

## Paper solution

Class- TE EXTC (VI)  
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Subject-“Digital Telephony”  
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### Q.1 1)

Time division switching	Space division switching
Switching element is used to establish connection	Cross-point element is used to establish connection
Switching element is unused most of the time	Cross-point is dedicated to one connection
Switching element shared by no. of simultaneous active speech circuits	Cross-point shared by no. of elements
Saving in Switching element	No such saving
Digital speech waveform is passed through switch in Time division switching	Analog speech waveform is passed through switch in Space division switching

### 2) Waiting time jitter

- For de-multiplexing the higher level TDM data stream, it is necessary to generate a clock for each derived sub-channels.
- Sub-channels are transferred as synchronous data stream, the derived clock must be continuous.
- TDM data stream of overhead bits create gaps in the bit arrival times.
- so irregularity in the data arrival rate caused by these gaps is referred to as Waiting time jitter

### 3) DTMF working of telephone

		upper band frequency		
		1209	1336	1477
lower band frequency	697	1	2	3
	770	4	5	6
	852	7	8	9
	941	*	0	#

- it is a pushbutton keypad.
- touch tone generates 'tone'. Which is a combination of two frequencies, one from lower & other from upper band frequencies?
- E.g.-pushing button 9 transmits 852Hz & 1477Hz frequency.
- Extended design provides for additional frequency 1633Hz in upper band.

## Q.2 1)

$$\text{Traffic carried per server} = \frac{\text{occutionpied duraion}}{\text{total duration}}$$

$$\text{Traffic carried per server} = \frac{30}{2 \times 60} = 0.25 E$$

$$\text{Total traffic carried by group} = 10 \times 0.25 = 2.5 E$$

## 2) DSL

- It is a link between subscriber & network.
- Challenging part in high speed wide area public digital network.
- Various DSL technologies are:
  - ADSL-new modern technology provides high speed digital data transmission over ordinary telephone wire.
    - More capacity downstream than upstream.
    - Fit for internet requirement.
    - Uses FDM to exploit 1MHz capacity of twisted pair.
  - HDSL-High data rate DSL
    - Provides more cost efficient means of T1 data rate.
    - Limited distance up to 1Km between repeaters.
    - One or more repeaters.
    - 2B1Q coding
    - BW=196KHz, Range=3.7 Km
  - VDSL- Very high data rate DSL.
    - Newest scheme.
    - Signaling techniques DMT/QAM.
    - No use of Echo cancellation.
    - Upstream=300 to 700 KHz
    - Downstream>=1MHz
  - SDSL- Single line DSL.
    - Used by residential subscribers.
    - Same service as HDSL.
    - Echo cancellation.

### Q.3 a) ATM protocol stack

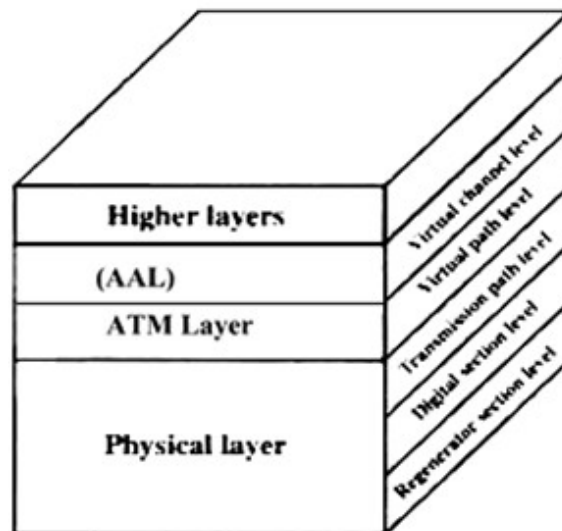
Physical layer of the ATM protocol architecture involves the specification of a transmission medium and a signal encoding scheme.

