



NVIDIA NetQ & AIR Introduction: Cloud-scale Telemetry, Analytics and Simulation

NVIDIA SPECTRUM SWITCH PLATFORM

ACCELERATED ETHERNET TECHNOLOGIES



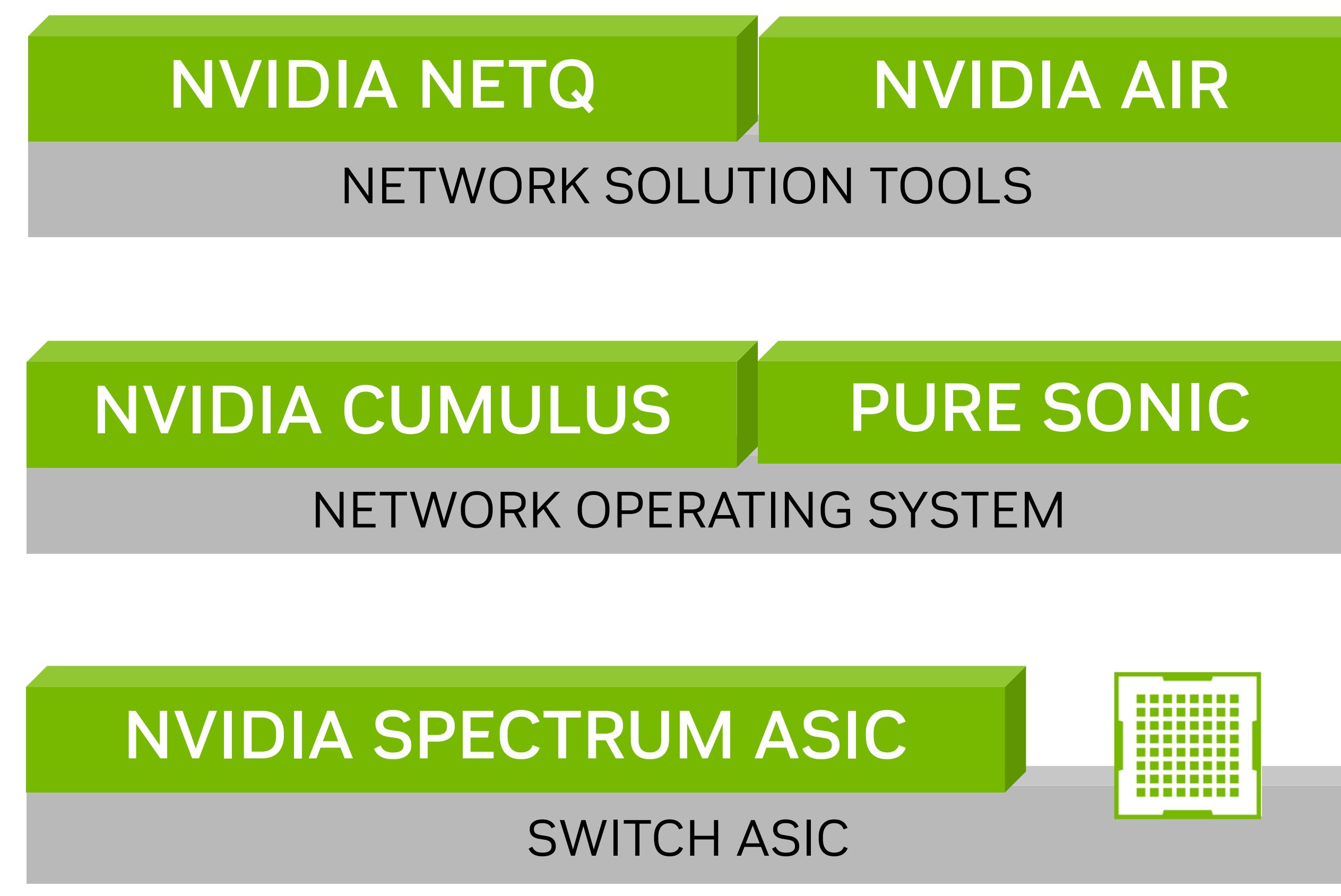
ACCELERATED

Best-in-class hardware performance
with cloud-scale software efficiency



INNOVATIVE

5th generation in-house ASIC design
optimizes Cloud, AI, & storage workloads



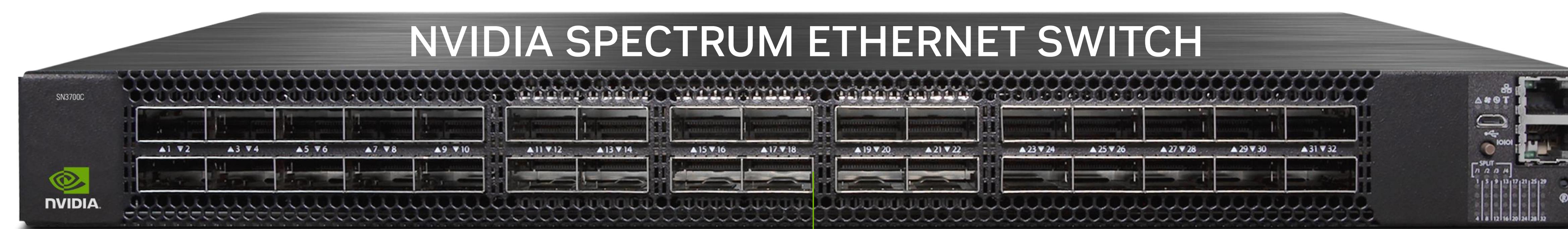
OPTIMIZED

Faster network deployments with
lowest TCO and highest ROI



RELIABLE

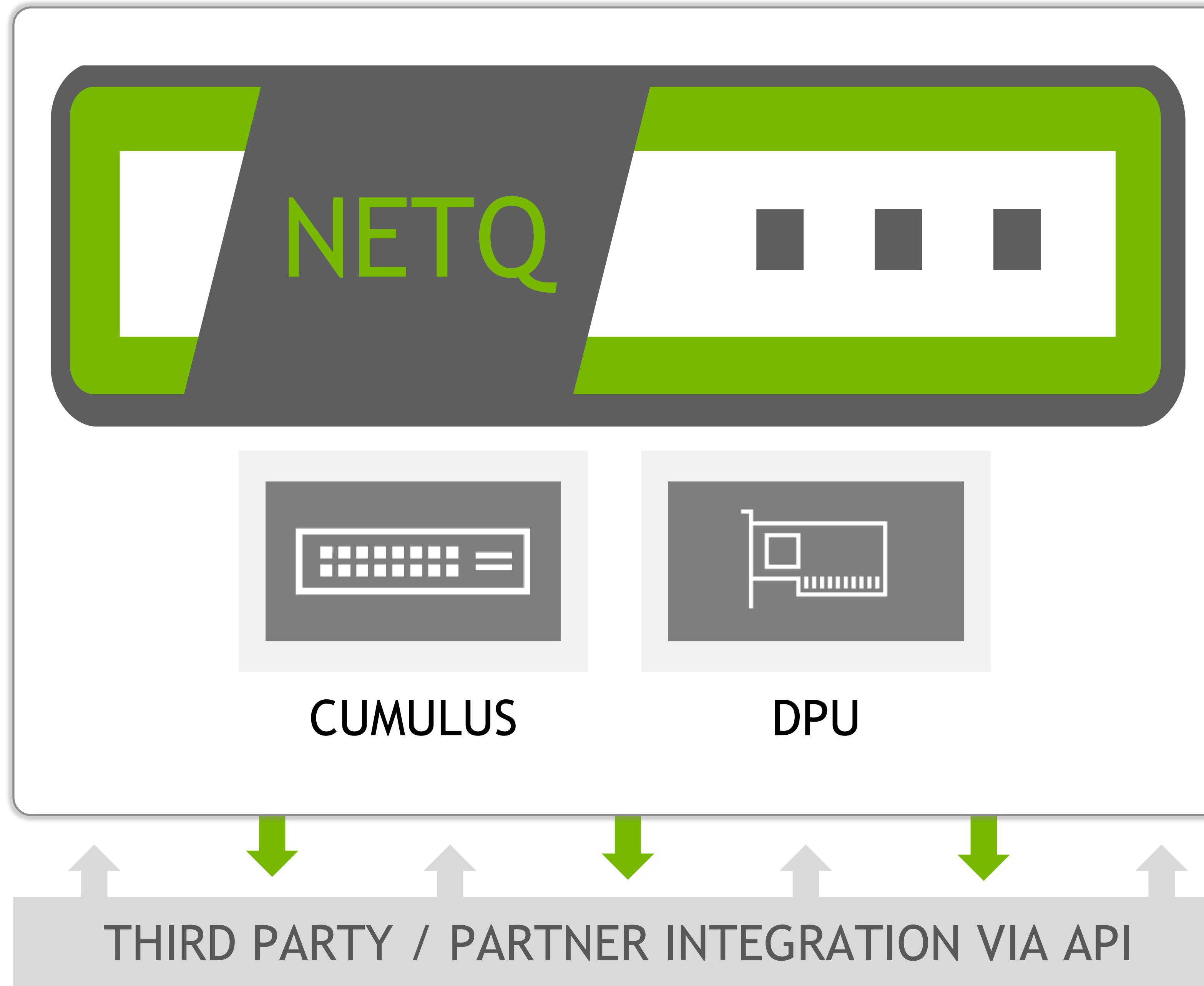
Exclusive features enabling fairness,
predictability and actionable visibility



NVIDIA SPECTRUM
ETHERNET NIC/DPU

NVIDIA NetQ

Network operations tool providing visibility and validation in real time



Using advanced telemetry, NetQ makes it easier to troubleshoot and automate network workflows in real time while reducing maintenance and downtime.



CENTRALIZED VISIBILITY

Monitor & trouble-shoot
NVIDIA switches
(Cumulus)



NETWORK HEALTH

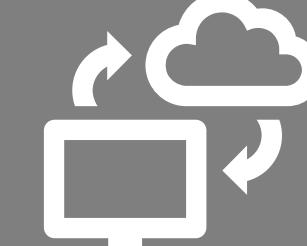
Validations of network
to identify and fix
issues quickly



DATA AGGREGATION

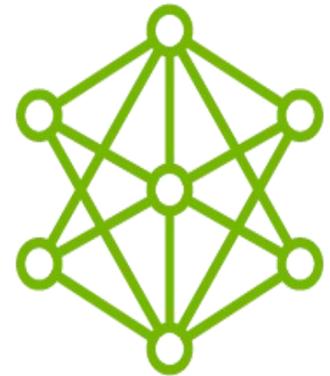
Centrally gather &
analyze data across
entire network

NetQ is integral part of NVIDIA reference architectures for network monitoring

 Spin Up NetQ on
NVIDIA Air

 NetQ
Webpage

NetQ for Spectrum-X



Topology Validations – Reduce Time To AI

Detect cabling issues using LLDP data



AI Performance – Maximize GPU Utilization

For high performance GPU-to-GPU traffic, monitor and validate status of ASIC, BGP, EVPN, VXLAN, Adaptive Routing, RoCE etc.



Actionable Visibility – Reduce Time To Identify Issues

Get an aggregated view of fabric wide events and packet drop data using What Just Happened™



Link Health Monitoring – Detect Links Causing Issues

Ensure optimal AI fabric utilization and proactively minimize AI performance impact by monitoring link health



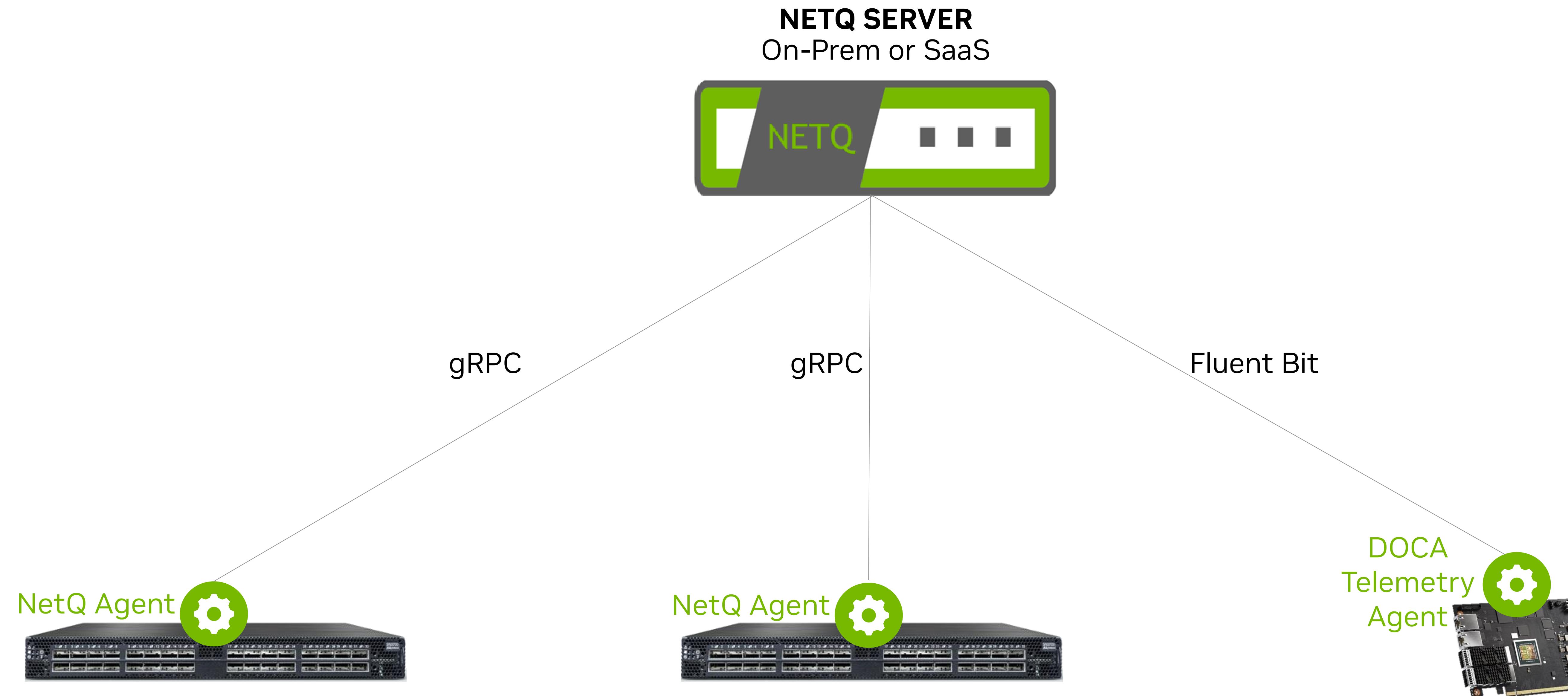
Hardware Monitoring – Identify Faulty Hardware

Validate basic system hardware components (sensors, fans, PSUs etc.) as healthy and operational



