Session 14274

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Introduction to Storage Technologies SAN (Storage Area Networking) and FICON (FIber CONnection)

David Lytle – Brocade – dlytle@brocade.com

SAN 101

SHARE in Boston

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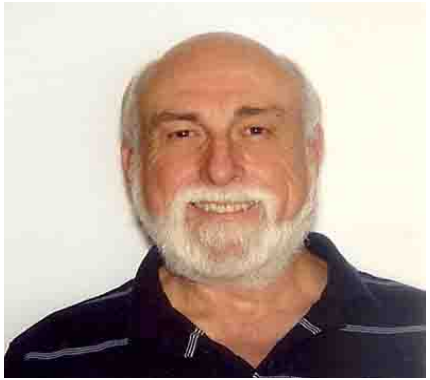
Introduction to SAN and FICON Infrastructures



Data Centers Will Continue To Evolve!

Notes as part of the online handouts

I have saved the PDF files for my presentations in such a way that all of the audience notes are available as you read the PDF file that you download.

If there is a little balloon icon in the upper left hand corner of the slide then take your cursor and put it over the balloon and you will see the notes that I have made concerning the slide that you are viewing.

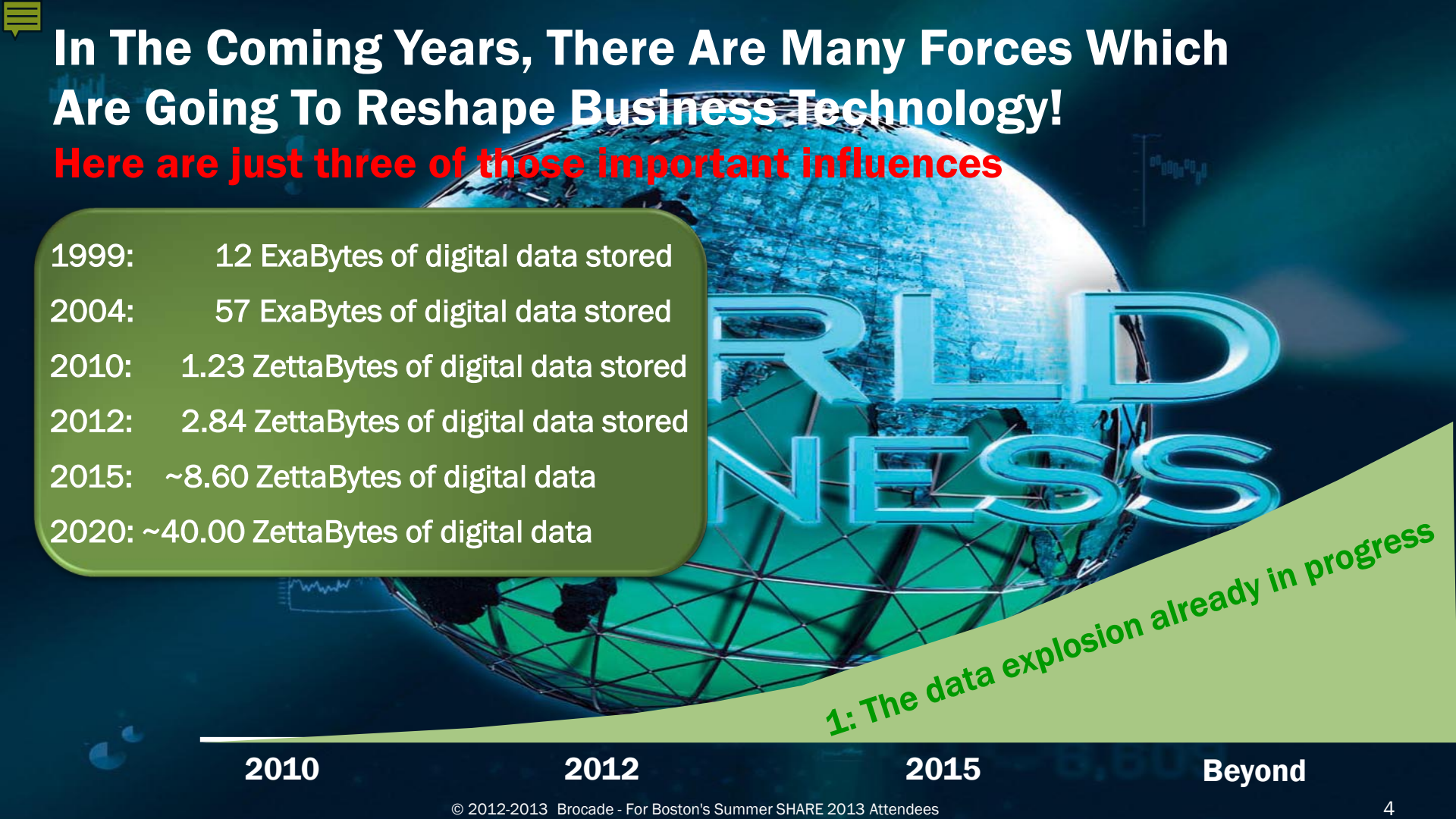
This will usually give you more information than just what the slide contains.

I hope this helps in your educational efforts!

In The Coming Years, There Are Many Forces Which Are Going To Reshape Business Technology!

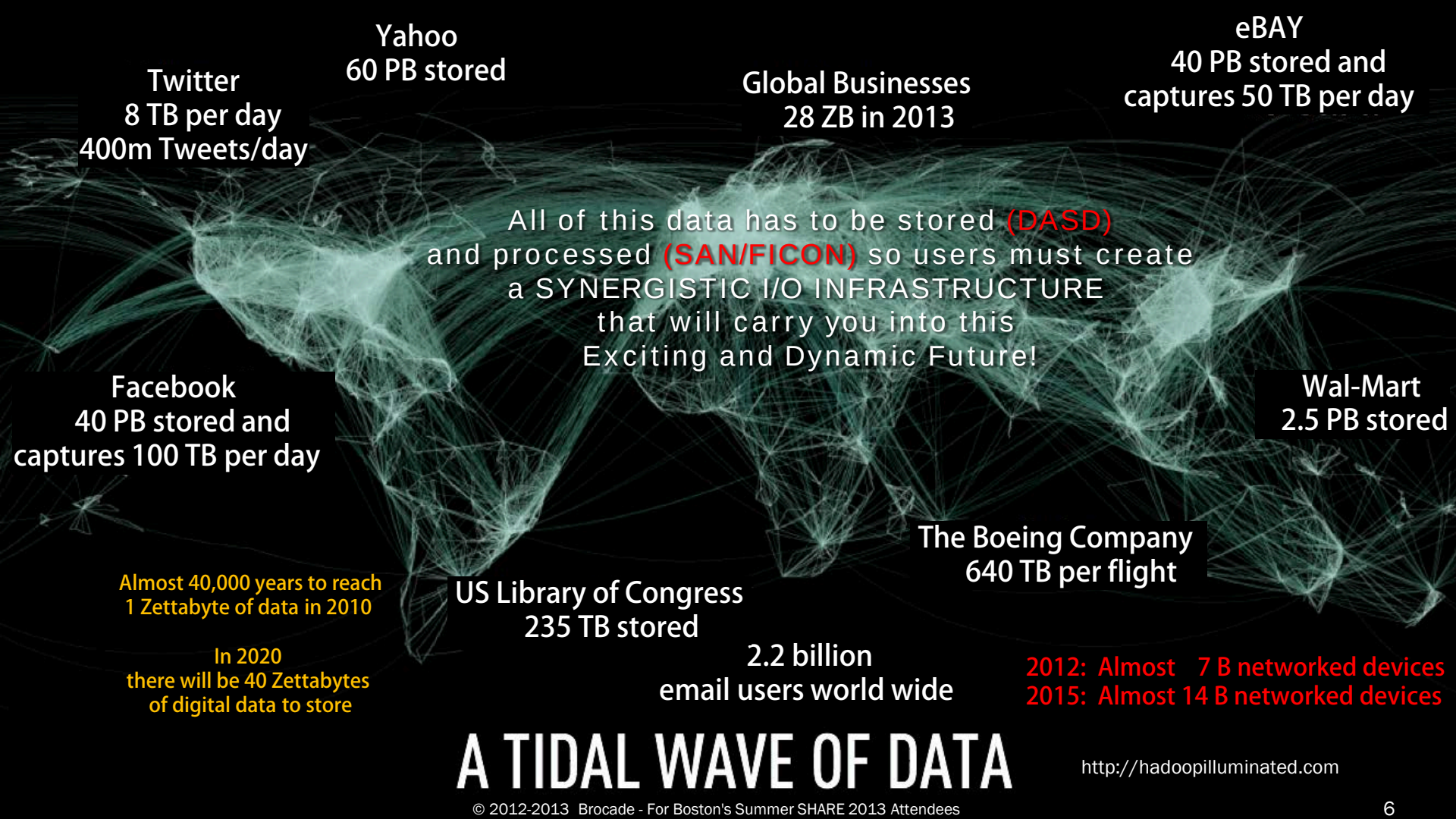
Here are just three of those important influences

