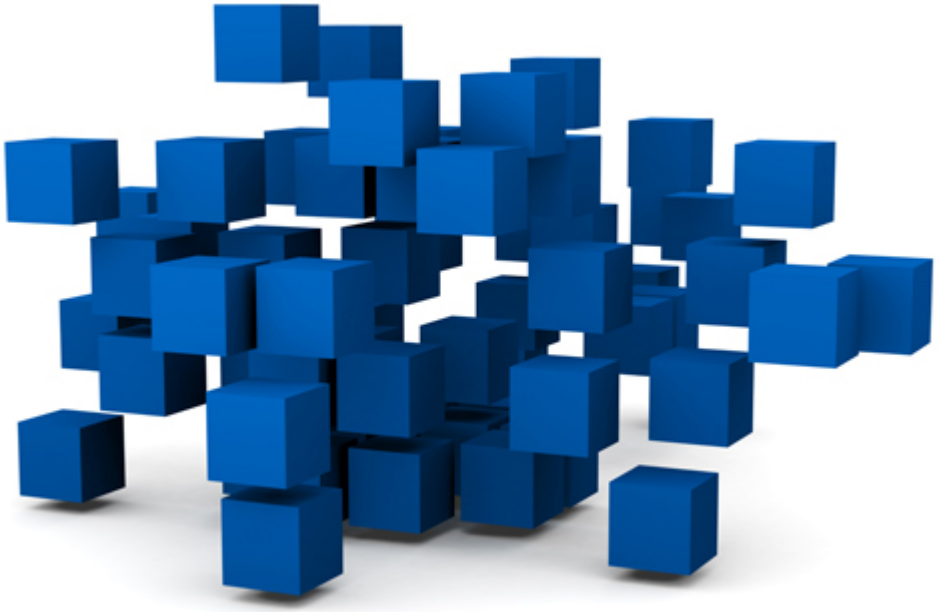
INTERNATIONAL
SUPERCOMPUTING CONFERENCE

HMK

High Performance Computing meets High Performance Storage



Member of SNIA Europe

Hamburg, 21. June 2011
Dr. Klaus Heihoff

HMK Agenda

Storage!

- HMK & Enterprise Storage
- Storage Performance
  - SSD
- Storage Capacity
  - MAID
- Storage Availability
  - Filesystems & Archiving

HMK Mission

Designer for Architectures

- HMK deliveres more cost effective Storage Solutions.
- Our customers save 30-50% of their costs with our solutions
- Innovative Technologies
  - Allow better efficiency and
  - Reduce costs even at growing data volumes
  - Fit in all open systems environements.

HMK Storage Customers

ADAC

Amway

Atos Origin

Audi

BITMARCK®

BMW

BOEING

CSCS
Swiss National Supercomputing Centre

DATEV

Deutsche Telekom

DLR

ETH
Eidgenössische Technische Hochschule Zürich
Swiss Federal Institute of Technology Zurich

EUMETSAT

FMI
Friedrich Miescher Institute for Biomedical Research
Part of the Novartis Research Foundation

gamigo

GBV VZG

GWDG

HELLA

HELMHOLTZ ZENTRUM BERLIN
für Materialien und Energie

JUNGHEINRICH

KDV

KLASSIK STIFTUNG WEIMAR

MAX-PLANCK-GESELLSCHAFT

MVV Energie

Nokia Siemens Networks

Polizei
Sachsen - Anhalt

PAUL SCHERRER INSTITUT
PSI

RRZN

RTL

sonopress
arvato

Universitätsklinikum Erlangen

Universität Jena

OTTO-VON-GUERICKE
UNIVERSITÄT
MAGDEBURG

VOLKSWAGEN BANK
GMBH

ZDF

HMK Focus Today

SSD

- Fastest storage at lowest costs
- Texas Memory Systems

MAID

- Highest capacity on smallest footprint at lowest energy consumption
- Nexsan

Fileservices & Archiving

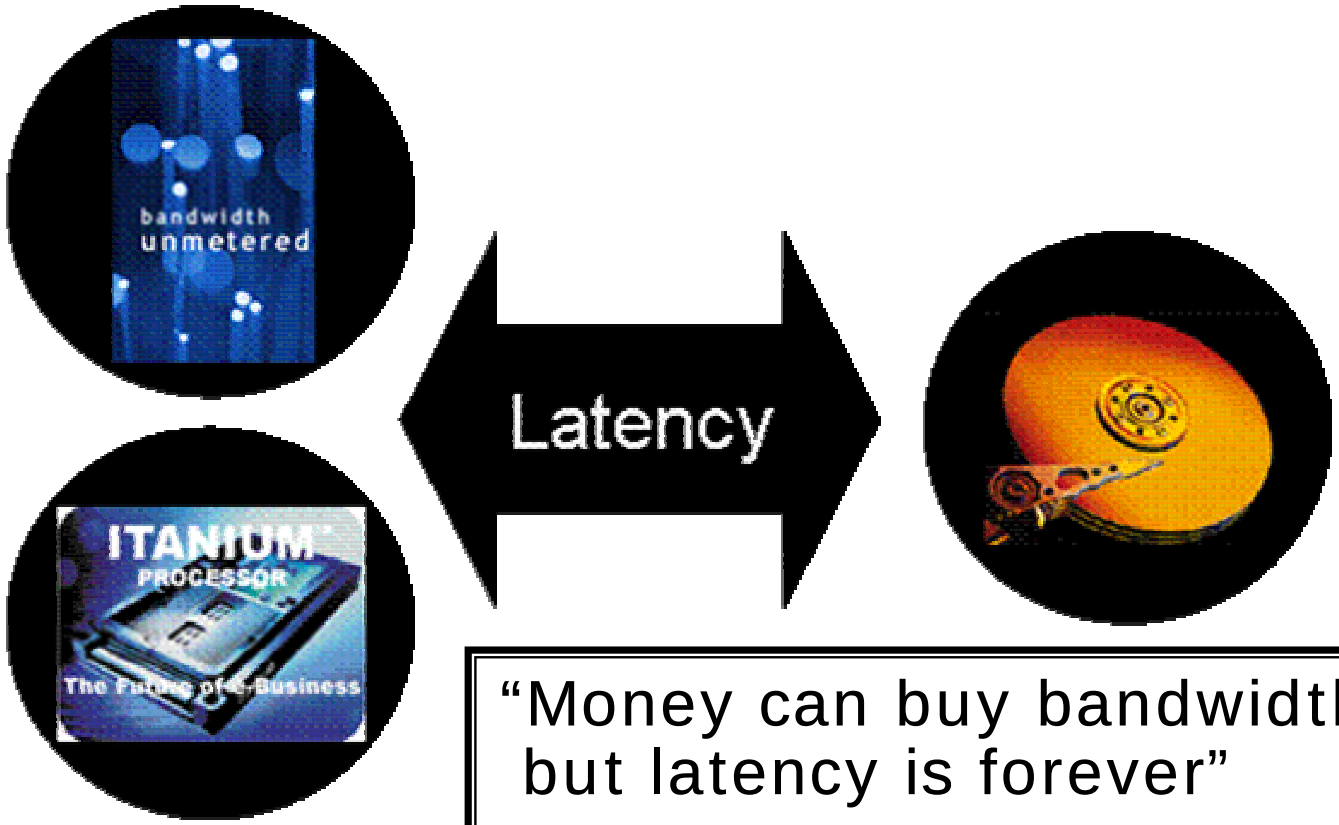
- IBM GPFS + TSM (on IBM booth)
- Quantum StorNext
- Oracle Sun SAM-QFS

