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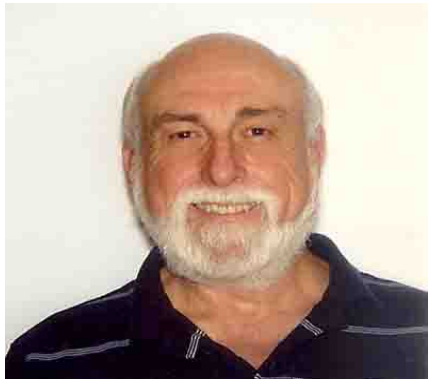

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Brocade SAN and FICON Update

Brocade GEN 5 Fibre Channel

Session 14482

SHARE in Boston

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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.

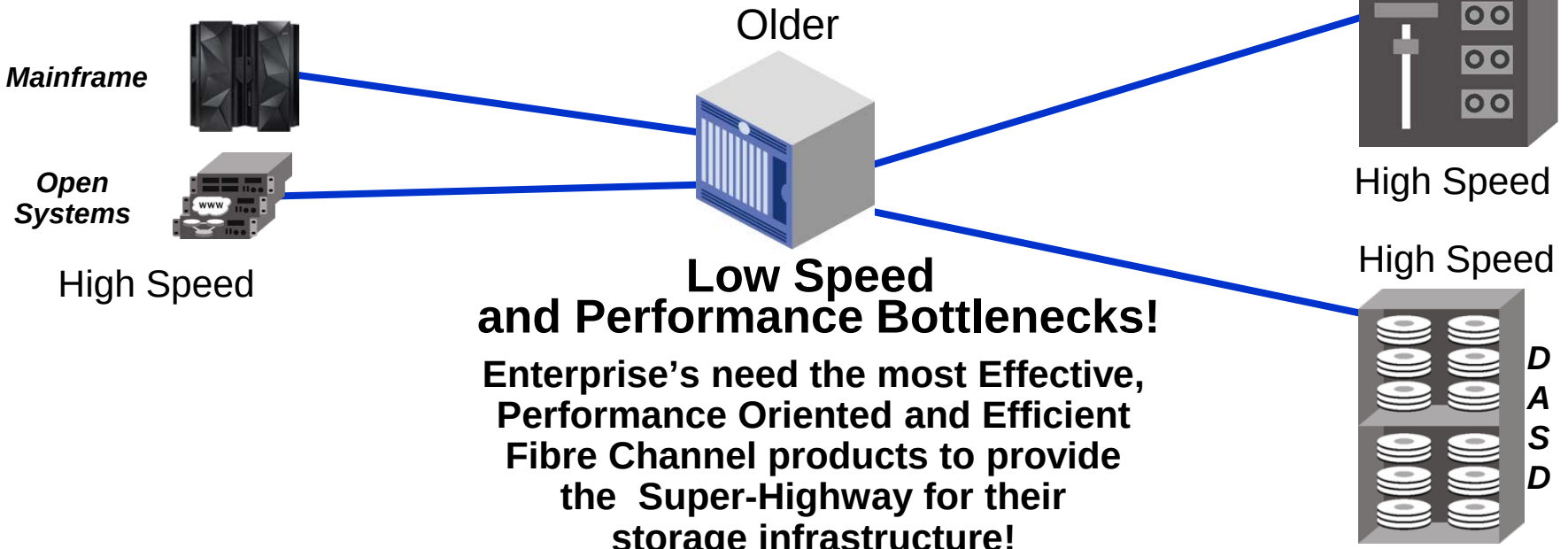
This will usually give you more information than just what the slide contains.

I hope this helps in your educational efforts!

Keeping I/O Technology Upgraded is Important

All Components Must Work In Harmony To Achieve Value

Servers and Disk have been scaling up for performance and scaling out for capacity which means that, for many user's, their old I/O infrastructure needs updating!



Enterprise's need the most Effective, Performance Oriented and Efficient Fibre Channel products to provide the Super-Highway for their storage infrastructure!

All Components Must Work In Harmony To Achieve Value

Servers and Disk have been scaling up for performance and scaling out for capacity which means that, for many user's, their old I/O infrastructure needs updating!

Some Things Need To Be Replaced!

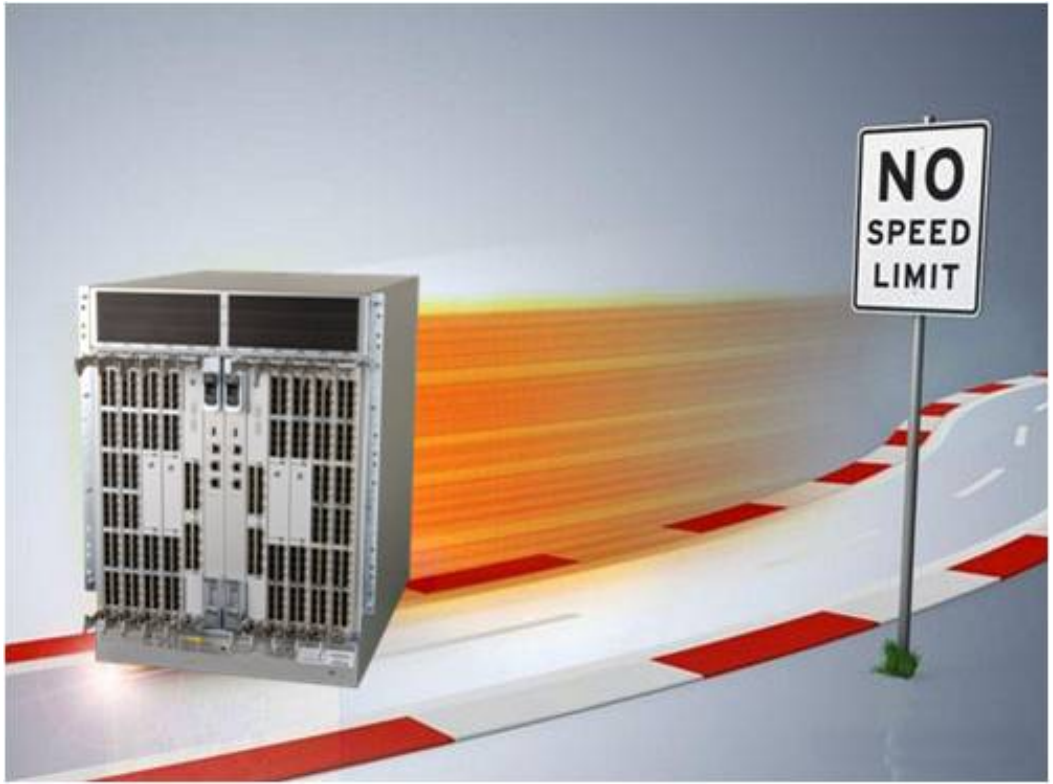
Host and Storage is getting Faster and More Economical

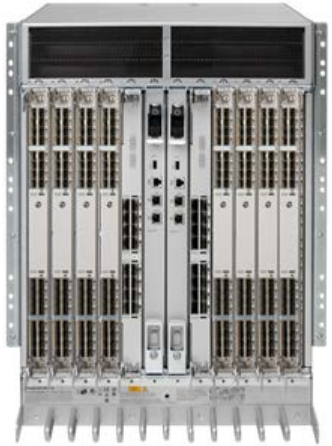
Low Speed and Performance Bottlenecks!

Enterprise's need the most Effective, Performance Oriented and Efficient Fibre Channel products to provide the Super-Highway for their storage infrastructure!

If It Is Time To Upgrade The I/O Infrastructure Then…

Upgrade To The World's Best, and Most Acclaimed, Fibre Channel





Gen 5
DCX 8510-8

Gen 5
DCX 8510-4

Brocade DCX 8510-8 and DCX 8510-4

Brocade FX8-24 and 7800

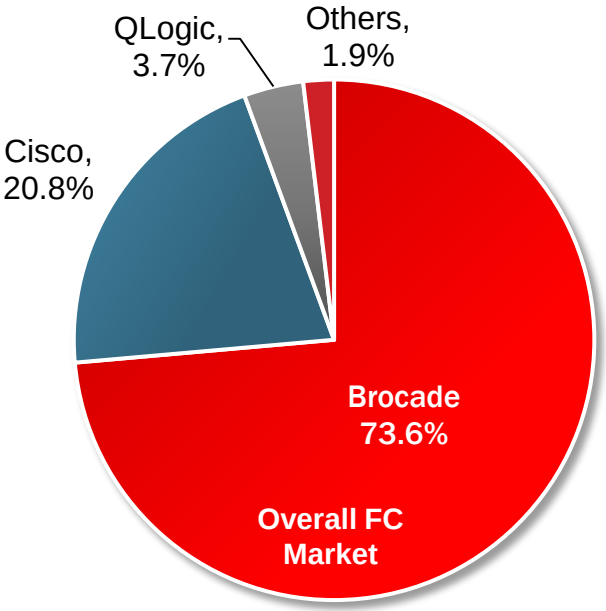
Brocade is The Gold Standard for Fibre Channel I/O Connectivity!

Brocade DCX 8510 and Bocade extension for the Mainframe

Fibre Channel Total Switch Market Share

Brocade still dominating the FC market

- CY12 total revenue performance
  - Brocade gained +1.8% share overall to 68.6%
- 1QCY13 QoQ revenue performance
  - Brocade gained +3.3% share to 73.6%
  - Strength in directors and switches
- There is a continued, strong adoption of Brocade Gen 5 Fibre Channel directors and switches by customers worldwide



SAN Share (Fixed + Modular) — Total based on revenue

Source: Dell'Oro Group, "SAN Worldwide Tables, 1Q13," May 2013

Brocade Switching Infrastructure Is Deployed In Over 90% Of The World's Mainframe Data Centers!

Complete your sessions evaluation online at SHARE.org/BostonEval

What's in a Name?

Articulating the true value of Fibre Channel

- Gen 5 Fibre Channel is the purpose-built, data center-proven network infrastructure for storage, delivering unmatched reliability, simplicity, and 16 Gbps performance

Changing Fibre Channel name from speed-based naming…

1 Gbps **2** Gbps **4** Gbps **8** Gbps **16** Gbps **32** Gbps

To generation-based naming

Gen 1 Gen 2 Gen 3 Gen 4 Gen 5 Gen 6

Brocade Director Generations

48000

2005

FOS 5 and 6

Condor ASIC

4 or 2 Gbps SFPs

Sample Innovations

Local Switching
Exchange-based Routing
Brocade Hardware Trunking

DCX

2008

FOS 6 and 7

Condor2 ASIC

8 or 4 Gbps SFPs

Sample Innovations

Inter-Switch Links (ICLs)
Optional Virtual Fabrics
Port De-Comissioning

8510

2011

FOS 7

Condor3 ASIC

16, 10 or 8 Gbps SFPs

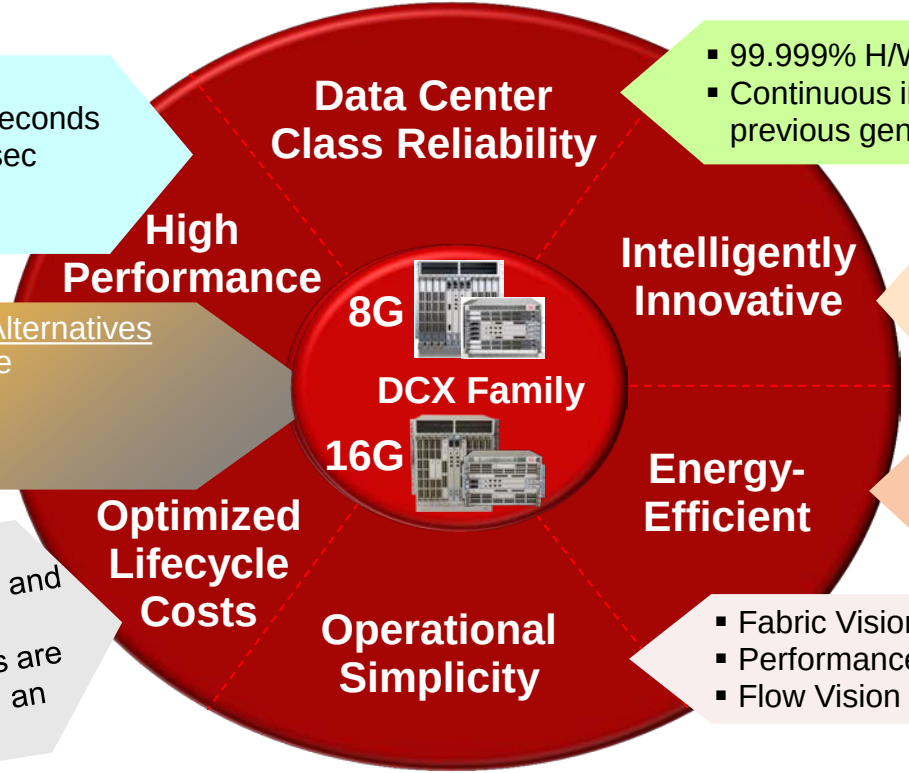
Sample Innovations

ClearLink Diagnostic Port (D_Port)
Forward Error Correction (FEC)
Fabric Vision Technology

