My Background to explain my bias :

Distributed and Parallel Objects

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SOS 10, Maui, March 6-9

ProActive

Programming, Composing, Deploying on the Grid

A Java API + Tools for Parallel, Distributed Computing

A uniform framework: **An Active Object pattern**

A formal model behind: **Determinism (POPL'04)**

Programming Model:

- **Asynchronous Remote Objects, Wait-By-Necessity**
- **Groups, Mobility, Components, Security, Fault-Tolerance: Checkpoints**

Environment:

- **XML Deployment Descriptors, File Transfers**
- **Interfaced with:** **`rsh, ssh, LSF, PBS, Globus, Jini, SUN Grid Engine`**
- **Graphical Visualization and monitoring: IC2D**

In the www. ObjectWeb .org Consortium

(Open Source **LGPL**)

ObjectWeb

Open Source Middleware

JEM 3D : Java 3D Electromagnetism

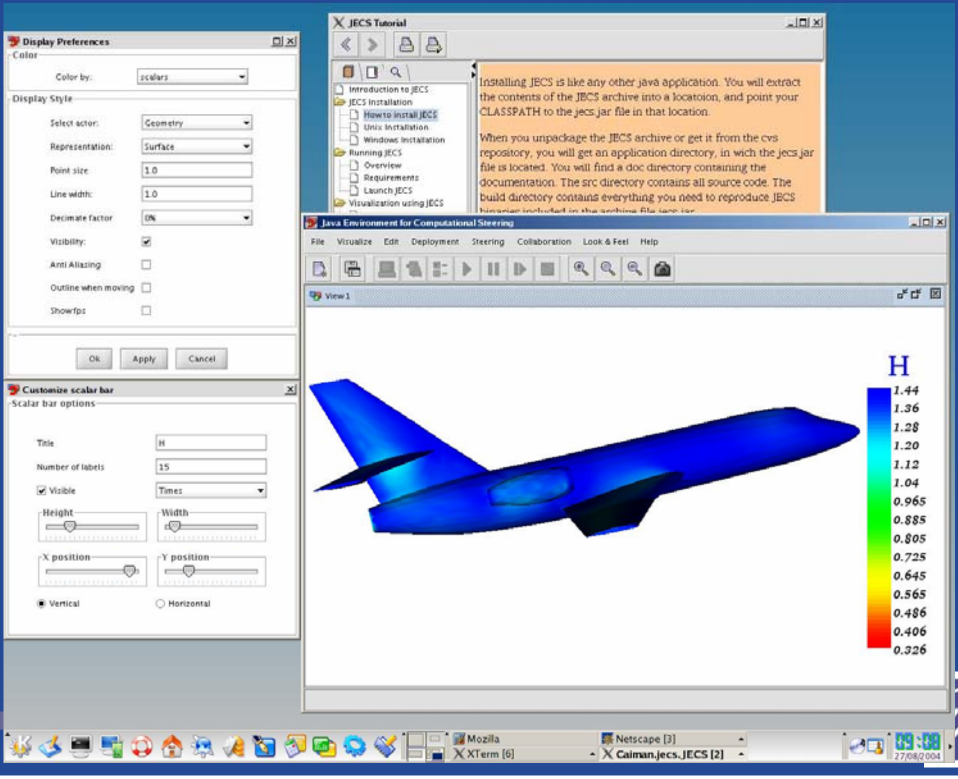
together with Said El Kasmi, Stéphane Lanteri (caiman)

Maxwell 3D equation solver, Finite Volume Method (FVM)

Pre-existing Fortran MPI version: EM3D (CAIMAN team @ INRIA)

Up to 294 machines at the same time (Intranet and cluster)

Large data sets: 150x150x150 (100 million facets)



