



Dell Networking S5000

Modular 1RU, top-of-rack 10/40 GbE and FC 2/4/8 unified storage switch

High-density 1RU 1/10GbE or 2/4/8G FC modules with four fixed 40GbE uplinks and low latency for line-rate performance, feature-rich layer 2/3 and storage networking for iSCSI, FC/FCoE and RoCE.

The Dell S5000 1RU top-of-rack (ToR) switch offers innovative modular, converged networking capabilities. The switch converges LAN and SAN traffic over a single 10 Gigabit Ethernet (10GbE) connection to help optimize server and storage connectivity in enterprise-scale data centers deploying separate networks based on different networking protocols.

Converged LAN/SAN ToR switch

The Dell S5000 is a 10/40GbE unified storage switch architected for a ToR virtualized data center environment. It provides a fully modular converged LAN/SAN switch purpose-built for applications in high-performance data center and fabric deployments. The S5000 supports LAN and native Fibre Channel ports using optional modules for maximum flexibility and scalability.

Leveraging a non-blocking, cut-through switching architecture, the S5000 provides line-rate L2 and L3 forwarding capacity with low latency to maximize network performance. The S5000 is a fully modular switch with four modular bays and four fixed 40GbE uplink ports. Each 40GbE QSFP+ uplink can also support four 10 GbE ports using a breakout cable. The Ethernet module supports 12 1/10GbE ports, while the Unified port module supports up to 12 FC 2/4/8 and/or 12 1/10GbE ports.

S5000 is powered by the industry-hardened, feature-rich Dell Networking OS9 (OS9) designed for maximum dependability and uptime. Virtual link trunking (VLT) provides a loop-free topology with active-active load-sharing of links from access to core. Hardware stacking using front port stacking up to six units provides maximum flexibility and scalability for data center environments. The S5000 supports Dell Open Automation Framework, which provides advanced network automation and virtualization capabilities for virtual data center environments. The Open Automation Framework is comprised of a suite of interrelated network management tools which can be used together or independently to provide a more flexible, available and manageable network while helping to reduce operational expenses.

Key applications

- Lossless fabric for LAN/SAN deployments
- Design with the Dell Z Series core switch to create a flat, two-tier, non-blocking 1/10/40 GbE data center network design
- Design a Clos fabric with S5000 switch in leaf and spine with the S Series 1/10GbE ToR switches for cost-effective aggregation of 10 GbE uplinks

Key features

- OS9 offers inherent stability as well as advanced monitoring and serviceability functions
- Open Automation Framework adds VM-awareness as well as automated configuration and provisioning capabilities to simplify the management of virtual network environments
- Scalable L2 and L3 Ethernet switching with QoS and a full complement of standards-based IPv4 and IPv6 features
- VLT and mVLT for layer 2 multipath
- User port stacking support for up to six units
- Support for jumbo frames for high-end server connectivity
- 128 link aggregation groups with up to eight members per group, using advanced hashing
- Fibre Channel, FCoE, FCoE transit (FIP Snooping) and NPV Proxy Gateway (NPG), Fibre Channel Forwarding (FCF)
- Full data center bridging (DCB) support for lossless iSCSI SANs and converged network.
- Redundant, hot-swappable power supplies and fans
- I/O panel to PSU airflow or PSU to I/O panel airflow (reversible airflow)
- Software-defined networking/OpenFlow support
- 16, 28, 40, 52, 64 10GbE ports available

Modular ToR switch optimized for LAN and SAN convergence in large enterprise and data centers.

Dell S5000 overview

Server virtualization and cloud-based deployment models are increasing IT organizations' productivity while improving their ability to respond to continuously changing business needs. However, the rate at which the technology is evolving is forcing IT departments to invest in solutions that are flexible, future-ready and cost-effective.

The Dell S5000 is a high-density 1RU switch that offers innovative flexibility due to its unique modular architecture. S5000 is well suited for data center access and aggregation layer deployments for physical and virtual servers and LAN and SAN convergence over lossless fabrics.

