NYSE EURONEXT DATA CENTERS AND THE NEXT-GENERATION NETWORK

The data centers in Basildon, England and Mahwah, NJ, will change the face of the exchange.

The floor of the New York Stock Exchange (NYSE) remains one of the world's most iconic locations. Images of traders staring at screens in either joy or despair are beamed around the world whenever financial trading makes it onto the front pages.

However, if all goes according to plan, by the middle of 2010 their place at the heart of the world of financial trading will change radically. As the number of trades conducted through automated trading systems skyrockets – even if the individual value of those trades decreases – the amount of network traffic between data centers will explode.

While the NYSE floor is not about to become a museum – though with its wooden booths, and in places rotary dial phones combined with computer terminals and large data screens, there appear certain anachronisms to its operation – the data centers that are under construction in the less glamorous areas of Basildon, east of London, and Mahwah, north New Jersey in the US, will alter the very way in which stocks and shares are traded.

MODEST AMBITIONS

The exchange is consolidating its data center footprint from 10 to four, including the two new megasites.

NYSE Euronext has said it is very close to a time when the two most important assets it owns are the data centers outside London and in New Jersey.

It says it is building capacity for automated financial trading through the lowest latency networks in a way the industry has never before seen.

That is the view of NYSE Euronext chief executive officer Duncan Niederauer, when speaking on the day that its networking supplier, Juniper Networks, listed on the exchange.

That day, 29 October 2009 (40 years to the day that the first signal was sent across ARPAnet, and rather less auspiciously 80 years to the day of the 1929 Wall Street crash), was a significant day for Juniper.

It was no less a significant day for the NYSE, publicly cementing as it did a two-way customer supplier partnership. Juniper is providing the network backbone that is going to underpin this brave new world of low-latency automated trading.

For it's the network, and to use an old phrase – the network is the computer – that tightly binds together the futures of both NYSE Euronext and Juniper.

Kevin Johnson, chief executive officer of Juniper, says: "All the innovation is in stuffing data centers with more storage and connecting them in a low-latency fashion. Automation is coming to exchanges as fast as we can make it happen."

To Juniper and to the NYSE, this is all about collapsing the network layers in the data center.

ALL SYSTEMS GO

The system will be based on its existing technology – combining Juniper EX Series Ethernet Switches and MX Series Ethernet Services Routers with its Junos network operating system running across existing MPLS backbone.

Though Juniper says that today's data center network comprises at least two networks with fibre channel through the backbone and Ethernet to the switches, it is not yet ready to reveal details of its project Stratus under which it says a single network layer will control server, storage and switches.

It is developing the next-generation network infrastructure, which will see data flow freely across virtual private LAN service (VPLS) over MPLS between data centers.

"Juniper's simplified data center approach will allow us to deploy a complete 10GB Ethernet network with ultra-low latency at a substantial cost savings," says Steve Rubinow, executive vice president and co-global chief information officer of NYSE Euronext.

NYSE – old, but not a museum

"It has developed truly unique and innovative technologies that help us to deploy a high-capacity, low-latency network that meets the stringent demands of the new data center.

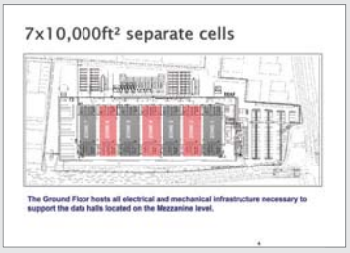
"With Juniper, we are able to dramatically cut the cost and complexity of managing our data center network today, while continuing to enhance our competitive position with a next-generation data center fabric that will enable us to scale to tens of thousands of 10GbE ports.

"With such an elastic and efficient infrastructure, we can provide enhanced functionality to our customers at unmatched scale, while also minimising total cost of ownership," says Rubinow.

VPLS OVER MPLS

Extending the VLAN between data centers using VPLS over MPLS provides low-latency variation and statistically bound low convergence times within the MPLS network. It also supports QoS using the traffic engineering capabilities of the MPLS network.

BUILDING IN BASILDON



Ian Bitterlin, chief technology officer at Prism Power, showed delegates at DatacenterDynamics London the inner workings of the NYSE Euronext data center.