Display Preferences

Color

Color by: scalars

Display Style

Select actor: Geometry

Representation: Surface

Point size: 1.0

Line width: 1.0

Decimate factor: 0%

Visibility: ☑

Anti Aliasing: □

Outline when moving: □

Showfps: □

Customize scalar bar

Scalar bar options

Title: H

Number of labels: 15

☑ Visible — Times

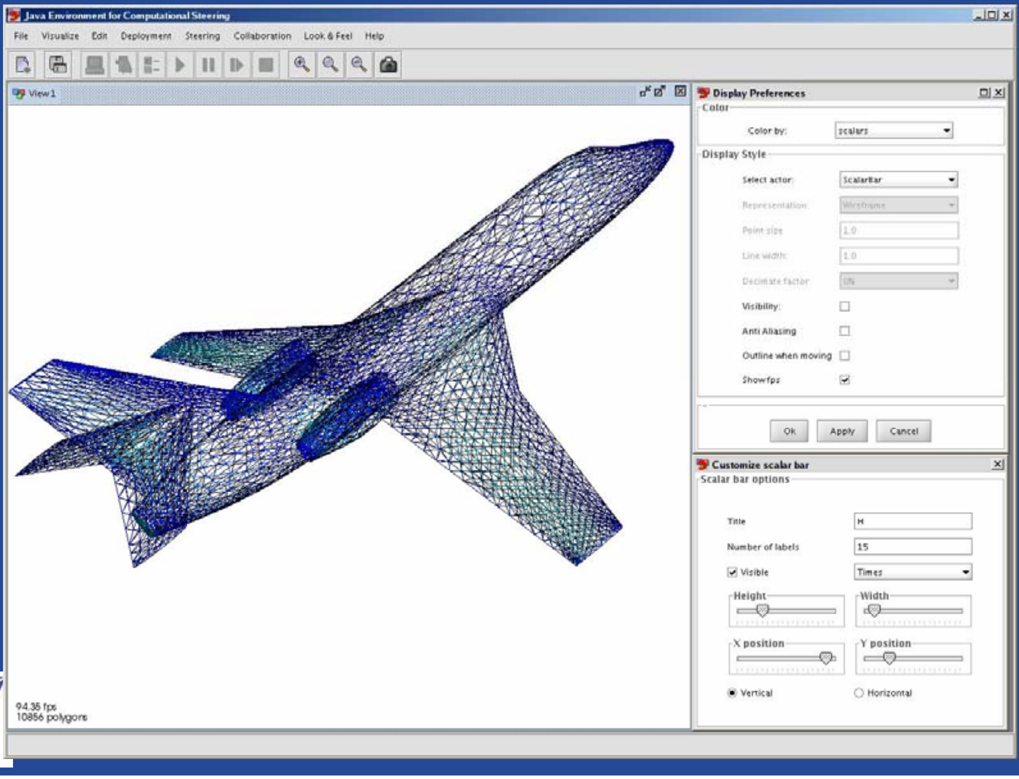
● Vertical ○ Horizontal

JECS Tutorial

Introduction to JECS
JECS Installation
How to install JECS
Unix Installation
Windows Installation
Running JECS
Overview
Requirements
Launch JECS
Visualization using JECS

Installing JECS is like any other java application. You will extract the contents of the JECS archive into a locatoion, and point your CLASSPATH to the jecs.jar file in that location.

When you unpackage the JECS archive or get it from the cvs repository, you will get an application directory, in wich the jecs.jar file is located. You will find a doc directory containing the documentation. The src directory contains all source code. The build directory contains everything you need to reproduce JECS binaries included in the archive file jecs.jar



Display Preferences

Color

Color by: scalars

Display Style

Select actor: ScalarBar

Representation: Wireframe

Point size: 1.0

Line width: 1.0

Decimate factor: 0%

Visibility: □

Anti Aliasing: □

Outline when moving: □

Showfps: ☑

Customize scalar bar

Scalar bar options

Title: H

Number of labels: 15

☑ Visible — Times

● Vertical ○ Horizontal

94.35 fps
10856 polygons

Beating Fortran-MPI ?

Facts:

- Sequential Java vs. Fortran code: 2 times slower
- Large data sets in Java ProActive: 150x150x150 (100 million facets)
- Large number of machines: up to 294 machines in Desktop P2P
- Speed up on **`16 machines:`**

- Fortran:	13.8
- ProActive/Ibis:	12
- ProActive/RMI:	8.8

Grid on 5 clusters (DAS 2): Speed up of 100 on 150 machines

Fortran: no more than 40 proc. …

Beating Fortran MPI with Java ProActive? X/40 (14/16) = 2X/ n (100/150)

Yes, starting at n=105 machines !

Data Intensive: What are the Driving Applications ?

Mainly:

- Sciences and Military, etc.
- Bio Technologies
- Business Data-Mining, Finance-Banking, Insurance

➔ Where is the money ?

