



Fibre Channel

Roadmap to your SAN Future !

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Fibre Channel

Fibre Channel is a robust and evolving technology that enables:

- Leading investment protection*
- Innovation*
- Superior business application uptime*
- Flexible business continuity*
- Best performance options*

*Delivering leading investment protection,
application uptime and performance*



Fibre Channel Continuous Evolution

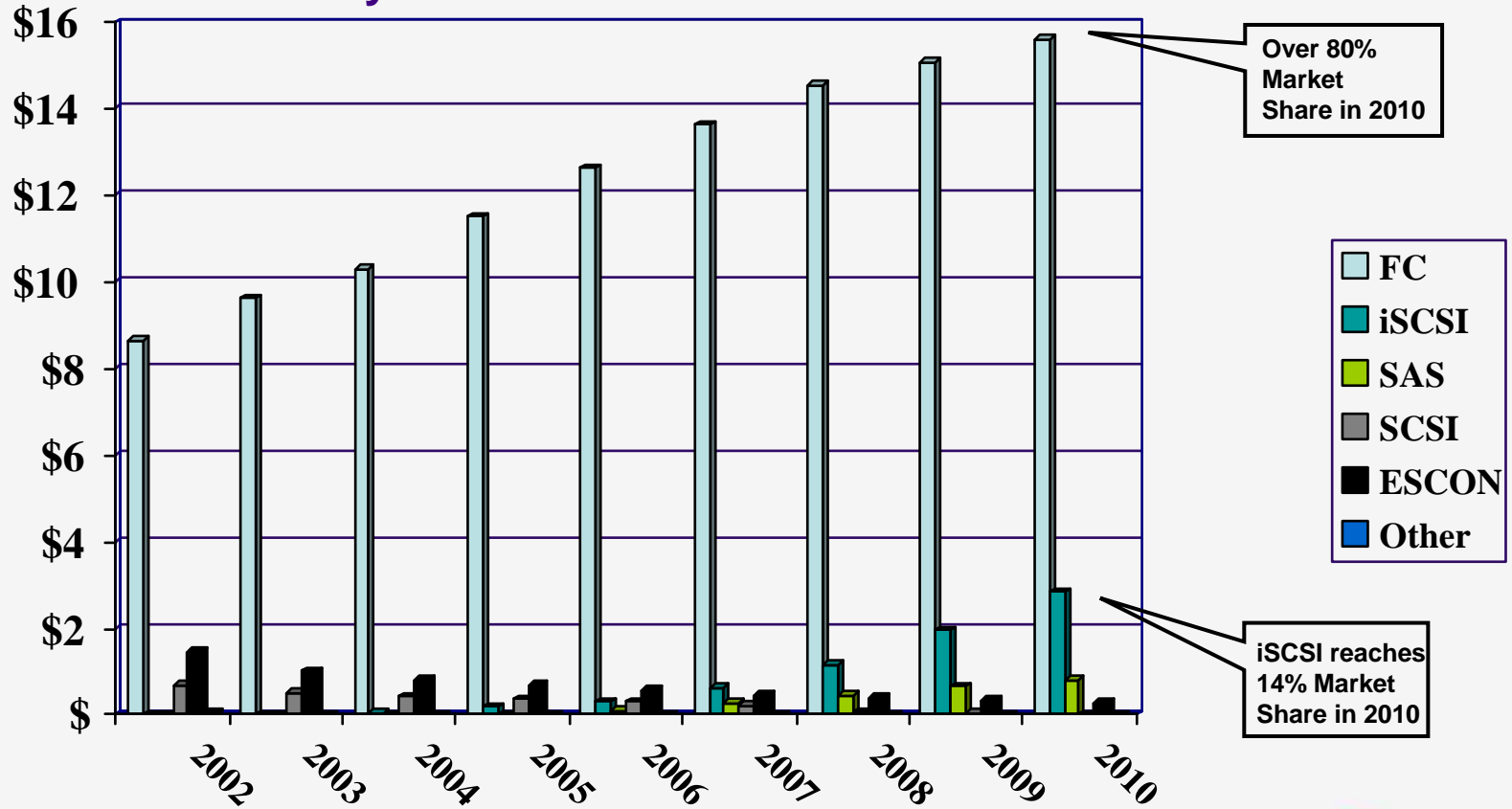
- *FC has been the major storage system interconnect since the mid 90s*
 - *FC now dominates the SAN and external storage market place with over 90% market share*
- *How will FC continue to Meet customers' evolving needs?*
 - *Faster speeds*
 - *Bandwidth/Cost leadership*
 - *Investment protection*
 - *Additional capabilities*
 - *Lower cost solutions*
 - *Simplified solutions (plug-n-play)*

