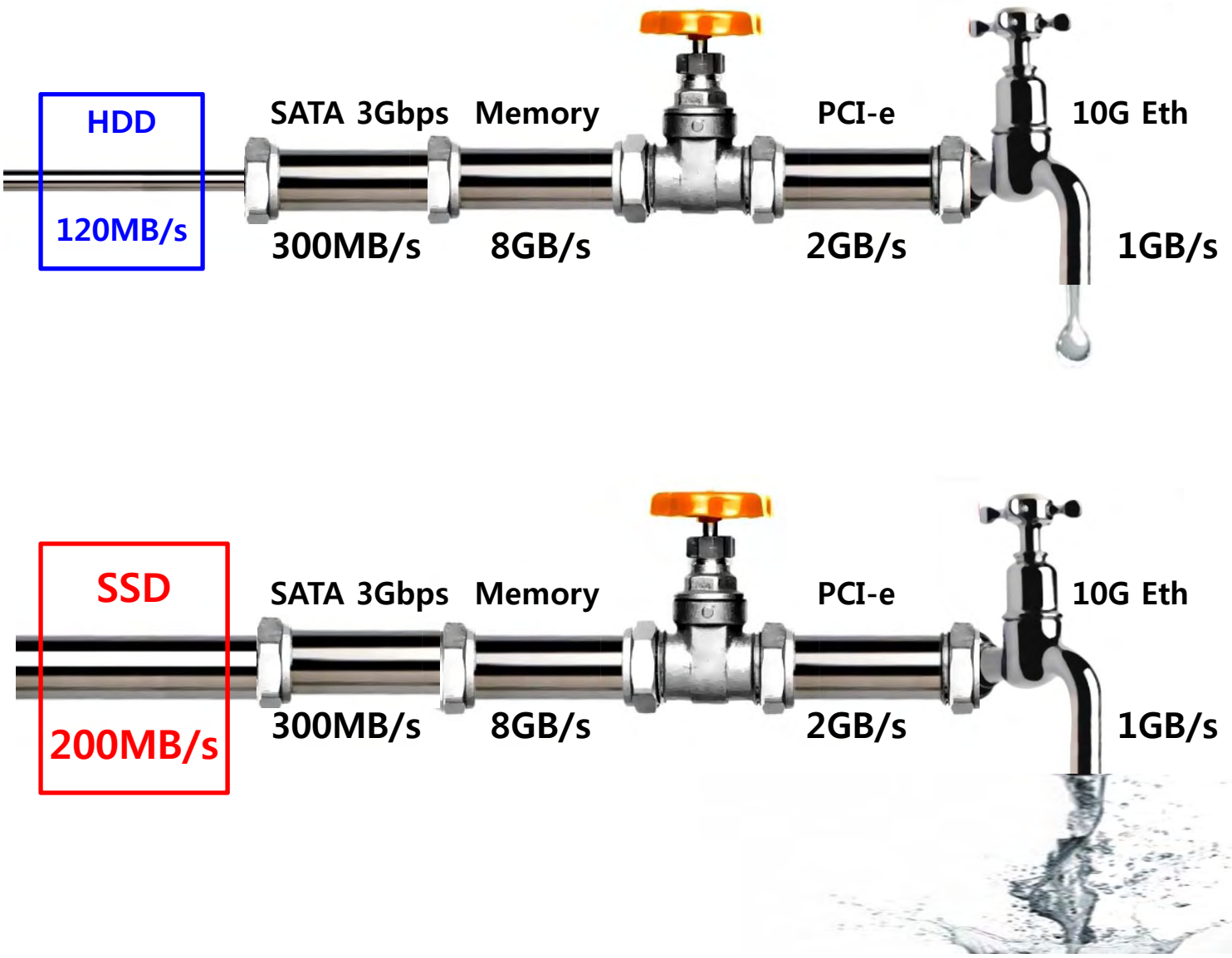
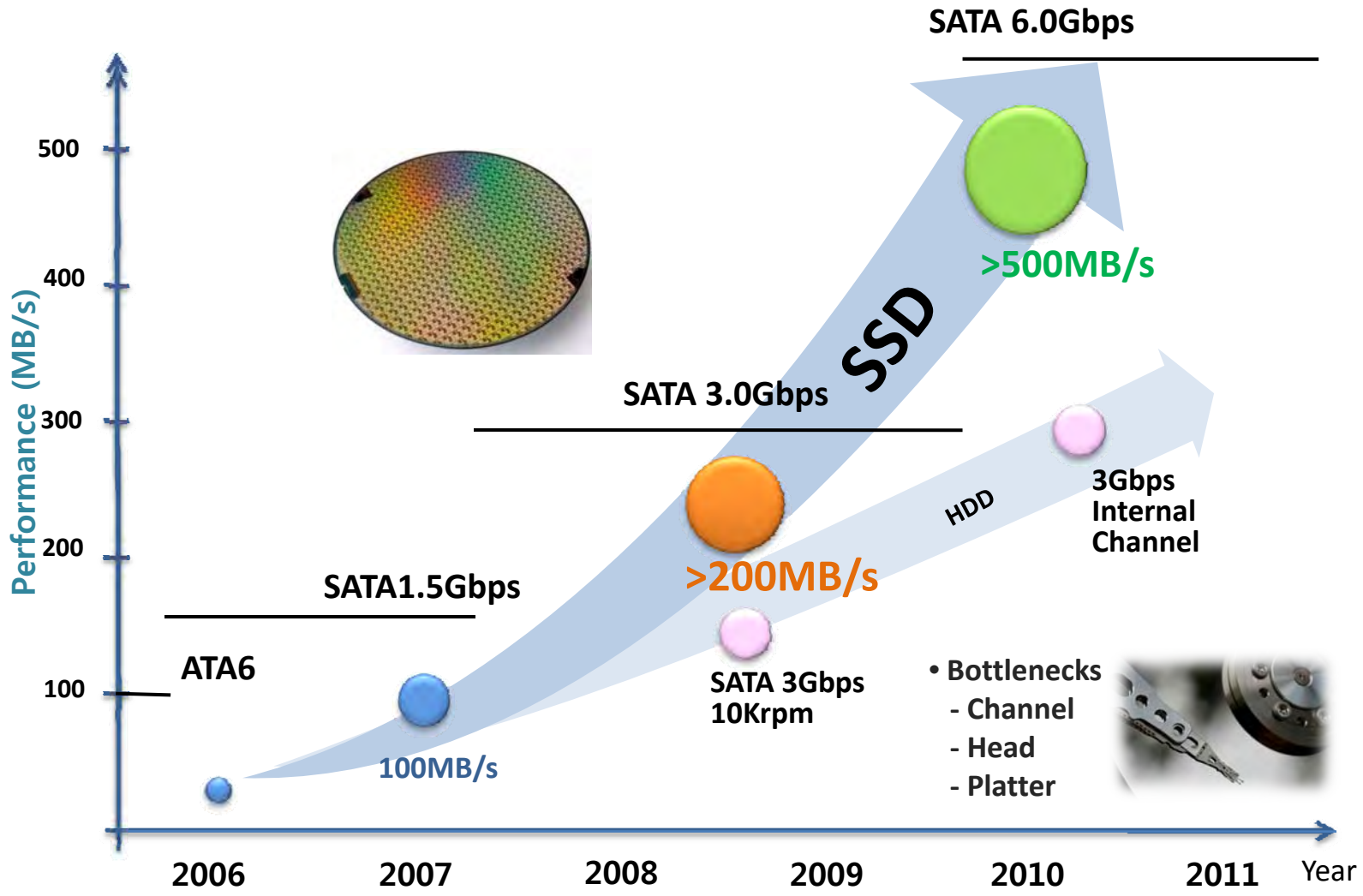
High Performance SSD & Benefit for Server Application

