

SAN-Lösungen von Cisco Systems



Wolfram Maag
Internetworking Consultant

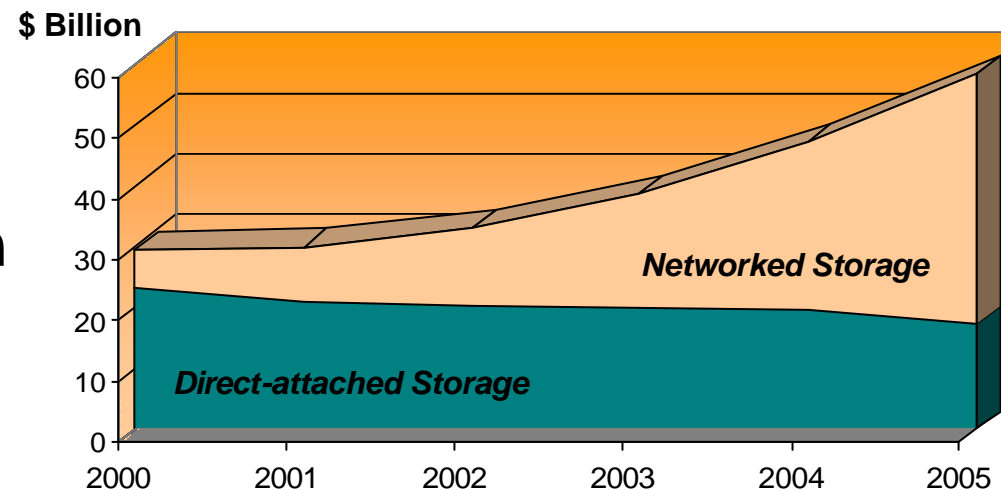
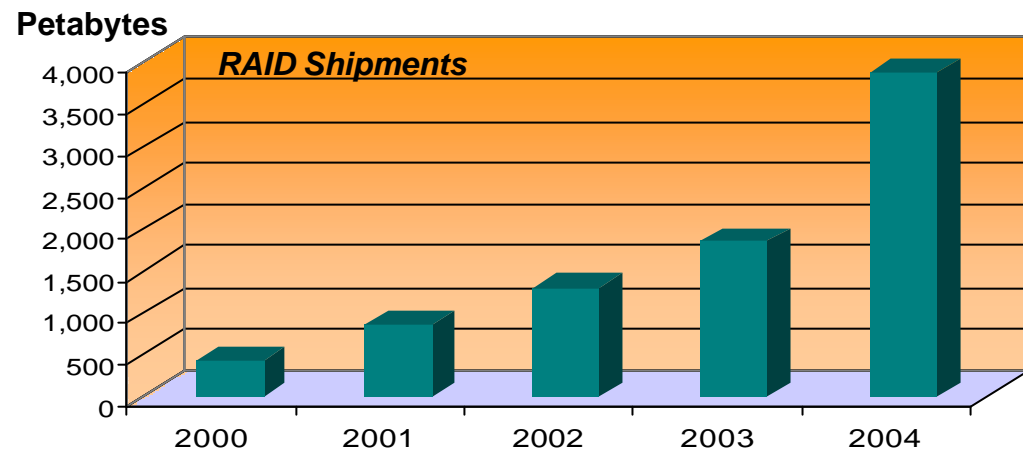
Storage Marktüberblick/Trends

Wachstum führt zu Networked Storage

Cisco.com

Laufende Speichererweiterungen führen zum Modell des vernetzten Speichers

- Speicherkapazität wächst exponentiell
- Verhältnis vernetzten Speichers zu direkt angeschlossenem Speicher beträgt heute 25/75. In 2005 wird sich dieses Verhältnis umgekehrt haben.



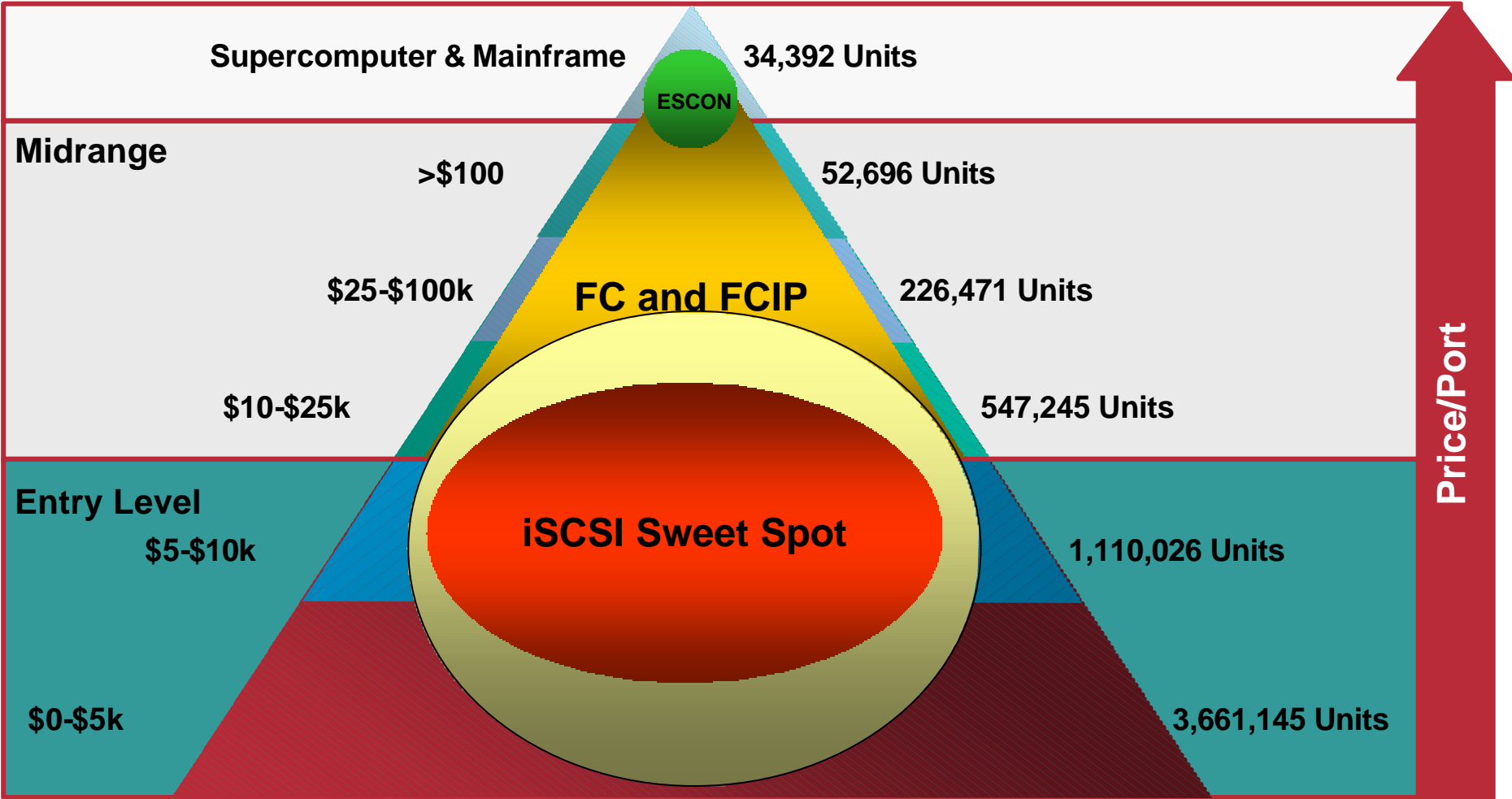
Source: Gartner, 2001

Warum Storage Networking ?

Cisco.com

- **Speicher macht 80% aller Investitionen in Serverkapazitäten aus (Dataquest)**
- **IDC: pro 1 GB zentral verwaltetem Speicher existieren:**
 - 2 GB in Abteilungsservern
 - 3-5 GB in Desktop Clients
- **McKinsey Studie zur “total cost of ownership” (TCO):**
 - dezentraler Speicher kostet 89 ¢ pro Monat und Mbyte
 - zentraler Speicher kostet 35 ¢ pro Monat und Mbyte
- **Während die Anschaffungskosten pro Gbyte Speicher sinken, explodieren die Kosten fürs Speicher-Management**
- **Konkretes Beispiel: Die gespeicherte Datenmenge bei Cisco wächst pro Stunde um 40 Gbyte pro Stunde**

2003+ iSCSI and Server Markt Positionierung



Gartner, August 16, 2001

Cisco Storage Networking Lösungen

Cisco Storage Network Lösungen

Cisco.com

- **iSCSI**
SN5420 SN5428
- **FCIP**
- **MDS9000 Serie**

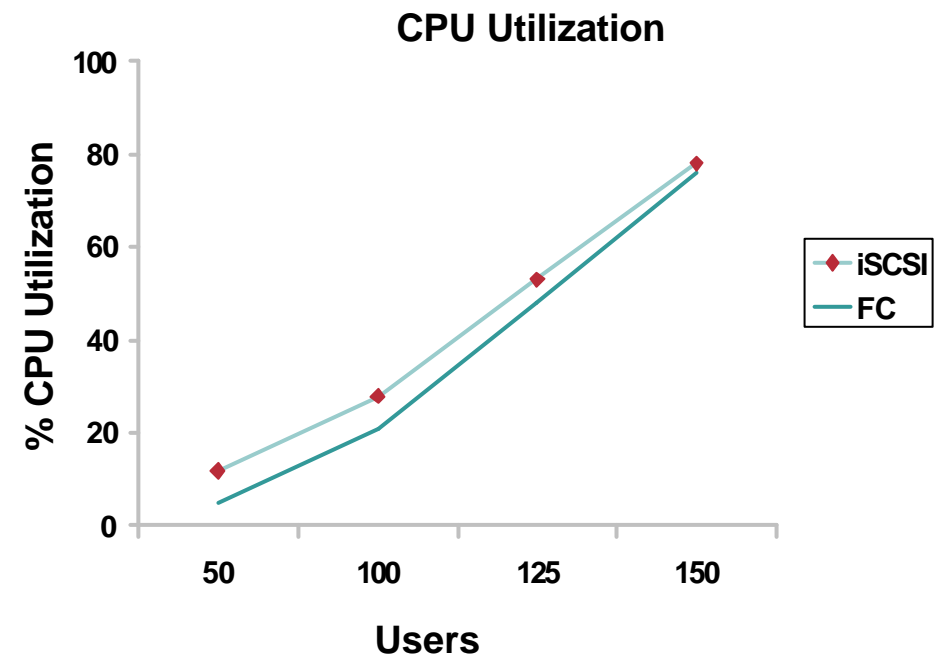
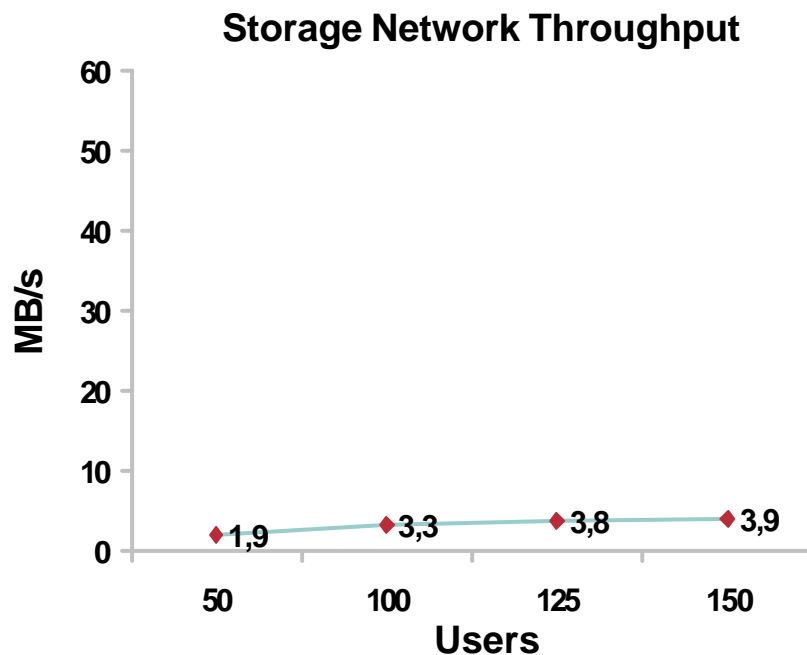
iSCSI

