TEST REPORT

Tolly.

#211103
February 2011
Commissioned by Cisco Systems, Inc.

Cisco Small Business 300 Series Managed Switches:

Performance, Power Consumption and Features vs. D-Link, HP Networking and NETGEAR

Executive Summary

Small businesses today require high-performance, high-functionality switches for both 10/100 and Gigabit Ethernet deployments. Businesses deploying VoIP solutions will also require switches that deliver Power over Ethernet (PoE), quality of service (QoS) and Voice VLANs. With respect to economics, switches should be easy to use, to help lower administrative costs, offer attractive cost-per-Gigabit and, where appropriate, cost-per-Watt of PoE delivered.

Cisco Systems commissioned Tolly to evaluate several models of the new Cisco Small Business 300 Series of managed switches along with comparable models from D-Link, HP Networking and NETGEAR. In all, eleven switches were tested.

Tolly evaluated a range of features and capabilities including: Power over Ethernet, Layer 2 throughput and latency, power consumption, feature/functionality and advanced recovery and performance options, such as link aggregation and MSTP. Engineers also calculated cost-per-Gigabit and cost-per-Watt-delivered as appropriate.

Small business users have a wide range of LAN switch implementations to choose from: fixed/stackable/chassis, managed/smart/unmanaged, Fast Ethernet (10/100)/Gigabit Ethernet, PoE/non-PoE, etc.

The Bottom Line

The Cisco 300 Series 10/100 and GbE Managed Switches delivered:

1. Wire-speed, non-blocking, Layer 2 throughput at all frame sizes tested from 64 to 1518 bytes
2. Consistently low latency at all frame sizes
3. Best Price/Performance among switches tested
4. Most extensive feature set: IPv6, traffic shaping and rate limiting, scope of GUI-based configuration
5. Lowest power consumption in 2 of the 3 classes tested, and best-in-class power efficiency overall
6. Most extensive set of IPv6 protocol and application support
7. Best usability with a simplified user interface delivering both basic and advanced capabilities in an intuitive fashion

This evaluation was restricted to fully managed, non-stackable (fixed) switches offering a basic complement of at least 24 ports. Within that class, switches were further categorized as follows: 1) 10/100 (Fast Ethernet) with PoE, 2) 10/100 without PoE, and 3) Gigabit Ethernet without PoE. The Cisco Small Business 300 Series features a switch in each of these categories.

All three Cisco 300 Series switches delivered wire-speed throughput and consistently low latency at all frame sizes tested (64-byte through 1518-bytes). The power consumption of each switch was calculated using the industry-standard ATIS methodology. Cisco switches ranked first or second in energy efficiency in every category - in some cases consuming only 25% as much power as competing switches. The Cisco switches also offer additional energy efficiency capabilities not present in the competing switches such as power scaling on cable length and reduction of power on ports with endpoints disconnected or powered down.

All three of the Cisco switches tested run on the identical code base, thus, provide support for the same advanced feature set which simplifies switch maintenance. In addition to supporting features like QoS, MSTP, Layer 3, Voice VLAN, LLDP-MED, DHCP Options 66/67/82, IGMP snooping, Querier, and security features, such as ACLS and time-based 802.1X, the Cisco boxes were unique in this test for their extensive support for IPv6 as well as sophisticated, configurable rate limiting and traffic shaping features. (Not all features listed were tested as part of this evaluation.)

While all of the systems tested provide a graphical user interface (GUI), the Cisco GUI had the most modern look-and-feel with Ajax-based features. Testers also verified that, even with the Cisco switch running 100% load on 24 of its ports, that the GUI (accessed in-band via port 25) remained responsive and that the switch could maintain wire-speed throughput.

Introduction

The evaluation included eleven LAN switches from four prominent vendors and explored a wide range of areas that included price/performance, Power over Ethernet, feature sets and usability.

Certain areas, such as feature sets and usability, typically remain consistent across the various models of a single vendor. Other information, such as price/performance, will be tied to a specific switch.

Results will be detailed first for those areas that generally apply to all products tested from a given vendor. Then, product-specific results will be detailed for each of the three product categories tested.

Power

In recent years, the importance of how a device consumes and manages power has surged.

As network architects focus more on total cost of ownership (TCO), the cost of energy and the recurring costs associated with running network infrastructure devices 7x24x365 have become increasingly important.

Cisco Systems, apparently, has made energy efficiency a focus for the 300 Series Switches.

In this series of tests, the Cisco switches delivered "best-in-class" power efficiency for the Gigabit Ethernet and 10/100 PoE switches and were in a virtual tie for best power efficiency in the 10/100 Non-PoE switch category. See Figure 1.

Additionally, Cisco has implemented features that can respond to actual, run-time conditions to reduce power consumption.

Specifically, the energy detect feature enables the switch to sense whether the attached device is powered on and to put the switch port into a power-conserving sleep mode when the device is powered off.

The power scaling feature provides for dynamic detection of cable length thus allowing the switch to reduce port power for shorter cable lengths.

