is a Load Injection Framework

a new initiative of ObjectWeb consortium's
Java Middleware Open Benchmarking project

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Outline

- JMOB project overview
- Lessons learned with RUBiS
- Requirements for a load injection and performance measurement framework
- CLIF: design and current status
- Conclusion

ObjectWeb and the Java Middleware Open Benchmarking (JMOB) project

ObjectWeb & JMOB

- **ObjectWeb**
  - consortium fostering the development of open source middleware
  - a « European Apache » with a W3C organization
- **JMOB**
  - middleware benchmarks
  - open source implementations
  - online experimental results
  - place to exchange benchmarking experiences and software

JMOB current projects

- **Stock-Online**
  - stock market simulation
  - J2EE benchmark
  - reports from CSIRO (Australia)
- **RUBiS**
  - eCommerce web site modeled after eBay.com
  - PHP, Servlets, 7 EJB implementations available
  - ongoing JDO and .Net implementations
  - Oopsla'02 paper
- **RUBBoS**
  - site modeled after slashdot.org
  - PHP and Servlets
  - Middleware'03 paper

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ObjectWeb
Open Source Middleware

RUBiS

- **Auction site modeled after eBay**
- **26 interactions**
- **Browsing mix: read-only mix**
- **Bidding mix: 15% read-write interactions**
- **Database: 1.4 GB**
  - 1 million users, ~500000 comments
  - >500000 items, 330000 active bids

RUBiS main results

Academic side (Oopsla'02)

- Design pattern determines performance
- Reflection limits scalability
- Communication is the main CPU consumer

Technical side

- benchmarking is a nightmare
- 6 months of cpu time to obtain the results
- What is going wrong is the hardest question
- load injection is as complex as the benchmark app.

RUBiS main results

Load injection

- monitoring necessary not only on SUT (System Under Test)
- one client emulator with a bottleneck resource at any point in time will give unstable results
- online monitoring is (too?) expensive

Resources needed for injection

- up to 5 clients machines to saturate one server
- how many for a cluster of servers ?
- how to scale ?

RUBiS main results

RUBiS load injection design

- ad-hoc client emulator using a transition state matrix
- distributed Java application
- monitoring using Linux specific tools (sar)
  - dump into temporary directory
  - post-mortem analysis of monitoring information
- awk+bash scripts for HTML reports generation

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Existing solutions and projects

A couple of very good commercial solutions exist:

- high level loads, user-friendly, multiple target protocols

but:

- license costs are high, protocol-specific and depend on the required load level
- OS-bound (e.g. running on Windows only)
- how about testing custom protocols? (free extendibility issue)

Other solutions:

- more than 400 platforms/projects found on the Web ! (not all alive)
- reduced load levels, target protocols, user-friendliness, supported OS

Typical technical limitations (1)

OS-specific...

- development for optimized injection performance
- Graphical User Interface
- access to system information about resources usage
- distribution and deployment support

Poor injection performance and scalability

- virtual machine execution overhead
- interpretation of scripting languages
- lack or bad tuning of distributed injection support

Typical technical limitations (2)

Fixed, single or reduced...

- load scenario definition tools/modes
  - scripting, GUI, XML-based or ad hoc configuration file, probabilistic state transition matrix, coarse-grain load profiles (ramps, peaks...)
- target protocols

Untransparent distribution management

- deployment of injectors and test scenarios
- collection of test results

The platform we are dreaming about is...

- **OS-independent**
- **versatile:**
  - target protocol independent and extendible
  - enables any kind of load profile to be generated
- **scalable to generate high load levels**
- **user-friendly**
  - for a variety of users

