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利用新硬件提升数据库性能

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ADC
Alibaba Developer
Conference

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Agenda

- 数据库软硬件发展趋势
- CPU
- 内存
- 磁盘
- 网络

数据库百万TPS不再稀罕！

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MemSQL

MemSQL 1.2 million inserts/second on a 64-core, 1/2 TB of RAM machine

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MySQL Cluster

MySQL Cluster 7.2 achieves 4.3BN reads per minute with 30 data nodes

2-socket servers using X5670 with Infiniband interconnect and 48GB of memory per machine

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硬件发展迅猛

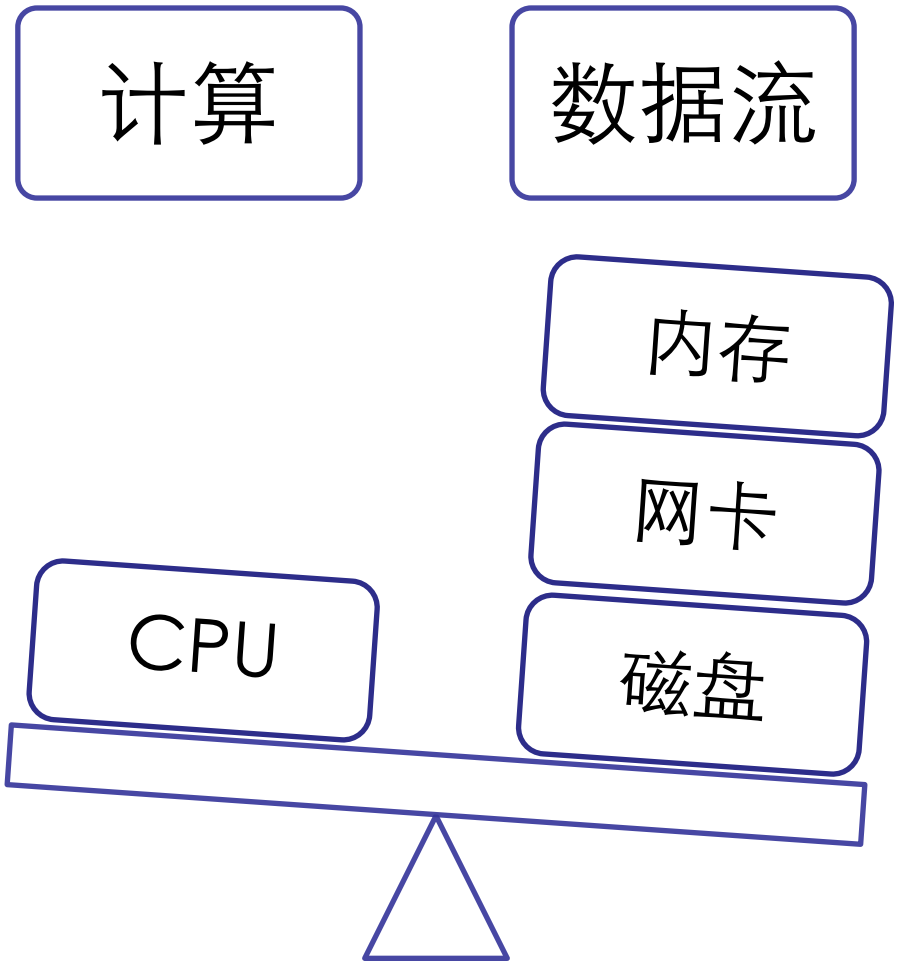
- 8 Xeon 7540 CPU，96逻辑CPU
- 512 GB DDR3
- 600G SSD *12
- 万兆网卡

文艺青年的装备

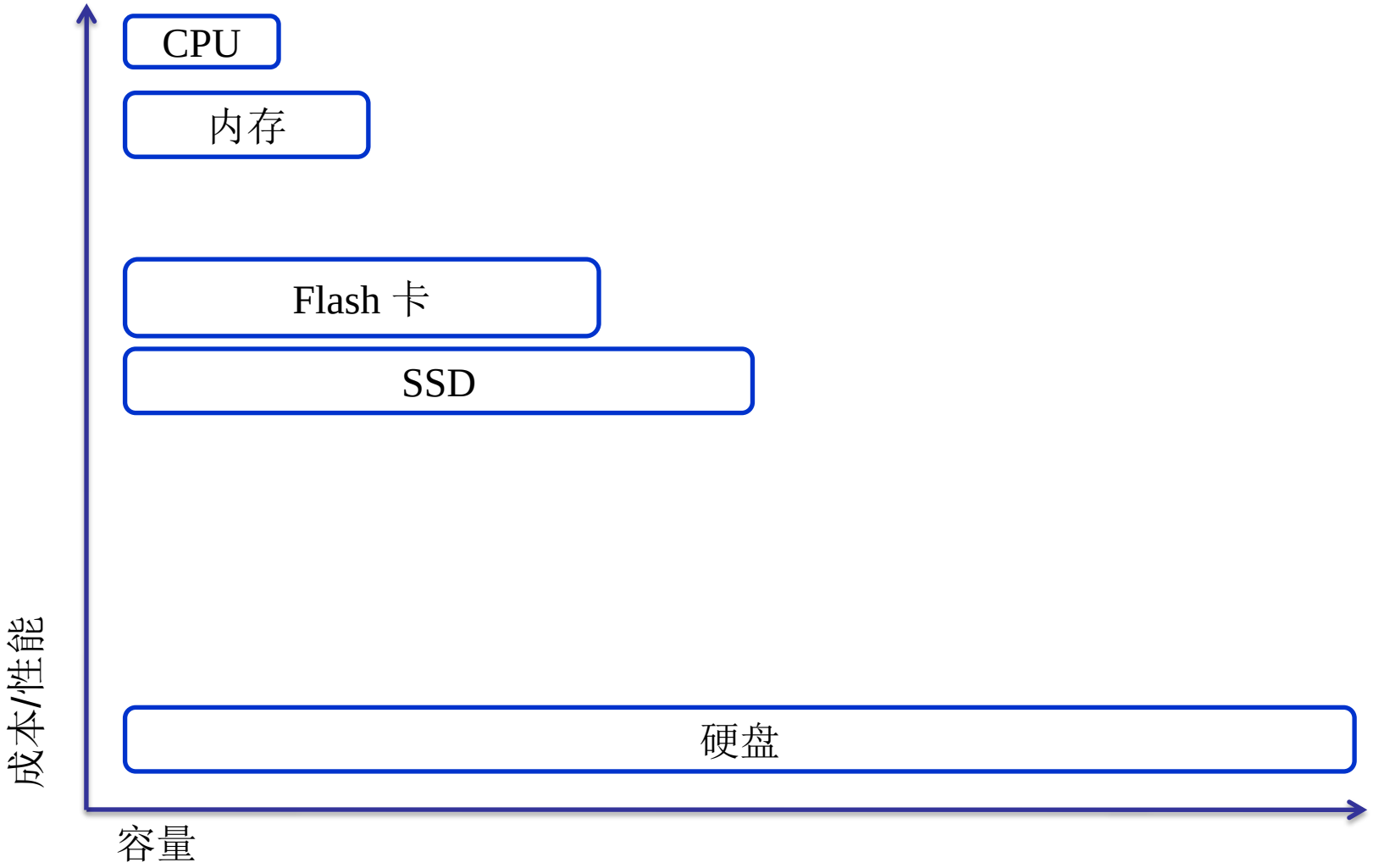
- 2 E5-2420 CPU，24逻辑CPU
- 96GB DDR3
- 600G SSD *8
- 千兆网卡