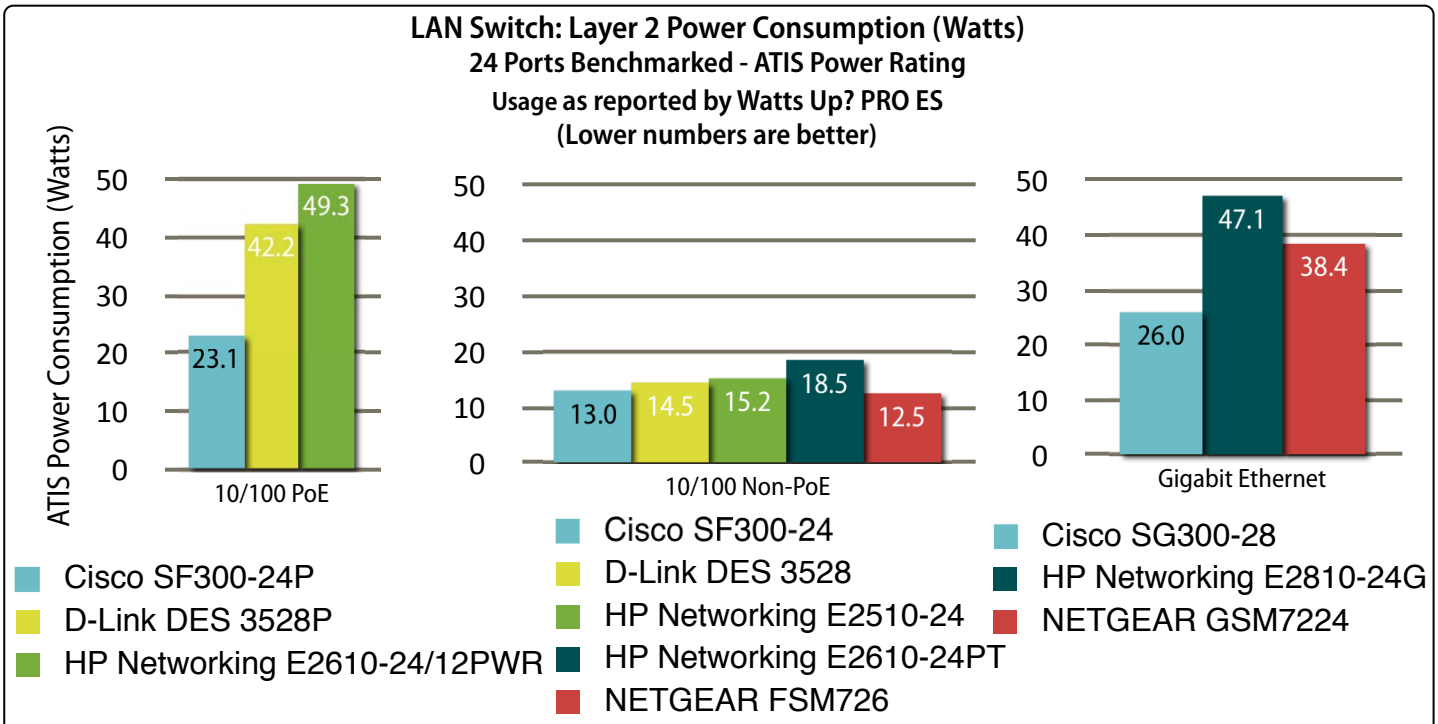
Cisco Systems, Inc.

300 Series Switches

LAN Switch: Performance, Power Consumption, PoE, Advanced Features

Tolly. Certified

Tested December 2010



Note: No power over Ethernet was being delivered during this test. The ATIS power is 0.1*(at 0)+.8*(at 10) +.1*(at 100) where (at n) are utilization rates. HP Networking and NETGEAR GbE switches have 24 ports were Cisco has 28. ATIS values for Cisco used 24 ports for comparison purposes. Even running 28 ports Tolly engineers confirmed that the Cisco ATIS was the lowest of the three Gigabit Ethernet switches.
Source: Tolly, December 2010

Figure 1

Cisco was the only vendor in this evaluation that provided these enhanced energy management features. See Table 1.

Features

Tolly engineers validated a range of features on each of the devices and reviewed each system's configuration screens to identify the presence or absence of other functions. Table 2 summarizes those results and highlights are discussed below.

Traffic Prioritization

Engineers confirmed that all of the systems under test supported 802.1p/Q prioritization and VLAN tagging. Engineers also validated that all the systems under test provide support for 802.3ad link aggregation which allows multiple physical links to function as a single logical link between switches.

Engineers investigated, but did not test, additional proprietary features each vendor makes available to provide more granular control over bandwidth.

Products from HP and NETGEAR offered some additional control over the traffic stream with HP providing multiple traffic queues but no explicit rate limiting and NETGEAR offered a per-port limit for transmit rate.

D-Link provided more granular control with per-port rate limiting for ingress/egress and both per-port and per-queue rate limiting.

The Cisco offering, however, provided the most extensive set of rate limiting and traffic shaping options. Unique among the products in the test, Cisco offers two modes for traffic management: Basic - providing per-port functionality, and Advanced - adding more granular per-flow control. The support was very granular and allows network administrators to manage traffic at per-port levels and/or at ingress or egress to the switch. Furthermore, the traffic shaping policy could be applied to a single port or to a set of ports belonging to a logical link aggregation group.

Spanning Tree and Multicast Support

Tolly engineers validated that all systems under test supported both multiple spanning tree (MSTP) and rapid spanning tree (RSTP) protocols.