*Delivering leading investment protection,
application uptime and performance*



Continuous SAN Market Growth

Block External Controller-Based Disk Storage By Host Interface Revenue

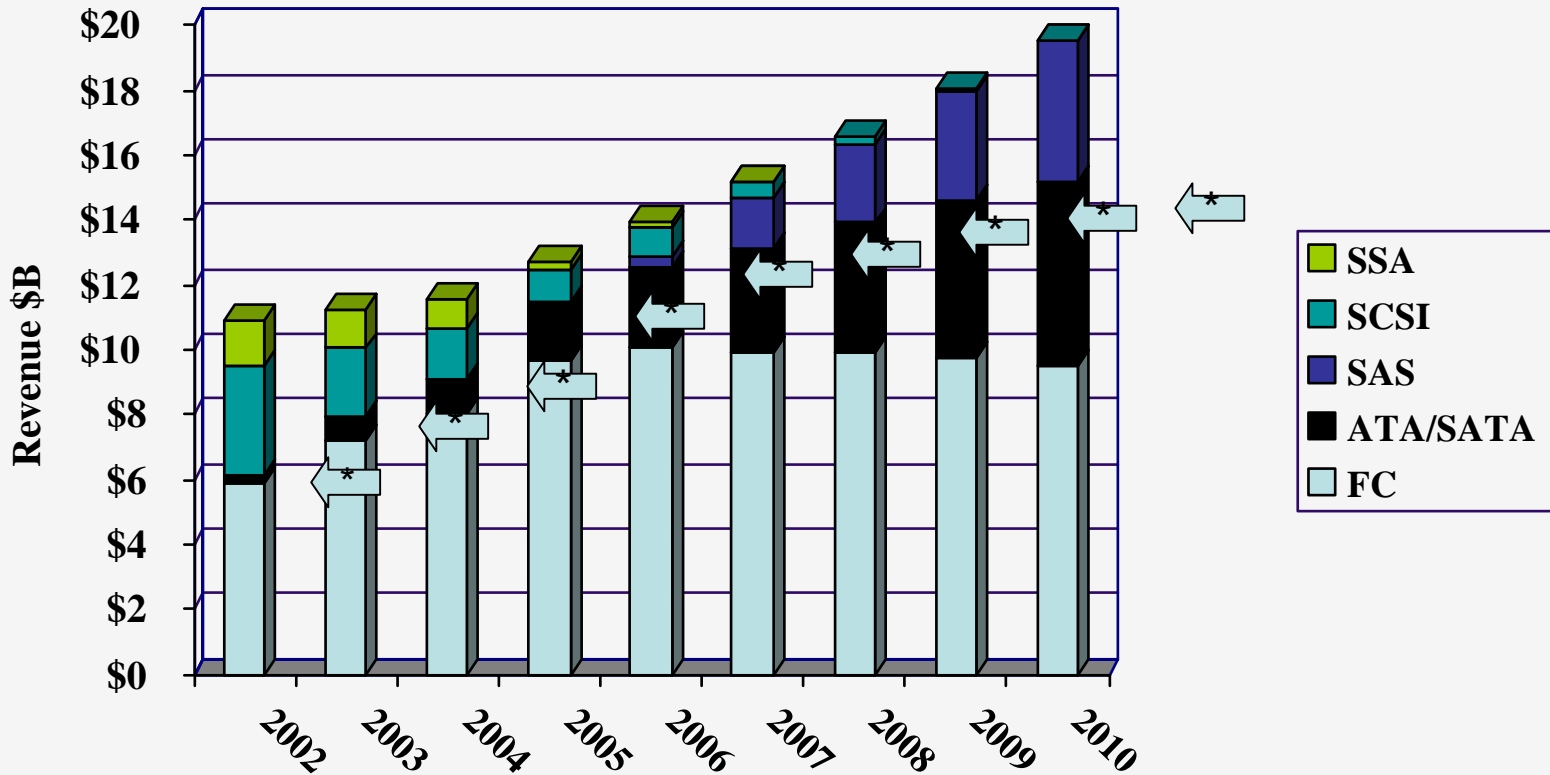


Source: Gartner External Controller-Based Disk Storage
WW 2006-2010, 6 October 2006 (FICON Included in Fibre Channel)



Continuous Back-End Market Growth

Block External Controller-Based Disk Storage By HDD Interface Revenue



Source: Gartner External Controller-Based Disk Storage