- 1RU high-density switch with four module slots and four fixed 40GbE (QSFP+) uplinks (totaling 64 10GbE ports with breakout cables)
- Two optional modules supported are Ethernet and Unified Port Module. Ethernet module supports 12 1/10GbE ports and Unified Port Module supports up to 12 FC 2/4/8 and/or 12 1/10GbE ports.
- 1.28Tbps (full-duplex) non-blocking, cut-through switching fabric delivers line-rate performance
- FCoE, iSCSI and RDMA over Converged Ethernet (RoCE) is supported on all Ethernet ports

S5000 I/O module options

The S5000 supports the following I/O modules.

Module	Port Type and Count	Purpose
 <p>Unified port module</p>	Up to 12 FC 2/4/8 and/or 12 1/10GbE ports.	Supports LAN and SAN connectivity on the same module
 <p>Ethernet module</p>	12 1/10GbE ports using SFP+ interface	Supports Ethernet based LAN traffic and Ethernet based SAN traffic for FCoE, iSCSI and RoCE

Figure 1. S5000 switch I/O modules

- Ethernet module provides 12 1/10GbE ports using SFP+ interface. The Ethernet module supports Ethernet-based LAN traffic and Ethernet-based SAN traffic for FCoE and iSCSI, and RoCE.
- Unified port module provides up to 12 ports for 2/4/8Gbps native Fibre Channel using SFP+/SFP interface. The unified port module supports Fibre Channel-based SAN traffic as well as up to 12 FC 2/4/8 and/or 12 1/10GbE ports. .

Deployment models for S5000

Dell S5000 supports deployment models for traditional, virtualized and converged data centers.

Traditional Ethernet deployments

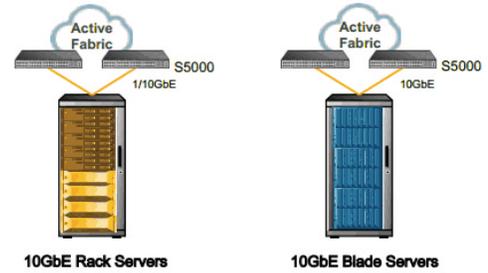


Figure 2. Redundant connections from 10GbE rack and blade servers deployed in a traditional Ethernet environment

Each server rack in this deployment model contains two S5000 switches offering redundant 10GbE connections to each server. The switches may be deployed as stand-alone switches or stacked for management simplification. Typical stacking configurations include a pair of stacked switches in each rack or two stacks of switches extending horizontally across multiple racks. In a typical single high-density server rack with redundant connections, up to 48 Dell PowerEdge rack servers or up to 96 PowerEdge Blades can be connected to a pair of S5000 in a single rack.

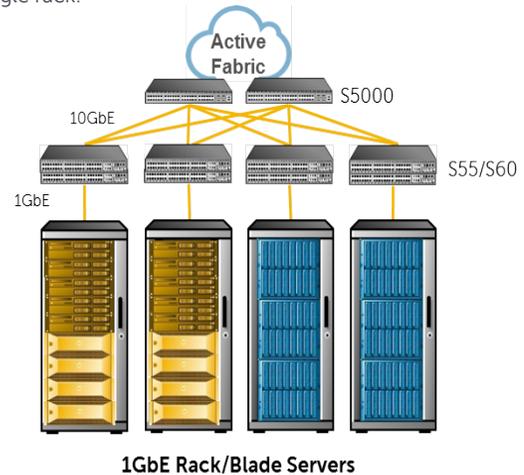


Figure 3. Large-scale 1GbE server connections

Servers with 1GbE redundant ports are connected to a pair of Dell Networking S55 or S60 1GbE ToR switches. Using 10GbE uplink connections, S55 or S60 leaf switches are connected to a pair of S5000 spine switches to form a large access layer fabric. In a typical high-density server configuration with redundant connections, up to 576 1GbE (1152 if redundancy not required) servers can be connected to a pair of S5000 switches through 24 Dell S55 or S60 switches.