➔ Where will be the investment ?

- Consequence:
  - Should fit in standard business IT
  - Portability is the key (not dedicated systems)

Relation Intensive Computation and I/O: One-Sided Operations

Remotely triggered operations:

- MPI one-sided
- X10 asynch { … }
- ProActive Immediate Services
- Active Messages

In the context of Multi-Core Processors:

- might be very important for fast implementations of I/O

Data Intensive Computing should define in the future as:

Using:

- Large scale machines and I/O capabilities
- Dedicated implementation of standard I/O interfaces

But:

- No specific paradigms for application programmer
- No specific user-interfaces

ProActive:

A Java API + Tools for Parallel, Distributed Computing

- A uniform framework: **An Active Object pattern**
- A formal model behind: **Prop. Determinism, insensitivity to deploy.**

Main features:

- **Remotely accessible Objects (Classes, not only Interfaces, Dynamic)**
- **Asynchronous Communications with synchro: automatic Futures**
- **Group Communications, Migration (mobile computations)**
- **XML Deployment Descriptors**
- **Interfaced with various protocols:** `rsh,ssh,LSF,Globus,Jini,RMIregistry`
- **Visualization and monitoring: IC2D**

In the www. ObjectWeb .org Consortium (Open Source middleware)

since April 2002 (**LGPL license)**

What is the status of uptake and exploitation ?

