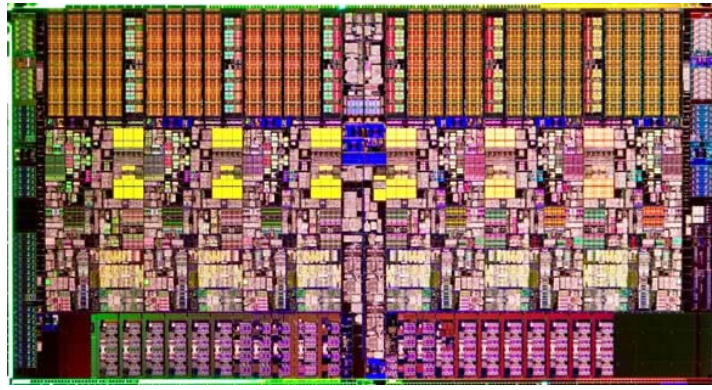


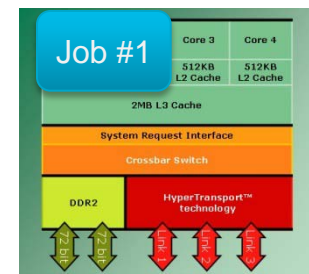
Improving Efficiency in High Core Density Environments

William Lu, Ph.D.
Platform Computing

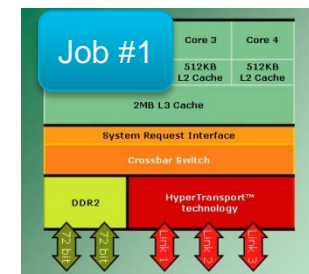
Application Runtime Challenges in MultiCore Environment



