

Telecom

---

*For RTS*

## Training Objective

- ❑ After attending this training program the participants will get basic domain knowledge on Telecom, Telecom network entities and telecom services.
- ❑ Flow of the training is as below.
  - A general introduction of Telecom
    - Discusses about role of telephone exchanges, access network and transport network.
  - Introduction to mobile telephony
    - What is GSM, CDMA? Brief introduction on various Network Elements e.g. MSC, GMSC, HLR, VLR, AuC, BTS, BSC, SMS, VMS, IN, CRBT, Voice Portal
    - RCOM network structure is discussed along with.
  - Introduction to Services
    - Voice (FLP, wireless, E1 PRI, Centrex) with generic call flow, SMS, Broadband Internet Access
  - Brief introduction to NGN
    - What is NGN and its role in telecom network.
  - Brief introduction to 3G
    - Evolution and services

This module of learning program gives an idea about Reliance network elements & architecture.

## Introduction of Telecom

---

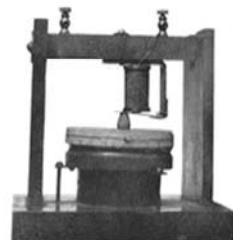
---

*Switching System*

## The First Telephone Call



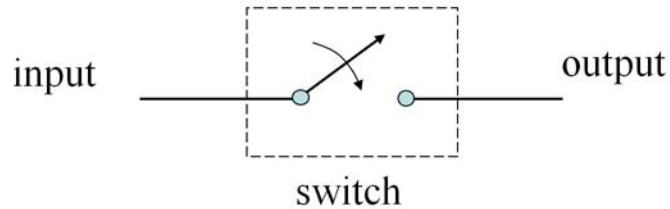
Bell's first telephone



Alexander Graham Bell at the opening of the long-distance line from New York to Chicago, 1892.

## What is a Switch?

- A switch is a means to connect an input to an output.



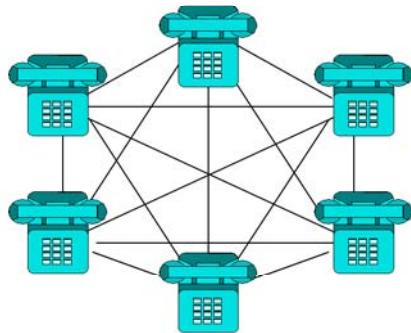
... and the process is known as **switching**.

A switch has ports on input side as well as on output side. It also has a control input by which switch path is closed or opened. Once switch path is closed, input port gets connected to output port. This path helps passing on information from input side to output side. If subscribers are connected to these points then it represents that their speech is getting transmitted by this switch connection.

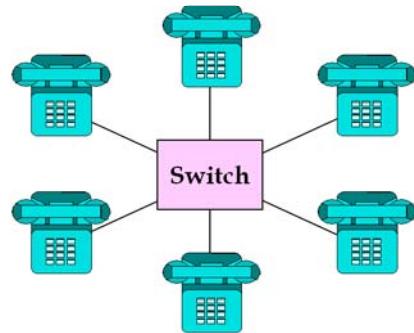
Closing & opening of switch is controlled by a processor. In an exchanges we can assume to have a big array of such switches so as to cater to lot of subscribers speech simultaneously. Depending on digit dialed, a calling subscriber, connected at certain input port is connected to required called subscriber at output port side by the controller.

## Key Concepts: Switching

**Network without switching**



**Network with a switch**



- Requires  $n(n-1)/2$  transmission links
- 15 independent links would be required in this example to allow calling between users
- Requires  $n$  transmission links
- Only 6 independent links would be required when a central switch is used

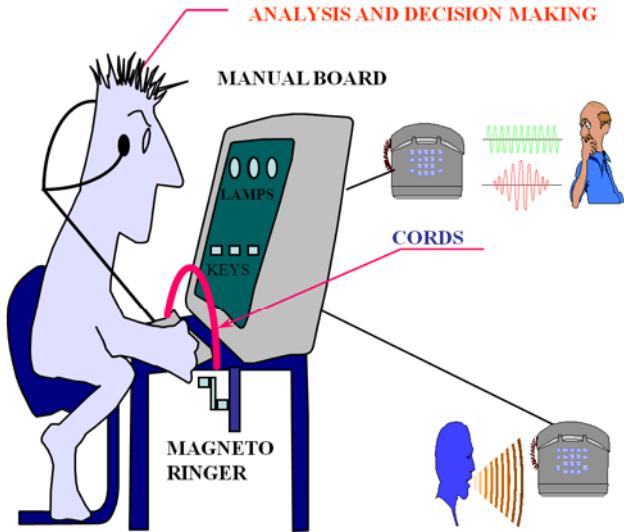
Switch not only reduces transmission cost but also reduces the complexity of connecting subscribers. Here subscribers have complete control on information flow to a subscriber.

Similar concept is further extended to route subscribers traffic to long distance exchanges by taking calls through exchanges arranged in tandem.

## Manual Exchange



## Manual Exchange



1. CALLING PARTY OFF HOOK- LAMP ON-
2. VERIFICATION OF ELIGIBILITY- QUERY FOR CALLED PARTY INFORMATION
3. CALLED PARTY INFORMATION- ANALYSIS BY THE OPERATOR-
4. VERIFICATION OF CALLED PARTY STATUS-
5. RING TO CALLED PARTY IF FREE-
6. CALLED PARTY ANSWER- CONNECTION
7. EITHER PARTY ON HOOK- LAMP OFF-
8. RECAPITULATION OF THE LINK- DISCONNECTION

In a manual exchange, an operator used to control the call setup, supervision & release. Switch board is used to connect subscribers & supervise their activity.

Present day switches are known as Stored Programmed Controlled (SPC) exchanges. These are digital exchanges.

## Stronger Exchange



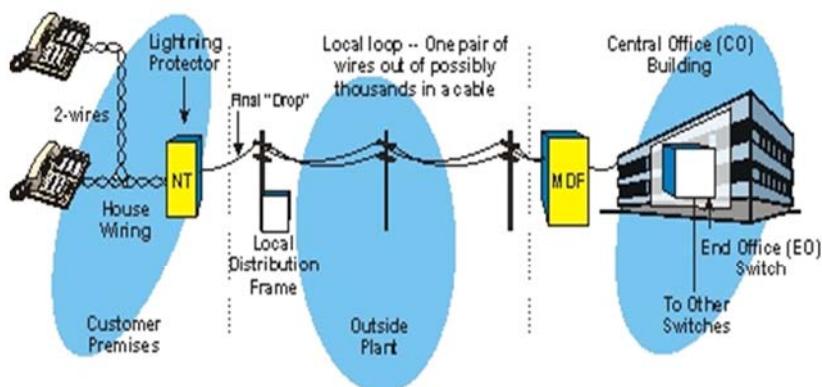
## Crossbar Exchange



## Did Someone Unplug the Wrong Cable?



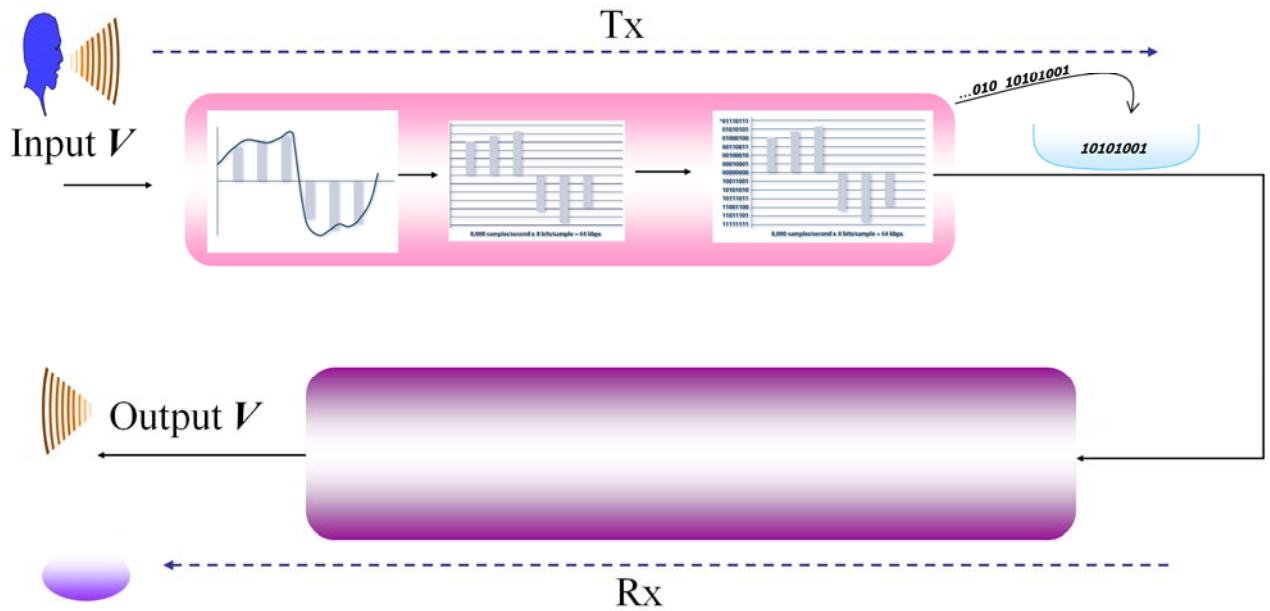
## Subscriber Connection



## Telephone Wiring



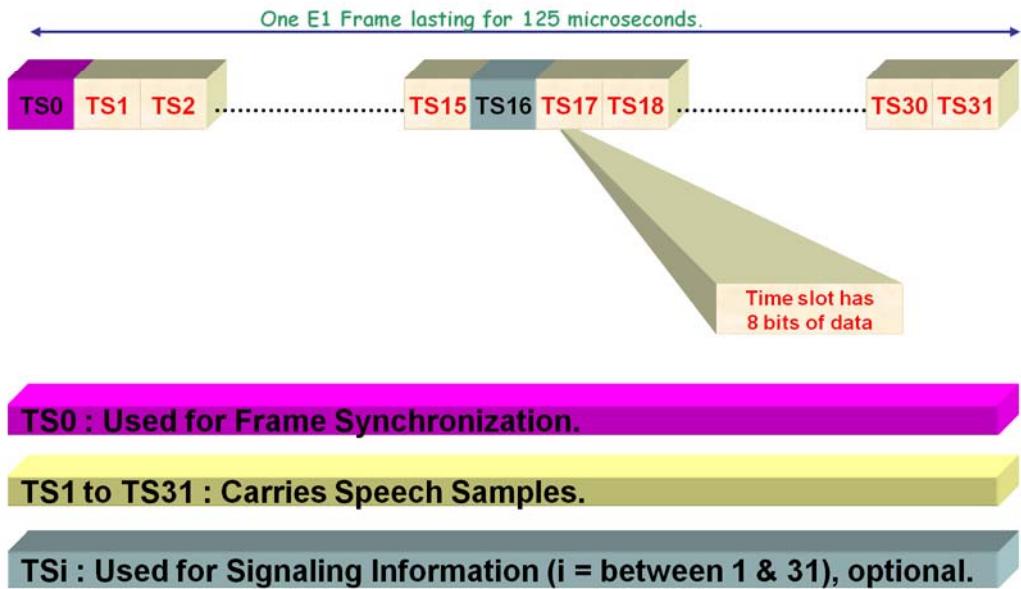
## Speech Digitization



Speech digitization helps eliminating noise & signal attenuation problem. Certain other advantages are inherited by way of digitization e.g. once an exchange is capable of carrying a digital signal so any sort of digital signal can be carried through it. In other words a digital exchange can carry data, and data may in turn have speech or video or computer data etc. So it has become possible to support lot of services through a digital exchange.

At the receiver, reverse process is followed to get the analog signal back from digital signal.

## Frame Structure – E1



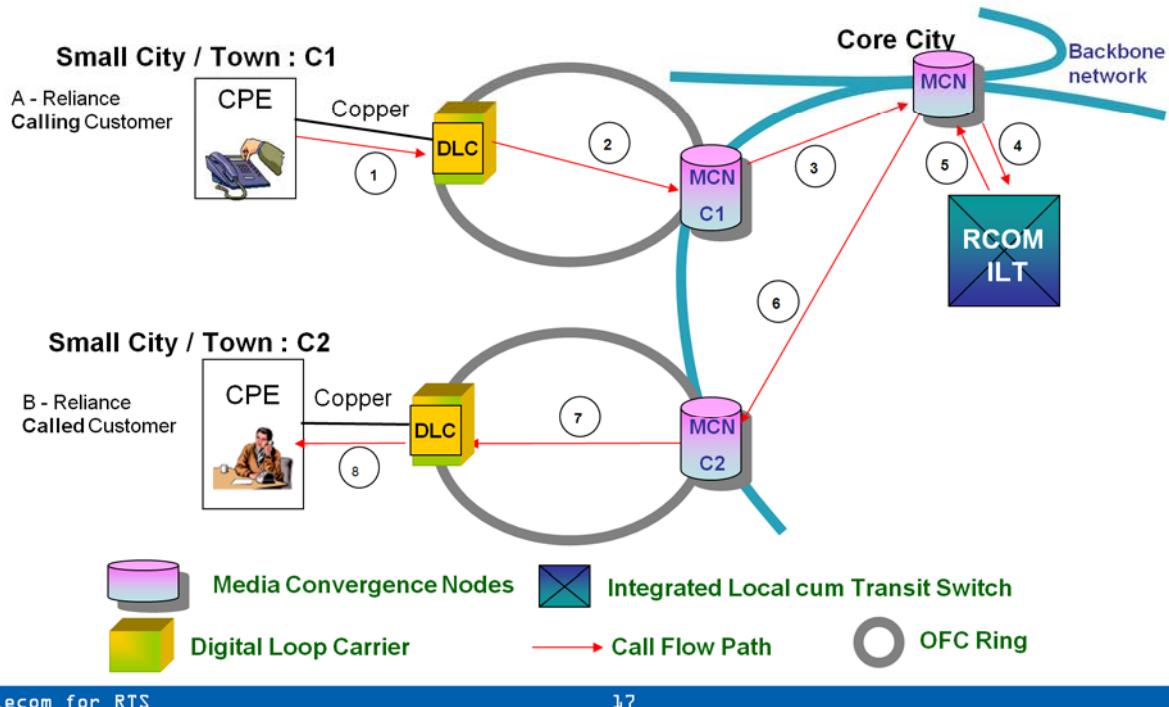
E1 (or E-1) is a European digital transmission format devised by the ITU-T and given the name by the Conference of European Postal and Telecommunication Administration (CEPT). European & certain non-European countries use the E1 system.

It's the equivalent of the North American T-carrier system format, which is mainly used in North America, Canada & Japan.

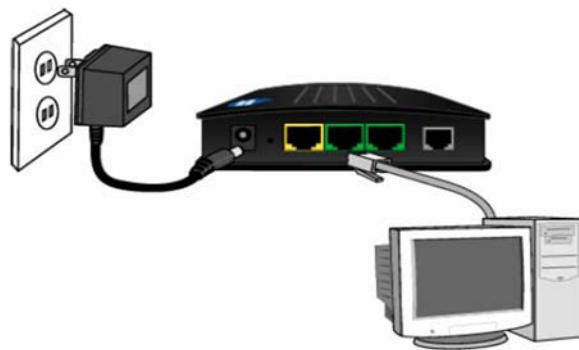
The E1 signal format carries data at a rate of 2.048 million bits per second and can carry 32 channels of 64 Kbps each.

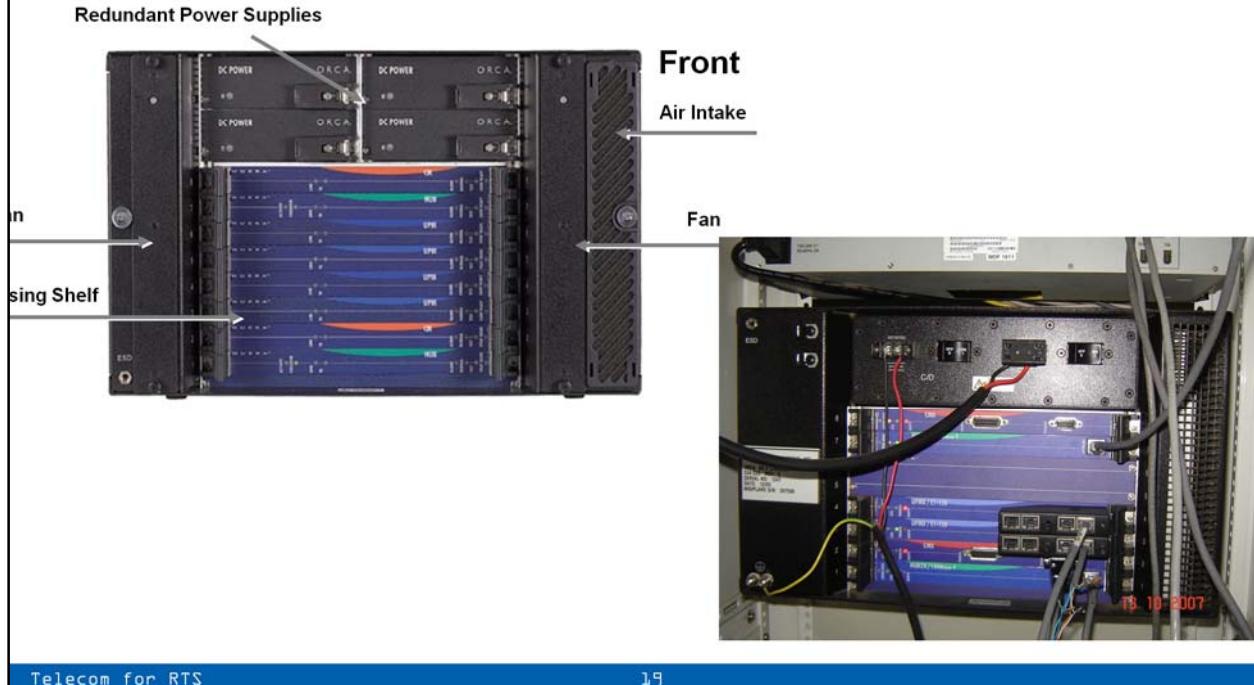
The channels are divided by Time Division Multiplexing.

## Call Flow - Landline

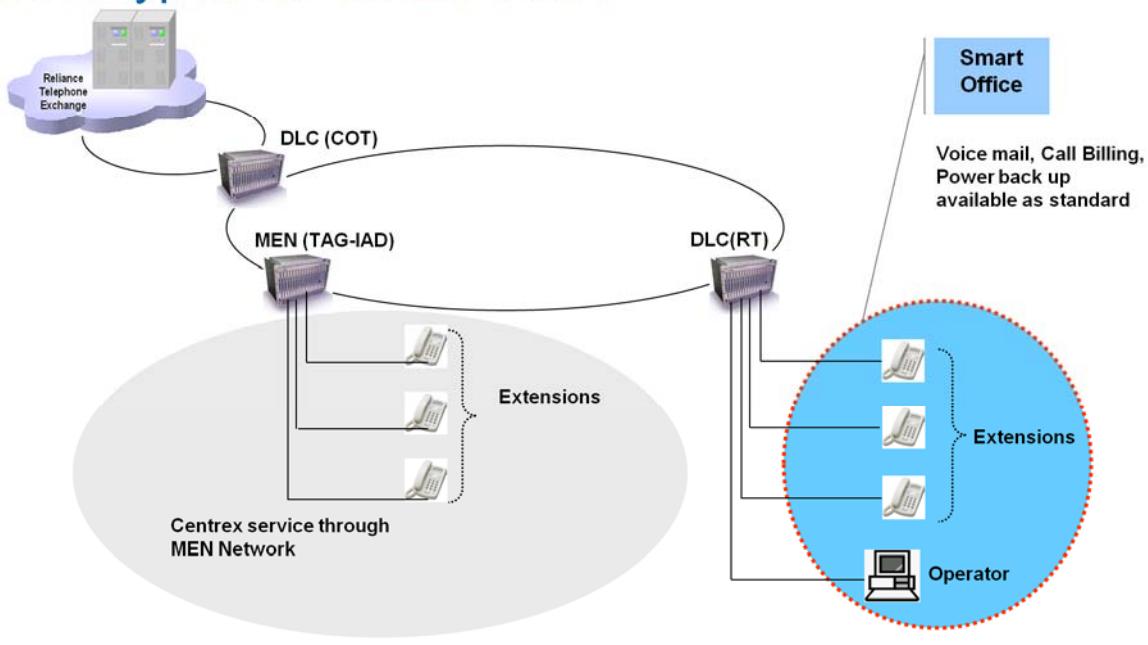


The above is an example of fixed line subscriber call flow. An ILT in a circle, is handling local calls coming in through an access network.

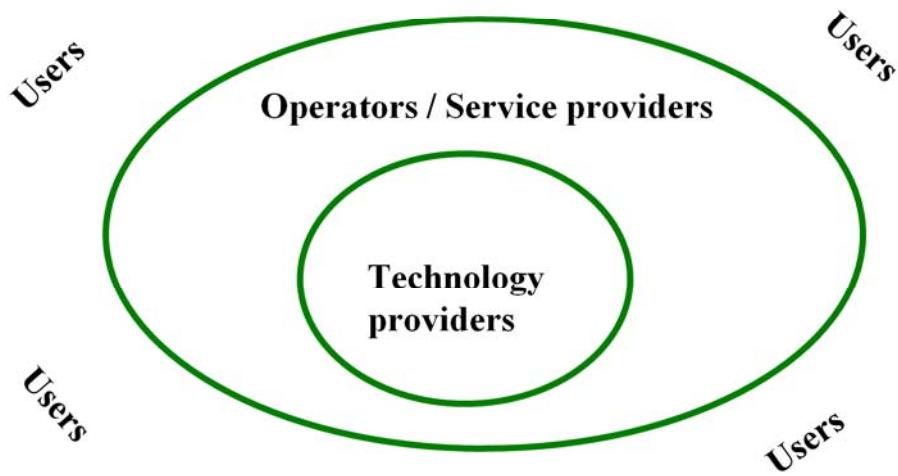




## Access types for Smart Office



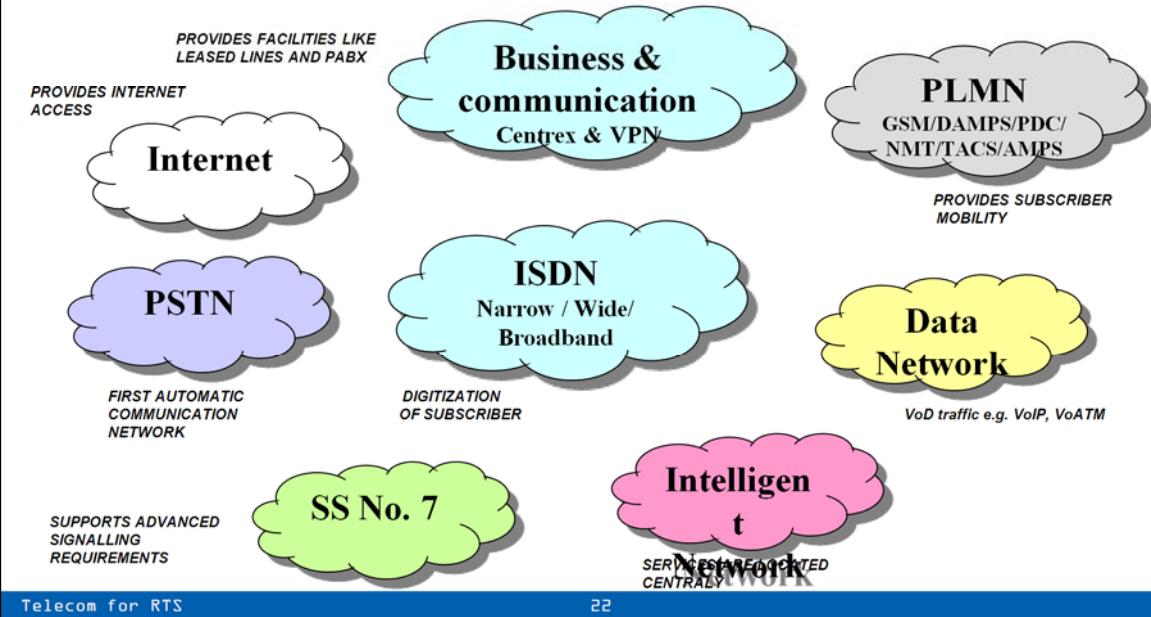
## Present Telecom Field



Deregulation of the market has resulted in the entry of new players, both network and service providers are competing with the established operators.

