UNIT -III

Elobrate Non-return to Zero

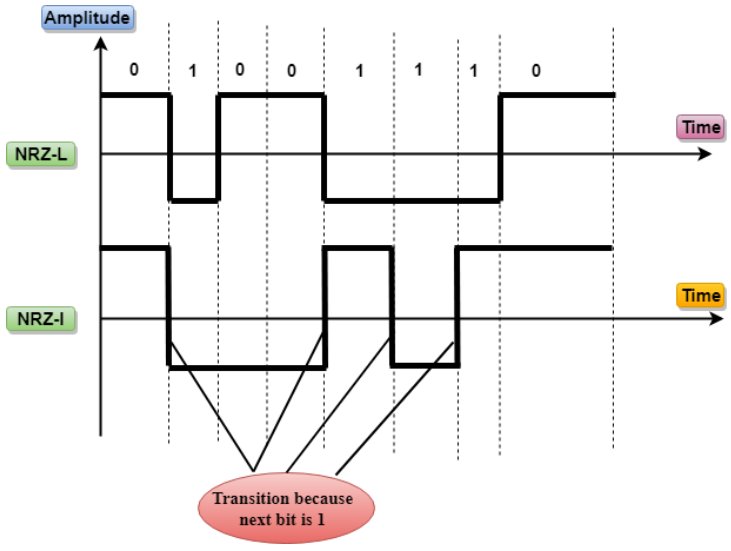
NRZ

- NRZ stands for Non-return zero.
- In NRZ encoding, the level of the signal can be represented either positive or negative.

The two most common methods used in NRZ are:

NRZ-L: In NRZ-L encoding, the level of the signal depends on the type of the bit that it represents. If a bit is 0 or 1, then their voltages will be positive and negative respectively. Therefore, we can say that the level of the signal is dependent on the state of the bit.

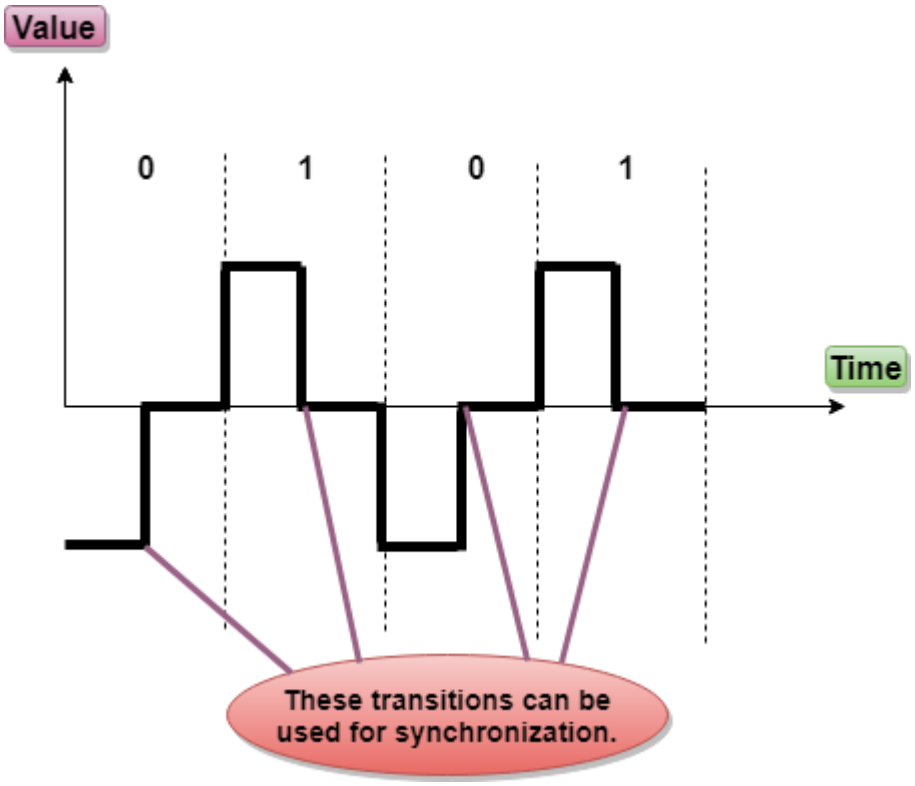
NRZ-I: NRZ-I is an inversion of the voltage level that represents 1 bit. In the NRZ-I encoding scheme, a transition occurs between the positive and negative voltage that represents 1 bit. In this scheme, 0 bit represents no change and 1 bit represents a change in voltage level.