1999:	12 ExaBytes of digital data stored
2004:	57 ExaBytes of digital data stored
2010:	1.23 ZettaBytes of digital data stored
2012:	2.84 ZettaBytes of digital data stored
2015:	~8.60 ZettaBytes of digital data
2020:	~40.00 ZettaBytes of digital data



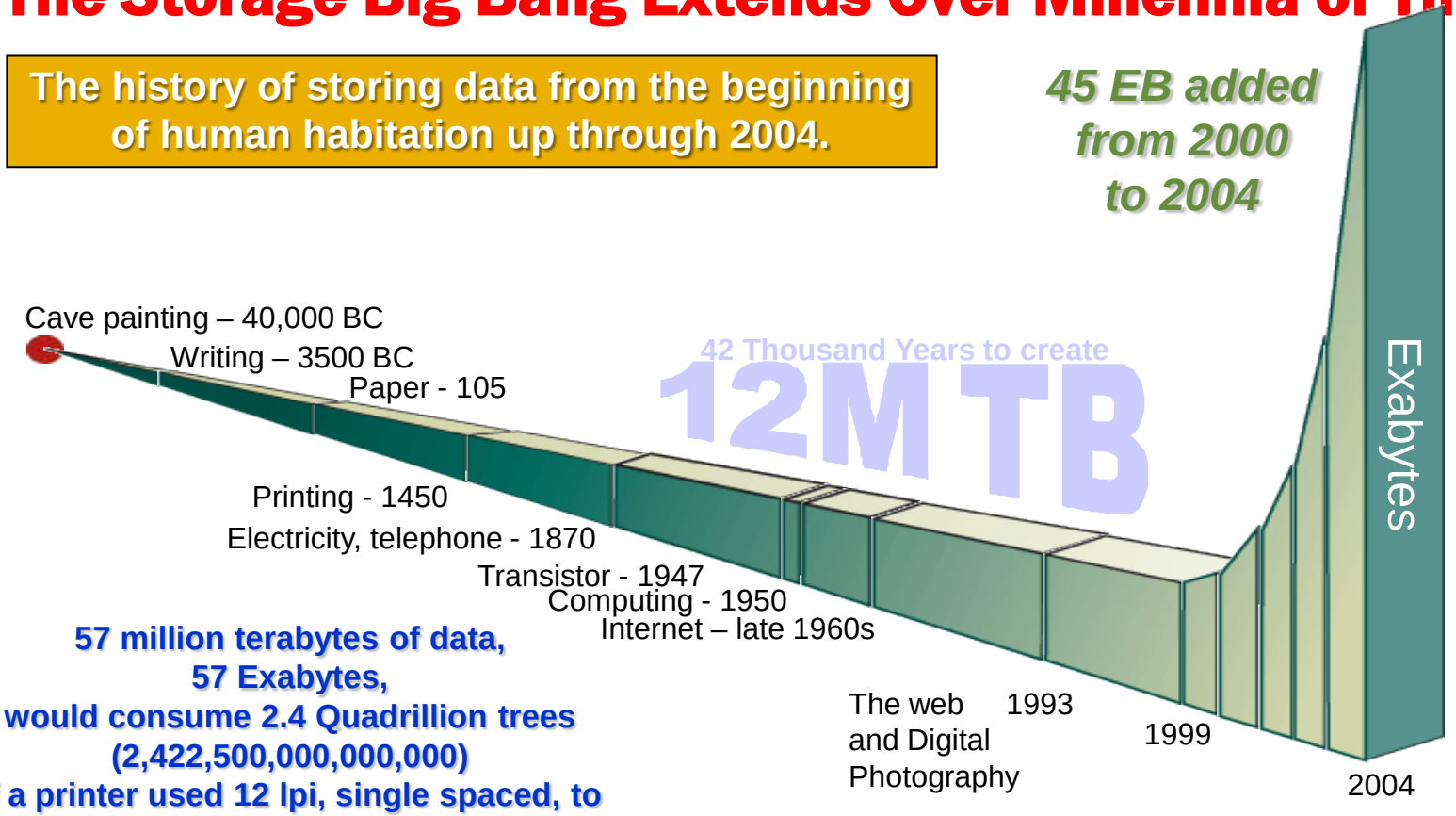
A TIDAL WAVE OF DATA

http://hadoopilluminated.com



The Storage Big Bang Extends Over Millennia of Time

The history of storing data from the beginning of human habitation up through 2004.



57 million terabytes of data, 57 Exabytes, would consume 2.4 Quadrillion trees (2,422,500,000,000,000) if a printer used 12 lpi, single spaced, to print all of that data

57 Exabytes

OF INFO STORED as of 2004!

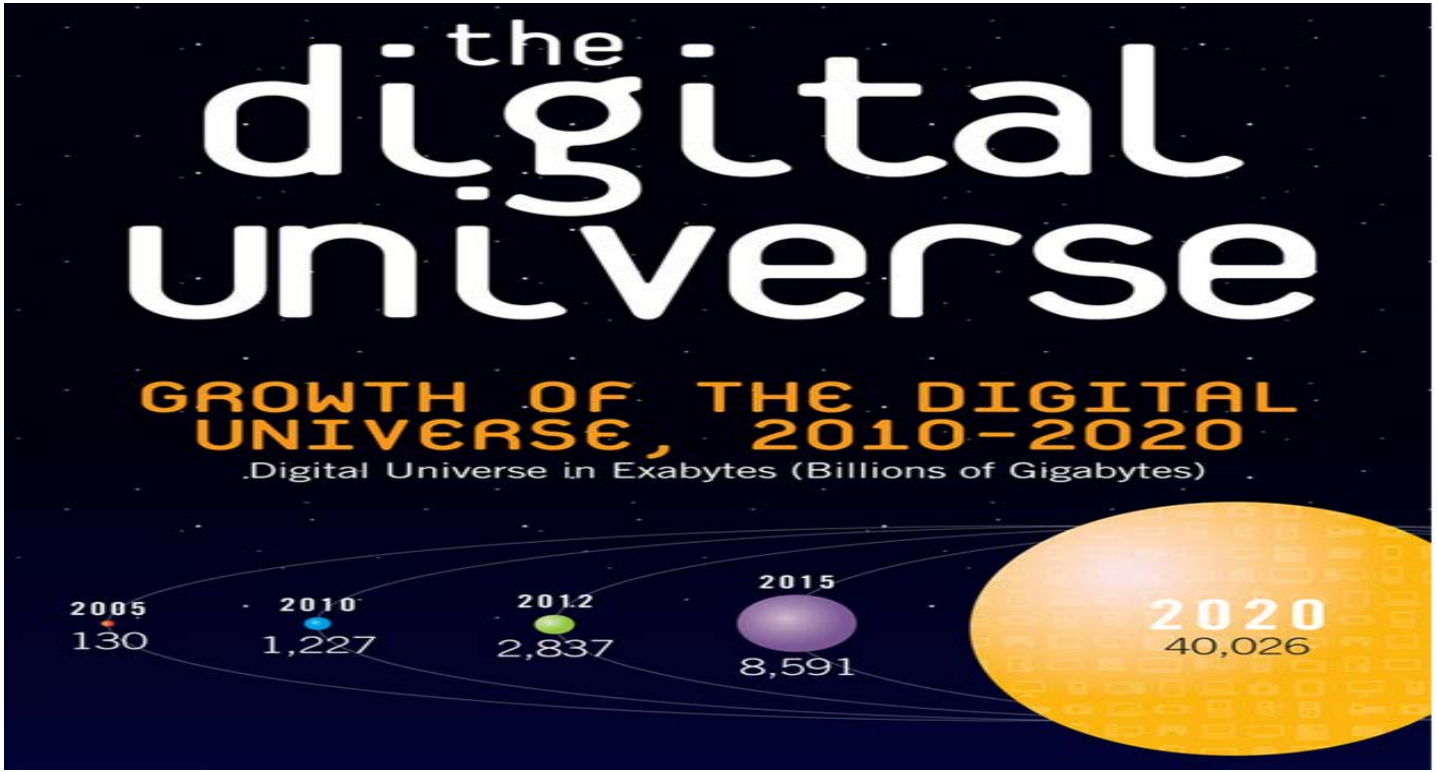
It has been a Tsunami of stored data and it does not get better over time!

Complete your sessions evaluation online at SHARE.org/BostonEval

Source: School of Information Management and Systems, Berkeley.

Force #1: The Storage Content Big Bang

Storage From 2005 Up To The End of 2020



During 2010 we cracked the Zettabyte storage barrier for the first time!

By 2020 users will be creating and replicating 10s of Zettabytes of information Every Year!