    plain users, advanced users, developers...
  - handling cumbersome tasks

    test deployment, results synthesis...
- **cheap**

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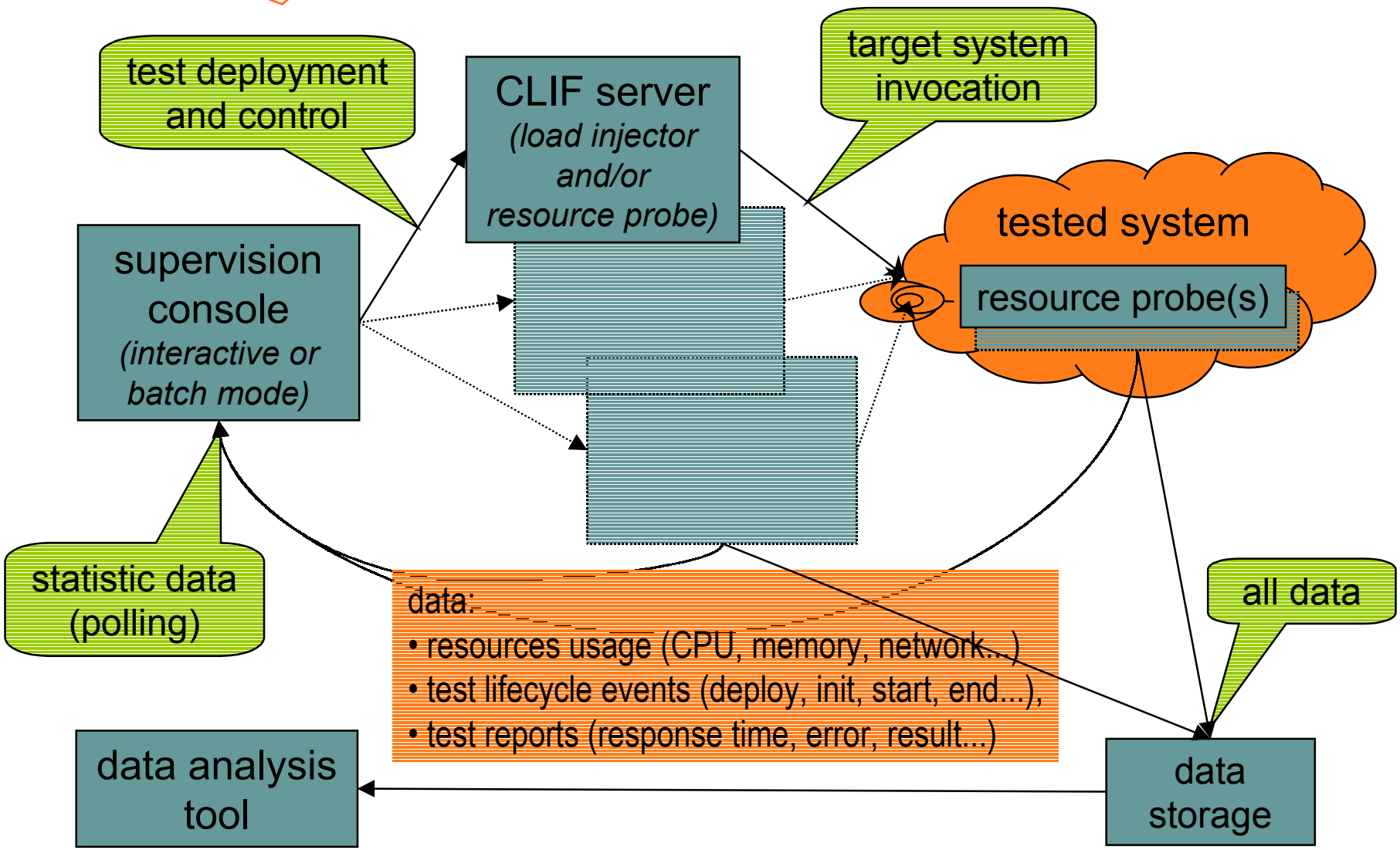
CLIF: yet another benchmarking tool?

CLIF aims at providing the platform we are dreaming about:

