Dell PowerConnect 3248

Ethernet Switch Hits Hard on Price/Performance

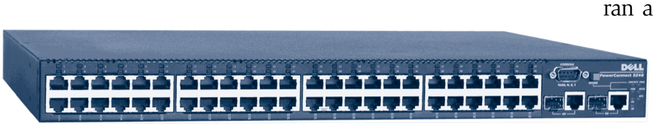
Network World published a review of the Dell™ PowerConnect™ 3248 Ethernet switch on October 7, 2002, and gave it high ratings. The full review appears here.

BY JOHN BASS

Ethernet switching technology has matured to the point where customers expect a pile of features and wire-speed performance. Normally, this combination translates into rising switch prices, but Dell has made an exception to that rule with its newest Ethernet switch. The Dell™ PowerConnect™ 3248 is a lower-priced Layer 2 wiring closet switch and, while it does not perform routing, the 3248 does a great job implementing quality of service (QoS) and multicast optimization features.

Dell's box performed at wire speed for Layer 2 forwarding and QoS prioritization, had acceptable latencies for unicast and multicast, and is sold at less than half the price per port of the typical Ethernet switch on the market.

The PowerConnect 3248 has 48 10/100Base-T Ethernet ports and two copper Gigabit Ethernet ports. The gigabit ports have Category 5 connectors and small form-factor pluggable (SFP) gigabit interface card connectors. Optional SFP adapters can be used in the SFP ports to provide 1000Base-LX and 1000Base-SX connections to the switch. To add redundancy to the 3248's power supply, an optional RPS-600 power supply unit can be purchased to add power to up to four 3248 switches. Features include support for standards-based link aggregation, virtual LANs, QoS, multicast optimization, and port mirroring.



We tested Layer 2 forwarding throughput and latency, multicast/unicast throughput, multicast latency, maximum number of multicast groups supported, VLAN bleed-over and throughput, and QoS performance (see the "How we did it" section).

The PowerConnect 3248 can forward packets at nearly wire speed, even when we mixed unicast and multicast traffic (see the "Performance data" section). There is a small dip in performance, with 64-byte packets passed at 99% wirespeed. The 3248 forwarded packets at wire-speed for all other packet sizes (128, 256, 512, 1,024, 1,280, and 1,518 bytes).

The 3248's QoS implementation can prioritize traffic properly at wire speed. The 3248 provides QoS by implementing 802.1p, IP Precedence and Differentiated Services Code Point (DSCP) protocols. The queuing scheme is implemented by four egress queues on each port, associated with one of four logical classes of service. Priority values from any of the three queuing protocols can be mapped to one of the classes of service. This falls in line with the industry's de facto standard for queuing implementations for Layer 2 forwarding. For 802.1p, DSCP and IP Precedence tests, we found that the flows were prioritized as they should have been.

VLAN implementation keeps traffic at wire speed. We ran a bleed-over test, which tracks whether packets from one VLAN show up on the other VLAN. The test revealed that all VLAN traffic was forwarded to the proper destination.

HOW WE DID IT

The following sections describe the tests run on the Dell PowerConnect 3248. All testing was executed using one Spirent Communications™ SmartBits® 2000 chassis, one SmartBits 6000 chassis, and two SmartBits 20 chassis. The chassis were loaded with 48 10/100 SmartMetrics™ ML-7710 cards and a two-port Gigabit TeraMetrics™ LAN-3301A card. We used SmartFlow™, VLAN, and SmartMulticast™ test applications.

Layer 2 throughput test

This test finds the maximum transmission rate at which the switch can forward traffic with no loss. The test starts at 100% of the maximum allowed transmission rate. If a single frame is dropped, the transmission rate is decreased to 50%, and the test is repeated. If no frame is dropped, the transmission rate is increased to half way between the current rate and the maximum rate without loss (binary search). The test finishes when the difference between the rate of the last passed test and last failed test is less than or equal to 1%.

For our test, we ran the throughput test in a fully meshed fashion using all 48 10/100M bit/sec Ethernet ports. Traffic was sent in bi-directional mode between the two Gigabit Ethernet ports. All 10/100 ports were configured for 100M bit/sec and full duplex operation. The test was run for frame sizes of 64, 128, 256, 512, 1024, 1280 and 1518 bytes. Each iteration of the test ran for 120 seconds.

Layer 2 latency test

This test tracks the latency of each test frame on a frame-by-frame basis. An average of all the frames is calculated for a particular frame size. Transmit timestamp is the time when port sends the first bit of the frame. The receive timestamp is the time when the receiving port receives the last bit of the frame. Latency is calculated as the difference between the Receive Timestamp and the Transmit Timestamp.

The test was run in a fully meshed fashion with all 48 100 Mbps ports configured for 100 Mbps and full duplex operation. Traffic was sent in bi-directional mode between the two Gigabit ports. The test was run with the maximum throughput without loss for frame sizes of 64, 128, 256, 512, 1024, 1280 and 1518 bytes. Test duration was set to 120 seconds for each iteration.

