LS-DYNA performance on new computing choices from IBM

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LS-DYNA platform choices from IBM

- POWER5
  - 1.65 GHz: p5-520 (2-way) and p5-550 (4-way)
  - 1.9 GHz: p5-570 (16-way), p5-575 (8-way), p5-595 (64-way)
  - JS20 BladeCenter (2-way, 2.2 GHz)
  - Linux on Power options (OpenPower 710, OpenPower 720)
- Intel Xeon EM64T
  - x336 servers (2-way, 3.6 GHz)
  - x366 servers (4-way, 3.6 GHz)
  - HS20 BladeCenter (2-way, 3.6 GHz)
- AMD Opteron
  - e326 servers (2-way, 2.4 GHz)

Consistent 1.9 GHz POWER5 speedup from POWER4+

- **1.30x** – 200k+ elements, 970_s_3858.2
  - 9107 sec – 1.7 GHz 8-way p655 node
  - 7012 sec – 1.9 GHz 16-way p5-570
- **1.32x** – 400k+ elements, 300 msec, 960_s_1488
  - 34487 sec – 1.7 GHz 8-way p655
  - 26086 sec – 1.9 GHz 16-way p5-570
- **1.34x** – 500k+ elements, 140 msec, 960_s_1488
 - 24080 sec – 1.7 GHz 8-way p655
  - 17984 sec – 1.9 GHz 16-way p5-570

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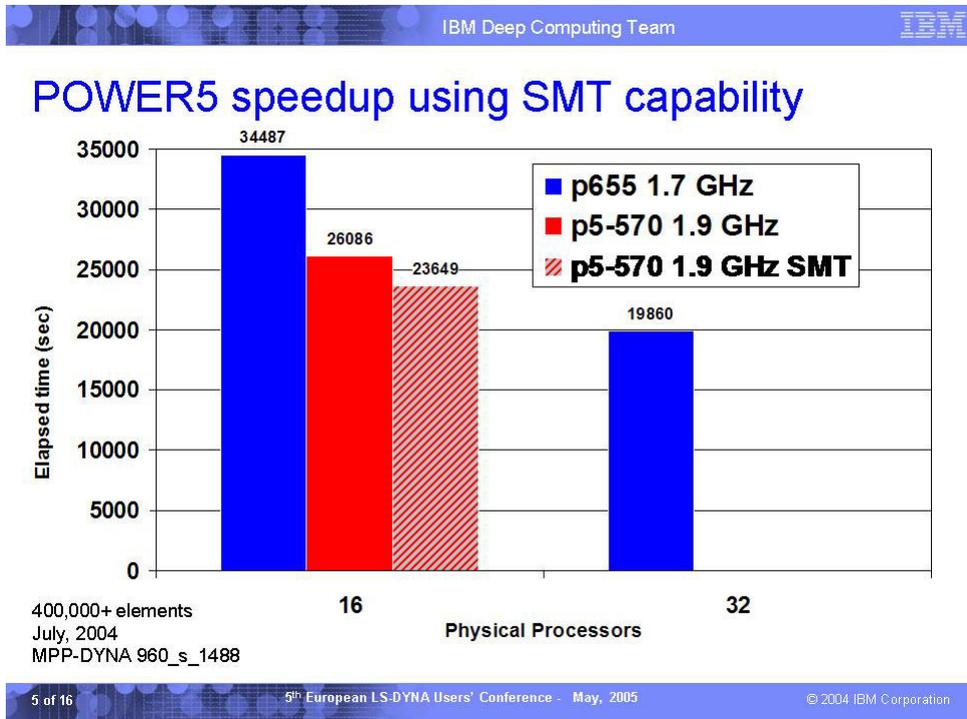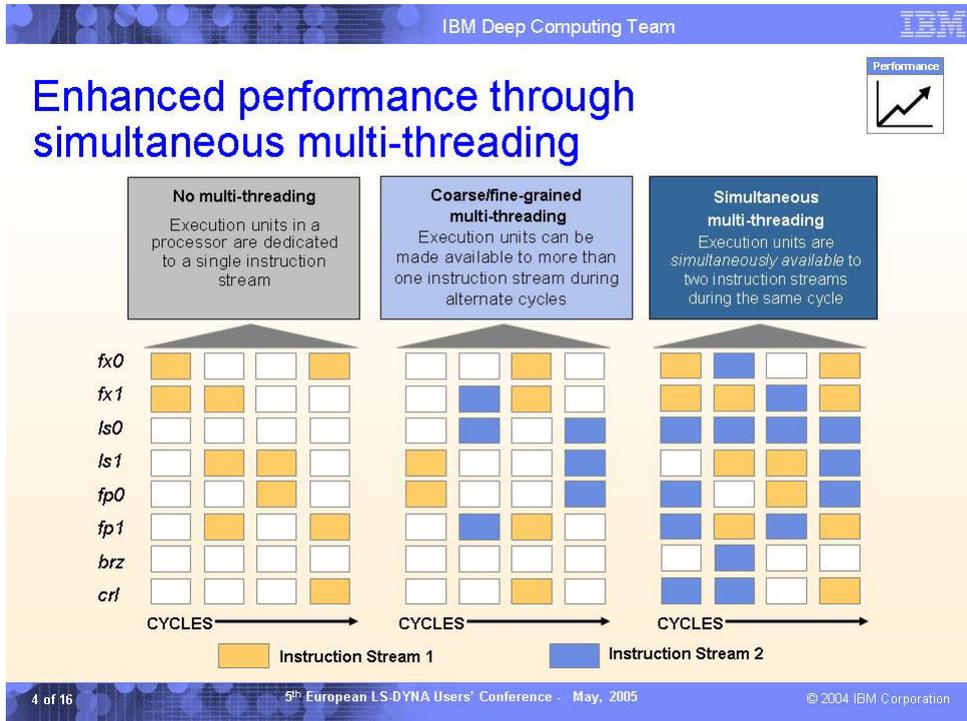
POWER5 parallel scaling and SMT capability

