

Scaling the EIT Problem

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Single Core Solutions

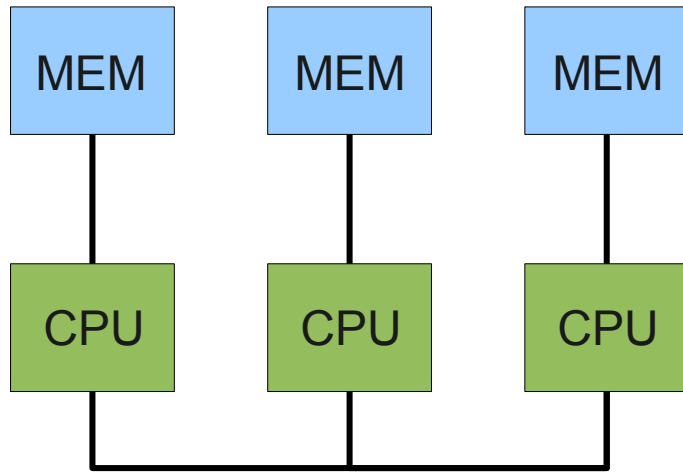
Faster Hardware

Since the 1960s, increasing processor frequencies have enabled a broad range of challenging problems to be tackled.

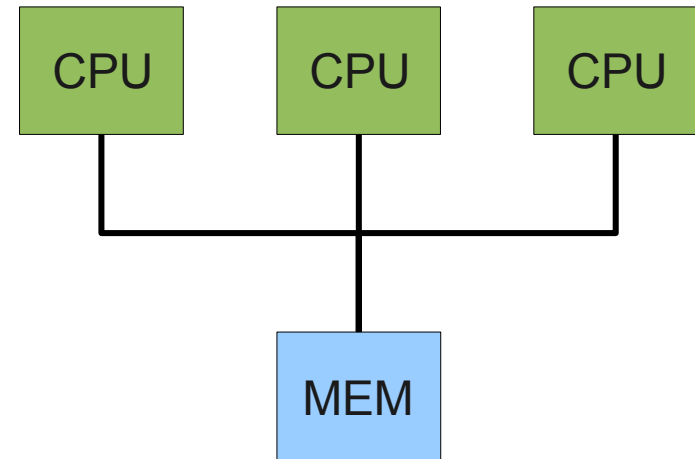
Recently, power consumption has forced a change in processor design strategy.

