The Zero-Force MPI Toolkit – Toward Tractable Toolkits for HPC

Presented by

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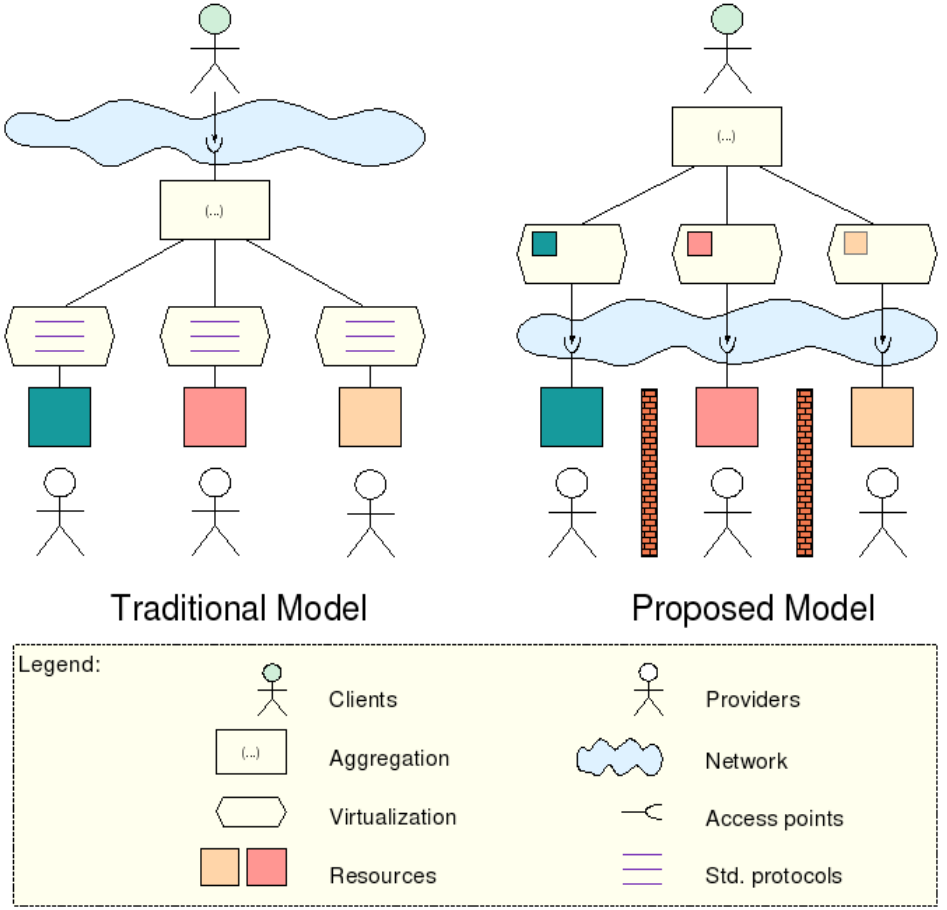
Goals

- New approach to resource sharing
  - Aggregation and virtualization resources at the client side
- Automating tasks
  - MPI environment configuration
  - Uploading and compiling computational applications
  - Staging input data / result collection



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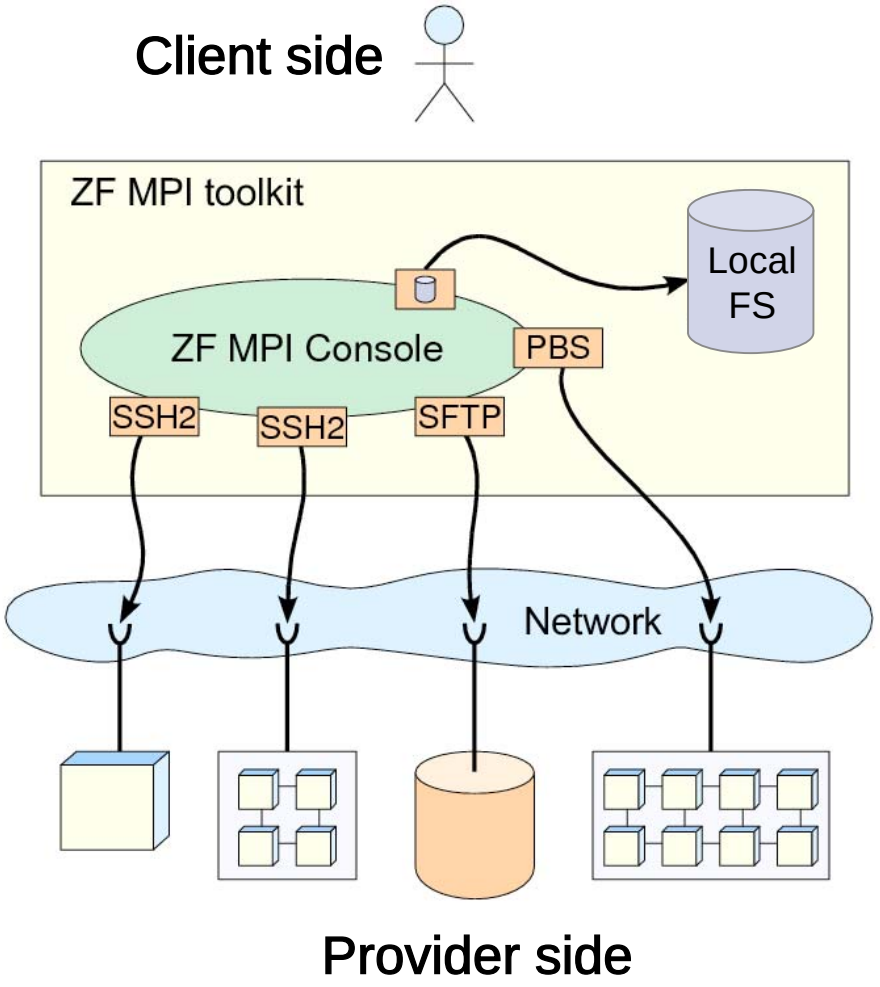
Architecture

