



**Draft Specification
of
Router**

SPECIFICATION NO. RDSO/SPN/TC/84/2008

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**TELECOM DIRECTORATE
RESEARCH DESIGNS & STANDARDS ORGANISATION
Manak Nagar,
LUCKNOW-226011**

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Author Director/ Telecom-II/ RDSO		
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Abstract This document specifies technical specification of Router for IT applications in Indian Railways.		

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TABLE OF CONTENTS

Sr. No.	Item	Page No.
1.	Introduction	6
2.	General Requirements	6
3.	Technical specification of Router for End Location	8
4.	Technical specification of Router for Sub Divisional Location	12
5.	Technical specification of Router for Divisional Location	17
6.	Technical specification of Router for Central Location	23
7.	Regulatory compliances of Routers	28
8.	Warranty	29
9.	Marking and Packing	29
10.	Documentation	29

I. SUMMARY:

This document covers the technical requirements of Router for IT applications specifically for UTS & PRS applications for Indian Railways.

II. SOURCE:

Draft specification RDSO/ SPN/ TC/ 84 /2008, Rev 0.0 have been prepared by RDSO, Lucknow as per Railway Board letter No. 2006/Tele/TC/1 dated 28/07/2008.

III. FOREWORD:

RDSO/ SPN specification is issued as draft specification. This specification is circulated to customers/ Railways and field inspection units for comments.

In the absence of IRS specification, procurement may be made as per RDSO/ SPN specification.

Wherever, reference to any specifications appears in this document, it shall be taken as a reference to the latest version of that specification unless the year of issue of the specification is specifically stated.

**RESEARCH DESIGNS & STANDARDS ORGANIZATION
MINISTRY OF RAILWAYS
MANAK NAGAR, LUCKNOW**

Draft Specification of Router

Draft Specification No: RDSO/SPN/TC/84 /2008 (Revision 0.0)

1.0 INTRODUCTION:

- 1.1 This specification lays down the technical requirements of different kinds of the Wide Area Network (WAN) Routers used for WAN applications in the Indian Railways network. The WAN Routers shall be used in Internet / intranet as mechanism for allowing interconnection of servers, clients, RAS, Routers and other devices used in the Internet, Intranet, PRS, UTS, FOIS, COIS and other IT applications environments of Indian Railways.
- 1.2 A WAN Router is a wide area networking device operating at Layer 3 of the seven layer ISO-OSI model. The basic function of a WAN Router is path selection and bridging between two distant networks segments and to forward packets from one Interface to another.
- 1.3 In the path determination function, a router creates routing table to look up the interface for given packet. The creation and routing table update is part of the intelligence of the router
- 1.4 This specification covers basically four different type of routers as mentioned below.
 - 1.4.1 Router for end location i.e. Tier 3 level of networks.
 - 1.4.2 Router for sub divisional hub i.e. Tier 2 level of networks.
 - 1.4.3 Router for divisional hub i.e. Tier 1 level of networks.
 - 1.4.4 Router for central location i.e. Tier 0 level of networks.

2.0 GENERAL REQUIREMENTS:

- 2.1 The router shall be fully solid state and adopt state of the art technology.
- 2.2 The router shall be compact, composite construction and lightweight. The actual dimension and weight of the equipment shall be furnished by the manufactures.
- 2.3 All connectors of router shall be reliable, low loss and standard type so as to ensure failure free operations over long operations.

- 2.4 Router shall have adequate cooling arrangements to meet environment conditions as specified in document QM 333/ Issue- 1/September 1990 (IPT 1001A-revised) regarding specification for Environmental Testing of Electronic Equipments for Transmission and Switching use issued by Telecommunication Engineering Centre (TEC).
- 2.5 Each sub-assembly shall be clearly marked with schematic reference to show its function, so that it is identifiable from the layout diagram in the handbook.
- 2.6 Each terminal block and individual tags of router shall be numbered suitably with clear identification code and shall correspond to the associated wiring their circuit diagrams and functions.
- 2.7 The router shall be designed for continuous operation. The manufacturer shall furnish the MTBF (Mean Time Between Failure) and MTRR (Mean Time to Restore) predicted and observed values along with calculations.
- 2.8 Suitable visual indications for healthy, unhealthy conditions and for non-urgent alarms shall be provided.
- 2.9 The design of the router shall not allow plugging of a module in a wrong slot or upside down.
- 2.10 The removal or addition of any interface cards shall not disrupt traffic on other cards.
- 2.11 In the event of a bug found in the software, the manufacturer shall provide patches and firmware replacement if involved, free of cost. Compatibility of the existing hardware shall be maintained with future software/firmware.
- 2.12 In the event of a full systems failure, a trace area shall be maintained in non-volatile memory for analysis and problem resolution.
- 2.13 Necessary alarms (indicators) for indication of faults at various levels of hardware shall be provided on the individual modules.
- 2.14 A power down condition shall not cause loss of connection configuration data storage.
- 2.15 The hardware and software components shall not pose any problems in the normal functioning of all network elements wherever interfacing with Indian Railways network for voice, data and transmission systems, as the case shall be.