ObjectWeb
Open Source Middleware

ProActive
Programming, Composing, Deploying on the Grid

About 10 000 hits / month

About 400 Downloads / month

About 4 000 recorded Downloaders

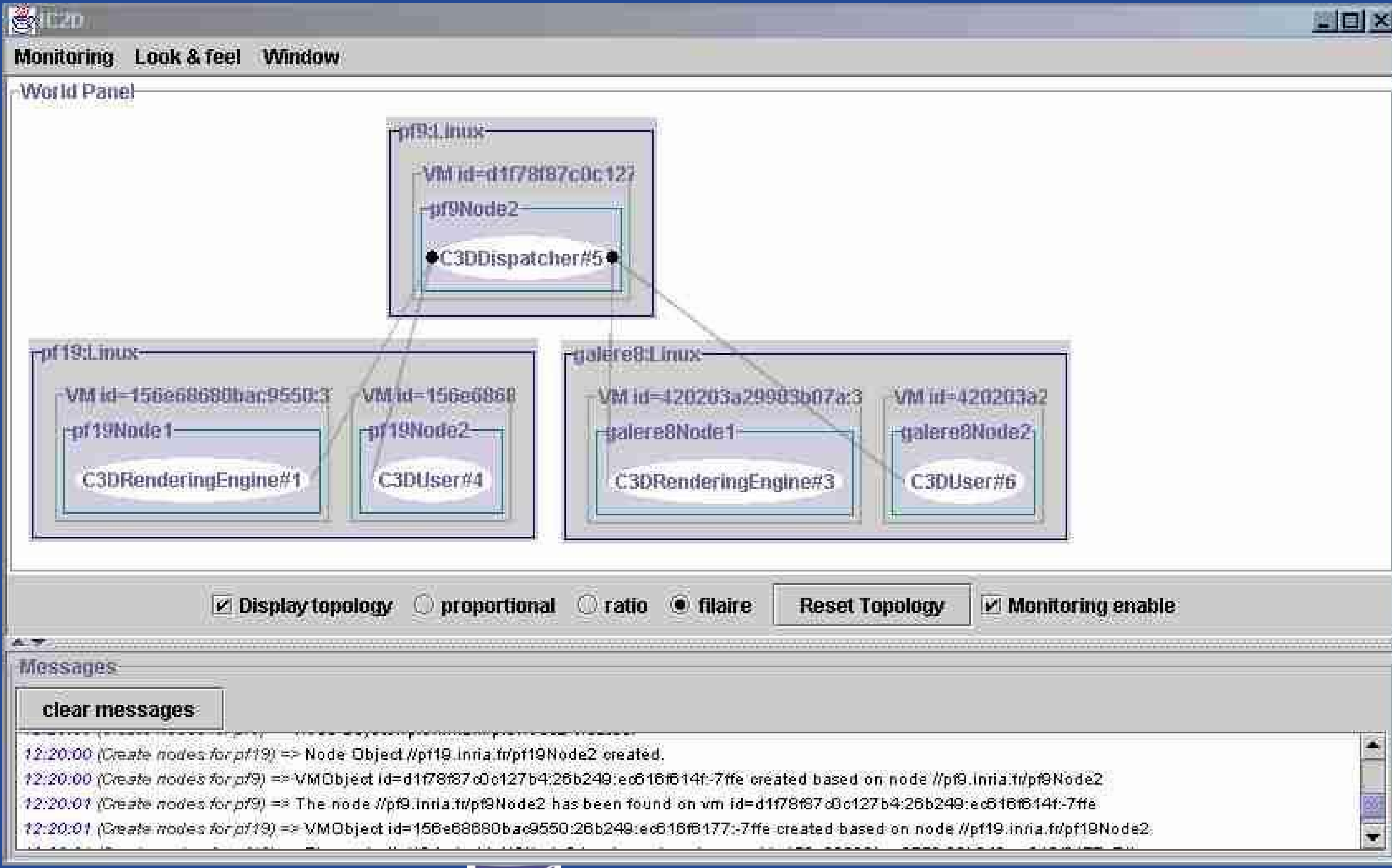
Among which 400 Industrials

IC2D: Interactive Control and Debugging of Distribution

Main Features:

- Hosts, JVM,
- Nodes
- Active Objects
- Topology
- Migration

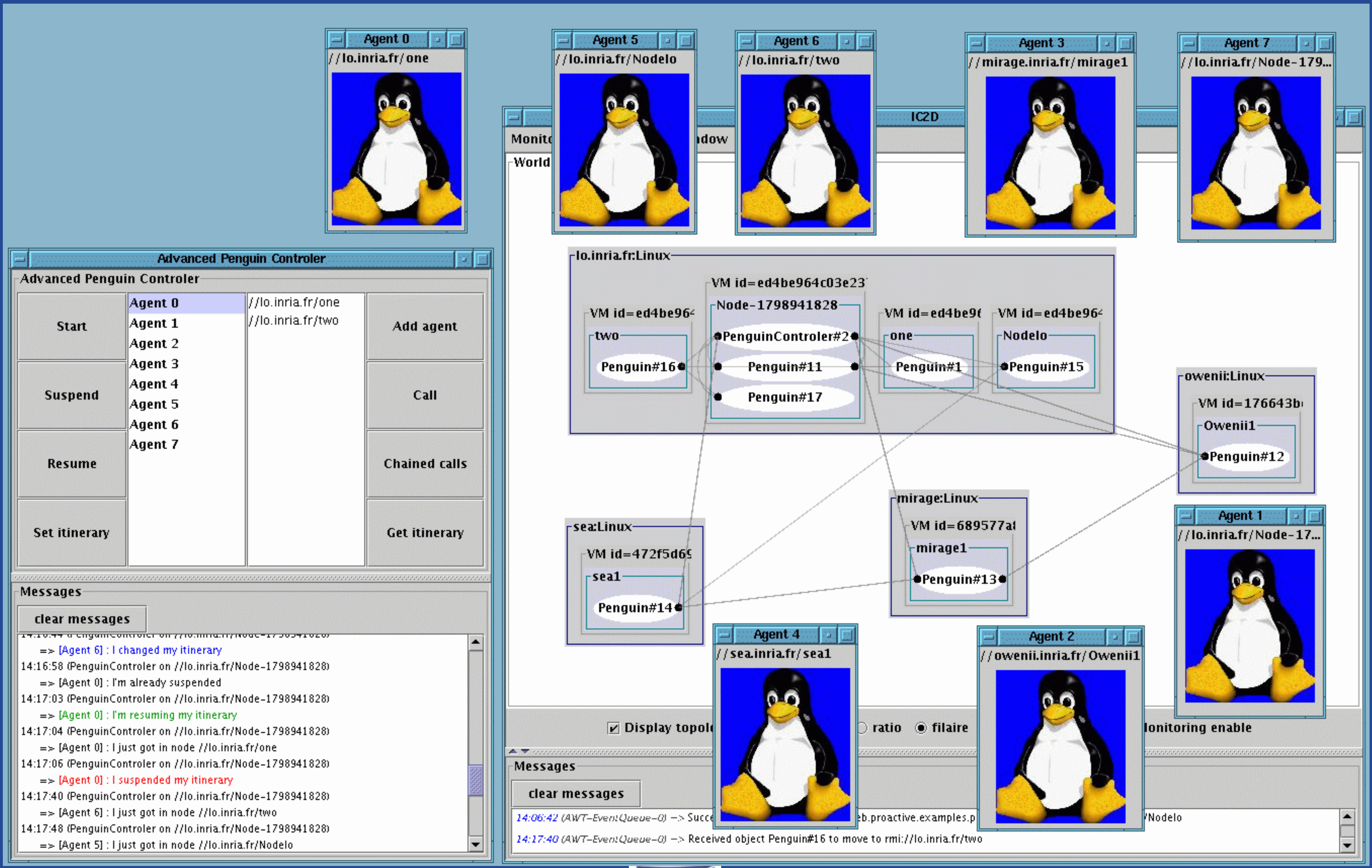
- Logical Clock



☑ Display topology ○ proportional ○ ratio ● filaire ☑ Monitoring enable

```
12:20:00 (Create nodes for pf19) => Node Object //pf19.inria.fr/pf19Node2 created.
12:20:00 (Create nodes for pf9) => VMObject id=d1f78f87c0c127b4:26b249:ec616f614f:-7ffe created based on node //pf9.inria.fr/pf9Node2
12:20:01 (Create nodes for pf9) => The node //pf9.inria.fr/pf9Node2 has been found on vm id=d1f78f87c0c127b4:26b249:ec616f614f:-7ffe
12:20:01 (Create nodes for pf19) => VMObject id=156e68680bac9550:26b249:ec616f6177:-7ffe created based on node //pf19.inria.fr/pf19Node2.
```

Mobile Application executing on 7 JVMs

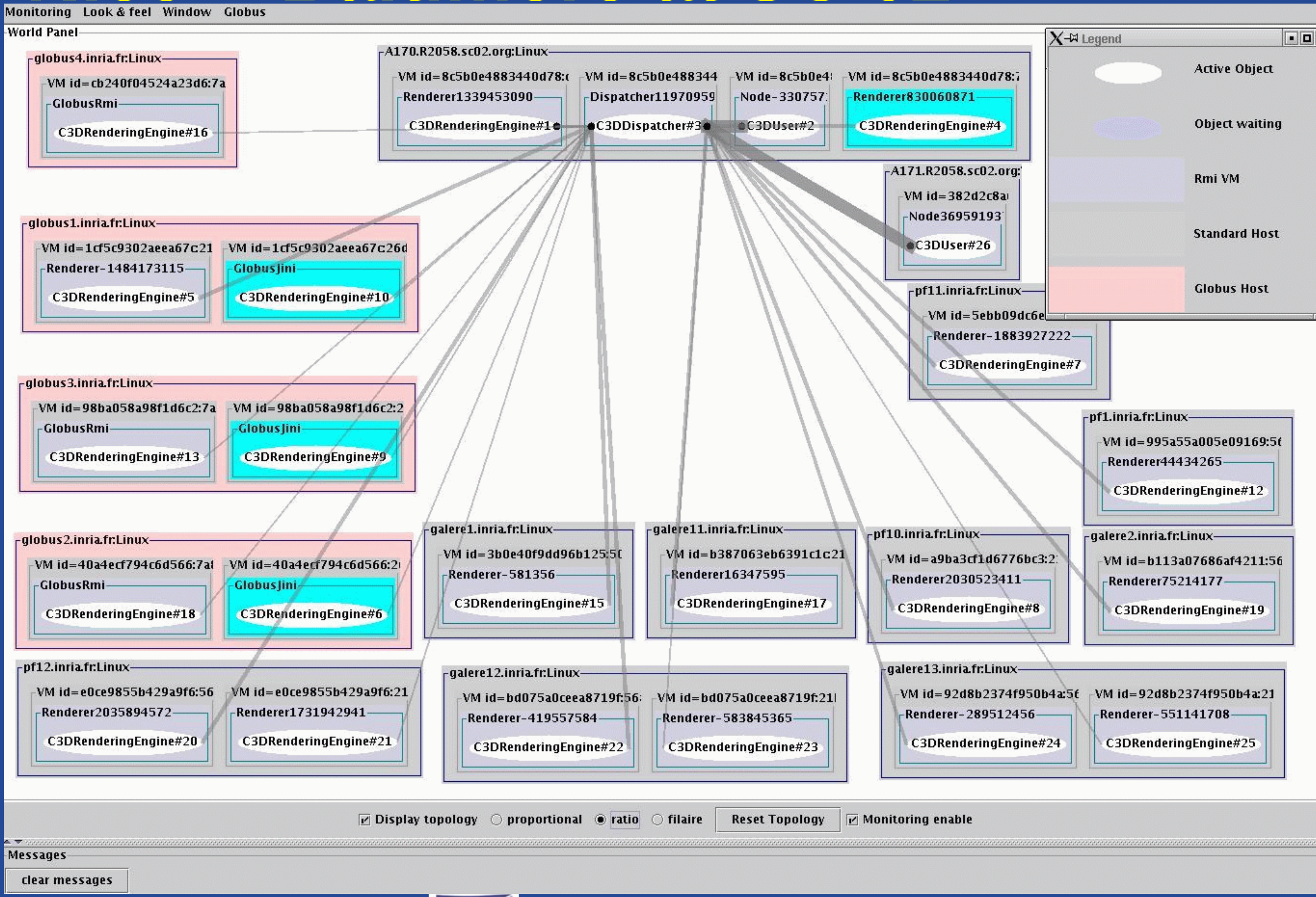


```
14:16:44 (PenguinControler on //lo.inria.fr/Node-1798941828)
     => [Agent 6] : I changed my itinerary
14:16:58 (PenguinControler on //lo.inria.fr/Node-1798941828)
     => [Agent 0] : I'm already suspended
14:17:03 (PenguinControler on //lo.inria.fr/Node-1798941828)
     => [Agent 0] : I'm resuming my itinerary
14:17:04 (PenguinControler on //lo.inria.fr/Node-1798941828)
     => [Agent 0] : I just got in node //lo.inria.fr/one
14:17:06 (PenguinControler on //lo.inria.fr/Node-1798941828)
     => [Agent 0] : I suspended my itinerary
14:17:40 (PenguinControler on //lo.inria.fr/Node-1798941828)
     => [Agent 6] : I just got in node //lo.inria.fr/two
14:17:48 (PenguinControler on //lo.inria.fr/Node-1798941828)
     => [Agent 5] : I just got in node //lo.inria.fr/Nodelo
```

```
14:06:42 (AWT-EventQueue-0) -> Succe          eb.proactive.examples.p          /Nodelo
14:17:40 (AWT-EventQueue-0) -> Received object Penguin#16 to move to rmi://lo.inria.fr/two
```