- Convey Hybrid Core Computing on booth

HMK Agenda

- HMK & Enterprise Storage
- Storage Performance
  - SSD
- Storage Capacity
  - MAID
- Storage Availability
  - Filesystems & Archiving

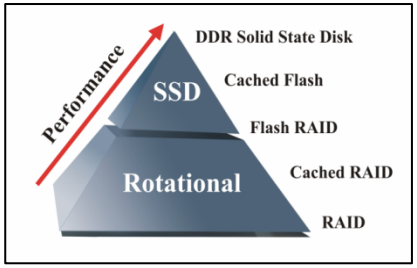
HMK Why SSD: The Latency Problem

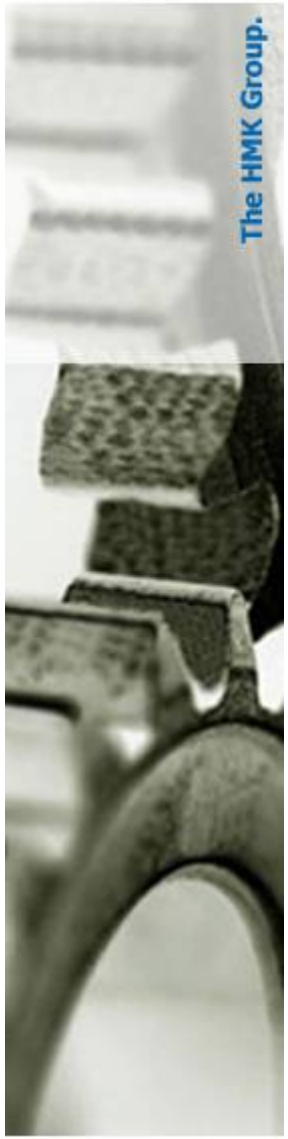


"Money can buy bandwidth, but latency is forever"

John R. Mashey, Chief Scientist SGI,
"Big Data and the Next Wave of InfraStress", USENIX, 1999

Overview SSD Technologies

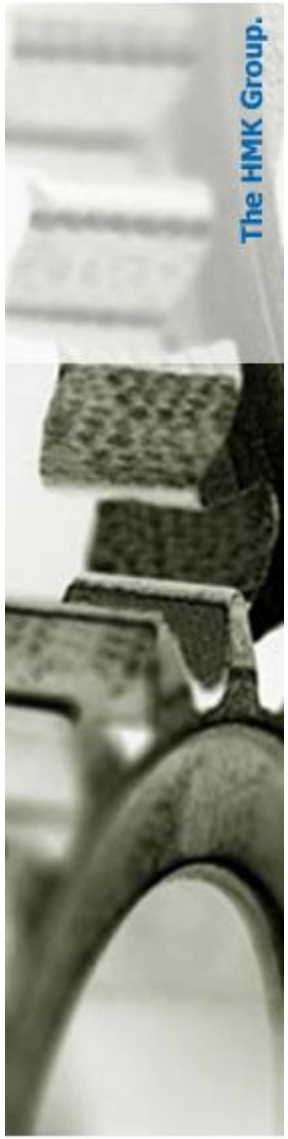




- **RAM-based SSDs**
  - Highest performance & speed-up
  - Extremly high IOPS
  - Extremly low Latency
  - Backup by flash SSDs or SATA-drives & batteries

- **Flash-based SSDs**
  - Flash with high density
  - Lowest energy requirements
  - Faster than RAID-Systeme, but slower than RAM-SSDs
  - Good for high read requirements & lower write requirements