- Client side: Interactive console
  - Unified and coherent interface
  - Resource virtualization
  - Mediators – “service-drivers”
- Provider side: Access daemons
  - E.g., sshd, ftpd
- Prototype implementation
  - FT-MPI
  - Java
  - JSch (SSH2 implementation)



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ZF-MPI console

DVM assembly

Add computational resource to DVM

- Upload FT-MPI
- Decompress sources
- Install
- Launch FT-MPI daemons

Data sync

Synchronize data, source files across DVM nodes

Compile and build

Invoke standard shell commands

Application launch

Run MPI programs

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Install FT-MPI

```
zf-mpi> add ft_mpi joe@{lab6a,lab6b,lab6c,lab6d,compute}
zf-mpi> ft_mpi setNS compute
zf-mpi> ft_mpi add lab6a,lab6b,lab6c,lab6d,compute
zf-mpi> sync ~/NPB3.2.1/NPB3.2-MPI ~/zf-mpi/
zf-mpi> cd ~/zf-mpi/NPB3.2-MPI
zf-mpi> make bt NPROCS=4 CLASS=B
zf-mpi> mv bin/bt.B.4 $HARNESS_BIN_DIR/$HARNESS_ARCH/
zf-mpi> ft_mpi ftmpirun compute -np 4 -o bt.B.4 > log
zf-mpi> cat log | grep "Time in seconds"
zf-mpi> ft_mpi console haltall
```

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Experimental evaluation

- NAS Parallel Benchmarks 3.2 for MPI
- Linux/i86
  - Pentium 4 (2.4-2.8 GHz), 1 GB RAM
  - Linux Mandriva 2006 (kernel 2.6.12-12)
- Solaris (non-GNU-based UNIX)
  - Sun Blade 2500, UltraSPARC-III, 1280 MHz
  - 1 MB cache memory per processor, 2 GB RAM
  - Connected directly to 100 Mbit HP network switches
  - SunOS 5.10
- Homogeneous cluster: class A, up to 16 processes
- Heterogeneous cluster: class B, 8, 9 processes