Monitoring of RMI, Globus, Jini, LSF cluster Nice -- Baltimore at SC'02

Width of links proportional to the number of com-munications



☑ Display topology ○ proportional ● ratio ○ filaire ☑ Monitoring enable

Which success stories do we have?

World record : 53 years of computations in 6 months

Distributed Financial Applications

GRID PlugTests (2004, 2005): Deploying on 2700 CPUs worldwide

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PLUGTESTS
The interoperability service

Amsterdam
Belfast
Beijing
Benevento
Fribourg

GILDA
Grid5000
Heraklion
Hong Kong
Juelich

Lille
Los Angeles
Metz
Melbourne
Nancy

Oslo
Pisa
Shanghai
Rio de Janeiro
Zurich

Which success stories do we have?

World record : 53 years of computations in 6 months

Distributed Financial Applications

GRID PlugTests (2004, 2005): Deploying on 2700 CPUs worldwide

Hard: x86_32, x86_64, ia64, AIX, SGIIrix, PPC, Sparc

OS: Linux, AIX, SGIIrix, MacOS, Solaris

Interoperability: EGEE gLite, Unicore, NorduGrid, LSF, PBS, Ibis/… Globus

ProActive
Programming, Composing, Deploying on the Grid

Open Source Middleware for the GRID

Programming Concurrent, Parallel, Distributed Applications with Active Objects

Denis Caromel, et al.

ProActive.ObjectWeb.org or GOOGLE ProActive

OASIS Team

INRIA -- CNRS - I3S -- Univ. of Nice Sophia-Antipolis, IUF

IEEE ISSADS Symposium and School,
Guadalajara, Mexico, Jan. 23-27 2006

1. GRIDs
2. Distributed Objects – Components
3. Application and Benchmarks
4. Conclusion – Perspective: Adaptive

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