The Earth Simulator

An overview and report

Robert Bell, CSIRO Australia

4:45 Thursday, Great Hall

Outline

- Visit last week during NUG
- Aims
- System description
- Performance
- Pictures - WWW

Visit last week during NUG

- NEC Users Group
- Met at Yokohama, Japan
- Near to Earth Simulator
- Purpose-built building, facility

Aims

- Improving predictions of global change
  - global warming, seasons, ocean currents, weather
- Seismic – little publicity
- NASDA, JAERI, JAMSTEC
- Commenced 1997, completion March 2002
- 5 Tflop/s sustained

System description

- NEC won contract to develop system
- US$350M
- Completed on time, March 2002
- Requirements from modellers, in terms of balance, memory, interconnect
- Vector processors
- High speed interconnect

System description

- One-chip vector processor!
- 2 cm x 2 cm, about 50 M transistors,
- 5200 i/o pads, 150 W, radiator
- 500 MHz/1 GHz, 8 vector pipes
- Peak 8 Glop/s, 32 Gbyte/s
- Nodes with 8 CPUs, 16 Gbyte memory

System description

- 640 nodes, so 5120 processors
- Peak 40 Tflop/s (ASCI white 12 Tflop/s)
- Single stage cross-bar switch
- 64 data pass cabinets, 1 x-bar cabinet
- Each has two cables to each of 640 nodes
- 2900 km of external cabling!
- 8 Gbyte/s bi-directional on each path

System description

- 675 Tbyte of disc (not enough!)
- 12 STK 9310, 86 STK drives

Software

- SSI – 40 times larger than previous largest SX system!
- Developments of SUPER-UX – double clustering – groups of 16 nodes
- Development of scheduling, management
- Development of HPF – JAHPF +

Performance

- Linpack (peak!)
- 35.61 Tflop/s on 5104 CPUs
- 35.9 Tflop/s on 5120 CPUs (87.5% of peak)
- (ASCI White 7.3 Tflop/s, 58.8% of peak)
- Climate model: 3840 x 1920 x 96
- One day in 4.65 s – 26.58 Tflop/s (2/3 peak)
- Estimated app’s perf – 40 times ASCI?
- HPF – 12 Tflop/s

Implications

- Importance of sustained effort
- Refocus on non-commodity processors
- Interconnect importance
- Software – HPF
- Looking for users! Collaborations
- US – revitalising vector market?

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The Earth Simulator may be the most significant system in HPC since the Cray-1.

This brief talk will give an overview, and present some performance figures, following the author’s visit there last week.