



IBM TotalStorage

G32 – Storage Networking Trends & Directions

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TM

Grand Challenges of Storage

- **1. Managing Complexity**
- **2. Building bulletproof storage**
- **3. Creating maintenance-free storage**
- **4. Bringing business continuity to the masses**
- **5. Securing storage**
- **6. Finding or searching for information**
- **7. Guaranteeing the authenticity of data**
- **8. Long-term presentation of data**
- **9. Creating an information grid**
- **10. Replacing disk drives as the primary storage medium**

Data Size!

- ◆ **Gigabytes** (10^9) (Billion) of disk storage - small customers
- ◆ **Terabytes** (10^{12}) (Trillion) of disk storage - most customers and many individuals
- ◆ **Petabytes** (10^{15}) (Quadrillion) of disk storage - several customers today!
- ◆ **Petabytes** (10^{15}) (Quadrillion) of tape storage - large customers
- ◆ **Exabytes** (10^{18}) (Quintillion) of tape storage - a few accounts by 2004
- ◆ **Zettabytes** (10^{21}) (Sextillion) WW digital data by 2004 - IDC
- ◆ **Yottabytes** (10^{24}) (Septillion) - How Long will it take?

Benefits of SAN vs Direct Attached Storage (DAS)

■ Cost Savings

- Storage Consolidation (15%-50% of DAS storage is utilized) SAN utilization can be higher than 80%
- Environmentals can be improved with SANs rather than having many scattered "mini-IT shops"
- People costs can be improved by having a dedicated SAN management group rather than forcing system administrators and end users to perform storage management tasks
- The costs of more sophisticated equipment (like ESS or Tape Libraries) can be more easily justified by amortized the cost across many servers

■ Performance - leading to more transactions or higher throughput

■ Higher Availability - less planned and unplanned outages which cost real money to organizations

■ Better Business Continuance

- SAN provides for greater operational distances
- SANs can provide mirrored storage solutions for local disasters
- SANs can provide failover support for local disasters
- SANs can provide remote vaulting anywhere in the world

■ Scalability - SANs can scale to hundreds of Terabytes of disk

■ Flexibility - Physical installation planning is much easier with the distances support by short and long wave fibre channel

■ Other Management Considerations

- Consolidated SAN storage allows for consistent security and storage policies and practices
- Consolidated SAN storage in conjunction with Storage Resource Management tools (TSRM) allows for a single point of view for all storage within the SAN

■ Strategic - Implementing SANs is a necessary step to getting to Storage Virtualization

SAN Solution Building Blocks

■ Software

- SAN Management, SAN Exploitation

■ Servers

- UNIX, Windows, Novell, LINUX, z/Series

■ SAN Fabric Components

- Switches/Directors, Gateways/Routers

■ Storage Virtualization Engines

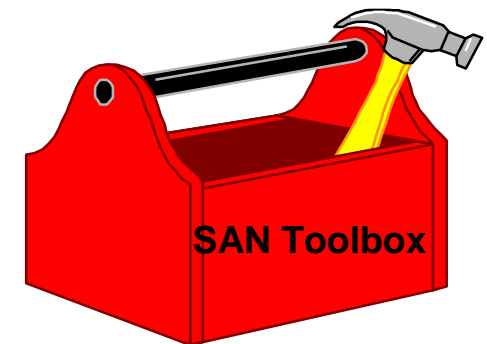
- Symmetric and Asymmetric Block Virtualization/LUN Mgt

■ Storage

- Disk Control Units, Tape Drives, Tape Libraries

■ Services

- Planning, Testing and Implementation, Education



Servers

- **Server Planning is crucial to SAN Implementations:**
 - Operating System levels
 - File Systems
 - Device Drivers
 - HBA's and Their Microcode Levels
 - Understanding Application requirements and priorities - Important for introducing automated Policy Management
 - Understanding Data requirements – Important for implementing virtualization
- **TCP/IP Offload (TOE) HBA's/NIC's**

Storage

- **All IBM Storage 2Gb/s for 2004 - 10GB/s 2005?**
- **Moving to larger/faster disks - 145GB 10K, 73GB 15K - 300 GB next!**
- **Faster storage processors/control units**
- **More Advanced function software - ESS and FAStT**
- **Storage starts using SNIA Storage Management Initiative Specification (SMI-S)**

SAN Fabric Components

- **Almost completely migrated to 2Gb/s Fibre**
- **Let's talk about 4Gb/s & 8Gb/s**
- **2004/5 - 10Gb/s for Trunking (ISL) between SANs**
- **High Port Count Density in Directors and Core Switches (128 Brocade, 224 Cisco, 140 McData, 256 Inrange)**
- **Native iSCSI Blades/Modules coming for Vendors Switches/Directors**
- **NAS Gateways extends values of SAN to the Ethernet Ecosystem**
- **Interoperability between Vendors - some progress**

IBM Storage Networking Portfolio

- Entry-level fabric switches
- Mid-range fabric switches
- Enterprise-class directors



IBM SAN Fabric Switch Portfolio Growth

Entry Switches

Midrange Switches

Enterprise Directors

	SAN Switch F16 & H16 (2109-F16, 2005-H16) 16 ports, 2Gbps	
SAN Switch F08 & H08 (3534-F08, 2005-H08) 8 ports, 2Gbps	SAN Switch F32 (2109-F32) 32 ports, 2Gbps	SAN Switch M14 (2109-M14) 32-128 ports, 2Gbps
McDATA Sphereon 4300 (2031-224) 12 port, 2Gbps	McDATA Sphereon 4500 (2031-224) 24 port, 2Gbps	McDATA Intrepid 6064 (2032-064) 64 ports, 2Gbps
	McDATA Sphereon 3232 (2031-232) 32 ports, 2Gbps	McDATA Intrepid 6140 (2032-140) 140 ports, 2Gbps
	Cisco MDS 9120/40 (2061-020/-040) 20/40 ports, 2Gbps	CNT UMD 256 (2042-N16) 256 ports, 2Gbps
	Cisco MDS 9216 (2062-D01) 48 ports, 2Gbps	Cisco MDS 9506/9509 (2062-D04/-D07) 128/224 ports, 2Gbps

