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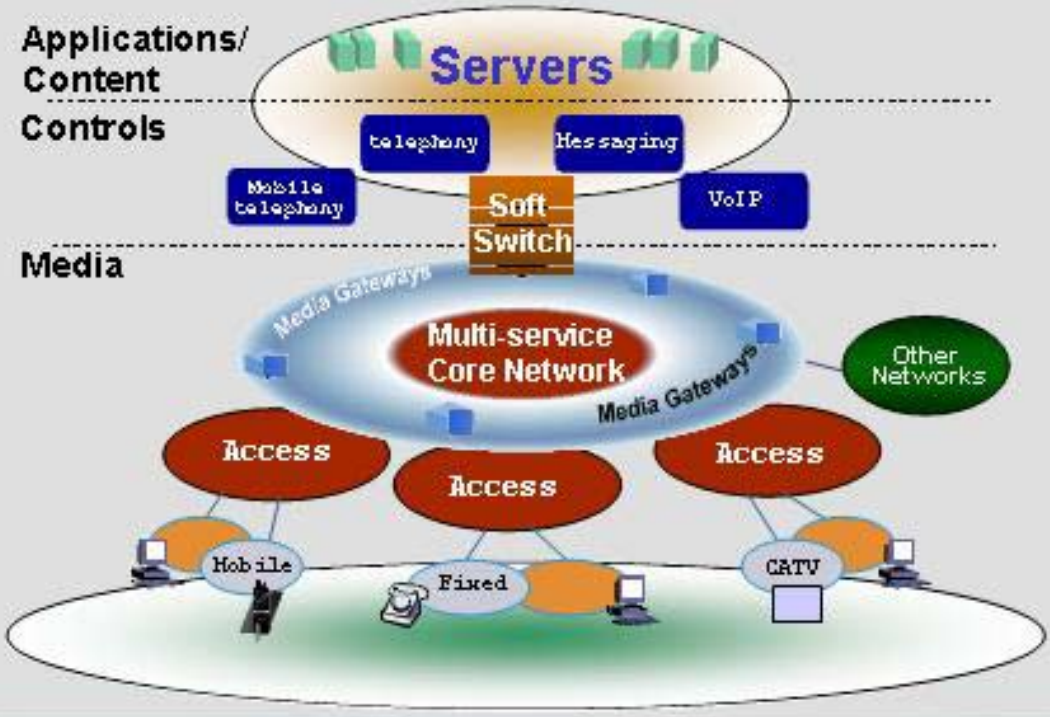
NEXT GENERATION NETWORK



IN THIS ISSUE

Foreword

The last decade had seen remarkable changes in the Indian Telecom scene. Telecom sector has been opened up for private participation. In such an open and competitive scenario, customer services play an all important role. Network operators worldwide are looking for new network architectures, which can facilitate introduction of new innovative services quickly in a cost effective manner. Communication and information technologies are converging. Phenomenal success of Internet and popularity of interactive multi-media services has resulted in an exponential increase in data traffic, while the voice traffic continues to bring in the revenues for the operators. To cope with these changing demands, next generation networks are envisaged to be based on packet transport technology in the core network. In such a scenario, standardisation of protocols assumes vital importance in facilitating a seamless migration to such a new network architecture and ensuring interoperability between the existing equipment and services.

I am happy to note that Telecom Engineering Centre, through TEC Newsletter, is keeping their readers updated about various technological developments in the area of telecom.

(C. V. Rajan)
Member (Technology)
Telecom Commission

NEXT GENERATION NETWORK

Next Generation Network (NGN) is envisaged to facilitate the convergence of voice and data networks into a single unified multi-service network capable of providing futuristic services including multi-media. There are several drivers behind the move towards NGN. Foremost among them is the explosion of Internet and popularity of Internet services, emphasising the need to shift towards packet based core networks from the present circuit-switched networks. The present networks are service dependent. Separate networks exist for voice, data, mobile, Internet etc. Over the years, network operators are looking for a service independent network architecture which can facilitate rapid and economical introduction of new services. NGN promises to provide such a service creation environment. Converging voice, data and video services onto a common network infrastructure will provide cost savings and performance advantages to network operators.