SSD Architectures



a) Integrated Solutions

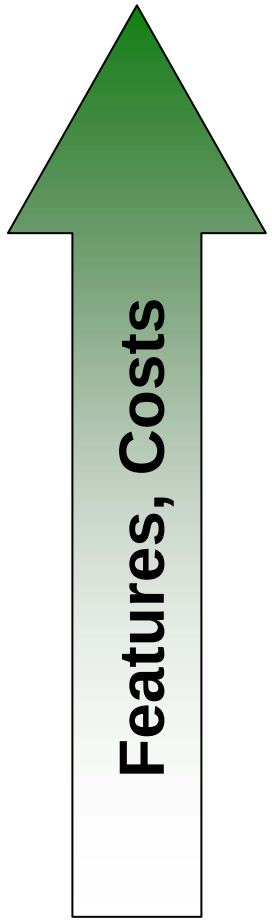
- RAM (Storage cache, server cache)
- Flash as cache

b) SAN Attached

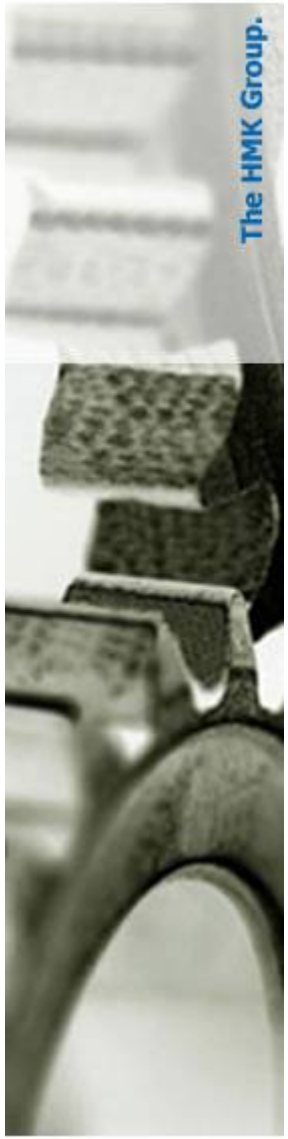
- RAM-based SSDs
- Flash-based SSDs

c) Direct Attached / PCI

- RAM-based
- Flash-based

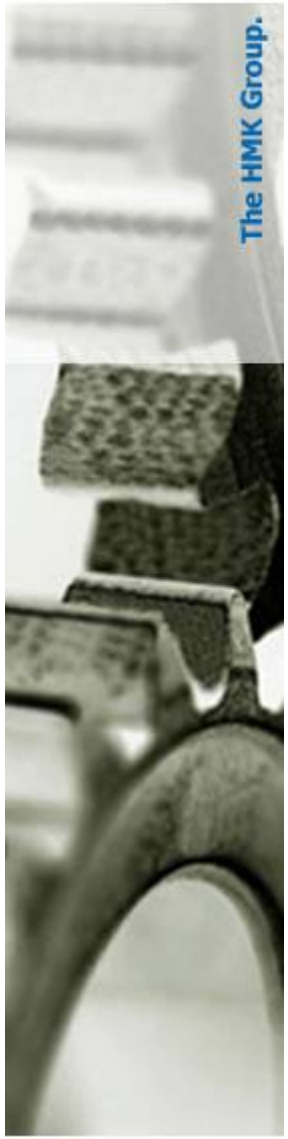


HMK a) Integrated Solutions



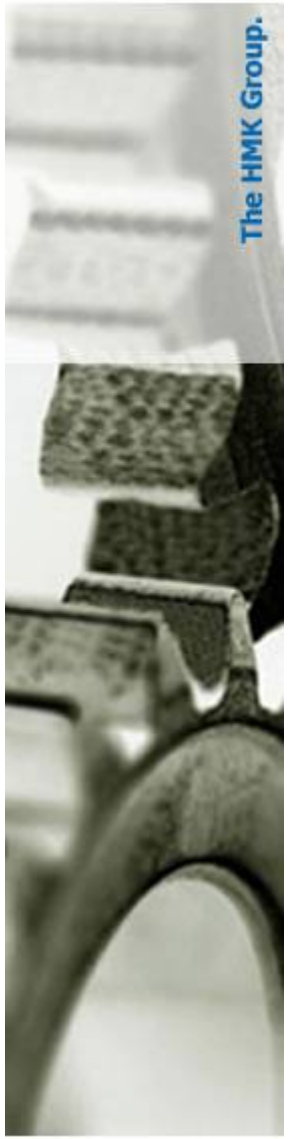
- **Pros**
  - Storage management functionalities
    - Mirroring
    - Replication
    - Dedup etc.
- **Cons**
  - Slowest usage for SSDs
    - Increased latencies
  - High costs byadditional controllers
  - Limited scalability
- **Usage**
  - Applications with high IOPS per GB requirements

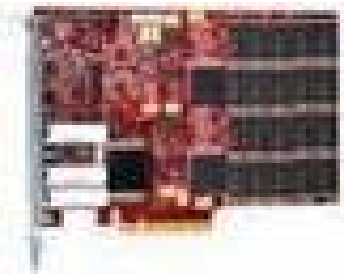
HMK b) SAN Attached



- **Pros**
  - Lowest latencies
  - Extreme scalability
  - Integrated monitoring, alarming, backup
  - Completely redundant
- **Cons**
  - Small management functionalities
  - High costs per GB
- **Usage**
  - Speed-up of point applications
  - Database speed-up
  - Large SSD-only solutions