WW 2006-2010, 6 October 2006 (FICON Included in Fibre Channel)

* Estimate of FC+SATA over FC Infrastructure.
Source: FCIA



Performance and Flexibility

Highest Performance with Maximum Flexibility

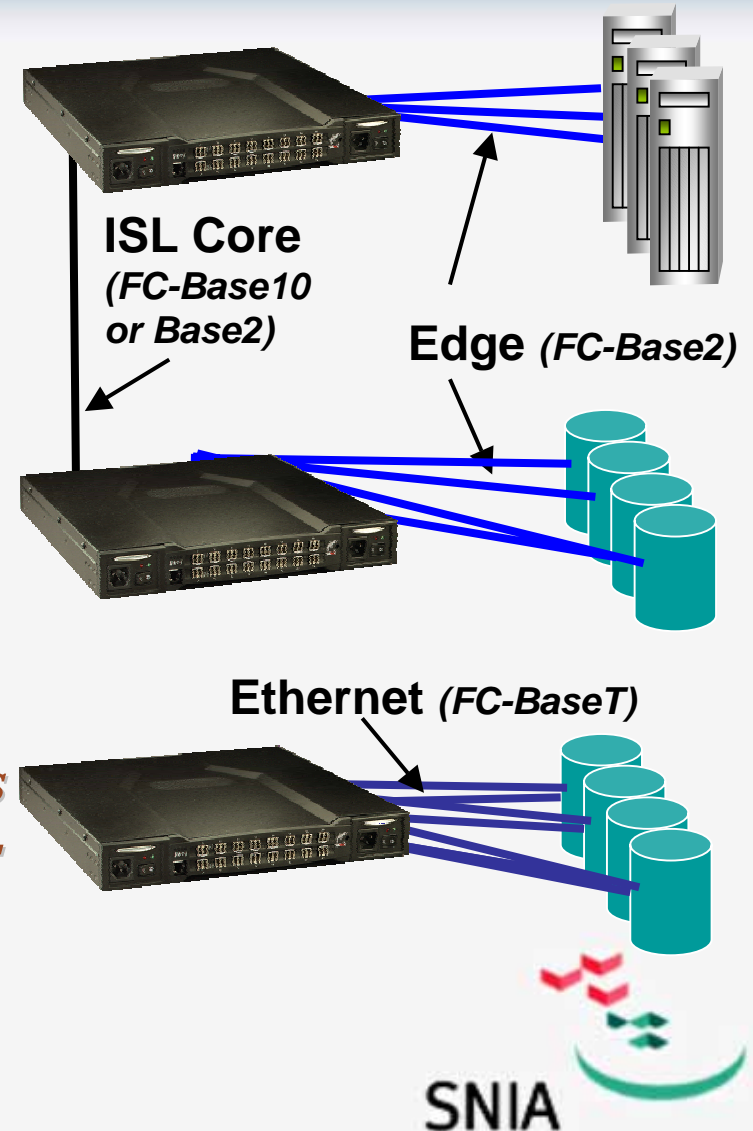
- Superior business application uptime*
- Affordable, flexible business continuity*
- Storage tiering by design*
- Faster performance with greater options*
- Easier and more secure*
- Non-stop innovation by addressing real customer requirements*



