



SC2002 Baltimore

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# Integrated Performance Analysis of Distributed Computer Systems

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1999

Cluster - SMP/ Vector  
PC-Cluster enter TOP 500  
Clusters good in Linpack  
but bad as systems

**Need for a System  
Benchmark**

Berkeley 2000  
Initiatives to establish new  
Benchmarks

2002

**US and German projects have started**



- Develop realistic, scalable and portable benchmarks  
Benchmarks should be useful in 10 Years, be the outcome of real applications)
- Make Benchmarking easy ( benchmark client/ repository)
- Low –level benchmarks (Memory, communication, I/O)
- Define benchmarks for commercial codes
- Develop Performance prediction methods
- Object oriented approach
- Combine Codes to a Grid Benchmark



**Fraunhofer** Institut  
Techno- und  
Wirtschaftsmathematik



**pallas**

...T...Systems...

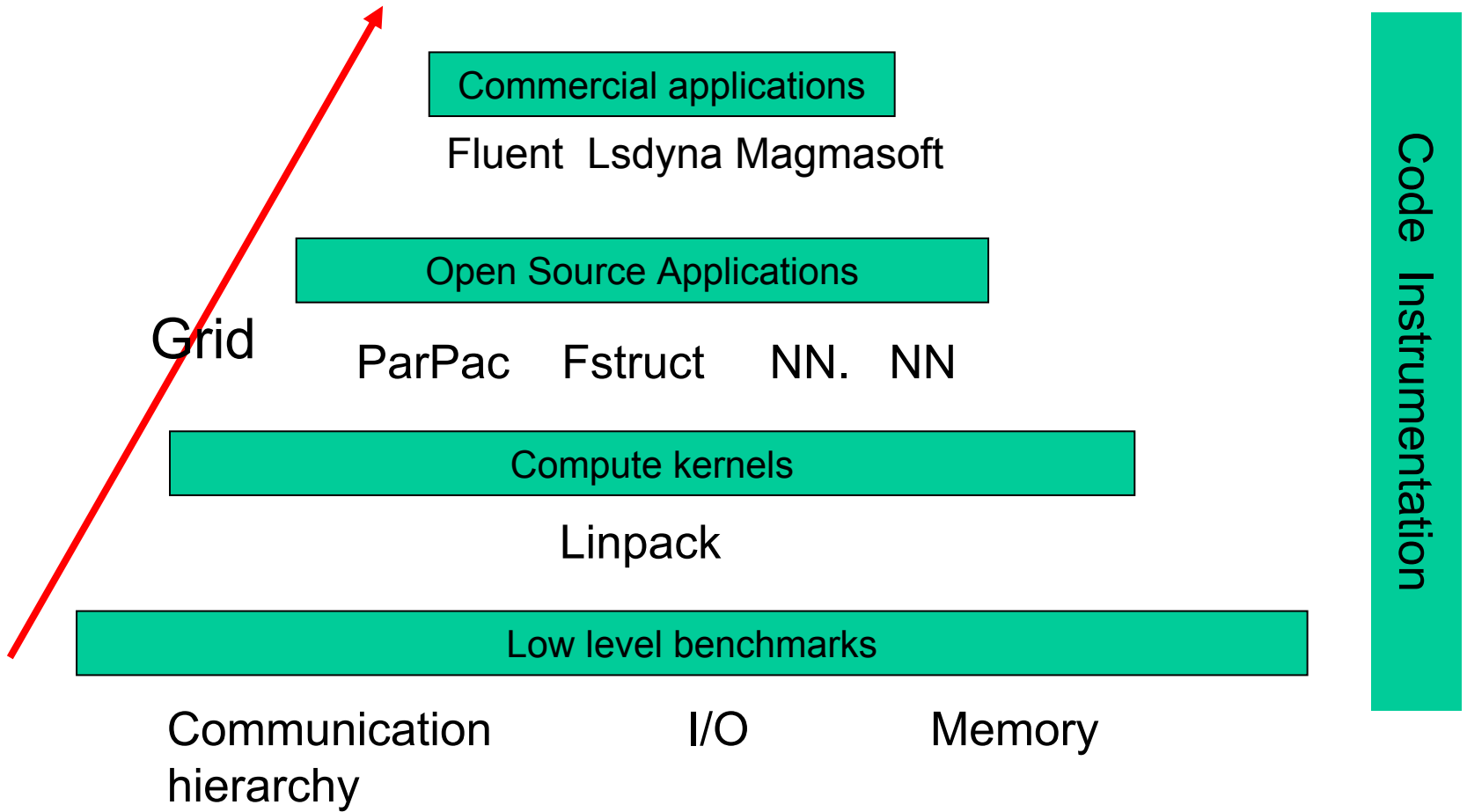


**NATIONAL ENERGY RESEARCH  
SCIENTIFIC COMPUTING CENTER**

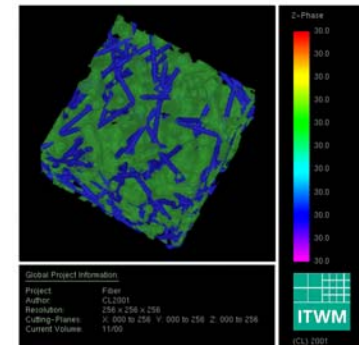
Advancing Computational Science of Scale—  
Producing Real Results



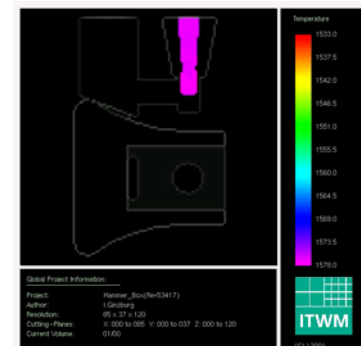
# Benchmarks



- developed at ITWM during the last 5 Years
- C++ Code , complex datastructures
- suited for very complex geometries
- fully parallelized
- automated domain decomposition
- dynamical load balance
- optimized communication paths
- (the parallel library will not be pulic domain)



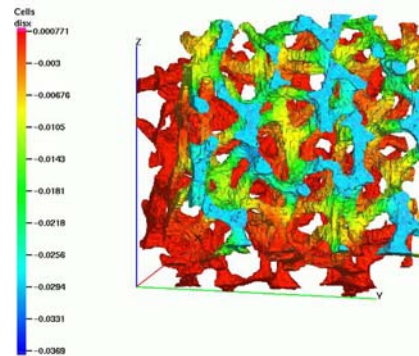
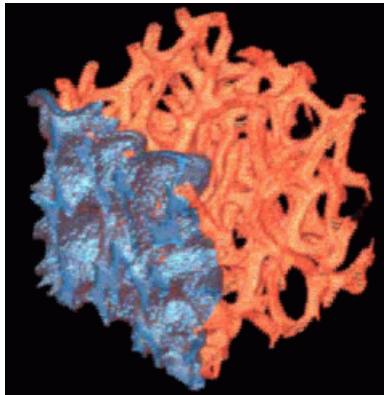
2-Phase flow Porous Material



Filling Process

## Benchmark:

- Flow through a porous structure to compute its permeability
- Geometry is generated synthetically and will be done during benchmark execution
- Same type of structure will be used for the structural mechanics code