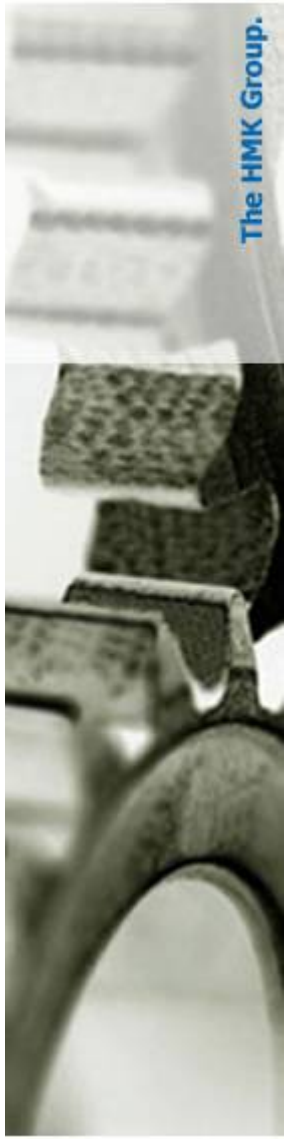
HMK c) Direct Attached / PCI

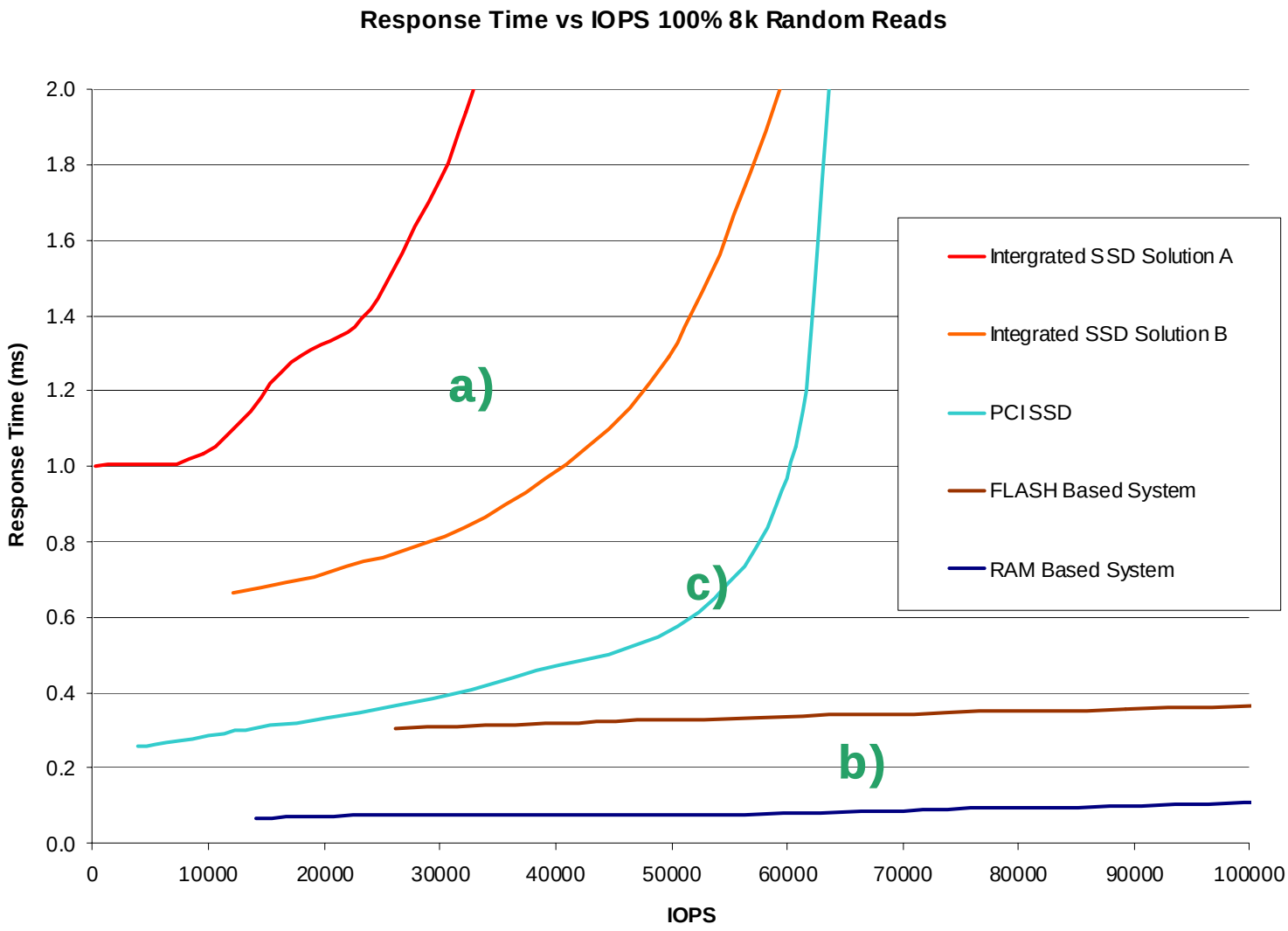




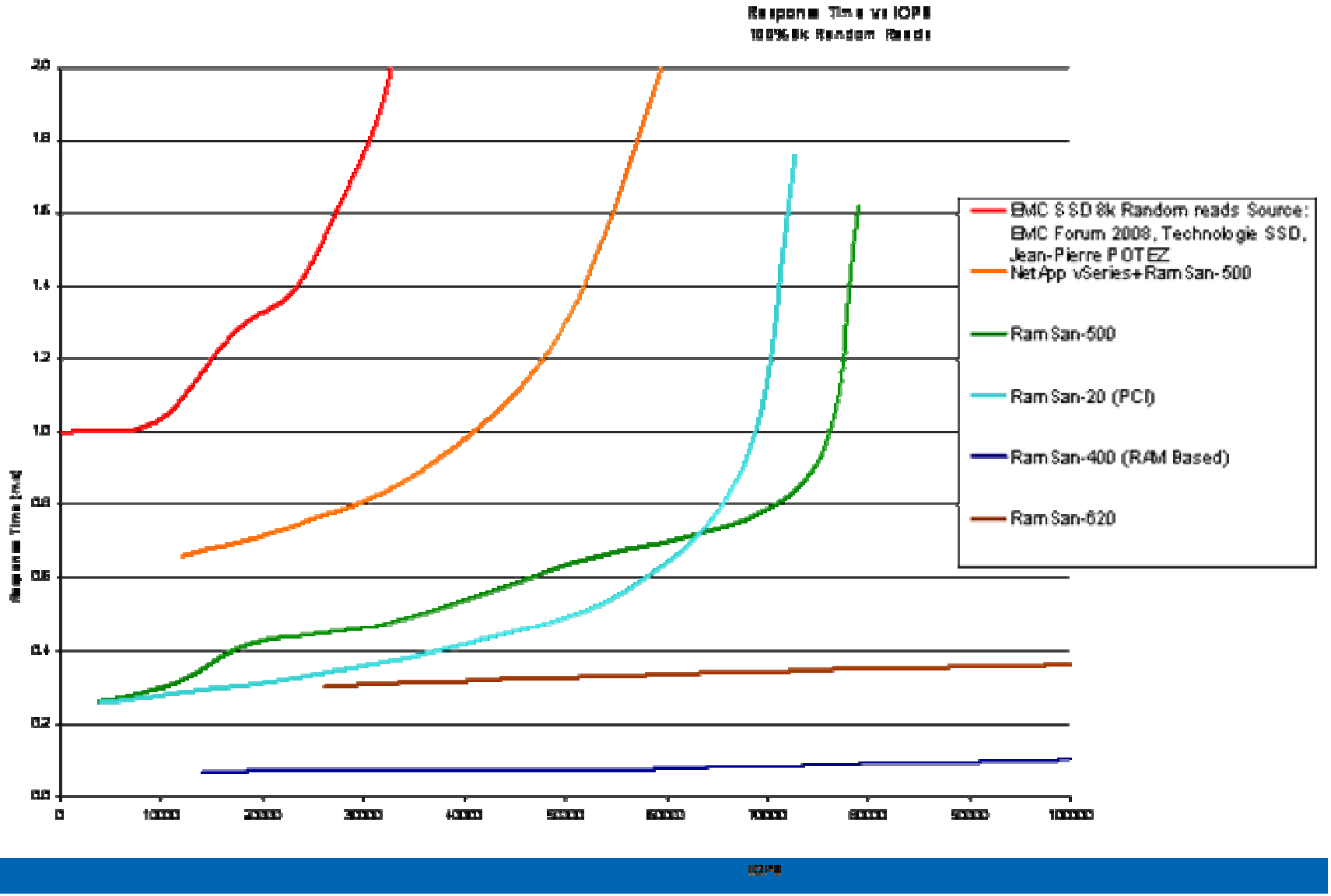
- **Pros**
  - Relatively cheap
  - No external connections necessary
  - Low space requirements
- **Cons**
  - Server bound
  - Fixed capacities
- **Usage**
  - Workstation environments
    - Scientific analysis
    - OLAP
  - High performante & dense locale storage clusters

Technology Comparison





HMK Response Time vs IOPS



Texas Memory RAM-SAN Portfolio

The HMK Group.

SYSTEMS

b)

RamSan-440

RAM-Based
SAN Attached
0.015 ms Latency

- 128-512 GB RAM
- 4Gb FC
- 600.000 IOs
- 4,5 GB/s Bandwidth

b)

RamSan 710

b)

RamSan 630

FLASH-Based
SAN Attached
0.035- 0.175 ms Latency

- 1-10 TB Flash
- 8 Gb FC or QDR Infiniband
- 500.000 IOs
- 8 GB/s Bandwidth

PCI

c)

RamSan 70

FLASH-Based