Overview of the Gen 5 Fibre Channel Products

- Non-blocking 16Gbps ports
- Local Switching @ 700 nanoseconds
- Backplane switching @ 2.1 µsec
- Cut-through frame routing
- FCIP batching and trunking

- 99.999% H/W availability
- Continuous improvement upon previous generations of I/O switching.



- 100m Inter-chassis Links
- Diagnostic Port (D-port)
- Port Decommission
- Forward Error Correction

8-slot and 4-slot ED-8510 Alternatives
- Industry best performance
- Industry best reliability
- Industry best availability
- Industry best scalability

- Less power (.3 watts/Gbit)
- Less heat (BTUs) output
- Less CO^2 emissions

- Investment protection
- Compatibility between 8G and 16G products
- 8G DCX Family chassis's are future-proofed to accept an upgrade to 16Gbps

- Fabric Vision Value and Benefits
- Performance and Health Dashboards
- Flow Vision to avoid "Taps" in a SAN

Brocade Switching Infrastructure Is Deployed In 74% Of The World's Data Centers!

Brocade DCX 8510 Gen 5 Directors

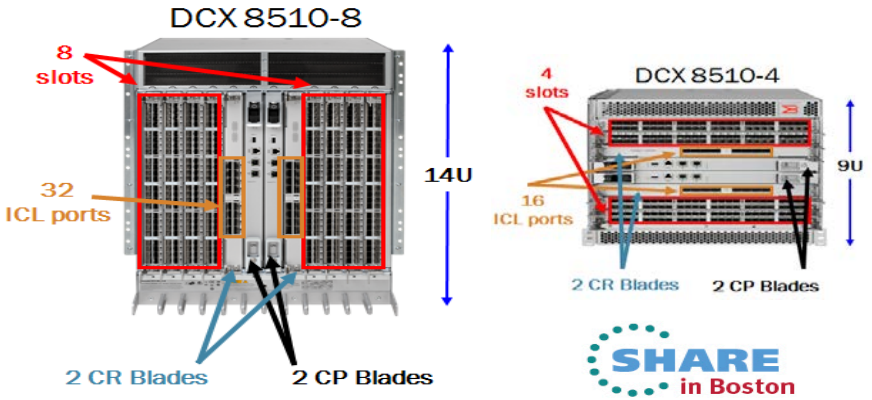
Scalability
- 32 and/or 48 port blades
- 192/384 non-blocking ports at 8Gbps
- 128/256 non-blocking ports at 16Gbps
- Inter-Chassis Links for massive scalability

Connectivity
- 8,10 and 16Gbps Optics in ports
- 10Gb and 16Gb native ports
- FX8-24 Extension Blade

Performance
- Non-blocking internal/external design
- Low, deterministic latency (.7 - 2.1 µs)
- 8,192 Buffer Credits/ASIC for distance
- Cut-through frame routing
- Inflight compression/encryption of ISL Links

New Gen 5 8510 ISL Features
- 64b66b data encoding for efficiency
- Diagnostic Port (D_Port) for better ISL provisioning
- Forward Error Correction (FEC)
- Improved Bottleneck Detection
- Port De-Commissioning / Re-Commissioning
- Automatic Buffer Credit Recovery at the VC level

Management
- Brocade Network Advisor and CUP



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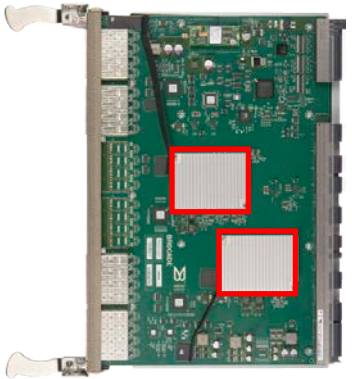
Brocade DCX 8510 Gen 5 Directors – 2 of 2 on Hardware

Most Advanced Switching ASIC – Condor3

- Unmatched performance
  - 16/10/8/4/2 Gbps speed
  - <= 420 million frames switched per second per ASIC
  - <= 6.72 billion frames switched per second per chassis
  - 768 Gbps of bandwidth per slot
  - In-flight compression and encryption
- Industry-leading efficiency < 1 watt/Gbps
- More scalable across distance
  - 8000 buffer credits (four times existing) pooled per ASIC
  - Up to 5000 km distance at 2 Gbps
- Unmatched investment protection compatible with 30 million existing SAN ports

Each Gen 5 Connectivity blade utilizes two Condor3 ASICs



Brocade in the User's Data Center

Proven Solutions

- Does your Current Switching Hardware provide you with the industries best and most proven Reliability and Availability?

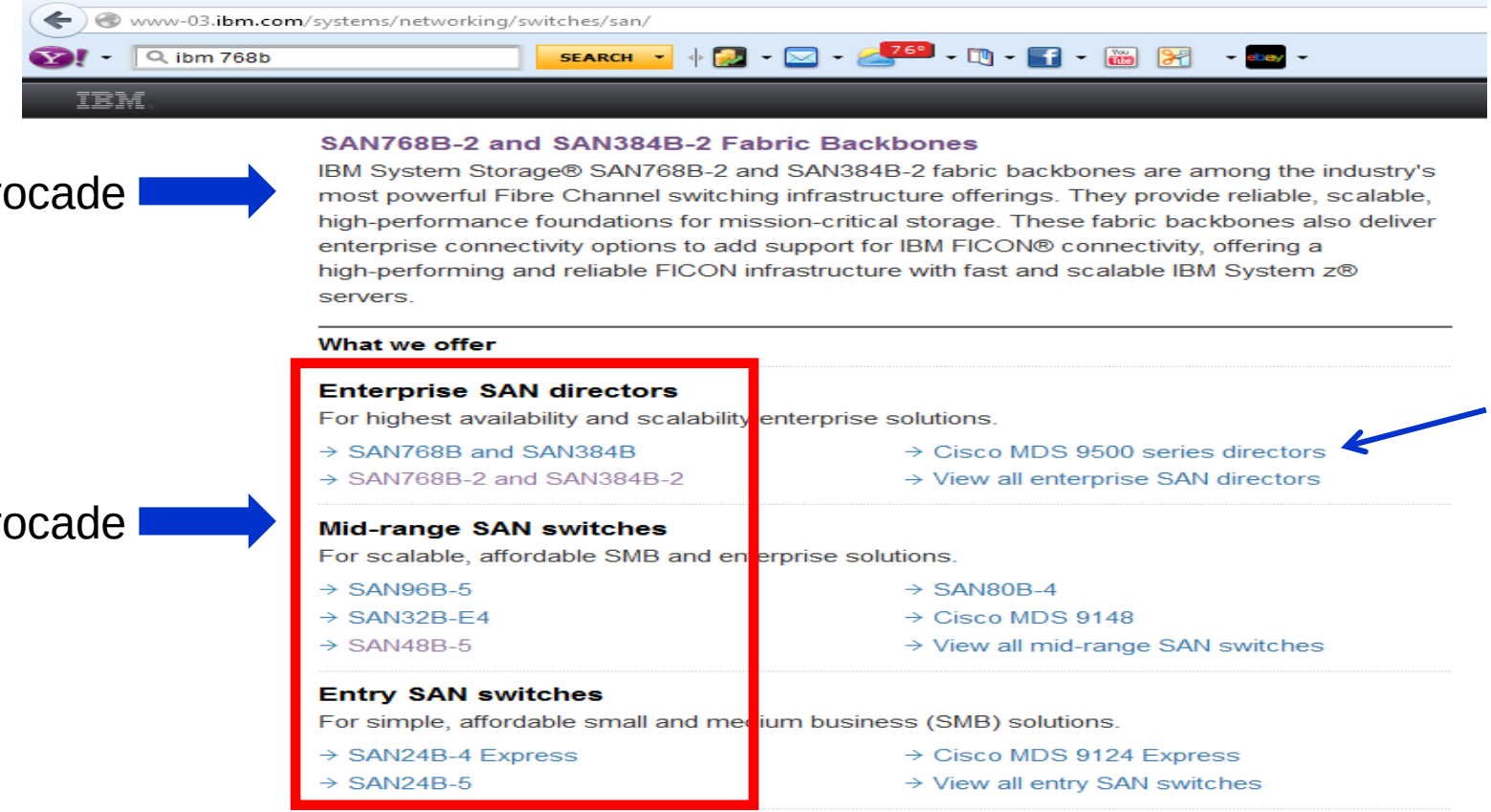
- **SINCE THIS IS A BROCADE HALLMARK, BROCADE DOES!**

- Brocade switching devices are re-branded (OEM'd) by IBM and EMC to wear their name!
  - When IBM and EMC sell a Brocade device it is sold as one of their devices with their name
  - Brocade devices show up in these partner's price lists and are sold by their sales team
  - This shows the UTMOST TRUST that a storage vendor can place in one of their partners
  - It is a Mark of Excellence

  - Our competitor does not have this status with any storage vendor!
  - They are re-sold by IBM, EMC and HDS but under their own logo only.

An Example of Maturity, Reputation and Respect

Here is the IBM Storage Area Network Webpage:



Brocade

Brocade

Competitor

Finance and Insurance Companies

Automobile and Parts Manufacturers

Chemical Companies

Electronics and Electrical Manufacturers

Health Care and Pharmaceutical Companies

Industrial and Farm Equipment Manufacturers

Energy, Mining and Petroleum Firms

Telecom Providers And Suppliers

Regardless of Industry, Consider Brocade Gen 5 For Your Data Center I/O Infrastructure

Brocade Gen 5 Fibre Channel Technology

EXCLUSIVE Brocade Features

1. Brocade Network Advisor “Fabric Vision” Health and Performance Dashboards
2. Brocade Network Advisor “Flow Vision” technology to end “tapping” into fabrics
3. Cut-through frame routing to reduce frame latency
4. Forward Error Correction (FEC) to dynamically repair ISL link bit errors
5. Virtual Channels (VCs) to minimized ISL Head-of-Line Blocking
6. Inter-chassis Links (ICLs) to minimize ISLs and maximize customer port consumption
7. Diagnostic Port (D_Port) functionality to test SFPs and cables before deployment
8. Port DeCommission/ReCommission for non-disruptive removal of ISLs and N_Ports
9. Data in-flight Compression and/or Encryption on ISL links
10. Bottleneck Detection within fabrics

Brocade Gen 5 Fibre Channel Technology

Additional **EXCLUSIVE** Brocade Features

11. Hardware ISL Trunking feature (ASIC controlled) for fabric effectiveness
12. Exchanged-based Routing (EBR) and Device-based Routing (DBR) for ISL traffic
13. Virtual Fabrics and Multi-tenancy capabilities
14. FCIP using switches, or uniquely, BLADES in the Brocade Gen 5 Director chassis
15. Access Gateway for SAN deployment simplicity
16. Quality of Service and Ingress Rate Limiting for SAN
17. Traffic Isolation Zones for ISL management
18. FC-FC integrated routing per port
19. Advanced Performance Monitoring (APM)
20. APM Top Talkers Feature
21. SAN Health Check consultative utility program

Customers tell us that they want features and functionality that provide them with VALUE and that they are not very interested in just another Speed Bump!