2.16 The system hardware / software shall not pose any problem, due to change in date and time caused by events such as changeover of millennium / century, leap year etc., in the normal functioning of the system.

2.17.1 Router shall be protected in case of voltage variation beyond the range specified and also against input reverse polarity.

3.0 TECHNICAL SPECIFICATION OF ROUTER FOR END LOCATION (TIER 3):

3.1 Architecture:

3.1.1 The router shall have support for Data, Voice & Video services.

3.1.2 The router shall be chassis based having modular architecture for scalability and should be a single box configuration for ease of management.

3.1.3 The router shall support hardware based VPN (3DES/AES) Encryption card with throughput of 90Mbps.

3.1.4 The router shall support complete Firewall, IPS features.

3.1.5 The router shall have 128MB RAM & 32MB Flash memory and shall be upgradeable.

3.1.6 It shall have integrated USB port.

3.1.7 It shall be supplied with necessary power cards, data cables, connectors, CD's, manuals, bracket accessories, wire managers and other appropriate accessories.

3.2 Performance:

3.2.1 It shall support high performance traffic forwarding with con-current features like firewall and encryption.

3.2.2 Forwarding Capacity shall be a minimum of 65 Kpps (considering 64byte packet size).

3.2.3 It shall support variety of interfaces like V.35 Sync Serial (64Kbps, 2 Mbps), G.703, Ethernet Interfaces –10/100 Mbps, ISDN, BRI, Analog Dialup, Wireless Access Point.

3.2.4 It shall support DSL connectivity using ADSL, G.SHDSL.

3.2.5 It shall support other IP Services like GRE tunneling, ACLs, IPSEC VPNs, Firewalling, NAT services.

3.2.6 It shall support Voice traffic optimization with features like LFI, cRTP.

3.3 High Availability:

3.3.1 It shall support redundant Fast Ethernet connection to LAN.

3.3.2 It shall support fast reboot for minimum network downtime.

3.3.3 It shall support non-stop forwarding for fast re-convergence of routing protocols.

3.3.4 It shall support boot options like booting from TFTP server, network node and flash memory.

3.3.5 It shall support storage of multiple images and configurations.

3.3.6 It shall support VRRP or equivalent

3.4 Protocol Support:

3.4.1 The router shall have routing protocols like IS-IS, RIP ver1 & RIP Ver.2, OSPF ver2, OSPF on demand, BGP4.

3.4.2 It shall support multicast routing protocols IGMPv1, v2 (RFC 2236), PIM-SM (RFC2362) and PIM-DM, Multicast VLAN Registration, DVMRP.

3.4.3 It shall support DHCPv6, IPv6 QoS and IPv6 Multicast support, Bi-directional PIM, Multicast VPN, RIPng and OSPFv3 for IPv6, IPv6 PIMv2 Sparse Mode and IPv6 PIMv2 Source-Specific Multicast.

3.4.4 It shall support MPLS functionality. MPLS VPN, MPLS mVPN (Multicast VPN), VRF-Aware Services (NAT, FW, IPsec, Syslog), Carrier Supporting Carrier (CsC), DiffServ Tunnel Modes, MPLS TE (Fast re-route), DiffServ-Aware TE, Inter-AS VPNs).

3.4.5 It shall support for Load balancing Protocol.

3.4.6 It shall support unequal cost link load sharing for better utilization of the alternate paths.

3.4.7 Configuration Roll Back feature shall be available to recover the mis-configured router to last good configuration.

3.5 Quality of Service (QoS) Features:

3.5.1 The router shall support the following:

- 3.5.1.1 Classification and Marking: Policy based routing, IP Precedence, DSCP.
- 3.5.1.2 Congestion Management: WRED, Priority queuing, Class based weighted fair queuing.
- 3.5.1.3 Traffic Conditioning: Committed Access Rate, Rate limiting Signalling, RSVP.
- 3.5.1.4 Link efficiency mechanisms: cRTP, LFI, MLPPP, support for class-based cRTP and time based policing & queuing.
- 3.5.1.5 Per VLAN QoS. Time Based Shaping and Policing for QoS

3.6 Security Features:

- 3.6.1 The router shall support GRE Tunneling & NAT Services.
- 3.6.2 It shall support IPSEC Site-to-Site and Remote Access VPNs, Hardware based encryption, Any Office to Any other office, dynamic establishment of VPNs so that the configuration & management of IPSEC VPNs becomes easier. Tunnel-less VPN connectivity shall be available. IPSEC VPNs shall be able to carry data, voice, video.
- 3.6.3 It shall support Firewall, IPS features & SSL VPN.
- 3.6.4 It shall support MD-5 route authentication for RIP, OSPF and BGP.
- 3.6.5 It shall support AAA support using Radius.
- 3.6.6 It shall support PAP and CHAP authentication for P-to-P links.
- 3.6.7 It shall support DoS prevention through TCP Intercept & DDoS protection.
- 3.6.8 It shall support IP Access list to limit Telnet and SNMP access to router.
- 3.6.9 It shall support multiple privilege level authentications for console and telnet access through Local database or through an external AAA Server.
- 3.6.10 It shall support Time based & Dynamic ACLs for controlled forwarding based on time of day for offices.
- 3.6.11 It shall have features to limit the spread of viruses & worms on the desktops / workstations.
- 3.6.12 It shall support IEEE 802.1x support for MAC address authentication.