Fibre Channel Speeds

3 Connection Types

- **FC specifies 3 connection types**
 - *FC-Base2, FC-Base10, FC-BaseT*
 - All speeds of each type Auto-negotiate best speed w/o any user intervention!
 - Each speed within its connection type is backward compatible 2 generations!
- **FC-Base2**
 - *Predominant FC interconnect*
 - *Used for fabric Edge and ISL*
 - *Also used for Disk and Tape Drives*
 - *All speeds single lane serial streams*
 - *Optics and copper cabling, SFP/SSF*



Fibre Channel Speeds

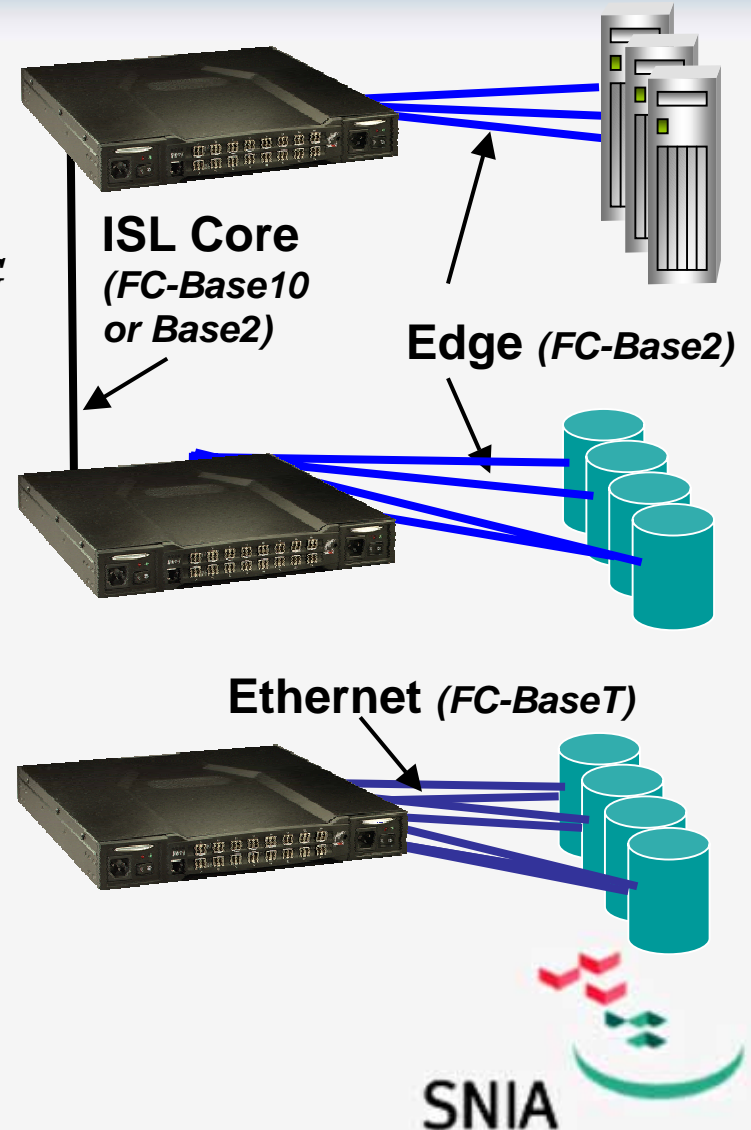
3 Connection Types

- **FC-Base10**

- *Used for ISL (2.5x-3x bandwidth of edge)*
 - *4G Edge/10G ISL migrates to 8G Edge/20G ISL migrates to 16G Edge/40G ISL, etc*

- **FC-BaseT**

- *Used to plug FC into Ethernet installations*
- *Copper only (Cat5/5e/6 cables)*
- *RJ-45 connector*
- *User can use FC without changing any existing or new Ethernet cabling!*



Fibre Channel Roadmap (Speed Gb/s)