## Dual PIII System

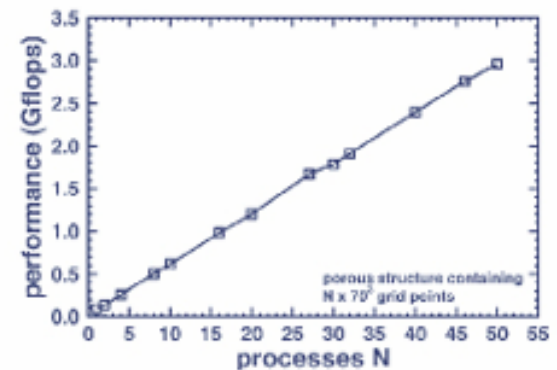
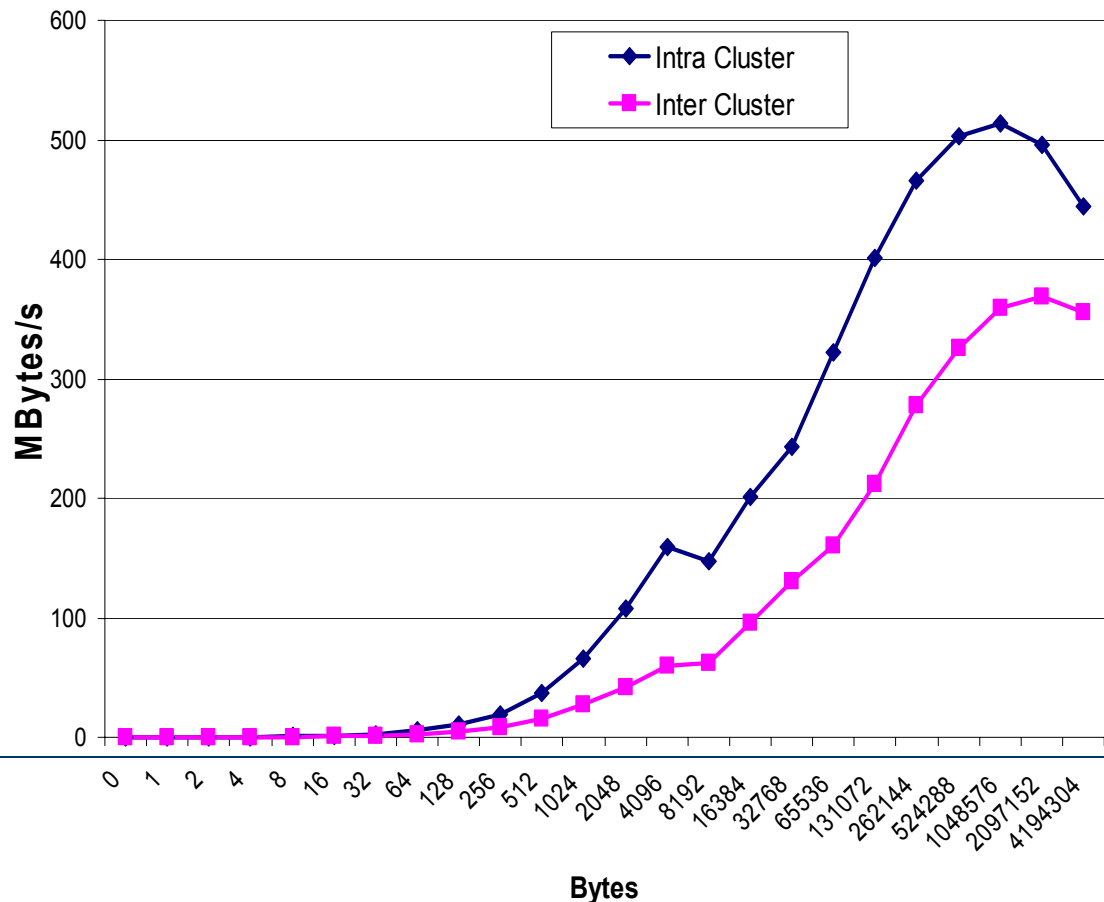


Fig. 2: Performance results running the benchmark on the ITWM cluster.