Tolly engineers validated the support for various multicast functions and verified that the Cisco solution supported IGMP Snooping, Querier and MLD Snooping functions. The D-Link and NETGEAR solutions did not offer MLD Snooping and the HP solutions offered only IGMP Snooping - no MLD Snooping or Querier.

IPv6 Support

With the IPv4 address set already fully allocated, IPv6 is a must-have feature for network equipment in businesses of all sizes.

While not part of the testing phase, Tolly engineers used product documentation to identify the current IPv6 support offered by each product.

HP's products did not appear to have any IPv6 functionality and the D-Link and NETGEAR products offered minimal support for IPv6 addressing and management.

In contrast, the Cisco solution offered an extensive set of IPv6 protocol and application support. This is the most extensive IPv6 support that Tolly has seen, to date, in an SMB-class product.

As noted earlier, a summary of feature support can be found in Table 2. For Cisco, the protocol support includes dual-stack IPv6/IPv4, ACLs, QoS and MLD Snooping with a full range of IPv6 network management functions and applications including Telnet/SSH, RADIUS and DNS.

LAN Switch Energy Conservation Features
Vendor Products Tested

Feature	Cisco Systems	D-Link Systems	HP Networking	NETGEAR
Energy Detect	✔	✘[2]	✘[2]	✘[2]
Power Scaling	✔[1]	✘[2]	✘[2]	✘[2]

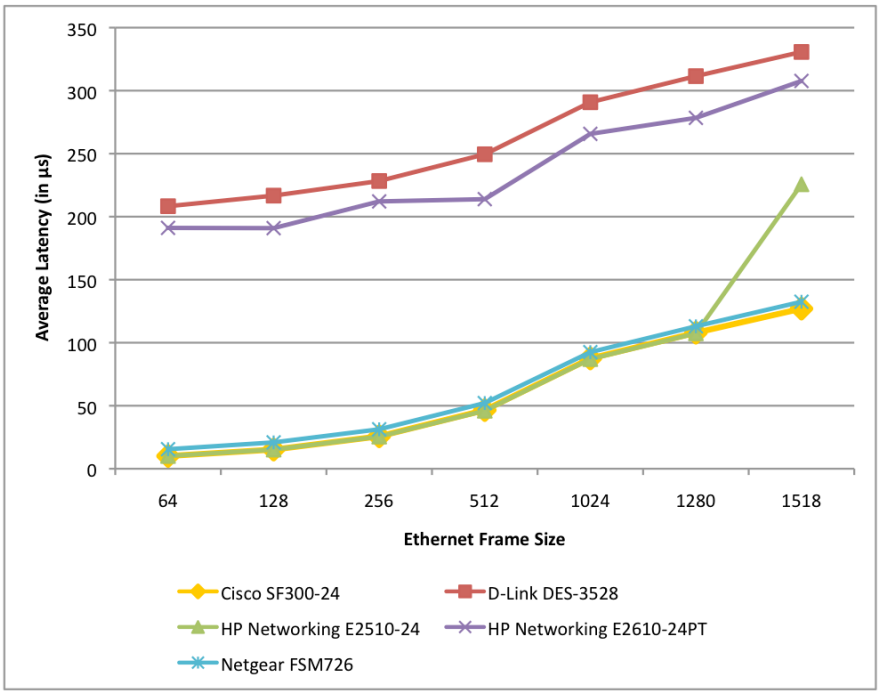
Notes: 1) Available on Cisco Gigabit Ethernet switch only. 2) Switch documentation did not reference these functions or similar functions.
As feature availability is the same across all products tested from each vendor, only the vendor name is referenced.

Source: Tolly, December 2010

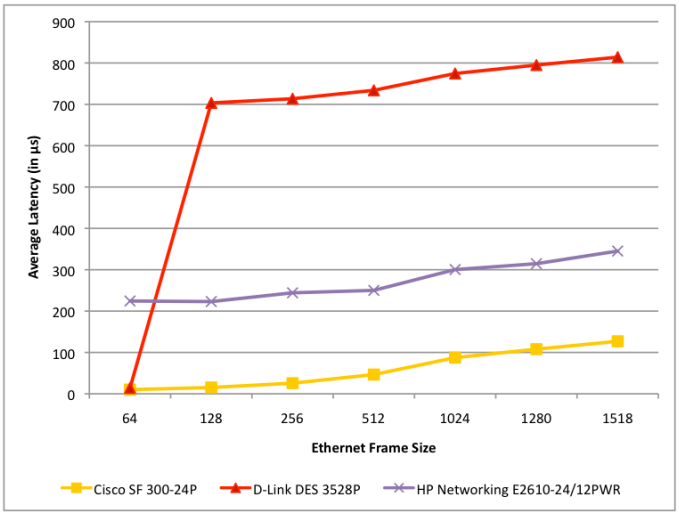
Table 1

Gigabit Ethernet LAN Switch: Layer 2 System Latency (µsec) Under 100% Load
24 Ports in Full Mesh Configuration
(as reported by Ixia IxAutomate 6.90)
Lower numbers are better

