GRID Standardization
GCM and ProActive Ref. Implementation

Sophia Antipolis, December 6th

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http://ProActive.ObjectWeb.org
OASIS Team
INRIA -- CNRS - I3S -- Univ. of Nice Sophia-Antipolis, IUF
GCM: Grid Component Model
Code Coupling:
Vibro Acoustic (courtesy of EADS)
JECS : 3D Electromagnetism Radar Reflection on Planes
GCM Origin

- **GCM: Grid Component Model**
  - GCM Being defined in the NoE CoreGRID (42 institutions)
  - Open Source ObjectWeb ProActive implements a preliminary version of GCM
  - Autonomic Features
  - Service Oriented: NESSI-Grid (Services come to life from Cp)

- **ETSI 3 GRID Plugtets**

- **GridCOMP EU project:**
  - GCM as a first specification
  - Further assess and refine GCM

- **EchoGrid EU project:**
  - Asses GCM in 2007, 2008 Grid Plugtests
GCM planned parts:

- GCM Interoperability Deployment
- GCM Application Description
- GCM Fractal ADL (Architecture Description Language)
- GCM Management (Java, C, WSDL API)
Scope of GCM Interoperability Deployment

- Describing Application, Components and Deployment in a Standard manner
- To be used as building blocks for Grid applications.
- To be used for Virtualization
- Targeting different frameworks:
  - Grid, Clusters, SMP Parallel machines, Servers, Multi-Cores
- XML based
ETSI GRID Plugtest

2007: N-Queens - 6 TEAMS

- “ACT” - Beihang University – China
- “BUPT N-Queens” – China
- “OutPUT N-Queens” – POZNAN – Poland
- “KAAPI-MOAIS” – France
- “Grid-TU” - Tsinghua University - China
- “ChinaGRID-TU” - Tsinghua University – China
Interoperability achieved with this technology: ETSI Grid Plugtests, 04, 05, 06, 07

- Between 20 to 40 sites around the world:
  - 2006: 4130 cores
  - Total power: ~1700 GFlops (100 Giga Flops in 04)
  - 2007: about 7000 cores

- Highly heterogeneous:
  - Machines: IBM, SGI, Sun, Bull, Mac
  - OS: Linux, Windows, Solaris, MacOS, SGI Irix
  - JVMs: Sun, SGI, BEA
  - Protocols: ssh, rsh, sshGSI, rcp, scp, Unicore, Globus Gram
  - Job Schedulers: PBS, LSF, Sun Grid Engine, Oar, Prun, EGEE gLite, NorduGrid, Globus, IBM Load Leveler
  - Recently added: CGSP China Grid
Grid Plugtests IV 2007: Result Analysis

- **Nb. Of Workers:**
  - 3 888 by ACT, Beihang University (BUAA), China
  - 3 654 by MOAIS, Grenoble, Fr.
  - **Compared to last year: x2**

- **Nb. of Solutions:**
  - N=23 + 6 times N=22, MOAIS, Grenoble, Fr.
  - N=22 + N=21 + 6 times N=20, BUPT
  - **Compared to last year: x6.5**
  - (2006: N=22 in 50mn on 2193 workers)

**Keeping (or even improving) Moore’s Law:**

- x2 in middleware (Nb. Nodes) x2 Solution Quality
**Grid Plugtests V -- 2008**

- **Agreed dates:**
  - Monday October 20th to Friday 24th, 2008
- **Location:**
  - Sophia Antipolis, French Riviera, France,
  - ETSI / INRIA

⇒ Technical Committee On GRID, ETSI

Laurent Vreck
• GCM – ProActive

• In the lobby!
Scheduler: User Interface
Scheduler: Resource Manager Interface
ProActive Parallel Suite (1)
GridCOMP Partners
ERCIM - GEIE ERCIM
National Technical University of Athens - ICCS/NTUA
ATOS Origin SAE - ATOS
Engineering Ingegneria Informatica S.p.A. - ENG
THALES
Beihang University - BUAA
Institute of Computing Technology, Chinese Academy of Sciences - ICT
Computer Network Information Center, Chinese Academy of Sciences - CNIC
National University of Defence Technology - NUDT
Huawei Technologies Co., Ltd - HUW
GCM Technical Structure

1. Component Specification as an XML schema or DTD
2. Run-Time API defined in several languages
   C, Java
3. Packaging described as an XML schema
4. Information for Deployment
   (Virtual Nodes, ... Variables, File Transfer, ...)

European Commission
World Class Standards
Status of GCM in ProActive

• **Improved implementation:**
  - ADL schema, API, Multicast, Gathercast, VN Deploy etc.
  - Autonomicity (Unipi)
  - Component GUI (prototype Westminster)

• **Distributed components for various applications:**
  - Numerical, Legacy, ...

