SWITCHING
ISSUE 02: Feb 2013

Softswitch for Local and Transit Wire-line Applications

GENERIC REQUIREMENTS
No. TEC/GR/SW/NGN-LTS/02. Feb' 13
(Supersedes GR No. TEC/GR/SW/NGN-LTS/01.JAN- 09)

© TEC

DEPARTMENT OF TELECOMMUNICATIONS
TELECOMMUNICATION ENGINEERING CENTRE

All rights reserved and no part of this publication shall be reproduced, stored in a retrieval system, or transmitted, in any form or by any means, electronic, mechanical, photocopying, recording, scanning or otherwise without written permission from the Telecommunication Engineering Centre, New Delhi.

Contents

History Sheet

S.No.	Name of the GR and Number	Issue	Remarks
1.	Softswitch for Local and Transit Wire line Applications GR No. GR/LTS-01/01 SEP.2007	01	
2.	Softswitch for Local and Transit Wire line Applications No. TEC/GR/SW/NGN-LTS/01.JAN - 09	01	As per new GR Format Mandatory Requirements are described in chapter 3 to chapter 9 and Desirable requirements are described in chapter 10
3.	Softswitch for Local and Transit Wire line Applications No. TEC/GR/SW/NGN-LTS/02.Feb'13	02	

Chapter 1

Introduction

1.1 This document specifies the Generic Requirements (GR) of a softswitch. This softswitch shall form a component of NGN system to be used for local and transit wire line applications. The mandatory requirements are described in chapter 3 to chapter 9 and the desirable requirements are described in chapter 10.

1.2 NGN system consists of the following main components:

i). Softswitch
ii). Session Border controller
iii). Line Media Gateway
iv). Signalling gateway
v). Trunk Media gateway
vi). Element Management System
vii). SIP Application Server
viii). Media Server
ix). IAD (integrated Access Device)

1.3 NGN system and its components shall support the following protocols and services :

i). H.248 ver3 (As per TEC standard IR No. SD/MGCP-01)
ii). H.323(As per ITU Rec. H.323)[Optional]
iii). SIGTRAN standards (As per TEC standard No. SD/SGT-01)
iv). SIP standards (As per TEC standard No. SD/SIP-01)
v). SIP-I (as per ITU – Rec. Q.1912.5)
vi). IUA for ISDN services (As per IIETF RFC 4233) or NGN system shall support ISDN services using suitable gateway.
vii). V5UA for V5.2 subscribers (As per IETF RFC 3807) or NGN system shall support V5.2 subscribers using suitable gateway.
viii). NGN services (As per TEC SR No. SR/NSF-01)

1.4 This GR covers mandatory requirement namely functional, interconnection, quality, EMI/EMC, safety and security requirements for softswitch to be used as local and transit wire line applications.

1.5 The Softswitch shall support IP addressing as per version 4 (IPv4) and IP version 6 (IPv6).

Chapter-2

Description of the system and Architecture

2.1 In general NGN system consists of the following components as shown in figure 1. Different protocols used are also shown in the diagram.

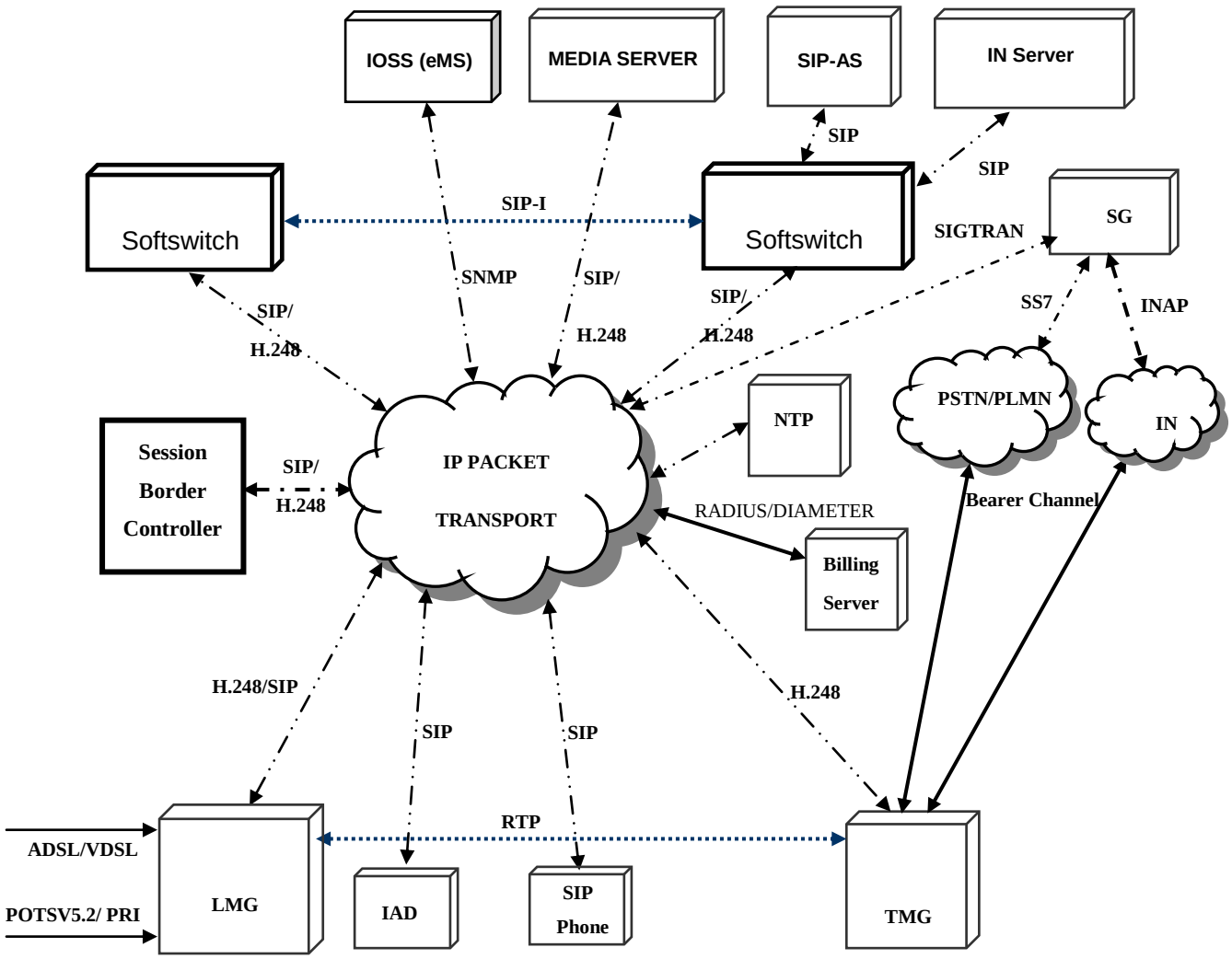

Figure 1: NGN components

2.2 Main NGN components are as follows

i). Softswitch
ii). Session Border controller
iii). Line Media Gateway
iv). Signalling gateway

v). Trunk Media gateway
vi). Element Management System
vii). SIP Application Server
viii). Media Server
ix). IAD (integrated Access Device)

2.3 Based on the particular function different NGN components may be described as below:

2.3.1 **Softswitch**: Softswitch is also known as Media Gateway Controller, (MGC), Call Server (CS) or Call Agent (CA). The Softswitch is located in the service provider's network and handles call control and signaling functions, typically maintaining call state for every call in the network. A Softswitch interacts with Application Servers to provide services that are not directly hosted on Softswitch.
Softswitch is used for local/transit or local cum transit application which is deployed in the control layer of NGN (Next Generation Network), in a network architecture employing standards NGN protocol as per international standards and IP based packet transport.

The Softswitch shall provide interoperability with all types of network elements in the present Switched Circuit Network (SCN). The Softswitch shall interface with existing SCN switches through Trunk Media Gateways, Line Media Gateways, and Signalling Gateways etc.

The Softswitch shall use fault-tolerant, highly scalable and open-ended state-of-the-art hardware, software & networking technologies; and provide carrier-grade performance, to comply with the reliability and service quality standards specified in this document.

2.3.2 **Session Border Controller (SBC):** Session Border Controller is a set of functions that enables interactive communication across the borders or boundaries of disparate IP administrative domains. It provides sessions of real time IP voice, video and other data across borders between IP networks and provides Protocol Interworking, Admission Control, security, Quality of Service, Service Level Agreements, legal intercept and other functions using IP signalling protocols. SBC shall be deployed at the edge and core of a service provider's network to control signalling and media streams as they enter and exit the network. Depending on the performance requirements SBC may be categorized as low capacity, medium capacity and high capacity. SBC shall manage signalling and control real-time traffic flows between IP networks.

2.3.3 **Line Media gateway (LMG):** The LMG is located in the service provider's network. It supports the line side interface to the core IP network for use by

phones, devices, and PBXs. This element provides functions such as media conversion (circuit to Packet, Packet to circuit) and echo control. Mainly the Access Gateway is termed as Line Media Gateway (LMG). Line Media Gateway (LMG) for wire-line access applications, in network architecture employs ITU-T H.248 or SIP protocol and a core packet network based on IP. The Line Media Gateway can be implemented as two physically separated equipments or single integrated equipment. In case of integrated equipment, all the parameters specified separately for each functionality, shall be met. The Line Media Gateway is intended to provide subscriber access, media conversion, call related & service related signalling and management functions. The call processing will be done by Soft-switch in association with Line Media Gateway. LMG shall have interfaces namely POTS, ISDN, V5.2, ADSL2+ & VDSL2. These can be implemented as two separate units or single integrated equipment.

2.3.4 **Signalling gateway (SG):** The SG provides the signalling interface between the VoIP network and the PSTN signalling network. It terminates SS7 links and provides Message Transport Part (MTP) Level 1 and Level 2 functionality. Each SG communicates with its associated CS to support the end-to-end signalling for calls. The SG is intended to facilitate seamless interworking between Signalling System Number 7 (SS7) network and IP based network.

2.3.5 **Trunk Media gateway (TMG):** The TMG supports a trunk side interface to the PSTN and/or IP routed flows in the packet network. It supports functions such as packetisation, echo control etc. While providing telephony services using TMG, all existing telephony functionality in the circuit switched networks is preserved when the bearer network is changed to IP/MPLS network. TMG shall provide a smooth migration of the telephony service in circuit switched network to packet network. The TMG shall interface for supporting traditional telephony services, including all existing PSTN/ISDN/PLMN over a packet based network. The TMG shall include:

(i). Trunk Media Gateway Control,
(ii). Media Resource

2.3.6 **Element Manager System (eMS):** eMS is a centralised service that manages one or more of a specific type of Network Elements. A Network Element (NE) is basically a unit of manageable hardware equipment combined with software that provides telecommunications function and can be controlled through an element manager.

The eMS minimizes the cost of operations by integrating element management processes and making them simple. The important management functions of eMS include Fault Management, Configuration Management, Accounting Management, Performance Management and Security Management to ensure maximum usage of the devices resources.

eMS shall manage multiple network elements present in a Service Provider's network in a unified manner, which shall help to monitor, configure, and maintain the entire network easily. Except in occasional conditions when the eMS is down or when the network element is initially being placed in service, all day-to-day operations functions for the network element shall typically be performed by eMS.

2.3.7 **SIP Application Server(SAS):** The AS is located in the service providers network, and provides the service logic and execution for one or more applications or services that are not directly hosted on the CS. Typically the CS routes calls to the appropriated AS for features which CS does not support. Depending upon the various functions the application servers will be different types. One of the servers which is based on the SIP protocol and for providing different application in the network is termed as SIP application server.
SIP Application Server (SAS) enables service providers to develop roll out and host next – generation network (NGN) services e.g. Multimedia services, broadcasting, messaging etc.
Various types of new services that can be provided by use of 3rd party ISV's (Independent Software vendors) / other SIP Application Servers may be provided to wire line subscribers.

2.3.8 **Media server (MS):** The MS is located in the service provider's network and uses a control protocol such as H.248 or SIP, under the control of the CS or application server, to provide announcements and tones, and collect user information. Media Server (MS) is used within the NGN network for providing announcements and general media processing assistance to the services. The Media server shall use SIP or H.248 protocol under the control of Soft switch Media Server shall provide following functionalities:

(i) Announcements
(ii) Tones
(iii) DTMF
(iv) Conferencing
(v) IVRS
(vi) Transcoding

Media Server shall have the ability to play voice & multimedia based announcements to the users. It shall support DTMF tone detection and generation. It shall support IPV4 and IPV6.

2.3.9 **Integrated Access Device (IAD):** IAD provide access to voice, data, Internet and video services simultaneously delivered by an IP based network.