Data rates specified at the physical layer

**155.52 Mbps**

**622.08 Mbps**

Possibility of other data rates (higher and lower)



Overall hierarchy function in ATM network

- Two specific layers for ATM functions

#### 1) ATM Layer

- independent of physical medium, with the following functions

##### 1) Cell multiplexing and demultiplexing

- having multiple logical connections across an interface similar to X.25 and frame relay

##### 2) Virtual path identifier and virtual channel identifier translation

- VPI and VCI have local significance on logical connections and may need to be translated during switching

##### 3) Cell header generation/extraction

- appending cell header to user data from the AAL

##### 4) Generic flow control

- generating flow control information for placement in cell headers

##### 5) defines the transmission of data in fixed-sized cells

##### 6) defines the use of logical connections

#### 2) ATM Adaptation Layer

- consists of segmentation and reassembly and convergence sublayers
- The segmentation and reassembly sublayer is responsible for the segmentation of higher-layer information into a size suitable for the information field of an ATM cells and the reassembly of the contents of a sequence of ATM cell information field into higher-layer information on reception.
- The convergence sublayer is an interface specification. It defines the services that AAL provides to higher layers.
- mapping the higher-layer information into ATM cells to be transport over an ATM network
- collecting information from ATM cells for delivery to higher layers

**b)**

$$\text{subscriber traffic in E} = \frac{\text{busy period}}{\text{total period}}$$

$$\text{subscriber traffic in E} = \frac{3 + 4 + 2}{60} = 0.15E$$

$$\text{subscriber traffic in CCS} = \frac{3 + 4 + 2}{100} \times 60 = 5.4CCS$$

$$CM = 3 + 4 + 2 = 9CM$$

#### **Q.4 1) Network Management & Network Control**

**Network Management:** To maintain efficient operations during equipment overload.

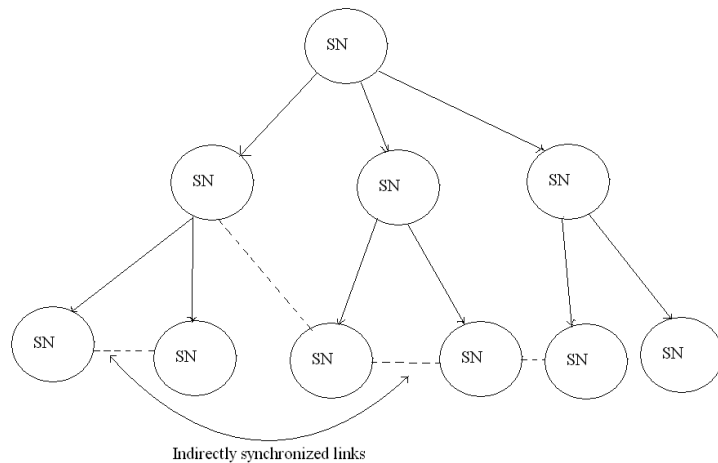
Two main considerations:-

1. Routing Control
  - It determines paths assigned o connection.
  - direct routes at lowest levels.
  - low blocking probability due o alternate routes.
2. Flow Control
  - Routing algorithm is decided.
  - it provides traffic control in network.
  - Flow Control manages a rate at which traffic enters a network.
  - during increased load traffic is rejected.

**Network Control:-** synchronization concept is extended to higher level functions of connection control & network control.

#### **2) b) master-slave synchronization & packetization.**

Master slave synchronization-



- network reference frequency is transmitted bto few selected higher level switching nodes.
- these synchronize their clocks to reference.
- This reference passes to lower level switches by way of existing digital links.

### Q.5 1) TCP/IP protocol architecture.

TCP/IP protocol Architecture

OSI Model Layers	TCP/IP Protocol Architecture Layers	TCP/IP Protocol Suite
Application Layer	Application Layer	Telnet, FTP, SMTP, DNS, RIP, SNMP
Presentation Layer		
Session Layer		
Transport Layer	Host-to-Host Transport Layer	TCP, UDP
Network Layer	Internet Layer	ARP, IP, IGMP, ICMP
Data-Link Layer	Network Interface Layer	Ethernet, Token Ring, Frame Relay, ATM
Physical Layer		

i) Network Interface Layer: The Network Interface layer (also called the Network Access layer) is responsible for placing TCP/IP packets on the network medium and receiving TCP/IP packets off the network medium. TCP/IP was designed to be independent of the network access method, frame format, and medium. In this way, TCP/IP can be used to connect differing network types. -The Network Interface layer encompasses the Data Link and Physical layers of the OSI model.

ii) Internet Layer: The Internet layer is responsible for addressing, packaging, and routing functions. The core protocols of the Internet layer are IP, ARP, ICMP, and IGMP.

- The Internet Protocol (IP) is a routable protocol responsible for IP addressing, routing, and the fragmentation and reassembly of packets.
- The Address Resolution Protocol (ARP) is responsible for the resolution of the Internet layer address to the Network Interface layer address such as a hardware address.
- The Internet Control Message Protocol (ICMP) is responsible for providing diagnostic functions and reporting errors due to the unsuccessful delivery of IP packets.
- The Internet Group Management Protocol (IGMP) is responsible for the management of IP multicast groups.

