

SECTION-VI

Technical Specifications

1. MPLS - P/PE/CE/GW Routers
2. Aggregation Switch :(Layer 3 Capable of IPv4 & Ipv6)
3. Firewall:
4. Layer 2 Ethernet Switch
5. Servers

1. MPLS - P/PE/CE/GW Router:

Should have advanced IP (IPV6 and IPv4) and MPLS capabilities along with sufficient nos. and types of interfaces. Main role as P / PE/CE/GW router, however it can also function as normal IP router.

1. Modular platform
2. Powered by high-performance multi-core processors
3. Embedded IP Security with Security Sockets Layer (IPSec/SSL) VPN hardware acceleration
4. Multigigabit fabric (MGF)
5. Integrated Gigabit Ethernet ports
6. (All onboard WAN ports are 10/100/1000 Gigabit Ethernet WAN routed ports with at least one of the three 10/100/1000 Ethernet WAN ports supporting Small Form-Factor Pluggable (SFP)-based connectivity in lieu of a RJ-45 port and enabling fiber connectivity)
7. Console access
8. Service module slots

Software capable of supporting multiple technology areas, including security, voice, high availability, IP Routing and Multicast (Both IPv4 & IPv6), quality of service (QoS), IP Mobility, Multiprotocol Label Switching (MPLS), VPNs, and embedded management.

Router Hardware:

Embedded hardware-based cryptography acceleration (IPSec + SSL)	Yes
Total onboard WAN 10/100/1000 Ports	3
RJ-45-based ports	3
SFP-based ports (use of SFP port disables the corresponding RJ-45 port)	1
Service Module slots	1
Double-wide Service Module slots	1
EHWIC slots	4
Double-wide EHWIC slots	2
ISM slots	1
Onboard DSP (PVDM) slots	3
Memory DDR2 ECC DRAM - Minimum	512 MB
Memory (DDR2 ECC DRAM) - Maximum	2 GB
Compact Flash (external) - Minimum	slot 0: 256 MB slot 1: none
Compact Flash (external) - Maximum	slot 0: 4 GB slot 1: 4 GB
External USB 2.0 flash memory slots	2
USB /RJ45 Console port (up to 115.2 kbps)	1
Serial console port	1
Serial auxiliary port	1
Power-supply options	AC, PoE
Redundant Power Supply	Yes
Power Specifications :	
AC input voltage	100 to 240 VAC auto ranging

AC input frequency	47 to 63 Hz
AC input current range AC power supply (maximum)	3.4 to 1.4A
Physical Specifications :	
Rack-mount	Yes
Airflow	Front to back
Environmental Specifications :	
Operating Conditions :	
Temperature	32 to 104°F (0 to 40°C)
Relative humidity	10 to 85%
Non-operating Conditions :	
Temperature	-40 to 158°F (-40 to 70°C)
Relative humidity	5 to 95%
Regulatory Compliance :	
Telecom	TIA/EIA/IS-968 CS-03 ANSI T1.101 ITU-T G.823, G.824 IEEE 802.3 RTTE Directive

2. Aggregation Switch :(Layer 3 Switch with IPv4 & Ipv6 capability)

The enterprise-class switch that include IEEE 802.3af and Power over Ethernet (PoE) functionality in FastEthernet and Gigabit Ethernet configurations with the following features:

1. Minimum 10 Ethernet 10/100 ports and 2 Small Form-Factor Pluggable (SFP)-based Gigabit Ethernet ports for optical connectivity (with the IP Base and IP Services licenses supporting both IPv4 & Ipv6)
2. Power Over Ethernet
3. Enhanced Security
4. Availability & Scalability
5. Manageability & Redundancy for Fault Backup
6. High Performance IP Routing
7. Integrated OS Features for Bandwidth Optimisation
8. Networkwide Security Features
9. Easy & Quick Setup

Switch Hardware:

Performance

Minimum 32 Gbps forwarding bandwidth. -Forwarding rate based on 64-byte packets.