3.7 Debug, Alarms & Diagnostics:

- 3.7.1 The router shall have display of input and output error statistics on all interfaces.
- 3.7.2 It shall have display of dynamic ARP table.
- 3.7.3 It shall have display of physical layer line status signals like DCD, DSR, DTR, RTS, and CTS on all serial interfaces.
- 3.7.4 Trace-route, Ping and extended Ping shall be available.
- 3.7.5 It shall support extensive support for SLA monitoring for metrics like delay, latency, jitter, packet loss, and MOS.

3.8 Accounting:

- 3.8.1 The router shall have following accounting features:
 - 3.8.1.1 Packet & Byte Counts.
 - 3.8.1.2 Start Time Stamp & End Time Stamps.
 - 3.8.1.3 Network Time Protocol.
 - 3.8.1.4 Input & Output interface ports.
 - 3.8.1.5 Type of service, TCP Flags & Protocol
 - 3.8.1.6 Source & Destination IP addresses
 - 3.8.1.7 Source & Destination TCP/UDP ports

3.9 Management:

- 3.9.1 The router shall have support for Web, GUI based management, CLI, Telnet and SNMPv3.
- 3.9.2 It shall support Secure Shell for secure connectivity.
- 3.9.3 It shall have to support out of band management through Console and an external modem for remote management.
- 3.9.4 It shall have embedded RMON support for four groups – history, statistics, alarms and events.
- 3.9.5 Event and System logging: Event and system history logging functions shall be available. The Router shall generate system alarms on events. Facility to put selective logging of events onto a separate hardware where the analysis of log shall be available.

3.9.6 Pre-planned scheduled Reboot Facility: The Router shall support the preplanned time reboot to upgrade their hardware to a new software feature and plan the rebooting at an off-peak time.

3.10 Interface Requirements:

3.10.1 The router shall be equipped with following minimum interfaces or as specified purchaser.

3.10.1.1 1 x V.35 64 Kbps WAN Interfaces.

1.10.1.2 2 x Fast Ethernet Interfaces.

4.0 TECHNICAL SPECIFICATION OF ROUTER FOR SUB DIVISIONAL LOCATION (TIER 2):

4.1 Architecture:

4.1.1 The router shall have support for Data, Voice & Video services.

4.1.2 It shall be chassis based & modular architecture for scalability and should be a single box configuration for ease of management.

4.1.3 It shall be capable of supporting redundant power supply.

4.1.4 It shall support hardware based VPN (3DES/AES) Encryption card with throughput of 120Mbps.

4.1.5 It shall support complete Firewall, IPS features.

4.1.6 It shall have 256MB RAM & 128MB Flash memory and shall be upgradeable.

4.1.7 It shall have integrated USB port.

4.1.8 It shall have free slot for future expansion.

4.1.9 Chassis of router shall be 19" rack mountable type.

4.1.10 It shall be supplied with necessary power cards, data cables, connectors, CD's, manuals, bracket accessories, wire managers and other appropriate accessories.

4.2 Performance:

- 4.2.1 The router shall support high performance traffic forwarding with con-current features like Firewall and encryption.
 - 4.2.2 Forwarding Capacity shall be a minimum of 110 Kpps (considering 64byte packet size).
 - 4.2.3 It shall support variety of interfaces like V.35 Sync Serial (64Kbps, 2 Mbps), G.703, Ch-E1, E3 Interfaces for future uplink purposes, Ethernet Interfaces – 1Gbps, 10/100 Mbps, ISDN PRI, BRI, ATM.
 - 4.2.4 It shall support voice interface like FXS, FXO, E&M, T1/E1.
 - 4.2.5 It shall support DSL connectivity using ADSL, G.SHDSL.
 - 4.2.6 It shall support application acceleration and WAN optimization module that can accelerates the performance of any TCP-based application delivered across the WAN.
 - 4.2.7 It shall support network modules, such as Network Analysis, Intrusion Detection System, Voice Mail Module, and Content Engine network modules, with embedded processors and hard drives that allow them to run largely independently of the router, while allowing their management from a single management interface.
 - 4.2.8 It shall support two onboard DSPs slots to provide support for analog voice, digital voice, conferencing, transcoding, and Secure Real Time Protocol (sRTP).
 - 4.2.9 It shall support other IP Services like GRE tunneling, ACLs, IPSEC VPNs, Firewalling, NAT services.
 - 4.2.10 It shall support Voice traffic optimization with features like LFI, cRTP.
- 4.3 High Availability:**
- 4.3.1 The router shall support redundant Fast Ethernet connection to LAN.
 - 4.3.2 It shall support redundant power supply.
 - 4.3.3 It shall support fast reboot for minimum network downtime.
 - 4.3.4 It shall support non-stop forwarding for fast re-convergence of routing protocols.
 - 4.3.5 It shall support boot options like booting from TFTP server, Network node and Flash Memory.
 - 4.3.6 It shall support multiple storage of multiple images and configurations.