Was ist iSCSI?

- **Ein Weg, um auf Storage über ein IP Netzwerk zuzugreifen als wäre er lokal**
- **Transportiert SCSI Kommandos und Data über ein IP Netzwerk**
- **Standards status update**
ratifiziert
Implementiert von Cisco
Support: Cisco, IBM, EMC, Intel, SUN, ...)

Beispiel Microsoft SQL Server 2000

- Verbreitete Workgroup Database
- Großes Volume an Storage, aber wenig Durchsatz
- Minimale CPU Utilization Unterschied zwischen iSCSI Software Drivers und Fibre Channel HBAs



Rahmenbedingungen für iSCSI

Cisco.com

- **Über einen SN5420 max. 65 MByte**
- **Über einen SN5428 (2 x GE) max. 140 MByte**
- **Server über FastEthernet max. 10 MByte**
- **Server über GigabitEthernet max. 60 MByte**
- **Server über FibreChannel max. 70 MByte**

Solutionbeschreibung

Cisco.com

- Design Guides
 - Microsoft SQL (2-4 Mbyte)
 - NetBackup DMZ
 - Microsoft Exchange (1 - 6,5MBytes / s)

Microsoft SQL **Solution** Design Guide

DMZ **Backup** with iSCSI

Driven by a new class of mission-critical management and online transaction processing applications, enterprises are growing exponentially. Additionally, because these enterprises, businesses increasingly demand the significant tangible and intangible cost of information, these same enterprises are

DataPeer Enlarges Its Market
with Cisco SN 5420 Storage Routers

- Customer Case Studies
 - DataPeer
 - University of Houston Downtown
 - Komatsu

University of **Houston**-Downtown Supports Online Business Model with Cisco SN 5420 Storage Routers

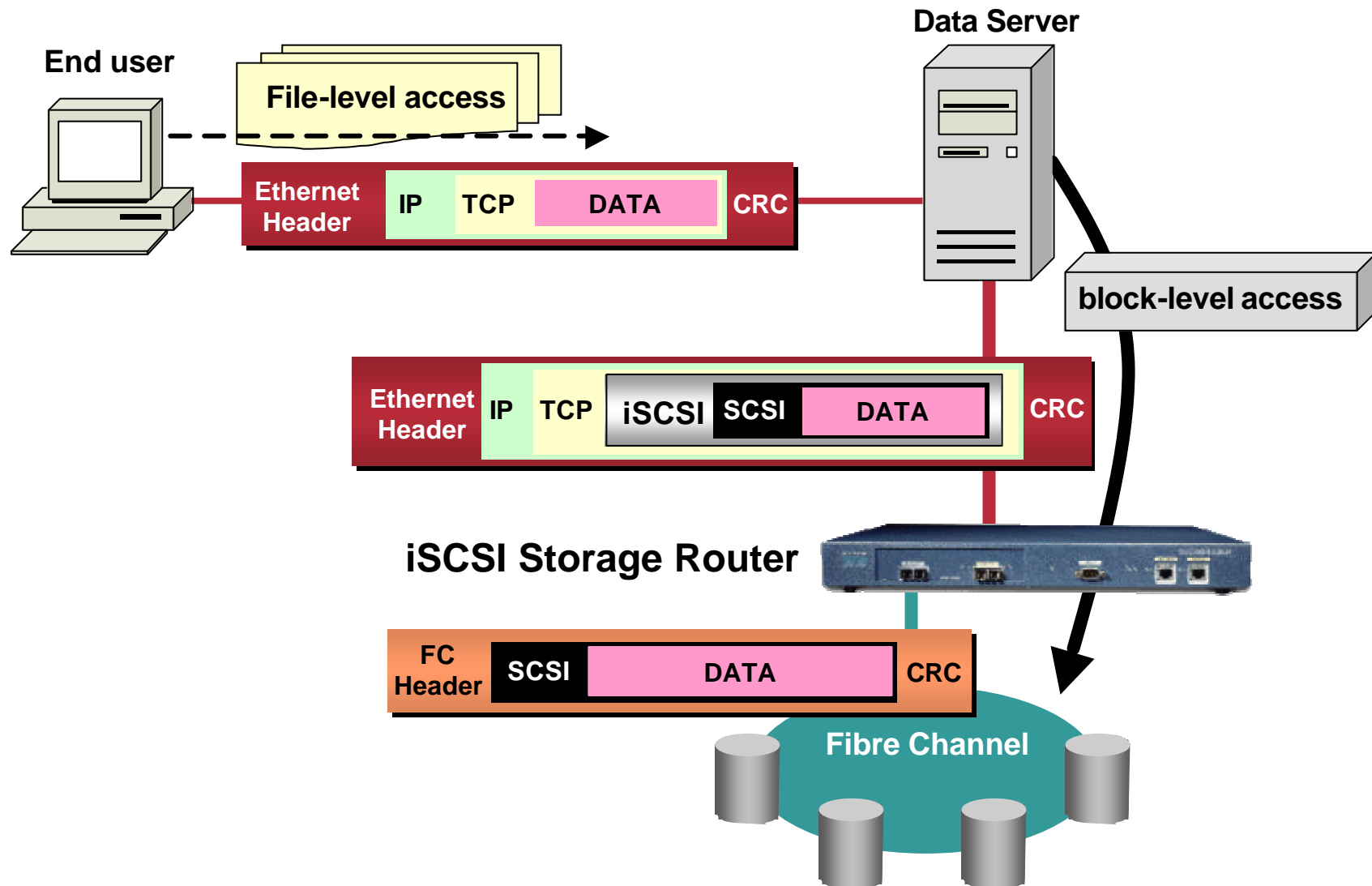
Komatsu Implements IP-Based Storage with Redundancy Using Cisco SN 5420 Storage Routers

Discrete Storage Devices Prove Inefficient to Handle Growth

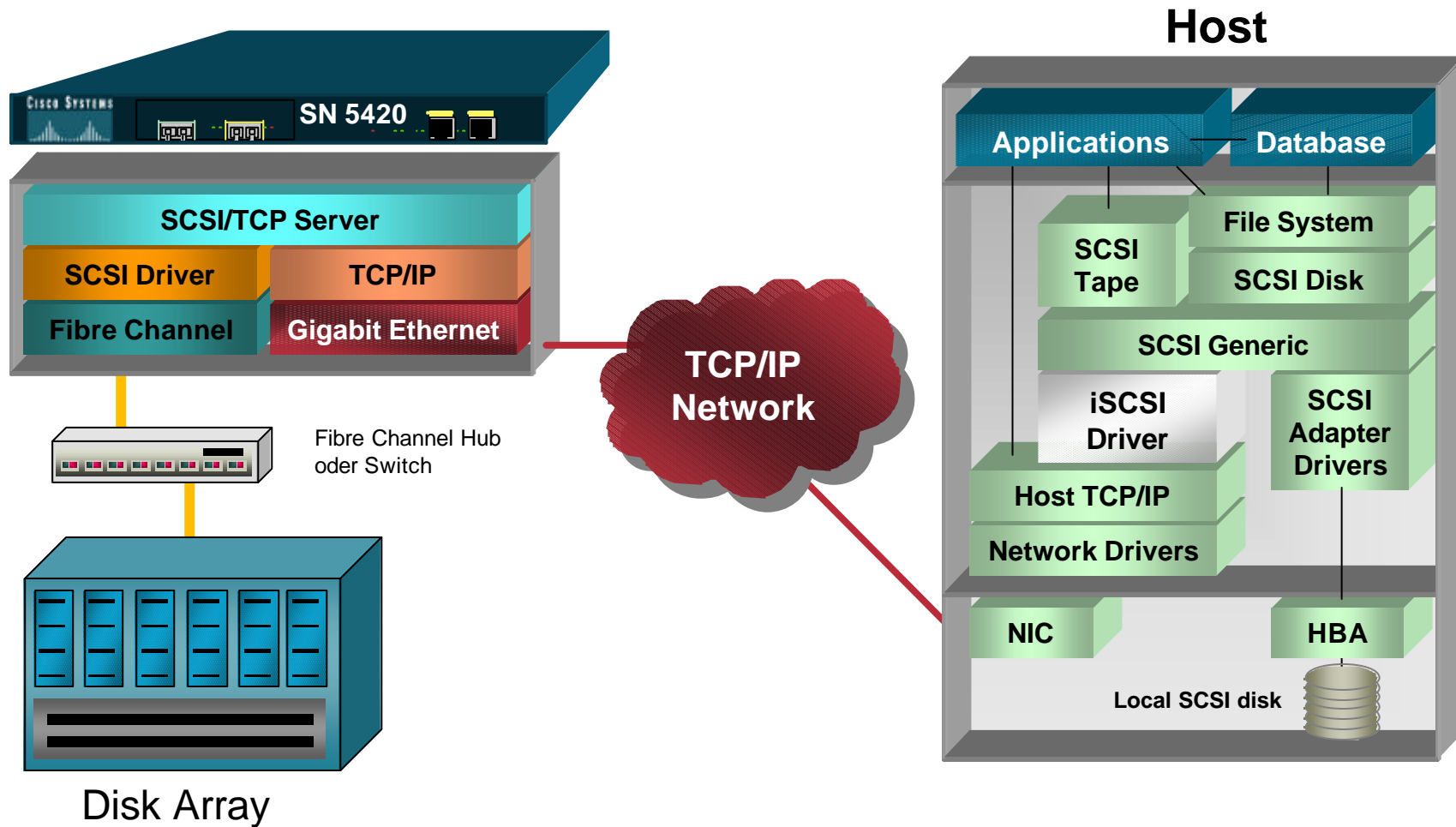
For many years, Komatsu relied on directly attached storage for its Web servers to