NGN ARCHITECTURE

The NGN architecture is shown on the cover page. It is a horizontally layered network architecture instead of the present vertically separated networks for each service. It uses packet-based transport for all services (including voice). The access, switching, transport, control and service functions which are integrated in today's switches are separated into individual network layers, which interwork via interfaces based on open standards. The most significant aspect is the separation of call control from switching and transport functions.

Media Gateway (MGW)

The transport and switching functions are handled by 'Media Gateway' (MGW), which adapts voice and other media to the packet transport network and provide a path for transporting the content for any type of service. MGW supports access interfaces for Public Switched Telephone Network (PSTN) and the Packet Switched Public Data Network (PSPDN) Cellular Mobile, Asynchronous Transfer Mode (ATM), Frame Relay (FR), Internet etc. and provides an Interworking Function (IWF) between them and packet core network. It can also support several applications e.g. MGW for voice networks, edge or core ATM switch, a Multi Protocol Label Switching Router etc. The access type is transparent to the media gateway.

Softswitch

The intelligence for call control resides in a separate element called a Softswitch (also known as 'Media Gateway Controller'), which is the heart of the next generation network. It provides signalling, call control and feature delivery using open standards. In the softswitch, call control and bearer control are separated. Softswitch can receive signalling from existing narrow-band circuit-switched

networks through signalling gateway. Based on the signalling information received, the softswitch sends appropriate commands for call establishment, release etc., to the Media Gateway. It supports accounting function in addition to call control functions.

Standards for protocols between different NGN components are evolving. ITU-T recommendation H.248 defines the communication protocol between Softswitch and Media Gateways. It is used to coordinate the communication between a softswitch & MGW and between functional entities of the media gateway such as access control functions, bearer control functions and switch control functions. Via access control functions, various kinds of access can be put under the control of a soft switch. One softswitch can control several media gateways depending on the network requirements. Communication between two softswitches is possible using the ITU-T defined Bearer Independent Call Control (BICC) protocol.

Application Servers

These servers are responsible for provisioning of different services and shall be based on open standards to allow the use of servers from multiple vendors. These servers provide flexibility in the NGN for deploying diverse services and creation of new services specific to a service provider.

Access Network

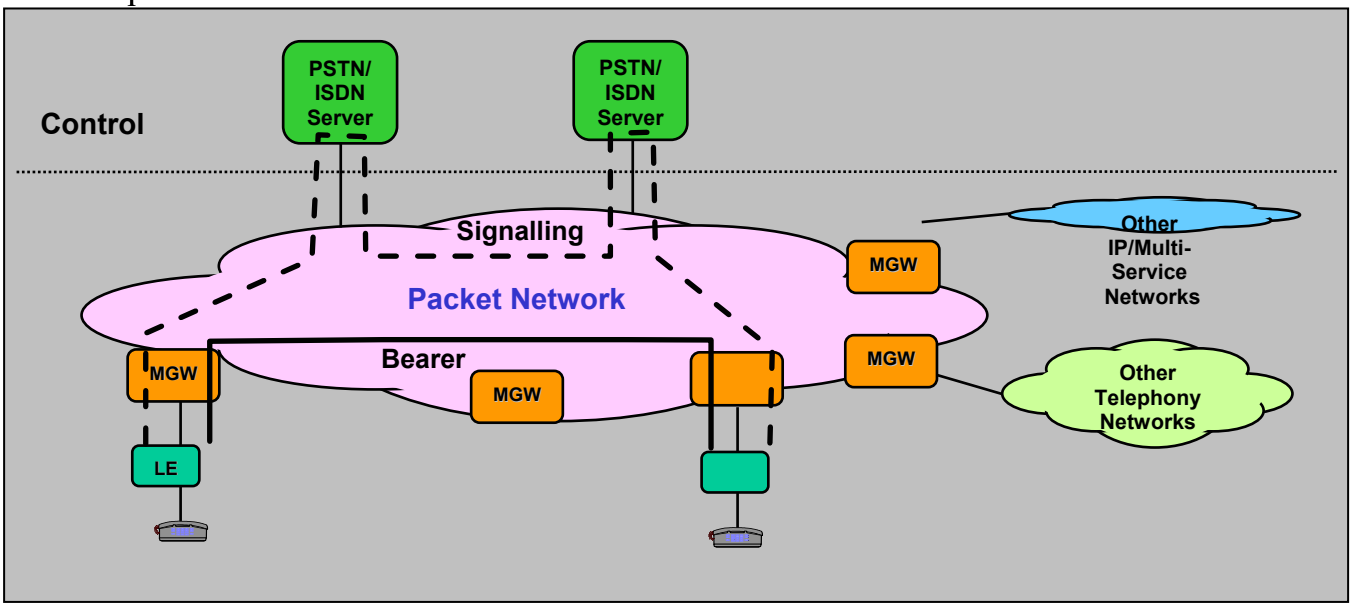
As the core network evolves into a multi-service backbone network, access network needs to support a multi-service environment at high data rates. It should be possible to provide access using the existing technologies and networks such as PSTN, ISDN, ATM, IP etc. In addition, emerging technologies like Digital Subscriber Lines (DSL), Ethernet, Wireless and fibre technology will be used for providing access to NGN.