That is what Gen 5 is all about!

There are too many wonderful features in Gen 5 to be able to discuss all of them in 1 hour

So Here Are Some Of The Highlights

Brocade in the User's Data Center

New Management Technology and Philosophy

- It would be great if you could manage all of your FC, FICON and IP devices from a single management interface – a single pane of glass.

- **BROCADE GEN 5 PROVIDES THAT CAPABILITY!**

- Brocade Network Advisor = Management Simplicity:
  - Our key differentiation is our **open, standards-based architecture**
  - We provide Partner-centric solutions
  - New “Fabric Vision” Dashboards to better understand Health and Performance issues
  - Simple wizards to configure, FICON, Fibre Channel, and FCIP tunnels
  - Simplified management of Virtual Fabrics

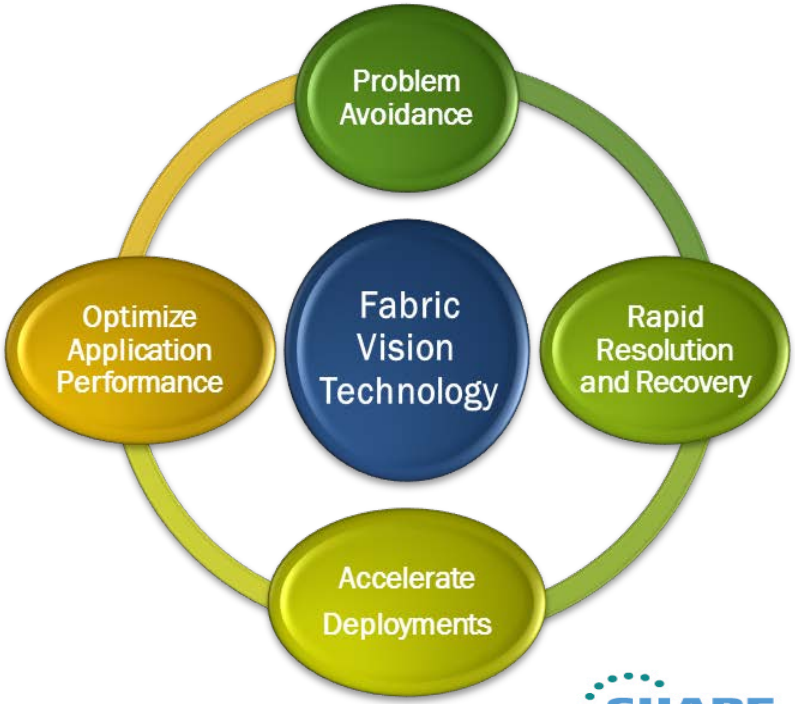
Brocade Gen 5 FC Enabled Features

Brocade Exclusive Fabric Vision Management Technology

Brocade Fabric Vision Technology

Advanced monitoring, management, and diagnostics

- **Maximize infrastructure uptime**
  - Prevent problems from occurring
  - Address problems before they impact operations - accelerate problem resolution and recovery
- **Dramatically reduce costs**
  - Speed time to deploy additional capacity
  - Reduce day-to-day network administration
  - Negate need for 3rd party tools
- **Optimize application performance**
  - Minimize latency and maximize network throughput



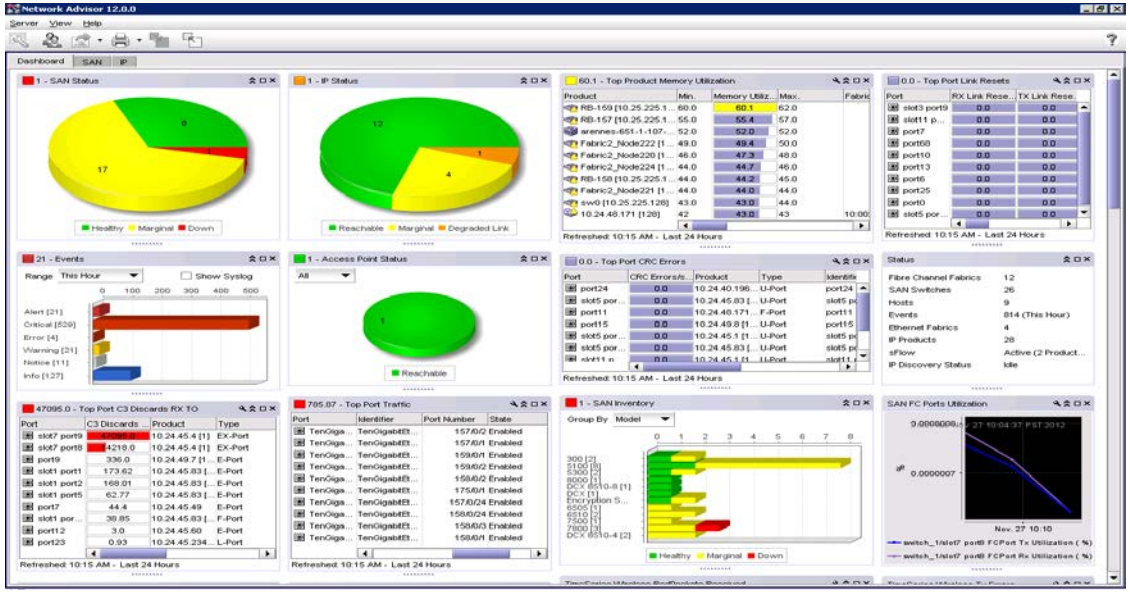
An Example of a At-a-Glance Health Dashboard

Today's Typical Start-of-the-Week routine:

- Manually collect information from the various network tools and try to discern if anything happened over the week-end that would require investigation – **lots of manual effort!**

Now a users Start-of-the-Week routine will be easy:

- New CLI displays and Brocade Network Advisor dashboards automatically provide:
  - Summary switch health report, along with details on out-of-policy conditions to help pinpoint potential issues
  - Historical data for the past week so you can quickly see trends, and see if anything occurred recently that needs to be investigated
  - User's can customize the dashboard Widgets to see what they want to see



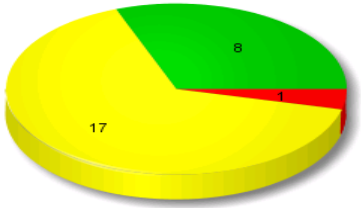
One screen shows all of the critical status information

Network Advisor 12.0.0

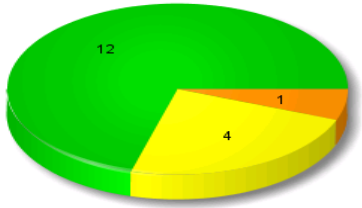
Server View Help

Dashboard | SAN | IP

1 - SAN Status



1 - IP Status



60.1 - Top Product Memory Utilization

Product	Min.	Memory Utiliz...	Max.	Fabric
RB-159 [10.25.225.1...	60.0	60.1	62.0	
RB-157 [10.25.225.1...	55.0	55.4	57.0	
arennes-651-1-107-...	52.0	52.0	52.0	
Fabric2_Node222 [1...	49.0	49.4	50.0	
Fabric2_Node220 [1...	46.0	47.3	48.0	
Fabric2_Node224 [1...	44.0	44.7	46.0	
RB-158 [10.25.225.1...	44.0	44.2	45.0	
Fabric2_Node221 [1...	44.0	44.0	44.0	
sw0 [10.25.225.128]	43.0	43.0	44.0	
10.24.48.171 [128]	42	43.0	43	10:00:

Refreshed: 10:15 AM - Last 24 Hours

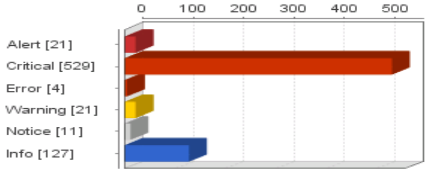
0.0 - Top Port Link Resets

Port	RX Link Rese...	TX Link Rese...
slot3 port9	0.0	0.0
slot11 p...	0.0	0.0
port7	0.0	0.0
port68	0.0	0.0
port10	0.0	0.0
port13	0.0	0.0
port6	0.0	0.0
port25	0.0	0.0
port0	0.0	0.0
slot5 por...	0.0	0.0

Refreshed: 10:15 AM - Last 24 Hours

21 - Events

Range: This Hour Show Syslog



1 - Access Point Status

All

0.0 - Top Port CRC Errors

Port	CRC Errors/s...	Product	Type	Identifie
port24	0.0	10.24.40.196...	U-Port	port24
slot5 por...	0.0	10.24.45.83 [...	U-Port	slot5 po
port11	0.0	10.24.48.171 ...	F-Port	port11
port15	0.0	10.24.49.8 [1...	U-Port	port15
slot5 por...	0.0	10.24.45.1 [1...	U-Port	slot5 po
slot5 por...	0.0	10.24.45.83 [...	U-Port	slot5 po
slot11 p...	0.0	10.24.45.1 [1...	U-Port	slot11 p

Refreshed: 10:15 AM - Last 24 Hours

Status

Fibre Channel Fabrics	12
SAN Switches	26
Hosts	9
Events	814 (This Hour)
Ethernet Fabrics	4
IP Products	28
sFlow	Active (2 Product...
IP Discovery Status	Idle

47095.0 - Top Port C3 Discards RX TO

Port	C3 Discards ...	Product	Type
slot7 port9	47095.0	10.24.45.4 [1]	EX-Port
slot7 port8	14218.0	10.24.45.4 [1]	EX-Port
port9	336.0	10.24.49.7 [1...	E-Port
slot1 port1	173.62	10.24.45.83 [...	E-Port
slot1 port2	168.01	10.24.45.83 [...	E-Port
slot1 port5	62.77	10.24.45.83 [...	E-Port
port7	44.4	10.24.45.49	E-Port
slot1 por...	38.85	10.24.45.83 [...	F-Port
port12	3.0	10.24.45.60	E-Port
port23	0.93	10.24.45.234...	L-Port

Refreshed: 10:15 AM - Last 24 Hours

785.87 - Top Port Traffic

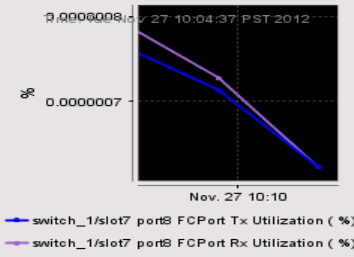
Port	Identifier	Port Number	State
TenGiga...	TenGigabitEt...	157/0/2	Enabled
TenGiga...	TenGigabitEt...	157/0/1	Enabled
TenGiga...	TenGigabitEt...	159/0/1	Enabled
TenGiga...	TenGigabitEt...	159/0/2	Enabled
TenGiga...	TenGigabitEt...	158/0/2	Enabled
TenGiga...	TenGigabitEt...	175/0/1	Enabled
TenGiga...	TenGigabitEt...	157/0/24	Enabled
TenGiga...	TenGigabitEt...	158/0/24	Enabled
TenGiga...	TenGigabitEt...	158/0/3	Enabled
TenGiga...	TenGigabitEt...	158/0/1	Enabled

