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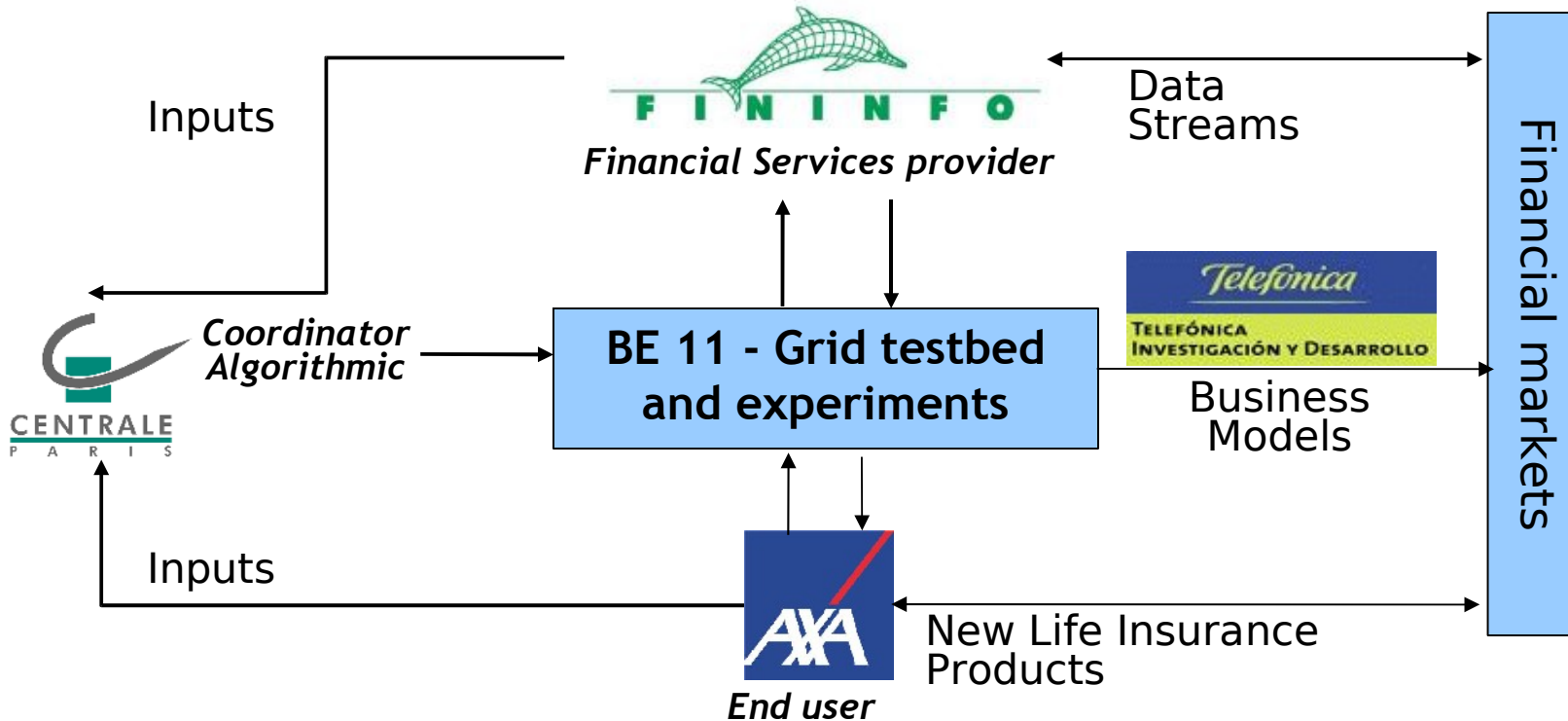
BE11 – Risk Management in Finance CRSA – AXA – Fininfo – TID

