

CISCO *Live!*

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#CiscoLiveAPJC



Manage, Operate, and Optimise High-Performance Storage Area Networks

Getting your SAN to perform at its best

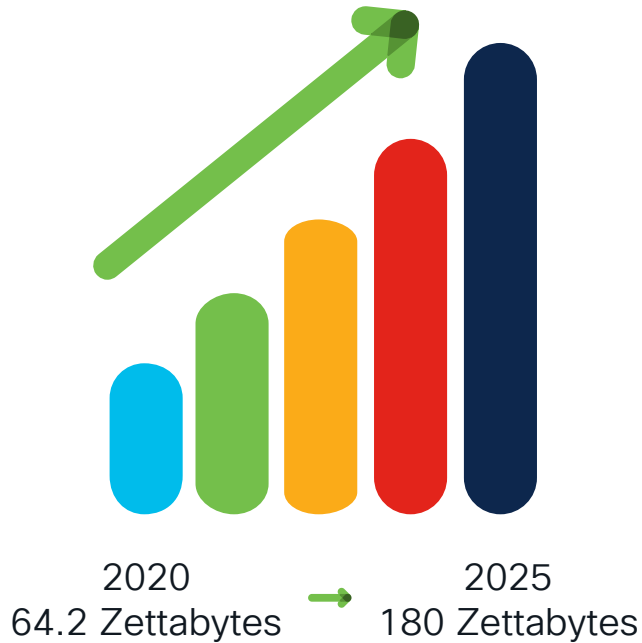
Jonathon Lanzon – Solutions Engineer
@jlanzon
BRKDCN-3641

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Exponential Growth of Data

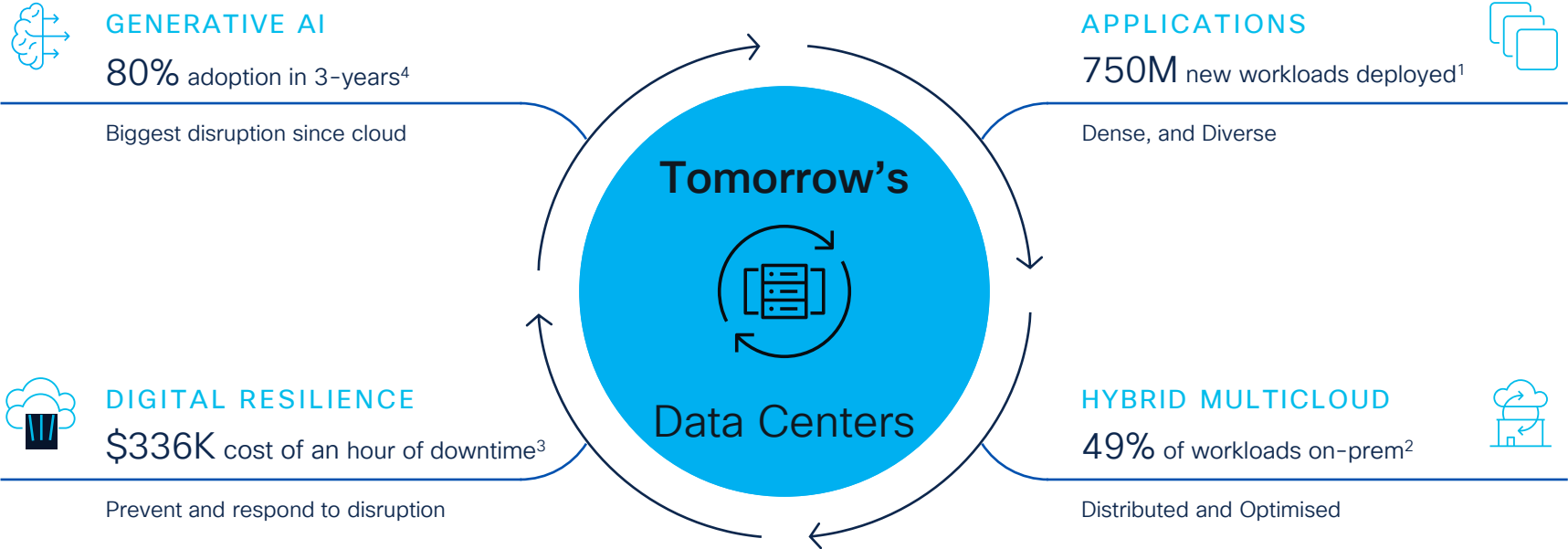


1 Yottabyte

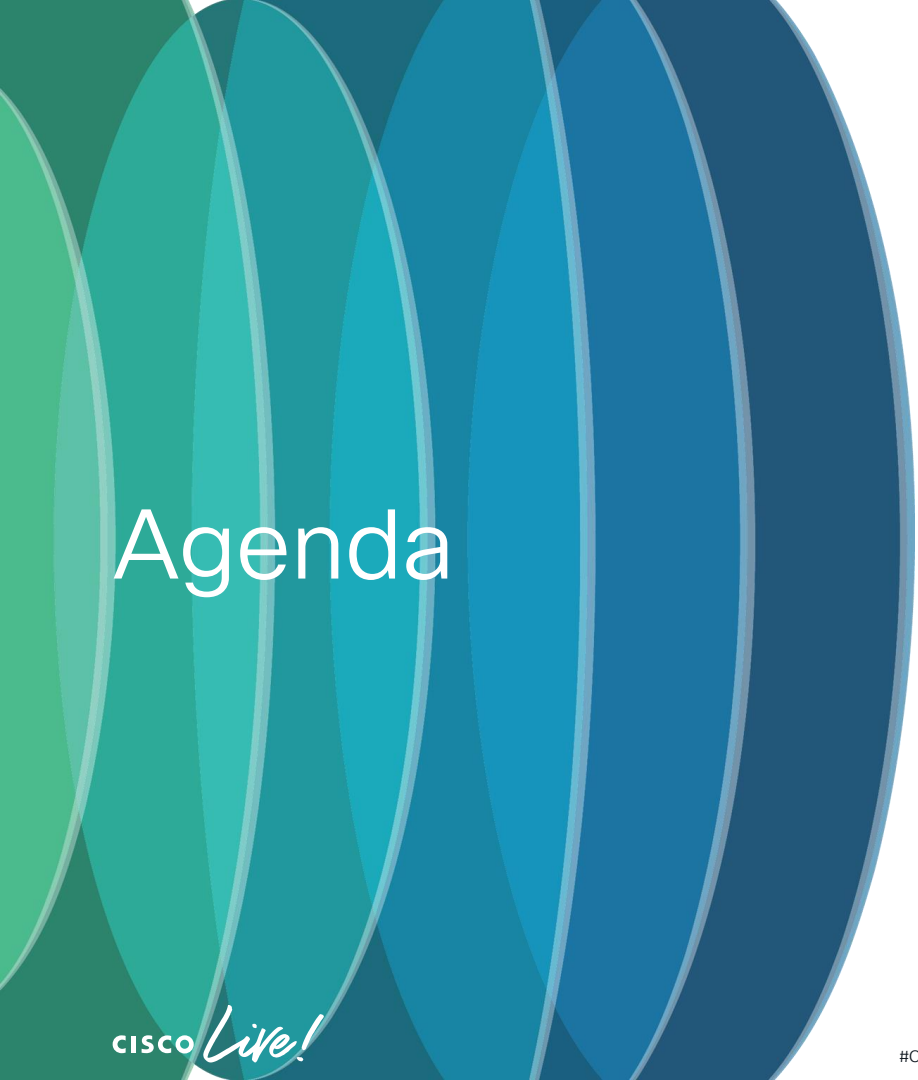
by 2030

<https://insightsnadata.com/the-exponential-growth-of-data-understanding-the-implications-and-preparing-for-the-future-ee07c380e98d>

Technology Trends Driving Data



Sources: 1. IDC 2. Flexera 3. Splunk 4. Gartner



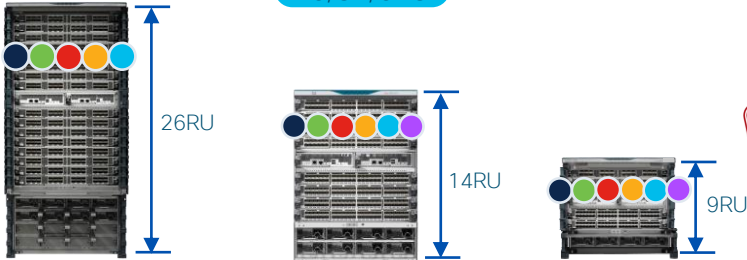
Agenda

- Overview
- Common architecture
- Understanding and detecting SAN congestion
- Preventing and predicting SAN congestion
- Summary