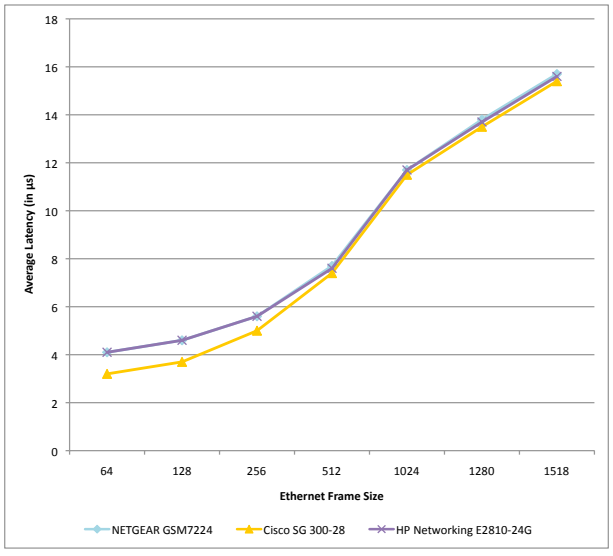
10/100 Non-PoE



10/100 PoE



Gigabit Ethernet



Note: Cisco's GbE switch has 28 ports where HP Networking and NETGEAR'S have 24 ports. For purposes of comparison, 24 ports were used on the Cisco switch. For the HP E2510-24 up to .5% of traffic was dropped at all frame sizes during the 100% load, latency test. For the D-Link DES-3528P approximately .5% of traffic was dropped at 64-byte frames only.

Source: Tolly, December 2010

Figure 2

LAN Switch Feature Summary
Based on Vendor Products Tested

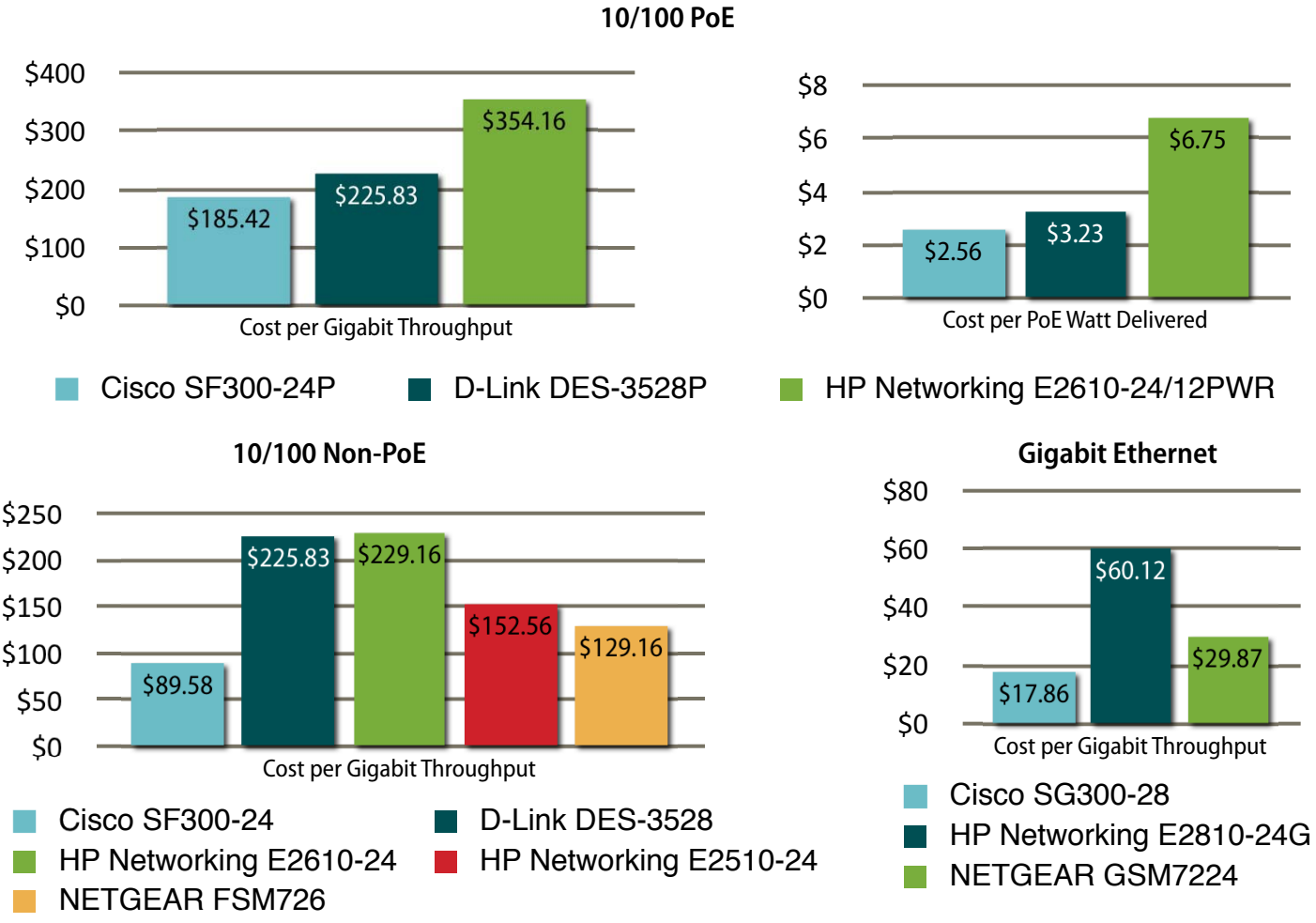
Feature	Cisco Systems	D-Link Systems	HP Networking	NETGEAR
802.1p/Q	✔	✔	✔	✔
MSTP 802.1s	✔	✔	✔	✔
RSTP 802.1w	✔	✔	✔	✔
Link Aggregation 802.3ad	✔	✔	✔	✔
IGMP Snooping, Querier and MLD Snooping	✔	Partial, no MLD	Partial, no Querier or MLD	Partial, no MLD
IPv6[1]	✔✔✔ (Extensive) Dual Stack IPv6/IPv4 IPv6 ACLs IPv6 QoS (DSCP) MLD Snooping Transition mechanism – ISATAP IPv6 Applications – SNMP, Telnet/SSH, RADIUS, Syslog, Web/SSL, DNS, etc	✔ (Minimal)	✘	✔ (Minimal)
VLAN Mirroring	✔	✘	✘	✘
Layer 3[2]	✔	✘	Partial, only on E2610 model	✔
Rate Limiting/Traffic Shaping[1]	✔✔✔ (Extensive) Basic and advanced modes. Per-port and per-flow policies and mapping can control ingress/egress/both. Applicable to single port or LAG.	✔✔ (Partial) Per-port rate limiting for ingress or egress, can specify maximum per port and per queue (7) rate limiting.	✔ (Minimal) QoS but no explicit rate limiting. Also some settings require configuration via CLI.	✔ (Minimal) QoS supports a per-port cap for transmit rate.