RZ

- RZ stands for Return to zero.
- There must be a signal change for each bit to achieve synchronization. However, to change with every bit, we need to have three values: positive, negative and zero.

- RZ is an encoding scheme that provides three values, positive voltage represents 1, the negative voltage represents 0, and zero voltage represents none.
- In the RZ scheme, halfway through each interval, the signal returns to zero.
- In RZ scheme, 1 bit is represented by positive-to-zero and 0 bit is represented by negative-to-zero.



Disadvantage of RZ:

It performs two signal changes to encode one bit that acquires more bandwidth.

Interpret a short note on Biphase

Biphase

- Biphase is an encoding scheme in which signal changes at the middle of the bit interval but does not return to zero.

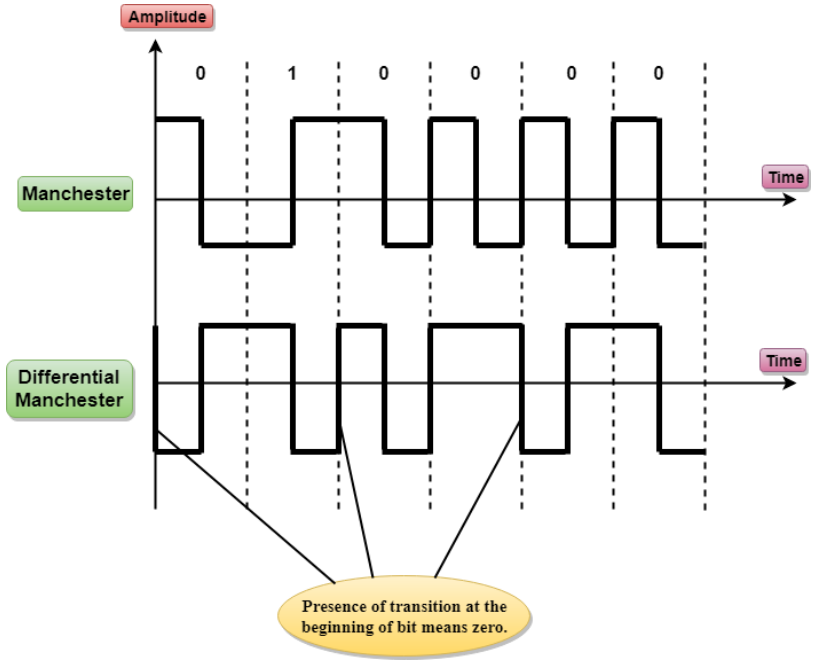
Biphase encoding is implemented in two different ways:

Manchester

- It changes the signal at the middle of the bit interval but does not return to zero for synchronization.
- In Manchester encoding, a negative-to-positive transition represents binary 1, and positive-to-negative transition represents 0.
- Manchester has the same level of synchronization as RZ scheme except that it has two levels of amplitude.

Differential Manchester

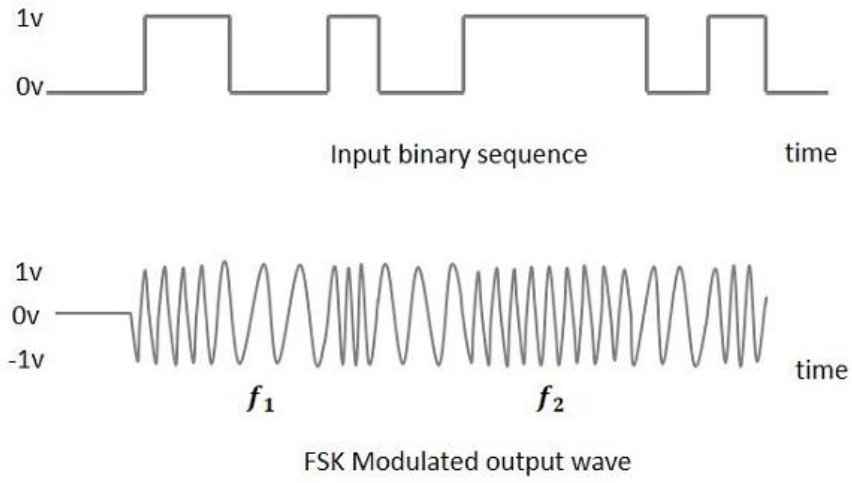
- It changes the signal at the middle of the bit interval for synchronization, but the presence or absence of the transition at the beginning of the interval determines the bit. A transition means binary 0 and no transition means binary 1.
- In Manchester Encoding scheme, two signal changes represent 0 and one signal change represent 1.