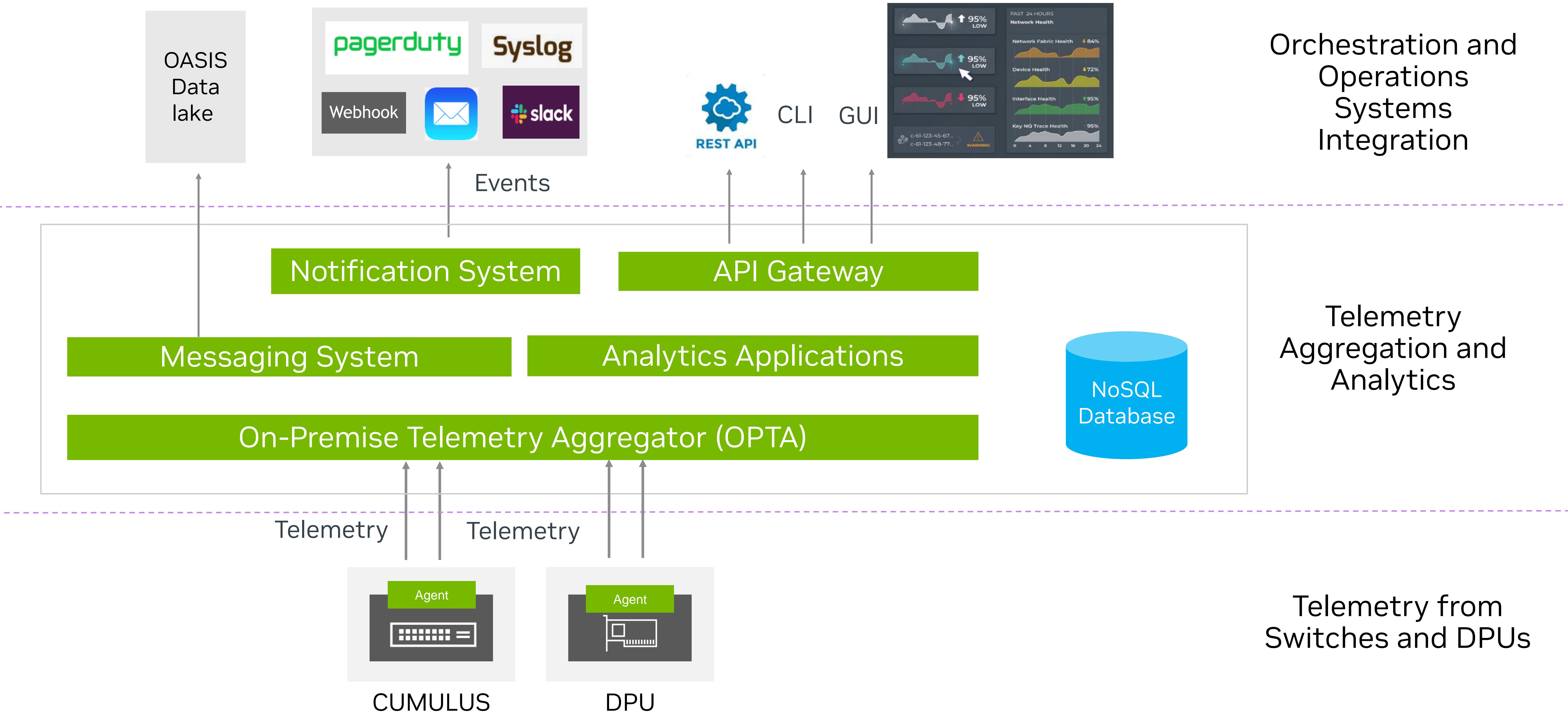
NetQ Components

Telemetry Agents run on Switches and DPUs & NetQ Server can be On-prem or SaaS



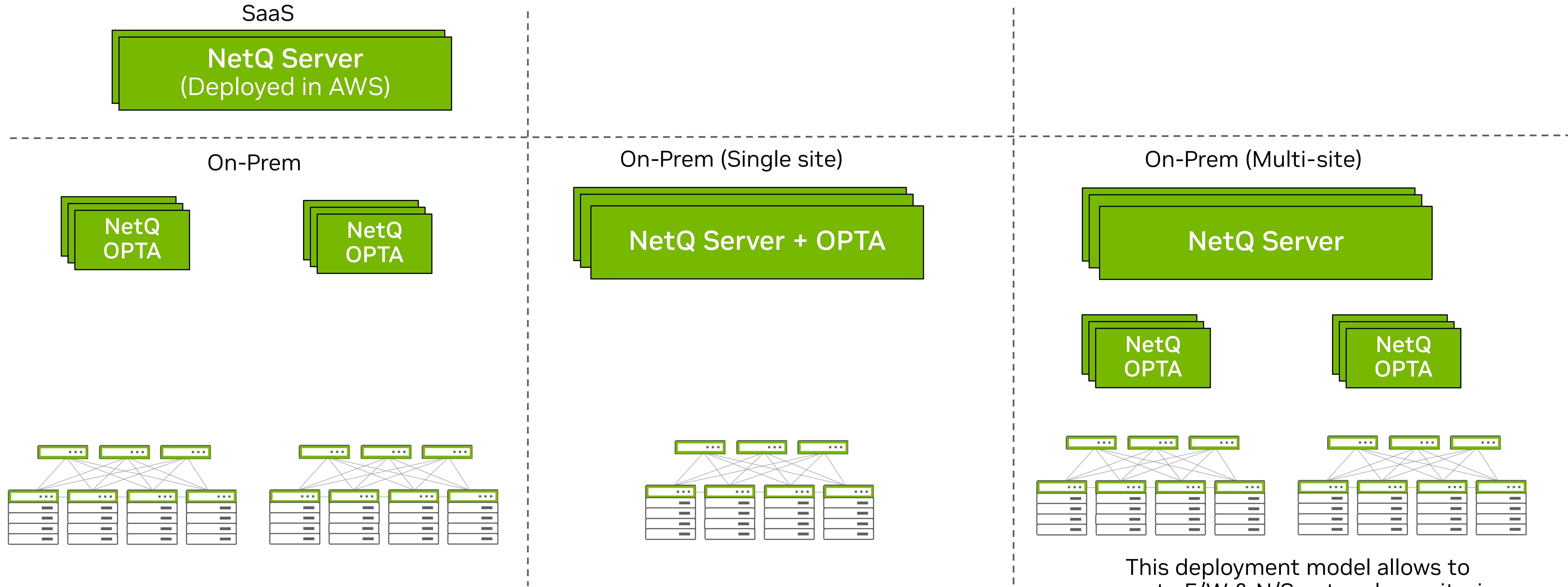
NetQ - Transforming Network Operations

On-prem and SaaS deployment options with scale out architecture



NetQ Deployment Models

Distributed System With Scale Out Architecture

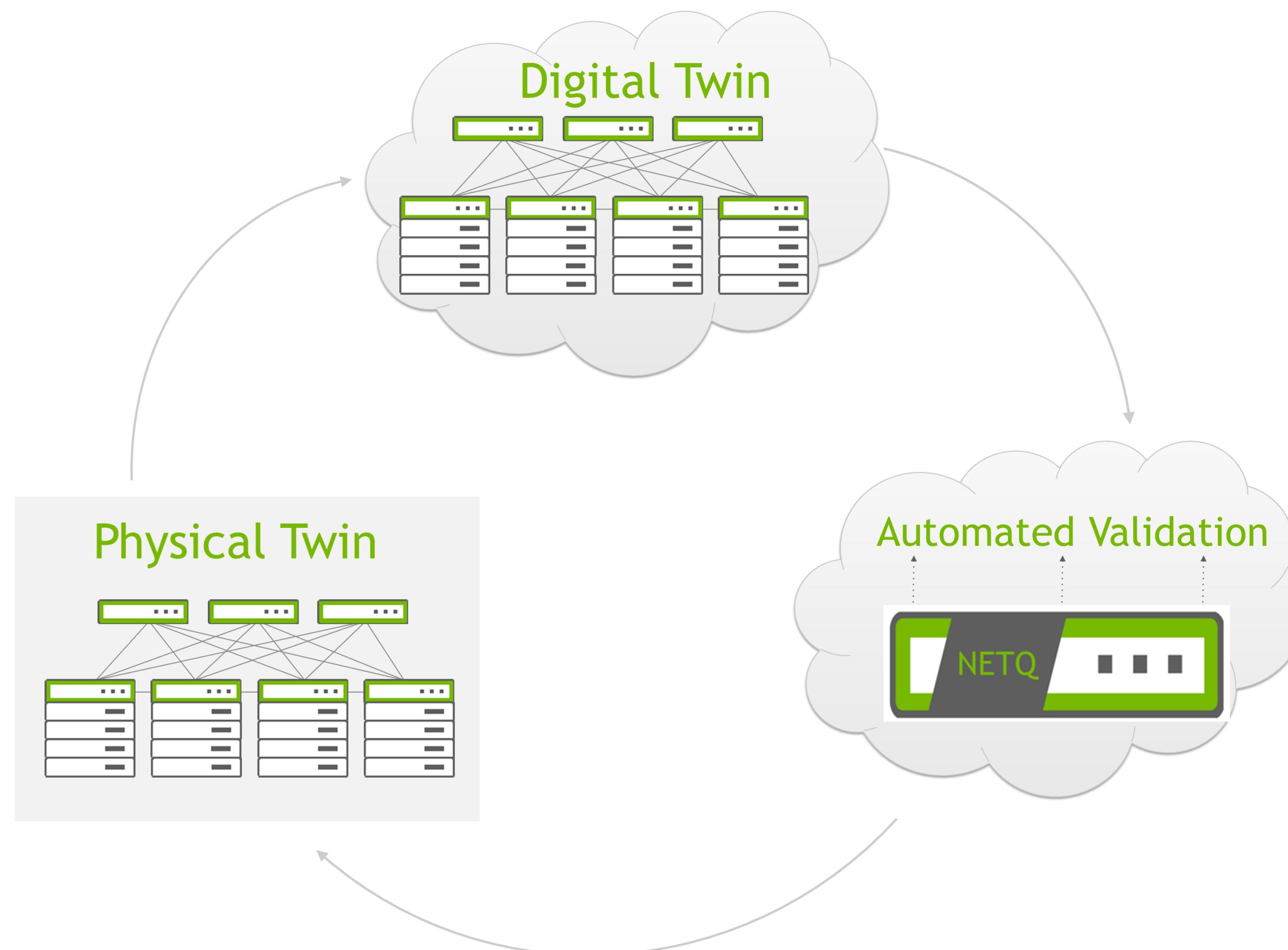


OPTA: On-Premise Telemetry Aggregator



Transforming Network Operations

Continuously Integrated (CI/CD) Networks



CHALLENGE #1

Simulate and validate before production

NetQ validations in pre-production Data Center Digital Twin powered by NVIDIA Air

Reduce time to production

CHALLENGE #2

Configuration and software updates with confidence

NetQ validation of configuration and software changes in Data Center Digital Twin in NVIDIA Air

Reduce downtime

CHALLENGE #3

Proactive detection of production network issues

NetQ validation checks to monitor and report production network health issues in real-time

Reduce time to root cause issues

Validation for the Entire Networking Stack (1)

100's of validation tests at all levels of the stack saving precious time for network operators

Interfaces

- Auto-negotiation setting
- Consistency of the speed setting
- Consistency of operational and administrative states

RoCE

- RoCE enabled with the same mode (lossy / lossless)
- Congestion control – ECN enabled with same thresholds
- Flow control – enabled (in lossless mode)

MLAG

- Checks for bonds in conflicted / proto down state
- Consistency of SYSMAC, ANYCAST IP, BACKUP IP, SVI
- Consistency of STP on single and dual home MLAG bonds

EVPN

- VNI type consistency, replication group consistency across all VTEPs
- Check BGP EVPN sessions established, EVPN address family advertisement consistency
- VLAN to VNI mapping and VRF to L3 VNI mapping consistency

BGP

- Router ID conflicts
- Consistency of transmit and receive address family advertisements
- Session establishment

Validation for the Entire Networking Stack (2)

100's of validation tests at all levels of the stack saving precious time for network operators

Agents

- Checks for nodes that have failed or lost communication with NetQ server

Sensors

- Checks for power supply, fan and temperature sensors are in good state

NTP

- Checks for NTP service is running and in sync state

MTU

- Consistency of MTU setting on two sides of a physical interface
- MTU of an SVI is no smaller than the parent interface, subtracting the VLAN tag size
- MTU on a bridge is not arbitrarily smaller than the smallest MTU among its members

VLAN

- Consistency of VLAN configuration on two sides of a port or a bond
- Consistency of VLAN membership of a CLAG (MLAG) bond on each side of the CLAG (MLAG) pair

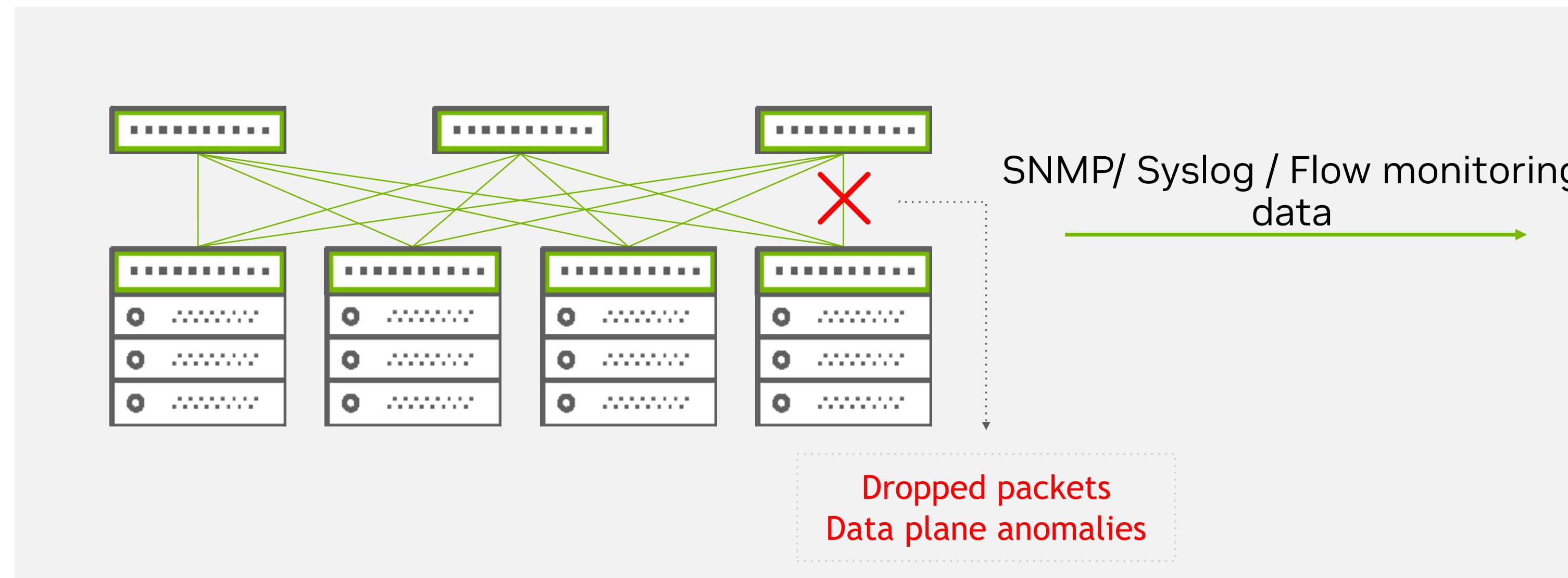
VXLAN

- Consistency of VLAN to VXLAN mapping across all VTEPs
- Consistency of replication group membership across all VTEPs

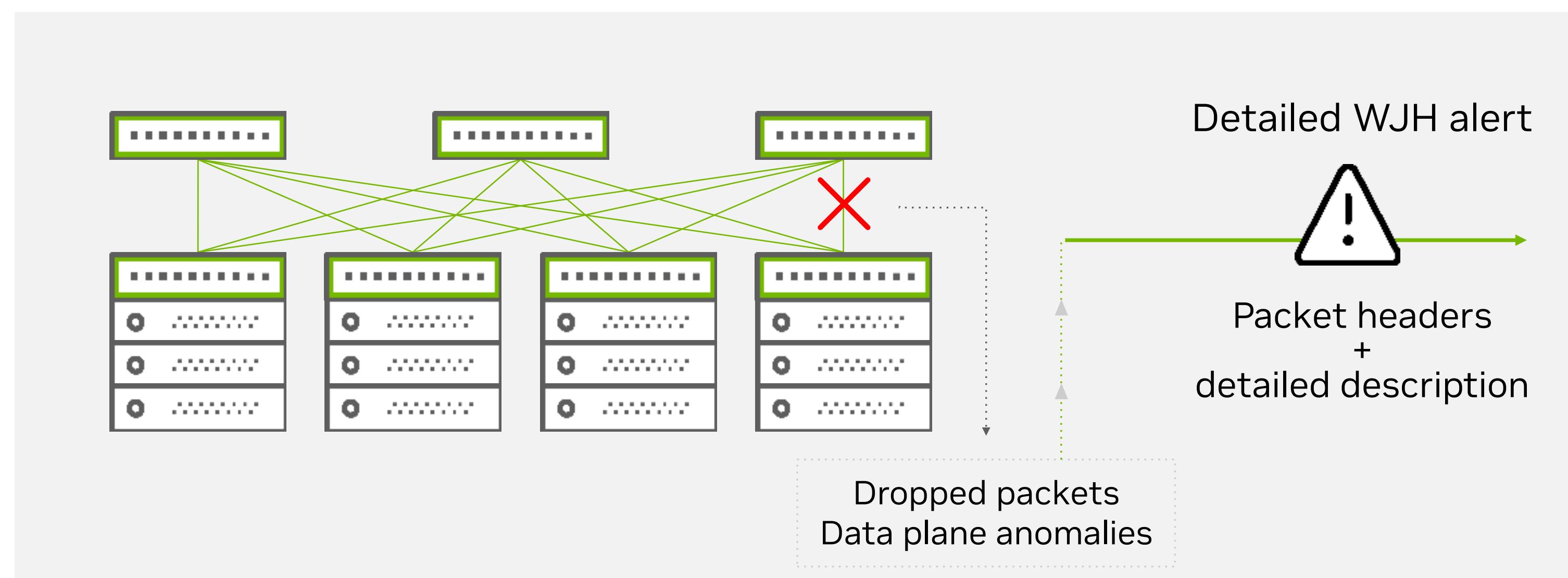
Accelerating Time to Root Cause

Quickly identify and resolve data plane issues

Legacy Network Monitoring



What Just Happened (WJH)



CHALLENGE #1

Which packets were dropped when and why?