Two different types of IAD are available. In type IAD-I, DSL modem is not integrated whereas in type IAD-II, DSL modem is integrated in the device. The use of IAD-II is possible both with IP access network as well as DSL access network. The IAD shall aggregate real time voice and packet data across a shared transmission facility connecting the customer premises to a Service Provider's Network. IAD enables VoIP over existing broadband connection. IAD shall be placed at the customer premises and shall be under the control of Softswitch in IP environment.

2.3.10 **IP core network:** The primary function of the IP core network is to provide routing and transport of IP packets. The IP core also has the added value of architecturally isolating the gateways, and their associated access networks, from the CS and associated service intelligence. In order to address the performance needs of each of the typical traffic streams associated with the VoIP architecture (bearer channels, signalling, and management traffic), the core network may support COS (class of service) per-hop behaviors.

2.3.11 **IP terminals:** The IP terminals refer to IP phones, SIP phone/Terminal, IP PBX and software phones. They are typically intelligent terminals based on either H.323 or SIP protocol. The difference between IP terminals and media gateways is that there is no need to convert media as the voice already digitalized with IP terminals.

Using the above components the Softswitch shall provide the different NGN services. These are the services that may be provided to the NGN subscribers by the Softswitch or IMS based on SIP platform.

Chapter-3

Functional Requirements

3.1 Functional requirements of softswitch to be used as local and transit wireline applications are described in this chapter. These requirements are mandatory**.**

Softswitch can be used for local, transit, local cum transit and International exchange applications. Depending upon the use the softswitch functionality shall be asked. These functionalities may be divided into the following sections:

A. Common requirements for Softswitch to be used as Local (class 5)/ Transit (class4)/ Local cum Transit / International applications : Section A

B. Additional features required for different applications are as follows in different sections

i) Softswitch for local applications : Section B
ii) Softswitch for transit applications : Section C
iii) Softswitch for Local cum Transit applications : Section B &C
iv) Softswitch for International Gateway Functionality : Section D

SECTION – A
(Common requirements for all types of applications)

3.1.1 The underlying packet transport technology shall be Internet Protocol (IP).

3.1.2 The equipment shall not necessitate any changes in the existing Public Switched Telephone Network (PSTN), Integrated Services Digital Network (ISDN), Public Land Mobile Network (PLMN) and Intelligent Network (IN) and shall not impact the interfaces and protocols in these networks.

3.1.3 The Softswitch shall provide text encoding in ABNF format of IETF as per protocol H.248 Ver.3.

3.1.4 The Softswitch shall control number of Media Gateways (physically separated as well as virtual Gateways by logical partition within a physical entity) in its 'domain'. Domain is considered to be a set of Line Media Gateways, Access Gateways, Trunk Media Gateways and signaling gateways controlled by a Softswitch.

3.1.5 The Softswitch shall support transfer of text-based (URL/URI) naming for identification purposes, by interfacing with an ENUM platform. However, it may be possible to use the same for routing purpose.

3.1.6 Codec Negotiation

3.1.6.1 The Softswitch shall support the procedure for codec negotiation, in association with the media gateway

Codec Support: It shall support all the codec's as given below as per

latest ITU-T recommendations:

(i) G.711

(ii) G.729 A

(iii) T.38

(iv) It shall support following video codecs:

a) H.264

b) H.263

3.1.6.2 The Codec modification procedures shall also be supported, wherein the Codec selected for a call can be modified in any direction and at any time during the active phase of the call. For example, this feature will be required when the announcements are required during the call

3.1.6.3 It shall be possible to convey the 'list of supported codec' by the Softswitch to another Softswitch.

3.1.6.4 It shall be possible to create, modify interrogate the 'list of supported codecs' to add and delete codecs as per requirements.

3.1.6.5 It shall be possible to convey the 'list of available codecs' that can be used for this call set-up and in active phase of the call.

3.1.6.6 It shall be possible to assign codecs to various routes and trunk groups for all calls.

3.1.6.7 Call by call support for voice or modem termination must be available. Disabling of voice processing functions necessary for transparent interchange of FAX and modem signals shall be provided. Switch over to voice from Fax and vice versa shall be available during the call.

3.1.6.8 Softswitch shall provide the ability for one Trunk Media Gateway to connect to other Trunk Media Gateways without necessarily knowing the type of Codec (used at the time of call set-up). It shall also support mid call detection and codec negotiation e.g. Voice call to fax call, voice call to modem call. Voice call to ISDN data call and vice versa.

3.1.7 Tones and Announcements

3.1.7.1 The Softswitch shall be capable to transport DTMF signals, tones and other telephony events as out-of band information using the signalling protocols H.248 and SIP-I, on detection and reporting of these events by MGW.

3.1.7.2 The tones as specified below shall be supported by the softswitch through signaling protocols.

Tones (with frequency and cadence)

S.No	Type of Tone	Frequency	Cadence
1.	Special Dial Tone	400+300 HZ	Continuous
2.	Second Dial Tone	Do -	-do-
	Indication tone (Acceptance Tone)	400 HZ	1 sec. ON 4 sec. OFF Duration at least 30 sec
4.	Call Waiting Tone	400 HZ	0.2 sec ON 0.1 sec OFF 7.5 sec OFF Duration 30 sec
5.	Negative Indication Tone (Rejection Tone)	400 HZ	250 ms ON 250 ms OFF
6.	Hold tone	400 HZ	250 ms ON 250 ms OFF 250 ms ON 3250 ms OFF
7.	Distinctive ringing tone	400 HZ modulated by 25 HZ	1000 ms ON 2000 ms OFF

It shall be possible to define new tones whenever required.

3.1.7.3 The Softswitch shall support tones functionalities within the scope of IETF RFC 2833 and H.248 Ver.3 control profile ETSI ES 283 002 and ETSI ES 283 024 depending upon local, transit or local cum transit applications of Softswitch. The support shall be for both reception and transmission.

3.1.7.4 The Softswitch (or Softswitch in conjunction with separate Media Server) shall provide following announcements:

S. No.	Announcement name
1.	This telephone number does not exist.
2.	This telephone number is temporarily out of service
3.	The service to the dialled number has been temporarily withdrawn
4.	This number is changed. Please consult telephone Directory or 197
5.	This facility is not available on your telephone
6.	Please check the number you have dialled
7.	The route is busy. Please dial after some time
8.	Your line has been taken out of service temporarily. Please contact your area accounts officer.
9.	Namaskar; this is wake up call for you
10.	International subscriber dialling facility is not available. Please book your call with the trunk exchange.
11.	Country code dialled is not available. Please contact your trunk exchange
12.	Dialled code does not exist. Please check the code
13.	The route is busy. Please dial after some time.
14.	STD service to the station is disturbed. Please try after some time
15.	The subscriber is absent to answer your call. Please try after some time.
16.	The subscriber does not want to be disturbed. Please try after some time.

It shall be possible to change the announcements at site due to revision of the above list, which may be carried out from time to time.

3.1.8 Requirements Specific Millennium Problem

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

3.1.9 ADDRESSING, ANALYSIS, ROUTING AND CHARGING FACILITIES

Analysis facilities:

(i) The Softswitch shall provide facility for translating the input information into data necessary for setting up the Call routing, and analysis data (start of Selection, number of digits to be sent, etc,) and data necessary for functions such as traffic observation, system, etc. management etc. Flexibility shall be provided to accommodate change in the routing, numbering and charging.

(ii) Facility shall be provided (with necessary safeguards), to enable authorized operating personnel to modify the routing, charging and analysis of data with the help GUI Web interface.

(iii) The depth of analysis required is up to 16 digits (including trunk prefix) and the analyzing capacity shall be at least 10,000 codes.

(iv) Depending on the analysis of dialled digits, the Softswitch shall be able to decide whether a call will be metered or non-metered. It shall be possible to declare any code (e.g.197) metered or non-metered using GUI Web interface.

(v) The Softswitch shall be capable to prefix or suffix up to 6 digits. It shall also be capable to replace any set of dialled digits by new digits (upto7 digits).

(vi) The softswitch shall be capable of storing at least 24 dialled digits.

(vii) It shall be able to enhance the depth of analysis by single command to provide separate routing /charging treatment for individual number or number ranges

(viii) It shall be possible to prefix an access code using GUI Web interface to the digits dialled by a subscriber, based on subscriber category (e.g. pre-paid subscriber) and routing the call on a desired route.

3.1.10 Service Detail Record(SDR)

3.1.10.1 The softswitch shall provide SDR based on duration and content/volume of data. It shall support reverse charging, flexible charging (duration based, A- party pays, B Party pays, A party pays for voice and B-Party pays for video etc.) for local application only.

3.1.10.2 SDR over junctions for at least 300 selected trunk groups for incoming and outgoing calls shall be possible. In a specified trunk group, Softswitch shall support measurement of answered calls, metered call units and the total duration of answered calls. These counters shall be highly secure and fully protected during any type of system and sub-system re-initialization and against modifications by man-machine commands. It shall be possible to take backup of these counters.

3.1.10.3 SDR over junctions

(i) For each incoming trunk group at least four records shall be provided.

(ii) It shall also be possible by GUI based terminals to assign any record for any incoming call/service-request based on the dialled digits (e.g. 0, 00, 98 etc.)

(iii) It shall also be possible to define one of these records to store accumulated charge-units for all the incoming calls/service-requests.

(iv) For each outgoing trunk group, one bulk record shall be provided.

(v) Each of the record for I/C and O/G trunk- groups shall have a minimum capacity of 1,00,00,00,000 units.

(vi) SDR over junctions shall also be possible on individual incoming junctions of E1 link shall be possible to assign subscriber numbers on these individual junctions of E1.

3.1.10.4 SDR over junctions for selected trunk groups for both incoming and outgoing calls shall be possible. It shall be possible to restrict SDR only for the answered calls by GUI.

3.1.10.5 Different fields and information required in SDR.

(A) This feature shall make it possible for a subscriber to get a specific printed record of called number, duration and charge information of calls. This service will enable a subscriber to get detailed bill to generate for all or part of the completed calls and possibly supplementary services originated from their number.

The subscriber will have different categories for generation of SDR items for their O/G calls as given below:

- Category 1 --- No detailed SDR
- Category 2 --- Detailed SDR for national calls
- Category 3 --- Detailed SDR for international calls
- Category 4 --- Detailed SDR for national & international calls
- Category 5 --- Detailed SDR for all calls etc.
- Category 6 --- Detailed SDR for national, international and '95' level call
- Category 7 --- Detailed SDR for local calls.

It shall be possible to assign any combination of above categories to any subscriber

(B) SDR shall have the following information according to the type of calls originated from the subscriber's number:

(a). Type of call (Normal, forwarded, conference etc.),

(b). Number dialled by the caller

(c). No. of units charged

(d). Parameters related to volume of content (for each media type separately)

(e). Domain ID

(f). Date and time of answer

(g). Date and time of call origination (in case of unsuccessful call)

(h). Calling subscriber identity including Local Area Code (LAC) (10 digits)

(i). Calling subscriber category (individual, CCB Subs., Priority Subs.)

(j). Type of calling subscriber (analog /digital/SIP)

(k). Number dialled by the calling subscriber and TRANSLATED Number.

(l). Indication of bearer capability for ISDN call (Speech /3.1 kHz/64 kbps unrestricted), data call

(m). Duration of conversation and number of units charged with a resolution up to a 10 millisecond

(n). Incoming and outgoing trunk group & trunk identity

(o). Indication of whether the call is successful or unsuccessful

(p). Supplementary services (in case of forwarded call, number of hops to be indicated along with forwarding number)

(q). Charge band number

(r). Career selected

(s). IP address of Ingress and Egress Media Gateways, Signalling Gateway and Softswitches

(t). Codec Selected

(u). QoS information from MG related to Network Package and RTP Package

(v). Additional information required for International Gateway Functionality

(w). Packets and bytes sent, lost and received

(x). Call Reference

3.1.10.6 SDR file shall be available in duplicated hard disk. SDRs shall be write protected. In case of any overflow of hard disk capacity, audible and visual alarm shall be raised. Audible and visual alarm shall be provided in case of overflow of subscriber and junction bulk records.

3.1.10.7 50%, 75% & 90% utilisation of capacity of SDR file shall generate alarm of suitable category.

3.1.10.8 It shall be possible to interrogate and check the status of billing file generated.

3.1.10.9 Transfer of SDR files shall be programmable for the time of the day and the frequency at which the SDR shall be down loaded to the billing centre. Integrity of the SDR file downloaded to billing mediation device shall be ensured.

3.1.10.10 The collection of billing and traffic data from the network shall not affect the performance of the network.

3.1.10.11 SDR on assigned trunk-groups/junctions shall be possible for all the calls irrespective of whether CLI is received or not.