Summarize briefly about Frequency Shift Keying

Frequency Shift Keying

- FSK is the digital modulation technique in which the frequency of the carrier signal varies according to the digital signal changes. FSK is a scheme of frequency modulation.
- The output of a FSK modulated wave is high in frequency for a binary High input and is low in frequency for a binary Low input. The binary **1s** and **0s** are called Mark and Space frequencies.
- The following image is the diagrammatic representation of FSK modulated waveform along with its input.



To find the process of obtaining this FSK modulated wave, let us know about the working of a FSK modulator.

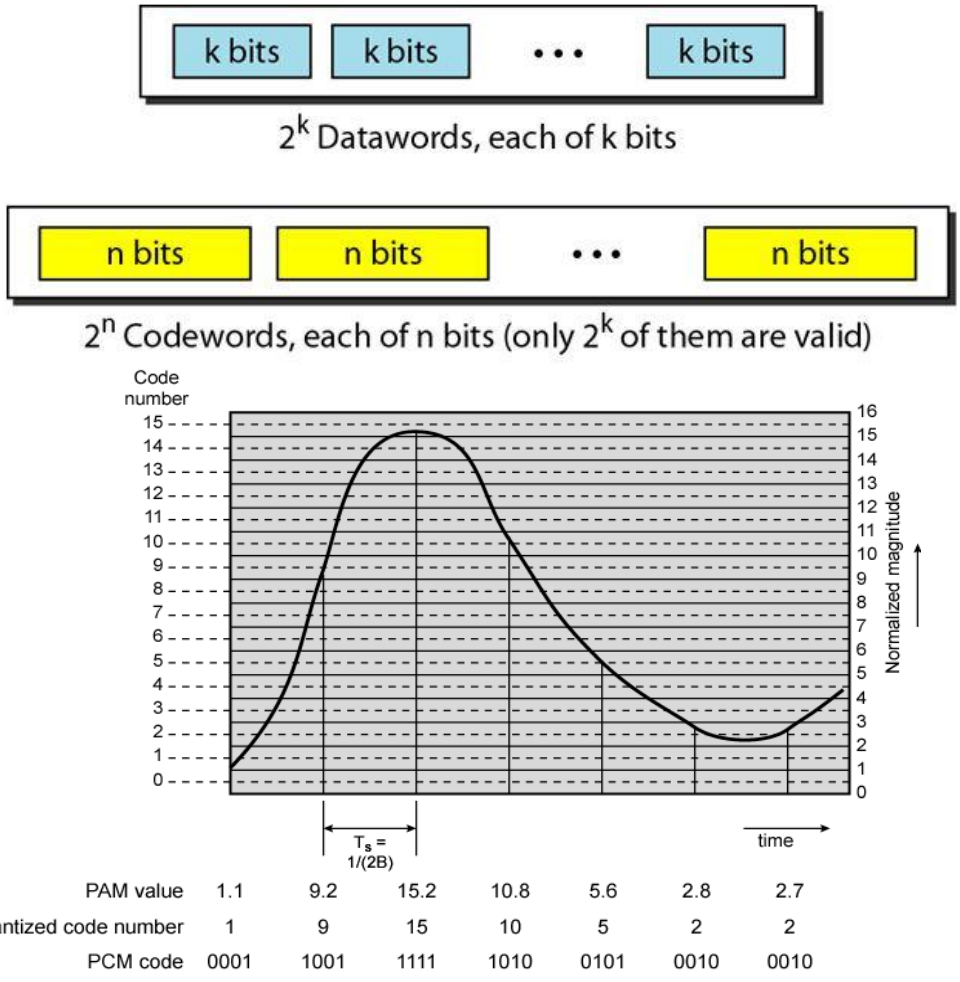
Analyze the Block Code Principles with simple examples

In block coding, we divide our message into blocks, each of k bits, called data words. We add r redundant bits to each block to make the length n = k + r. The resulting n-bit blocks are called code words.