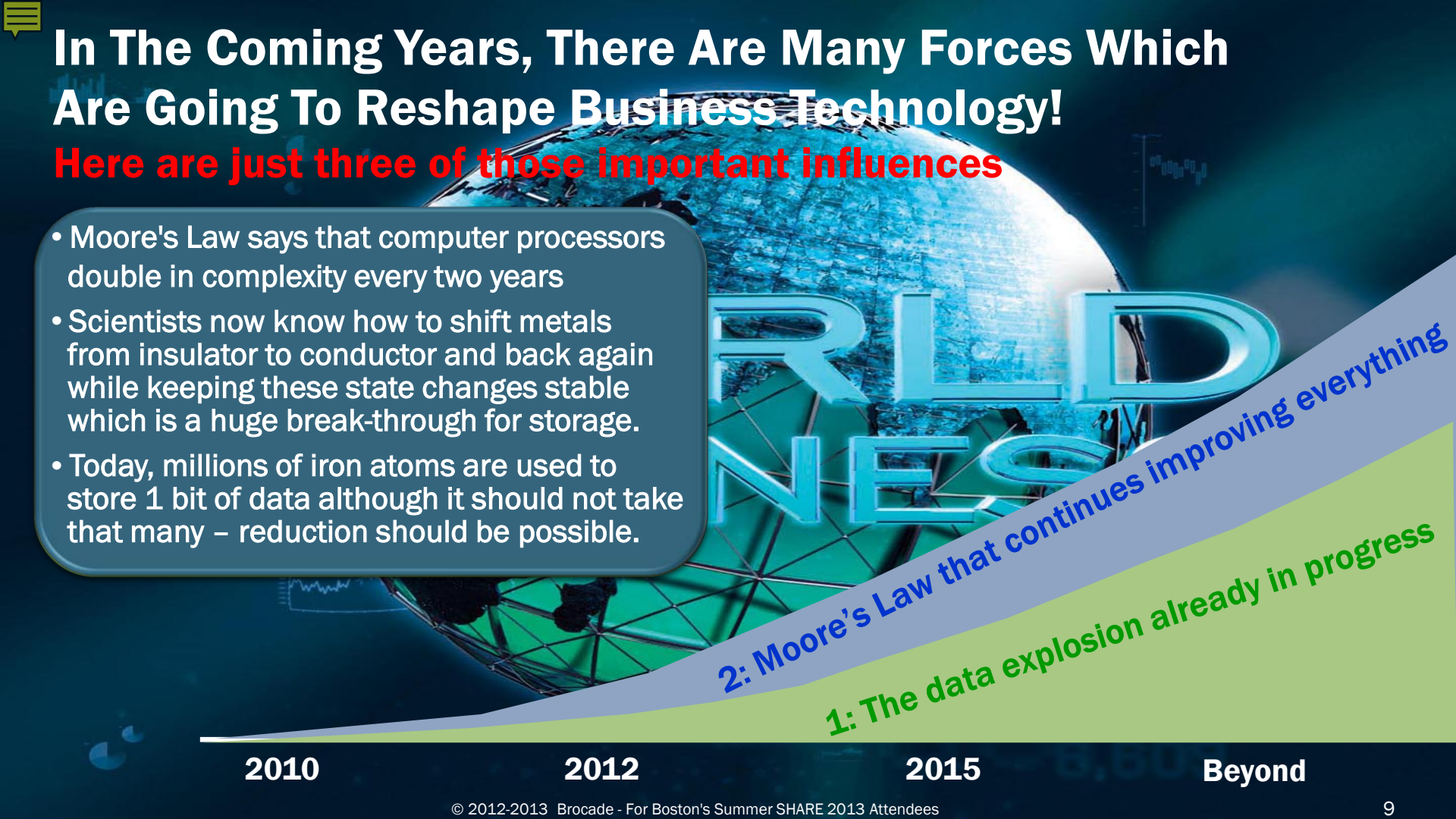
AND GROWING!

An EMC and IDC Study: http://www.emc.com/leadership/programs/digital-universe.htm

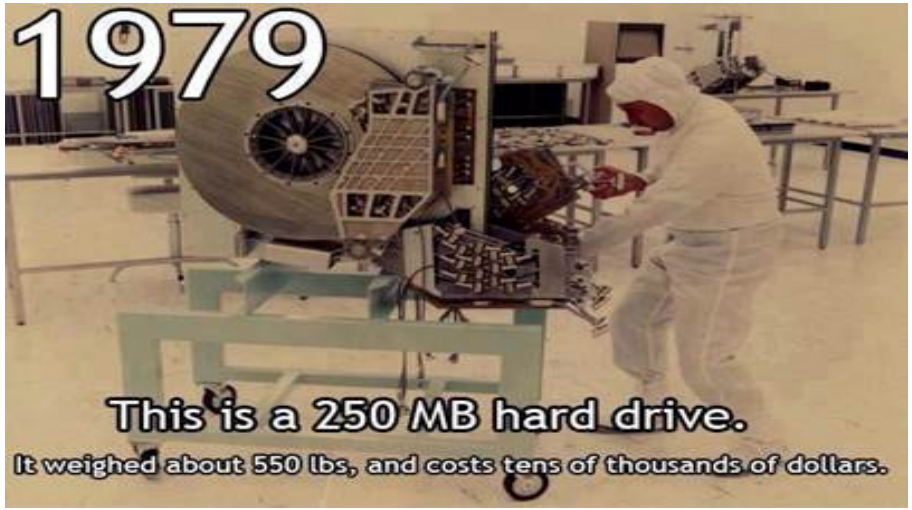
In The Coming Years, There Are Many Forces Which Are Going To Reshape Business Technology!

Here are just three of those important influences

- Moore's Law says that computer processors double in complexity every two years
- Scientists now know how to shift metals from insulator to conductor and back again while keeping these state changes stable which is a huge break-through for storage.
- Today, millions of iron atoms are used to store 1 bit of data although it should not take that many – reduction should be possible.



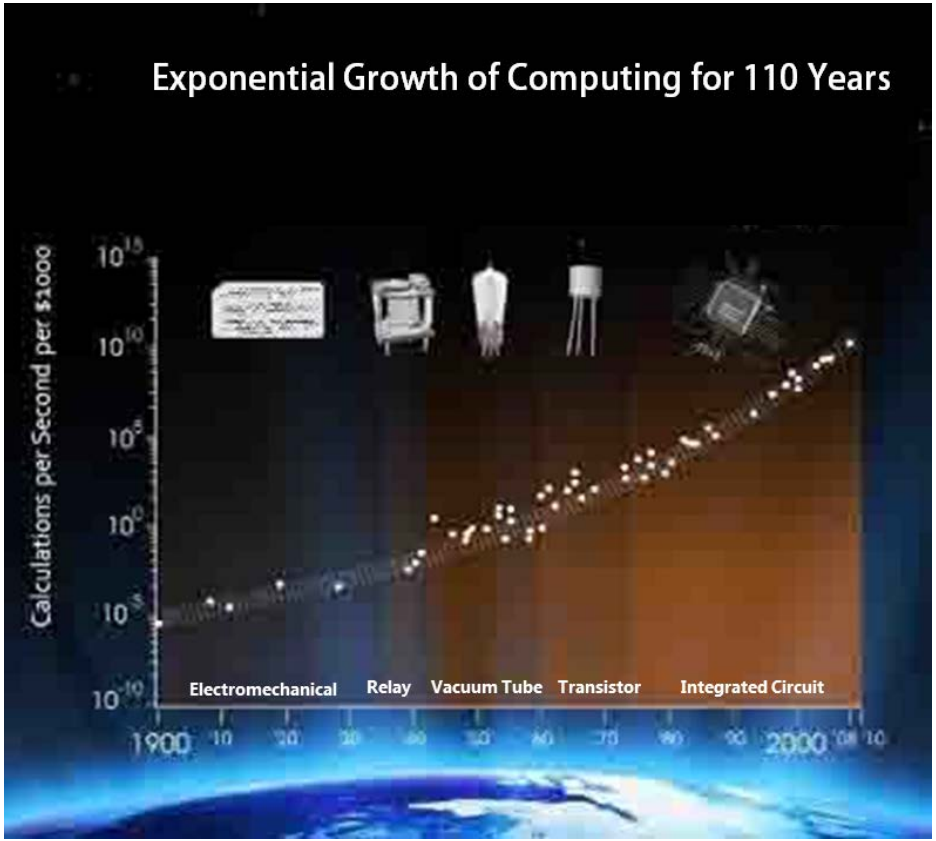
Force #2:
Moore's Law has been working for 110 years and it…



…has Provided us with Benefits as well as Challenges!

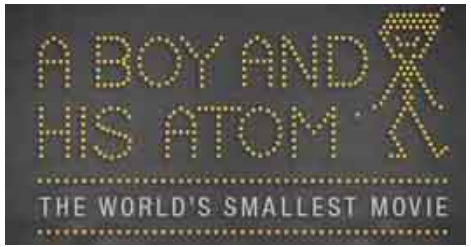
Moore's Law is still going strong!