Komatsu installed two Cisco SN-5420s, one for production and one for redundancy, that connect over Fibre Channel to the IBM TotalStorage Enterprise Storage Server

iSCSI Encapsulation



Cisco iSCSI Architektur



Cisco SN 5420 Storage Router

Cisco.com



Spring 2001

Industry's First iSCSI Networking Product



Spring 2001



- **Erweitert das Storage Network auch für Midrange Server**
 - Ermöglicht Storage Consolidation für alle Server
 - Sämtliche Daten unterliegen damit den Business Continuance Planungen
- **Verbindet iSCSI/IP und Fibre Channel Networks**
- **Ermöglicht Secure Storage Networking**
 - Support von VLANs (Virtual LANs) und Virtual Trunking Protocol
 - Support von RADIUS und TACACS+ Authentication
- **Clustering ermöglicht Hochverfügbarkeit**
- **Easy to install und manage**

Cisco SN 5428 Storage Switch

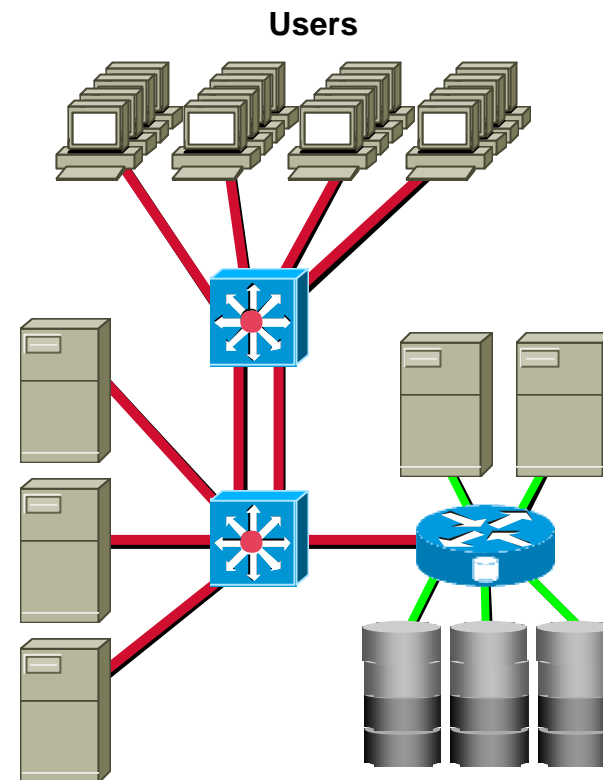
Cisco.com



- **8 Port FC Switch mit iSCSI (2 GigEthernet)**
Enterprise Departments & Workgroups
Small/Medium Businesses
- **Migration von DAS auf Storage Area Network**
- **Kombiniert IP & Fibre Channel Technologie**
- **Ermöglicht Secure Storage Networking**
- **Easy to install & manage**

Software Features

- **Access Control Lists**
- **LUN Mapping und Masking**
- **RADIUS und TACACS+ Authentication**
- **Management SNMP**
- **Virtual LANs (VLANs)**
- **Fibre Channel zoning**
- **Nutzt existierende IP security (firewalls, encryption, etc.)**
- **iSCSI Standard**
- **iSCSI Driver zum Download**
- **AAA - Authentication, Authorization, and Accounting**



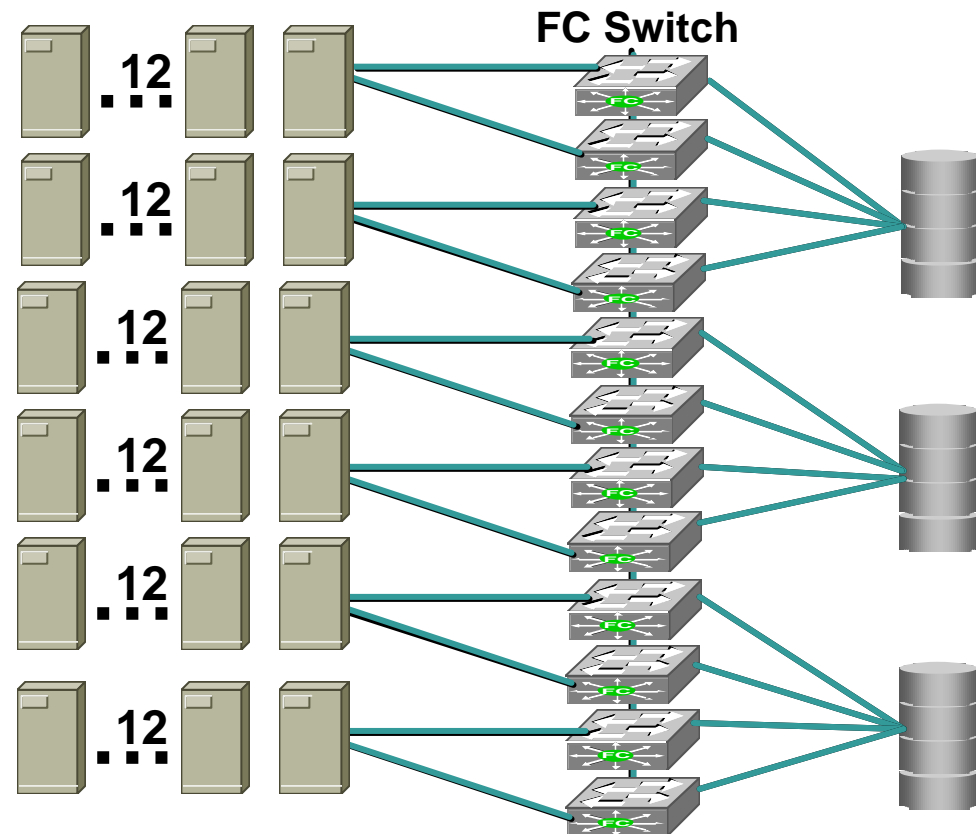
Projektbeispiel

74 Server an 4TB Disk
Alternative
iSCSI oder FC-Switches

Fibre Channel Lösungsansatz

Cisco.com

- Hohe Anzahl von FC Switches benötigt
- Eventuel viele FC-Hops vom Server zum Speicher
- Die meisten User/ Server brauchen keinen High Speed Access von 1Gigabit/sec
- Kosten der Lösung überstiegen das Budget
- Die bereits bestehende IP Infrastruktur wurde nicht mitberücksichtigt
- Keine Überlegungen bzgl. Security
- Hohe Management und Betriebskosten (FC KnoHow wurde gebraucht)

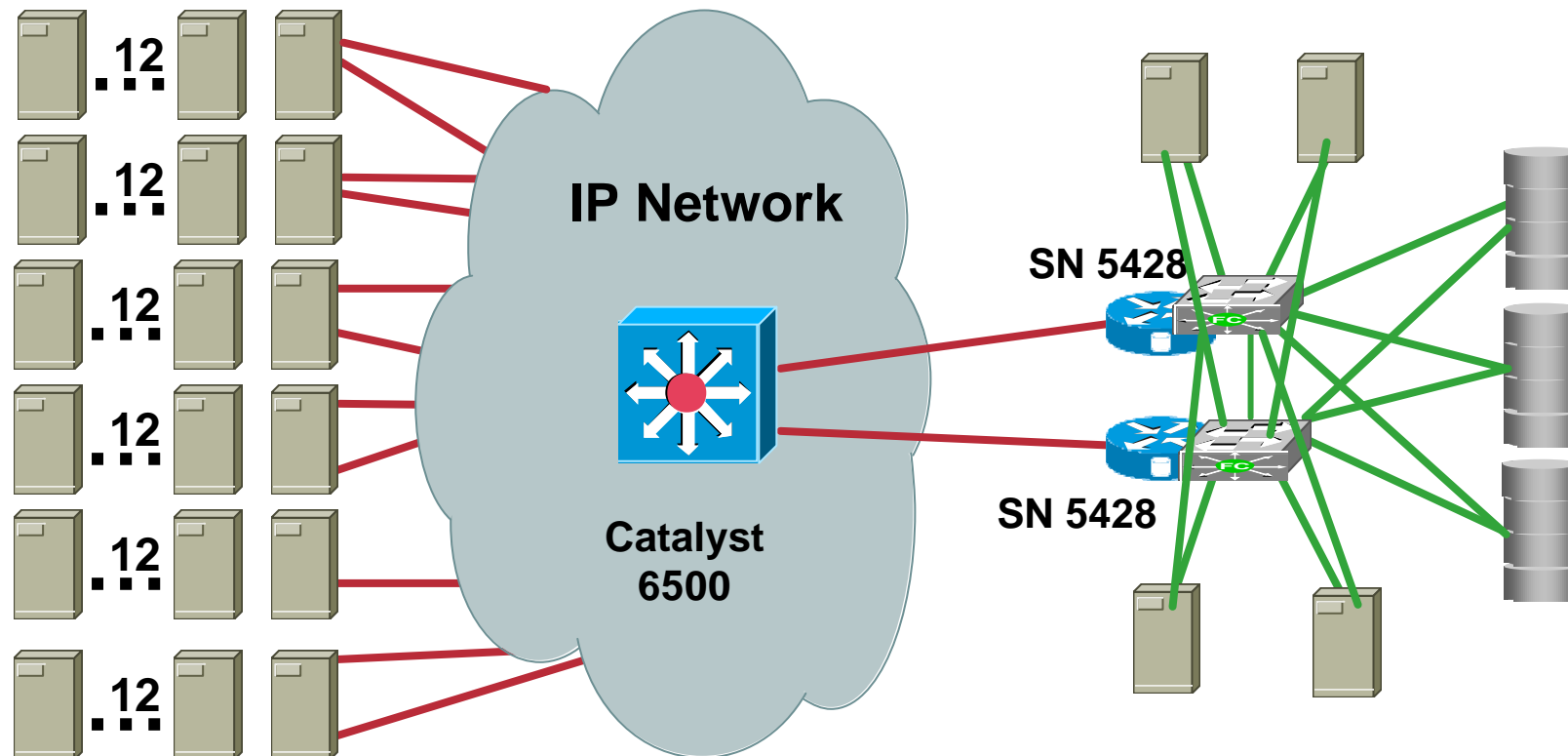


- 72 NT servers
- 4 TB disk
- 13 Fibre Channel switches
- Redundante Pfade zwischen allen Devices