For example, we have a set of data words, each of size k, and a set of code words, each of size of n. With k bits, we can create a combination of 2k data words, with n bits; we can create a combination of 2n code words. Since n > k,

the number of possible code words is larger than the number of possible data words.

The block coding process is one-to-one; the same data word is always encoded as the same code word. This means that we have 2n-2k code words that are not used. We call these code words invalid or illegal. The following figure shows the situation.



Elobrate about Topology

The way in which devices are interconnected to form a network is called network topology. Some of the factors that affect choice of topology for a network are –

- **Cost** – Installation cost is a very important factor in overall cost of setting up an infrastructure. So cable lengths, distance between nodes, location of servers, etc. have to be considered when designing a network.
- **Flexibility** – Topology of a network should be flexible enough to allow reconfiguration of office set up, addition of new nodes and relocation of existing nodes.
- **Reliability** – Network should be designed in such a way that it has minimum down time. Failure of one node or a segment of cabling should not render the whole network useless.
- **Scalability** – Network topology should be scalable, i.e. it can accommodate load of new devices and nodes without perceptible drop in performance.
- **Ease of installation** – Network should be easy to install in terms of hardware, software and technical personnel requirements.
- **Ease of maintenance** – Troubleshooting and maintenance of network should be easy.

Formulate effects of Congestion

What is **congestion**?

A state occurring in network layer when the message traffic is so heavy that it slows down network response time.

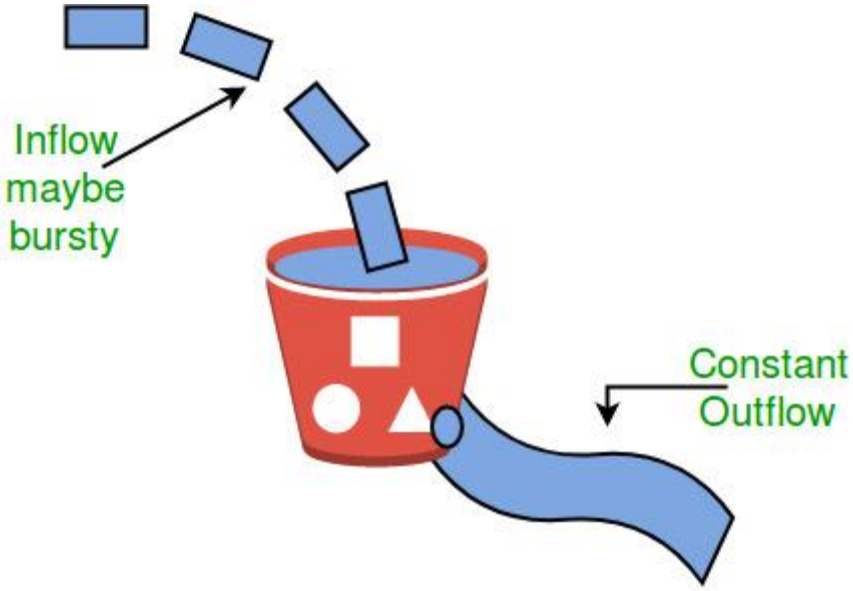
Effects of Congestion

- As delay increases, performance decreases.
- If delay increases, retransmission occurs, making situation worse.