AUG 12th, 2008

Tony Park
Marketing
INDILINX Co., Ltd.


HDD
120MB/s
SATA 3Gbps
300MB/s
Memory
8GB/s
PCI-e
2GB/s
10G Eth
1GB/s
SSD
200MB/s
SATA 3Gbps
300MB/s
Memory
8GB/s
PCI-e
2GB/s
10G Eth
1GB/s

Only SSD is the Solution!



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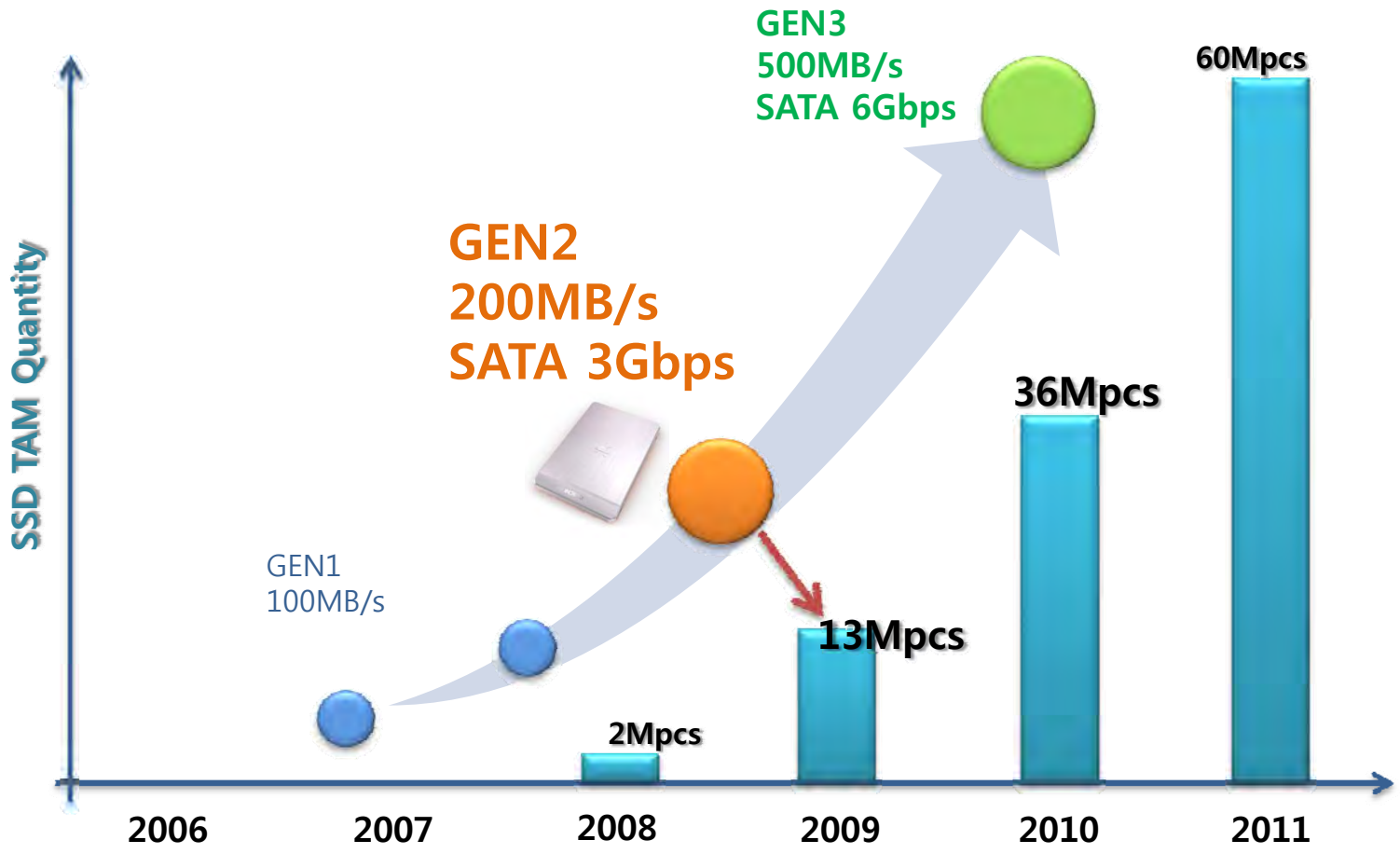
CY2009 SSD



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What is GEN2 SSD?

MUSTHAVES :

- Native SATA 3Gbps and Backward Compatibility
- Buffer/Cache Memory
- 200MB/s and up to 300MB/s Throughput
- Steady Performance under Fragmentation
- SLC/MLC Support
- More than 12bit/sector ECC
- 256GB and More Capacity
- Enhanced Power Management