Notes: 1. IPv6 and rate limiting configuration options reviewed but not tested. 2. Layer 3 does not imply full layer 3 routing functionality.
As feature availability is the same across all products tested from each vendor, only the vendor name is referenced.

Source: Tolly, December 2010

Table 2

Ethernet LAN Switch: Price/Performance
Cost per Gigabit Throughput & Cost per PoE Watt Delivered
Lower numbers are better
Calculations based on US MSRP January 2011



Note: The cost per Gigabit was calculated using the aggregate bidirectional throughput of each switch when transmitting 1518-byte frames at the switch's maximum rate. The MSRP is divided by the throughput. The cost per PoE Watt was calculated by dividing the MSRP by the measured power budget.
For PoE, HP recommended using the version of the E2610 (J9087A) that provided PoE on all 24 ports but that switch was not in stock for testing.The cost per PoE watt delivered would have been $3.20 based on a CDW price of $1,299 and an advertised 406W PoE budget.
GbE uplinks not included in 10/100 cost per Gbps calculation. All 10/100 switches were equipped with 4 GbE uplinks except the NETGEAR FSM726 and the HP E2510 which had 2 uplinks.For GbE, HP and NETGEAR switches offer 24 ports where Cisco provides 28 ports. All available ports used for cost calculations on the Gigabit Ethernet switches.
Source: Tolly, December 2010

Figure 3

Usability

While usability cannot be measured in the same way as system performance, it is an important area when considering total cost of ownership (TCO) especially in an SMB environment where dedicated IT resources might be constrained or even non-existent.

Graphical User Interface

While all managed switches will be able to claim to offer a "GUI", this cannot be treated as a "check mark" item that a product either does or does not offer.

The GUI environments offered by the other vendors were on par with what has been available in the industry for years. HP required a JAVA download to function. The GUI's offered minimal "help" functions and Tolly engineers found that they had to leave the "easy" GUI environment and use the command-line interface (CLI). In summary, the D-Link, HP and NETGEAR represented the status quo GUI environments that one has come to expect.

Cisco has raised the bar on switch management GUIs. Cisco's GUI was designed with new generation technology and could be seen immediately to provide a state-of-the-art user experience offering Ajax-style interaction with the user. More importantly, the GUI does not just provide access to basic functionality. Even the granular traffic shaping functions discussed earlier can be configured via the GUI. And, the GUI offers both a "basic" and an "advanced" screen set for this function so that network managers concerned only with basic traffic shaping functions do not need to deal with screens and functions related to advanced traffic management functions. Also, the Cisco GUI offers a very complete, context-sensitive help not present in the other products evaluated.

Common Code Base

Additionally, usability needs to go beyond the traditional definition of the look-and-feel of the management interface.

While the Cisco switches tested ranged from 10/100 to Gigabit Ethernet with and without Power over Ethernet, they all share the same code base. Thus, users of the Cisco 300 family only need to maintain and deploy a single code base and, consequently, have identical software functionality in all models. Of the vendors tested, only Cisco used the same code base across all of the products in this test.

Product-Specific Comparisons

10/100 Power over Ethernet Switches

The Cisco SF300-24P was compared with a D-Link DES-3528P xStack and an HP Networking E2610-24/PWR. (See Table 4 for a complete listing of switches evaluated in this report.)

Both the Cisco and D-Link models tested were able to deliver PoE on any of the 24 ports. While HP has a model of the switch tested that has this capability, the model in stock and used for this test supported PoE on only 12 ports.

Power Efficiency

The Cisco SF300-24P is the most power efficient of the three tested with power usage calculated using the ATIS method that are roughly half of the HP and D-Link offerings. See Figure 1.

