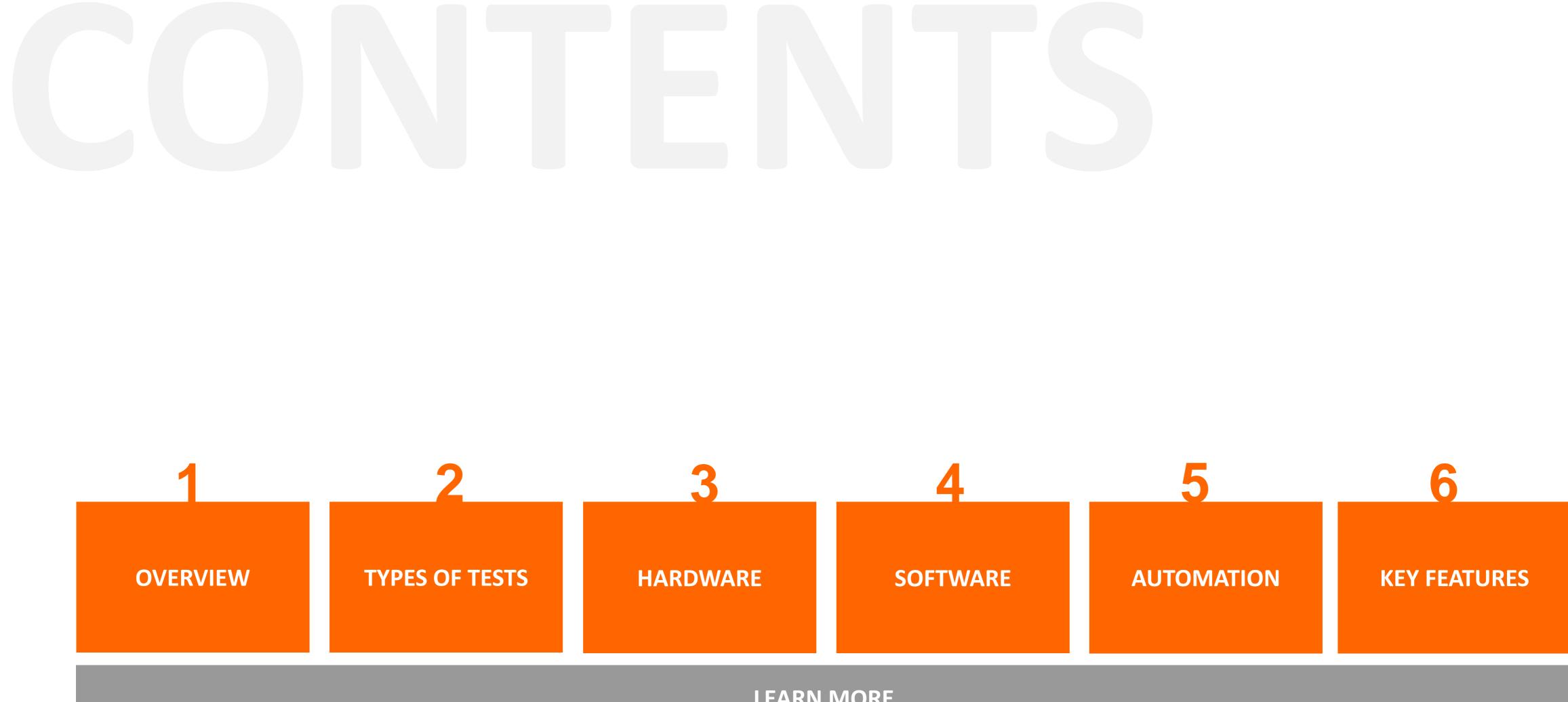
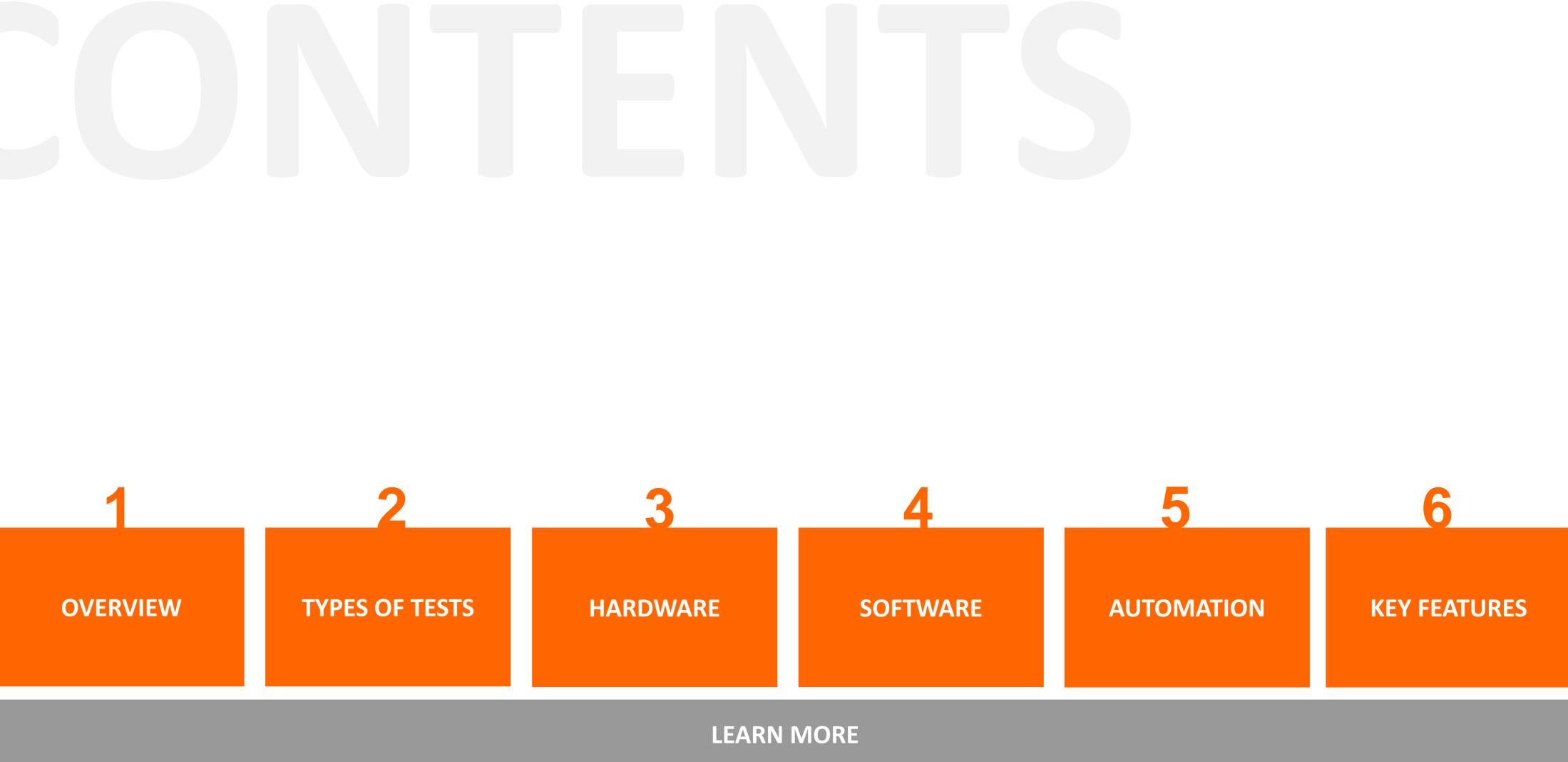
# VALKYRE TM

Probably the world's best stateless Ethernet traffic generation and analysis platform









# OVERVIEW

Valkyrie is a full-featured stateless traffic generator and analysis platform. It is used to configure and generate Layer 2-3 Ethernet traffic - at all speeds up to 400GE - and analyze how network devices and services perform in response. This makes it ideal for most lab-based data-plane test scenarios.







# OVERVIEW Valkyrie and you

#### WHO USES VALKYRIE?

•	NEMs	•	Switche
•	Government & Defense	٠	Wireline
•	Semiconductors	٠	NICs
•	Automotive & Aerospace	٠	GPON D
•	Network Service Provider	٠	Cable m
•	Energy & Utility	٠	Packet E
•	Finance	٠	Transce
•	Academia	•	ASIC em



### WHAT DUTS CAN YOU TEST?

- S
- ne & Wireless Networks
- Devices
- nodems
- Brokers
- eivers and Cables
- ASIC emulators

#### WHAT TYPES OF TESTING?

- Performance Testing
- Functional Testing
- QoS and Service Validation
- Security
- Convergence
- Quality Assurance Testing

# Why choose Valkyrie

### **PRICE/PERFORMANCE**

- Competitive HW prices
- Free SW licenses
- 3 years' free SW updates
- 3 years' HW warranty
- Free lifetime tech support

### EASE OF USE

- Intuitive UI ("2-clicks" to get a stream running)
- Simple licensing system
- Fast, smooth chassis software upgrade process
- Multi-user platform with port reservation resolution down to one port per user



#### **OVERVIEW**

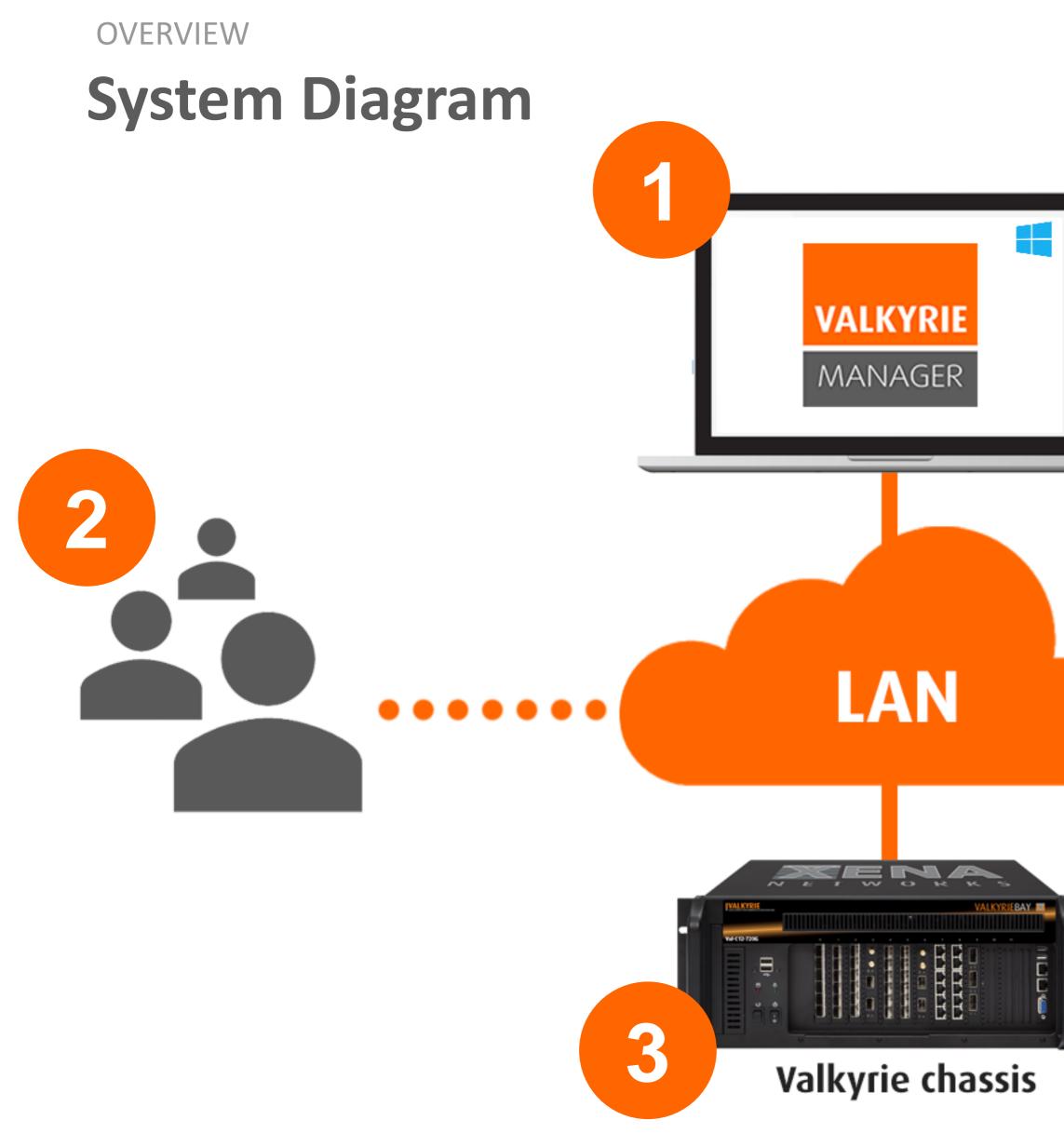
#### **UNIQUE PRODUCT FEATURES**

- Industry's only UI integrated Traffic Generation & Impairment solution (Valkyrie & Chimera)
  - Industry's best automation & scripting options (same CLI and RESTapi commands across all port speeds)
- Test both PAM4 based speeds (400GE, 200GE, 100GE, 50GE) and NRZ based speeds (100GE, 50GE, 40GE, 25GE, 10GE) with 1 test module (Thor-400G-7S-1P)

