The Quest for an Autonomous Storage Fabric

Fibre Channel Fabric Notifications Technology

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Agenda

Storage fabrics
Getting more intelligent?

Self driving SANs
Under the hood

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Future of storage fabrics

Leading the transition from one heterogeneous world to another

Fibre Channel Connectivity
Purpose built for Business-critical apps

iSCSI Acceleration
Standard Ethernet Based infrastructure

FCoE Acceleration
Blades and Converged

Hyper Converged Systems
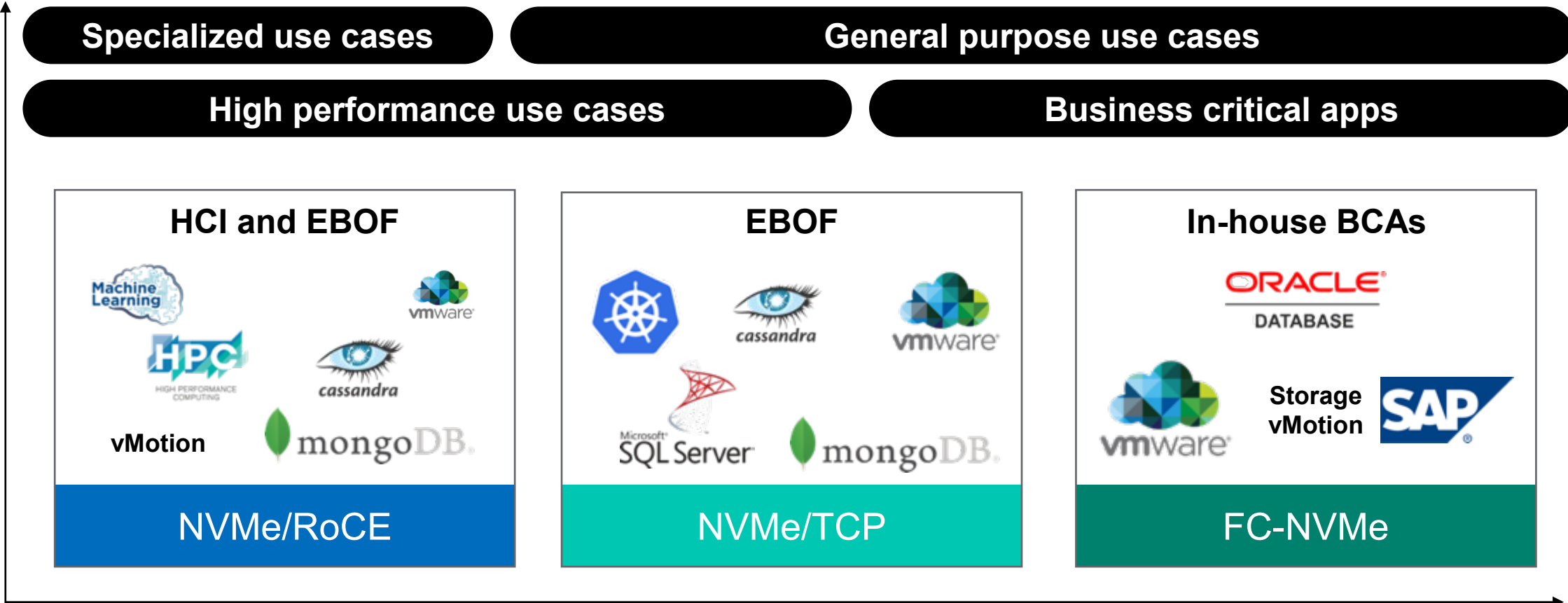vSAN, AzureStack on standard networking

Concurrent FC-NVMe and FCP

NVMe/TCP and NVMe/RoCEv2

RDMA Acceleration for HCI

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Storage fabrics use cases

Logos are indicative of workload characteristics only.

HCI = Hyper Converged Infrastructure
EBOF = Ethernet BO Flash
BCA = Business Critical Apps

Operational simplicity

"Consistent" performance

Security

Reliability

Leverage existing infrastructure

Open standards

What customers expect from Storage Fabrics?