Layer 2 fabrics

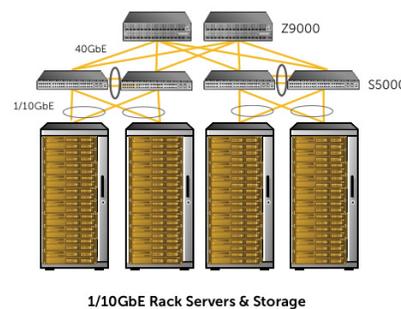


Figure 4. 1/10GbE rack servers in a virtualized data center

Virtual Link Trunking (VLT) is a Dell Networking multi-path solution to create a dynamic or static LAG that terminates on two different VLT-enabled physical switches. VLT is a dual active control plane implementation of multi-system LAG. VLT creates a single logical view of the two physical switches for the node at the other end.

In a virtualized data center, each server can transmit a significant amount of data easily overwhelming a traditional network infrastructure. VLT-based network infrastructure provides active-active connections from the server expanding the available bandwidth while increasing network resiliency. In a typical high-density server configuration with redundant connections, up to 1188 1/10GbE servers can be connected to a pair of Z9500 switches through 66 S5000 switches.

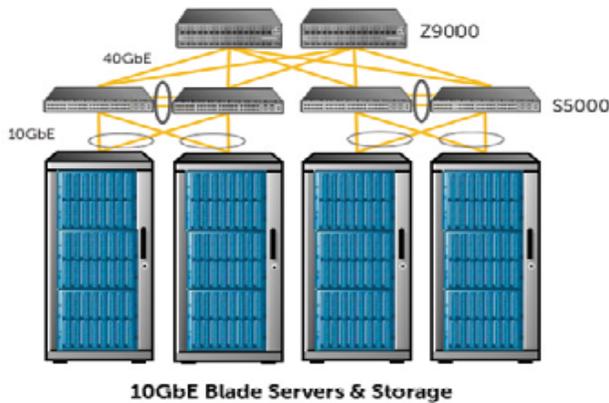


Figure 5. 10GbE blade servers in a virtualized data center

For organizations creating the next-generation architecture for their information technology, meeting performance requirements for critical workloads is paramount. Dell blade solutions combine high-speed connectivity in the form of the backplane of the Dell PowerEdge M1000e blade enclosure with the compute density of Dell blade servers. The MXL/IOA switch for M1000e blade enclosure is a 40GbE capable, modular and stackable blade switch.

In a typical high-density server configuration with redundant connections, up to 4752 10GbE servers can be connected to a pair of Z9500 switches through 58 S5000 switches.

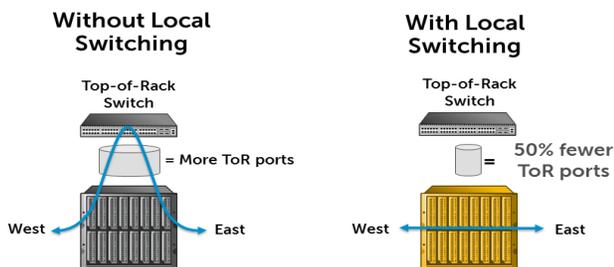


Figure 6. M1000e comparisons showing East/West traffic advantage

Modern data centers are going through a dramatic shift of traffic patterns from mostly north-south to mostly east-west traffic. Dell solutions with local switching capabilities help ensure that server to server traffic will take the least amount of hops, which can significantly enhance application performance.

LAN and SAN convergence

Organizations can take advantage of LAN/SAN convergence by deploying Internet Small Computer System Interface (iSCSI), Fibre Channel over Ethernet (FCoE), or even both network fabrics, on the DCB-enabled network. These technologies allow IT organizations to leverage a single, lossless and converged Ethernet network to enable LAN and SAN convergence.