VLAN test

This test determines if traffic from one VLAN is received at all the participating ports and is not received on ports that do not belong to that VLAN.

Multiple VLANs are created on the switch. Traffic is sent on each VLAN, and frame loss is measured. For our test, we created eight VLANs with six ports each thus utilizing all 48 10/100 Mbps Ethernet ports. Traffic was sent between each of the six ports in a fully meshed fashion. Frame loss for each VLAN was recorded for frame sizes of 64, 128, 256, 512, 1024, 1280, 1518 bytes. The test duration for each iteration was set to 120 seconds. All 10/100 ports were configured for 100 Mbps and full duplex operation.

QoS tests

This test determines the relative priority of traffic based on different QoS mechanisms supported on the switch. The test was performed for three different types of QoS supported:

- Differential Services Code Point (DSCP)
- IP Precedence (ToS)
- IEEE® 802.1p

In this test, multiple flows are created with different DSCP, ToS or VLAN priority values. Traffic from two ports is received at one port, forming a group of three ports with two transmitters and one receiver. The total traffic sent from the two ports is increased in steps until it exceeds the maximum line rate. The latency values for traffic in each priority level are recorded.

For our test, we created eight flows for each port having different priority levels. All 48 10/100 ports were utilized therefore creating 16 groups of ports. The test was run for packet size of 128 bytes where the iteration duration was 120 seconds.

Mixed Class Throughput test

Mixed Class Throughput tests the maximum transmission rate at which the switch can forward both multicast and unicast traffic for a 16 multicast groups. Each group consists of one transmitter and two receivers. The multicast and unicast traffic is transmitted at the same rates. A binary search is performed to find the maximum throughput before loss of this mixed class traffic.

Test duration of each iteration was 120 seconds. The same test was run for frame sizes of 128, 256, 512, 1024, 1280, 1518 bytes.

Multicast latency test

Forwarding Latency tests the minimum, maximum, and average multicast forwarding latency of the switch at the maximum throughput rate before loss for 16 multicast groups. Both the transmission rate and multicast groups remain constant during the test.

After verifying that the receiving ports successfully joined the groups, frames are transmitted at the specified rate for 120s. The latency values of the received frames are measured. This test was run for 128-, 256-, 512-, 1,024-, 1,280-, and 1,518-byte frame sizes.

Maximum number of multicast groups test

Multicast Group Capacity tests the number of multicast groups concurrently supported by the switch at a specific transmission rate. The number of multicast groups increases by 10 during the test at 100% maximum transmission rate.

The test starts by initially setting up 10 multicast groups. The number of multicast groups (Initial Group Count) is divided evenly among the five receiver destination (receiving) ports in each of the groups initially set up. Each iteration is run for 10 seconds.

The multicast groups that are added with each increase are assigned to one receiving port at a time, in sequence. The trial continues until a receiving port in one of the group(s) does not receive at least one multicast frame from any of the multicast groups that it joins, or the maximum possible number of groups supported by the test equipment is reached. Our test equipment supports a maximum of 1,000 multicast groups.

Port mirroring

Sending traffic into Port 1 of the switch destined for a device connected to Port 2 tested the port mirroring feature. The following steps are followed.

1. The switch is configured to mirror the received traffic from Port 1 to Port 3. Measure packet counts on Port 3 and Port 1.
2. Configure the switch to mirror the transmit traffic from Port 1 to Port 3. Measure packet counts on Port 3 and Port 1.
3. Configure the switch to mirror both the transmit and receive traffic from Port 1 to Port 3. Measure packet counts on Port 3 and Port 1.
4. Reverse the direction of the traffic flow and repeat steps 1–3.

NET RESULTS: DELL POWERCONNECT 3248

☆☆☆☆ 4.25 Rating

Company: Dell, (800) 289-3355
Cost: $1,500
Pros: Great price/performance ratio; strong Layer 2 feature set
Cons: Lacks Layer 3 support, access control lists and centralized management platform

Individual category scores are based on a scale of 1 to 5. **Percentages** are the weight given each category in determining the total score.

Scoring Key:
5: Exceptional showing in this category. Defines the standard of excellence; **4:** Very good showing. Although there may be room for improvement, this product was much better than the average; **3:** Average showing in this category. Product was neither especially good nor exceptionally bad; **2:** Below average. Lacked some features or lower performance than other products or than expected; **1:** Consistently subpar, or lacking features being reviewed.

What's the score?

Dell PowerConnect 3248

Performance 30%	4.5
Features 25%	4.0
Management 25%	4.0
Scalability 10%	4.0
Installation/Documentation 10%	5.0
TOTAL SCORE	4.25

Latencies for unicast and multicast seem a little high for a device of this type. We saw about 1.2 msec for 64-byte unicast packets and about 1.3 msec for multicast packets. Even though this is higher than most switches we have tested, which register less than 1 millisecond latency, it should be acceptable for virtually all network applications. However, network design with too many hops using these switches could create noticeable end-to-end latencies.