Major developments in the standardization field have resulted in increased competition between manufacturers with a resultant reduction in costs to network operators and end users.

## Present Day Telecom Network

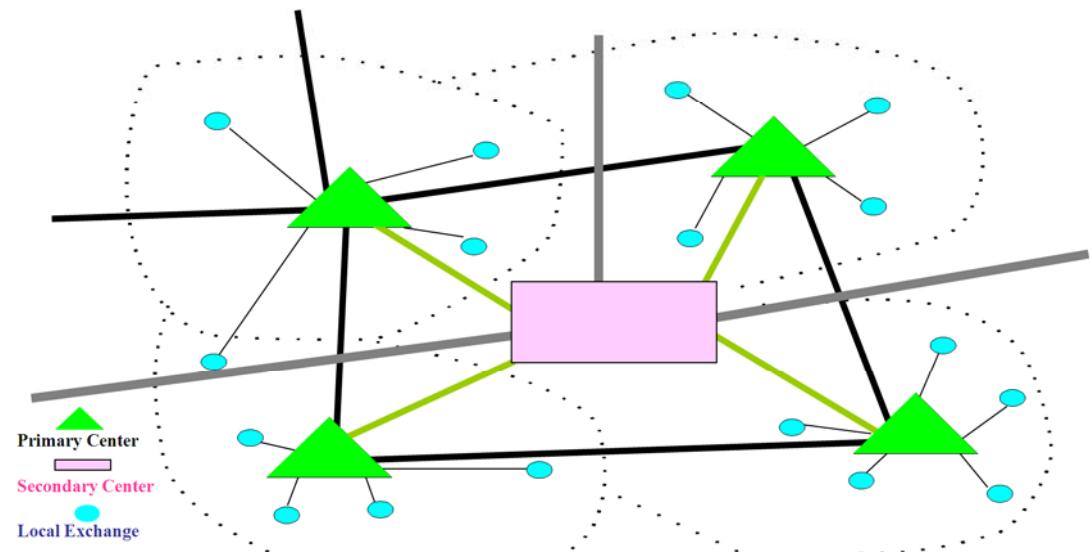


Today communication's network support voice, data, Internet and multimedia traffic. This gives rise to different networks like Data Network, Internet, Intelligent Network.

Subscribers are demanding new services, increased mobility and higher bandwidth in the access network. Operators are linking together to form global companies providing worldwide customized services.

Subscriber mobility is now a key feature of communications. This advance has been made possible by the successful implementation of cellular systems, such as the GSM/GPRS/EDGE/WCDMA, cdmaONE/IS95B/CDMA2000 1X/3X, the digital advanced mobile phone system (D-AMPS) and the personal digital cellular (PDC).

## Telephone Network Hierarchy

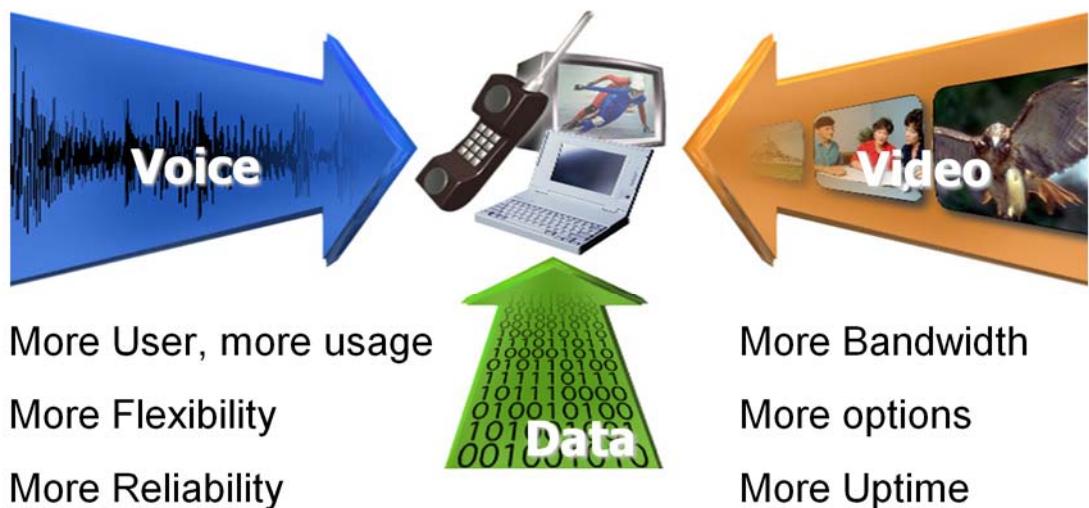


Telephone network elements are connected to each other in an hierarchy. This hierarchy help reducing backhaul media need and complexity in routing calls. Examples of nodes in switch hierarchy are Local Switch, TAX / Tandem Switch, National Gateways, International Gateways.

---

*Transport Network*

## Importance of Backbone



In modern telecommunication, there is an increasing realization that transport is as important a building block as any other like Switch or Services. Transport has traveled it's distance from being merely the physical connectivity to being a performance enabler.

Why is that so evident today. Because as technology evolves, there is increasing demand for:

### More & more bandwidth

More users, more frequent use, more information & data to be carried, so more bandwidth

**More Quality & Reliability**

Mere transmission is not good enough, quality of voice or video is also important, so is the reliability with which information is transmitted

### **More flexibility**

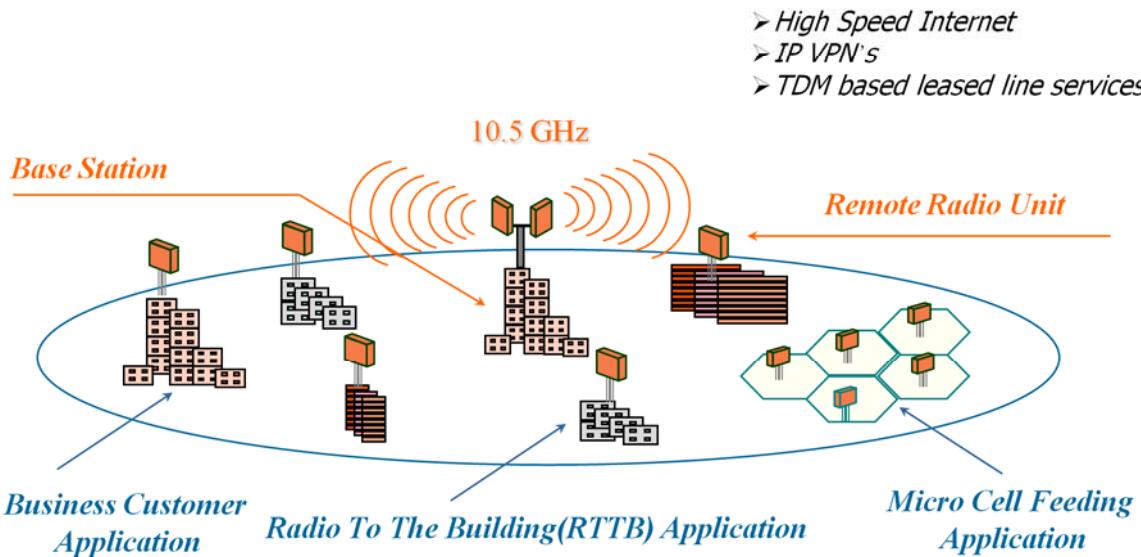
We can have both voice & data on the same line, at the same time, Can we get more download speed with increasing uploading speed.

## Transport Media

- ❑ Electrical.
  - Copper.
- ❑ Electromagnetic.
  - Microwave, Radio frequencies.
- ❑ Optical.
  - Optical fiber.

Transport media used may depend on convenience and bandwidth required to be carried.

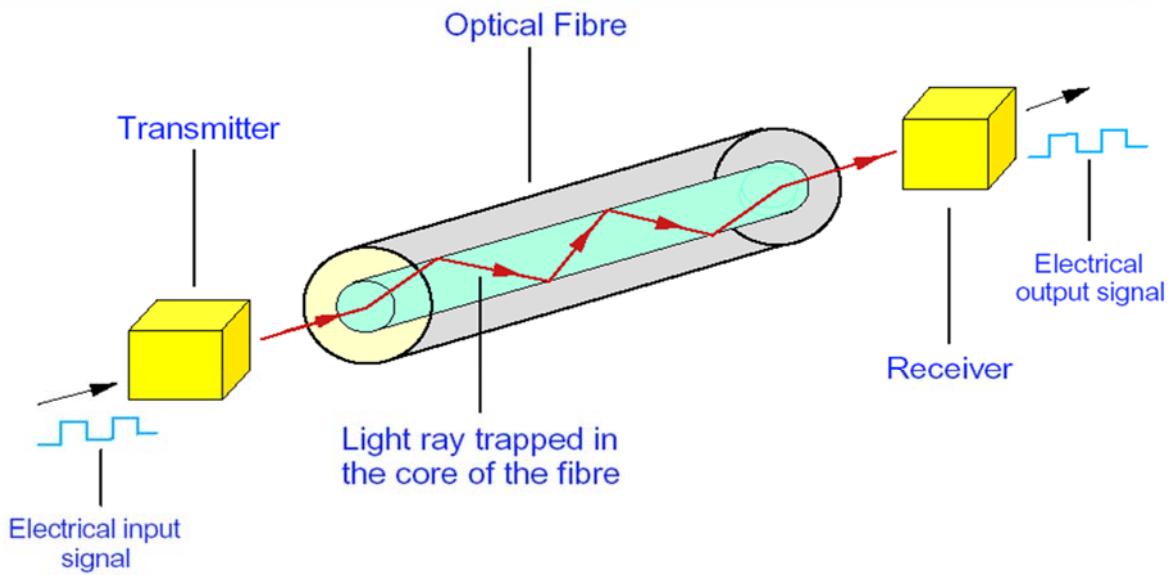
## Microwave Connectivity (LMDS)



Local Multipoint Distribution System operates in  $\mu$ Wave range. In Reliance we are operating at 10.5GHz.

With this frequency we can go upto 10km.

## Optical Fiber



Transmission through a OFC is like light ball traveling down a tunnel. It bounces several times on the “wall” before reaching the end of the tunnel.

Advantages of OFC over other media like Cu wire are:

Very low attenuation

No Electromagnetic Interference (EMI)

No Bandwidth-distance relation, hence enormous bandwidth available.

OFC are far thinner in diameter.

Disadvantages are

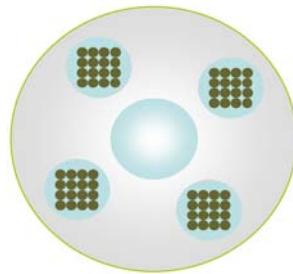
OFC is costlier than Cu-wire.

OFC is fragile.

OFCs are difficult to join.

OFC has its own set of losses – dispersion, absorption, etc.

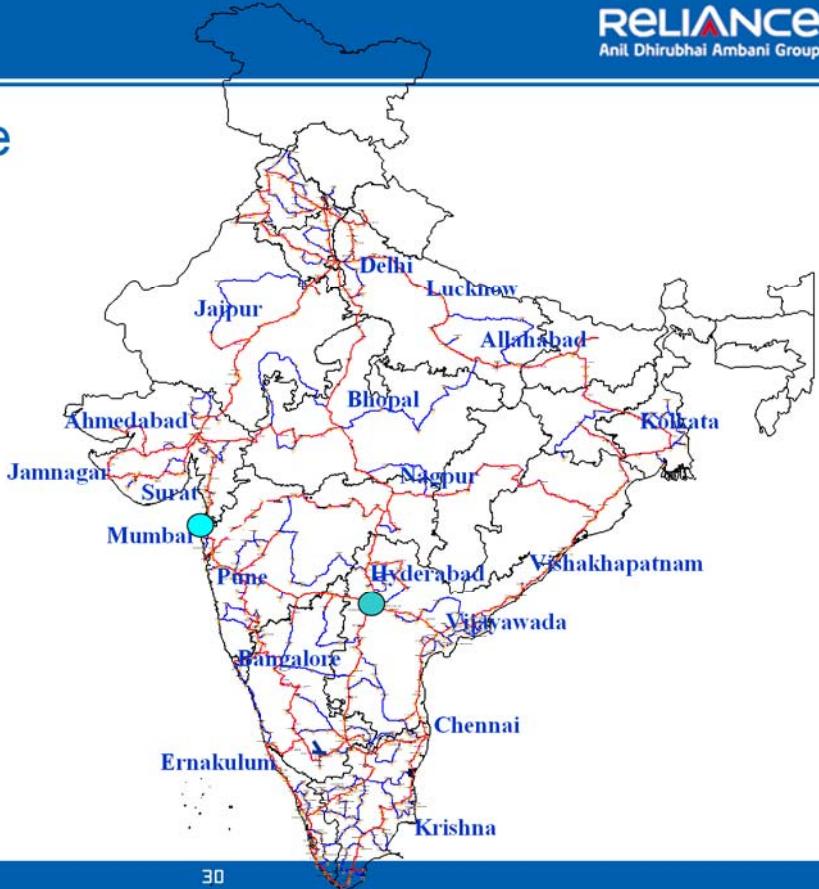
## Optical Fiber



Multi-fiber cable

On our backbone we have laid many multi-fiber cable. These cables carry optical signals from one place to another. Optical cable has large capacity, so normally it connects many nodes in a loop, called “ring”.

## National Backbone



Telecom for RTS

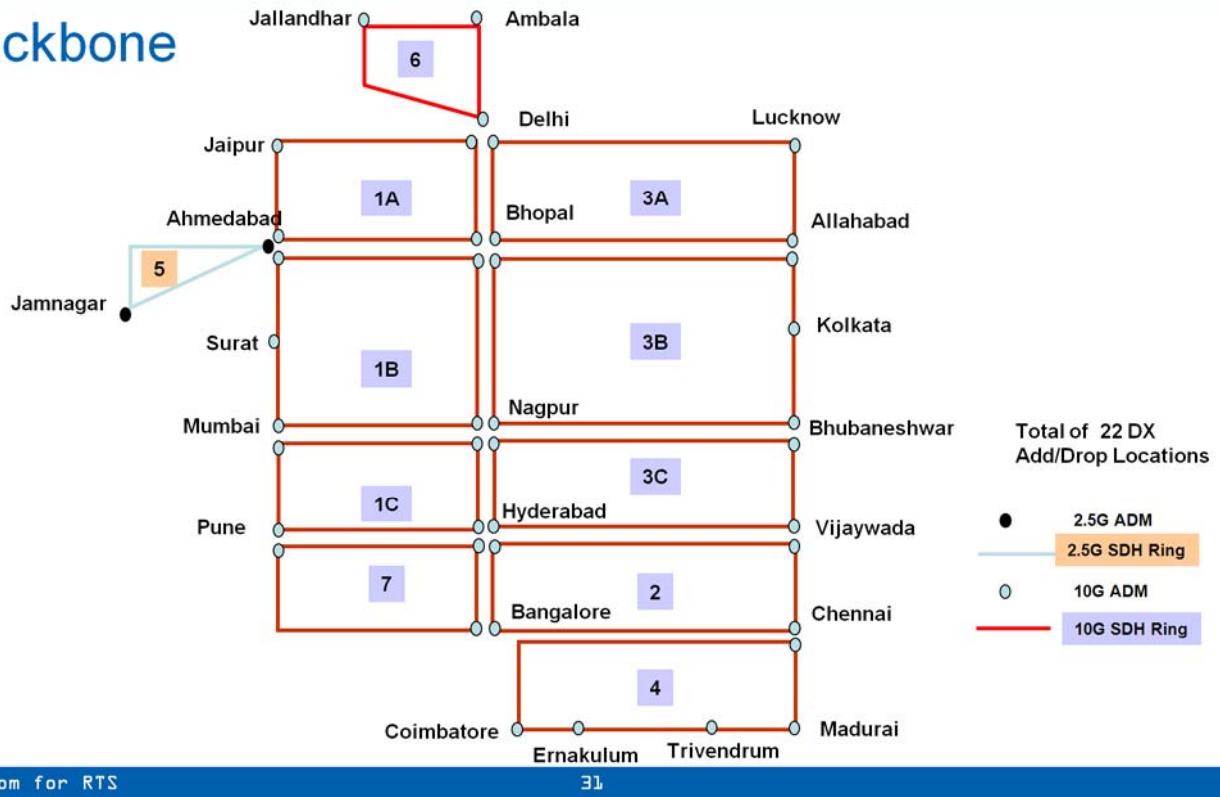
30

This is our Reliance India Roadmap. It's a mega network of 80,000 km of OFC highway.

The core rings connect core MCN's with ILT's at this moment.

Like multiple lanes of highways, Transport network provide bandwidth which decides how much traffic or calls can be carried.

## Backbone



Telecom for RTS

31

At the National level RIC has established 7 very high bandwidth Transport Rings, called National Backbone/ Long Distance Rings. Practically there are 11 rings as Ring 1 and 3 comprise 3 rings each (1A, 1B, 1C & 3A, 3B, 3C). These Rings are so designed that all major cities get enough bandwidth and not too many cities come on the same ring. Also having these 11 rings provide enough alternative routes in case of failure in one section. These rings traverse all the 18 circles, touch all major cities and cover about 90% of Indian population.

From these rings, at these 22 MCN's, emerges several Metro Access Rings, which connect other small cities and towns to the NBB.

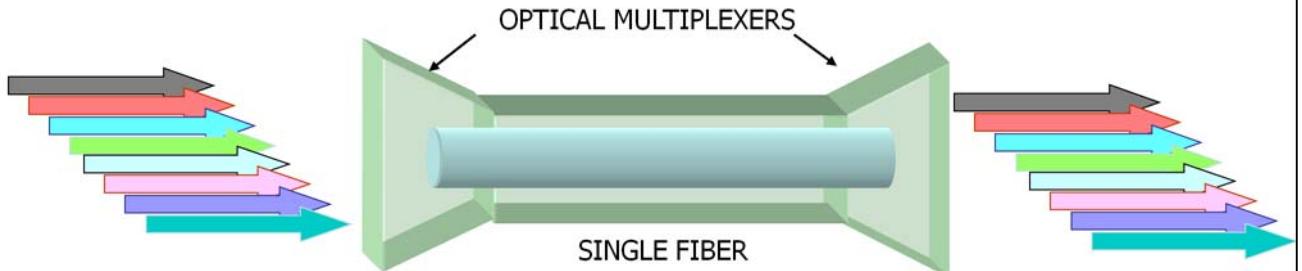
## Transmission Rate

<b>Signal Designation</b>			<b>Line Rate (Mbps)</b>
<b>SONET</b>	<b>SDH</b>	<b>Optical</b>	
STS-1	STM-0	OC-1	51.84
STS-3	STM-1	OC-3	155.52
STS-12	STM-4	OC-12	622.08
STS-48	STM-16	OC-18	2,488.32
STS-192	STM-64	OC-192	9,953.28
		OC-768(?)	39,813.12

European standard Synchronous Digital Hierarchy (SDH) and its North American counterpart SONET propose a transport system with highly synchronized network elements and OFC as the physical media.

STM-n has now been defined from STM-1 (63 E1's) to STM-64 (4032 E1's). Proposal for STM-256 is under examination for standardizing. That would take us to an amazing 40 Gbps.

## Dense Wave Division Multiplex



A quantum jump in bandwidth is achieved by using a technique called Dense Wave Division Multiplexing (DWDM).

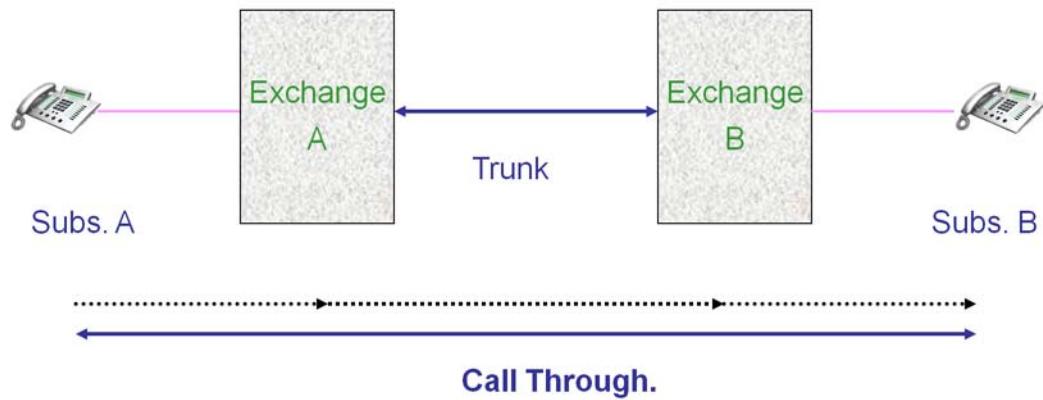
Signal transmission uses one wavelength. In DWDM technique, many wavelengths can be summed up (each carrying one signal stream) at the transmitter, which travels through the optical fiber. At the receiver it can be separated out in individual streams.

So effectively increasing the carrying capacity of same fiber many times.

## An Introduction to Mobile Telephony

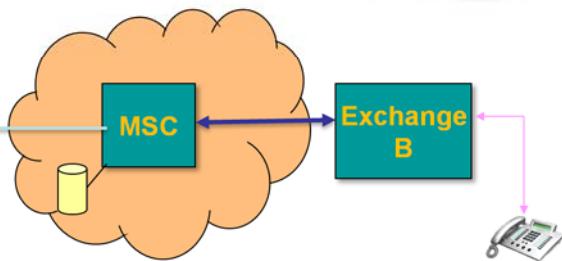
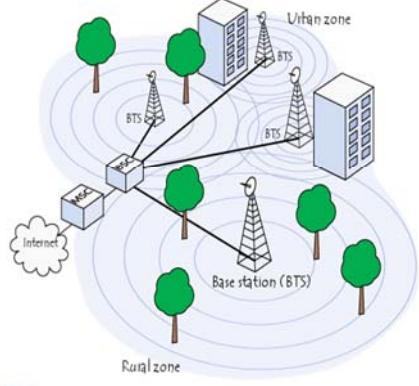
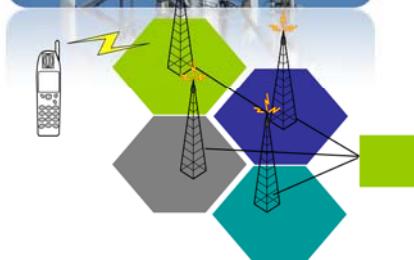
---

## Call Setup in PSTN



In PSTN, subscribers are fixed i.e. connected over wire to a local exchange. Call is routed through exchanges in tandem, to called subscriber.

## Cellular Telephony

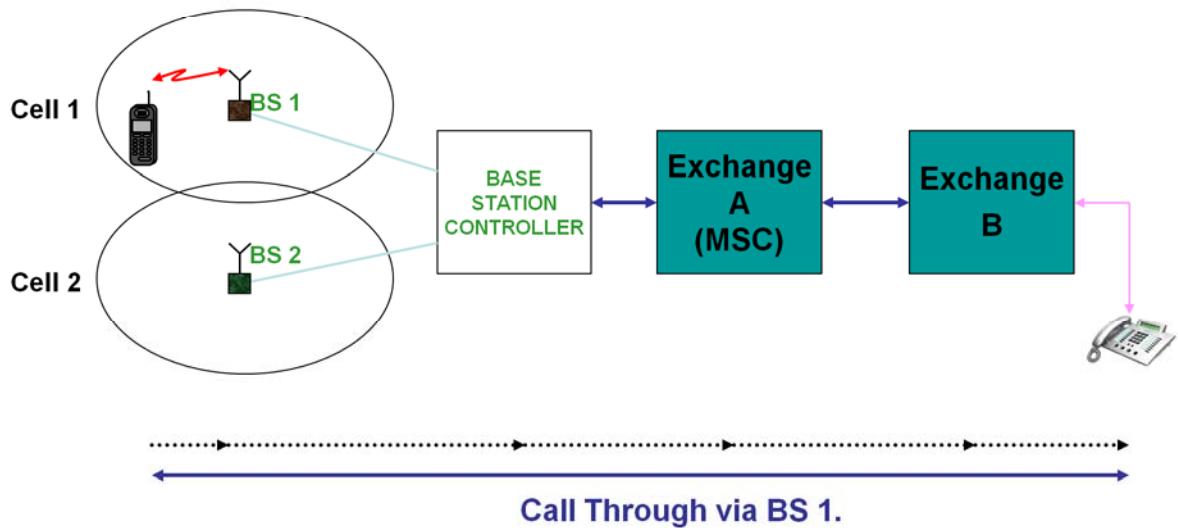


Telecom for RTS

36

Mobile moves to border area covered from Base-station#1. Though it is getting equally strong radio signals from neighbor Base-stations#2.