- Message passing  
PMB ([www.pallas.com/products/PMB](http://www.pallas.com/products/PMB))
- Cache  
CACHEBENCH ([icl.ics.utk.edu/projects/llcbench](http://icl.ics.utk.edu/projects/llcbench))
- IO  
IOZONE ([www.iozone.org](http://www.iozone.org))
- Try to characterize performance by few numbers

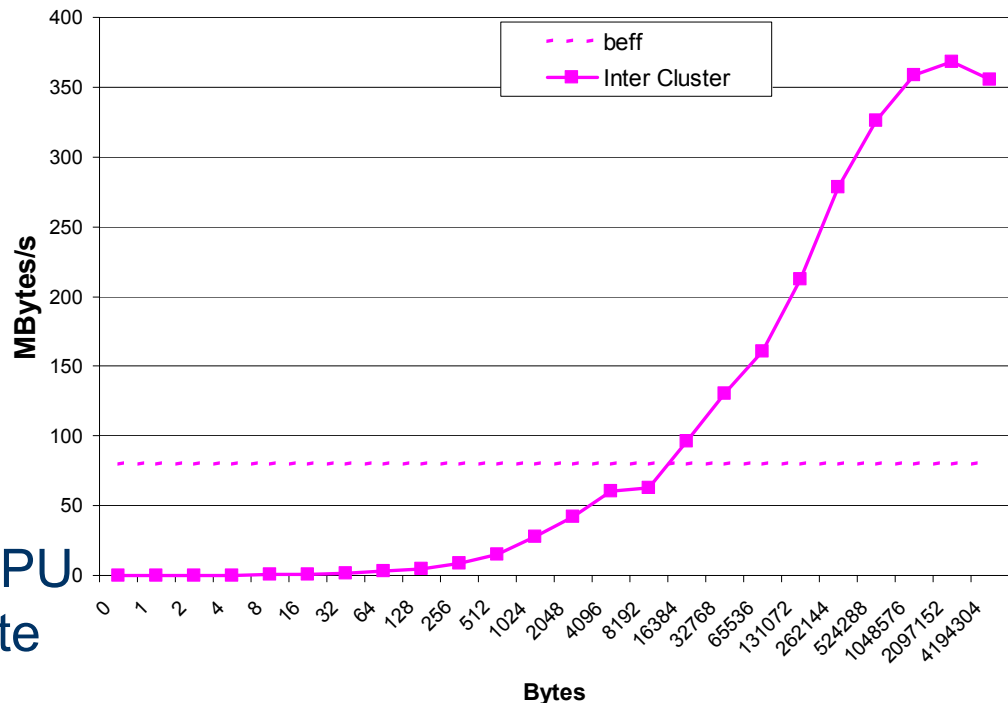
- Pallas MPI Benchmark
- Checks many MPI communication patterns
- Automatically detects clustering and reports intra-cluster and inter-cluster performance