3.1.10.12 The Softswitch shall modify the charging rate when the call crosses into the other time band.

3.1.10.13 Facilities shall be provided for modification of office data related to charging under control of authorized personnel with adequate safeguards to prevent misuse by unauthorized persons.

3.1.10.14 In case of transit calls SDR for incoming and outgoing part of the call shall appear in the same detailed billing record.

3.1.10.15 The Softswitch shall provide the Service Detail Record (SDR) feature for all terminating calls.

3.1.10.16 Charge band number shall be recorded in the SDR.

3.1.10.17 The Softswitch shall provide CLI based charging functionality.

3.1.10.18 The Softswitch shall provide the generation of SDR on CCS 7 routes for different messages received as per the TEC IR No. TEC/IR/CCS-SIG/01

3.1.10.19 The charging periodicity shall be in the multiple of 10 ms

3.1.11 Charging threshold alarm

The Softswitch shall be capable of assigning two thresholds through GUI based web portal for each subscriber individually for chargeable units for each call and total accumulated charge units, When these thresholds exceed, necessary alarm print outs giving all details shall be printed and shall also be logged in the disk. A separate AMA ticket shall be produced for these types of calls. The alarm print out shall be generated as soon as any of these two thresholds exceed during the call and the call shall continue

3.1.12 Addressing

The Softswitch shall be addressable using IP address which shall be used during call control signalling, bearer control signalling and bearer transport.

For implementation of redundant hardware, another IP address can be used.

The Softswitch shall support IP addressing as per version 4 (IPv4) and IP version 6 (IPv6).

3.1.13 Network Timing

The Softswitch shall use the timing information supplied by a Network Time Protocol (NTP) Server.

3.1.14 Calendar Management

It shall be possible to execute any command at any time by attaching a time tag to the command and it shall be executed when the system real time matches the time tag. It shall be possible to define both time and date. If no date is mentioned, the command shall be executed daily at the time indicated.

3.1.15 Slip measurement

The Softswitch shall be capable of measuring the slips on 2048 kbps interfaces, designated through GUI based Web portal in case of integrated signalling gateways. It shall be possible to get display and print-out of the measurement results on demand at any time during the measurement period.

3.1.16 Automatic Traffic Controls

The Softswitch shall support the following “Automatic traffic controls for network management” as per ITU-T recommendation Q.542.

(i) Automatic Congestion Control (ACC)
(ii) Selective Circuits Reservation control (SCR)
(iii) Hard-to-reach code recognition/control (HTR)

3.1.17 The Softswitch shall also print-out adequate information during an impending or existing overload situation to enable the management to actuate manual controls and take any other necessary action to contain the situation.

3.1.18 It is expected that where traffic limitation has to be restored to, preference is given, to those calls which have the highest probability of completion. Calls refused service shall be connected to recorded announcement which can be provided from Announcement Server integrated in media gateway or from a standalone server.

3.1.19 Necessary control consoles for efficient management of the Softswitch

shall be provided. Simultaneous operation from the different consoles provided shall not cause any malfunction of the equipment.

3.1.20 The Softswitch shall support all Network management Controls as per ITU-T Recommendations E. 412, Q. 542 and Q. 823.

3.1.21 System access

a) It shall be possible to carry out the system operations without any interruptions to service.

b) Suitable safeguards shall be provided in the man-machine communication and GUI based Web portal programs to debar unauthorized persons form making any changes in the memory contents or office data.

c) The man-machine communication programs shall have the facility of restricting the use of certain commands or procedures to certain passwords and terminals.

d) Input/Output terminal shall be based on Windows/NT or Windows 2000 or later versions of Windows or Linux. Necessary software package to prevent loading of any unauthorized software or driver on the I/O terminal (without specific authorization from PC administrator) shall be provided.

3.1.22 Command log

All commands issued for modification of software or data shall be logged in a file/ database (read only) and it shall be possible to retrieve the same on demand whenever required, using GUI based terminals. The log files should not be modified by any GUI based terminals.

3.1.22.1 It shall be possible through a single Man-Machine Command to obtain a list and the total number of equipment of a particular type (e.g. trunks, subscriber etc.) in a particular state (e.g. in-service, blocked etc.) belonging to a complete domain or particular LMG and TMG etc.

3.1.22.2 It shall be possible to read or modify the data related to a group of trunks of TMG and group of subscribers of particular LMG and TMG etc. by a single command.

3.1.22.3 It shall be possible to store at least the last 1000 commands on the screen and by scrolling and editing any command can be re-executable. It shall be possible to read commands issued for particular TMG, LMG etc.

3.1.22.4 It shall be possible through a GUI based terminal or Web portal to obtain a list of spare Subscriber Line equipment number which are not allocated to any subscriber number (separately for different Line Access Gateways/Access Gateways), along with the related bulk meter information.

3.1.22.5 It shall be possible through a GUI based terminal or Web portal to obtain a list of spare subscriber numbers in each hundred group, which are not attached to any line equipment number, along with the related bulk meter information.

3.1.22.6 It shall be possible through a GUI based terminal or Web portal to obtain a list of subscribers and the total number of subscribers with a particular class of subscriber service category (e.g. dynamic STD control, call waiting etc.).

3.1.22.7 It shall be possible through a single GUI based terminal or Web portal to transfer the billing information for all the subscribers of Line Access Gateway/Access Gateway in the domain or particular TMG/LMG etc to any storage device.

3.1.22.8 It shall be possible to assign a multiple geographic area codes such as SDCA, SSA, circle, zone to trunks and subscribers, so that all the system operation, administration and maintenance features are possible, by using these codes.

3.1.22.9 The line testing (PSTN, BRI, DSL etc.) and circuit testing (trunks, PRI) shall be provided in association with MGW as per requirements of TEC GR No. GR/LMG-01 and GR/TMG-01 for respective clauses of line testing.

3.1.23 Maintenance facilities

i). The Softswitch shall have the capability to monitor its own performance and to detect, analyze, locate and report faults.

ii). The equipment design shall be such that any special care and precautions on the part of the maintenance personnel are kept to an absolute minimum.

iii). Facility shall be available for introduction of centralized maintenance control.

iv). The Softswitch shall provide in-built facilities to trace the signals for CCS7 (MTP, ISUP, SCCP, TCAP and INAP), H.248 Ver.3, SIP-I, M2UA, M3UA, V5UA, H.323 (Optional) with message and parameter decoding.

v). Loop-back testing of signalling and voice paths for CCS7 and IP shall be supported.

3.1.24 Alarm Indications

i) It shall be possible to display or print out the number of calls and occupancy for a given group of devices.

ii) Facility shall exist for audio/visual alarm indication of ‘Route Busy’ (RTB) on any group or circuits to enable initiation of suitable remedial action.

iii) Audio/visual alarm indication shall be given when the processor load exceeds a certain pre-set value, to be set by a suitable GUI command.

SECTION B

Applicable to Softswitch for Local (class 5) applications (In addition to the requirements given in Section A)

3.1.25 The softswitch shall provide complete Local applications suitable for providing end-to-end packet network, PSTN/PLMN network, IP local and transit applications, as well as multimedia applications via an IMS platform.

3.1.26 Service

i). The Softswitch shall provide call logic and call control functions. It may include service logic for various services. Service logic for one or more services/ applications that are not directly hosted on the softswitch may be provided by Application Server (s).

ii). The Softswitch shall provide interoperability with all types of network elements in the present Switched Circuit Network (SCN) and provide all existing bearer, tele and supplementary services in PSTN/ISDN.

3.1.27 Line Media Gateway Control

LMG should be controlled either with H.248 or SIP.

3.1.28 The Softswitch shall be able to control Integrated Access Devices (IAD).It shall be possible to connect the Access Network (AN) based on following protocols

i). V5UA (V5.2 User Adaptation for V5.2) as per IETF RFC 3807

ii). IUA (ISDN User Adaptation) protocol as per IETF RFC 3057

These protocols shall provide all PSTN/ISDN services as specified in TEC SR on service Requirements for NGN subscribers, TEC/SR/NSF-SU2/01.

SECTION C

Applicable to Softswitch used for Transit (class 4) applications (In addition to the requirements given in Section A)

3.1.29 The softswitch shall provide complete transit applications for packet network and PSTN/PLMN network.

3.1.30 Trunk Media Gateway Control

The Softswitch shall control Trunk Media Gateways (TMG) using H.248 ver.3 TMGW Control Profile ETSI ES 283024.

3.1.31 The Softswitch shall control Trunk Media Gateways (TMG) of different make and models in respect of all services, features and other functionalities as specified in this document.

SECTION D

Applicable to Softswitch used for International Gateway Functionality (IGF) (In addition to the requirements given in Section A&C)

3.1.32 The Softswitch shall have following additional functions :
The softswitch shall provide International Gateway functionality to work on CCS7, SIGTRAN, H.323 (Optional) and SIP signalling with exchanges in other countries directly. This facility supports use of different versions of ISUP, SIGTRAN, H.323 (Optional) and SIP for national and international working. This facility shall support multiple signalling point codes for use in national and international CCS7 networks.

3.1.33 Country of Origin Routing

It shall be possible to support routing of calls based on country of origin (as per incoming trunk group).

3.1.34 Automatic testing of the circuits

The exchange shall provide facility for automatic testing of the circuits as per predetermined time using digital loop back test line as per ITU-T recommendation Q.11 (test code 68).

Chapter - 4

Inter connectivity and Inter operability Requirements

4.1 The equipment shall provide seamless inter working with Session initiation Protocol (SIP) network. Interworking with H.323 (Optional) network for international working only shall be provided. Softswitch shall inter work with Session Border Controller**.**

4.1.1 Interfaces

4.1.1.1 The Softswitch shall provide IP interface towards MPLS network and shall consist of either Gigabit Ethernet interface or 100 base T (Fast Ethernet) Optical interface(s), 1000 Base SX/1000 Base LX at 1310 nm/1550nm ITU-T G.652 single mode dark fibre with (1 + 1) redundancy. It shall interface with a router (co-located or remotely located) as per interface specified in TEC GR No. GR/TCP-01.

4.1.1.2 The Softswitch shall provide redundant (1+1) call control sub-system, with no single point of failure.

4.1.2 Signalling and protocol interworking

The Softswitch shall support the following signalling Protocols:

(i) Access Gateway Control as per ITU-T H.248 ver 3 with control profile ETSI ES 283 002 for Line Media Gateway Control and Media Gateway Control as per ITU-T Rec. H.248 ver 3 with control profile ETSI ES 283 024 depending upon local, transit or local cum transit applications of Softswitch

(ii) SIP-I as per ITU-T Q.1912.5, the extension protocol of SIP, used for the transparent transfer of ISUP signalling.

(iii) SIP as per IETF RFC 3261, used for the interconnection between Softswitch and other Softswitches or SIP application servers and also to access SIP multimedia terminals.

(iv) Session Description Protocol (SDP) as per IETF RFC 3407, 3264, 3266, 3108, 3107, 2845 and 2327.

(v) Stream Control Transport Protocol (SCTP) as per IETF RFC 3309, 3286 and 2960. Used to provide the reliable data packet transfer service for the adaptation protocols of IP-based Switched Circuit Network (SCN) signalling.

(vi) M3UA (MTP3 User Adaptation Layer protocol) as per IETF RFC

3332 and M2UA (MTP2 User Adaptation Layer protocol) as per IETF RFC 3331.

(vii) INAP CS-1 and CS-2 as per TEC Standard No. SD/INP-01 to define the information streams between the functional entities of the IN so that Softswitch can support the Service Switching Function (SSF), the Call Control Function (CCF), the Specialized Resource Function (SRF) and the Call Control Access Function (CCAF) and act as the SSP using the standard IN architecture.

(viii) FTP as per IETF RFC0959, for transfer of billing information over TCP/IP links to the billing centre for file transfer shall be used. In addition it shall be possible to take the billing information on Optical/Magnetic media locally.

(ix) DIAMETER protocols as per IETF RFC 3588 with extensions or RADIUS protocol as per IETF RFC 2138, shall be supported for integration with billing system as per the requirement.

(x) DSS1 as per ITU-T I.430, I.431, Q.921, Q.931, for the interworking between Softswitch and PSTN through MGW.

(xi) MPEG.4 video Standard as per ISO/IEC-14496-2.

4.1.3 Inter-working with different components

4.1.3.1 The Softswitch shall support inter-working with SIP-I (ITU-T Recommendation Q.1912.5) to inter working with another softswitch.

4.1.3.2 The Softswitch shall support inter working with a Softswitch supporting BICC-CS2 as per ITU-T approved recommendations (for inter operator network only).