The NYSE Euronext data center consists of 7 x 10,000 sq ft separate cells at an initial 10.5MW of IT load.

The ground floor hosts all the electrical and mechanical equipment, with the data halls situated on a mezzanine.

As a Tier IV facility it is designed for 3MW per hall for high-density loads.

It has two independent power and cooling systems throughout – original 2S where S=N+1, not the revised 2N.

The Mechanical Plant Floor houses an individual mechanical plant dedicated to the Data Hall above.

Service holes in slab provide the ability to directly cool IT equipment and high-density cabinets with chilled water from below.

In each hall redundancy levels exceed the current Tier IV classification.

Two separate/segregated 'N=N'4MVA MV/LV supply transformers;

'N+2' 24,000L (individual) fuel-oil tanks;

Two/four separate/segregated 'N+1' UPS rotary systems for 1.5/3MW of IT load;

Two separate/segregated 'N+1' chilled-water CRAC systems;

Two separate/segregated 'N+1' electric chiller systems; and

Two separate/segregated 'N+1' UPS rotary systems for the mechanical cooling plant

By using MPLS as its underlying transport, Ethernet packets forwarded in a VPLS domain are label-switched across pre-established LSPs between the LER/core data center routers at each location.

This label-switching mechanism, using defined paths across the backbone, provides low latency as packets do not require route lookup across the WAN backbone.

All packets for a given VPLS connection follow the same path and hence provide low-latency variation.

VPLS supports logical network segmentation in support of granular security policies and compliance requirements by extending segmentation across data centers.

Data center networks typically need to be divided into logical segments for traffic protection, integrity and enforcement of granular security policies. Thus, VPLS is helpful in extending this architecture between multiple sites.

Because Juniper's data center networks already provide strong segmentation capabilities within data center sites and complement application server clustering strategies, the fact that VPLS allows extension of this complementary architecture between sites creates an extremely robust design option in the hands of network managers. They can then provide this segmentation in a scalable, resilient and high-performance manner.

The supplier is currently lab-testing the VPLS VPN to extend the layer two network across two data centers by, for example, taking the spare CPU cycles in the London data center and applying them to the New Jersey data center.

The firm says it can provision complex VPNs such as this in less than a minute.

This is the key to NYSE's promises of low-latency, high-resiliency and increased throughput. The idea, says Juniper, is to simplify the infrastructure.

SECURITY MATTERS

Once built, you want to share, and once sharing you want to make sure it is secure. The simile is that in the past security was based on a castle, with all the security at the edge. In a new data center network paradigm it is more like making a hotel secure.

Like other exchanges, NYSE Euronext invites its customers to position their servers within its data centers in order to shave further fractions of milliseconds from trades.

In such a setup, the security aspect of data travelling across the network becomes key.

"You've already invited everyone in. Data will flow freely between servers, between data centers and from clients to the data center, and you have to make it secure," Juniper says.

FLAT

Ultimately, the idea is to deliver a single flat fabric for all devices in the data center and make the management of it the same as running a single switch.

In traditional networks, says Juniper, adding capacity meant adding complexity. And as the number of packets scales – as in automated trading – the complexity scales exponentially.

It says it is reversing this process by removing the point solution approach. What is clear is that once the physical infrastructure is simplified "you don't want to physically partition the network, you want to virtualise it", according to Juniper.

SO FAR, SO VISIONARY

NYSE Euronext knows that the next stage of its future depends on slinging packets across the Atlantic ocean resiliently, safely and securely in milliseconds.

The exchange is committed to moving to the Stratus network fabric when it becomes available at some point next year. This is not as great a leap as it would appear as NYSE is already deploying many, if not all, of the components of Stratus in its network.

Stratus, says Juniper founder Pradeep Sindhu, is an integration of all of the Juniper stack – from its Junos Plus software (the crown jewel) to the new Trio chipset – which is deployed in its latest MX products, to its security layer.

NYSE knows that the success of this network and that of its supplier are closely tied. ■

FURTHER READING

Juniper Networks' white paper on implementing VPLS over MPLS can be found at **www.juniper.net/us/en/local/pdf implementation-guides/8010050-en.pdf**