Industry Days Demo, Barcelona, June 3rd-6th, 2008

Ioane Muni Toke – Hélène Huard – Christian Saguez
Centrale Recherche SA

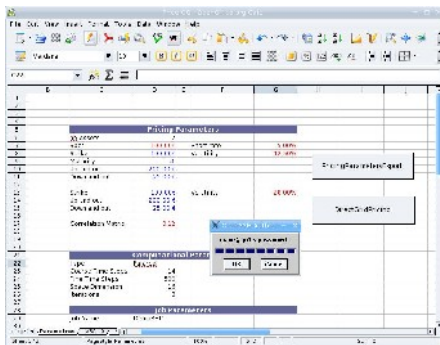
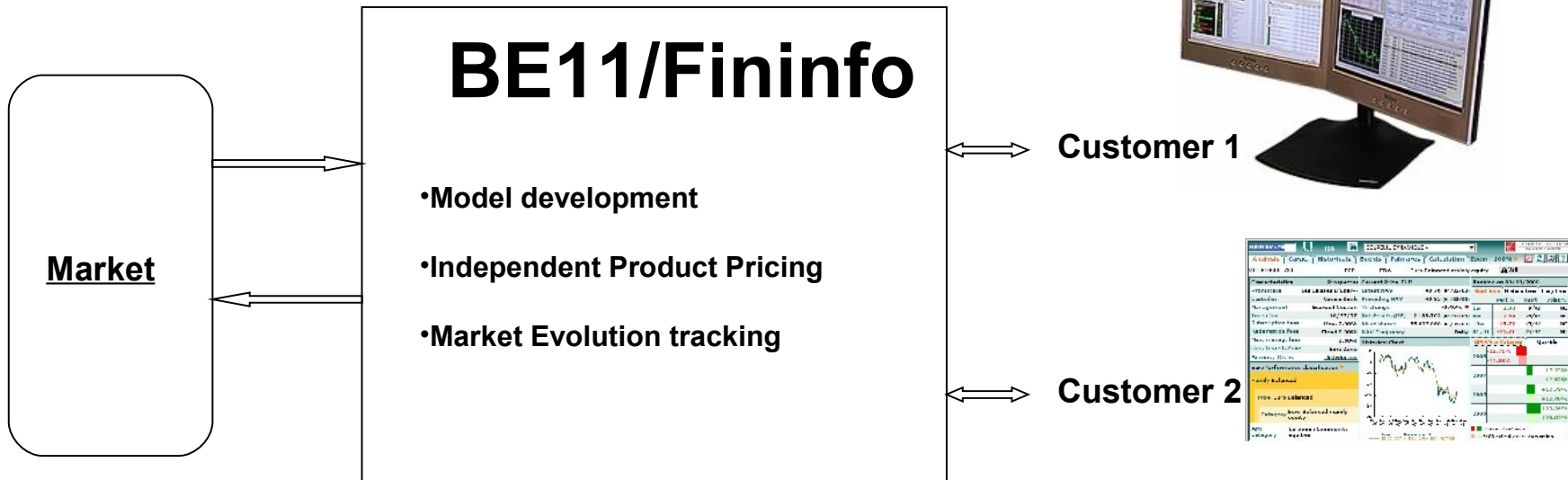
{ioane.muni-toke, helene.huard, christian.saguez} @ecp.fr

BE11 Overview

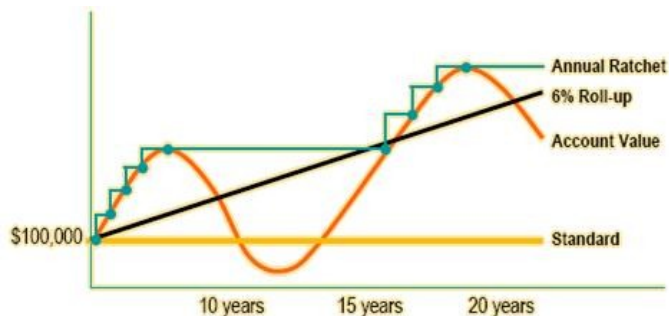
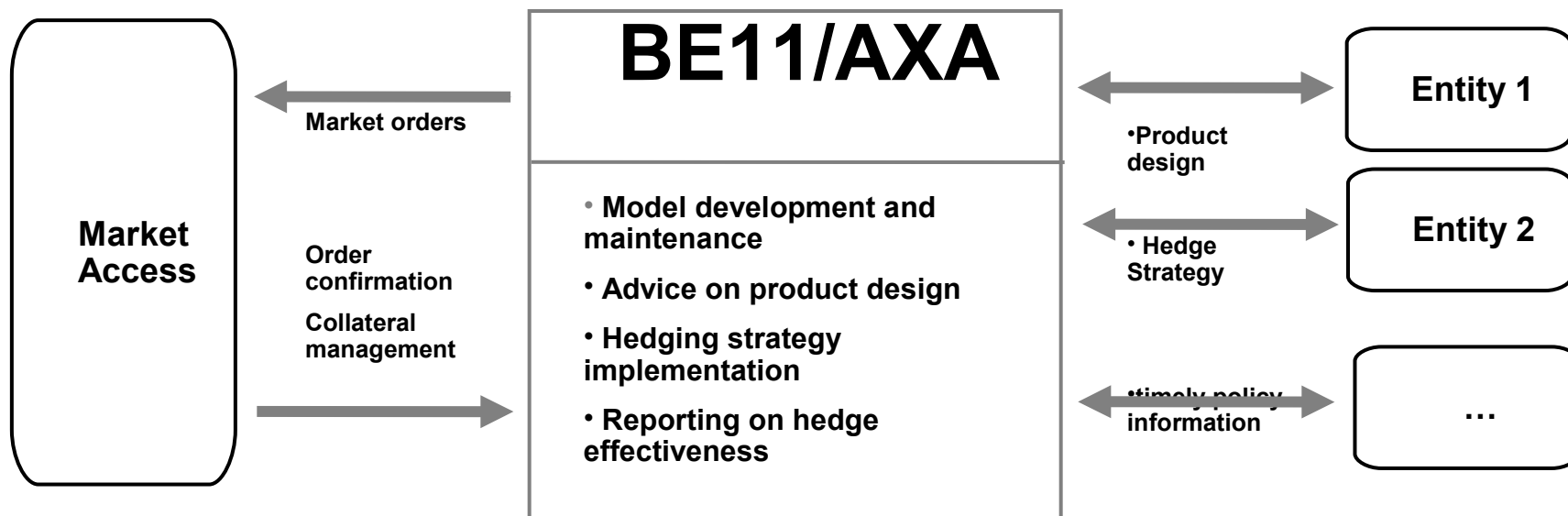