4.3.7 It shall support link aggregation using LACP as per IEEE 802.3ad.

4.3.8 It shall support VRRP or equivalent.

4.4 Protocol Support:

4.4.1 The router shall support Routing protocols like IS-IS, RIP ver1 & RIP Ver.2, OSPF ver2, OSPF on demand, BGP4.

4.4.2 It shall support Multicast routing protocols IGMPv1, v2 (RFC 2236), PIM-SM (RFC2362) and PIM-DM, Multicast VLAN Registration, DVMRP.

4.4.3 It shall support DHCPv6, IPv6 QoS and IPv6 Multicast support, Bi-directional PIM, Multicast VPN, RIPng and OSPFv3 for IPv6, IPv6 PIMv2 Sparse Mode and IPv6 PIMv2 Source-Specific Multicast.

4.4.4 It shall support MPLS Provider Edge functionality. MPLS VPN, MPLS mVPN (Multicast VPN), VRF-Aware Services (NAT, FW, IPsec, Syslog), Carrier Supporting Carrier (CsC), DiffServ Tunnel Modes, MPLS TE (Fast re-route), DiffServ-Aware TE, Inter-AS VPNs).

4.4.5 It shall support for Load balancing Protocol.

4.4.6 It shall support unequal cost link load sharing for better utilization of the alternate paths.

4.4.7 Configuration Roll Back feature shall be available to recover the mis-configured router to last good configuration.

4.5 Quality of Service (QoS) Features:

4.5.1 The router shall support the following:

4.5.1.1 Classification and Marking: Policy based routing, IP Precedence, DSCP, MPLS exp bits.

4.5.1.2 Congestion Management: WRED, Priority queuing, Class based weighted fair queuing.

4.5.1.3 Traffic Conditioning: Committed Access Rate, Rate limiting Signaling: RSVP.

4.5.1.4 Link efficiency mechanisms: cRTP, LFI, MLPPP. Support for class-based cRTP and time based policing & queuing.

2.5.1.5 Per VLAN QoS. Time Based Shaping and Policing for QoS.

4.6 Security Features:

4.6.1 The router shall support GRE Tunneling & NAT Services.

4.6.2 The router shall support IPSEC Site-to-Site and Remote Access VPNs, Hardware based encryption, Any Office to Any other office, dynamic establishment of VPNs so that the configuration & management of IPSEC VPNs becomes easier. Tunnel-less VPN connectivity shall be available.

4.6.3 It shall support IPSEC VPNs which should be able to carry data, voice, and video.

4.6.4 It shall support Firewall feature set supporting Stateful, application-based filtering, per-user Authentication and Authorization, transparent firewall, IPv6 firewall and Http and email inspection engine to detect port 80 misuses and email connectivity. IPS feature set with predefined and customizable signatures shall be available.

4.6.5 It shall support MD-5 route authentication for RIP, OSPF and BGP.

4.6.6 It shall support multi-level of access.

4.6.7 It shall support SNMPv3 authentication, SSHv2.

4.6.8 It shall support AAA server using Radius.

4.6.9 It shall support CHAP authentication for P-to-P links.

4.6.10 It shall support DoS prevention through TCP Intercept & DDoS protection.

4.6.11 It shall support IP Access list to limit Telnet and SNMP access to router.

4.6.12 It shall support multiple privilege level authentications for console and telnet access through Local database or through an external AAA Server.

4.6.13 It shall support Time based & Dynamic ACLs for controlled forwarding based on time of day for offices.

4.6.14 It shall support IEEE 802.1x for MAC address authentication.

4.7 Multi-Media Support:

4.7.1 The router shall support following voice capabilities.

- 4.7.1.1 Codec support for G.711 and G.729
- 4.7.1.2 It shall support the capability to integrate with PBXs using E1 connectivity.
- 4.7.2 It shall support H.323, SIP, MGCP.
- 4.7.3 It shall support QSIG, E1 R2 and several CAS signaling.
- 4.7.4 It shall support in-built voice call processing in the event of WAN link failure to central call processing Engine.
- 4.7.5 It shall support bandwidth optimization features like Voice Activity Detection, Silence Suppression, Echo cancellation.
- 4.7.6 It shall not consume more than 14-15Kbps of bandwidth (including overheads) for a single voice over IP call.

4.8 Debug, Alarms & Diagnostics:

- 4.8.1 The router shall support for monitoring of Traffic flows for Network planning and Security purposes.
- 4.8.2 Display of input and output error statistics on all interfaces shall be available.
- 4.8.3 Display of Dynamic ARP table shall be available.
- 4.8.4 Display of physical layer line status signals like DCD, DSR, DTR, RTS, CTS on all serial interfaces shall be available.
- 4.8.5 Trace-route, Ping and extended Ping shall be available.
- 4.8.6 Router shall support extensive support for SLA monitoring for metrics like delay, latency, jitter, packet loss, RTP-Based VoIP traffic and shall support the capability for measurement of the call setup time using H.323/SIP signaling protocol over IP network.
- 4.8.7 It shall support embedded event manager that enables automation of many network management tasks and directs the operation of router OS to increase availability, collect information, and notify external systems or personnel about critical events

4.9 Accounting:

- 4.9.1 The router shall have following accounting features:
 - 4.9.1.1 Packet & Byte Counts