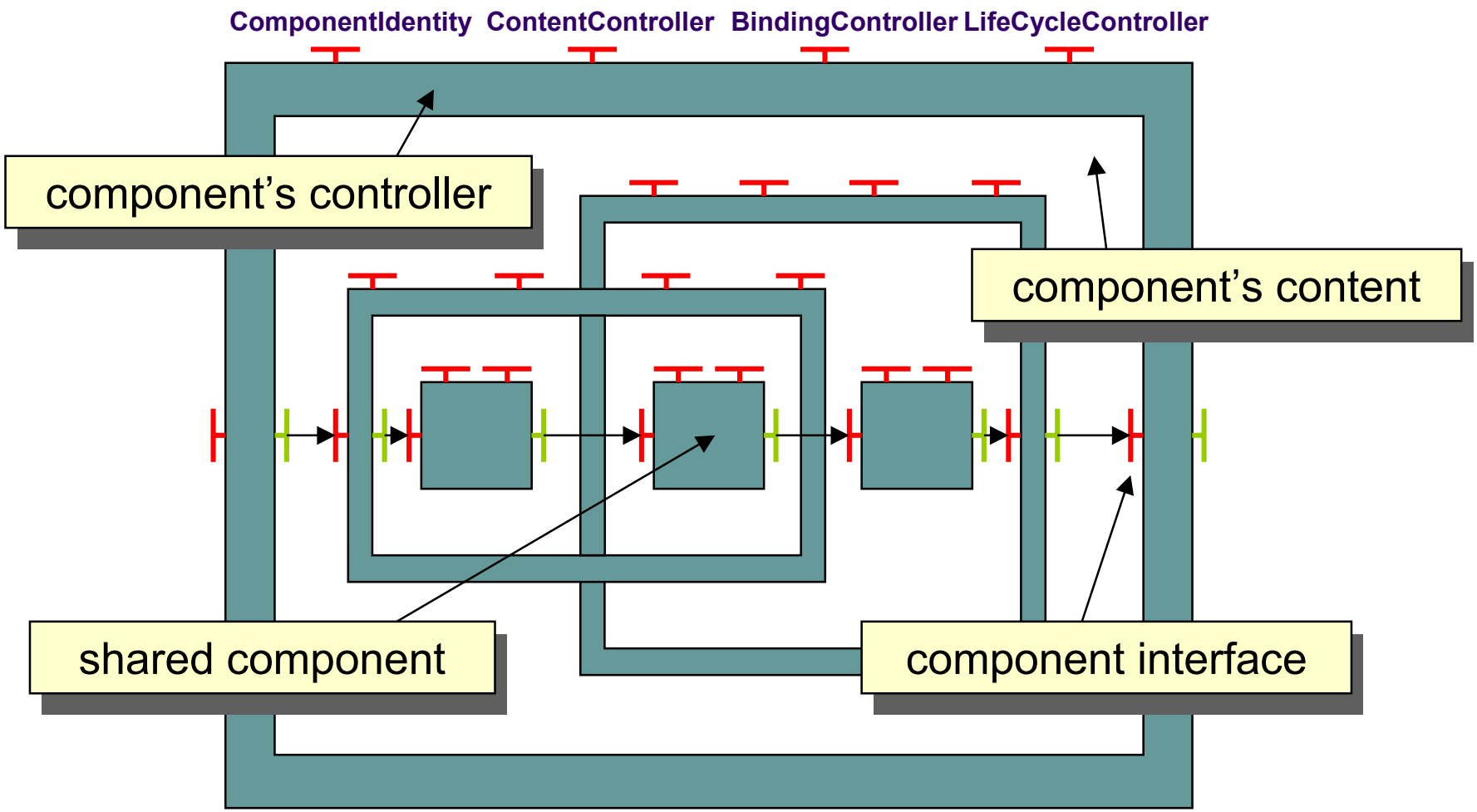
- based on Java for hardware and OS independence
- distributed to enable high loads, with transparency support (deployment, control, data collection...)
- based on ObjectWeb's Fractal component model to have a neat, open architecture for straightforward adaptability (test scenarios, protocols)

- open source!