Fibre Channel Option

QTY	Equipment	Price	Total
72,000	72,000 ft. of Fiber Cable at \$1.87/foot	\$1.87	\$134,640
13	16 Port Fibre Channel Switches	\$25,940	\$337,220
144	EMULEX FC-HBA GBIC 64BIT 33MHZ PCI	\$1,089	\$156,816
Total Equipment Cost: \$628,676			

iSCSI/Ethernet Option



- 72 NT Server
- 4 TB Disk
- 2 Fibre Channel Switches
- Redundante Pfade zwischen allen devices

iSCSI/Ethernet Option

- **Ausnutzen der bestehenden IP Infrastruktur (eher Upgrade als Neuinstallation)**
- **Verkürzte Implementierungszeit**
- **Preisgünstiger weil weniger FC Switches, HBAs, Glasfaserstrecken**
- **Preisgünstigeres Management und Betrieb**
- **Nur 5% der Applikationen brauchen vollen FC Durchsatz**
- **IP KnowHow im Unternehmen wird genutzt**
- **Weiteres späteres Erweitern verursacht weniger Unterbrechungen im Betrieb**
- **Hohe Verfügbarkeit von Servern zu Storage**

iSCSI Option detaillierte Kosten: 10/100 Server

QTY	Equipment	Preis	Total
72,000	72,000 ft. of Cat. 5 Cable at \$1.09/foot	\$1.09	\$78,480
2	SN 5428 Storage Routers mit SFPs	\$14,995	\$29,990
1	Catalyst 6506 Chassis with Power Supply	\$8,995	\$8,995
1	Catalyst Spare Power Supply	2,995	2,995
1	Cat. 6000 Sup. Engine 1 w MSFC + 2GE pts	\$29,995	\$29,995
3	48 Port Catalyst 6000 10/100 E-Net Cards	\$12,995	\$38,985
2	1000 Base SX GBICs	\$500	\$1,000
144	3Com EtherLink 10/100 NIC's	\$39	\$5,616
Total Equipment Cost: \$184,056			

Network Boot

Cisco's Network Boot Solution

Cisco.com

- **Solution Komponenten**

Cisco Network Boot program (BIOS extension)

Cisco SN 542X products

Cisco Win2K iSCSI Driver (initiators)

DHCP/TFTP server

Cisco Installation Utilities

Utility to ensure server is Network Boot capable

Utility to copy boot images from master servers to external arrays

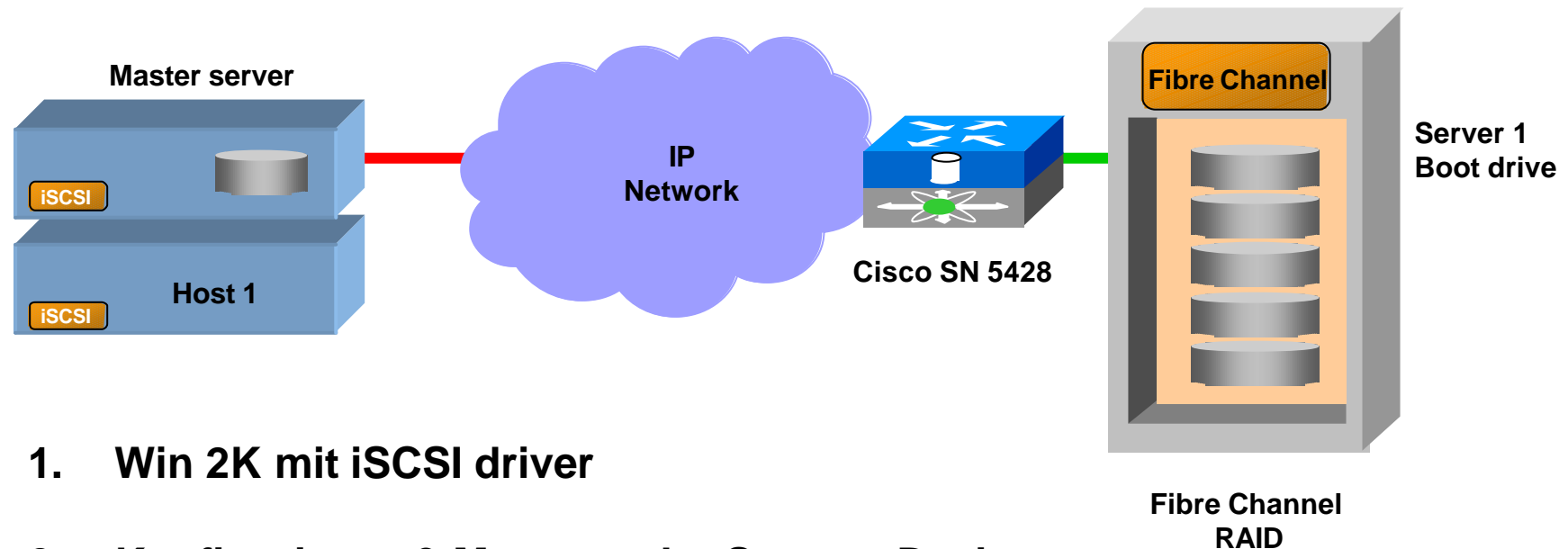


Requirements

- **PXE 2.1 Server oder NIC Karte**
- **Supported auf Windows 2000 Server oder Advanced Server, andere Microsoft OS und Linux werden kommen**
- **Ein (Master) Boot Image per Serverart und OS**
- **Jeder Server muß seine eigene Boot-LUN haben**
Registry und Swap Files unique per server
- **Supported mit Cisco SN 5420 und Cisco SN 5428 Hardware**

Network Boot Operation: Installation and Setup

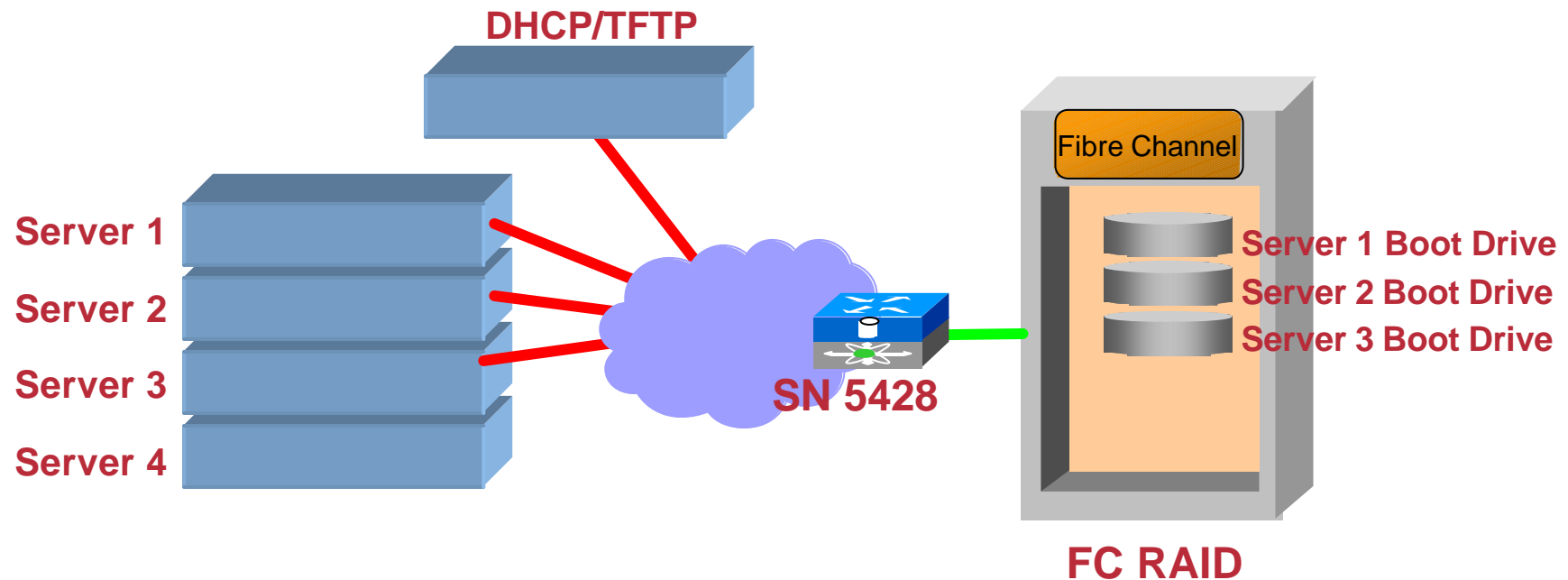
Cisco.com



1. Win 2K mit iSCSI driver
2. Konfigurieren & Mounten der Storage Devices
3. Cisco Utility kopiert Boot Image vom Master Server auf Storage