NGN Management System

Network elements in access, media and service layers will provide network management interface for unified management of the network based on Telecommunication Management Network (TMN) model.

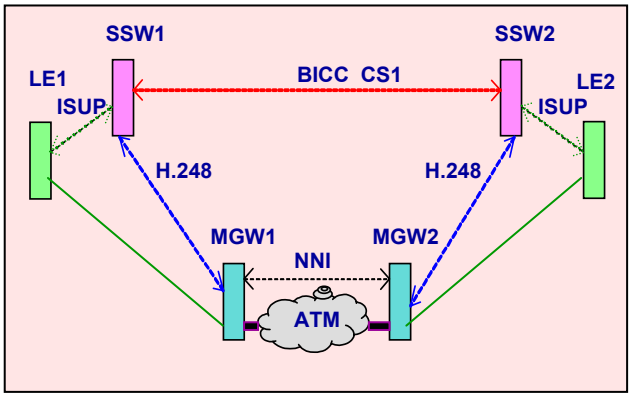
CALL FLOW IN NGN

An example of a voice call in NGN is explained here. The incoming call control signalling from the Local Exchange (LE1) is transported transparently to the originating Softswitch (SSW1). The originating Softswitch then initiates the call handling procedures towards the terminating Softswitch (SSW2) through the BICC call control protocol. The Softswitches are logically connected to each other over Packet network and each one is identified by packet addresses. The Media gateways are also



identified by individual packet addresses. The Softswitch sends a BICC request to the nearest Softswitch for determining whether the terminating entity is available in its domain. If it is present then the Packet address of the terminating point on the media gateway is sent back to the originating Softswitch. Once the packet addresses of the terminating end point is determined then control messages are sent to set up the path across the packet network.

The voice content on TDM speech channel from the originating entity is packetised in the originating MGW of domain 1 before it is transported. The packetised speech is then routed through the packet network and terminated in the MGW of domain 2 where it is converted back to TDM before it is passed on to the terminating entity. Routing between originating and terminating MGWs through the packet network is performed by means of the packet address of the terminating MGW received from the terminating MGW via H.248 and BICC signaling.



BICC

Bearer Independent Call Control (BICC) is a protocol being standardised by ITU-T for call-control in telephone networks using technologies (e.g. ATM, IP) for transport of voice. It is a derivative of the present ISUP (ISDN User Part) of CCS7. BICC separates call and bearer signalling. BICC CS1 (Capability Set 1) standardised by ITU-T in June-2000, focused on ATM as the bearer technology. ITU-T is in the process of standardising BICC CS2 (Capability Set 2) for IP networks.

H.248

H.248/Megaco is a protocol for media gateway control and is jointly developed by international standardisation bodies viz. ITU-T and Internet Engineering Task Force (IETF). The protocol is used to control switching, media-stream manipulation, transport technology adaptation and other functions residing in media gateways. During the period from 18th to 22nd February 2001, Multi-service Switching Forum (MSF) and the International Softswitch Consortium (ISC) conducted tests for interoperability of H.248 using eleven media Gateway and nine Media gateway Controller implementations using H.248.