Direct Attached
0.045-0.170 ms Latency

- 450 / 900 GB net
- PCIe Card
- 160-330 kIOs
- 1.4-2 GB/s Bandwidth

HMK Agenda

- HMK & Enterprise Storage
- Storage Performance
  - SSD
- Storage Capacity
  - MAID
- Storage Availability
  - Filesystems & Archiving

HMK Why MAID ?

- High Availability = High Costs ?
  - No fast access to archives ?
  - Always too slow ?
- MAID: SATA Disks in idle mode
  - Combination of advantages from
    - disk (performance, access) and
    - tape (scalability, floor space, costs)
  - Higher SATA disk lifetime, less support costs

Highest Capacity on lowest Footprint with lowest Energy Consumption !

HMK New Storage Tier

Disk
- Performance
- Availability
- Data Protection
- Reliability

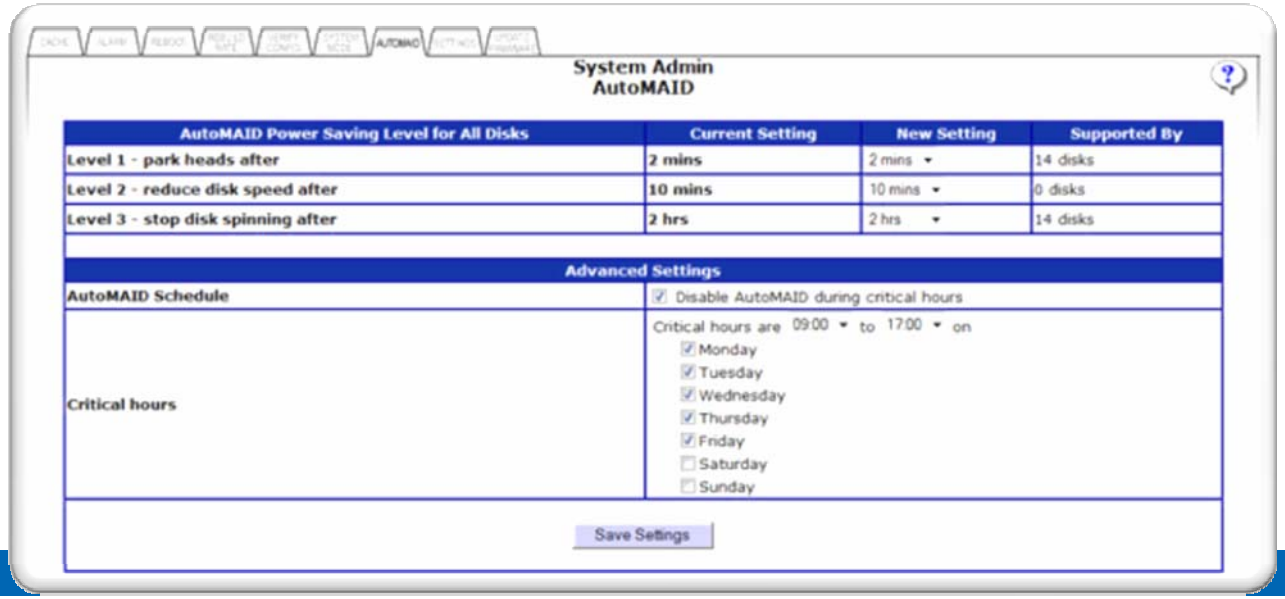
- Performance
- Availability
- Data Protection
- Reliability
- Scalability
- Footprint
- Affordability

