
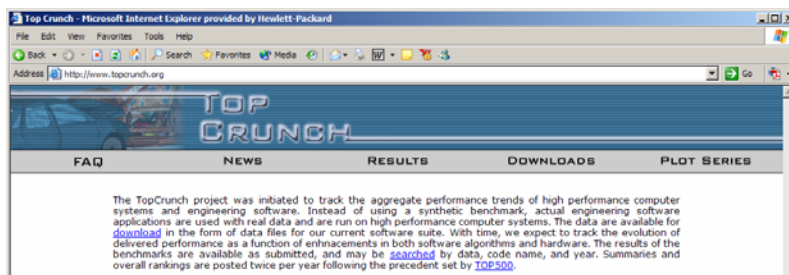


# Platform Choices for LS-DYNA

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High Performance Computing Division, HP  
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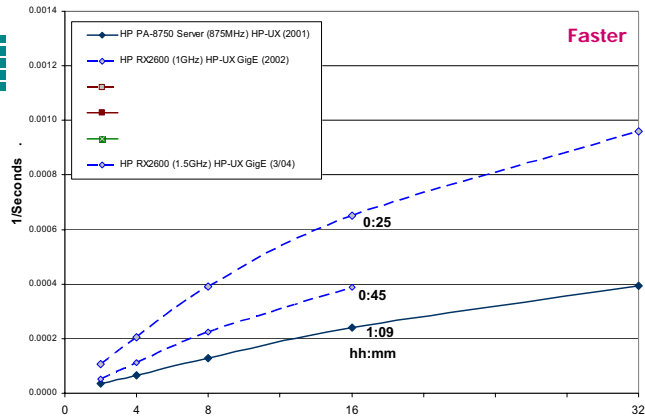
## Public Benchmarks for LS-DYNA



- [www.TopCrunch.org](http://www.TopCrunch.org)
- administered by University of California, San Diego (Prof. David Benson)
- Refined Neon and 3 Vehicle Collision models for LS-DYNA

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### LS-DYNA Neon – from PA-RISC to IPF



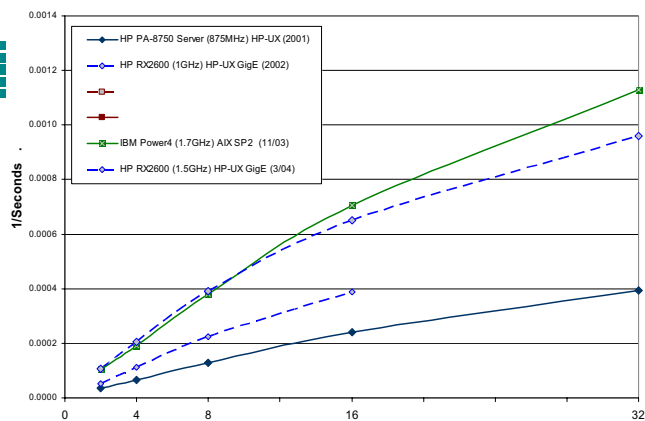
**Observation:**

- 1.5GHz Itanium is 70% faster than old Itanium (fall, 2002)

Reference: LS-DYNA v970.3858. Refined NCA Neon model for public benchmarks, 535K elements, posted as of 1-Oct-04 at: [www.topcrunch.org/benchmark\\_results.sfe](http://www.topcrunch.org/benchmark_results.sfe)

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### LS-DYNA Neon – Power4 SP2 cluster



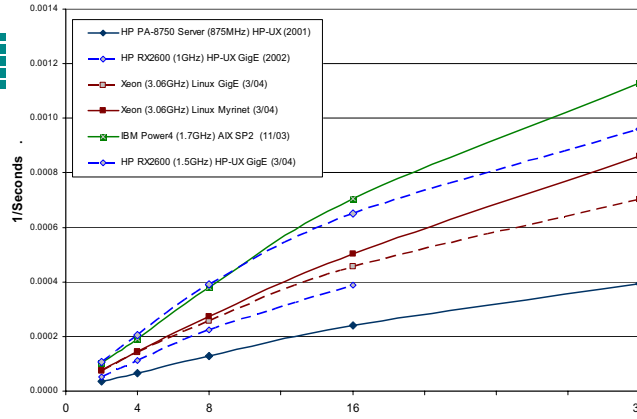
**Observation:**

- Itanium faster than Power4 at 2-8 CPUs
- Power4 faster above 8 due to low latency switch vs. GigE