普通青年的装备

平衡系统



存储成本/性能



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性能必知数字

L1 cache reference	0.5 ns
Branch mispredict	5 ns
L2 cache reference	7 ns
Mutex lock/unlock	25 ns
Main memory reference	100 ns
Compress 1K bytes with Zippy	3,000 ns
Send 2K bytes over 1 Gbps network	20,000 ns
Read 1 MB sequentially from memory	250,000 ns
Round trip within same datacenter	500,000 ns
Disk seek	10,000,000 ns
Read 1 MB sequentially from disk	20,000,000 ns
Send packet CA->Netherlands->CA	150,000,000 ns

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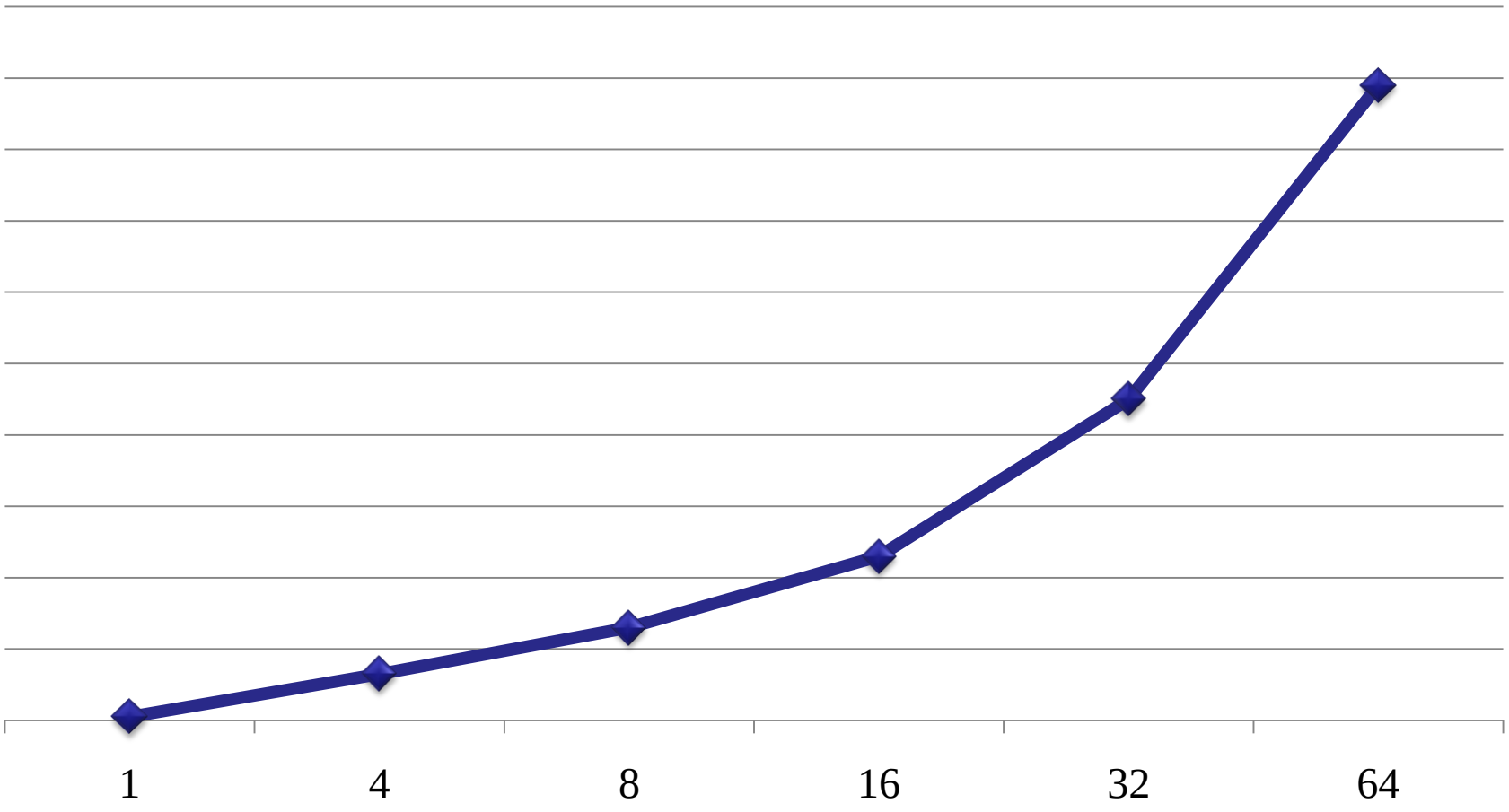
CPU Scalability