Challenge : Grid technologies for real-time constraints problems and resource challenges in the risk analysis of investment portfolios

Business Objectives Equity Market Case



Business Objective Life Insurance Case



Technical Achievements – Equity Market Case

- **Problems – Constraints**

- 3-year maturity option on 3 to 5 assets
- Time and resource consuming pricing
- Time constraint : 3 minutes

- **Mathematical model**

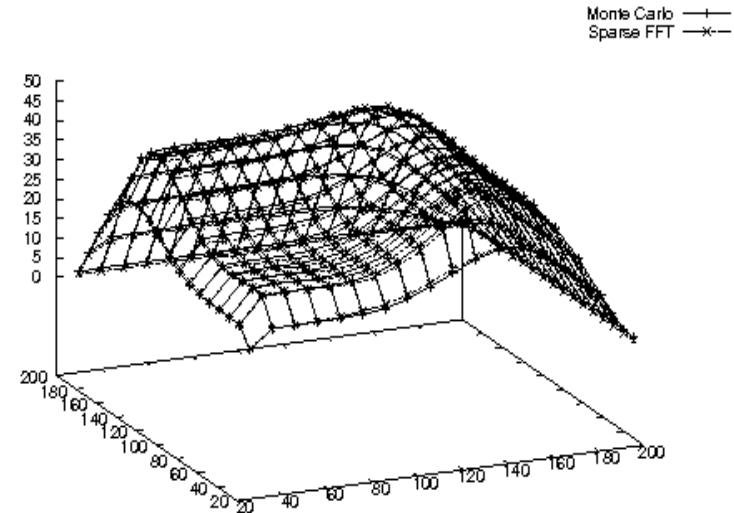
- Multidimensional PDE with time dependant parameters

- **Solution**

- Parareal algorithm (Lions et al., 2001) mixed with new techniques of dimension reduction (Spectral methods, POD)
- Web services pricers running on a dedicated enterprise grid

- **Results**

- Time constraint satisfied with 9 processors
- Comparison to market prices : within 0.9% of MC prices
- Speed-up : up to 90% of the theoretical accelerations