**IPACS Message Passing Benchmark (IBM SP3)**

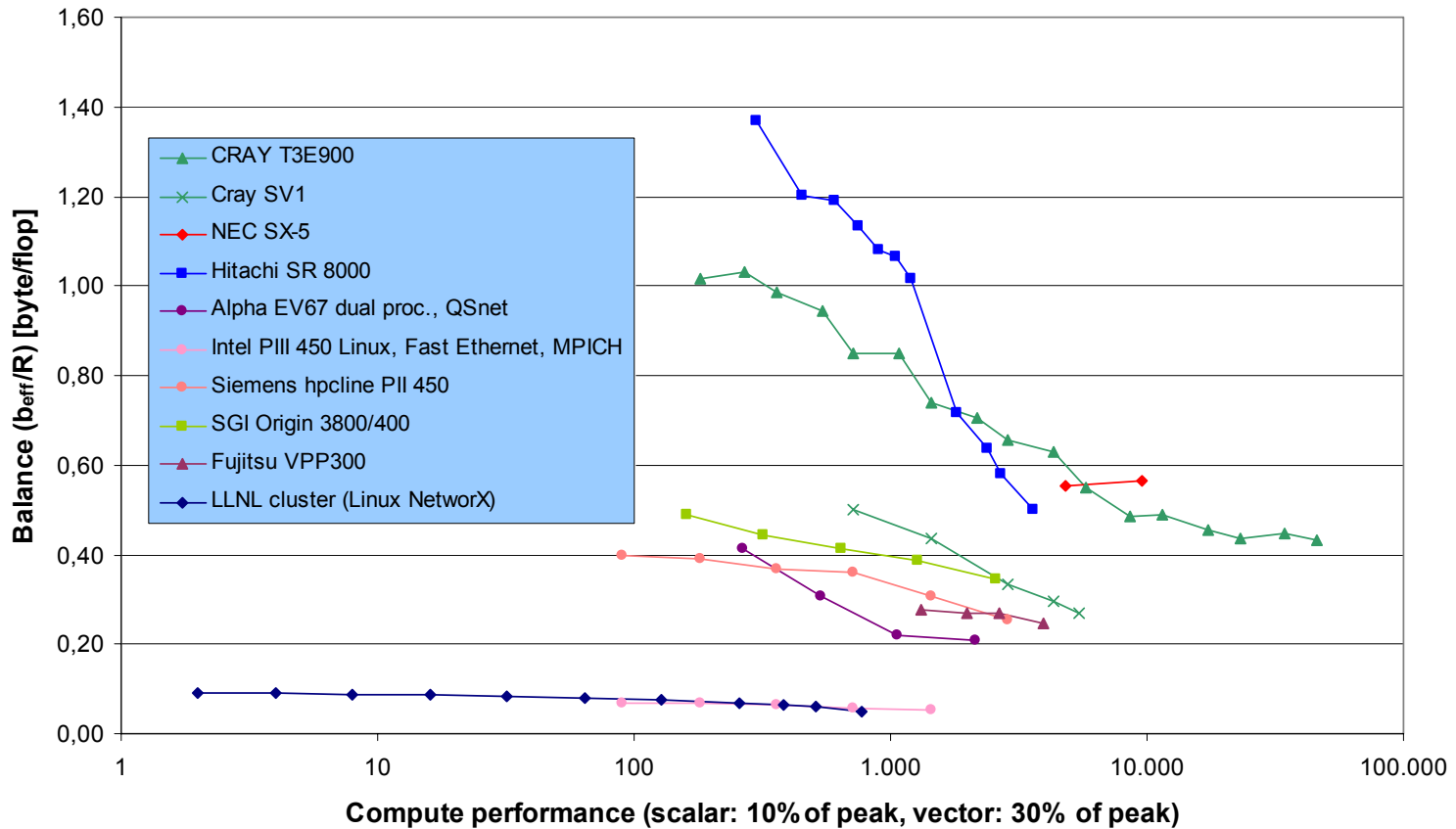


- MPI Communcation performance as single number
- N/2-N/2 ping-pong, integration over messange-lengths, average over various patterns
- Can be compared to CPU performance to compute „balance“

