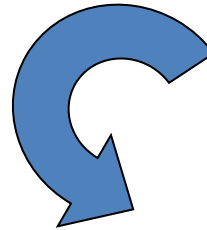


# Coupling Mechanics, Aerodynamics ...



3D Air Conditionning

10min  
CPU



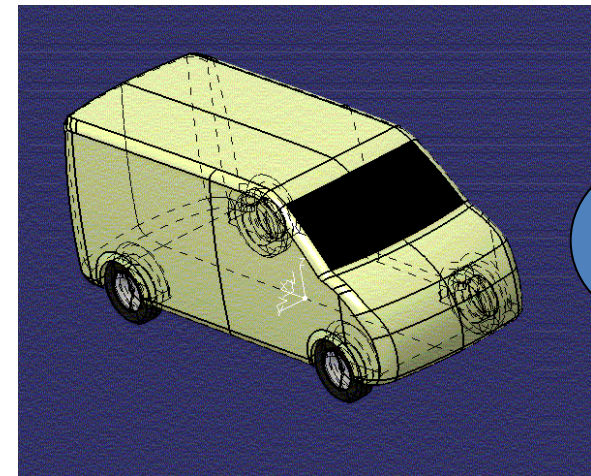
2D Air Conditionning

<1min  
CPU



Cylinder Head

100h  
CPU



External  
Aerodynamic

1000h  
CPU



# ProActive OMD2 Demo

RENAULT

SIREHNA  
a DCNS company

CATIA

CD-adapco

OpenFOAM

- PRE
  - Resource Selection
  - Dataspace Input
  - Native Executable
  - Dataspace Output
- GEOM\_AND\_MESH
  - Resource Selection
  - Dataspace Input
  - Native Executable
  - Dataspace Output
- SOLVE
  - Resource Selection
  - Dataspace Input
  - Native Executable
  - Dataspace Output
- POST
  - Resource Selection
  - Dataspace Input
  - Native Executable
  - Dataspace Output

1000 Cores  
Production  
Cloud Portal

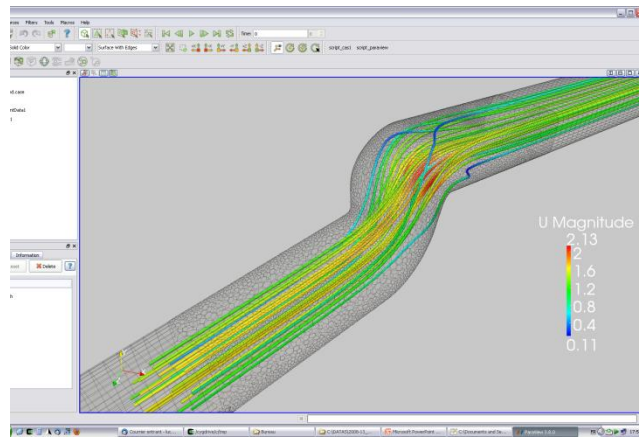
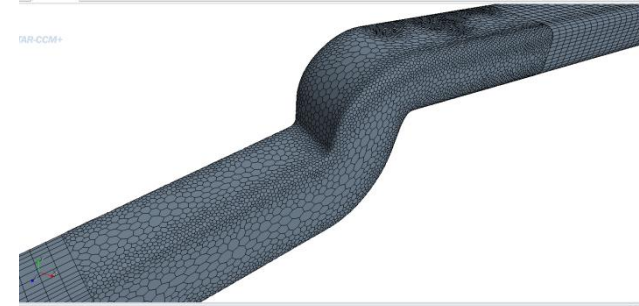
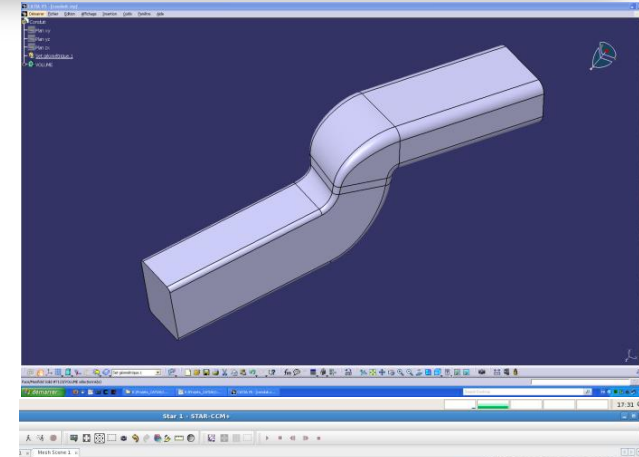
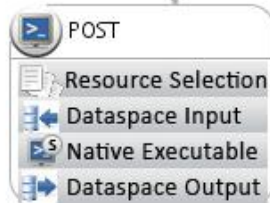
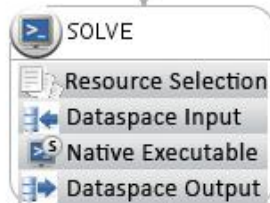
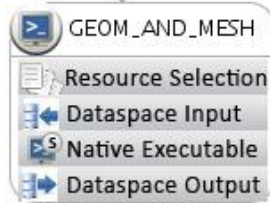
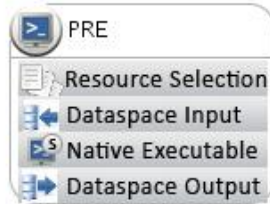