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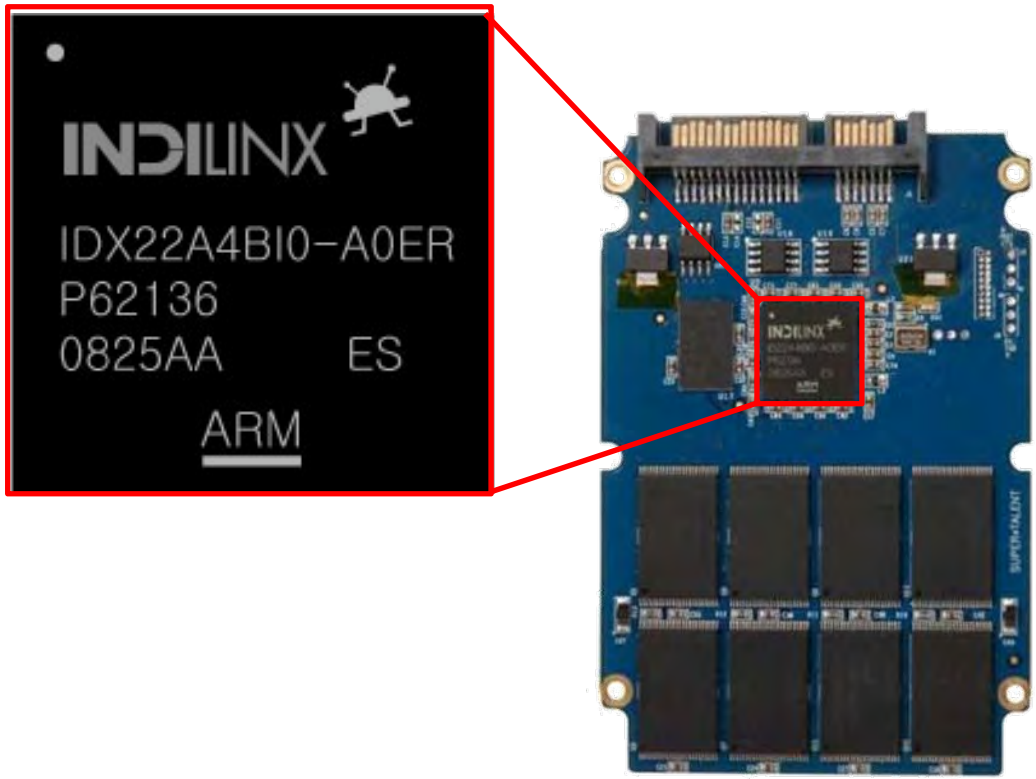
INDILINX GEN2 SSD Solution : Barefoot



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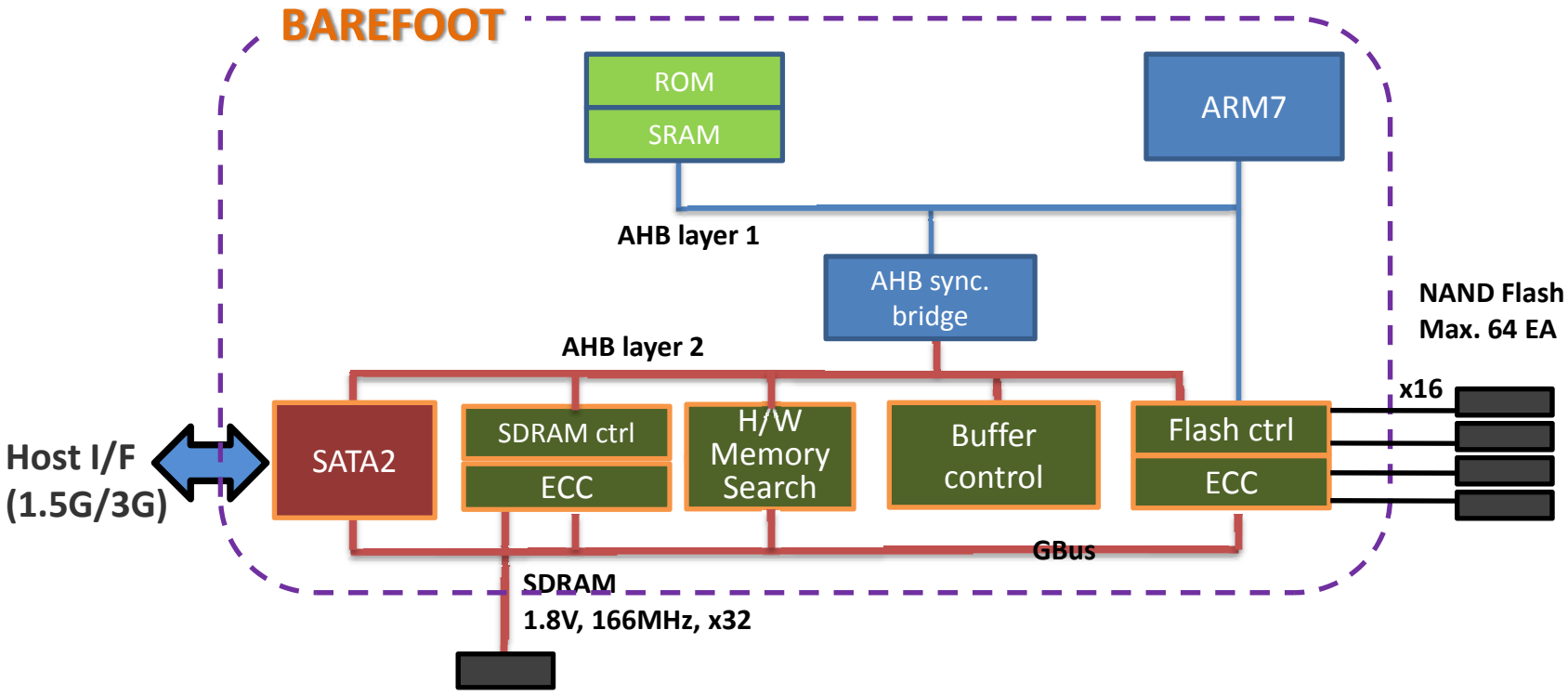
Barefoot Architecture

- Embedded ARM7TDMI and Native SATA 3Gbp/s in Single chip controller
- 16~64MB LP SDRAM for buffer memory
- Independent 4Channel (x16), 4way interleaving NAND I/F
- H/W memory search engine and the introduced high bandwidth AHB bus



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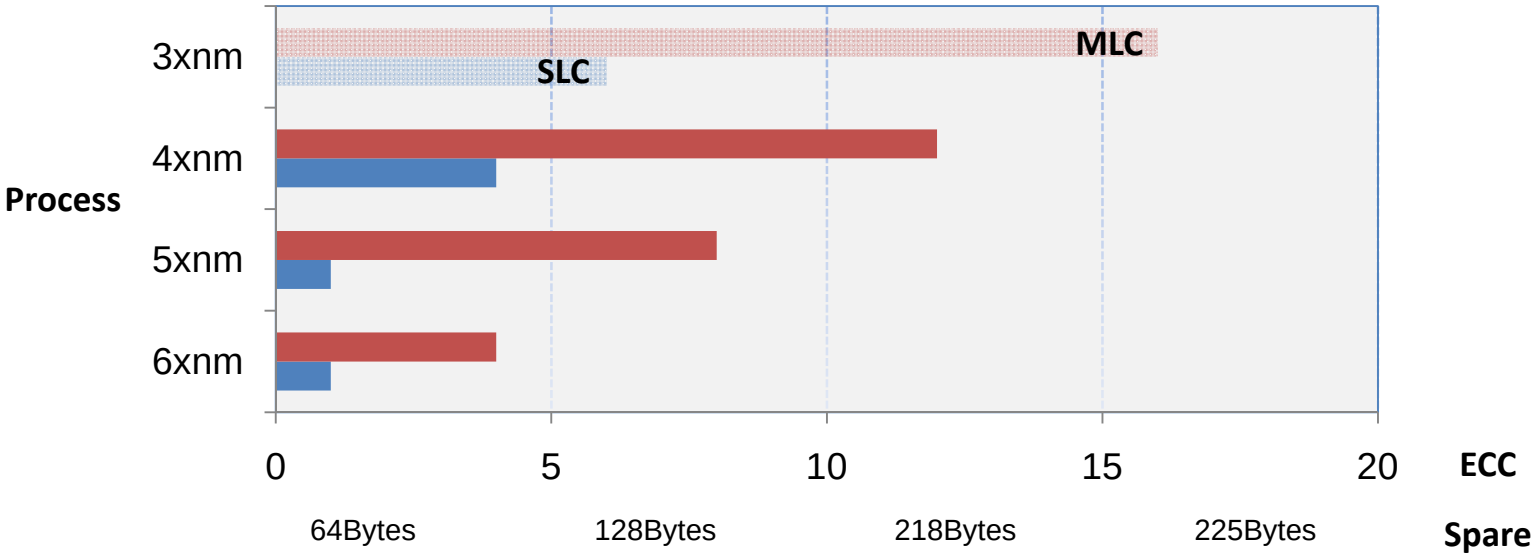
Error Correction Capability