4.1.4 Signalling Transport

4.1.4.1 Transport over TCP or UDP shall be provided for SIP-I (ITU-T Recommendation Q.1912.5)

4.1.4.2 Transport for all CCS7 related protocols within IP domain shall be provided over SCTP.

4.1.4.3 Signalling for protocols H.248 Ver.3 shall be transported using SCTP/UDP/TCP.

4.1.4.4 The IP bearer control signalling conveying SDP information shall be transported through H.248 Ver.3 (between MGW & Softswitch) and ITU-T Q1912.5 (between two Softswitches) and interworking with end-to-end functional transparency shall be ensured.

4.1.5 Interworking with CCS7

One of the following two cases shall be supported.

CASE 1: Softswitch connected to a stand-alone 'Signalling Gateway'

4.1.6 The Softswitch shall be capable of inter working with the CCS7 signalling in the Switched Circuit Network as per TEC IR No. TEC/IR/CCS-SIG/01 when the CCS7 User Parts are transported using 'SCTP over IP' between Softswitch and a 'Signalling Gateway' as per TEC GR No. GR/SGW-01. User adaptation protocol namely M3UA (MTP Layer 3 User Adaptation) shall be provided. The Softswitch shall provide ISUP, SCCP, TCAP and INAP as per National Standards below:

i) ISDN User Part (ISUP) as per TEC IR for CCS7 for MTP and ISUP' (TEC IR No. TEC/IR/CCS-SIG/01).

ii) Signalling Connection and Control Part (SCCP) as per TEC National SCCP standards for Large Digital switching system (TEC Standard No.S/CCS-03).

iii) Transaction Capabilities Application Part (TCAP) as per TEC document No. SD/CCS-05/01.

iv) Intelligent Network Application Part (INAP) as per TEC document no. SD/INP-01.

4.1.7 The availability, maximum end-to-end call set up delay and other performance requirements of CCS7 signalling shall be as per TEC IR No. TEC/IR/CCS-SIG/01.

Case 2: CCS7 signalling links terminated on Softswitch (having integrated signalling Gateway functionality in Softswitch)

4.1.8 The Softswitch shall be capable of supporting CCS7 as per National Standards as follows:

(i) Message Transfer Part (MTP) and ISDN User Part (ISUP) as per 'TEC IR for CCS7 for MTP and ISUP' (No. TEC/IR/CCS-SIG/01).

(ii) Signalling Connection and Control Part (SCCP) as per National SCCP standards (No.S/CCS-03).

(iii) Transaction Capabilities Application Part (TCAP) as per as per TEC document No. SD/CCS-05/01.

(iv) Intelligent Network Application Part (INAP) as per TEC document No. SD/INP-01.

4.1.9 It shall be possible to extract and process the signalling information from 64 kbps signalling links multiplexed on a 2048 kbps (ITU-T G.703) links. The signalling links can be on any or all the time slots of a 2048 kbps link.

4.1.10 The Softswitch shall be capable of merging into a single synchronised network. (TEC document No. GR/SYN-01 may be referred).

4.1.11 The synchronisation method shall be master/slave.

4.1.12 The Softswitch shall have integrated synchronisation interface conforming to TEC Generic Requirements No. G/SYN-01. Holdover stability for Layer-2 i.e. $1* 10^{-10}$ per day or better shall be applicable.

4.1.13 The acceptable slip rate shall be in accordance with ITU-T Recommendation G.822.

4.1.14 The accuracy of the real time clock shall be 1 ppm (1.0x10E-6) or better.

4.1.15 Inter-working with SIP-I and SCP

4.1.15.1 Inter-working with SIP-I and other interfaces in the Network.

The softswitch shall interwork as following:

(i) SIP-I based on Q1912.5 provided in the Softswitch shall interwork with CCS7 signalling in the network with full service transparency for the services specified in TEC SR No. TEC/SR/NSF-SU2/01.
(ii) The Call control protocols shall be capable of carrying mid-call control information.
(ii) Both enbloc and overlap addressing (using Re-invite method) shall be supported.

4.1.15.2 Interworking with SCP

The softswitch shall be capable of interworking with the Service Control Points (SCP) in the network as per TEC GR No.S/INP-01 and shall not necessitate any changes to interfaces or protocols in SCPs. Support of INAP-CS2 for Interworking shall be supported with Intelligent Peripheral for IN services.

4.1.16 Interface to Billing System

The Softswitch shall provide detailed SDR. The Softswitch shall provide transfer of SDRs over TCP/IP links to the billing centre using FTP or FTAM for file transfer. It shall also be possible to transfer the SDR in real time to the billing server using DIAMETER/ RADIUS protocol. In addition, it shall be possible to take the SDRs on Optical /Magnetic media locally.

4.1.17 eMS (Element Manager System) requirements

Softswitch shall support eMS requirements as given in the TEC GR No. GR/eMS-01**.** Soft switch shall also be controlled by GUI based eMS terminal locally or remotely.

4.1.18 Interworking for local (class 5) Softswitch applications.

4.1.18.1 Inter-working with Application Server

Softswitch shall support SIP protocol and inter work with Application Server. Softswitch shall provide call control functions and the SIP network services. The softswitch shall enable subscribers to avail SIP-based services along with voice and Internet integrated services.

4.1.18.2 Inter-working with other networks

i) **Interworking with PSTN/PLMN of other operator's networks**: The Softswitch shall be able to interwork with the PSTN, CDMA and GSM network of other operators.
ii) **Interworking with 3G network:** The Softswitch shall interwork with MSC server/GMSC server on SIP for voice data and video calls for its own network and other operator network.

4.1.18.3 IMS Inter working and Migration

The softswitch shall inter work with IP Multimedia System (IMS) for voice, video and data calls as per 3GPP, ETSI, TISPAN and ITU-T NGN standards and recommendations.

4.1.19 Interworking for Transit (class 4) Softswitch applications.

IMS Inter working and Migration

The softswitch shall inter work with IP Multimedia System (IMS) at the transit level for voice, video and data calls as per 3GPP, ETSI, TISPAN and ITU-T NGN standards and recommendations.

Chapter - 5

Quality Requirements

5.1 The performance of Softswitch shall not degrade at peak load for any of the functions i.e. Local, Transit or local cum transit etc. For this the following quality requirements shall be provided.

5.1.1 Hardware

(A) Quality of hardware:

i) In a distributed configuration no softswitch should initiate overload mechanisms, unless the overall BHCA handled by all the call servers exceeds the value specified for overload.

ii) In the event of failure of a call/session controller and reconfiguration of a standby call/session controller, established calls should not be disconnected. There shall be no abnormality or degradation in the functions related SDR generation. There shall be no revenue loss due to the failure and reconfiguration. The reconfiguration should not have any effect on the performance of any other call/session controller.

iii) Availability of each call/session controller and Application Server shall be at least 99.999%.

(B) Hardware Management:

i) The Softswitch shall consist of duplicated control modules, power modules, Storage device (Like Hard Disk, SAN etc.) and Links to packet network so that there is no single point of failure. The Softswitch shall support adequate redundancy for different sub-systems (e.g. processors, control links, disk storage, power supplies and I/O ports etc.) so as to comply with the requirements of system reliability and stability as specified for the system. The redundancy in (1+1) or as desired configuration shall be for all processors, control links, disk storage, power supplies and I/O ports.

ii) If a malfunction of a ‘main’ subsystem occurs during operation, the changeover to a redundant ‘standby’ subsystem shall be without loss of any established connections.

iii) The Softswitch shall support redundancy in power supply feeding.

5.1.2 Redundancy for Softswitches: The softswitch should have redundancy to avoid the outage in the network or disruption of services in the network due to the failure of a single softswitch. This requires the introduction of a duplicated softswitch in the network. The softswitch pair(main and the

redundant) should work either in the ACTIVE/ACTIVE – load sharing mode or in ACTIVE/STANDBY mode. In 1+1 geographical redundancy each active Softswitch is protected by stand-by Softswitch. The standby softswitch constantly replicates all call related data, trunk semi-permanent data as well as transient data (MGW status) and SDR related information in real time. The softswitch redundancy offered should be transparent. In case of failure of the main/primary softswitch, the other softswitch (redundant) should take on the full functionality of the failed softswitch instantaneously, thereby avoiding any outage/disruption of services in the network. The softswitch redundancy is lost during this time period. Once the primary softswitch is recovered from failure and is brought back into service, the database in this softswitch should automatically get updated and the softswitch redundancy should be restored back immediately. This function should be automatic. This redundancy mechanism is failover and fallback mechanism. Failover between softswitch results in dropping all calls In case of a disaster failure of an active Softswitch, the stand-by softswitch will take over the failed softswitch function and control the media gateway that were initially controlled by the failed softswitch. The process to initiate a switch over is to be accomplished automatically as well as by operator, while the switch over process is to be fully automated.

The call processing performance and service quality performance as required shall not degrade even on the peak load conditions.

5.1.3 Voice quality monitoring

The various thresholds to raise the voice quality deterioration alarms shall be definable by GUI based terminal or Web portal. Monitoring shall be possible by measuring RTCP performance.

5.1.4 Quality of Service (QoS)

5.1.4.1 The Softswitch shall support the establishment of media streams according to the definable QoS requirements and to change the QoS during a call.

5.1.4.2 QoS as per ITU-T standards (Y-1541 and Y.1221), RFC 2474, 2475, 2497, 2498, G.114; and as defined by Regulator (TRAI)/Licensor (DoT) or any designated authority shall be supported.

5.1.4.3 The Softswitch shall have facility to request MGW to send ‘QoS classes’ statistics at the end of each call and record in the SDR. QoS based route selection shall be possible.

5.1.4.4 It shall be possible to map and convey various ‘QoS classes’ between different protocols supported by the Softswitch.

5.1.4.5 It shall be possible to negotiate end-to-end QoS at call control level. ITU-T Q1912.5 shall be capable to negotiate QoS classes.

5.1.4.6 Details of various QoS parameters and the mechanism supported for QoS management shall be indicated by the supplier.

5.1.4.7 It shall be possible to assign QoS class to subscribers, trunk groups, routes and destinations.

5.1.4.8 The Softswitch shall be able to control packetisation interval based on different QoS classes.

5.1.4.9 Call admission control (CAC): It shall be possible to limit the number of sessions for both incoming and outgoing calls. CAC shall also support on the media IP interface.

5.1.4.10 The softswitch shall support handling of malicious and late media condition after a pin hole has been closed. Media packets may arrive for a while, since media does not stop simultaneously in all the SIP clients and session controllers that reside in the path of a session. Hence system should be able to handle this and also in case packet are received from unknown source, these packets should be discarded, a log of such packets received should be maintained and alarm raised in case continuous outgoing late media or invalid source.

5.1.4.11 The softswitch shall support to perform access network specific admission control to ensure that the links towards the user is not over utilized with respect to bandwidth.

5.1.4.12 Requirements of system reliability/availability requirements of system reliability/availability and service quality. System availability refers to system ‘up time’ and requirements given herein specify the permissible ‘down time’. The service quality standards define the quality of service expected from the equipment.

5.1.4.13 There shall be sufficient means to check the Quality of Service in the Softswitch.

5.1.5 Reliability

For purposes of assessing the service reliability, the period after commissioning of the system shall be divided into a non-stabilized period and a stabilized period. The non- stabilized period shall cover a running-in period followed by a six-month test period. The service quality figure obtained during the running-in period shall not be used for assessing long-term reliability of the system. However, this period shall be as short as possible and should not exceed two weeks.

5.1.5.1 The 'service reliability' during the six-month test period and the 'stability period' shall be as follows:

	Six-month test period	Stabilized period
Total unavailability (permissible)	1 Hour	1 Hour / 20 years

5.1.5.2 Each sub-system hardware should have at least 99.999% availability.

5.1.5.3 The downtime experienced during automatic reconfiguration of the system where,

(a) only calls in setting-up stage are lost and,

(b) all calls including established calls are lost, shall be minimised. Frequency of occurrence of such automatic reconfigurations and the downtimes have to be calculated and indicated to the administration. Planned outage shall be excluded from the above availability figures.

5.1.6 Service quality

The Softswitch service standards for call processing, blocked call attempts, call processing delays at various stages, call processing performance during overload are detailed in this section.

5.1.7 Call processing performance objectives

5.1.7.1 Premature release

The probability that a system malfunction will result in the premature release of an established connection in any one minute interval should be:

P < = 2/1,00,000

5.1.7.2 Release failure

The probability that a system malfunction will prevent the required release of a connection should be:

P < = 2 / 1,00,000

5.1.7.3 Incorrect charging

The probability of a call attempt receiving incorrect charging due to a System malfunction should be:

P < = 1 / 10,000

5.1.7.4 Misrouting

The probability of a call attempt being misrouted following receipt by the system of a valid address should be:

P < = 1 / 10,000

5.1.7.5 No tone

The probability of a call attempt encountering no tone following receipt of a valid address by the system should be:

P < = 1 / 10,000

5.1.7.6 Other failures

The probability of the system causing a call failure for any other reason not identified specifically above should be:

P < = 1 / 10,000

5.1.7.7 Inadequately handled call attempts

Inadequately handled call attempts are attempts which are lost or are excessively delayed within the system due to non-availability of circuits, service circuits, internal congestion, internal time-outs, or any other internal traffic situations other than three times the “0.95 probability of not exceeding” values recommended in clause 5.3.3. Probability of inadequately handled call attempts should be within the values recommended for different type of connections under Reference load ‘A’ and Reference load of ‘B’ conditions as specified in the ITU-T Recommendation Q.543.