Bottleneck

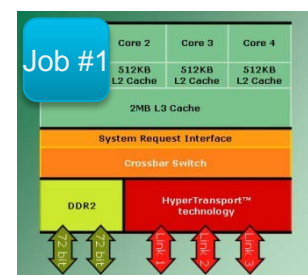


Socket #0

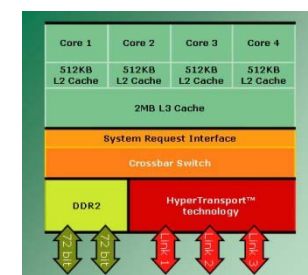


Socket #1

- Bandwidth Constraint
- Capacity Constraint

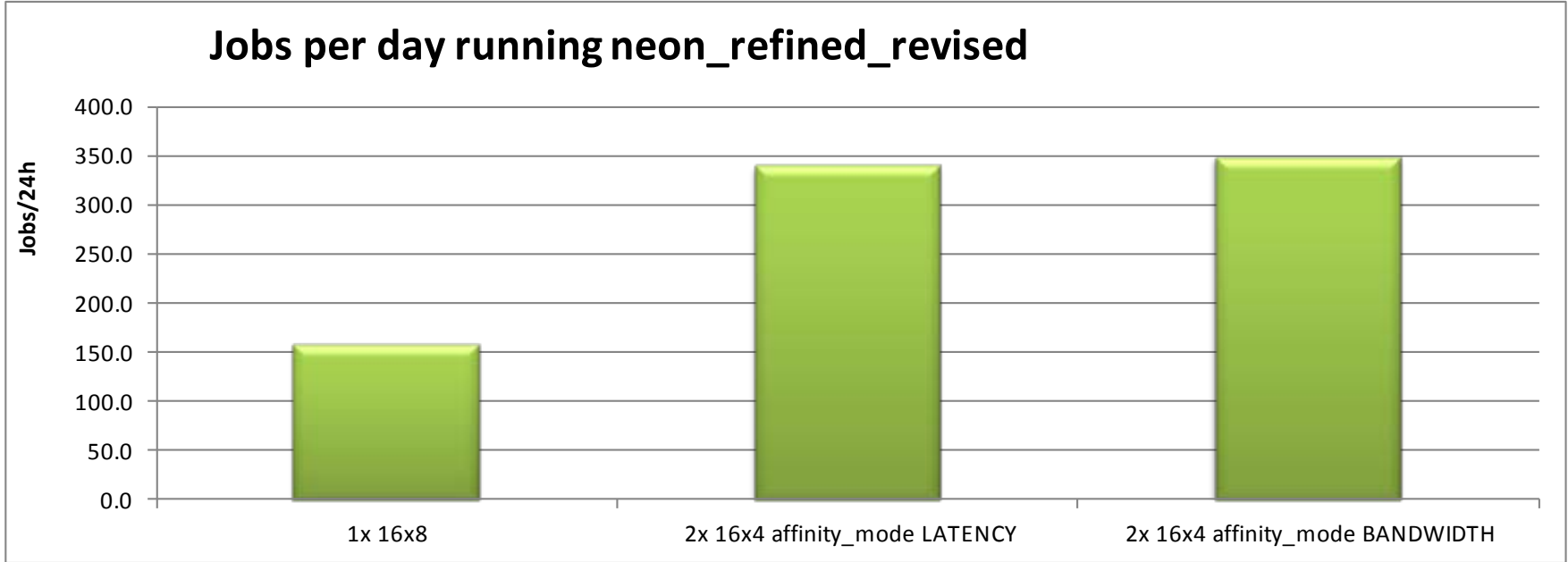


Socket #0

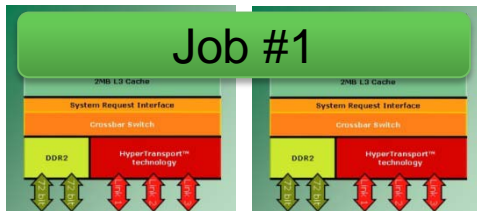


Socket #1

Performance Impact on Core Affinity

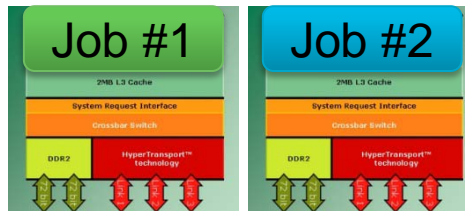


8 tasks/node



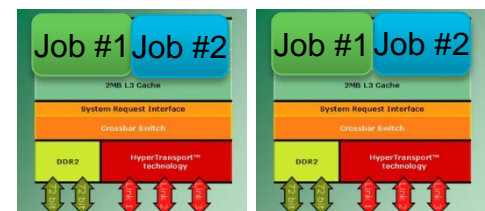
Socket #0 Socket #1

4 tasks/node
(latency binding)