#### **ROCK SOLID PLATFORM**

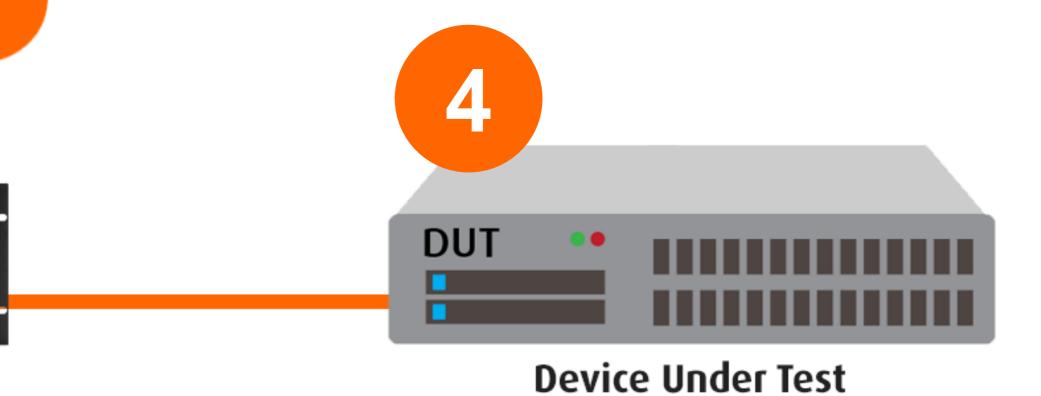
- Very robust chassis platform (Linux), runs "forever", supporting +40-day test cases
- Compact 1U ValkyrieCompact chassis covers all NRZ & PAM4 speeds up to 400GE
- Very precise and accurate traffic generation
- Industry's best traffic scheduler







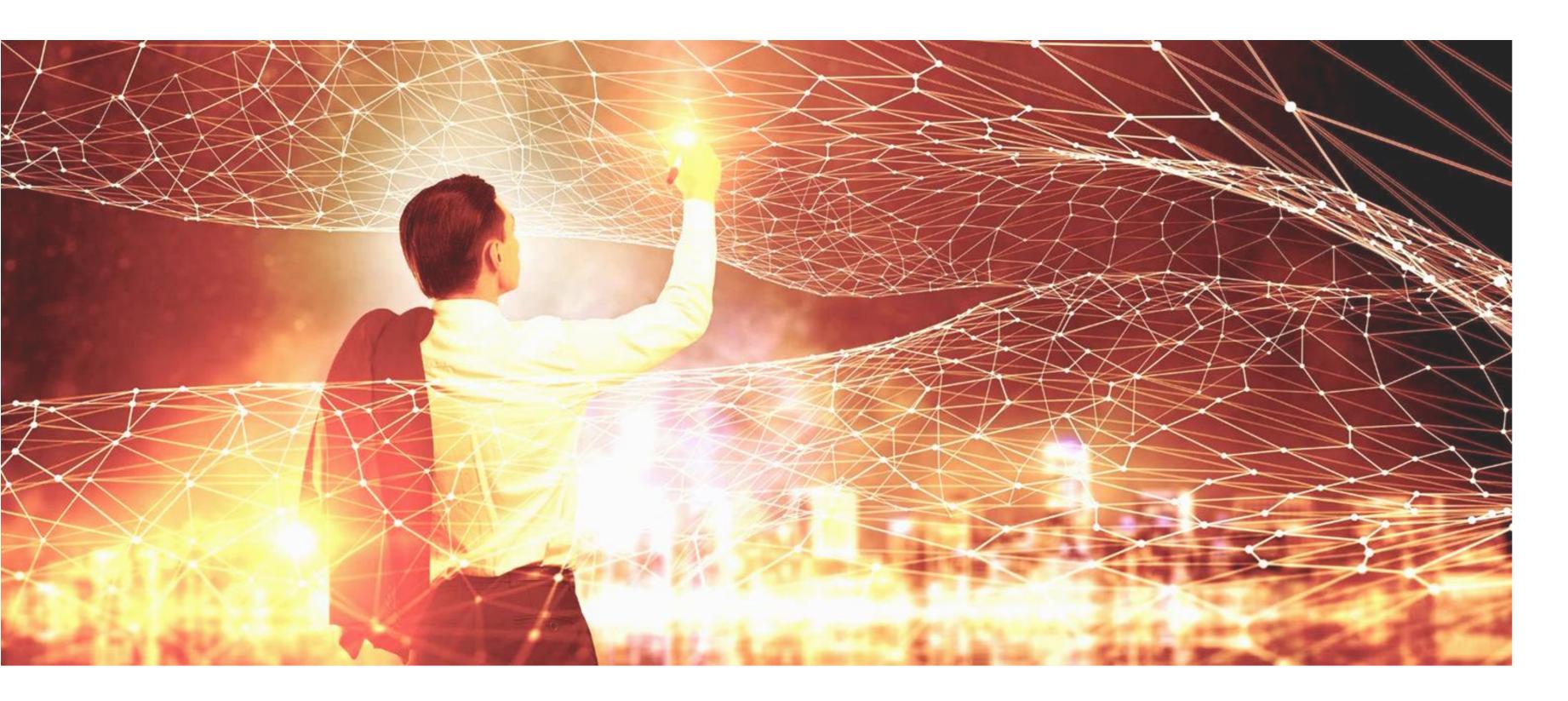
- 1. Valkyrie software includes the main management app, 4 standalone apps, plus automation & CLI scripting tools
- 2. Multiple users in different locations can use Valkyrie to monitor test results on different devices simultaneously.
- 3. Valkyrie offers a wide range of hardware components multiple chassis options and test modules for all scenarios from 10/100Mbps to high-port density 400GE testing
- 4. Valkyrie is used for different types of tests on many different DUTs



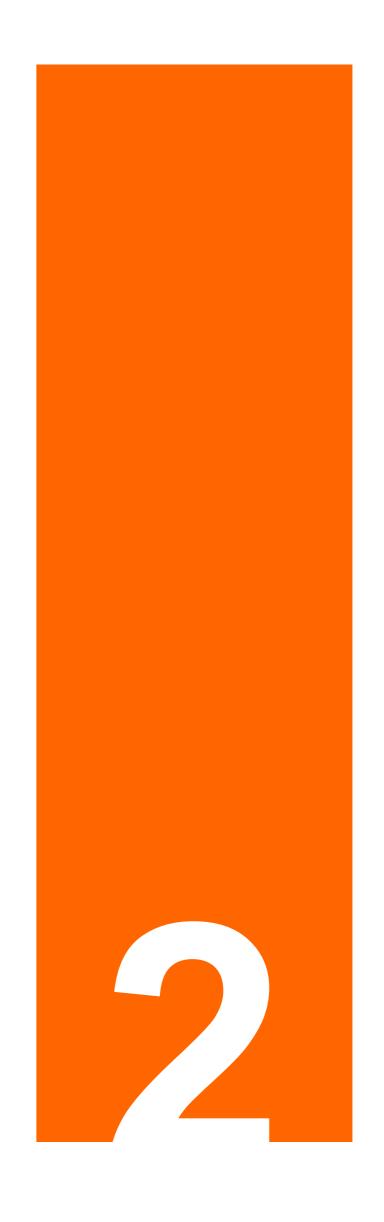
ent

# **TYPES OF TESTS**

Valkyrie is typically used for these core test solutions







# TYPES OF TESTS **Performance Testing**

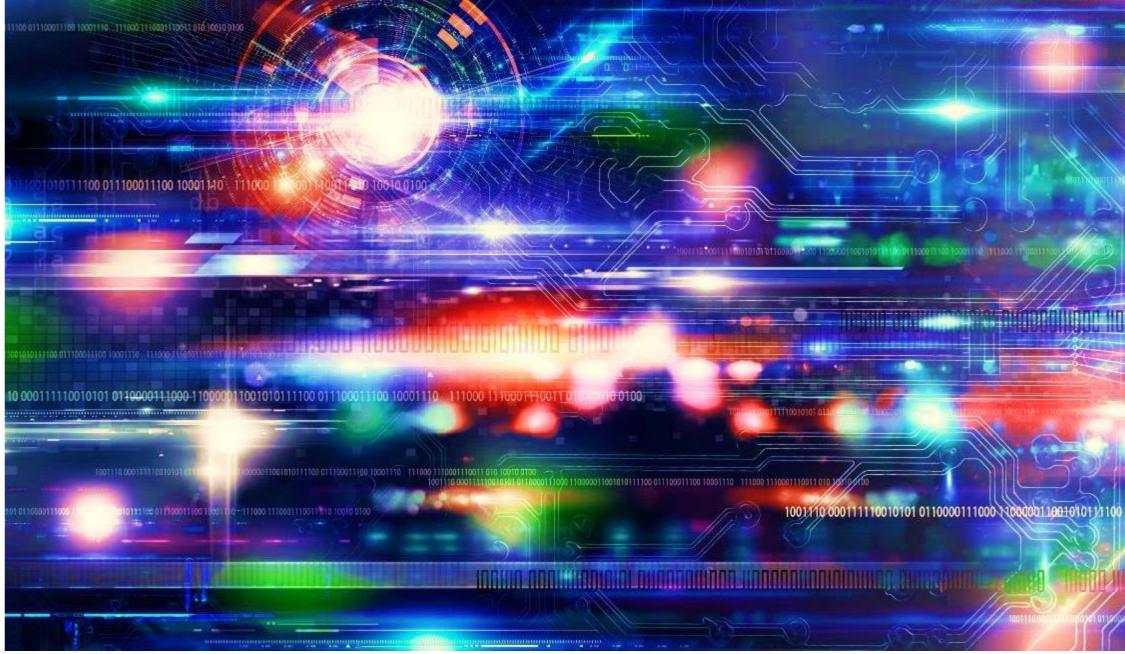
Performance testing focuses the performance of a DUT via parameters like maximum throughput, latency and jitter.

Valkyrie provides comprehensive generation and analysis of Ethernet traffic including analysis of throughput, latency, jitter, loss, sequence, and misorder errors. Results can be presented in easy to understand tables, charts and histograms and documented in customizable reports.

WHITE PAPERS \_\_\_\_\_

VSPERF





- Stream Oriented Traffic generation and reception
- Statistics tracked per stream, or user-defined packet header filters
- Analysis of throughput, latency, jitter, loss, sequence, and misorder errors
- Generate 100'k unique traffic flows using Modifiers
- Generate stream based on import of PCAP files
- Real-time performance logging with charting and histograms
- Reporting in PDF or HTML files
- Polling of counters with logging to CSV or XML file
- Wire-speed and event triggered packet capture and export to Wireshark





- Multicast
- 40/100/400G PCS and PMA Layer
- Energy Efficient Ethernet (EEE)
- Microbursts and random IFG
- Custom packet headers via templates or fully user specified
- Easy to use graphical (UI) based scheduling function

#### WHITE PAPERS \_\_\_\_\_



Microburst

# TYPES OF TESTS **Functional Testing**

Functional testing verifies the basic functionality of the DUT and will depend on the DUT and the application.

Valkyrie provides a wide range of features for functional testing, including PCS and PMA Layer testing and microbursts and random IFG testing.

Automotive Ethernet

2,5 & 5GE to the test

The case for 25 & 50 GE



# TYPES OF TESTS Certification & Interoperability

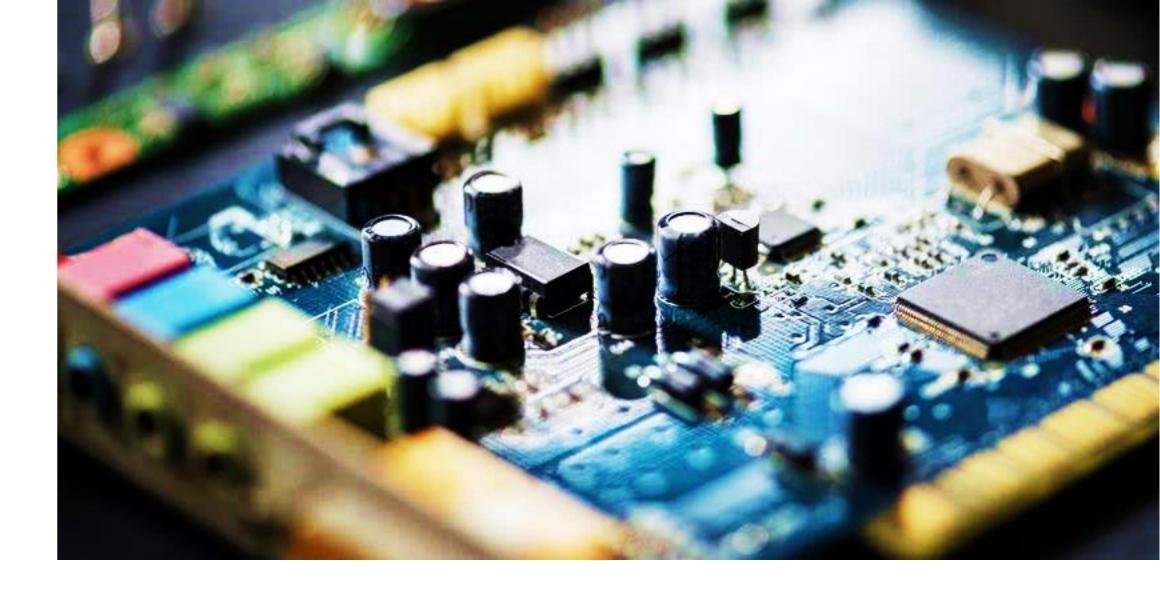
Being able to verify and document that devices and services meet international standards for performance and interoperability is an important test scenario.

Xena participates regularly in interoperability testing events.

Valkyrie is used for certification testing of G.fast per IR-337 which provides a set of functional, stability, and basic performance test cases and related pass/fail requirements for G.fast implementations according to ITU-T Recommendations G.9700 and G.9701.

For GPON devices, Valkyrie is used to perform the tests described in the Broadband Forum's specification OD-247/IR-247.