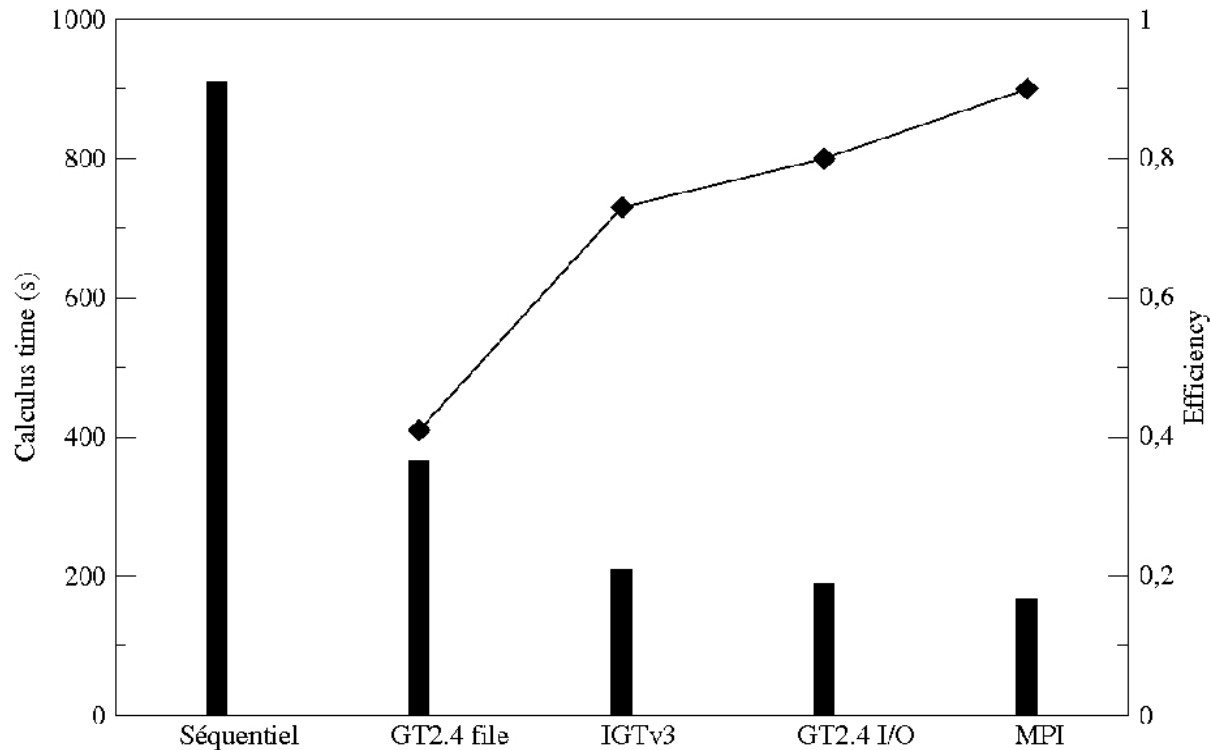


Technical Achievements – Insurance Case

- **Problems, constraints**
 - Path-dependant products with many optional clauses: two-scale Monte Carlo
 - Run-time challenge for the pricing and “Greeks”-hedging
 - Time constraints: overnight job
- **Mathematical Model**
 - American Monte Carlo : Ibanez-Zapatero, Longstaff-Schwartz,... (non parametric methods (Picazo) for optimal flexibility)
- **Solution**
 - Coarse volume parallelization of multiple policies
 - Fine pricing parallelization of a single policy (Parallel estimation of sample exercise points with a Grid service + parallel final Monte Carlo)
- **Results**
 - Great flexibility in frontier approximation

Design Plan	Deferral period	Deferral bonus	IB	Equity mix
	1 yr	2%	@2.0%	50%, 30% for ages 71+
	3 yrs	2%	@2.5%	50%, 30% for ages 71+
	5 yrs and +	2%	@3.0%	50%, 30% for ages 71+

