



KEYSIGHT
WORLD 2019

World's High-Density 400GE Testing

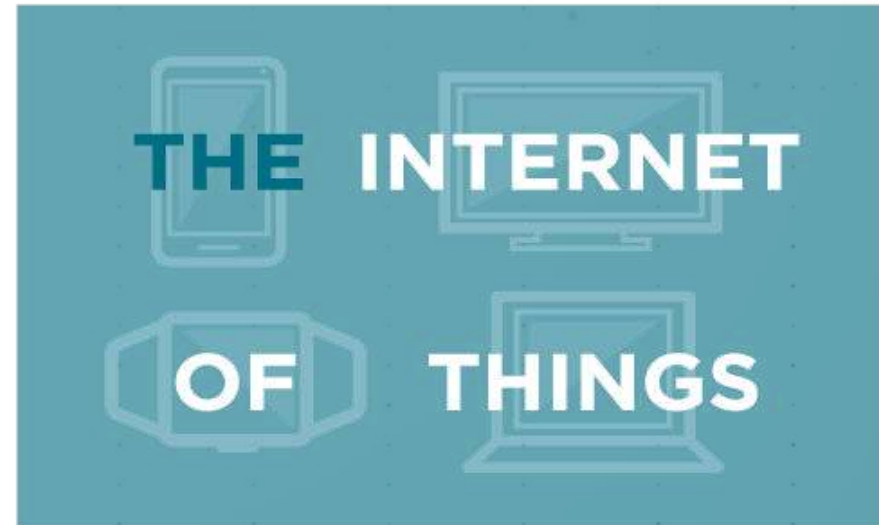
Product Management / Keysight Technologies

Dean Lee



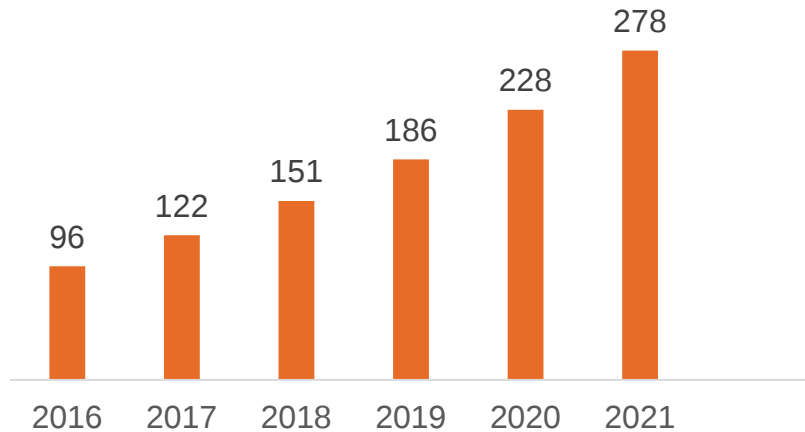
A vibrant, futuristic digital landscape. In the foreground, several tall, dark server racks are illuminated with glowing blue and green lights, displaying various data visualizations and charts. A central cluster of glowing white icons represents a wide range of digital concepts, including communication (Wi-Fi, email, video), commerce (shopping cart, dollar sign), industry (factory, gear), and personal life (heart, house, car). The background is a deep blue gradient, suggesting a vast digital space. The overall aesthetic is high-tech and data-driven.