IBM TotalStorage SAN Switch (Brocade) Family Positioning

currently available

Entry
Switches
& Hubs

SAN Switch H08

(2005-F08)

8 ports, 2 Gb

www.ibm.com/storage/fcswitch

Midrange
Switches

SAN Switch F32

(2109-F32)

32 ports, 2 Gb

www.ibm.com/storage/fcswitch

SAN Switch H16

(2005-F16)

16 ports, 2 Gb

www.ibm.com/storage/fcswitch

Enterprise
Core Fabric
Switch

SAN Switch M12

(2109-M12)

2 x 64 ports, 2 Gb

www.ibm.com/storage/fcswitch

SAN Switch M14

(2109-M14)

128 ports, 2 Gb

www.ibm.com/storage/fcswitch

McDATA FICON/FCP Director and Fabric Switch Family Positioning

currently available

Entry
Switches
& Hubs

McDATA Sphereon 4500
(2031-224)
8/16/24 ports, 2 Gbps
www.ibm.com/storage/mcdata

McDATA 4300
(2031-232)
4/8/12 ports, 2 Gb
www.ibm.com/storage/mcdata

Midrange
Switches

**McDATA Sphereon
3232**
(2031-232)
32 ports, 2 Gb
www.ibm.com/storage/mcdata

Enterprise
Core Switch
& Directors

McDATA Intrepid 6140
(2032-014)
140 ports, 2 Gb
www.ibm.com/storage/mcdata

McDATA Intrepid
(2032-064)
64 ports, 2 Gb
www.ibm.com/storage/mcdata

CNT UltraNet Multi-service Director (UMD)

■ Features / Functions

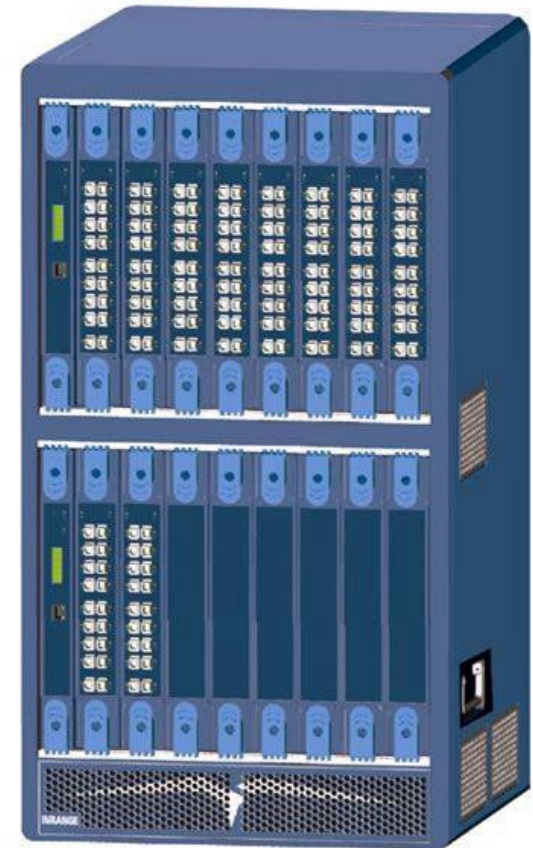
- Protocol Agnostic Director
 - Ability to support iSCSI, InfiniBand, 10 Gbps IP port modules
 - FICON, FCP protocol & NPIV support
- 1,2 & 4 Gbps F & E-ports
- Scalable up to 512 ports
- Improved security
 - Logical Partitioning into up to 4 Distinct Directors (Domains) with Independent Services
- Advanced ISL management
- Full interoperability with
 - FC/9000 Director
 - IBM SAN Switch (Brocade)
- Online Diagnostics, enhanced error reporting and fault isolation

■ Performance

- Full any to any non-blocking 512 x 512 single stage cross-point architecture Cascading up to 100 km

■ High Availability

- Hot Swap of All Field Replaceable Modules
- Non-Disruptive Firmware Activation and Feature Upgrade
- 256 Ports in 18 U Chassis
- IBM machine type 2042-N16