Reference: LS-DYNA v970.3858. Refined NCA Neon model for public benchmarks, 535K elements. IBM data posted 13-Nov-03 at: [www.topcrunch.org/benchmark\\_results.sfe](http://www.topcrunch.org/benchmark_results.sfe)

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### LS-DYNA Neon – Xeon GigE & Myrinet



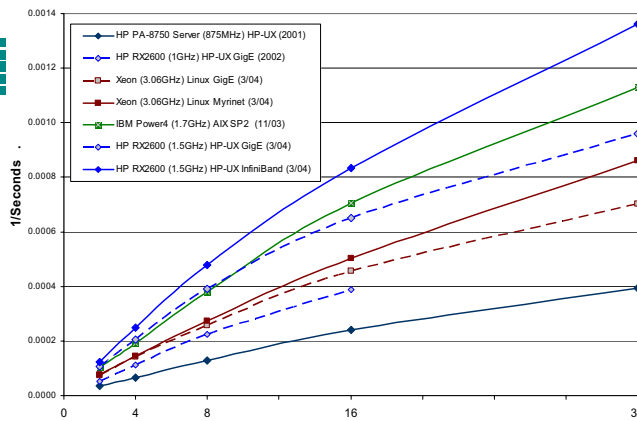
**Observations:**

- at 16 CPUs, Xeon adds half again as much time as Itanium
- scalability of GigE Xeon & Itanium track each other; scalability of Myrinet & SP2 track each other

Reference: LS-DYNA v970.3858. Refined NCA Neon model for public benchmarks, 535K elements. [www.topcrunch.org/benchmark\\_results.ssf](http://www.topcrunch.org/benchmark_results.ssf)

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### LS-DYNA Neon – Itanium InfiniBand



**Observation:**

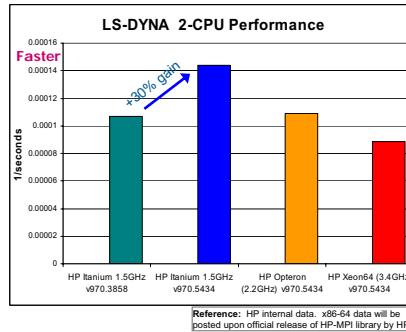
- low latency InfiniBand switch puts Itanium/HP-UX in the lead

Reference: LS-DYNA v970.3858. Refined NCA Neon model for public benchmarks, 535K elements. [www.topcrunch.org/benchmark\\_results.ssf](http://www.topcrunch.org/benchmark_results.ssf)

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## What about Opteron?

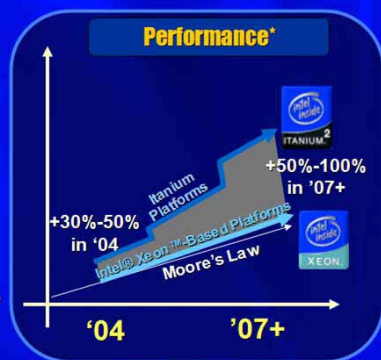
- All preceding data is v970.3858
  - this version does NOT include native recompile for x86-64 (e.g. Opteron)
- New v970.5434 was released 3-Aug-04, supporting x86-64
  - no vendor has posted Opteron data at TopCrunch using this official release yet
  - LSTC has improved general performance by ~30% in this new release (contact algorithm)
  - therefore, BEWARE any comparison of hardware performance that mixes LS-DYNA versions!
  - also, insure runs do not leave idle CPUs in any nodes (classic benchmark trick)



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## Itanium® Architecture: Optimized for Multi-Core

- **Parallel execution leadership: only Intel has all 3:**
  - Multi cores on same die
  - Multi threads on same core
  - Explicit parallelism in each core
- **EPIC\*:** inherent advantages for multi-core, multi-thread
  - Architecture: parallelism + many registers to keep data on-chip
  - Core size: smaller than IA-32, up to 2X more cores per die on Tukwila (than on IA-32)
  - Up to 2X higher performance than Xeon-based platforms by '07



\* For Enterprise & Technical Computing Application Segments

**Itanium® processor family delivering >2X Moore's law performance**



\* EPIC = Explicitly Parallel Instruction Set Computing

\* Other names and brands may be claimed as the property of others.