MEGA-TRENDS IN TECHNOLOGY



Demand for Terabits

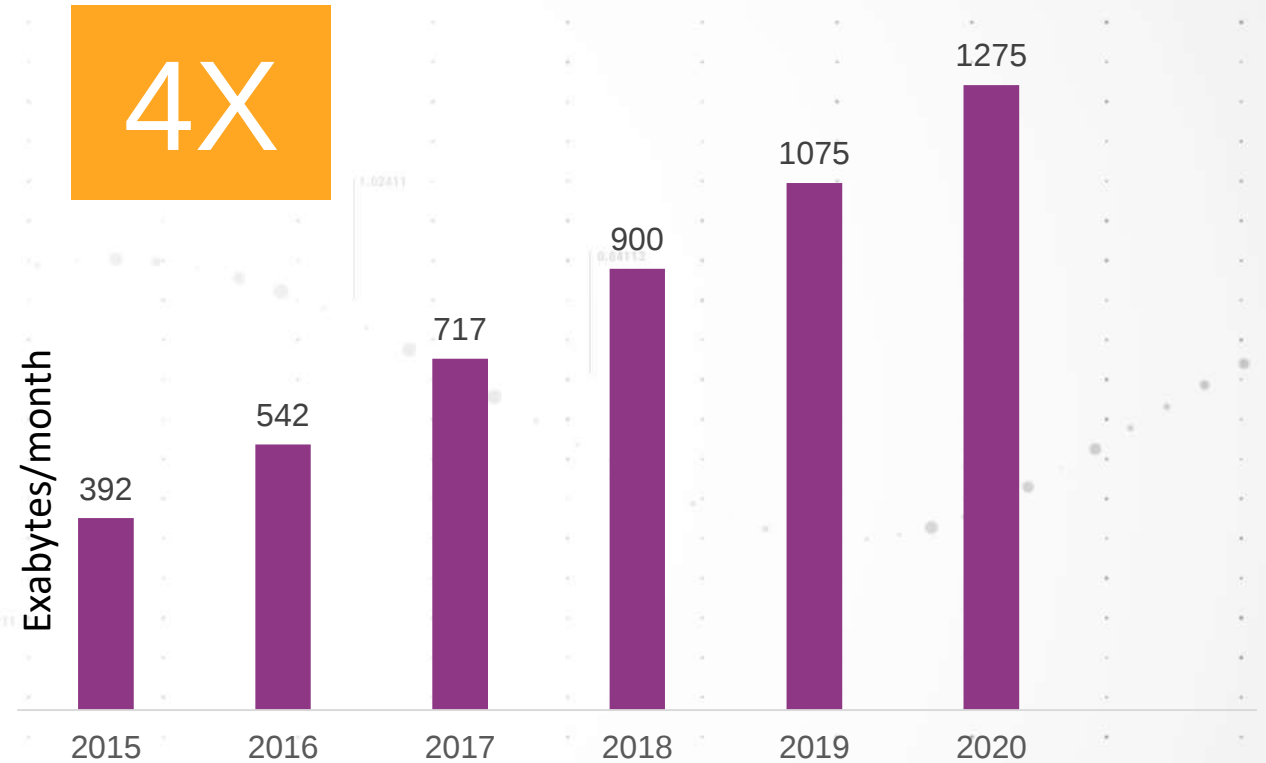
24% CAGR



Global Non-Datacenter IP Traffic

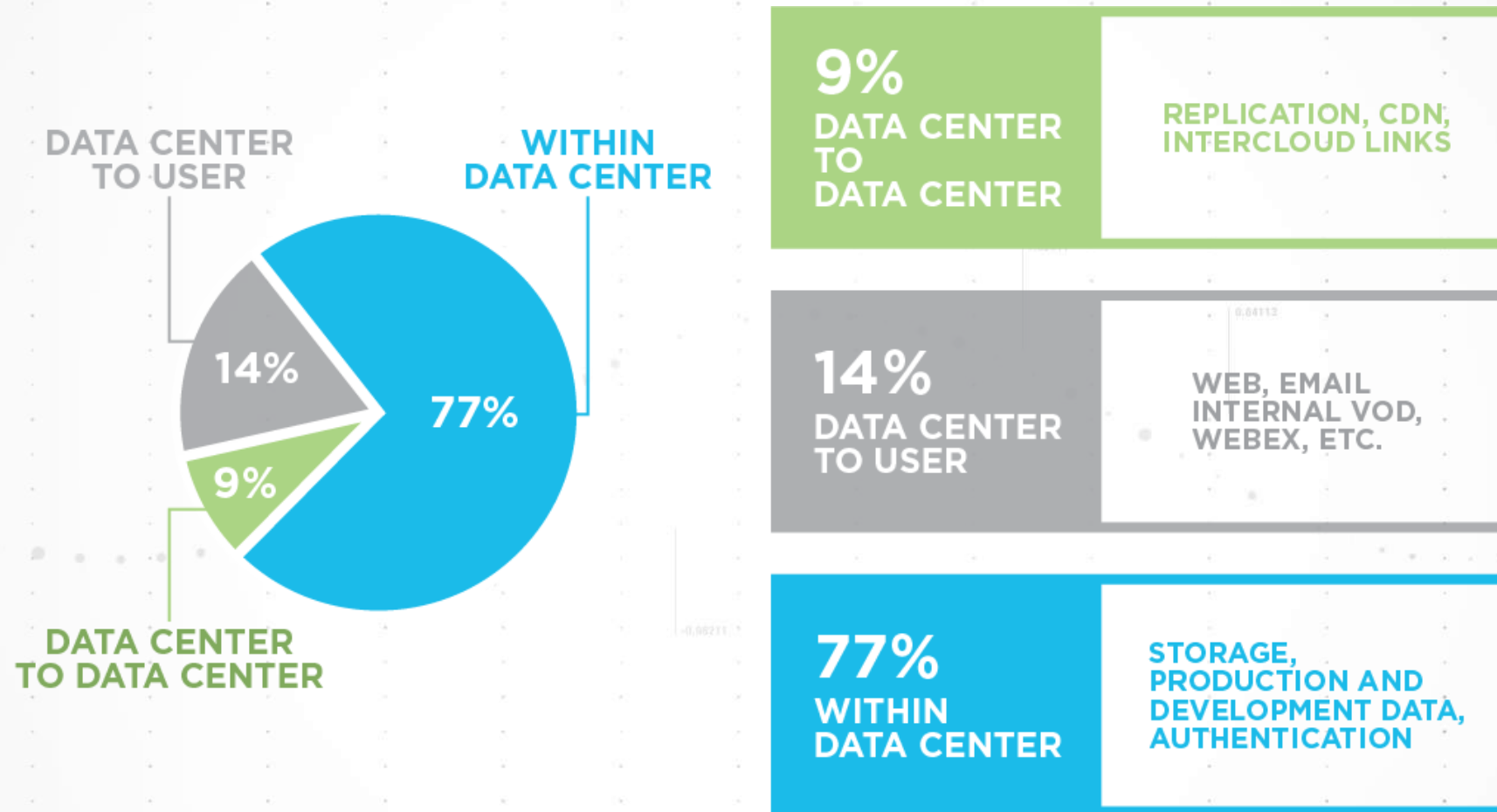
4X

27% CAGR



Global Datacenter IP Traffic