## Cellular Telephony



In cellular telephony, subscriber has mobility. It also has a radio access to nearest Base-station, which keeps radio transceiver. Area under coverage is covered by many Base-stations. Subscriber mobility is provided by keeping the connection through Base-stations, when mobile subscriber changes cell area.

To support radio access by mobile subscriber, many new elements are added in this network towards radio side.

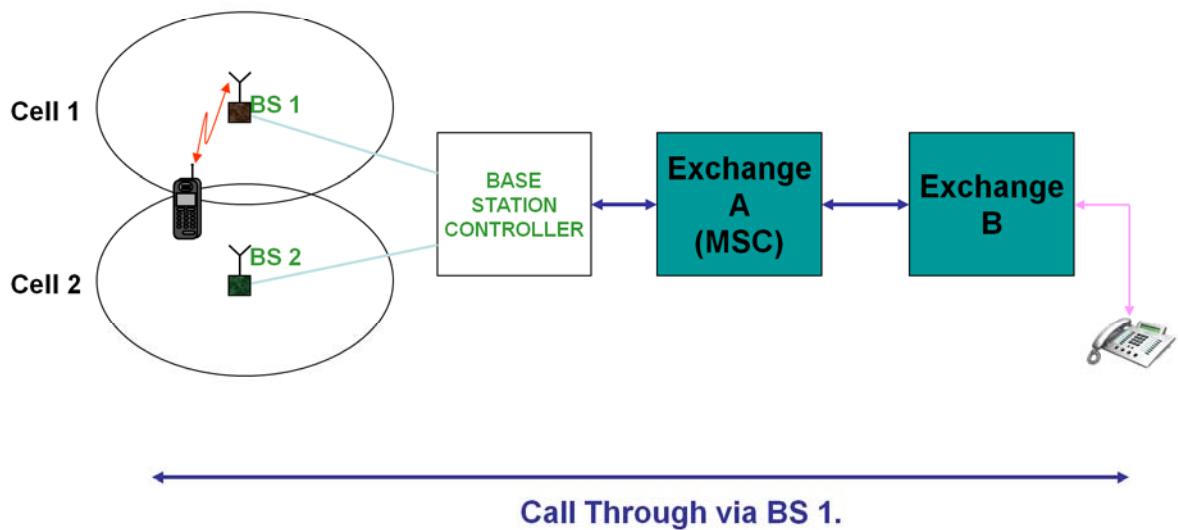
BTS – Base Transceiver Station, keep radio equipments.

BSC – Base Station Controller, controls radio resources in BTSs.

Mobile handset – Subscriber's intelligent radio terminal.

## Cellular Telephony

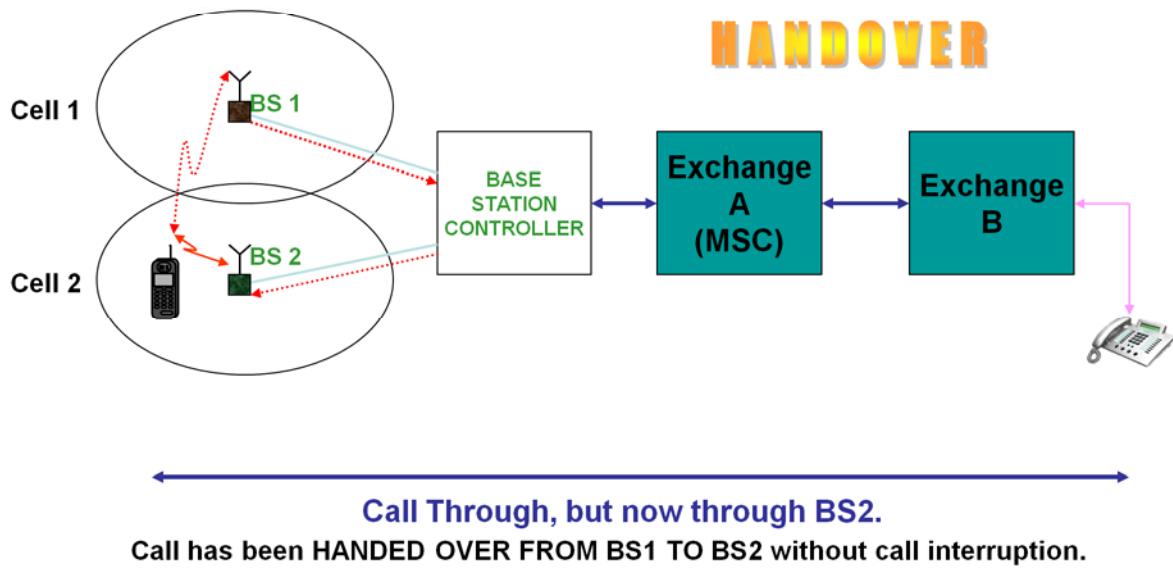
*continue*



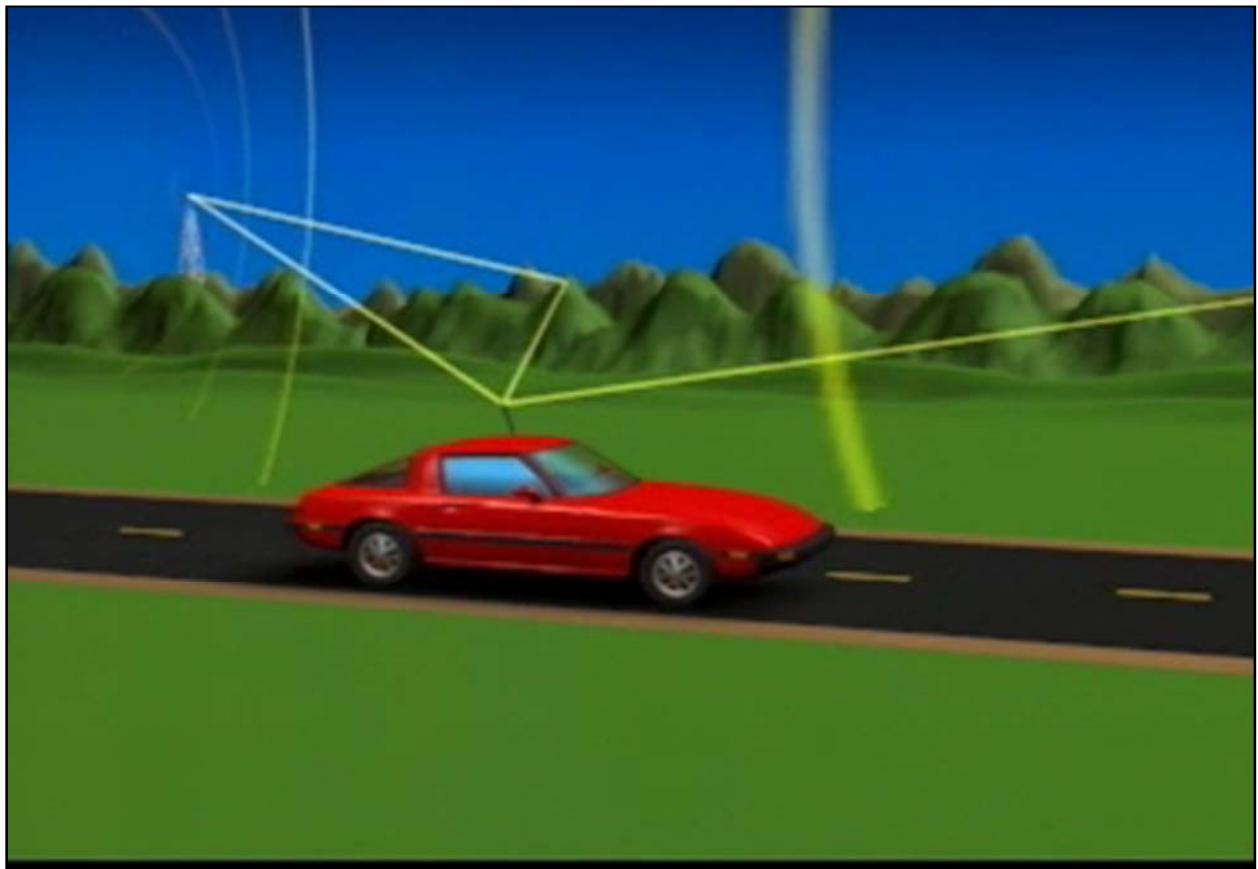
Mobile moves to border area covered from Base-station#1. Though it is getting equally strong radio signals from neighbor Base-stations#2.

## Cellular Telephony

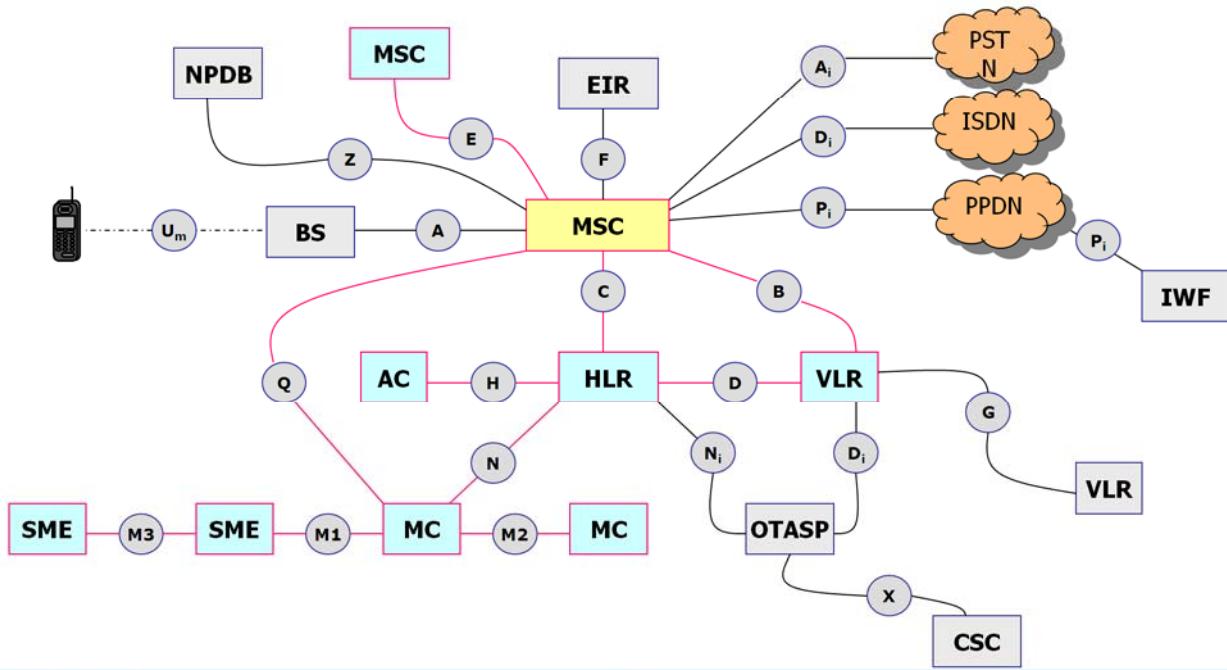
*continue*



Radio signal from BS2 is strongest, so mobile locks to it. Base-Station Controller hands over call from BS1 to BS2. Subscriber does not know about this handover.



## Elements in Cellular Switching



Various Mobile calls are different than a fixed line call, so many new elements are needed in a cellular network, to cater for mobile calls.

AC	Authentication center.
CSC	Customer service center.
MC	Message center.
NPDB	Number portability database.
PPDN	Public packet data network.
SME	Short message entity.

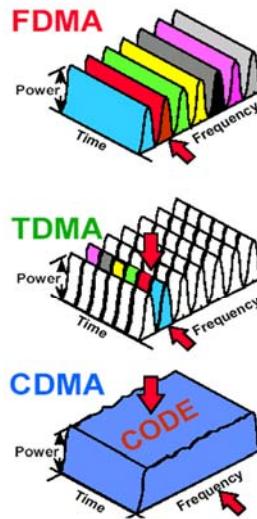
## Spectrum for Cellular Communication In India

Frequency Allocation (MHz)	Technology	Spectral width
824-844 / 869-889	CDMA-800	2 x 20MHz
890-915 / 935-960	GSM-900	2 x 25MHz
1710-1785 / 1805-1880	GSM-1800 (DCS 1800-2G)	2 x 75MHz
1920-1980 / 2110-2170	Allocation for UMTS/ 3G	2 x 60MHz

## Wireless Access

- ❑ CDMA
- ❑ GSM

### Wireless Multiple Access Methods



#### Frequency Division Multiple Access

- A user's channel is a private frequency

#### Time Division Multiple Access

- A user's channel is a specific frequency, but it only belongs to the user during certain time slots in a repeating sequence

#### Code Division Multiple Access

- Each user's signal is a continuous unique code pattern buried within a shared signal, mingled with other users' code patterns. If a user's code pattern is known, the presence or absence of their signal can be detected, thus conveying information.

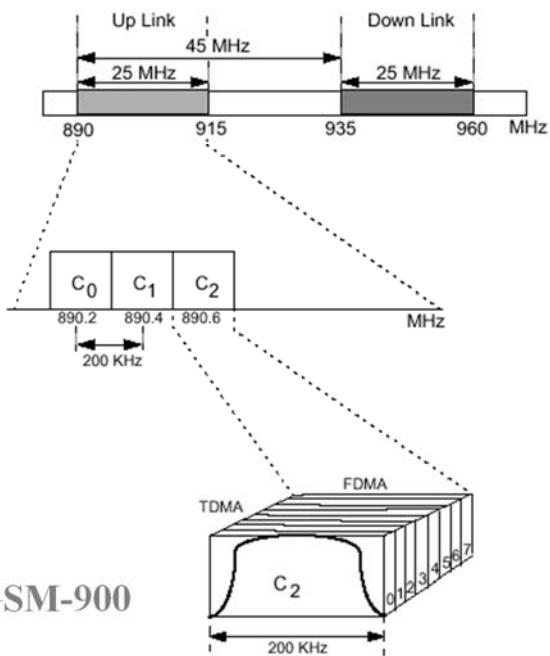
Wireless access now a day is becoming most preferred way of access. At the same time it is offering ease in deployment of network.

Since radio is a scarce resource, simultaneous usage by many users has certain restriction. There are many standards which controls it e.g. CDMA/GSM etc.

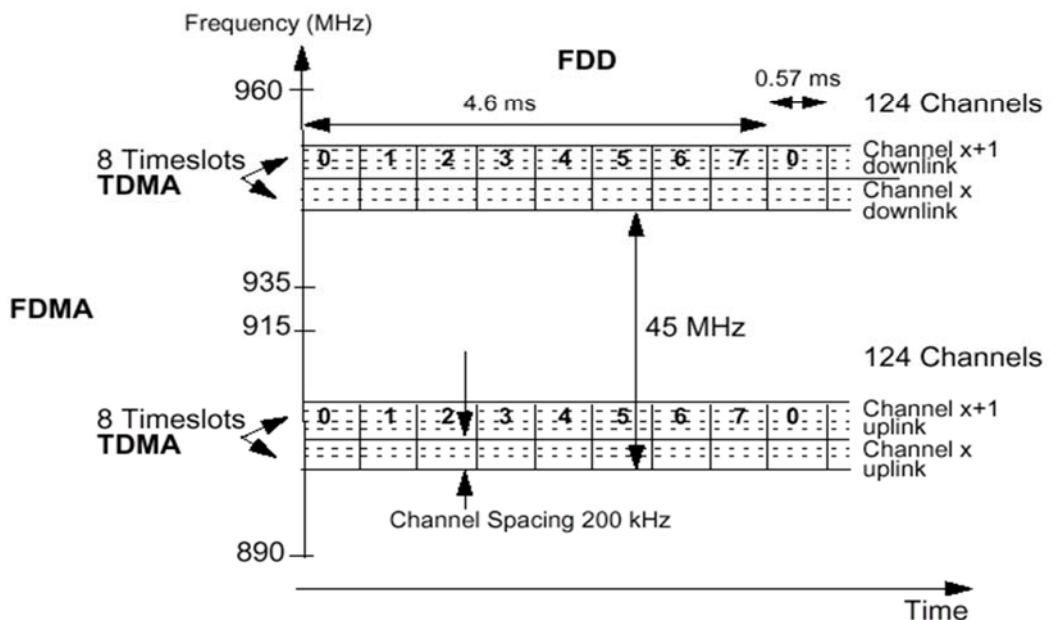
## Frequencies & Channels

### □ GSM

- 890 to 915 and 935 to 960MHz (900MHz)
- 1710 to 1785 and 1805 to 1880 (1800MHz)

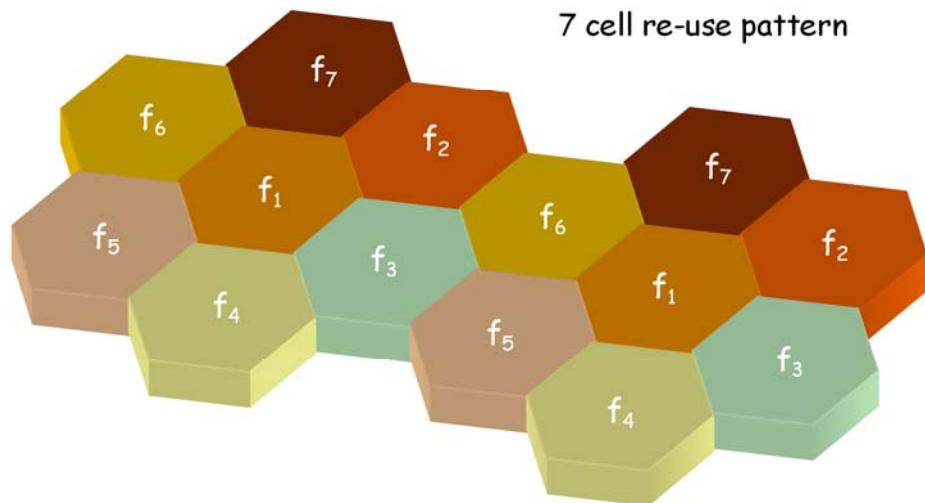


## TDMA, FDMA and FDD-GSM





## Cellular Coverage



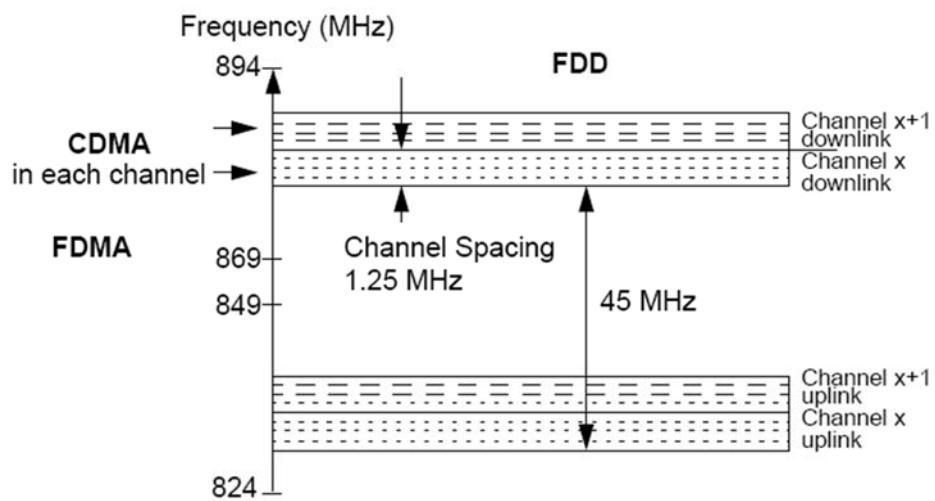
### Small cells

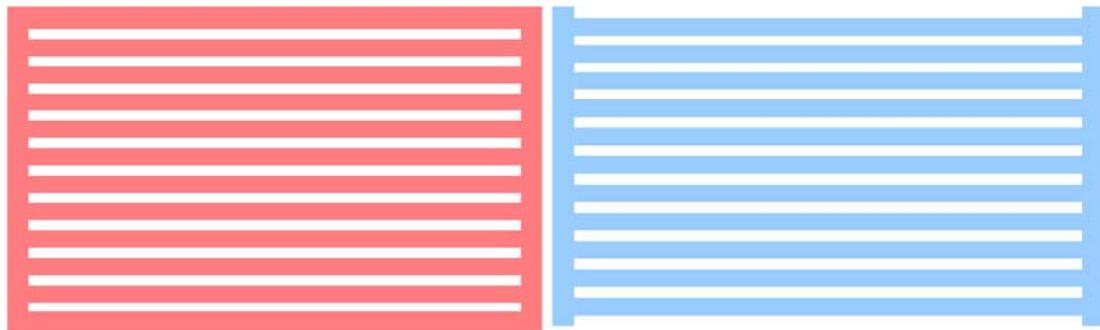
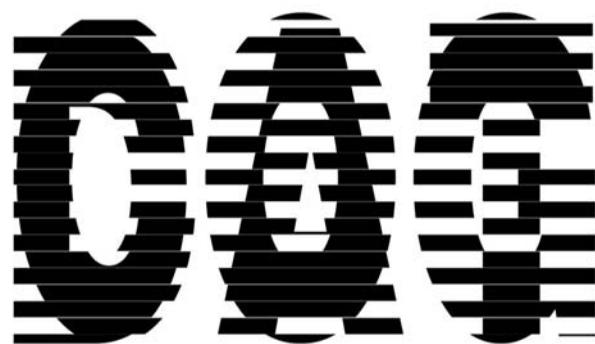
A cellular system uses many base stations with relatively small coverage area.

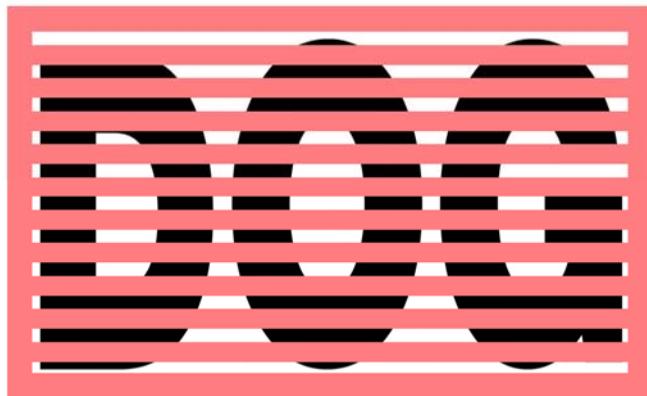
### Frequency reuse

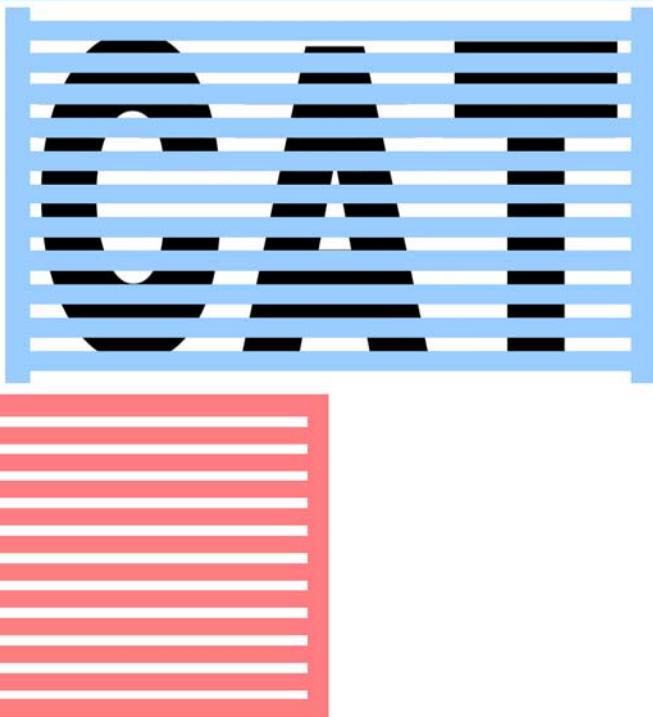
The spectrum allocated for a cellular network is limited. As a result there is a limit to the number of channels or frequencies that can be used. For this reason each frequency is used simultaneously by multiple base-mobile pairs. This frequency reuse allows a much higher subscriber density per MHz of spectrum than other systems. System capacity can be further increased by reducing the cell size (the coverage area of a single base station), down to radii as small as 200 m.