Cisco MDS 9000 switch hardware

SAN directors

16/32/64G



MDS 9718
768 ports

MDS 9710
384 ports

MDS 9706
192 ports

26RU

14RU

9RU

All Certified
NVMe/FC
Switching and analytics

Modules

64G



48 x 64G FC

32G



48 x 32G FC

FCIP

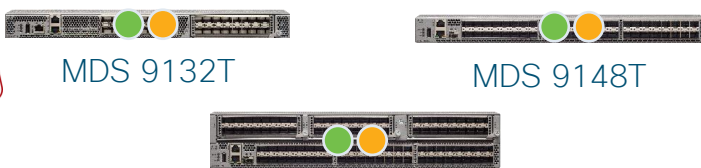


24 x 16G FC, 8 x 1/10 GE & 2 x 40 GE

● 8/16/32/64G FC ● 4/8/16/32G FC ● 2/4/8/10/16G FC

Fabric switches

32G



MDS 9132T

MDS 9148T

MDS 9396T

64G



MDS 9124V

MDS 9148V

MDS 9396V

FCIP

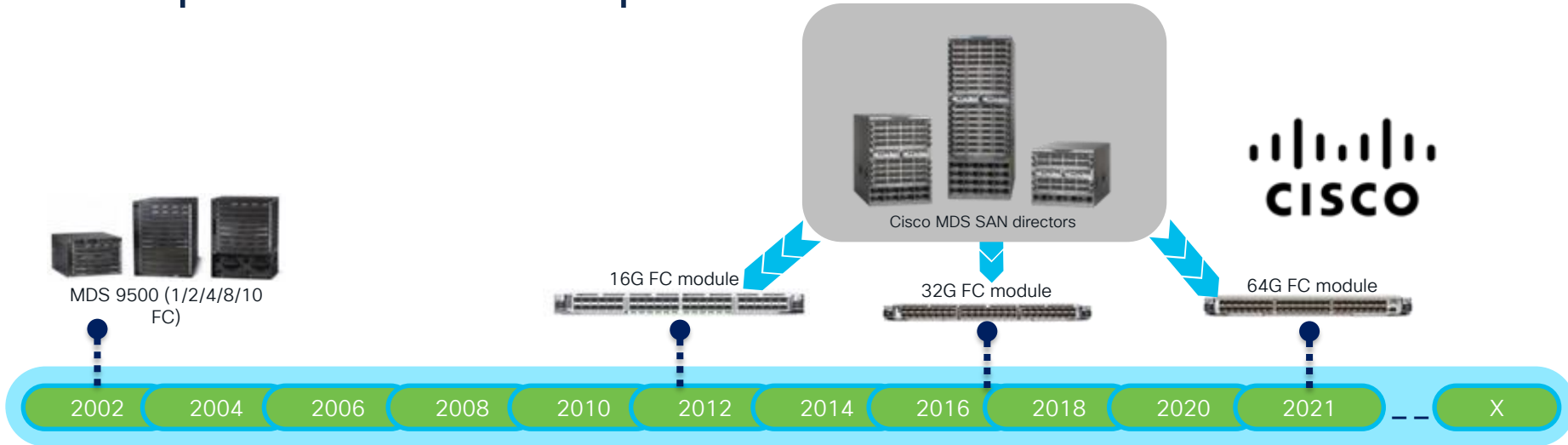


MDS 9220i

● SAN Analytics ● FCIP ● FICON

Line-rate, non-blocking, non-oversubscribed, since 2013

Unique investment protection



Non-disruptive multi-generation upgrades

Multi-generation optics support

8/16/32/64G FC optics

Multi-generation module support

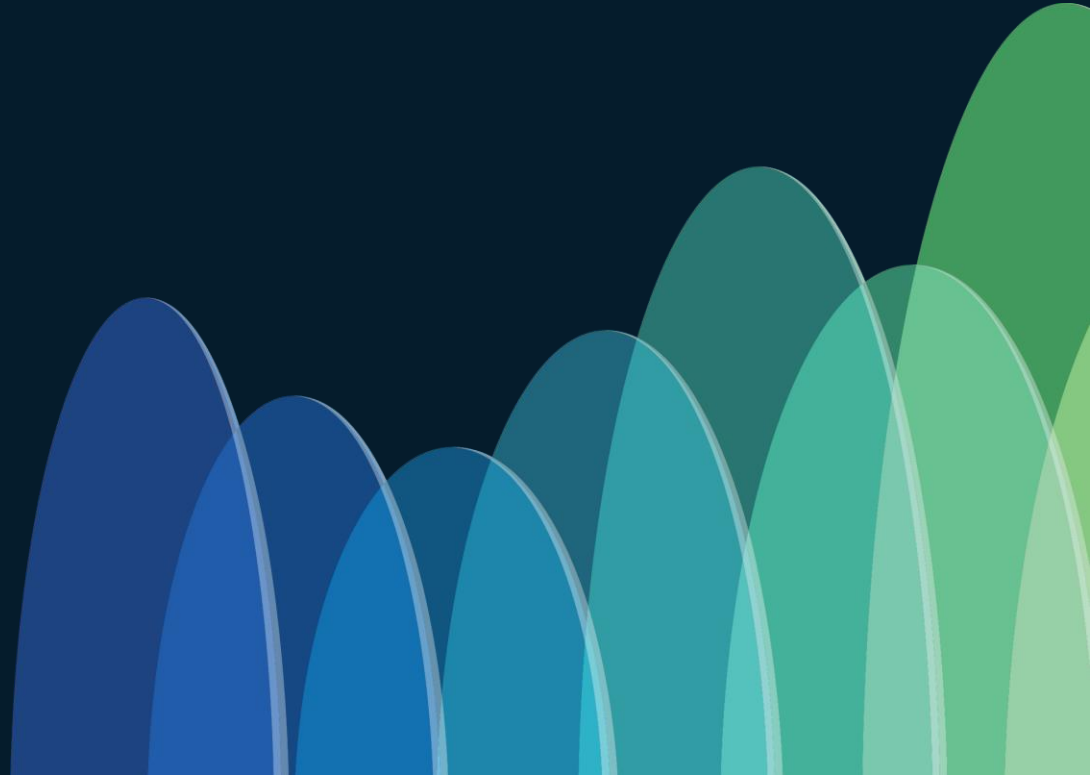
16/32/64G FC module

Multi-generation FC speed support

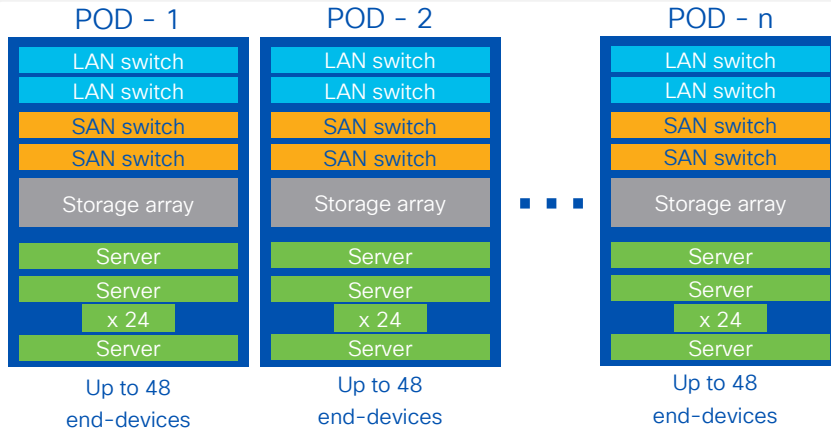
2/4/8/10/16/32/64G FC

Cisco MDS SAN directors: Single chassis multi-generation support

Common Architecture



Pod fabric



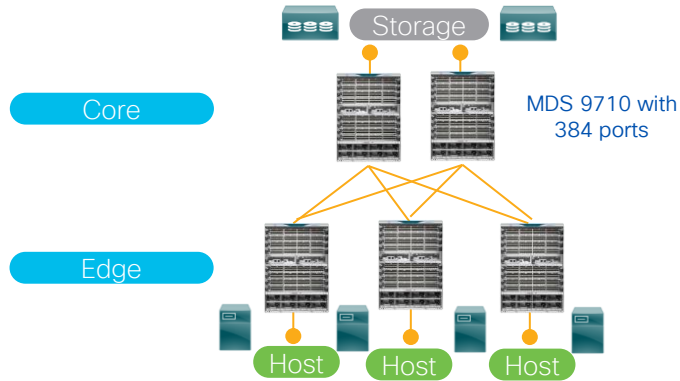
Benefits

- Best at containing SAN congestion / slow drain within the rack
- No effect on other racks while one rack is under maintenance

Challenges

- Requires a different data center operational model

Edge-core design



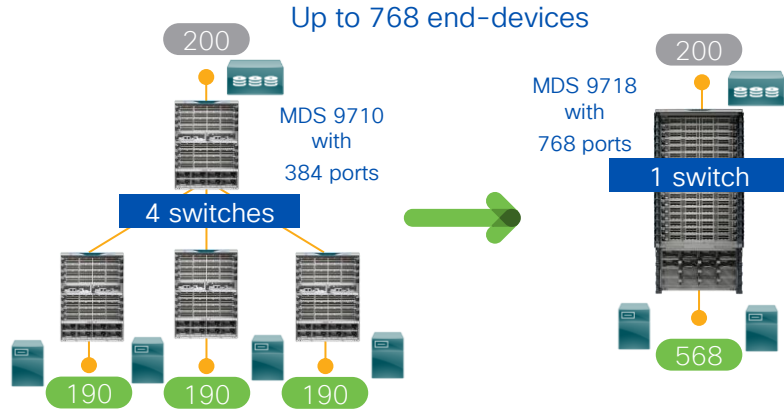
Benefits

- Most deployed option
- Tried and tested

Challenges

- Prone to congestion and slow drain

Consolidated fabric



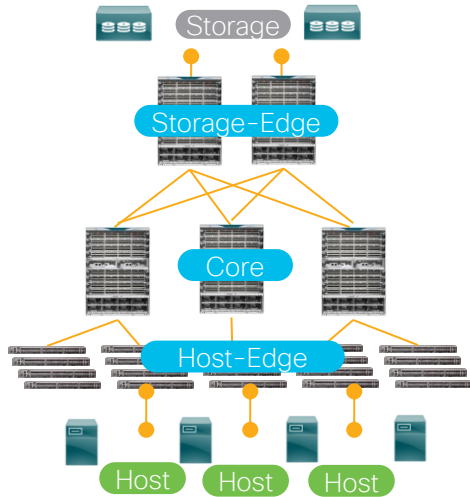
Benefits

- Fewer switches
- Less operational overhead
- Reduced congestion / slow drain

Challenges

- Watch out for cable length
- Scaling beyond 768 devices

Large scale edge-core-edge design



Benefits

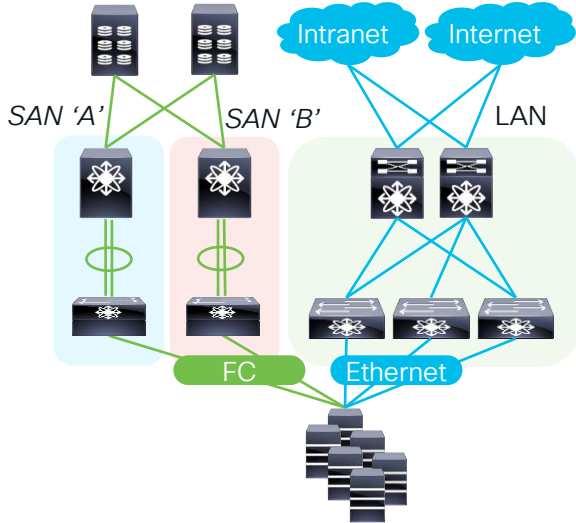
- Best at scaling up an existing fabric
- Long term investment protection (20 years)