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Autonomous fabrics? Need to go beyond day 0!

iSCSI	NVMe/TCP	FC-NVMe
Automated discovery	**Automated discovery**	**Discovery, metering, congestion, auto routing**
▪ iSNS ▪ Proprietary methods	▪ Centralized discovery controller ▪ Direct discovery controller	▪ Discovery ▪ Virtual machines IDs ▪ Fabric notifications (FPINs)

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Sensing the road ahead – foundation for the autonomous SAN
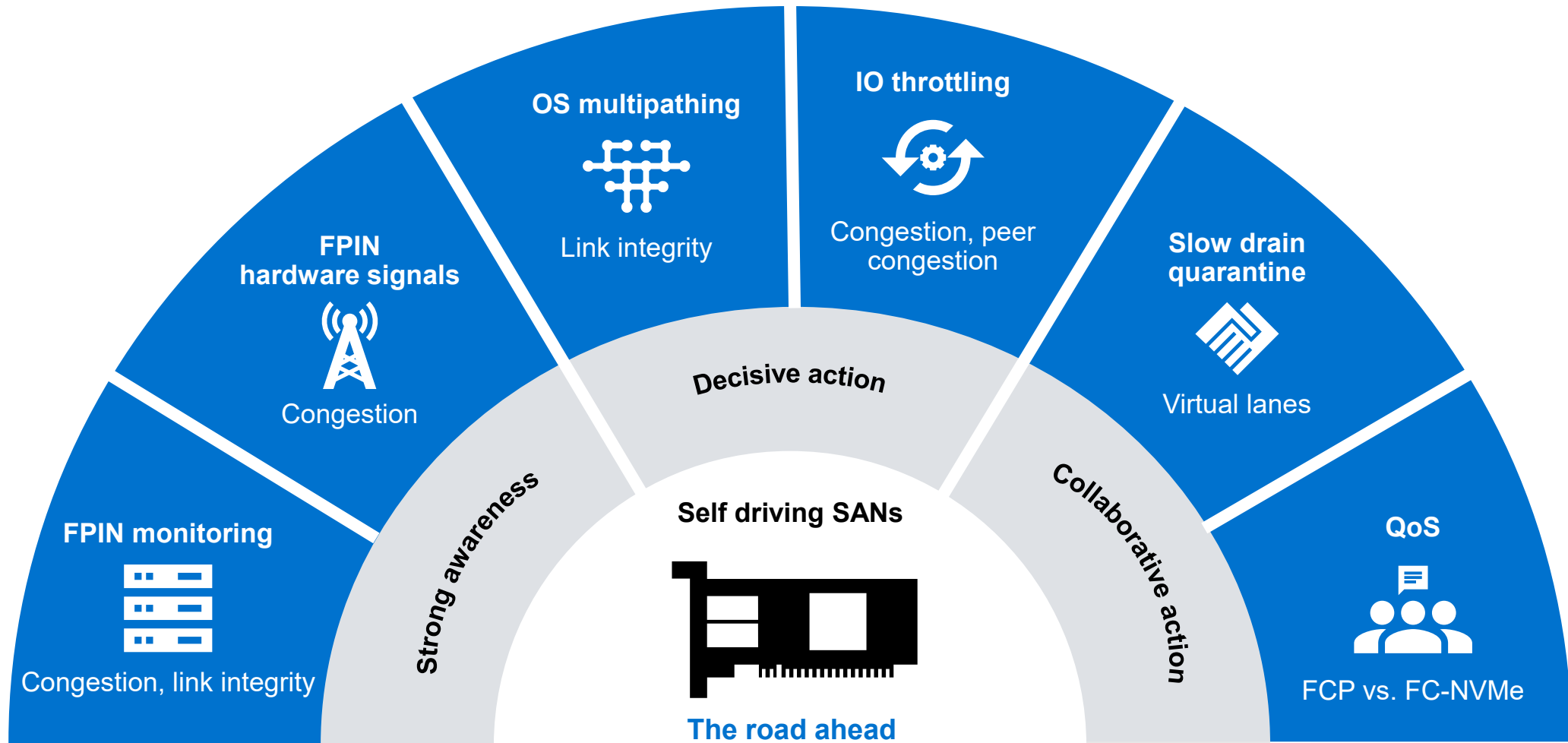
"Awareness" of FC SAN conditions

- **Link integrity (Potholes)**
  - Awareness: Physical layer errors exceed a threshold
  - Decisive Action: Use an alternative path or adjust for the error rate

- **Congestion (NB Traffic)**
  - Awareness: Fabric has identified the congestion source (it's you)
  - Decisive Action: Reduce the rate of IO requests or quarantine flows

- **Peer congestion (SB Traffic)**
  - Awareness: Fabric has identified the congestion source (not you)
  - Decisive Action: Use another path or reduce the transfer rate

- **Delivery (can't make it)**
  - Awareness: Fabric transmit timeout, cannot deliver
  - Decisive Action: Report IO error immediately (short-circuit protocol timeout)

INDUSTRY STANDARD

"Decisive Action" – fight or flight!