And there is no limit in sight to continued technology scalability



Today it takes millions of iron atoms to store a single 0/1 bit of data on disk!

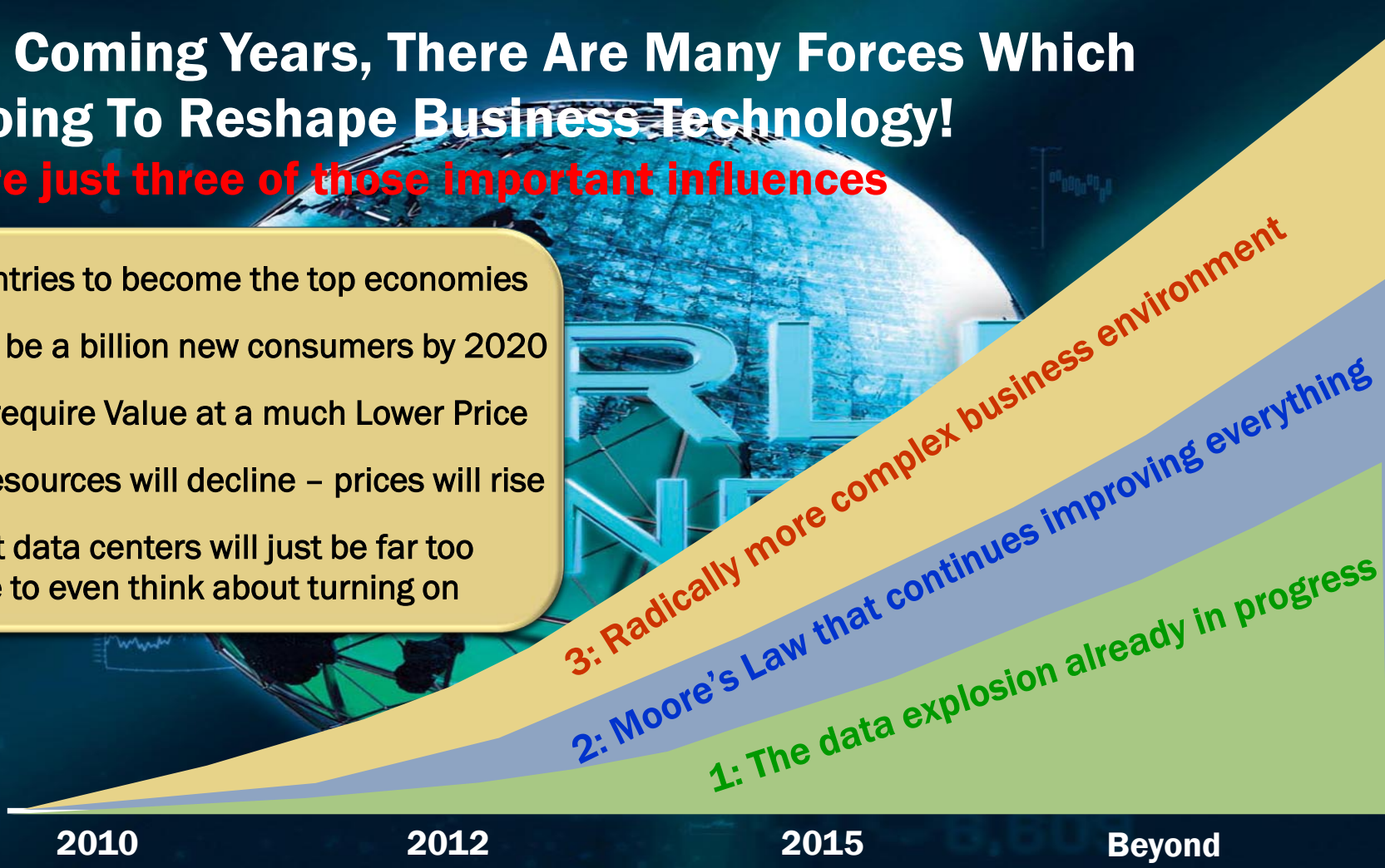
- Scientists have proven that it takes 12 iron atoms for a disk to stabilize a 0 or 1 on disk
- Use 11 iron atoms to store the bit and after a short time that bit goes wobbly -- unstable
- Although scientists can now control single atoms, the process to create media with that technology has not been invented – YET!



In The Coming Years, There Are Many Forces Which Are Going To Reshape Business Technology!

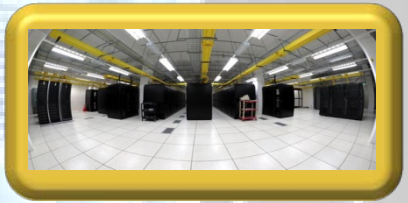
Here are just three of those important influences

- BRIC countries to become the top economies
- There will be a billion new consumers by 2020
- They will require Value at a much Lower Price
- Natural resources will decline – prices will rise
- Inefficient data centers will just be far too expensive to even think about turning on



Force #3: Radically New, Complex Business Environments

Because of these 3 sets of forces,
a data tsunami, increasing technical complexity, and
a radically different business environment,
next-generation data centers will have to be both
very efficient as well as very effective
or they simply will not be able to turn their lights on at all!



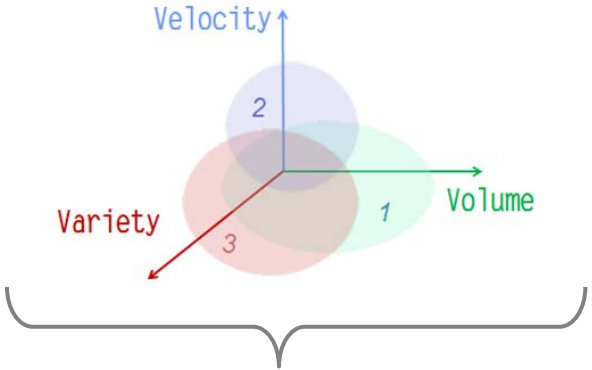
1 Billion new consumers
will want new things but
will have different values

By 2020 China is the largest economy and
neither the USA nor Western Europe will be
in the top 5 -- it will become a BRIC world

2012's best selling car
cost ~ US$18,500
which would be US$16,500
to much for these new 1B working
class consumers who will have
less income and will pay higher
prices for almost everything

Data Center Evolution and Growth

Force #1 – The Data Explosion
Compels Everyone To Be Concerned About Little Data and Big Data



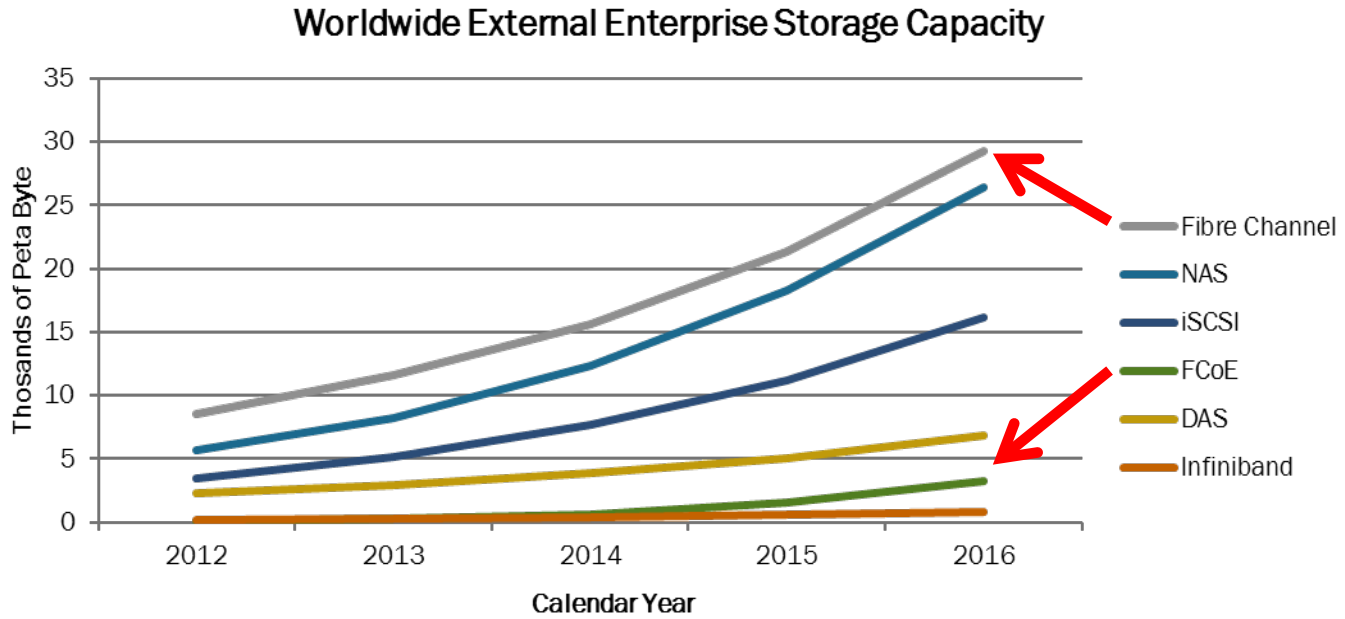
- **Big Data is when the data is too large, moves too fast, or doesn't fit the limitations of the user's database design and/or the user's architectures.**
- **To gain value from this data, customers must choose an alternative way to process it.**