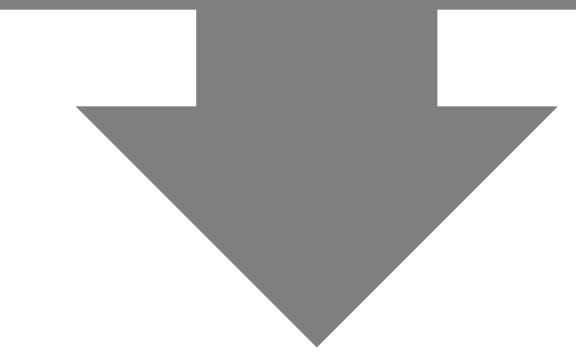


WJH reports packet drops, congestion events, routing loops, and other data plane problems natively

Reduce time to troubleshoot issues

CHALLENGE #2

Is there congestion in the network?

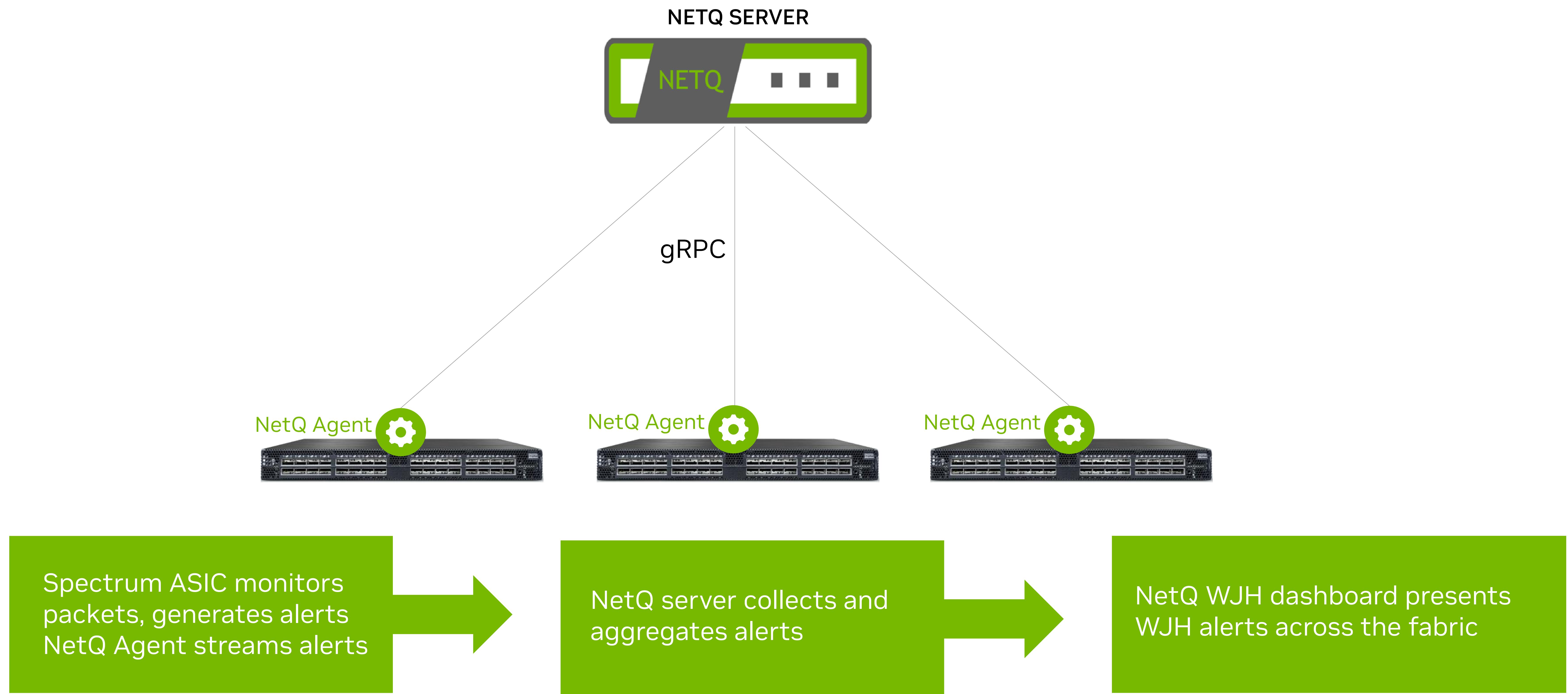


NetQ dashboard aggregates network wide drops, congestion events etc. to see the source of the problem without sorting through a mountain of data

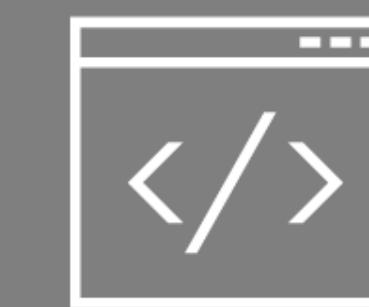
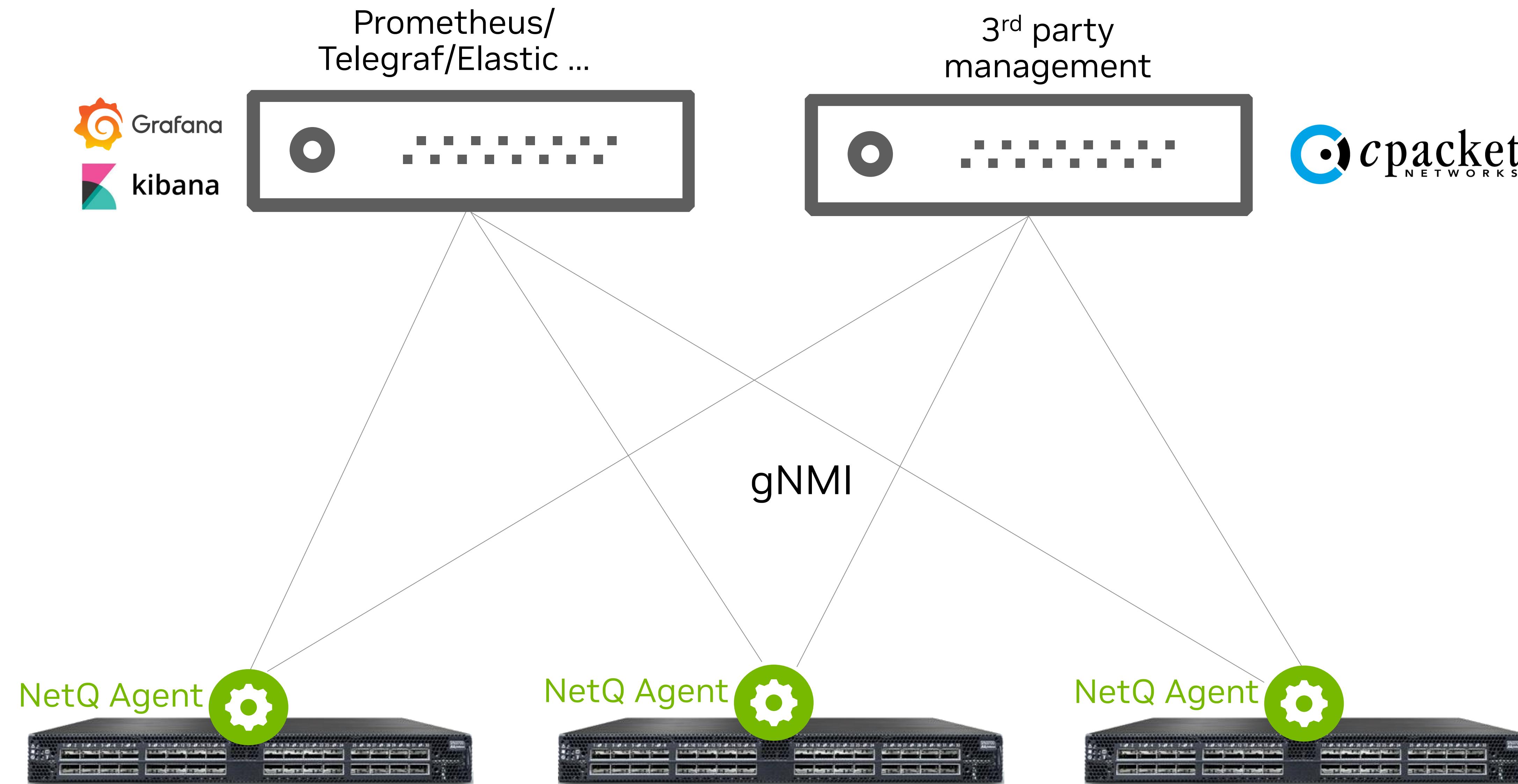
Reduce time to root cause issues

What Just Happened™

How does it work?



Integrating other Applications with WJH Events Using NetQ Agent



[YANG Model](#)



[WJH Message Reference](#)

What Does WJH Monitor?

Event Categories



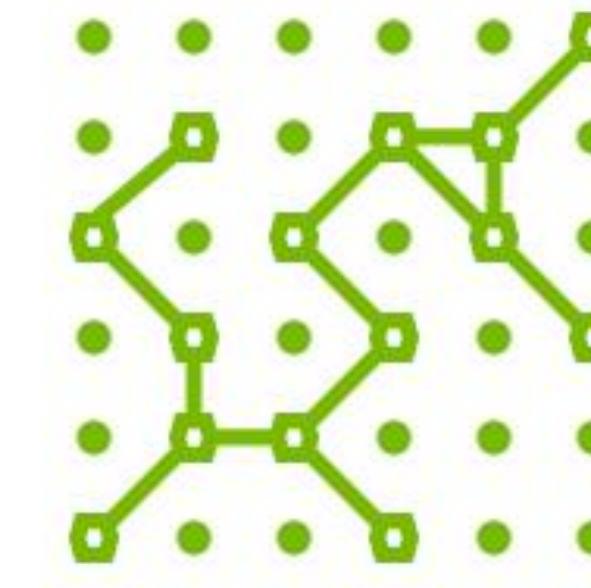
Layer 1

Auto-neg failure, flaky cables, optic signal degradation



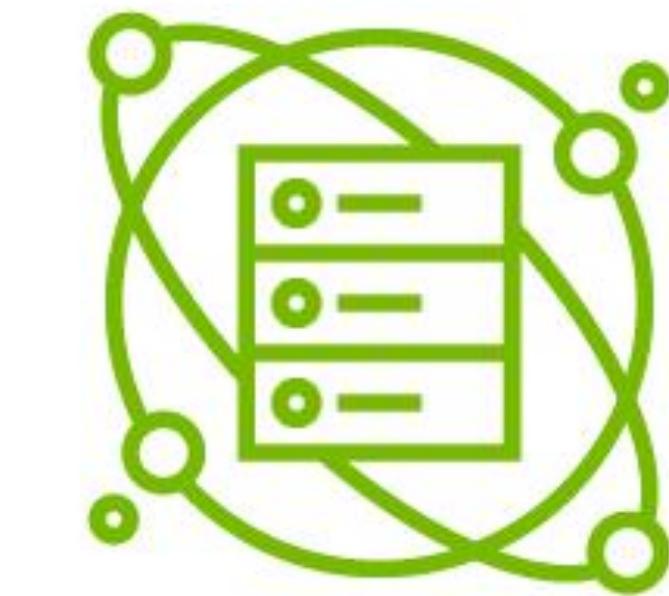
Layer 2

VLAN mismatch, ingress VLAN filtering, src.MAC equals dst.MAC



Layer 3

Blackhole route, small MTU, small TTL, disabled router interface



Overlay

Decapsulation errors, disabled tunnel interface



Access List

Ingress/egress port ACL, ingress/egress router ACL



Congestion

Buffer tails drop, WRED, threshold crossing events



Latency

Packet-latency threshold crossing events

WJH on Cumulus/NetQ

GLOBAL SEARCH

CUMULUS NetQ v2.4.0

4 MINS AGO LOCAL TIME LOW HEALTH +2 GMT ▾ Admin Cumulus Internal

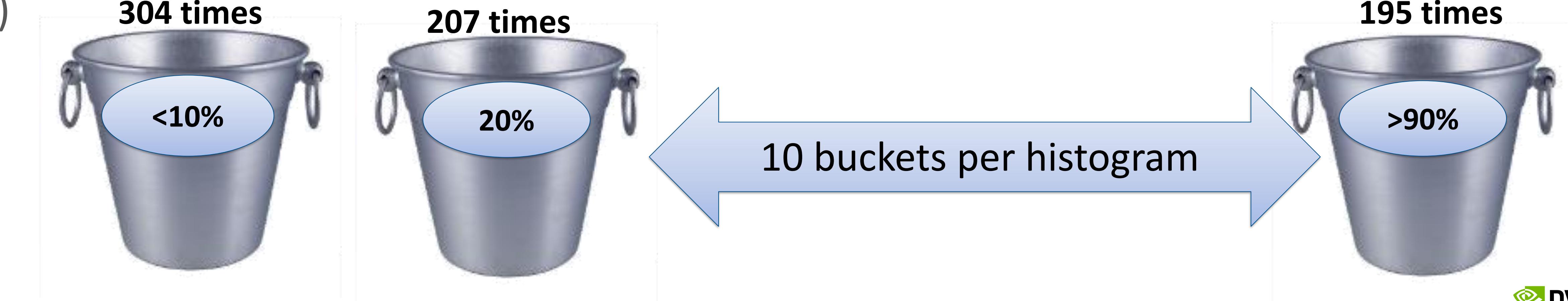
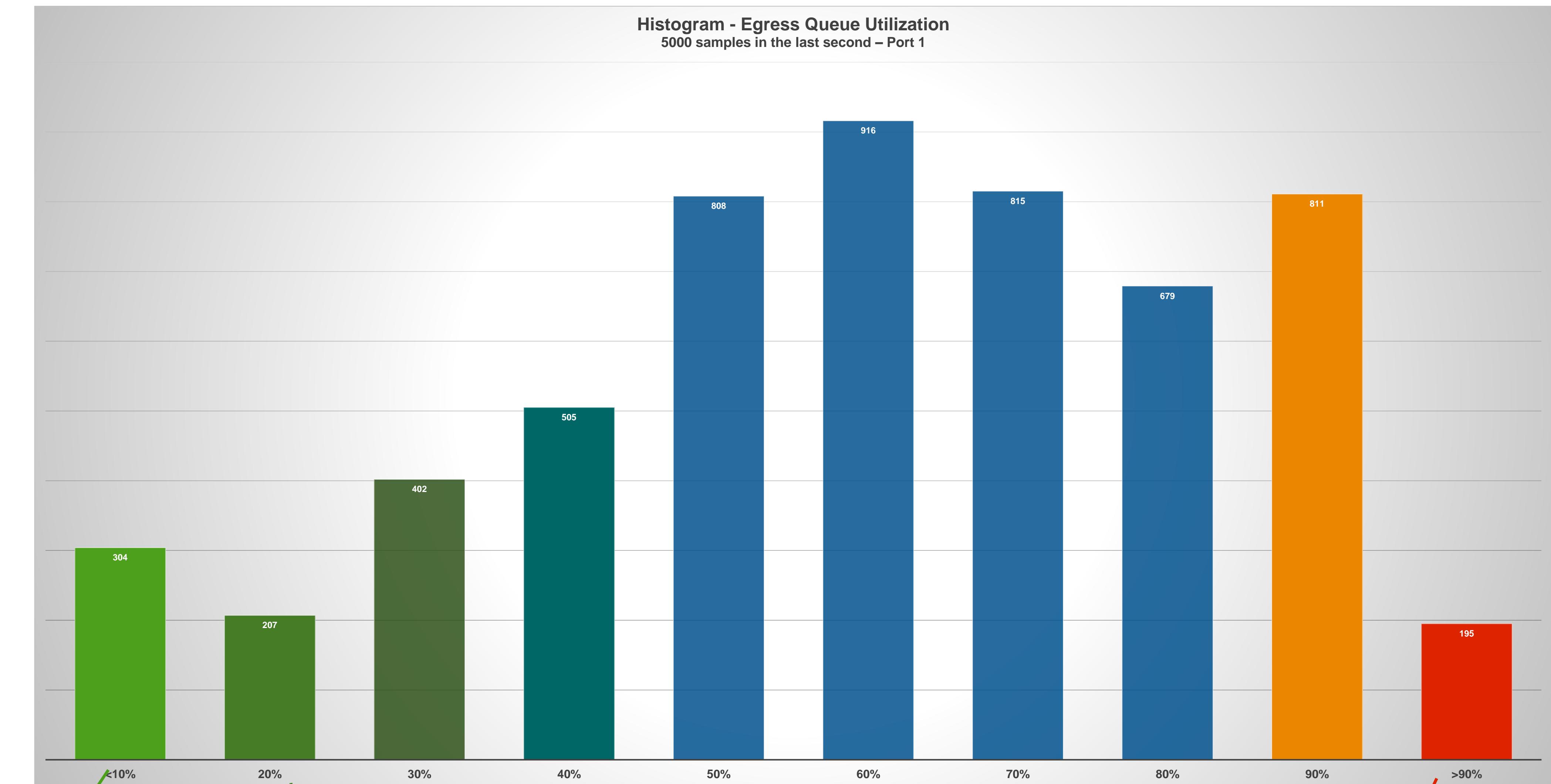
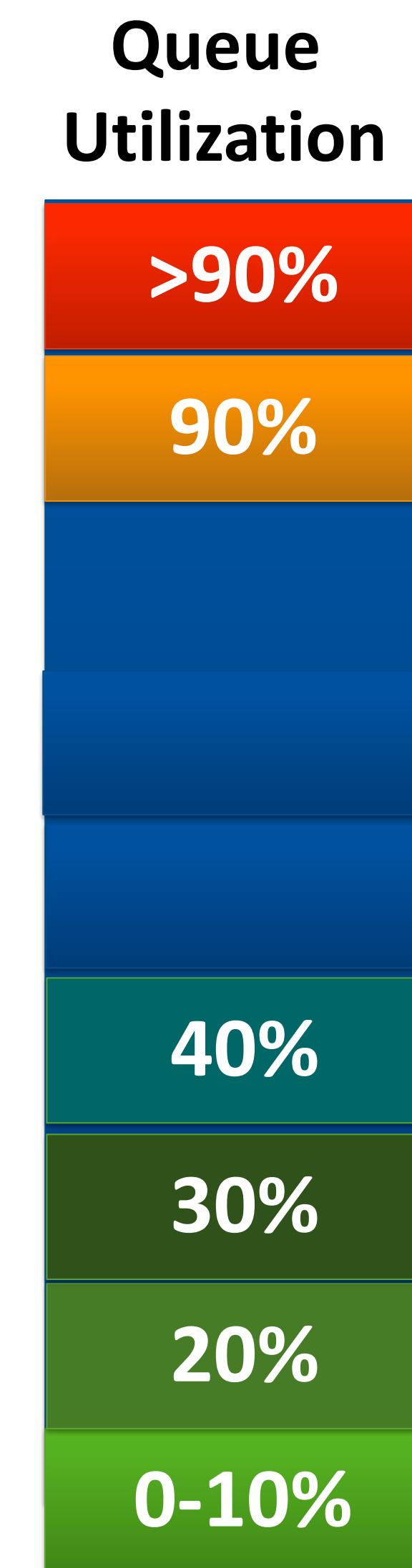
L1 Drops L2 Drops Router Drops Tunnel Drops Export