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The path to the autonomous SAN

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Road to Autonomous SANs

Thinking beyond Day 0

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What it takes to build an autonomous SAN?

Understanding road conditions and driver behavior

Adoption and co-existence of heterogeneous speeds
Longer shelf life of a single FC speed
8/16/32FC in datacenters concurrently

Increased pressure on CapEx and OpEx
IT asked to improve utilization
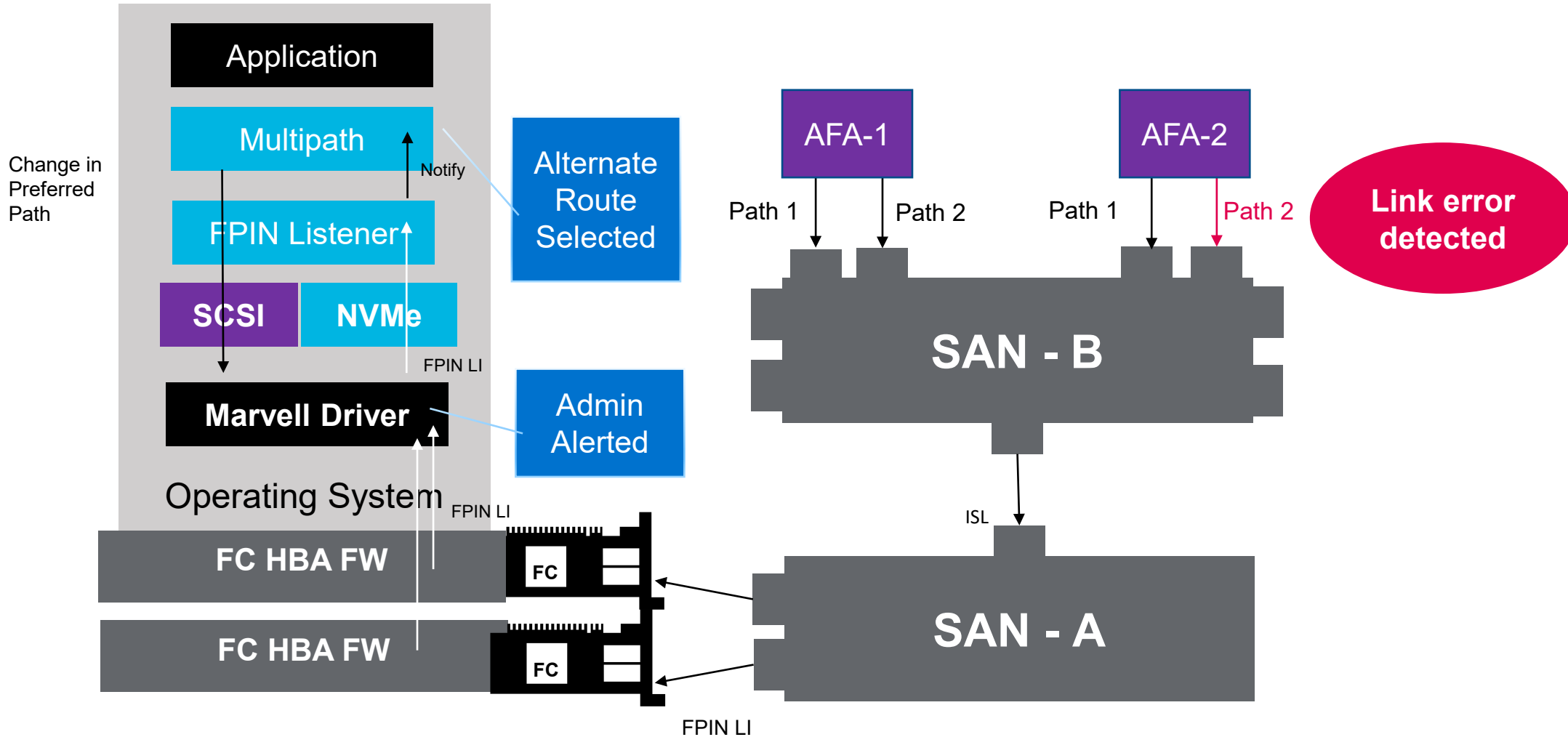Workload migration