Tape
- Scalability
- Footprint
- Affordability

Unlock the Value of your long-term Persistent Data !

3 MAID Levels for Energy Savings

- **Level 1: Heads Unloaded**
  - 20% savings vs. Idle without AutoMAID
  - Recovery time < 1 Sec
- **Level 2: Heads Unloaded, only 4000 RPM**
  - 40% savings
  - Recovery time < 15 Sec
- **Level 3: No Spinning (Sleep Mode; Power On)**
  - 60% savings
  - Recovery time < 30 Sec



HMK Nexsan AutoMAID™ Level 4

- New AutoMaild level 4 since 2011:
  - Disk Power off
  - Controller on
  - 80% savings (95% savings shutdown exp chassis)
  - Recovery time < 45 Sec
- Stores 360TB in 8U and needs 2-3 kW in idle, drops to 300-500W in AutoMaid level 4
- Do yo still need tape ? For all data ?

HMK Nexsan E60

- High Capacity and Dense RAID Storage System
- Provides 180TB of SATA Capacity in Only 4U
- New AutoMAID level 4 for extreme energy efficiency
  - RAID controllers and 60 bay chassis
  - 3 active capacity drawers
  - Dual power supplies
  - All cables and mounting kits
  - Management software

HMK Nexsan E60X

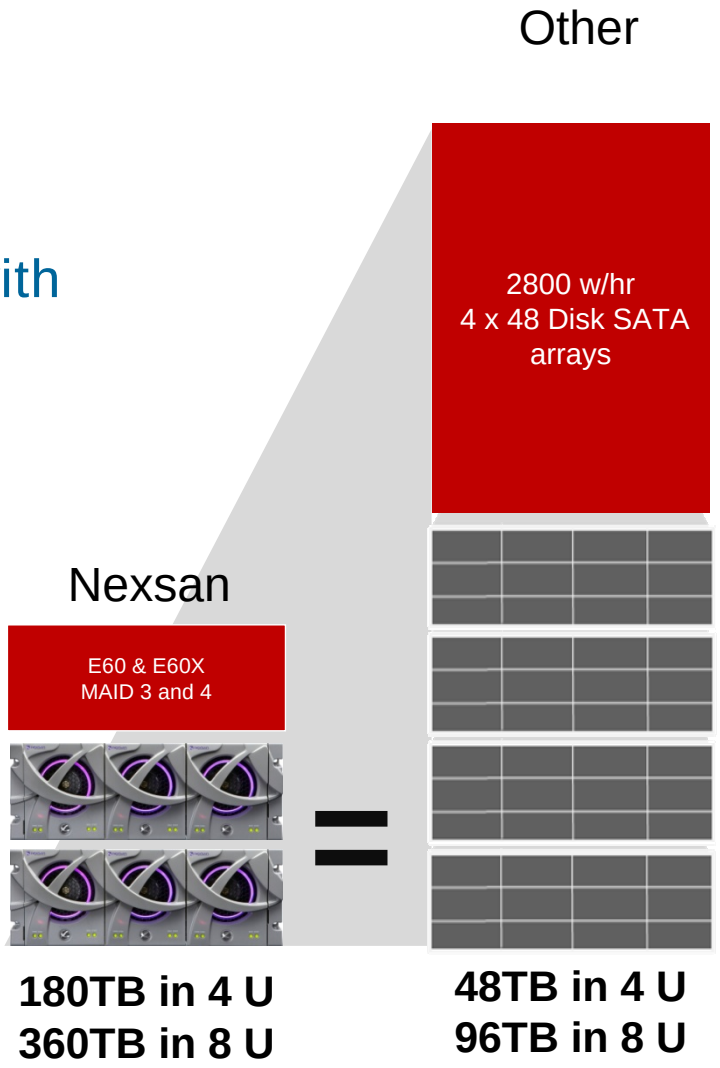
- 60 disk expansion chassis
- Designed for adding on to Beast 2 or E60
- Provides up to 360TB in a config with E60
- New AutoMAID level 4 for extreme energy efficiency