WHAT JUST HAPPENED 27 RESULTS

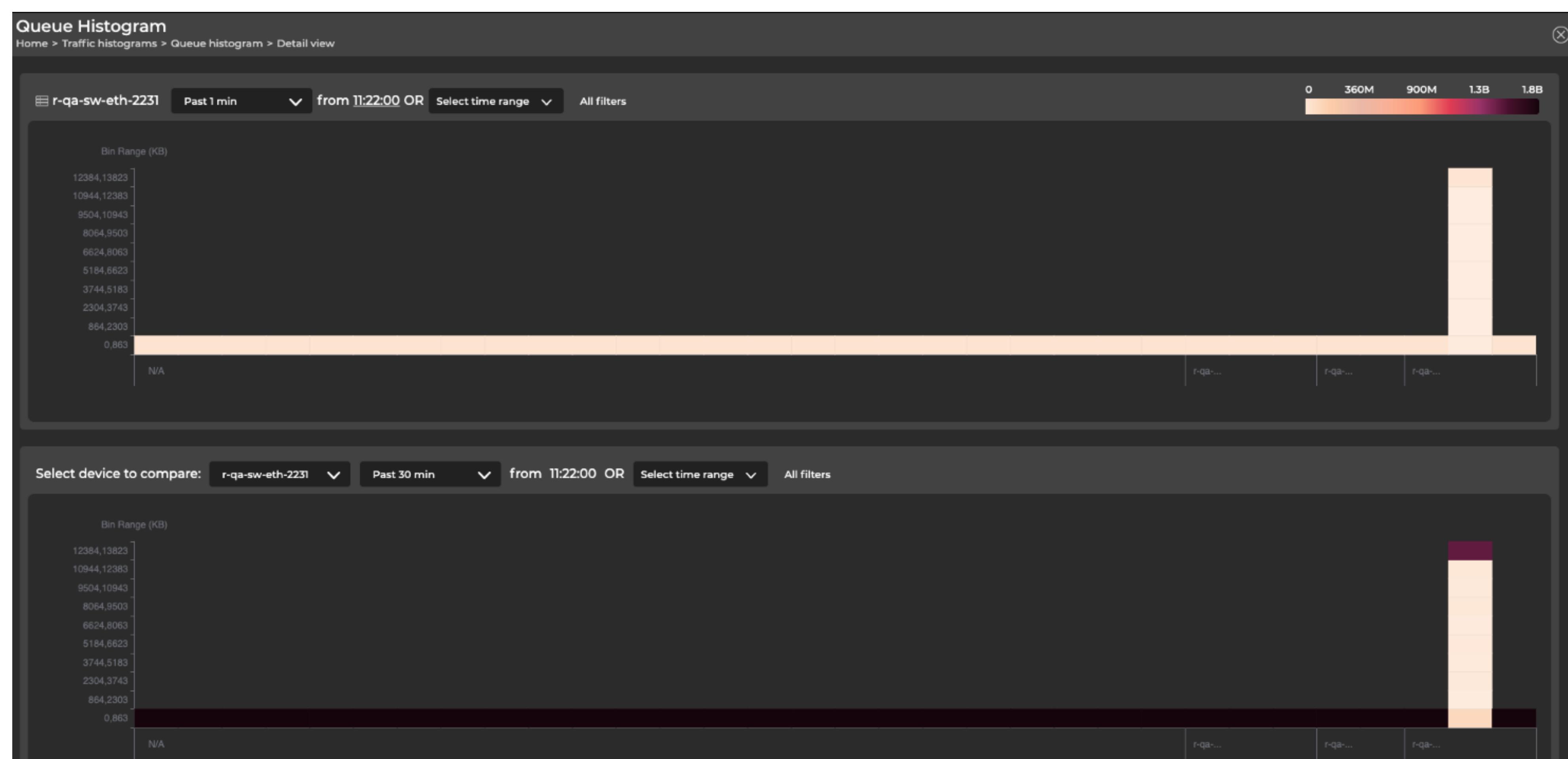
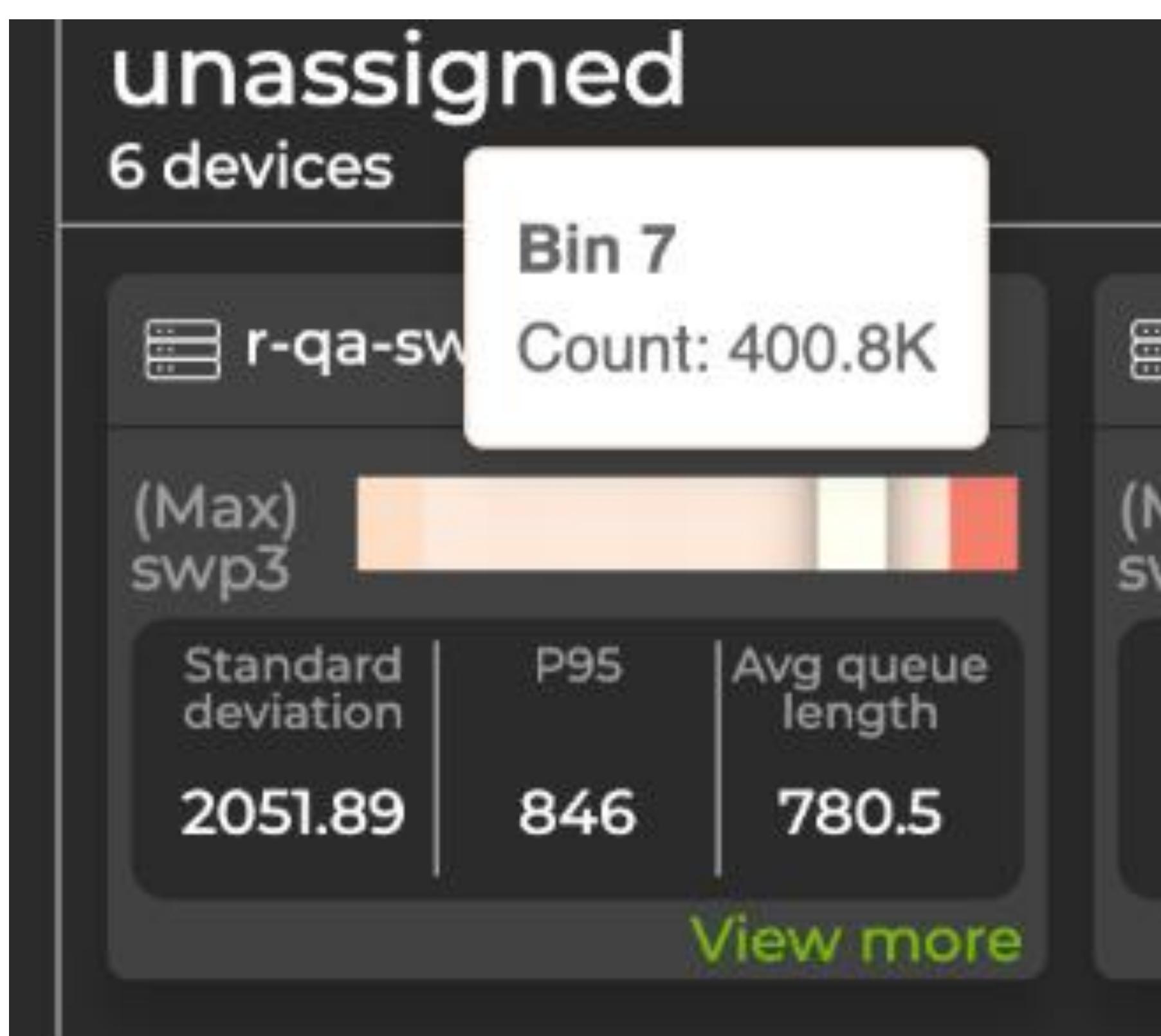
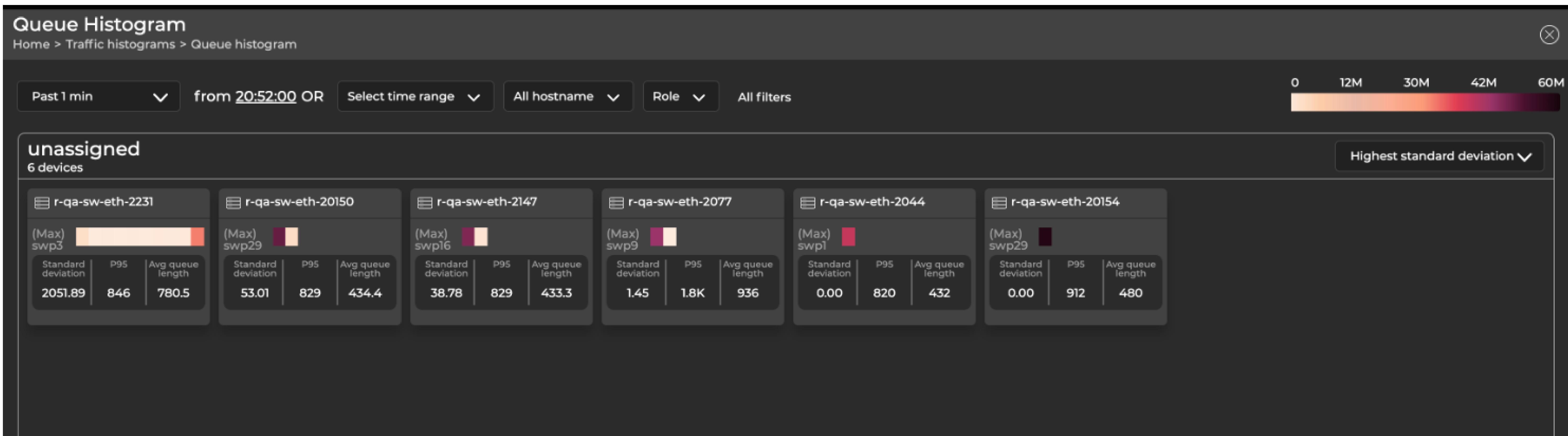
	LAST TIME...	DESTINATI...	AGGREGA...	HOSTNAME	DROP TYPE	SOURCE P...	PROTOCOL	SOURCE IP	REASON	FIRST TIM...	DESTINATI...	OPID
Buffer Drops	12/25/19 7:39 ...	192.168.37.1	768	SN2700-Leaf3	Router	0	1	192.168.20.4	Packet size is larger than MTU	12/25/19 7:38 ...	0	0
ACL Drops	12/25/19 7:38 ...	1.1.1.10	1	SN2100BR-L...	Router	20524	17	1.1.1.3	Non IP packet	12/25/19 7:38 ...	4789	0
	12/25/19 7:38 ...	0.0.0.0	1	SN2100BL-L...	Router	0	0	0.0.0.0	Non IP packet	12/25/19 7:38 ...	0	0
	12/25/19 7:38 ...	0.0.0.0	1	SN2700-Leaf3	Router	0	0	0.0.0.0	Non IP packet	12/25/19 7:38 ...	0	0
	12/25/19 7:38 ...	192.168.37.1	740	SN2700-Leaf3	Router	0	1	192.168.20.4	Packet size is larger than MTU	12/25/19 7:38 ...	0	0
	12/25/19 7:38 ...	192.168.37.1	367	SN2700-Leaf3	Router	0	1	192.168.20.4	Packet size is larger than MTU	12/25/19 7:38 ...	0	0
	12/25/19 7:38 ...	0.0.0.0	1	SN2100BL-L...	Router	0	0	0.0.0.0	Non IP packet	12/25/19 7:38 ...	0	0
	12/25/19 7:38 ...	0.0.0.0	1	SN2700-Leaf3	Router	0	0	0.0.0.0	Non IP packet	12/25/19 7:38 ...	0	0
	12/25/19 7:38 ...	1.1.1.10	2	SN2100BR-L...	Router	20524	17	1.1.1.3	Non IP packet	12/25/19 7:38 ...	4789	0
	12/25/19 7:38 ...	0.0.0.0	2	SN2100BL-L...	Router	0	0	0.0.0.0	Non IP packet	12/25/19 7:38 ...	0	0
	12/25/19 7:38 ...	0.0.0.0	2	SN2700-Leaf3	Router	0	0	0.0.0.0	Non IP packet	12/25/19 7:38 ...	0	0
	12/25/19 7:38 ...	1.1.1.10	3	SN2100BR-L...	Router	20524	17	1.1.1.3	Non IP packet	12/25/19 7:37 ...	4789	0
	12/25/19 7:37 ...	1.1.1.10	8	SN2100BR-L...	Router	20524	17	1.1.1.3	Non IP packet	12/25/19 7:37 ...	4789	0
	12/25/19 7:38 ...	0.0.0.0	10	SN2100BL-L...	Router	0	0	0.0.0.0	Non IP packet	12/25/19 7:37 ...	0	0
	12/25/19 7:38 ...	0.0.0.0	10	SN2700-Leaf3	Router	0	0	0.0.0.0	Non IP packet	12/25/19 7:37 ...	0	0
	12/25/19 7:35 ...	192.168.37.1	777	SN2700-Leaf3	Router	0	1	192.168.20.4	Packet size is larger than MTU	12/25/19 7:35 ...	0	0
	12/25/19 7:35 ...	192.168.37.1	677	SN2700-Leaf3	Router	0	1	192.168.20.4	Packet size is larger than MTU	12/25/19 7:35 ...	0	0
	12/25/19 7:35 ...	192.168.37.1	413	SN2700-Leaf3	Router	0	1	192.168.20.4	Packet size is larger than MTU	12/25/19 7:35 ...	0	0
	12/25/19 7:28 ...	43.43.43.43	71	SN2700-Leaf3	Router	0	1	192.168.20.4	TTL value is too small	12/25/19 7:28 ...	0	0
	12/25/19 7:28 ...	43.43.43.43	1203	SN2700-Leaf3	Router	0	1	192.168.20.4	TTL value is too small	12/25/19 7:27 ...	0	0
	12/25/19 7:27 ...	43.43.43.43	790	SN2700-Leaf3	Router	0	1	192.168.20.4	TTL value is too small	12/25/19 7:27 ...	0	0
	12/25/19 7:27 ...	43.43.43.43	1061	SN2700-Leaf3	Router	0	1	192.168.20.4	TTL value is too small	12/25/19 7:27 ...	0	0
	12/25/19 7:27 ...	43.43.43.43	1135	SN2700-Leaf3	Router	0	1	192.168.20.4	TTL value is too small	12/25/19 7:27 ...	0	0

Histograms 强大的Buffer统计工具

- Sampling 64ns granularity
- 10 sample buckets
- Port Histograms
 - RX/TX bandwidth
 - PFC duration
- Queue histograms
 - Fill Level
 - Latency
- Micro-bursts detection
 - Watermarks (capture highest value)
 - Thresholds Trigger events (Hysteresis)