Congestion control algorithms

- Congestion Control is a mechanism that controls the entry of data packets into the network, enabling a better use of a shared network infrastructure and avoiding congestive collapse.
- Congestive-Avoidance Algorithms (CAA) are implemented at the TCP layer as the mechanism to avoid congestive collapse in a network.
- There are two congestion control algorithm which are as follows:

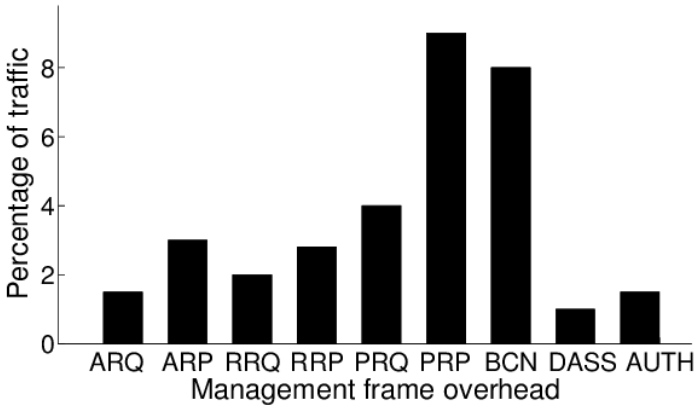
- **Leaky Bucket Algorithm**
- The leaky bucket algorithm discovers its use in the context of network traffic shaping or rate-limiting.
- A leaky bucket execution and a token bucket execution are predominantly used for traffic shaping algorithms.
- This algorithm is used to control the rate at which traffic is sent to the network and shape the burst traffic to a steady traffic stream.
- The disadvantages compared with the leaky-bucket algorithm are the inefficient use of available network resources.
- The large area of network resources such as bandwidth is not being used effectively.



Solve the traffic rate management

Traffic Rate Management

- Must discard frames to cope with congestion
  - —Arbitrarily, no regard for source
  - —No reward for restraint so end systems transmit as fast as possible
  - —Committed information rate (CIR)
    - Data in excess of this liable to discard
    - Not guaranteed
    - Aggregate CIR should not exceed physical data rate
- Committed burst size
- Excess burst size

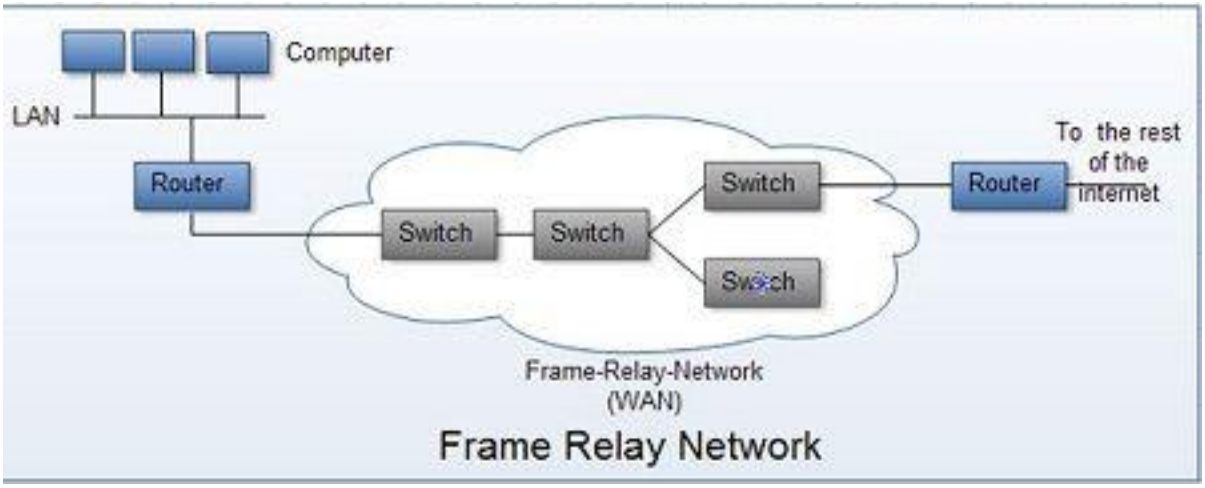

Percentage of traffic
0
2
4
6
8
ARQ
ARP
RRQ
RRP
PRQ
PRP
BCN
DASS
AUTH
Management frame overhead

UNIT- IV

Outline the frame relay Congestion control

Frame relay is a packet mode communication service that is designed to manage enhanced ***WANs. X.25*** was the previous technology utilized in place of frame relay, although it has some drawbacks like poor data rate, an unnecessary increase in flow rate, and error control.