Refreshed: 10:15 AM - Last 24 Hours

1 - SAN Inventory

Group By: Model

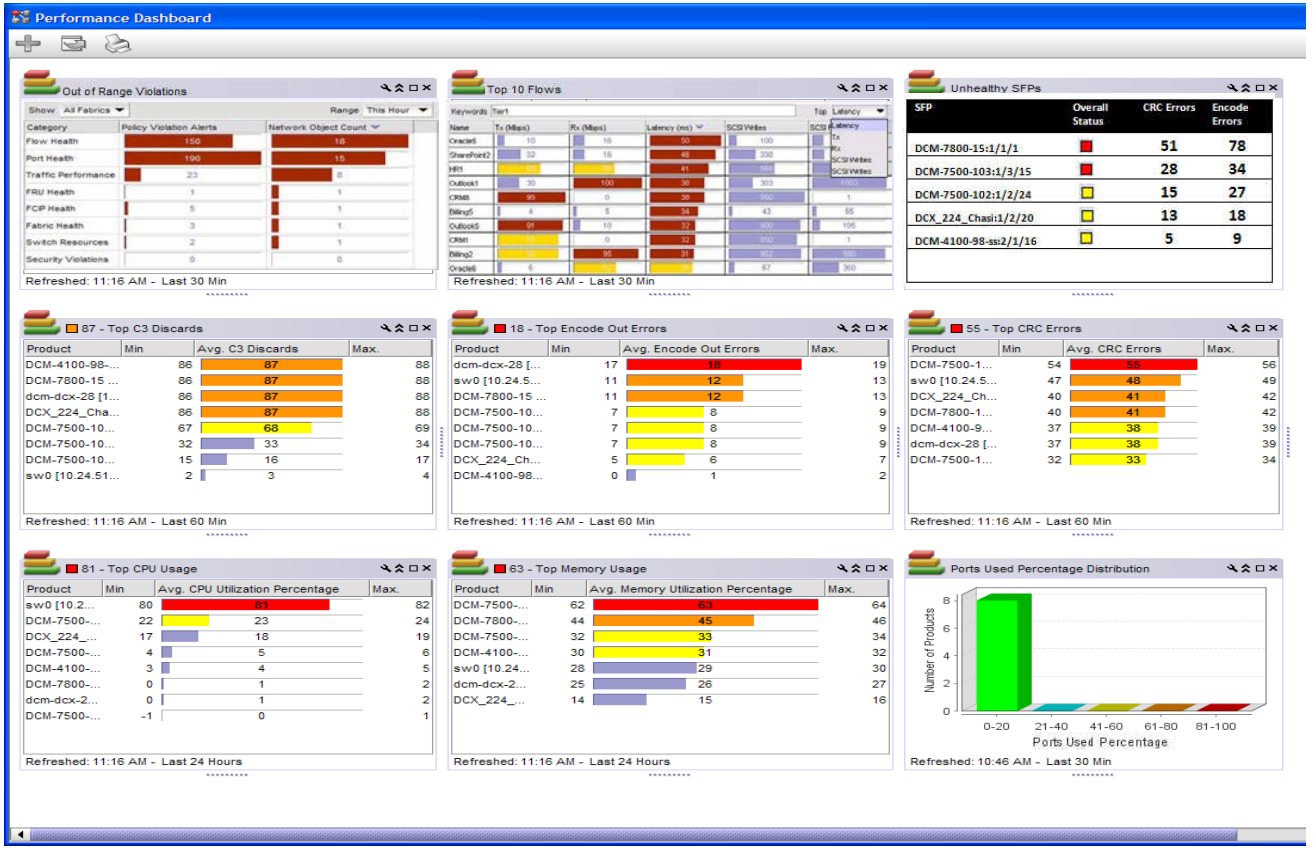
SAN FC Ports Utilization



Performance Dashboard Helps Pinpoint Problem Areas

Instantly identify hot spots and potential issues

- Quickly detect if there are any hotspots along the flow
- View ports with CRC errors, bottlenecked ports, link congestion, etc.
- View statistics on time-based graphs to easily see when events have occurred and correlate with other events
- Customizable to your requirements and needs



Performance Dashboard

Out of Range Violations

Show: All Fabrics | Range: This Hour

Category	Policy Violation Alerts	Network Object Count
Flow Health	150	18
Port Health	190	15
Traffic Performance	23	8
FRU Health	1	1
FCIP Health	5	1
Fabric Health	3	1
Switch Resources	2	1
Security Violations	0	0

Refreshed: 11:16 AM - Last 30 Min

Top 10 Flows

Keywords: Tier1 | Top: Latency

Name	Tx (Mbps)	Rx (Mbps)	Latency (ms)	SCSI Writes	SCSI R
Oracle5	10	16	50	100	
SharePoint2	32	16	46	330	
HR1	30	30	41	588	
Outlook1	30	100	38	303	1003
CRM8	95	0	38	950	1
Billing5	4	5	34	43	55
Outlook5	91	10	32	900	105
CRM1	95	0	32	850	1
Billing2	30	95	31	902	980
Oracle6	6	82	30	67	360

Latency / Tx / Rx / SCSI Writes / SCSI Writes

Refreshed: 11:16 AM - Last 30 Min

Unhealthy SFPs

SFP	Overall Status	CRC Errors	Encode Errors
DCM-7800-15:1/1/1		51	78
DCM-7500-103:1/3/15		28	34
DCM-7500-102:1/2/24		15	27
DCX_224_Chasi:1/2/20		13	18
DCM-4100-98-ss:2/1/16		5	9

87 - Top C3 Discards

Product	Min	Avg. C3 Discards	Max.
DCM-4100-98-...	86	87	88
DCM-7800-15 ...	86	87	88
dcm-dcx-28 [1...	86	87	88
DCX_224_Cha...	86	87	88
DCM-7500-10...	67	68	69
DCM-7500-10...	32	33	34
DCM-7500-10...	15	16	17
sw0 [10.24.51...	2	3	4

Refreshed: 11:16 AM - Last 60 Min

18 - Top Encode Out Errors

Product	Min	Avg. Encode Out Errors	Max.
dcm-dcx-28 [...	17	18	19
sw0 [10.24.5...	11	12	13
DCM-7800-15 ...	11	12	13
DCM-7500-10...	7	8	9
DCM-7500-10...	7	8	9
DCM-7500-10...	7	8	9
DCX_224_Ch...	5	6	7
DCM-4100-98...	0	1	2

Refreshed: 11:16 AM - Last 60 Min

55 - Top CRC Errors

Product	Min	Avg. CRC Errors	Max.
DCM-7500-1...	54	55	56
sw0 [10.24.5...	47	48	49
DCX_224_Ch...	40	41	42
DCM-7800-1...	40	41	42
DCM-4100-9...	37	38	39
dcm-dcx-28 [...	37	38	39
DCM-7500-1...	32	33	34

Refreshed: 11:16 AM - Last 60 Min

81 - Top CPU Usage

Product	Min	Avg. CPU Utilization Percentage	Max.
sw0 [10.2...	80	81	82
DCM-7500-...	22	23	24
DCX_224_...	17	18	19
DCM-7500-...	4	5	6
DCM-4100-...	3	4	5
DCM-7800-...	0	1	2
dcm-dcx-2...	0	1	2
DCM-7500-...	-1	0	1

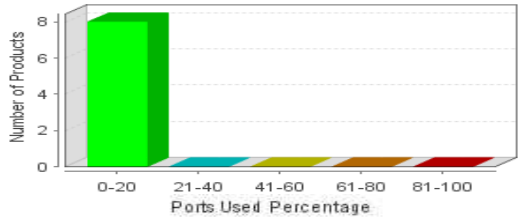
Refreshed: 11:16 AM - Last 24 Hours

63 - Top Memory Usage

Product	Min	Avg. Memory Utilization Percentage	Max.
DCM-7500-...	62	63	64
DCM-7800-...	44	45	46
DCM-7500-...	32	33	34
DCM-4100-...	30	31	32
sw0 [10.24...	28	29	30
dcm-dcx-2...	25	26	27
DCX_224_...	14	15	16

Refreshed: 11:16 AM - Last 24 Hours

Ports Used Percentage Distribution



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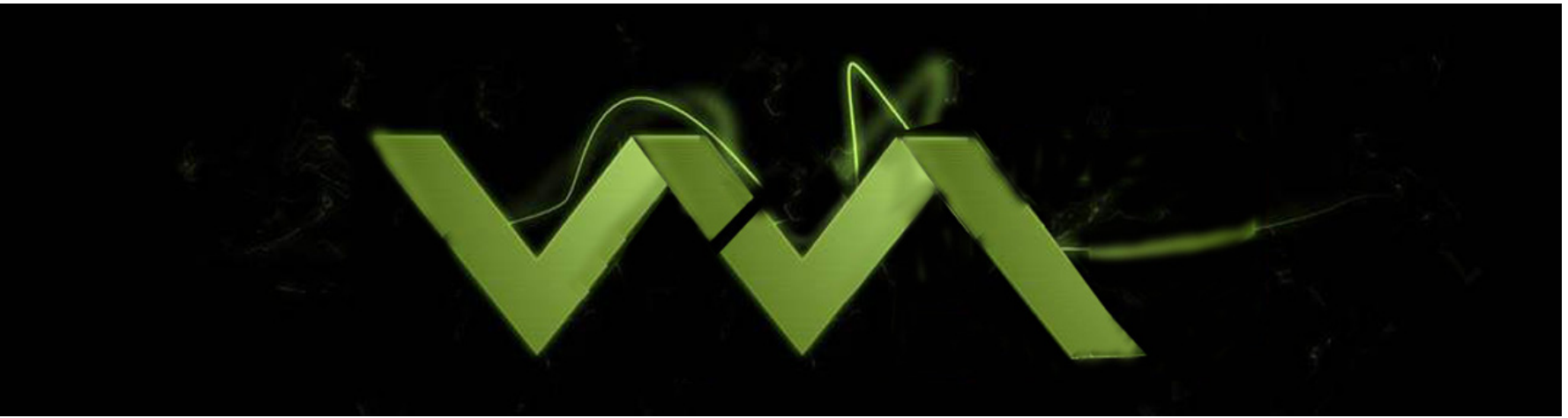
TYPICAL SAN USE CASE

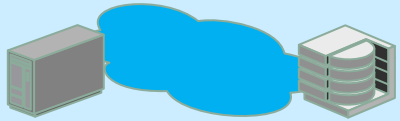
OPTIMIZING VM APPLICATION PERFORMANCE



Your phone rings….“My VM-based application is really slow. What’s wrong?”

SAN Systems Administrator

1st Thought!



How do I quickly identify the root cause of the problem?

2nd Thought!

I have all kinds of data but no useful information!

3rd Thought!