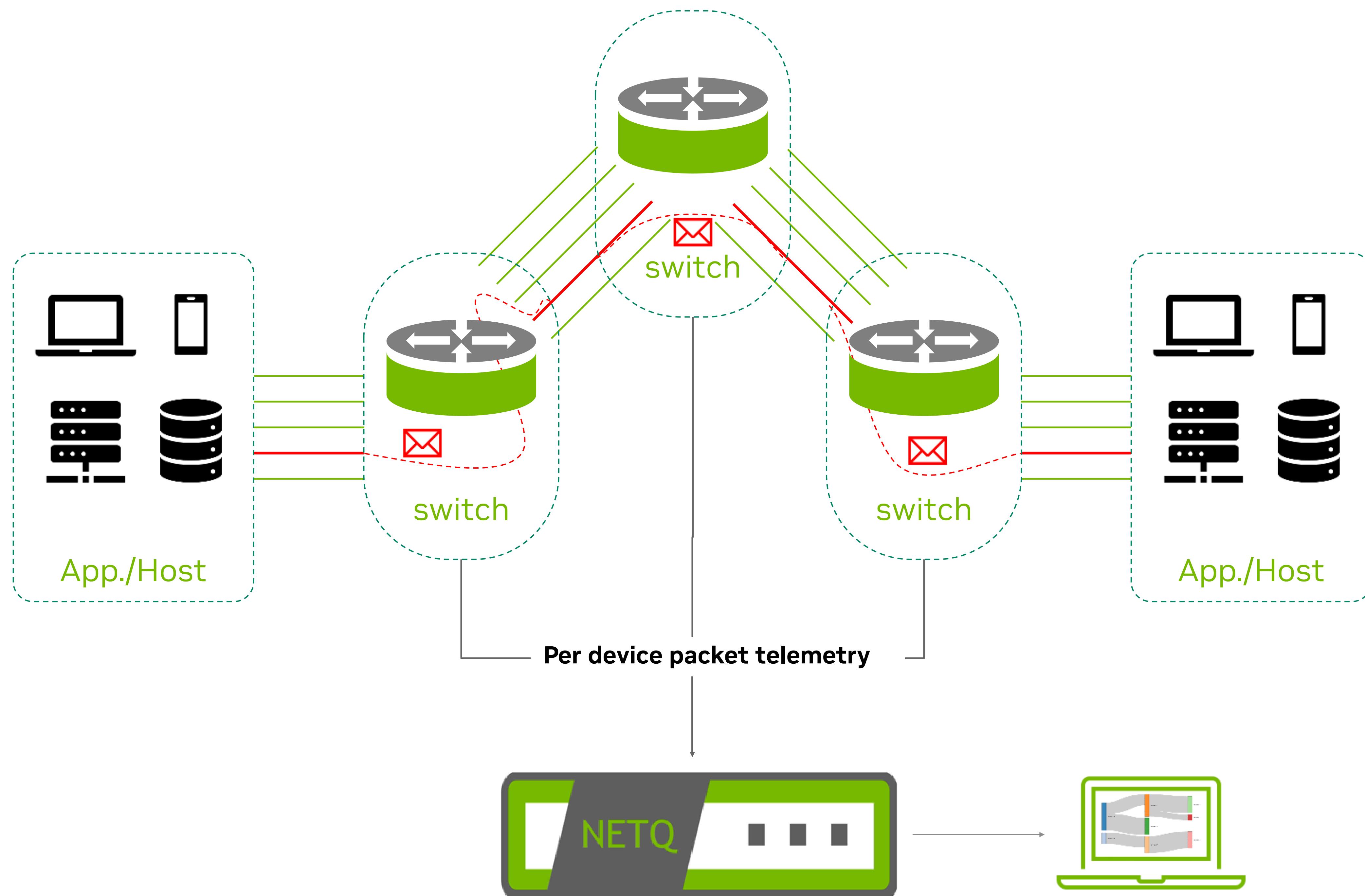


Histograms 强大的Buffer统计工具



Troubleshooting Application Performance Issues

Non-invasive application data flow analysis



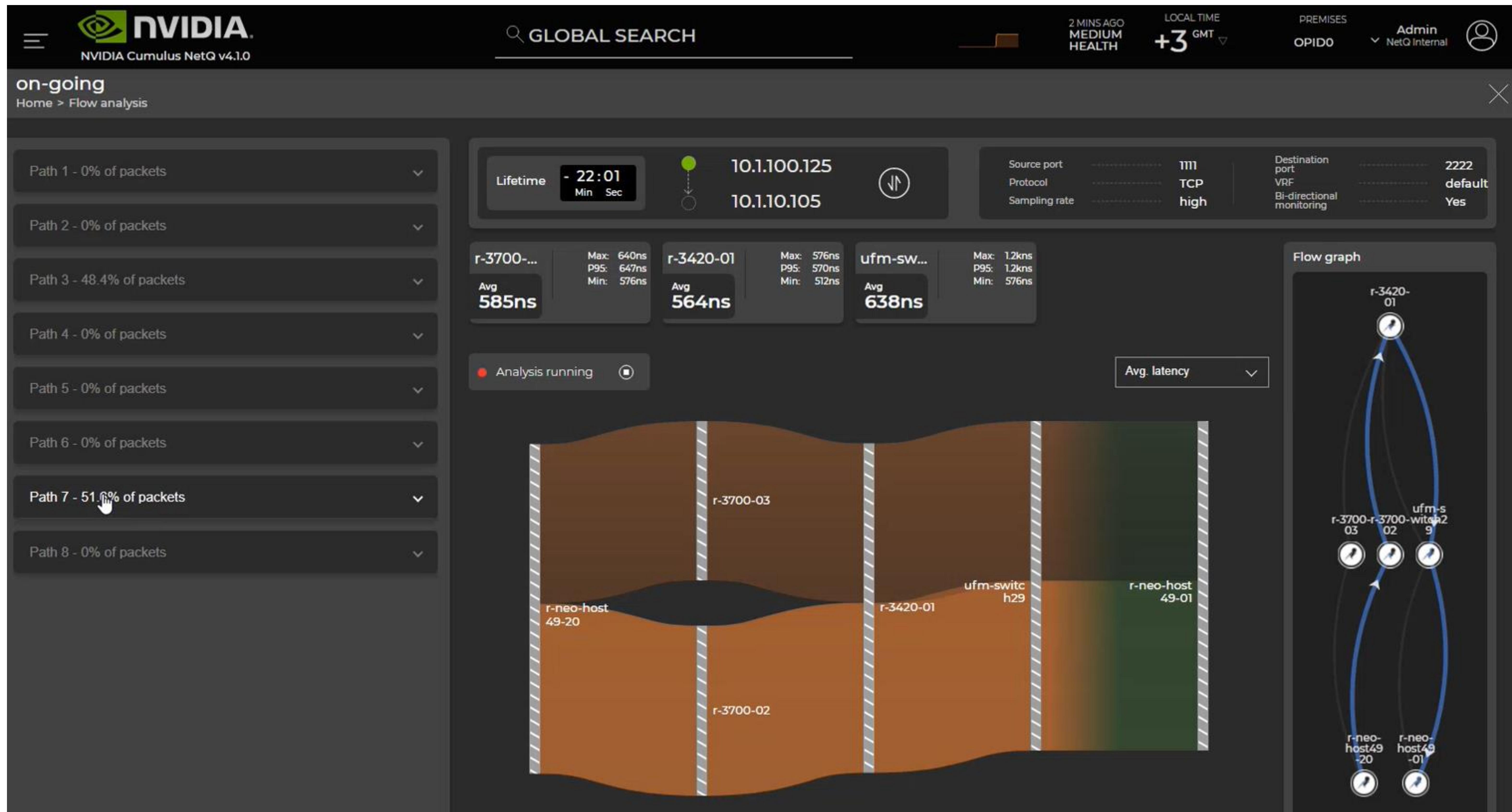
CHALLENGE

Why is the service slow?
Is the Network to blame?

NetQ flow telemetry analysis
shows per switch latency and
buffer occupancy details, WJH
Events, etc. along multiple paths
of application traffic

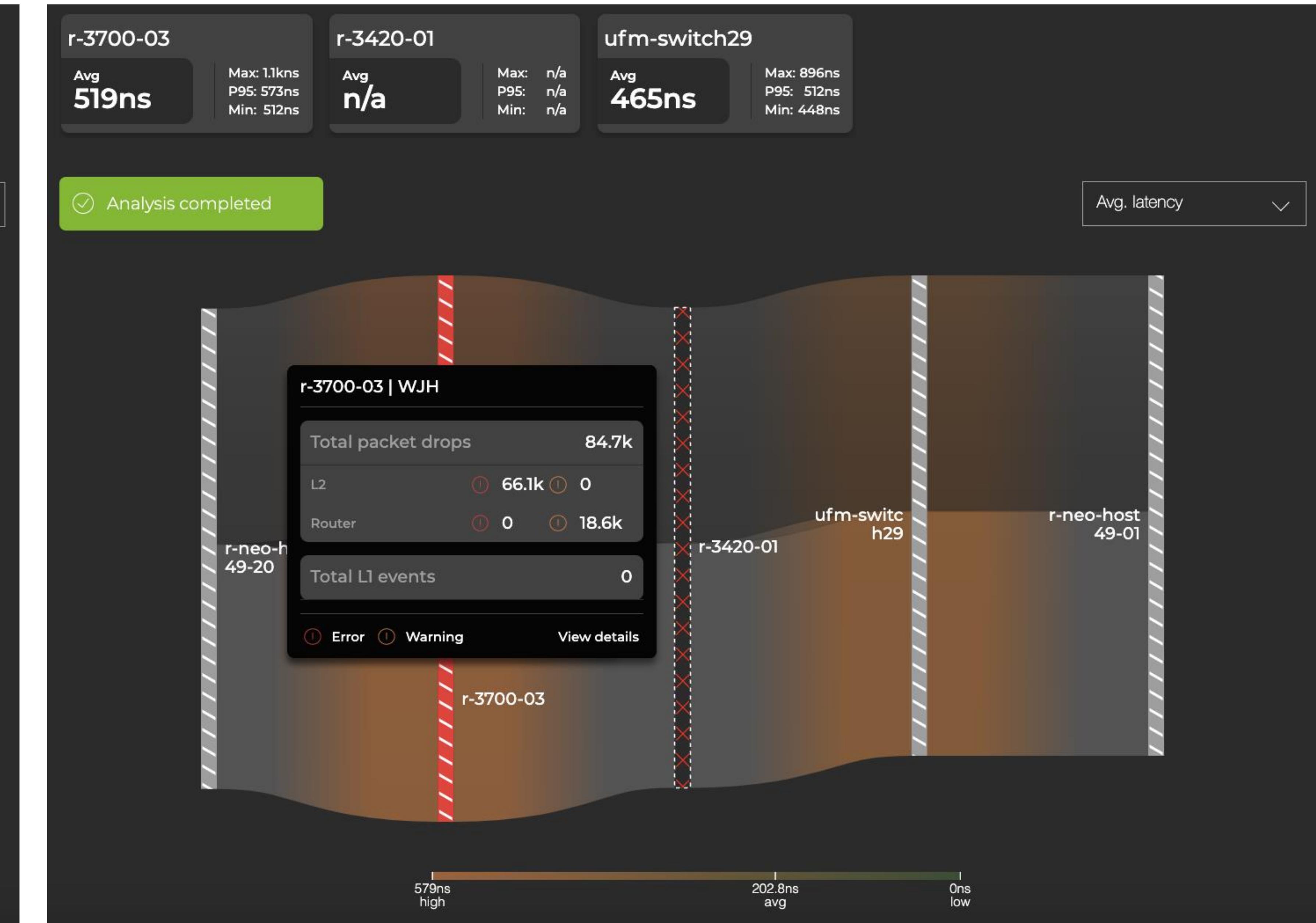
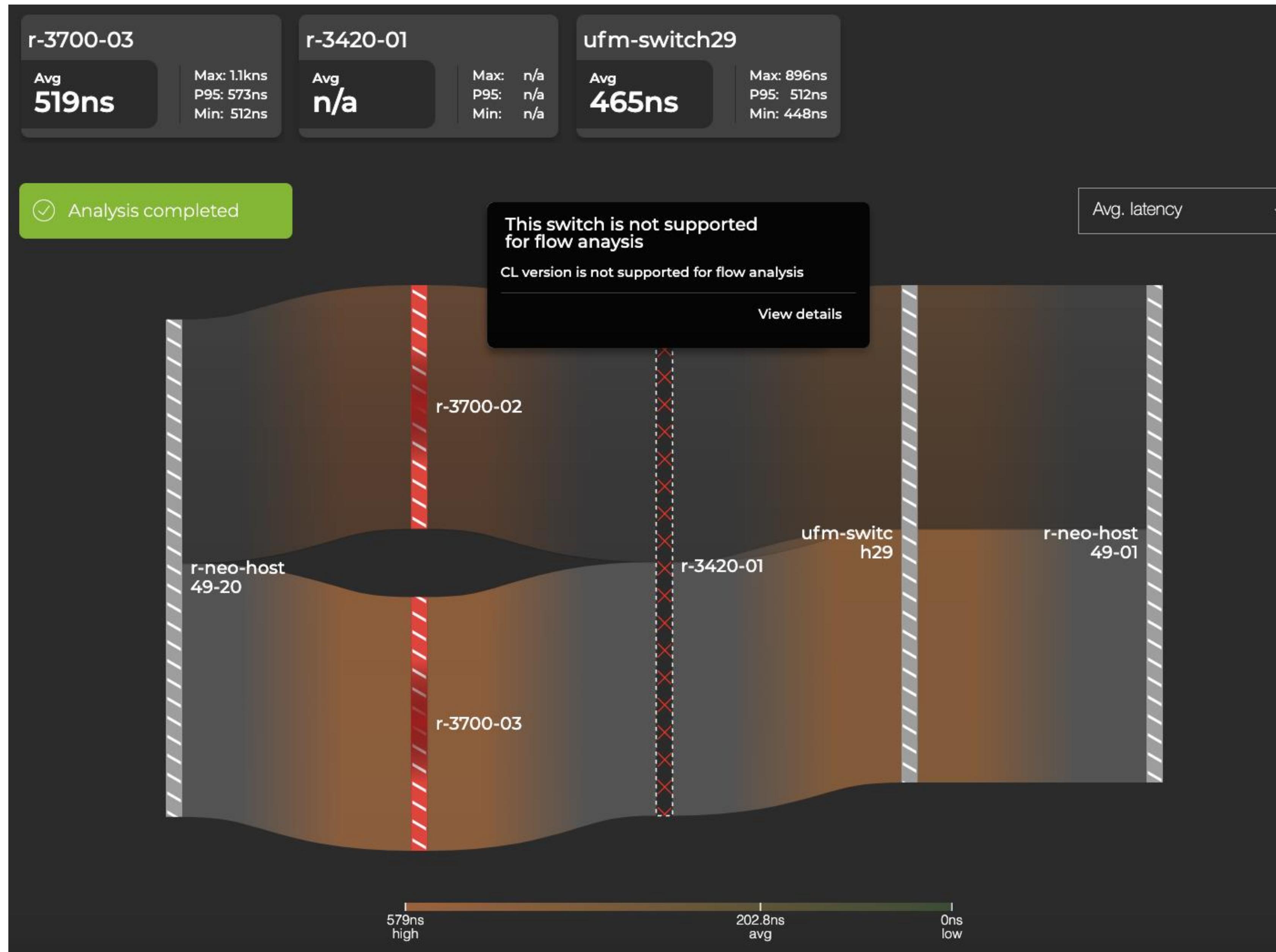
Reduce time to troubleshoot
network latency and
congestion issues

Flow Telemetry Analysis



Flow Telemetry Analysis (Cont)

NetQ 4.2.0 – Partial Path Analysis & WJH Events



WJH + FLOW-BASED → 100% COVERAGE

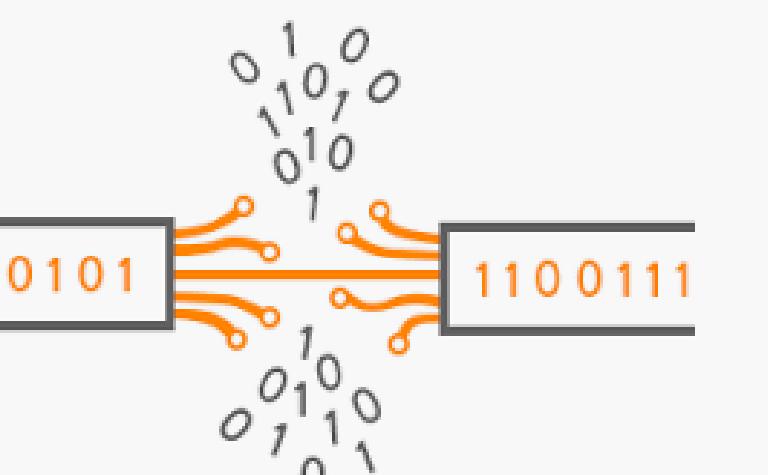
Best of all worlds: Catch every anomaly + get the flow specific context

- **WJH – What Just Happened**
(switch centric)

Always-on, packet drop and non-drop issues detection

- **Flow Telemetry**
(network wide)

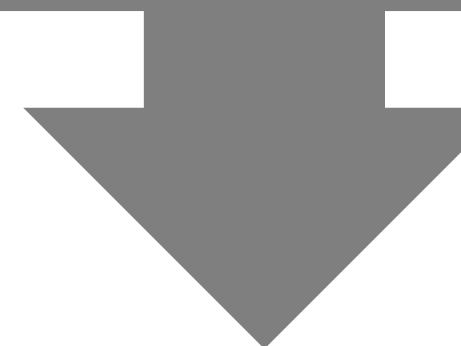
On-demand, multi-path network analysis (latency and congestion)

Issue	Use Case	WJH	Flow Telemetry
Drop 	L1		N/A
	L2/L3		N/A
	Buffer		N/A
	ACL		N/A
Non drop 	Congestion		
	Latency		
	Load Balance		

RoCE - Monitoring and Validation

CHALLENGE #1

Is RoCE performing well?



