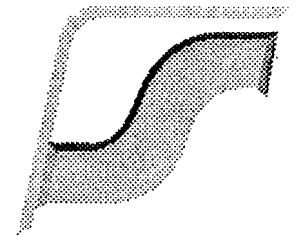


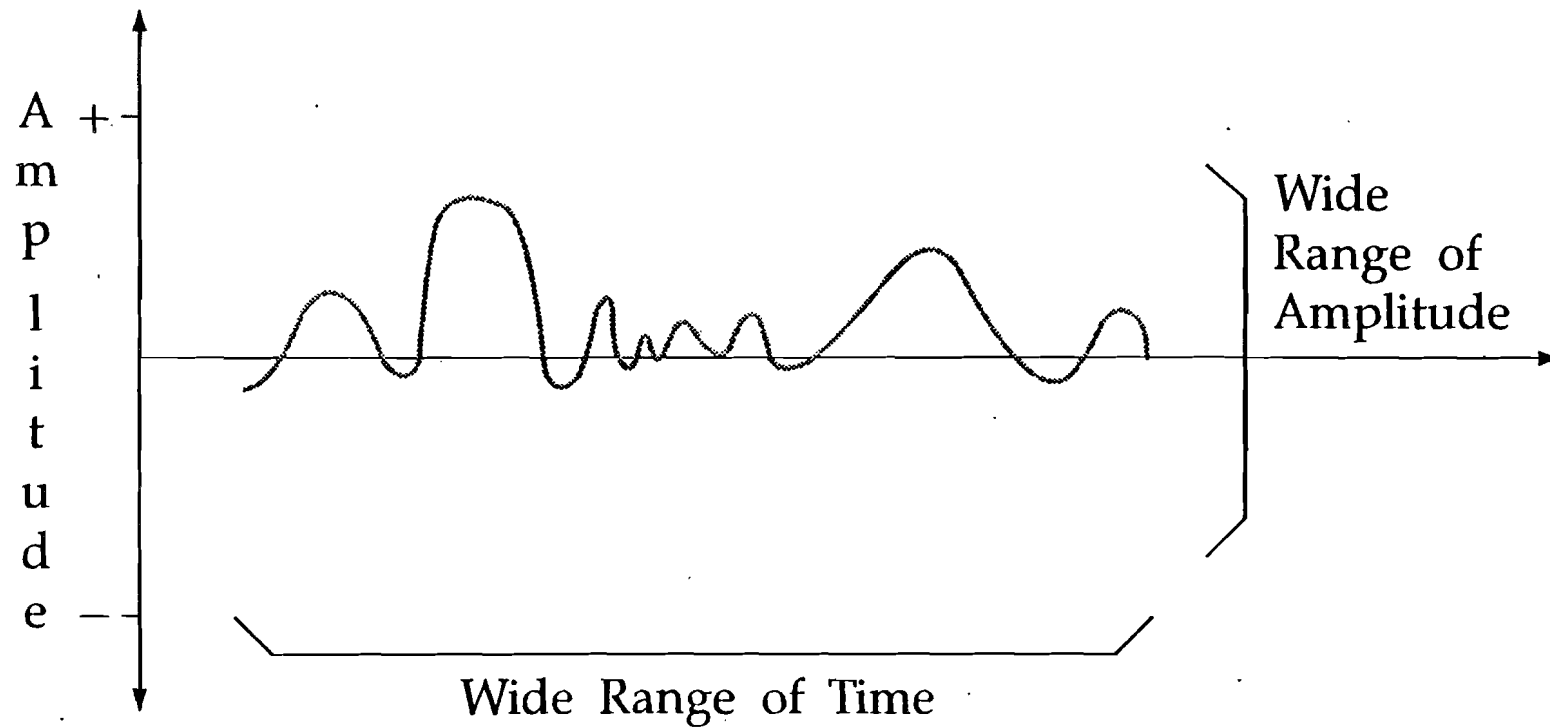
*Integration of Voice
and Data
Communications*