## CDMA, FDMA and FDD-CDMA

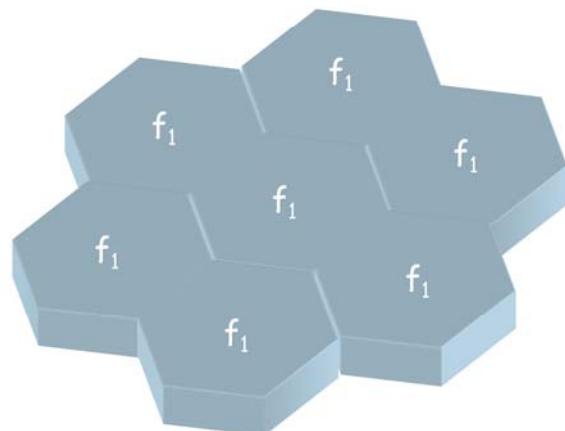




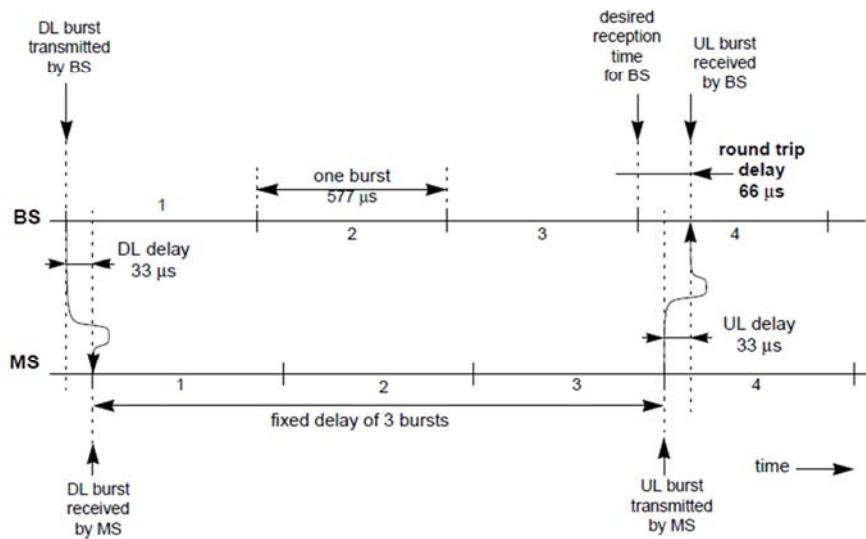




## Frequency Reuse



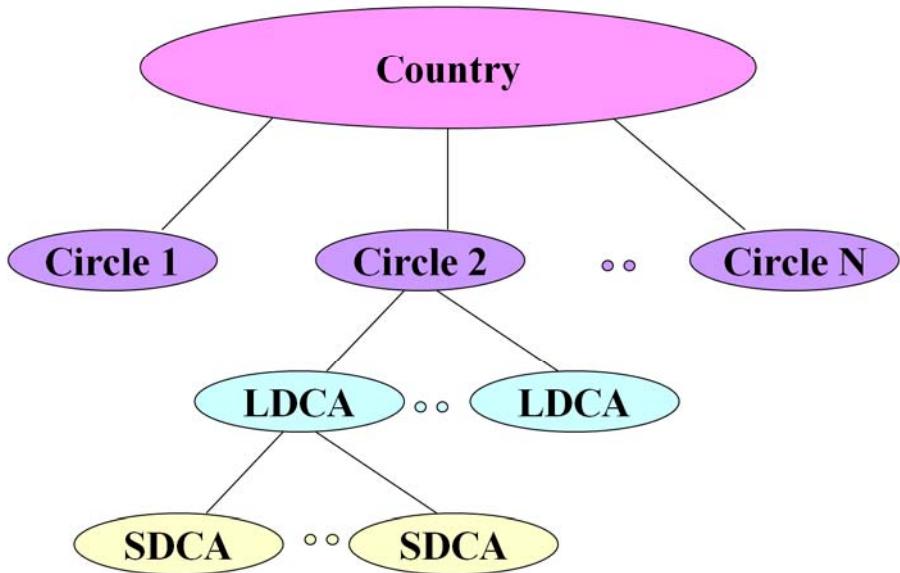
## Timing Advance



## RCom Network

---

## Geography Division

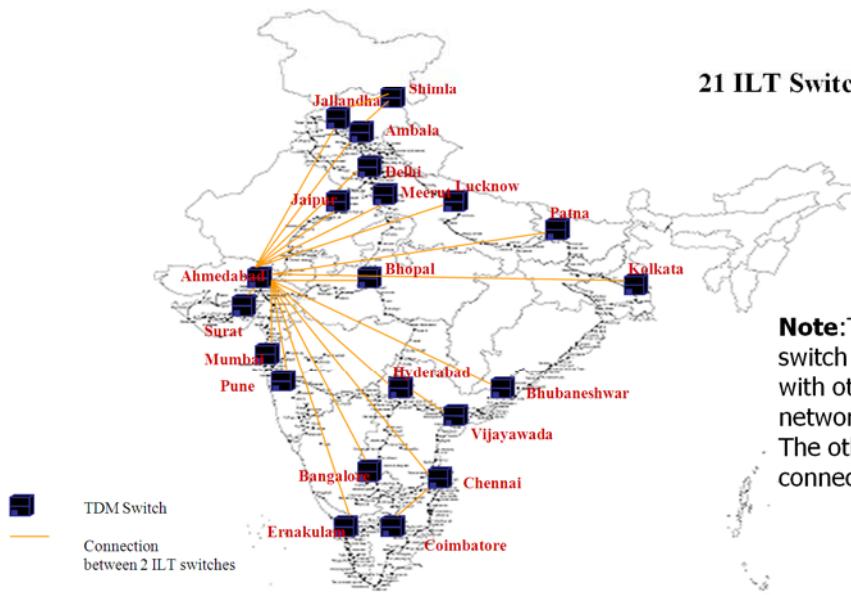


LDCA – Long Distance Calling / Charging Area.

SDCA – Short Distance Calling / Charging Area.

Whole country is divided into LDCA and SDCA, for charging functions.

## ILT Network Architecture

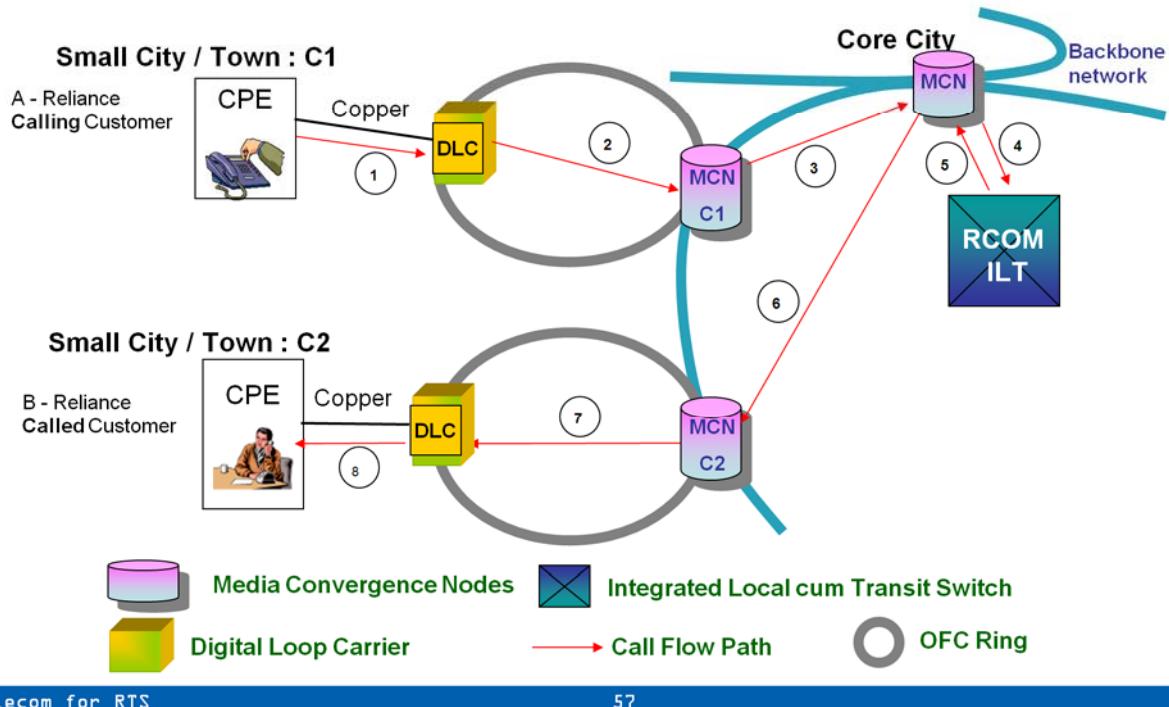


**21 ILT Switches Architecture**

**Note:** The figure shows a ILT switch at Ahmedabad connected with other 16 switches in the network.  
The other switches will be mesh connected in similar manner.

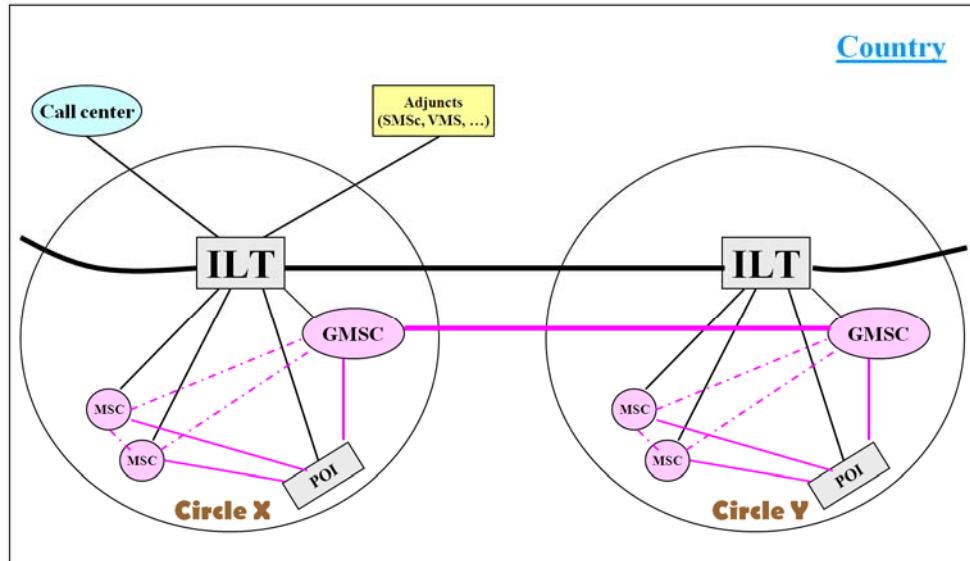
We have 21 fixed line exchange locations. National long distance calls are handled by these exchanges. All these exchanges are meshed connected to all other.

## Fixed Access



The above is an example of fixed line subscriber call flow. An ILT in a circle, is handling local calls coming in through an access network.

## Core Network



ILT carry calls from one LDCA to another. It also provides connectivity to adjunct systems e.g. SMSc, VMS, IN etc.

Point of interconnect to other operators in a circle is from ILT, MSCs & GMSCs.

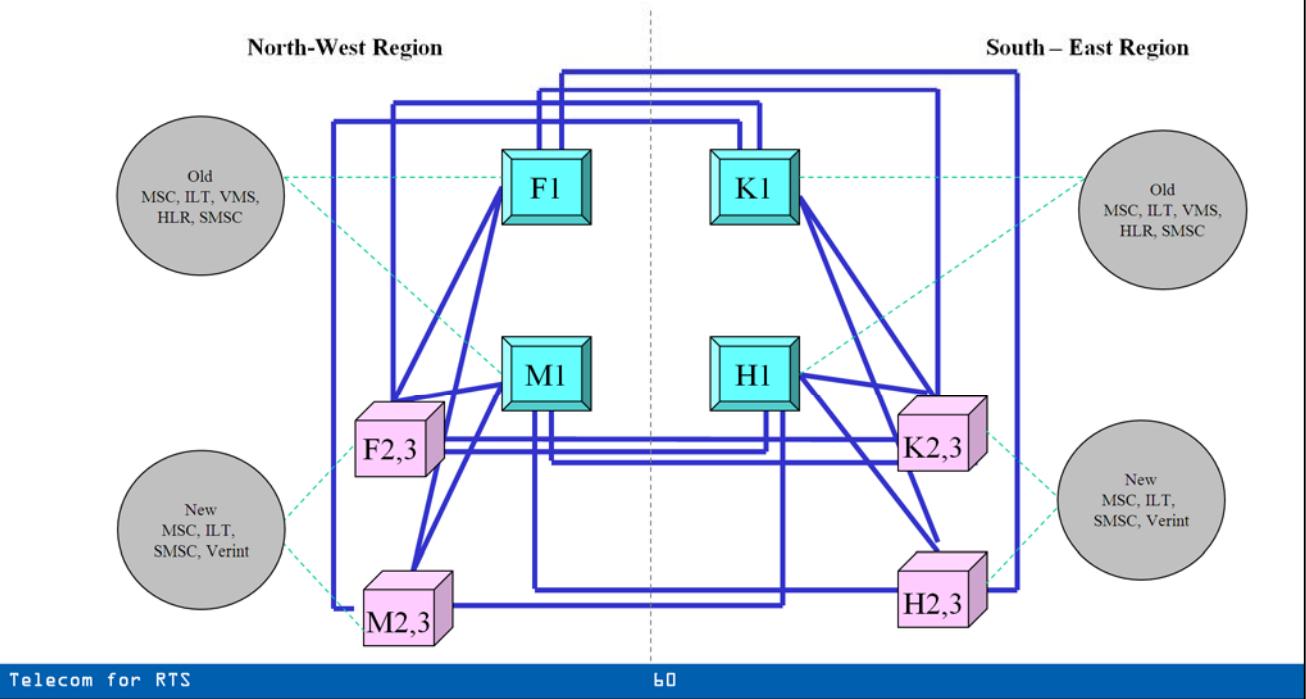
AXE switches are also put at International gateways.

## International Gateways

- ❑ Delhi.
- ❑ Kolkata.
- ❑ Chennai.
- ❑ Ernakulam.
- ❑ Mumbai.

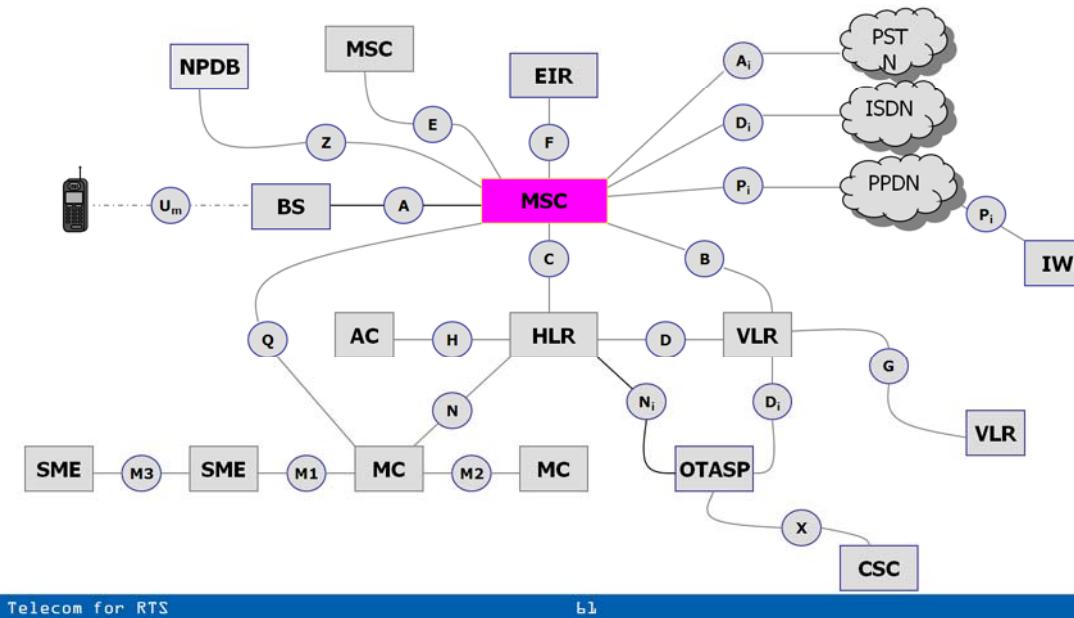
Reliance's Fixed Network consists of 21 'ILT' switches and 5 international gateways.

## Signaling Connectivity



Signaling network has a pair of Signaling Transfer Points at four locations. These locations are Mumbai, Faridabad, Calcutta, & Hyderabad. All other Signaling Points are directly connected to it for signaling exchange. Mumbai & Faridabad STPs forms a pair to load share. They are backup STP to all others. Same is true for Calcutta & Hyderabad STPs.

## MSC



Each Reliance Circle consists of one or more MSCs to serve CDMA 1X RTT BSS network.

All the MSCs of a circle are connected in Mesh and are also connected to circle GMSC, NLD carrier, ILD carrier to route bearer traffic and associated mode of SS7 for signalling.

A MSC in circle is having various PSTN (POI)/PLMN connectivity depending upon location.

Each MSC of circle is connected to centralised NMS/NOC/PMS, Regional OMC centre and have local element wise management system for operation, maintenance and performance.

Each MSC of circle is also connected to adjuncts system like CRBT/Voice Portal/IN-IVR/OTAF-IVR/VMS directly or via tandem switch for bearer traffic.

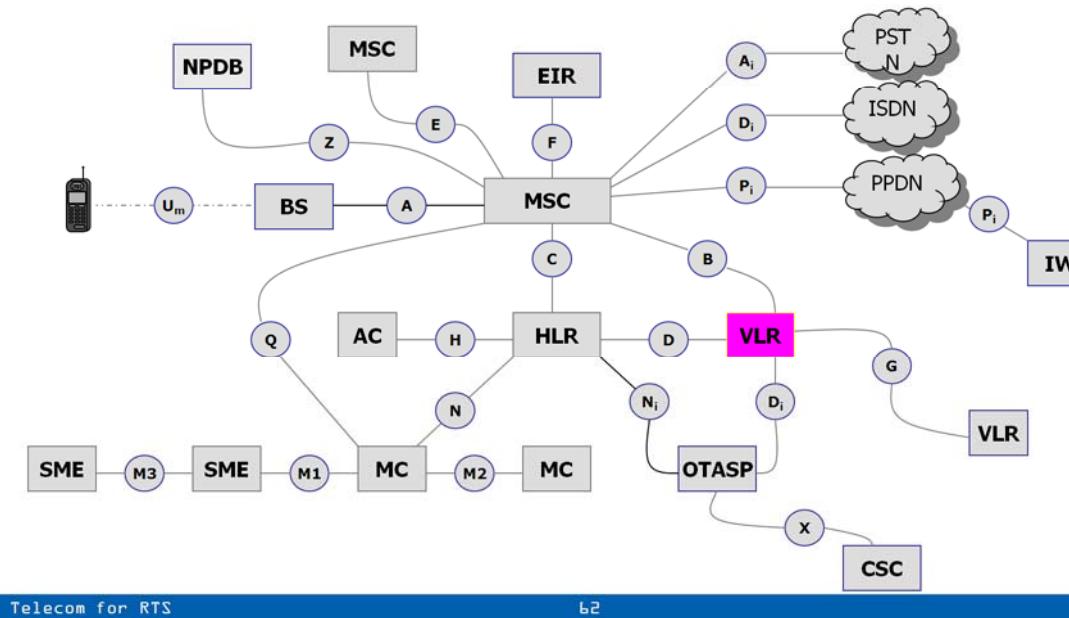
Each MSC of circle is connected to mated pair STPs over LSL SS7/HSL SS7 for signalling traffic for HLR/WIN/SMSC/OTAF/CMS/MCA.

Each MSC of circle connected to CMS (LIS) system for lawful interception call content, SMS, and call related information.

Each MSC of circle is connected to PDSN over IP (As PCF functionality is integrated with MSC in existing MSCs.) for 3G 1X data calls.

Each MSC of circle is connected to Mediation and Billing over IP for post processing of CDR.

## VLR



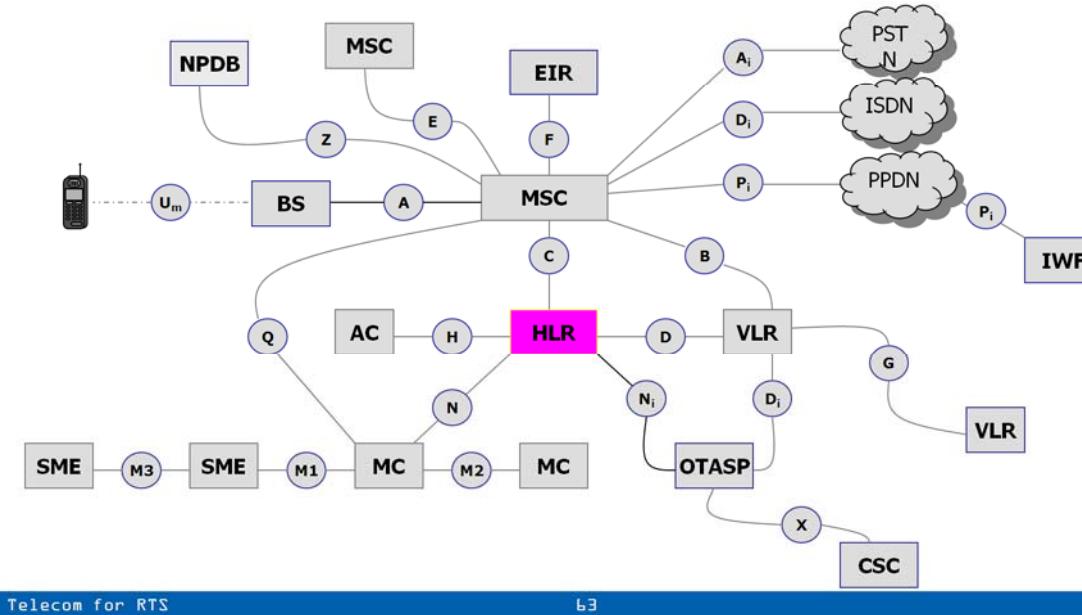
AC	Authentication center.
CSC	Customer service center.
MC	Message center.
NPDB	Number portability database.
PPDN	Public packet data network.
SME	Short message entity.

The network is compliant to CDMA 1X RTT standard. Geographically network is divided into 21 PLMN areas as per Indian National Telecom Policy and Regularity. Each circle geographically further divided into LDCA and SDCA for fixed and Limited mobility services. Limited mobility services are limited to SDCA level. Telecom services are restricted to the geography of a SDCA only for limited mobility subscriber.

Full mobility services are seamlessly available across a circle where as outside a circle (another circle) services are treated as "Roaming services". For full mobility subscriber, Handoff of call is not allowed at geographical boundaries of two adjacent circles.

Reliance Circle consists of one or more MSCs to serve CDMA 1X RTT BSS network. One or more than one GMSC are there in circle where three or more than three MSCs are present. GMSC is primarily used as gateway for intra circle PSTN/PLMN calls and inter circle Reliance-to-Reliance calls.

## HLR



The HLR is of "STAND-ALONE" (SHLR) nature. SHLRs are located at four regional places with mated pair capability. The regions are East, West, North and south and locations are Kolkatta, Mumbai, Faridabad and Hyderabad respectively.

North-West regions SHLRs are mated pair and South-East region SHLRs are mated pair to provide the geographical and equipment level redundancy.

SHLRs are collocated with mated pair STPs. Each SHLR of a region is connected to each member of mated pair STP. In normal operation a SHLR receives/sends load balanced signalling traffic from/to mated pair STPs.

Each MSC/GMSC and WIN are connected to SHLR via STP for SS7 signalling using LSL/HSL over E1/IP (SIGTRAN)/ATM.

Each SHLR is connected to centralised NMS/NOC/PMS, Regional OMC centre and having local element wise management system for operation, maintenance and performance.