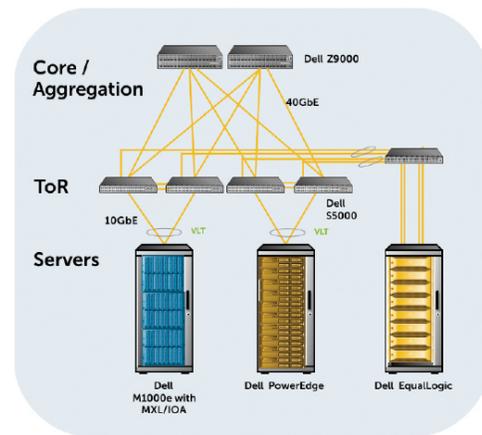


Figure 7. Lossless converged LAN and iSCSI SAN

A typical architecture will connect Dell PowerEdge rack servers directly to S5000 or M1000e blade servers through MXL/IOA blade switches to S5000. Such architecture reduces the number of server and switch optics, fiber optic cables, and number of ToR switches in the data center. This approach can result in simplification of I/O, reduced capital and operational costs, and improved IT staff productivity.

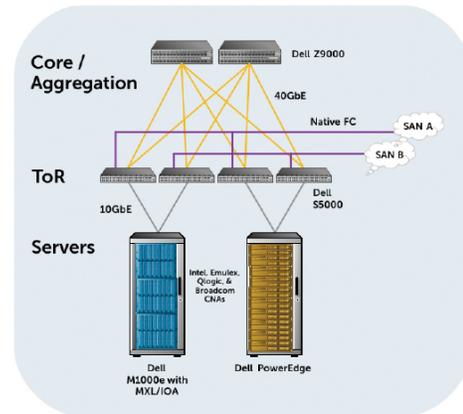


Figure 8. Lossless converged LAN and FCoE SAN

S5000 consolidates LAN and SAN networks on one physical network infrastructure while providing logical separation of LAN and SAN traffic in the network. This approach helps ensure organizations are able to connect to existing FC SANs for non-stop and optimal IT operations while extending the advantages associated with LAN and SAN convergence. A typical architecture will connect Dell PowerEdge rack servers directly to S5000 or M1000e blade servers through MXL/IOA blade switches to S5000.

S5000 acts as an FCF offering direct connectivity to FC storage or as an NPG, offering connectivity between servers and FC SANs. Using 10GbE Converged Network Adapters (CNAs) servers are able to connect to S5000 using FCoE capability. Up to 12 ports on S5000 can be configured for native Fibre Channel connectivity to FC storage, servers or SANs. All Ethernet ports can be connected to FCoE servers.

Specifications: Dell S5000 Unified Storage/ToR Switch

Ordering Information

S5000

1RU, LAN/SAN Converged Switch, 4x40GbE QSFP+, 4 Modular Bays, 2x AC PSU, 2x Fan Modules, I/O to PSU Airflow, 4-Post Rack Mount Kit

1RU, LAN/SAN Converged Switch, 4x40GbE QSFP+, 4 Modular Bays, 2x AC PSU, 2x Fan Modules, PSU to I/O Airflow, 4-Post Rack Mount Kit

1RU, LAN/SAN Converged Switch, 4x40GbE QSFP+, 4 Modular Bays, 2x DC PSU, 2x Fan Modules, I/O to PSU Airflow, 4-Post Rack Mount Kit

1RU, LAN/SAN Converged Switch, 4x40GbE QSFP+, 4 Modular Bays, 2x DC PSU, 2x Fan Modules, PSU to I/O Airflow, 4-Post Rack Mount Kit

1RU, LAN/SAN Converged Switch, 4x40GbE QSFP+, 4 Modular Bays, 2x AC PSU, 2x Fan Modules, PSU to I/O Airflow, 4-Post Rack Mount Kit, TAA

1RU, LAN/SAN Converged Switch, 4x40GbE QSFP+, 4 Modular Bays, 2x AC PSU, 2x Fan Modules, PSU to I/O Airflow, 4-Post Rack Mount Kit, TAA