- 4.9.1.2 Start Time Stamp & End Time Stamps.
- 4.9.1.3 Network Time Protocol
- 4.9.1.4 Input & Output interface ports.
- 4.9.1.5 Type of service, TCP Flags & Protocol
- 4.9.1.6 Source & Destination IP addresses
- 4.9.1.7 Source & Destination TCP/UDP ports

4.10 Management:

- 4.10.1 The router shall have support for Web, GUI based management, CLI, Telnet and SNMPv3.
- 4.10.2 It shall support Secure Shell for secure connectivity.
- 4.10.3 It shall have embedded RMON support for four groups – history, statistics, alarms and events.
- 4.10.4 It should have support for Out of band management through Console and an external modem for remote management.
- 4.10.5 Event and System logging: Event and system history logging functions shall be available. The Router shall generate system alarms on events. Facility to put selective logging of events onto a separate hardware for the analysis of log shall be available.
- 4.10.6 Pre-planned scheduled Reboot Facility: The Router shall support the preplanned timed reboot to upgrade their hardware to a new software feature and plan the rebooting as an off-peak time

4.11 Interface Requirements:

- 4.11.1 The router shall be equipped with following minimum interfaces or as specified by purchaser.
 - 4.11.1.1 16 x V.35 (64kbps) WAN Interfaces.
 - 4.11.1.2 2 x Fast Ethernet Interfaces.

5.0 TECHNICAL SPECIFICATION OF ROUTER FOR DIVISIONAL LOCATION (TIER 1):

5.1 Architecture:

- 5.1.1 The router shall have support for Data, Voice & Video services.

- 5.1.2 It shall be chassis based & modular architecture for scalability and should be a single box configuration for ease of management.
- 5.1.3 It shall be capable of supporting redundant power supply.
- 5.1.4 It shall support hardware based VPN (3DES/AES) Encryption card with throughput of 150 Mbps.
- 5.1.5 It shall support complete Firewall, IPS features.
- 5.1.6 It shall have 256MB RAM & 128MB Flash memory and shall be upgradeable.
- 5.1.7 It shall have integrated USB Port.
- 5.1.8 Chassis of router shall be 19" rack mountable type.
- 5.1.9 It shall be supplied with necessary power cards, data cables, connectors, CD's, manuals, bracket accessories, wire managers and other appropriate accessories.

5.2 Performance:

- 5.2.1 The router shall support high performance traffic forwarding with con-current features like Firewall and encryption.
- 5.2.2 Forwarding Capacity shall be a minimum of 200 Kpps (considering 64byte packet size).
- 5.2.3 It shall support variety of interfaces like V.35 Sync Serial (64Kbps, 2 Mbps), G.703, Ch-E1, E3 Interfaces for future uplink purposes, Ethernet Interfaces – 1Gbps, 10/100 Mbps, ISDN PRI, BRI, ATM.
- 5.2.4 It shall support voice interface like FXS, FXO, E&M, T1/E1.
- 5.2.5 It shall support DSL connectivity using ADSL, G.SHDSL.
- 5.2.6 It shall support network modules, such as Network Analysis, Intrusion Detection System, Voice Mail Module, Wide Area Application Services and Content Engine network modules, with embedded processors and hard drives that allow them to run largely independently of the router, while allowing their management from a single management interface.
- 5.2.7 It shall support three onboard DSPs slots to provide support for analog voice, digital voice, conferencing, transcoding, and Secure Real Time Protocol (sRTP).

5.2.8 It shall support other IP Services like GRE tunneling, ACLs, IPSEC VPNs, Firewalling, NAT services.

5.2.9 It shall support Voice traffic optimization with features like LFI, cRTP.

5.3 High Availability:

5.3.1 The router shall support redundant Gigabit Ethernet connection to LAN.

5.3.2 It shall support Redundant Power supply.

5.3.3 It shall support fast reboot for minimum network downtime.

5.3.4 It shall support Non-Stop forwarding for fast re-convergence of routing protocols.

5.3.5 It shall support boot options like booting from TFTP server, Network node and Flash Memory.

5.3.6 It shall support multiple storage of multiple images and configurations.

5.3.7 It shall support link aggregation using LACP as per IEEE 802.3ad.

5.3.8 It shall support VRRP or equivalent.

5.4 Protocol Support:

5.4.1 The router shall support Routing protocols like IS-IS, RIP ver1 & RIP Ver.2, OSPF ver2, OSPF on demand, BGP4.

5.4.2 It shall support Multicast routing protocols IGMPv1, v2 (RFC 2236), PIM-SM (RFC2362) and PIM-DM, Multicast VLAN Registration, DVMRP.

5.4.3 It shall support DHCPv6, IPv6 QoS and IPv6 Multicast support, Bi-directional PIM, Multicast VPN, RIPng and OSPFv3 for IPv6, IPv6 PIMv2 Sparse Mode and IPv6 PIMv2 Source-Specific Multicast.