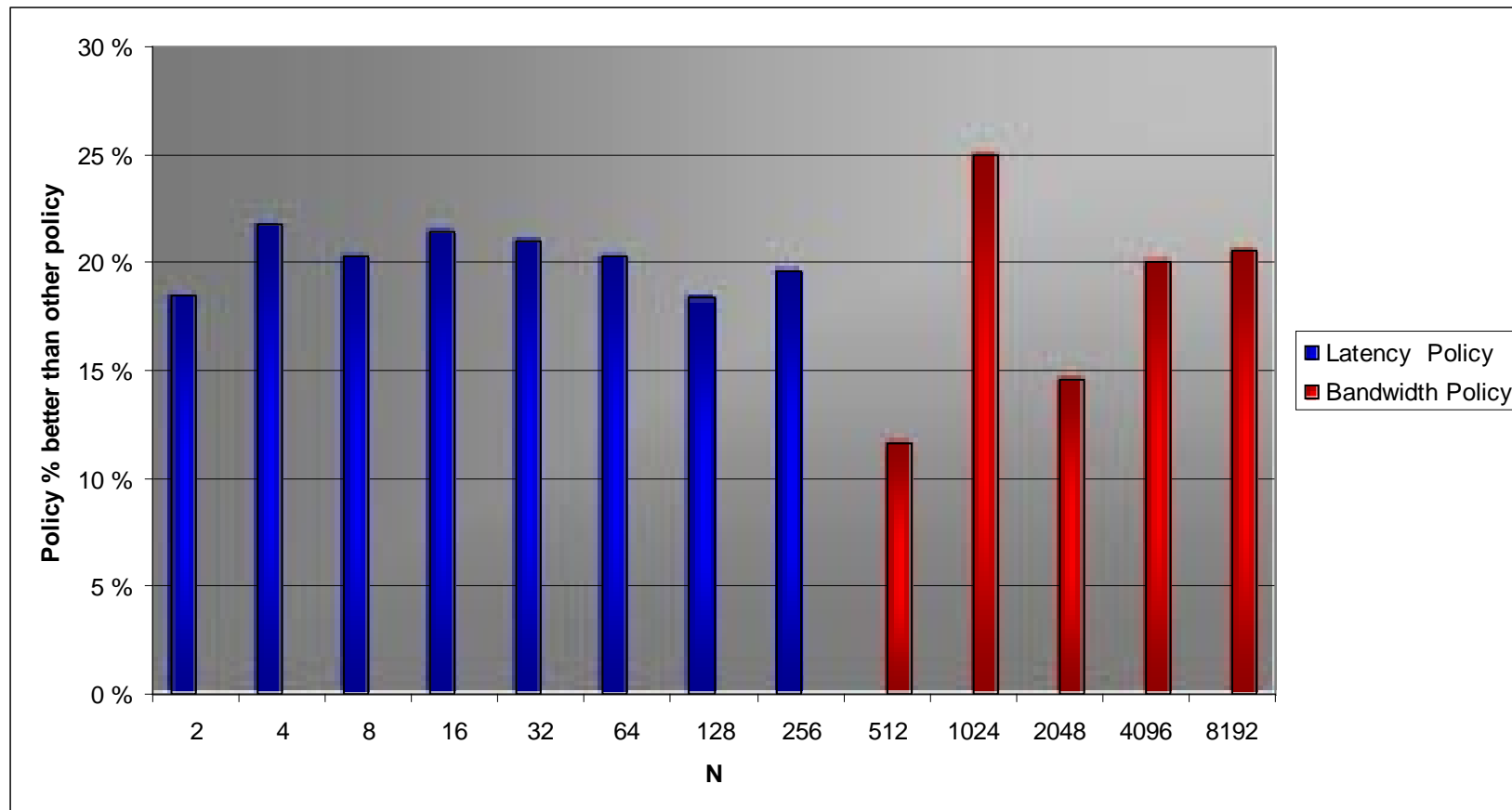
Socket #0 Socket #1

4 tasks/node
(latency binding)



Socket #0 Socket #1

Multicore Affinity Impact



Multi-core policy provides up to **25% improvement**

Halo benchmark – N is matrix dimension

Study performed with 2x dual core Intel Covertown

User Efficiency – Job Submission

Platform HPC Console - Windows Internet Explorer

http://172.25.243.30:8080/platform/

Platform Computing root (Administrator)

Platform HPC Console

Dashboard Clusters Jobs Reports Configuration Help Log Out

Submit Job Job Status Create and Edit Forms My Job Directories All Data Directories Remote Consoles

Expand all | Collapse all

- ABAQUS
- ANSYS
- BLAST
- ECLIPSE
- FLUENT
- LS-DYNA
- NASTRAN
- generic

Submit an FLUENT Job

Submit Save As Delete

Application Parameters

Job name:

Version:

Release:

Console Support:

Additional FLUENT options:

Cluster Parameters

Notify me when job status changes:

CPUs:

Memory Architecture:

Span:

Queue:

MPI type:

Additional Parameters:

Application Data Files

Fluent journal file *

File Name	Location	Size (KB)	Date Modified
-----------	----------	-----------	---------------

CAS input file (.cas .dat)

File Name	Location	Size (KB)	Date Modified
-----------	----------	-----------	---------------

Submit Revert

That functionality is restricted. Internet | Protected Mode: On 100%

Pre-set parameters to ensure optimal performance

User Efficiency - View Result Interactively

The screenshot displays the Platform Computing Workload & Portal Center interface. The main navigation bar includes 'Dashboards', 'Host Status', 'Jobs', 'Data', 'Application Forms', 'Reports', and 'Portal Configuration'. The 'Remote Consoles' section is active, showing a list of consoles with '2' selected for user 'lsfadmin'.

The 'Remote Consoles : pmcint' window is open, displaying a VNC configuration and a FLUENT simulation result. The VNC config includes:

- y-velocity
- z-velocity
- energy
- k
- epsilon

The simulation results are shown in two plots:

- Scaled Residuals:** A line graph showing residuals for iterations 1 to 10. The y-axis is logarithmic, ranging from $1e-05$ to $1e+01$. The x-axis is 'Iterations' from 1 to 10. The legend indicates: y-velocity (red), z-velocity (green), energy (blue), k (purple), and epsilon (yellow).
- Convergence history of Static Temperature on pressure-outlet 5:** A line graph showing the convergence history for iterations 3 to 5. The y-axis is 'Mass Weighted Average (k)' ranging from 296.0000 to 297.7500.