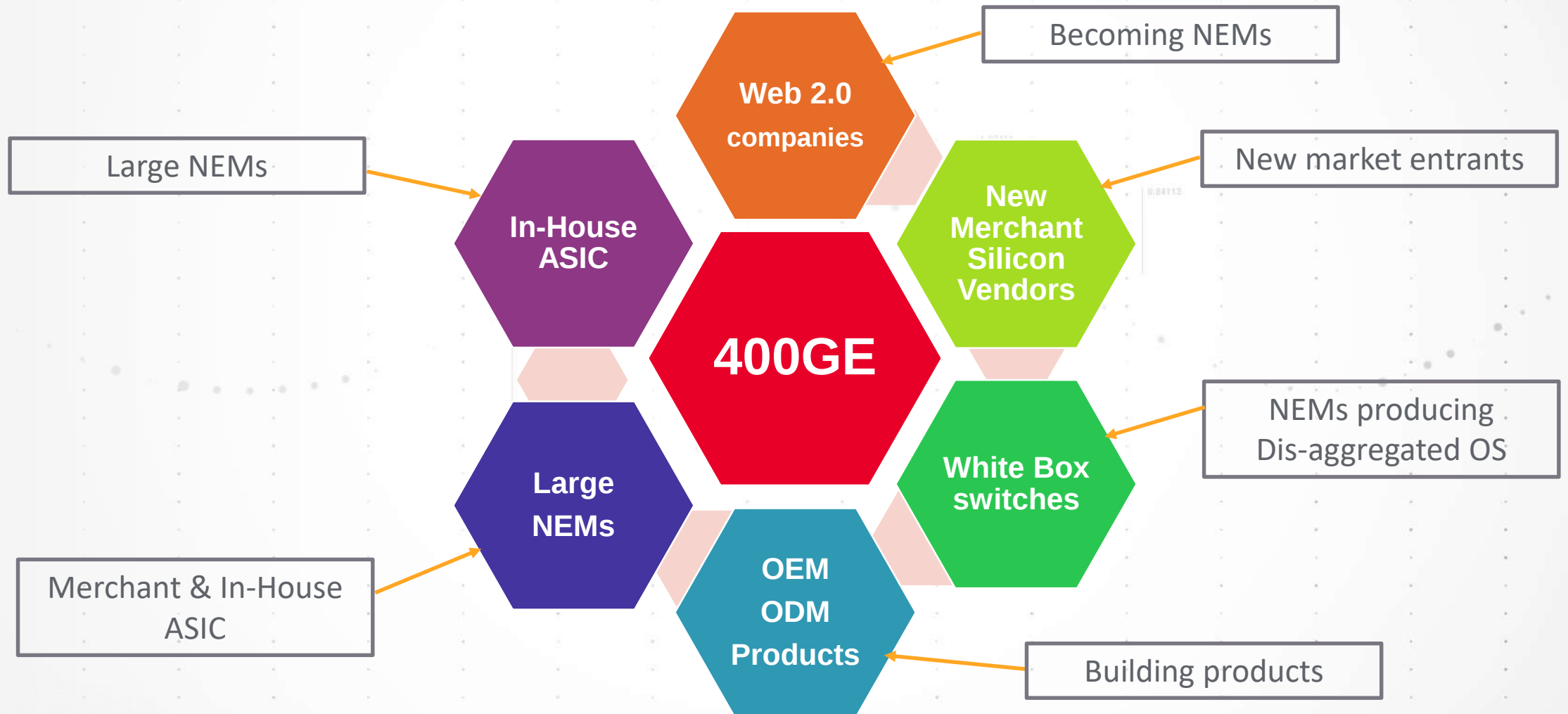
Demand for Terabits Inside Data Center



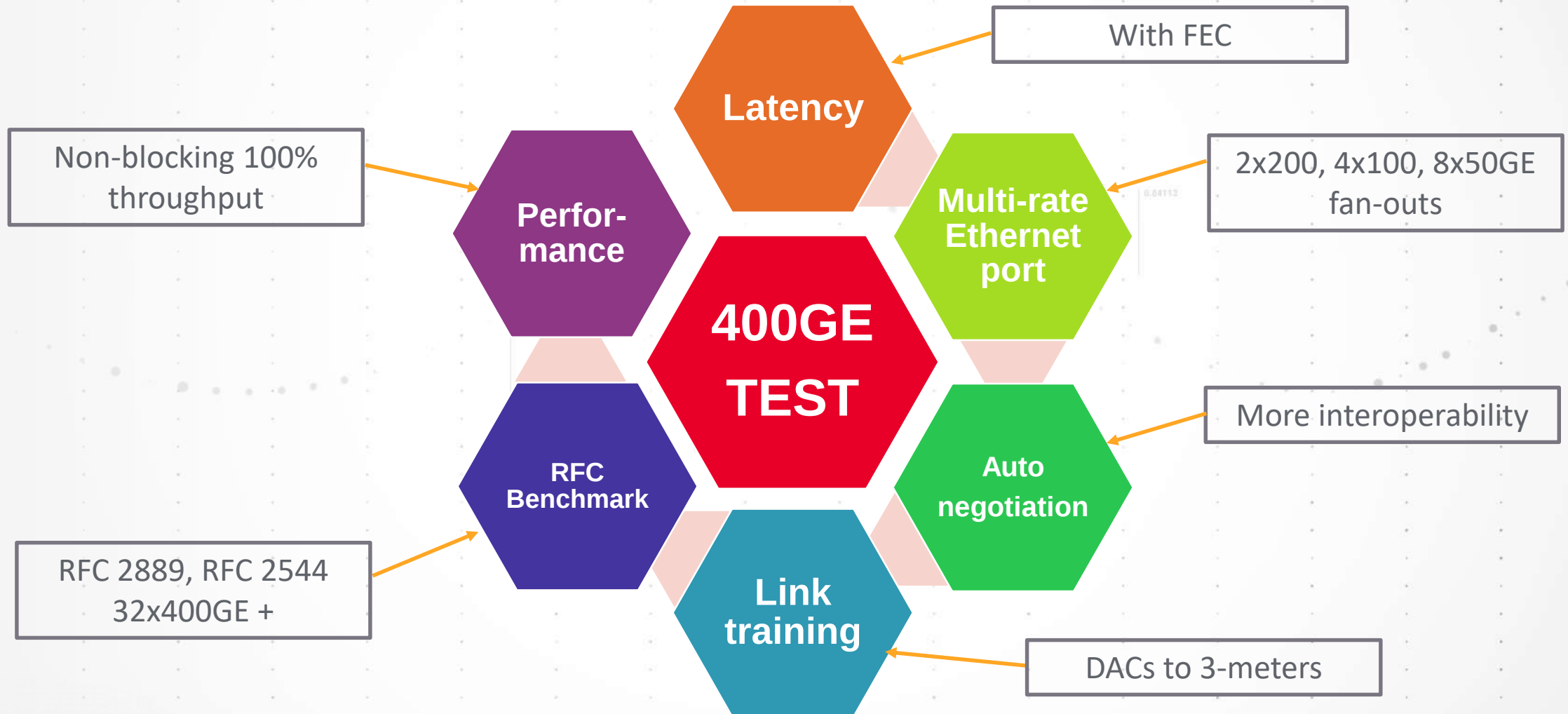
GLOBAL DATA CENTER TRAFFIC IN 2020

Source: Cisco Global Cloud Index, 2015-2020

400G Vendor Base Grows

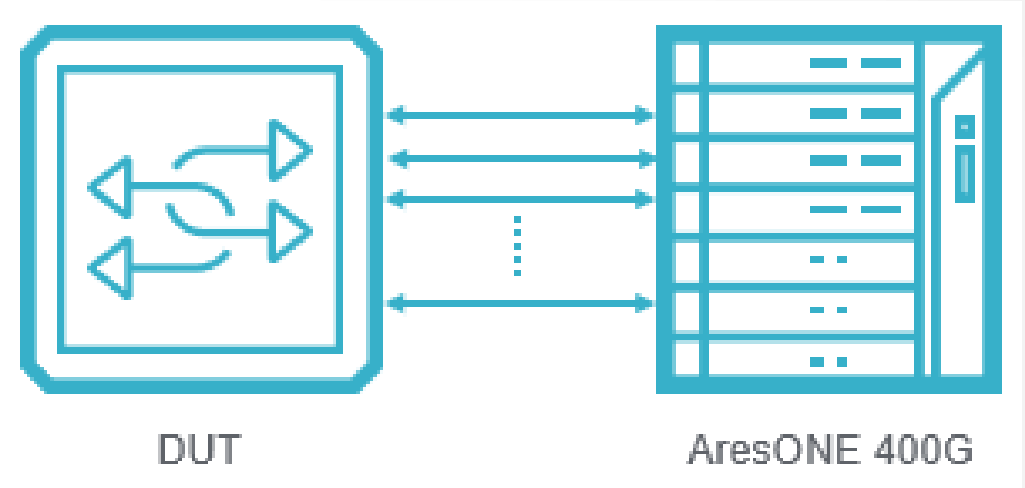