Flash storage
Storage no longer throttling the SAN
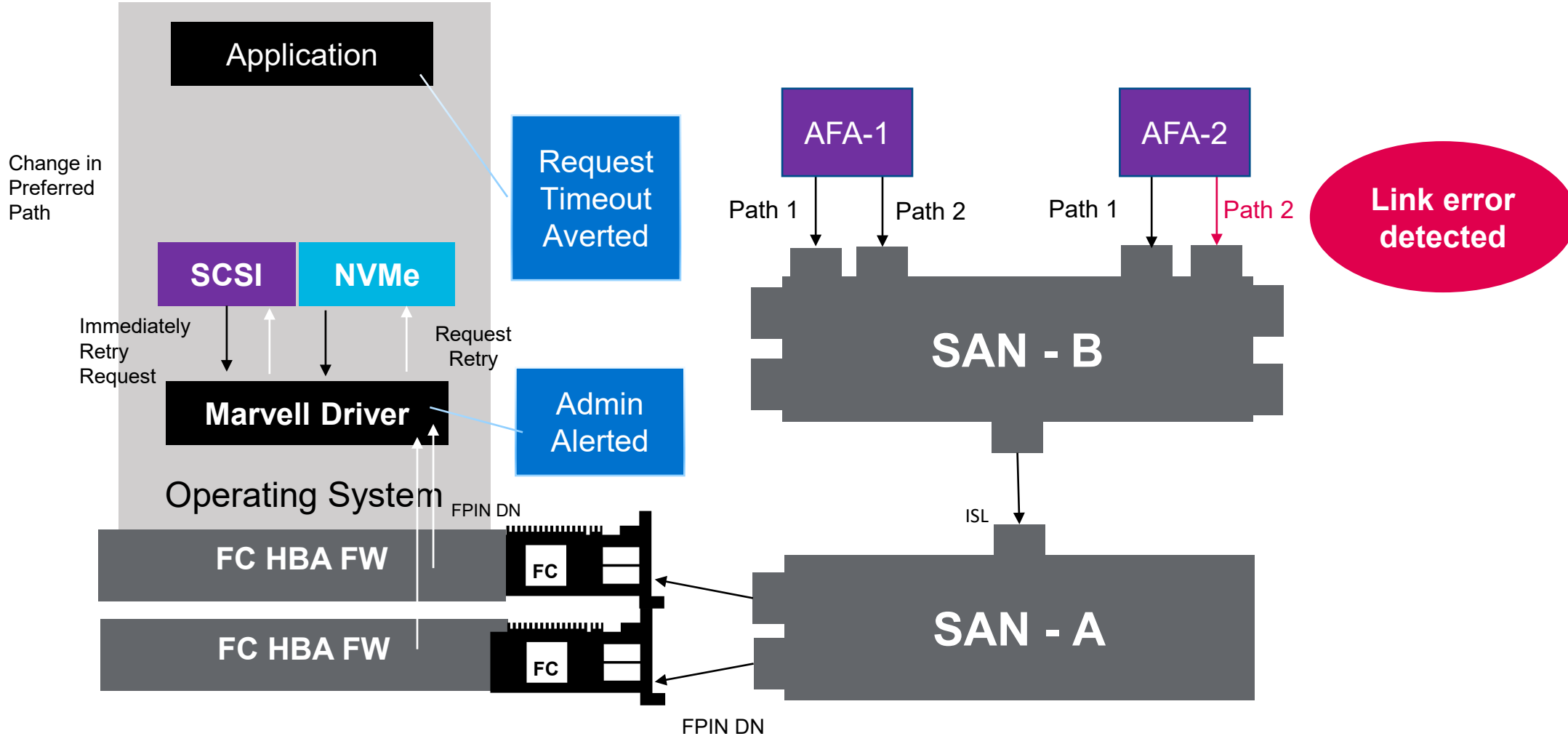Pushing SAN infrastructure to its limit