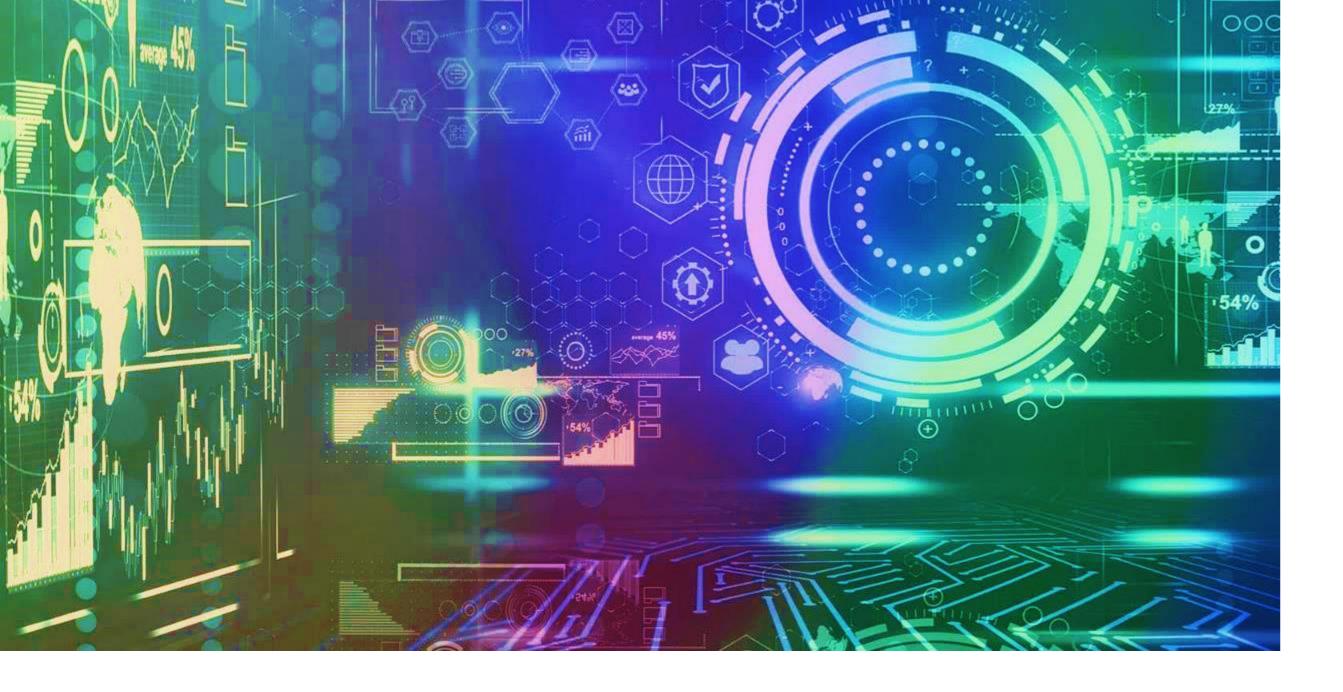
Valkyrie is used for certification & interoperability testing:

- G.fast per ID-337
- GPON per TR-247/ATP-247/TR-255

WHITE PAPERS \_\_\_\_\_

GPON Testing

G.fast



Quality Assurance (QA) gives companies a systematic way to maximum consistent product quality by minimizing errors and mistakes in products. QA testing typically includes stress testing of environmental conditions, e.g. EMC tests, mechanical drop and shock tests, heat and humidity tests.

When testing Ethernet products Valkyrie is used to generate Ethernet traffic from outside a test chamber into the DUT to verify it performs as expected. Other features like timestamping of results and industry-leading automation options make Valkyrie ideal for QA testing.



# TYPES OF TESTS **Quality Assurance Testing**

- RFC2544
- Throughput analysis
- Lost packets statistics
- Latency analysis

WHITE PAPERS \_\_\_\_\_

Quality Assurance



# **TYPES OF TESTS QoS & Service Validation**

Valkyrie offers QoS validation solutions in accordance with RFC 2544 and Y.1564, as well as advanced statistics functions that help users track, analyze and troubleshoot QoS to maintain a high service quality guarantee.

ValkyrieManager offers charting, histogram and latency/jitter analysis of test traffic. Testing that link performance complies with a Service Level Agreement (SLA) includes verifying Frame Transfer Delay (FTD), Frame Delay Variation (FDV) and Frame Loss Ratio (FLR) at the Committed Information Rate (CIR) defined in the SLA.

Verifying the SLA with Valkyrie1544 allows doing the test on a line simultaneously loaded with traffic from other services.

WHITE PAPERS \_\_\_\_\_



Latency & Jitter

Time Synchronization



- Charting and histograms
- Background traffic injection
- Jitter analysis
- One-way latency analysis
- Inline measurements mode

- ITU-T Y.1564
- Live Monitoring
- Proactive Testing
- Wholesale Ethernet
- Performance Logging

Quality of Service

SD-WAN





Xena offers QoS validation solutions in accordance with RFC 2544 and Y.1564, as well as advanced statistics functions that help users track, analyze and troubleshoot QoS to maintain a high service quality guarantee.

Testing that link performance complies with a Service Level Agreement (SLA) includes verifying Frame Transfer Delay (FTD), Frame Delay Variation (FDV) and Frame Loss Ratio (FLR) at the Committed Information Rate (CIR) defined in the SLA. Verifying the SLA with the Valkyrie1564 allows doing the test on a line simultaneously loaded with traffic from other services.

WHITE PAPERS \_\_\_\_\_



Latency & Jitter

# TYPES OF TESTS Benchmarking

Valkyrie is used for benchmarking in accordance with:

- RFC2544
- RFC2889
- RFC3918
- Vsperf
- Y.1564

Time Synchronization Quality of Service

SD-WAN

# TYPES OF TESTS Security

Security testing is usually conducted during development to reveal how a DUT handles abnormal conditions.

WHITE PAPERS \_\_\_\_\_



DDoS



• Traffic that mimics various types of DDoS attacks

Very high traffic loads

•

Undersized and oversized frames

Non-standard Inter-Frame-Gaps

- Deviation of the Ethernet signal frequency
- Insertion of L2/3 packet level errors
- Insertion of PCS Layer Errors
- Emulation of fragment Overlap



Many network topologies provide resiliency to protect network services. Resilience typically means re-routing traffic away from a faulty line section. However re-routing connections can result in frame loss. This is defined in standards for spanning and routing protocols, such as G.8031/G.8032, MPLS protocols and others.

When traffic with a given transmitted frame rate is sent through the connection during re-routing, ValkyrieManager can measure the packet loss and calculate the convergence time.

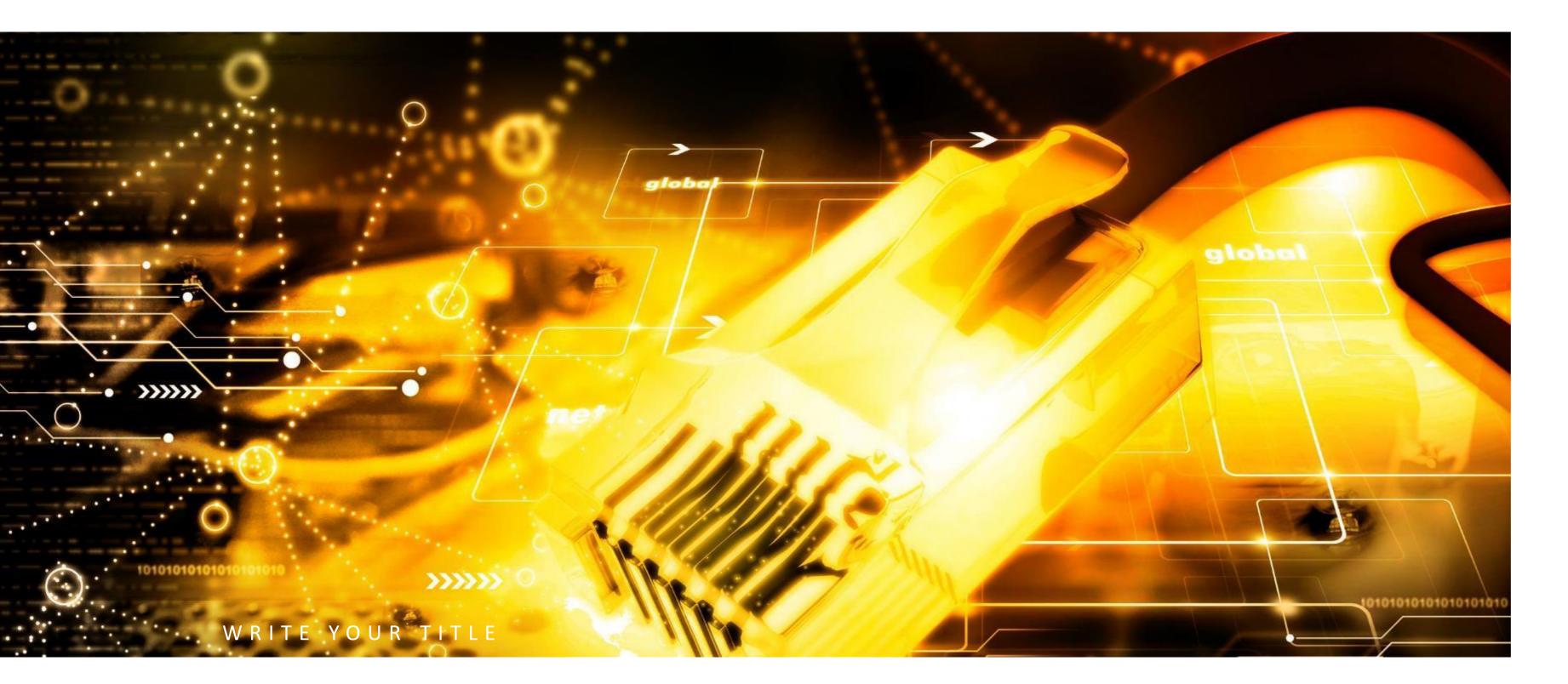


# TYPES OF TESTS Convergence

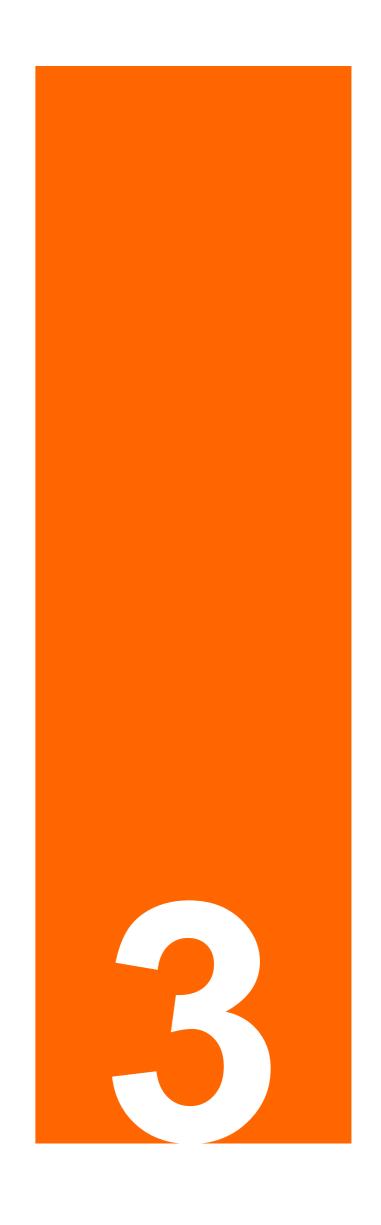
ValkyrieManager does link sync gap monitoring and measurement with microsecond precision

# HARDWARE

Different chassis and test modules options to fit all needs.







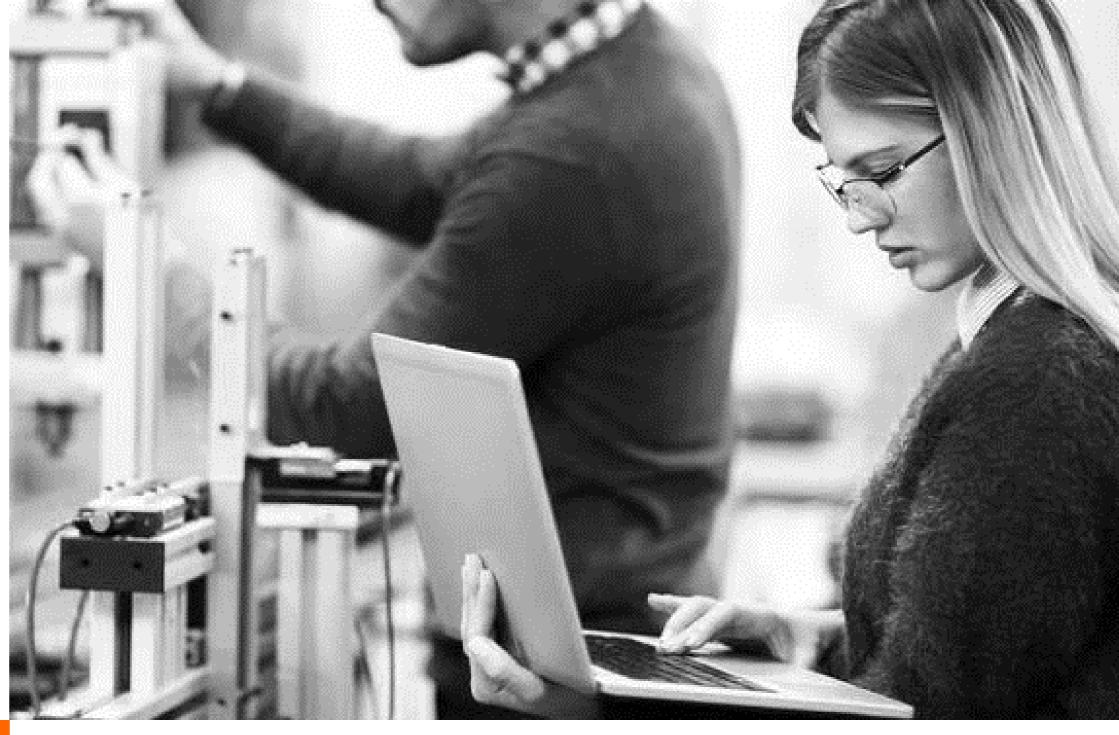
# hardware ValkyrieBay



## **Physical Specifications**

High port density: 12 slots in a 4U high chassis Multi-user: one user per port
6.7" (H) x 17" (W) x 17.9" (D) (17 x 43.5 x 45cm)
35 lbs (16 kg) with no test modules installed Low noise: Max. 58.5 dBa





### **Extreme Performance**

Reach 2.4 terabit test fabric in just one ValkyrieBay Chassis with:

6 x Thor-400G-7S-1P test modules or 12 x Loki-100G-5S-2P test modules.