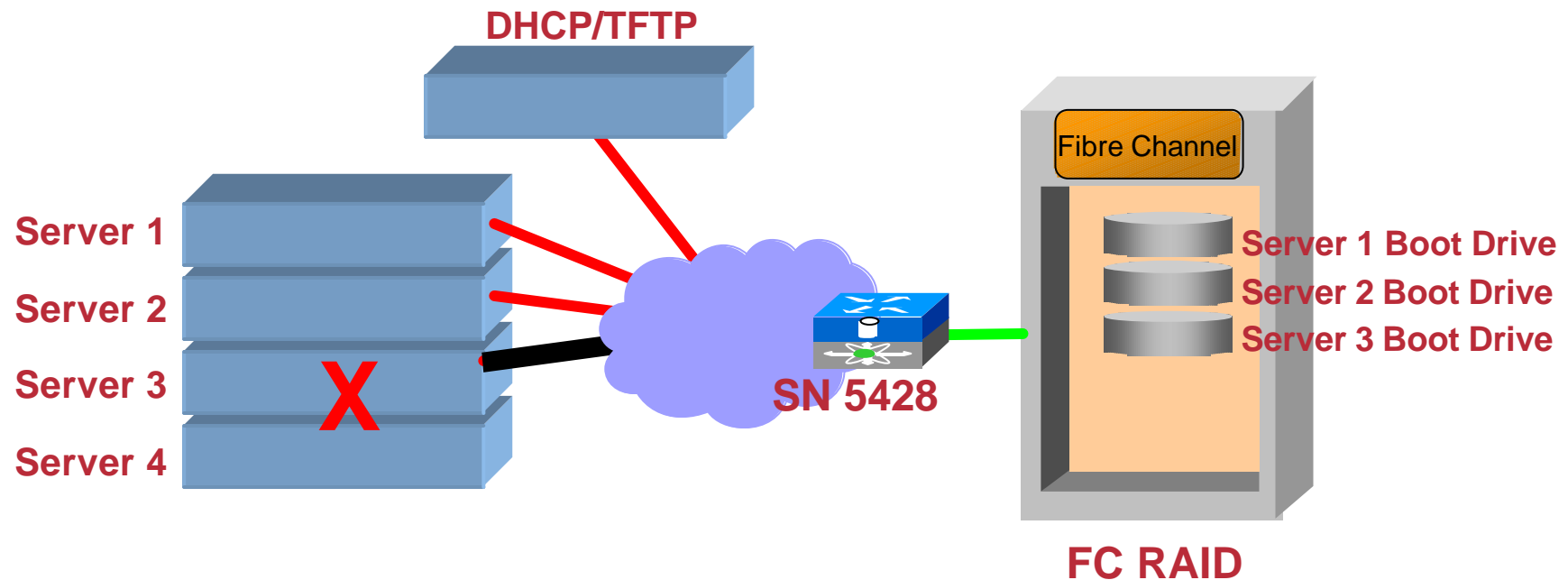
Network Boot Operation

1. System Fully Operational; Servers 1-3 running, Server 4 ist spare



Network Boot Operation

1. System fully operational; Servers 1-3 running, Server 4 is a spare
2. Server 3 fails

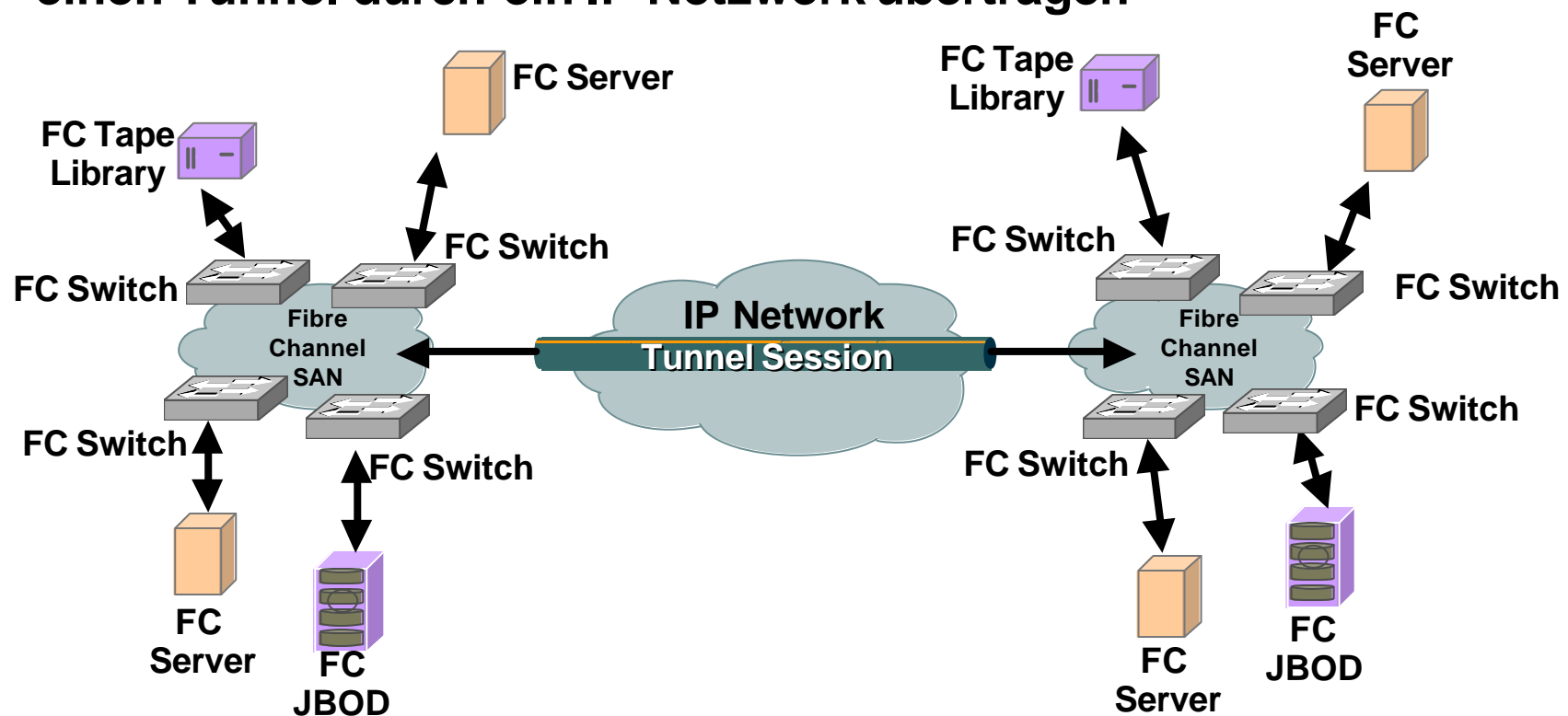


FCIP PA

FCIP Transport Methode

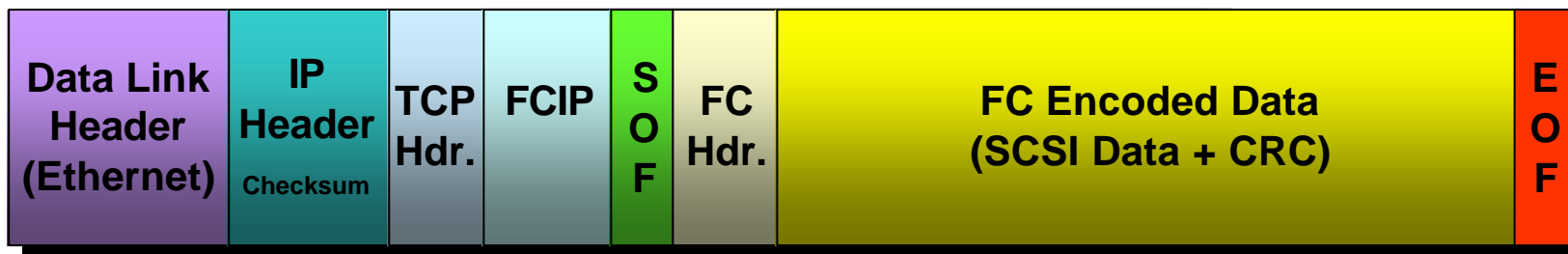
- **FCIP – Fibre Channel over Internet Protocol**

Fibre Channel Frames werden in IP Pakete verpackt und über einen Tunnel durch ein IP Netzwerk übertragen



FCIP Packet Structure

- **TCP/IP als Transport Protokoll**
Flow Control / Retransmission bei Network Congestion
In-order Packet Delivery gesicherter Daten
- **Fibre Channel Fabric Domains werden auf IP Adressen gemapped**
- **Alle Klassen von FC Frames unterstützt**
- **Blocks werden normalerweise fragmentiert und in der richtigen Reihenfolge wieder zusammengesetzt**
- **IP kennt Fibre Channel Payload nicht und die Fibre Channel Fabric kennt nicht das IP Netzwerk**



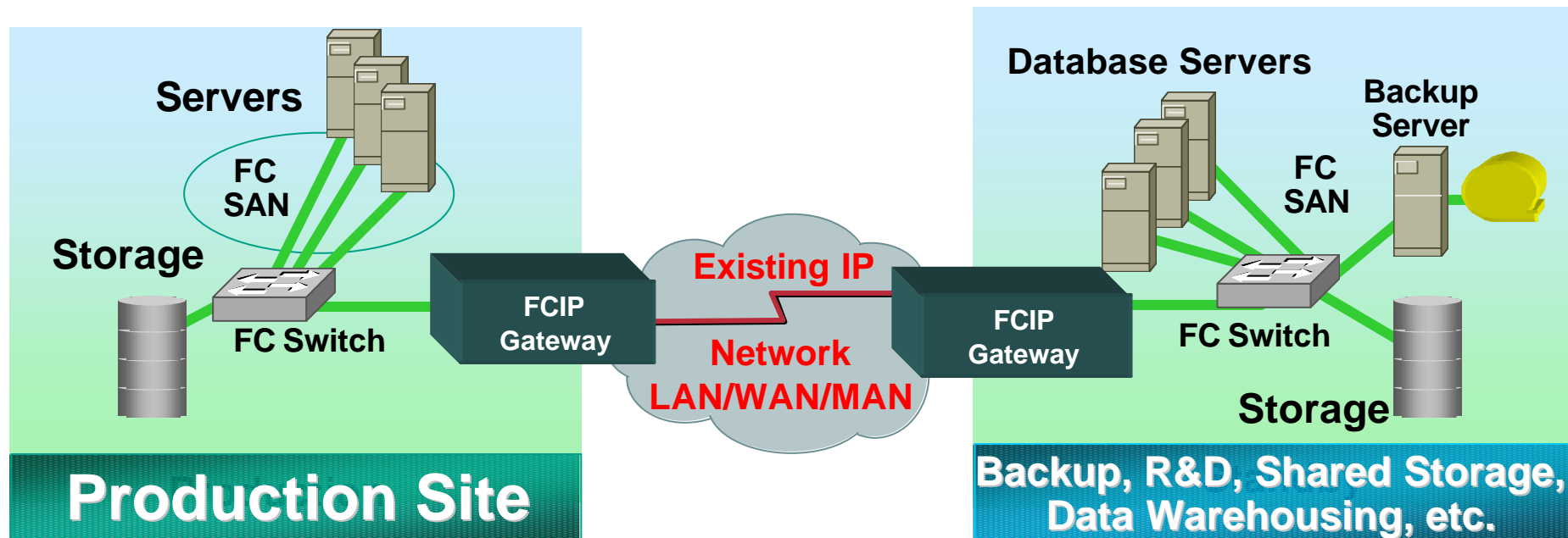
FCIP Applications

Cisco.com

FCIP Gateways packen Fibre Channel Pakete in IP Pakete und entpacken am anderen Ende