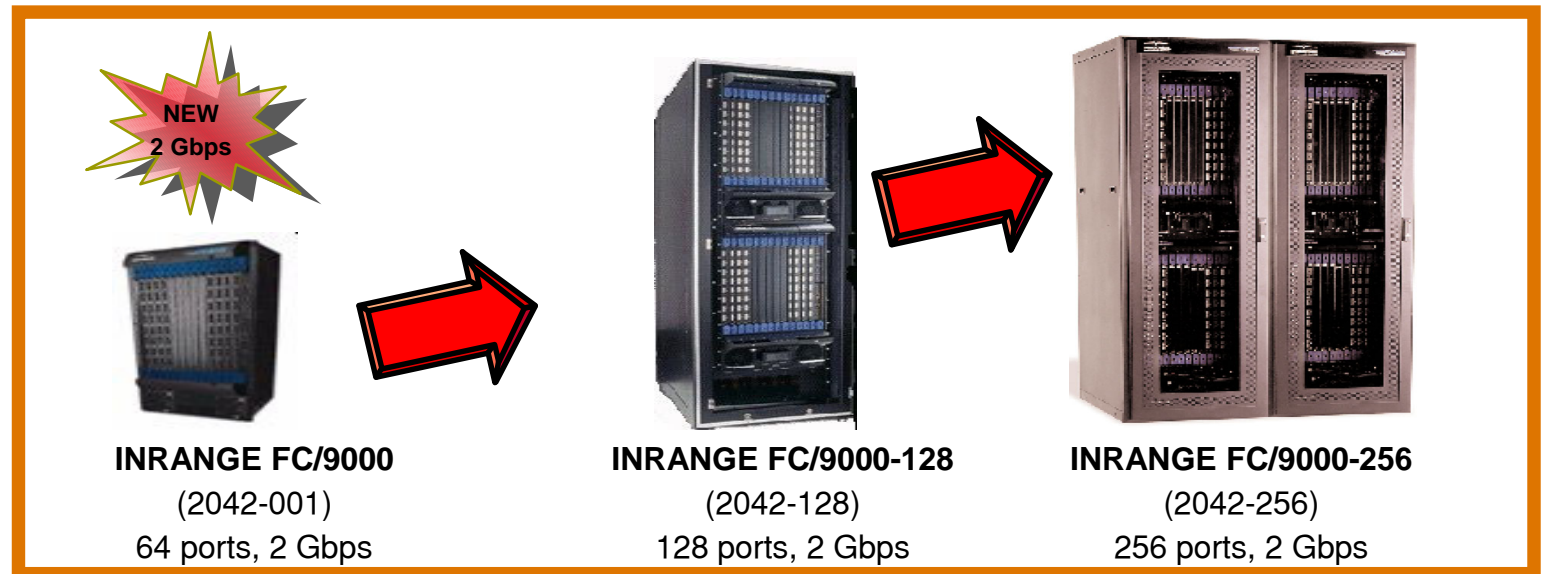


CNT/INRANGE FICON/FCP Director Family Positioning

Entry Switches & Hubs

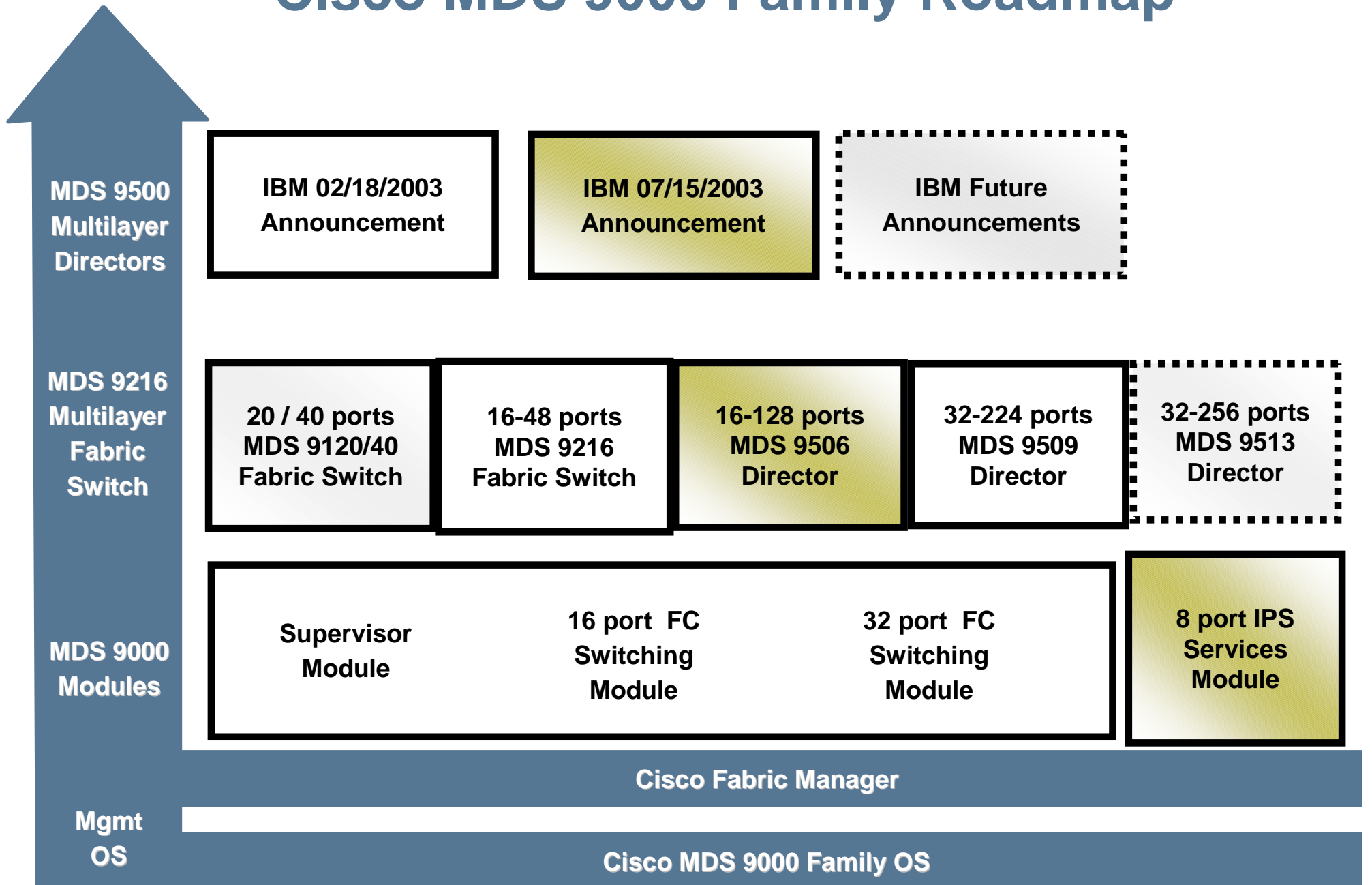
Midrange Switches

Enterprise Core Switch & Directors



www.ibm.com/storage/inrange

Cisco MDS 9000 Family Roadmap



Inter-SAN connectivity

■ E-Port (ISL) connection to network edge boxes

- Edge boxes that convert FCP to ATM
- FCIP edge boxes
- iSCSI routers
- Mixed iSCSI/FCIP Blades in SAN Fabric Directors/Switches