Multicore Solutions

More Hardware



Distributed Memory



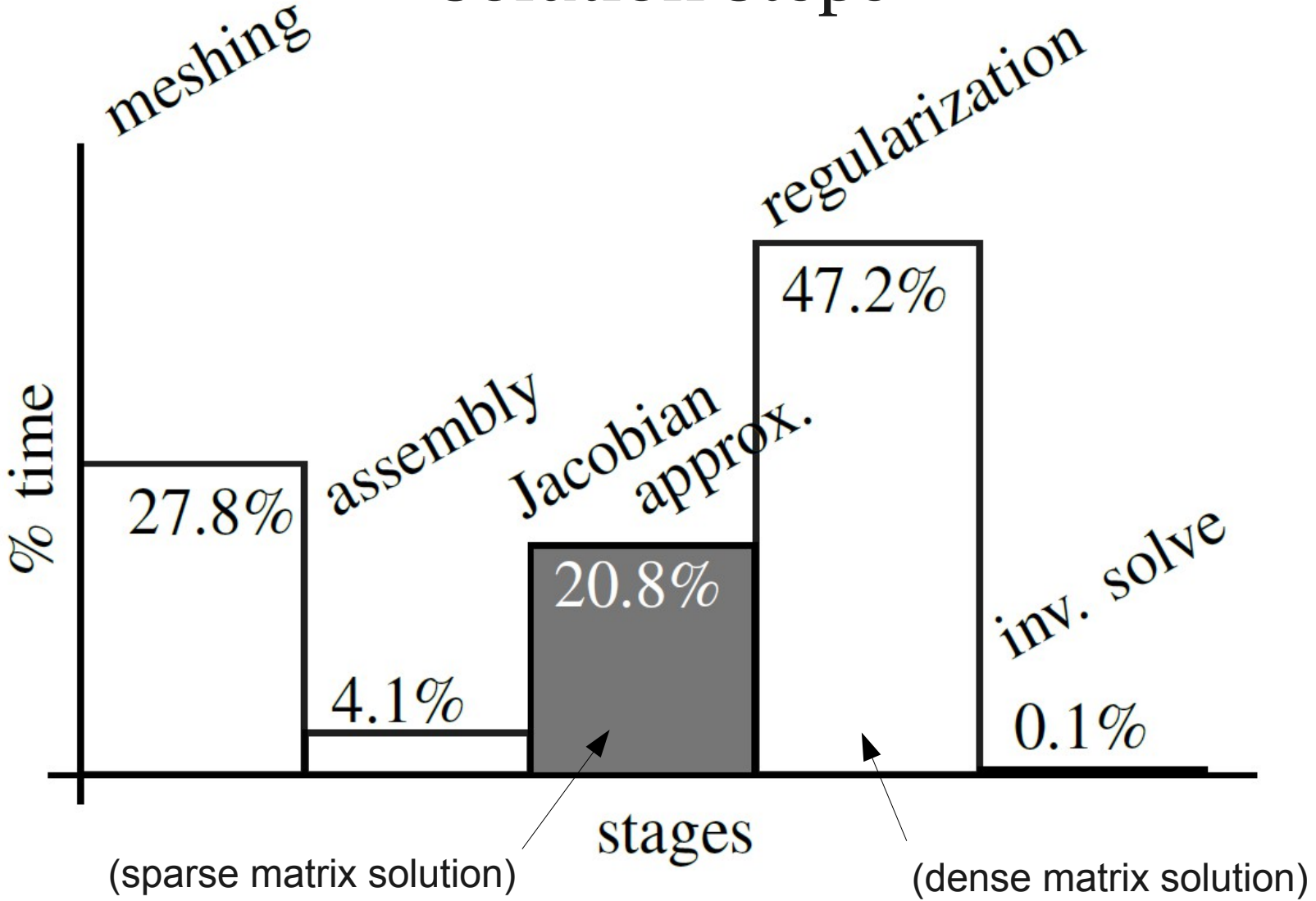
Shared Memory

Multicore Solutions

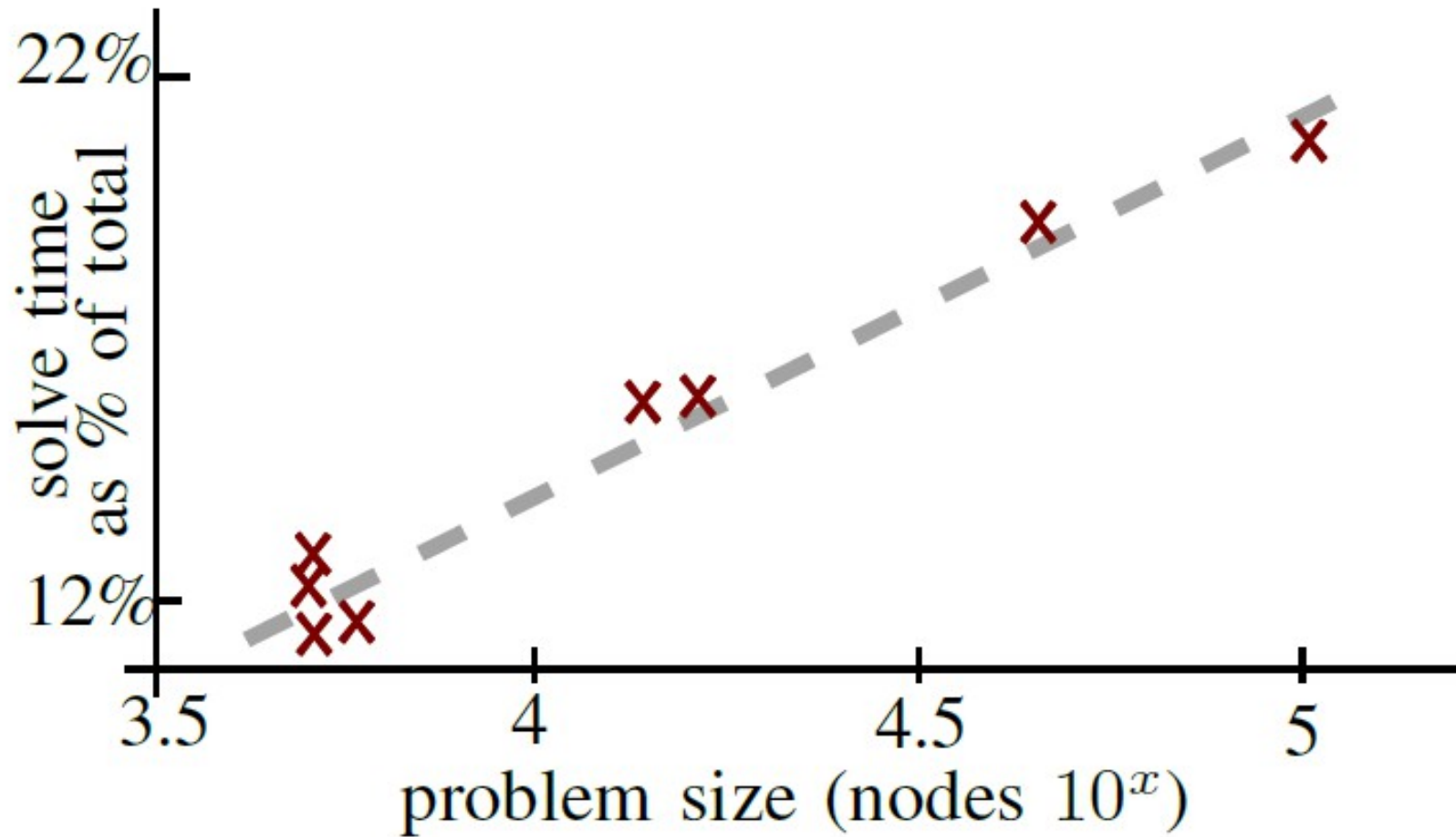
Software Cost

\$ = redesign?