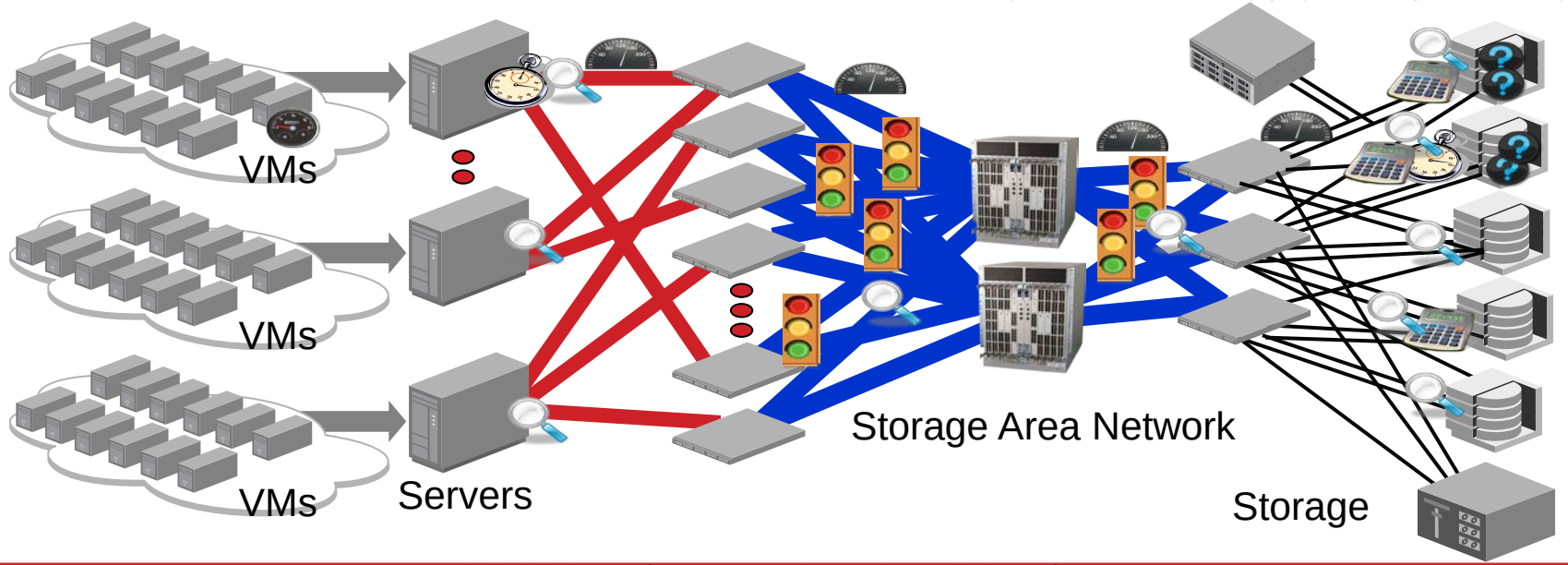
This will take me days to fix!

You get the call.
You must gather performance stats from VM management tool

You must Identify Target and LUN being accessed by the VM having a problem

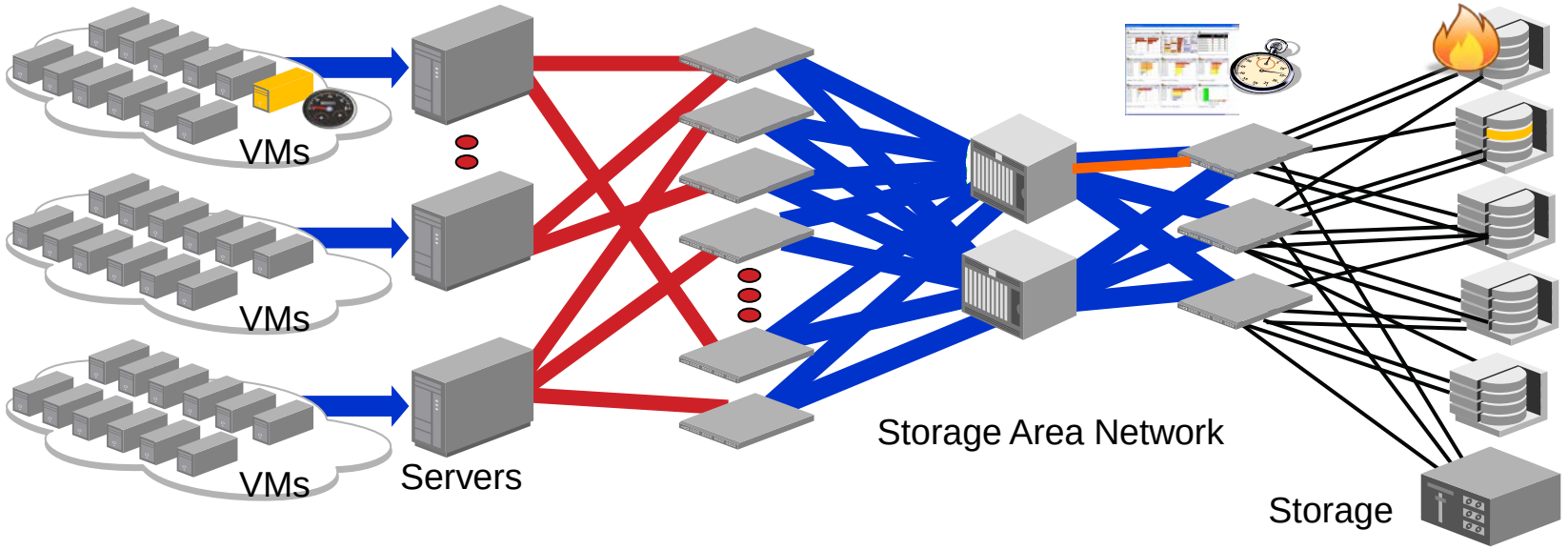
Possible troubleshooting steps/CLI commands:

- **Monitor for device latency bottleneck** at host and storage port with FOS Bottleneck Detection
- **Monitor SCSI RESERVEs** at the target
- **Monitor for latency and congestion on ISLs**
- **Monitor for CRC errors/dropped frames** at host and storage ports; errors could be on ISLs too.
- **Set up end-to-end performance monitoring** using FOS Advanced Performance Monitoring (APM)
- **Monitor for I/O latency** at FC SAN using physical taps/FC analyzer



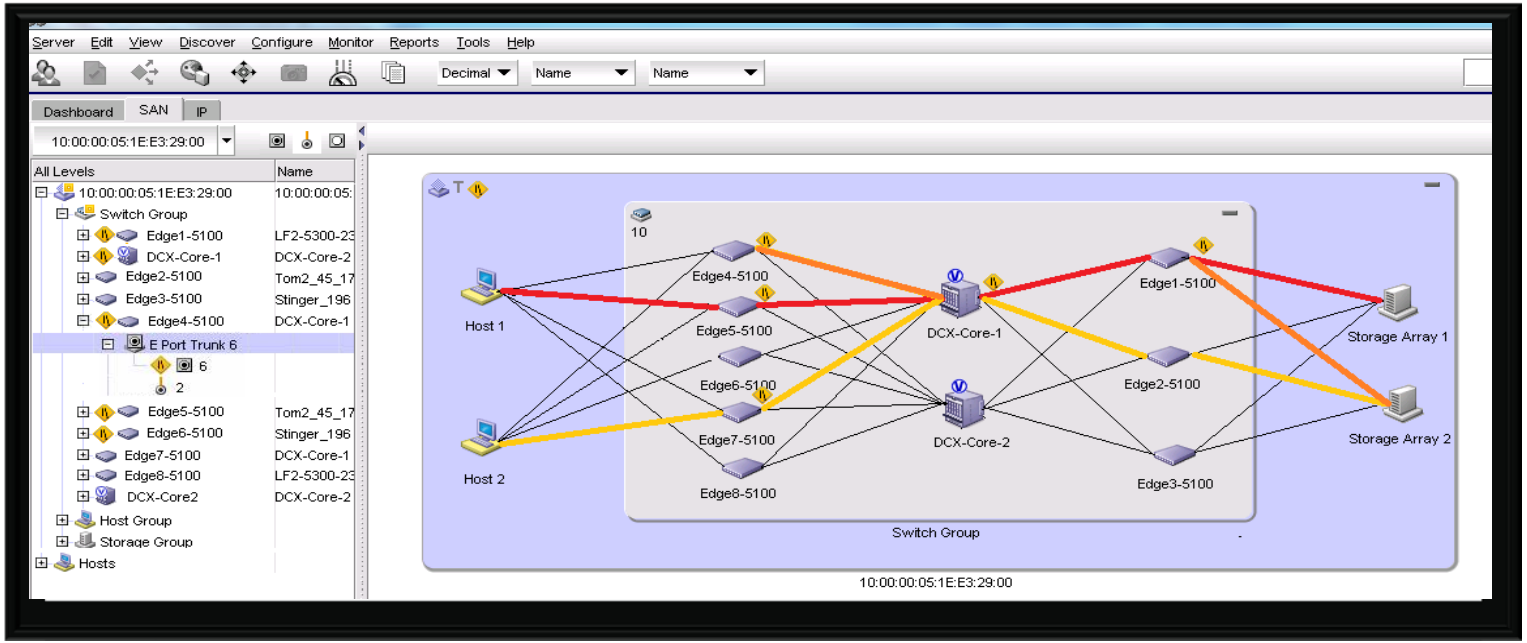
Imagine if...

- You could instantly see the flow you're concerned about?
- You could quickly identify the specific issue causing the problem?
- You could monitor for latency conditions in the fabric without using physical, disruptive taps?



Imagine if...

- You could instantly see the flow you're concerned about?
- You could quickly identify the specific issue causing the problem?
- You could monitor for latency conditions in the fabric without using physical, disruptive taps?
- You could instantly see flows with high latency and be alerted when levels exceed thresholds??

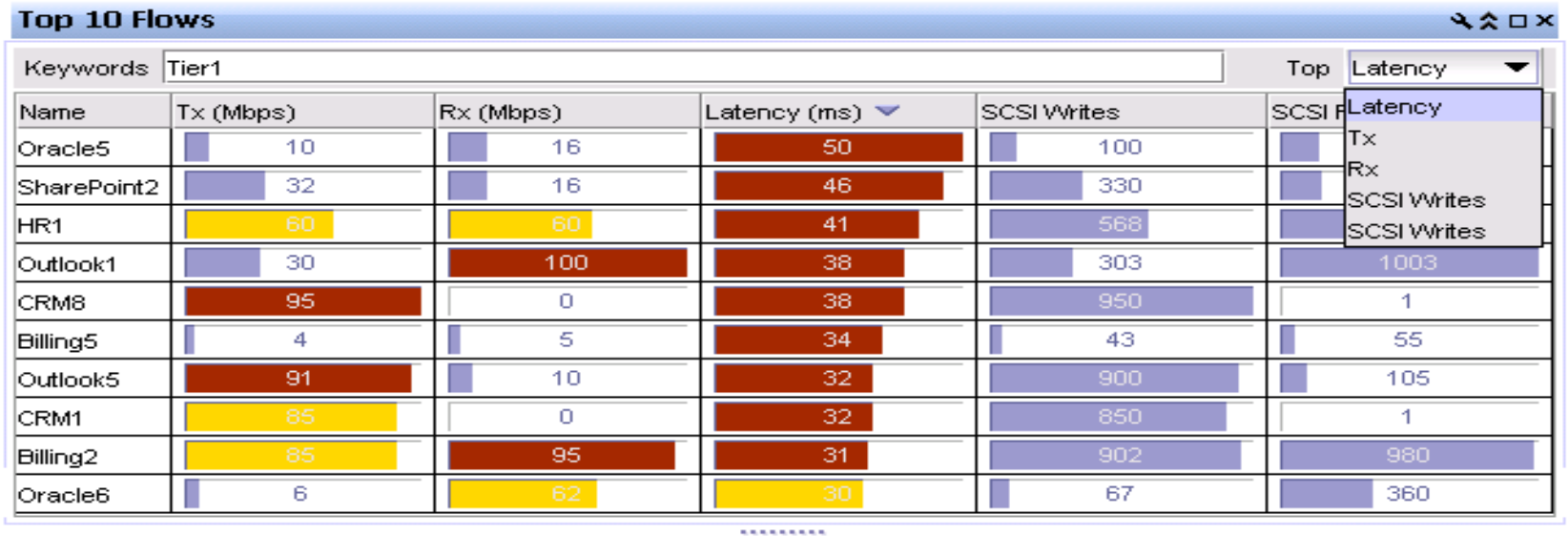


NOW YOU CAN!