Challenges

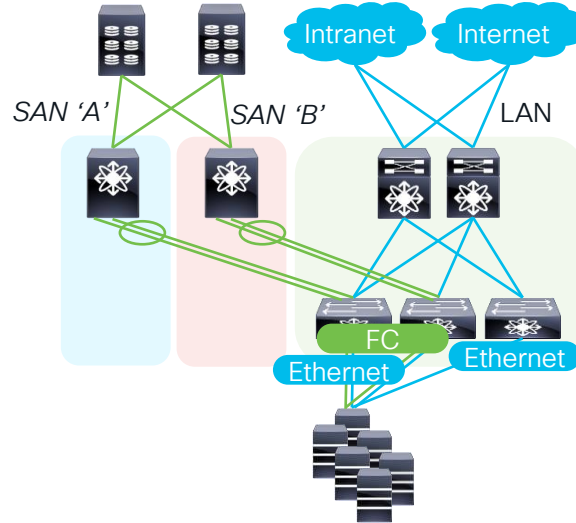
- Prone to congestion and slow drain
- Requires strict processes around operation control

Typical LAN and SAN designs

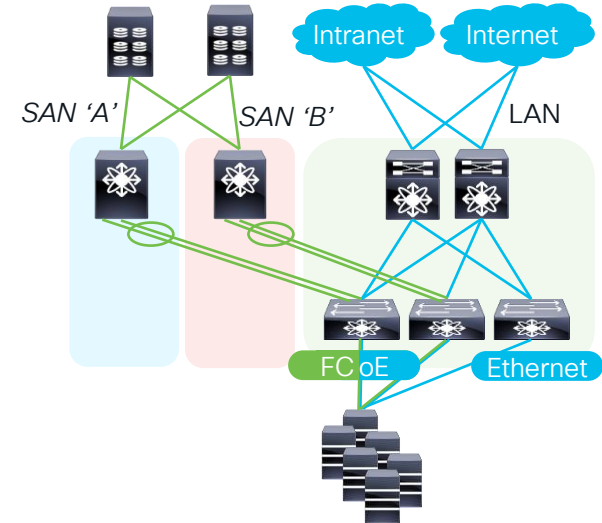
LAN and SAN separation



Convergence at ToR switch



Converged at ToR switches and host



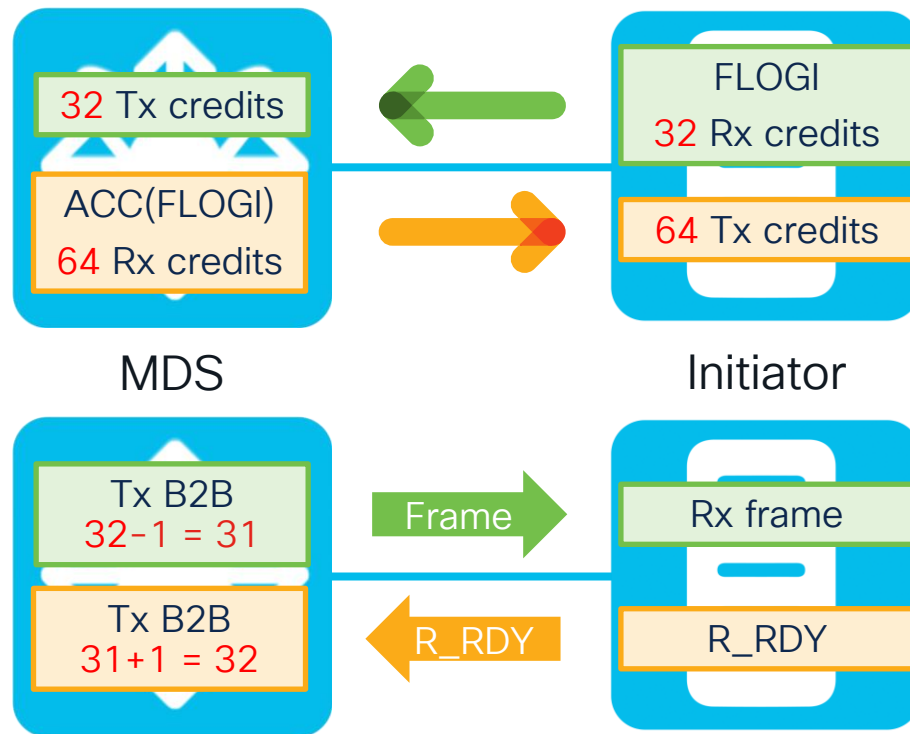
Understanding and Detecting SAN Congestion



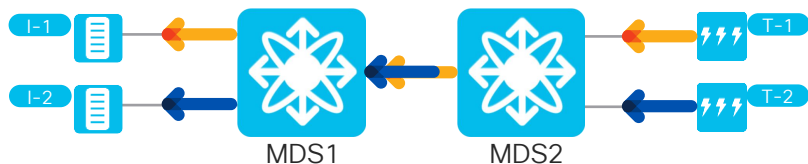


Troubleshooting SAN congestion is like
searching for a needle in a haystack

Fibre channel flow control



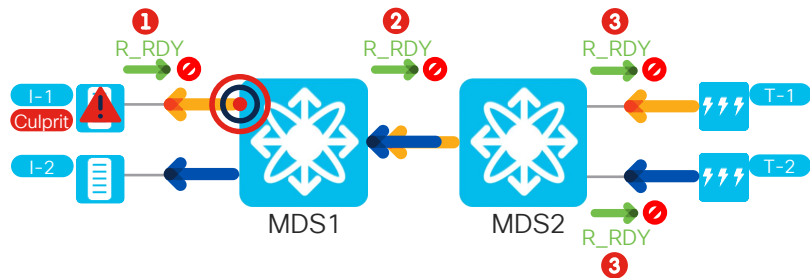
Common causes of SAN congestion



Common causes of SAN congestion

Slow drain

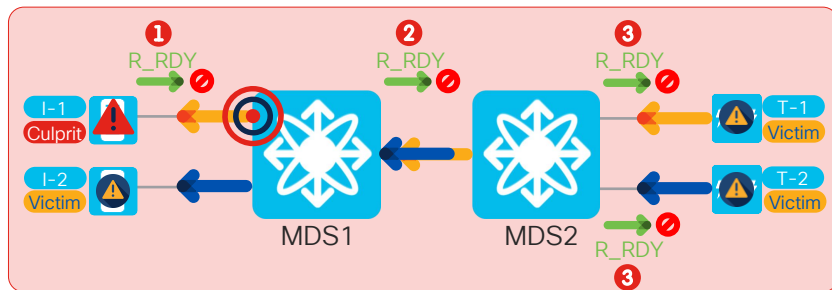
Tx B2B credit starvation



Common causes of SAN congestion

Slow Drain

Tx B2B credit starvation

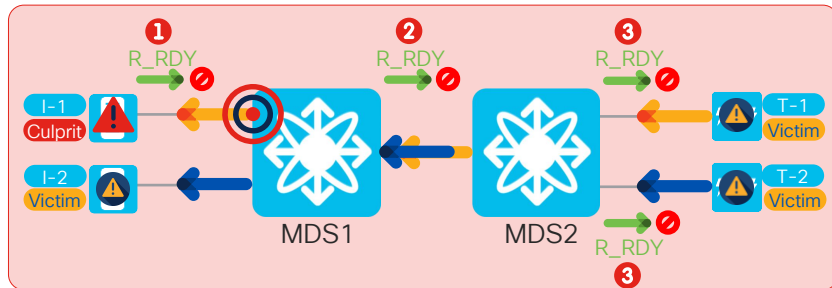


Frames are not dropped in FC fabric. Rather, they consume switch buffers causing a fabric-wide congestion.

Common causes of SAN congestion

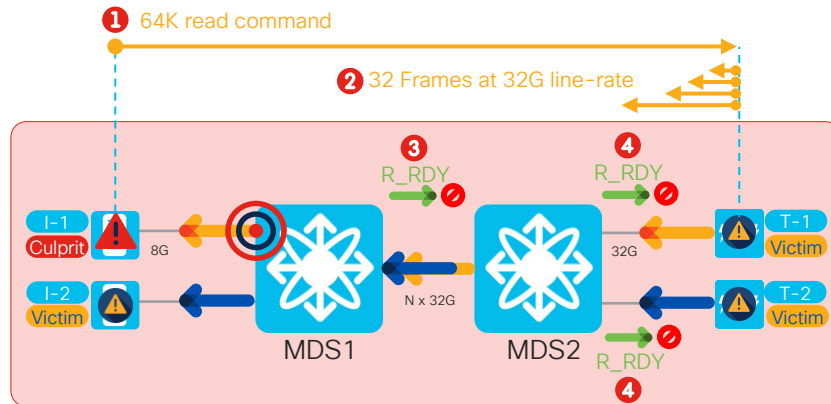
Slow Drain

Tx B2B credit starvation



Overutilisation

Receive data rate on ISL port is faster than the host port speed



Frames are not dropped in FC fabric. Rather, they consume switch buffers causing a fabric-wide congestion.

Congestion detection

- Most problems start when a port hits 0 Tx/Rx B2B credits
- Increment Tx/Rx “**B2B Transitions to Zero**” counter
- Additional counters to provide further context:



TxWait
2.5μs



Slowport-monitor
1–500ms



Tx-datarate
%



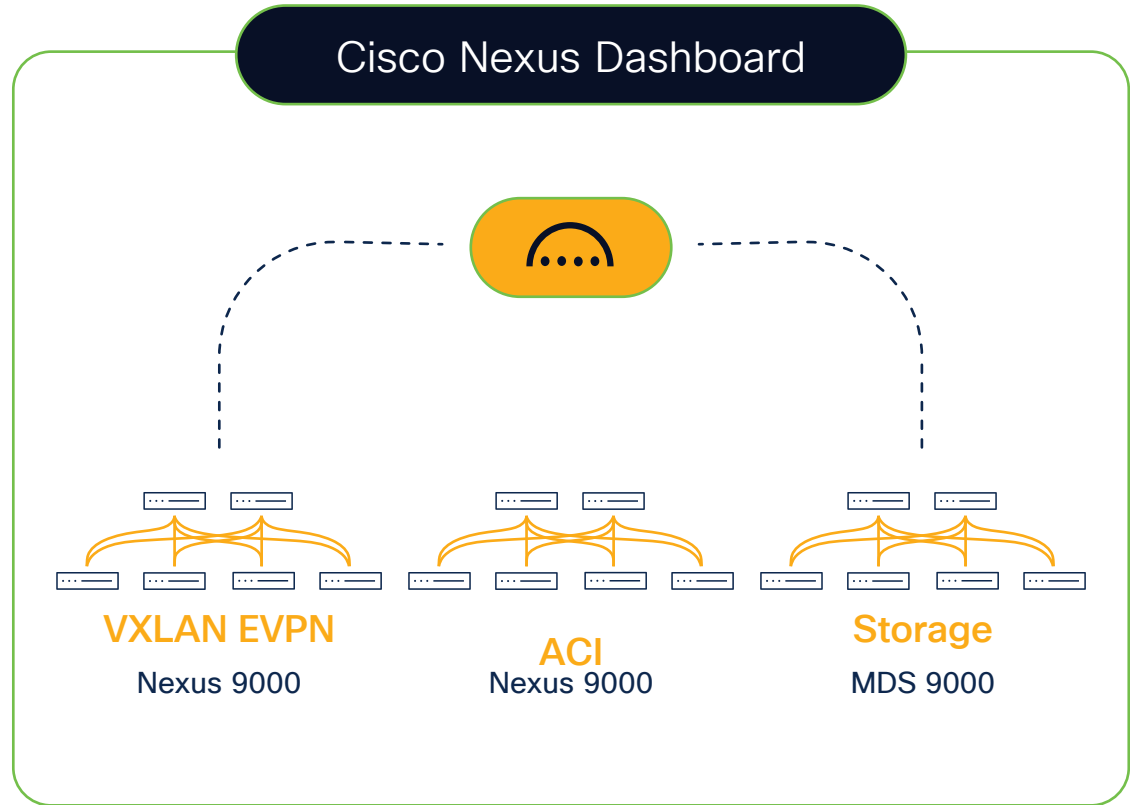
Timeout-drops
500ms



Credit-Loss-Recovery
1s / 1.5s

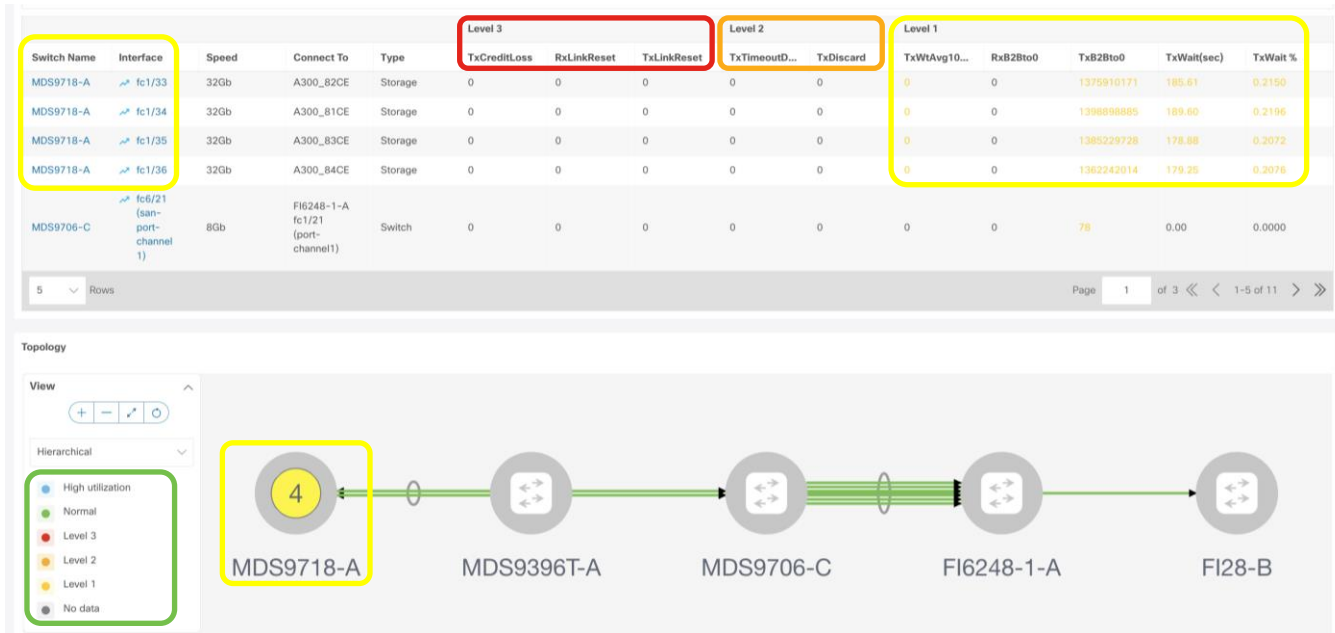
Nexus One

- MDS joins
Nexus Dashboard
Fabric Controller
- One Management
Platform for all Cisco
Nexus and Cisco MDS
- Physical or Virtual

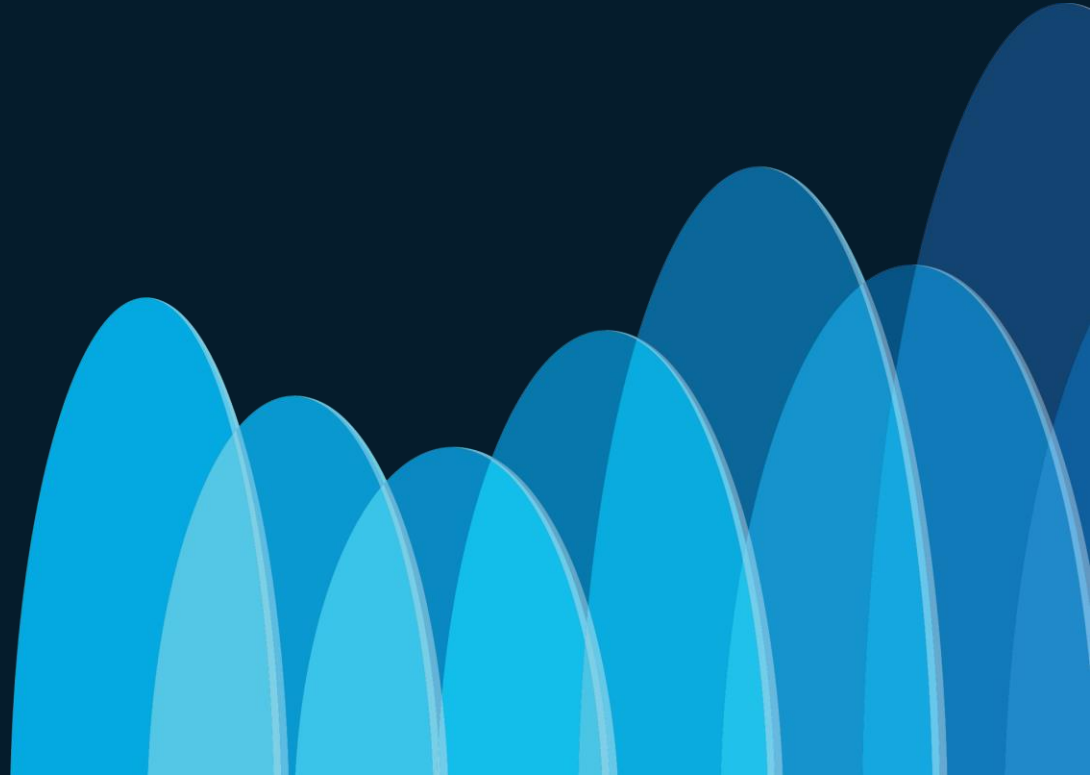


NDFC SAN Controller

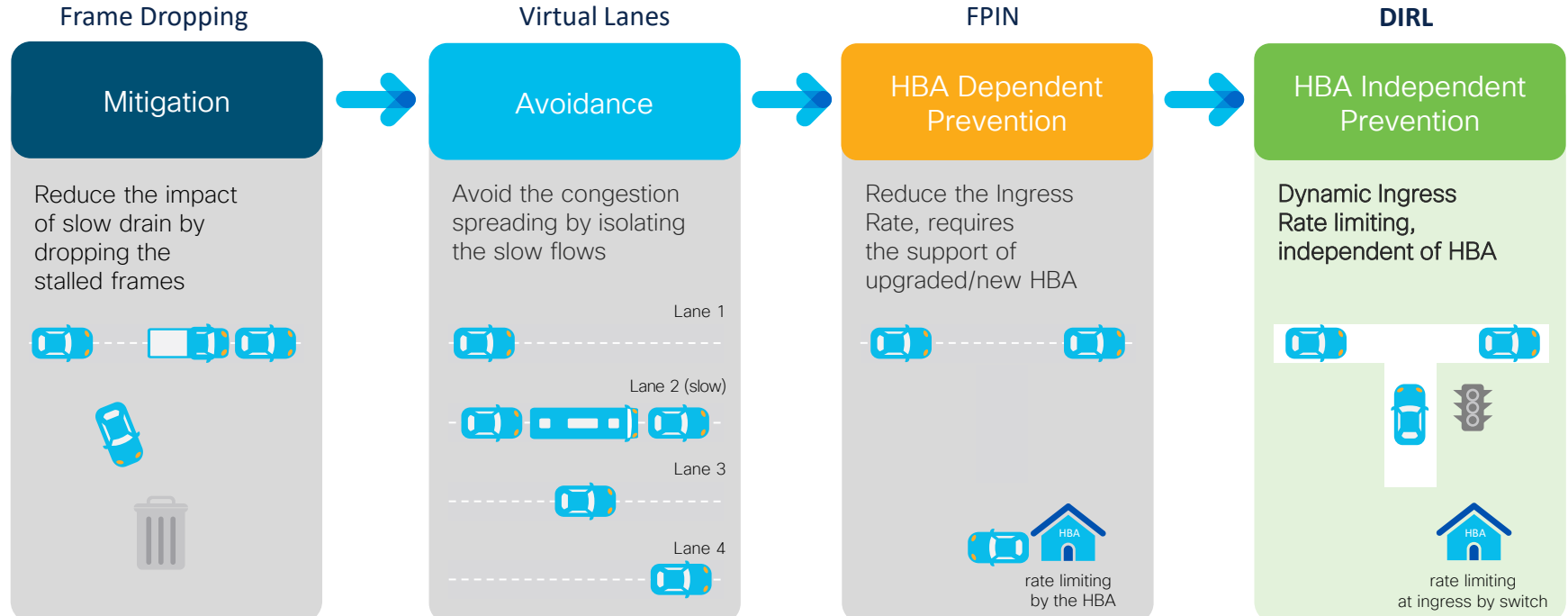
- NDFC provides online congestion analysis, and displays list of devices with potential slow drain issues:



Preventing and Predicting SAN Congestion



SAN Congestion Management Innovation



Prevent SAN Congestion with MDS DIRL – Cisco exclusive capability/patent

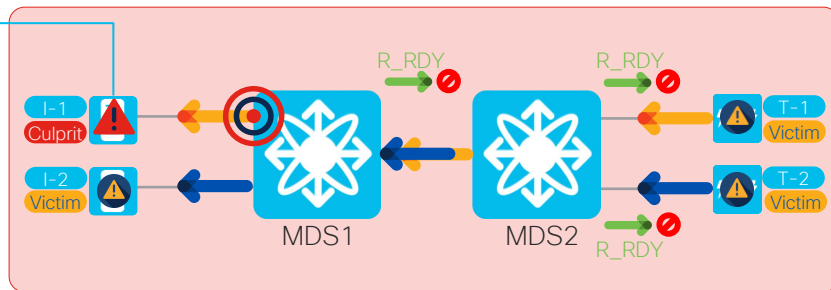
The Root Cause of SAN Congestion

The Root Cause

I-1 is receiving more than it can ingest

Why is I-1 receiving more than it can ingest?