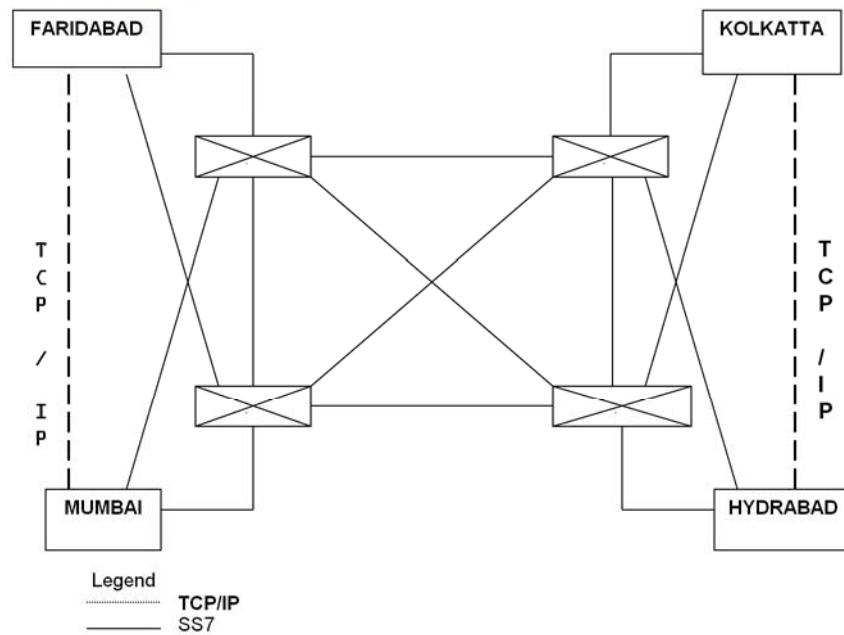
Each SHLR is connected to OSS for provisioning and operation support via DCN network.

The capacity of the each SHLR is such that it shall support it's own requirement and the (full) requirement of the its Mated Pair at any time. In "normal" course, however, these "mated pairs" are working in "load sharing" mode – each catering to the requirements of its own region.

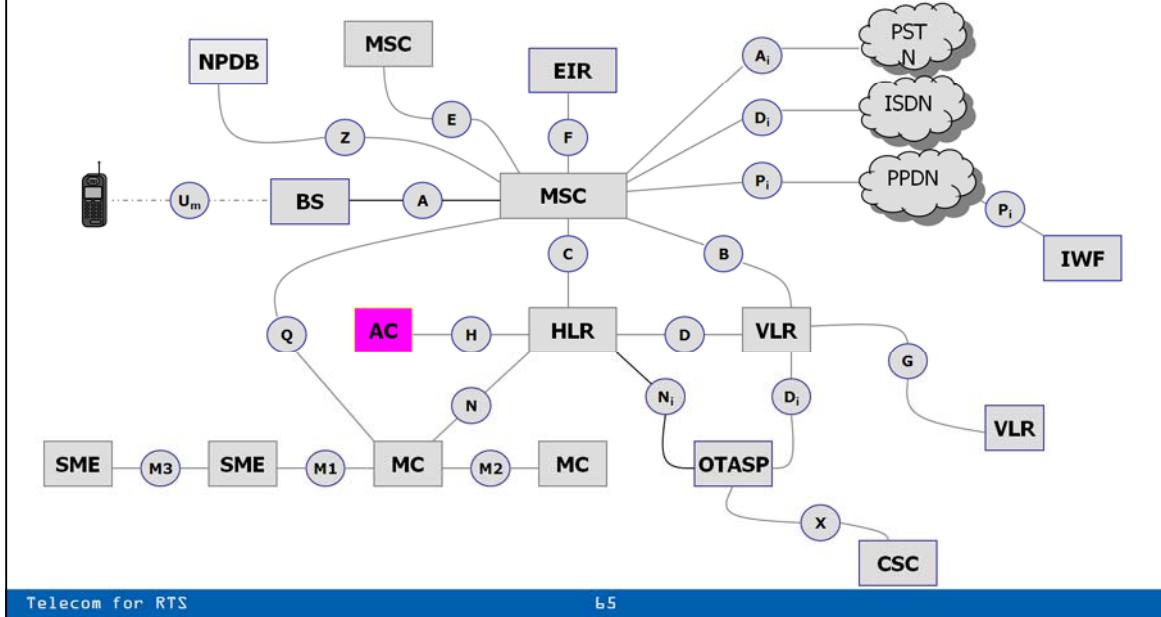
This redundant-duplicated architecture is supporting seamless automatic changeover to the standby (Mated) unit. The "Synchronisation" of data between the "Mated Pairs" is near real time using redundant "replication link" over IP.

There are two types of SHLRs exist in Reliance Network, the Full mobility SHLR and Limited Mobility SHLR. Full mobility SHLRs are serving full mobility services and Limited mobility SHLRs are serving limited mobility services.

## HLR Architecture



## AuC

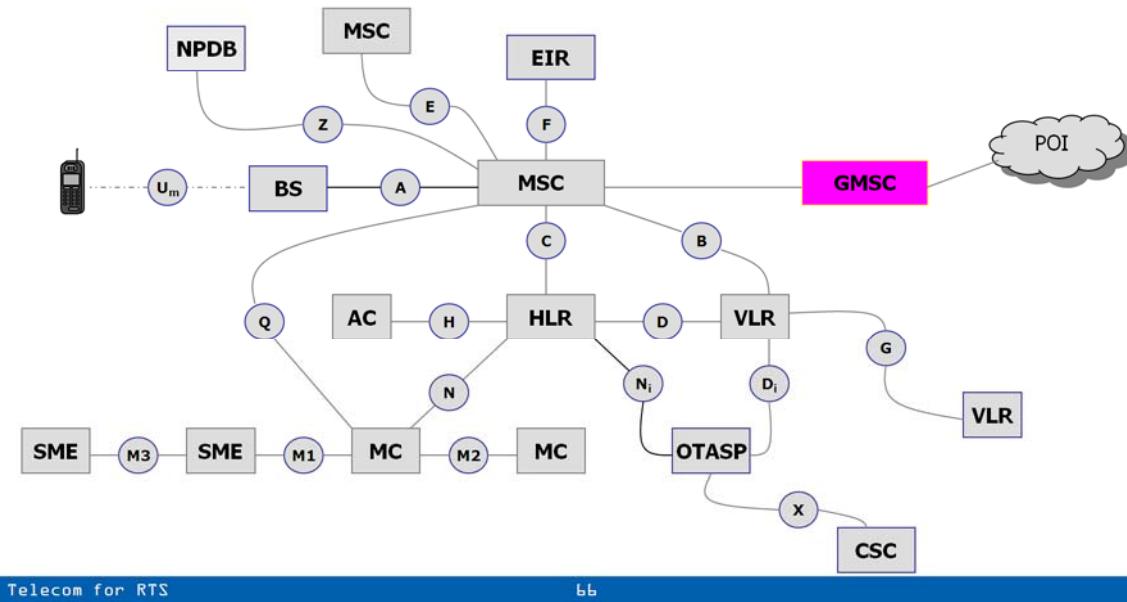


Authentication is needed to protect against fraudulent access in mobile network. If authentication feature is enabled then a mobile is first has to complete authorization process before accessing the services.

Authentication keys are kept secret and never transmitted over air.

Authentication can be invoked by Registration / Call origination / Call termination.

## GMSC



One or more than one GMSC are there in circle where three or more than three MSCs are present. GMSC is primarily used as gateway/tandem for intra circle PSTN/PLMN calls and inter circle Reliance-to-Reliance calls.

All the GMSCs in network are connected in mesh architecture to carry inter circle traffic within Reliance network. GMSC is connected to PSTN/other operator within PLMN/Circle. GMSC is also connected to all other MSCs of circle, NLD carriers and ILD carriers.

GMSC of a circle acts as Gateway MSC for traffic from circle PSTN/PLMN, NLD carrier, ILD carrier and other circle GMSC; it interrogates the SHLR and route the call to the MSC on the basis wireless subscriber/phone location.

GMSC of a circle acts as tandem switch for traffic from other MSC of circle and route the calls to PSTN/PLMN, NLD carrier, ILD carrier and other circle GMSCs.

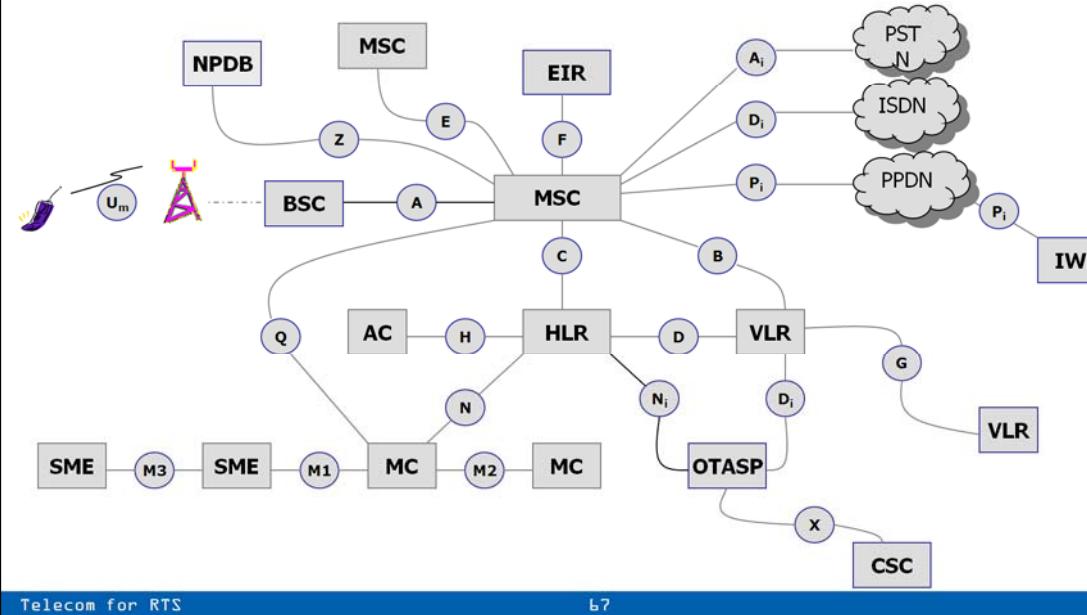
GMSC is also connected to CRBT/Voice Portal/IN-IVR for adjuncts traffic.

Each GMSC is connected to mate pair STP for SS7 signalling using LSL/HSL over E1/ATM towards SHLR/WIN.

Each GMSC is connected to centralise NMS/NOC/PMS, Regional OMC centre and having local element wise management system for operation, maintenance and performance.

Each GMSC is connected to Mediation and Billing over IP for post processing of CDR.

## BTS

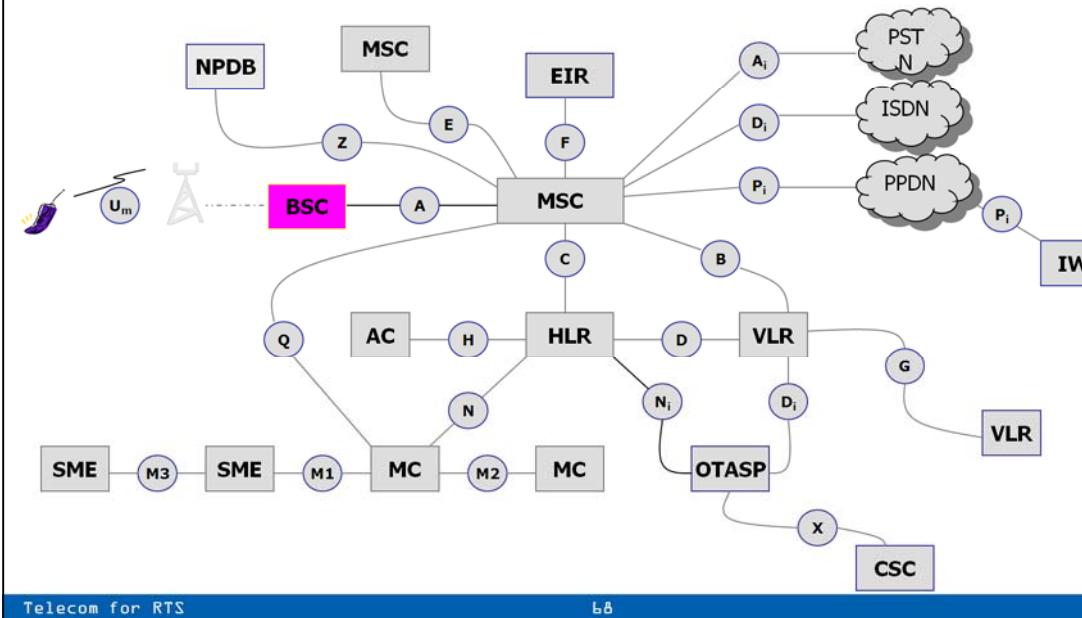


BTS is used to provide CDMA 1X/EVDO coverage and capacity to a geographical area depending upon location, traffic and requirement. BTS is connected to BSC for bearer and signalling over E1.

BTS is having multiple sector/carrier combination.

The BTS shall be capable of supporting minimum of 4 Carrier/ 3 sectors connectivity with BSC over E1, IP over E1 and over IP only. Further, it is preferable that it shall require a maximum of only one cross-polarised antenna per sector.

## BSC/RNC



Present network of Reliance consists of different type of BSCs integrated with MSC, standalone/remote and integrated with BTS. All the BTSSs are directly connected to BSC for bearer and signalling traffic.

A BSC/RNC supports partial, one or more than one circle that comprise of multiple City/Town/SDCA's / LDCAs. In circles, where more than one BSCs/RNCs are needed, it is necessary that multiple BSCs/RNCs must be inter connected to handle the soft handoff functions as per standard IOS interface/protocol.

BSCs/RNC's are co-located with their MGW or geographically remotely located. BSCs have capability to interface with MGW over various transports like IP/ATM/TDM as per IOS for bearer traffic.

BSC/RNC has capability to interface with Softswitch as per IOS for signalling and control.

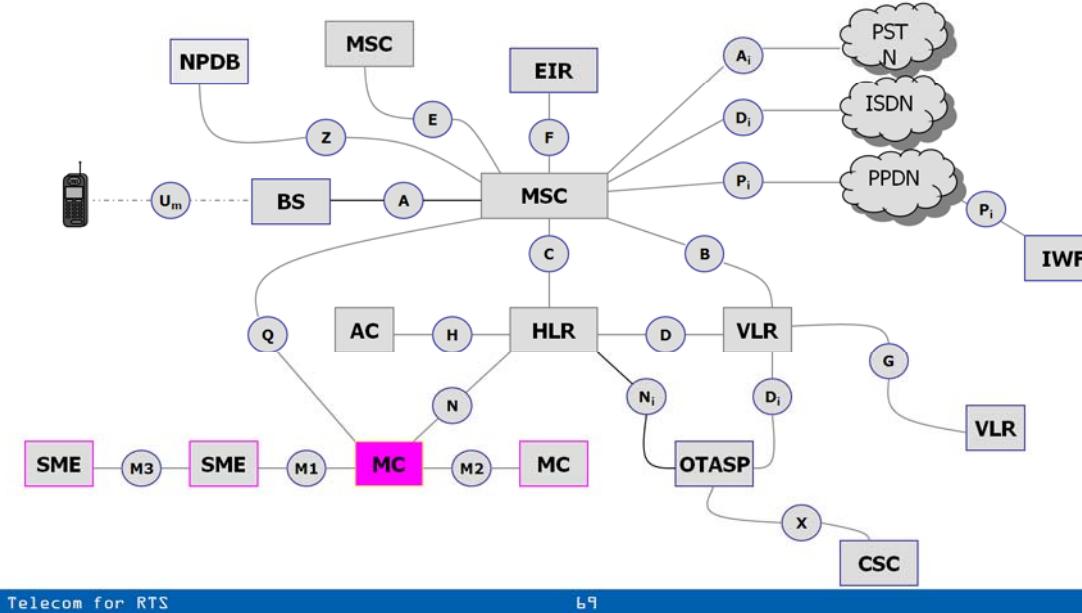
BSC/RNC has capability to interface with multiple softswitch using "Softswitch pooling" or "Softswitch cluster" feature/concept.

BSC/RNC's are connected to one or more Packet Data Serving Nodes (PDSN) over IP for 3G1X/EVDO calls.

The BSC/RNC supports Multiple BTS/Sector configuration in direct, cascade and ring/loop architecture over IP/TDM/ATM with fibre/MW/Satellite backhaul.

BSC/RNC connected to centralise NMS/NOC/PMS, Regional OMC centre and having local element wise management system for operation, maintenance and performance.

## SMSc



The SMS solution is implemented on a National basis. There are set of SMS-C placed at locations (Mumbai and Hyderabad), which is serving the requirements of all the subscribers spread over 20 circles.

These SMS-C are configured and engineered to work on load sharing basis in normal operation and redundant in case of failure of either SMS-C.

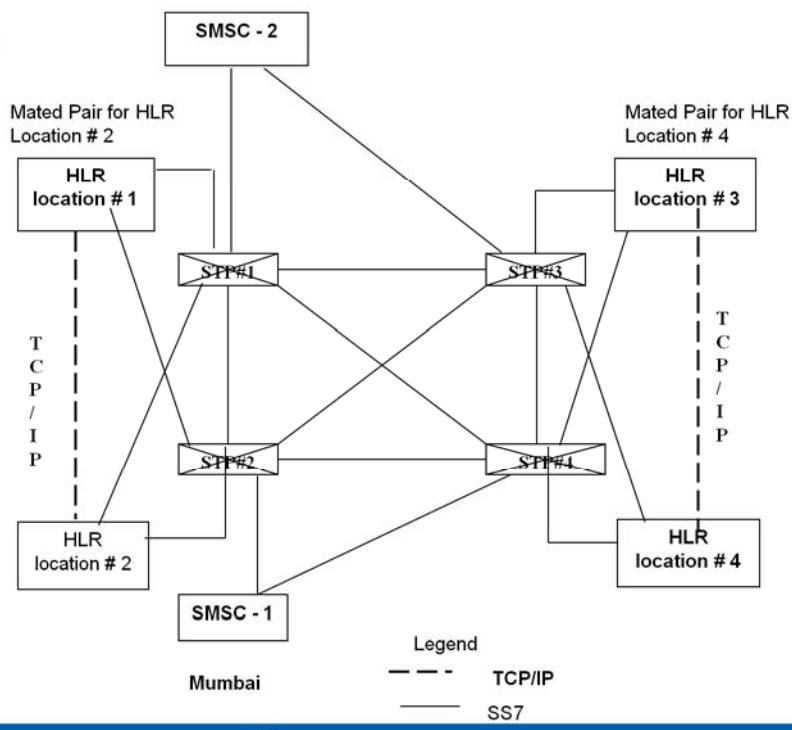
The SMSCs are interfaced to the CDMA & GSM MSCs through mated pair STPs for SS7 signalling.

The SMSCs are interfaced to application servers/RAP/WAP gateways/Email-SMS gateway/Voice mail/IN/Billing/Real time charging gateways and other ESMEs using SMPP over TCP/IP.

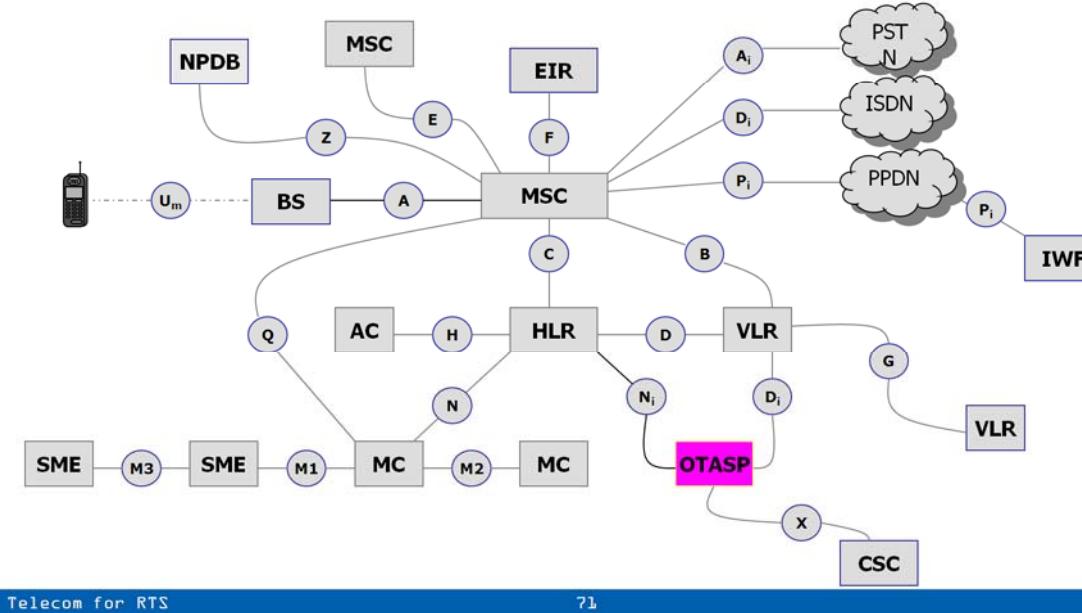
Each SMSC system is connected to centralised NMS/NOC/PMS, and having local element wise management system for operation, maintenance and performance.

Each SMSC is connected to OSS for provisioning and operation support via DCN network.

## Reliance SMSc



## OTAF

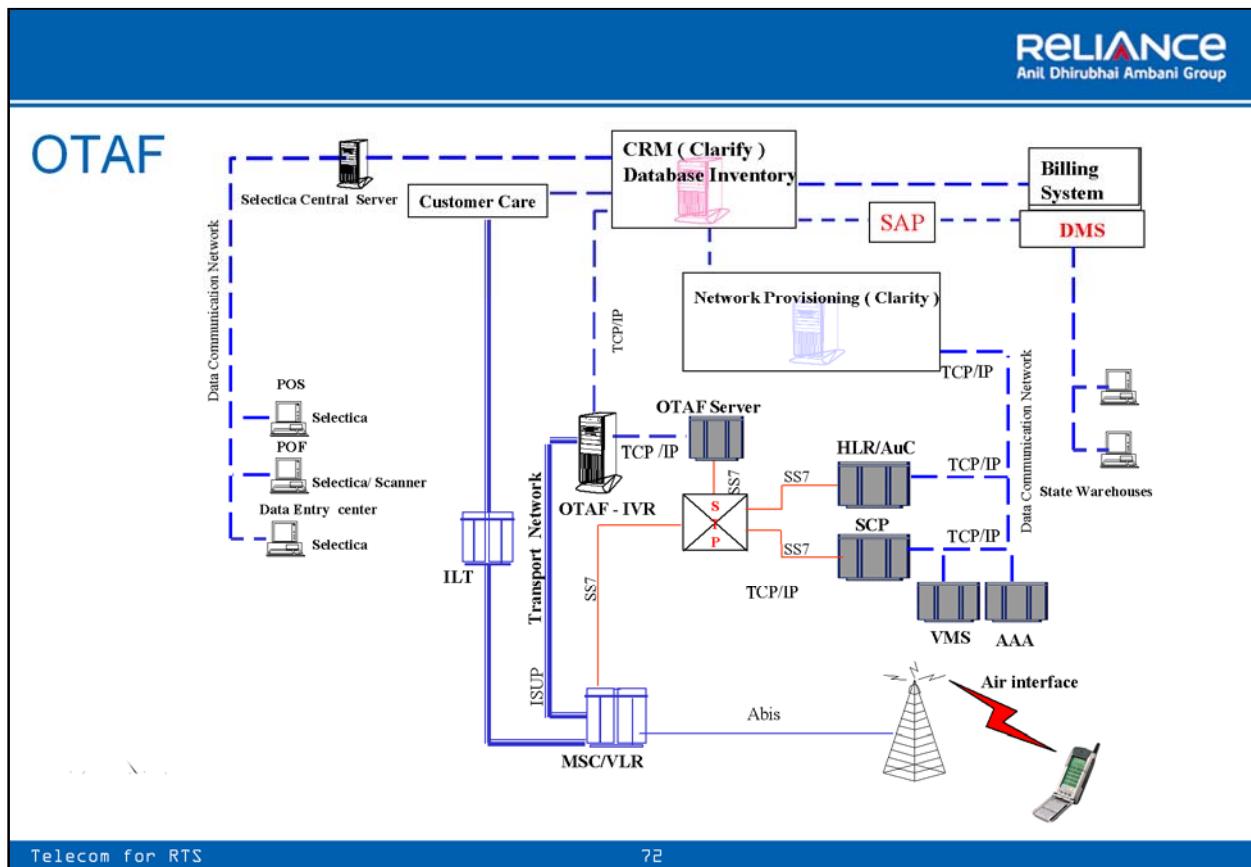


There is a common OTAF (OTASP/OTAP) platform placed at a Central location (Mumbai) which is serving the provisioning requirements of all the subscribers spread over all circles. There is also an OTAF platform at Bangalore.

Each OTAF system is connected to centralised NMS/NOC/PMS, and having local element wise management system for operation, maintenance and performance.

All MSC are connected to OTAF-IVR/OTAF via GMSC/ILT OTAF calls.