Big Data poses Big Challenges for folks deploying Infrastructure and Applications

The Unrelenting Storage Growth Has No End In Sight

Data must be stored, retrieved and processed (disk/SAN/analytics)

Fibre Channel is forecasted by IDC to remain on top for SAN connectivity

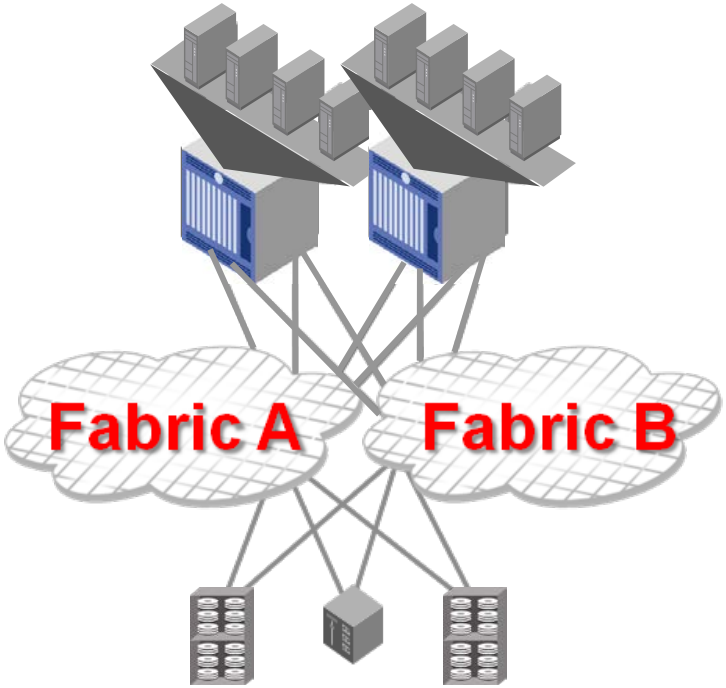


IDC Worldwide Enterprise Storage Systems Forecast Update, November 2012

FC Storage is predicted to have ~36% CAGR (2012/2016)

Data Centers Depend on FC-based Storage Area Networks

FC is designed to meet the requirements of shared storage environments

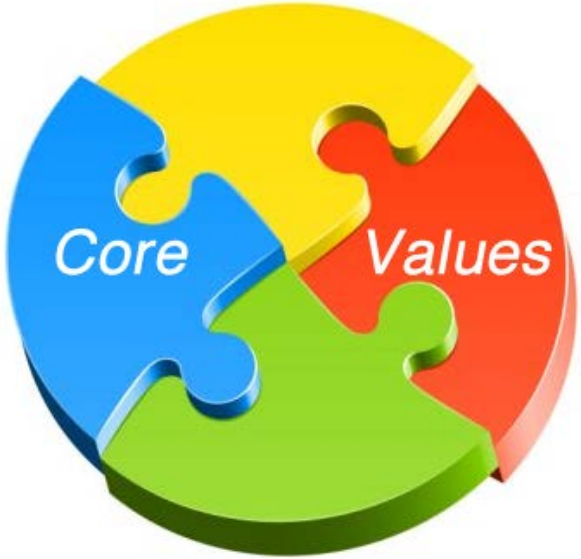


- **Fibre Channel Core Values:**
  - Enterprise class reliability
  - Vast Scalability
  - Engineered for I/O performance
  - Widely deployed worldwide
  - Billions of US$ already invested
  - **A Mature and Proven Solution**

Fibre Channel Momentum

Factors driving continued strength

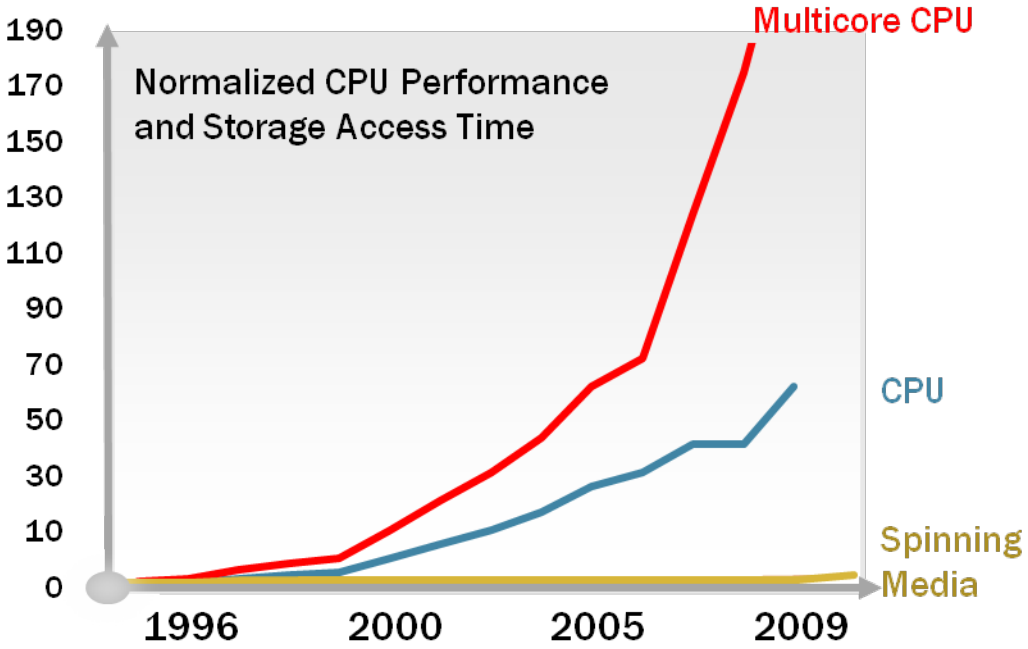
- **Why the strength?**
  - Fibre Channel core values remain attractive to mid/large enterprises and service providers
  - Thousands of proven implementations accounting for Billions of US Dollars in investments
  - Lowest risk approach for a customer's most important applications



- **Alternative approaches?**
  - None, at scale, for block storage

The Storage Network Really Matters for Solid State Disks

User's want optimized hardware to avoid I/O bottlenecks and long latency times



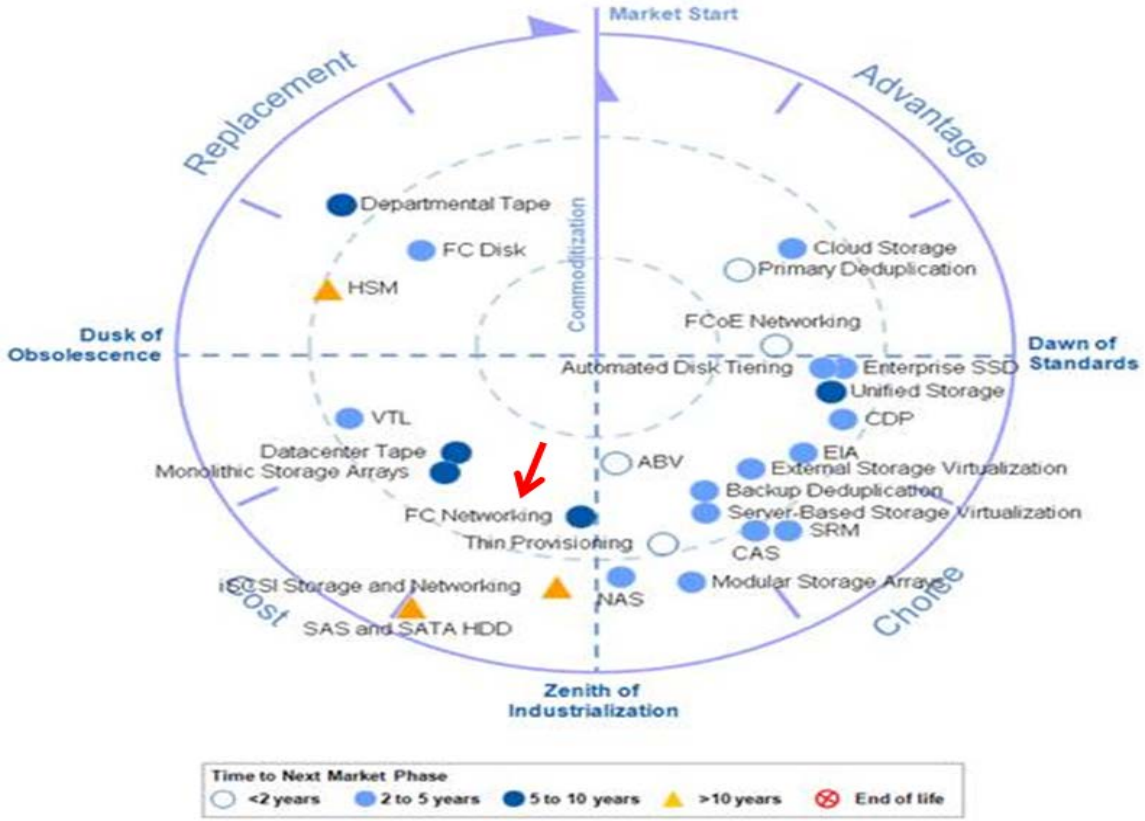
175x
CPU PERFORMANCE IMPROVEMENT

1.3x
SPINNING MEDIA PERFORMANCE IMPROVEMENT

- Dramatically lower access times
- Increased IOPS (100x)
- Greater reliability, lower power and cooling
- 71% CAGR (2010−2014)