Tests were run to determine how many ports could deliver 15.4W simultaneously. The maximum for HP was 8. Cisco delivered maximum power on 11 ports and D-Link on 23 ports. See Table 3.

Cost Per PoE Watt Delivered

Using price information available on CDW and CompSource as of January, 2011, Tolly engineers calculated the "cost per Watt" of PoE power delivered.

For Cisco, that value was $2.56 compared with $3.23 for D-Link and $6.75 for HP. Using HP's advertised power budget of 406W for the E2610-24/24PWR switch HP recommended for test that provides PoE on 24 ports, engineers calculated the cost per PoE Watt delivered of that unit as $3.20 based on a CDW price of $1,299.99. See Figure 3 for details and calculation.

Performance

Tolly engineers performed a series of standard throughput tests using the 24 10/100 ports on each device. See Table 1.

All devices performed at wire-speed for all frame sizes tested except the D-Link which dropped some frames when tested at 64-bytes.

Engineers also benchmarked and verified that the Cisco switch exhibited much lower latency than the other two switches.

With 64-byte frames, the Cisco switch latency was 10.1µs compared with 1 224.4µs for HP. With the largest frames, 1518-bytes, the Cisco latency was only 127µs compared to 814.1 for D-Link and 345.1µs for HP. See Figure 2 and Table 5.

Cost Per Gbps of Throughput

Engineers related throughput to device cost by calculating the cost of each Gbps of throughput. The Cisco switch had the lowest cost per Gbps at $185.42 followed by D-Link at $225.83 and HP at $354.16. See Figure 3 for details and calculation.

The cost per Gbps includes only the 24 10/100 ports as those represent the core capacity of the switch. All switches in this category provided 4 GbE uplink ports.

10/100 Ethernet Switches (Non-PoE)

The Cisco SF300-24 was compared with a D-Link DES-3528, an HP Networking E2510-24, and HP Networking E2610-24PT and a NETGEAR FSM726.

Power Efficiency

The Cisco SF300-24 is the second most power efficient of the five tested with power usage calculated using the ATIS method that is lower than both HP switches and the D-Link offering. See Figure 1.

Performance

Tolly engineers performed a series of standard throughput tests using the 24 10/100 ports on each device.

All devices performed at wire-speed for all frame sizes tested except the HP Networking E2510 that passed between 99.481 and 99.979% of the theoretical maximum traffic load at all frame sizes.

As with the PoE switch category, Cisco switch exhibited much lower latency when tested at 100% load than the other switches. In fact, the Cisco latency was identical to its PoE results.

While NETGEAR latency was competitive, the D-Link switch and the HP E2610 had latency that was some 3x longer than Cisco at larger packet sizes. (The HP E2510 dropped frames in every latency test and cannot be compared accurately.) See Figure 2 and Table 5.

Cost Per Gbps of Throughput

Engineers related throughput to device cost by calculating the cost of each Gbps of throughput. The Cisco switch had the lowest cost per Gbps at $89.58 followed by NETGEAR at $129.16 and the HP Networking E2510-24 at $152.56. See Figure 3 for details and the calculation used.

The cost per Gbps includes only the 24 10/100 ports as those represent the core capacity of the switch. The NETGEAR FSM726 and the HP Networking E2510-24 provide two Gigabit Ethernet uplinks where the other switches in the category provide 4 GbE uplinks each.

Gigabit Ethernet Switches

The Cisco SG300-28, a 28-port switch, was compared with two 24-port switches: an HP Networking E2810-24, and a NETGEAR GSM7224.

Competitive Interaction

Tolly acquired the D-Link, HP Networking and NETGEAR switches via normal product distribution channels. The Tolly Group invited representatives from those companies to participate in the testing as per The Tolly Group's Fair Testing Charter.
(See http://www.tolly.com/FTC.aspx).

All three vendors participated.
HP recommended using the E2610-24/24PWR, with PoE on 24 ports, but the recommended switch was not available in the timeframe for this test.

The various vendors reviewed their results and did not dispute the accuracy of the results.

For more information on the Tolly Fair Testing Charter, visit:

http://www.tolly.com/FTC.aspx

Power Efficiency

The Cisco SG300-28 is the most power efficient of the three tested with power usage calculated using the ATIS method that is lower than both of the other GbE switches. While the comparisons shown in Figure 1 are based on 24 ports for each of the products, Tolly engineers confirmed that even with all 28 ports active, the Cisco GbE switch still has the lowest ATIS value.

Performance

Tolly engineers performed a series of standard throughput tests using 24 GbE ports on each device. See Table 1.

All devices performed at wire-speed for all frame sizes tested. Additionally, Tolly engineers re-ran the performance test on Cisco using all 28 GbE ports and, again, the Cisco switch delivered wire-speed throughput.

While all three GbE switches exhibited low latency, the Cisco latency was the lowest of all switches tested for all frame sizes. See Figure 2 and Table 5.

Cost Per Gbps of Throughput

Engineers related throughput to device cost by calculating the cost of each Gbps of throughput. The Cisco switch had the lowest cost per Gbps at $17.86 followed by NETGEAR at $29.87and HP at $60.12. See Figure 3 for details and calculation.