The big picture

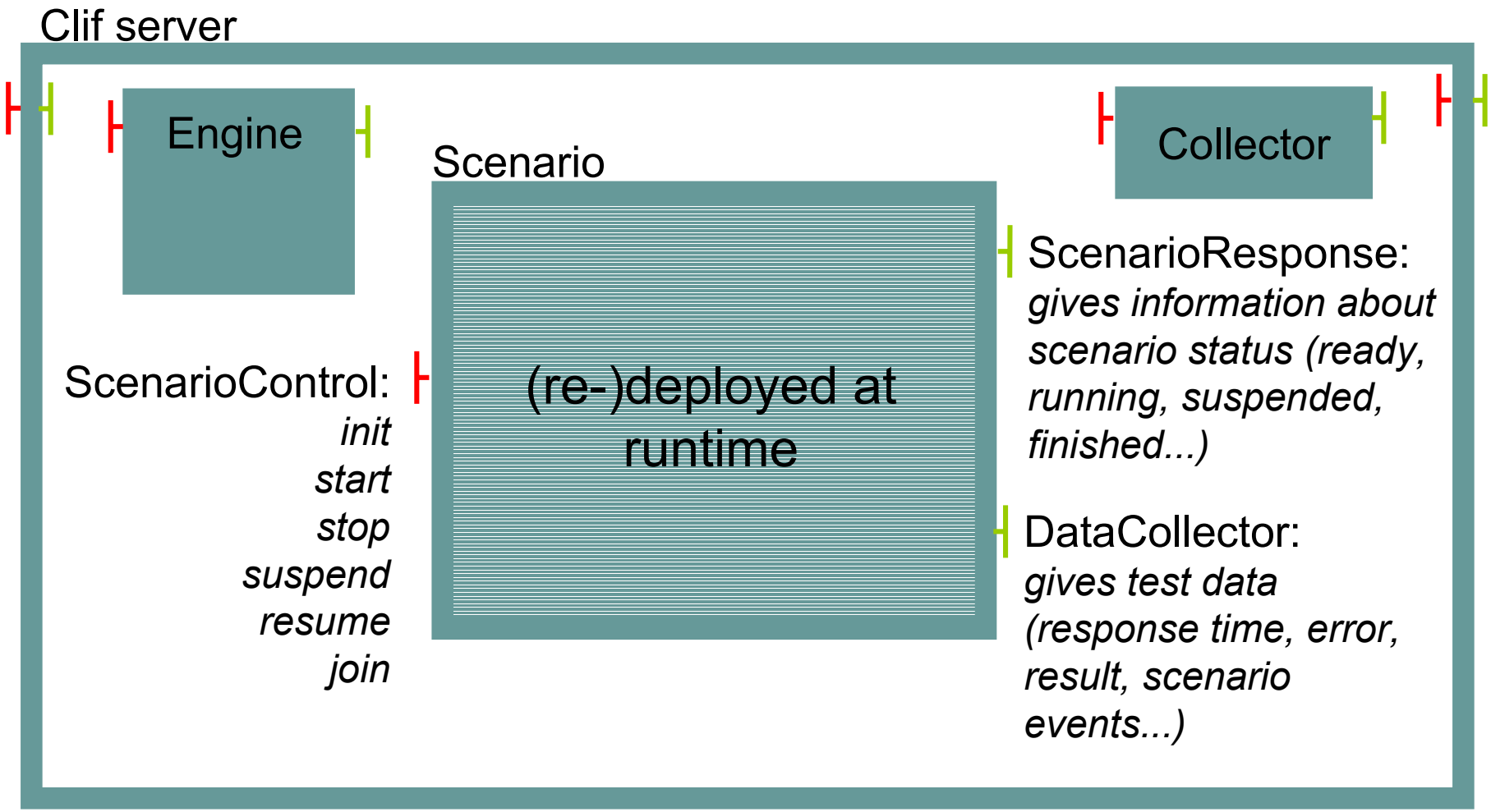


Fractal Component Model



server interface (offered service) ⊢ ⊣ client interface (required service)

Focus on scenario component



Current status

CLIF is a distributed load injection framework in Java, based on Fractal component model

multi-OS, open to any target protocol/system, open to any test scenario definition

Next development steps

- asynchronous collection, storage and analysis of data
- generic scenario tools (scripts, GUI, load profiles...)
- library of utilities for a variety of target protocols
- resource probe only implemented for Linux
- distributed log and user-defined alarm management
- state-of-art HTTP test tool (with integration of Rubis)

Future work

Further design work

- complete archival and exploitation support for full test campaigns
- scalability for very high loads (e.g. hierarchical organization of servers for test monitoring and control)

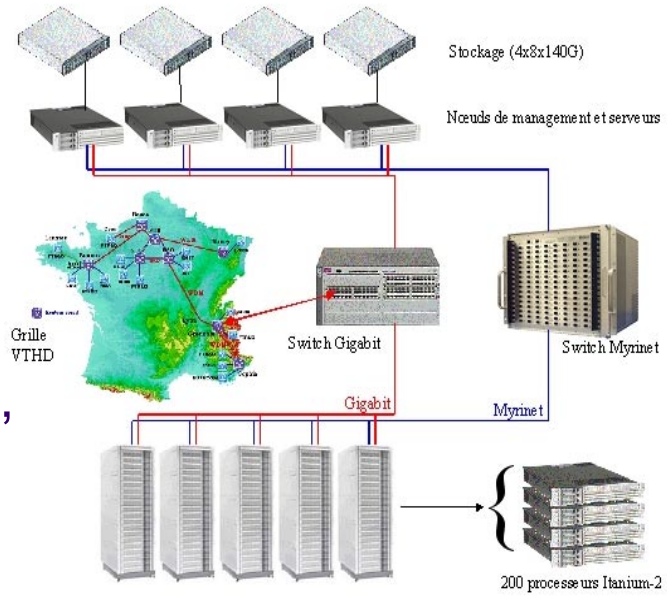
Conclusion

- load injection is a complex distributed application
- CLIF is a framework for load injection
- contributions and feedback welcome

Join us: jmob@objectweb.org

iCluster 2

- Itanium-2 processors
- 104 nodes (Dual 64 bits 900 MHz processors, 3 GB memory, 72 GB local disk) connected through a Myrinet network
- 208 processors, 312 GB memory, 7.5 TB disk
- Connected to the GRID network
- Linux OS (RedHat Advanced Server)
- First Linpack experiments at INRIA (Aug. 2003) have reached a 560 GFlop/s performance



- Applications : Grid computing experiments, classical scientific computing, high performance Internet servers, …