Legend:
- p5-575 1.9 GHz 8 physical processors
- p5-575 1.9 GHz 8 physical processor - SMT
- p5-595 16-way run

Values: 10283, 8618 (600,000+ elements); 8595, 7114 (800,000+ elements)

Y-axis: Elapsed time (sec)
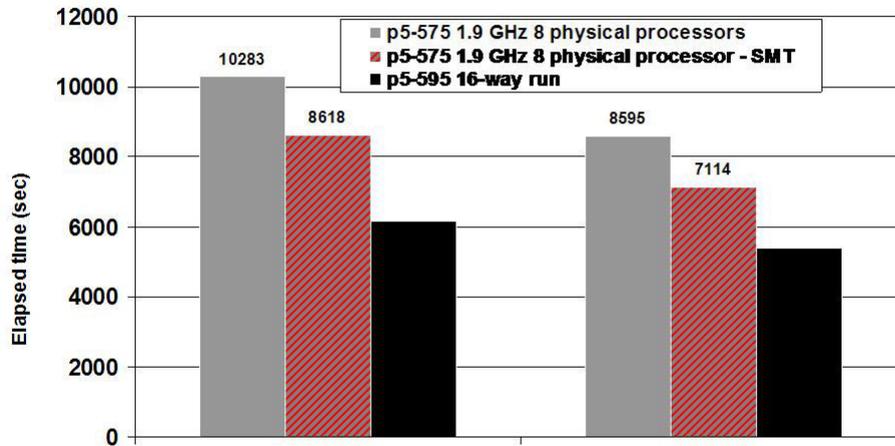
20 msec benchmarks
March, 2005
MPP-DYNA 970_s_5434

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IBM Linux cluster communication improvement

Legend:
- e325 2.0 GHz MPICH 1.2.5
- e325 2.0 GHz LAM
- e325 2.0 GHz MPICH 1.2.5 64-bit
- e325 2.0 GHz Myrinet