- Flash Memory
  - RS 6, 12bytes/sector Error Correction
  - BCH 8, 12, 16bits/sector Error Correction



- SDRAM : 1Byte/64Bytes Error Correction

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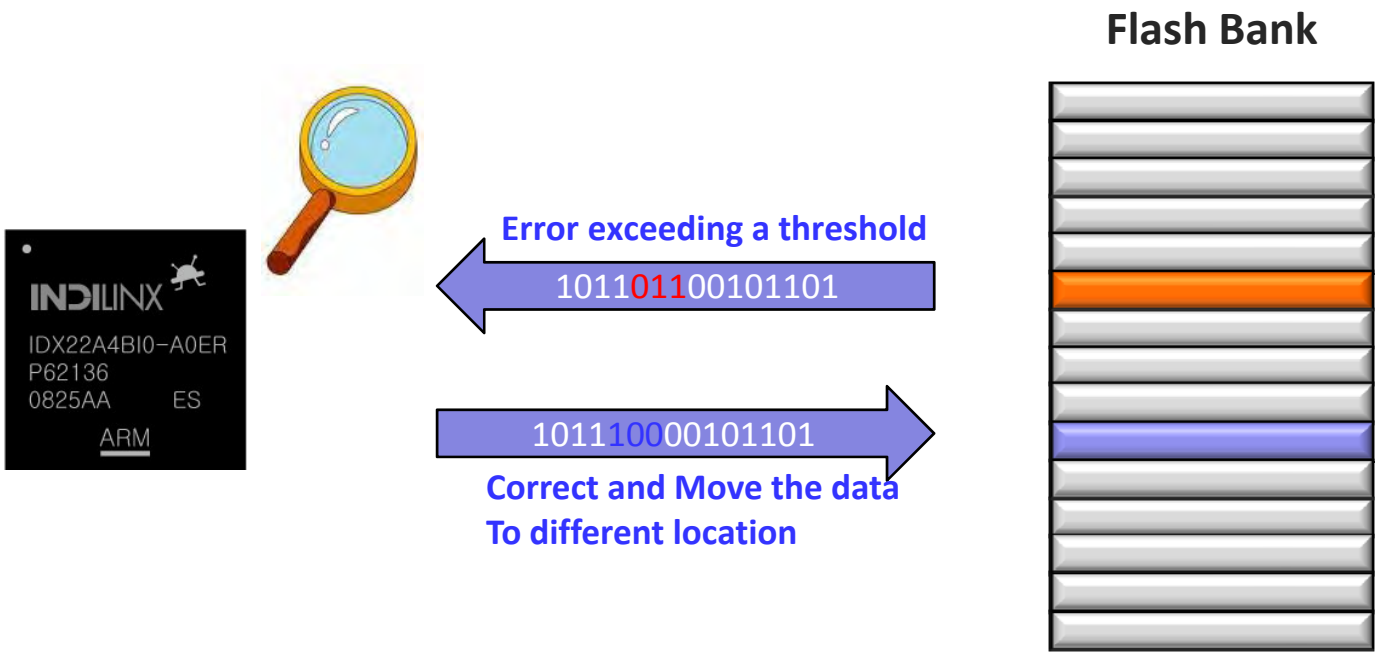
Bit Error Monitoring and Management

- MLC Flash has higher error rates by program/read disturbance
- Barefoot monitors a bit error level and move the read data to different location if the bit error rate exceeds certain threshold value to prevent the read fail from program and read disturbance



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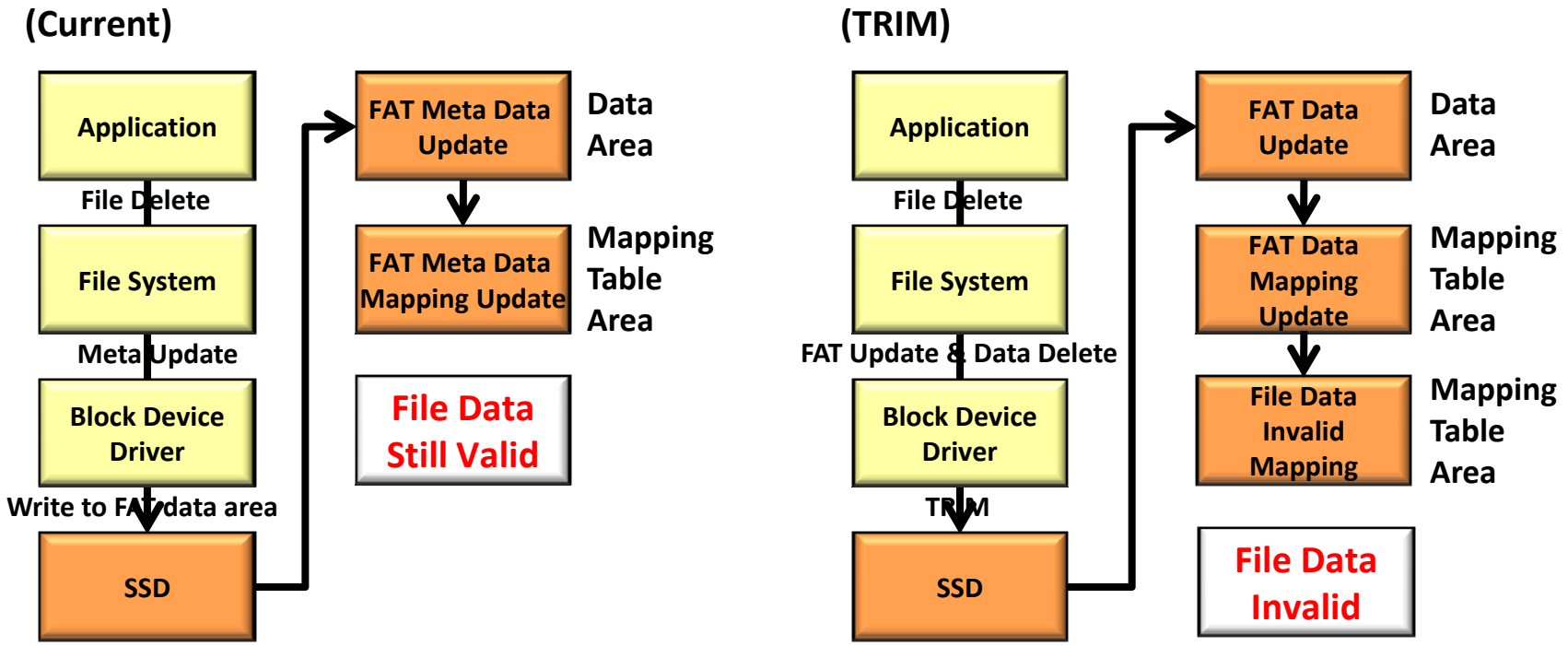
TRIM Command