What We Must Test



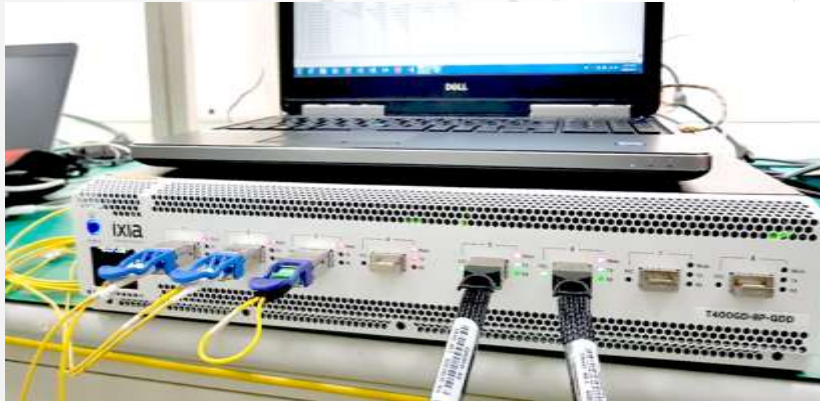
Test Methodology – Interface/Link Qualification

- Link quality check
 - Layer 1 BERT (bit error rate testing) with PRBS patterns
 - IEEE 802.3bs Pre-FEC Bit Error Ratio Measurement
- Link Stability & Recovery – Post-FEC Frame Loss Ratio (FLR) and Long Traffic Runs
- Deeper Look & Borderline Detection at Physical Coding Sublayer (PCS)
 - Per lane Pre-FEC Bit Error Rate & error distribution