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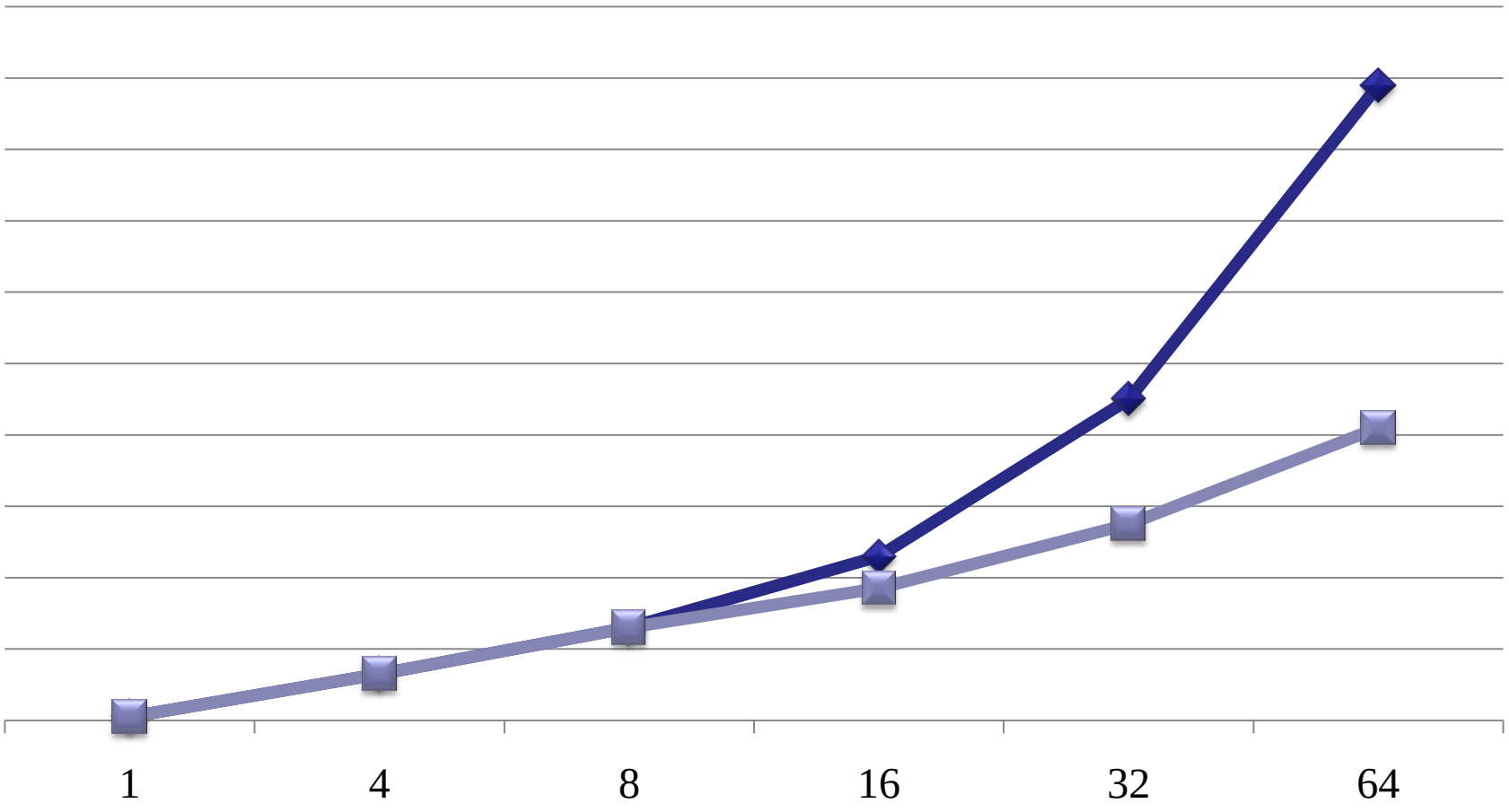
CPU Scalability