# HARDWARE ValkyrieBay Comparison

	Val-C12-720G
400GE	N/A
200GE	N/A
100GE	12 x LR4/SR4/CDWM4 /CR4
50GE	24 x LR2/SR2/CR2
40GE	12 x QSFP+ (or 6 x LR4 / 12 x SR4)
25GE	48 x LR/SR/CR
10GE	72 x copper ports
5GE	72 x copper ports
2.5GE	72 x copper ports
1GE	72 x copper/optical ports



### Val-C12-2400G

6 x (QSFP-DD) SR8/FR8/LR8/CR8/DR4

12 x (QSFP56) DR4/SR4/FR4/LR4/CWDM4/CR4 (6 CR8)

24 x LR4/SR4/CDWM4 /CR4/SR2/CR2/DR (8 x SR10)

48 x LR2/SR2/CR2/SR/CR

24 x LR4/SR4/CR4

96 x LR/SR/CR

96 x optical ports, 72 copper ports

72 x copper ports

72 x copper ports

72 x copper/optical ports

# HARDWARE ValkyrieCompact



### **Physical Specifications**

Supports all Xena test modules Multi-user: one user per port

1 slot and 1 rack unit (RU) high 1.7" (H) x 17" (W) x 9.8"(D) (5 x 43.5 x 25cm) 10 lbs (4.5 kg) Low noise: Max. 49 dBa







Lightweight flightcase available

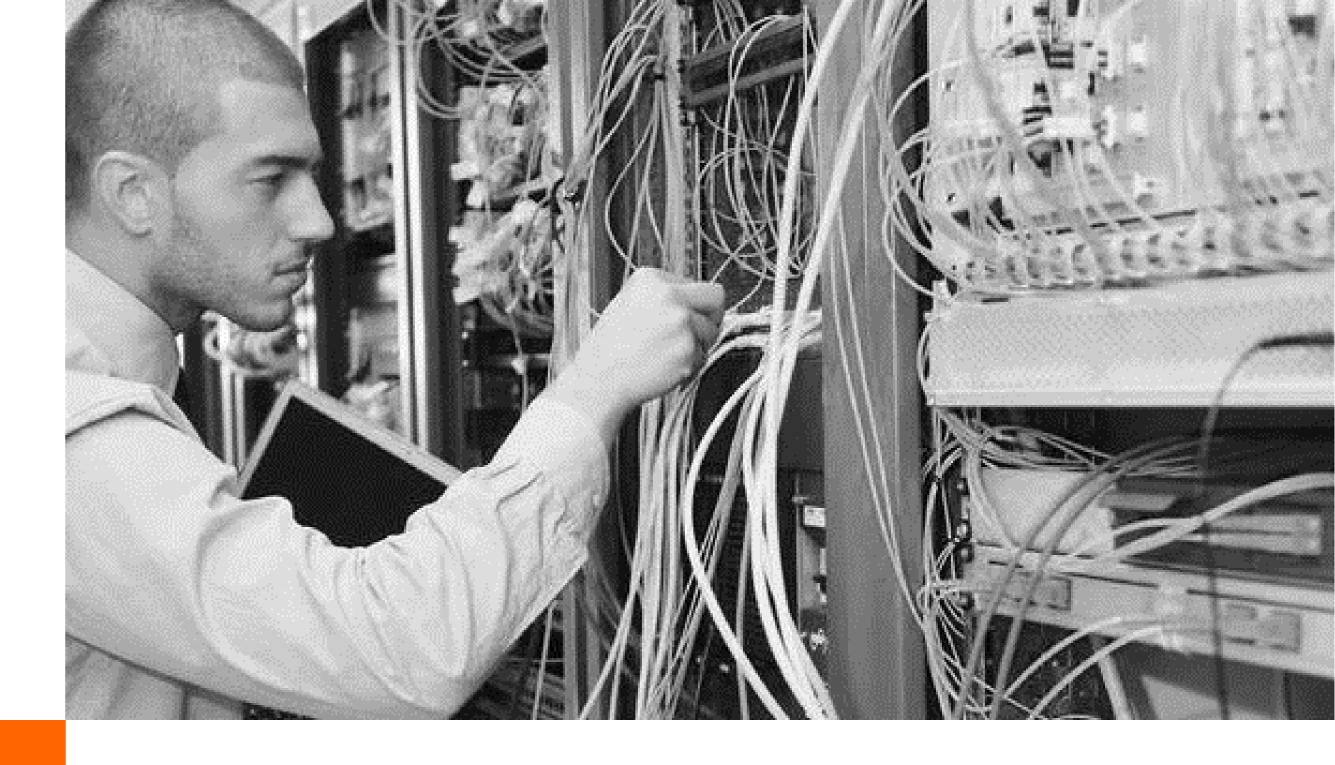
# HARDWARE Valkyrie Test Modules



### **Specifications**

13 different test modules Support for all Ethernet speeds and interfaces Unique multi-speed / media capabilities





# HARDWARE Valkyrie Test Module Speeds

	<1GE	1GE	2.5GE
ODIN-1G-3S-6P	$\checkmark$	$\checkmark$	
ODIN-1G-3S-6P-E	$\checkmark$	$\checkmark$	
ODIN-5G-4S-6P-CU	$\checkmark$	$\checkmark$	$\checkmark$
ODIN-10G-1S-2P			
ODIN-10G-1S-6P			
ODIN-10G-3S-6P-CU	$\checkmark$	$\checkmark$	
ODIN-10G-5S-6P-CU	$\checkmark$	$\checkmark$	$\checkmark$
C-ODIN-10G-4S-2P-COMBI*	$\checkmark$	$\checkmark$	
ODIN-40G-2S-2P			
LOKI-100G-3S-1P			
LOKI-100G-5S-1P			
LOKI-100G-5S-2P			
THOR-400G-7S-1P			



5GE	10GE	25GE	40GE	50GE	100GE	200GE	400GE
$\checkmark$							
	$\checkmark$						
	$\checkmark$						
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$\checkmark$	$\checkmark$						
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	$\checkmark$		$\checkmark$				
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	$\checkmark$						

\*Exclusively available in the ValkyrieCompact chassis

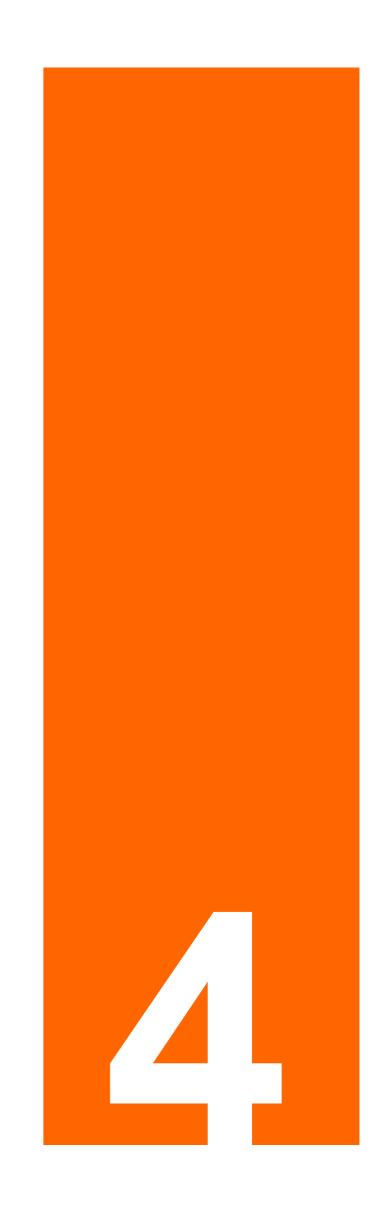
# SOFTWARE

We work hard to make sure your job easy. All our software is designed to be intuitive and user-friendly.



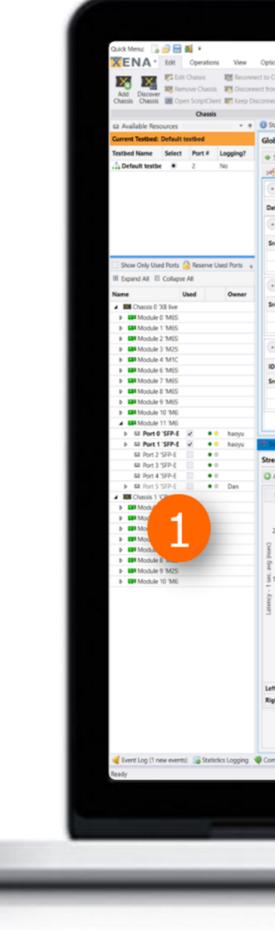


 $(\uparrow)$ 



# SOFTWARE User Friendly UI

- 1. Easy to use "tree" structure for managing test bed of chassis, modules and ports.
- 2. Top ribbon provides instant access to commonly used functions.
- 3. Color-coding and tool tips are included to make user-interface very intuitive.
- 4. Graphical elements help testers quickly scan results. Panels can also be dragged free of main UI for testing convenience.
- Convenient reporting options make it easy to export and document results.





		hyuxmcfg - XenaManager-2G v1.41			- @ ×
ions Tools Chassis					^ Ø
	ation Grid 📮 Stream Configuration Grid 🚧 Global Statistics 💱 Fibers 🛔	📓 Capture 💼 Histograms			×
bal Statistics (2 Ports, 2 Streams)		🗐 Mark 🔚 Save 🗯 Clean Inactive		All Ports as	nd Streams in Current Testbed
Start Traffic 🥃 Stop Traffic 🔍 Running Time: 000000 Stop At: Port Statistics 🔰 Stevam Statistics	2 000000 Cear Counters	ng Mark 📷 Save 📷 Clean Inactive			
Aggregated Stream Statistics					
a Pager: H + 1 + H				Page 1	of 1 Rows per Page: 10 🗘
Stream Traffic Statistics					_
CPort         SID         Dest.Port         TID         Description           Port Q/11/1         0         Port Q/11/0         8         Stream number 0           Port Q/11/0         0         Port Q/11/1         6         Stream number 0			RX (bytes)         RX (packets)           148,009         1,550,947,706,304         24,233,557,911           148,009         1,550,947,637,440         24,233,556,835		
Stream Errors         StD         Dest.Port         TID         Description           Port Q/11/1         0         Port Q/11/0         8         Stream number 0           Port Q/11/0         0         Port Q/11/1         6         Stream number 0	(TX-RX)         Lost Packets         Misordered         Payload Error           (running)         0         0         0           (running)         0         0         0	BER (aggr)         BER (curr)           0         0.00000-0000         0.00000-0000           0         0.00000-0000         0.00000-0000			
Latency and Jitter					
0 10	RX LATENCY	RX JITTER Mi CurrRn ApgrM ApgrA: ApgrM ApgrRi CurrN			
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# 





# SOFTWARE ValkyrieManager

The main software of the Valkyrie line, it's the one you'll use most of the time

Windows-based application to configure and generate streams of Ethernet traffic between your Valkyrie tester and devices under test (DUTs) and then analyze the results.



# SOFTWARE Valkyrie Test Suites



Supports the 4 test-types specified in RFC2544. There are extensive configuration options, support for single stream and multi-stream testing and you can define protocol layers supported by the test (Ethernet, Customer and Service VLANs, IP and UDP) precisely the way you want.



For validating Ethernet service-level agreements (SLAs) in a single test per Y.1564. It supports multiple protocols per UNI (Ethernet, Customer and Service VLANs, MPLS, IPv4, IPv6, and UDP) and you can define Per-UNI or per-CoS bandwidth profiles and specify CoS-to-DSCP mapping.





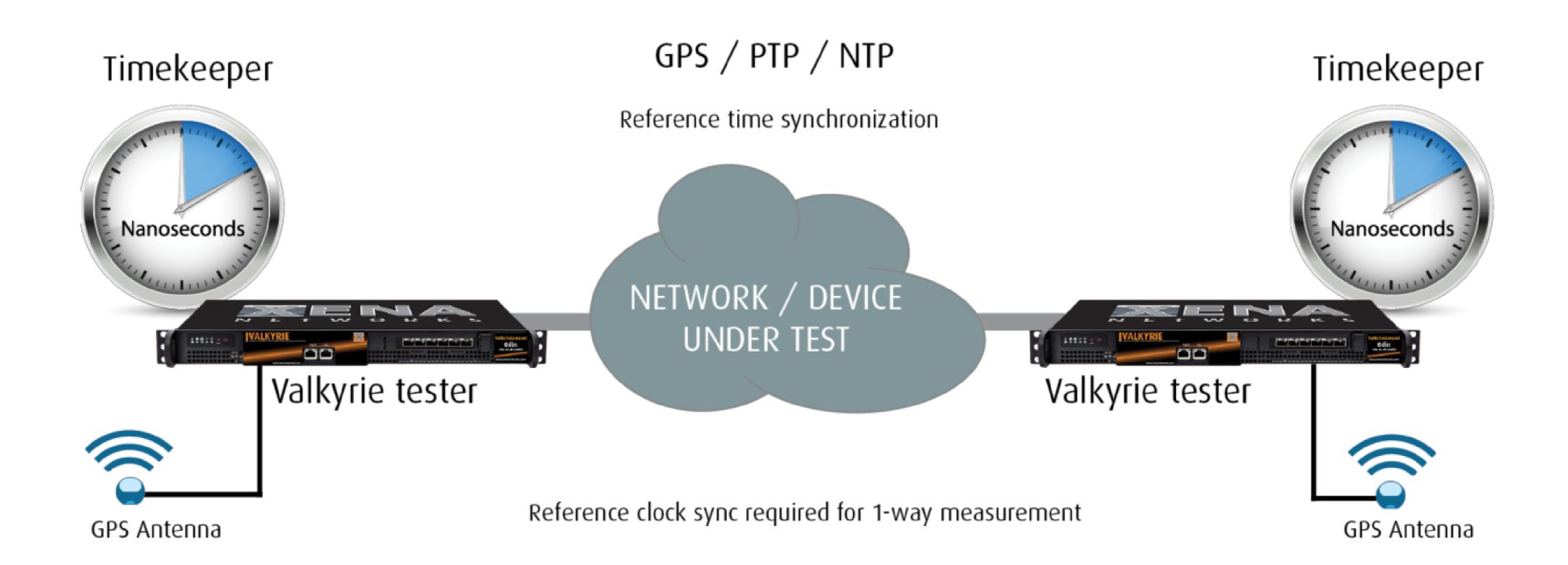
For accurately benchmarking the performance of Layer 2 LAN switches according to RFC 2889 tests. Incl. all throughput and forwarding rate tests, congestion control, address caching capacity, address learning rate, broadcast frame forwarding and latency, forward pressure and max. forwarding rate.