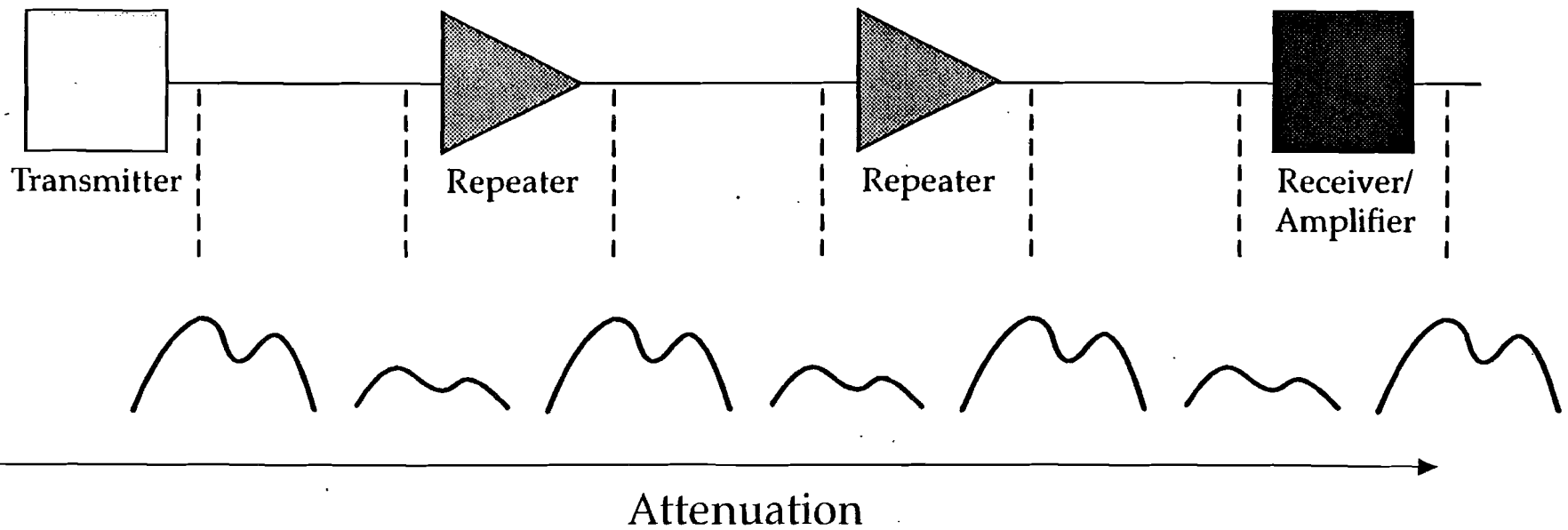
First Key Point

Voice = Data

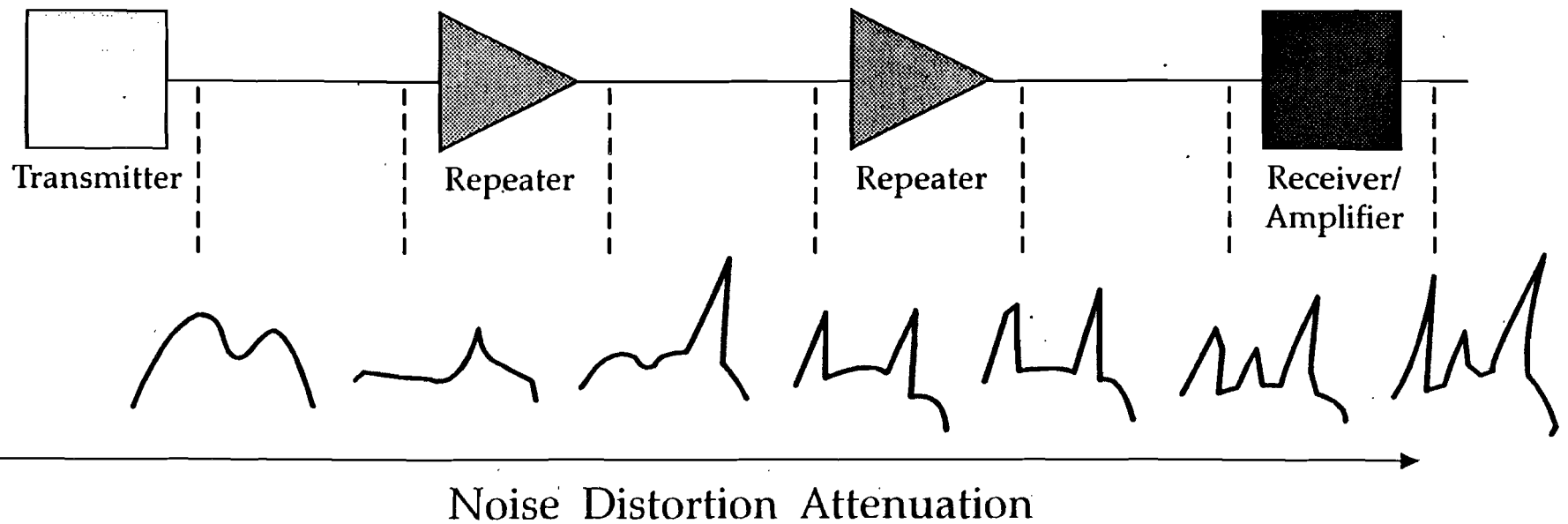