- Resolves the mismatch between File System and FTL in SSD
- Enhanced performance and increased life time
- TRIM is proposed to T13 and planned to be a standard in next ATA spec.
- INDILINX has already developed TRIM solution for Linux



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Test Cases

- Iometer on PC
- On-line Transaction Processing
- Streaming Server

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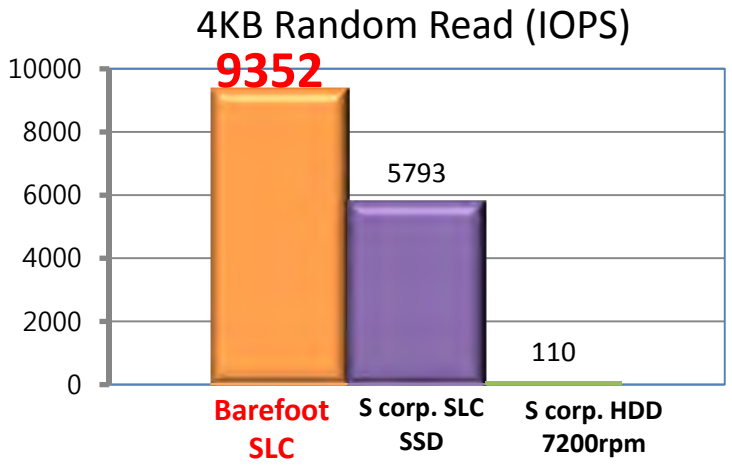
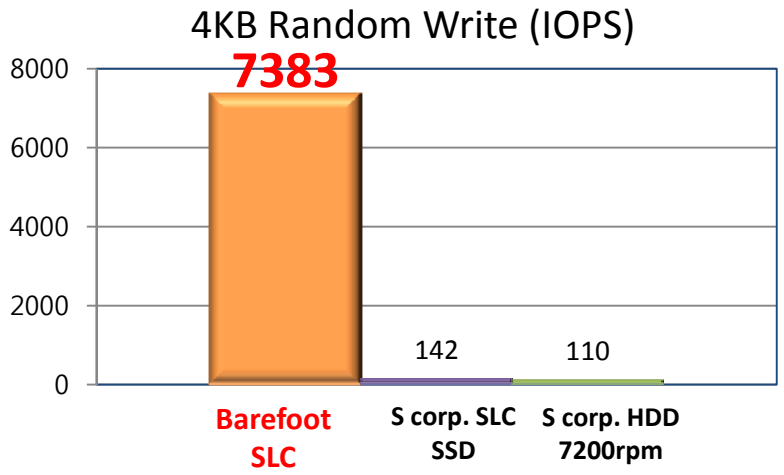
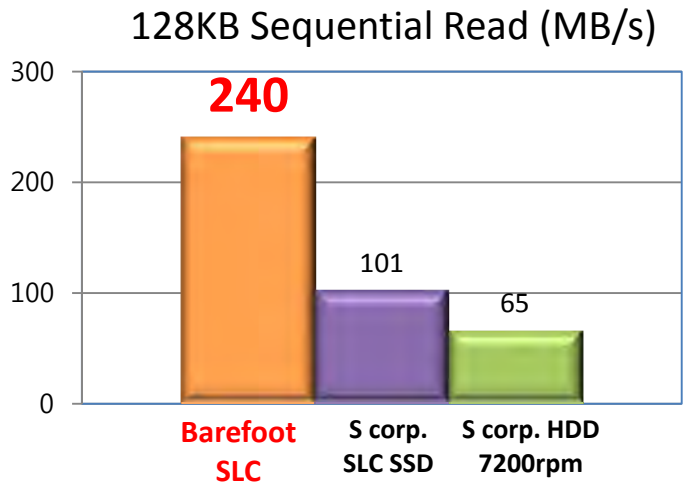
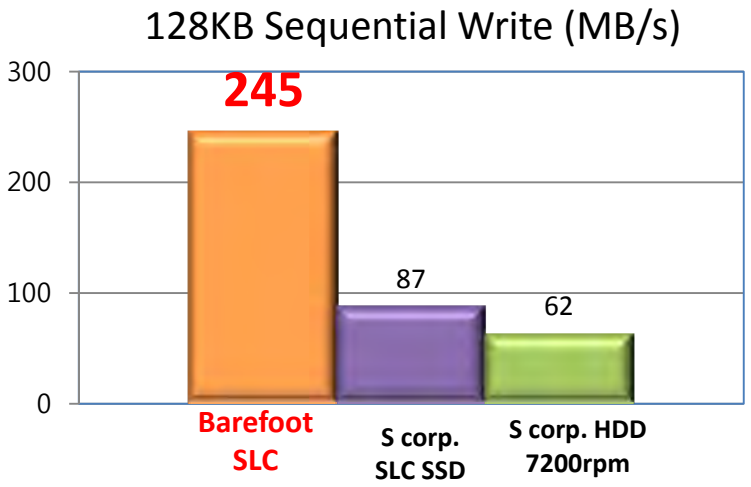
Iometer Test Results - SLC