FC Switches werden über E_Port als SAN Fabric Extension angeschlossen

Eine Tunnel Connection wird über das bestehende IP Netzwerk gelegt



7200/7400 FCIP PA



**Cisco
7200**



**Cisco
7400**



- PA for the 72xx/74xx series of routers
- Up to OC-3 Data Rates
- VPN acceleration module (SA-VAM) for encryption/compression (2 to 1)
- CQ1 03 FCS, EFT CQ4 02
- B Port capability
- 12.2 (T) x (special release)
- NTE: \$10,000.00
- Platforms Supported
 - 7401, 7411
 - 7200 VXR, NPE-G1, NSE-1, NPE-400

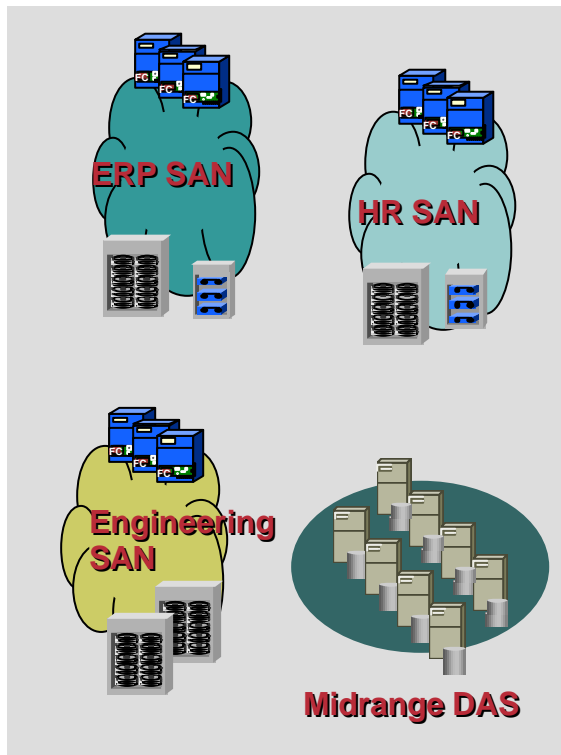
Cisco Storage Networking Vision

Evolution to Multilayer Storage Utility Model

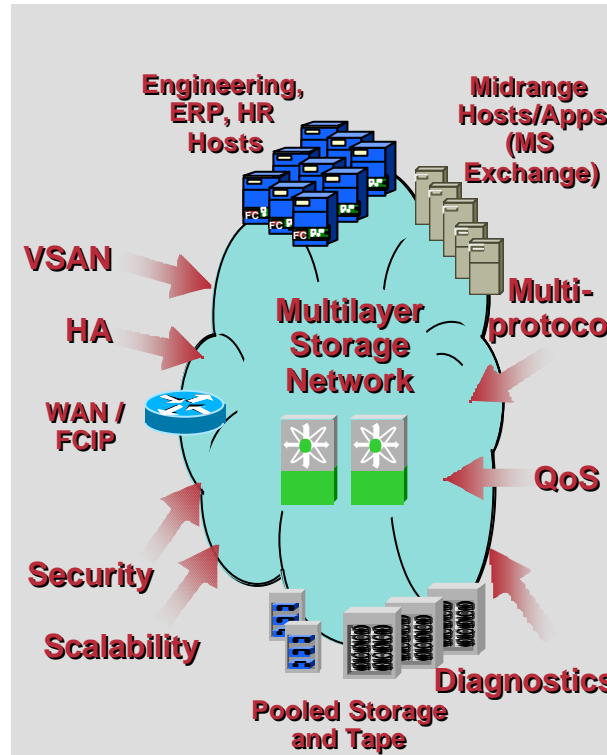
**Homogenous
"SAN Islands"**

**Multilayer
Storage Network**

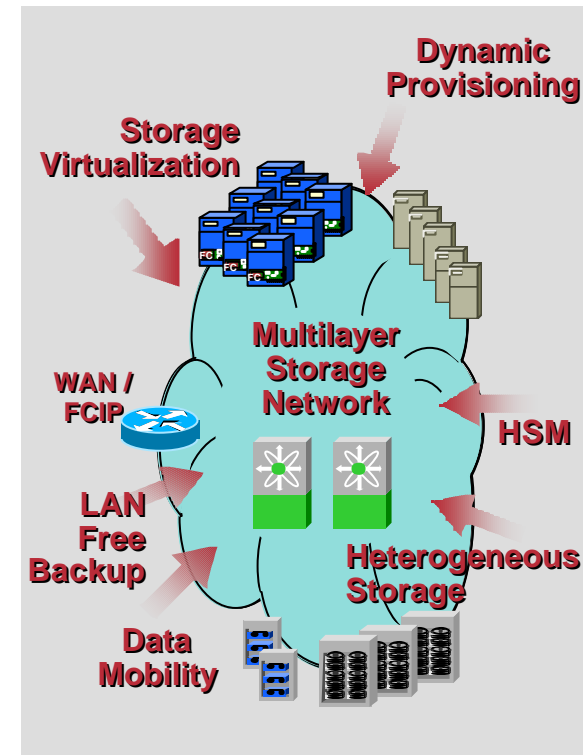
**Multilayer
Storage Utility**



Phase 0: Isolated SANs and Mid-range DAS

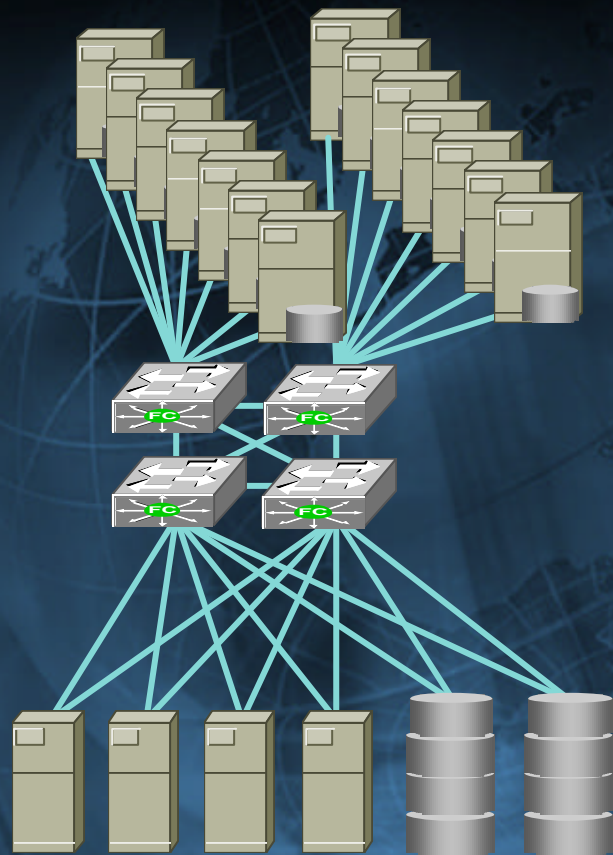


Phase 1: High-end and Mid-range Consolidation



Phase 2: Network Hosted Storage Applications

Skalierbarkeit in derzeitigen SAN's



Fibre Channel SAN

Typical Configuration Fortune 500 Company

	Fibre Channel SAN	IP Data Network
# of Nodes	4	10,000
# of Ports	200	150,000
Distance Spanned	Data Center	Worldwide

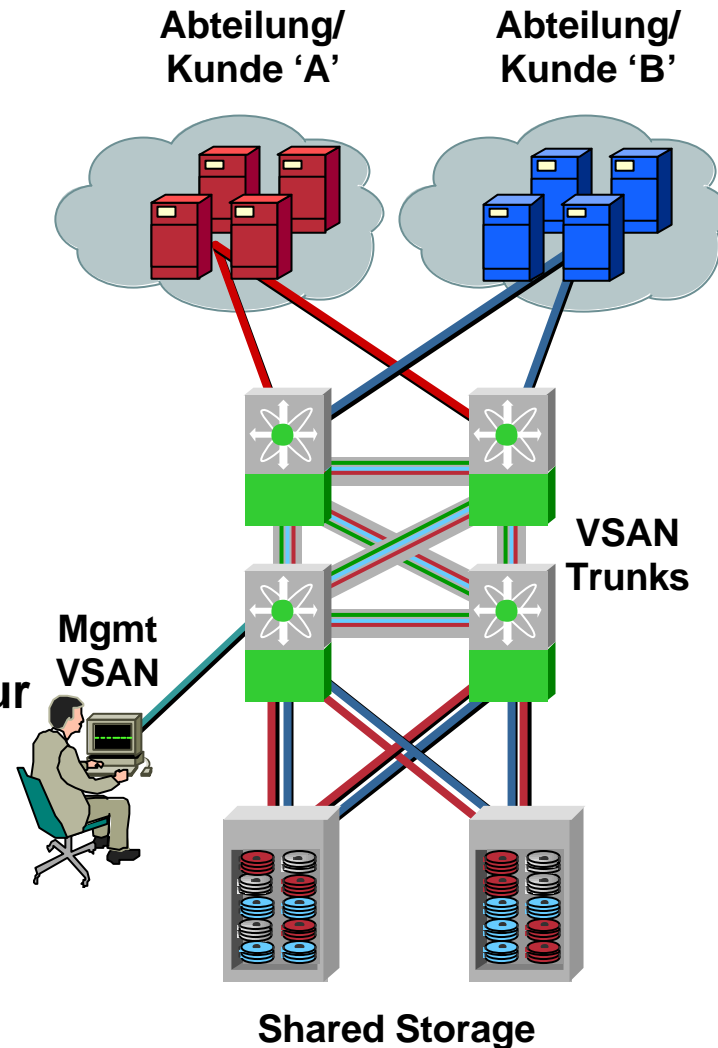
MDS9000 Übersicht

Einsatzbereiche MDS9000 Serie

Cisco.com

- **Speicherkonsolidierung**
- **Backup**
- **Disaster Recovery / Spiegelungen**
- **Virtualisierung**
- **SAN und Storage Management**

- **Server – Storage Kommunikation**
- **Storage – Storage Kommunikation**
- **Hochperformante Netzwerkarhitektur**
- **Hohe Verfügbarkeit**
- **Multiprotokollfähig (FC, iSCSI, FCIP)**