Analog Wave Form



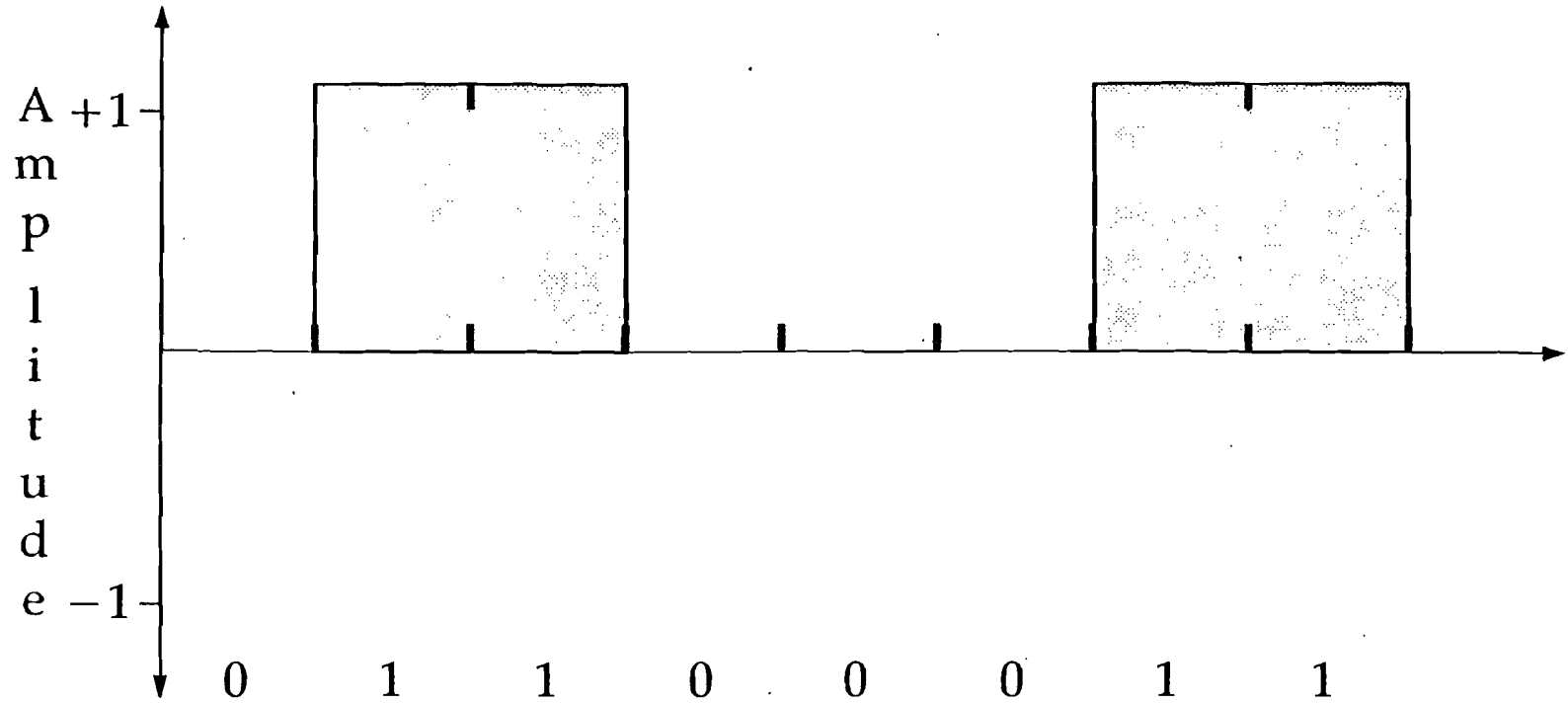
Analog Transmission: Signal Attenuation and Amplification