Profiling Solution Steps



Profiling Problem Size



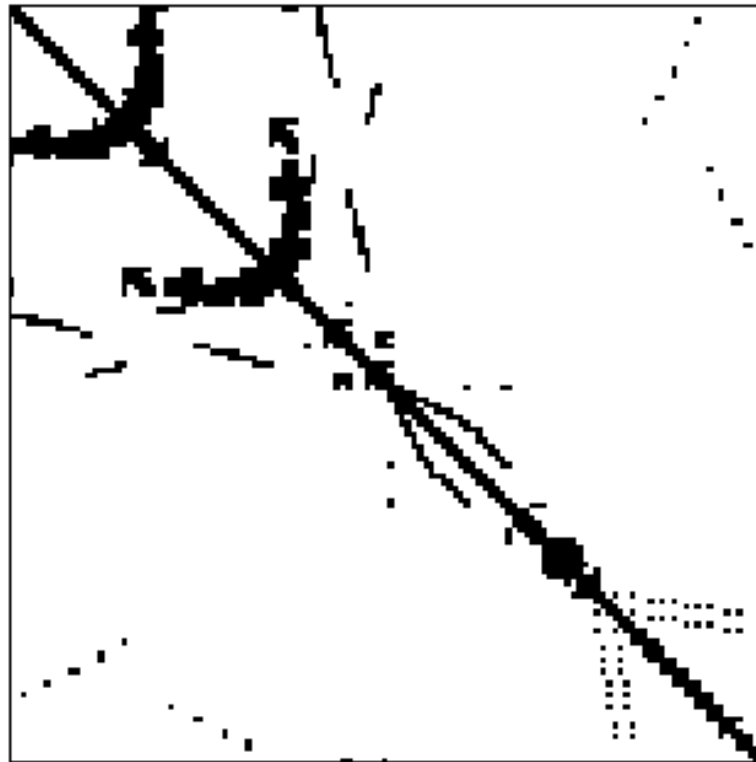
Ratio of Jacobian approximation to total time as node density increased
1 of 8 cores, 64GB, 2.66GHz Intel Xeon X5550