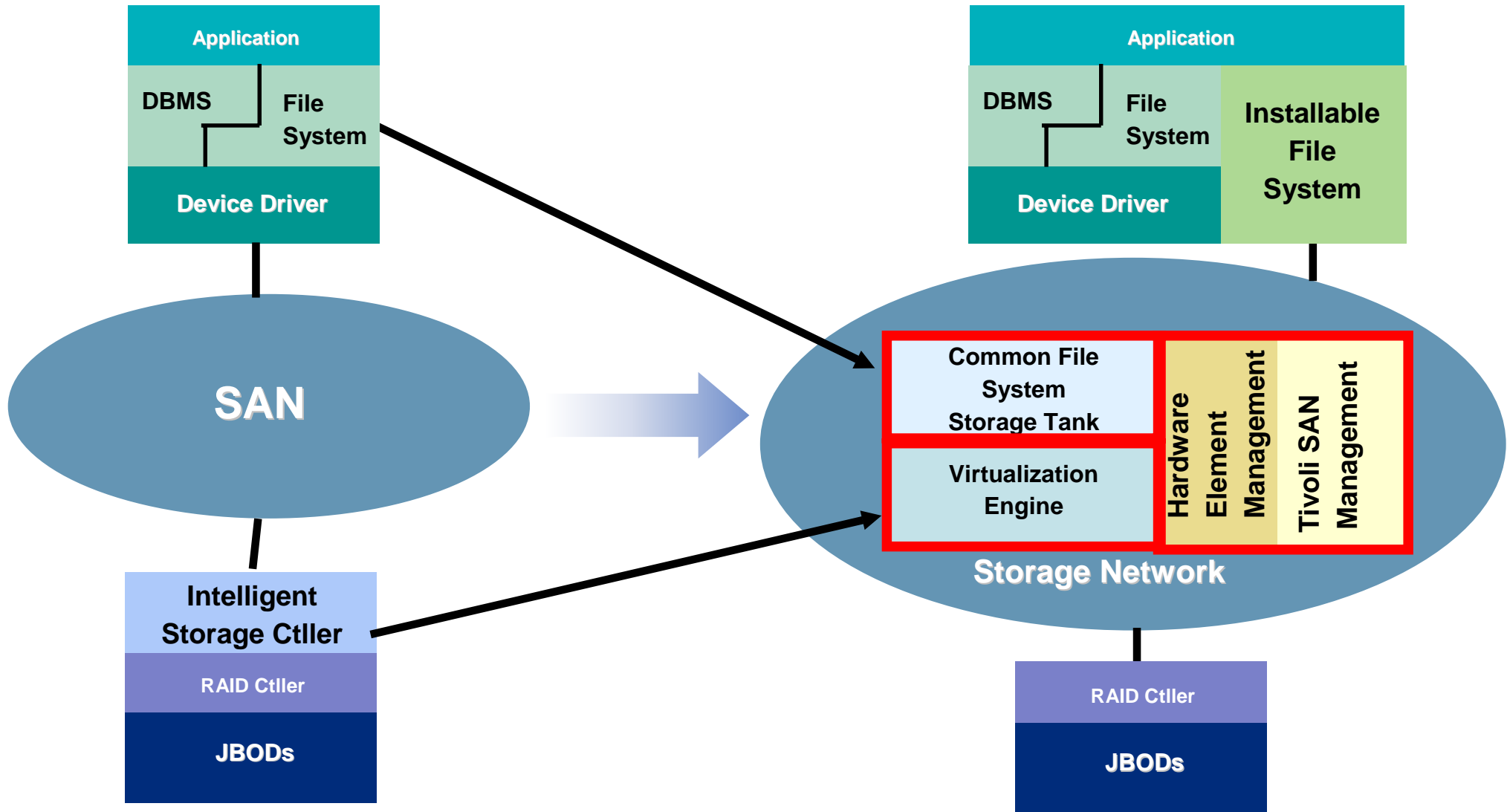
■ Inter-SAN applications

- Data Exchange and Access
- SAN Federation
- Centralized backup to automated tape libraries
- Geographic DR facilities
- Data Migration