5.1.7.8 Delay probability

Delays at various stages of the call processing for analog and ISDN calls shall be within the limits as specified in the ITU-T Recommendation Q.543.

5.1.8 Call processing performance during overload

The mean offered load at which the Softswitch just meets all grade of service as mentioned in the above sections is defined as the engineered capacity of the system**:**

(a) The softswitch shall provide the rated BHCA irrespective of the distribution of call load between various domain. It should deliver at least 90% BHCA in case of 50% above the rated BHCA overload condition.

(b) Overload is defined as the label of call attempts offered to the system in excess of the system engineered capacity.

(c) The system shall have an effective overload control mechanism which shall prevent the rapid decrease in processed call attempts with increasing offered load.

(d) Throughput is defined as the number of call attempts processed successfully by the system per unit time.

(e) The system throughput at an overload of 50% above the engineered capacity load shall be at least 90% of the throughput at engineered capacity.

(f) The system shall incorporate suitable means for detecting overload conditions e.g. real time occupancy of processor as well as of the working memory. The threshold at which the overload control starts shall be controllable through Man-Machine Command or GUI based Web portal.

(g) After detecting overload beyond a specified threshold, the system shall start automatic congestion control mechanism to restrict admission of new calls into the system. It shall be based on the priority of the trunk group which can be assigned by man-machine commands.

(h) In order to reduce the load on the system caused by calls that cannot be processed during overload, it may be necessary to discourage further attempts by customers during this situation. Methods used to achieve this reduction shall not significantly increase the load on processors, as for example, routing calls to recorded announcements.

(i) Overload controls, once applied, shall be removed as quickly as possible when the degree of overload reduces, consistent with the need to avoid oscillatory behavior which might prolong the period of degraded service.

5.1.9 Software Management:

5.1.9.1 The Softswitch shall have resource supervision function that shall reject call requests from applications if resources are not enough to handle the application with negotiated QoS parameters, with an indication to the subscriber.

5.1.9.2 Primary Database backup: the Softswitch shall support distributed real-time database management system which handles all data in the network It shall ensure that synchronized copies are maintained in the processor pair. It shall also support storage of configuration data on the discs of the eMS and NMS.

5.1.9.3 Off Line stored backup: It shall be possible for the system administrator to make the system network database backups for off-line storage. Such

backups shall be automatically transferred (by the built-in file transfer function) to external management systems for archival. The generation of backups for off-line storage, and their transfer to external storage, shall be ordered to occur immediately, or scheduled to be performed automatically at certain time intervals.

5.1.9.4 Rollback Backup: When a software upgrade (both at installation of maintenance package and a new system release) is performed, the system shall generate a database backup and an incremental code backup for the currently running system. These backups shall be used if there is a need to revert the system to the state it had immediately before the upgrade.

5.1.9.5 The Softswitch elements shall have Load control and task priority function to ensure processor overload mechanism.

5.1.9.6 The Softswitch shall support system backup/copy of the contents of the central processor stores as security for use in the case of a serious error in the element. It shall be possible to take manual or automatic backup regularly to an external medium (for example an optical disk) or to an area of active (CP) memory.

5.2 System supervision

Provision shall be made for continuous testing of the system to allow both system quality check and fault indication as a fault arises.

5.2.1 The Softswitch shall provide at least the following types of supervision:

(i) Automatic detection of congestion on the incoming route, the final backbone route, the signalling devices and control units.

(ii) Continuous supervision of fuses.

(iii) Automatic detection of any abnormalities in processing.

(iv) Detection of trunks that are incapacitated for accepting traffic.

(v) Supervision of automatically blocked devices to ensure that conditions leading to traffic overload are not created.

5.2.2 The system shall provide for print-outs and visual/audible alarms and their storage in systems log to assist in efficient administration. The following minimum printouts/alarms are envisaged:

(i) Audible and visual alarm on failure of any fuse.

(ii) Print-out congestion condition on junctions, trunks common control devices, processors. An audible/visual alarm shall also be activated to give instant warning of a developing overload situation.

(iii) Print-out of a record of the system configuration at any specified time, designating equipment which is in service, in stand by mode or out of service. A visual display shall also be provided to indicate the

operating status of the processors.

(iv) Print-out of present status of the system or designated equipment such as trunks free, busy or blocked, input/output device in use or blocked, etc.

(v) Print-out of faults detected with identification of faulty units. The print-out shall contain the date and the time. Details of any other print-out provided in the design for supervision and efficient management of the system, details of the supervision panel and the control arrangement shall be furnished.

(vi) Alarm and print-out in case of failure of CCS7 signalling link.

5.2.3 The visual display and devices for manual control of the different parts of the system shall preferably be centralized on a supervisory panel. Details of the displays and the control arrangement shall be provided.

5.2.4 In case a fault is detected requiring reloading of the program, this shall be carried out automatically. In case of manual re-loading, it should be possible to stop and start at any particular point of the program.

5.2.5 It shall be possible to automatically detect a 'killer trunk' (on which false seizures take place rapidly due to a fault on the trunk, creating severe artificial load on the system). On detection of such a trunk, the system shall automatically block the trunk/PCM preventing any further seizures and shall generate necessary alarm print-outs giving details of trunk/PCM etc.

5.2.6 The Softswitch shall have sufficient secondary memory (hard disk capacity) to keep the SDR of 100% calls for duration as required by the purchaser.

5.2.7 In case of 50%, 75% & 90% utilization of capacity of billing file shall generate alarm of suitable category

5.3 Traffic Reports

5.3.1 In addition to traffic reports mentioned in clauses 5.3.2 and 5.3.3 below, the following reports shall be available daily/weekly/monthly basis:

(i). Reports of paid minutes for incoming and outgoing ILD calls for different time slabs (00 hrs to 24 hrs) for each destination (ILD Code).

(ii). Reports of paid minutes for incoming and outgoing ILD calls for different distance slabs wise for each time slab (00 hrs to 24 hrs).

(iii). Reports of paid minutes for incoming and outgoing ILD call carrier-wise.

(iv). Reports of paid minutes for incoming and outgoing ILD calls route -wise.

(v). The exchange shall have the facility of measuring effective traffic i.e. paid time & revenue earned per day on each trunk group (for each tariff rate)

5.3.2 TRAFFIC MEASUREMENT AND RECORDING

5.3.2.1 Traffic measurements are broadly classified into two categories.

i) Regular measurements (clause 5.3.4).

ii) Occasional measurements (clause 5.3.5).

These measurements along with the maintenance information (fault messages and test-results), should allow effective supervision of the system. Traffic measurements/report generation shall not affect the normal call processing during the busy hour.

5.3.2.2 Facilities shall be provided to measure and record the load and grade of service for various subsystems of the Softswitch and the Softswitch as a whole. Traffic measurements for individuals Media Gateways shall also be possible.

5.3.2.3 Man-machine functions for traffic measurement administration shall be as per ITU-T Recommendation E.504.

5.3.2.4 It shall be possible through man-machine command to program at least two recording periods per day and it shall also be possible to program the duration of a recording period from a minimum of 5 minutes to a maximum of 24 hours.

5.3.2.5 It shall be possible to select measurement types with defined objects for printing/recording purposes. In case this facility is not supported by the Softswitch, a user-friendly software package on PC compatible shall be provided for this purpose.

5.3.2.6 The scanning interval for traffic measurements shall be sufficiently small to ensure accuracy of measurements.

5.3.2.7 It shall be possible to measure all traffic parameters that are supported by H.248 Ver. 3.

5.3.2.8 Softswitch shall provide signalling trace mechanism to trace the SIP signalling through assigned SIP-I trunk, and also trunk traffic statistic should be provided.

5.3.2.9 SIP-I trunk group should support call overflow control function, it shall define max call through the trunk, max simultaneous call and other call overflow control mechanism

5.3.2.10 Temporary Trunk Blocking (TTB) may be asked by the operator

5.3.3 Traffic observations

5.3.3.1 The following measurements shall be provided:

a) Processor(s) occupancy.
b) Total traffic handled.
c) Total signalling, control and O&M traffic carried by the Ethernet Interface and total number of errored packets.
d) Number of Ethernet frames sent out.
e) Number of Ethernet frames received
f) Number of re-transmitted H.248 Ver.3 messages during a period.
g) Traffic handled per codec type.

5.3.3.2 The above measurements, shall not unduly affect the call handling capacity of the processor.

5.3.3.3 It shall be possible to measure Number of call attempts, number of call attempts resulting in seizure, number of answered calls and traffic intensity for originating, terminating, internal (within a Softswitch domain), outgoing and incoming traffic for complete domain as well as separately for LMG of a particular geographical area identified by zone, circle, Secondary Switching Area (SSA) or Short Distance Charging Area (SDCA).

5.3.3.4 Following traffic data shall be presented by the Softswitch measurements:

i) Data traffic including the Internet traffic(HTTP, e-mail, FTP etc)
ii) Voice or Data including SMS, GPRS, CDMA or MMS traffic
iii) Voice-over-IP (ITU-T H.323 [Optional], H.248, G.711, G.722.2, G.723.1, G.726, G.728, G.729AB), SIP
iv) Fax including Fax over IP (ITU-T T.37, T.38)
v) Video including Video over IP (ITU-T H.261, H.263, H.264)
vi) Any combination of the above forms

5.3.3.5 Traffic measurements shall be possible for IP Centrex and PABX subscribers.

5.3.4 Regular Measurements

These types of measurements are performed by the Softswitch (including system overload periods) by call processing programs as the events concerned take place. However, the list of measurements required shall be modifiable through MMC or GUI based Web portal. Facility shall be provided for measuring and printing out or recording on a back up store,

the total traffic carried during each 15 minutes (or as required) to determine the mean busy hour as per ITU-T recommendation E.500.

5.3.4.1 Call attempt destinations:

These measurements are used to assess the probability of success on calls to various routes & destinations and may used in deciding on any network management actions considered necessary. The number of route/destination codes specified for measurement at any one time may be limited. For any specified route/destination code, the following parameters should be measured:

Number of call attempts
Number of call attempts resulting in an outgoing seizure
Number of answered calls
Call destination can be represented by country code, area code, system code, or any combination of them.
Occupancy of:
Common devices: Occupancy and congestion for each pool of devices for any specified period.
Processors: Occupancy and total number of calls handled in a specified period.

(Faulty junctions or equipment busied by maintenance personnel shall be excluded from the measurements).

Facility shall be provided for initiating the measurements through a suitable command giving details of the measurement required, the time, period and intervals at which the measurements are to be made. The results of the measurements shall be stored for retrieval, as and when required.

5.3.5 Occasional measurements: The occasional measurements are those observations which are always initiated by GUI Commands. They involve activation, execution, and final processing. These are characterized by the duration of their observation.

5.3.5.1 The activation is initiated by the man-machine command or GUI based Web portal under the control of operator or by means of a measuring schedule, specifying: (a) the type of observations, (b) a list of objects concerned if necessary, (c) the duration and (d) the output media like printer, removable magnetic tape etc.

5.3.5.2 The final processing is initiated by a cessation request or on exceeding the observation duration.

5.3.5.3 Unless otherwise specified, all types of temporary observations shall take place simultaneously.

5.3.6 List of measurements

i). The softswitch shall provide traffic measurement according to E.502 measurements like traffic volume, number of call attempts, number of seizures, number of successful call attempts, number of call attempts for which a delay exceeds a predetermined threshold value etc are provided as mentioned in E.502. Objects like subscriber line groups, circuit groups, common channel signalling links, signal transfer points (STP) etc shall also be are supported.

ii). All circuit groups should be measurable. For traffic intensity, it shall be possible to measure all circuit groups. Information for estimating the average number of circuits in service during the result accumulation period should be provided in addition to the traffic data for each circuit group.

5.3.6.1 Facility shall be provided for measuring and printing out or recording on a backup store, the total traffic carried during each 15 minutes to determine the mean busy hour as per ITU-T Recommendation E. 500

5.3.6.2 The system shall provide the following measurements:

(a). Traffic dispersion from a given incoming route destination-wise. This can be taken on a sampling basis. However, the size of the sample shall be adequate to give result level of over 85%.