- Minimum 128 MB DRAM.
- Minimum 32 MB Flash memory.
- Minimum 12,000 Configurable MAC addresses.
- Minimum 11,000 Configurable unicast routes -Minimum of 1000 Configurable IGMP groups and multicast routes -Configurable maximum transmission unit (MTU) of up to 9000 bytes, with a maximum Ethernet frame size of 9018 bytes (Jumbo frames), for bridging on Gigabit Ethernet ports, and up to 1546 bytes for bridging of Multiprotocol Label Switching (MPLS) tagged frames on 10/100 ports.

Connectors and Cabling	-10BASE-T ports: RJ-45 connectors, two-pair Category 5 or 6 unshielded twisted-pair (UTP) cabling
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	-10BASE-T PoE ports: RJ-45 connectors, two-pair Category 5 or 6 UTP cabling power pins 1,2 (negative) and 3,6 (positive) -100BASE-TX ports: RJ-45 connectors, two-pair Category 5 UTP cabling. -100BASE-TX PoE ports: RJ-45 connectors, two-pair Category 5 or 6 UTP cabling, power on pins 1,2 (negative) and 3,6 (positive) . -1000BASE-T ports: RJ-45 connectors, four-pair Category 5 UTP cabling. -1000BASE-T SFP-based ports: RJ-45 connectors, four-pair Category 5 or 6 UTP cabling. -1000BASE-SX, -LX/LH, -ZX, and CWDM SFP-based ports: LC fiber connectors (single/multimode fiber). -SFP Interconnect Cable: two-pair shielded cabling, 50 cm. -Management console port: RJ-45-to-DB-9 cable for PC connections; for terminal connections, use RJ-45-to-DB-25 female data-terminal-equipment (DTE) adaptor
Power Supply	Power supply with redundancy
Indicators	- Per-port status LEDs: Link integrity, disabled, activity, speed, full-duplex indications, PoE applied, PoE error, and PoE disabled indications . - System-status LEDs: System, link status, link duplex, link speed, and PoE indications.
Environmental Ranges	-Operating temperature: 32 to 113°F (0 to 45°C) - Storage temperature: -13 to 158°F (-25 to 70°C) -Operating relative humidity: 10 to 85% (noncondensing)
AC Input Voltage and Current	-100-240 VAC (autoranging), 450-190mA, 50-60 Hz
PoE	-Maximum power supplied per port: 15.4W -Total power dedicated to PoE: 370W

Management and Standard

Management Should support all private & public MIBs

Standards IEEE 802.1s 1000BASE-X (SFP)
IEEE 802.1w 1000BASE-SX
IEEE 802.1x 1000BASE-LX/LH
IEEE 802.3ad 1000BASE-ZX
IEEE 802.3af 1000BASE-CWDM SFP 1470 nm full duplex on 10BASE- 1000BASE-CWDM SFP 1490 nm

T, 100BASE-TX, and 1000BASE-T ports IEEE 802.1D Spanning Tree Protocol IEEE 802.1p CoS Prioritization IEEE 802.1Q VLAN IEEE 802.3 10BASE-T specification IEEE 802.3u 100BASE-TX specification IEEE 802.3ab IEEE 802.3x

1000BASE-CWDM SFP 1510 nm
1000BASE-CWDM SFP 1530 nm
1000BASE-CWDM SFP 1550 nm
1000BASE-CWDM SFP 1570 nm
1000BASE-CWDM SFP 1590 nm
1000BASE-CWDM SFP 1610 nm
1000BASE-T RMON I and II standards
SNMPv1, SNMPv2c, and SNMPv3

IEEE 802.3z 1000BASE-X specification

Telecom TIA/EIA/IS-968 ,CS-03, ANSI T1.101, ITU-T G.823, G.824, IEEE 802.3, RTTE Directive

