InfiniBand Strengthens Leadership as the Interconnect Of Choice By Providing Best Return on Investment
TOP500 Performance Trends

- Explosive high-performance computing market growth
- Clusters continue to dominate with 85% of the TOP500 list

Mellanox InfiniBand solutions provide the highest systems utilization in the TOP500 for both high-performance computing and clouds
InfiniBand is the de-facto Interconnect solution for High-Performance Computing
  • Positioned to continue and expand in Cloud and Web 2.0

InfiniBand is the most used interconnect on the TOP500 list, connecting 222 systems
  • Increasing 8.3% year-over-year, from 205 system in June’13 to 222 in June’14

FDR InfiniBand systems grew 1.9X year-over-year from 67 systems in June’13 to 127 in June’14

FDR InfiniBand Petascale-capable systems grew 2X year-over-year from 8 in June’13 to 16 in June’14

InfiniBand enables the most efficient system on the list with 99.8% efficiency – record!

InfiniBand enables 24 out of the 25 most efficient systems, and the top 17 most efficient systems

InfiniBand is the most used interconnect for Petascale-capable systems with 24 systems out of 48

Mellanox InfiniBand is the only Petascale-proven InfiniBand solution
InfiniBand is the most used interconnect technology for high-performance computing

- InfiniBand accelerates 222 systems, 44.4% of the list
- FDR InfiniBand connects the fastest InfiniBand systems – TACC (#7), ENI (#11), LRZ (#12)

InfiniBand enables the most efficient cloud infrastructure – Microsoft Azure, with 90.2% cloud efficiency

InfiniBand connects the most powerful clusters

- 24 of the Petascale-capable systems (TOP48)

The most used interconnect solution in the TOP100, TOP200, TOP300, TOP400

- Connects 52% (52 systems) of the TOP100 while Ethernet only 8% (8 systems)
- Connects 52% (104 systems) of the TOP200 while Ethernet only 20% (40 systems)
- Connects 51.3% (154 systems) of the TOP300 while Ethernet only 25.7% (77 systems)
- Connects 46.5% (186 systems) of the TOP400 while Ethernet only 35.3% (141 systems)
- Connects 44.4% (222 systems) of the TOP500, Ethernet connects 40.4% (202 systems)

InfiniBand is the interconnect of choice for accelerator-based systems

- 81% of the accelerator-based systems are connected with InfiniBand

Diverse set of applications

- High-end HPC, commercial HPC, Cloud and enterprise data center
Mellanox FDR InfiniBand is the fastest interconnect solution on the TOP500
  • More than 12GB/s throughput, less than 0.7usec latency
  • Being used in 126 systems on the TOP500 list – 1.9X increase from the June’13 list
  • Connects the fastest InfiniBand-based supercomputers – TACC (#7), ENI (#11), LRZ (#12)

Mellanox InfiniBand is the fastest interconnect technology on the list
  • Enables the highest system utilization on the TOP500 – 99.8% system efficiency
  • Enables the top 17 and 24 out of 25 highest utilized systems on the TOP500 list

Mellanox’s end-to-end scalable solutions accelerate GPU-based systems
  • GPUDirect RDMA technology enables faster communications and higher performance
- InfiniBand is the de-facto interconnect solution for performance demanding applications
Mellanox InfiniBand is the interconnect of choice for Petascale computing
• Accelerates 50% of the sustained Petaflop systems (24 systems out of 48)
- Number of Mellanox FDR InfiniBand systems doubled from June’13 to June’14
  - Accelerates 66% of the InfiniBand-based Petaflop-capable systems (16 systems out of 24)
Mellanox Enables World-Leading Research and Science Platforms

Accelerating Half of the World’s Petascale Supercomputers (Examples)
TOP100: Interconnect Trends

- InfiniBand is the most used interconnect solution in the TOP100
- The natural choice for world-leading supercomputers: performance, efficiency, scalability
InfiniBand is the most used interconnect of the TOP100, 200, 300, 400 supercomputers

Due to superior performance, scalability, efficiency and return-on-investment
InfiniBand is the high performance interconnect of choice
  • Connects the most powerful clusters, and provides the highest system utilization

InfiniBand is the best price/performance interconnect for HPC systems
InfiniBand’s Unsurpassed System Efficiency

- TOP500 systems listed according to their efficiency
- InfiniBand is the key element responsible for the highest system efficiency; in average 30% higher than 10GbE
- Mellanox delivers efficiencies of more than 99% with InfiniBand

Average Efficiency
- InfiniBand: 87%
- Cray: 79%
- 10GbE: 67%
- GigE: 40%
- Mellanox InfiniBand connects the most efficient system on the list
  - 24 of the top25 most efficient systems, all of top 17 most efficient system
- Enabling a record system efficiency of 99.8%, only 0.2% less than the theoretical limit!
- InfiniBand systems account for 2.2X the performance of Ethernet systems
- The only scalable HPC interconnect solutions
- InfiniBand connected systems’ performance demonstrate highest growth rate
- InfiniBand responsible for 2.2X the performance versus Ethernet on the TOP500 list
InfiniBand Performance Trends

- InfiniBand-connected CPUs grew 23% from June‘13 to June‘14
- InfiniBand-based system performance grew 40% from June‘13 to June‘14
- Mellanox InfiniBand is the most efficient and scalable interconnect solution
- Driving factors: performance, efficiency, scalability, many-many cores
Leading Supplier of End-to-End Interconnect Solutions