...because I-1 is asking for it.



The Solution

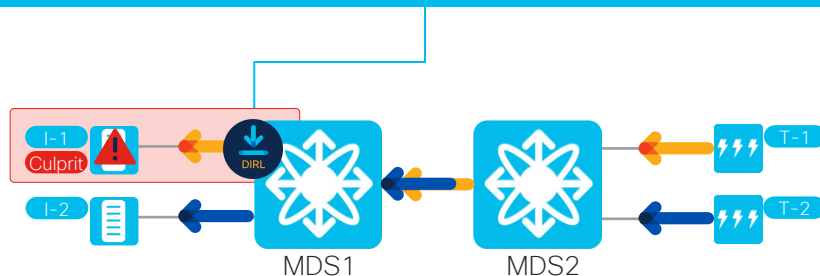
Cisco Dynamic Ingress Rate Limiting



I-1 is asking for more than it can ingest

DIRL limits I-1's asking rate to reduce its receiving rate

DIRL dynamically changes I-1's asking rate to adapt to its traffic profile



DIRL prevents SAN Congestion due to Slow-Drain and Overutilisation.

Cisco Dynamic Ingress Rate Limiting



End-device Independent

No need to upgrade end-devices.



Adaptive

Dynamically adjusts to the traffic profile of the host.



No Side Effects

Rate limits congested hosts only.



Easy Adoption

Software-only upgrade NXOS 8.5.1+.



Affordable

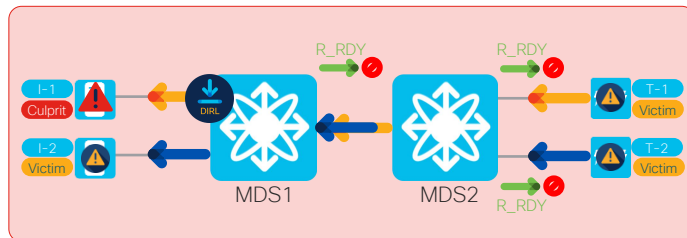
No additional license needed.



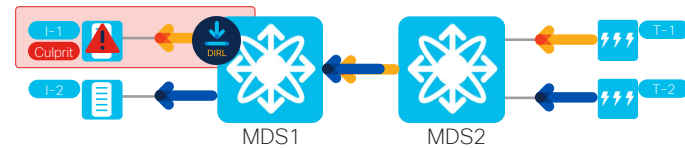
Topology Independent

Edge-core, edge-core-edge, or collapsed core topologies.

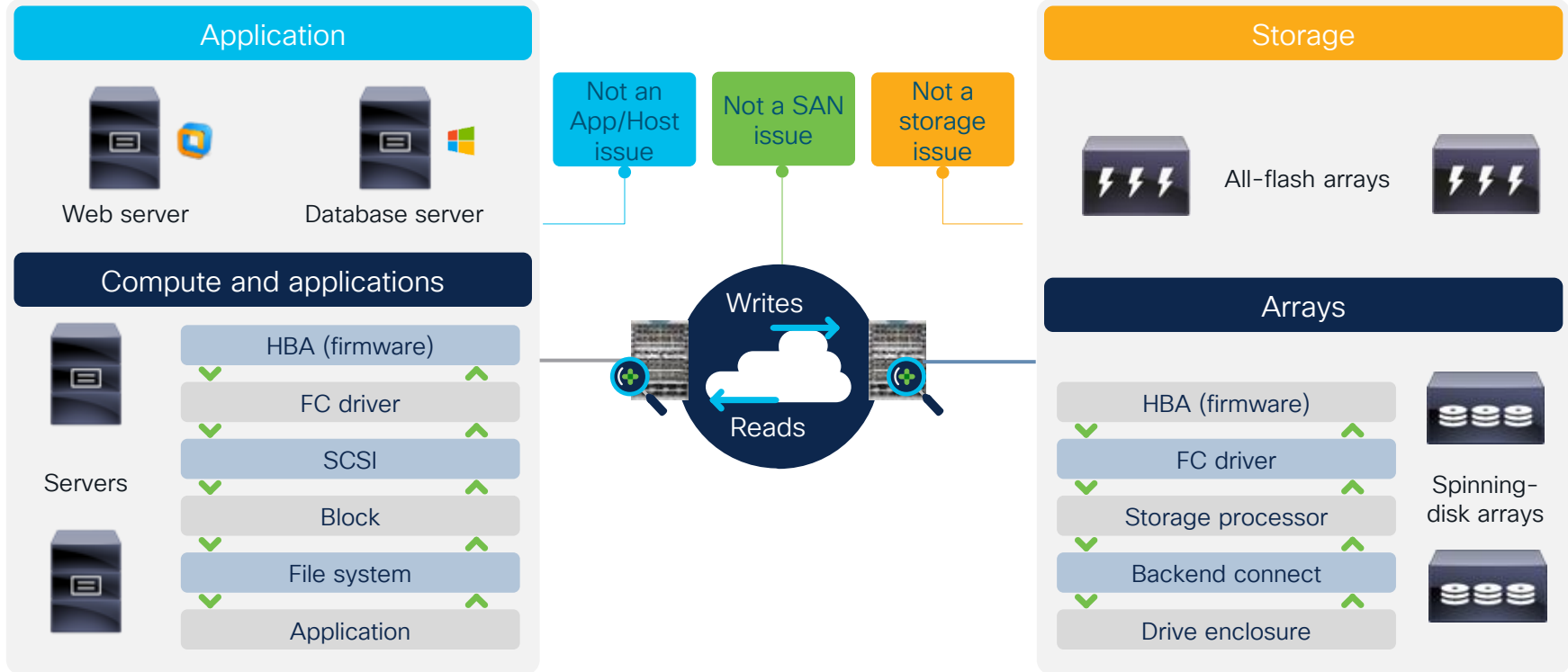
Without Cisco DIRL



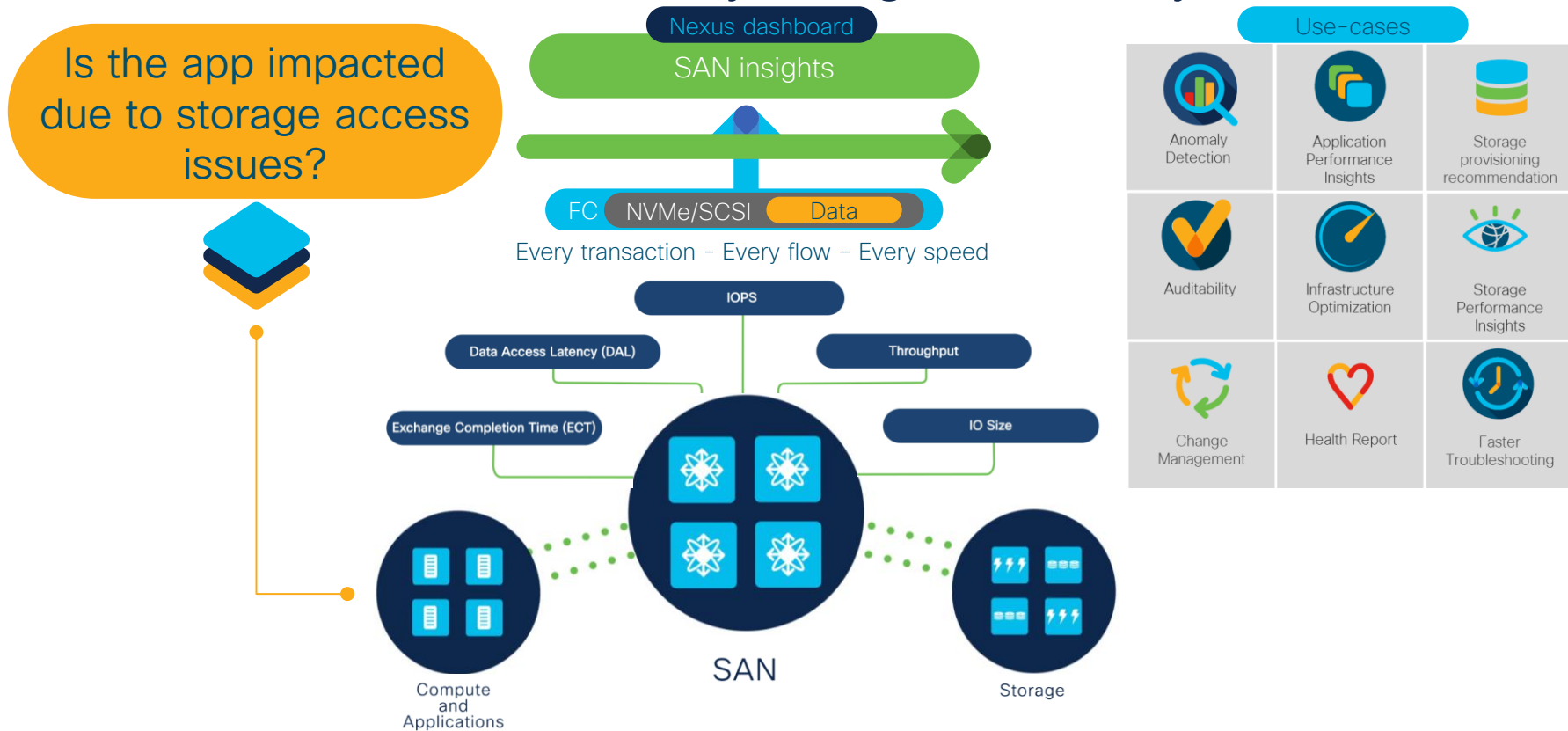
With Cisco Dirl



Where is the problem?