Fibre Channel Acceptance

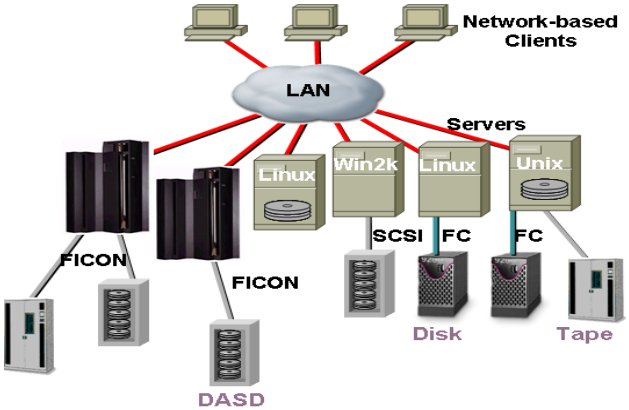
- In September 2011 Gartner, Inc. analysts made an interesting update to their "IT Market Clock" series specifically for the Storage Technology market.
- What they show is that Fibre Channel Networking has just reached the Zenith of Industrialization of the technology lifecycle.



Storage Area Networking

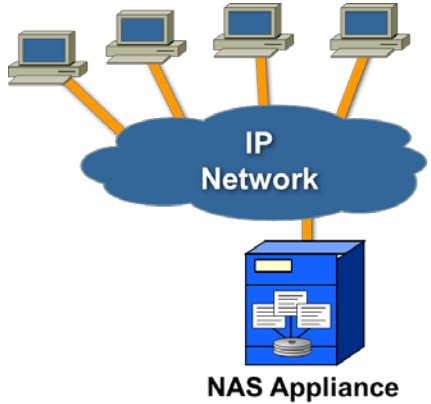
Direct Attached Storage

- Direct Attached Storage (DAS)
- Storage is captive ‘behind’ the server, limited mobility
- Limited scalability due to limited devices
- No storage sharing possible
- Costly to scale
- Management can be complex
- Cannot take full advantage of the technology



Network Attached Storage (NAS)

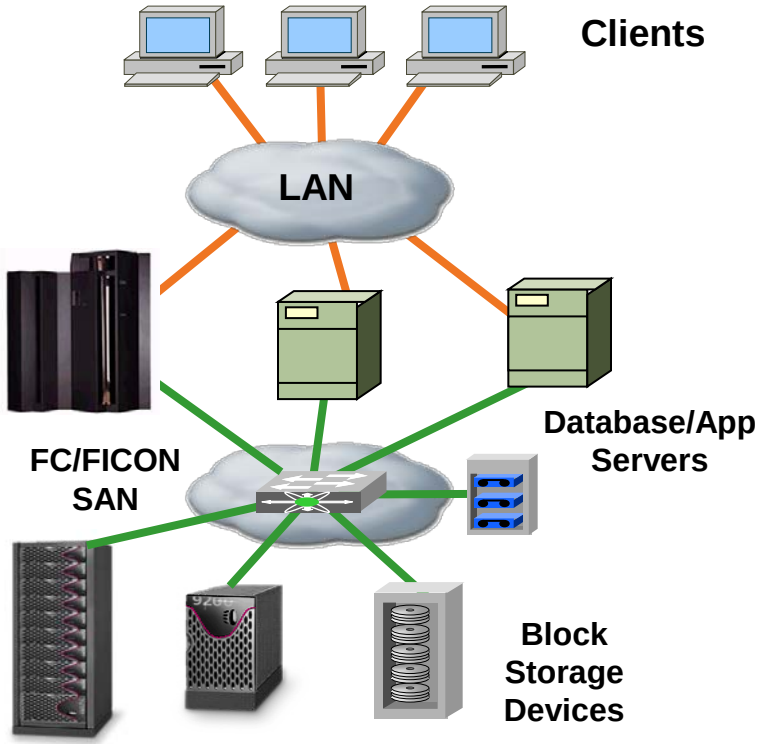
- Dedicated file server
- Optimized for file-based access to shared storage over an IP network
- Suitable for applications involving file serving/sharing
- High-performance access, data protection, and disaster recovery
- Capable of storage partitioning
- Network file system protocols like NFS / CIFS



Storage Area Network (SAN)

Separation of Storage from the Server

- Storage is accessed Block-level via SCSI/FICON and uses a switched environment (Directors/switches)
- High performance interconnects and low latency provide for exceptionally high I/O rates
- Lower TCO relative to direct attached storage since storage can be shared on a SAN
- Have to consider Vendor Interoperability / Qualifications but SAN solutions work well
- Use modern management platforms to cut through the complexity created by the size/scale of the data center

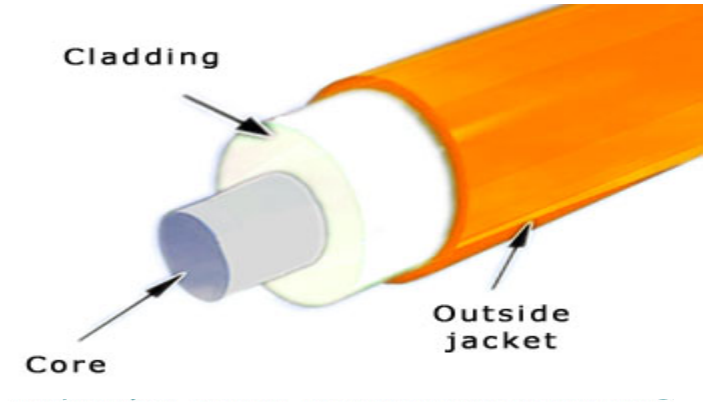


FICON or Storage Area Network (SAN)

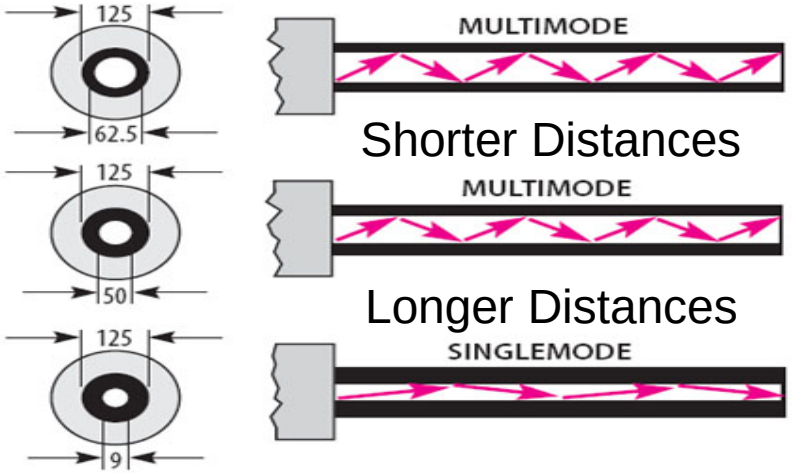
FC Storage Networking Terminology

Fiber Channel Links

- Fiber Optic cables transmit a digital signal via pulses of light through a very thin strand of glass. Fiber strands (the core of the fiber optic cable) are extremely thin, no thicker than a human hair. The core is surrounded by a cladding which reflects the light back into the core and eliminates light from escaping the cable.



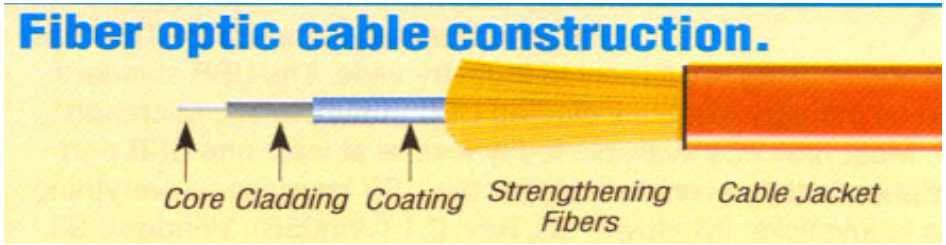
- A "mode" in Fiber Optic cable refers to the path in which light travels. Multimode cables have a larger core diameter than that of singlemode cables.
- Multimode fiber is available in two sizes, 50 micron and 62.5 micron. Singlemode fiber is available in a core diameter of 9 microns (actually 8.3 microns).