HMK NEW Bar for Storage Efficiency

360 TB in only **8U**

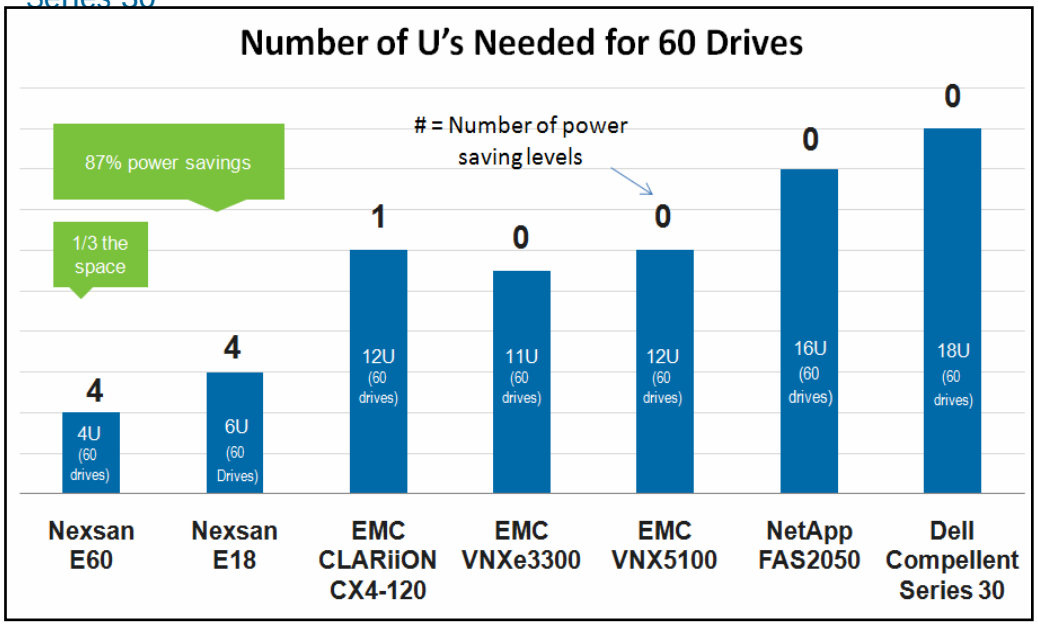
AutoMAID GREEN Energy Savings

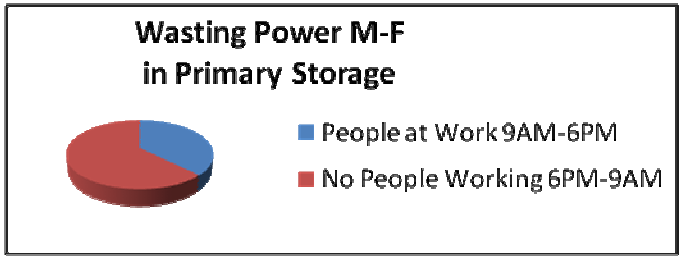
- Over **2x** more capacity per rack
- More **high performance** per U
- Nearly ¼ the energy and cooling costs with AutoMAID level 3 and 4
  - Supported on SAS and SATA disks
  - Three levels of energy savings
    - Level 1, up to 20%
    - Level 2, up to 40% (SATA only)
    - Level 3, up to 60%
    - Level 4, up to 87%

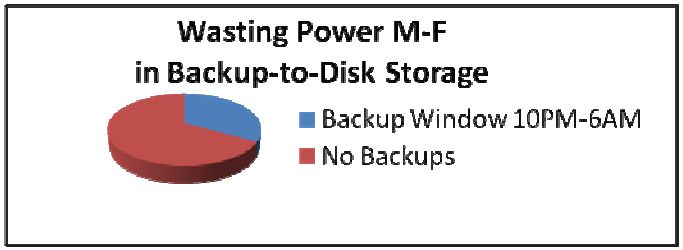


Nexsan's Flexible Storage Platform

Product	Dual Active	No Single Point of Failure	Max # of Disks	# of Hosts	FC, iSCSI, or Both
Nexsan E-Series	Yes	Yes	120	254	Both
NetApp FAS2050	Yes	Yes	60	32	Both
EMC VNX5100	Yes	Yes	75	512	FC
EMC VNXe3300	Yes	Yes	120	256	iSCSI
EMC Clariion CX4-120	Yes	Yes	120	128	Both
Dell Compellent Series 30	Yes	Yes	1232	22	Both







AUTOMAID®

Industry-leading Power Savings

Power Savings Levels
1: Unload heads 25% Power Savings Sub-second recovery time
2: Slow to 4000 RPM 40% Power Savings 15 seconds recovery time
3: Stop rotating 60% Power Savings 30-45 seconds recovery time
4: Drive electronics off 87% Power Savings 30-60 seconds recovery time

Does not require any changes to applications

HMK MAID for Persistant Data

- Interactive access on „tape data“
  - Not possible with tape
- High storage density up to 1PB/m^2
  - Higher than tape
- >75% energy cost savings
  - Compared to disk
- >80% foot print savings
  - Compared to disk
- Further cost savings via De-Duplication

Disk solution for the price of tape

HMK Agenda

- HMK & Enterprise Storage
- Storage Performance
  - SSD
- Storage Capacity
  - MAID
- Storage Availability
  - Filesystems & Archiving