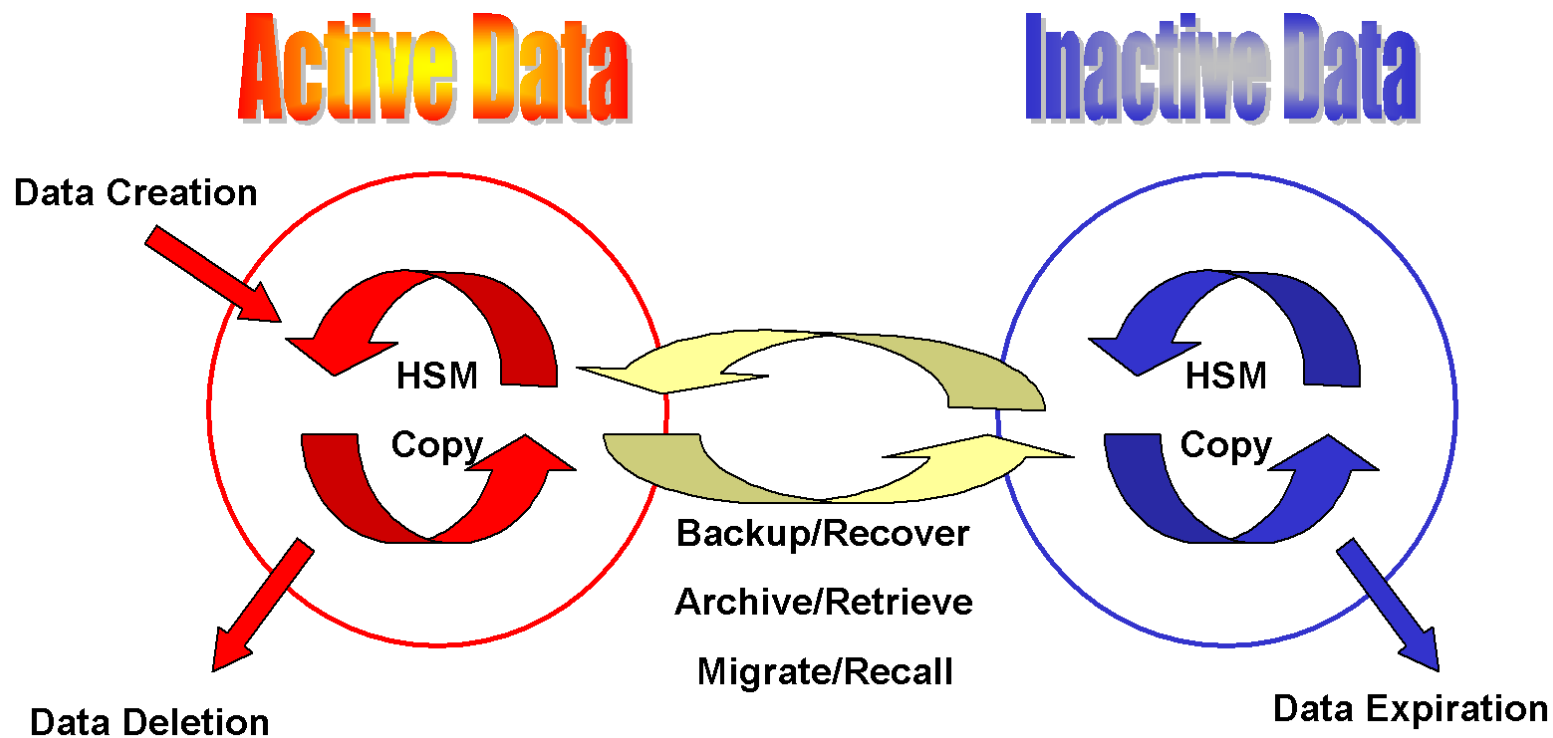
Sampling of Distance Solution Providers (xWDM, FCIP, iSCSI, ATM, etc.)

- **Adva AG, Alcatel, Canoga-Perkins**
- **Ciena, Cisco, CNT, Fujitsu, Huawei**
- **Lightsand, Lucent, McData/Nishan, Nortel**
- **SANValley, Sorrento Networks (Zhone Technologies) and many others**

SAN Virtualization Engines – Intelligence Moving into the Network



Life Cycle of Data



Tivoli Storage Management Portfolio

■ Tivoli Storage Manager (TSM)

- What It Does: Backup/recovery, archive/restore, HSM, disaster recovery
- Differentiation: Performance, platform support, non-disruptive
- Value: Protects data, simplifies administration, improves storage ROI

■ Tivoli Storage Area Network Manager (SAN Mgr)

- What It Does: Open standards-based enterprise-class SAN management
- Differentiation: Scalability, time-to-value, device support, predictive features
- Value: Accelerates SAN deployment, ensures SAN availability

■ Tivoli Storage Resource Manager (SRM)

- What It Does: Storage resource monitoring, reporting, automation
- Differentiation: Quick to deploy, analytical & predictive, active, integrated
- Value: Improves storage utilization, reduces administration expense

Tivoli Storage Management Solutions

The Tivoli Storage Management Solution

Gartner

Listed as a Leader in Gartner Backup & Recovery 2H01 Magic Quadrant
IBM Tivoli Storage Management solutions



Best Enterprise Storage Product
IBM Tivoli Storage Manager



Best in Product Class Award for Storage Backup and Recovery Software

IBM Tivoli Storage Manager



Enterprise Systems Journal Magazine
Readers' Choice Award
IBM Tivoli Storage Manager