Its service employs either a permanent or switching virtual circuit to create the link and permit the transfer of bits from source to destination at a reasonable speed and price. Before the introduction of ***frame relay*** and ***X.25***, slow telephone connections were utilized for their specific purpose. The key limitations of previous technologies were network delays, protocol overheads, and equipment costs.



Advantages

1. It supports a frame size of 9000 bytes, which is sufficient for all LAN frame kinds.
2. It provides a secure connection because the PVCs between the locations are tough to break.
3. At the user-network interface, it performs fewer functions.
4. It has faster speeds. It is due to the lack of error detection, which reduces overhead. It has a higher throughput than X.25.
5. It supports bursty data with no defined data rate.

6. The bandwidth can be dynamically assigned based on demand.

Disadvantages

1. It may only run at 44.376 Mbps, making it unsuitable for protocols that need higher data rates.
2. It does not support flow control or error control.
3. It supports variable-length frames, which may result in various latencies for different users.
4. It is more expensive than internet access.
5. There is data overhead and processing overhead with each packet.

Execute on requirements for ATM Traffic and Congestion Control

How ATM Works

1. ATM network uses fixed-length cells to transmit information. The cell consists of 48 bytes of payload and 5 bytes of header. The flexibility needed to support variable transmission rates is provided by transmitting the necessary number of cells per unit time.
2. ATM network is connection-oriented. It sets up virtual channal connection (VCC) going through one or more virtual paths (VP) and virtual channals (VC) before transmitting information. The cells is switched according to the VP or VC identifier (VPI/VCI) value in the cell head, which is originally set at the connection setup and is translated into new VPI/VCI value while the cell passes each switch.
3. ATM resources such as bandwidth and buffers are shared among users, they are allocated to the user only when they have something to transmit. So the network uses statistical multiplexing to improve the effective thoughput.

Why Need Congestion Control

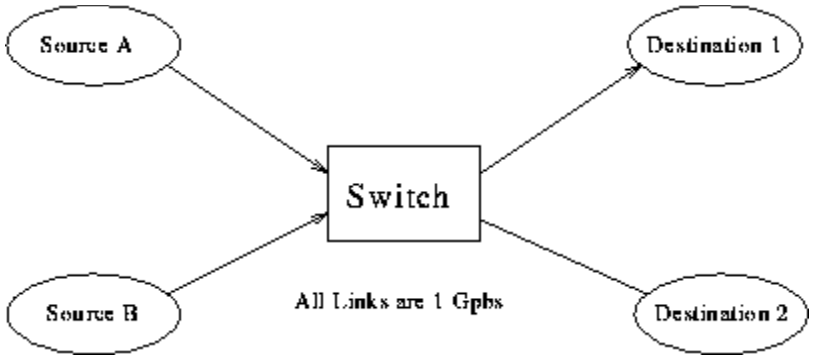
The assumption that statistical multiplexing can be used to improve the link utilization is that the users do not take their peak rate values simutaneously. But since the traffic demands are stochastic and cannot be predicted, congestion is unavoidable. Whenever the total input rate is greater than the output link

capacity, congestion happens. Under a congestion situation, the queue length may become very large in a short time, resulting in buffer overflow and cell loss. So congestion control is necessary to ensure that users get the negociated QoS. There are several misunderstandings about the cause and the solutions of congestion control [6]

1. Congestion is caused by the shortage of buffer space. The problem will be solved when the cost of memory becomes cheap enough to allow very large memory.

   Larger buffer is useful only for very short term congestions and will cause undesirable long delays. Suppose the total input rate of a switch is 1Mbps and the capacity of the output link is 0.5Mbps, the buffer will overflow after 16 second with 1Mbyte memory and will also overflow after 1 hour with 225Mbyte memory if the situation persists. Thus larger buffer size can only postpone the discarding of cells but cannot provent it. The long queue and long delay introduced by large memory is undesirable for some applications.
2. Congestion is caused by slow links. The problem will be solved when high-speed links become available.