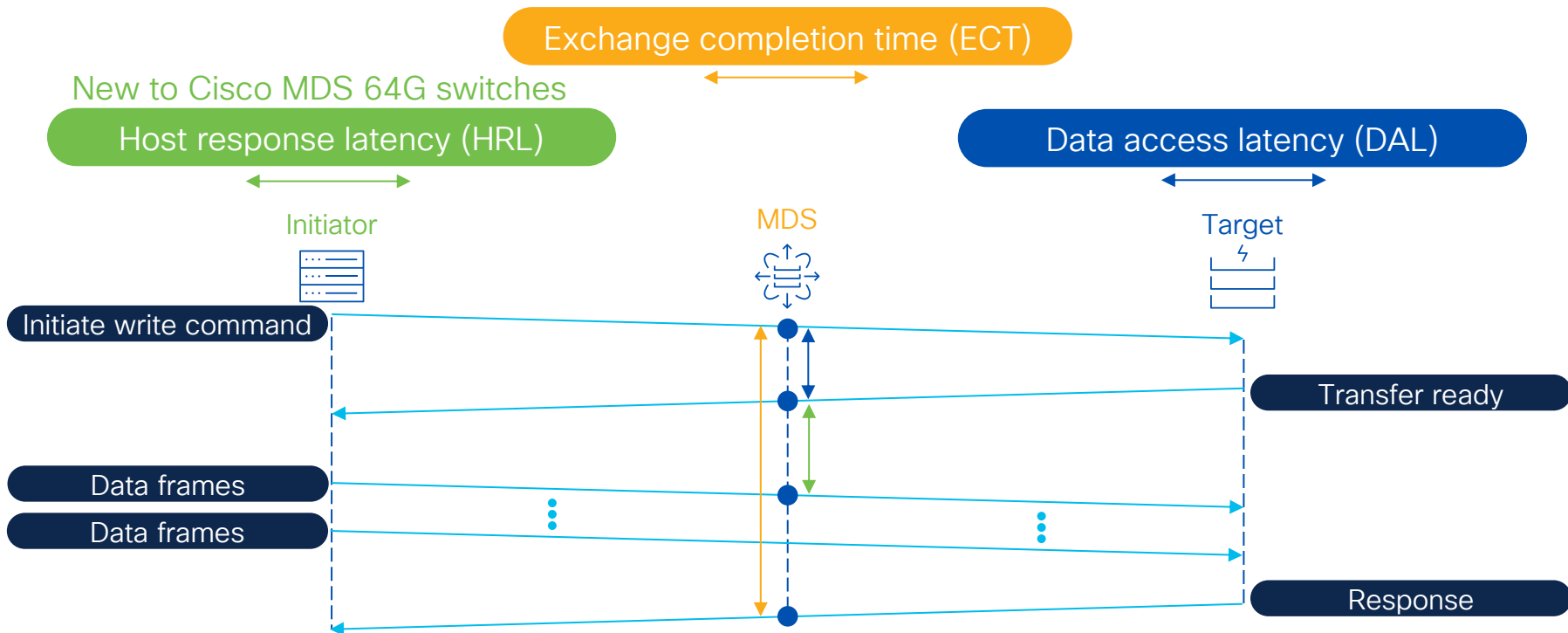


NVMe and SCSI I/O visibility using SAN Analytics



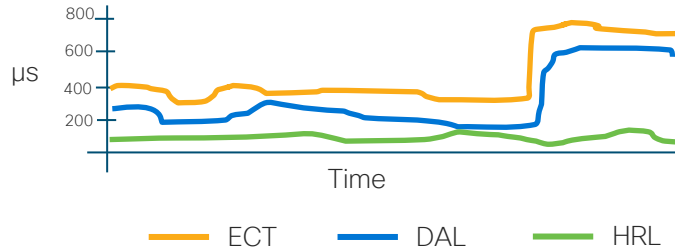
Cisco SAN Analytics flow metrics

Write I/O operation

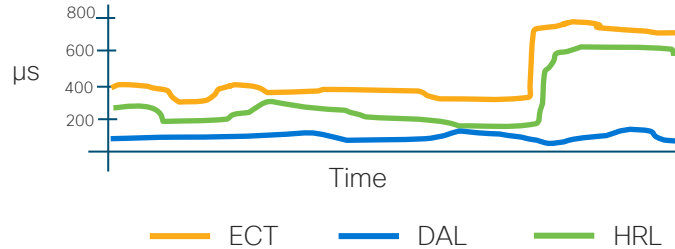
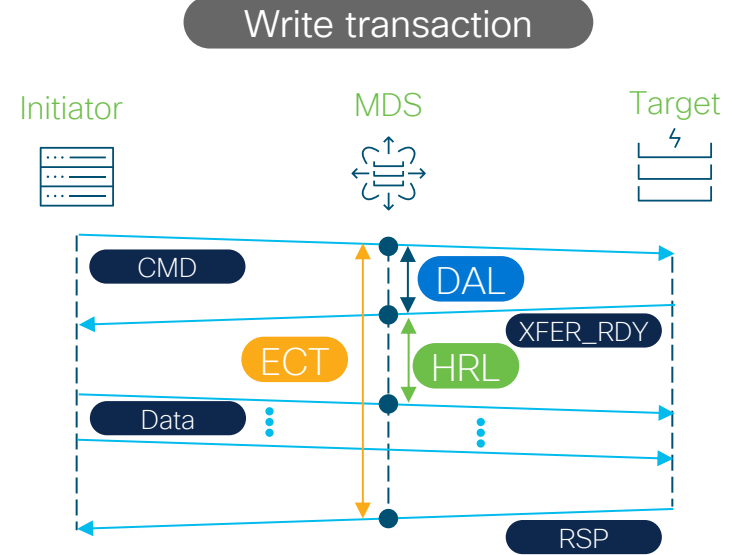


Pinpointing storage I/O performance issues

Storage performance is degraded due to delay caused by **storage array**



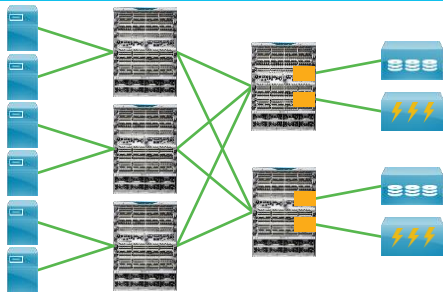
Storage performance is degraded due to delay caused by **host**



Where is the bottleneck ?

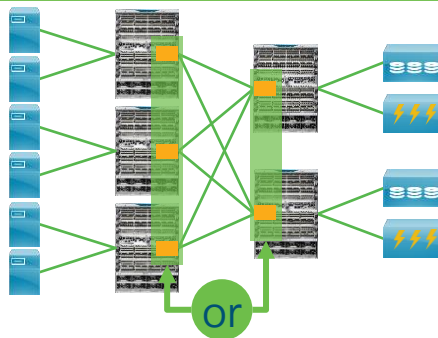
Deployment models

Storage ports



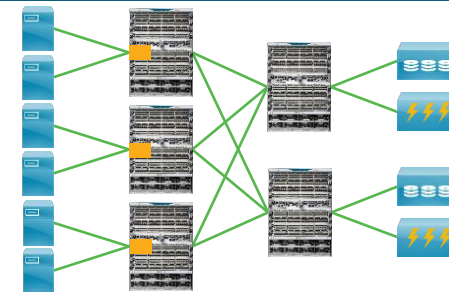
Closest to storage

ISL ports



High capacity 64G ISLs

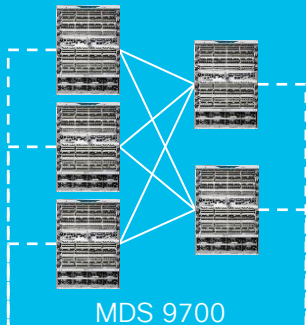
Host ports



Closest to apps

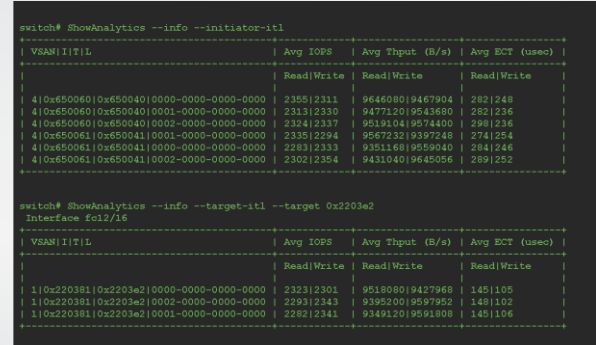
- Inspection of traffic at least once in the end-to-end data path is enough
- Avoid double inspection of traffic
- Design for uniform utilisation of the NPU
- Most customers are enabling analytics on storage ports

Cisco SAN analytics scale for always-on visibility



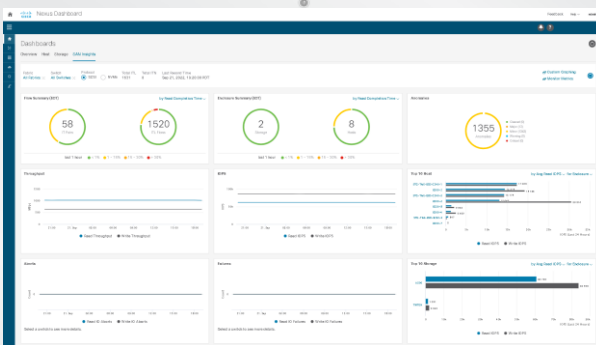
SAN analytics

- 100K flows monitored per MDS 9700
- Real-time (microsecond) visibility into any flow using on-switch CLI
- 30-second export interval to NDFC