For advanced IP multicast network testing using various frame sizes, either as in-test variations or as multiple test runs each using a fixed frame size. Unicast and multicast traffic can be configured to use the exact protocol headers needed.

# SOFTWARE ValkyrieTimeSynch

For One-Way Latency (OWL) measurements, synchronized traffic start and accurate timestamping.



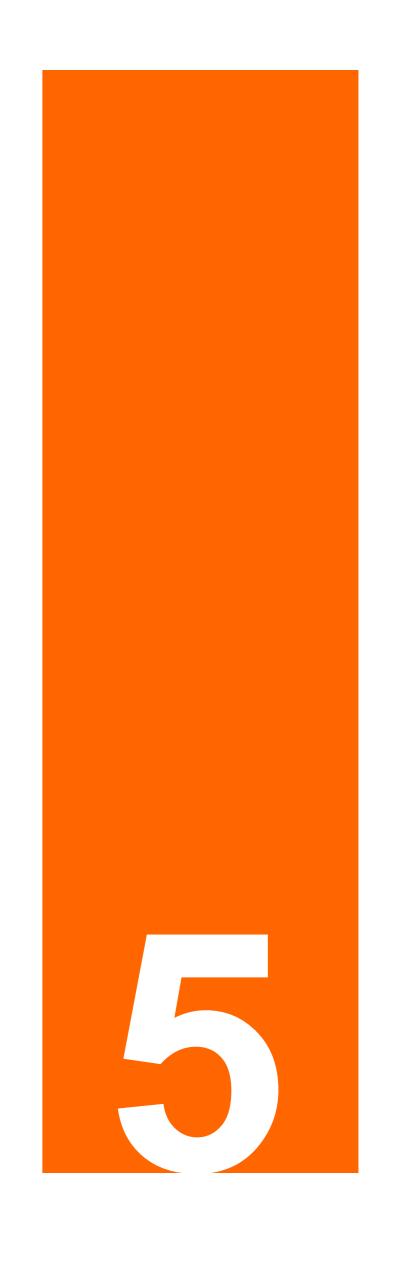


# AUTOMATION

Valkyrie boasts the best test automation & scripting options







# SOFTWARE ValkyrieCLI





ValkyrieCLI supports multiple concurrent scripting sessions by different users in different locations.

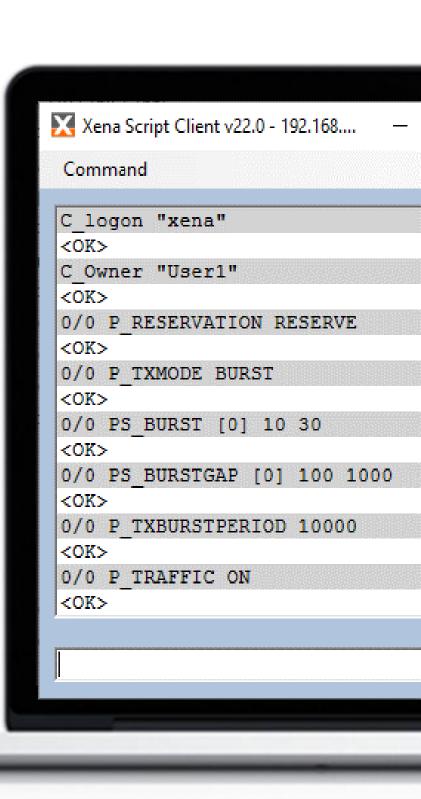
ValkyrieCLI is a command-line-interface (CLI) scripting API with hundreds of scriptable parameters. Any client platform can be used (e.g. Python, Tcl, Bash). View samples on GitHub





The best test automation tool in the industry







# SOFTWARE Valkyrie REST API



### **Top features**

Client-less, language-agnostic, out-of-the-box, chassis embedded REST server.

Lets you build automation scripts with your choice of language, tool and client environment.

Supports all Valkyrie CLI commands and adds many more abstract operations (like returning statistics as ready-to-consume JSON) that simplify and speed up automation development.

### Full Python object-oriented REST client

Enables Python developers to simply pip install it and start building automation scripts without spending time on developing the traffic generator layer.

### More information:

How to build client apps using Valkyrie REST Server







#### **DOCUMENTATION**

Step-by-step guides on how to automate Xena test suites and explore scripting for stateless platforms.

#### DRIVERS & SCRIPTS

Find and download drivers and scripting examples in scripting languages.



SOFTWARE **Xena Automation Resources** 





### **PLATFORMS**

Learn about commercial and open source platforms and frameworks that support Xena's Ethernet test solutions.

### **PROJECTS**

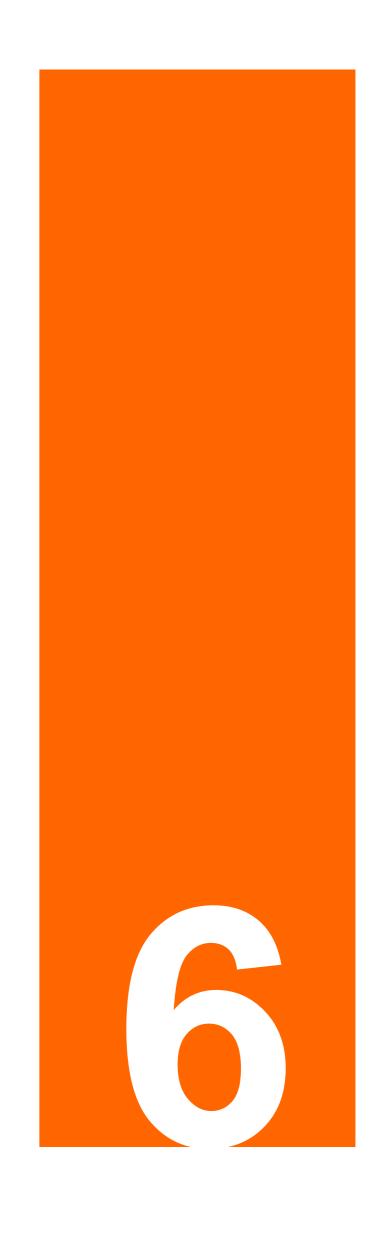
Read about Xena's work with Open Platform for NFV (OPNFV) community on the vSwitch Performance (VSPerf) project.

# **Key Features**

These are Valkyrie's most powerful technical features.