Power Supplies

S5000, AC Power Supply, I/O to PSU Airflow, 100–240V, 750W

S5000, AC Power Supply, PSU to I/O Airflow, 100–240V, 750W

S5000, DC Power Supply, I/O to PSU Airflow, -48 to -60V, 1100W

S5000, DC Power Supply, PSU to I/O Airflow, -48 to -60V, 1100W

Fans

S5000, Fan Module, I/O to PSU airflow

S5000, Fan Module, PSU to I/O airflow

Service Side Kits

S5000, Service Side Kit, 2x AC PSU, 2x Fan Modules, I/O to PSU Airflow

S5000, Service Side Kit, 2x AC PSU, 2x Fan Modules, PSU to I/O Airflow

S5000, Service Side Kit, 2x DC PSU, 2x Fan Modules, I/O to PSU Airflow

S5000, Service Side Kit, 2x DC PSU, 2x Fan Modules, PSU to I/O Airflow

Miscellaneous

S5000, Modular I/O Bay Blank Faceplate

Software

Software, OS9: Dell Networking Operating System, Layer 3 Software License

Software, OS9: iSCSI Optimized Configuration, Software License

Software, OS9: FCoE Transit Optimized Configuration

Software, DNOS: FC/FCoE fabric and NPIV Proxy Gateway (NPG), Software License

I/O Modules

S5000, 12-Port Ethernet/FCoE Module, 1/10GbE SFP+ Interconnect

S5000, 12-Port Unified Port Module, 2/4/8Gbps Native Fibre Channel or 10GbE SFP+ Interconnect

Optics

Transceiver, QSFP+, 40GbE, SR Optics, 850nm Wavelength, 100–150m Reach on OM3/OM4

Transceiver, QSFP+, 40GbE, eSR Optics, 850nm Wavelength, 300–400m Reach on OM3/OM4

Transceiver, SFP+, 10GbE, SR, 850nm Wavelength, 300m Reach

Transceiver, SFP+, 10GbE, SR, 850nm Wavelength, 300m Reach, 12-pack

Transceiver, SFP+, 10GbE, LR, 1310nm Wavelength, 10Km Reach

Transceiver, SFP+, 10GbE, ER, 1310nm Wavelength, 40Km Reach

Transceiver, SFP+, 10GbE, LRM (Long Reach Multimode) Optic, 1310nm Wavelength, 220m Reach on MMF

Transceiver, SFP+, 8Gbps, Fibre Channel-SW, 150m Reach

Transceiver, SFP+, 8Gbps, Fibre Channel-SW, 150m Reach, 12-pack

Transceiver, SFP+, 8Gbps, Fibre Channel-LW, 4Km Reach

2/4/8Gbps Native Fibre Channel or 10GbE SFP+ Interconnect

Cables

Cable, 40GbE MTP to 4xLC 5M Optical Breakout Cable (optics not included)

Cable, 40GbE QSFP+ to 4xSFP+ 5M Direct Attach Breakout Cable

Cable, 40GbE QSFP+, Active Fiber Optic, 10m

Cable, 40GbE QSFP+, Active Fiber Optic, 50m

Cable, 40GbE QSFP+, Direct Attach Cable, 1m

Cable, 40GbE QSFP+, Direct Attach Cable, 5m

Cable, SFP+, CU, 10GbE, Direct Attach Cable, 0.5m

Cable, SFP+, CU, 10GbE, Direct Attach Cable, 1m

Cable, SFP+, CU, 10GbE, Direct Attach Cable, 3m

Cable, SFP+, CU, 10GbE, Direct Attach Cable, 5m

Cable, SFP+, CU, 10GbE, Direct Attach Cable, 7m

Note: Contact Dell for a more comprehensive SKU list

Physical

Four module slots (Optional Ethernet module or Unified port module)