Y-axis: Elapsed time (sec)
X-axis: Processors (2, 4, 8, 16)
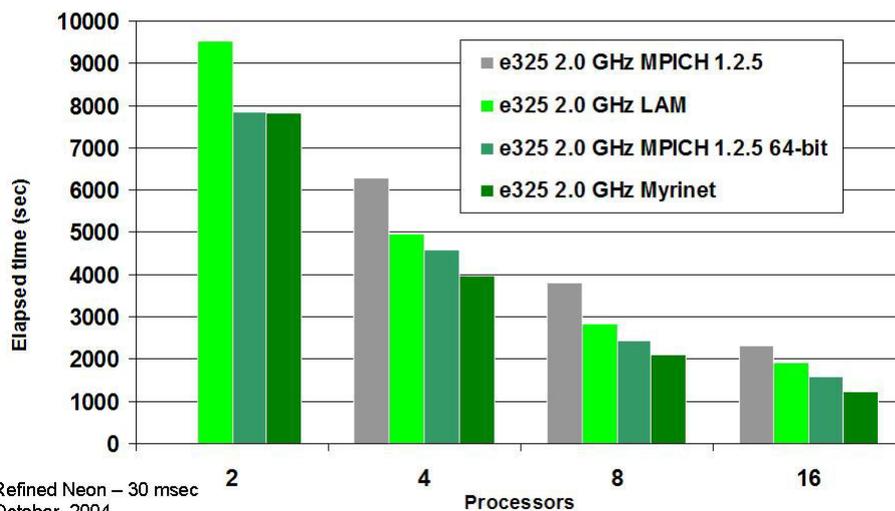
Refined Neon – 30 msec
October, 2004
LS-DYNA 970_s_3454, Gigabit Ethernet (except where noted)

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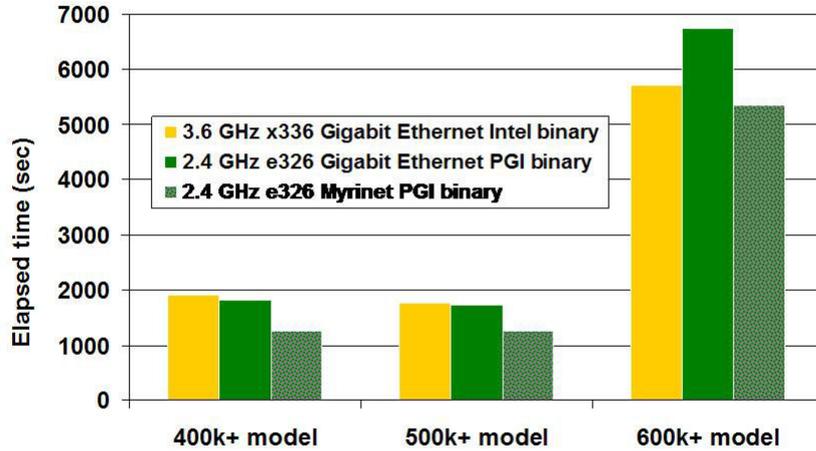
April 2005
LS-DYNA v970r5434
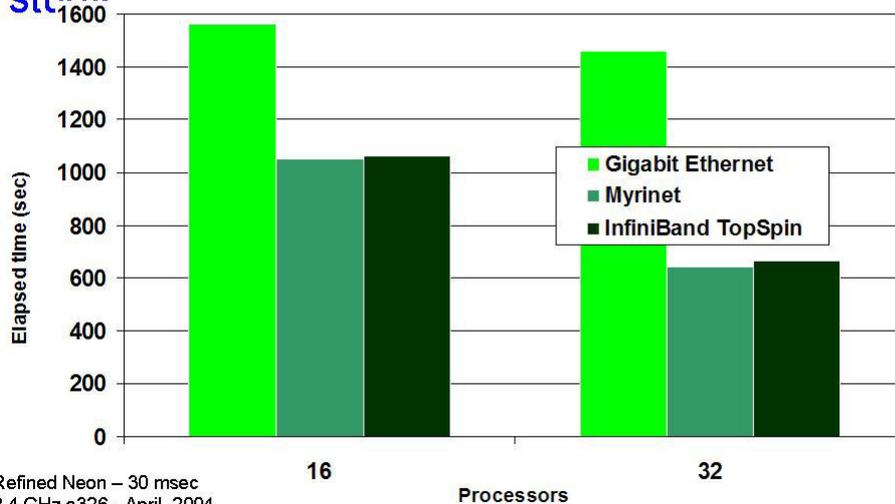
Refined Neon – 30 msec
2.4 GHz e326 - April, 2004
LS-DYNA 970_s_3454