(b). Number of operator-handled call attempts and subscriber dialled call attempts on a given route.

(c). Average holding times of answered and non answered calls, route wise and for the whole Softswitch.

(d). Grade of service, route wise.

(e). Proportion of calls to a high usage route switched over overflow routes.

5.3.6.3 Care shall be taken to ensure that the above measurements, when performed, shall not unduly affect the call handling capacity of the processor.

Chapter-6

EMI/EMC Requirements

6.1 Electromagnetic Interference

The equipment shall conform to the following EMC requirements for Class A:

Electromagnetic Compatibility (EMC) Requirements:

The equipment shall conform to the EMC requirements as per the following standards and limits indicated therein. A test certificate and test report shall be furnished from an accredited test laboratory.

a) Conducted and radiated emission (applicable to telecom equipment):

Name of EMC Standard: "CISPR 22 {2005} with amendment 1 (2005) & amendment 2 (2006) - Limits and methods of measurement of radio disturbance characteristics of Information Technology Equipment".

Limits:-

i) To comply with Class A of CISPR 22 {2006}
ii) The values of limits shall be as per TEC Standard No. TEC/EMI/TEL-001/01/FEB-09**.**

b) Immunity to Electrostatic discharge:

Name of EMC Standard: IEC 61000-4-2 {2001) "Testing and measurement techniques of Electrostatic discharge immunity test".

Limits: -

a. Contact discharge level 2 {± 4 kV} or higher voltage;
b. Air discharge level 3 {± 8 kV} or higher voltage;

c) Immunity to radiated RF:

Name of EMC Standard: IEC 61000-4-3 (2006) "Testing and measurement techniques-Radiated RF Electromagnetic Field Immunity test"

Limits:

i) Under Test level 2 {Test field strength of 3 V/m} for general purposes in frequency range 80 MHz to 1000 MHz and

ii) Under test level 3 (10 V/m) for protection against digital radio telephones and other RF devices in frequency ranges 800 MHz to 960 MHz and 1.4 GHz to 6.0 GHz.

d) Immunity to fast transients (burst):

Name of EMC Standard: IEC 61000-4-4 {2004) "Testing and measurement techniques of electrical fast transients/burst immunity test"

Limits:-

Test Level 2 i.e. a) 1 kV for AC/DC power lines; b) 0. 5 kV for signal / control / data / telecom lines;

e) Immunity to surges:

Name of EMC Standard: IEC 61000-4-5 (2005) “Testing & Measurement techniques for Surge immunity test"

Limits:-

i) For mains power input ports : (a)1.0 kV peak open circuit voltage for line to ground coupling (b) 0.5 kV peak open circuit voltage for line to line coupling

ii) For telecom ports : (a) 0.5 kV peak open circuit voltage for line to ground (b) 0.5 KV peak open circuit voltage for line to line coupling.

f) Immunity to conducted disturbance induced by Radio frequency fields:

Name of EMC Standard: IEC 61000-4-6 (2003) with amendment 1 (2004) & amendment. 2 (2006) "Testing & measurement techniques-Immunity to conducted disturbances induced by radio- frequency fields"

Limits:-

Under the test level 2 {3 V r.m.s.} in the frequency range 150 kHz-80 MHz for AC / DC lines and Signal /Control/telecom lines.

g) Immunity to voltage dips & short interruptions (applicable to only ac mains power input ports, if any):

Name of EMC Standard: IEC 61000-4-11 (2004) “Testing & measurement techniques- voltage dips, short interruptions and voltage variations immunity tests”

Limits:-

i) a voltage dip corresponding to a reduction of the supply voltage of 30% for 500ms (i.e. 70 % supply voltage for 500 ms)

ii) a voltage dip corresponding to a reduction of the supply voltage of 60% for 200ms; (i.e. 40% supply voltage for 200ms) and

iii) a voltage interruption corresponding to a reduction of supply voltage of > 95% for 5s.

Note: For checking compliance with the above EMC requirements, the method of measurements shall be in accordance with TEC Standard No. TEC/EMI/TEL-001/01/FEB-09 and the references mentioned therein unless otherwise specified specifically. Alternatively, corresponding relevant Euro Norms of the above IEC/CISPR standards are also acceptable subject to the condition that frequency range and test level are met as per above mentioned sub clauses (a) to (g) and TEC Standard No. TEC/EMI/TEL-001/01/FEB-09.The details of IEC/CISPR and their corresponding Euro Norms are as follows:

IEC/CISPR	**Euro Norm**
CISPR 11	EN 55011
CISPR 22	1 EN 55022
IEC 61000-4-2	2 EN 61000-4-2
IEC 61000-4-3	EN 61000-4-3
IEC 61000-4-4	EN 61000-4-4
IEC 61000-4-5	3 EN 61000-4-5
IEC 61000-4-6	EN 61000-4-6
IEC 61000-4-11	EN 61000-4-11

Chapter – 7

Safety Requirements

7.1 Safety Requirements

(i) The operating personnel shall be protected against shock hazards as per IS 8437(1993)-“Guide on the effects of current passing through the human body” [equivalent to IEC publication 60479-1(1984)]. The manufacturer/supplier shall submit a certificate in respect of compliance to these requirements.

(ii) The equipment shall conform to IS 13252 (2003)-“Safety of information technology equipment including electrical business equipment” [equivalent to IEC publication 60950{2001}] and IS 10437 {1986} “Safety requirements of radio transmitting equipments” [equivalent to IEC publication 60215]. The manufacturer/supplier shall submit a certificate in respect of compliance to these requirements.

Chapter – 8

Security Requirements

8.1 Softswitch shall provide two types of security(for services and system) requirements as given below:

8.1.1 Lawful Interception.

8.1.1.1 The Softswitch in association with Line Media Gateway, Trunk Media Gateway or both depending upon Local, Transit or Local cum Transit application shall provide lawful interception of various media types of communication, such as voice and data including all types of messaging content.

8.1.1.2 The softswitch shall interface as per TEC GR No. GR/LIS - 01 for lawful interception and monitoring. It shall interface to the mediation equipment as per TEC GR No. GR/LIM-01& GR/ISP-01.

8.1.2 Security mechanism in the system.

8.1.2.1 Adequate security mechanisms at different levels shall be provided in the Softswitch so as to prevent unauthorized access or interference to services, calls, protocols and data

8.1.2.2 The Softswitch shall have facility to prevent Denial of Service (DOS) attacks. It shall be able to interact with various elements based on known IP address (source and destination), port number (source and destination) and Interface Identity.

8.1.2.3 Softswitch shall support encryption on DTMF delivered by RFC2833.

8.1.2.4 Softswitch shall support of security as per the required clauses applicable to softswitch to be used as local or transit or both application as defined in SBC document or as per the Firewall System document of TEC GR No. GR/FWS-01.

8.1.2.5 Softswitch shall support dynamic pinhole fire walling – only media streams corresponding to observed signalling state and SDP parameters are allowed to be set up.

8.1.2.6 Softswitch shall have NAT (Network Address Translation)/FW (Fire Wall) traversal – to ensure that inbound signalling and media can traverse (i.e. make it through) from customer premises located NAT/ FW.

8.1.2.7 Softswitch shall have topology hiding – the gateway performs NAPT on both signalling and media streams, IP address information carried within signalling messages towards SIP clients is modified by the gateway in order not to disclose network address information.

Chapter-9

Other Mandatory Requirements

9.1 Addressing

The Softswitch shall support numbering and addressing as per the 'National Numbering Plan' of Department of Telecommunications.

9.2 Announcements

It shall be possible to feed frequently used announcements (e.g. busy, congestion) from the Media Gateway, under the control of Softswitch. Other announcements may be given through softswitch or a separately supplied Media Server as per GR No. GR/MDS-01.

Chapter – 10

Desirable Requirements

(Operator specific Requirements)

10.1 Design and operational

10.1.1 In addition to performing Local and Transit exchange functions, the softswitch shall provide integrated Service Switching Point (SSP) functionality for supporting the Intelligent Network (IN) services.

10.1.2 The Softswitch shall support interworking with a Stand alone Media Server

10.1.3 Support for H.323 protocol for International Gateway may be specified by the purchaser.

10.1.4 Support for codec G.726 and G.723.1 may be asked by the purchaser.

10.1.5 H.323 protocol as per ITU-I, used for the interconnection between Softswitch and Gate Keepers (GKs). Gate ways, or Media control units (MCUs) in the traditional H.323 network and also to access H.323 multimedia terminals for inter operator connectivity only. This may be specified by the purchaser.

10.1.6 FTAM as per ISO, ISO8571, to support the interconnection between Softswitch and billing centers.

10.1.7 In case of disaster the switchover time from affected softswitch to redundant softswitch shall be less then 15 minutes.

10.1.8 The softswitch shall provide the rated BHCA with 90% CCS7 calls over junctions and 10% intra media gateway calls.

10.1.9 The average traffic per subscriber shall be taken as 0.25 Erlang and average traffic on junction shall be taken as 0.7 Erlang per junction.

10.1.10 Link utilization shall not exceed 20% for network planning purpose. The detailed calculations for dimensioning considering SNMP, H.248 Ver.3, SIGTRAN, SIP-I, and SIP load shall be provided by purchaser.

10.1.11 SDR for unsuccessful calls may be asked by the purchaser.

10.1.12 Up-gradation of softswitch for local functions in IMS scenario: The Softswitch should be up gradable to have AGCF (Access Gateway Control Function for local application and the database should be available in a separate server which shall be up gradable to HSS (Home Subscriber Server) in IMS environment. These functionalities shall be available by upgrading the software and shall not require any hardware upgrade. These functionalities may be provided in one or more network element (NE). (IMS functionalities required from day one or on later stage

may be specified by the purchaser).

10.2 Hardware

(A) Quality of hardware:

(i) In case of Server based hardware, it shall be indicated whether the hardware architecture is based on CTCA (Compact Telecom Computing Architecture) or Advance TCA architecture or any other open architecture.

(ii) In a distributed configuration, any softswitch should be capable of accepting and processing a call attempt from any end-user device or any Media Gateway, at any given point of time.

(B) Hardware Management:

(a) Hardware management shall be done with a minimum impact on the service level and the PCBs shall be replaced with “hot swap”

(b) Hardware extensions shall not cause any disturbance to the services.

(c) It shall be possible to retrieve board type and serial number and store it in an inventory database to be viewed via the eMS and/or accessible from a NMS via the SNMP or North bound interface during installation.

(d) It shall support automatic supervision, re-configuration, fault location and built in functions for diagnostics and repair.

10.2.1 Management of full load condition: The system shall be able to meet the performance requirements under full load conditions even when redundant equipment is out of service.

For the purpose of guaranteeing the high reliability of the system, a number of protective measures are taken in the hardware design, software design, system overload control, charging system and geographical redundancy of Softswitch.

(a). Hardware design: The system shall adopt active/standby mode, load sharing and redundant in (1+1) or as desired configuration with high availability and no single point of failure for the boards and optimizes fault detection and isolation techniques of the boards and the system to improve the maintainability of the whole system.

(b). Software design: The system shall adopt hierarchical modularized architecture with protective performance, error tolerance capability and fault monitoring function.

(c). System overload control: The system shall provide 4-level overload restrictions, dynamic code adjustment mode and traffic control to fully ensure the reliability of the system.

(d). Charging system: The charging gateway server shall adopt dual-system hot backup to implement dual backup and mass storage of bill data.

(e). Geographical Redundancy: The SoftSwitch shall provide dual-homing feature with MGWs and SGs. A MGW or SG shall simultaneously connect with two independent Softswitches which physically located in different geographical sites, one of which acts as an active softswitch and the other as a standby softswitch. A real-time backup mechanism between the Softswitches guarantees the data consistency of the controlled MGWs/SGs. Whenever the active Softswitch fails, the standby one immediately receives the control of the MGWs/SGs against interruption of the services, so that the reliability of the system can be improved and the disaster-proof ability of the network can also be enhanced.

10.2.2 Dimensioning parameters of Softswitch for local function may be taken as:

S. No.	Parameters
1.	Subscriber capacity
2.	Simultaneous call flow for Normal calls
3.	Number of trunks /circuits connected
4.	Minimum number of prepaid subscribers
5.	Media Gateways connecting capacity (LMG &TMG)
6.	SIP terminations
7.	BHCA (with call mix for CCS7 calls over junction and Intra Media Gateway calls)
8.	Call holding time for normal calls and SIP calls
9.	Traffic carried per call (Erlangs) for normal calls and SIP calls
10.	Average Traffic per junction (Erlang)
11.	Over load BHCA capacity for normal calls & SIP calls
12.	Processed BHCA capacity in case of overload for normal calls and SIP calls
13.	VoIP calls BHCA for normal calls and SIP calls
14.	Average Holding Time for SIP calls
15.	Call Mix – intra softswitch inter SIP-to-SIP calls, SIP-to-PSTN/PLMN calls and inter network calls.
16.	Number of calling line category
17.	Number of Signalling Point codes supported
18.	Number of low speed link and high speed link for SS7.