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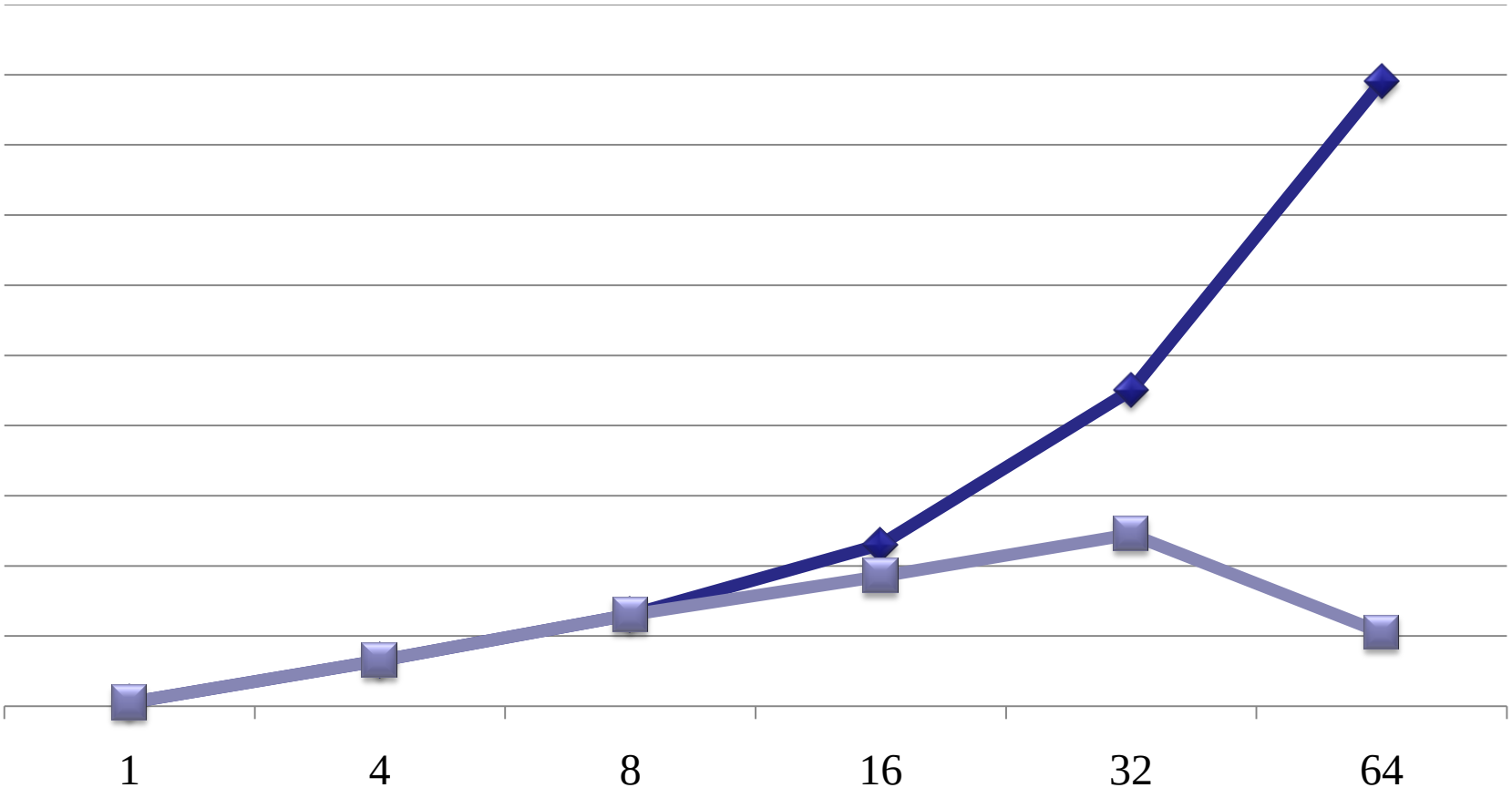
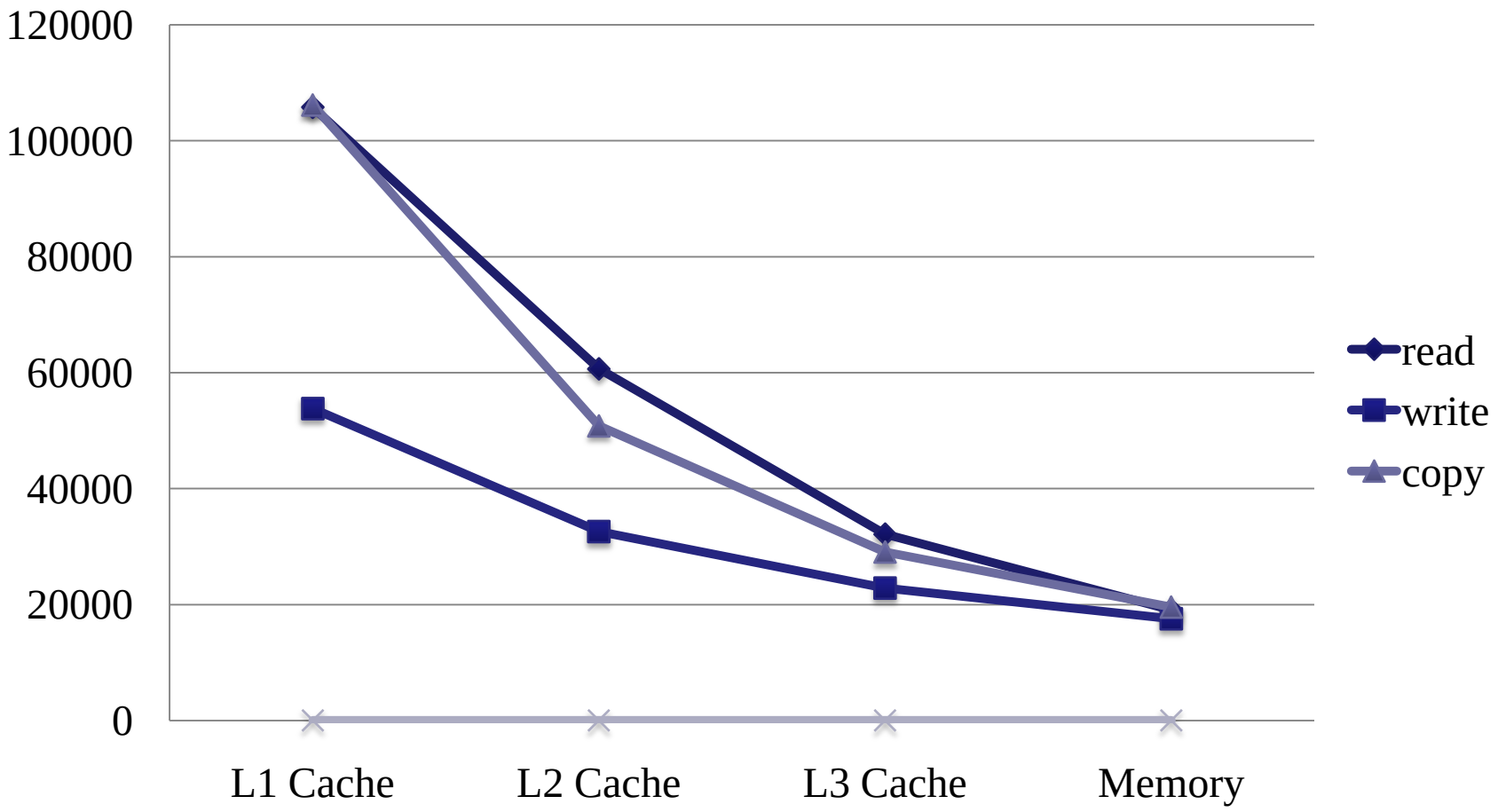
CPU Scalability