SERVICES IN NGN

It is expected that NGN will provide new services which are a combination of voice, data and video services. NGN can support different access technologies and different types of terminals like traditional telephones, IP phones, multi-media terminals etc., connected to a media gateway or directly to the packet network. New generation phones supporting intelligent protocols like Session Initiated Protocol (SIP), allow any user to login from any phone and access the services. Services like Click-to-Dial, Messaging Services, e-Business communication services, value-added services like voice activated calling, personal directory services etc., will be available. Person-to-person video calls, multi-party video conference and different interactive multi-media services will be possible. Mobile services will cover user-mobility also in addition to terminal mobility. Service transparency across different types of end-user terminals, both fixed and mobile, can be provided. By using speech recognition systems, some of the advanced services can also be made available to an ordinary telephone. An example is to retrieve or send emails and faxes using the Unified Messaging Service (UMS) that combines speech-to-text and text-to-speech capabilities.

MIGRATION TO NGN

New entrant operators may directly opt for a converged voice and data network using NGN architecture to provide advanced voice and data services. However, incumbent operators have to choose a cost-effective strategy to migrate to NGN, which will keep them competitive. It should also protect the investments in the existing circuit-switch infrastructure.

One way is to adopt a top-down approach, by deploying an overlay packet core network consisting of Softswitches and media gateways to handle the voice and data traffic and to cap the investments in circuit-switch based Trunk Automatic Exchanges (TAX) at the top of the network hierarchy. Media gateways shall support multi-service access to provide new services to NGN subscribers while ensuring interworking for the existing subscribers. Initially, it will also result in better utilisation of bandwidth. Outdated TAX switches can be replaced with Media Gateways. The packet network has to gradually spread to the lower hierarchical levels of the network.

Issues

However, the migration to NGN requires strategic planning. The choice of packet technology in the core transport network, which should support real-time multi-media services with acceptable quality of services (QoS), is a critical issue. ATM, IP and IP over ATM are being widely debated. While IP appears to be the choice in the near future, IP has not yet matured to provide guaranteed QoS for voice and video applications. Multi Protocol Label Switching (MPLS) is emerging as a new technology, which can enhance the services provided in the IP networks by offering scope for traffic engineering, guaranteed QoS and Virtual Private Networks (VPNs). Availability of global standards for protocols between different NGN components, availability of products based on these standards, cost of the equipment and interoperability between the equipment in a multi-vendor environment are some of the key issues bothering the network operators.

MPLS

Multiprotocol label switching (MPLS) is an emerging technology, which combines the capabilities of ATM and IP. It provides connection-oriented features in the connection-less IP networks. When entering the MPLS network, IP traffic is tagged with an MPLS label in the label edge router (LER). Once inside the MPLS network, the label switch router (LSR) forwards the traffic along the label-switched path according to the value of the tag. When the traffic reaches an LER at the edge of the MPLS network, the tag is removed and the packet is forwarded using IP. MPLS allows IP networks to offer virtual circuit-like structures and provides traffic engineering capability to achieve bandwidth provisioning.

NGN Glossary

ATM	*Asynchronous Transfer Mode*
BICC	*Bearer Independent Call Control*
CS	*Capability Set*
DSL	*Digital Subscriber Line*
IP	*Internet Protocol*
ISUP	*ISDN User Part*
IWF	*Interworking Function*
LER	*Label Edge Router*
MGW	*Media Gateway*
MPLS	*Multi Protocol Label Switching*
NGN	*Next Generation Network*
NNI	*Network Node Interface*
PSPDN	*Packet Switched Public Data Network*
PSTN	*Public Switched telephone Network*
QoS	*Quality of Service*
SIP	*Session Initiation Protocol*
TDM	*Time Division Multiplexing*
TMN	*Telecommunication Management Network*

IMPORTANT ACTIVITIES OF TEC DURING THE 2ND QUARTER OF 2001 - 2002

A. Preparation of GRs/IRs & Technical documents

Following GRs and Technical documents issued:

- GR for BB Access on Cable TV Architecture.
- GR for BGP/MPLS Virtual Private Network.
- GR for CDOT RLC (AN) 120 Lines.
- GR for Interface Requirement for Integrated Media Gateway.
- GR for MDF/Protection arrangement for 128/256 Port Rural Auto Exchanges.
- GR for Wholesale Dial Access Port System.
- Revised GR for Digital Circuit Multiplication Equipment (DCME) with 5:1 and 10:1 gain.
- Revised IR on Facsimile Apparatus.
- Test Schedule for Digital Circuit Multiplication Equipment (DCME) with 5:1 and 10:1 gain.
- Test Schedule for SMPS Based Power Plant with amendment-1.
- Technical instructions prepared to prevent the No Speech /Voice Loop-Back in the Network for calls through OCB 283 exchanges.
- Technical Paper prepared on Satellite Communication Technologies for BSNL.