10.2.3 **Up gradation of softswitch for transit functions in IMS scenario:** The soft switch should be up gradable to MGCF (Media Gateway Control function) functionality for transit application in IMS environment. This function shall be available by upgrading the software and shall not require any hardware upgrade**.** This function may be provided in one or more network element (NE). (This function required from day one or on later stage may be specified by the purchaser).

10.2.4 Dimensioning parameters for softswitch used for transit applications may be as:

S. No.	Parameters
1.	BHCA (with call mix for CCS7 calls and IN calls)
2.	Average Call holding time
3.	Average Traffic per circuit
4.	Over load BHCA capacity
5.	Processed BHCA in case of overload condition
6.	Simultaneous call flow
7.	Number of trunks / junctions connected on Media Gateways
8.	Number of Media Gateway connected
9.	Number of low speed signalling link and high speed signalling link.

10.3 Routing facilities

10.3.1 The Softswitch shall cater to a number of outgoing directions as required by the purchaser.

10.3.2 Alternative routing facility shall be provided and it shall be possible to define at least 32 alternate routes. It shall also be possible to define at least 5 time intervals in a day with a minimum granularity of one hour .different set of alternate routes shall be possible.

10.3.3 Facilities shall be provided for changing routing data under control of authorized personnel with adequate safe-guards o prevent misuse by unauthorized persons both locally as well as from NMC.

10.3.4 Under normal traffic conditions, certain routing restrictions may apply; for example, the routing plan may not permit certain incoming routes to have access to specified outgoing route. The Softswitch shall provide facility for assigning the category of incoming trunk group and for taking routing decision based on a comparison of the origin and the destination. These decisions may vary according to the time of the day.

10.3.5 A call shall not normally be routed on more than a single satellite channel in tandem.

10.3.6 Facilities shall be provided for restricting service during conditions of heavy overload or faults on route. Some of the restrictions envisaged are as follow:

10.3.7 Total restrictions: All calls for a particular direction arriving on the normal path routed to recorded announcement; no calls permitted on the overflow path.

10.3.8 Partial Restrictions: Only certain categories of calls, for example from Operators may be served on the overflow path or only ‘m’ out of ‘n’ calls

may be allowed to overflow.

10.3.9 Facilities shall be provided for making temporary changes in routing under control of authorized personnel as desired. A visual or other suitable indication shall be available on the Local Craft Terminal as well as Network Management Centre when such temporary routing instructions are in force.

10.3.10 The Softswitch shall support at least 500 different trunk group and subscriber group categories for origin dependent routing.

10.3.11 The Softswitch shall have the capability of invoking CLI dependent routing on a specified trunk group. Based on CLI, it shall reject the call and route it to the specified announcement. It shall be possible to assign by GUI Web interface definable codes (Complete CLI and /or initial digits of CLI) for the purpose of CLI based call rejection in case CLI is not available.

10.3.12 The Softswitch shall be able to route the call based on the calling line category" received during call setup phase for all types of signalling. Reservation of Circuits for" priority" calling line shall be available.

10.3.13 The Softswitch shall support rerouting a call attempt on an alternate route in case a congestion situation is indicated through the CCS7 messages.

10.3.14 The Softswitch shall support reservation of certain percentage of circuits in a both way trunk group of outgoing traffic. This provision shall be possible by defining thresholds.

10.3.15 The Softswitch shall have capability to redirect a call to an announcement service or to a centralized interception service in various cases, e.g. at congestion, wrong number, change in area code.

10.3.16 The Softswitch shall provide the possibility for blocking of calls based on characteristics of the incoming circuit group and the destination being selected.

10.3.17 The Softswitch shall support real time load balancing in alternate routes for the same destination, depending on the percentage of traffic and the time-period during which the balancing is required. All the parameters shall be defined by GUI based terminals.

10.3.18 It shall be possible to upload the bulk routing and other information.

10.3.19 It shall be possible to change routing patterns automatically based on time of day, type of day and calendar of the week.

10.3.20 The Softswitch shall support "least cost routing'.

10.3.21 Transmission Media based Routing (TMR), charged number based routing, Location based routing, two stage routing and Hair – Pinning at Media gateway shall be provided

10.3.22 In case the Softswitch uses the Private IP addresses then it shall support Port Address Translation (PAT) so that the minimum Number of Public IP

addresses are used.

10.4 Routing requirements for ISDN

The routing principles applicable for ISDN shall be as per ITU- T Recommendation E-172

10.5 OPERATION, ADMINISTRATION AND MAINTENANCE

10.5.1 The Softswitch shall provide easy handling of operation, administration, maintenance, supervision, traffic measurements, testing and routine control to meet the requirements.

10.5.2 Administration

The facilities required for Softswitch administration may be broadly classified under the following heads:

(i) Subscriber administration
(ii) Trunk administration
(iii) Network Interface administration
(iv) Routing administration
(v) Traffic administration
(vi) Charging administration
(vii) System control operation.

10.5.2.1 The Softswitch shall support management of all interfaces towards PSTN/PLMN and IP network.

10.5.2.2 Administrative routing functions include those for modification of data relating to a group of circuits/subscribers and those for modifying routing and analysis data, changing the signalling system; adding a new circuit or a group of circuits, in-let & out-let of media gateways etc.; changing the traffic routing or alternative routing tables and changing the digit analysis data (start or selection, number of digits to be sent, etc.)

10.5.2.3 Issuing commands for traffic recording, changing the traffic load control criteria, inserting or removing a given route, etc. from a series of measurements and issuing printout orders for data relating to the grade of service are some of the functions considered under traffic administration.

10.5.2.4 The Softswitch shall support functions relating to the tariff and charging administration. These are required, for instance, when changes in tariff or concessional period have to be made.

10.5.2.5 The Softswitch shall control required operations like changing the equipment configuration, reconfiguration of input and output devices, loading a new software package, etc. Both automatic and manual reconfiguration of capability shall be available.

10.5.2.6 The changes to be made in the operations listed above shall require only changes in the system software and shall be made by commands using the Man Machine Communication (MMC) or via GUI based Web portal. It shall also be possible to carry out these operations by issuing commands from the remote NMS.

10.5.2.7 In addition to the day-to-day administration, there will be the requirement to introduce new services, to cut into service extensions to the system, etc. the operating procedures for introducing these changes shall be very simple to operate. They shall also not cause any interruption to service.

10.5.2.8 Various operational functions required for the subscriber administration are like taking subscriber's lines (including lines on PG) into or out of service, allocating, changing and removing classes of subscriber service, changing of a subscriber's number, blocking and unblocking of a subscriber's blocked lines, reading of subscribers' charging information, retrieval of charging information, malicious call tracing, putting a subscriber on to a "subscriber charging observation," etc. shall be provided.

10.5.2.9 The operational functions required under trunk and junction administration namely putting trunks (junctions), into or out of service, allocating trunk category, blocking and unblocking designated trunk, trunk groups or links, interrogating trunk category or blocked trunk, etc shall be provided.

10.5.3 Maintainability

i). Software management shall include functions for loading software for add-on services, performing software upgrade, installation of patches and viewing information about the installed software version, installed patches, and the software upgrade history for the node.

ii). Software upgrading the software of a node, a software upgrade package file shall be downloadable to the node from a remote management centre or from a locally connected management terminal.

iii). Standard upgrade mechanisms like Smooth, Sequential, Restart, Rollback etc, shall be available for the control processor software upgrade as per the complexity of upgrade.

iv). The Softswitch shall include built-in tools for tracing errors effectively to the source during normal operation.

v). The Softswitch shall have the possibility of testing and loading the software blocks separately and the re-local-ability of the program blocks, all contributing to simplified software maintenance and easy maintainability.

10.5.4 Diagnostic capability

On a fault condition the system shall identify the faulty sub-system automatically and take it out of service. This shall automatically bring in the diagnostic programmes for diagnosis. In such cases the details of the sub-systems taken out for executing diagnostic programmes shall be printed out. Availability of Intelligent terminal (PC) to display the location of bay, shelf, PCB on the screen would be desirable. The dimensioning of the processing capacity shall be such that the normal call processing is not effected due to invocation of any diagnostic program.

10.5.4.1 It shall be possible to diagnose up to single PCB level

10.5.4.2 The diagnostic capability of the system shall be such as to minimize the human efforts required. To this end, the supplier shall indicate how much of the diagnostic programs are normally resident in the on-line program. Details of the off-line diagnostic programs shall be given. The procedure for invoking such programs shall be described. The procedure for consulting fault dictionary for diagnostic programs should be made available.

10.5.4.3 The resolution of the fault diagnosis in the offered system shall be indicated separately for different sub-systems. The resolution should be indicated as the percentage of faults which can be localized up to 1 card and 2 cards

10.5.5 Testing Procedures:

10.5.5.1 All the hardware testers necessary for efficient maintenance of the system shall be provided. Details of the testers shall be indicated.

10.5.5.2 The test procedures that are recommended for efficient maintenance of the system shall be indicated. This shall include details of the tests, their periodicity, etc. The tests may be classified as on line tests, on demand tests, and off-line tests performed on:

(i) Control Processor equipment
(ii) IP interface
(iii) Internal Switching hardware
(iv) Computer peripheral equipment
(vi) Power Supply

10.5.5.3 The Softswitch shall be able to initiate directed calls by designating the media gateways to be used.

10.5.5.4 Facility shall be provided for manual blocking of incoming trunks, with transmission of relevant backward signal.

10.5.5.5 Any malfunction in the system shall initiate a fault message and/or a visible and audible alarm. The fault information shall direct personnel to

the appropriate maintenance manual for location of the faulty unit or for detailed procedures on further action to be taken for rectification of the fault conditions. The classification of alarms in the system shall be indicated as critical, Major, Minor etc. It shall be possible to provision various alarms into these categories as per the requirements.

10.5.5.6 Fault message relating to individual circuits shall not normally be printed-out. They shall be printed only when they exceed a pre-set threshold value. They shall be stored for subsequent analysis on a batch basis.

10.5.5.7 It shall be possible to obtain a list of equipment out of service at any given time.

10.5.5.8 The Softswitch shall provide facility for automatic restart under severe fault conditions. Where automatic restart fails to restore system sanity, facility shall be provided for manual restart of the system. The supplier shall indicate system controls in detail provided for manual restart. In particular, the controls provided for manual reconfiguration of hardware sub-assemblies and the method used for transfer of control to the various recovery programs shall be indicated.

10.5.5.9 The need for intervention of operating personnel shall be minimum. In particular, the putting out of service of faulty equipment after a confirmed fault shall be done automatically.

10.5.5.10 Repair facilities: Establishment of facilities to repair all the PCBs in the system is an important operational requirement. The testing equipment, software packages, documents required for carrying out repairs on various types of PCBs etc. shall be made available.

10.6 Power Supply

The equipment shall be capable of working with - 40V to - 57V D .C. input power supply. Switching mode Power Supply (SMPS) and VRLA battery shall be used for stand by supply.

10.6.1 Switching mode Power Supply (SMPS) and VRLA battery to be used shall be as per TEC Generic Requirements No. GR/SMP–01 and GR/BAT-01 Respectively. Power supply and battery shall be modular and expendable to support the ultimate equipment configuration.

10.6.2 For power supply two options may be adopted :

Option 1:

The equipment shall be capable of working with –40 V to –57 V. D .C. input from power supply.

Switching Mode Power Supply (SMPS) and VRLA battery to be used shall be as per TEC Generic Requirements No. GR/SMP-01/05.JAN 2005 and

GR/BAT-01/03.MAR 2004 respectively. Power supply and battery shall be modular and expendable to support the ultimate equipment configuration.

Option 2:

AC Mains supply of 220 Volts with a tolerance of -15% to + 10% would be available. The frequency may be 50 Hz ± 2 Hz. UPS and other power requirements are to be specified by the system developer. Relevant TEC Specification/ Generic Requirements as applicable may be referred

Purchase may specify the power requirement as per option1 or 2.

10.7 Traffic Mix for the Network

Note: These figures are only indicative and shall be specified by the purchaser for tendering purposes.