Cisco MDS 9000 Family

Cisco.com

MDS 9500
Multilayer
Directors

MDS 9216
Multilayer
Fabric
Switch

MDS 9000
Modules

Mgmt

OS



MDS 9216



MDS 9506



MDS 9509



MDS 9513



Supervisor



16-port FC



32-port FC



8-port IP

Cisco Fabric Manager

MDS 9000 Family-OS

Cisco MDS 9216 Multilayer Fabric Switch

Cisco.com

- **Full-featured Fabric Switch mit Ausbaupotential**
 - Basis Konfiguration mit 16 Ports fixed**
 - Durch den Expansion Slot sind bis zu 48 Ports möglich**
 - 1 / 2 Gbps auto-sensing SFP/LC Interfaces**
 - Kompatibel mit alle MDS 9000 Family Switching Modulen**
 - 16 und 32-port FC Switching Module**
 - 8-port IP Storage Services Module**
 - Hardware-Based Services**
 - Security services—VSANs, VLANs, ACLs**
 - Traffic management—QoS, FCC**
 - Enhanced services—PortChannel, load balancing**
 - Diagnostics—SPAN, FC Traceroute, FC Ping, Cisco Fabric Analyzer**



Cisco MDS 9509 Multilayer Director

Cisco.com

- **Neudefinition eines Director-class Storage Switches**

Non-blocking fabric—1.44 Tbps

1 / 2 Gbps auto-sensing ports—10Gbps ready

Platform for storage management software

Hardware-based services

Security services—VSANs, VLANs, ACLs

Traffic management—QoS, FCC

**Diagnostics—SPAN, FC Traceroute,
Fabric Analyzer**

**Enhanced services—PortChannel, load
balancing**

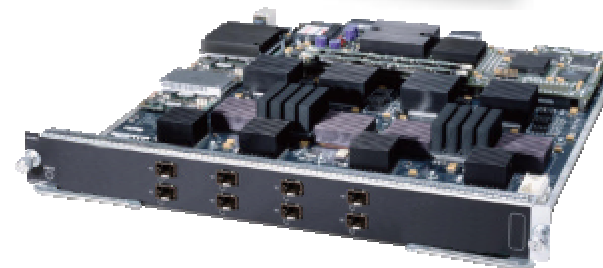
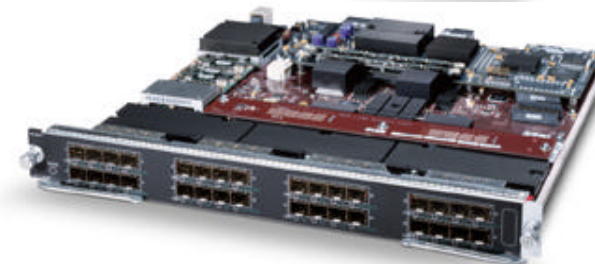
- **Multitransport switch—FC, iSCSI, FCIP**



10Gig Ready

Cisco MDS 9000 Family Switching Module Summary

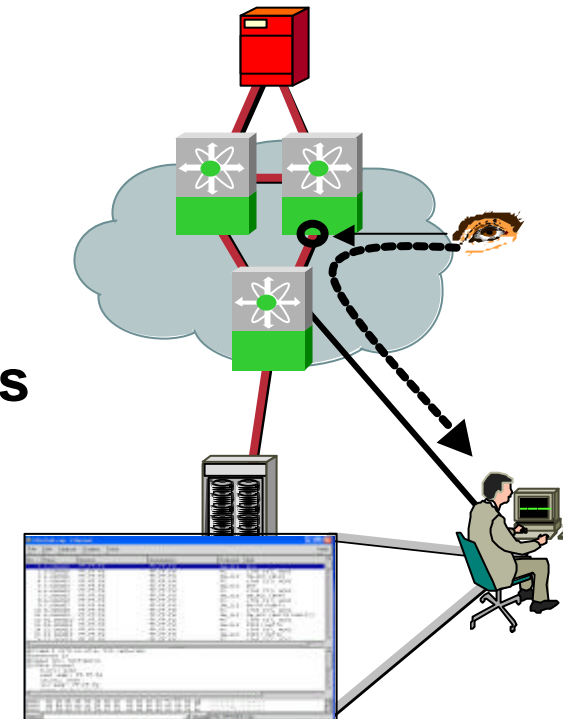
- **16-Port Fibre Channel**
16-port 1 / 2-Gbps auto-sensing Fibre Channel (SFP/LC)
- **32-Port Fibre Channel**
32-port 1 / 2-Gbps auto-sensing Fibre Channel (SFP/LC)
- **8-Port IP Storage Services**
8-port 1-Gbps Ethernet with iSCSI and FCIP Gateway functionality (SFP/LC)



Diagnose Tools minimieren Downtime und verbessern Performance

Cisco.com

- **Cisco Fabric Analyzer: Decodiert und analysiert Fibre Channel und SCSI Protokolle und sendet die Controllframes an eine Workstation über IP**
- **SPAN Ports ermöglichen das Mitlesen des Verkehrs**
- **FC Traceroute hat timestamps aller Hops**
- **FC Ping**
- **Call Home**

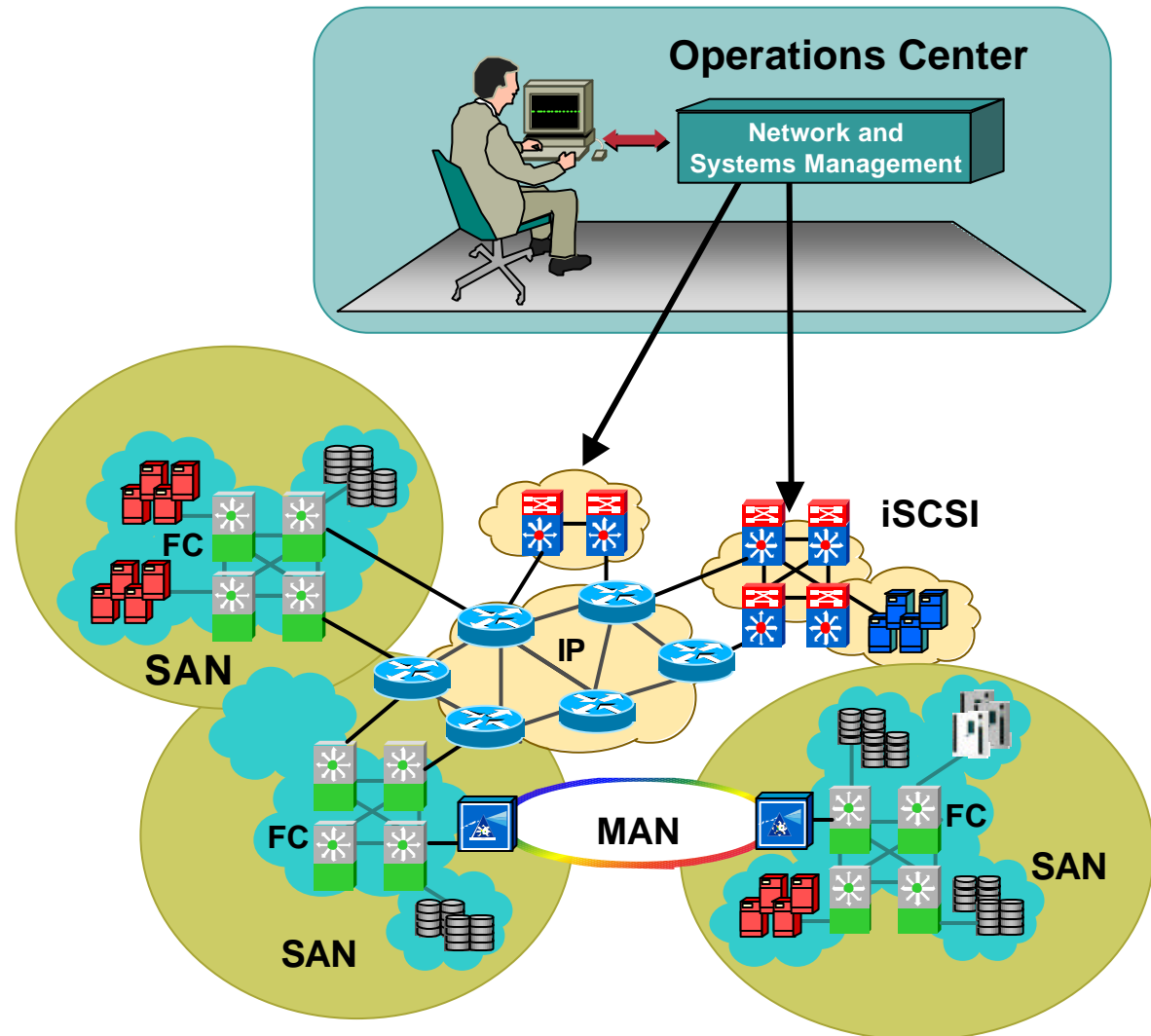


Management Overview

Cisco.com

**Kombiniert alle
verschiedenen
Management-
möglichkeiten**

- Cisco IOS-like CLI
- Cisco Fabric Manager
- Open API
 - BMC Software
 - Computer Associates
 - EMC WideSky
 - IBM Tivoli
 - StorageNetworks, Inc.
 - VERITAS
- Nutzt FC-GS-3, CDP



Cisco Fabric Manager

Cisco.com

Einfaches Management für einen und mehrere Switches

- Switch-embedded Java-based Application
- Discovery und Topology Mapping
- Multiple Views
 - Fabric View
 - Summary View
 - Physical View
- Configuration
- Monitoring and Alerts
- Network Diagnostics
- Security
 - SNMPv3
 - SSH
 - RBAC