5.4.4 It shall support MPLS Provider Edge functionality. MPLS VPN, MPLS mVPN (Multicast VPN), VRF-Aware Services (NAT, FW, IPsec, Syslog), Carrier Supporting Carrier (CsC), DiffServ Tunnel Modes, MPLS TE (Fast re-route), DiffServ-Aware TE, Inter-AS VPNs).

5.4.5 It shall have support for Load balancing Protocol.

5.4.6 It shall support unequal cost link load sharing to better utilize the alternate paths.

5.4.7 Configuration Roll Back to recover the mis-configured router to last good configuration shall be possible.

5.5 Quality of Service (QoS) Features:

5.5.1 The router shall support the following.

5.5.1.1 Classification and Marking: Policy based routing, IP Precedence, DSCP, MPLS exp bits.

5.5.1.2 Congestion Management: WRED, Priority queuing, Class based weighted fair queuing.

5.5.1.3 Traffic Conditioning: Committed Access Rate, Rate limiting Signaling, RSVP.

5.5.1.4 Link efficiency mechanisms: cRTP, LFI, MLPPP. Support for class-based cRTP and time based policing & queuing.

5.5.1.5 Per VLAN QoS. Time Based Shaping and Policing for QoS.

5.6 Security Features:

5.6.1 The router shall support GRE Tunneling & NAT Services.

5.6.2 It shall support IPSEC Site-to-Site and Remote Access VPNs, Hardware based encryption, Any Office to Any other office, dynamic establishment of VPNs so that the configuration & management of IPSEC VPNs becomes easier. Tunnel-less VPN connectivity shall be available.

5.6.3 It shall support IPSEC VPNs which should be able to carry data, voice, and video.

5.6.4 It shall support Firewall feature set supporting Stateful, application-based filtering, per-user Authentication and Authorization, transparent firewall, IPv6 firewall and Http and email inspection engine to detect port 80 misuses and email connectivity. IPS feature set with predefined and customizable signatures.

5.6.5 It shall support for large scale any-to-any IPSEC VPNs without any dependency on tunnel limitation.

5.6.6 It shall support MD-5 route authentication for RIP, OSPF and BGP.

5.6.7 It shall support multi-level of access.

5.6.8 It shall support SNMPv3 authentication, SSHv2.

5.6.9 It shall provide AAA support using Radius.

5.6.10 It shall support CHAP authentication for P-to-P links.

5.6.11 It shall provide DoS prevention through TCP Intercept & DDoS protection.

5.6.12 It shall provide IP Access list to limit Telnet and SNMP access to router.

5.6.13 It shall provide multiple privilege level authentications for console and telnet access through Local database or through an external AAA Server.

5.6.14 It shall provide time based & Dynamic ACLs for controlled forwarding based on time of day for offices.

5.6.15 It shall provide IEEE 802.1x support for MAC address authentication.

5.7 Multi-Media Support:

5.7.1 The router shall support following voice capabilities.

5.7.1.1 Codec support for G.711 and G.729.

5.7.1.2 The router shall support the capability to integrate with PBXs using E1 connectivity.

5.7.2 The router shall support H.323, SIP, MGCP.

5.7.3 It shall support QSIG, E1 R2 and several CAS signaling.

5.7.4 It shall support in-built voice call processing in the event of WAN link failure to central call processing Engine.

5.7.5 It shall support bandwidth optimization features like Voice Activity Detection, Silence Suppression, and Echo cancellation.

5.7.6 It should not consume more than 14-15Kbps of bandwidth (including overheads) for a single voice over IP call.

5.8 Debug, Alarms & Diagnostics:

5.8.1 The router shall support for monitoring of Traffic flows for Network planning and Security purposes.

5.8.2 Display of input and output error statistics on all interfaces shall be available.

- 5.8.3 Display of Dynamic ARP table shall be available.
- 5.8.4 Display of physical layer line status signals like DCD, DSR, DTR, RTS, CTS on all serial interfaces shall be available.
- 5.8.5 Trace-route, Ping and extended Ping shall be available.
- 5.8.6 The router shall support extensive support for SLA monitoring for metrics like delay, latency, jitter, packet loss, RTP-Based VoIP traffic and shall support the capability for measurement of the call setup time using H.323/SIP signaling protocol over IP network.
- 5.8.7 The router shall support embedded event manager that enables automation of many network management tasks and directs the operation of router OS to increase availability, collect information, and notify external systems or personnel about critical events.

5.9 Accounting:

- 5.9.1 The router shall have following accounting features:
 - 5.9.1.1 Packet & Byte Counts
 - 5.9.1.2 Start Time Stamp & End Time Stamps.
 - 5.9.1.3 Network Time Protocol
 - 5.9.1.4 Input & Output interface ports.
 - 5.9.1.5 Type of service, TCP Flags & Protocol
 - 5.9.1.6 Source & Destination IP addresses
 - 5.9.1.7 Source & Destination TCP/UDP ports

5.10 Management:

- 5.10.1 The router shall have support for Web, GUI based management, CLI, Telnet and SNMPv3.
- 5.10.2 It shall support Secure Shell for secure connectivity.
- 5.10.3 It shall have embedded RMON support for four groups – history, statistics, alarms and events.
- 5.10.4 It shall support Out of band management through Console and an external modem for remote management.
- 5.10.5 Event and System logging: Event and system history logging functions shall be available. The Router shall generate system alarms on events. Facility to put selective logging of events onto a separate hardware here the analysis of log shall be available.