Storage

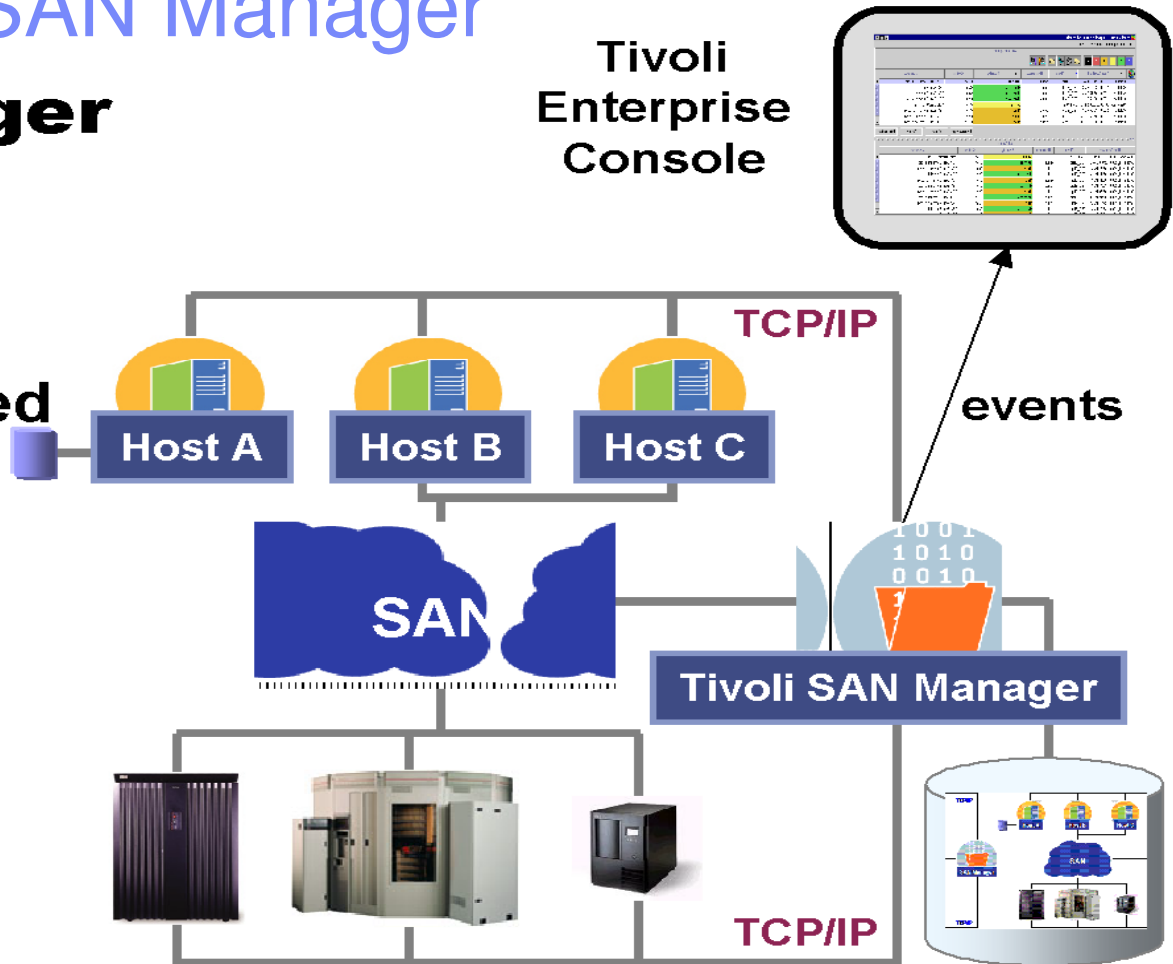
- IBM Tivoli Storage Resource Manager 1.1
- IBM Tivoli Storage Area Network Manager 1.1
- IBM Tivoli Storage Manager 5.1.5
 - IBM TSM Enterprise Edition 5.1.5
 - IBM TSM for Enterprise Resource Planning 5.1.5
 - IBM TSM for Mail 5.1.5
 - IBM TSM for Hardware 5.1.5
 - IBM TSM for Databases 5.1.5
 - IBM TSM for Application Servers 5.1.5

- New product
- New version

Tivoli SAN Manager

Tivoli SAN Manager

- Centralized SAN Management
- Open Standards based
- Automatic discovery
- Topology views via NetView
- TEC integration
- Brocade zoning API support



Customer Value

- Ensures application availability
- Simplifies storage administration
- Improves ROI by shortening the time to SAN deployment

Tivoli Storage Resource Manager Offerings

Tivoli Storage Resource Manager for **Databases**

- Prevent Database Downtime
- Reduce Unnecessary Space Usage
- Perform Capacity Planning
- Plan Network Migration or SAN Implementation
- Export Storage Data

DB2 Data Management Software

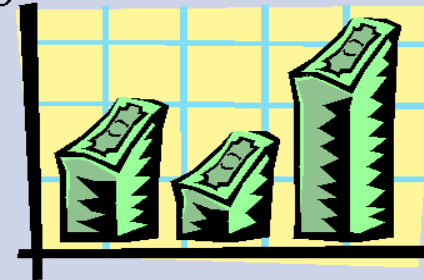


ORACLE



Tivoli Storage Resource Manager for **Chargeback**

- Generate Invoices
- Invoice Flexibility
- Special format for import into CIMS



Tivoli Storage Resource Manager

- Extensive platform support
- Capacity planning
- Quotas
- Event routing to management console
- Policy-based alerts
- Triggered action facility
- 5-minute automated agent install
- Operational reports within 30 minutes

Tivoli Storage Management Software

Plan for next 12 - 18 months



**Tivoli
Storage
Management**

Tivoli Storage Strategy

- Significantly Enhance Backup & Recovery Offerings
- Extend SAN Management and Business Impact Management Offerings to Deliver Full Storage Resource Management Solution
- Leverage the Power of IBM

TSM V 5.2 +

- zOS LAN-free backup/recover
- zLinux TSM Server
- Windows XP and .Net enhancements
- HSM enhancements for Life Sciences, Digital Media
- TSM for . . . WebSphere V5 support
- pSeries and iSeries Linux clients
- Tivoli Data Warehouse integration
- Virtualization and Storage Tank support