PRELIMINARY

Sparse Solvers

“Sparse” versus “Dense”

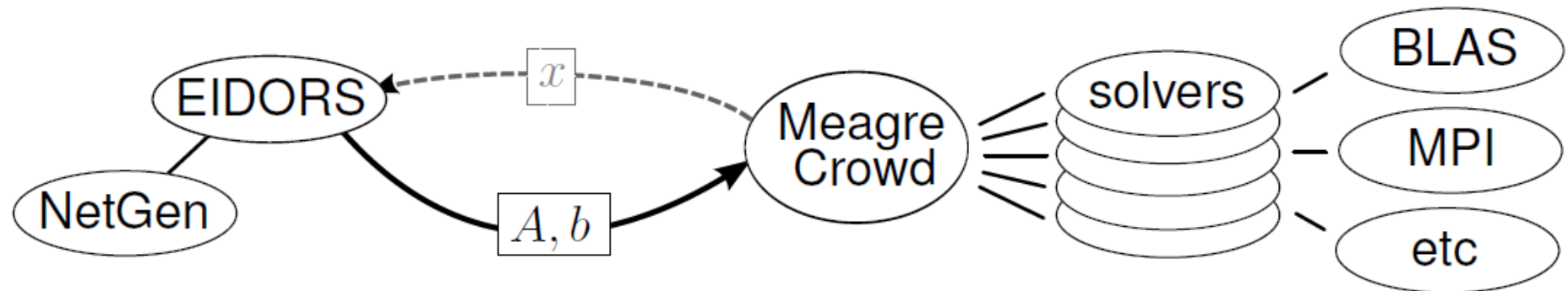
A



Sparse Solvers

Meagre-Crowd

We developed Meagre-Crowd as a new open source project that integrates sparse solvers in a common framework to benchmark sparse linear algebra performance. Code was released under the GPL.



Meagre-Crowd 0.4.5 was used to test the performance of the sparse matrix solvers:
UMFPACK 5.5.0, MUMPS 4.9.2, WSMP 11.01.19, Pardiso 4.1.2, TAUCS 2.2,
SuperLU_DIST 2.5 and CHOLMOD 1.7.1.

Sparse Solvers

A measure: “Speed-up”