FC Storage Networking Terminology

Fiber Channel Links

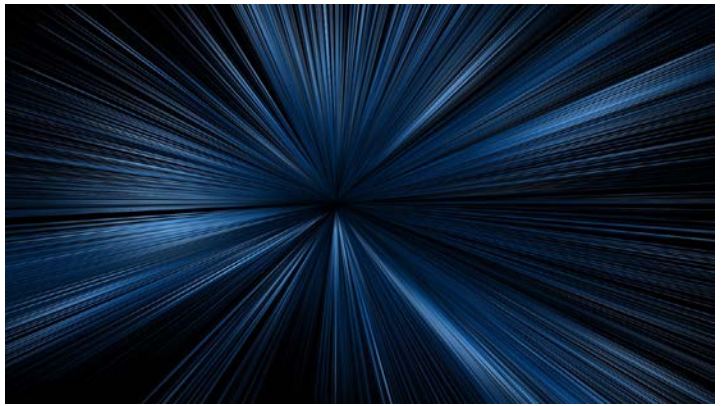
- **Multimode fiber** is used for numerous frequencies which are all short-wave frequencies (62.5, 50 micron) of laser light:
  - Should always used with short wave optics (transceivers) – this is what is qualified
  - Used for **local distance connectivity** (~33-1,640 feet...or...10-500 meters)
- **Single-mode fiber** has a smaller core that allows only one frequency of light (9 micron) which is long-wave laser light:
  - Should always used with long wave optics (transceivers) – this is what is qualified
  - This is used for **longer distance connectivity** (up to 15.5 miles or 25 km)
- Optical power budgets, or link loss budgets, measured in decibels (dBs), are used to manage optical signal loss.



FC Storage Networking Terminology

Light and Fibre Channel

- Light wavelengths in fiber are expressed in nanometers
- Speed of light (C) is about 3 x 10^8 microseconds (**µs**) in a vacuum
- In fibre cable it is about 2/3^{rds} of C or 2 x 10^8 **µs**
- Speed of light in fiber cable is slower than the speed of light in a vacuum so:
  - Light travels at ~5 nanoseconds per meter (3.3 ft) of distance in glass
  - A rough rule of thumb is 18 inches (45.72 millimeter) per nanosecond
  - It takes about 5 µs to travel one kilometer (.621 of a mile) in FC cable
  - It takes about 5 milliseconds to travel 1,000 km (621.4 miles) in FC cable



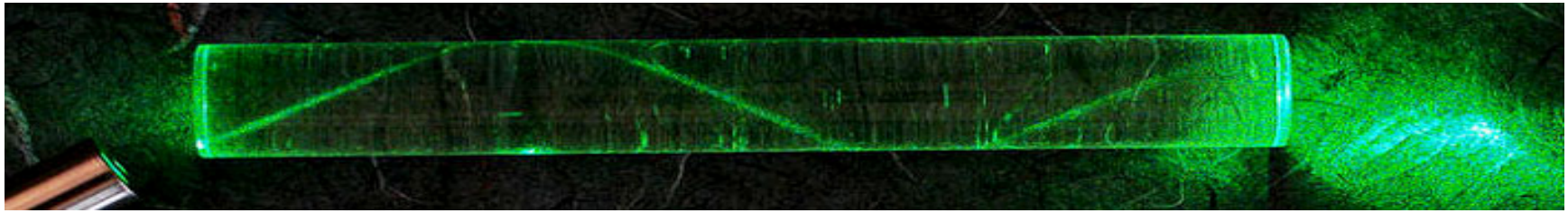
Latency Considerations:

- Switch latencies from .7 to 100s µs
- Light is about 5 µs/Km (.62 miles)
- Inadequate BCs = more latency

FC Storage Networking Terminology

Fiber Channel Links

- **Photo of Modal dispersion**
  - As you can see, a beam of light travels from side to side as it travels from one end of the cable to the other. This is how fibre optics can transmit data across long distances while not confined to being straight line of sight paths.

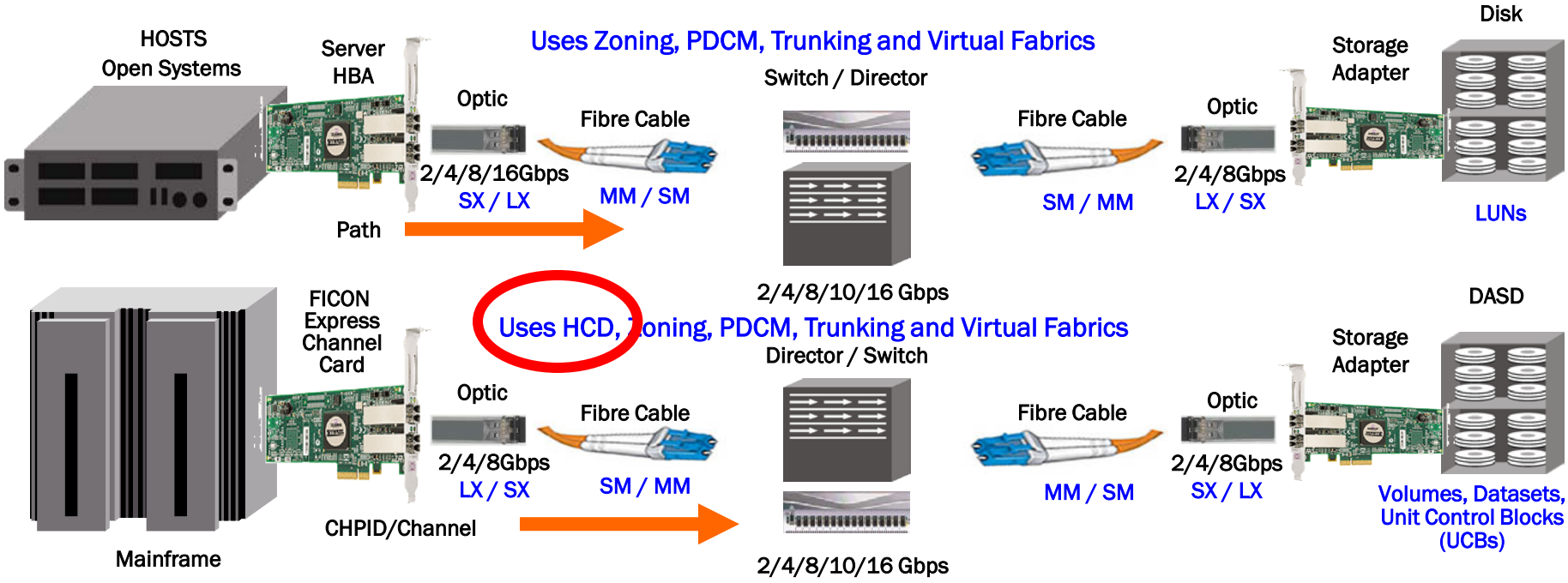


Light enters the cable

Light carries through the cable with a little dispersion

Without the cable

Open Systems compared to Mainframe



Multi-mode OM2
50 micron 500mHz
2/4 Gbps

Multi-mode OM3
50 micron 2000mHz
2/4/8/10/16Gbps

Multi-mode OM4
50 micron 4700mHz
2/4/8/10/16Gbps

Single-mode OS1
9 micron
2/4/8/10/16Gbps ~ 10k

As A Key Technology, The Storage Network Matters

Now more than ever!

DISASTER RECOVERY

Disaster Recovery and Business Continuance

BUSINESS CONTINUANCE

Disaster Recovery and Business Continuance

- Disaster Recovery (DR) Plan:
  - Focuses on getting a user's business back up and running after a major outage

- DR Recovery Time Objective (RTO):
  - The amount of time that it takes for a customer systems back online after a failure

- DR Recovery Point Objective (RPO):
  - This is the last consistent data transaction prior to the disaster
  - If a customer had a disaster, how much data can they afford to lose?
  - Foundation must be an offsite tape backup stored someplace offsite

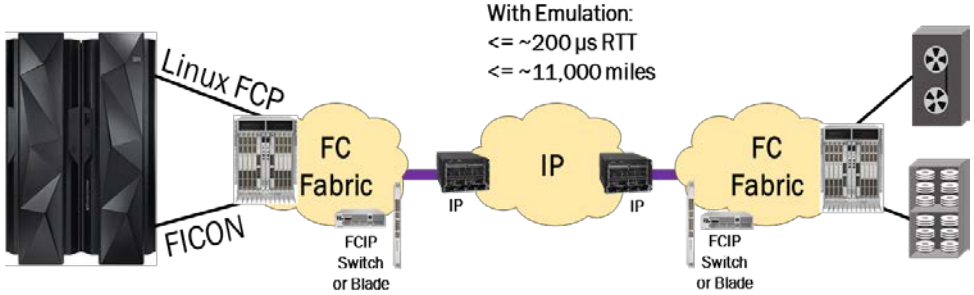
- Business Continuance (BC) Plan:
  - Focuses on keeping a user's business running BEFORE, DURING and AFTER the disaster