72-hours Test for DAC & High Power Transceivers

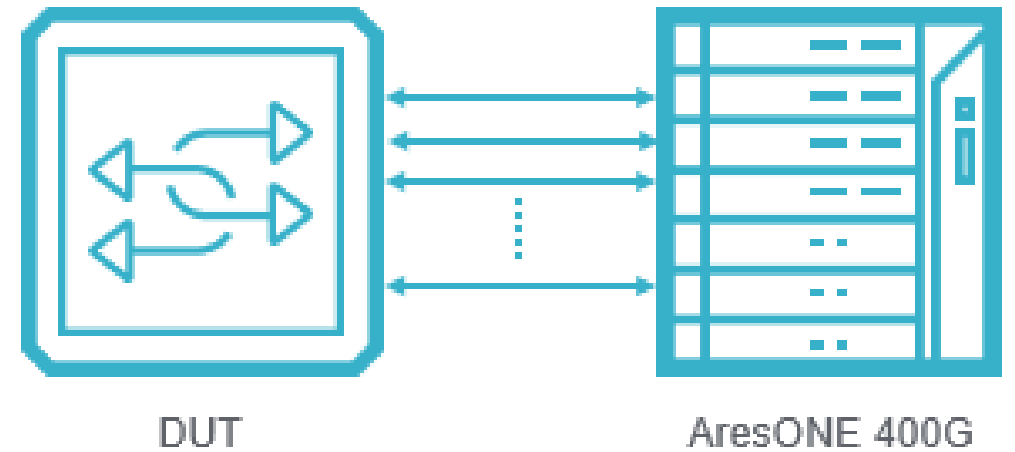
- AresONE 400G passed 72 hours test with below optics and cable vendors:
- Finisar 400Gbase-DR4 and 400Gbase-LR8 optics
- FOIT 400Gbase-FR4 optic
- Molex 2.5m 400Gbase-CR8 DAC



	A	B	C	D	E	F
1	400GE Transceiver/Cable	Finisar LR8 Transceiver Port01 to Port02	Finisar LR8 Transceiver Port02 to Port01	Finisar DR4 Transceiver with loopback connector	Molex 2.5 meters DAC Port05 to Port06	Molex 2.5 meters DAC Port06 to Port05
2	Name	192.168.1.112:01.01	192.168.1.112:01.02	192.168.1.112:01.03	192.168.1.112:01.05	192.168.1.112:01.06
3	Link State	Link Up	Link Up	Link Up	Link Up	Link Up
4	Line Speed	400GE	400GE	400GE	400GE	400GE
5	Frames Sent	154,376,613,560,754	154,376,613,560,754	154,376,613,560,754	154,376,613,560,754	154,376,613,560,754
6	Frames Sent Rate	0	0	0	0	0
7	Valid Frames Received	154,376,613,560,754	154,376,613,560,754	154,376,613,560,754	154,376,613,560,754	154,376,613,560,754
8	Valid Frames Received Rate	0	0	0	0	0
9	Bytes Sent	9,880,103,267,888,256	9,880,103,267,888,256	9,880,103,267,888,256	9,880,103,267,888,256	9,880,103,267,888,256
10	Bytes Sent Rate	0	0	0	0	0
11	Bytes Received	9,880,103,267,888,256	9,880,103,267,888,256	9,880,103,267,888,256	9,880,103,267,888,256	9,880,103,267,888,256
12	Bytes Received Rate	0	0	0	0	0
13	Fragments	0	0	0	0	0
14	Undersize	0	0	0	0	0
15	Oversize and Good CRCs	0	0	0	0	0
16	CRC Errors	0	0	0	0	0
17	Transmit Duration(Cleared on Start Tx)	72 :2 :32.710782069	72 :2 :32.710782070	72 :2 :32.710782070	72 :2 :32.710782070	72 :2 :32.710782072
18	FEC Total Bit Errors	614840002	3962546410	4.30341E+11	28746132	13622837
19	FEC Max Symbol Errors	3	7	7	2	2
20	FEC Corrected Codewords	614825846	3882647011	4.2497E+11	28745444	13622305
21	FEC Total Codewords	2.02656E+13	2.02656E+13	2.02656E+13	2.02656E+13	2.02656E+13
22	FEC Frame Loss Ratio	0.00e+000	0.00e+000	0.00e+000	0.00e+000	0.00e+000
23	pre FEC Bit Error Rate	5.58e-009	5.59e-008	5.90e-006	2.61e-010	1.24e-010
24	FEC Codeword with 0 error	2.0265E+13	2.02617E+13	1.98406E+13	2.02656E+13	2.02656E+13
25	FEC Codeword with 1 error	614812439	3816856886	4.19783E+11	28745166	13622193
26	FEC Codeword with 2 errors	13404	63815799	5134943734	278	112
27	FEC Codeword with 3 errors	3	1907829	52060360	0	0
28	FEC Codeword with 4 errors	0	64122	544246	0	0
29	FEC Codeword with 5 errors	0	2289	6708	0	0
30	FEC Codeword with 6 errors	0	82	114	0	0
31	FEC Codeword with 7 errors	0	4	2	0	0
32	FEC Codeword with 8 errors	0	0	0	0	0
33	FEC Codeword with 9 errors	0	0	0	0	0
34	FEC Codeword with 10 errors	0	0	0	0	0
35	FEC Codeword with 11 errors	0	0	0	0	0
36	FEC Codeword with 12 errors	0	0	0	0	0
37	FEC Codeword with 13 errors	0	0	0	0	0
38	FEC Codeword with 14 errors	0	0	0	0	0
39	FEC Codeword with 15 errors	0	0	0	0	0
40	FEC Uncorrectable Codewords	0	0	0	0	0
41	FEC Transcoding Uncorrectable Errors	0	0	0	0	0
42	Oversize and CRC Errors	0	0	0	0	0
43	Flow Control Frames Received	0	0	0	0	0