speed-up

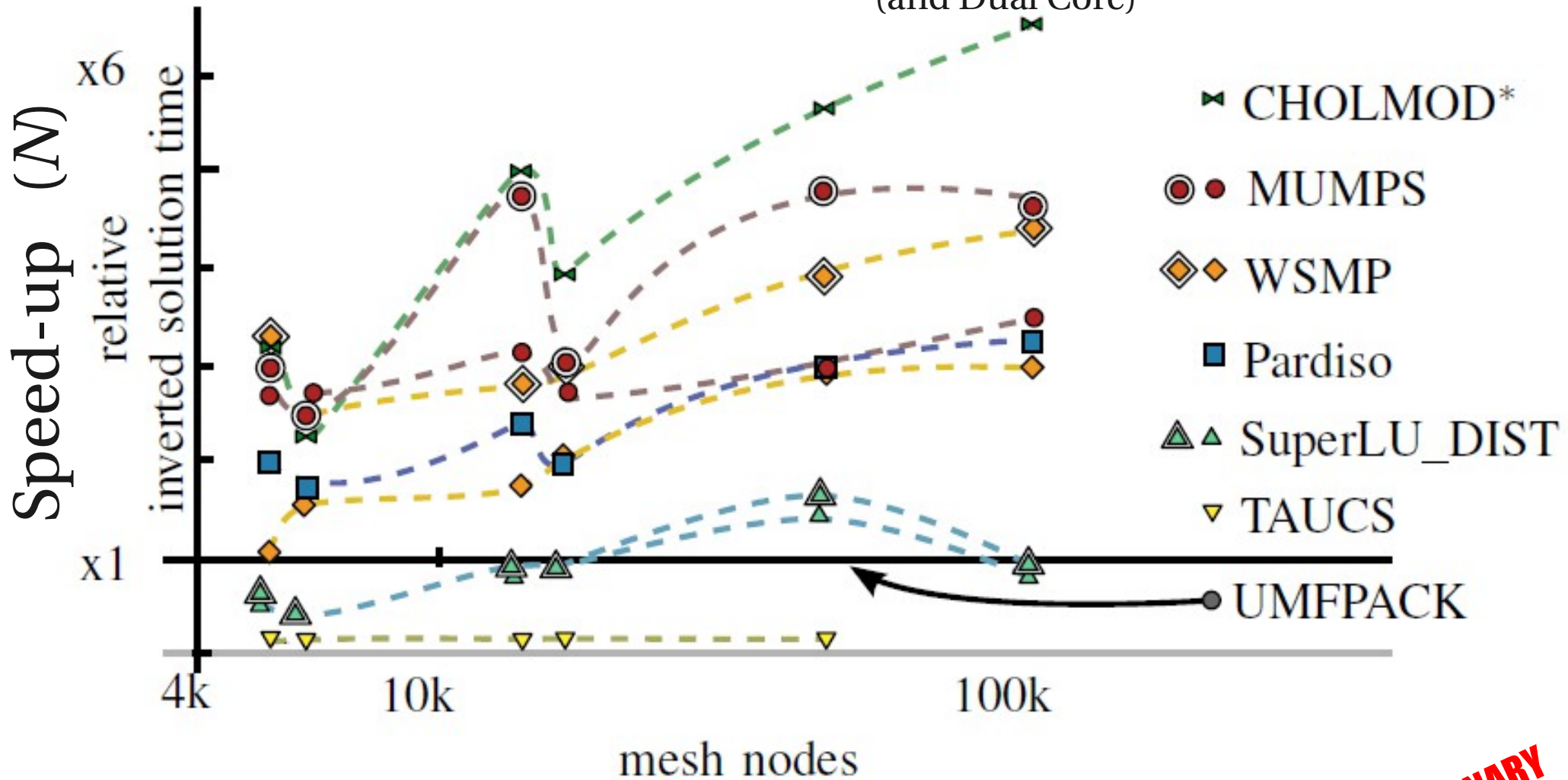
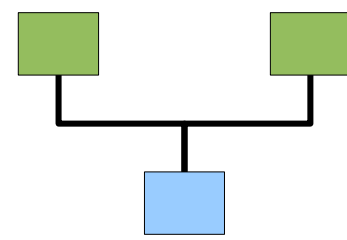
$$N_{XYZ} = \frac{T_{UMFPACK}}{T_{XYZ}}$$

... gives “XYZ is N times faster than UMFPACK.”

UMFPACK, because its the default MATLAB sparse matrix solver

Sparse Solvers

Alternatives, Single Core (and Dual Core)