OTAF system is connected to OSS/BSS/DSS for provisioning and operation support via DCN network.

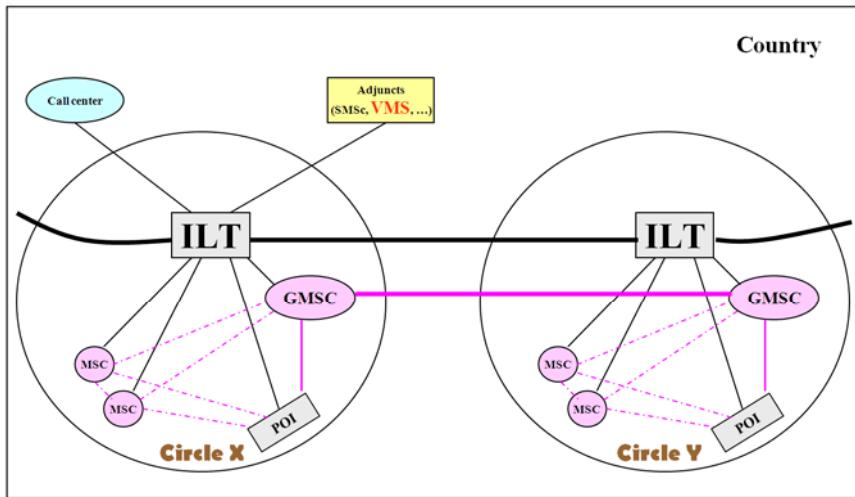


The CDMA system requires the handset to be provisioned.

The terminal is provisioned with Number Assignment Module (NAM). The NAM consists of MIN (Mobile Identification Number) allotted to the Reliance subscriber and other parameters, which enables the handset to work satisfactorily in the Reliance Network.

The handset manufacturers would program Reliance specific Preferred Roaming List (PRL) in the handsets. PRL mainly consists of the SID (System Identification) of Reliance and the channels allotted to Reliance to enable the handset for system acquisition.

## VMS



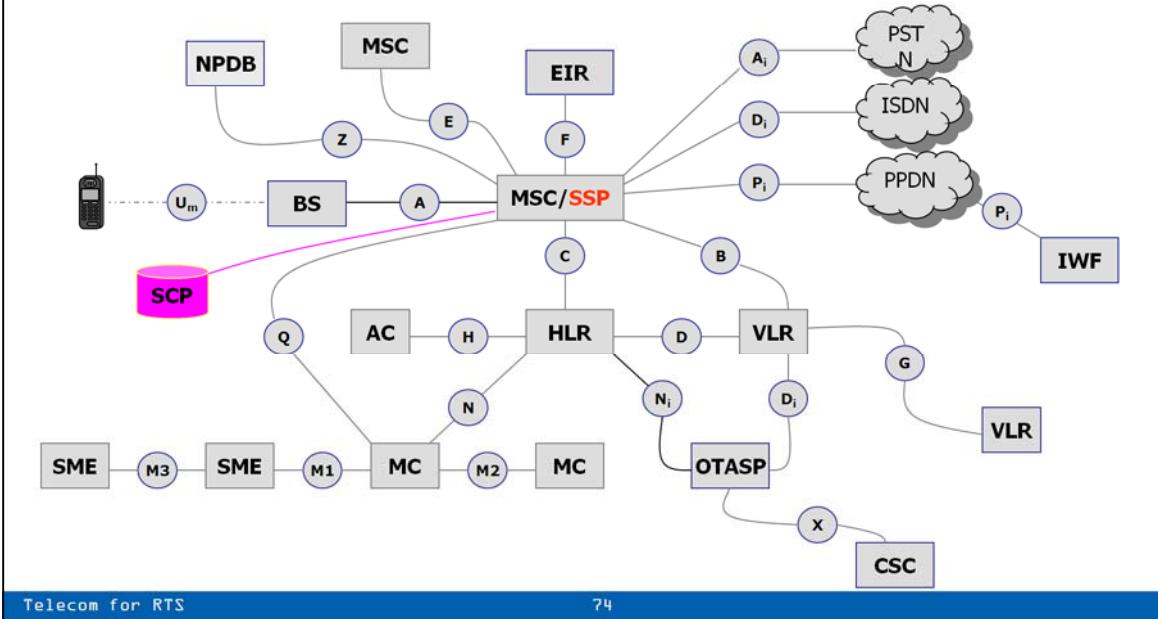
The Voice Messaging solution (VMS) is implemented on a Centralized basis with two locations Mumbai and Bangalore.

All MSCs/GMSC are connected to VMS via ILT (Integrated Local cum Tandem/TAX switch) for forwarded calls and voice mail retrieval.

Each VMS system is connected to centralised NMS/NOC/PMS, and having local element wise management system for operation, maintenance and performance.

Each VMS is connected to OSS for provisioning and operation support via DCN network.

IN



"Intelligent Network (IN)" infrastructure is located at centralized locations Mumbai and Bangalore. There are various services offered by IN system i.e. Prepaid mobile, Prepaid FWT/FWP/PCO with 16 KHz METERING Pulses, Cell Locking, location based services, VPN etc.

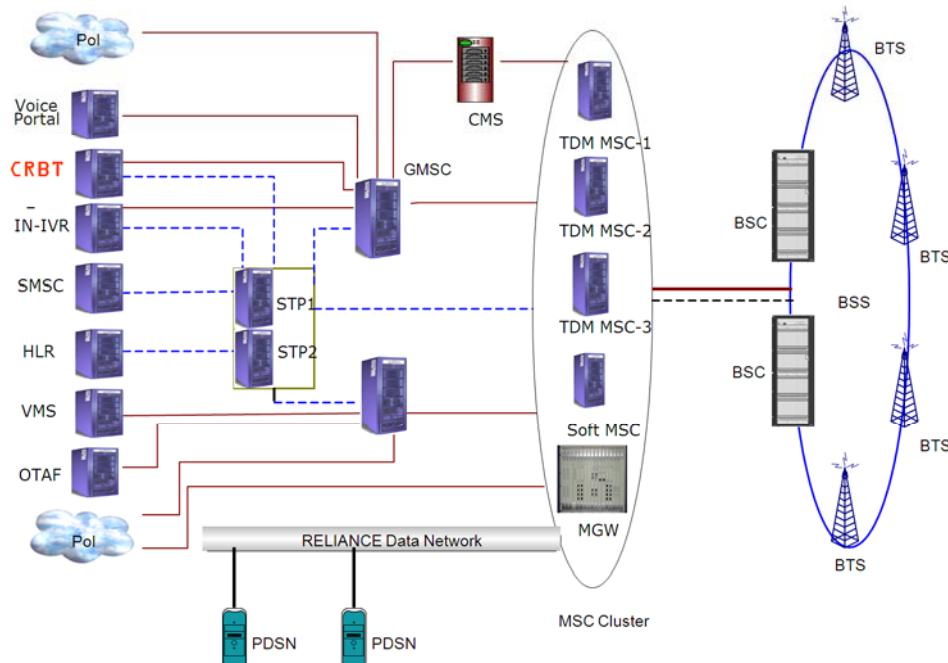
The Intelligent Peripheral (IP) /Specialised Resources Functions (SRF) equipment is co-located with present IN system and in future it can be distributed depending upon architecture requirement.

All MSCs/GMSC are connected to IN system via mated pair STP of their region for WIN signalling over E1, in future WIN signalling shall be transported over IP using SIGTRAN.

Each IN system is connected to centralised NMS/NOC/PMS, and having local element wise management system for operation, maintenance and performance.

Each IN system is connected to OSS/BSS/DSS for provisioning and operation support via DCN network.

## CRBT



CRBT system is used to provide the Caller ring back tone on mobile termination calls as subscriber's choice and subscription.

CRBT system is implemented on regional basis, presently it is located at Mumbai and Bangalore. Mumbai system is serving the North-West region and Bangalore system is serving South-East region. In future it will be expanded to multiple locations depending upon growth and architecture.

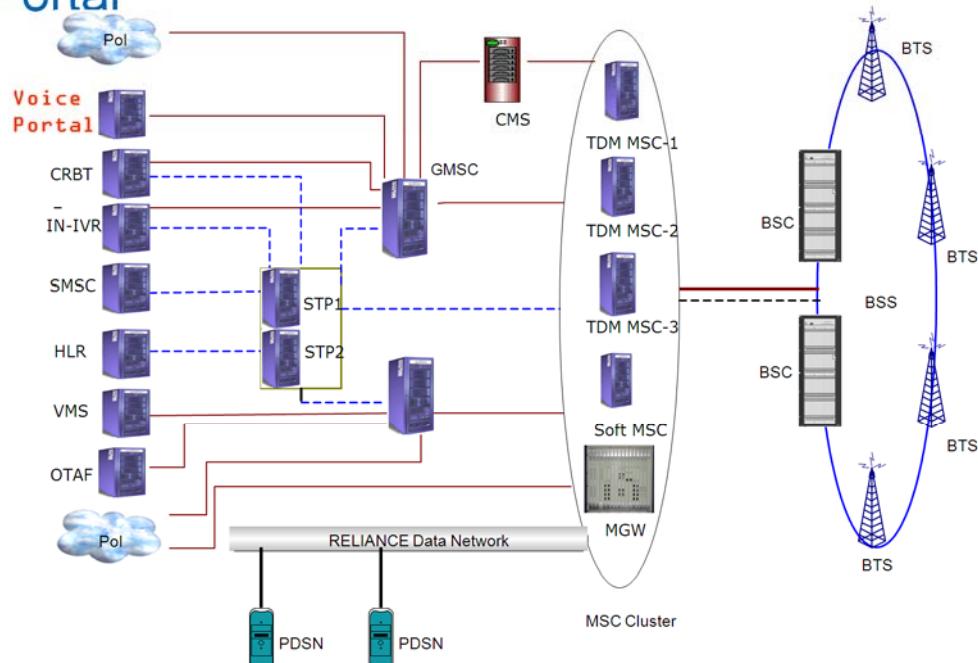
All MSCs and GMSCs are connected to respective region CRBT system over E1; where as signalling is through STP.

CRBT system is connected to centralised NMS/NOC/PMS, and having local element wise management system for operation, maintenance and performance.

CRBT system is connected to OSS/BSS/DSS for provisioning and operation support via DCN network.

CRBT system is connected to packet data network content provisioning and downloading via RDN network.

## Voice Portal



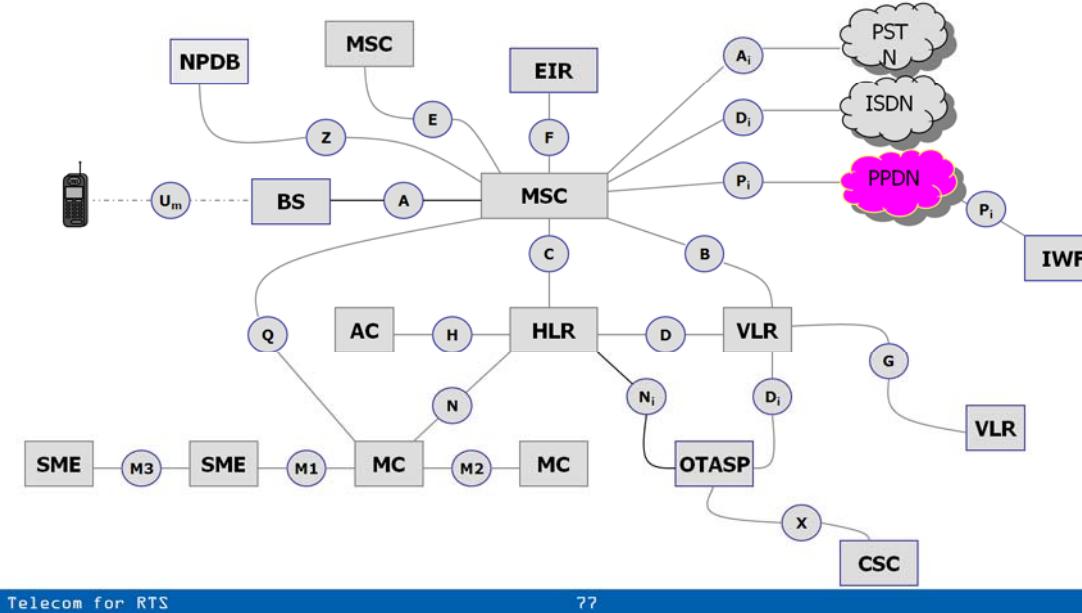
Telecom for RTS

76

Voice portal is a voice activated value added service. Reliance network consists of voice portal system, which is implemented on regional basis at two locations. For North-West region voice portal system is located at Mumbai and for South-East region voice portal system is located at Kolkata.

All the MSCs are connected to voice portal system via GMSCs and SS7 signalling is also through the GMSC in associated mode.

## PDN



The Packet Data network consists of all the necessary elements (such as PDSN/FA, HA, AAA servers etc) placed at two locations for load sharing in normal operation and redundant in case of failure of one the Node.

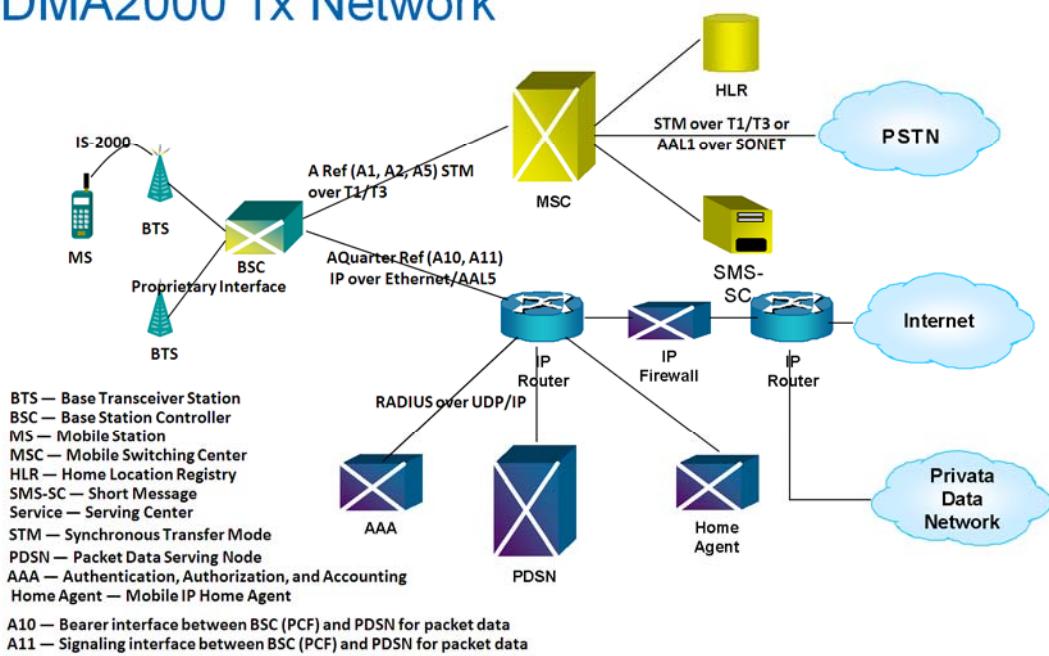
Both the packet data nodes are interconnected to each other over Reliance's managed IP network, and provide access to the customers to any of the subscribers in the region served, and offer services to other regions whenever one Packet Data solution for the other region is unavailable.

The packet data solution is interfaced to the Reliance's Application Platform (RAP), over IP network. The packet data network provides private network access as well as Internet access, and appropriate interfaces are provided on the offered platform.

The Packet Data network is having the AAA server and it's OMC behind the firewall, and such protection is provided that will prevent any unauthorised / undesirable access or flooding attempts from any mobile or landline nodes.

All the BSC/RNC are connected to the PDSN over IP. The system provides access to Internet and private/corporate networks.

## CDMA2000 1x Network

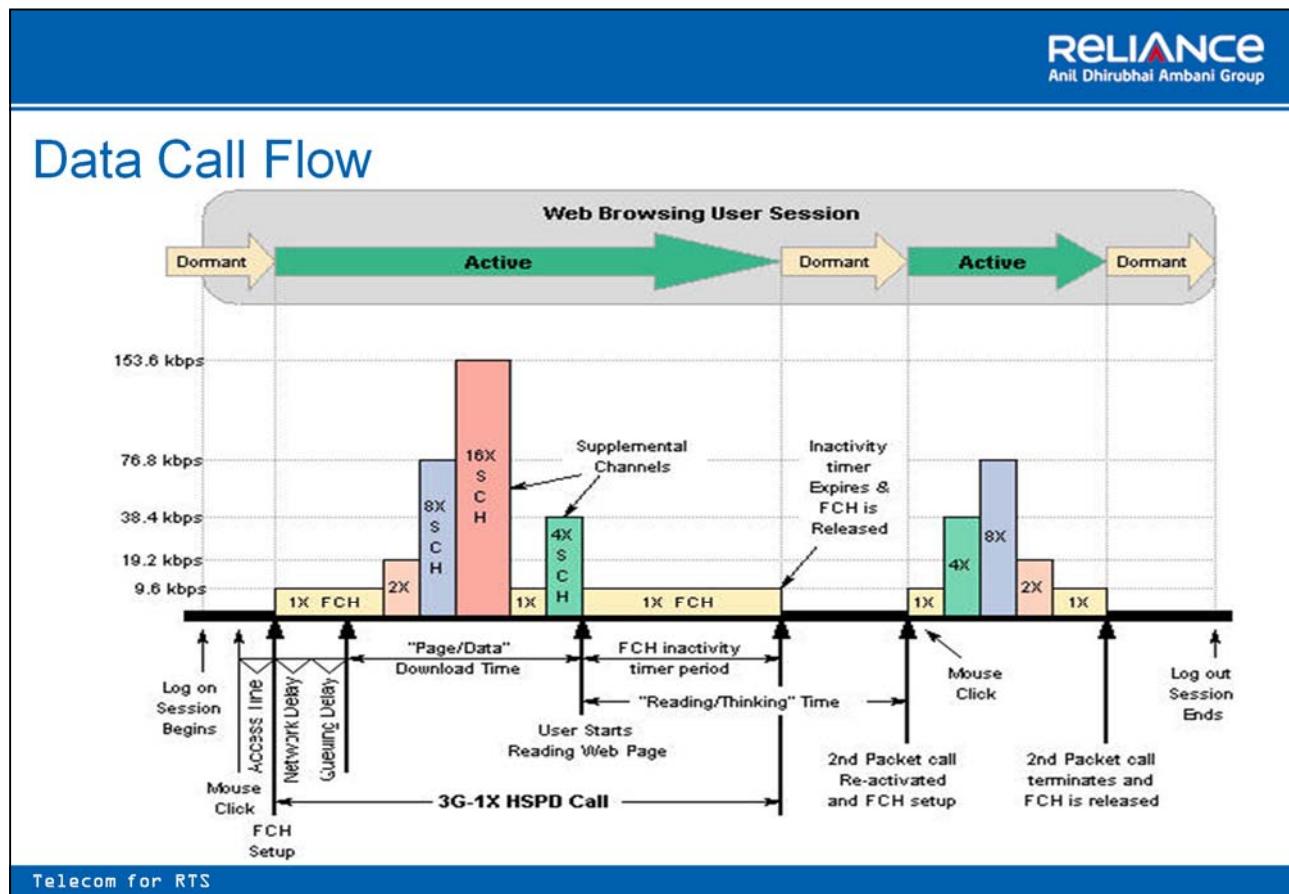


## Packet Data Serving Node (PDSN)

- ❑ Establish, maintain, and terminate PPP sessions with mobile station
- ❑ Support simple and mobile IP services
  - Act as mobile IP Foreign Agent for visiting mobile station
- ❑ Handle authentication, authorization, and accounting (AAA) for mobile station
  - Uses RADIUS protocol
- ❑ Route packets between mobile stations and external packet data networks
- ❑ Collect usage data and forward to AAA server

## AAA Server and Home Agent

- ❑ AAA server
  - Authentication: PPP and mobile IP connections
  - Authorization: service profile and security key distribution and management
  - Accounting: usage data for billing
- ❑ Mobile IP Home Agent
  - Track location of mobile IP subscribers when they move from one network to another
  - Receive packets on behalf of the mobile node when node is attached to a foreign network and deliver packets to mobile's current point of attachment



The forward traffic code channels are used to transmit user data and signaling information. The Forward Traffic Code Channels are separated by their unique Walsh code assignments. Once the mobile is assigned a Walsh code in an omni cell (or sector), the code cannot be assigned to any other mobile in that omni cell (or sector) for the entire duration of the call. A Forward Traffic Channel can be comprised of a Fundamental Code Channel and Supplemental Code Channels.

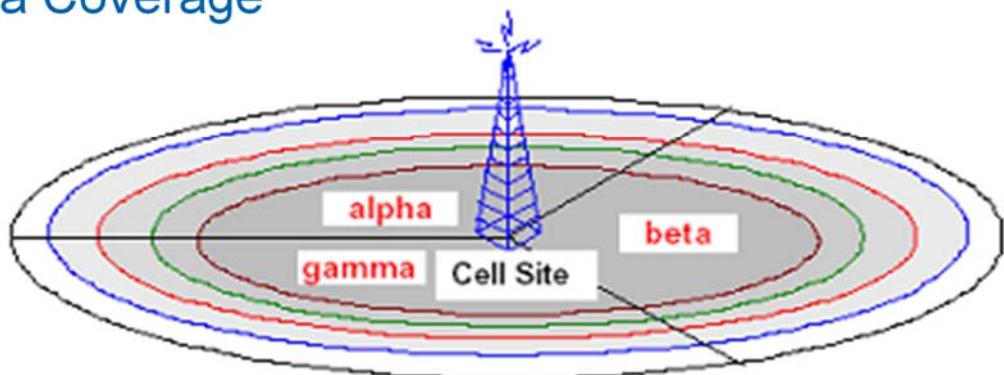
### The Fundamental Code Channel

The Fundamental Forward Code Channel is used to transmit user data, signaling, and the power control sub-channel.

### The Supplemental Code Channel

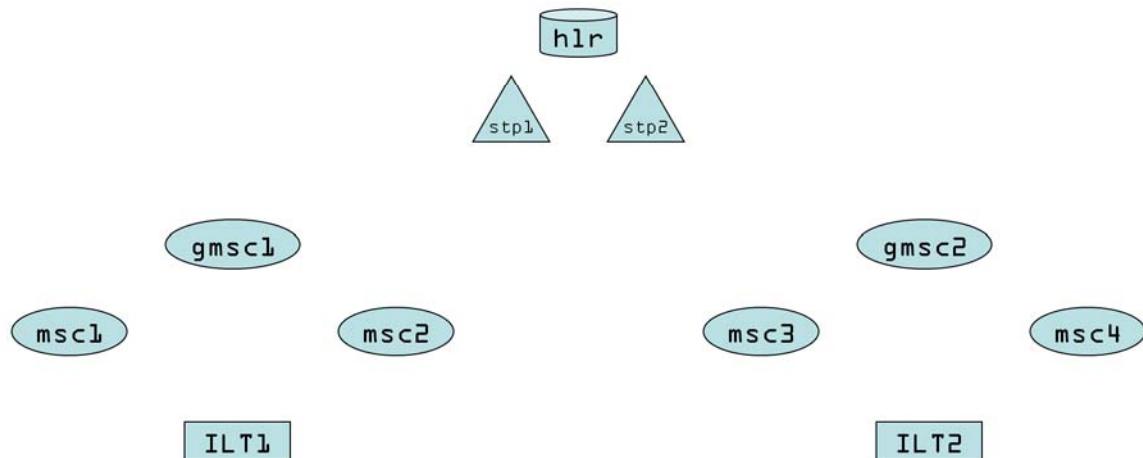
Supplemental Code Channels may be used to provide the subscriber with a high speed data capability. The bit rate of a single Fundamental Code Channel is limited by the Rate Set frame formats. A Forward Traffic Channel may include several Supplemental Channels to provide the required bit rate. Each Supplemental Code Channel requires an additional unique Walsh Code assignment. The Supplemental Code Channels always transmit at the maximum rate for the rate set in use and do not carry any signaling or power control sub-channel information. Supplemental Code Channels are a TIA/EIA-95 capability and are not defined in IS-95A.