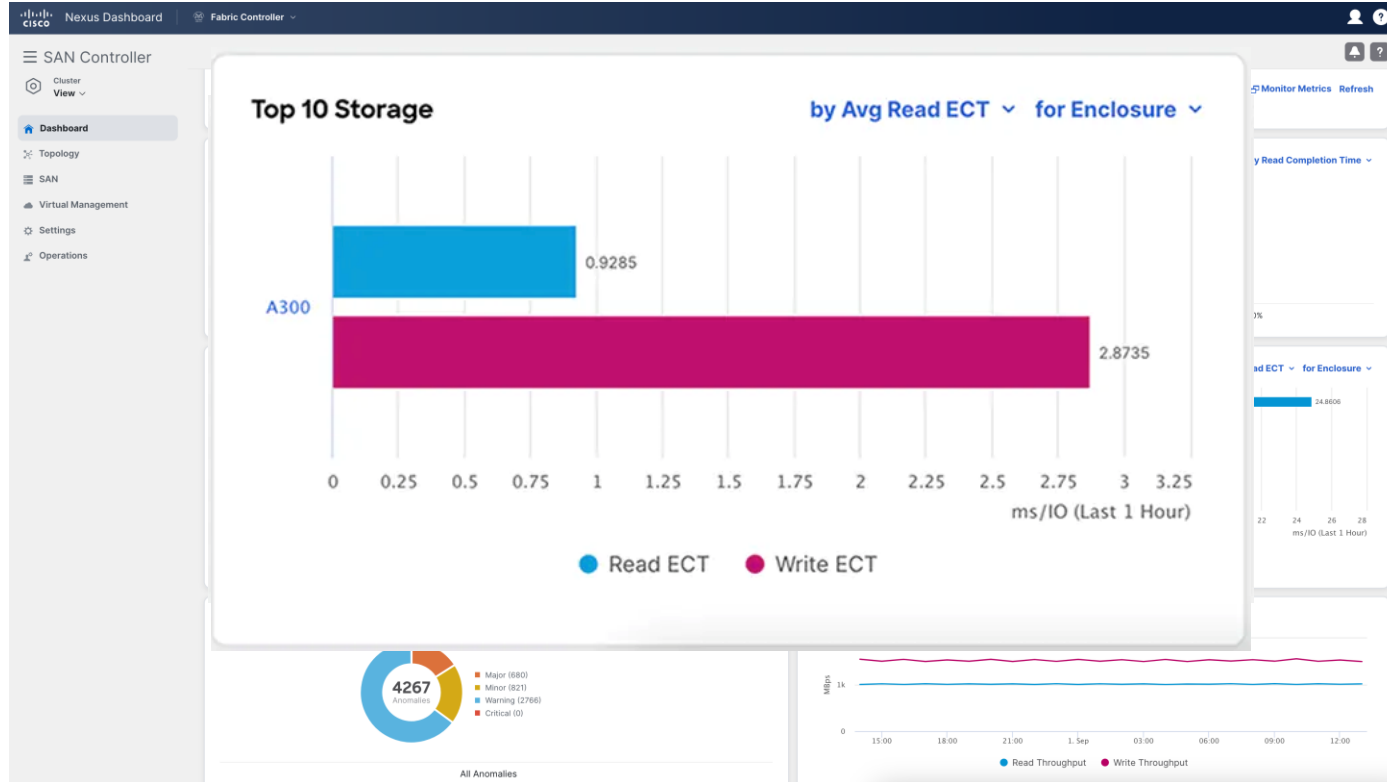


NDFC SAN insights

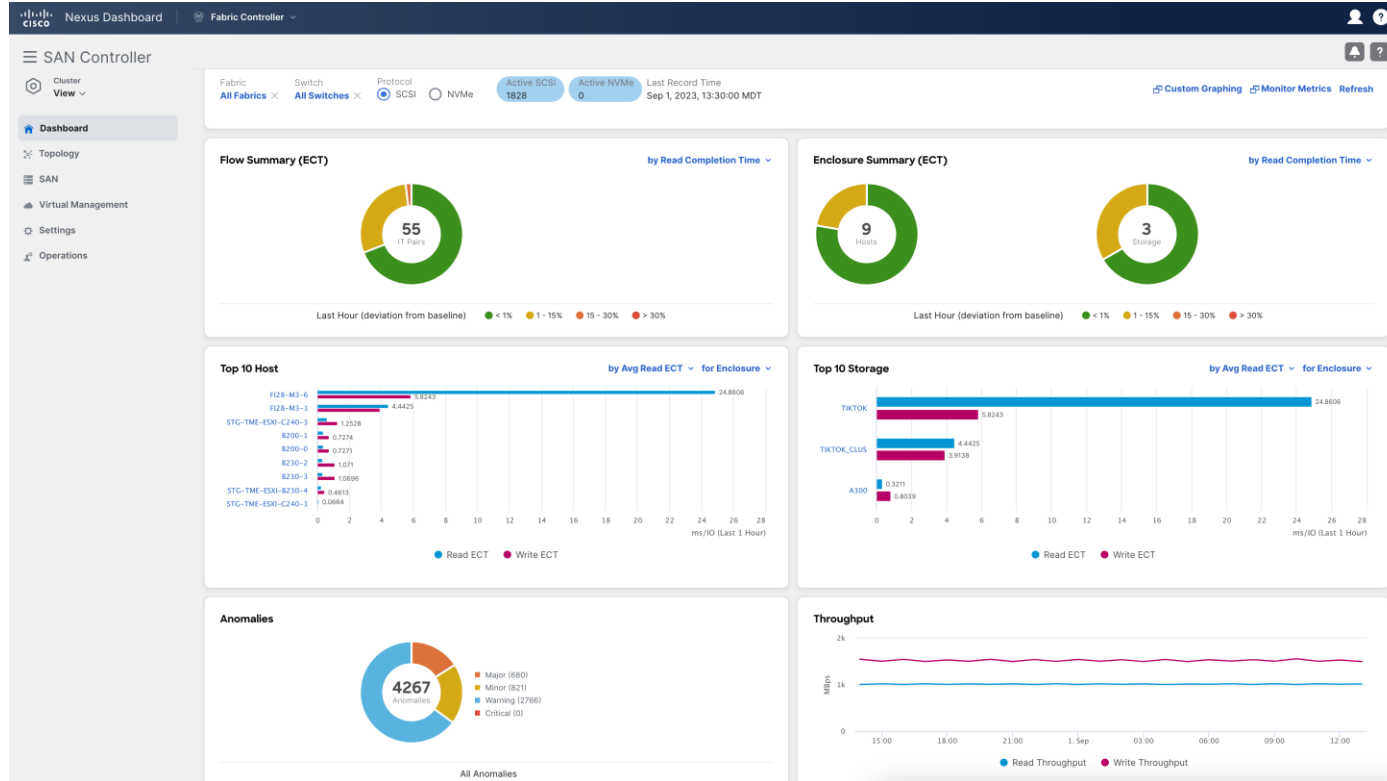
- 1 million flows received from multiple switches
- Anomaly detection
- Automatic baseline, deviations, trending
- End-to-end correlation



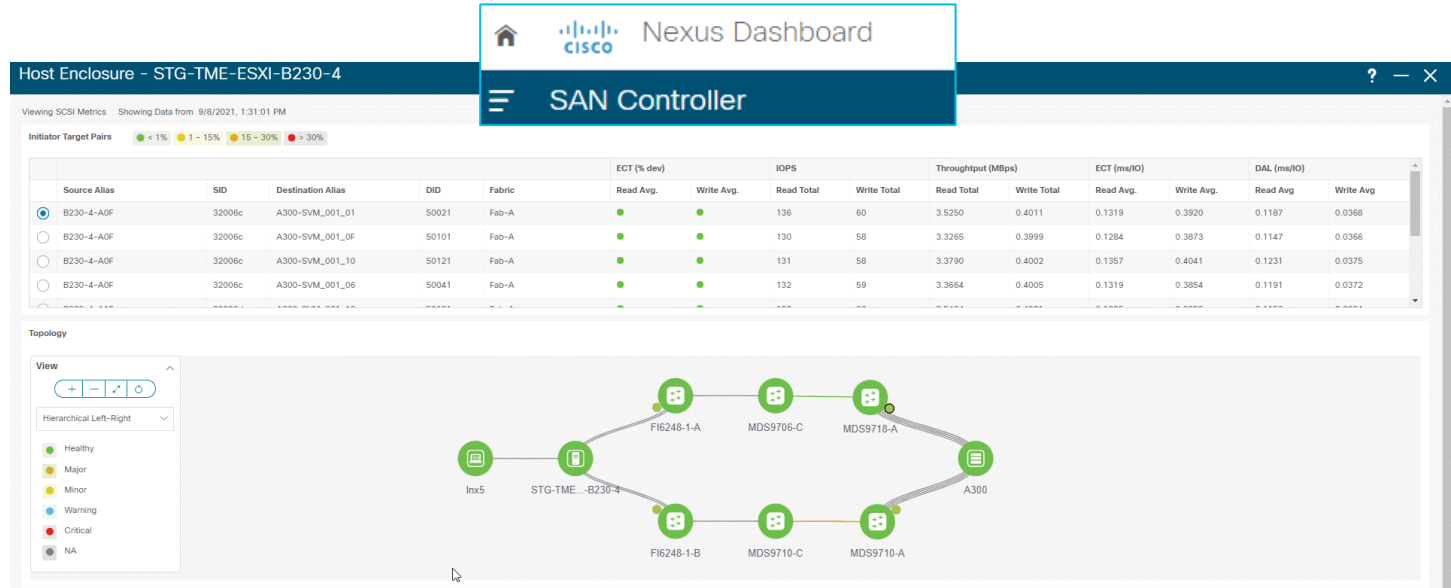
NDFC SAN Insights Dashboard



NDFC SAN Insights Dashboard



Cisco UCS and VM traffic visibility using NDFC



End-to-end visualisation

VM hosted on UCS servers, service profiles, vHBA/vNIC names, FI ports, etc.