An Example of Brocade's Unique "Flow Vision" Technology

Troubleshoot SAN Congestion Issues Without Physical Taps!

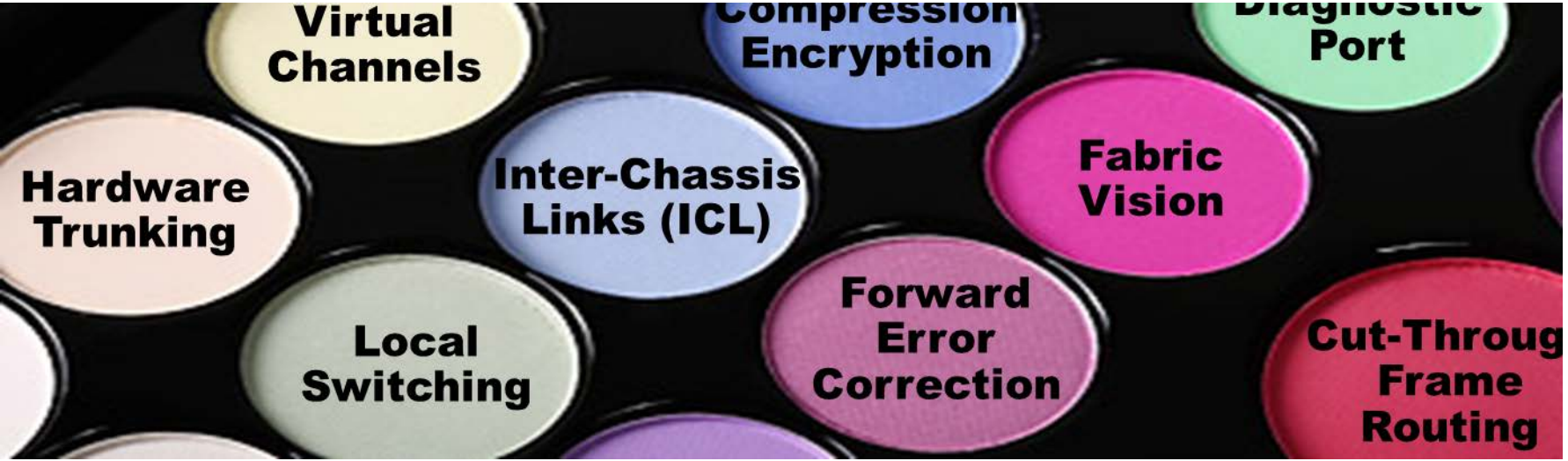
- You can instantly see the data I/O flow that you are most concerned about
- You can quickly identify the specific issue that is causing a problem (more about SAN than FICON)
- You can monitor all flows within an ISL without using disruptive, signal degrading physical taps
- You can see flows with high latency (slow drain) and be alerted when levels exceed thresholds



Name	Tx (Mbps)	Rx (Mbps)	Latency (ms)	SCSI Writes	SCSI R
Oracle5	10	16	50	100	
SharePoint2	32	16	46	330	
HR1	60	60	41	568	
Outlook1	30	100	38	303	1003
CRM8	95	0	38	950	1
Billing5	4	5	34	43	55
Outlook5	91	10	32	900	105
CRM1	85	0	32	850	1
Billing2	85	95	31	902	980
Oracle6	6	62	30	67	360

There are MANY MORE Unique Gen 5 Enabled Features

We only have enough time left to discuss just a few of them



Brocade in the User's Data Center

Troubleshooting and Performance

- It is the goal of every enterprise to obtain the maximum value and utilization from the FC, FICON and IP assets that are deployed

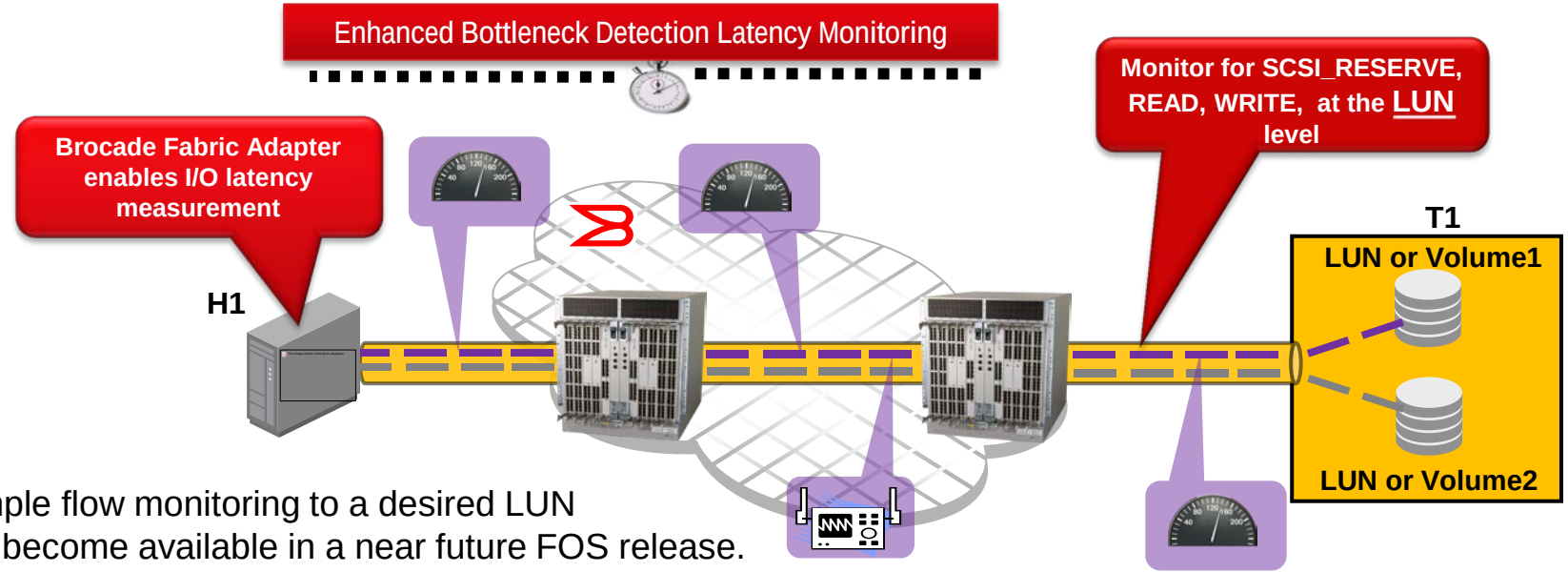
- **BROCADE GEN 5 SUPPORTS THAT GOAL!**

- Fabric OS, Brocade Network Advisor and our superior Fabric Vision Technology:
  - Bottleneck Detection/Alerting of Latency and/or Congestion problems (slow draining)
  - Overcoming Bit Error problems on ISL links with Forward Error Correction techniques
  - Avoid Head-of-Line performance blocking with Virtual Channels for ISLs
  - Validate good path links before deploying them with our Diagnostic Port (D_Port)
  - Identify, monitor, and analyze specific application data flows – avoid port taps and 3rd party applications

Enhanced Detection of Congestion and Latency Issues

Quickly Identify and Resolve VM, FCP and FICON Performance Degradation!

- Monitor for fabric latency with Bottleneck Detection and receive problem notifications
- Measure I/O latency – measured by Brocade Adapter, information visible in BNA
- Monitor resource contention, congestion, and other issues impacting SAN app. performance
- Monitor resource contention, congestion, and other issues impacting M/F FICON performance

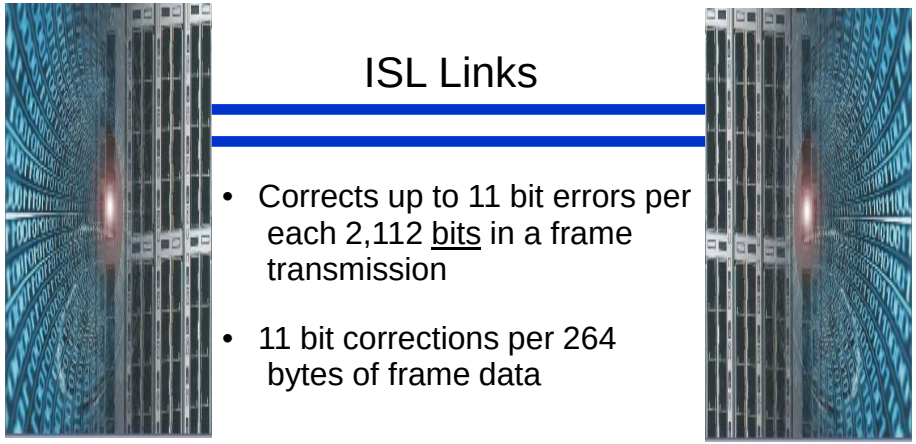


Simple flow monitoring to a desired LUN will become available in a near future FOS release.

Forward Error Correction

Repairing Link Bit Errors using the Sync bits from 64b/66b encoding

- Dirty or worn cable links can cause bit errors in frames and even frame errors which, in the worst case, will drive I/O retry
- The 16 Gbps standard provides for a mechanism to correct ISL link bit errors – this new Brocade Gen 5 capability is called Forward Error Correction (FEC)
- Both sides of the ISL link must use Condor3 ASICs – not for DWDM or FCIP



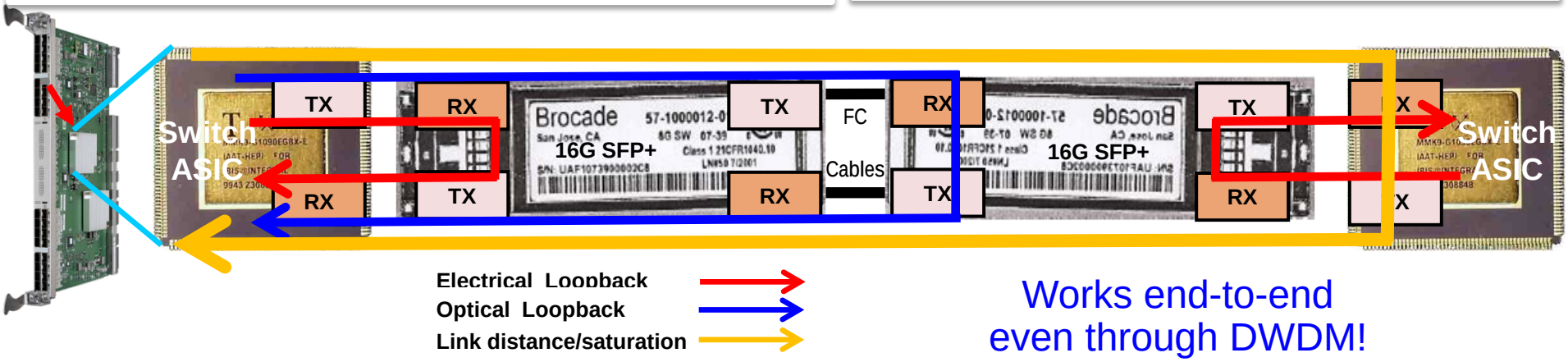
- Works on Frames and on Primitives
- The high-order bits are collected from the 64b/66b data encoding to help correct transmission bit errors
- Used on our E_Ports (ISLs) that are Condor3-to-Condor3 ASIC connections
- Does slightly increase frame latency by about 400 nanoseconds per frame
- But this significantly enhances reliability of frame transmissions across an I/O network and reduces I/O retries which can hurt I/O performance