Enabling the Use of Data

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<th>Comprehensive End-to-End InfiniBand and Ethernet Portfolio</th>
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At the Speeds of 10, 40 and 100 Gigabit for Second

From Data Center to Metro and WAN

X86, ARM and Power based Compute and Storage Platforms
Extending High-Speed Connectivity and RDMA into Metro / WAN

- RDMA connectivity over InfiniBand / Ethernet
- From 10 to 80 Kilometers
- Mega Data Centers, Mega Clouds, Disaster Recovery

“A common problem is the time cost of moving data between data centers, which can slow computations and delay results. Mellanox's MetroX lets us unify systems across campus, and maintain the high-speed access our researchers need, regardless of the physical location of their work.”

Mike Shuey, Purdue University
FDR InfiniBand Delivers Highest Return on Investment

Higher is better

ICON RAPS 2.0 Performance (test_hat_jww, Ivy Bridge)

Higher is better

GROMACS Performance (d.dppc)

Source: HPC Advisory Council

ECLIPSE 2012 Performance (FOURMILL)

Higher is better

RADIOSS Benchmark (NEON1M11, MPI)

Higher is better
Mellanox Technology Roadmap – Keeping You One Generation Ahead

Mellanox → 20Gbs → 40Gbs → 56Gbs → 100Gbs → 200Gbs

Terascale
- 3rd
- TOP500 2003 Virginia Tech (Apple)

Petascale
- 1st
- "Roadrunner" Mellanox Connected

Exascale
- Mega Supercomputers


"Roadrunner" Mellanox Connected
“Stampede” system
6,000+ nodes (Dell), 462462 cores, Intel Phi co-processors
5.2 Petaflops
Mellanox end-to-end FDR InfiniBand
- “HPC2” system
- IBM iDataPlex DX360M4
- NVIDIA K20x GPUs
- 3 Petaflops sustained Petaflop performance
- Mellanox end-to-end FDR InfiniBand
IBM iDataPlex and Intel Sandy Bridge
147456 cores
Mellanox end-to-end FDR InfiniBand solutions
2.9 sustained Petaflop performance
The fastest supercomputer in Europe
91% efficiency
- TSUBAME 2.0, first Petaflop system in Japan
- 2.8 PF performance
- HP ProLiant SL390s G7 1400 servers
- Mellanox 40Gb/s InfiniBand

Petaflop
Mellanox Connected
- “Cascade” system
- Atipa Visione IF442 Blade Server
- 2.5 sustained Petaflop performance
- Mellanox end-to-end InfiniBand FDR
- Intel Xeon Phi 5110P accelerator
“Pangea” system
- SGI Altix X system, 110400 cores
- Mellanox FDR InfiniBand
- 2 sustained Petaflop performance
- 91% efficiency

Total Exploration Production - #16
• SGI Altix ICE X/8200EX/8400EX
• 20K nodes, 125980 cores
• 1.5 Petaflops sustained performance
• Mellanox end-to-end FDR and QDR InfiniBand
• Supports variety of scientific and engineering projects
  • Coupled atmosphere-ocean models
  • Future space vehicle design
  • Large-scale dark matter halos and galaxy evolution

Petaflop
Mellanox Connected
“Spirit” system
SGI Altix X system, 74584 cores
Mellanox FDR InfiniBand
1.4 sustained Petaflop performance
92.5% efficiency
Bull Bullx B510, Intel Sandy Bridge
77184 cores
Mellanox end-to-end FDR InfiniBand solutions
1.36 sustained Petaflop performance
Dawning TC3600 Blade Supercomputer
5200 nodes, 120640 cores, NVIDIA GPUs
Mellanox end-to-end 40Gb/s InfiniBand solutions
  • ConnectX-2 and IS5000 switches
1.27 sustained Petaflop performance
The first Petaflop systems in China

Shenzhen Institutes of Advanced Technology
- “Yellowstone” system
- 72,288 processor cores, 4,518 nodes (IBM)
- Mellanox end-to-end FDR InfiniBand, full fat tree, single plane
- Bull Bullx B510, Intel Sandy Bridge
- 70560 cores
- 1.24 sustained Petaflop performance
- Mellanox end-to-end InfiniBand solutions
- Tera 100, first Petaflop system in Europe - 1.05 PF performance
- 4,300 Bull S Series servers
- 140,000 Intel® Xeon® 7500 processing cores
- 300TB of central memory, 20PB of storage
- Mellanox 40Gb/s InfiniBand
- Fujitsu PRIMERGY CX250 S1
- Mellanox FDR 56Gb/s InfiniBand end-to-end
- 980 Tflops performance
“Conte” system
HP Cluster Platform SL250s Gen8
Intel Xeon E5-2670 8C 2.6GHz
Intel Xeon Phi 5110P accelerator
Total of 77,520 cores
Mellanox FDR 56Gb/s InfiniBand end-to-end
Mellanox Connect-IB InfiniBand adapters
Mellanox MetroX long Haul InfiniBand solution
980 Tflops performance
“MareNostrum 3” system
1.1 Petaflops peak performance
~50K cores, 91% efficiency
Mellanox FDR InfiniBand
Thank You