Traffic trends and seasonality

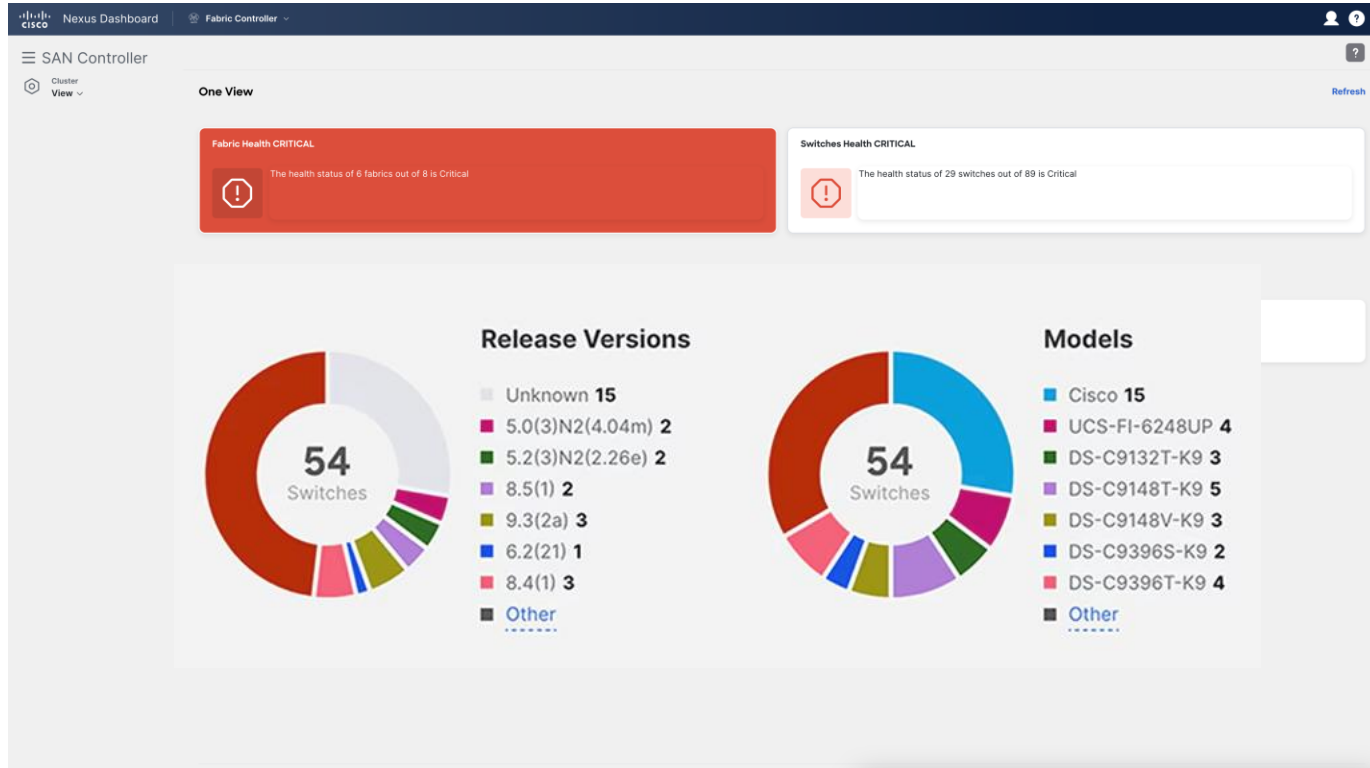
For every vNIC/vHBA and service profile

Inventory

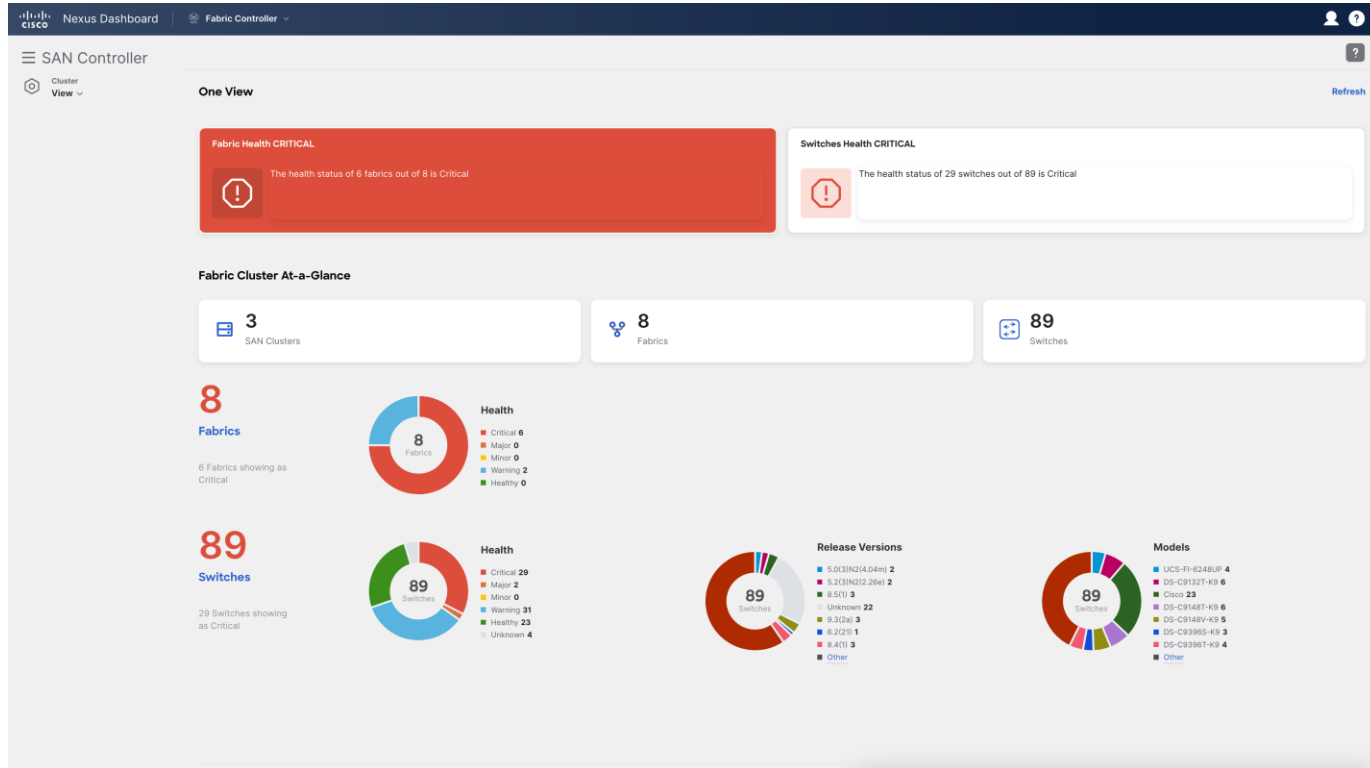
Server memory, CPU, serial numbers, etc.

End-to-end visibility into I/O flows is also available in non-UCS environments

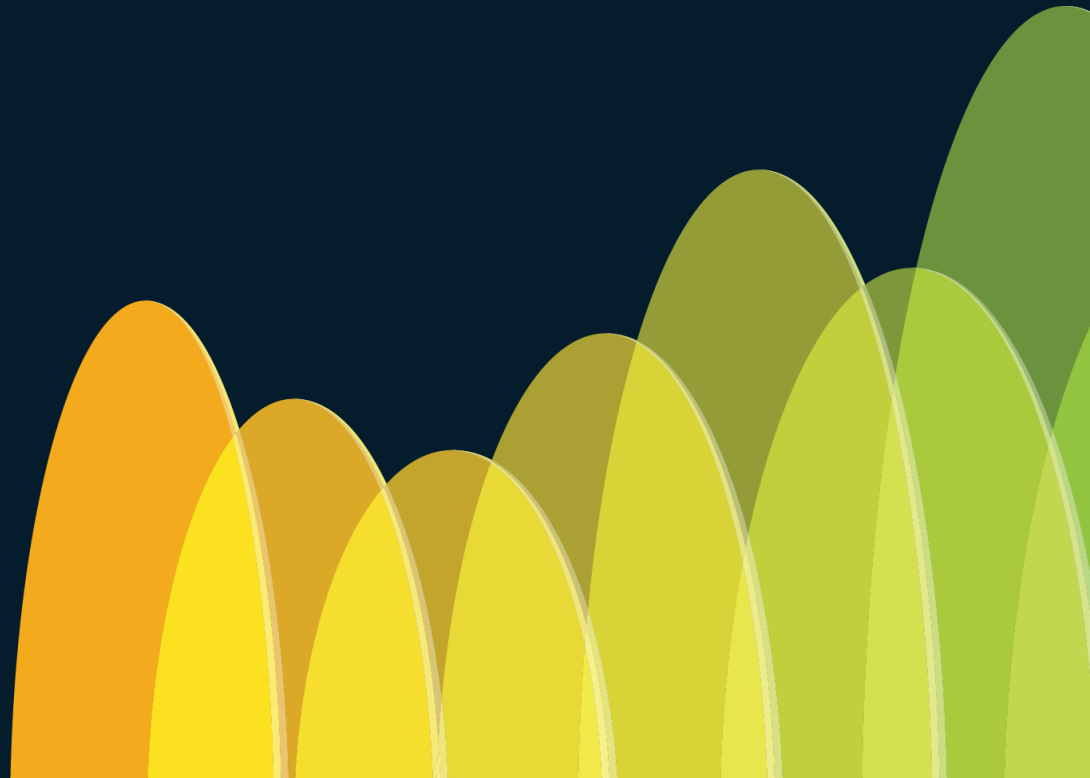
NDFC SAN Controller One View



NDFC SAN Controller One View



Summary

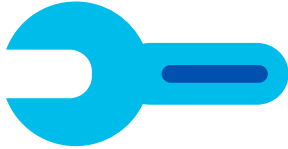


Summary

Reactive

Proactive

Predictive



Detecting SAN
congestion

(TxWait, RxWait, Tx-datarate)



Preventing SAN
congestion

(Dynamic ingress rate limiting)



Predicting SAN
congestion

(SAN analytics and insights)

Keynote Deep Dives

Wednesday
10:30am – 11:30am



Experiences Amplified:
How AI Can Fuel Better Employee and Customer Experiences

Level 1
Room 106



Smart, Secure, Seamless:
Transforming Experiences with Next-Generation Networking

Level 2
Room 204



Harness a Bold New Era:
Transform Data Centre and Service Provider Connectivity

Level 2
Room 203



Securing User to Application and Everything in Between

Level 2
Melbourne Room 2



Unlocking Digital Resilience through Unified Observability

The HUB
Centre Stage

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- Visit the Cisco Stand for related demos
- Book your one-on-one Meet the Expert meeting
Tomorrow 11:30am – 1:30pm
- Attend the interactive education with DevNet, Capture the Flag, and Walk-in Labs
- Visit the On-Demand Library for more sessions at www.CiscoLive.com/on-demand

Contact me at: jolanzon@cisco.com



Thank you

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