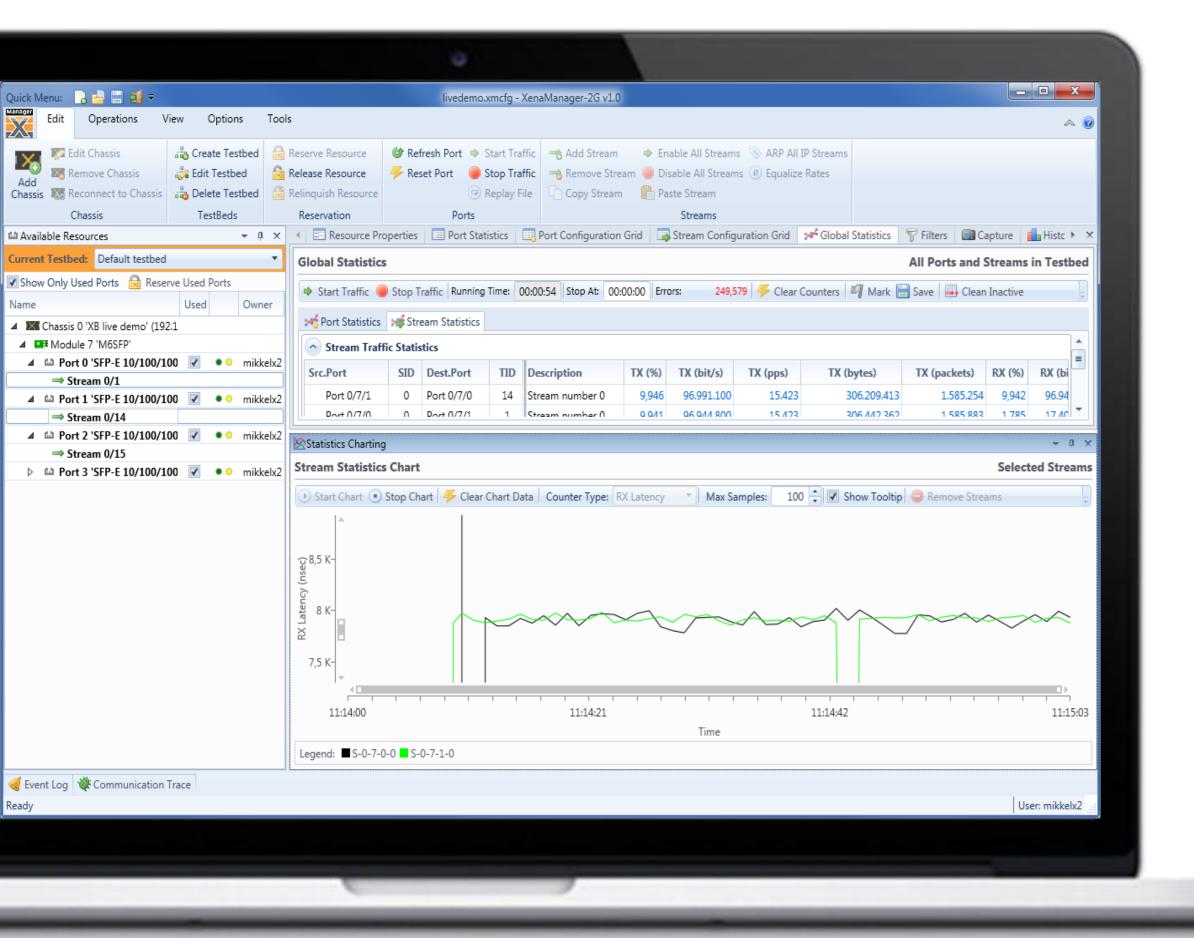




# KEY FEATURES User Friendly and intuitive UI

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Expand All      Collapse All	Stream Errors	
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Image: Chassis 0 'X8 live     Module 0 'M6Si	Src.Port         SID         Dest.Port         TID         Description         (TX-RX)         Lost Packets         Misordered         Payload Error:         BER (aggr)         BER (curr)           Port 0/11/1         0         Port 0/11/0         8         Stream number 0         (running)         0         0         0.000E+000         0.000E+000	
Module 0 Mbs     Module 1 M6Si	Port 0/11/1         0         Port 0/11/1         6         Stream number 0         (running)         0         0         0         0.000E+000           Port 0/11/0         0         Port 0/11/0         6         Stream number 0         (running)         0         0         0.000E+000         0.000E+000	
Module 2 M65		
Module 3 'M2Si	* Latency and Jitter	
Module 4 'M1C     Module 6 'M6Si	ID ID RX LATENCY RX JITTER	
Module 6 Miss  Module 7 M6S	Src.Port SID Dest.Port TID Description AggrA AggrA AggrA AggrA AggrA CurrMi CurrAv CurrM: CurrAn AggrA AggrA AggrA AggrA CurrMi CurrAv CurrAv CurrMi CurrAv CurrAv CurrAv CurrMi CurrAv CurrAv CurrMi CurrAv	
Module 8 'M6Si	Port 0/11/1 0 Port 0/11/0 8 Stream number 0 2,320 2,524 4,168 1,848 2,320 2,523 2,632 312 0 108 1,752 1,752 24 109 240 216	
Module 9 'M6S	Port 0/11/0 0 Port 0/11/1 6 Stream number 0 2,368 2,460 4,216 1,848 2,368 2,466 2,560 192 0 64 1,752 1,752 24 64 120 96	
Module 10 'M6:     Module 11 'M6:		
▷ A Port 0 'SFP-E ✓ ● ● haoyu		
Port 1 'SFP-E	🖉 Statistics Charting	x
Port 2 'SFP-E      O     Port 3 'SFP-E      O	Stream Statistics Charts	All Streams in Current Testbed
A Port 4 SFP-E	🔾 Add Chart 🤤 Remove All Charts 🕕 Start Charting 🕕 Pause Charting 🗮 Snapshot (All) 🛃 Clear Chart Data 🛛 Max Samples: 100 🗘 🗹 Show Tooltip	
Port 5 'SFP-E' Oan		🗹 Select All 🔲 Deselect All 🔚 Snapshot 🛞 Add 2nd 🛞 Remove 2nd 🥥 Remove Chart 🖂 🖉
A Ba Chassis 1 'CPH RE	Latency - 1 sec. avg (nsec) / Jitter - 1 sec. avg (nsec)	M Select All E Deselect All Spansbot 100 Add 2nd 100 Remove 2nd 100 Remove Chart E
	2.4-	
Module 0 'M1C     Module 2 'M2X	3 K	P-0-11-0/T:8: 08:39:42 / 2,524
CHA Module 0 MTC     CAA Module 2 M2X     CAA Module 3 M2S	3 K -	P-0-11-0/T:8: 08:39:42 / 2,524 P-0-11-1/T:6: 08:39:42 / 2,465
Andule 2 TM2X     Andule 3 TM2S     Andule 3 TM2S     Andule 4 TM1C		P-0-11-0/T:8: 08:39:42 / 2,524
Clif Module 2 'M2X     Clif Module 3 'M2S     Clif Module 4 'M1C     Clif Module 6 'M6S		P-0-11-0/T38: 08:39:42 / 2,524 P-0-11-1/T36: 08:39:42 / 2,465 P-0-11-0/T38: 08:39:42 / 108 -100
Gli Module 2 'M2X     Gli Module 3 'M2S     Gli Module 4 'M1C	2.5 K- (00) 2 K- 66	P-0-11-0/T:8: 08:39:42 / 2,524 P-0-11-1/T:6: 08:39:42 / 2,465 P-0-11-0/T:8: 08:39:42 / 108 P-0-11-1/T:6: 08:39:42 / 64
Cla Module 2 M2X     Cla Module 3 M2S     Cla Module 4 M1C     Cla Module 6 M6S     Cla Module 8 M6S	2.5 K- () 2 K- 0 1.5 K-	P-0-11-0/T38: 08:39:42 / 2,524 P-0-11-1/T36: 08:39:42 / 2,465 P-0-11-0/T38: 08:39:42 / 108 P-0-11-1/T36: 08:39:42 / 64
Sill Module 2 TM2X     Sill Module 3 TM2S     Sill Module 3 TM2S     Sill Module 4 TM1C     Sill Module 6 TM6S     Sill Module 8 TM6S     Sill Module 9 TM2S	2.5 K- () 20 2 K- 0 2 K- 0 0 0 0 0 0 0 0 0 0 0 0 0	P-0-11-0/T38: 08:39:42 / 2,524 P-0-11-1/T36: 08:39:42 / 2,465 P-0-11-0/T38: 08:39:42 / 108 P-0-11-1/T36: 08:39:42 / 64 60 000 60 00000000
Eli Module 2 TM2X     Eli Module 3 TM2S     Eli Module 4 TM1C     Eli Module 6 TM6S     Eli Module 8 TM6S     Eli Module 9 TM2S	2.5 K- () 2 K- 0 1.5 K-	P-0-11-0/T38: 08:39:42 / 2,524 P-0-11-1/T36: 08:39:42 / 2,465 P-0-11-0/T38: 08:39:42 / 108 P-0-11-1/T36: 08:39:42 / 64 00 000 06
Eli Module 2 TM2X     Eli Module 3 TM2S     Eli Module 4 TM1C     Eli Module 6 TM6S     Eli Module 8 TM6S     Eli Module 9 TM2S	2.5 K- (200 2 K- 00 1 5 K- - 0 1 K- 1 K-	P-0-11-0/T38: 00:39:42 / 2.524 P-0-11-1/T36: 00:39:42 / 2.465 P-0-11-0/T38: 00:39:42 / 108 P-0-11-1/T36: 00:39:42 / 64 -00 000 000 000 000 000 000 000 000 000
>         Image: An and a stress of the	2.5 K- () 20 2 K- 0 2 K- 0 0 0 0 0 0 0 0 0 0 0 0 0	P-0-11-0/T38: 08:39:42 / 2,524 P-0-11-1/T36: 08:39:42 / 2,465 P-0-11-0/T38: 08:39:42 / 108 P-0-11-1/T36: 08:39:42 / 64 00 00 00 00 00 00 00 00 00 00 00 00 00
>         CH4 Module 2 'M2X           >         CH4 Module 3 'M2S           >         CH4 Module 4 'M1C           >         CH4 Module 6 'M6S           >         CH4 Module 8 'M6S           >         CH4 Module 9 'M2S	2.5 K- (200 2 K- 00 1 5 K- - 0 1 K- 1 K-	P-0-11-0/T.8: 08:39:42 / 2,524 P-0-11-1/T.6: 08:39:42 / 2,465 P-0-11-0/T.8: 08:39:42 / 108 P-0-11-1/T.6: 08:39:42 / 64 60 00 06 00 06 00 06 00 06 00 06 00 06 00 06 00 06 00 06 00 06 00 06 00 06 00 06 00 06 00 06 00 06 00 06 00 06 00 06 00 06 00 06 00 06 00 06 00 06 00 06 00 06 00 06 00 06 00 06 00 06 00 06 00 06 00 06 00 06 00 06 00 06 00 06 00 06 00 06 00 06 00 06 00 06 00 06 00 06 00 06 00 06 00 06 00 06 00 06 00 06 00 06 00 06 00 06 00 06 00 06 00 06 00 06 00 06 00 06 00 06 00 06 00 06 00 06 00 06 00 06 00 06 00 06 00 06 00 06 00 06 00 06 00 06 00 06 00 06 00 06 00 06 00 06 00 06 00 06 00 06 00 06 00 06 00 06 00 06 00 06 00 06 00 06 00 06 00 06 00 06 00 06 00 06 00 06 00 06 00 06 00 06 00 06 00 06 00 06 00 06 00 06 00 06 00 06 00 06 00 06 00 06 00 06 00 06 00 06 00 06 00 06 00 06 00 06 00 06 00 06 00 06 00 06 00 06 00 06 00 06 00 06 00 06 00 06 00 06 00 06 00 06 00 06 00 06 00 06 00 06 00 06 00 06 00 06 00 06 00 06 00 06 00 06 00 06 00 06 00 06 00 06 00 06 00 06 00 06 00 06 00 06 00 06 00 06 00 06 00 06 00 06 00 06 00 06 00 06 00 06 00 06 00 06 00 06 00 06 00 06 00 06 00 06 00 06 00 06 00 06 00 06 00 06 00 06 00 06 00 06 00 06 00 06 00 06 00 06 00 06 00 06 00 06 00 06 00 06 00 06 00 06 00 06 00 06 00 06 00 06 00 06 00 06 00 06 00 06 00 06 00 06 00 06 00 06 00 06 00 06 00 06 00 06 00 06 00 06 00 06 00 06 00 06 00 06 00 06 00 06 00 06 00 06 00 06 00 06 00 06 00 06 00 06 00 06 00 06 00 06 00 06 00 06 00 06 00 06 00 06 00 06 00 06 00 06 00 06 00 06 00 06 00 06 00 06 00 06 00 06 00 06 00 06 00 06 00 06 00 06 00 00
>         CR4 Module 2 'M2X           >         CR4 Module 3 'M2S           >         CR4 Module 4 'M1C           >         CR4 Module 6 'M6S           >         CR4 Module 8 'M6S           >         CR4 Module 9 'M2S	2.5 K- (2002) 2 K- 1.5 K- Coupt 1.5 K- 500- 0 -	P-0-11-0/T.8: 08:39:42 / 2,524 P-0-11-1/T.5: 08:39:42 / 2,465 P-0-11-0/T.8: 08:39:42 / 108 P-0-11-1/T.5: 08:39:42 / 64 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0
Sill Module 2 TM2X     Sill Module 3 TM2S     Sill Module 3 TM2S     Sill Module 4 TM1C     Sill Module 6 TM6S     Sill Module 8 TM6S     Sill Module 9 TM2S	25 K- (200) 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0	P-0-11-0/Ti8: 00:39:42 / 2.524 P-0-11-1/Ti8: 00:39:42 / 2.465 P-0-11-0/Ti8: 00:39:42 / 108 P-0-11-1/Ti8: 00:39:42 / 64 00 00 00 00 00 00 00 00 00 00 00 00 00
Eli Module 2 TM2X     Eli Module 3 TM2S     Eli Module 4 TM1C     Eli Module 6 TM6S     Eli Module 8 TM6S     Eli Module 9 TM2S	2.5 K- (2002) 2 K- 1.5 K- Coupt 1.5 K- 500- 0 -	P-0-11-0/T3: 08:39:42 / 2,524 P-0-11-1/T3: 08:39:42 / 2,465 P-0-11-0/T3: 08:39:42 / 64 P-0-11-1/T6: 08
Eli Module 2 TM2X     Eli Module 3 TM2S     Eli Module 4 TM1C     Eli Module 6 TM6S     Eli Module 8 TM6S     Eli Module 9 TM2S	2.5 K- (90) 0 0 0 15 K- 0 0 1 15 K- 0 0 1 15 K- 0 0 2 847 0 0 2 903 0 0 839:20 1 15 K- 0 0 2 847 0 0 839:03 0 0 839:20 1 16 10 10 10 10 10 10 10 10 10 10 10 10 10	P-0-11-0/T.8: 08:39:42 / 2,524 P-0-11-1/T.5: 08:39:42 / 2,465 P-0-11-0/T.8: 08:39:42 / 108 P-0-11-1/T.5: 08:39:42 / 64 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0
Eli Module 2 TM2X     Eli Module 3 TM2S     Eli Module 4 TM1C     Eli Module 6 TM6S     Eli Module 8 TM6S     Eli Module 9 TM2S	25 K- (90 0 0 0 15 K- 1 K- 500- 0 0 38:30 0 0838:47 0839:03 0839:0 1 K- 0 0 0 0838:30 0839:0 1 K- 1	P-0-11-0/T.8: 08:39:42 / 2,524 P-0-11-1/T.5: 08:39:42 / 2,465 P-0-11-0/T.8: 08:39:42 / 108 P-0-11-1/T.5: 08:39:42 / 64 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0
Clif Module 2 7M2X     Clif Module 3 7M2S     Clif Module 3 7M2S     Clif Module 4 7M1C     Clif Module 6 7M6S     Clif Module 8 7M6S     Clif Module 8 7M6S     Clif Module 9 7M2S	2.5 K- (90) 0 0 0 15 K- 0 0 1 15 K- 0 0 1 15 K- 0 0 2 847 0 0 2 903 0 0 839:20 1 15 K- 0 0 2 847 0 0 839:03 0 0 839:20 1 16 10 10 10 10 10 10 10 10 10 10 10 10 10	P-0-11-0/T3: 08:39:42 / 2,524 P-0-11-1/T3: 08:39:42 / 2,465 P-0-11-0/T3: 08:39:42 / 64 P-0-11-1/T6: 08
CIII Module 2 TM2X     CIII Module 3 TM2S     CIII Module 3 TM2S     CIII Module 4 TM1C     CIII Module 6 TM6S     CIII Module 8 TM6S     CIII Module 9 TM2S	2.5 K- (90) 0 0 0 15 K- 0 0 1 15 K- 0 0 1 15 K- 0 0 2 847 0 0 2 903 0 0 839:20 1 15 K- 0 0 2 847 0 0 839:03 0 0 839:20 1 16 10 10 10 10 10 10 10 10 10 10 10 10 10	P-0-11-0/T38: 08:39:42 / 2.524 P-0-11-0/T38: 08:39:42 / 2.465 P-0-11-0/T38: 08:39:42 / 108 P-0-11-1/T36: 08:39:42 / 64 -0000 0000 0000 0000 0000 0000 0000 00
Eli Module 2 TM2X     Module 3 TM2S     Eli Module 4 TM1C     Eli Module 6 TM6S     Eli Module 8 TM6S     Eli Module 9 TM2S     Eli Module 10 TM6:	25 K- 000 01 5 K- 0 15 K- 0 15 K- 0 02 38:30 00:38:47 00:39:03 00:39:20 1 Cert Axis Legend: P-0-11-0/7.8 P-0-11-1/7.6 Right Axis Legend: P-0-11-0/7.8 P-0-11-1/7.6 	P-0-11-0/T3: 08:39:42 / 2,524 P-0-11-1/T3: 08:39:42 / 2,465 P-0-11-1/T3: 08:39:42 / 64 P-0-11-1/T3: 08:39:42 / 64 P-0-10 P-0-10 P-0-10 P-0-11-1/T3: 08:39:42 / 64 P-0-10 P-0-10 P-0-10 P-0-10 P-0-10 P-0-10 P-0-10 P-0-10 P-0-10 P-0-10 P-0-10 P-0-10 P-0-10 P-0-10 P-0-10 P-0-10 P-0-10 P-0-10 P-0-10 P-0-10 P-0-10 P-0-10 P-0-10 P-0-10 P-0-10 P-0-10 P-0-10 P-0-10 P-0-10 P-0-10 P-0-10 P-0-10 P-0-10 P-0-10 P-0-10 P-0-10 P-0-10 P-0-10 P-0-10 P-0-10 P-0-10 P-0-10 P-0-10 P-0-10 P-0-10 P-0-10 P-0-10 P-0-10 P-0-10 P-0-10 P-0-10 P-0-10 P-0-10 P-0-10 P-0-10 P-0-10 P-0-10 P-0-10 P-0-10 P-0-10 P-0-10 P-0-10 P-0-10 P-0-10 P-0-10 P-0-10 P-0-10 P-0-10 P-0-10 P-0-10 P-0-10 P-0-10 P-0-10 P-0-10 P-0-10 P-0-10 P-0-10 P-0-10 P-0-10 P-0-10 P-0-10 P-0-10 P-0-10 P-0-10 P-0-10 P-0-10 P-0-10 P-0-10 P-0-10 P-0-10 P-0-10 P-0-10 P-0-10 P-0-10 P-0-10 P-0-10 P-0-10 P-0-10 P-0-10 P-0-10 P-0-10 P-0-10 P-0-10 P-0-10 P-0-10 P-0-10 P-0-10 P-0-10 P-0-10 P-0-10 P-0-10 P-0-10 P-0-10 P-0-10 P-0-10 P-0-10 P-0-10 P-0-10 P-0-10 P-0-10 P-0-10 P-0-10 P-0-10 P-0-10 P-0-10 P-0-10 P-0-10 P-0-10 P-0-10 P-0-10 P-0-10 P-0-10 P-0-10 P-0-10 P-0-10 P-0-10 P-0-10 P-0-10 P-0-10 P-0-10 P-0-10 P-0-10 P-0-10 P-0-10 P-0-10 P-0-10 P-0-10 P-0-10 P-0-10 P-0-10 P-0-10 P-0-10 P-0-10 P-0-10 P-0-10 P-0-10 P-0-10 P-0-10 P-0-10 P-0-10 P-0-10 P-0-10 P-0-10 P-0-10 P-0-10
Event Log (1 new events)      Statistics Logging      Statistics      St	2.5 K- (90) 0 0 0 15 K- 0 0 1 15 K- 0 0 1 15 K- 0 0 2 847 0 0 2 903 0 0 839:20 1 15 K- 0 0 2 847 0 0 839:03 0 0 839:20 1 16 10 10 10 10 10 10 10 10 10 10 10 10 10	P-0-11-0/Tis: 08:39:42 / 2524 P-0-11-0/Tis: 08:39:42 / 108 P-0-11-0/Tis: 08:39:42 / 64 0 60 90 1 - 10 0 0 60 90 1 - 10 0 0 0 60 0 - 10 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0
Event Log (1 new events)      Statistics Logging      Statistics	25 K- 000 01 5 K- 0 15 K- 0 15 K- 0 02 38:30 00:38:47 00:39:03 00:39:20 1 Cert Axis Legend: P-0-11-0/7.8 P-0-11-1/7.6 Right Axis Legend: P-0-11-0/7.8 P-0-11-1/7.6 	P-0-11-0/T3: 08:39:42 / 2,524 P-0-11-1/T3: 08:39:42 / 2,465 P-0-11-1/T3: 08:39:42 / 64 P-0-11-1/T3: 08:39:42 / 64 P-0-10 P-0-10 P-0-10 P-0-11-1/T3: 08:39:42 / 64 P-0-10 P-0-10 P-0-10 P-0-10 P-0-10 P-0-10 P-0-10 P-0-10 P-0-10 P-0-10 P-0-10 P-0-10 P-0-10 P-0-10 P-0-10 P-0-10 P-0-10 P-0-10 P-0-10 P-0-10 P-0-10 P-0-10 P-0-10 P-0-10 P-0-10 P-0-10 P-0-10 P-0-10 P-0-10 P-0-10 P-0-10 P-0-10 P-0-10 P-0-10 P-0-10 P-0-10 P-0-10 P-0-10 P-0-10 P-0-10 P-0-10 P-0-10 P-0-10 P-0-10 P-0-10 P-0-10 P-0-10 P-0-10 P-0-10 P-0-10 P-0-10 P-0-10 P-0-10 P-0-10 P-0-10 P-0-10 P-0-10 P-0-10 P-0-10 P-0-10 P-0-10 P-0-10 P-0-10 P-0-10 P-0-10 P-0-10 P-0-10 P-0-10 P-0-10 P-0-10 P-0-10 P-0-10 P-0-10 P-0-10 P-0-10 P-0-10 P-0-10 P-0-10 P-0-10 P-0-10 P-0-10 P-0-10 P-0-10 P-0-10 P-0-10 P-0-10 P-0-10 P-0-10 P-0-10 P-0-10 P-0-10 P-0-10 P-0-10 P-0-10 P-0-10 P-0-10 P-0-10 P-0-10 P-0-10 P-0-10 P-0-10 P-0-10 P-0-10 P-0-10 P-0-10 P-0-10 P-0-10 P-0-10 P-0-10 P-0-10 P-0-10 P-0-10 P-0-10 P-0-10 P-0-10 P-0-10 P-0-10 P-0-10 P-0-10 P-0-10 P-0-10 P-0-10 P-0-10 P-0-10 P-0-10 P-0-10 P-0-10 P-0-10 P-0-10 P-0-10 P-0-10 P-0-10 P-0-10 P-0-10 P-0-10 P-0-10 P-0-10 P-0-10 P-0-10 P-0-10 P-0-10 P-0-10 P-0-10 P-0-10 P-0-10 P-0-10 P-0-10 P-0-10 P-0-10 P-0-10 P-0-10 P-0-10 P-0-10 P-0-10 P-0-10 P-0-10 P-0-10 P-0-10 P-0-10 P-0-10 P-0-10 P-0-10 P-0-10 P-0-10 P-0-10
	25 K- 000 01 5 K- 0 15 K- 0 15 K- 0 02 38:30 00:38:47 00:39:03 00:39:20 1 Cert Axis Legend: P-0-11-0/7.8 P-0-11-1/7.6 Right Axis Legend: P-0-11-0/7.8 P-0-11-1/7.6 	P-0-11-0/Tite: 08:39:42 / 254 P-0-11-0/Tite: 08:39:42 / 108 P-0-11-0/Tite: 08:39:42 / 64 00:000 000 000 000 000 000 000 000 000
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Event Log (1 new events)      Statistics Logging      Statistics      St	25 K- 000 01 5 K- 0 15 K- 0 15 K- 0 02 38:30 00:38:47 00:39:03 00:39:20 1 Cert Axis Legend: P-0-11-0/7.8 P-0-11-1/7.6 Right Axis Legend: P-0-11-0/7.8 P-0-11-1/7.6 	P-0-11-0/Tis: 08:39:42 / 2546 P-0-11-0/Tis: 08:39:42 / 103 P-0-11-1/Tis: 08:39:42 / 64 08:39:37 08:39:37 08:39:37 08:39:33 08:39:37
Event Log (1 new events)	25 K- 000 01 5 K- 0 15 K- 0 15 K- 0 02 38:30 00:38:47 00:39:03 00:39:20 1 Cert Axis Legend: P-0-11-0/7.8 P-0-11-1/7.6 Right Axis Legend: P-0-11-0/7.8 P-0-11-1/7.6 	P-0-11-0/Tis: 08:39:42 / 254 P-0-11-0/Tis: 08:39:42 / 108 P-0-11-0/Tis: 08:39:42 / 64 00:000 000 000 000 000 000 000 000 000
	25 K- 000 01 5 K- 0 15 K- 0 15 K- 0 02 38:30 00:38:47 00:39:03 00:39:20 1 Cert Axis Legend: P-0-11-0/7.8 P-0-11-1/7.6 Right Axis Legend: P-0-11-0/7.8 P-0-11-1/7.6 	P-0-11-0/Tis: 08:39:42 / 2546 P-0-11-0/Tis: 08:39:42 / 103 P-0-11-1/Tis: 08:39:42 / 64 060 00 00 00 00 00 00 00 00 00 00 00 00
Event Log (1 new events)	25 K- 000 01 5 K- 0 15 K- 0 15 K- 0 02 38:30 00:38:47 00:39:03 00:39:20 1 Cert Axis Legend: P-0-11-0/7.8 P-0-11-1/7.6 Right Axis Legend: P-0-11-0/7.8 P-0-11-1/7.6 	P-0-11-0/T3E: 08:39:42 / 2524 P-0-11-0/T3E: 08:39:42 / 44 P-0-11-0/T3E: 08:39:42 / 64 P-0-11-0/T3E: 08:39:42 / 64 00 00 00 00 00 00 00 00 00 00 00 00 00
Event Log (1 new events)	25 K- 000 01 5 K- 0 15 K- 0 15 K- 0 02 38:30 00:38:47 00:39:03 00:39:20 1 Cert Axis Legend: P-0-11-0/7.8 P-0-11-1/7.6 Right Axis Legend: P-0-11-0/7.8 P-0-11-1/7.6 	P-0-11-0/T38: 08:39:42 / 2524 P-0-11-0/T38: 08:39:42 / 44 P-0-11-0/T38: 08:39:42 / 44 P-0-11-1/T36: 08:39:42 / 64 00 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0
Call Module 2 'M2X     Call Module 3 'M2S     Call Module 4 'M1C     Call Module 6 'M6S     Call Module 8 'M6S     Call Module 9 'M2S     Call Module 10 'M6:	25 K- 000 01 5 K- 0 15 K- 0 15 K- 0 02 38:30 00:38:47 00:39:03 00:39:20 1 Cert Axis Legend: P-0-11-0/7.8 P-0-11-1/7.6 Right Axis Legend: P-0-11-0/7.8 P-0-11-1/7.6 	P-0-11-0/T38: 08:39:42 / 2524 P-0-11-0/T38: 08:39:42 / 44 P-0-11-0/T38: 08:39:42 / 44 P-0-11-1/T36: 08:39:42 / 64 00 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0