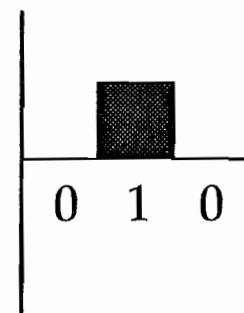
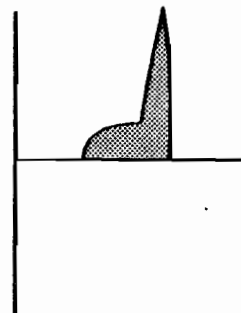
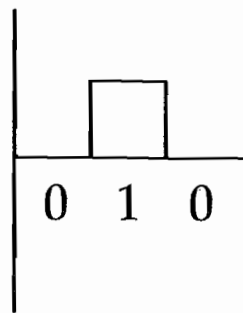
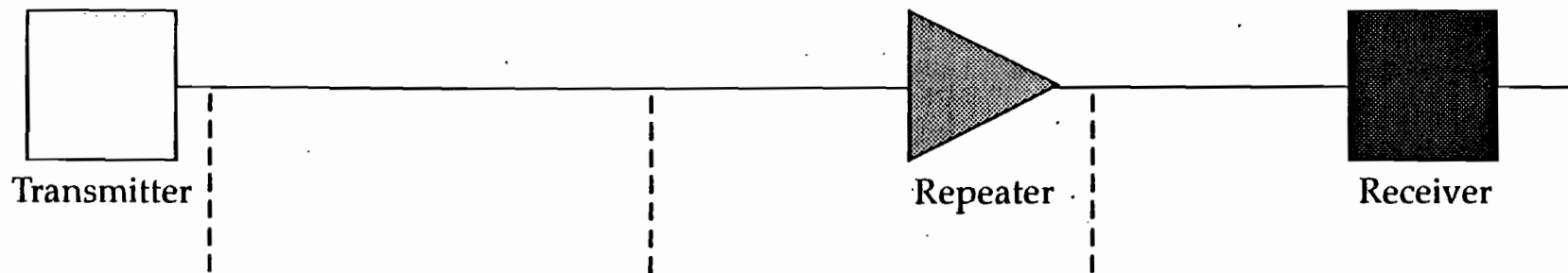
Analog Transmission: Amplifying Distorted Signals



Digital Wave Form

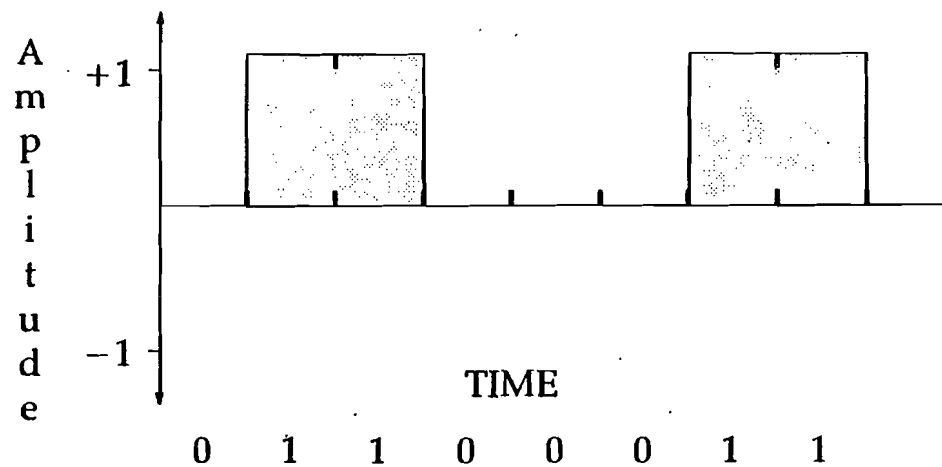


Digital Pulse Regeneration

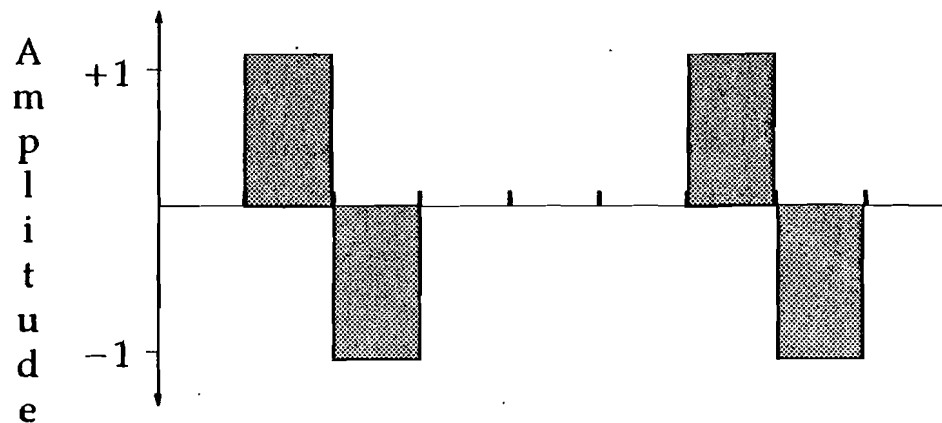


Binary vs. Bipolar

Binary (DC)