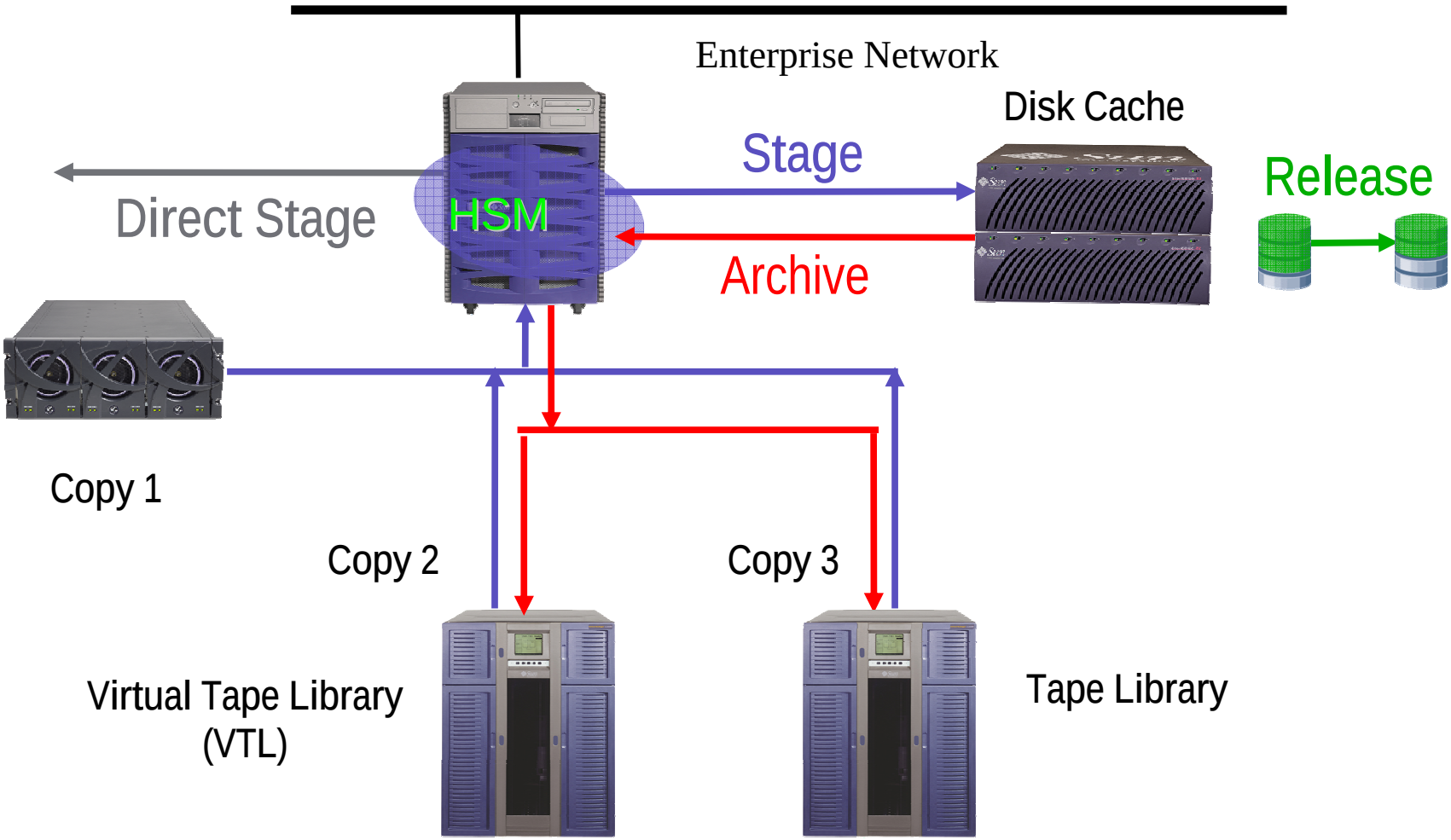
HMK Why HSM FS ? Requirements

1. Information access ?
   - 40% of users are unhappy today !
2. Downtime ?
   - 50% have 1-2 downtimes per month !
3. Enough capacity ?
   - 50% say NO !

After HSM usage:

1. 95% of users are happy
2. 10% have 1-2 downtimes
3. 100% say YES

HMK HSM FS: Filesystem plus Storage Management



HMK IBM GPFS

- HPC clustered filesystem
- Very high performance
- Scales to PBs
- All in one namespace
- Self managed & policy driven storage tiering
- Integrated file versioning

- Needs more polices for tape
- Needs more performance for tape

-> Cooperation with HMK

HMK Quantum StorNext

- Shared filesystem
- Good performance
- Scales to TB - PB
- Self managed & policy driven storage tiering including tape

- Needs more performance for top power

HMK Oracle Sun SAM-QFS

- Shared filesystem
- Very Good performance
- Scales to PB
- Very comfortable policies for storage tiering including tape
- Stores data in extended tar

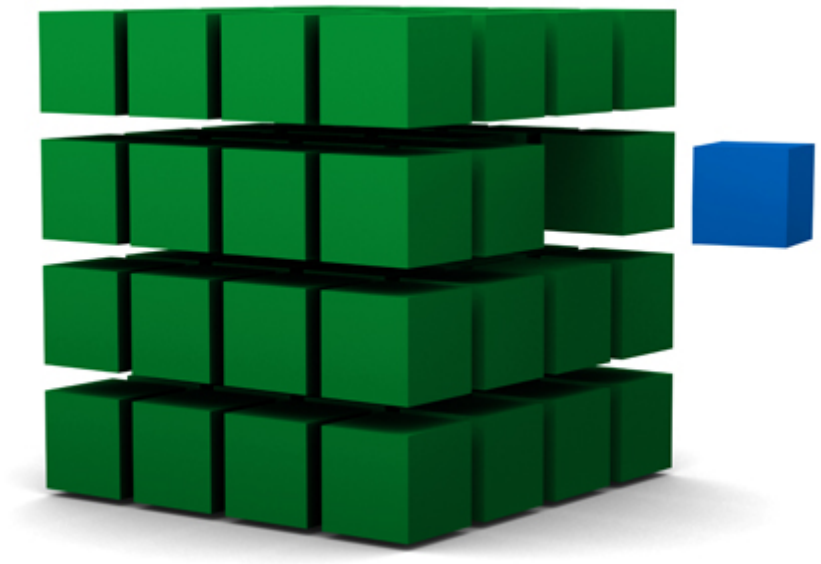
- Runs only on Solaris

HMK Summary

- High end Storage Technologies deliver
  - Highest availability (and archive storage)
  - Fastest access (e.g. to metadata)
  - Highest capacity (lowest operational costs)
- When do you need it ?
  - Limit of classical solutions
  - Good price-performance ratio
  - Non proprietary solutions
- We help you with analysis of your requirements

HMK Computer Technologies GmbH

We manage your data...



Klaus Heihoff, kheihoff@hmk.de, +49-6173-32747-0
Frankfurter Straße 111 | 61476 Kronberg
www.hmk.de | info@hmk.de