The Internet layer is analogous to the Network layer of the OSI model.

iii) Transport Layer: The Transport layer (also known as the Host-to-Host Transport layer) is responsible for providing the Application layer with session and datagram communication services.

The core protocols of the Transport layer are Transmission Control Protocol (TCP) and the User Datagram Protocol (UDP).

- TCP provides a one-to-one, connection-oriented, reliable communications service. TCP is responsible for the establishment of a TCP connection, the sequencing and acknowledgment of packets sent, and the recovery of packets lost during transmission.
- UDP provides a one-to-one or one-to-many, connectionless, unreliable communications service. UDP is used when the amount of data to be transferred is small (such as the data that would fit into a single packet), when the overhead of establishing a TCP connection is not desired or when the applications or upper layer protocols provide reliable delivery.

The Transport layer encompasses the responsibilities of the OSI Transport layer and some of the responsibilities of the OSI Session layer.

iv) Application Layer: The Application layer provides applications the ability to access the services of the other layers and defines the protocols that applications use to exchange data. There are many Application layer protocols and new protocols are always being developed. The most widely-known Application layer protocols are those used for the exchange of user information:

- The Hypertext Transfer Protocol (HTTP) is used to transfer files that make up the Web pages of the World Wide Web.
- The File Transfer Protocol (FTP) is used for interactive file transfer.
- The Simple Mail Transfer Protocol (SMTP) is used for the transfer of mail messages and attachments.
- Telnet, a terminal emulation protocol, is used for logging on remotely to network hosts.

Additionally, the following Application layers protocols help facilitate the use and management of TCP/IP networks:

- The Domain Name System (DNS) is used to resolve a host name to an IP address.
- The Routing Information Protocol (RIP) is a routing protocol that routers use to exchange routing information on an IP internetwork.
- The Simple Network Management Protocol (SNMP) is used between a network management console and network devices (routers, bridges, intelligent hubs) to collect and exchange network management information.

## 2) VOIP & Architecture of H.323 protocol suit.

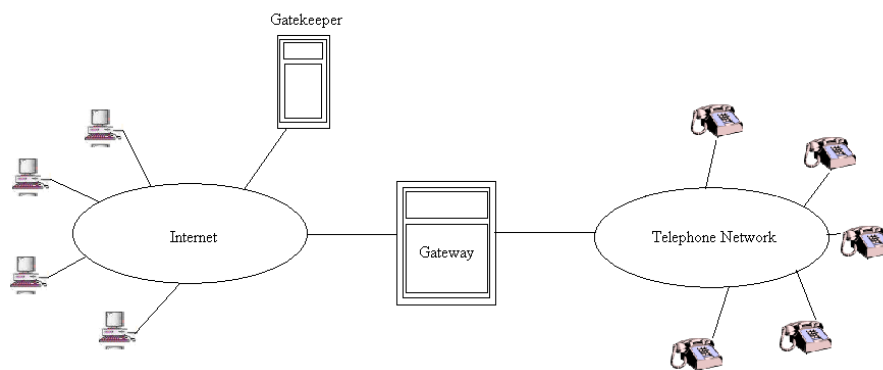
### Architecture of H.323-

It is designed by ITU to allow telephones on public network to talk with computers connected to internet.

H.323 Gateway: H.323 endpoint which provides for real-time, two-way communications between terminals belonging to networks with different protocol stacks

Gatekeeper (GK): A GK is an H.323 entity on the network that provides address translation and controls access to the network resources for H.323 terminals, GWs and MCUs.

- Endpoints do register themselves at a GK
- All H.323 endpoints registered to a single GK build an H.323 zone
- H.323 zones are independent of physical network topology
- Each zone has only one GK (exception: Alternate GKs)



### Gatekeeper Functionality

- Address translation:
  - No “normal” DNS address resolution is possible
  - Endpoints do register with their H.323 aliases<sup>1</sup> and call signaling IP address
  - A GK translates H.323 aliases into call signaling IP addresses (especially useful for endpoints with dynamic IP addresses)
  - Multiple GKs can communicate to build a multi-zone address translation service (Æ e.g. Global Dialing Scheme, GDS)

### Protocol suit –

- H.323 uses number of protocols to establish & maintain voice or video communication.
- G.71 or G.723 is used for compression.
- H.245 allows parties to negotiate the compression method.
- Q.931 to establish & terminating connections.
- H.255 used for registration with gatekeeper.