Technical Achievements – Grid middleware

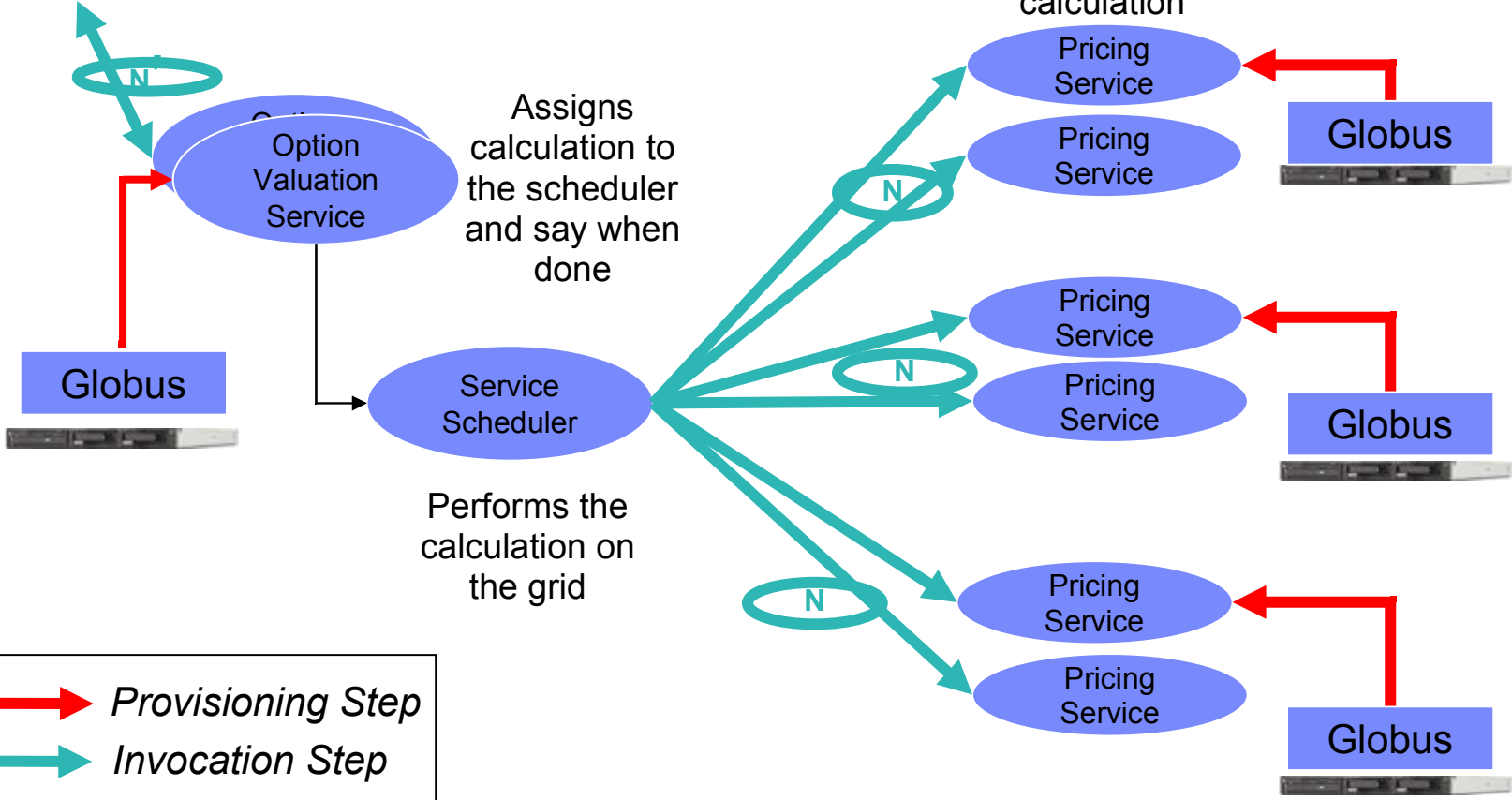


Source : Muni Toke, Girard, *Proc. Large Scale Scientific Computing, Lecture Notes in Computer Science, Springer, 2005*

Service Oriented Approach



Want the value of my options ASAP!

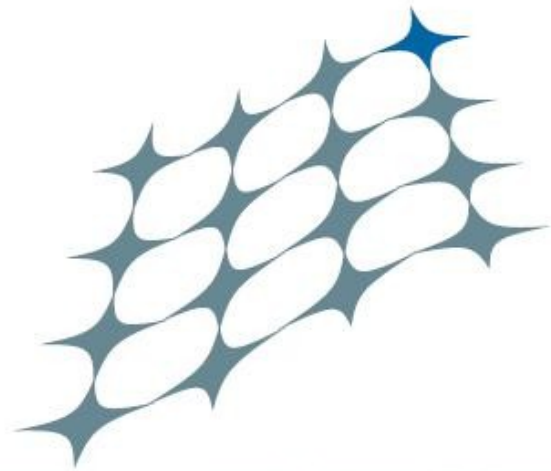




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BEInGRID
BUSINESS EXPERIMENTS IN GRID

Time for demo...

Conclusion

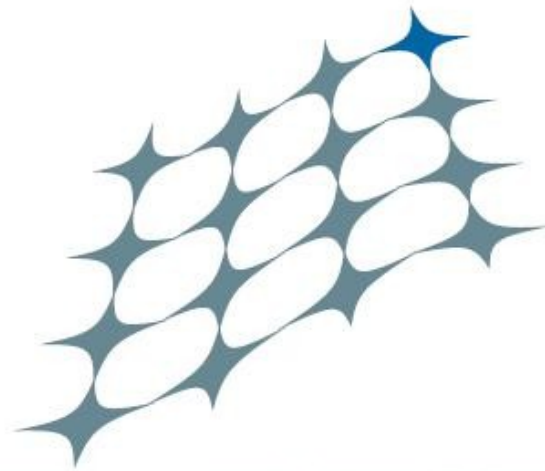
- **Technological breakthroughs**
 - High-dimensional PDE (up to 5)
 - New mathematical algorithms and implementation on grids in order to solve time-constraints problems
- **Equity Market Case**
 - Capacity to do real-time pricing thanks to grid implementation
- **Life-Insurance Case**
 - Capacity to handle highly complex models in order to ensure better risk analysis: definition of a pricing algorithm.
- **Dissemination**
 - Contacts taken with major actors of the market (Finance and New Information Systems, Europlace Institute of Finance, Paris)
 - Participation to international conferences (WorldComp, Las Vegas, 2007 ; Grid in Finance, London, 2008)



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Thank you.



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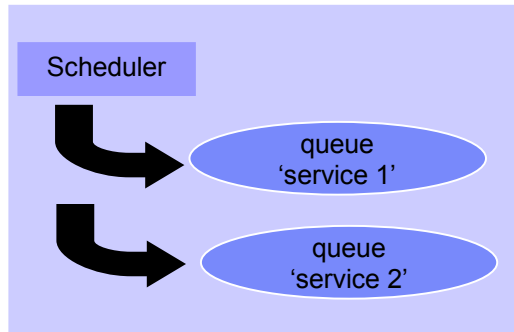
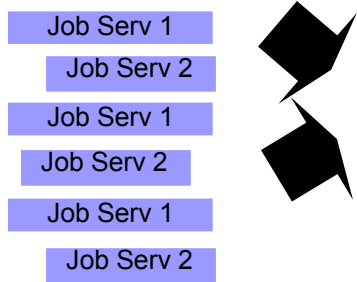


Some more documents...