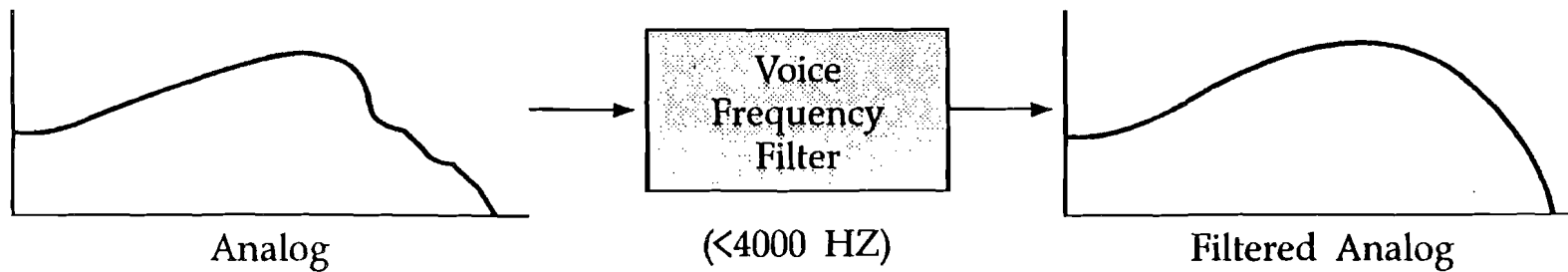
Bipolar (AC)