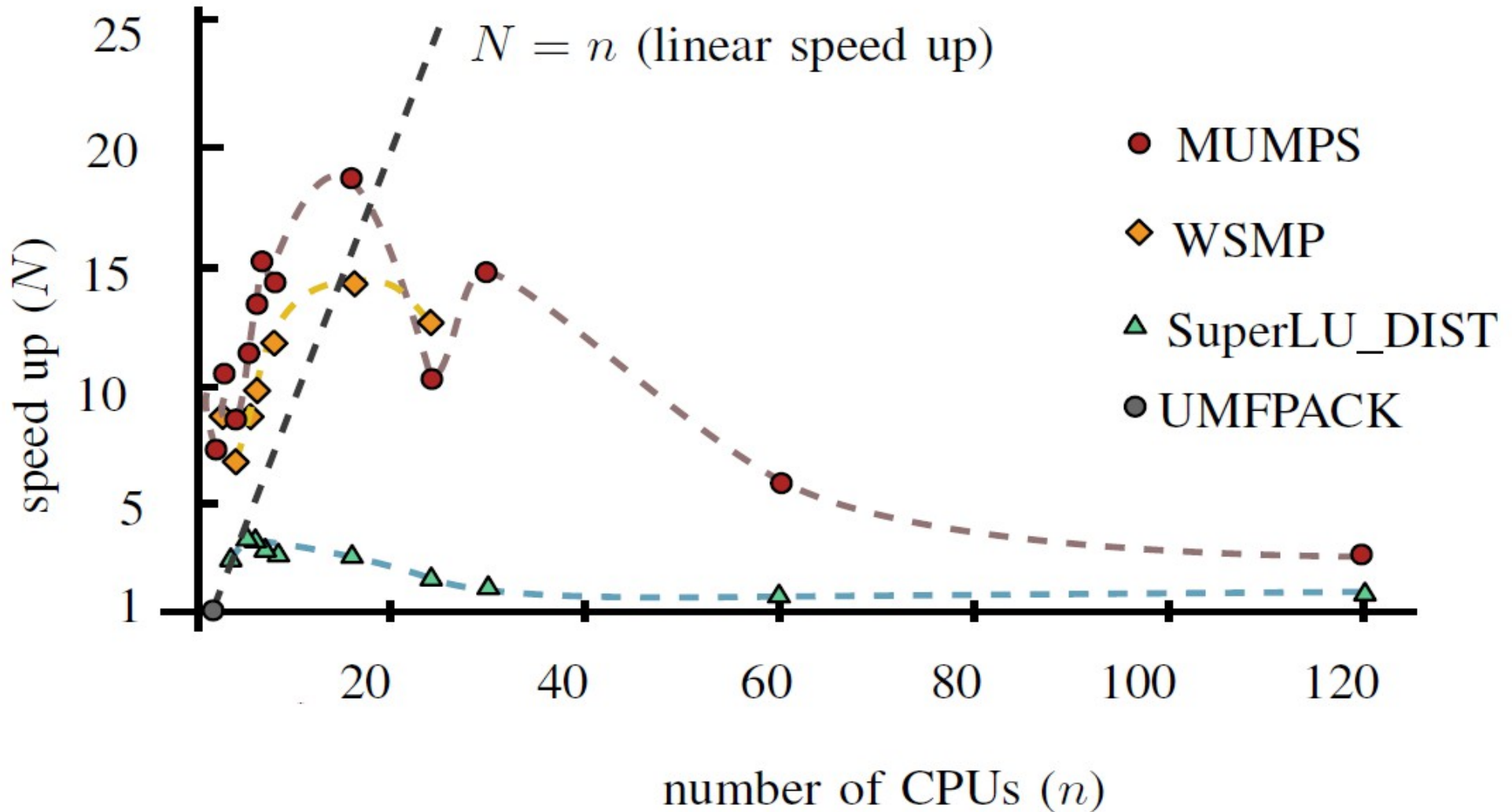
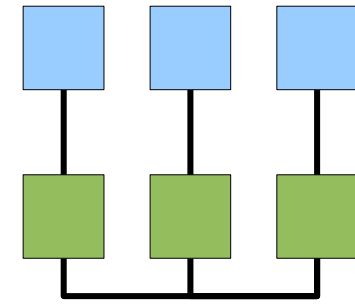


Intel Core2 Duo T9550 at 2.66GHz with 3GB of memory, max. memory used: 1GB
 For WSMP and MUMPS, results for two-cores have a double-symbol.
 Note that CHOLMOD is a symmetric sparse matrix solver while the others are handling unsymmetric matrices.)

PRELIMINARY

Sparse Solvers

Alternatives, Multicore



240 cores: 8 cores per system (Intel Xeon at 3.0GHz with 8GB of memory),
connected via gigabit ethernet (mako.sharcnet.ca)
45289 node mesh 3D difference EIT

PRELIMINARY

Conclusion

Alternative sparse matrix solvers are available

Meagre-Crowd is a testbench for comparing these

Respectable improvements are possible, even with
default/preliminary configurations

Improvements in sparse matrix solver capacity
that scale with the available resources are possible

References

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Thank you.

Any questions?



Meagre-Crowd source code available at
<http://github.com/boyle/meagre-crowd>

[<http://www.flickr.com/photos/takomabibelot/4164289232/>]



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