Hardware and Software Specifications

- **Typical computing node**
 - 2 Intel(R) Pentium(R) 4 CPU 3.20GHz
 - 1 Go RAM
 - Linux Mandrake 9.2 + IBM Grid Toolbox embedding Globus Toolkit
 - gcc-3.3+ ; jre-1.3.1
- **Grid Client**
 - Linux Mandrake 9.2 + IBM Grid Toolbox embedding Globus Toolkit
 - jdk-1.5+ ; swig 1.3+
 - ssh/sftp server
- **Trader Station**
 - Spreadsheet Software (MS-Excel, OpenOffice) with VBA support
 - Secure ssh/sftp client

Scheduler Architecture



```

public void run() {
    Job j=null;
    ServiceThread t =null;
    while (true) {
        Iterator i = DeployedService.listIteator();
        boolean HasRunAnything=false;
        while (i.hasNext()) {
            t=(ServiceThread)i.next();
            LinkedBlockingQueue
            sq=sched.getQueue(t.getName());
            if (sq!=null) {
                j=(Job)sq.poll();
                if (j!=null) {
                    HasRunAnything=true;
                    if (t.exec(j))
                        j.setDone();
                    else
                        sched.Submit(j);
                }
            };
            if (!HasRunAnything)
                sched.Wait();
        }
    }
}

```

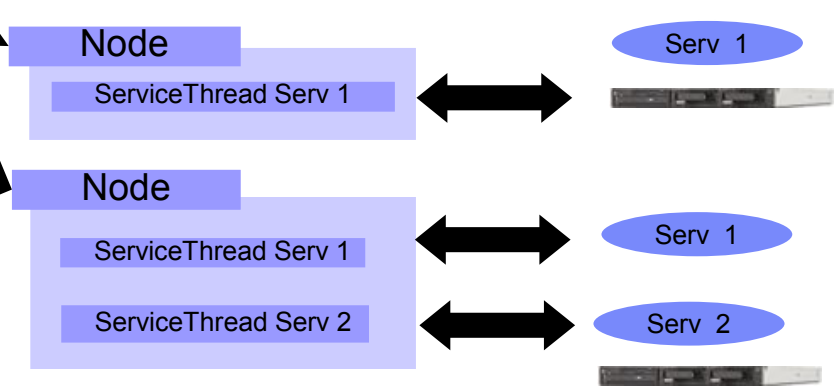
```

public class Node extends Thread {
    String hostname;
    Scheduler sched;
    LinkedList DeployedService = new
    LinkedList();

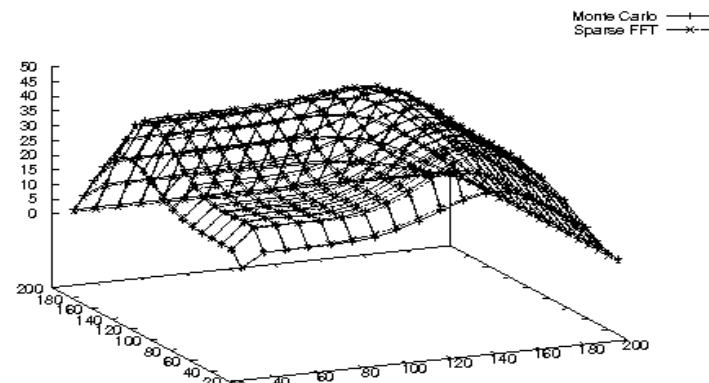
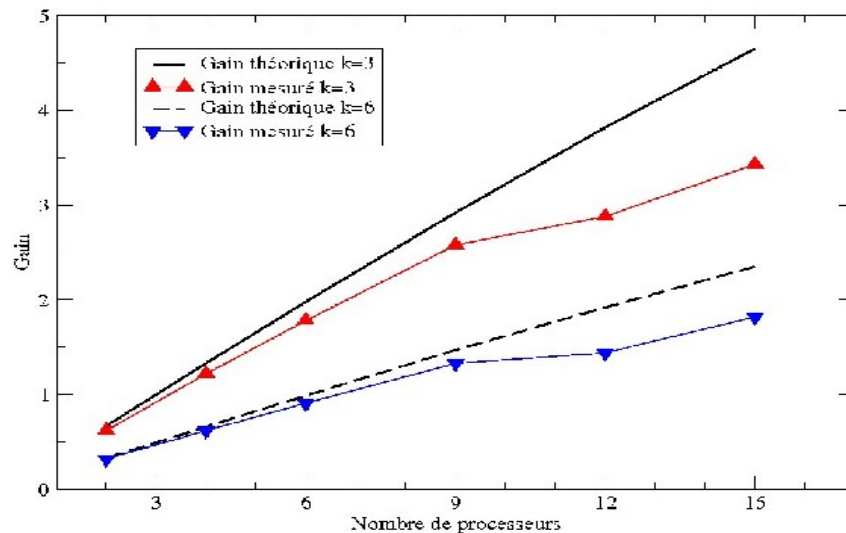
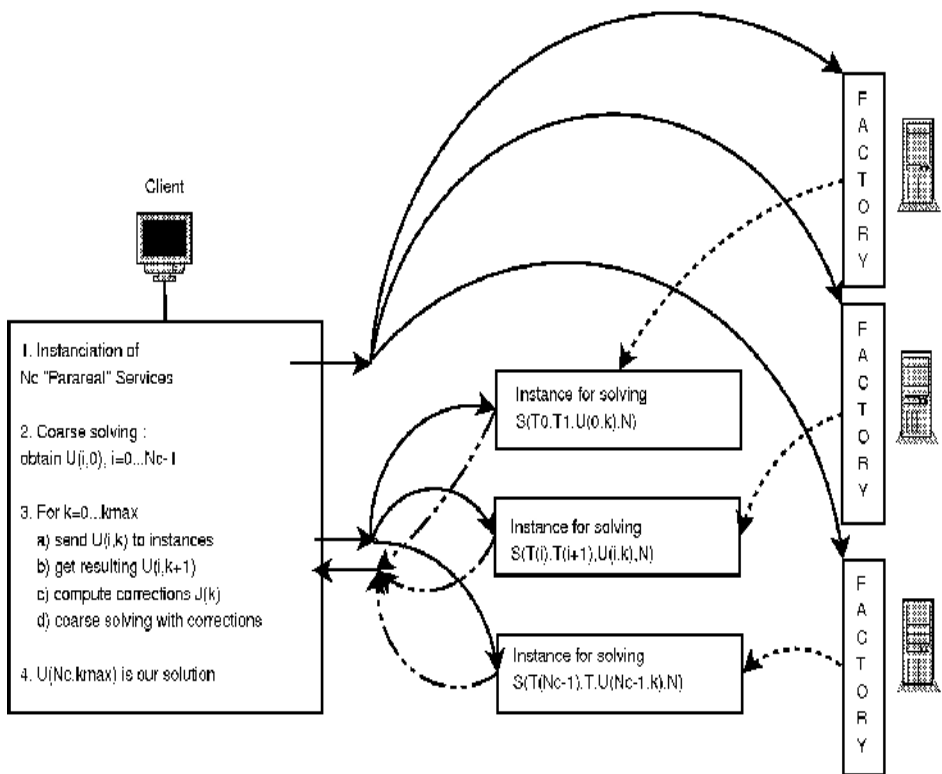
    public Node(String s,Scheduler sc) {
        hostname=s;
        sched=sc;
    };

    public void Deploy(ServiceThread t) {
        DeployedService.add(t);
        t.provision(hostname);
    };
}