5.10.6 Pre-planned scheduled Reboot Facility: The Router shall support the preplanned timed reboot to upgrade their hardware to a new software feature and plan the rebooting as an off-peak time

5.11 Interface Requirements:

5.11.1 The router shall be equipped with following minimum interfaces or as specified by purchaser.

5.11.1.1 2 x 64Kbps WAN Interfaces.

5.11.1.2 2 Gigabit Ethernet Interfaces.

6.0 TECHNICAL SPECIFICATION OF ROUTER FOR CENTRAL LOCATION (TIER 0):

6.1 Architecture:

6.1.1 The router shall have support for Data, Voice & Video services.

6.1.2 It shall be chassis based & modular architecture for scalability and shall be a single box configuration for ease of management.

6.1.3 It shall be capable of supporting redundant power supply.

6.1.4 It shall support hardware based VPN (3DES/AES) Encryption card with throughput of 200Mbps.

6.1.5 It shall have complete Firewall, IPS features.

6.1.6 It shall have 256MB RAM & 128MB Flash memory and should be upgradeable.

6.1.7 It shall have integrated USB port.

6.1.8 Chassis of router shall be 19" rack mountable type.

6.1.9 The router shall be supplied with necessary power cards, data cables, connectors, CD's, manuals, bracket accessories, wire managers and other appropriate accessories.

6.2 Performance:

6.2.1 The router shall support high performance traffic forwarding with con-current features like Firewall and encryption.

- 6.2.2 Forwarding Capacity shall be a minimum of 500 Kpps (considering 64byte packet size)
 - 6.2.3 It shall support variety of interfaces like V.35 Sync Serial (64Kbps, 2 Mbps), G.703, Ch-E1, E3 Interfaces for future uplink purposes, Ethernet Interfaces – 1Gbps, 10/100 Mbps, ISDN PRI, BRI, ATM, Digital/Analog dialup and remote access modules, Circuit Emulation over IP.
 - 6.2.4 It shall support voice interface like FXS, FXO, E&M, T1/E1.
 - 6.2.5 It shall support DSL connectivity using ADSL, G.SHDSL.
 - 6.2.6 It shall support network modules, such as Network Analysis, Intrusion Detection System, Voice Mail Module, Wide Area Application Services and Content Engine network modules, with embedded processors and hard drives that allow them to run largely independently of the router, while allowing their management from a single management interface.
 - 6.2.7 It shall support four onboard DSPs slots to provide support for analog voice, digital voice, conferencing, transcoding, and Secure Real Time Protocol (sRTP).
 - 6.2.8 It shall have other IP Services like GRE tunneling, ACLs, IPSEC VPNs, Firewalling, NAT services.
 - 6.2.9 It shall support Voice traffic optimization with features like LFI, cRTP.
- 6.3 High Availability:**
- 6.3.1 The router shall support redundant Gigabit Ethernet connection to LAN.
 - 6.3.2 The router shall support Redundant Power supply.
 - 6.3.3 It shall support fast reboot for minimum network downtime.
 - 6.3.4 It shall support Non-Stop forwarding for fast re-convergence of routing protocols.
 - 6.3.5 It shall support boot options like booting from TFTP server, Network node and Flash Memory.
 - 6.3.6 It shall support multiple storage of multiple images and configurations.
 - 6.3.7 It shall support link aggregation using LACP as per IEEE 802.3ad.
 - 6.3.8 It shall support VRRP or equivalent.

6.4 Protocol Support:

- 6.4.1 The router shall support Routing protocols like IS-IS, RIP ver1 & RIP Ver.2, OSPF ver2, OSPF on demand, BGP4.
- 6.4.2 It shall support Multicast routing protocols IGMPv1, v2 (RFC 2236), PIM-SM (RFC2362) and PIM-DM, Multicast VLAN Registration, DVMRP.
- 6.4.3 It shall support DHCPv6, IPv6 QoS and IPv6 Multicast support, Bi-directional PIM, Multicast VPN, RIPng and OSPFv3 for IPv6, IPv6 PIMv2 Sparse Mode and IPv6 PIMv2 Source-Specific Multicast.
- 6.4.4 It shall support MPLS Provider Edge functionality. MPLS VPN, MPLS mVPN (Multicast VPN), VRF-Aware Services (NAT, FW, IPsec, Syslog), Carrier Supporting Carrier (CsC), DiffServ Tunnel Modes, MPLS TE (Fast re-route), DiffServ-Aware TE, Inter-AS VPNs).
- 6.4.5 It shall support for Load balancing Protocol.
- 6.4.6 It shall support unequal cost link load sharing to better utilize the alternate paths.
- 6.4.7 Configuration Roll Back to recover the mis-configured router to last good configuration shall be available.