Test Methodology – Packet Forwarding Performance

- No drop packet forwarding throughput
- Latency
- RFC 2544/2889 Benchmark Tests



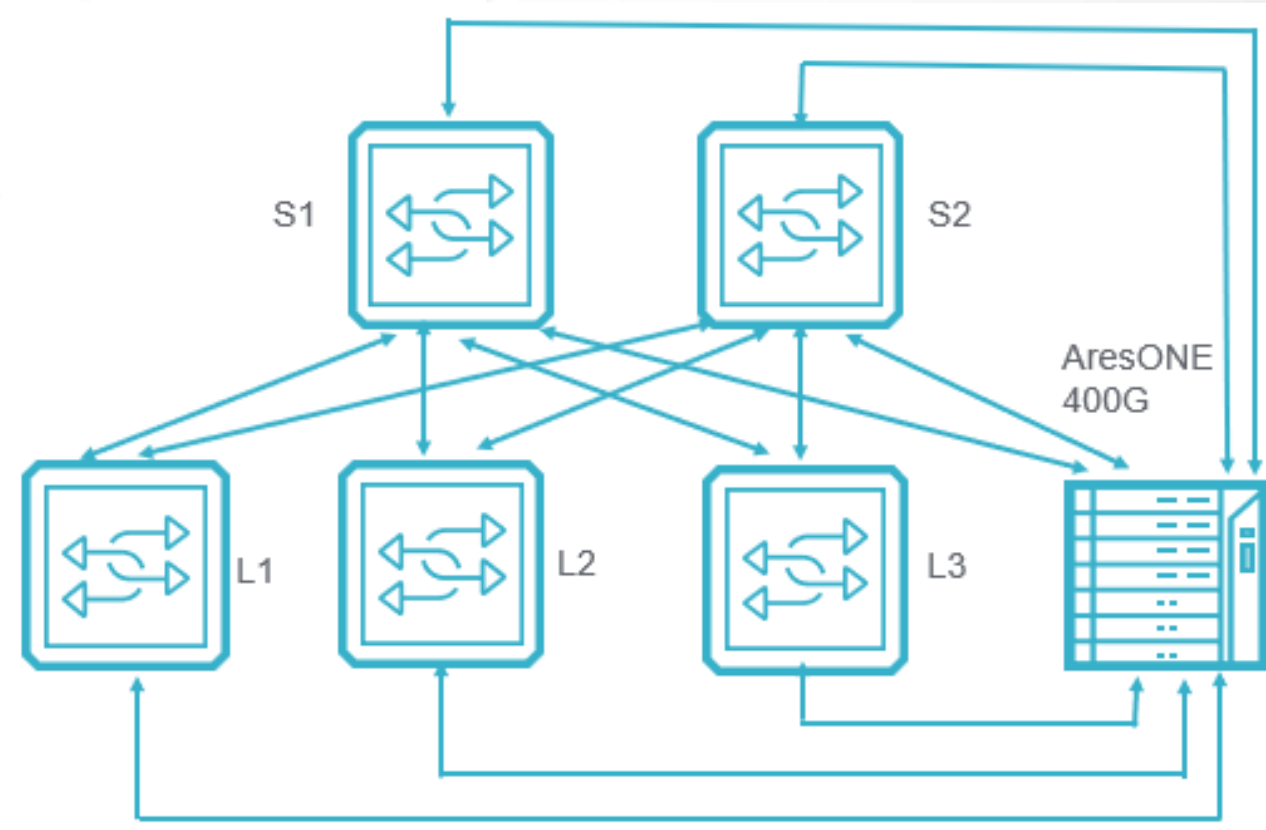
Marvell Prestera CX 8508 Full Box 12.8 Tbps Test

- Live demo at OCP Summit 2019
- 32 x 400G, 4 AresONE 400G
- RFC 2544/2889 benchmark tests
- Low latency, full line rate