TSRM R2 +

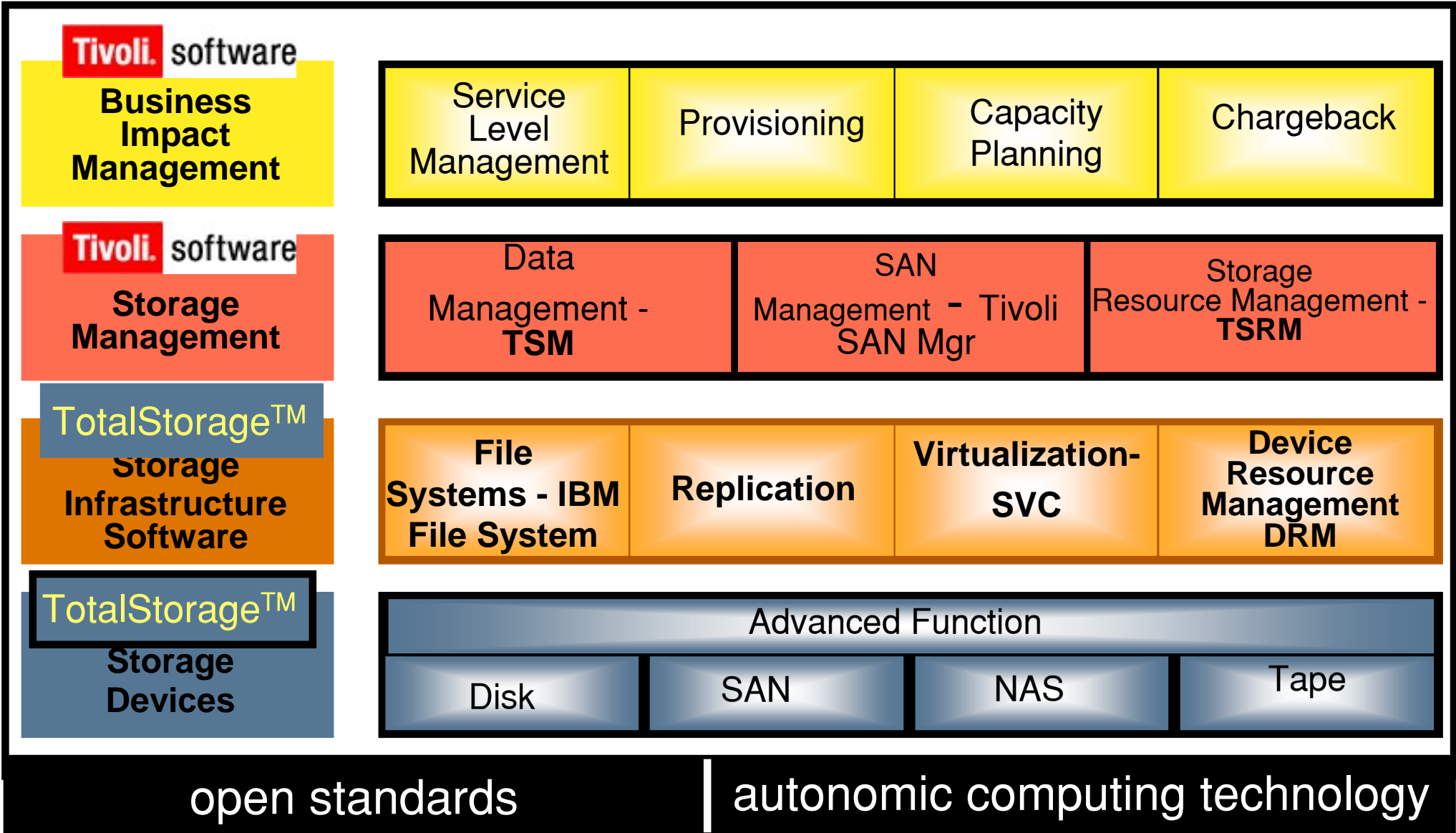
- Application support for DB2/UDB
- Capacity provisioning via Bluefin
- Subsystem support for Shark and EMC
- Policy based file system extension
- TSM integration for archive/delete, HSM
- Tivoli Event Console and Warehouse Integration
- Application support for e-mail
- Virtualization support

SAN Mgr R2 +

- Enhanced fault isolation
- Management via Bluefin
- Additional server and agent platforms
- SRM and Warehouse Integration
- Virtualization support

IBM roadmap is the direction of current intent and is subject to change

Enterprise Systems Management



Services

- **Planning for SANs is crucial**
- **SAN skills are more available now, but still not plentiful**
- **Implementing SANs can be very political - having a third party to arbitrate between groups can be effective**
- **A Sampling of IBM Global Services Offerings:**
 - Storage Assessment
 - SAN Planning and Implementation
 - Virtualization Planning and Implementation
 - Fibre Transport Services

Recent Changes to IBM NAS Roadmap

- **NAS Gateways are the best solution for NAS implementation in centralized environments**
- **NAS Gateways complement IBM's strategic investments in SAN based hardware and software virtualization products**

NAS Gateway 500

■ Single node or Dual node clustered configurations

- Single can be upgraded to dual
- Clustered nodes
 - ▶ Supports continuous non-disruptive operation during failure
 - ▶ Uses HACMP software

■ Node Characteristics

- 2 or 4 way Power 4+ 1.45 GHz processors incorporates the latest advancement in leadership chip technology from IBM
 - ▶ 2-way can be upgraded to 4-way / node
- Among the fastest 64-bit processors



NAS Gateway 500

■ UNIX kernel based on AIX 5L 5.2B

- Advanced, open, scalable UNIX operating system from IBM.
- Enhanced Journal File System (JFS2)
 - ▶ Maximum tested File size = 16TB
 - ▶ Maximum tested File system size = 16TB