Cache和主存吞吐量



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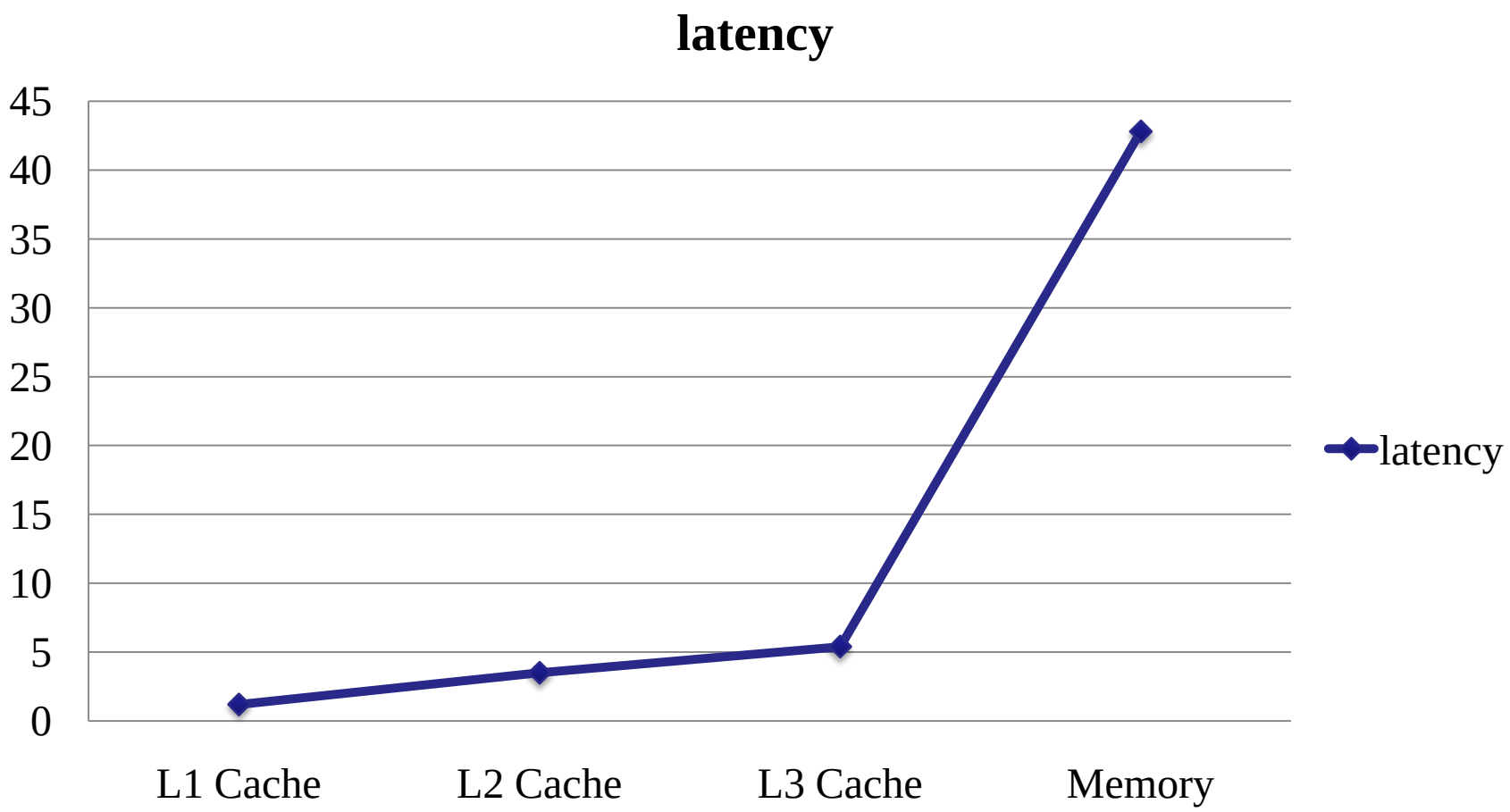
Cache和主存延时