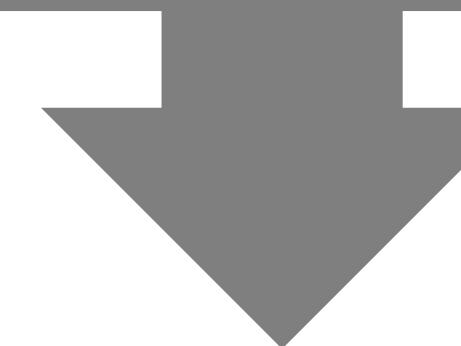
NetQ collects various RoCE counters for a given switch – Rx and Tx counters, counter pools and port-specific counters

NetQ allows to setup TCAs on RoCE counters

Reduce time to detect RoCE performance issues

CHALLENGE #2

Is RoCE configured right?



NetQ validates RoCE enabled with the same mode (lossy/lossless) across switches

NetQ validates congestion and flow control settings consistency

Reduce time to detect RoCE configuration issues

NVIDIA Spectrum Ethernet Software Stack

End-to-End Operational Efficiency Powering Network Innovation

CUMULUS LINUX



Flagship Ethernet NOS
Built for Automation



AIR



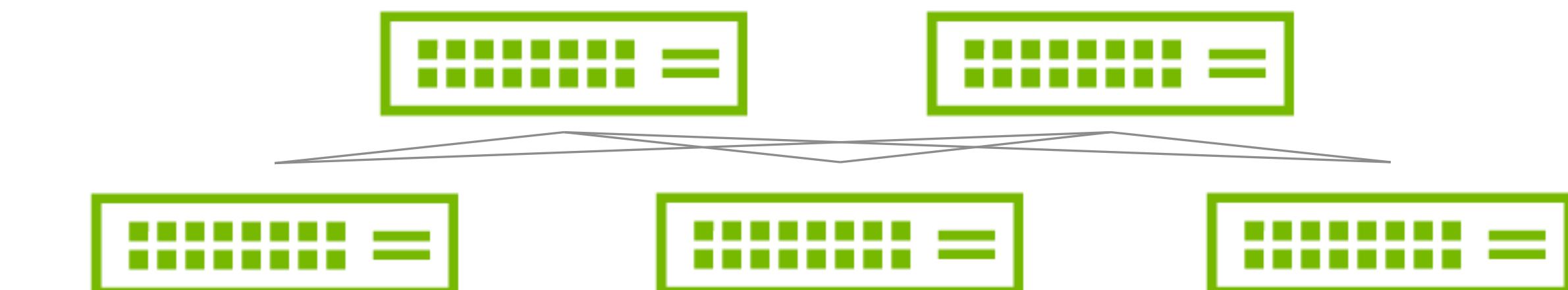
DC Digital Twin Platform
Built for Network Simulation



NETQ

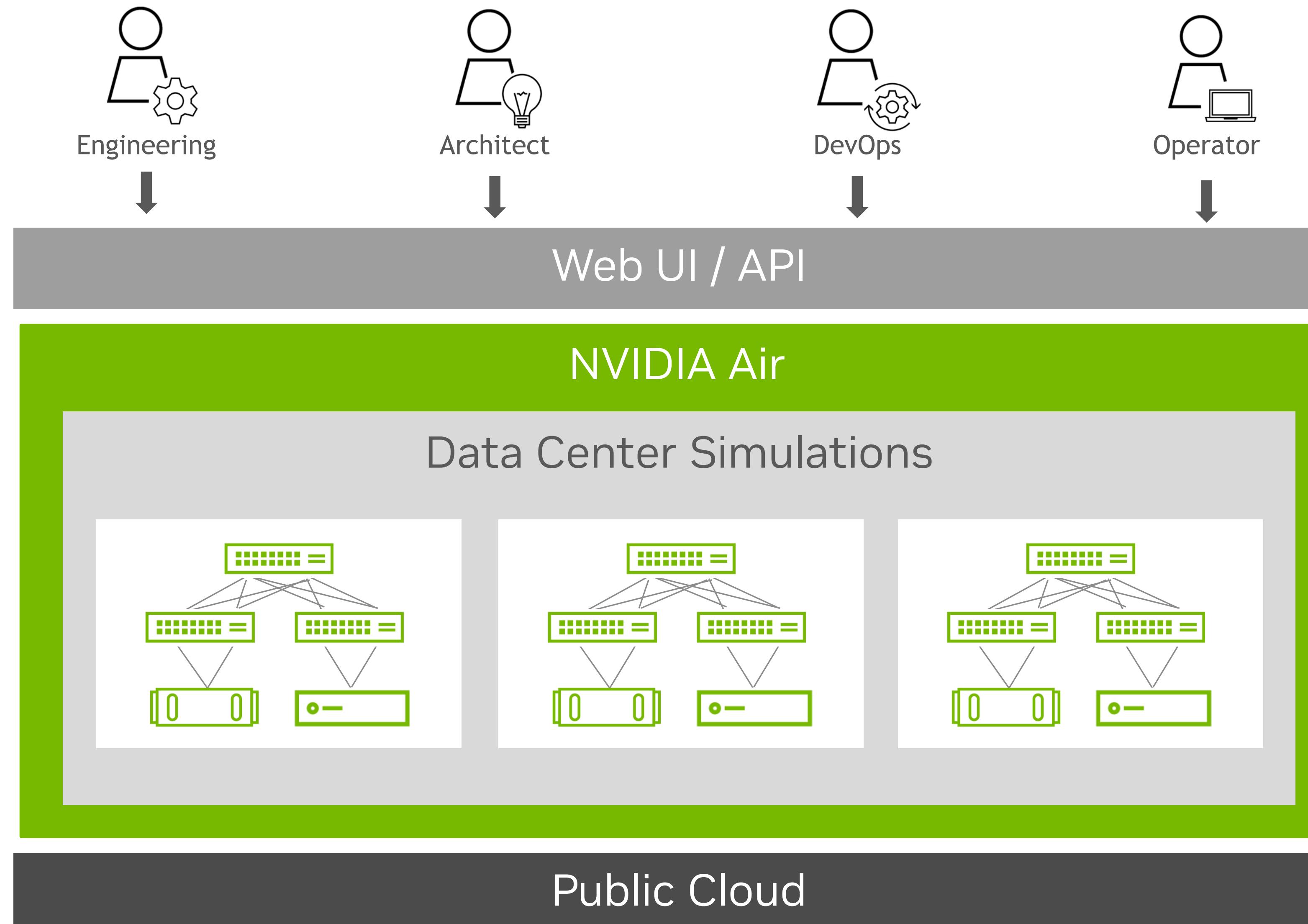


Fabric Validation Toolset Built
for Visibility



NVIDIA Air

Hosted Data Center Digital Twins with End-to-End Network Platform Simulation



Create a full-size virtual data center with network & compute featuring pre-built images. Validate solutions with security, automation, upgrades, failover, monitoring & interoperability.



FAST SPIN-UP

Create a digital twin in seconds, no HW required



HIGHEST ACCURACY

The most true-to-life simulation



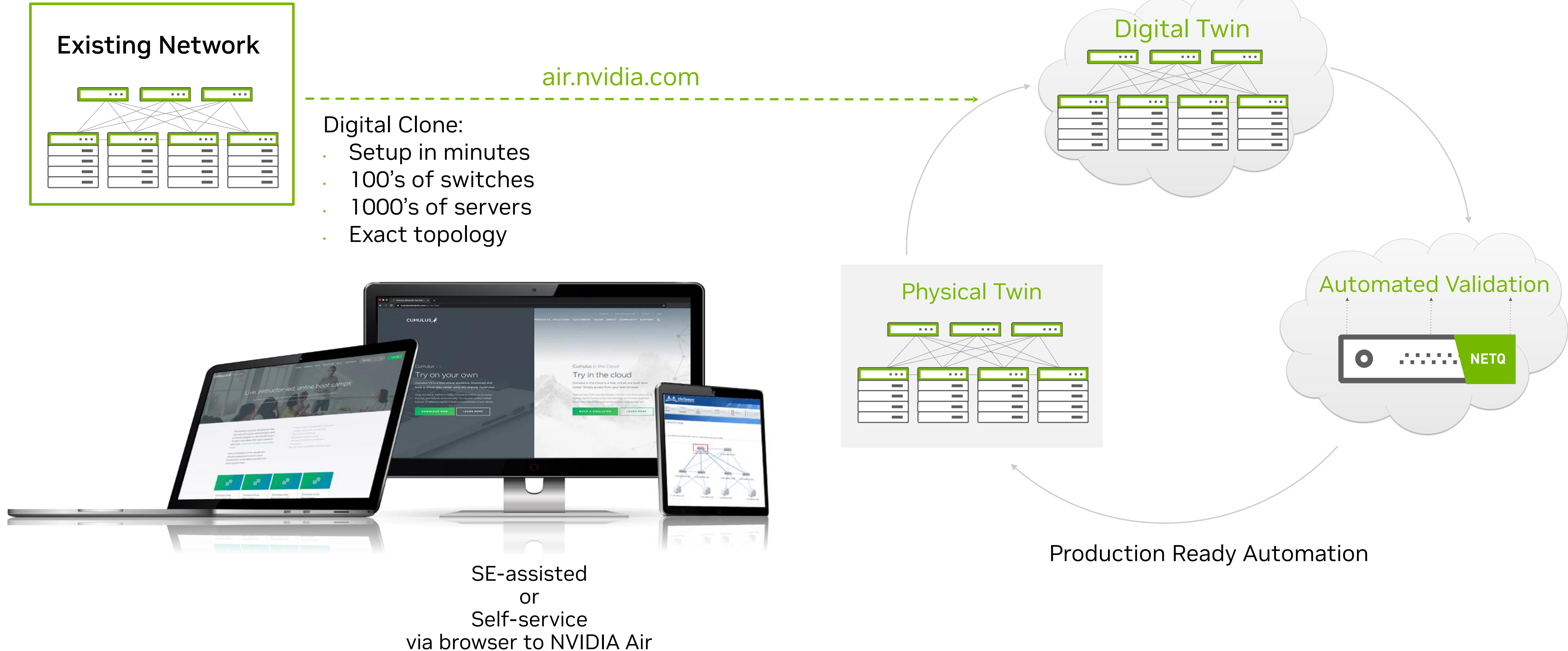
VALIDATE THEN DEPLOY

Deploy solutions with confidence to the physical data center

NVIDIA Air simulates full stack NVIDIA solutions and reference architectures

Getting Started

Take a Virtual Spin Today



NVIDIA Air

Spectrum-X Data Center Digital Twins



INFRASTRUCTURE SIMULATION

Full-size virtual data centers with compute and network
Topology + cabling modeling
Full data path connectivity, OOB config and ZTP test



SOLUTION VALIDATION

Compute and network automation
Host to switch traffic connectivity
Routing, failover, upgrade, telemetry, security protocols



PRODUCTION READY

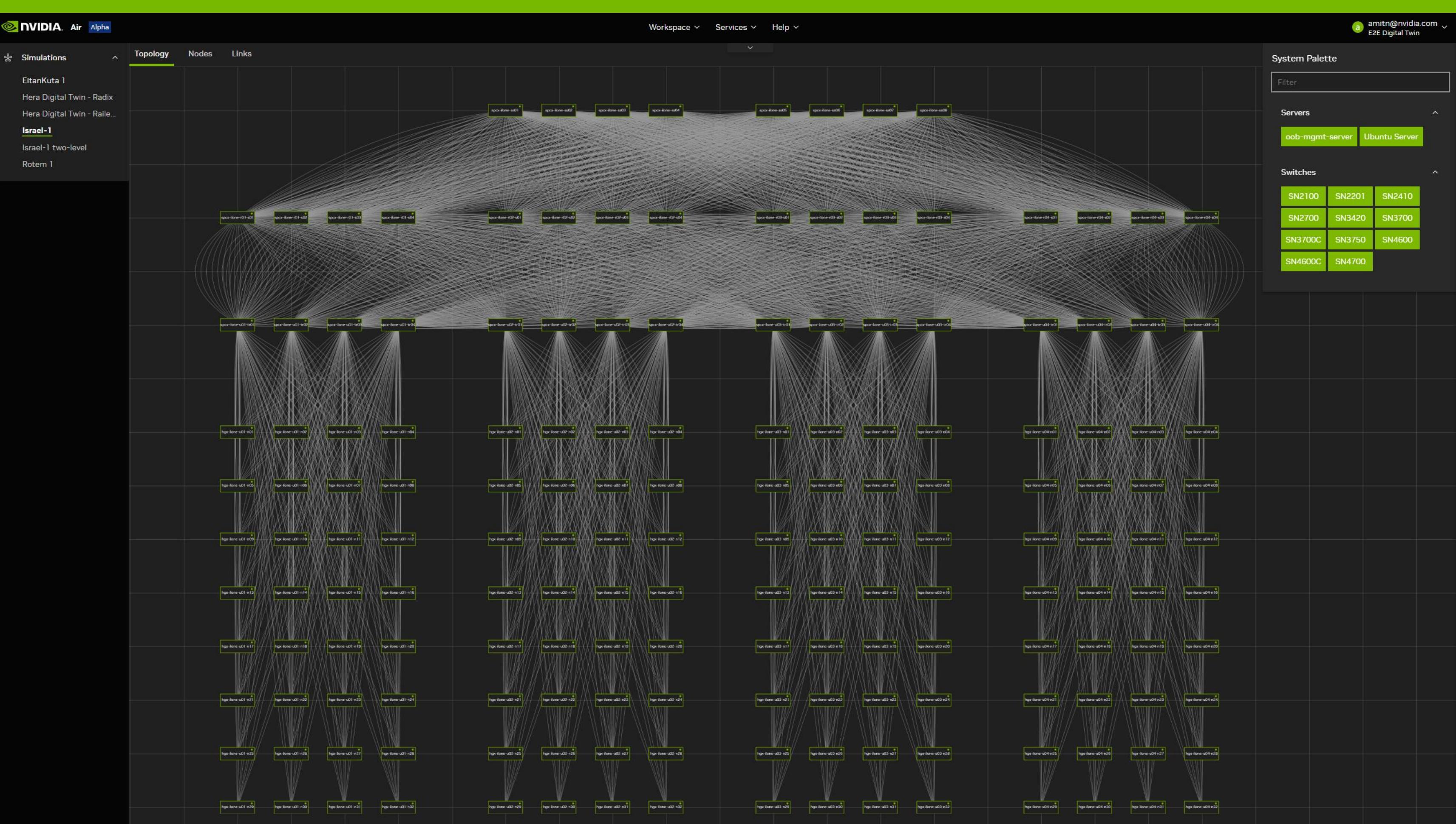
Deploy with confidence to production
Create multiple digital twins for parallel testing (CI/CD)
Share simulations, enhance training, skills transfer

“Over **80%** of network problems are due to improper configuration and issues with change management.”