The Cost Per Gbps includes all of the Gigabit Ethernet ports available on each switch as those represent the core capacity of the switch. The fact that Cisco provides 28 ports where HP and NETGEAR provide 24 has a beneficial impact on Cisco's price/performance results.

LAN Switch: Power over Ethernet (PoE) Support
as reported by Sifos PSA-3000 PowerSync Analyzer

Vendor	Product	Power Budget (W)	Power over Ethernet IEEE 802.3af-2003 - (up to 15.4W)
Cisco Systems	SF 300-24P	173.6	Yes. Available on all ports. 11 ports can be powered at a full 15.4W
D-Link Systems	DES-3528P xStack	363.0	Yes. Available on 24 ports. 23 ports powered simultaneously at full power
HP Networking	HP Networking E2610-24/12PWR PoE Switch	126.0	Yes. Available on 12 ports. 8 ports powered simultaneously at full power

Note: The Power Budget is the total amount of power that the switch can make available to PoE ports, thus, a higher number is better. Power Budget is typically shared among all PoE ports. For reference, Tolly notes that virtually every VoIP phone tested by Tolly has required less than 7.6W. Devices tested without any additional external PoE power source. HP Networking also offers the E2610-24/24PWR switch with PoE on 24 ports and an advertised power budget of 406W.

Source: Tolly, December 2010

Table 3

Systems Under Test: 10/100 & Gigabit Ethernet
Non-Stackable, Fully Managed, Non-PoE and PoE LAN Switches

Vendor	Product	Product Class	Software/Hardware Version	CDW Price (USD)
Cisco Systems	Cisco SF300-24 (SRW224-G4-K9-NA)	10/100 Non-PoE	1.0.0.27 21SEP2010 (Same software for all Cisco SUTs)	$215.00
	Cisco SF300-24P (SRW224-G4P-K9-NA)	10/100 PoE		$445.00
	Cisco SG300-28 (SRW2024-K9-NA)	GbE Non-PoE		$499.99
D-Link Systems	D-Link DES-3528 xStack (P1UQ3A8003662)	10/100 Non-PoE	2.60.017 (Same software for both D-Link SUTs)	$508.43
	D-Link DES-3528P xStack (P4LX199000012)	10/100 PoE		$1,174.99 (CompSource)
HP Networking	HP Networking E2610-24PT (J9085A)	10/100 Non-PoE	11.54 (Same software for both HP 2610 SUTs)	$528.99
	HP Networking E2610-24/12PWR (J9086A)	10/100 PoE		$794.42
	HP Networking E2510-24 (J9019B)	10/100 Non-PoE	Q11.26	$342.57
	HP Networking E2810-24G (J9021A)	GbE Non-PoE	N11.25	$1,432.92
NETGEAR	NETGEAR ProSafe FSM726	10/100 Non-PoE	8.0.1.9	$309.00
	NETGEAR ProSafe GSM7224	GbE Non-PoE	8.0.1.4	$716.99

Note:. Systems have at least 24 copper ports with some systems having 2+ uplink/stacking ports. Prices as listed as selling price on CDW website on Jan. 17, 2011 except for the the D-Link DES-3528P which was not listed on CDW, so the price on the CompSource website was used. HP recommended using the E2610-24/24PWR (J9087A), with PoE on 24 ports, but it was not available in the test window.

Source: Tolly, January 2011

Table 4

Test Methodology

Whenever possible, tests were run using default SUT configurations and using generally accepted test methodologies defined in relevant RFCs, Ixia test configurations and/or Tolly Common Test Plan methodologies. Thus, this section will present notes of interest and/or variations from standard test procedures.

Devices Under Test

The test compared LAN switches that were fully managed and without proprietary stacking ports. While actual port count varied slightly among switches, all had at least 24 ports of either Fast Ethernet (10/100) or Gigabit Ethernet copper ports. Most switches had 2 or more additional Gigabit Ethernet links and/or dual-personality links. See Table 4 for system details.

Test Tools

The test traffic was generated using an Ixia Optixia XM2 chassis outfitted with 2, 16-port Gigabit Ethernet line cards. The Power over Ethernet tests were run using the Sifos PSA-3000 PowerSync analyzer.

Energy consumption was measured using the Watts up? PRO ES power meter. This device recorded power consumption in one-second intervals to provide granular power consumption data.

Throughput and Latency

For this test, engineers connected all ports on the DUT to Ixia XM2 test ports, keeping the switch in its default configuration. Engineers then ran the RFC 2889 throughput test included as a standard test in the Ixia platform, varying the frame size and using a binary search to determine the maximum throughput. Latency metrics were taken using the RFC 2889 latency test, built in to IxAutomate, using the Cut-through calibrated metric at 100% line rate on all ports. In cases where the standard deviation across the port pairs was greater than 5%, additional tests were run and averaged.

Power Consumption

To measure the power consumption of the switches under load, engineers modified the RFC 2544 template in IxAutomate to yield a test which varied the load at 50% line rate increments over both 64 and 1518 byte frames, which was run with 24 links active on the DUT. Measurements were recorded using a Watts Up? PRO ES power meter. Each metric was recorded, with additional data collected including the Gigabit uplink ports. In no scenario was the percent error greater than 0.5% of the mean.

Devices were tested in default configurations. Testers noted that HP Networking offers an option that turns off the LEDs on the switch. Informal tests show that enabling this feature reduces switch power consumption by 1W.