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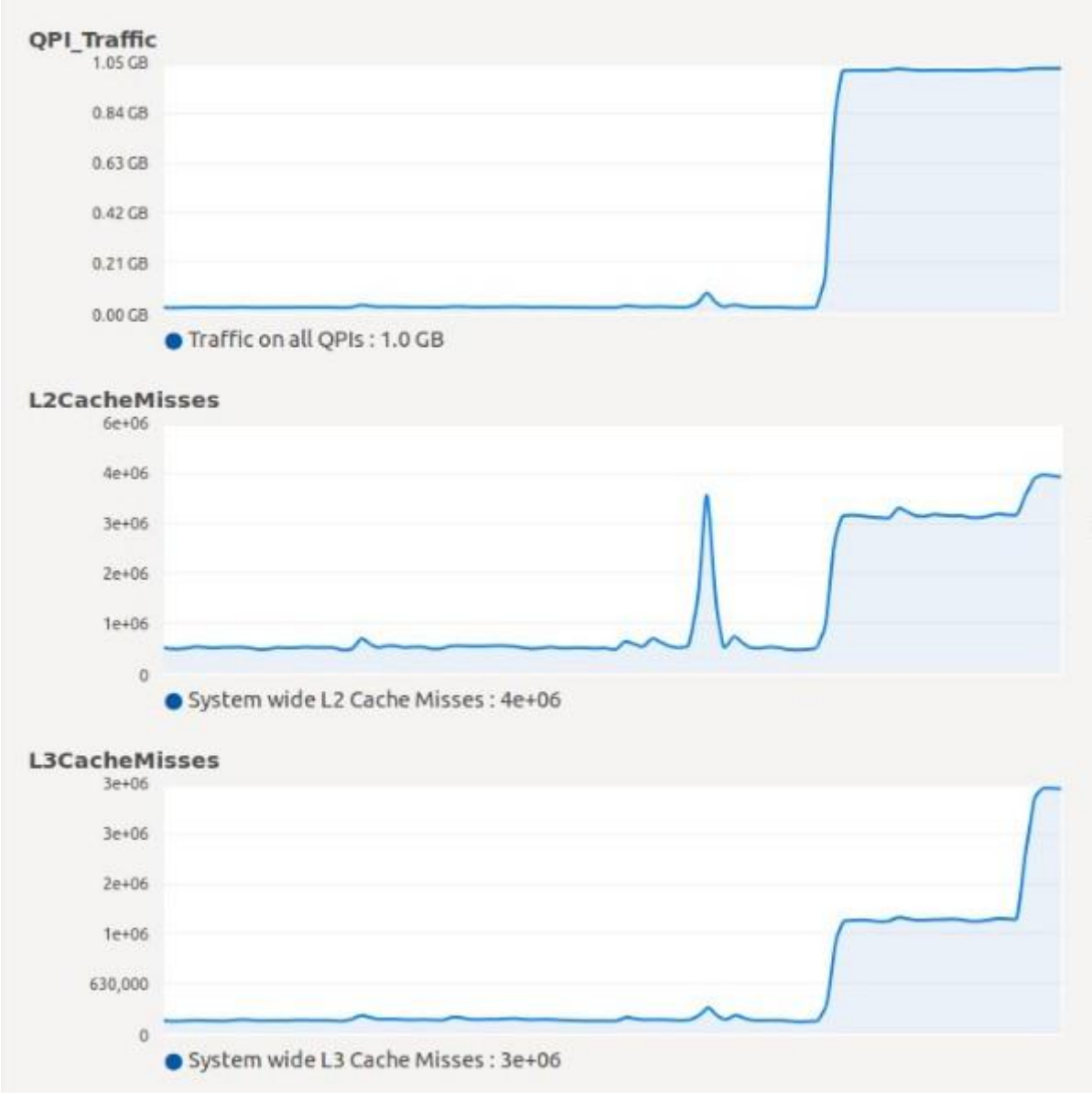
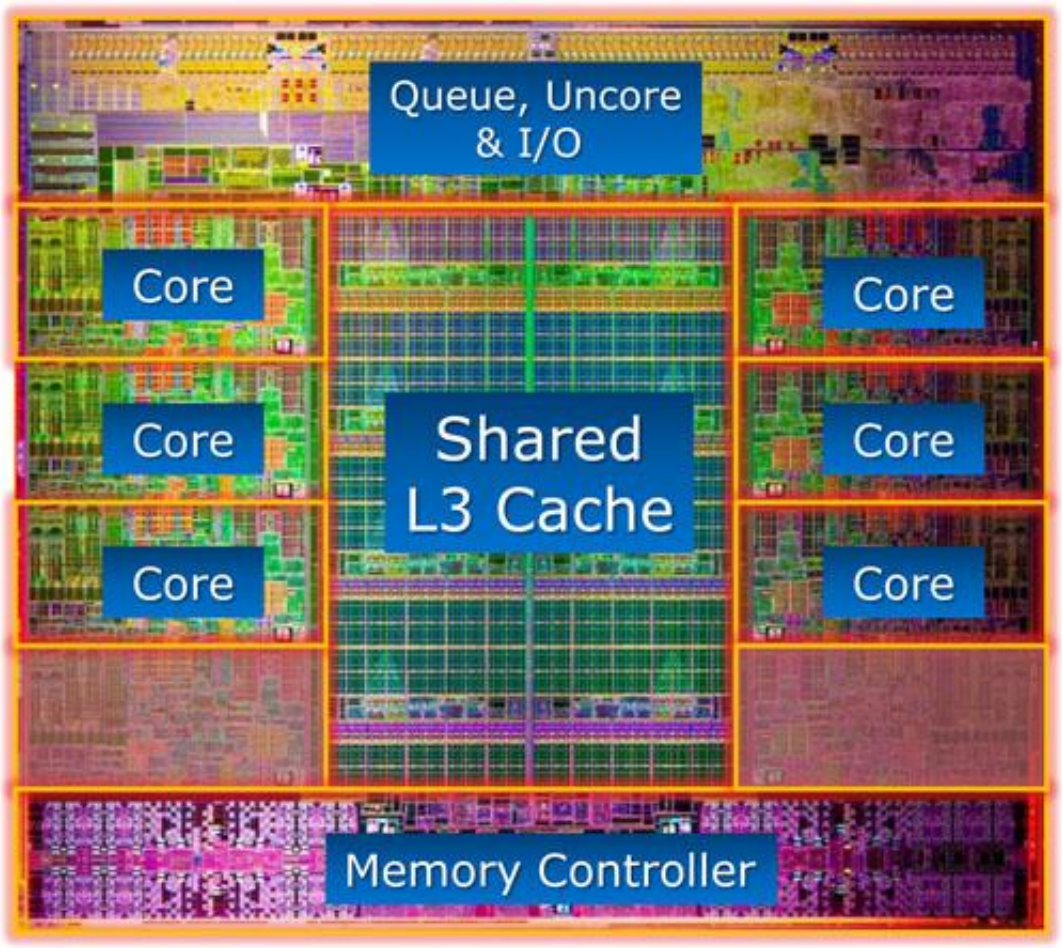
多核性能恶化原因



Sandy Bridge-E



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SB-E对数据库更友好

- 6个CORE，计算力强
- 4个DDR内存通道，2个QPI互联，内存带宽足
- 内置PCI-E 通道，IO能力强
- 更大的L3，Cache更高效

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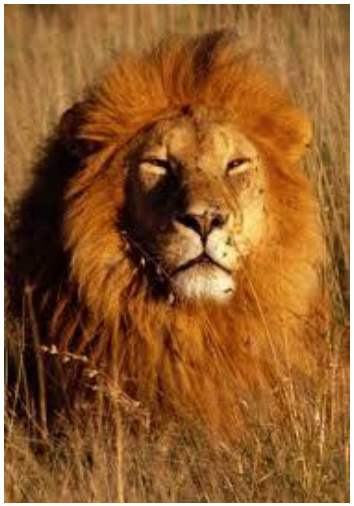
内存和外存的差距