**IPACS Message Passing Benchmark (IBM SP3)**

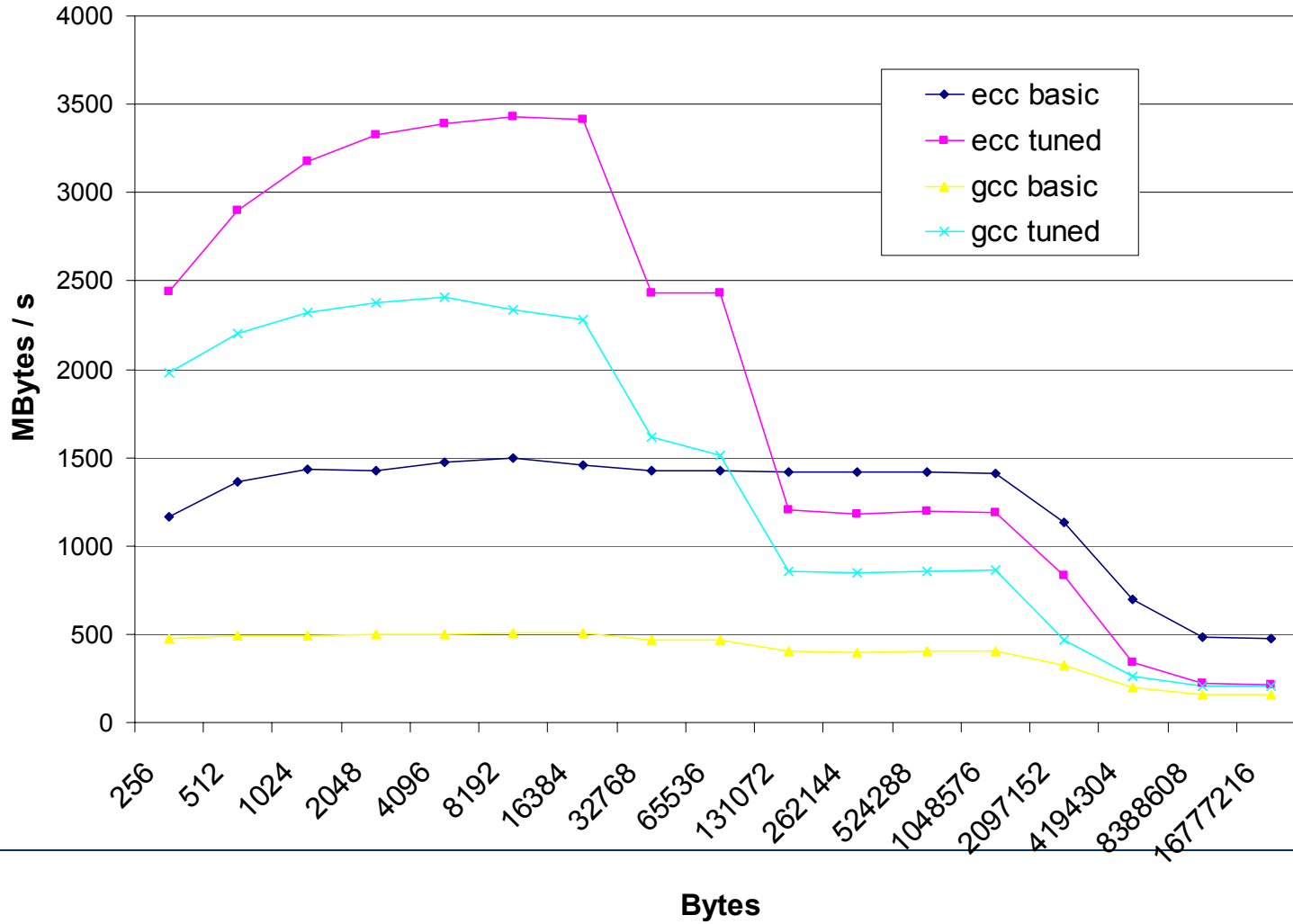


# Computer Balance

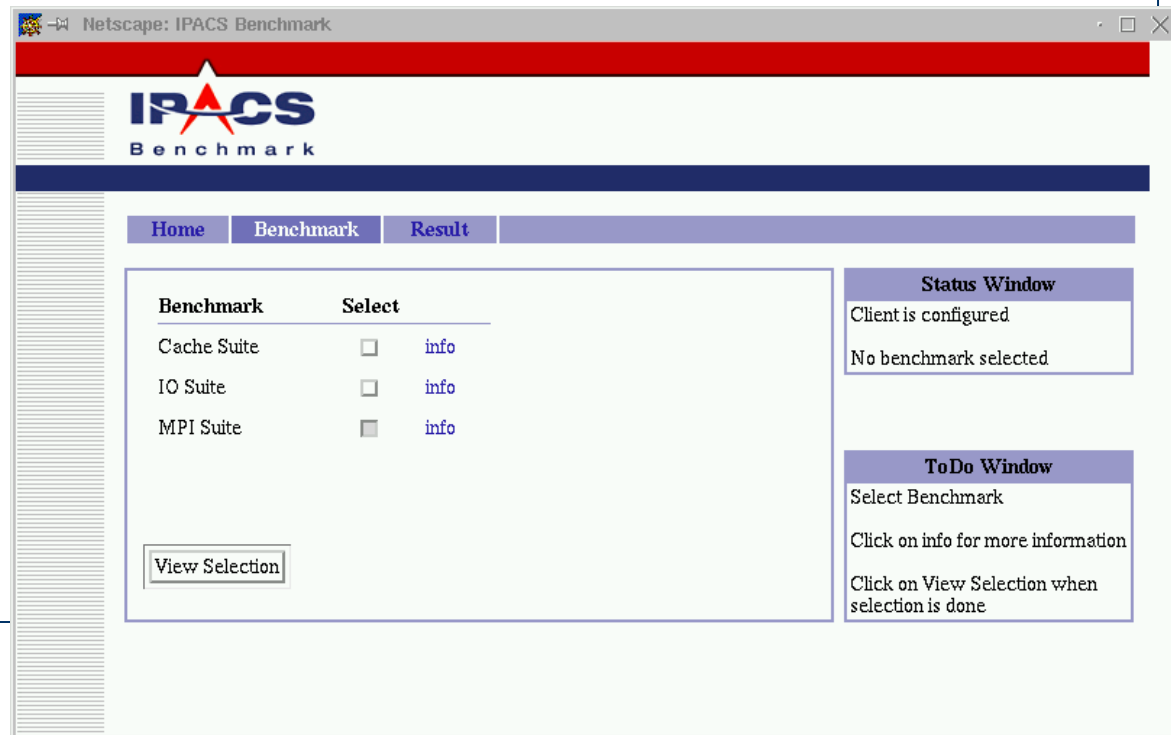


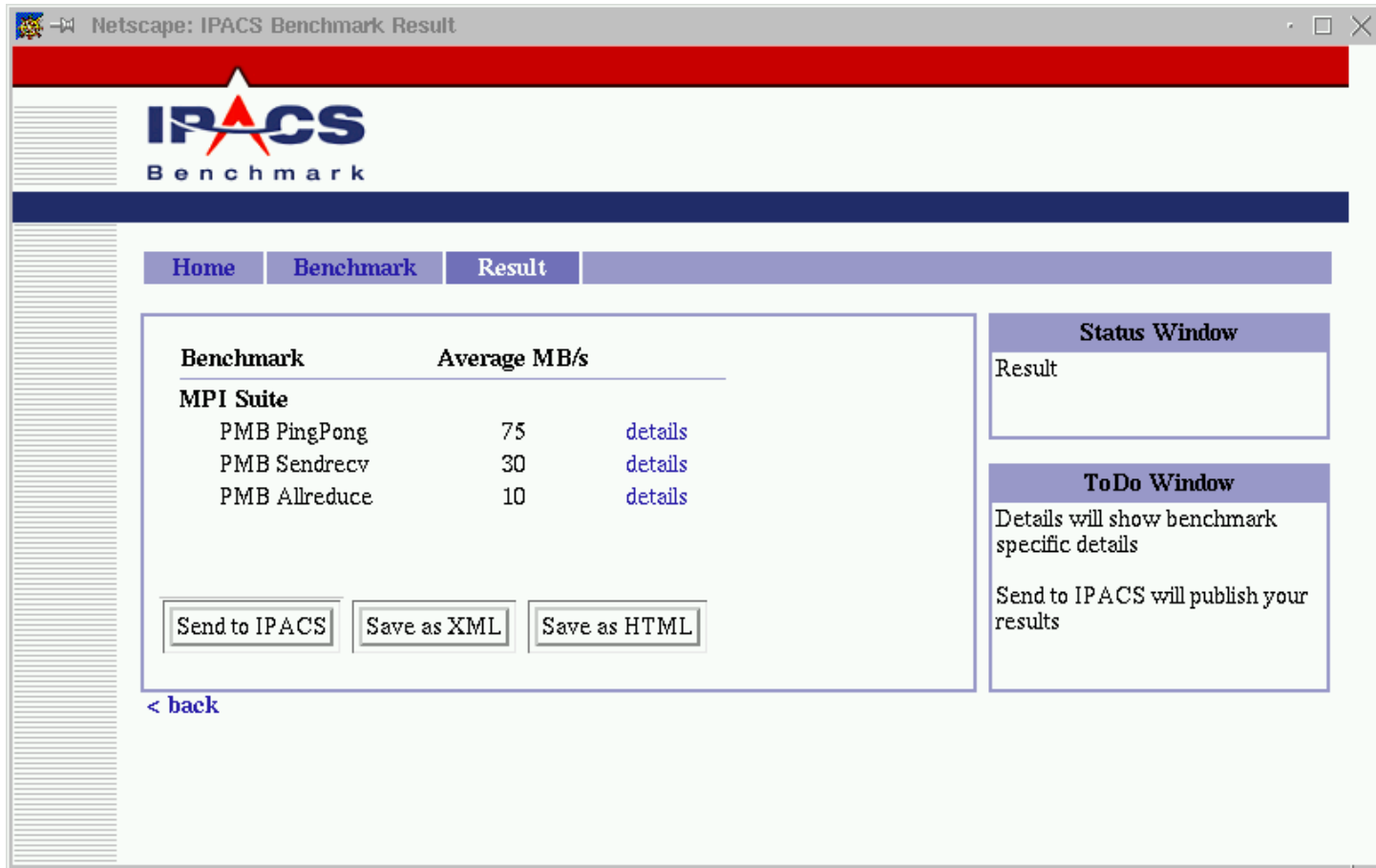
# Example CACHEBENCH

## IPACS Cache Read Benchmark



- Selecting and downloading benchmarks
- Configuring benchmarks for HPC machines
- Running benchmarks on HPC machines
- Submitting results to IPACS server





The screenshot shows a Netscape browser window titled "Netscape: IPACS Benchmark Result". The page features the IPACS Benchmark logo at the top. Below the logo is a navigation menu with three items: "Home", "Benchmark", and "Result", with "Result" being the active page. The main content area is divided into two columns. The left column contains a table with benchmark results for the MPI Suite. The right column contains two informational boxes: "Status Window" and "ToDo Window". At the bottom of the left column, there are three buttons: "Send to IPACS", "Save as XML", and "Save as HTML". A "< back" link is located at the bottom left of the page.

Benchmark	Average MB/s	
<b>MPI Suite</b>		
PMB PingPong	75	<a href="#">details</a>
PMB Sendrecv	30	<a href="#">details</a>
PMB Allreduce	10	<a href="#">details</a>

[Send to IPACS](#) [Save as XML](#) [Save as HTML](#)

[< back](#)

**Status Window**  
Result

**ToDo Window**  
Details will show benchmark specific details  
Send to IPACS will publish your results

## Next Steps

- Parpac 1.2 ready for benchmarking 1Q.2003
- Low Level benchmarks + Parpac 1.2 open for partners
- Have the codes instrumented (PAPI, Vampir)
- Benchmarks for commercial codes (2Q.2003)
- Get into discussions with vendors (soon)
- Get into discussions with buyers
- Accumulate benchmarks results
- Show first benchmark overview during ISC 2003

**Watch: [www.ipacs-benchmark.org](http://www.ipacs-benchmark.org)  
ask questions**