ATIS Power Rating

The ATIS power rating refers to the recommended methodology promulgated by the Alliance for Telecommunications Industry Solutions (ATIS).

The ATIS method is based on measuring the switch in three different states: idle, 10% load and 100% load. The ATIS calculation consists largely of the power consumption at 10% load. That is 80% of the ATIS value. The remaining part of the ATIS value consists of 10% of the idle power consumption and 10% of the power consumption at 100% load.

The formula for the ATIS power rating is 0.1*(at 0)+.8*(at 10) +.1*(at 100) where (at n) are utilization rates. For more information, see the Alliance for Telecommunications Industry Solutions website at http://www.atis.org.

Power over Ethernet

To measure PoE capabilities, engineers enabled PoE on each of the supported switches. Then, they connected all 24 ports to the Sifos PSA-3000 PowerSync Analyzer. Engineers used the integrated mp_power_cap test, which requested a minimal amount of power draw from the switch on all ports, then gradually increased the request on each port, terminating when the switch drops power from one port to keep a higher priority port active. The maximum supplied power was recorded, and tests were run a total of three times to accurately measure the power budget of the DUT.

TOLLY™ common TEST PLAN SERIES

The test methodology used for this report relies upon test procedures, metrics and documentation practices as defined in various Tolly Common Test Plan documents.

To learn more about Tolly Common Test Plans, go to:

http://www.CommonTestPlan.org

Gigabit Ethernet LAN Switch: Layer 2 System Throughput & Latency Under 100% Load

24 Ports in Full Mesh Configuration
(as reported by Ixia IxAutomate 6.90)

10/100 Non-PoE

System Under Test	Cisco SF300-24		D-Link DES-3528		HP Networking E2510-24		HP Networking E2610-24PT		NETGEAR FSM726	
Frame size (bytes)	Throughput (%)	Latency (µs)	Throughput (%)	Latency (µs)	Throughput (%)	Latency (µs)	Throughput (%)	Latency (µs)	Throughput (%)	Latency (µs)
64	100	10.10	100	208.3	99.481	10.1 [1]	100	191.1	100	15.5
128	100	15.2	100	216.7	99.701	15.2 [1]	100	190.9	100	20.9
256	100	25.7	100	228.3	99.841	25.5 [1]	100	212.1	100	31.3
512	100	46.5	100	249.5	99.915	46 [1]	100	213.9	100	52.1
1024	100	87.5	100	290.8	99.957	87 [1]	100	265.7	100	92.5
1280	100	107.9	100	311.5	99.963	107.4 [1]	100	278.4	100	113
1518	100	127	100	330.7	99.979	225.7 [1]	100	307.7	100	132.5

10/100 PoE

System Under Test	Cisco SF300-24P		D-Link DES-3528P		HP Networking E2610-24/12PWR	
Frame size (bytes)	Through put (%)	Latency (µs)	Through put (%)	Latency (µs)	Through put (%)	Latency (µs)
64	100	10.10	99.481	14 [1]	100	224.4
128	100	15.2	100	703.4	100	223
256	100	25.7	100	713.6	100	244.2
512	100	46.5	100	733.9	100	250.1
1024	100	87.4	100	774.6	100	300.4
1280	100	107.9	100	795	100	314.6
1518	100	127	100	814.1	100	345.2

Gigabit Ethernet

System Under Test	Cisco SG300-28		HP Networking E2810-24G		NETGEAR GSM7224	
Frame size (bytes)	Through put (%)	Latency (µs)	Through put (%)	Latency (µs)	Through put (%)	Latency (µs)
64	100	3.20	100	4.1	100	4.1
128	100	3.7	100	4.6	100	4.6
256	100	5	100	5.6	100	5.6
512	100	7.4	100	7.6	100	7.7
1024	100	11.5	100	11.7	100	11.7
1280	100	13.5	100	13.7	100	13.8
1518	100	15.4	100	15.6	100	15.7

Note: Throughput results are listed as the percentage of maximum theoretical throughput of 24 10/100 or Gigabit Ethernet ports as appropriate. Uplinks not used for the test. Note: Cisco's GbE switch has 28 ports where HP and NETGEAR's have 24 ports. For purposes of comparison, 24 ports were used on the Cisco switch.
1. Frames were dropped during the 100% load, latency measurement test.

Source: Tolly, December 2010

Table 5

About Tolly

The Tolly Group companies have been delivering world-class IT services for more than 20 years. Tolly is a leading global provider of third-party validation services for vendors of IT products, components and services. You can reach the company by e-mail at sales@tolly.com, or by telephone at +1 561.391.5610.

Visit Tolly on the Internet at: http://www.tolly.com

Test Equipment Summary

The Tolly Group gratefully acknowledges the providers of test equipment/software used in this project.

Vendor	Product	Web
IXIA TESTED	Chassis Type: XM2 Interfaces: 32x 1Gbps Card Type: 2 x LSM1000 XMV16-01 Software: IxAutomate 6.90.98.5GAPatch4, IxExplorer IxOS 5.70.600.9 EA-SP1	http://www.ixiacom.com
Sifos Technologies	PSA-3000 PowerSync Analyzer	http://www.sifos.com

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