Audio			Control & Signaling	
Compression code	RTCP	H.255	Q.931	H.245
RTP				
UDP			TCP	
IP				
Datalink protocol				
Physical layer protocol				

“Protocol suit”

### Q.6 1) Principles of ISDN

- Support of voice and non-voice applications using a limited set of standardized facilities
- Support for switched and non-switched applications
- Reliance on 64-kbps connections
- Layered protocol architecture
- Already developed standards for OSI may be used for ISDN (e.g. X.25)
- New ISDN standard can be based on existing ones (LAPD based on LAPB)
- Standards can be developed independently for various layers and functions
- Variety of configurations

#### Evolution of ISDN

- Evolution from telephone IDNs
- Transition of one or more decades
- Use of existing networks
- Interim user-network arrangements
- Connection at other than 64 kbps

#### Objectives

The objectives of the activities for developing a worldwide ISDN are

- Standardization
- Transparency
- Separation of competitive functions
- Leased and switched services
- Cost-related tariffs
- Smooth migration
- Multiplexed support

#### Working

User has access to ISDN via a local interface to a digital “pipe”.

- Pipes of various sizes are available to satisfy different needs.
- Pipe to the user’s premises has a fixed capacity but the traffic on the pipe may be a variable mix up to the capacity limit.

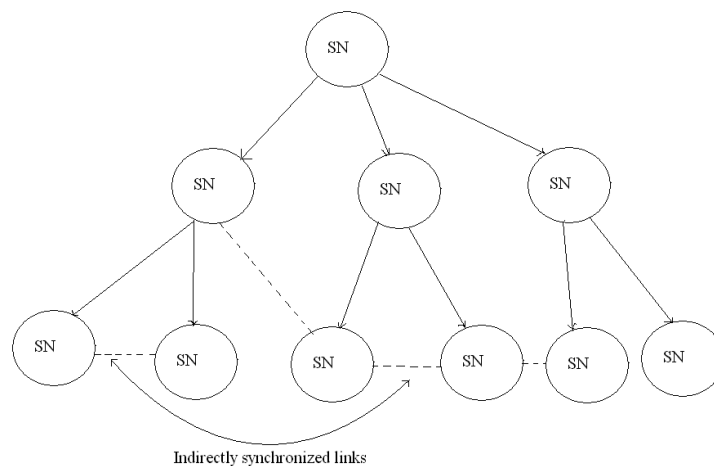
- ISDN requires control signals to instruct how to sort out the time-multiplexed data and provide the required services.
- Control signals are multiplexed onto the same digital pipe.
- A user may employ less than the maximum capacity of the pipe and will be charged according to the capacity used.

## 2) a) Network Blocking Probability

- End-o-End Blocking Probability
- Overflow traffic

## b) Master-slave synchronization & packetization.

Master slave synchronization-

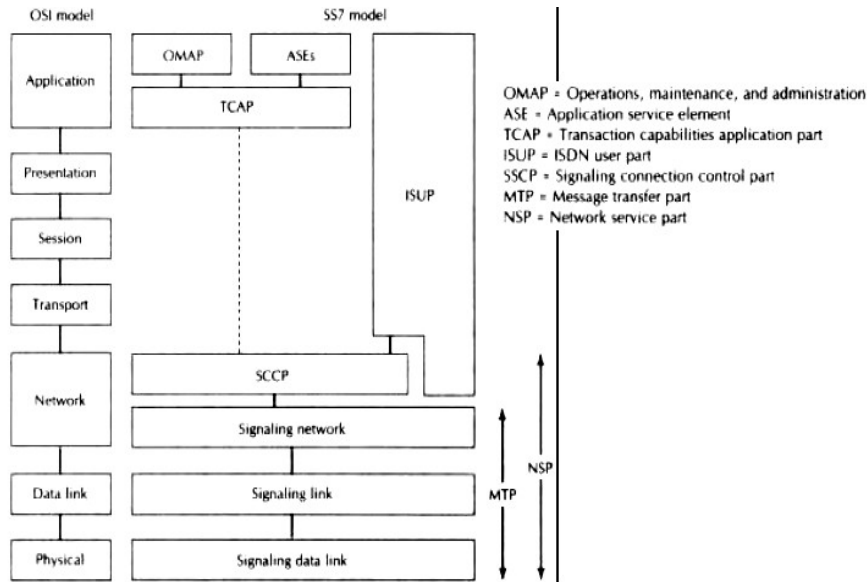


- network reference frequency is transmitted bto few selected higher level switching nodes.
- these synchronize their clocks to reference.
- This reference passes to lower level switches by way of existing digital links.