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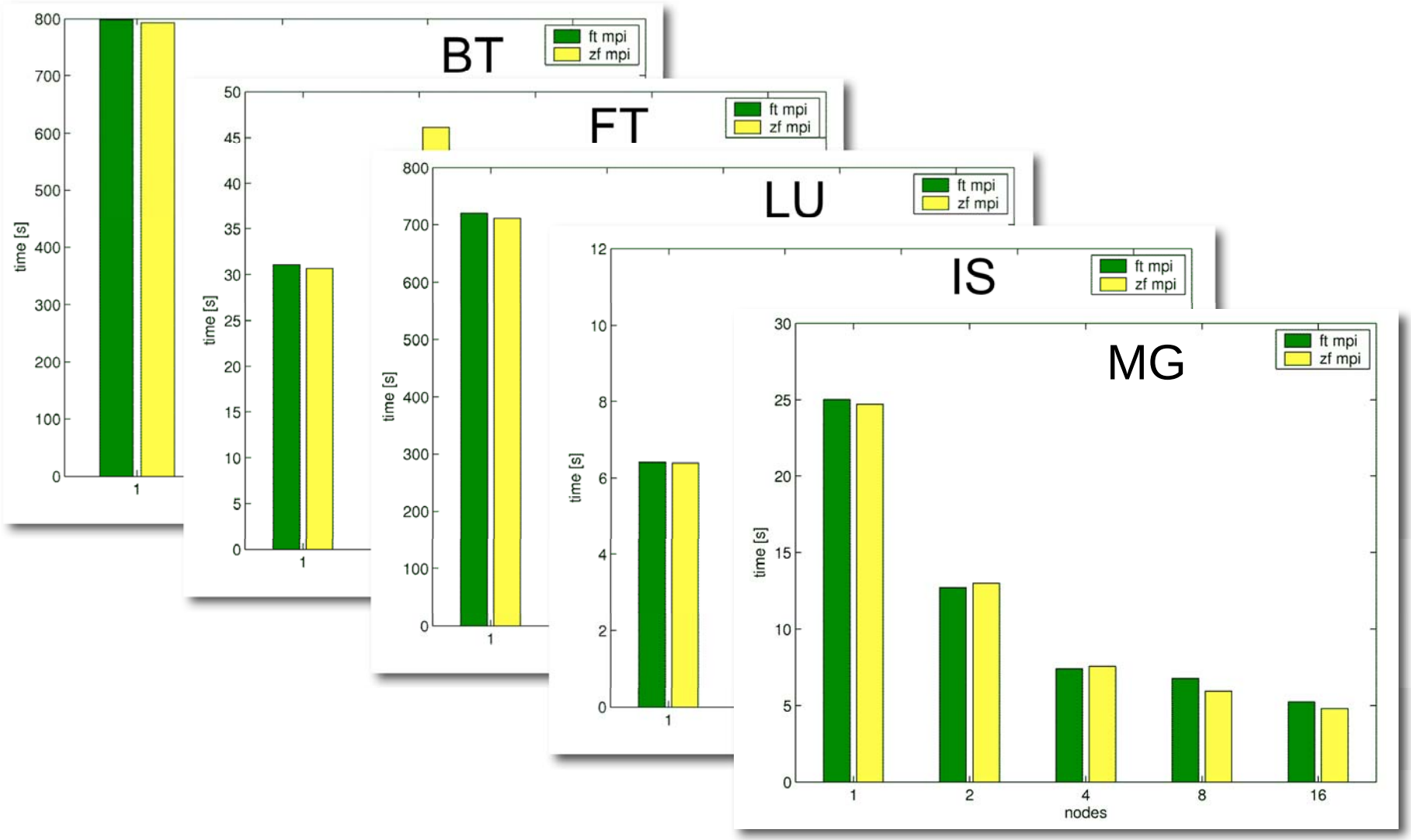