4 x 40GbE fixed QSFP+ ports

48 x 1/10GbE SFP+ with additional 16 x 10GbE SFP+ port

12 x FC 2, 4 or 8Gbps ports

1 RJ45 console/management port with RS232 signaling

Size: 1RU, 1.71 x 17.4 x 28 in (4.4 mm x 441 mm x 711 mm)

Weight: 34 lbs (15.42 kg)

ISO 7779 A-weighted sound pressure level: 59.6 dBA at 73.4°F (23°C)

Power supply: 100 to 240 VAC 50/60 Hz or -48 to -60 VDC

Max. thermal output: 1878 BTU/hr

Max. current draw per system:

7A at 100/120 VAC, 3.5A at 200/240 VAC

15.2A at -46 VDC, 11.7A at -60 VDC

Max. power consumption: 550 Watts

Typical power consumption: 250 Watts

Max operating specifications:

Operating temperature: 32°F to 104°F (0°C to 40°C)

Operating humidity: 10 to 85% (RH), non-condensing

Max non-operating specifications:

Storage temperature: -40°C to 158°C (-40°C to 70°C)

Storage humidity: 5 to 95% (RH), non-condensing

High-Availability

Hot swappable redundant power

Hot swappable redundant fans

Field replaceable I/O modules

Performance

MAC addresses: 128K

IPv4 routes: 16K

Switch fabric capacity: 1.28Tbps (full-duplex)

640Gbps (half-duplex)

960Mpps

Forwarding capacity: 8 links per group,

128 groups per stack

Link aggregation: 4 queues

Queues per port: 4K

VLANS: All protocols, including IPv4

Line-rate layer 2 switching: IPv4

Line-rate layer 3 routing: Ingress 1023; egress: 716

IP ACL: 2K ingress, 1k egress

LAGs: 128 with up to 8

LAG load balancing: Based on layer 2, IPv4 headers

Packet buffer memory: 9MB

CPU memory: 2GB

FCoE VLANS (Fabric Mode): 1

FCoE VLANS (NPIV Mode): 12

FCoE VLANS (FSB Mode): 8

Jumbo Frames: 12,000 bytes

IEEE Compliance

802.1AB LLDP

802.1ag Connectivity Fault Management

802.1p L2 Prioritization

802.3ad Link Aggregation with LACP

802.3ae 10 Gigabit Ethernet (10GBASE-X)

802.3ba 40 Gigabit Ethernet (40GBase-SR4, 40GBase-CR4)

on optical ports

802.3x Flow Control

802.3z Gigabit Ethernet (1000Base-X)

802.1Qbb PFC

802.1Qaz ETS

ANSI/TIA-1057 LLDP-MED

MTU 12K bytes

General Internet Protocols

768 UDP 1321 MDS

793 TCP 1350 TFTP

854 Telnet 2474 Differentiated

Services 959 FTP 3164 Syslog

General IPv4 Protocols

791 IPv4 1542 BOOTP (relay)

792 ICMP 1812 Routers

826 ARP 1858 IP Fragment Filtering

1027 Proxy ARP 2131 DHCP (relay)

1035 DNS (client) 2131 DHCP (Client)

1042 Ethernet Transmission 3021 31-bit Prefixes

1191 Path MTU Discovery 3046 DHCP Option 82

1305 NTPv3 3069 Private VLAN

1519 CIDR 3128 Tiny Fragment Attack Protection

RFC and I-D Compliance

General IPv6 Protocols

1858 IP Fragment Filtering 2463 ICMPv6

2460 IPv6 2675 Jumbograms

2461 Neighbor Discovery 3587 Global Unicast Address Format

2462 Stateless Address 4291 Addressing

RIP 1058 RIPv1 2453 RIPv2

BGP 1997 Communities 2858 Multiprotocol

Extensions 2385 MDS 2918 Route Refresh

RFC 2545 BGP-4 Multiprotocol Extensions for IPv6 Inter-Domain

Routing 2439 Route Flap Damping 3065 Confederations

2796 Route Reflection 4360 Extended

Communities 4893 4-byte ASN 2842 Capabilities

5396 4-byte ASN Representations

draft-ietf-idr-bgp4-20 BGPv4

draft-ietf-idr-restart-06 Graceful Restart

draft-michaelson-4byte-as-representation-05 4-byte ASN

Representation (partial)