B. Tests and Field trials

Tests have been carried out for:

- DWDM of M/s SIEMENS Kolkata.
- STM-1 of M/s ITI Naini Bench & Environmental testing.
- MCPC of ITI.
- Executive Telephone System of M/s Bharti Systel, Ludhiana & M/s HFCL with field trial.
- Testing of software patch for interworking for OCB-283 & Lucent NMS in R23 software version.

C. Other Activities

- Manufacturer Forum conducted for:
  - 1.8/2.4m earth station Antenna operating in C band.
  - Base station panel and omni antennas in 800 MHz & 1900 MHz.
  - CEPT 30 Channel echo canceller.
  - CDR based billing system.
  - Closed User Group (CUG) for Domestic VSAT, Network in C, Extended C and Ku bands.
  - Integrated LMDS equipment in 10.5 GHz & 26 GHz band.
  - IR for NLDO Gateway.
  - Multiwave Length Meter.
  - Next Generation Network.
  - RF Fixed Attenuator (40 GHz).
  - STM-1, STM-4 & STM-64.
  - Tunable Light Source.
  - VoIP Performance Analyser.

- MOU signed and forwarded for ITU's Global Mobile Personal Communications by Satellite (GMPCS-MOU).
- National Tax study for the year 2002-2003 completed and report submitted.
- Paper on Computerised Rural Planning sent for publication.
- Report on disaster management.
- Technology approval given to 120 line CDOT RLC (AN) based on V5.2.
- Technology approval given to CDOT SBM-XL (version 2_2_1_3) with V5.2.

Approvals issued by TEC during the period July 2001 to September 2001

Type Approvals.....	225
Interface Approvals.....	91
Service Test Certificates.....	64
Total	**380**

Approvals issued by TEC upto 30.09.2001

Type Approvals.....	5200
Interface Approvals.....	3139
Service Test Certificates.....	1313
Grand Total	**9652**

NO SPEECH / VOICE LOOP BACK PROBLEM FOR CALLS VIA OCB-283 EXCHANGES

'No Speech' Problem

After introduction of CCS7, there have been instances when subscribers experienced complete silence on the line after dialling the destination number. No ring back tone is received.

Cause of the problem

In CCS7 signalling, the time slot for carrying the CCS7 signalling information and the time slot for voice can be on two different PCMs. In case loop is given towards 'A' exchange (refer to the figure given below), circuit status will be treated as IDLE in 'A' exchange. Normally, 'B' exchange will then detect BREAK. In case loop is given towards 'A' and 'B' exchanges, circuit status will be treated as IDLE in 'A' as well as 'B' exchange. In this case, call signalling will be completed since CCS7 signalling can go on a different PCM. Only Ringing is fed to called party whereas Ring Back tone is blocked because of **both-way loop.**

'Voice loop back' Problem

In case of calls originated by a Mobile Subscriber, speech samples, encoded at 'low bit rate' are sent in 20 ms time frame, which introduces one way delay. Delay is also introduced due to transmission on radio channel and air interface on the return path. If there is both way loop-back on PCM, calling mobile subscriber receives back his own speech causing voice loop back.

However, the PSTN subscriber perceives it as 'no speech' since the voice is returned without any delay.

Precautions to be taken in OCB-283

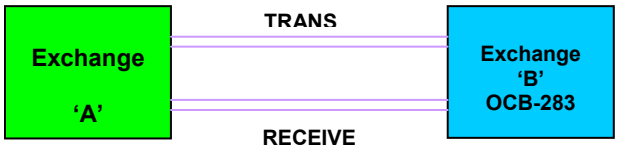
The problem is traced to internal loop condition on PCMs created during maintenance activities in OCB-283 exchanges. PCMs in OCB-283 are available on **ICTRQ card**. For each of the four PCMs, an ARROW PCM plug is provided which can be inserted in either of the four directions.