ClearLink Diagnostic Port (D_Port)

Reduce the time it takes to successfully deploy a fabric

- D_Port will check optics and cables integrity
  - D_Port is a special port type, configured by the user to run diagnostics
  - Does not carry any FC control or data traffic
- Supported only on ISL ports (E_Ports) configured as D_Ports as well as 8510 ICL ports (FOS 7.1+)
- For VC_RDY flows on all and R_RDY flows at 7.1+

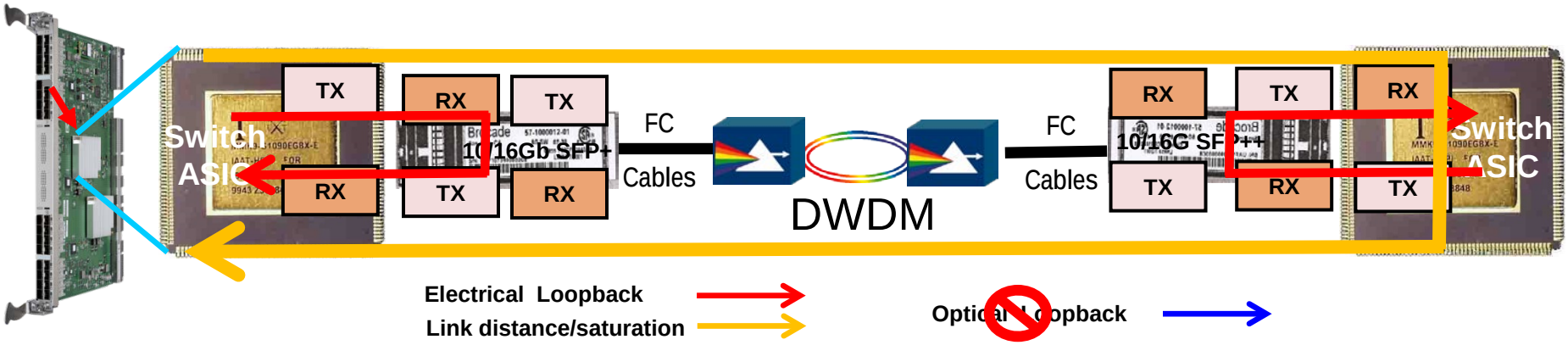
- Full support for 16G SFPs
- Partial support for 10G SFPs
- Provides the following capabilities:
  - Performs electrical loopback (16G)
  - Performs optical loopback (16G)
  - Measures link distance (10G, 16G)
  - Performs link saturation test (10G, 16G)



Works end-to-end
even through DWDM!

D_Port for DWDM and More

- A new sub-option “-dwdm” has been added to “*portcfgdport* --enable” CLI
- Allows a user to configure D_Port over active DWDM links.
- The “-dwdm” option will not execute the optical loopback test while performing D-Port tests as the active DWDM links do not provide necessary support to run optical loopback tests.



- D_Port is also available on Brocade 1860 Fabric Adapter, Access Gateway, and the optical ICLs
  - No Electrical/Optical Loopback support however.

Brocade in the User's Data Center

Massive Scalability

- You can step up to the industries best fabric Scalability if/when you need it

- **ONLY BROCADE PROVIDES THIS CAPABILITY!**

- Brocade SAN Directors can create a local fabric of up to 3,840 ports!
- Brocade FICON Directors can create a local fabric of up to 1,152 ports!
  - ICLs are a unique capability of Brocade Director technology (not for Gen 5 switches)
  - Inter-Chassis Links (ICLs) allow multiple Gen 5, 16 Gbps Directors to be linked together
  - For FICON, ICLs create a Cascaded FICON environment but DO NOT use your one hop
  - Inter-Switch Links (ISLs) can then connect sets of ICL connected Directors together
  - Each ICL carries 64 Gbps of throughput between a pair of Brocade Directors
  - Gen 5 eight slot Directors can have up to 32 ICL connections (32 x 64 = 2048 Gbps of B/W)
  - Gen 5 four slot Directors can have up to 16 ICL connections (16 x 64 = 1024 Gbps of B/W)

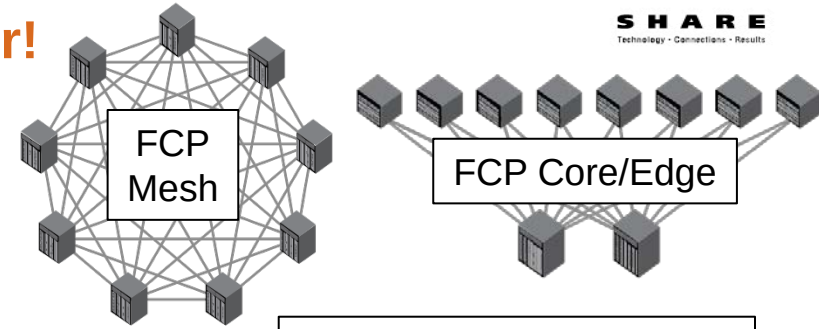
Brocade Unique Fabric Scalability

ICL Configuration at FOS 7.1.0c and higher!

- Chassis expansion scalability through UltraScale Inter-Chassis Links (ICLs)
- For FCP:
  - Can deploy a simple nine-chassis active-active mesh
  - Can deploy scalable Ten-chassis core/edge topologies

− For FICON:

  - Can deploy three Gen 5 8510-8s connected together providing 1,152 ports with from 128 – 2048 Gbps of ICL bandwidth (three 384p chassis equals 1,152 ports)
  - And two clusters of ICL'd Directors can be ISL'd together to create even more scalability



Up to 6,800 miles or 11,000 km
(with FCIP ISLs)

Brocade in the User's Data Center

Exceptional Performance

- Would you like to ENSURE great I/O performance?

- **BROCADE GEN 5 PROVIDES THAT CAPABILITY!**

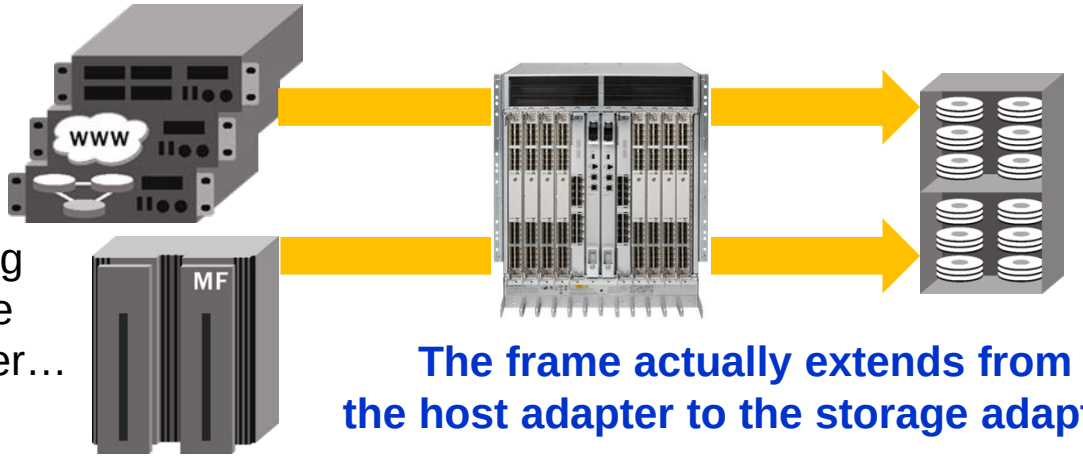
- Brocade hardware capabilities help you keep your performance at peak levels!
  - Simple, ASIC-based internal connectivity allows for fast and predictable path performance
  - Backplane Frame Latency is a consistent 2.1 microseconds
  - Local Switching Frame Latency is a consistent 700 nanoseconds
  - Compression/Encryption of data on ISL links improves fabric efficiency
  - Hardware balancing of frame flow across ISL links enhances performance
  - Capability to remove ISL links that are going bad or no longer needed or are failing

Cut-through Frame Routing

Reducing frame latency helps provide maximum performance

- Brocade Gen 5 Directors utilize Brocade unique “cut through” frame routing which means that a full frame does not have to reside in switch memory before it gets passed along
- “Cut through” frame routing allows the Brocade Gen 5 to have a low average frame latency delay for fibre channel data frames – especially significant with HBA, CHPID and SSD IOPS!
- And I/O path “Latency” is going to become its own bottleneck to I/O performance over time!

The last of a frame’s bits are leaving the HBA or the FICON adapter…



…as the first of a frame’s bits are entering the storage port and the storage systems begins to work with that same frame.

The frame actually extends from the host adapter to the storage adapter!

Beware of Latency – in any form – in the I/O path

Latency will reduce the potential IOPS

- Latency is typically only microseconds of time, usually overlooked when discussing performance
- But its affect can throttle your throughput
- Switched-FC might or might not impact IOPS. IBM IOPS testing of FICON Express8/8S utilized Brocade Gen 4 and Gen 5 Directors before they finalized their IOPS numbers.

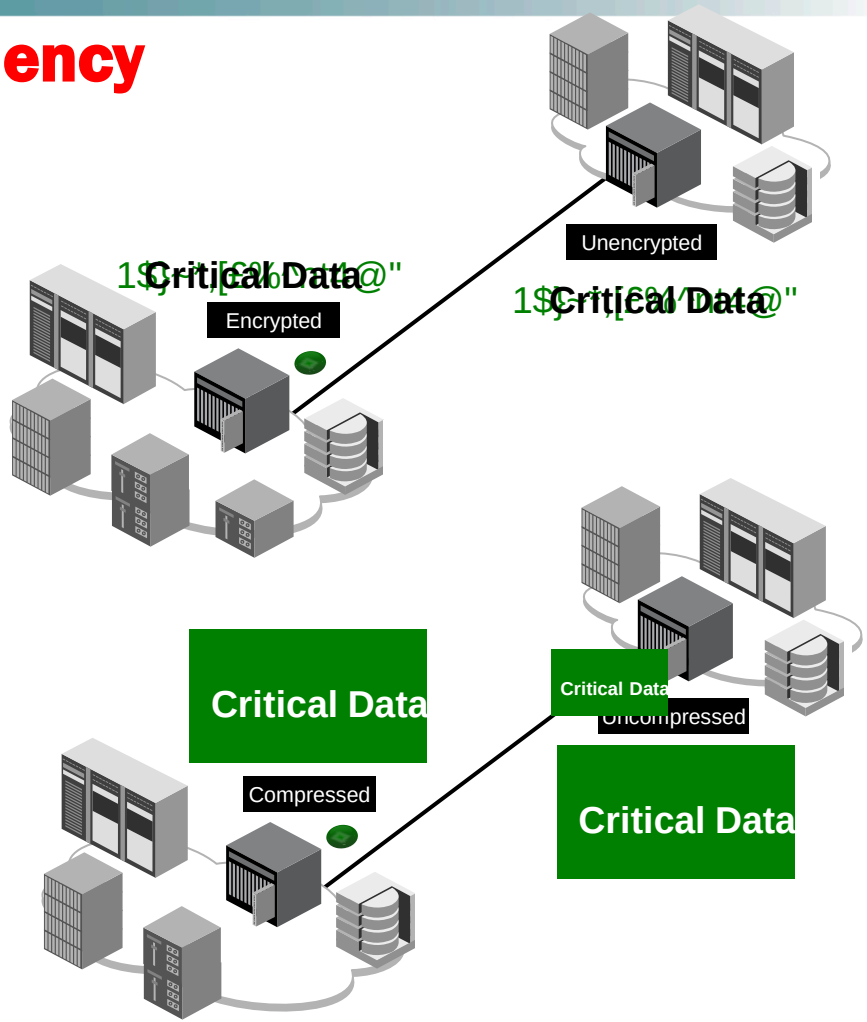
					IBM tests their FICON Express Cards through Brocade Switching Devices to determine Max achieable IOPS							
M/F	CHPID	Type	Rated IOPS	Each I/O µs	Max I/O with Switch Latency of 2x 2.1 µs	Brocade Max IOPS %	Max I/O with Switch Latency of 2x 5 µs	Other Max IOPS %	Max I/O with Switch Latency of 2x 10 µs	Other Max IOPS %	Max I/O with Switch Latency of 2x 100 µs	Other Max IOPS %
zEC12	FX8	CM	20000	50.00	20000	100.00%	16667	83.33%	14286	71.43%	4000	20.00%
zEC12	FX8	zHPF	52000	19.23	52000	100.00%	34211	65.79%	25490	49.02%	4561	8.77%
zEC12	FX8S	CM	23000	43.48	23000	100.00%	18699	81.30%	15753	68.49%	4107	17.86%
zEC12	FX8S	zHPF	92000	10.87	92000	100.00%	47917	52.08%	32394	35.21%	4742	5.15%