Alternate
Mark
Inversion

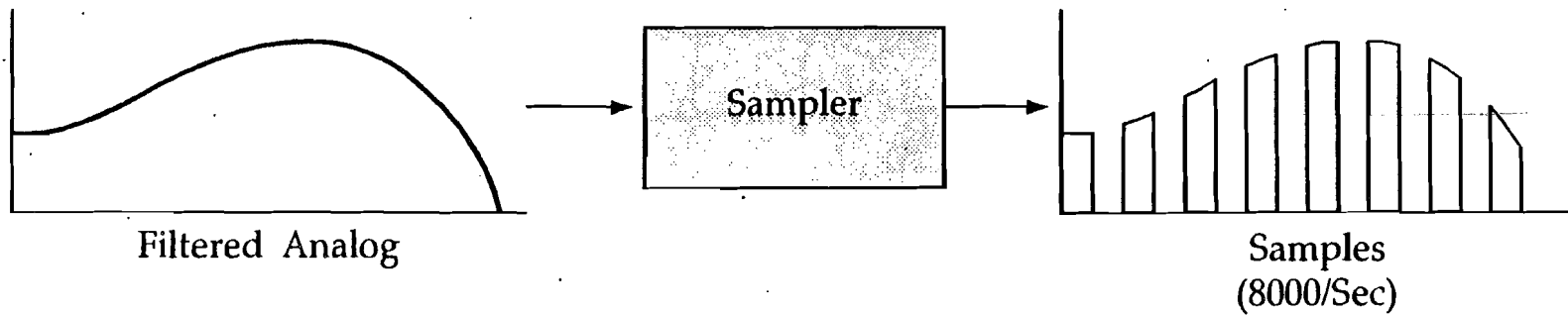
How Voice is Digitized

1) Filter

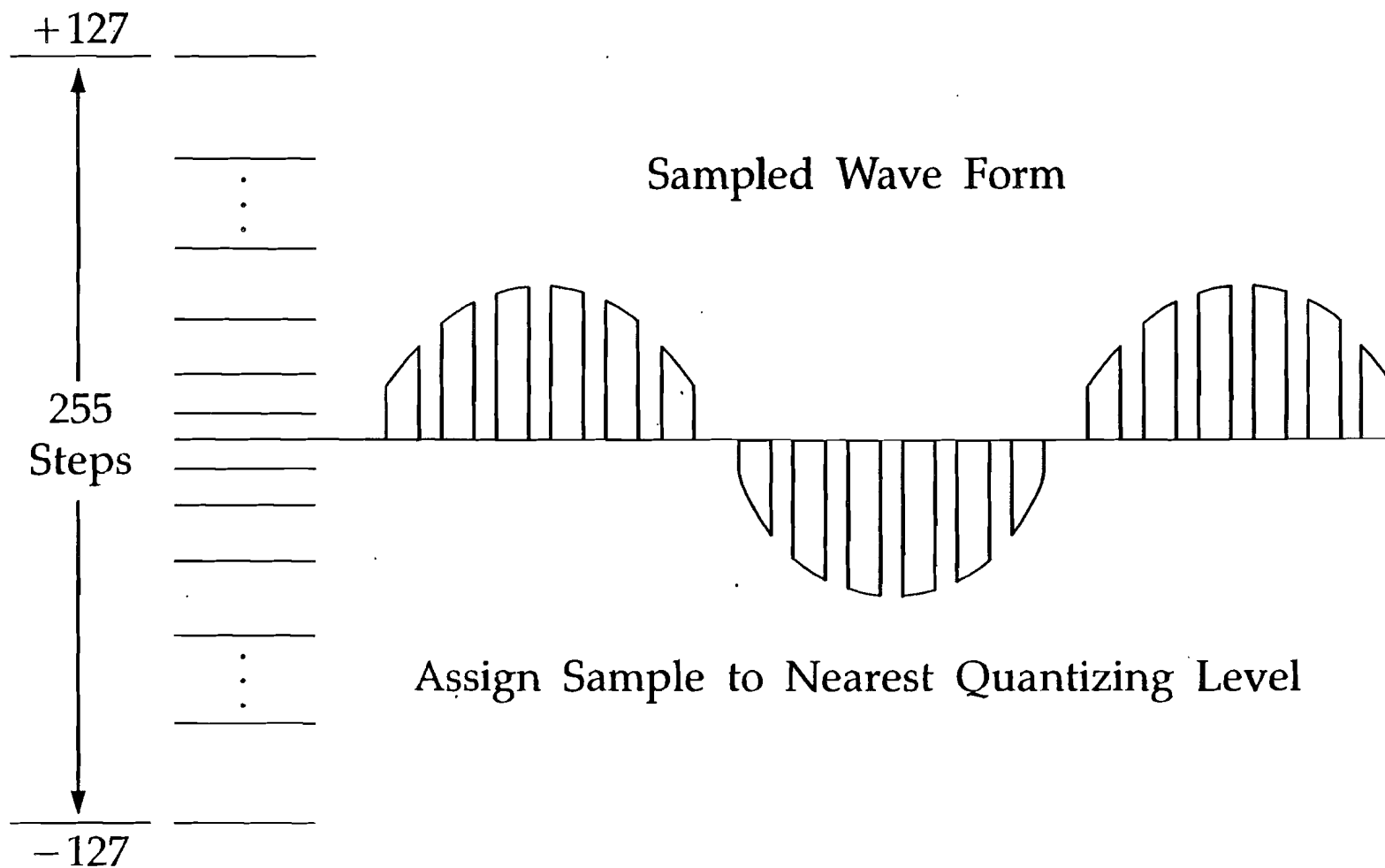


How Voice is Digitized

2) Sample

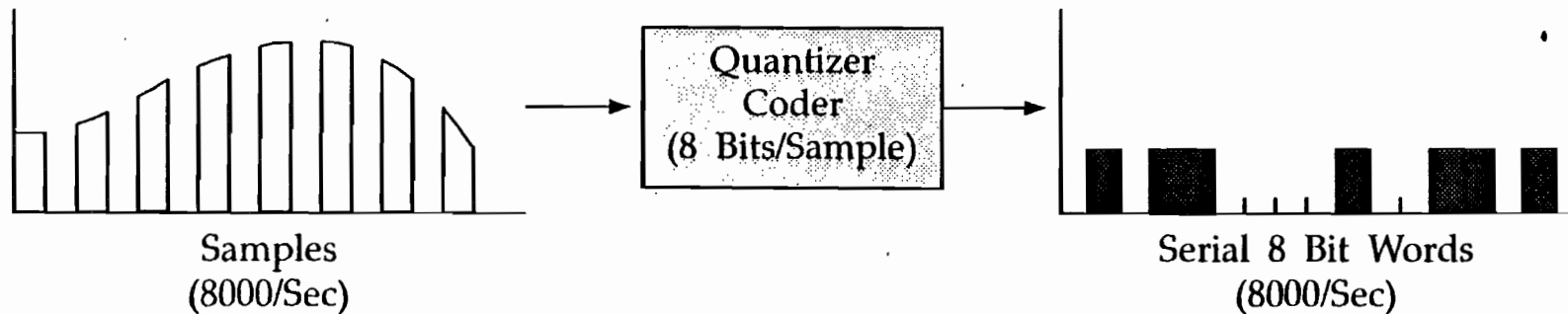


Quantizing Levels

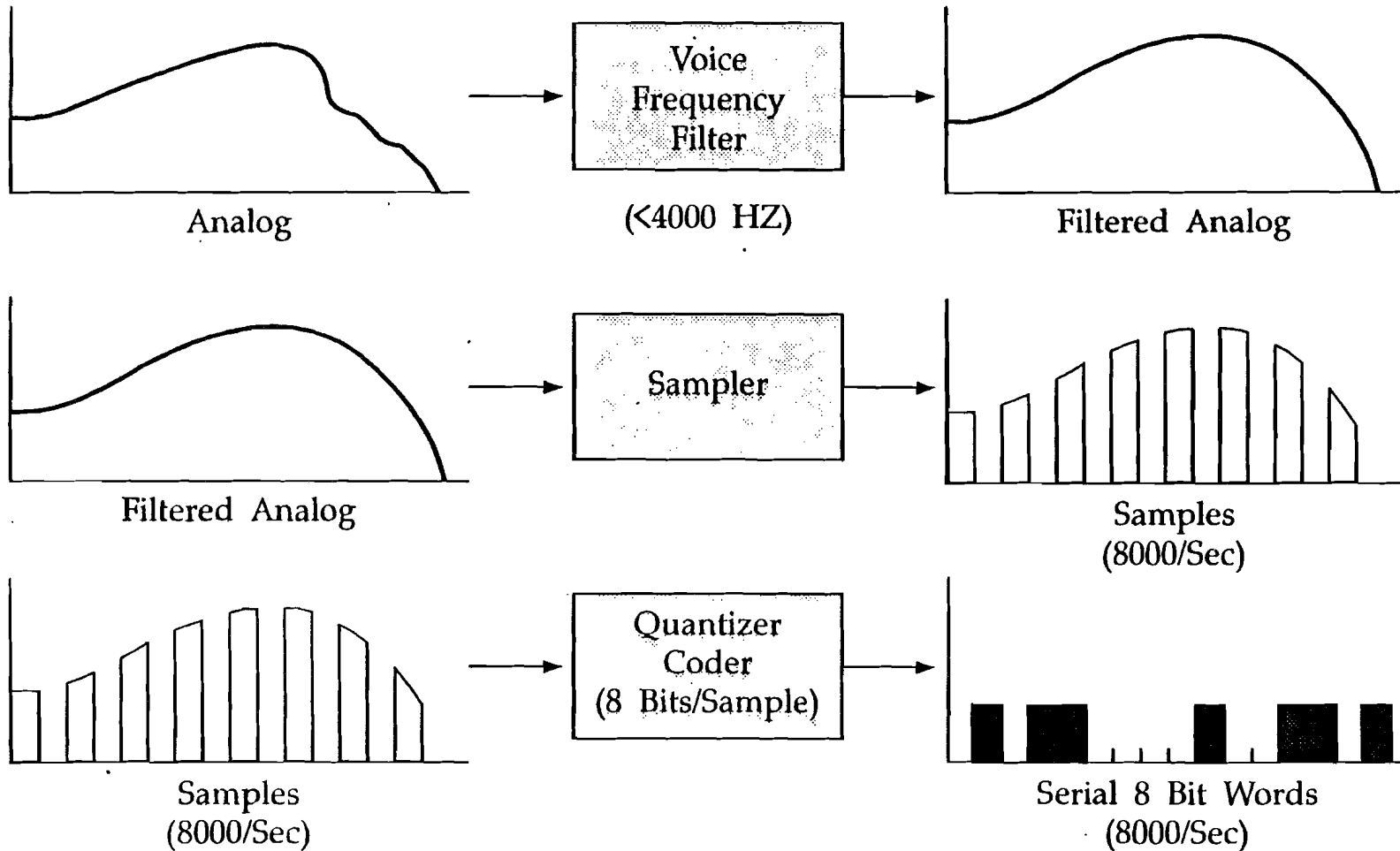