Normally, the ARROW plug should be in **'up'** position so **that PCM is through.**

Sometimes during Maintenance activity, if **ARROW plug** is put in **down position,** it will give **bothway loop** on the PCM. **THIS SHOULD NEVER BE THE CASE.**

The **ARROW plug** can be put in **left position** to give **EXTERNAL LOOP** towards distant exchange (and **INTERNAL BREAK**) for maintenance activity.

For non-working PCMs, **ARROW plug** can be put in **RIGHT direction** which means **INTERNAL LOOP, EXTERNAL BREAK.**



Four possible PCM PLUG positions in ICTRQ board in OCB-283 exchange and condition of PCM based on the direction of the Arrow in each case are as follows :

Plug Position in ICTRQ PCM Card in OCB exchange B	UP ▲	DN ▼ (Probihited)	Left ◀	Right ▶
PCM Condition	A B PCM is through	B Loop towards both sis	A B Loop towards A & Break towards B	A B Break toward A & Loop toward B exhange
ircuit Status in exchange A	OK	OK	OK	BLOF
Circuit Status in exchange B	OK	OK	BLOF	OK
Call condition	Call is succeessful	Call is succeessful	Call can not mature	Call can not mature
Speech	OK	No Speech on fixed line phone Voice Loop Back towrd MSC subscriber	-	-

Steps to avoid bothway loop back

- ARROW plug should never be in down position in OCB-283 exchange.
- ARROW plug should be put in left position for maintenance activities.

CENTREX

What is Centrex?

Centrex provides PABX services to business group subscribers by means of a virtual PABX implemented in a public exchange. It is implemented in software and does not require any specific hardware. A corporate subscriber can use lines connected directly to the exchange as if they are part of a PABX.

Intra-PABX communication is provided through private network whereas the intra-centrex calls utilise Direct Exchange Lines (DEL) in the public network. Centrex subscribers can be spread over a wide area connected to the main exchange, Remote switching units and Access networks.

Services offered by Centrex

The number of subscribers in a centrex group can be configured depending on the requirements. Various access barring restrictions (access to public network, STD, ISD etc.) are possible. Various services normally provided by a PABX like call transfer etc., can be provided to centrex subscribers. Some of the services typical to centrex subscribers are explained below:

Private Numbering Plan (PNP)

It is possible to have a private numbering plan for calls within a centrex group. Intra-centrex calls can be established by dialling short dialling codes (e.g. three digit numbers) without dialling the complete directory number.

Distinctive ringing

Different ringing cadence for incoming calls from public network and calls within a group allows subscribers to easily distinguish these calls.

Call pick-up

It enables a subscriber of a call pick-up group to answer a call in ringing state meant for another subscriber by dialling a pick-up access code.

Automatic Call-back

This facility allows a centrex subscriber to be automatically rung by the system and get connected to the called party, if an earlier attempt was unsuccessful on account of called party busy condition.

Multi-line hunt groups

It is possible to create a sub-group with some of the subscribers in centrex group and assign a group number. Calls to this number will land on an idle line within the hunt-group using hunting methods.

Commercial Considerations

A corporate customer planning to install a PABX will have to invest towards the cost of PABX, rent for the public lines connected to the PABX and cost towards operation & maintenance of PABX. On the other hand, the investment in centrex will involve the rent for the total number of DELs required from the public network. Network operator has to decide the tariff for centrex in such a way that the trade-off between the two (i.e. PABX and Centrex) would be cost-effective to encourage the subscriber to go in for centrex. Intra centrex calls can be made free of charge like in the case of a PABX.

Status

Centrex feature is available in Version 11 & 13 of EWSD, Version 13.1 of 5ESS and Version R24 of OCB-283 exchanges. At present, it is not available in other type of exchanges including AXE-10 and CDOT.

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Editor :
I. S. Sastry
DDG (S)
Phone : 3329540
Fax : 3723387
Email : ddgstec@del2.vsnl.net.in

Telecom. Engineering Centre
Khurshid Lal Bhavan
Janpath
New Delhi 110 001.