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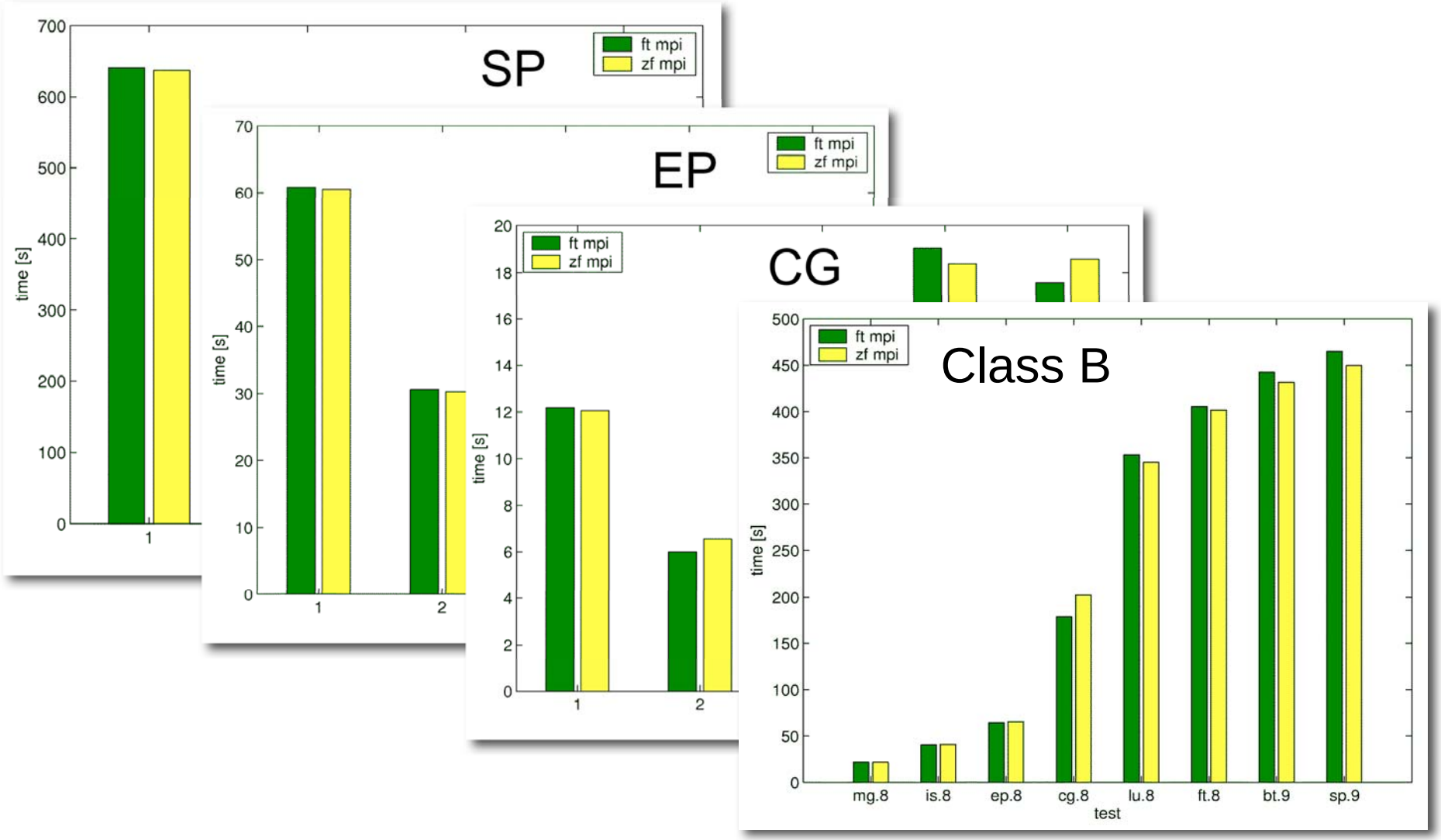

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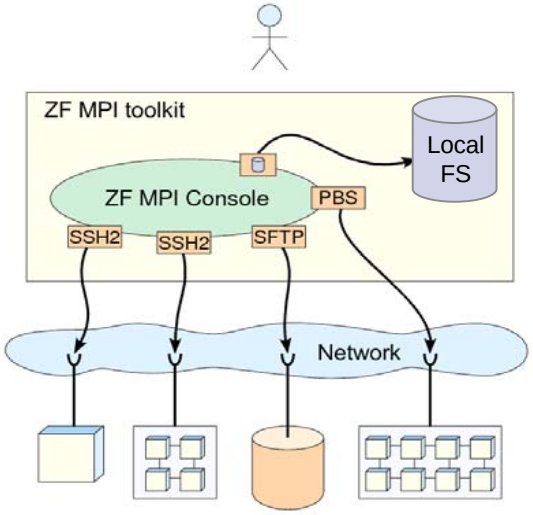
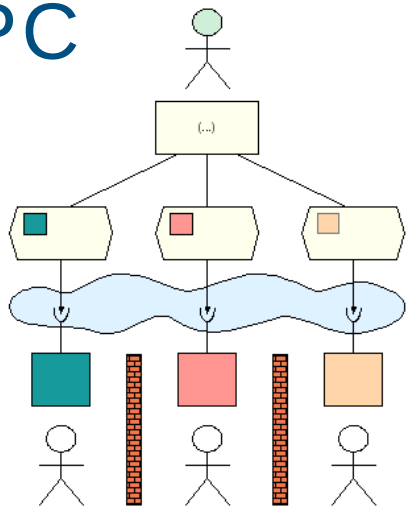
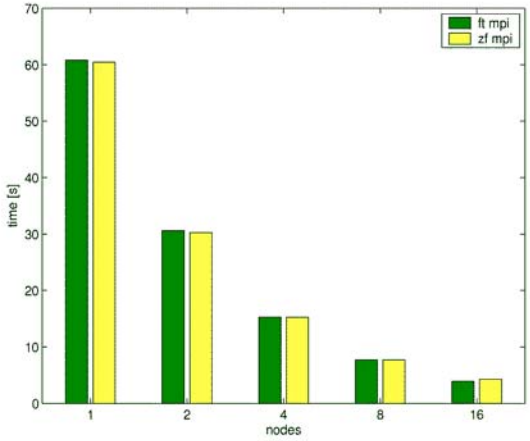
Summary

ZF-MPI

- Implements the new resource sharing model
- Demonstrates feasibility of the run-not-install approach
- Significantly reduces efforts such as deployment and execution
- Does not affect performance of MPI applications







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