```

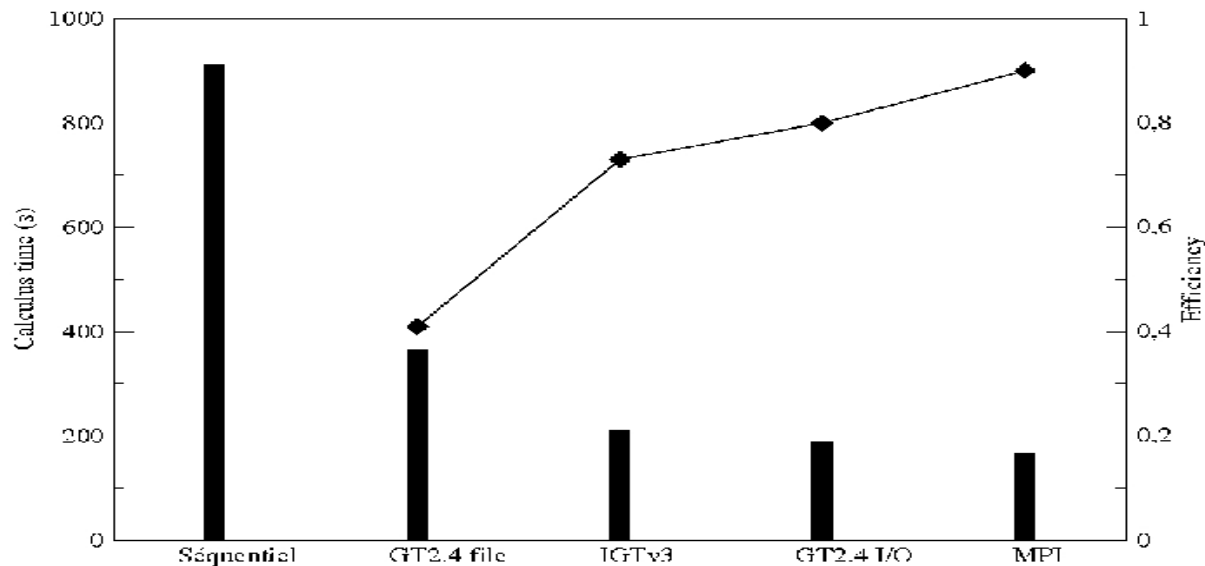


Technical Achievements – Equity Market (II)