How Voice is Digitized

3) Quantize/Code



Pulse Code Modulation



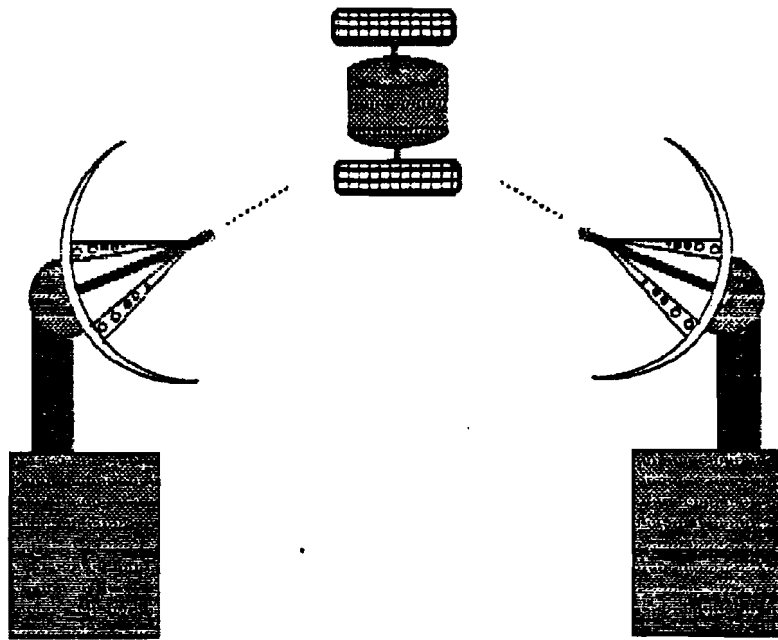
What Data Rate is Needed To Transmit Voice?

$$\begin{array}{r} 8 \text{ Bits/Sample} \\ \times 8,000 \text{ Samples/Sec} \\ \hline 64,000 \text{ Bits/Sec (bps)} \end{array}$$

Why 56 Kbps Data?