Same Price, Much Better Performance









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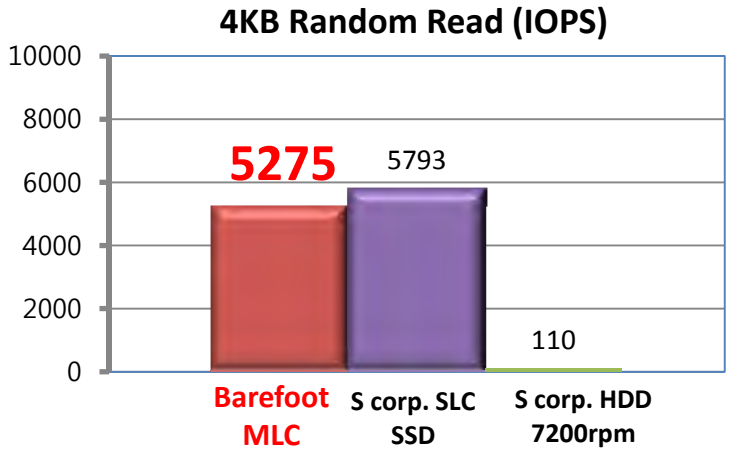
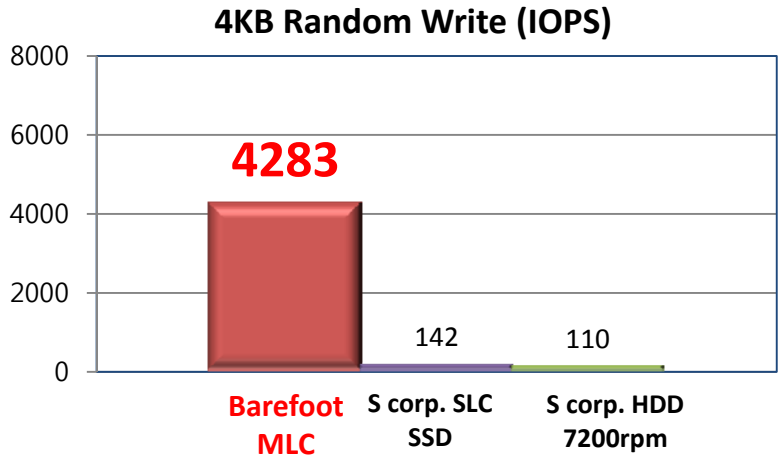
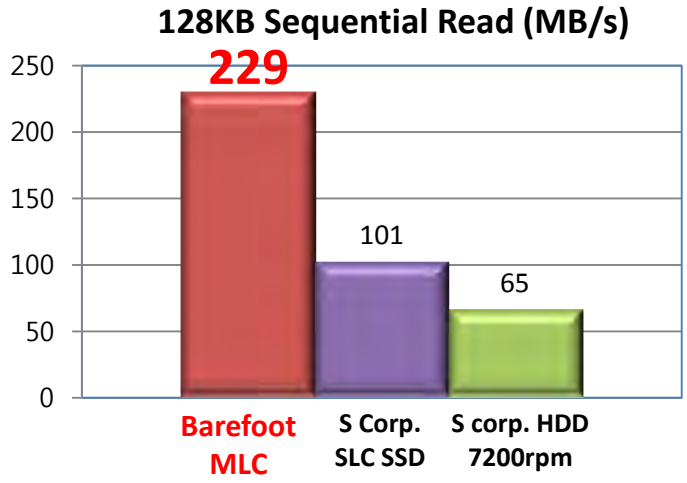
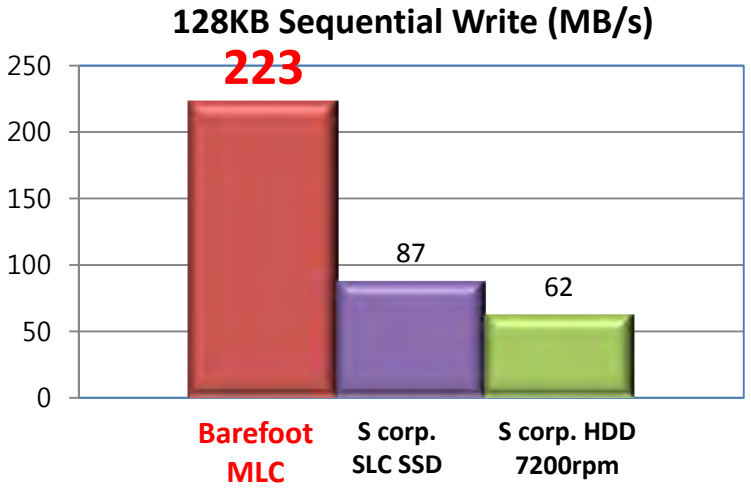
Less Money, Better Performance

MLC









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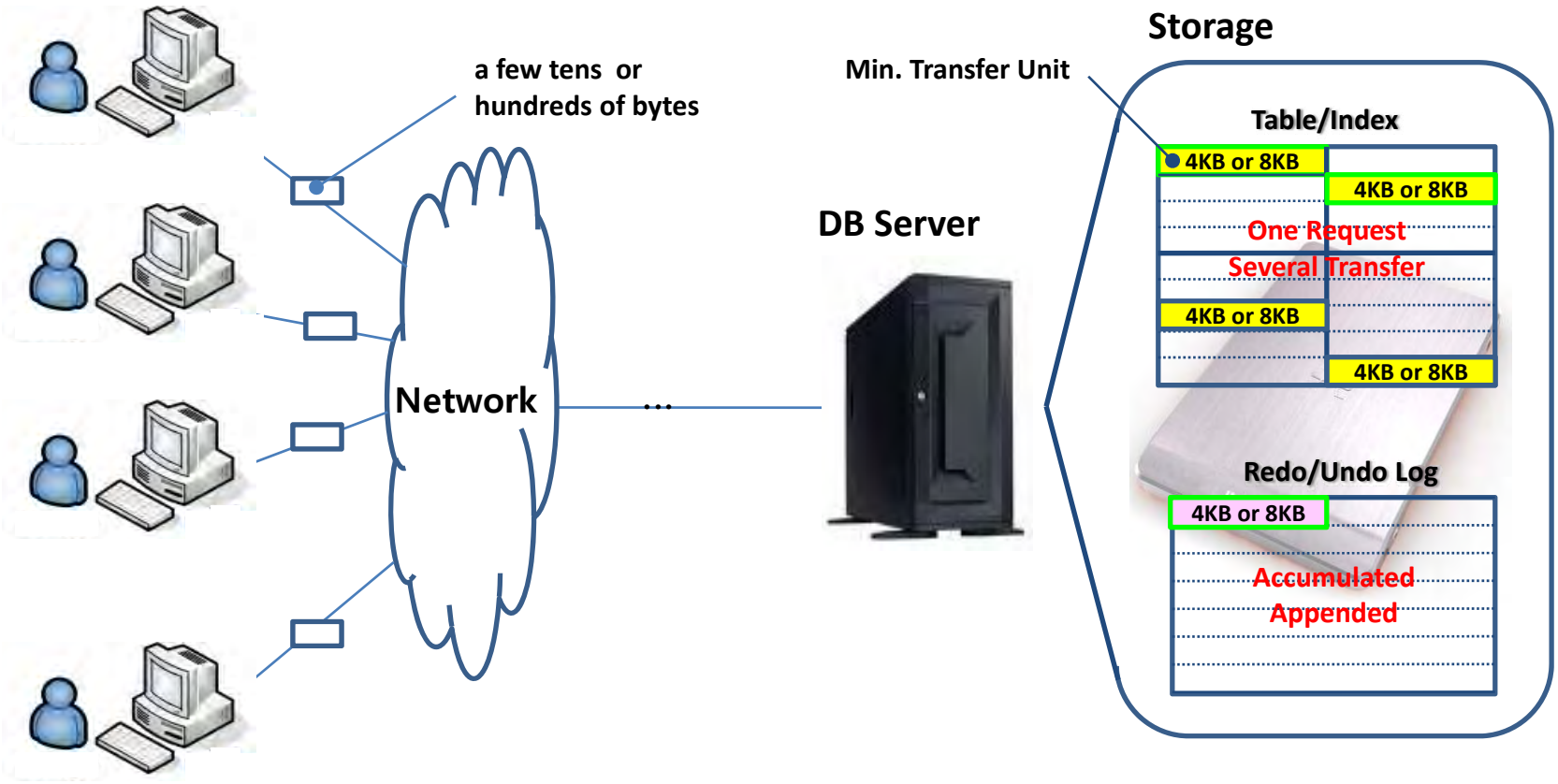
OLTP I/O Characteristics