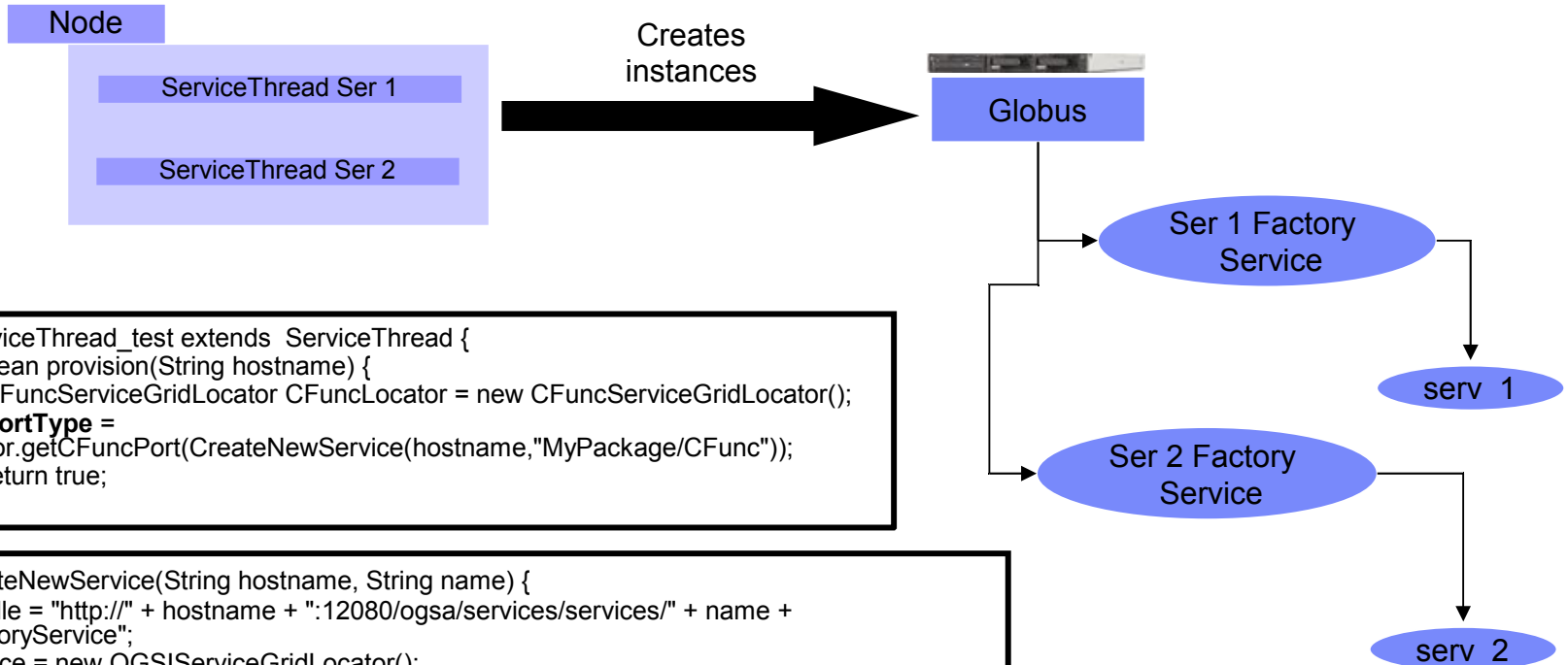


Technical Achievements – Insurance Products (II)

Design Plan	Deferral period	Deferral bonus	IB	Equity mix
	1 yr	2%	@2.0%	50%, 30% for ages 71+
	3 yrs	2%	@2.5%	50%, 30% for ages 71+
	5 yrs and +	2%	@3.0%	50%, 30% for ages 71+



Service Provisioning



```

public class ServiceThread_test extends ServiceThread {
    public boolean provision(String hostname) {
        CFuncServiceGridLocator CFuncLocator = new CFuncServiceGridLocator();
        PortType =
        CFuncLocator.getCFuncPort(CreateNewService(hostname,"MyPackage/CFunc"));
        return true;
    };
}
  
```

```

public URL CreateNewService(String hostname, String name) {
    String handle = "http://" + hostname + ":12080/ogsa/services/services/" + name +
    "ProviderFactoryService";
    factoryService = new OGSIServiceGridLocator();
    Factory factory = factoryService.getFactoryPort(new URL(handle));
    GridServiceFactory gridFactory = new GridServiceFactory(factory);
    LocatorType locator = gridFactory.createService(null,"Test");
    GSR reference = GSR.newInstance(locator);
    String location = reference.getHandle().toString();
    System.out.println(" Handle: " + location);
    return new URL(location);
};
  
```

Service Invocation