Customers want to be:

Customer's are implementing multi-site strategies

Consider Using Fibre Channel over IP for long haul BC/DR

- Why FCIP instead of extended (xWDM) native Fibre Channel?
  - Cost of IP bandwidth vs. FC bandwidth
  - Eliminate distance constraints
  - Leverage investment in existing IP network
  - IP ubiquity – it is just everywhere!
  - Reduce consumption of fiber



- Dramatically improve recovery time with reasonable cost
  - Recovery in minutes or hours vs. days as required with manual off-site vaulting
  - Less cost to backup multiple applications using in-house Disaster Recovery processes versus a single application performed by a 3rd party data warehousing company
  - Asynchronous replication capability to create a business continuance environment
  - Emulation capabilities for exceptional long distance I/O performance

The Storage Network Matters for Availability and Speed

Bad things happen when storage networks fail

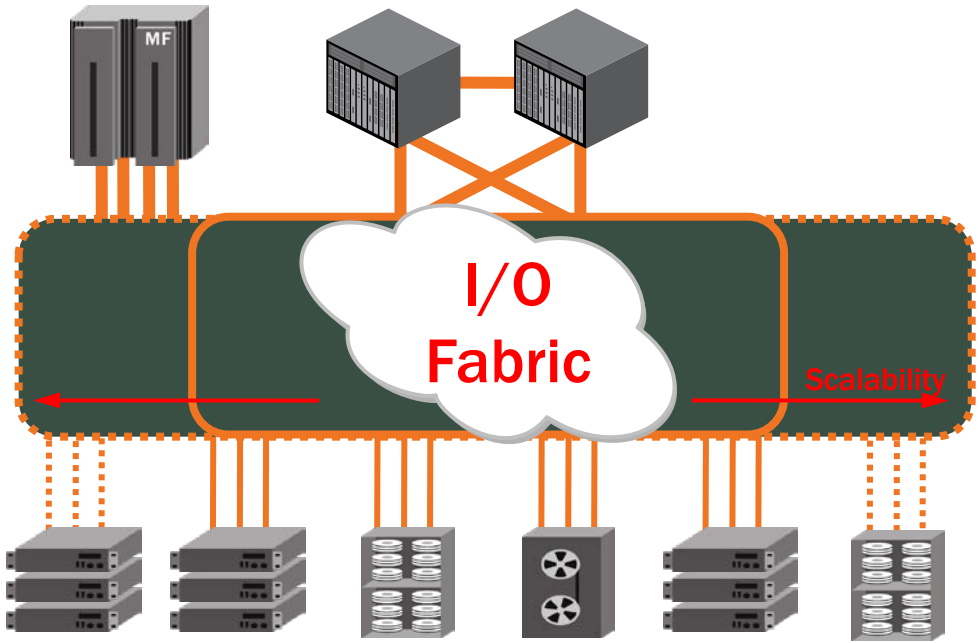
- Losing network connectivity can corrupt application data or file systems
  - Disk systems use Business Continuance or Disaster Recovery strategies like synch and async I/O to maintain data consistency
  - Corrupted data can require many hours (or even days) to restore
- Deteriorated cabling, aging patch panels, old servers and storage, outdated switching and poor network designs adversely affect performance

Enterprises require their SANs:

- Be Deployed for five-9s availability
- To be performance-oriented
- Provide Proven Results

Fibre Channel Fabrics

- Flexible, low latency
- Efficient utilization of links, built in multipathing
- Simple to configure and run
- Massive, linear scalability
- Great for hosting resilient data center and BC/DR I/O



Industry Recognized Professional Certification

SHARE

Brocade FICON Certification

Brocade Certified Architect for FICON

Certification for Brocade Mainframe-centric Customers – Available since Sept 2008

For people who do or will work in FICON environments

Brocade provides a free on-site or in area 2-day class (Brocade Design and Implementation for FICON Environments – FCAF200), to assist customers in obtaining most of the knowledge to pass this certification examination – ask your local sales team about this training – also look at www.brocade.com under Education

Certification tests a person's ability to understand IBM System z I/O concepts, and demonstrate knowledge of Brocade FICON Director and switching fabric components

After the class a participant should be able to design, install, configure, maintain, manage, and troubleshoot Brocade hardware and software products for local and metro distance (100 km) environments

Check the following website for complete information:

- http://www.brocade.com/education/certification-accreditation/certified-architect-ficon/index.page

Brocade Certified Architect for FICON (BCAF)

This FICON Certification is Unique in the Industry

BCAF is a Preparatory Certification Seminar – 2 days

- We have been holding classes since mid-2008
- This is good for mainframers who desire to become professionally certified as FICON subject matter experts
- This uses advanced materials and is not well suited for professionals with less than 1 year of experience

Total number of attendees at these seminars since 2008: **455** (as of May 2013)
Total number of Brocade FICON Certifications awarded: **222+**

We also have a Brocade Accredited FICON Specialist credential (based on WBT training and an exam): **122** awarded

Brocade Mainframe Social Media

Visit Brocade's Mainframe Blog Page at:
http://community.brocade.com/community/brocadeblogs/mainframe

Almost 250,000 hits

Also Visit Brocade's New Mainframe Communities Page at:
http://community.brocade.com/community/forums/products_and_solutions/mainframe_solutions

You can also find us on Facebook at:
https://www.facebook.com/groups/330901833600458/

- www.linkedin.com Groups

.....My Next Presentation.....

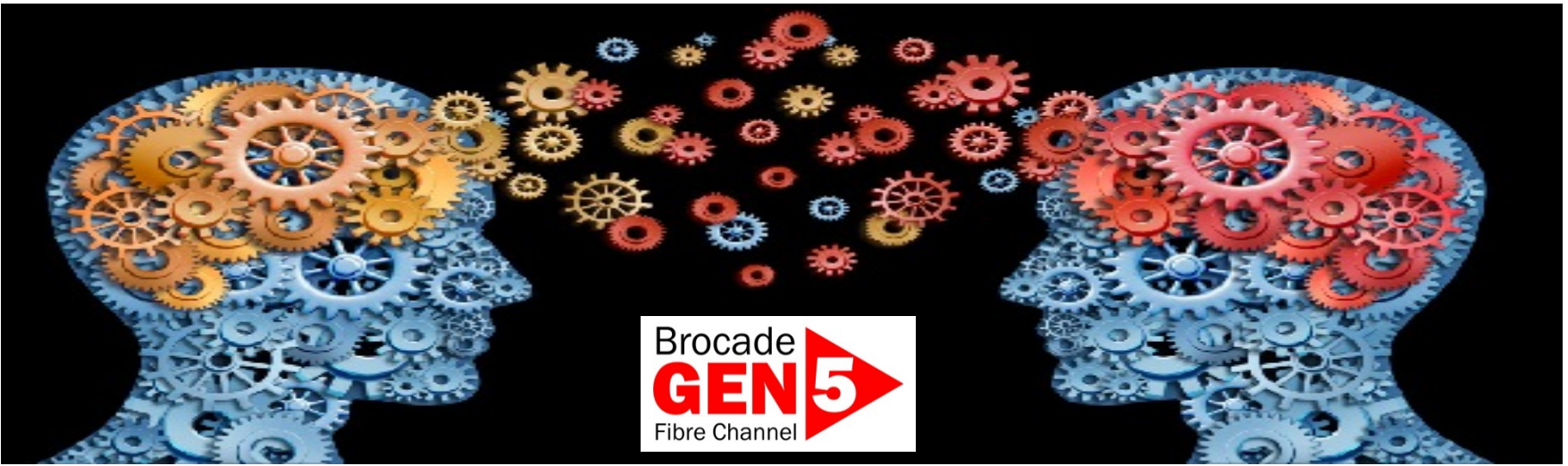
Why Customers Should Deploy Switches in Their SAN and FICON Environments

Monday August 12, 2013 -- 1:30pm to 2:30pm -- Session 14275

.....Newly Scheduled Presentation.....

Brocade SAN and FICON Update

Please consider attending to discover the innovation of Brocade's Gen 5 Fibre Channel Architecture



Wednesday August 14, 2013 -- 11:00am to 12:00pm -- Session 14482

Please Fill Out Your Evaluation Forms!!

Thank You For Attending Today!

This was session:

14274

QR Code

And Please Indicate On Those Forms If There are Other Presentations You Would Like To see in this track at SHARE!

Your Eval

My Reaction!

5 = “Aw shucks. Thanks!”
4 = “Mighty kind of you!”
3 = “Glad you enjoyed this!”
2 = “A Few Good Nuggets!”
1 = “You Got a nice nap!”

Monday August 12, 2013 -- 9:30am to 10:30am – Session 14274