### Lowering Platform Pricing and TCO for Itanium® -based Platforms

**Lowest Cost of Ownership**

**Platform Price\*\***

\*Data based on Intel projections  
\*\*'04 Price based on comparable OEM systems, HW only

- Today: Itanium® Processor exceeds RISC performance & price / perf
- Today: Itanium® platform delivering superior price / performance vs Intel® Xeon™ Processor on transaction processing
  - 30% more transactions at 10% incremental cost of hardware platform/ OS / database\*\*\*
- '07: Itanium® platform cost reduced to parity with Intel® Xeon™ processor-based platforms
  - Common platform components to lead to common platform infrastructure over time

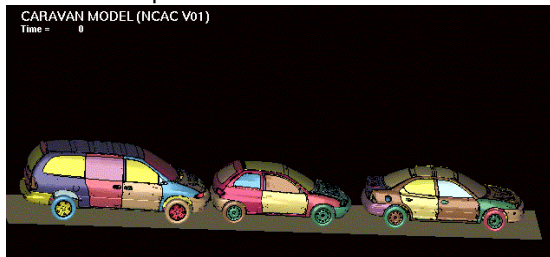
**Itanium® Platform cost reduced to parity with Xeon® processor based platforms by 2007**

\*\*\* 30%-60% or higher. Based on web pricing: 4P Xeon processor MP & Itanium platforms (24GB RAM) from Ion Computer; 2P platform (4GB RAM) from Dell

\*Other names and brands may be claimed as the property of others.

Value of HP Itanium platform increases as problems becoming more complex

- Bigger models
  - LS-DYNA 3 Vehicle Benchmark run 7.5 hours @ 16 CPUs
- Longer duration runs
  - Double Precision math is more efficient on 64-bit processors
- LS-DYNA for Implicit FEA
  - requires 64-bit address space and fast I/O



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## Benchmark Summary

- HP encourages hardware vendors and customers to use TopCrunch
- We offer choice: all leading architectures
  - Itanium/Xeon/Opteron clusters and SMP servers
- HP Itanium is the performance leader today
- x86 is price/performance leader today
- Technological changes will continue
- HP will consistently be a leader in performance & reliability



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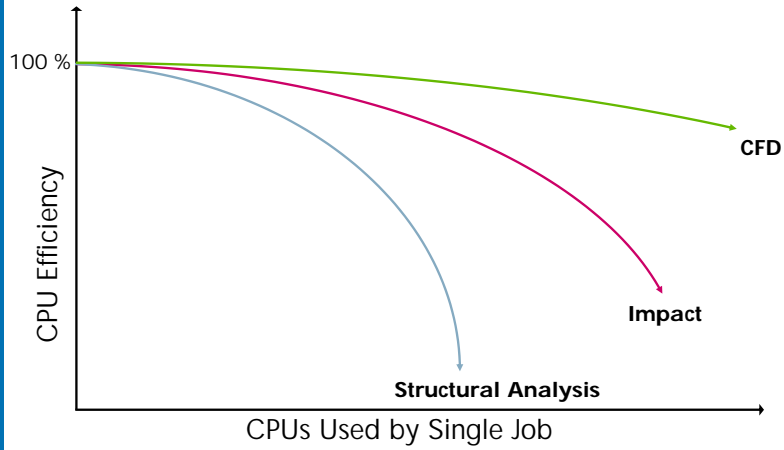
## HP Platform Recommendations for LS-DYNA?

- it depends!



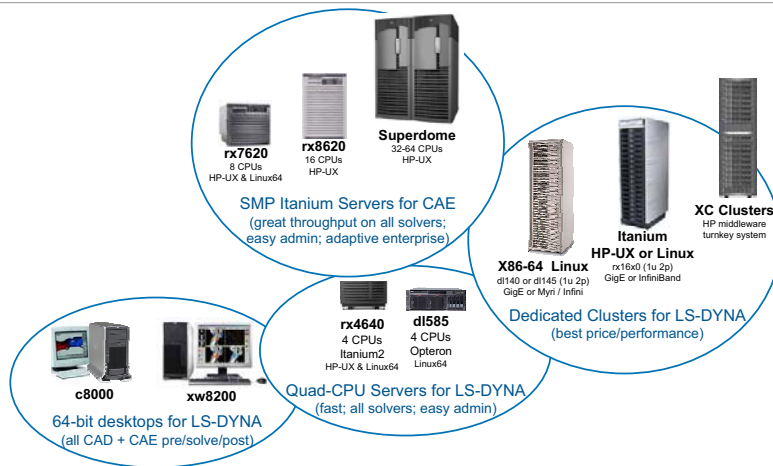
## HP Servers & Clusters for CAE

### Scalability of CAE Applications



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## HP: Platform of Choice for LSTC™



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