毫秒

纳秒

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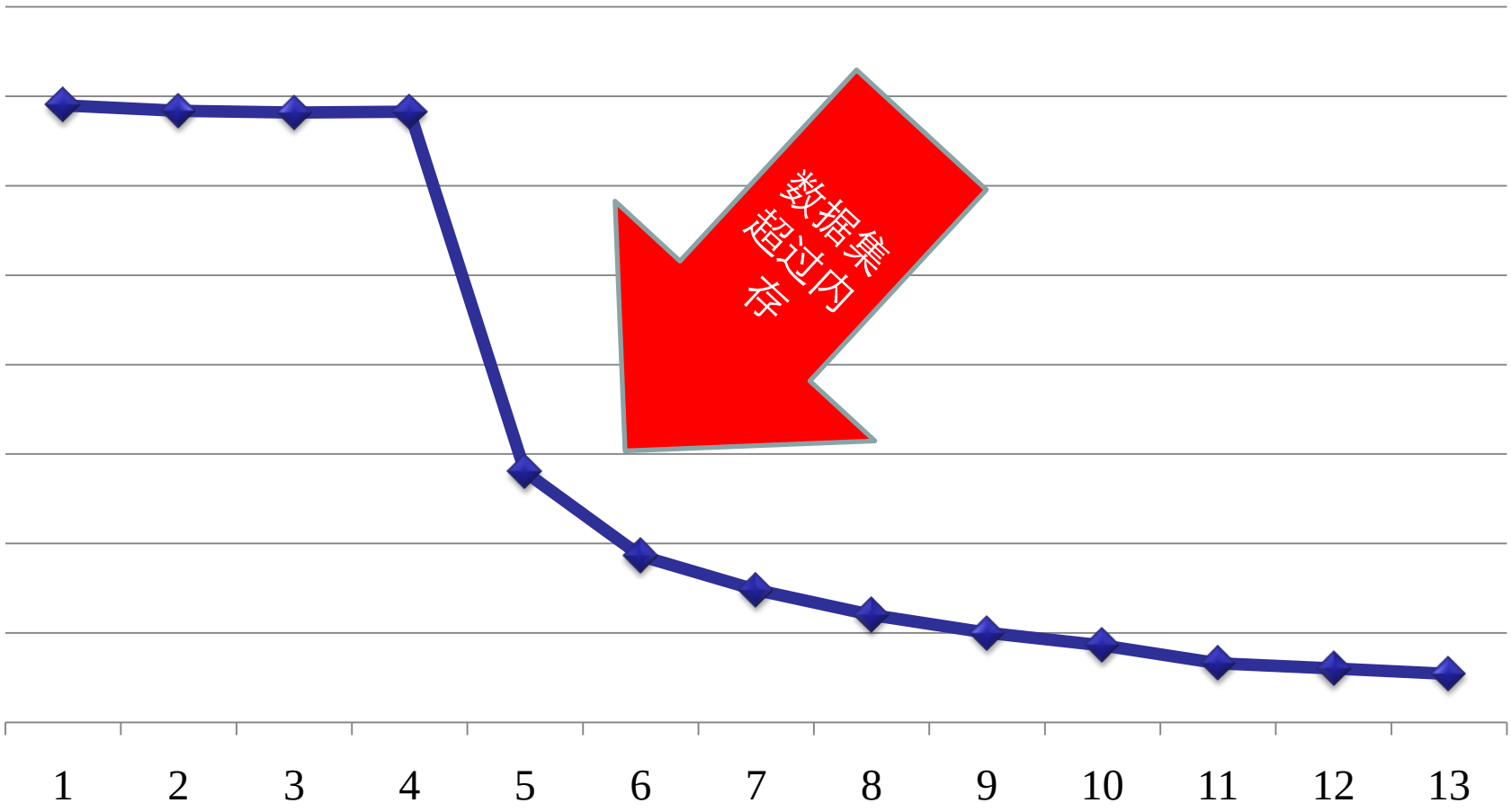
内存和数据集



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内存选择

- 来者不拒，越多越好
- 成本考虑，装下最热数据集
- 百G以上不奇怪

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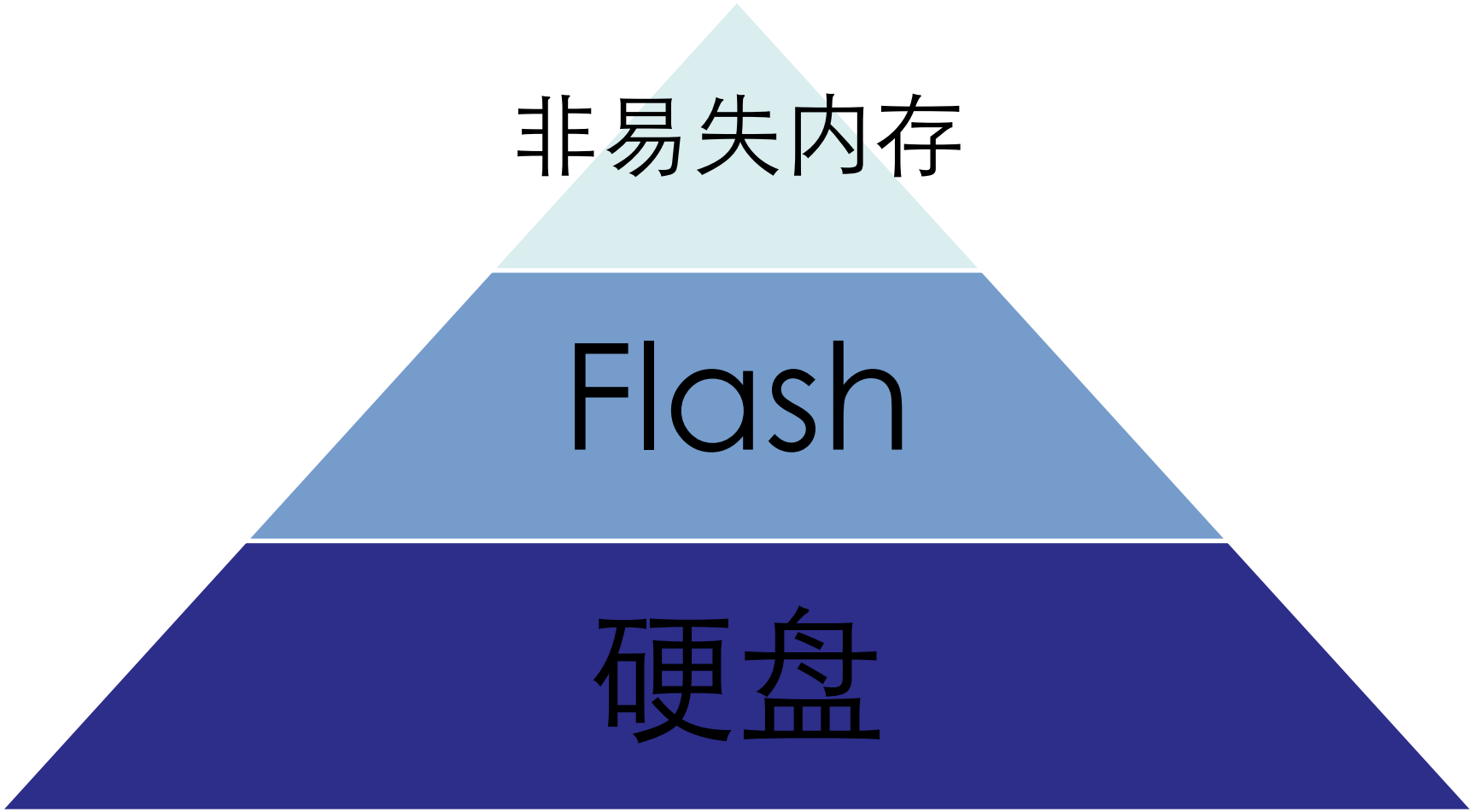
数据库IO模式