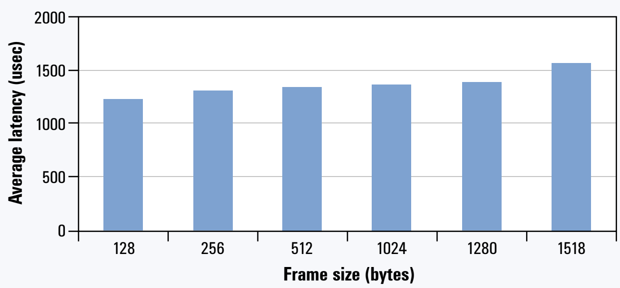
The port-mirroring feature is a troubleshooting device that allows send and/or receive traffic of one port or multiple ports to be reproduced and sent out to another port. This mirrored port could have an attached network analyzer to capture packets to diagnose a problem. The feature works as advertised.

PERFORMANCE DATA

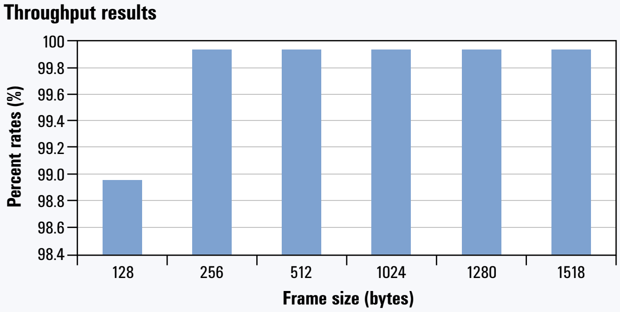
Average latency results

Latencies for both unicast and multicast seem a little high for a device of this type. We saw about 1.2 ms for 64 byte unicast packets and about 1.3 ms for multicast packets at 128 sized packets. Even though this is higher than most which register less than one millisecond latency, it should be acceptable for virtually all network applications assuming a reasonable network design.

Average latency results



Throughput results



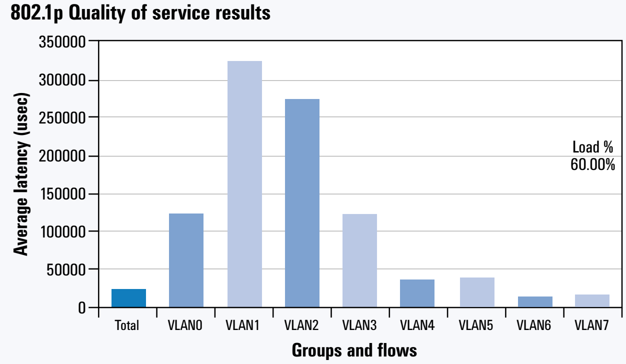
Throughput results

The PowerConnect 3248 can forward packets at nearly wirespeed, even when we mixed unicast and multicast traffic. There is a small dip in performance with 64 byte unicast packets at 99% wirespeed. Considering that the probability that all packets on a LAN at any time will be 64 B approaches 0, losing 1% of traffic that will virtually never occur is acceptable on our view.

802.1p Quality of Service results

In this test, the Dell 3248 switch prioritized traffic flows appropriately at all loads tested meaning that packets tagged with a high priority—VLAN6 and VLAN7—experienced the lowest latency.

802.1p Quality of service results



Strong management

Dell has done a good job creating a couple of simple, usable management interfaces for the unit, but it lacks a centralized interface to manage multiple 3248s. The 3248 can be managed in-band from one of the Ethernet ports or from a serial console port. The command-line interface (CLI) has a Cisco® look and feel.

Dell also provides a Web management interface. This graphical user interface gives access to all configuration options available from the CLI. However, only one 3248 can be configured at a time via the Web interface. If a network professional could manage all 3248s from one interface, managing VLANs and QoS would be easier. Dell has implemented SNMP for enterprise management and monitoring, and Remote Authentication Dial-In User Service for authentication management.

Another interesting usability feature is the 3248's ability to hold two firmware images at once. This is useful for firmware upgrades because it would be easy to back up to an earlier version of firmware.

Overall, the 3248 is a strong Layer 2 Ethernet switch for small to midsize enterprise networks. While the addition of routing capabilities would make this switch an astounding value, the current price/performance/feature value makes this an easy buying decision. At $999, it's definitely worth a try.

John Bass, a senior technical staff member at Centennial Networking Labs at North Carolina State University and co-author of McGraw Hill's *Building Cisco Multilayer Switched Networks*, designs and leads the execution of the test suites. He can be reached at john_bass@ncsu.edu. Sangram Kadam, Khurram Khan and Piyush Raju assisted with the testing.