3. Firewall:

The firewall should support the following features

High-performance firewall with Full IPv4 & IPv6 functionality, SSL and IPsec VPN, and rich networking services in a modular, "plug-and-play" appliance with valid licenses

- d) Support for Power over Ethernet (PoE) ports
- e) External wireless access points for extended network mobility
- f) Interfaces and softwares for Management functionality for client access

Capabilities and Capacities:

Firewall Throughput	Up to 150 Mbps
Maximum Firewall and IPS Throughput	Up to 150 Mbps
VPN Throughput	Up to 100 Mbps
Concurrent Sessions	Minimum 10,000
Interfaces	8-port Fast Ethernet switch with dynamic port grouping (including 2 PoE ports)
Virtual Interfaces (VLANs)	With and without trunking support

Features :

Users/Nodes	10, 50, or unlimited
3DES/AES VPN Throughput	Up to 100 Mbps
IPsec VPN Peers	Minimum 10
USB 2.0 Ports	Yes
Serial Ports	RJ-45 console
Rack-Mountable	Yes
Security Lock Slot (for Physical Security)	Yes

Technical Specifications :

Memory	512 MB
Minimum System Flash	128 MB
System Bus	Multibus architecture

Environmental Operating Ranges :

Operating

Temperature	32 to 104°F (0 to 40°C)
Relative humidity	5 to 95 percent noncondensing

Nonoperating

Temperature	-13 to 158°F (-25 to 70°C)
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Power

Input Supply	100 to 240 VAC
Frequency	50/60 Hz

4. Layer 2 Ethernet Switch :

Intelligent features at the network edge, such as sophisticated access control lists (ACLs) and enhanced security.

Dual-purpose uplinks for Gigabit Ethernet uplink flexibility, allowing use of either a copper or a fiber uplink— each dual-purpose uplink port has one 10/100/1000 Ethernet port and one Small Form-Factor Pluggable (SFP)-based Gigabit Ethernet port, with one port active at a time.

Network control and bandwidth optimization using advanced QoS, granular rate limiting, ACLs, and multicast services.

Network security through a wide range of authentication methods, data encryption technologies, and Network admission control based on users, ports, and MAC addresses. Easy network configuration, upgrades, and troubleshooting Auto-configuration for specialized applications .

- Should transport IPv4 & Ipv6 traffic
- Gigabit Ethernet
- Intelligent in the Network
- Enhanced Security
- Availability & Scalability
- Advanced QOS & Management

Configuration :

24 Ethernet 10/100/1000 ports, Minimum 2 of which are with GE-Optical ports

Features:

Ease of Use and Deployment Should support

Express Setup which simplifies initial configuration with a Web browser, eliminating the need for more complex terminal emulation programs and CLI knowledge.
 DHCP autoconfiguration of multiple switches through a boot server eases switch deployment.
 Automatic QoS (Auto QoS) simplifies QoS configuration in voice-over-IP (VoIP) networks by issuing interface and global switch commands to detect IP phones, classify traffic, and enable egress queue configuration. Autosensing on each 10/100 port detects the speed of the attached device and automatically configures the port for 10- or 100-Mbps operation, easing switch deployment in mixed 10- and 100-Mbps environments. Autonegotiating on all ports automatically selects half- or full-duplex