For more information about this, come and see Session 14269
"A first look at the Inner Workings and Hidden Mechanisms of FICON Performance"

Improved ISL Security and Efficiency

Unique Gen 5 Capabilities

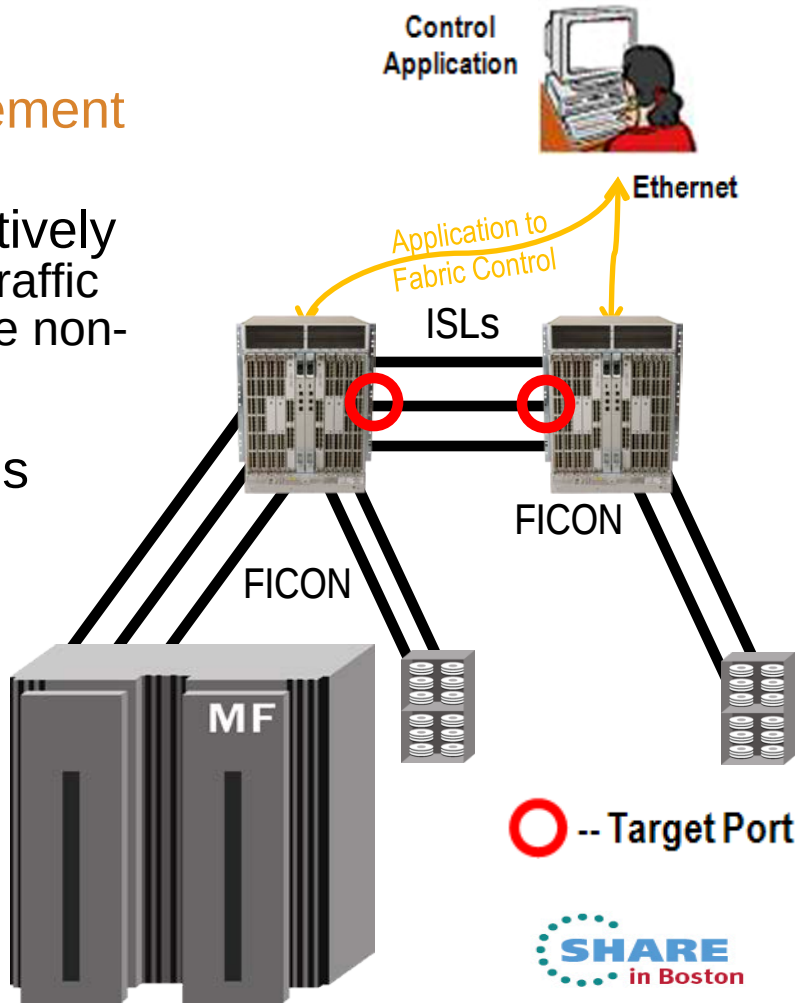
- **Secure Transfers**
  - Encrypts data on Brocade Gen 5 ISL ports
    - Switch-to-switch encryption, not at-rest encryption
    - Useful over Fibre Channel long-distance links
  - Uses AES-GCM algorithm for both authentication and encryption
  - Uses 256-bit encryption key but no key management
- **Maximum Network Efficiency**
  - Disk or tape traffic gets compressed on ISL and gets uncompressed at the receiving switch
  - Provides up to 2:1 compression and uses Brocade LZO algorithm
  - Provides up to 128 Gbps of compressed bandwidth per blade
- **No licenses and can be used separately or together on the same ISL link**



Port De/Re-commissioning

In Particular, improving FICON ISL Management

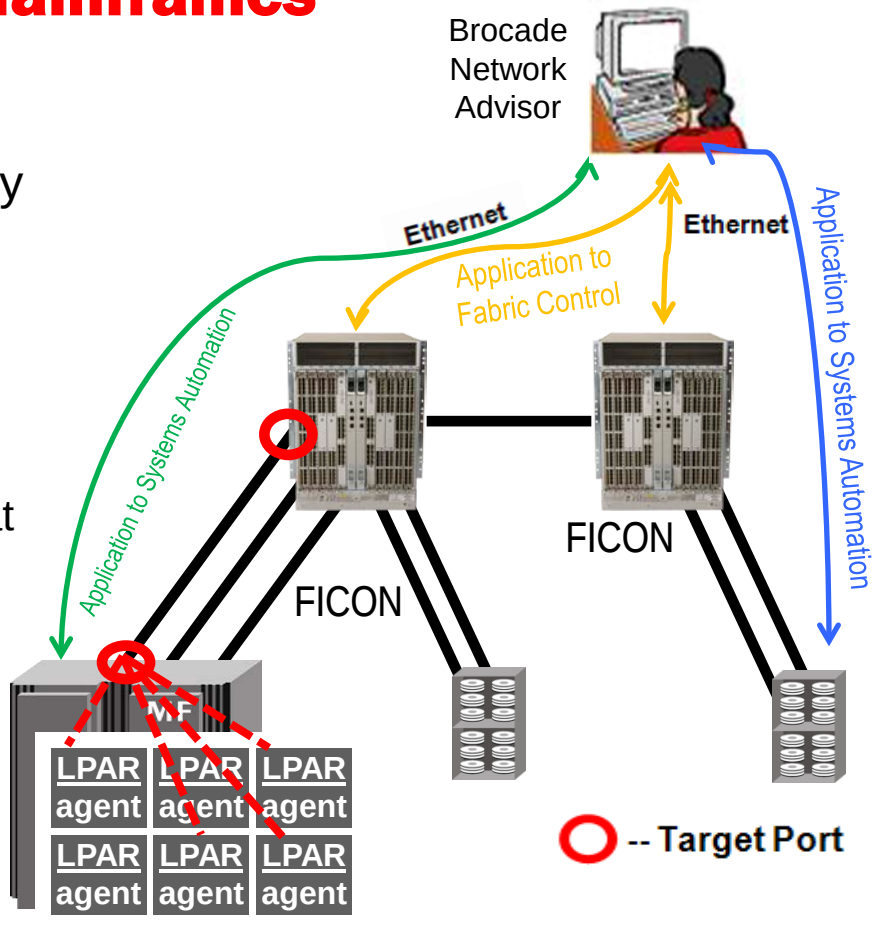
- Mechanism to remove an ISL non-disruptively
  - Block/Disable an ISL port after moving the traffic flow to other routes so that removing it will be non-disruptive
- Coordinate event with external applications
  - Switch operating system moves routes off of the target ISL before that ISL is disabled
- Can be attached to automated processes
  - Port Fencing / Port Auto Disable
    - Select Port Decommission as an action
      - Invokes decommission process instead of immediate disabling of the port



Port De/Re-commissioning for Mainframes

Improving FICON N_Port Management

- Mechanism to remove a port non-disruptively
  - Block/Disable a device port after allowing each LPAR to quiescing the path/device so that removing it will be non-disruptive
- Coordinate event with external applications
  - Application or system manager
    - Moves workload off of a target port before that port is disabled
- May be attached to automated processes
  - E.g., Port Fencing
    - Select Port Decommission as an action
    - Invokes decommission process instead of immediate disabling of the port



As You Begin To Make Decisions To Technology Refresh

Please Consider The Following:

- Our **MANAGEMENT** capabilities drive VALUE – enterprises like yours needs that
- Our **RELIABILITY** means less stress in your life and more sleep at night
- Our **SCALABILITY** matches our partner's strategic vision for on demand Computing
- Our **PERFORMANCE** is unmatched and helps you meet your Service Level Agreements
- Our **ENERGY EFFICIENCY** reduces your operational expense budget saving you money
- Our **INVESTEMENT PROTECTION** positions us to become your trusted advisor
- Our **PRIZED CERTIFICATIONs** increase your confidence and expertise in SAN and M/F I/O
- You, like other customers, vote their confidence in a vendor by buying their equipment and worldwide about **90% of all FICON infrastructure** deployed is from Brocade and overall about **74% of Fibre Channel infrastructure** deployed is from Brocade!

As You Begin To Make Decisions To Technology Refresh

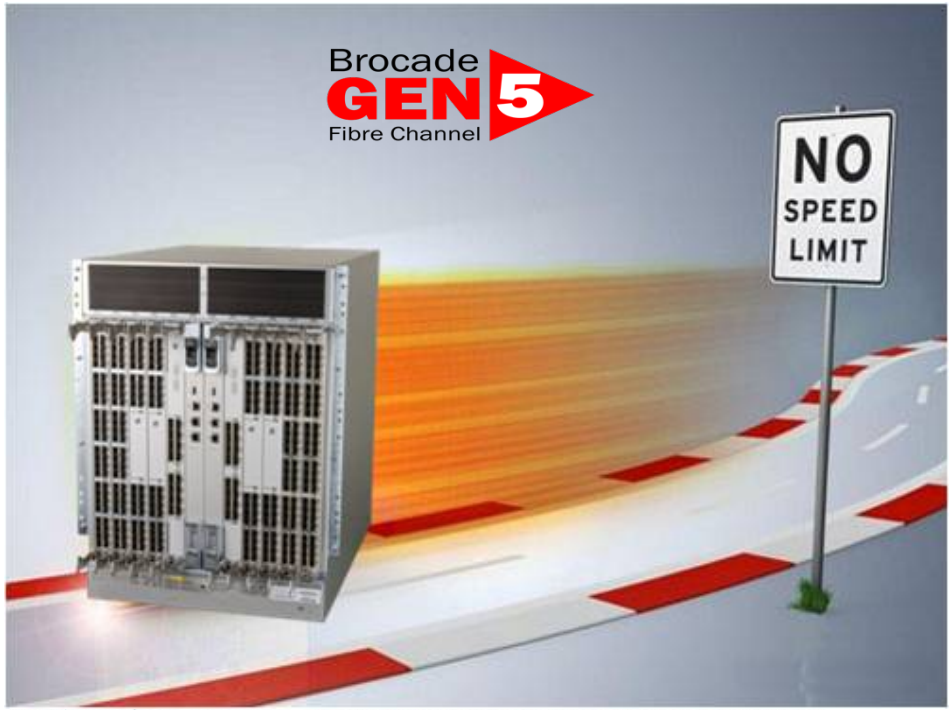
Please Consider The Following:

What you have seen here today is only a SAMPLING of the many innovations that are now bundled with Brocade hardware and software to make deploying and utilizing SAN and FICON fabrics as simple as possible!

As so many Customers in the World have done, is it now time to take a look at how Brocade can improve your data center environment once again!

Thank You!

Please Fill Out An Evaluation On This Session!



Session 14482

QR Code