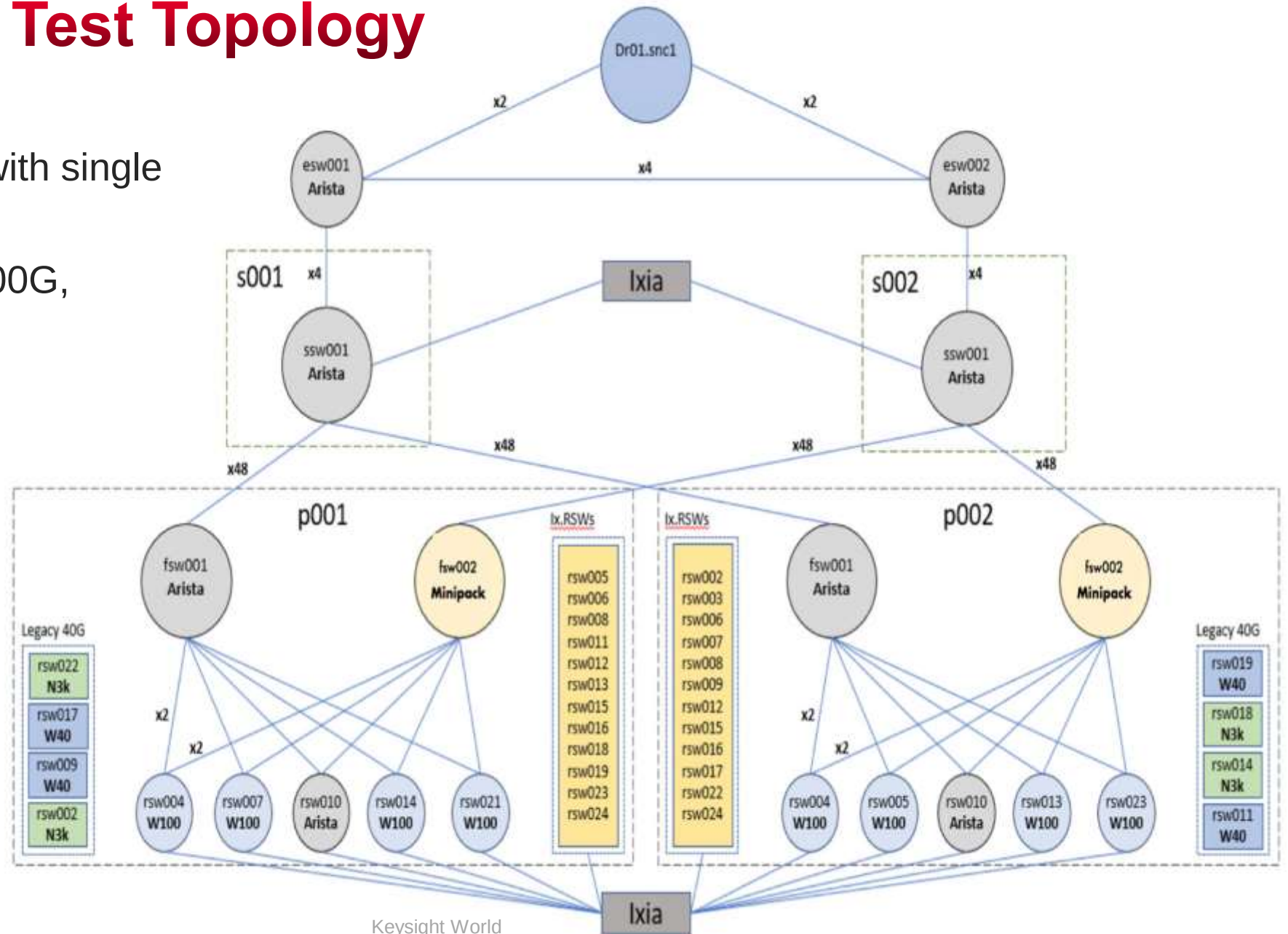
Test Methodology – Spine & Leaf

- East-West traffic throughput, latency & resiliency
- Effective & accurate performance & convergence measurement across ECMP (equal cost multi path)
- RFC 7747 - Basic BGP Convergence Benchmarking Methodology for Data Plane Convergence



FaceBook F16 Test Topology

- Minipak - 128 x 100G with single Tomahawk III chip
- Ready to upgrade to 200G, 400G



Summary – AresONE High Density 400G System Test

3.2
Tbps

2RU
Fixed
Chassis

56Gb/s
PAM4
Encoding



Multi-Speed
400/200/100/
50GE

100%
Backward
Compatible

QSFP-DD
OR
OSFP



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