	<p>transmission mode to optimize bandwidth. Dynamic Trunking Protocol (DTP) which enables dynamic trunk configuration across all switch ports. Port Aggregation Protocol (PAgP) which automates the creation of Fast EtherChannel groups or Gigabit EtherChannel groups to link to another switch, router, or server. Link Aggregation Control Protocol (LACP) which allows the creation of Ethernet channeling with devices that conform to IEEE 802.3ad. DHCP Server which enables a convenient deployment option for the assignment of IP addresses in networks that do not have without a dedicated DHCP server. DHCP Relay which allows a DHCP relay agent to broadcast DHCP requests to the network DHCP server. 1000BASE-SX, 1000BASE-LX/LH, 1000BASE-ZX, 1000BASE-BX, 100BASEFX, 100BASE-LX10, 100BASEBX, and coarse wavelength-division multiplexing (CWDM) physical interface support through a field-replaceable SFP module which provides unprecedented flexibility in switch deployment. The default configuration stored in flash memory which ensures that the switch can be quickly connected to the network and can pass traffic with minimal user intervention. Automatic medium-dependent interface crossover (Auto-MDIX) which automatically adjusts transmit and receive pairs if an incorrect cable type (crossover or straight-through) is installed on a copper port. Time-domain reflectometer (TDR) which can diagnose and resolve cabling problems on copper ports.</p>
AVAILABILITY AND SCALABILITY	
<p>Superior Redundancy for Fault Backup</p>	<p>Supports the following: UplinkFast and BackboneFast technologies IEEE 802.1w Rapid Spanning Tree Protocol Per-VLAN Rapid Spanning Tree Plus (PVRST+) Unidirectional Link Detection Protocol (UDLD) and Aggressive UDLD Switch port autorecovery Redundant Power System 675 (675) support provides superior internal power-source redundancy for up to six networking devices Bandwidth aggregation up to 8 Gbps through Gigabit EtherChannel technology and up to 800 Mbps through Fast EtherChannel technology</p>
<p>Software Features for Bandwidth Optimization</p>	<p>Per-port broadcast, multicast, and storm control IEEE 802.1d Spanning Tree Protocol support for redundant backbone connections and loop-free networks PVST+ IEEE 802.1s Multiple Spanning Tree Protocol allows a spanning-tree instance per VLAN, Egress committed rate (ECR) guarantee Local Proxy Address Resolution Protocol (ARP) works in conjunction</p>

	<p>with Private VLAN Edge VLAN1 minimization VLAN Trunking Protocol (VTP) pruning Internet Group Management Protocol (IGMP) version 3 snooping IGMP filtering Multicast VLAN registration (MVR)</p>
QoS AND CONTROL	
Advanced QoS	Should support: Standard 802.1p CoS and DSCP field classification Control-plane and data-plane QoS ACLs on all ports Up to four egress queues per port SRR scheduling
	Weighted tail drop (WTD) Strict priority queuing
SECURITY	<p>Should support:</p> <p>IEEE 802.1x which allows dynamic, port-based security, providing user authentication.</p> <p>IEEE 802.1x with VLAN assignment which allows a dynamic VLAN assignment for a specific user regardless of where the user is connected.</p> <p>IEEE 802.1x with voice VLAN which permits an IP phone to access the voice VLAN irrespective of the authorized or unauthorized state of the port.</p> <p>IEEE 802.1x and port security to authenticate the port and manage network access for all MAC addresses, including those of the client.</p> <p>IEEE 802.1x with Guest VLAN to allow guests without 802.1x clients to have limited network access on the guest VLAN.</p> <p>Port-based ACLs for Layer 2 interfaces to allow application of security policies on individual switch ports.</p> <p>MAC filtering which prevents the forwarding of any type of packet with a matching MAC address.</p> <p>Unknown multicast port blocking which allows tight control by filtering packets that the switch has not already learned how to forward.</p> <p>SSHv2 and SNMPv3 which provides network security by encrypting administrator traffic during Telnet and SNMP sessions.</p> <p>Bidirectional data support on the Switched Port Analyzer (SPAN) port which allows the Secure intrusion detection system (IDS) to take action when an intruder is detected.</p> <p>TACACS+ and RADIUS authentication to enable centralized control of the switch and restrict unauthorized users from altering the configuration.</p> <p>MAC address notification which allows administrators to be notified of users added to or removed from the network.</p> <p>DHCP snooping which allows administrators to ensure consistent mapping of IP to MAC addresses.</p> <p>DHCP Interface Tracker (Option 82) feature which augments a host IP address request with the switch port ID.</p> <p>Port security which secures the access to an access or trunk port based on MAC address.</p> <p>Trusted Boundary which provides the ability to trust the QoS priority settings if an IP phone is present and to disable the trust setting if the IP phone is removed, thereby preventing a malicious user from overriding prioritization policies in the network.</p> <p>Multilevel security on console access which prevents unauthorized users from altering the switch configuration.</p> <p>The user-selectable address-learning mode which simplifies configuration and enhances security.</p> <p>BPDU Guard which shuts down Spanning Tree Protocol PortFast-enabled interfaces when BPDU's are received to avoid accidental topology loops.</p> <p>Spanning-Tree Root Guard (STRG) which prevents edge devices not in the network administrator's control from becoming Spanning Tree Protocol root nodes.</p> <p>IGMP filtering which provides multicast authentication by filtering out no subscribers and limits the number of concurrent multicast streams available per port.</p> <p>Dynamic VLAN assignment supported through implementation of VLAN Membership Policy Server (VMPS) client functions to provide flexibility in assigning ports to VLANs. Dynamic VLAN helps enable the fast assignment of IP addresses.</p> <p>Up to 512 (Aces) are supported, with two profiles: Security (384 Security ACL</p>
	entries and 128 QoS policies), and QoS (128 Security ACL entries and 384 QoS polices).
MANAGEABILITY	
Manageability	Should Support :