# Video: Distributed Workflow





# Engineering Optimizations: Renault UC



# Use Case 3: 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)
- Post\_processing\_speed\_4 (Child of Test\_case\_speed\_3)
- 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. The top-left panel shows a workflow diagram with nodes for 'Post\_processing\_speed' and 'Test\_case\_speed'. The top-right panel is the 'FINE/Marine' application window, showing 'Project Mesh Solver' and 'computation\_1'. The bottom-left panel contains 'Job Properties' with fields for Project Name, Job Name, Job Description, Input Space URL, Output Space URL, and Log File. The bottom-right panel is the 'CFView' window, showing a 3D simulation of a submarine in a fluid domain. The 'CFView' window includes a 'Filter (regex)' section, a 'Quantities' list (with 'Mass Fraction' checked), and a 'Representations' section with 'Grid' and 'Plots & Values' options. The status bar at the bottom of the CFView window shows: 'Macro 'istore/workspaces/yroux/simus/Subof/Subof\_computation\_1/post\_processing.py' has been executed.' and 'Mass Fraction: -6.87489e-21 -> 1' and '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 red fins and a purple hull, surrounded by blue flow streamlines. 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 results.

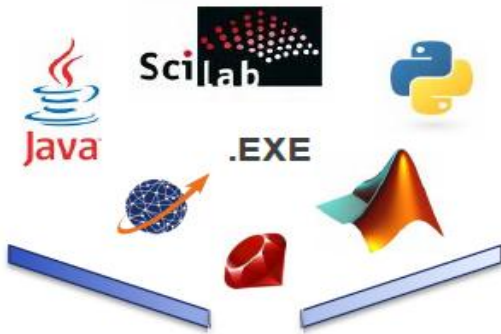
A terminal window on the left shows a series of shell commands and their outputs, including file listings and directory navigation. The status bar at the bottom of the CFView window displays "Mass Fraction : -6.87489e-21 -> 1" and coordinates "X: 1.34192 Y: 1.28157 Z: -1.65029".



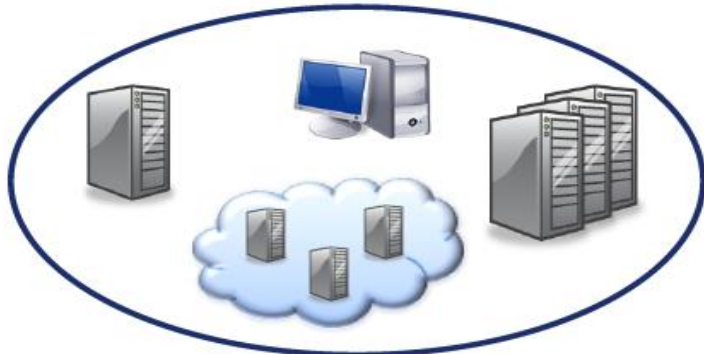
# Conclusions



# Conclusion: Technology Preview



ProActive  
Scheduling



❑ ProActive Fine Grain CLOUD management:

➔ Pricing at the second (like GSM)

❑ Open Source Cloudware Initiative (OSCI)



➔ Elastic Clouds



# Industrial (1750) & Cloud Revolution Compared

	Industrial Revolution	Cloud Revolution
<b>Concept</b>	Mechanization and centralization of manufacturing activities	Computing as a Utility Centralization of Data Center
<b>Technology</b>	Supporting new technos (Mechanic, Tool Machines, etc.)	Distributed Computing Virtualization Multi-Cores Network
<b>Socio Economical Factors</b>	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





[proactive.inria.fr](http://proactive.inria.fr)

# Conclusion

## ❑ Business revolution:

Not selling Hardware, nor Software, but **Services**

Also a Marketing Revolution:

→ Big thing is SLA, no longer ~~Features Insides™~~

## ❑ Scientific Revolution:

- Capacity to use large Public facilities
- Capabilities: CERN-like EGEE no longer needed ?
- Large Workflows: SpeedUp of Discoveries

## ❑ Social Revolution:

- What will happen to CIOs ?
- What will happen to outsourcing companies ?
- Personal and Business facility convergence  
(like PC, Internet)

→ Impact ?





CLOUD COMPUTING - BY ROBERTBRAVERY



WWW.TOONDOO.COM