# KEY FEATURES Statistics Charting, Reporting and Logging

- Real-time charts of monitored parameters. Displays multiple charts at once
- Choose two different parameters where
   each parameter is associated with its own
   Y-axis
- Periodically poll counters for all ports in a testbed and log to a CSV or XML file
- Generate reports as PDF or HTML files of counters for all ports in a testbed

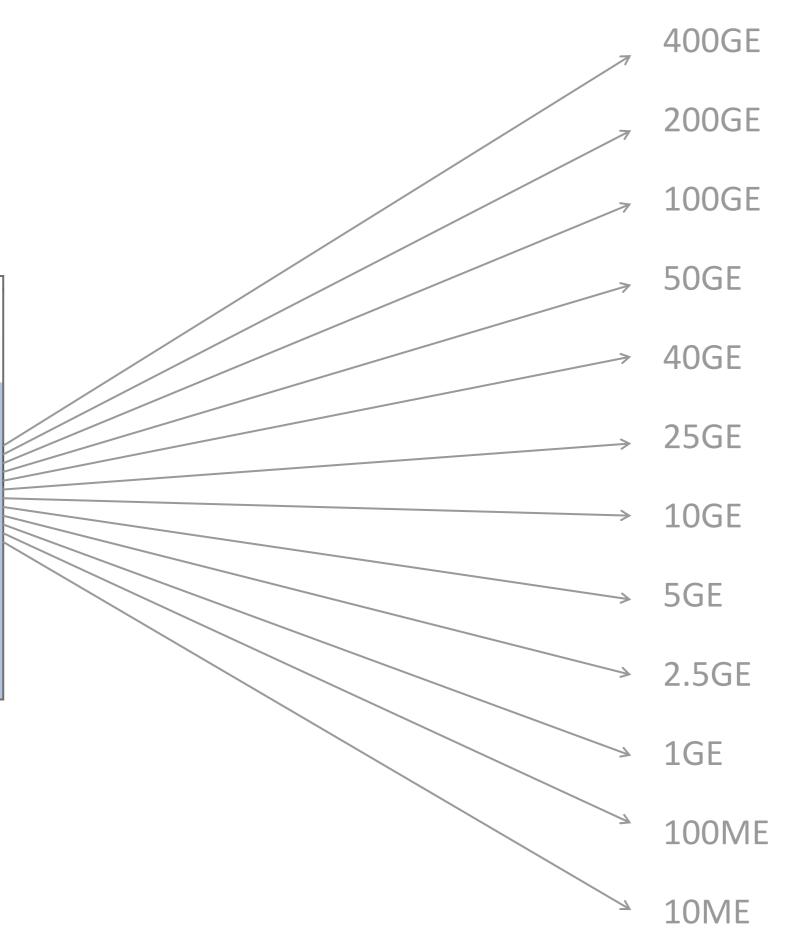




# KEY FEATURES Same CLI commands across all port speeds

🔀 Xena Script Client v22.0 — 🛛	Х
Command	
C_logon "xena"	^
<ok> C_Owner "User1" <ok></ok></ok>	
0/0 P_RESERVATION RESERVE	
<0K>	¥





# **KEY FEATURES** Precise and accurate traffic generation (1/2)



Stream-oriented Traffic Generation: Generate hundreds of unique transmit and receive traffic "streams"

Each stream can generate 100k's of unique traffic "flows" using programmable packet field modifiers to increment or randomize field values such as MAC addresses, IP addresses, and VLAN identifiers

Stream rates can be defined as a percentage of line rate, frames per second, or bit-rate

Packet injection can be controlled as a single-packet shot, number of packets, time duration, or in continuous mode

Traffic profiles can be defined as uniform or bursty

Custom packet editing (via a graphical editor) lets you build any packet format via predefined packet templates for Ethernet, Ethernet II, VLAN, ARP, IPv4, IPv6, UDP, TCP, LLC, SNAP, GTP, ICMP, RTP, RTCP, STP, SCTP, MPLS, PBB, FCoE, IGMPv2/3, or fully specified by

# **KEY FEATURES** Precise and accurate traffic generation (2/2)

Real-time Analysis and Reporting

- Packet flow statistics are tracked per stream, or per-user defined filters which can include any combination of programmable field values. Incoming packet streams are automatically identified using optionally auto-inserted Test Payload fields.
- Analysis of traffic throughput, latency, jitter, loss, sequence, and misorder errors is performed real-time per received stream with 16/32 ns accuracy depending on the interface type (optical/electrical).
  - Users can capture packets at wire speed on each port for detailed analysis and hot-button export packet analysis tool WireShark, which in conjunction with event triggering and programmable filters provides a unique ability to identify and isolate performance issues.





# KEY FEATURES Industry's best traffic scheduler

ValkyrieManager supports scheduling – a sequence of operations activated with a single mouse click – to make testing easier.

Stream Scheduler can be used to startand-stop traffic, change packet rate, change operations orders, add loop section, etc.