Degraded Physical Links
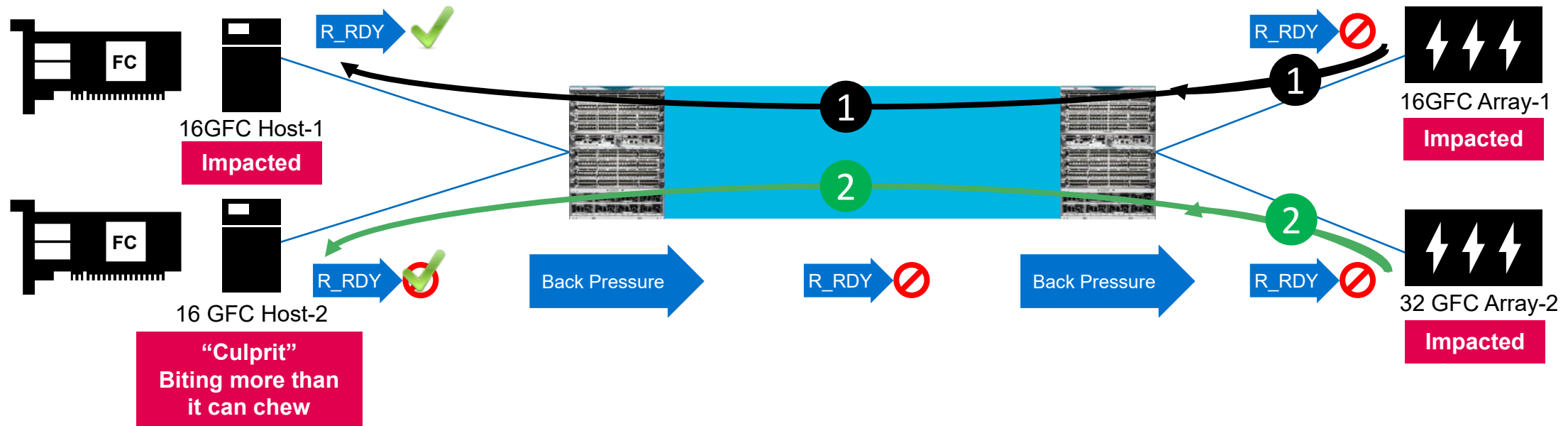Consistent performance required smarter reporting that goes beyond a hard link down

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Mitigating temporal link / layer 1 issues

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Mitigating temporal link / layer 1 issues

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Flash arrays and the oversubscription problem

- A single target upgrade (Array 2), with the ability to send faster responses can cause slow drain / oversubscription

- Switchport connected to a slow drain device (Host 2) is starved for B2B credits

- Impact is seen on multiple end-devices sharing the same pair of switches and ISLs

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Congestion mitigation solutions

✅ Switch only   ✅ HBA driven   🚫 Future

Switch only	HBA driven	Collaborative
Independent of FC HBA Capability	**Switch driven awareness, HBA driven Action**	**Switch driven awareness, HBA + SW action (isolation)**
▪ Cisco DIRL ▪ Brocade SDDQ, Port Fencing, Traffic Optimizer	▪ Brocade and Cisco FPIN ▪ QLogic USCM IO Throttling (initiator driven)	▪ Brocade and Cisco FPIN ▪ Brocade and Cisco Virtual Channel

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Level of mitigation

✅ ✅ 🚫 Future

Switch only	Switch + host	Switch + host + target
▪ Triaging requires an analysis of fabric statistics. ▪ Issue noticeable only after a severe impact. ▪ Mitigation options are limited.	▪ Simplified triaging with alerts and warnings on impacted hosts. ▪ Issue noticeable before severe impact. ▪ Mitigation options are greater (but not perfect).	▪ Simplified triaging with alerts and warnings on impacted hosts and targets. ▪ Issue noticeable before severe impact. ▪ Potential of eliminating Congestion altogether.

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What comes next?

You!

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Calling the cavalry!

1 Spread the awareness – literally and programmatically.

2 Determine who is best positioned to "take action" – device or stack or app

3 Plug the gap in standards – wants vs. need?

4 Visibility for workload balancers / schedulers

5 Test drive, this is in our GA code ("actions" are disabled by default)

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Thank You!

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