■ Multiple Network File Protocols Support (Included in base price)

- NFS (V2 & V3)
 - ▶ NIS & NIS+ Client Support
 - ▶ NTP Client

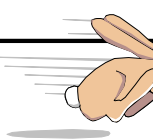
■ CIFS using IBM Fastconnect (priced separately)

- ▶ The Enterprise NAS Gateway allows for Windows users to be mapped to UNIX users for access via CIFS.
- ▶ Windows NT Domain supported
- ▶ Windows Active Directory supported

■ IBM HTTP Server & FTP

NAS 500 Performance Metrics

Performance (highest number achieved)

	CIFS MB/sec	NFS v3 UDP Ops/sec	NFS v3 TCP Ops/sec
NAS Gateway 300 Dual Node 2 processors/node	180	7,727	11,086
NAS Gateway 500 Single Node 4 processors/node	138	35,097	34,615
NAS Gateway 500 Dual Node 4 processors/node	276	68,444	68,585 

Comparison

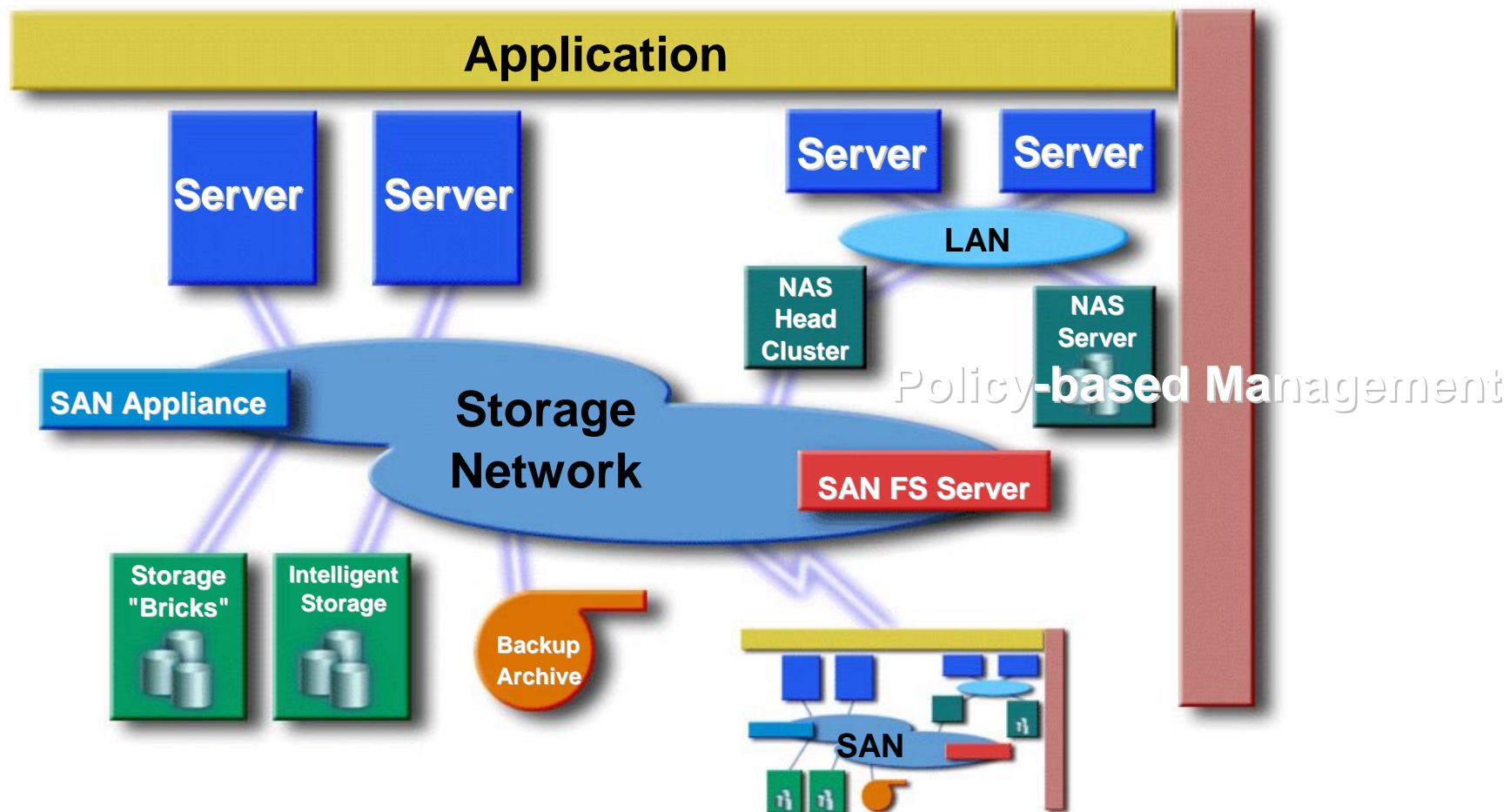
- NetApp gFiler Cluster – 50,139* ops/sec
- NetApp F980 Cluster – 68,139* ops/sec
- EMC NS600 - 45,045* ops/sec

* Source: <http://www.spec.org/>

The Storage Networking Industry Trends and Directions

- **Common Information Model (CIM) integration with server and network management is leading to better common management via SMIS adoption**
- **SAN File Systems are here for better data sharing**
- **The storage industry will make another run at HSM for active data in 2004 starting with the life sciences sector**
- **SAN distance solutions are mature and coming down in cost**
- **Policy based automated storage management extended in the Enterprise to include open systems**

Future Universal Access



Thank You



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