MPI LS-DYNA – scaling to 32 processors


customer input deck 1+ M elements
April, 2005
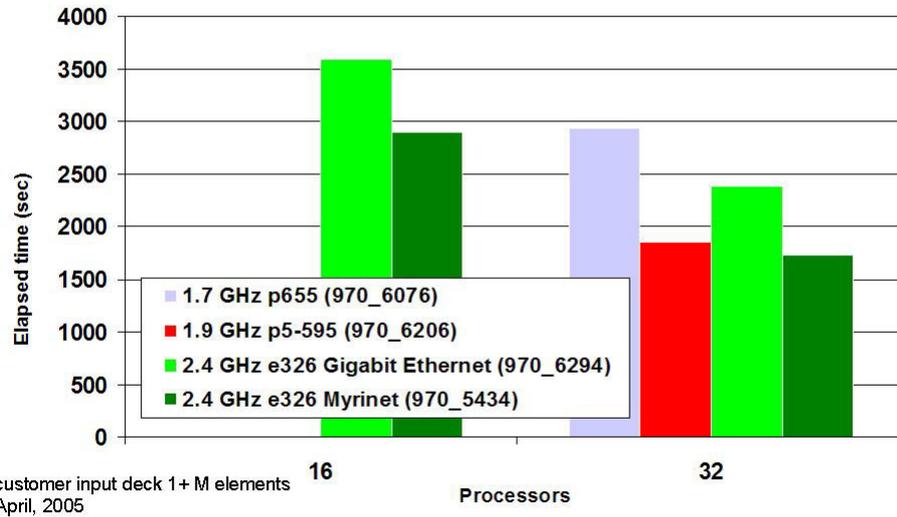
Effect of compiler on IBM xSeries performance
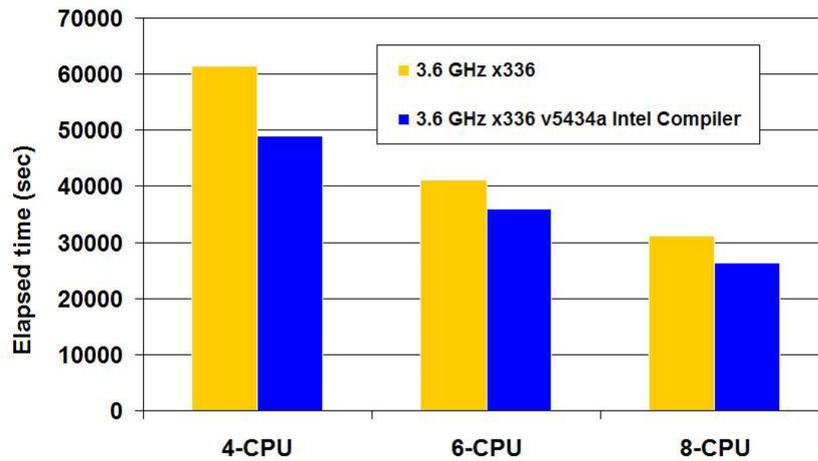
February 2005 customer input deck benchmark
LS-DYNA v970r6072 PGI compiler, except where noted

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IBM pSeries and eServer comparison
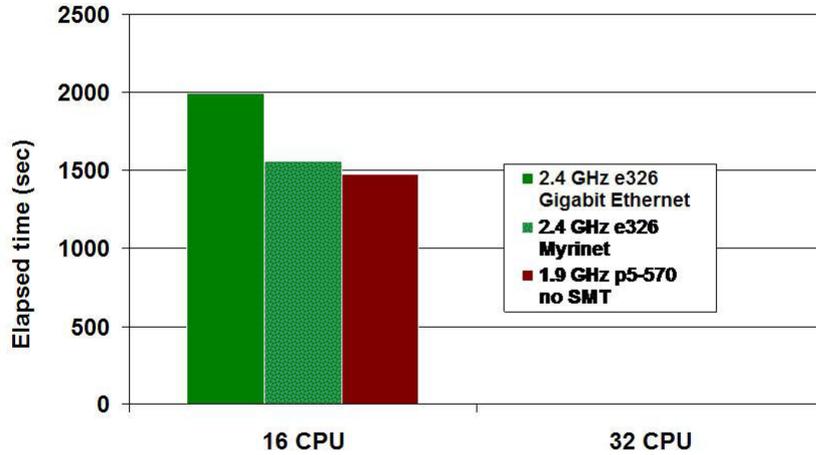
February, 2005 - 400k+ elements
LS-DYNA v970r5434