- OLTP I/O characteristic is 4K or 8KB size random transfer
- 4KB or 8KB transfer size is matched with NAND Flash page size



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TPC-C Benchmark Test Environment

- Server
  - OS : Redhat Enterprise Linux 5.0
  - Board : Intel S5000PAL
  - CPU : Xeon 3.0GHz x 4
  - Memory : 2GB
- Client
  - OS : Windows Server 2003 R2
  - Board : Tyan thunder s2915
  - CPU : Dual core AMD Opteron 2.4 GHz
  - Memory : 2GB
- RAID Controller
  - Intel RAID Controller SRCSASJV
  - RAID Level : RAID0, 2 Disks
  - Stripe Size : 256KB
- Oracle Enterprise 11g
  - Data & index size : 15GB
  - Buffer cache : 300MB
- Benchmark Factory 5.5
  - Scale factor : 150
  - Latency : no delay

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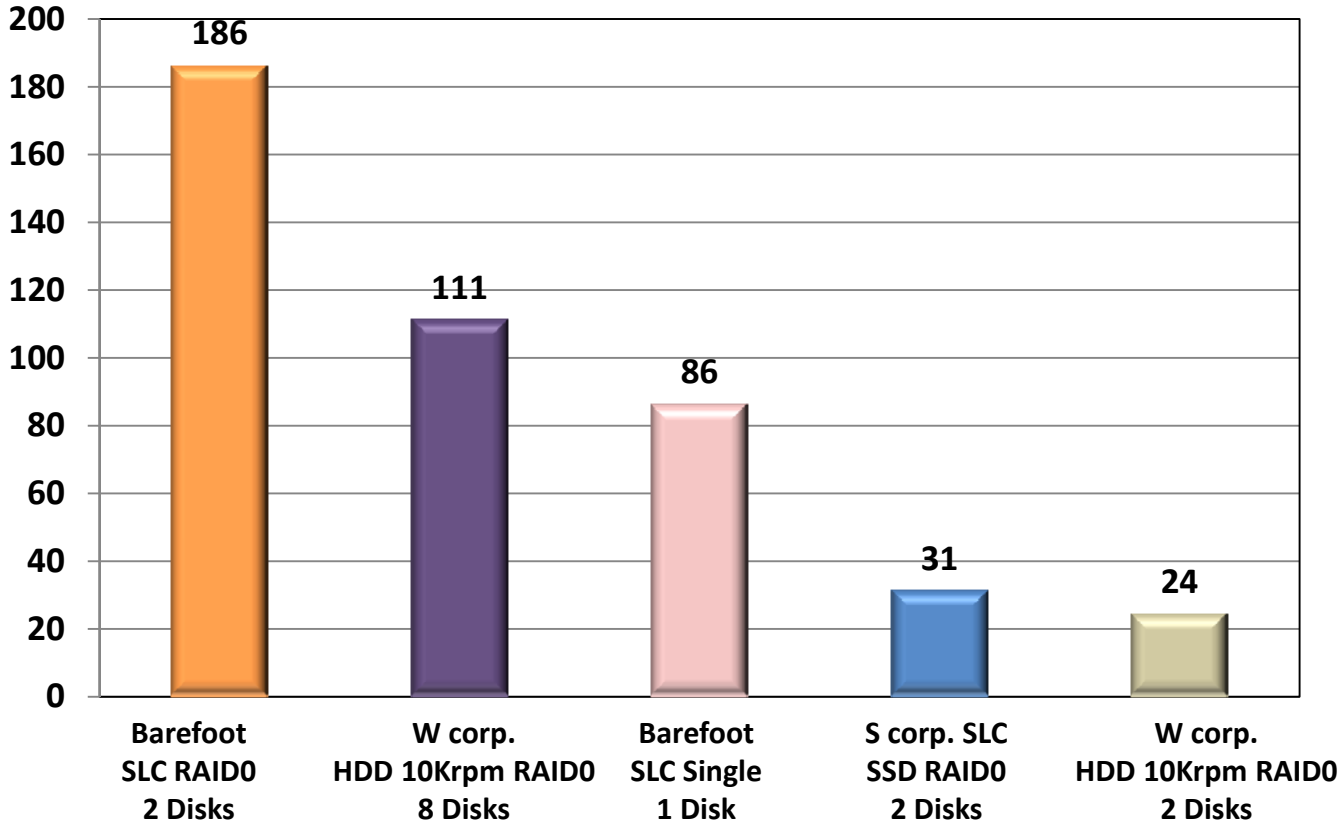
TPC-C Mixed Query Result

- Barefoot performs 8 times more transaction than HDD in OLTP application
- Barefoot 2 disks is better than HDD 8 disks
- Barefoot, even single device performance is almost similar to HDD 8 disks