	<p>CLI to provide a user interface and command set with all routers and desktop switches.</p> <p>VLAN trunks to be created from any port using standards-based 802.1q tagging.</p> <p>Up to 255 VLANs per switch or stack and up to 128 spanning-tree instances per switch</p> <p>Four thousand VLAN IDs</p> <p>Voice VLAN VTP</p> <p>IGMPv3 snooping</p> <p>Layer 2 trace route which eases troubleshooting by identifying the physical path that a packet takes from source to destination. Trivial File Transfer Protocol (TFTP) Network Timing Protocol (NTP)</p> <p>Multifunction LEDs per port for port status; half-duplex and full-duplex mode; and 10BASE-T, 100BASE-TX, and 1000BASE-T indication as well as switch-level status LEDs for system, redundant power supply, and bandwidth use provide a comprehensive and convenient visual management system. SNMP v1, v2c, and v3 and Telnet Discovery Protocol Versions 1 and 2</p>
Express Setup	Express Setup which simplifies initial configuration of a switch through a Web browser, eliminating the need for terminal emulation programs and CLI knowledge.

Switch Hardware :

Description	Specification
Performance	<p>Upto 32 Gbps switching fabric Forwarding bandwidth: upto 32 Gbps</p> <p>64 MB DRAM Upto 32 MB flash memory Configurable up to 8000 MAC addresses Configurable up to 255 IGMP groups</p> <p>Configurable maximum transmission unit (MTU) of up to 9000 bytes, with a maximum Ethernet frame size of 9018 bytes (Jumbo frames) for bridging on Gigabit Ethernet ports, and up to 1998 bytes for bridging of Multiprotocol Label Switching (MPLS) tagged frames on both 10/100 and 10/100/1000 ports</p>
Connectors and Cabling	<p>10BASE-T ports: RJ-45 connectors, two-pair Category 5 or 6 unshielded twisted-pair (UTP) cabling</p> <p>100BASE-TX ports: RJ-45 connectors, two-pair Category 5 or 6 UTP cabling</p> <p>1000BASE-T ports: RJ-45 connectors, four-pair Category 5 or 6 UTP cabling</p> <p>1000BASE-T SFP-based ports: RJ-45 connectors, four-pair Category 5 or 6 UTP cabling</p> <p>1000BASE-SX, -LX/LH, -ZX, -BX and CWDM SFP-based ports: LC fiber connectors (single/multimode fiber)</p> <p>100BASE-LX10, -BX, -FX: LC fiber connectors (single/multimode fiber).</p>
Power Supply	Power supply with redundancy