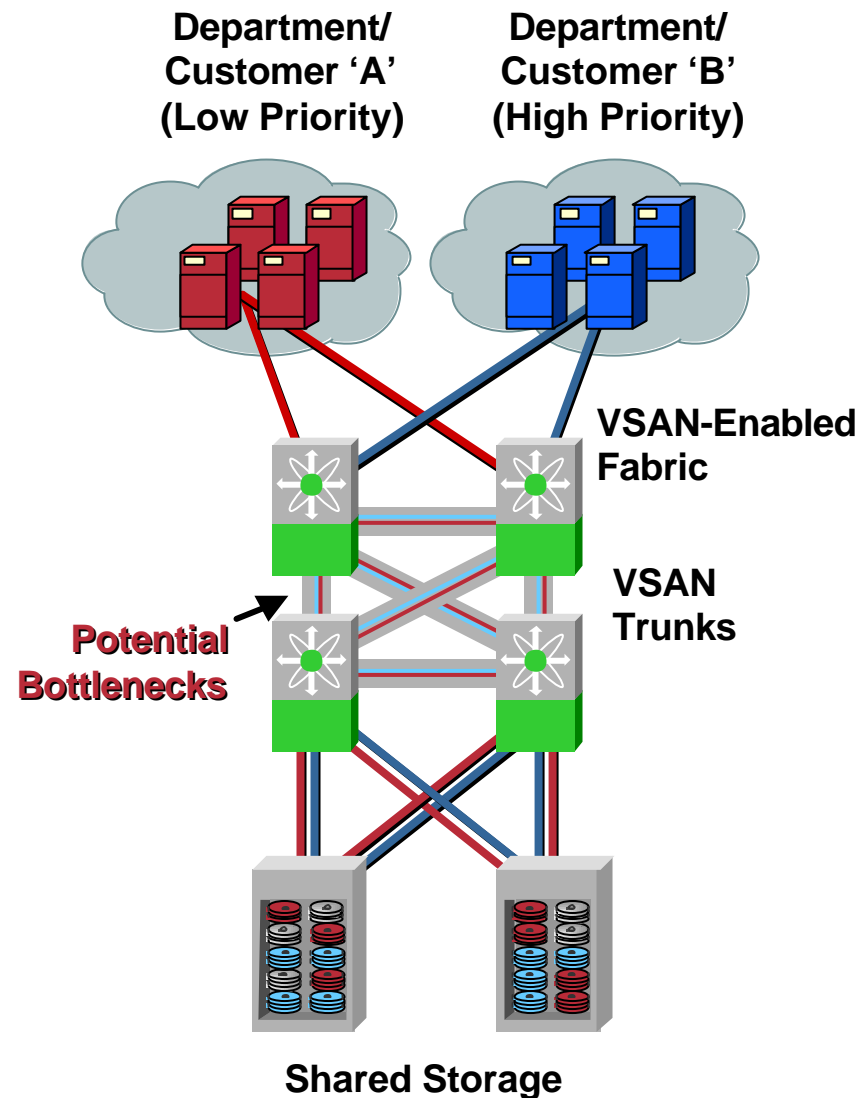
The screenshot displays the Cisco Fabric Manager interface. The main window is titled 'Zone Manager' and shows a hierarchical tree view of the network configuration. Below this, a 'Physical View' shows a network topology diagram with several switches and their interconnections. To the right, a 'Physical View' window shows a detailed view of a switch's physical ports, with a grid of port status indicators. At the bottom, a 'Fabric Manager Summary View' window displays a table of port statistics.

Port	Mode	Channel	Speed	VSAN(s)	Neighbor WANN	Neighbor Name	Rx Utilization%	Tx Utilization%	Errors	Discards
2/1	E		10Gbps	1	10.00.00.01:88:00:00:00		00	00	1,444	732
1/2	E		10Gbps	1	10.00.00.11:9b:00:00:00:00		00	00	1,524	752
4/1	E		10Gbps	1	10.00.00.11:9b:00:00:00:00		00	00	1,482	731
1/3	E		10Gbps	1	10.00.00.00:00:00:00:00:00		00	00	1,434	717
1/4	E		10Gbps	1	10.00.00.11:9b:00:00:00:00		00	00	1,588	793
9/3	E		10Gbps	1	10.00.00.11:9b:00:00:00:00		70	18	1,488	734
1/1	E		10Gbps	1	10.00.00.01:88:00:00:00:00		00	00	1,512	756
1/2	E		10Gbps	1	10.00.00.00:00:00:00:00:00		07	31	1,494	747
8/1	E		10Gbps	1	10.00.00.00:00:00:00:00:00		00	00	1,588	793
8/2	E		10Gbps	1	10.00.00.01:88:00:00:00:00		00	00	1,570	795
7/1	E		10Gbps	1	10.00.00.11:9b:00:00:00:00		00	00	1,544	772
7/2	E		10Gbps	1	10.00.00.01:88:00:00:00:00		16	50	1,492	748
7/3	E		10Gbps	1	10.00.00.00:00:00:00:00:00		14	0	1,492	741

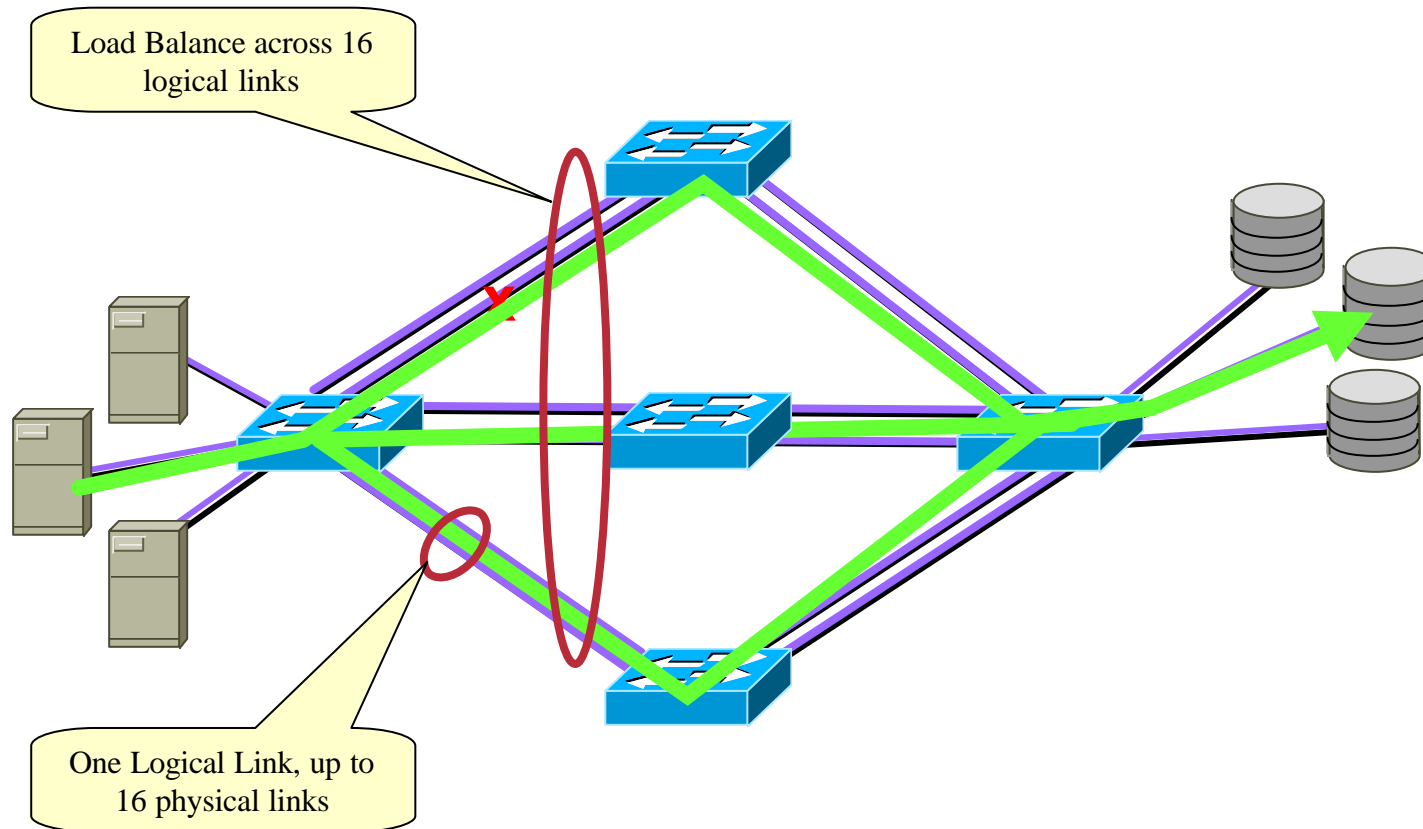
Intelligent Traffic Management

Cisco.com

- Congestion control mechanism (FCC) can throttle back traffic at its origin
- QoS allows traffic to be intelligently managed
 - Low-priority traffic throttled at source
 - High-priority traffic not affected
 - Minimizes impact of oversubscription
 - Allows more economical topologies

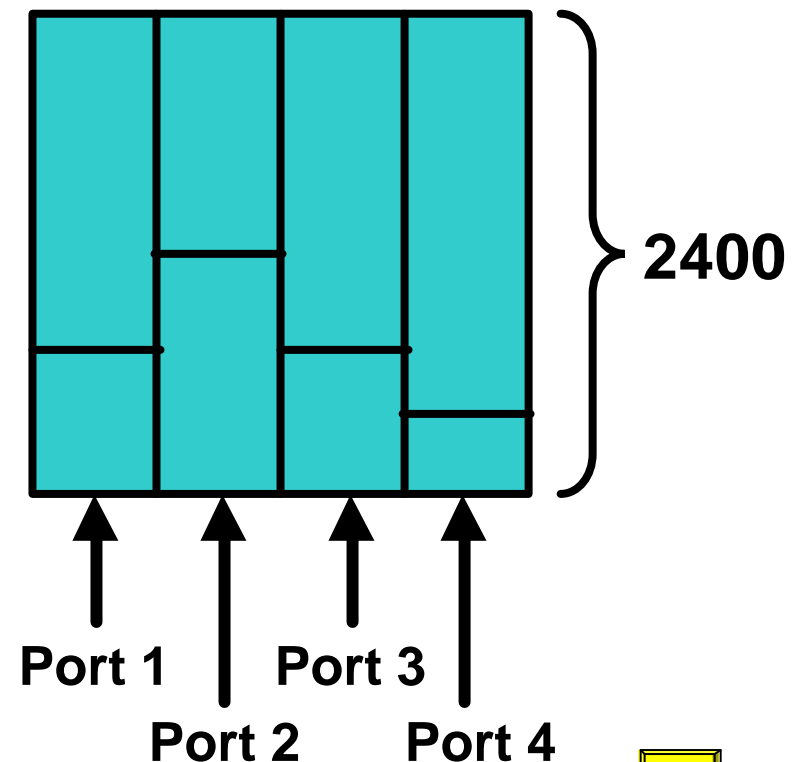


Multi-path Load Balancing



Flexibles Buffering

- **Pool of Buffers Shared Across 4 Ports**
- **2400 Buffers total in pool**
- **Flexible Carving of Buffers**
- **User settable credit amounts up to 255 w/ default**
- **Each buffer is 1 Maximum frame size**



Warum Cisco?

Multilayer Intelligent Storage Solution

Enable integrated SAN infrastructures
by driving **intelligence**
and **interoperability** standards
into **storage networking**

Layer	Capabilities / Protocols
Integrated Management	SRM, Policy-based Mgmt
Intelligent Storage Services	Network-based Virtualization, Data Mobility
Intelligent Network Services (End-to-End)	Diagnostic Tools, Security, Traffic Management, High Availability, SAN Scalability
Multiprotocol / Multitransport	FCIP - MAN/WAN, iSCSI - GE, Fibre Channel

CISCO SYSTEMS



EMPOWERING THE
INTERNET GENERATION