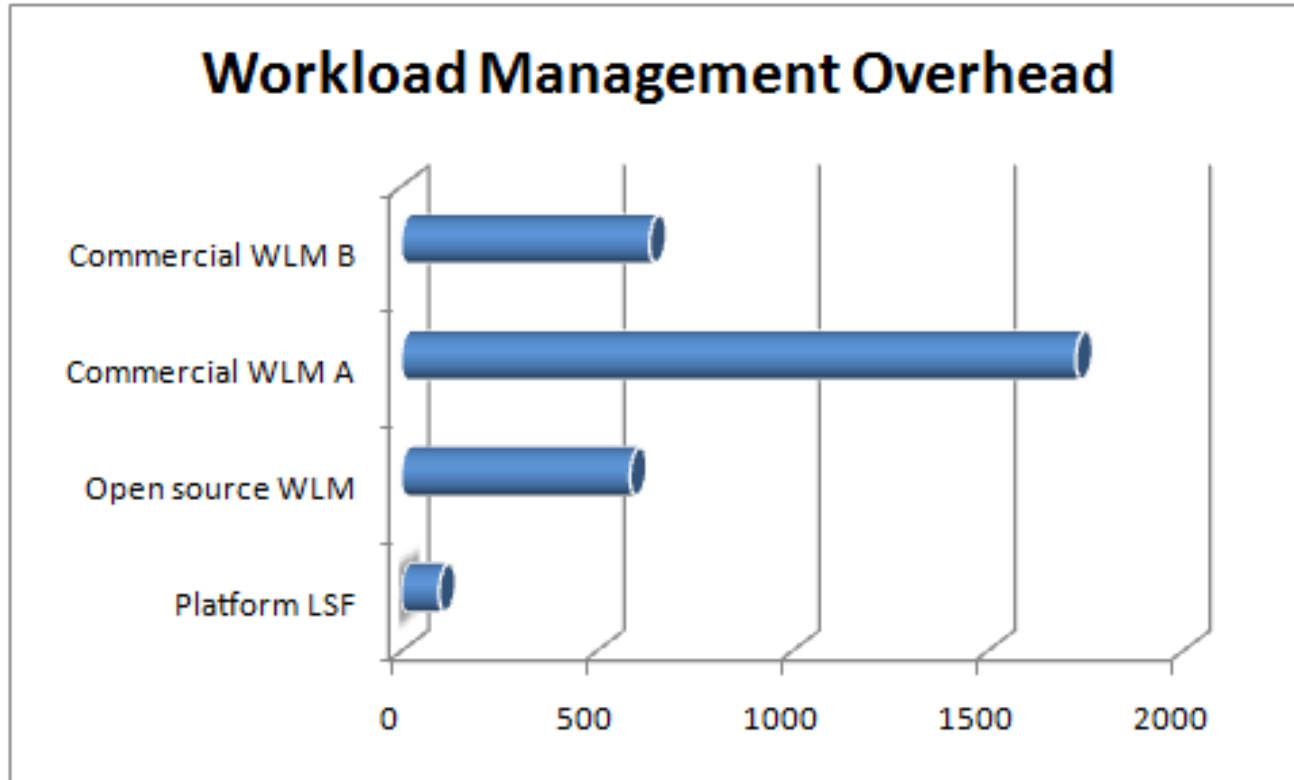
The terminal output at the bottom shows the following text:

```

Nov 06, 2009
FLUENT 6.3 (3d, dp, pbns, rke)
reversed flow in 7 faces on pressure-outlet 5.
4 2.7230e-01 6.1156e-02 1.1627e-01 4.7371e-02 1.2589e-04 9.9454e-02 3.6365e-01
reversed flow in 7 faces on pressure-outlet 5.
5 1.4181e-01 3.1163e-02 6.2543e-02 2.7825e-02 8.0276e-05 6.0229e-02 1.7289e-01
6 7.6267e-02 1.9050e-02 3.5766e-02 1.4764e-02 4.2006e-05 4.1186e-02 8.3240e-02
7 4.9588e-02 1.2371e-02 2.1296e-02 8.8253e-03 2.8325e-05 3.1221e-02 6.0012e-02
8 3.4164e-02 7.7212e-03 1.2898e-02 6.0698e-03 2.0236e-05 2.3908e-02 4.8004e-02
9 2.3701e-02 5.6398e-03 1.0399e-02 4.4041e-03 1.6275e-05 1.9212e-02 3.9162e-02
10 1.6781e-02 4.5750e-03 8.7374e-03 3.2750e-03 1.7847e-05 1.6099e-02 3.7152e-02
    
```

Workload Management Performance

- More cores can run more jobs
- Efficiency of workload management software impacts HPC efficiency



Summary

Efficiency

Programming

Runtime

- Core affinity support

- MPI library functionality

- Workload management performance

- Integration & Usability

Thank you