## Q.7 1) SS7 Protocol Architecture-

SS7 has layered protocol architecture similar to that of OSI model.

- Message transfer part (MTP):** the lowest three levels providing a reliable but connectionless (a datagram style) service for routing messages
  - signaling data link: a full-duplex physical link dedicated to SS7 (OSI L1):- includes control links between STPs, between an STP and an SP, between SPs
  - signaling link: a data link control protocol, corresponds to OSI layer 2:- provides reliable sequenced delivery of data across signaling data link
  - signaling network: provides routing data across multiple STPs from control source to control destination



ii) **Signaling connection control part (SCCP):** added in 1984 version of SS7

- SCCP + MTP = NSP (Network Service Part)

-contains different network-layer services to meet needs of NSP users

- NSP is a message delivery system

iii) **ISDN user part (ISUP):** controls signaling needed in an ISDN to deal with ISDN subscriber calls and related functions.

iv) **Transaction capabilities application part (TCAP):** provides the mechanisms for transaction-oriented (not connection-oriented) applications and functions.

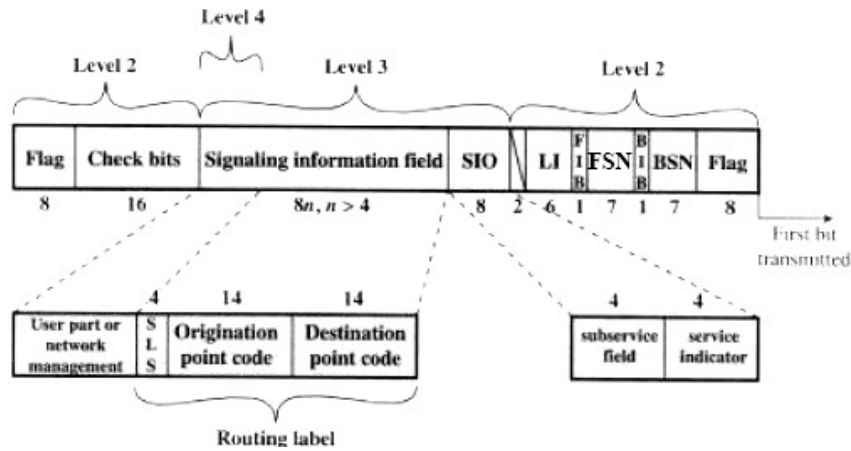
v) **Operation, maintenance, and administration part (O&MAP):** specifies network management functions and message related to operation & maintenance.

vi) **Application service elements (ASEs):** add modules to support new applicant's

Signal unit formats for signaling link level-

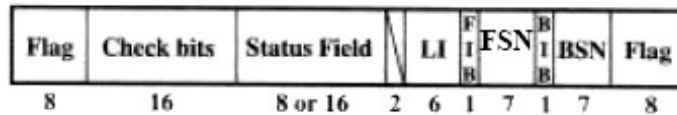
a) MSU (message signal unit)

-carries user data from level 4



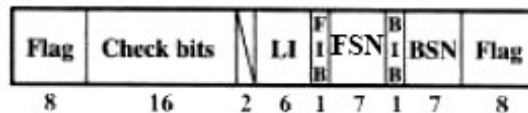
b) LSSU (link status signal unit)

– carries control information needed at the signaling link level



c) FISU (fill in signal unit)

– transmitted when no other signal units are available



2) a) Space division switch & Time division switch

Space division switch	Time division switch
Simplest switching structure-rectangular array of cross points	simple switching element
Dedicated cross points	Not required
At a time only one active speech	Shared speech
Continuous analog speech w/f	Samples of speech are sent as PAM or PCM pulses
At a time cross point is dedicated to only one active speech circuit	Switching element assigned to no. of inlet-outlet pairs

b) Benefits of ATM-

-Similar in concept to frame relay.

-Take advantage of reliability & fidelity of modern digital facility to provide faster packet switching than X.25.

- At higher data rate, it is streamlined.
- Packet oriented transfer mode.
- Allow multiple logical connections to be multiplexed over single physical interface.
- Information flow in fixed size packets called cells.