A. Originating Call Mix (average)

No dialing	: 10%
Incomplete and Incorrect dialling	: 10%
Congestion	: 5%
Subscriber busy	: 30%
Subscriber no reply	: 10%
Subscriber answer	: 35%

B. Terminating Call Mix

Congestion	: 5%
Subscriber busy	: 35%
Subscriber no reply	: 10%
Subscriber answer	: 50%

Purchaser shall specify the requirements in respect of different clauses including, but not limited to the following:

10.8 Carrier Pre-Selection [Optional]

The softswitch shall be able to implement carrier Pre -selection as per the following procedure

10.8.1 The exchange shall support pre-selection of carrier for all subscribers including ISDN subscribers. Based on the subscriber request, choice of carrier shall be administratively entered in the office-data (subscriber database). Carrier selection on call-by-call basis by subscriber dialling shall, however, override the pre-selection.

10.8.2 Carrier identity shall be indicated by two digit Carrier Access code (CAC) followed by two/three digit Carrier Identification Code (CIC).

10.8.3 The switch shall support pre-selection of at least three carriers for each subscriber.

10.8.4 National and International call shall be indicated by dialling ‘0” and “00”

respectively.

10.8.5 Subscriber shall dial the long distance calls without indicating the choice of carrier. The long distance calls from the subscriber shall be routed after addition of carrier identity(CAC+CIC) depending on the pre-selected carrier for each subscriber, between the trunk prefix (”0” for national calls/ “00” for international calls) and the destination digits dialled. For national long distance calls, it shall be possible to pre-select two different carriers depending upon whether the destination (identified by destination digit code) is within a ‘circle’ (geographical area) or outside a ‘circle”.

10.8.6 The switch shall support default carrier selection. Default carrier shall be selected in a situation when a subscriber neither indicates the carrier identity by dialling procedure nor has subscribed to the pre-selection of carrier.

10.8.7 The Softswitch shall support E.164 numbers.

10.8.8 The Softswitch shall be capable to support at least 256 local signalling point codes.

10.9 Softswitch application specific (Local or Transit) parameters.

10.9.1 Following parameters shall be decided by the purchaser:

i). Number (mix) of subscriber interfaces (POTS, ISDN, ADSL etc.)

ii). Number and mix of subscriber interfaces (V5.2, ADSLx and ISDN PRI etc.).

iii). Number and type of interfaces towards MPLS Network.

iv). Percentage of Link utilization for network planning.

v). Service mix i.e. the number of subscribers simultaneously using a service is to be specified separately for each service.

vi). Support for G.726 and G.723.1 Codecs

10.9.2 Capability of two Softswitches to act as primary and secondary, in case of failure, is to be ensured. Redundancy in ‘N+1’ or “N+N” switches may be planned against a requirement of ‘N’ Softswitches. N is to be specified by purchaser.

10.9.3 Period for which storage in redundant storage devices like CD-ROM/DVD-ROM, hard disk drives or SAN storage is required to store charging information, Service Detail Records (SDR) traffic statistics, command log, system software, office data etc.

10.9.4 Type of media server required (integrated or stand-alone) and other requirements such as number of announcements, number of languages, duration of the announcement etc. shall be indicated by the purchaser.

10.9.5 Details of different parameters for:

A. Use of Softswitch for local applications (following values may be asked as easy reference)

S. No.	Parameter	Suggested Value	Actual Value
1.	Subscriber capacity	350K	
2.	Simultaneous call flow for normal calls	100K	
3.	Calls Per Second (cps)	1000	
4.	Number of trunks /circuits connected	150K	
5.	Minimum number of prepaid subscribers	50% of total Subscribers	
6.	Media Gateways connecting capacity (LMG & TMG)	500	
7.	SIP terminations	300K	
8.	VoIP calls BHCA for normal calls and SIP calls	4 M	
9.	Call holding time for normal calls and SIP calls	180 Sec.	
10.	Over load BHCA capacity for normal calls and SIP calls	5 M	
11.	Processed BHCA capacity in case of overload for normal calls and SIP calls	3.6 M	
12.	Call Mix – 30% shall be SIP->SIP(Intra SS, Inter SS), 70 % OG calls to PSTN/ PLMN SIP->PSTN/Mobile & 10% IN calls		
13.	Number of incoming Trunk category	128	
14.	Minimum number of outgoing directions	1000	
15.	Itemised billing over junctions for selected trunk group for both incoming and outgoing calls	100%	
16.	Storage capacity of SDRs for 100% calls	30 days	
17.	Number of calling line category	512	
18.	Number of Signalling Point codes supported	2	Possibility to increase to 4 without hardware modifications
19.	Number of selected trunk groups for taking bulk billing for incoming and outgoing calls with maximum capacity of charge meter units.	100%	
20.	Percentage of link utilization for network planning	40%	
21.	Analyzing capacity of codes by the Softswitch	8	

B. Use of Softswitch for pure transit applications (following values may be asked as easy reference)

S. No.	Parameter	Suggested Value	Actual Value
1.	BHCA (with call mix (100% CCS7 calls & out of this 10% IN calls)	4 M	40% SIP-I, 50% PSTN/ MSC,10% IN
2.	Average Call holding time	120 sec.	
3.	Over load BHCA capacity	5 M	
4.	Processed BHCA in case of overload condition	3.6 M	
5.	Simultaneous call flow	100K	
6.	Calls Per Second (cps)	1000	
7.	Number of trunks / junctions connected on Media Gateways	160K	
8.	Media Gateway connected	250	
9.	Number of incoming Trunk category	128	
10.	Number of Signalling Point codes supported	2	Shall be scalable upto 4
11.	Number of selected trunk groups for taking bulk billing for incoming and outgoing calls with maximum capacity of charge meter units.	100%	
12.	Percentage of link utilization for network planning	40%	
13.	Analyzing capacity of codes by the Softswitch	8	
14.	Minimum number of outgoing directions	1000	
15.	Itemised billing over junctions for selected trunk group for both incoming and outgoing calls	100%	
16.	Storage capacity of SDRs for 100% calls	30 days	

GLOSSARY

3GPP	3rd Generation Partnership Project
ABNF	Augmented Backus-Naur Form
AC	Alternate Current
ADSL	Asymmetric Digital Subscriber Line
AGW	Access Gateway
ALTE	Automatic Line Testing Equipment
AMR	Adaptive Multi-Rate
AN	Access Node
APS	Automatic Protection System
AS	Application Server
BER	Bit Error Rate
BGCF	Border Gateway Control Function
BHCA	Busy Hour Call Attempt
BICC	Bearer Independent Call Control
BRA	Basic Rate Access
BSNL	Bharat Sanchar Nigam Ltd
CAMEL	Customized Application for Mobile Network Enhanced Logic.
CAP	Camel Application Part
CCB	Coin Collecting Box
CCF	Call Control Function
CCS7	Common Channel Signalling No.7
CDMA	Code Division Multiple Access
CDR	Call Detail Record
CISPR	International Special Committee on Radio Interference
CP	Control Processors
CRTP	Compressed RTP
CSCF	Call Session Control Function
CSH	Calling Subscriber Hold
DAT	Data Access Tape
DC	Direct Current
DHCP	Dynamic Host Configuration Protocol
DOS	Denial of Service
DOT	Department of Telecommunication
DR	Disaster Recovery
DSLAM	Digital Subscriber Line Access Multiplexer
DSP	Digital Signalling Processor
DTMF	Dual Tone Multi Frequency
E1	2 Mbit/s Interface
EFR	Enhanced Full Rate
EMC	Electro Magnetic Compatibility
eMS	Element Management System

ETSI	European Telecommunications Standards Institute
EVRC	Enhanced Variable Rate CODEC
FAX	Fascimile Transreceiver
FE	Fast Ethernet
FR	Frame Relay
GE	Gigabit Ethernet
GR	Generic Requirements
GSM	Global System For Mobile Communication
GUI	Graphical User Interface
H.248	ITU - T recommendation for Trunk Media Gateway control
HDSL	High Speed Data Link
HSS	Home Subscriber Server
HTR	Hard To Reach
I/C	Incoming
IAD	Integrated Access Device
IC	Integrated Circuit
I-CSCF	Interrogating-CSCF
IEC	International Electrotechnical Commission
IETF	Internet Engineering Task Force
IMS	IP Multimedia Subsystem
IM-SSF	IP Multimedia Service Switching Function
IN	Intelligent Network
INAP	Intelligent Networks Application Part
IO	Input Output
IP	Internet Protocol
ISDN	Integrated Services Digital Network
ISO	International Standard Organisation
ISUP	ISDN User Part
ISV	Independent Software Vendors
ITU	International Telecommunication Union
ITU-T	ITU Telecommunication Sector
IUA	ISDN User Adaptation Layer
IVR	Interactive Voice Response
IVRS	Interactive Voice Response System
JAIN	Java Advanced Intelligent Network
JSR	Java Specification Request
KV	Kilo Volt
LAG	Line Access Gateway
LDAP	Lightweight Directory Access Protocol
LE	Local Exchange
LEN	Line Equipment Number
LMG	Line Media Gateway
LSP	Label Switch Path
LTS	Soft-switch for Local and Transit Wire line Services

M2PA	MTP2- User Peer-to-Peer Adaptation Layer
M2UA	Message Transfer Part User Adaptation Layer 2
M3UA	Message Transfer Part User Adaptation Layer 3
MAP	Mobile Application Part
MGC	Media Gateway Control
MGCF	Media Gateway Control Function
MGW	Media Gateway
MMC	Man Machine Command
MML	Man Machine Language
MPLS	Multi Protocol Label Switching
MRFC	Media Resource Function Controller
MRFP	Media Resource Function Processor
MS	Media Server
MSU	Message Signalling unit
MTBF	Mean Time Between Failure
MTP	Message Transfer Part
MTP 1	Message Transfer Part 1
MTP 2	Message Transfer Part 2
MTP 3	Message Transfer Part 3
MTTR	Mean Time To Restore
NEXT	Near End Cross Talk
NGN	Next Generation Network
NMS	Network Management System
NOC	Network Operating Centre
NTP	Network Time Protocol
O&M	Operation & maintenance
O/G	Outgoing
OFC	Optical Fiber Cable
OMC	Operation and Maintenance Centre
OSA	Open Service Access
PABX	Private Automatic Branch Exchange
PAT	Port Address Translation
PBX	Private Branch Exchange
PC	Personal Computer
PCB	Printed Circuit Board
PCM	Pulse Code Modulation
PCO	Public Call Office
P-CSCF	Proxy-CSCF
PG	Permanent Glow
PLC	Packet Loss Concealment
PLMN	Public Land Mobile Network
POS	Packet Over SDH
POTS	Plain Old Telephone Set
PPPoE	Point to Point Protocol over Ethernet

PRA	Primary Rate Access
PRI	Primary Rate Interface
PSTN	Public Switched Telephone Network
QA	Quality Assurance
QCELP	Qualcomm Code Excited Linear Prediction
QM	Quality Manual
QoS	Quality of Service
QR	Quality Requirement
RAID	Redundant Array of Independent Disks
Rec..	Recommendations
RF	Radio Frequency
RFC	Request for comment
RISC	Reduced Instruction Set Code
RSTP	Rapid Spanning Tree Protocol
RSVP	Resource Reservation Protocol
RTB	Route Busy
RTCP	Real Time Control Protocol
RTP	Real Time Protocol
SCCP	Signalling Connection Control Part
SCN	Switched Circuit Network
SCP	Service Control Points
SCS	Service Capability Server
S-CSCF	Serving-CSCF
SCTP	Simple Control Transmission Protocol
SDH	Synchronous Digital Hierarchy
SDP	Session Description Protocol
SG	Signaling Gateway
SGW	Signalling Gateway
SHDSL	Symmetric High speed Digital Subscriber Line
SIP	Session Initiation Protocol
SIP-I	Session Initiation Protocol by ITU
SLF	Subscriber Location Function
SMPS	Switching Mode Power Supply
SMV	Selectable Mode Vocoder
SNMP	Simple Network Management Protocol
SOAP	Simple Object Access Protocol
SS7	Signalling System # 7
SSW	Softswitch
STD	Subscriber Trunk Dialling
STM	Synchronous Transport Module
SUA	Service User Adaptation
TAX	Trunk Automatic Exchange
TCAP	Transaction Capabilities Application Protocol
TCP	Transmission Control Protocol

TDM	Time Division Multiplex
TEC	Telecommunication Engineering Centre
TMG	Trunk Media Gateway
TMGW	Trunk Media Gateway
TTB	Temporary Trunk Blocking
UDP	User Datagram Protocol
UE	User Equipment
UMTS	Universal Mobile Telecommunication System
UPS	Uninterrupted Power Supply
V5UA	V5 User Adaptation Layer
VAD	Voice Activity Detection
VC	Virtual Circuit
VDSL	Very high speed Digital Subscriber Line trans-receiver
VoIP	Voice Over Internet Protocol
VPN	Virtual Private Network
VRLA	Valve regulated Lead Acid (Battery)
VXML	Voice Extensible Markup Language
XML	Extensible Markup Language