Background

1. Supercomputer – computer with a high level of computing performance compared to a general-purpose computer.

Performance – floating-point operations per second

Compare:

Milky Way 2 Intel Corei7-7700K

9.497×1016 floating-point operations/s 5.1×109 floating-point operations/s

18×106W (5.28×109 flops/W) 91W (5.26×107 flops/W)

1. History & Location

Milky Way

4.7×1015 floating-point operations/s

Oct 2009

Rank 48 (June 2017)

200 people team, 1 year, 90 million dollar

National University of Defense Technology, Changsha, China

Milky Way 2

5.49×1016 floating-point operations/s

May 2013

Rank 2 (June 2017)

280 people team, 2 year, 100 million dollar

National University of Defense Technology, Changsha, China

(cause the whole school black out)

National Supercomputer Center, Guangzhou, China

(Sun Yat-Sen University, Zhongshan University)

Milky Way 2

5.49×1016 floating-point operations/s

Sep 2017

Rank Unknown

National Supercomputer Center, Guangzhou, China

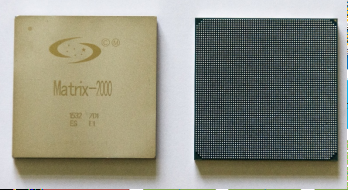
(Sun Yat-Sen University, Zhongshan University)

1. Specs

Upgrades

from Intel Xeon Phi Knights Corner (KNC) accelerators to Matrix-2000 accelerators

1. February 2015, the US Department of Commerce prevented some Chinese research groups receive some Intel technologies
2. Accelerator — computer hardware used to perform some functions more efficiently than is possible in a more general-purpose CPU (example Graphic Card)



PCIE 
DDR4 
Chip interconnectio 
DDR4 
DDR4 
DDR4 

16000 nodes to 17792 nodes

1. each node uses two matrix-2000 accelerators and two Intel Core Ivy Bridge CPUs (12 cores clocked at 2.2 GHz)
2. node performance 5.3376 ×1012 flops
3. combination results in a computer system with 35,584 Ivy Bridge CPUs, 35,584 Matrix-2000 accelerators, and a grand total of 4,981,760 compute cores

1.4PB DDR4 2400MHz memory to 3,4 PB DDR4 2400MHz memory

4.Usage

Dealing with large number of data

Simulate nuclear test

oil exploration

Weather Forecast

5. Challenge

difficult to use.

Chi Xuebin, deputy director of the Computer Network and Information Centre said, "the function of the supercomputer is still way behind, some users would need years or even a decade to write the necessary code"

Low efficiency

Rmax(max calculation power)/Rpeak(theoretical calculation power)

Tianhe 2A – 64.0%

Piz Daint (rank 3)–77.4%

Titan (rank 4) – 64.9%

Sequoia (rank 5) – 85.3%

K (rank 8) – 92.9%

Mira (rank 9) – 85.3%

Oversupply

Building objective is always the rank

Built by supercomputer center sell calculation to users, however potential user:

Research University—have own supercomputers, impossible to go all the way to Guangzhou

Military — Security of open computer center

Industries — slow software greatly reduce actual problem-solving ability

Built by user, example Titan – U.S. Department of Energy