



CUSTOMER CASE STUDY

Juniper Networks QFabric System Demonstrates Impressive Performance at Large Scale with Spirent TestCenter

JUNIPER NETWORKS QFABRIC SYSTEM

One Juniper Networks QFabric® can support up to 128 top-of-rack switches dispersed throughout a data center for a total of 6,144 x 10 GbE ports in a system that can be managed as a single, low latency switch. Using Spirent TestCenter, a leading independent test lab, Network Test, was able to objectively measure and demonstrate the performance and scale of the QFabric System.



CHALLENGE

Objectively demonstrate QFabric's performance at the large scale required in service provider, cloud computing and consolidated data center environments. The objective was to demonstrate that the QFabric System delivers a single, low latency data center switch fabric with a high level of performance and scalability.

Results achieved with Spirent TestCenter

- Objectively measured and validated performance at scale
- Demonstrated interoperability with legacy data center components

BUILDING A REVOLUTIONARY DATA CENTER FABRIC

QFabric delivers improvements in data center performance, operating costs, and business agility for enterprises, high-performance computing systems, and large-scale cloud providers. QFabric flattens the network to place all resources (servers, storage devices, L4-L7 services, routers) into a single, common pool and to allow any-to-any connection between all devices with very low latency and the appearance of unlimited bandwidth. One QFabric can support up to 128 top-of-rack switches dispersed throughout a data center for a total of 6,144 x 10 GbE ports in a system that appears as a single logical switch.

Terabits of data, thousands of ports, all able to connect any-to-any in a single resource pool with low latency.

Given the fact that the previous industry-first high-port-density switch test involved just a few hundred ports, it's clear that such claims might raise the eyebrow of more than one data center manager.



IT AIN'T BRAGGING IF YOU CAN BACK IT UP

With the famous line "It ain't bragging if you can back it up," Dizzy Dean predicted he and his brother would win 45 games for the St. Louis Cardinals in the 1934 season. Then he set out to back it up. Juniper Networks followed Dizzy's lead.

Since QFabric goes far beyond the capabilities of current data switching fabrics, the test requirements would place significant demands on a test system, which must support:

- High-port-density 10 GbE
- Standards-based Layer 2-3 benchmarking test support
- Data center protocols such as link aggregation, OSPF equal cost multipath, IGMP, and BGP
- Ability to scale up to millions of connections, analyzing per-stream results in real time
- Nanosecond-accurate latency measurements
- Ability to validate any-to-any port fabric connectivity with full-mesh traffic over all ports

Independent test lab Network Test set up and ran the rigorous test methodology with Spirent Communications to objectively demonstrate the QFabric System's performance at scale. With its ability to test thousands of ports as a system with unicast, multicast and control plane protocols on all ports and measure nanosecond accurate latency on millions of streams, the industry-leading Spirent TestCenter platform was the obvious choice.

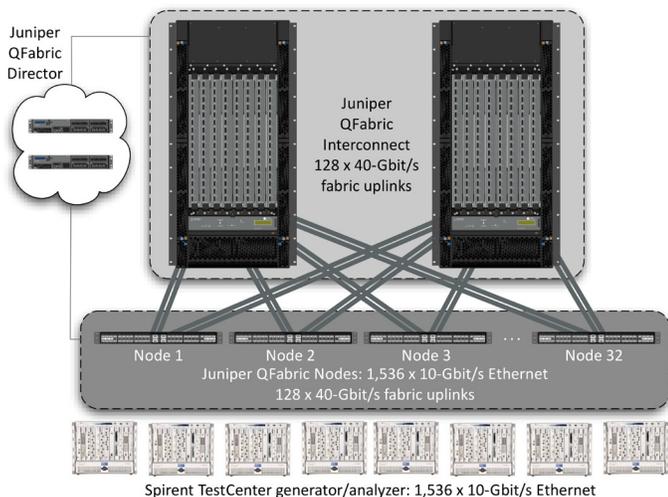
BACKING IT UP

To test a system with the exponential scale of QFabric, a massive test bed is required. The test used four to five times as many edge ports as any previous high-speed Ethernet test, but still represented only one-quarter of the QFabric maximum capacity.

The four-rack test bed comprised 1,536 x 10 GbE ports, 128 redundant 40 Gbps fabric uplinks, and management that provides a view of all components as a single device, regardless of how dispersed individual devices may be in the data center.

Juniper QFabric System components took two 42U racks. Spirent TestCenter chassis loaded with 32-port HyperMetrics DX modules filled the other two racks.

The test topology was the most demanding possible configuration for the device under test, much more stressful than the typical port-pair test, but a configuration that more accurately reflects the ultimate limits of system performance.



For example, to connect 1,536 ports in pairs requires 768 links $[N/2]$ and 1,536 streams (Tx and Rx for each pair). To connect the same number of ports in a full-mesh configuration requires over 1.2 million links $[(N*(N-1))/2]$ and over 2.3 million streams.

The tests assessed QFabric performance and interoperability. RFC benchmark performance tests measured throughput and delay for unicast and multicast traffic across the 1,536 10 GbE ports. Interoperability tests assessed the ability of the QFabric System to work with Cisco Systems switches and routers running common data center protocols, such as link aggregation, OSPF equal cost multipath, and BGP.

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KNOCKING IT OUT OF THE PARK

Dizzy and his brother backed up his pre-season claim of 45 wins by over-delivering. They won 49 games and the World Championship.

The results of the tests performed by Network Test using Spirent TestCenter verified that QFabric did indeed deliver on its promise of high performance at massive scale.

- All QFabric System components operated as a single device, simplifying network management and reducing operational complexity
- Throughput for Layer 2 traffic was virtually identical in store-and-forward and cut-through modes, with rates approaching the maximum channel capacity for most frame sizes
- QFabric forwarding delay is low and consistent across all tests (less than 5 microseconds for all frame sizes up to 512 bytes) when offered loads below the throughput rate
- Average latency for Layer 3 traffic is 10 microseconds or less for most frame sizes tested
- Multicast throughput was close to line rate in all tests, regardless of frame length, with the system moving traffic at speeds of up to 15.3 terabits per second
- Multicast average latency was low and consistent in all tests, never exceeding 4 microseconds

The QFabric System successfully interoperated with Cisco Nexus 7010 and Cisco Catalyst 6506-E switch/routers when using common data center protocols such as link aggregation, OSPF equal cost multipath, and BGP. By using Spirent TestCenter, Network Test was able to objectively demonstrate the performance and interoperability of the QFabric System under the most extreme data center traffic conditions.

To see the full test report:

<http://www.juniper.net/us/en/dm/networktest/>

To get more information on Spirent TestCenter:

<http://www.spirent.com/Solutions-Directory/Spirent-TestCenter>