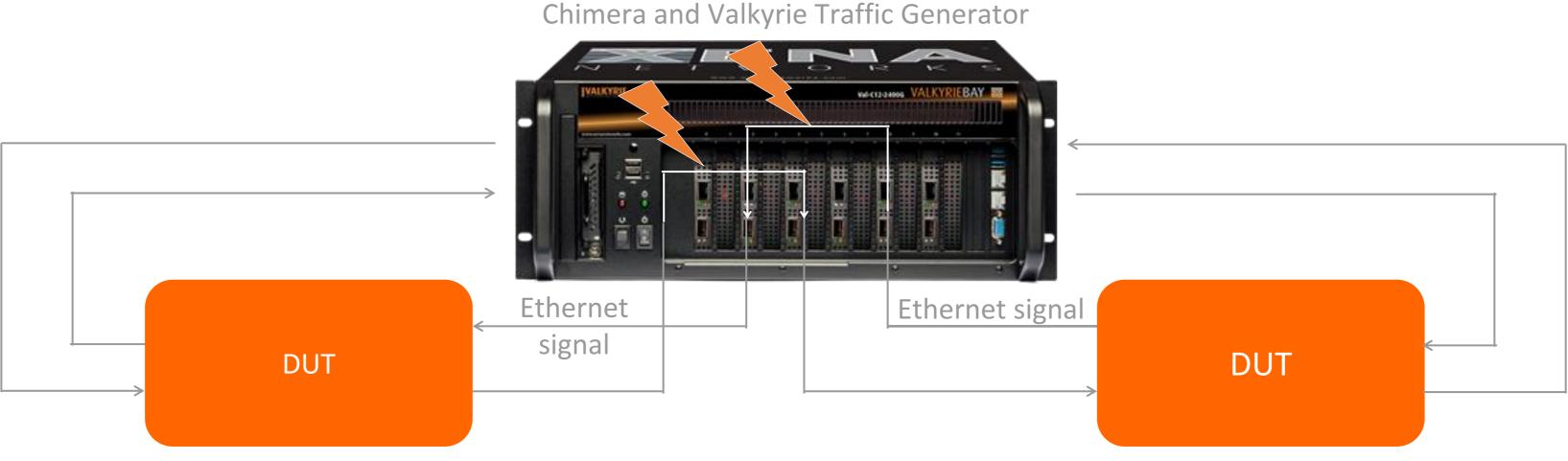
📀 Add Schedule 🥥 Remo	ove Schedule	Rename Schedule	: 🔀 Start Schedule	
Selected Schedule: New Sch			T State: St	
Current Schedule Operations	: O Add O	peration 🥥 Rem	ove Operation 🛛 🔒 l	
Operation	Parameter	Operation Data		State
🕞 🥜 Set Parameter Value	Bit Rate L2 (bit/s)	10.000 bit/s (L2)	S-0-0-2-0,S-0-0-3-0	1
— 🕟 Enable Stream			S-0-0-2-0	
— 🔿 Start Traffic			All targets	
— 过 Wait Period		10.000 seconds	N/A	
— 🥌 Stop Traffic			All targets	
— 🖲 Disable Stream			All targets	
— 过 Wait Period		10.000 seconds	N/A	
— 🕟 Enable Stream			S-0-0-3-0	
🕒 🔿 Start Traffic			All targets	
	6			

# **KEY FEATURES** Industry's only UI integrated Traffic Generation & Impairment solution (Valkyrie & Chimera)

Chimera is Xena's network impairment emulator - it lets you introduce consistent, accurate, welldefined and repeatable impairments to traffic between DUTs in the lab.

Valkyrie Traffic Generator modules generate test traffic to pass through the DUTs

Chimera and Valkyrie modules can be installed in the same chassis

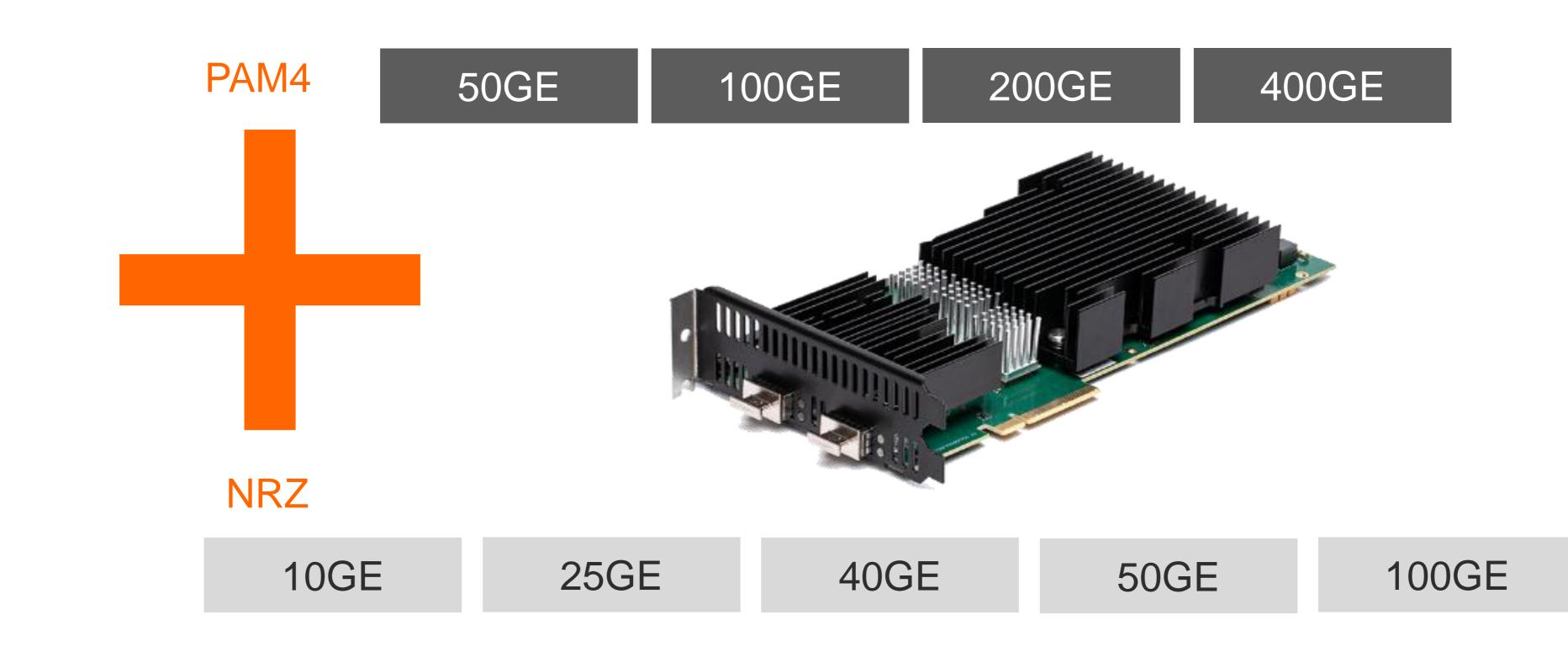




# **KEY FEATURES** Thor-400G-7S-1P tests both PAM4 and NRZ speeds

Upgrading to the new PAM4 (50/100/200/400GE) speeds from the NRZ (10/40/100GE) speeds means testing equipment and services using both NRZ and PAM4-based traffic generators.

Xena is the ONLY vendor on the market that lets you do that with just 1 test module – Thor-400G-7S-1P.



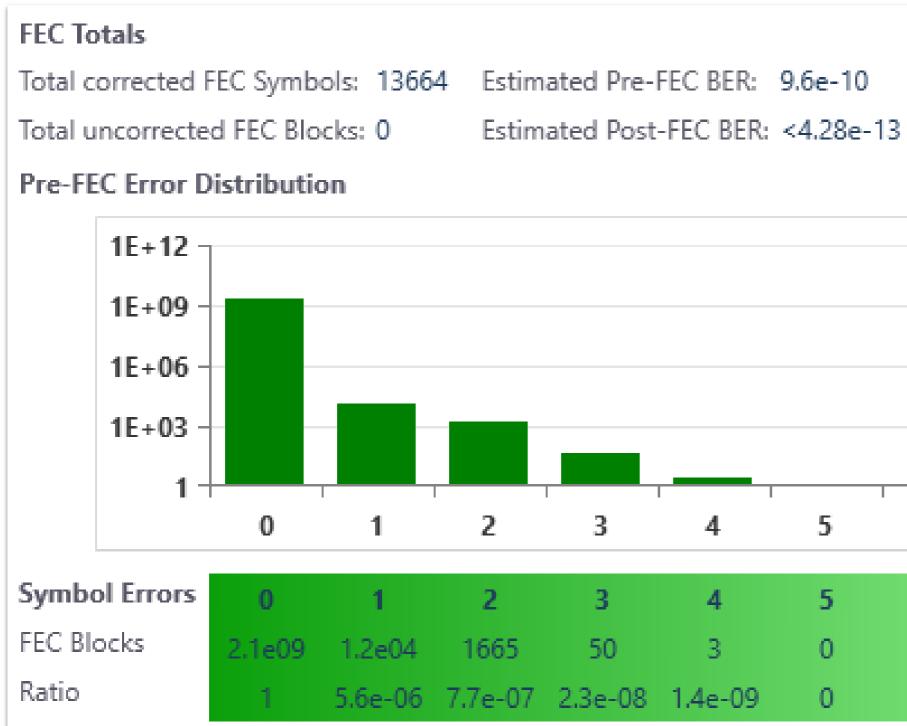




# **KEY FEATURES Advanced FEC stats for PAM4**

When using Thor-400G-7S-1P, ValkyrieManager also provides easy access to advanced FEC stats:

- Pre/Post FEC statistics
- Pre-FEC Error Distribution graph:

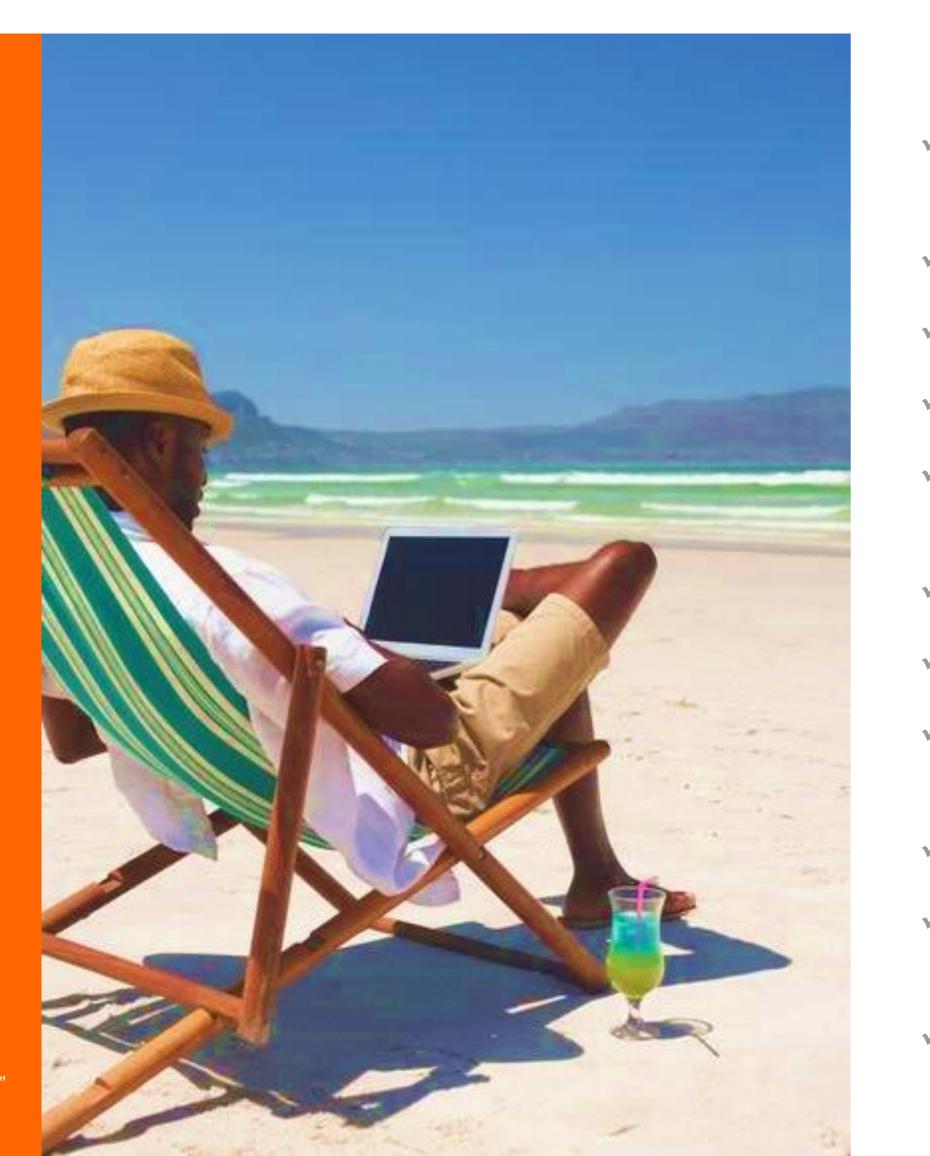




I	6	7	8	9	10	11	12	13	14	15	>15
	6	7	8	9	10	11	12	13	14	15	>15
	0	0	0	0	0	0	0	0	0	0	0
	0	0	0	0	0	0	0	0	0	0	0



# KEY FEATURES Valkyrie – making test engineers lives easier for over a decade





- ✓ ValkyrieManager is a richly-featured and easy-to-use UI ("2-clicks" to get a stream running)
- ✓ Same CLI commands across all port speeds
- ✓ Very precise and accurate traffic generation
- ✓ Industry's best traffic scheduler
- ✓ Industry's only UI integrated Traffic Generation & Impairment solution (Valkyrie & Chimera)
- ✓ Robust chassis platform (Linux), runs "forever", supporting +40-day test cases
- ✓ Smooth and fast chassis software upgrade processes
- Compact ValkyrieCompact 1U chassis covers 1, 2.5, 5, 10, 25, 40, 50, 100, 200, 400GE speeds
- ✓ Multi-user platform with port reservation resolution down to one port per user
- ✓ Thor-400G-7S-1P supports both four PAM 4 based speeds (50, 100, 200 and 400GE) and five NRZ based speeds (10, 25, 40, 50 and 100GE) in one test module
- ✓ Advanced FEC stats for PAM4

Test. Improve. Repeat. THANK YOU



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