OSPF 2154 MDS 2328 Opaque LSA

1587 NSSA 3623 Graceful Restart

2328 OSPFv2

IS-IS 1195 Routing IPv4 with IS-IS

5308 Routing IPv6 with IS-IS

Multicast 1112 IGMPv1 3569 SSM for IPv4

2236 IGMPv2 4541 IGMPv1/v2 Snooping

3376 IGMPv3

Availability

802.1D Bridging, STP

802.1s MSTP

802.1w RSTP

2338 V RRP

VLAN

802.1Q VLAN Tagging, Double VLAN Tagging, GVRP

802.3ac Frame Extensions for VLAN Tagging

Force10 PVST+

Data Center Bridging

IEEE 802.1Qbb Priority-Based Flow Control (PFC)

IEEE 802.1Qaz Enhanced Transmission Selection (ETS)

Data Center Bridging eXchange (DCBX)

DCBx Application TLV (iSCSI, FCoE)

Fibre Channel (requires license)

Fibre Channel Forwarding (FCF)

NPIV Proxy Gateway (NPG)

Fibre Channel port types: F, E, NP, FV

Bridging to FC SAN

Up to 12 FCoE Maps per switch

Fabric Shortest Path First (FSPF)

Name server

Zoning

FCoE Features (requires license)

FC-BB-5 support

Native FCoE forwarding

FCoE Initialization Protocol (FIP) v1

Connectivity to FIP Snooping Bridge

FCoE Transit (FIP Snooping Bridge)

FCoE to FC Forwarding

Dynamic FCoE to FC Load Balancing

Software Defined Network (SDN)

Open Automation BMI and Open Automation Scripting

OpenFlow 1.0 Agent

Network Management

1155 SMIv1

1156 Internet MIB

1157 SNMPv1

1212 Concise MIB Definitions

1215 SNMP Traps

1493 Bridges MIB

1850 OSPFv2 MIB

1901 Community-Based SNMPv2

2011 IP MIB

2012 TCP MIB

2013 UDP MIB

2024 DLsw MIB

2096 IP Forwarding Table MIB

2570 SNMPv3

2571 Management Frameworks

2572 Message Processing and Dispatching

2575 SNMPv3 VACM

2576 Coexistence Between SNMPv1/v2/v3

2578 SMIv2

2579 Textual Conventions for SMIv2

2580 Conformance Statements for SMIv2

2665 Ethernet-Like Interfaces MIB

2674 Extended Bridge MIB

2787 VRRP MIB

2819 RMON MIB (groups 1, 2, 3, 9)

2863 Interfaces MIB

3273 RMON High Capacity MIB

3416 SNMPv2

3418 SNMP MIB

3434 RMON High Capacity Alarm MIB

ANSI/TIA-1057 LLDP-MED MIB

draft-grant-taccas-02 TACACS+

IEEE 802.1AB LLDP MIB

IEEE 802.1AB LLDP DOT1 MIB

IEEE 802.1AB LLDP DOT3 MIB

rugin-mstp-mib-02 MSTP MIB (traps)

sFlow.org sFlow5

FORCE10-IF-EXTENSION-MIB

FORCE10-LINKAGG-MIB

FORCE10-COPY-CONFIG-MIB

FORCE10-MON-MIB

FORCE10-PRODUCTS-MIB

FORCE10-MS-CHASSIS-MIB

FORCE10-SMI

FORCE10-SYSTEM-COMPONENT-MIB

FORCE10-TC-MIB

FORCE10-TRAP-ALARM-MIB

Regulatory Compliance Safety

UL/CSA 60950-1, Second Edition