• **On-going experiments:**
  - up to 300+ CPUs
Current GCM experiments in ProActive

- **JEM3D**: 3D electromagnetic application: a single Cp on 300+ CPUs on Grid

- **Vibro-Acoustic** application with EADS (legacy MPI coupling)
On-going experiments

- **GridSystems:**
  - Wing design (Numerical, parameter sweeping)
  - EDR processing (Telecom)

- **ATOS:**
  - PL/SQL wrapping and acceleration

- **IBM:**
  - Real-Time Fingerprint recognition

- **China Tsinghua:**
  - MPI wrapping, Deployment, Autonomicity
Multicast interfaces

- Results as lists of results
- Invocation parameters may also be distributed from lists
Gathercast interfaces

**Transform**

- A list of invocations into a single invocation

- Synchronization of incoming invocations
  - "join" invocations
  - Timeout / Drop policy
  - Bidirectional Bindings (callers ↔ callee)

- Data gathering
  - Aggregation of parameters into lists

**Result:**

Redistribution of results

Redistribution function

- Invocation parameter
- List of aggregated parameters
Update on ProActive and GCM

- **Recent versions:**
  - June 2006: ProActive V 3.1 : first GCM version
  - November 2006: ProActive V 3.2 Beta
  - January 2007: ProActive V 3.2
    (After PlugTests’ Learning)
  - April 2007: ProActive 3.2.1
Update on ProActive and GCM (2)

⇒ New features in 3.2 release (January 2007):
  - Conformance tests for Fractal, towards conformance tests for GCM
  - IC2D Eclipse Plugin
  - **TimIt** (Hierarchical, Visual)
  - Skeleton (improved, with File Transfer, Documentation)
  - gLite EGEE deployment updated
  - Support for Java 1.5 Generics:
    ⇒ Active Objects can be instantiated from Generic Classes
    ⇒ Some Warnings removed
  - Improvements in OSGi integration
  - Prototype TTools for UML modeling of GCM components (TBC)
What’s new in April 3.2.1 1/2

- **JMX support**
  - Java Management Extensions, a standard
  - ProActive/GCM JMX connector i.e. remotely accessible JVM, Active Objects, Components
  - Towards component Monitoring, Steering, ...
  - Easier separation between GCM implementations and tools (IDE, …)

- **New ProActive/GCM source layout**
  - Clear separation between ProActive core library including GCM implementation and additional ProActive features
  - Ease development of new features (WP2 and WP3)
What’s new in April 3.2.1 2/2

• Initial experiments on NF components:
  Composite-Membrane Component
  ⇒ Allow Components in the membrane as controllers

• Upgrade of GCM deployment
  ⇒ Rewriting deployment descriptor parser
  ⇒ At the same time of GCM standardization (TC Grid WI 1)

• Legacy Code Wrapping and Interoperability
  ⇒ First specification proposed by Tsinghua University
  ⇒ GCM proposed API and ADL extension (see video)
Improvements and Fixes 1/2

• **Bug Fixes:**

  ➤ **Multicast parameter dispatching**
  
  ▪ Correct multicast parameter dispatching with Round Robin mode
  ▪ Customization of multicast parameters dispatch
    
    ➤ Quick fix made, a rewrite is needed to complete support of customization (end of summer)

  ➤ **Controller**
  
  ▪ Multicast: support **interceptor** with the bindFcMulticast method
  ▪ Binding: **getFcInterfaces()** method return the right interfaces according to Fractal specifications

  ➤ **Example** *Helloworld* works with the ProActive/GCM jar!
Improvements and Fixes 1/2

- **Pending improvement/fix**
  - Some Multicast results with Round Robin dispatch mode could be missing
  - Multicast aggregation result
    - Add an annotation allowing aggregation between List<T> and T results
    - Needed in case of multicast and simple interface connected to a same Multicast interface
  - Multicast interface and Virtual Node cardinality
    - Give a way to create (using ADL) as many components as nodes in a virtual node and connect them to a multicast interface.
Work Item number: DTS/GRID-0004
GCM: Grid Component Model
GCM Interoperability Deployment

Manchester, May 11 2007
ETSI TC GRID Meeting # 3
Potential GCM parts could include:

Work Item

- GCM Interoperability Deployment
- GCM Application Description
- GCM Fractal ADL
  (Architecture Description Language)
- GCM Management (Java, C, WSDL API)
Scope of GCM Interoperability Deployment

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ETSI Grid Plugtests:


Technology successfully tested in 3 event!
ETSI Work schedule: Progress milestone

- **Date of creation of Work Item:**
  - 11-may-2007

- **Date Work Item adopted by Technical Body:**
  - 11-may-2007

- **Start of work date:**
  - 11-may-2007

- **ToC and Scope:**
  - 11-june-2007

- **Stable Draft:**
  - 11-sep-2007

- **WG approval:** **Technical Body approval:**
  - oct-2007, Right after 4th ETSI GRID PlugTests in Beijing
    (co-organized by EchoGrid project)
Upcoming Version

- **Current GCM ProActive version always accessible:**
  - SVN repository from ProActive page

- **Next Stable release: end of July – Sept. 2007**
  - Stable Cp. In membrane
  - New improved deployment (XML)
  - IC2D: JMX integration, Step/Step debug

- **Should integrate with:**
  - Composition IDE (Westminster)
  - Autonomic framework (Unipi)
  - InnerGrid (Fura) GridSystems
EP class B Benchmark on 8 16 32 64

Time in seconds

Benchmarks

- 8 workers
- 16 workers
- 32 workers
- 64 workers

Legend:
- Total
- Gaussian
- Random
- Tabulation
Towards Integrated GCM/ProActive Debug