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SMP LS-DYNA example - pSeries and xSeries
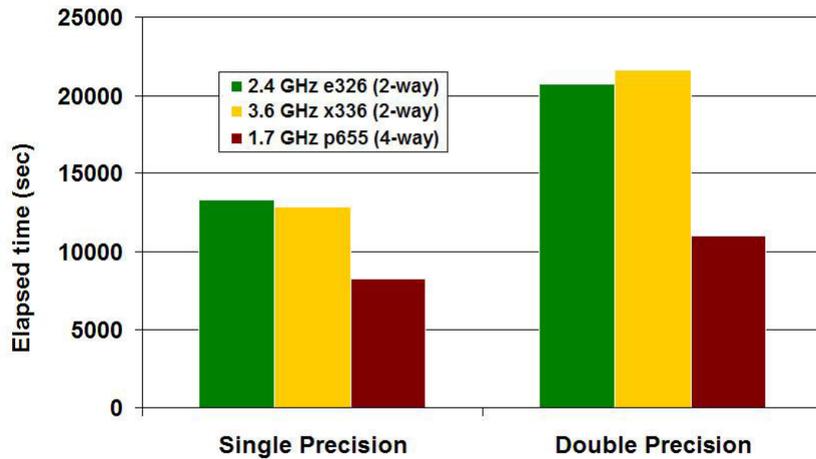
March 2005 customer input deck
LS-DYNA v970r5434a

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MPI LS-DYNA – comparison with customer input

Elapsed time (sec)

2500
2000
1500
1000
500
0

Legend:
- 1.9 GHz p5-570
- 2.4 GHz e326 Gigabit Ethernet
- 2.4 GHz e326 Myrinet
- 3.6 GHz x336 Gigabit Ethernet
- 3.6 GHz x336 Myrinet

8   16

Processors

customer input deck 400+ k elements
March, 2005
LS-DYNA 970_s_5434
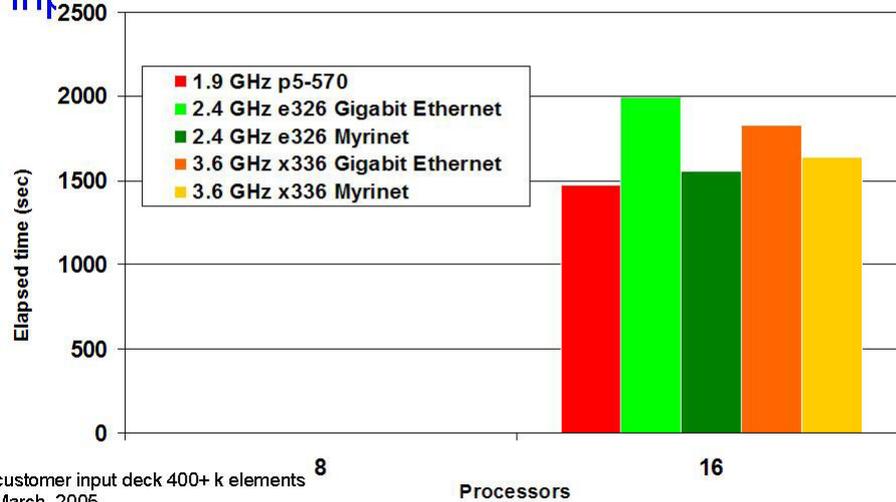
Performance is only part of the story

- **Performance – many subtle factors apply here**
  - processor
  - node architecture
  - communication options (hardware and drivers)
  - compilers (with care taken for numerical results)
- **Price**
  - initial hardware
  - maintenence
  - operating system and software costs

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Customer Value Metric (more than Price/Performance)

- Total cost of ownership (more than initial price)
  - hardware vs. application costs
  - maintenance - hardware
  - maintenance – compute environment (operating system, drivers, LS-DYNA versions, …) – including human costs
- Utility (more than just performance)
  - this varies from one customer to the next
  - standard job capacity, huge job capability, consistent worldwide environment, vendor application expertise and support, space and power considerations – just some examples which may be key deciding factors for a particular customer but not others
- IBM has options to match a particular customer value metric

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