## Data Coverage



- |  |   |
|--|---|
|  | → 9.6 kbps Fundamental Voice or Data Coverage |
|  | → 19.2 kbps Supplemental Coverage             |
|  | → 38.4 kbps Supplemental Coverage             |
|  | → 76.8 kbps Supplemental Coverage             |
|  | → 153.6 kbps Supplemental Coverage            |

## Call flow



## Introduction to Services

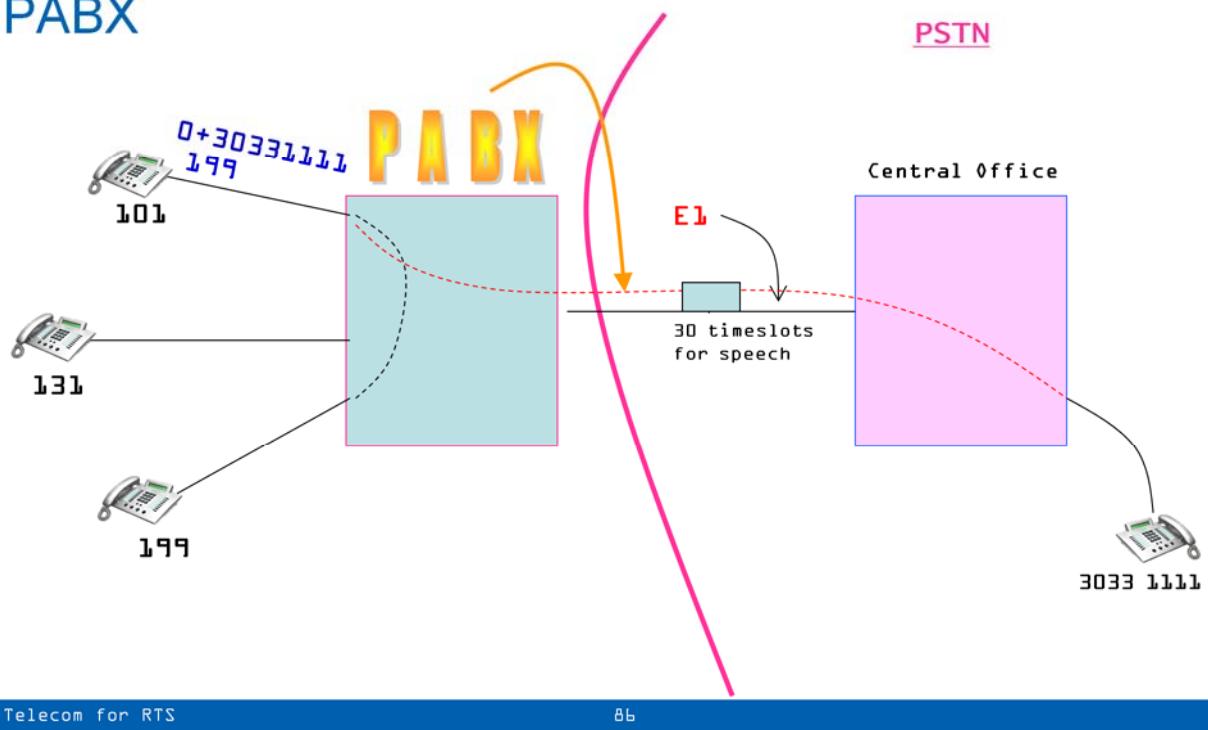
---

## Wireline DLC Application

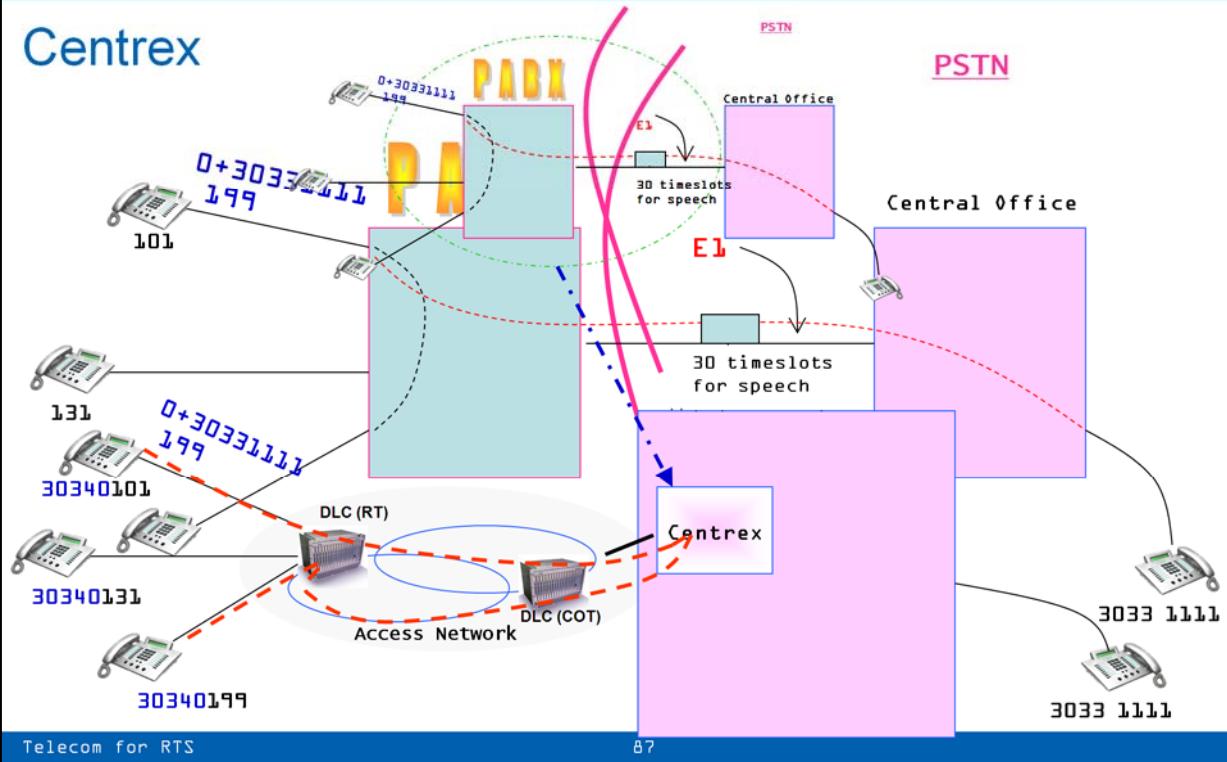
- ❑ Traditional Voice and data applications.
  - 2 wire PSTN/payphone.
  - ISDN - BRI ( 2B + D ).
- ❑ High Speed Internet, Data and Leased Lines.
  - E1,G.703 supporting Leased Line and ISDN PRI.
  - IP-ADSL providing broadband services.
- ❑ Narrowband Data and Leased Lines.

Digital loop carriers (DLC) are the access equipment, through which subscribers are connected. DLC can provide connectivity for normal 2 wire POTS line, digital lines or ADSL lines.

## PABX



## Centrex



## What is E1 DID Service

- ❑ E1 PRI is a Digital Trunk solution of 2 Mbps capacity
- ❑ It provides 30 digital channels over 4-wire system
- ❑ E1 PRI requires to be terminated in PABX on a PRI card at customer end
- ❑ Each channel can be configured as incoming, outgoing or bothway

PRI interface is used to connect a PABX. Physical media is E1 and signaling is PRI. It offers 30 B channels i.e. Bearer channels. Also a D-channel is provided for signaling. D-channel goes in timeslot 16.

R2MFC is another option to interface PABX. This is an old type of signaling. It also offers 30 speech channel plus a signaling channel.

Take care DID is a service which is provided through either PRI or R2MFC interface.

## Smart PRI

- Reliance introduced an advanced variant of E1 PRI called as Smart PRI. It offers following features.
  - Extension wise billing.
  - One office or One Office Duo products.
  - Authorization code for long distance calls.

Key benefits of Smart PRI include:

### **Networking Offices across the country**

Integrates multiple EPABXs across locations, thus building a company-wide national 'Private Telephony Network' enabling the users to call each other by dialling short digit extension numbers instead of long numbers.

### **Linewise Billing**

Smart PRI, provides extension-wise bill for each DID number and eliminates the need for additional investment in PBX billing software & PC.

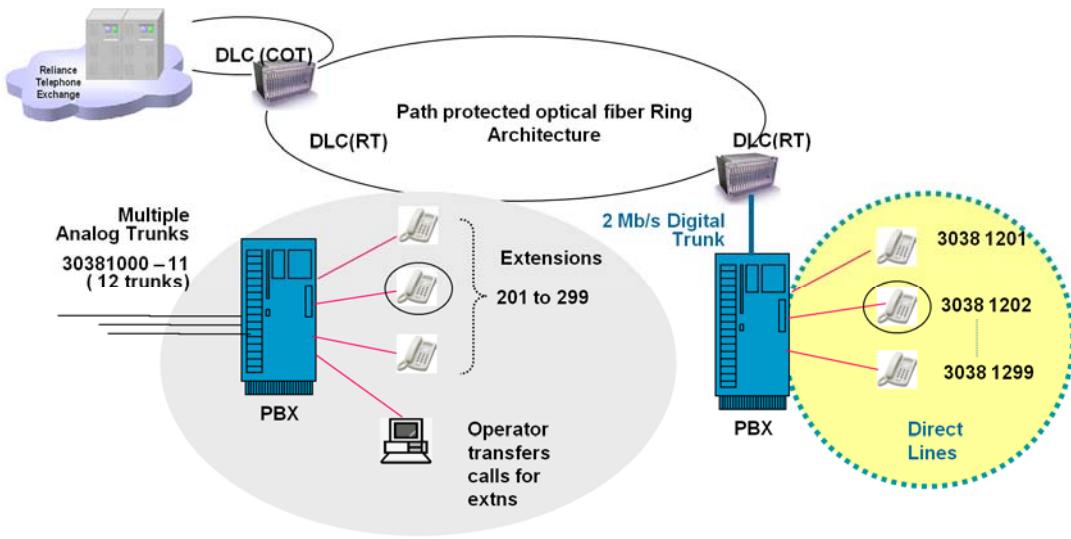
### **Authorization Code for Long Distance Calls**

Available as a network feature.

- Users can make official long distance calls from any office extension or any Reliance Fixed Line phone in the city, irrespective of the call class of that line .
- Call charges billed to office billing account
- Enterprise Administrator is provided with an Online Self-Service Portal for generation, assignment, editing & deletion of authorization codes/PINs to users.

## Direct line for every user

- Each extension on the EPABX is assigned a unique telephone number by virtue of the Direct Inward Dialing (DID) feature.



Slide shows a PBX with analog trunk connectivity. This PBX can't support DID over analog trunk. Calling person gets two options while calling an extension.

In first case, without DID facility on a PABX, all incoming calls from outside, lands on an Operator. Operator collects information from calling person about called person to terminate the call.

In second case, once an incoming call lands to the PBX, an announcement is played to collect extension number.

Both these cases are not good as it extends call setup time and calling person pays for the call the moment call is either answered by the operator or announcement played.

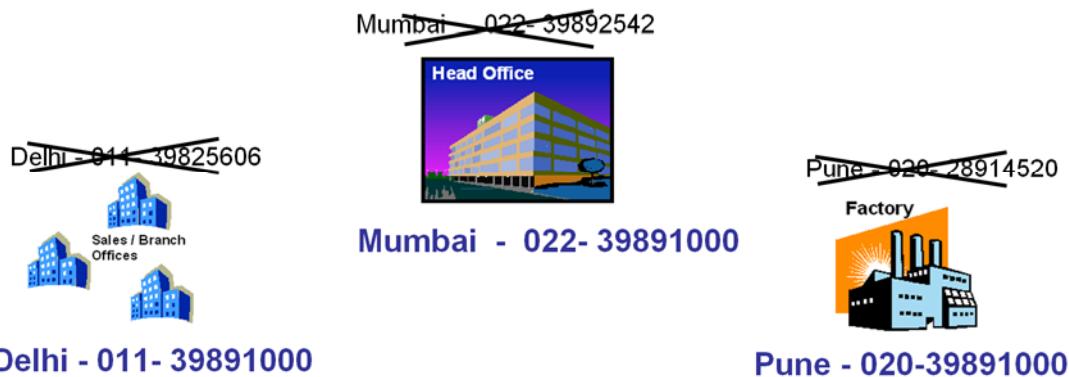
With DID facility, all the extensions of PABX becomes virtual extensions of main switch. So they get a main exchange number, which is used later by the main exchange to terminate an incoming call. Example is 3038 1201 as DID number, and at the same time normal PABX number is 201.

PABX subscribers can still use 3-digits number like 201, 202 etc to call each other.

This time billing starts when extension answers the call.

## Similar Board number across Cities

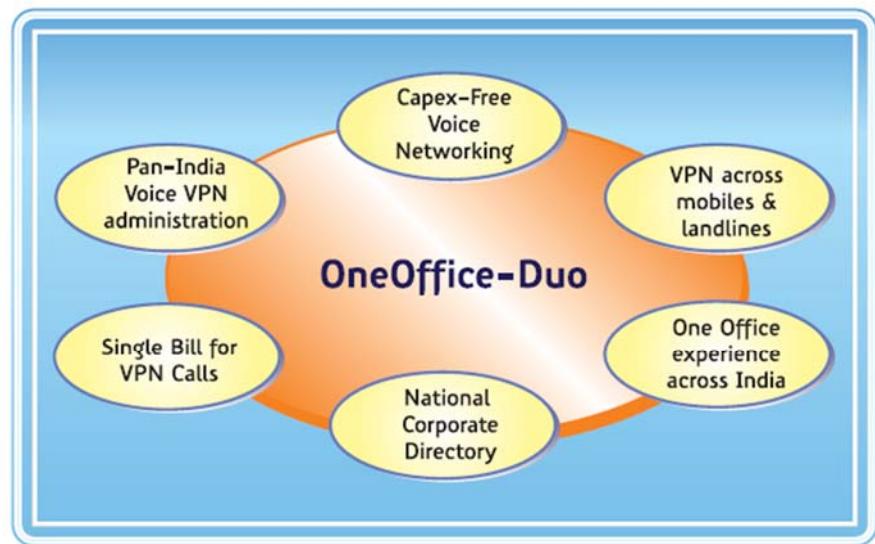
- ❑ A similar number (8 / 7 digit) across all cities. SBN cannot be offered in SDCA with 6 digit
- ❑ Customer can convey his/her biz no in one communication
- ❑ Local access for your customer (caller)
- ❑ Current SBN levels are 3988xxxx, 3989xxxx, 3940xxxx, 3941xxxx



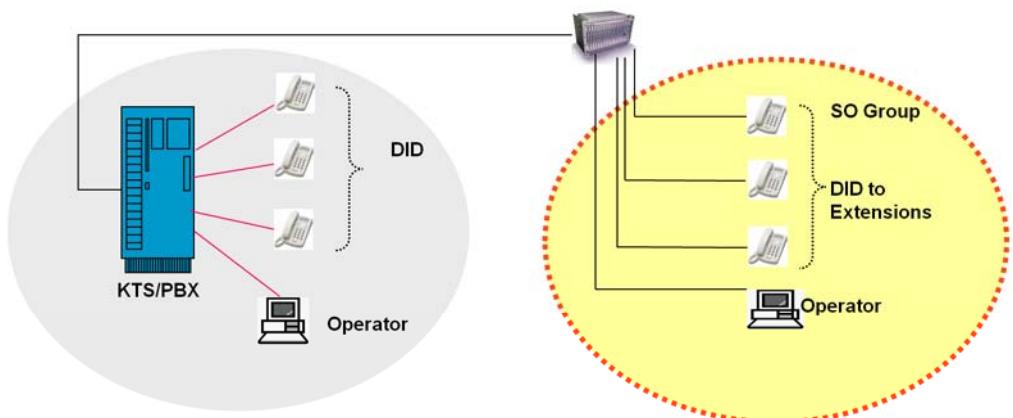
Similar Board number gives an edge to the business.

## One Office Duo

- ❑ Nation wise converged voice VPN across mobile & landlines.



## Smart Office



## Network

- ❑ 80,000 kms of optic fibre backbone.
- ❑ Wireless network covering over 20,000 towns and 4.5 lakh villages and counting.
- ❑ 15, 000 Base Transceiver Stations (BTSS) across the country.
- ❑ Network with superior reliability.
- ❑ All this managed from our state-of-the-art national network operations centre in Mumbai.

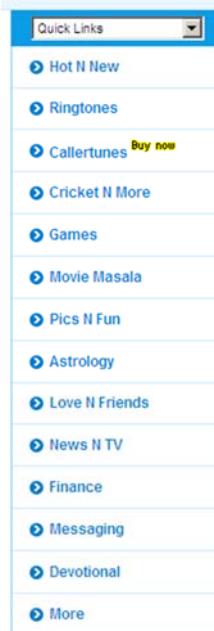


Our network is a pan India network. We have a state of the art Optical cable network, forming the backbone of our network.

## Services - Wireless

- ❑ Post-paid & Pre-paid.
- ❑ FWP / FWT.
- ❑ R-World / Reliance Mobile World.
- ❑ R Connect.

**RELIANCE**  
Mobile World



Our brand name for CDMA mobile service is RIM (Reliance India Mobile). It is available as post-paid & pre-paid connection.

Fixed wireless phone (FWP) and Fixed wireless terminal (FWT) provide fixed phone with wireless in local loop.

R-world provides lots of value added services over air to CDMA mobile customer e.g. live cricket score, news ring tone etc.

R-connect is internet access service on RIM.

## Services - Wireless

### ❑ FWP.

- Post & Pre-paid.
- CLI.
- Voice mail.
- CF, CW, Call divert.
- Call conference.
- SMS
- R Connect.



Fixed wireless phone now a day is cordless. It offers all the services available on RIM phone.

No wire goes to subscribers' premise, connectivity is through CDMA radio network.

## Services - Wireless

### ❑ FWT.

- Post paid.
- CLI.
- Voice mail.
- CF, CW, Call divert.
- Call conference.
- Parallel phone connection.
- R Connect.



Fixed wireless terminal is a device on which radio antenna is attached. It has no telephone push buttons. Rather it has sockets to plug in telephone. A subscriber has to attach either an existing or a new telephone to it.

## Services – Calling Card

- ❑ Reliance Global Call Card
  - One can make ISD calls from any Reliance phone, be it postpaid (Reliance Mobile / Fixed Wireless phone) or Reliance Mobile prepaid.
- ❑ Reliance STD Call Card
  - The prepaid Reliance STD Calling Card offers very affordable rates for local and national long distance (NLD) calls. This is a rechargeable account-based prepaid card that can be used from Reliance phones (Reliance fixed, fixed wireless and mobile - postpaid or prepaid) only and cannot be used from a PCO. With this card, NLD calls can be made even from Reliance phones without an NLD facility.
- ❑ Reliance Passport Calling card is an international long distance calling service currently offering calls to India & over 200 countries across the globe.
  - Reliance Global Call.



A subscriber may call back to India using Reliance's IndiaCall card. Being ILD operator, we can pick calls from few international points.

Reliance World Card is offered to subscribers in India to call abroad, even without ISD facility.

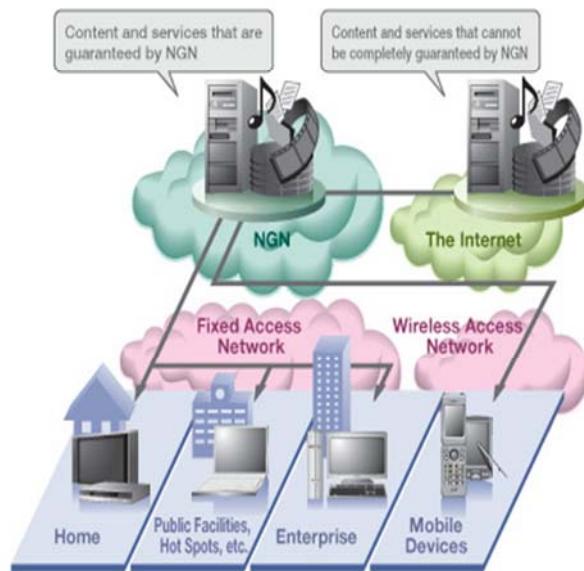
## Introduction to NGN

---

## Traditional Switches (Hard)

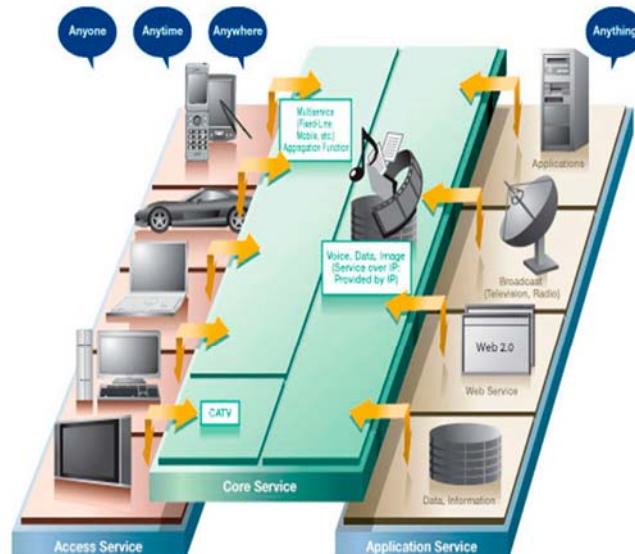
- ❑ The traditional switches that we know
  - Circuit-Switched
  - Proprietary Design
  - Large foot print
  - Reliable and high quality of service.
  - Expensive, difficult to implement and maintain

## Next Generation Network (NGN)



IMS (IP Multimedia Subsystem) and NGN (Next Generation Network) forms the technological foundation for future carrier networks, so it is imperative that these technologies be used effectively to create better solutions for businesses and consumers.

## IP Multimedia Subsystem (IMS)



### [Why did NGN appear?]

NGN is a future network currently being discussed globally. Carriers all over the world have already started building NGN. Standardization is being promoted by the TISPAN project led by ITU-T and the European standardization organization ETSI. But why has NGN appeared?

The Internet has two significant problems. One is security including spam and cyberterrorism. The other is the drop in communication quality when bandwidth is insufficient for a desired service. Meanwhile, carriers are faced with a shrinking fixed line telephone market due to the growth of the cellular phone market. Correspondingly, cellular phone markets in developed countries are near saturation. To help resolve these various issues, carriers are creating a network that can provide all fixed-line, cellular, data, and broadcast services and shifting to a business model that charges for the use of functions and services instead of for communication lines. Carriers are deploying NGN in an effort to solve not only the problem of Internet security and communication quality, they also expect to be able to reinvent and expand their business model by building an open I/F that facilitates network use by other parties.

### [Mechanism of NGN]

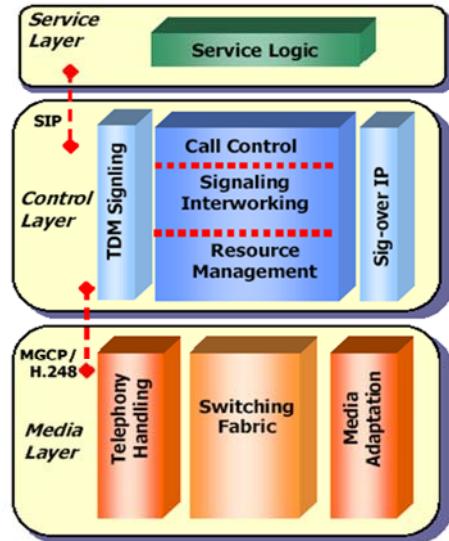
A mechanism is required in order to implement NGN, for example, the function to manage communication sessions. IMS (IP Multimedia Subsystem) provides this function. NGN is roughly divided into two parts in its structure: the service stratum (the layer that controls services), and the transport stratum (the layer that transmits services and data from the transmission source to its destination). IMS is used for the implementation of the service stratum that manages communication sessions, which is especially crucial for using services. Therefore, in order to connect with NGN, a terminal that can connect with IMS and establish sessions is required. This is the basic function that NetFront IMS Client Package provides for terminals.

## What is a Soft Switch?

- ❑ A soft switch (call agent, call server, media gateway controller, virtual switch) is a software based switching & control solution that runs on industry standard open platforms to provide the functionality of a traditional TDM switch in modular, distributed and scalable fashion.
  - Software switch.
  - Converges voice, data & video.
  - Provides centralized control.
  - Is bearer independent.
  - Is functionally layered.
  - Separates Call logic & Access.