- 日志文件顺序IO，落地为要
- 引擎尽最大努力把脏数据转变成顺序IO
  - 引擎不同，数据结构不同， 差距很大
- 历史原因，传统数据库基于IO设计，最大内存也避免不了IO

混合存储模型



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Raid卡

- PCIe 2.0x8
- Support Up to 128 SATA Devices
- Dual Core ROC
- 1GB cache

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SSD

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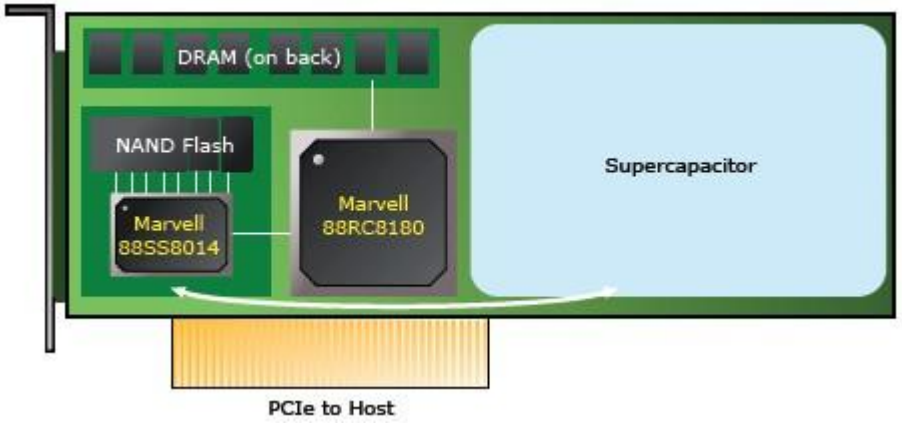
Flash卡

PCIe 2.0x8
850 MB/s (4KB)
220,000 IOPS (4KB)

PCIe 2.0x4
ioDrive IOPS: with Flash 140,000
Read IOPS, 135,000 Write IOPS

非易失内存

PCIe 1.1x4
4K Block Writes: 165,000 IOPS
4K Block Reads: 185,000 IOPS



DDR3 Non-Volatile DIMM 8G

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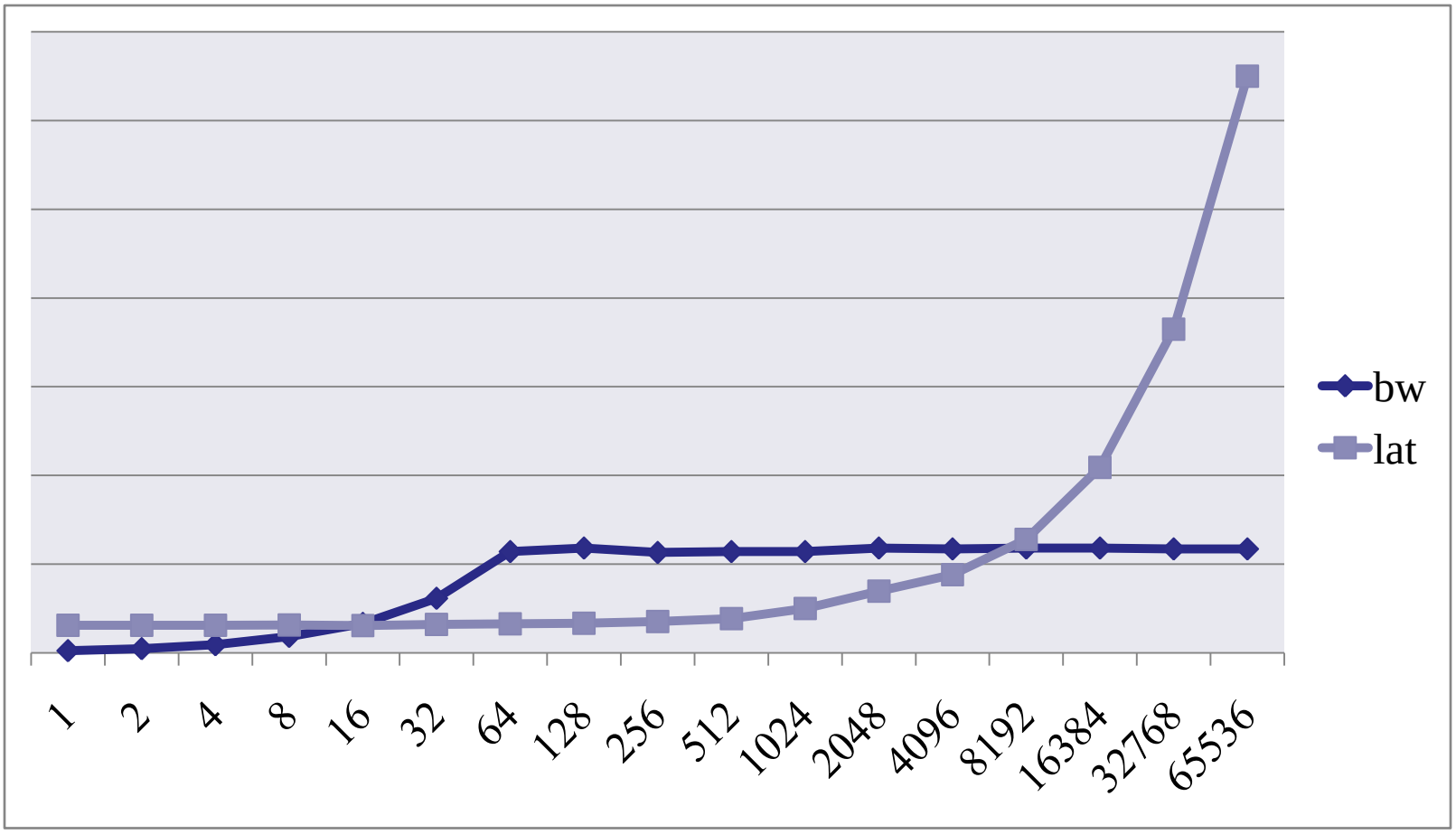
千兆网卡性能表现



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网卡选择

- 网卡Bonding
  - 更大吞吐量
- 万兆网卡
  - 百万以上PPS
  - CPU负担更小
  - 更小延时

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提问时间

谢谢大家！