Indicators	Per-port status: Link integrity, disabled, activity, speed, full-duplex System status: System, link status, link duplex, link speed
Environmental Ranges	Operating temperature: 32 to 113°F (0 to 45°C) Storage temperature: -13 to 158°F (-25 to 70°C) Operating relative humidity: 10 to 85% (noncondensing)

Management and Standards

<u>Descriptio</u> <u>n</u>	<u>Specification</u>
Management Standards	Should support all public and private MIBs _____ IEEE 802.1s (SFP) 100BASE-X IEEE 802.1w IEEE 802.1x 1000BASE-X (SFP) IEEE 802.3ad 1000BASE-SX IEEE 802.3ah (100BASE-X/1000BASE-ZX single/multimode fiber only) 1000BASE-CWDM SFP 1470 nm SFP 1490 nm IEEE 802.3x full duplex on 1000BASE-CWDM SFP 1510 nm 10BASE-1000BASE-CWDM T, 1530 nm SFP 1550 nm 100BASE-TX, and 1000BASE-T ports 1000BASE-CWDM SFP 1570 nm 1000BASE-CWDM SFP 1590 nm IEEE 802.1D Spanning Tree Protocol 1000BASE-CWDM SFP 1610 nm IEEE 802.1p CoS Prioritization I and II standards IEEE 802.1Q VLAN IEEE 802.3 10BASE-T specification 100BASE-TXRMON IEEE 802.3u specification IEEE 802.3ab 1000BASE-T specification IEEE 802.3z 1000BASE-X specification

5. Servers

Servers	Feature s	Specificatio ns
1. Linux / Free Unix	IPv4 & Ipv6 Compliant open source operating system for implementing Ipv6 DNS, Web, Mail,AAA and other services with Multiple FE ports INTEL 5520 CHIPSET VALUE EM 64T BASED SERVER 5U RACK INTEL XEON QUAD CORE E5620, 2.4 GHz, 12 MB L3 CACHE, 5.86 GT/s 300 GB SAS HDD, 15K RPM *3 4 GB DDR3, ECC, 1333 ,MHz *2 22X SATA DVD WRITER 8 PORT SAS RAID CARD WITH 256 MB CACHE HSHDD HSRP 8 PORT SAS RAID CARD WITH 256 MB CACHE RAID 0, 1, & 5 DUAL GIGABIT ETHERNET PORT CARD	
2. Microsoft windows Server 2008 R2	Windows IPv4 & Ipv6 compliant operating system for implementing Ipv6 DNS, Web and other services on Windows Platform with Multiple FE ports	INTEL 5520 CHIPSET VALUE EM 64T BASED SERVER 5U RACK INTEL XEON QUAD CORE E5620, 2.4 GHz, 12 MB L3 CACHE, 5.86 GT/s 300

GB SAS HDD, 15K RPM *3 4 GB DDR3, ECC,
1333 ,MHz *2
HSHDD HSRP

22X SATA DVD WRITER

		<p>8 PORT SAS RAID CARD WITH 256 MB CACHE DUAL GIGABIT ETHERNET PORT CARD RAID 0, 1, & 5 PRELOADED WINDOWS 2008 R2 STANDARD SERVER EDITION WITH 5 CALS WITH MEDIA</p>
3. Mid range server (Free Unix / Linux)	IPv4 & Ipv6 compliant with Virtualisation for hosting OS and applications as per testing requirements.with multiple FE ports	<p>INTEL 5520 CHIPSET VALUE EM 64T BASED SERVER 5U RACK INTEL XEON SIX CORE X5670, 2.93 GHz, 12 MBL3 CACHE, 6.4 GT/s 300 GB SAS HDD, 15K RPM*3 4 GB DDR3, ECC, 1333 ,MHz *2 22X SATA DVD WRITER 8 PORT SAS RAID CARD WITH 256 MB CACHE HSHDD,HSRP DUAL GIGABIT ETHERNET PORT CARD RAID 0, 1 & 5</p>