## What is NGN?

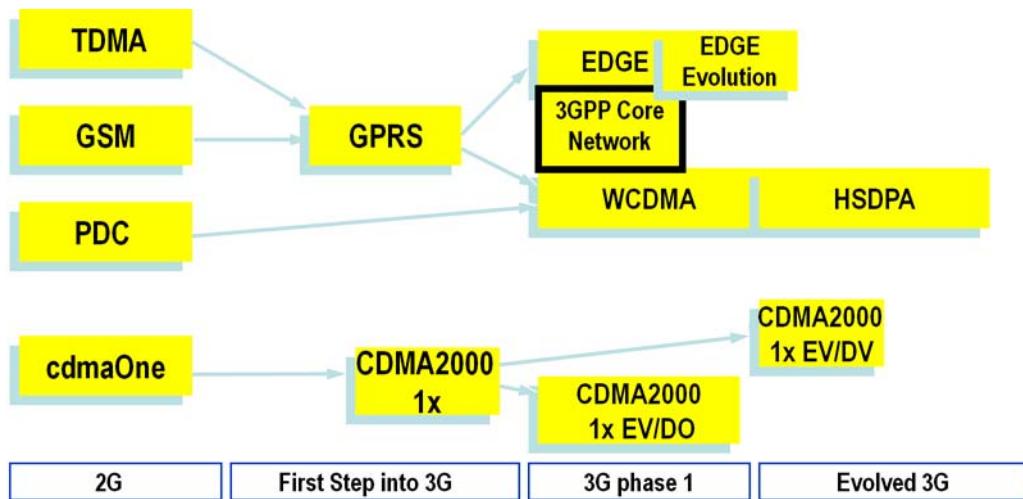
- ❑ Next Generation Network for the most part is a high speed packet based networks
- ❑ It needs to be flexible and reliable.
- ❑ It is capable of delivering a multitude of broadband services.
- ❑ NGNs are structured on open platform.



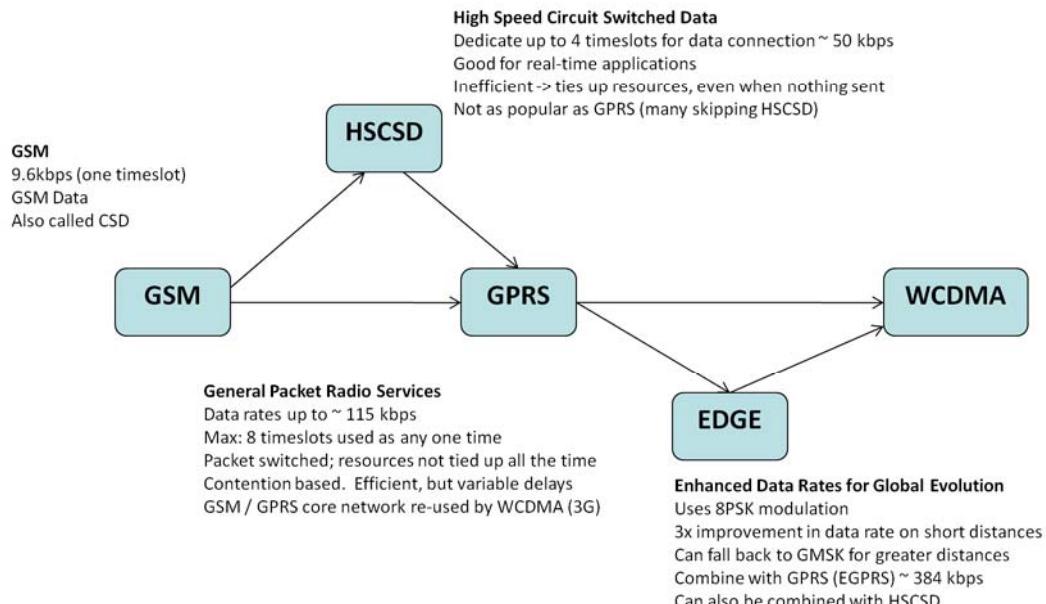
## Wireless Network Evolution

---

## Evolution of Mobile Systems to 3G

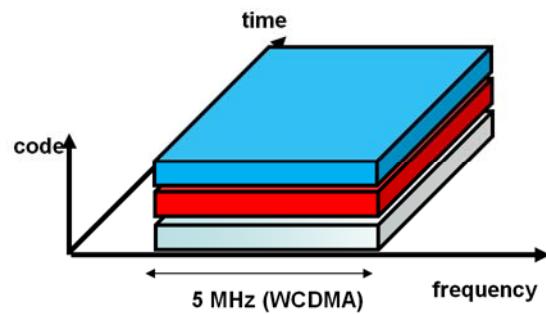


## GSM evolution to 3G

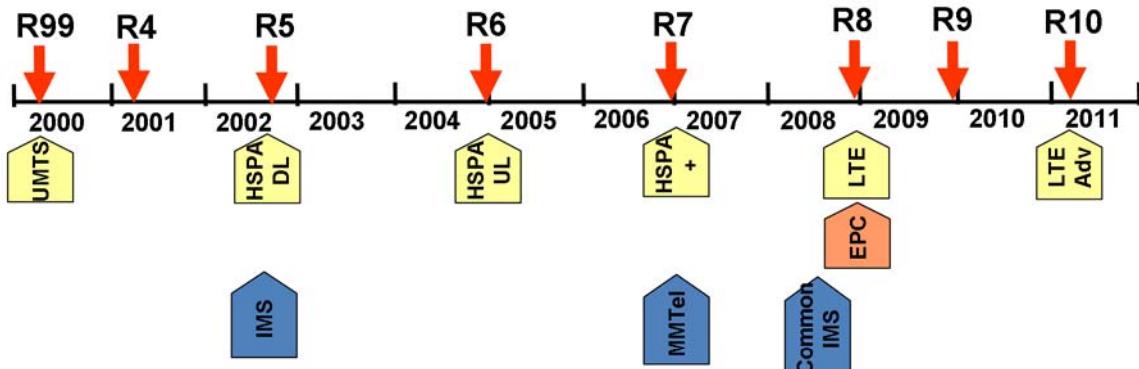


## WCDMA – Wideband Code Division Multiple Access

- ❑ Users separated by codes
- ❑ Having bandwidth of 5MHz per carrier
- ❑ Requires digital transmission
- ❑ Technology delivering High Speed Data & cost effective voice
- ❑ Spectrum
  - UL-1900MHz
  - DL-2100MHz



## 3GPP Releases



Releases cover the areas of:

- Accesses (GSM, EDGE, HSPA, UMTS, LTE, LTE-Advanced, etc.)
- Core Network (GSM Core, Evolved Packet Core)
- Services (IMS, IMS Multimedia Telephony)

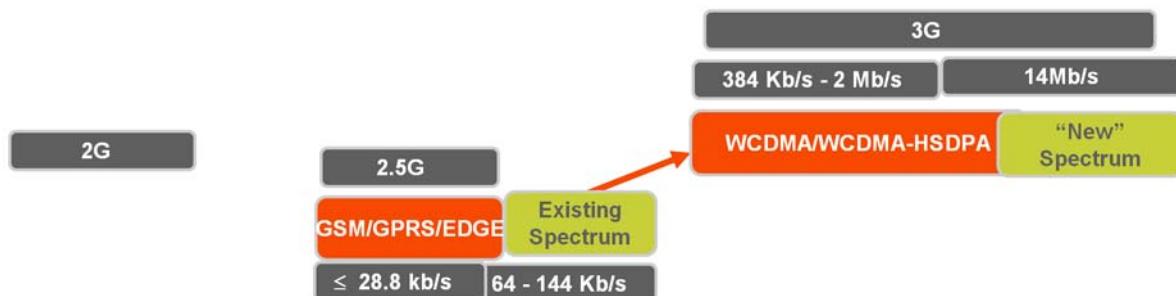
The 3GPP/NGN IMS Multimedia Telephony Service (MMTel) is a global standard based on the IP Multimedia Subsystem (IMS), offering converged, fixed and mobile real-time multimedia communication using the media capabilities such as voice, real-time video, text, file transfer and sharing of pictures, audio and video clips. With MMTel, users have the capability to add and drop media during a session. You can start with chat, add voice (for instance Mobile VoIP), add another caller, add video, share media and transfer files, and drop any of these without losing or having to end the session.

EPC or System Architecture Evolution (aka SAE) is the core network architecture of 3GPP's future LTE wireless communication standard.

SAE is the evolution of the GPRS Core Network, with some differences:

- simplified architecture
- All IP Network (AIPN)
- support for higher throughput and lower latency radio access networks (RANs)
- support for, and mobility between, multiple heterogeneous RANs, including legacy systems as GPRS, but also non-3GPP systems (for example WiMAX)

## Evolution paths into 3G

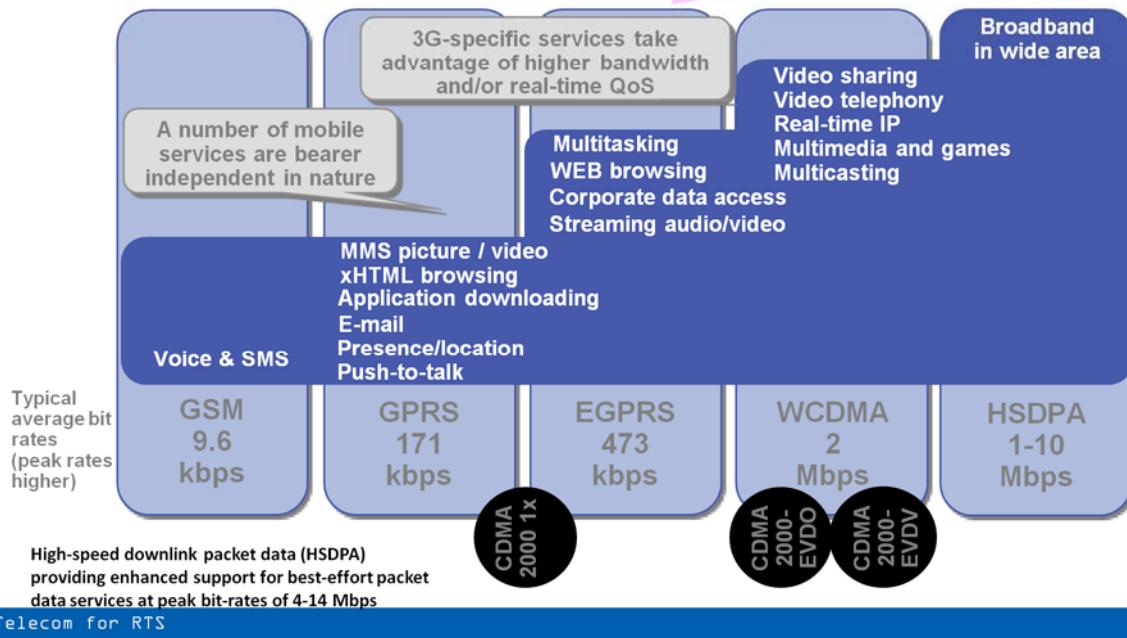


HSPA+, also known as Evolved High-Speed Packet Access is a wireless broadband standard defined in 3GPP release 7.

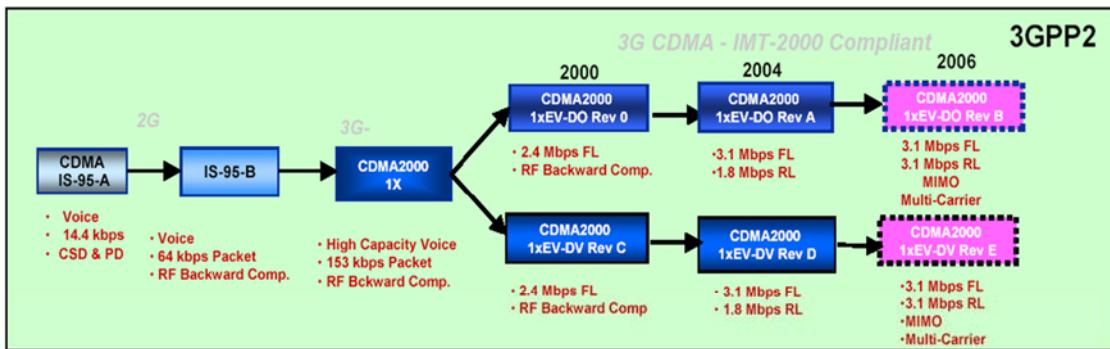
HSPA+ provides HSPA data rates up to 56 Megabits per second (Mbit/s) on the downlink and 22 Mbit/s on the uplink through the use of a multiple-antenna technique known as MIMO (for "multiple-input and multiple-output") and higher order modulation (64QAM). MIMO on CDMA based systems acts like virtual sectors to give extra capacity closer to the mast. The 56 Mbit/s and 22 Mbit/s represent theoretical peak sector speeds. The actual speed for a user will be lower.

## Services Roadmap

Improved performance



## CDMA Evolution



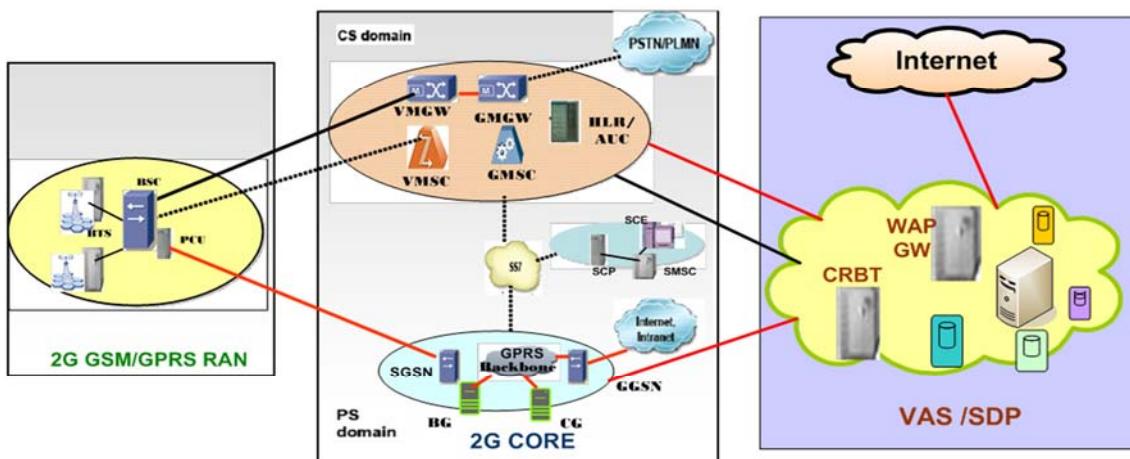
3G

---

Services

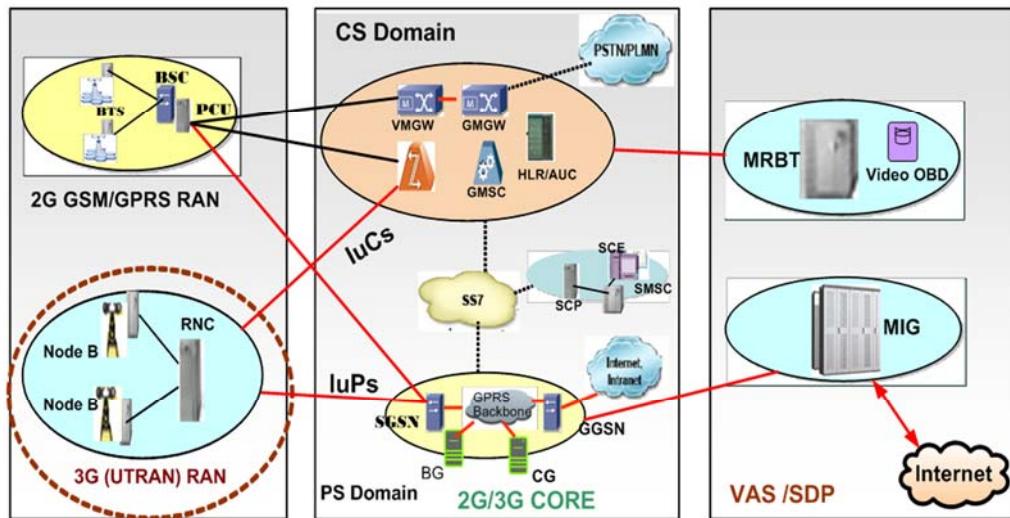
113

## 2G Network Architecture



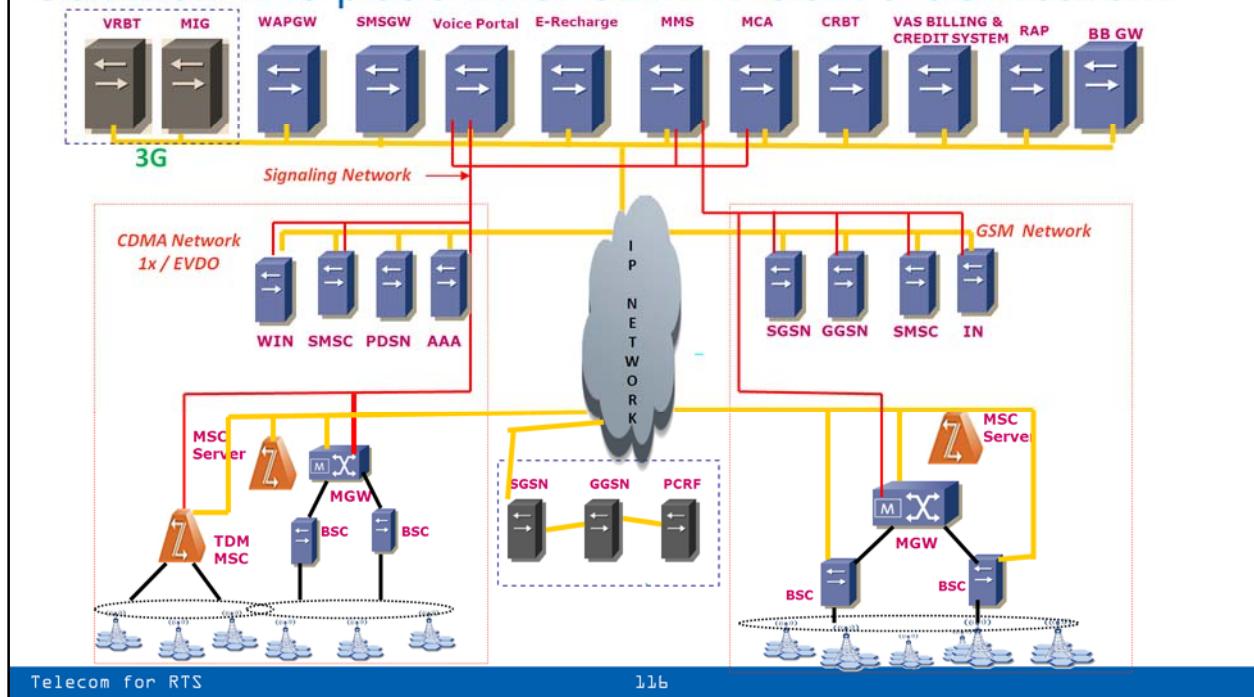
- ❖ 2G Core Network with MSC / MGW and HLR
- ❖ VAS Node with WAP GW , CRBT
- ❖ Packet core with SGSN and GGSN

## 3G Network Architecture



- ❖ Common Core Network is used to support 2G/3G
- ❖ Common HLR is for 2G and 3G Subscriber
- ❖ Access network is different for 3G Services

## Common VAS platform for CDMA / GSM & 3G Network



## 3G Services

- ❑ Video Call
- ❑ Video Conference
- ❑ Video ring back tone
- ❑ Mobile TV
- ❑ Mobile Internet
- ❑ Video Portal

## 3G Video Call

- ❑ Video Call
  - Via video call, subscribers having 3G handsets and 3G profile when in 3G coverage area can see each other during the call.



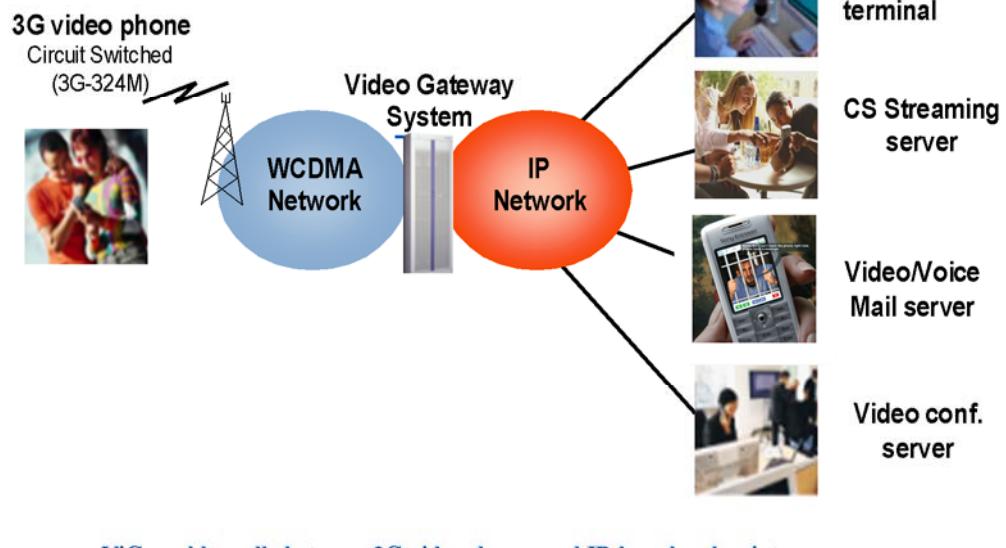
## Video Conference



- Subscribers will be able to make video conference calls from both CS & PS mode access (i.e Mobile, Laptop etc)

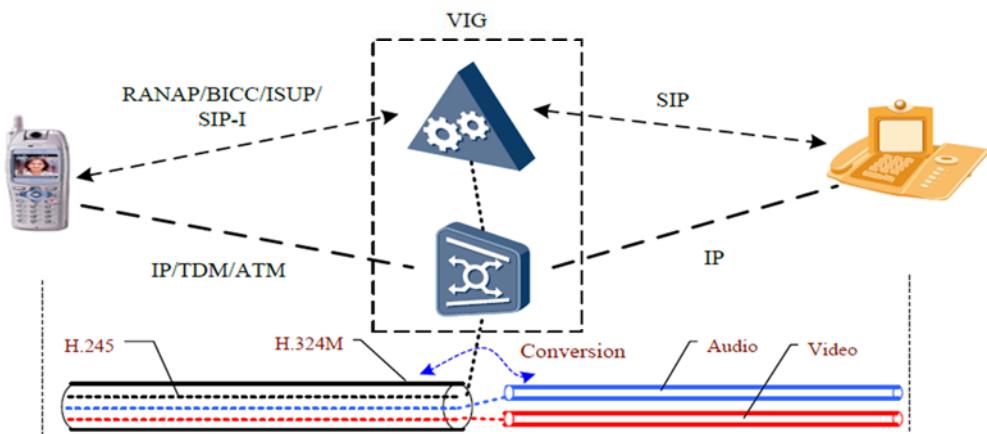


## VIG

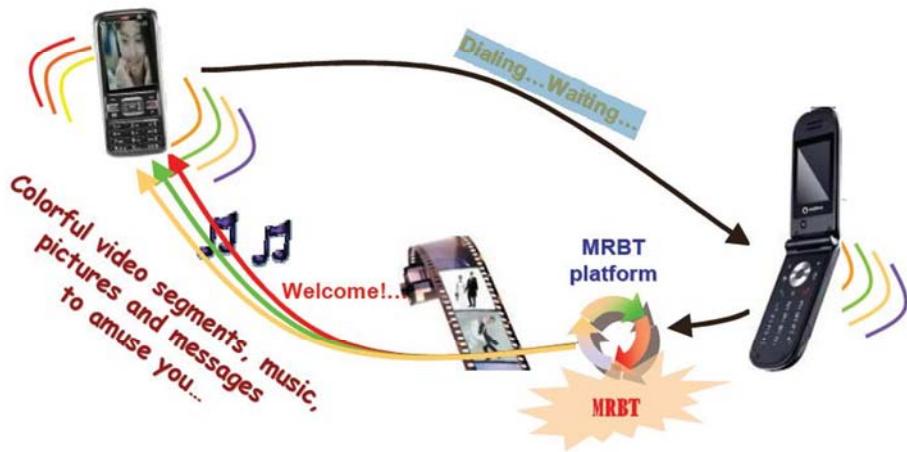


ViG enables calls between 3G videophones and IP-based end-points

## Functions of the VIG



## Video Ring Back Tone



When a video call will made, calling party will be shown video clip till the called party picks up the phone.

## Mobile TV



Subscribers will be able to see TV channels & Video On Demand contents through downloadable client as well as native media player on their handsets.

## Mobile Internet

- Subscribers will be able to access internet over high speed wireless link from browser on their phone as well as their PC by using phone as modem or dongle.



Thank you

---

*Ajay.Kr.Verma@RelianceADA.com*  
M: 93246 77558