— Gartner



Israel-1 (Spectrum-X) Data Center Digital Twin



[Try It Now](#)

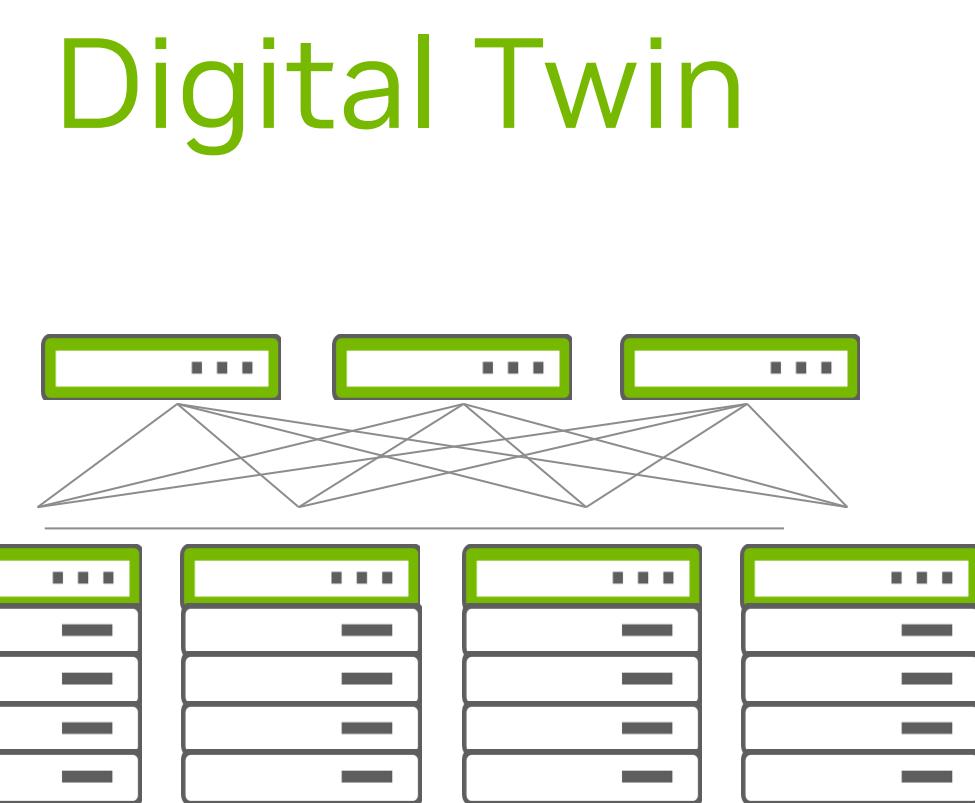
[SDK](#)

[API](#)

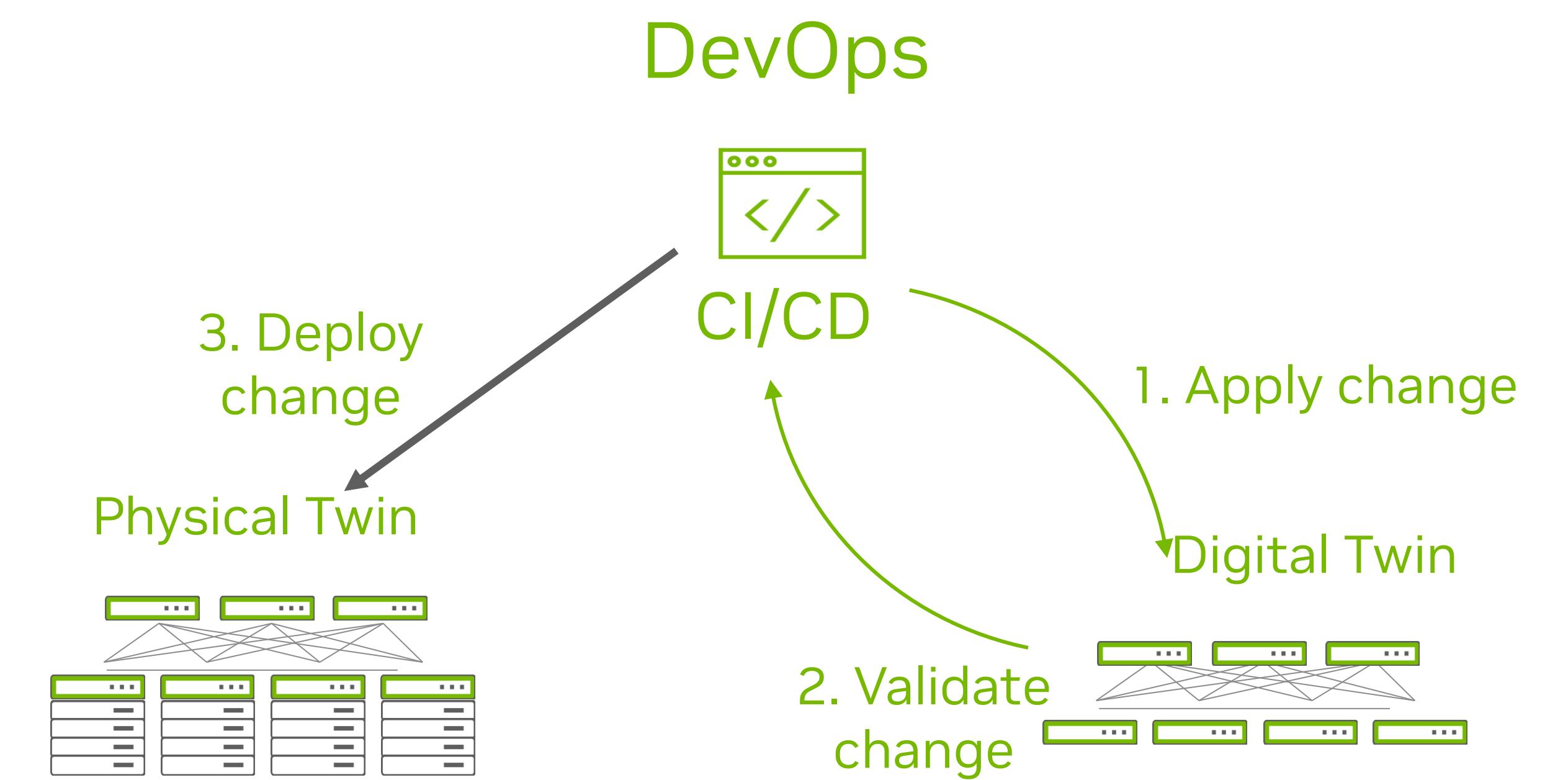
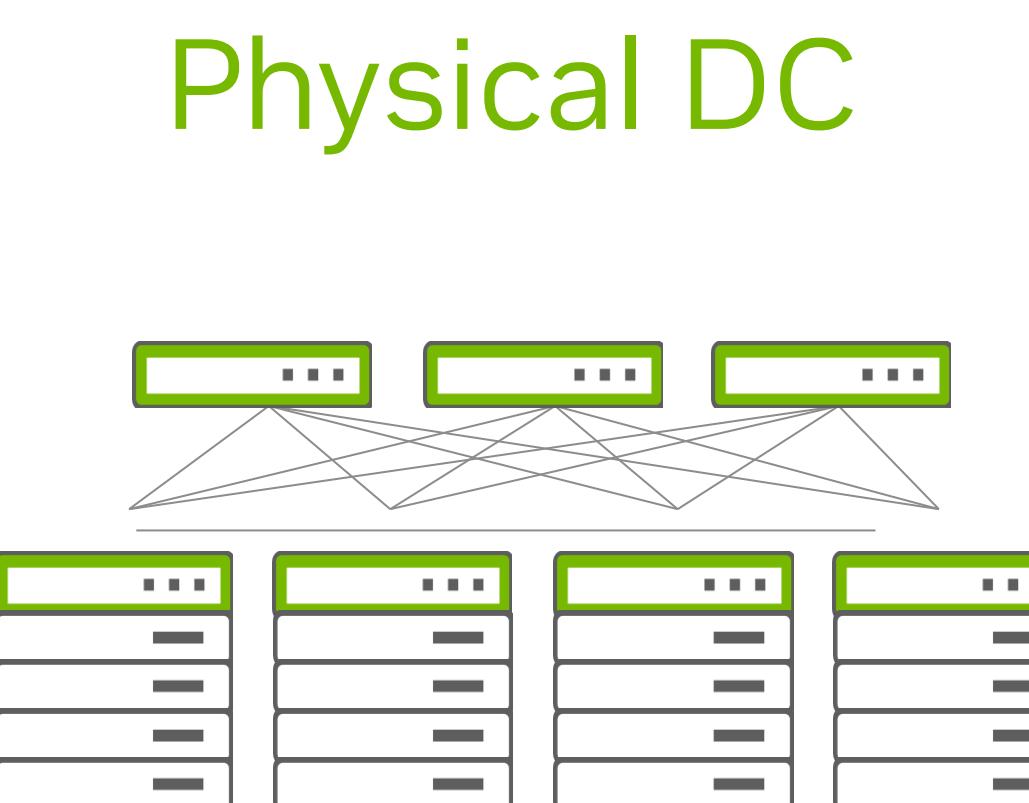
[User Guide](#)

Deployment Life Cycle

From POC to Decommission



Export Configuration



Training, Onboarding & Education
Presales PoC Labs
Interop Testing

Automation Development
Provisioning Process Development

Change Validation
Troubleshooting Assistance

First Look

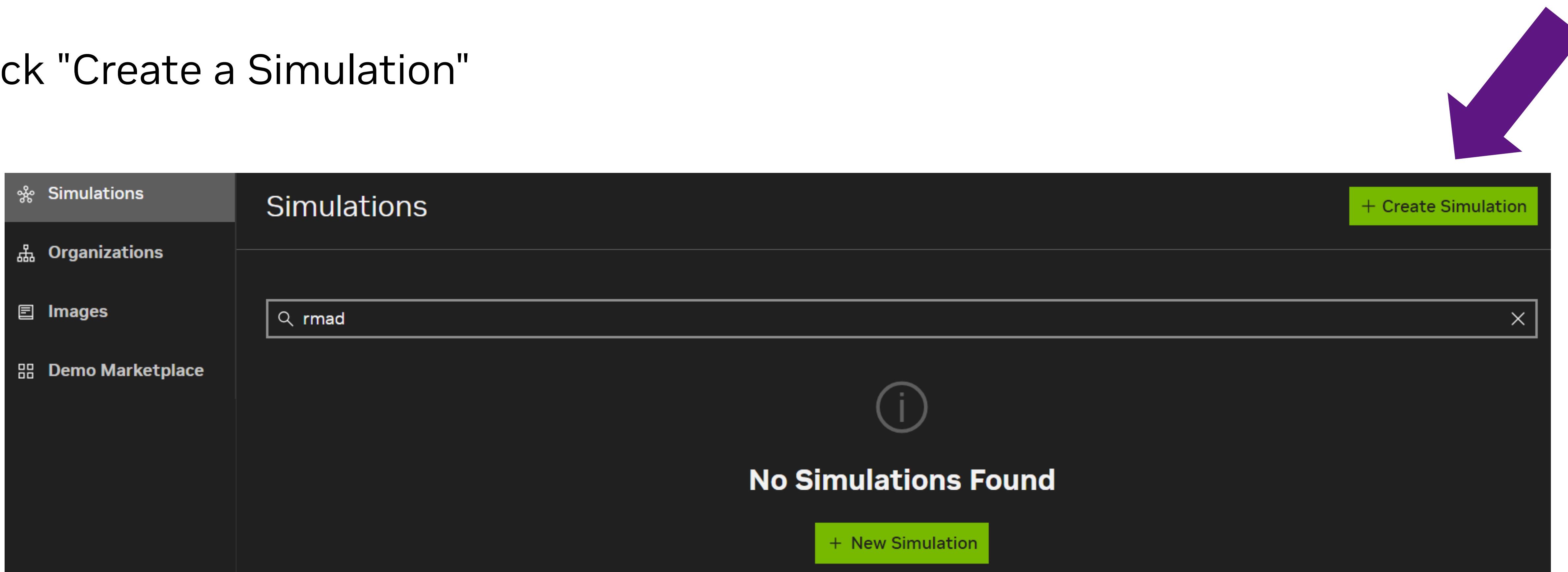


- Go to air.nvidia.com
- Enter your e-mail to get started

Try it today - it's free!

Creating your First Simulation

- Click "Create a Simulation"



Pre-Built Topologies – Demo Marketplace

Launch a pre-cabled and preconfigured demos

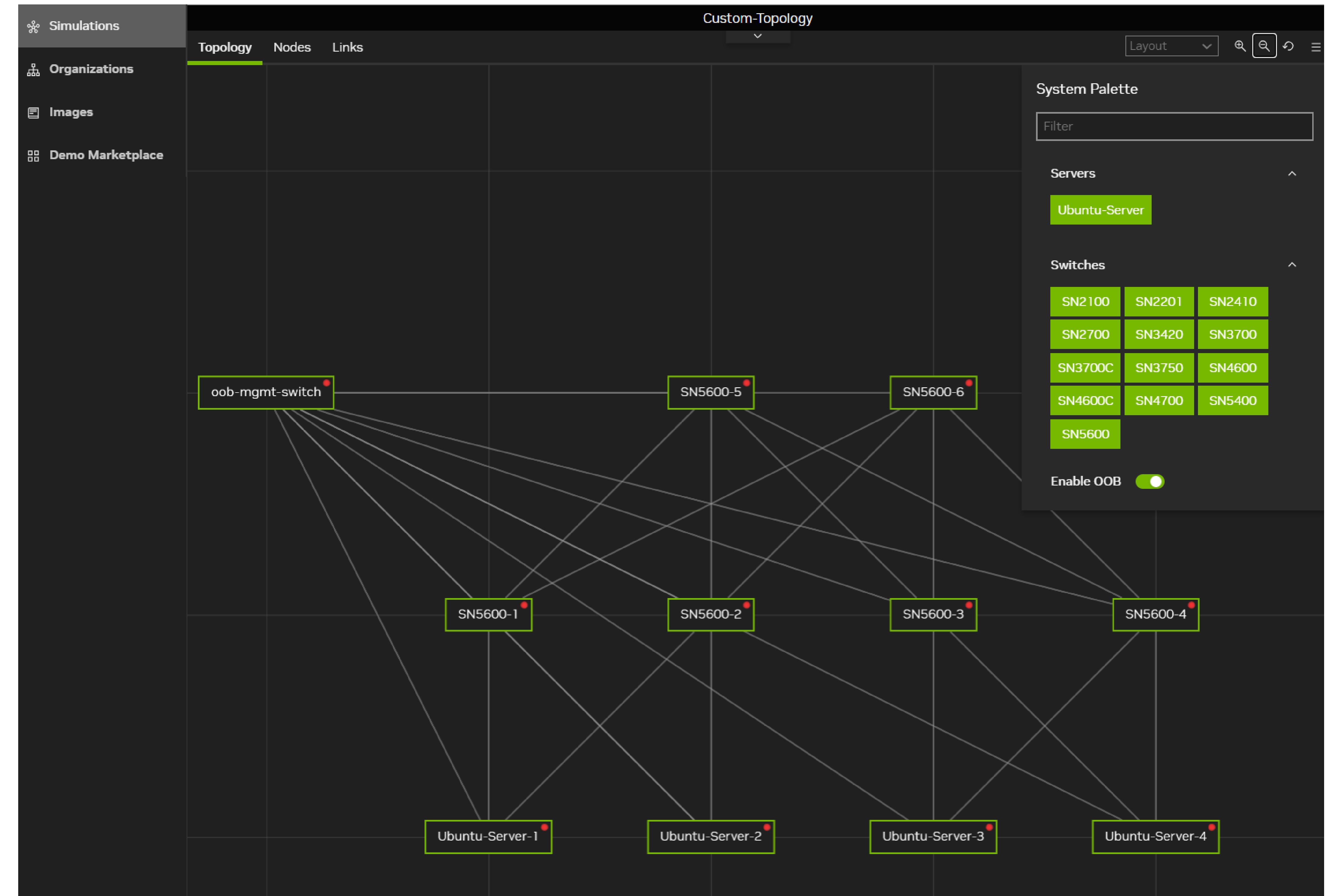
The screenshot shows the NVIDIA Air interface with the "Demo Marketplace" selected in the sidebar. The main area displays a grid of 12 demo cards, each representing a different networking topology or best practice. Each card includes a title, a brief description, a list of technologies or components, and two buttons: "Documentation" and "Launch".