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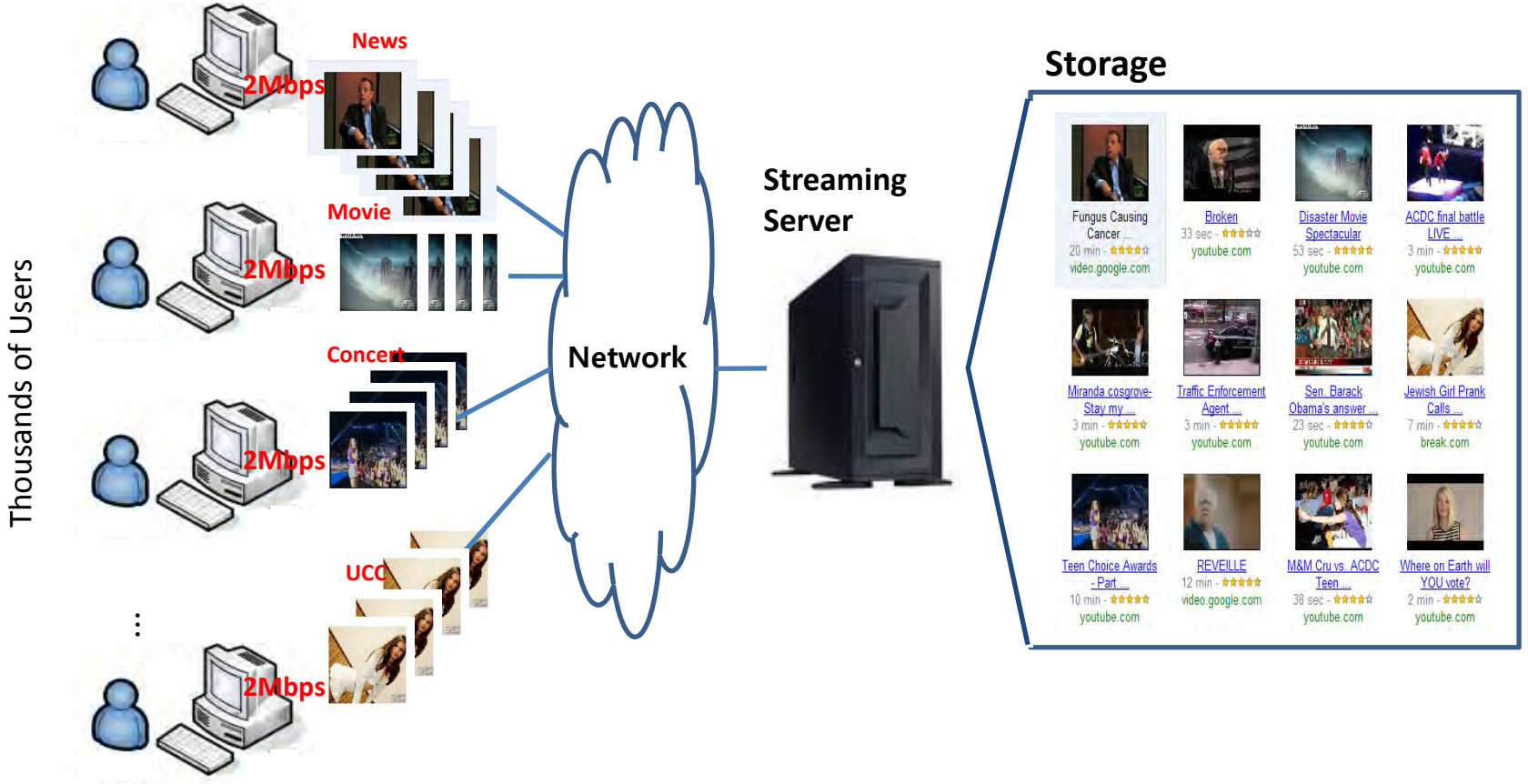
Streaming Server I/O Characteristics

- Streaming Service like IPTV uses Large (256KB~1MB) Size Random Read Pattern
- Number of simultaneous accesses is most important



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Streaming Server I/O Simulation Environment

- Server and Client
  - OS : Windows 2003 R2 Standard x64 Edition
  - CPU : Xeon 5160 3.0GHz dual core * 2
  - Memory : 8GB
- Connection Type
  - Contents : H.264 2Mbps encoding
  - All connection read different files (worst case)
- RAID Controller
  - Intel RAID Controller SRCSASJV
  - RAID Level : Raid0, 8 Disks
  - Stripe Size : 256KB
- Streaming Server Solution
  - INDILINX Proprietary Solution
- Client Load Generator
  - Proprietary Solution
  - Over 5000 User Load generation in a server

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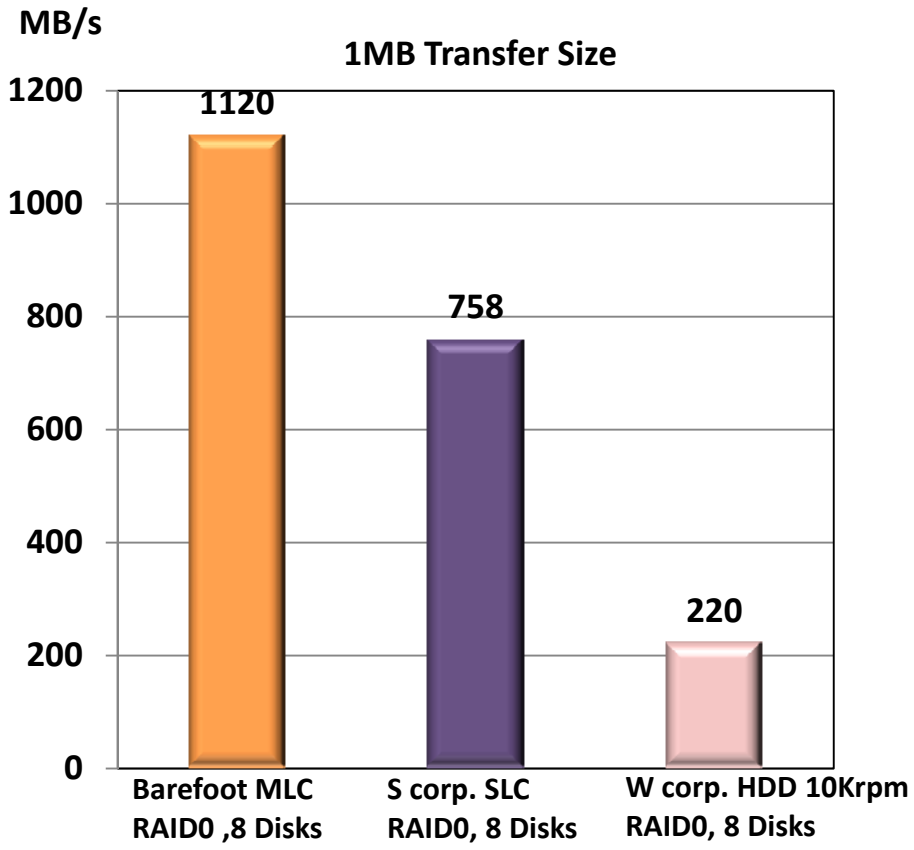
Streaming Server Simulation Result

- SSD streaming server even with MLC exceeds 10Gbps bandwidth
- SSD adoption can reduce the number of severs up to 80%



Barefoot MLC
4480 users / server

S corp. SLC SSD
3032users / server

W corp. HDD 10Krpm
880users / server

(2Mbps/user)

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Summary

- High Performance GEN2 SSD
  - Over 200MB/s throughput
  - High random IOPS
- SSD dramatically improves OLTP performance
- Even GEN2 MLC SSD is sufficient for 10G streaming server

Call to Action

- Standardization : Performance Classification
- Collaboration for GEN3 SSD

- tonypark@indilinx.com


With INDILINX
Enjoy GEN2 SSD Speed!

Thank You!