- **FC-Base2 (Edge and ISL)**
 - *1GFC, 2GFC, 4GFC (shipping today)*
 - *8GFC (ships in 12-18 months)*
 - *16GFC, 32GFC, 64GFC, 128GFC*
- **FC-Base10 (Edge)**
 - *10GFC (shipping today)*
 - *20GFC (ships in 12-18 months)*
 - *40GFC, 80GFC, 160GFC*
 - 100GFC under study (leverage IEEE 802.3 work)
- **FC-BaseT**
 - *1GFC, 2GFC, 4GFCF (ships in 12-18 months)*
 - *8GFC, 10GFC*
 - 8GFC follows typical FC trend
 - 10G follows typical Ethernet trend



FC Roadmap - Fastest Speeds

- **2GFC Dominates installed SANs worldwide**
 - *Twice 1 GbE speeds and more efficient*
- **4GFC Fibre Channel solutions shipping today**
 - *Fastest storage interconnect available today*
- **8GFC Under development**
 - *Active development of 8GFC, standard stabilized in April, 2007*
 - *Focused on low-cost, backward compatibility & fast time-to-market for Edge/ISL*
- **10GFC Deployed today for Inter-Switch Links**
 - *Provides 2.5x – 3x (of edge speed) core bandwidth for 4GFC edge links*
 - *Migrates to 20GFC to maintain 2.5x-3x ISL bandwidth for 8GFC edge links, 40GFC ISL for 16GFC Edge rates, 80G for 32G, etc*
- **16GFC Fibre Channel on the horizon**
 - *8G Edge/ISL links migrate to 16G Edge/ISL links or for maximum ISL bandwidth use 40GFC ISL with 16GFC Edge*



Roadmap All the Way to 160GFC!



New Fibre Channel Standards

- *There's More to Fibre Channel than being the Fastest Storage Interface*
- *New Fibre Channel Standards for Protocols, APIs, and Management*
- *Fibre Channel is Easier and More Secure than Ever!*



FC Roadmap - Standards Innovation

- **FC-SP: Security Protocol**
 - *Authentication with DH-CHAP*
 - *Encryption supported*
 - *Products shipping now*
- **FC-SCM: Simplified Configuration and Management**
 - *Moves FC into smaller SAN markets*
 - *Plug-n-play level easy install, maintain*
 - *Currently in FCIA requirements phase*
- **FC-SATA: SATA Tunneling over FC**
 - *Brings native tiered storage to FC*
 - *Technical specifications complete*
 - *Products within 12 months*



FC Roadmap - Standards Innovation

- **IFR: Inter-Fabric Routing**
 - *Provides heterogeneous fabric routing*
 - *Improves scalability and interoperability*
 - *Technical specifications complete*
 - *Products shipping now*
- **NPIV: N-Port ID Virtualization**
 - *Makes the port ID autonomous from the server*
 - *Improves the sharing of physical HBA's for Hypervisors*
 - *Specification Complete*
 - *Products shipping now*
- **FAIS: Fabric Application Interface Specification**
 - *Standardizes the interface to the fabric*
 - *Specification complete*
 - *Speeds time-to-market and improves interoperability*
 - *Products within 12 months*



Fibre Channel over Ethernet (FCoE)

- **Provides a method to encapsulate Fibre Channel over the Ethernet transport**
- **Similar to other Fibre Channel encapsulations defined in the T11 Back Bone project**
- **Mapping takes place over native Ethernet rather than TCP - ensures good performance**
- **Takes advantage of proposed enhancements to Ethernet in support of today's demanding storage environments**
- **Expands FC into Ethernet environment, providing more options for SAN connectivity and networking**
- **Allows servers using multi-protocol attached NICs to leverage & extend existing FC networks**
- **Helps to ensure FC remains the technology of choice for SAN connectivity**



Fibre Channel: The Storage of Business

- *Dominates the SAN market today*
- *Fibre Channel has a clear roadmap to provide:*
 - *Higher performance*
 - *Additional capabilities (Security, Tiered Storage, Intelligence...)*
 - *Enablers for new markets*
- *Easy to learn, use and implement*
- *Protects and future proofs storage investments*
- *Comprehensive end to end solution*

Fibre Channel: Unchallenged in Storage





Fibre Channel is Here to Stay
Roadmap for YOUR SAN!