Card Index	Title	Description	Technologies / Components	Action Buttons
1	01 CL5.9 - EVPN Symmetric Routing Best Practices	VXLAN EVPN Symmetric Routing Demo using NVUE (NVIDIA User Experience) CLI on Cumulus Linux 5.9	BGP, Cumulus Linux, EVPN, MLAG, Multi-tenancy, NVUE, official, Symmetric Routing, VXLAN	Documentation, Launch
2	02 SONiC BGP EVPN VXLAN	Numbered BGP underlay, VXLAN encapsulation server connectivity. EVPN control plane.	BGP, EVPN, official, SONiC, VXLAN	Documentation, Launch
3	03 CL5.9 - EVPN Centralized Routing Best Practices	VXLAN EVPN Centralized Routing Demo using NVUE (NVIDIA User Experience) CLI on Cumulus Linux 5.9	BGP, Centralized Routing, Cumulus Linux, EVPN, MLAG, Multi-tenancy, NVUE, official, VXLAN	Documentation, Launch
4	03 CL5.9 - EVPN L2 Extension Best Practices	VXLAN EVPN Layer 2 Extension Demo using NVUE (NVIDIA User Experience) CLI on Cumulus Linux 5.9	BGP, Cumulus Linux, EVPN, L2 Extension, MLAG, Multi-tenancy, NVUE, official, VXLAN	Documentation, Launch
5	03 CL5.9 - EVPN Multihoming Best Practices	VXLAN EVPN Symmetric Routing Demo with Multihoming using NVUE (NVIDIA User Experience) CLI on Cumulus Linux 5.9	BGP, Cumulus Linux, EVPN-Multihoming, Multi-tenancy, Multihoming, NVUE, official, PIM-SM, Symmetric Routing, +1 more	Documentation, Launch
6	04 NetQ Flow Analysis	Analyze active application traffic flows using NetQ Flow Analysis (FA). Sample TCP and UDP data in your fabric to get network path information and review latency and buffer...	BGP, Cumulus Linux, EVPN, Flow Analysis, MLAG, NetQ, NVUE, official, Symmetric, VXLAN	Documentation, Launch
7	04 Network Troubleshooting with NetQ	Learn how to use NetQ to troubleshoot some common network faults and misconfigurations.	BGP, EVPN, MLAG, NetQ, official, Troubleshooting, Validation	Documentation, Launch
8	05 CL5.8 - EVPN Centralized Routing Best Practices	VXLAN EVPN Centralized Routing Demo using NVUE (NVIDIA User Experience) CLI on Cumulus Linux 5.8	BGP, Centralized Routing, Cumulus Linux, EVPN, MLAG, Multi-tenancy, NVUE, official, VXLAN	Documentation, Launch
9	05 CL5.8 - EVPN L2 Extension Best Practices	VXLAN EVPN Layer 2 Extension Demo using NVUE (NVIDIA User Experience) CLI on Cumulus Linux 5.8	BGP, Cumulus Linux, EVPN, L2 Extension, MLAG, Multi-tenancy, NVUE, official, VXLAN	Documentation, Launch
10	05 CL5.8 - EVPN Multihoming Best Practices	VXLAN EVPN Symmetric Routing Demo with Multihoming using NVUE (NVIDIA User Experience) CLI on Cumulus Linux 5.8	BGP, Cumulus Linux, EVPN-Multihoming, Multi-tenancy, Multihoming, NVUE, official, PIM-SM, Symmetric Routing, +1 more	Documentation, Launch
11	06 CL5.7 - EVPN Symmetric Routing Best Practices	VXLAN EVPN Symmetric Routing Demo using NVUE (NVIDIA User Experience) CLI on Cumulus Linux 5.7	BGP, Cumulus Linux, EVPN, MLAG, Multi-tenancy, NVUE, official, Symmetric Routing, VXLAN	Documentation, Launch
12	06 CL5.7 - EVPN Multihoming Best Practices	VXLAN EVPN Symmetric Routing Demo with Multihoming using NVUE (NVIDIA User Experience) CLI on Cumulus Linux 5.7	BGP, Cumulus Linux, EVPN-Multihoming, Multi-tenancy, Multihoming, NVUE, official, PIM-SM, Symmetric Routing, +1 more	Documentation, Launch

Custom Topology Building

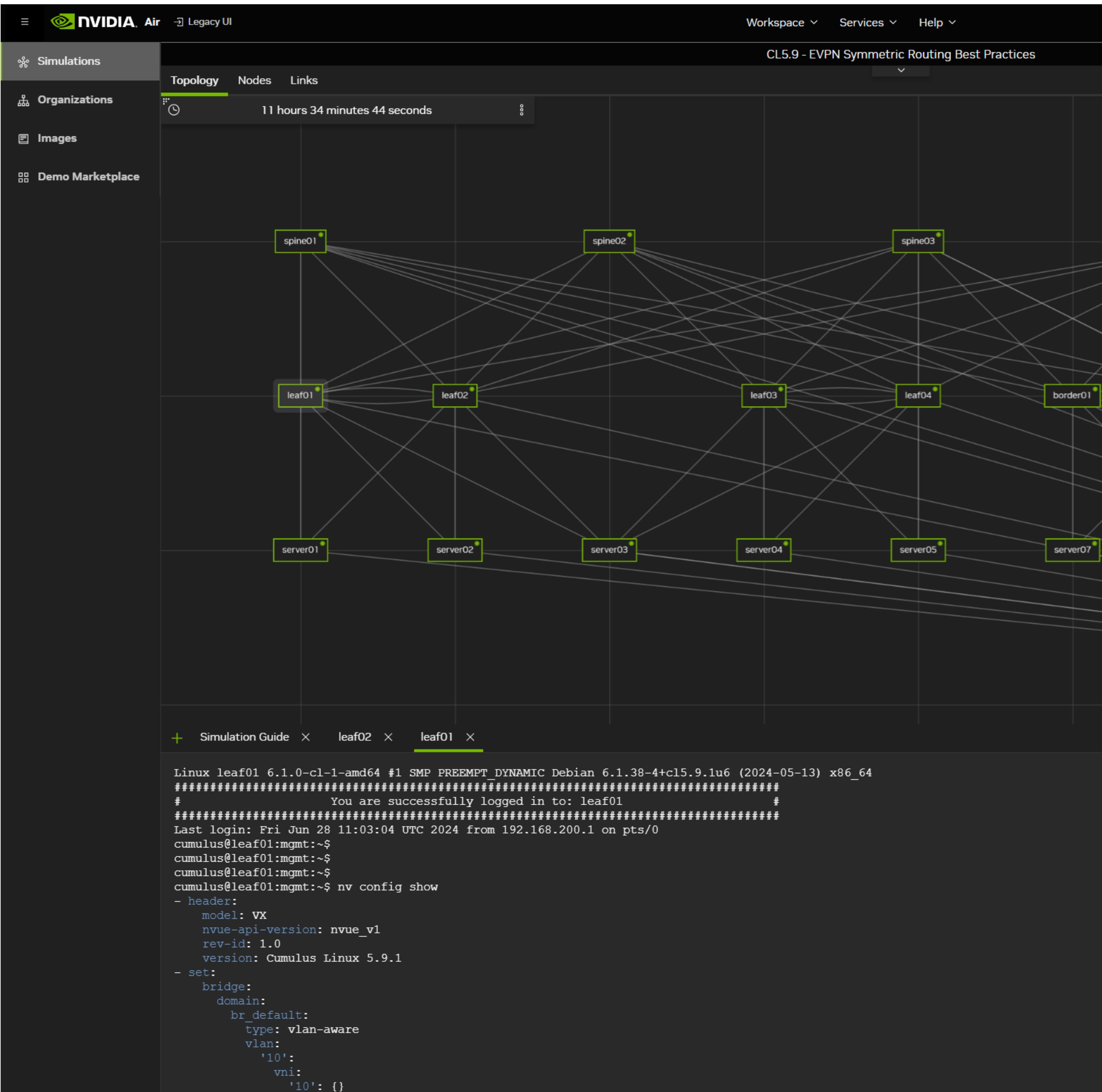
Build a copy of your existing physical network or try something entirely different

- Build your topology using “Workspace ➔ New Simulation ➔ Blank Canvas”
- When ready, “Workspace ➔ Start Simulation”



High Accuracy Simulation

Run applications on full-featured networking and server OS



- Console Access entirely through the Web
- Seamless experience compared to real HW

NetQ Consumption & Deployment

Spectrum Ethernet Platform

TRY NETQ BEFORE PURCHASE

NVIDIA AIR



SIMULATE WITH NVIDIA AIR

POC, model, test, automate, train

STEP 1: VIRTUAL POC

Login to architect network +
test drive NOS

STEP 2: TEST & DEPLOY

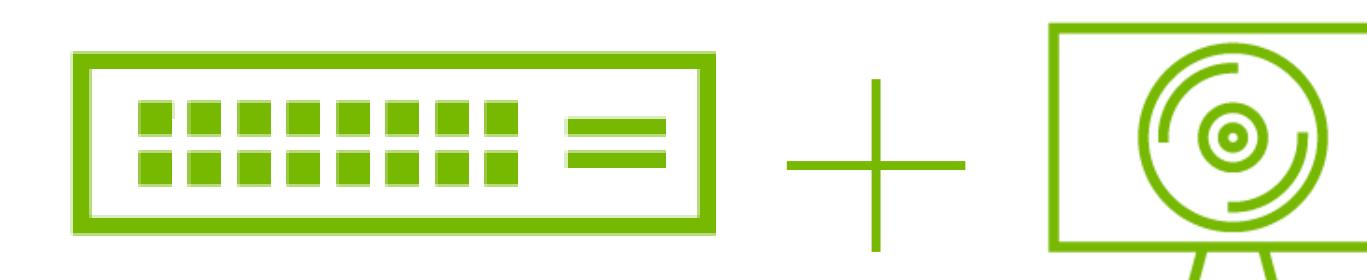
Pre-validate and pre-provision
network for speedy deployment

STEP 3: ONGOING OPERATIONS

Combine Air with NetQ for testing
and automation

ADD NETQ TO SWITCH PURCHASE

SWITCH + NOS



SPECTRUM SWITCH WITH CUMULUS



ENTERPRISE SUPPORT

Single support model
for both HW + SW

NETQ



SAAS

NetQ as NVIDIA Hosted and
Managed Cloud Service

+

NETQ License per Switch

OR



ON-PREMISE

NetQ software
hosted on x86
Server

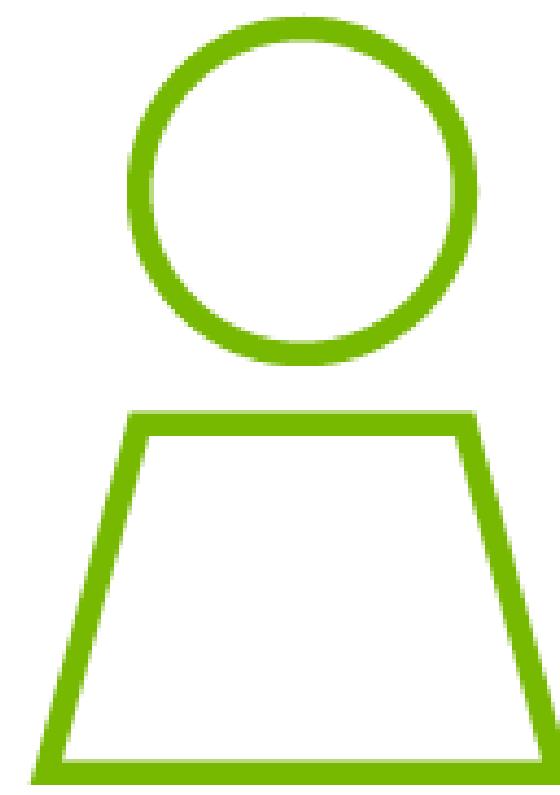
+

NETQ License per Switch

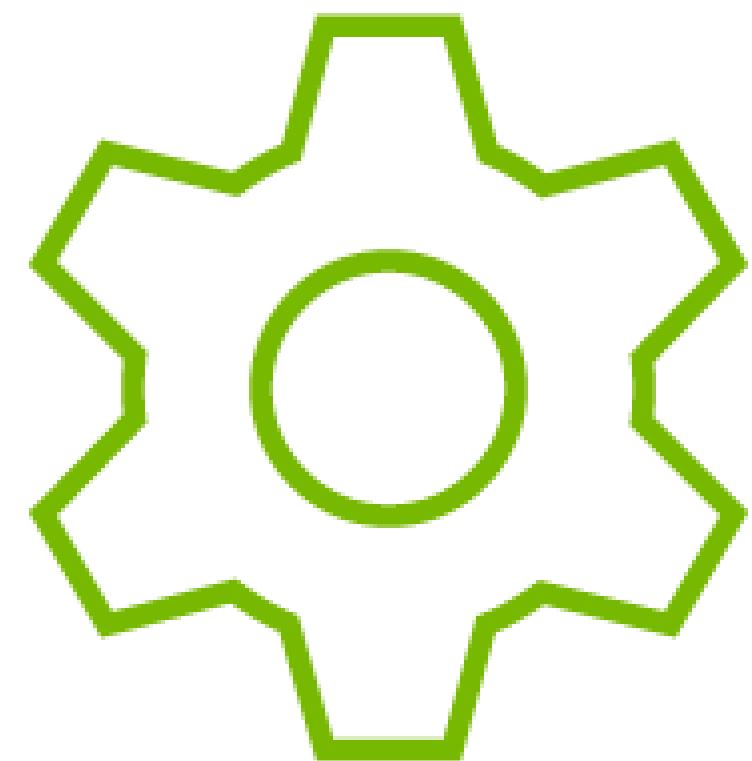
Resources

Where to Learn More

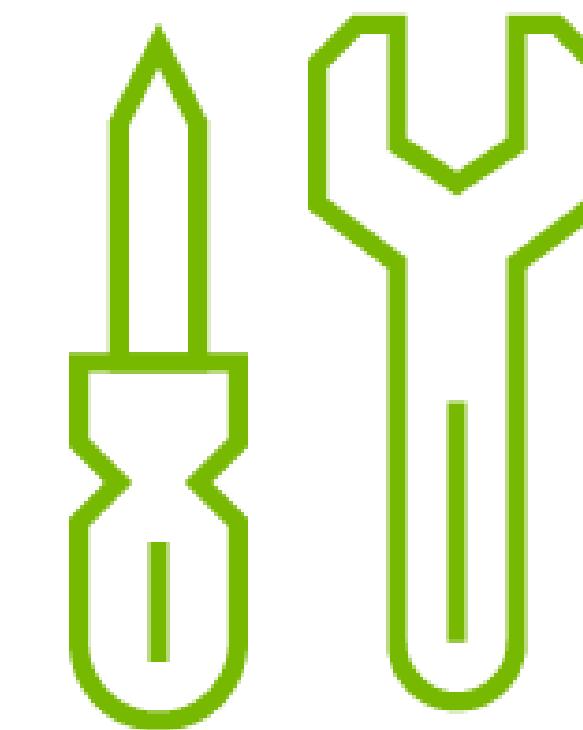
[Network Troubleshooting with NetQ – NVIDIA AIR pre-built demo](#)



CUSTOMER PRESENTATION



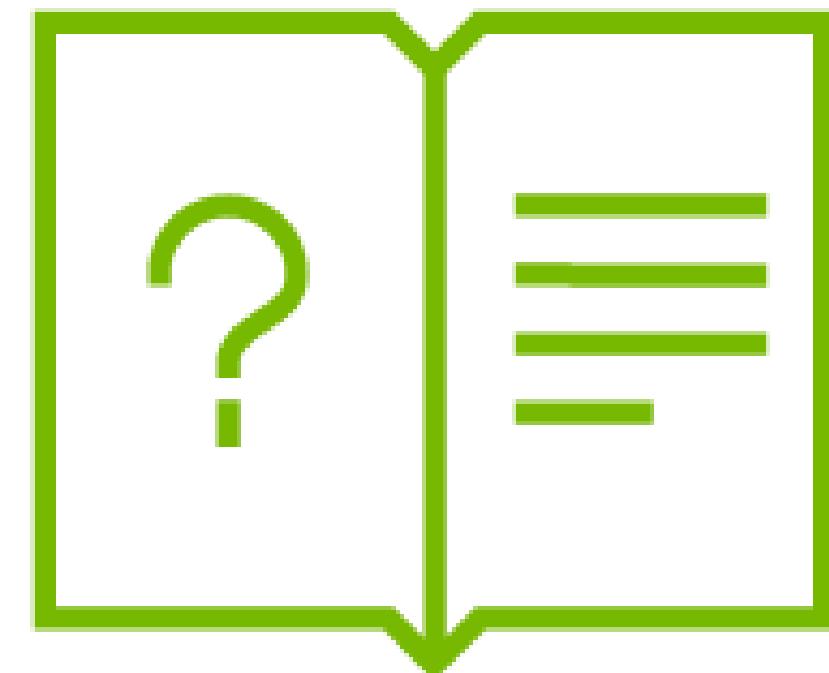
TECHNICAL PRESENTATION



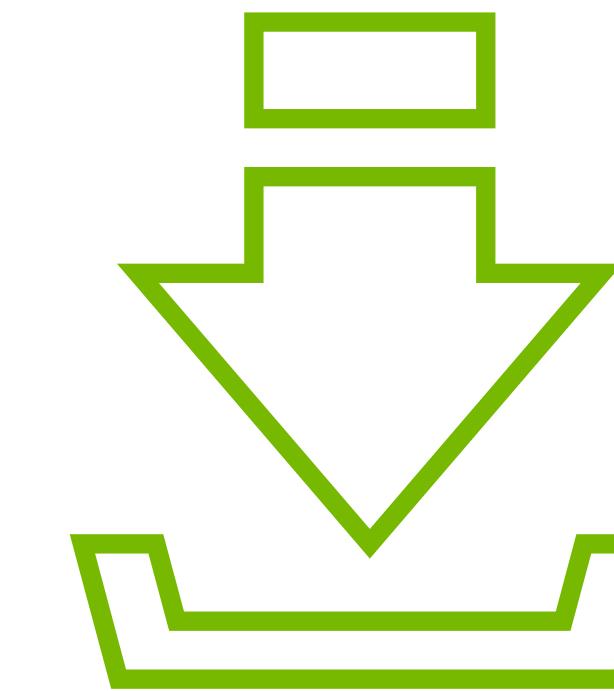
USER GUIDE



WEBSITE



DATASHEET



SOFTWARE DOWNLOADS