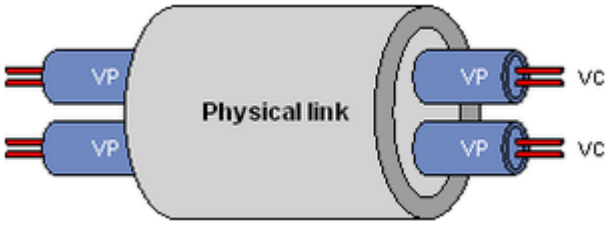
   It is not always the case, sometimes increases in link bandwidth can aggravate the congestion problem because higher speed links may make the network more unbalanced. For the configuration showed in the Figure 1, if both of the two sources begin to send to destination 1 at their peak rate, congestion will occur at the switch. Higher speed links can make the congestion condition in the switch worse.



Demonstrate ATM logical connection

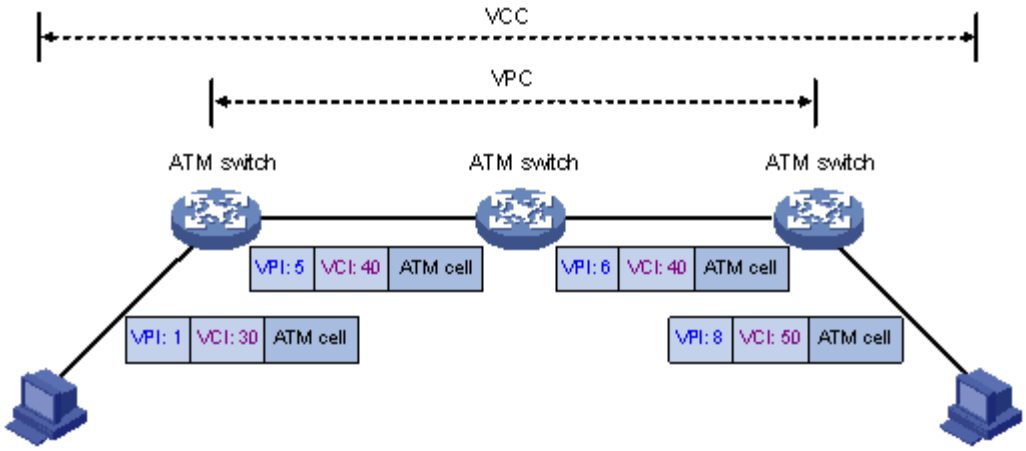
ATM connections are logical connections, or virtual circuits. In an ATM network, you can create logical connections called virtual paths (VPs) and virtual circuits (VCs) on physical links. As shown in Figure 63, you can create multiple VPs on a physical link, and each VP can be demultiplexed into multiple VCs. Cells from different users are transmitted over different VPs and VCs, which are identified by virtual path identifier (VPI) and virtual channel identifier (VCI).

Figure 63: Physical link, VP, and VC



ATM uses VPI/VCI pairs to identify a logical connection. When a connection is released, all the involved VPI/VCI pairs are reclaimed for new connections.
an ATM switch forwards ATM cells by looking up the switching entries and changing the VPIs/VCIs. The ATM switching by changing VPIs only is VP switching, and the connection established through VP switching is Virtual Path Connection (VPC). The ATM switching by changing VCIs only or changing both VCIs and VPIs is VC switching, and the connection established through VC switching is Virtual Circuit Connection (VCC).

Figure 64: ATM switching



ATM interfaces support only manually created permanent virtual circuits (PVCs) and permanent virtual paths (PVPs), not switched virtual circuits (SVCs) created through the exchange of signals

Schedule ATM-GFR Traffic management

GFR Traffic Management

- Guaranteed frame rate is as simple as UBR from end system viewpoint
- Places modest requirements on ATM network elements
- End system does no policing or shaping of traffic
- May transmit at line rate of ATM adaptor
- No guarantee of frame delivery
  - —Higher layer (e.g. TCP) must do congestion control
- User can reserve capacity for each VC
  - —Assures application may transmit at minimum rate without losses
  - —If no congestion, higher rates maybe used