6.5 Quality of Service (QoS) Features:

- 6.5.1 The router shall support the following.
 - 6.5.1.1 Classification and Marking: Policy based routing, IP Precedence, DSCP, MPLS exp bits
 - 6.5.1.2 Congestion Management: WRED, Priority queuing, Class based weighted fair queuing
 - 6.5.1.3 Traffic Conditioning: Committed Access Rate, Rate limiting Signalling: RSVP
 - 6.5.1.4 Link efficiency mechanisms: cRTP, LFI, MLPPP. Support for class-based cRTP and time based policing & queuing.
 - 6.5.1.5 Per VLAN QoS. Time Based Shaping and Policing for QoS

6.6 Security Features:

- 6.6.1 The router shall support GRE Tunneling & NAT Services.

6.6.2 The router shall support IPSEC Site-to-Site and Remote Access VPNs. Hardware based encryption. Any Office to Any other office, dynamic establishment of VPNs so that the configuration & management of IPSEC VPNs becomes easier. Tunnel-less VPN connectivity.

6.6.3 It shall support IPSEC VPNs should be able to carry data, voice, video.

6.6.4 It shall support Firewall feature set supporting Stateful, application-based filtering, per-user Authentication and Authorization, transparent firewall, IPv6 firewall and Http and email inspection engine to detect port 80 misuses and email connectivity. IPS feature set with predefined and customizable signatures.

6.6.5 It shall support for large scale any-to-any IPSEC VPNs without any dependency on tunnel limitation.

6.6.6 It shall support MD-5 route authentication for RIP, OSPF and BGP.

6.6.7 It shall support multi-level of access.

6.6.8 It shall support SNMPv3 authentication, SSHv2.

6.6.9 It shall provide AAA support using Radius.

6.6.10 It shall support CHAP authentication for P-to-P links.

6.6.11 It shall support DoS prevention through TCP Intercept & DDoS protection.

6.6.12 It shall support IP Access list to limit Telnet and SNMP access to router.

6.6.13 It shall support multiple privilege level authentications for console and telnet access through Local database or through an external AAA Server.

6.6.14 It shall support time based & dynamic ACLs for controlled forwarding based on time of day for offices.

4.6.15 It shall provide IEEE 802.1x support for MAC address authentication.

6.7 Multi-Media Support:

6.7.1 The router shall support following voice capabilities.

6.7.1.1 Codec support for G.711 and G.729

6.7.1.2 The router shall support the capability to integrate with PBXs using E1 connectivity.

6.7.2 It shall support H.323, SIP, MGCP.

- 6.7.3 It shall support QSIG, E1 R2 and several CAS signaling.
- 6.7.4 It shall support in-built voice call processing in the event of WAN link failure to central call processing Engine.
- 6.7.5 It shall support bandwidth optimization features like Voice Activity Detection, Silence Suppression, Echo cancellation.
- 6.7.6 It shall not consume more than 14-15Kbps of bandwidth (including overheads) for a single voice over IP call

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6.10.6 Pre-planned scheduled Reboot Facility: The Router shall support the preplanned timed reboot to upgrade their hardware to a new software feature and plan the rebooting as an off-peak time

6.11 Interface Requirements:

6.11.1 The router shall be equipped with following minimum interfaces or as specified by purchaser.

6.11.1.1 2 x 2Mb Channelized WAN Interfaces.

6.11.1.2 2 Gigabit Ethernet Interfaces.

7.0 REGULATORY COMPLIANCES OF ROUTERS:

7.1 The router shall conform to UL 60950 or IEC 60950 or CSA 60950 or EN 60950 Standards.

7.2 The router shall conform to EN 55022 Class A/B or CISPR22 Class A/B or CE Class A/B or FCC Class A/B Standards.

7.3 The router / router's Operating System should be tested and certified for EAL2 or above under Common Criteria Program for security related functions.

7.4 The router shall conform to the Electromagnetic Compatibility (EMC) requirement as per the following standards and limits indicated therein:

EN55022 class A, FCC class A, VCCI class A Immunity: EN55024, EN61000-3-levels 2

- 7.5 The operating personnel shall be protected against shock hazards as per IS8473 (1993) – Guide on the effects of current passing through the human body (equivalent to IEC publications 479 – 1984).
- 7.6 The router shall conform to IS 13252 (1992) – Safety of Information Technology equipment including electrical business equipment equivalent to IEC publication 95 (1986) and IEC 215 (1987) Safety requirements of Radio transmitting equipments (for Radio equipments only).

8.0 WARRANTY:

The manufacturer shall warrant the material covered by this specification to be free from defects in design, material and workmanship under ordinary use and service, his obligation under this warranty being limited to replace free of cost those parts which shall be found defective within THREE years after delivery to the purchaser.

9.0 MARKING & PACKING:

- 9.1 The following information shall be clearly marked at a suitable place on each equipment:
- i) Name and Address of the manufacturer.
 - ii) Month & Year of the manufacturing.
 - iii) Serial number of Equipment.
- 9.2 The equipment and its sub assemblies shall be packed in thermocole boxes and the empty spaces shall be filled with suitable filling material. Before keeping in the thermocole box, the equipment shall be wrapped with bubble sheet. The equipment shall be finally packed in a wooden case of sufficient strength so that it can withstand bumps and jerks encountered in a road/rail journey.

10.0 DOCUMENTATION:

The supplier shall provide the complete operation, maintenance and installation manuals in English for the product under procurement.