Robbed – Bit Signaling Robs One Bit
For On – Hook/Off – Hook Indication From
Each Timeslot Every 6 Frames

$$\begin{array}{r} 7 \text{ Bits/Timeslot} \\ \times 8,000 \text{ Timeslots/Sec} \\ \hline 56,000 \text{ Bits/Sec (bps)} \end{array}$$

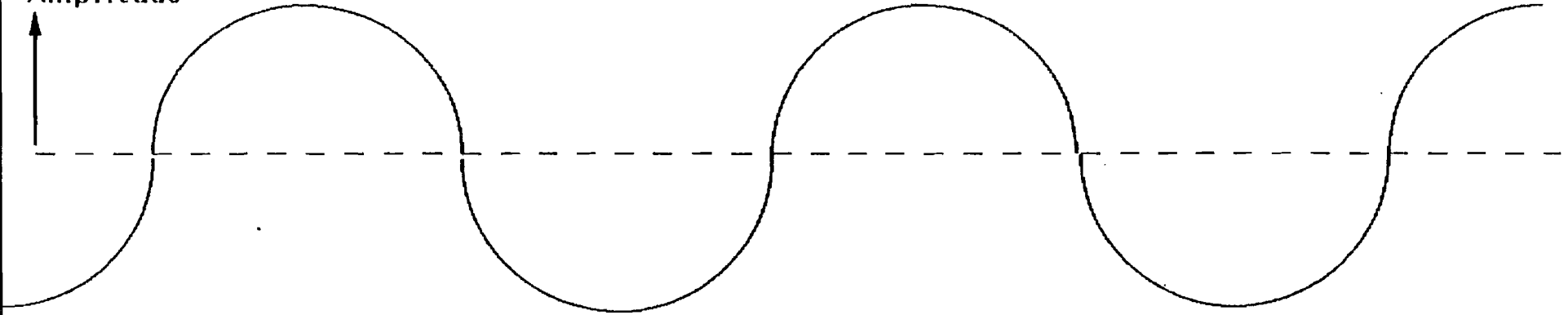


Data communications is the movement of computer coded information from one location to another.

This communication between machines is in a binary code of 1's and 0's.

Analog signal

Amplitude



← one cycle →

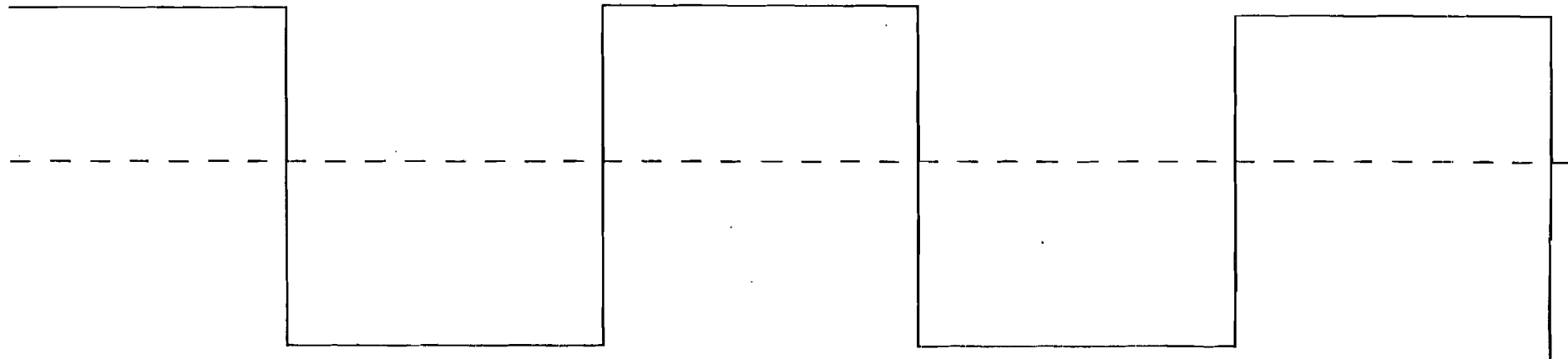
Digital signal

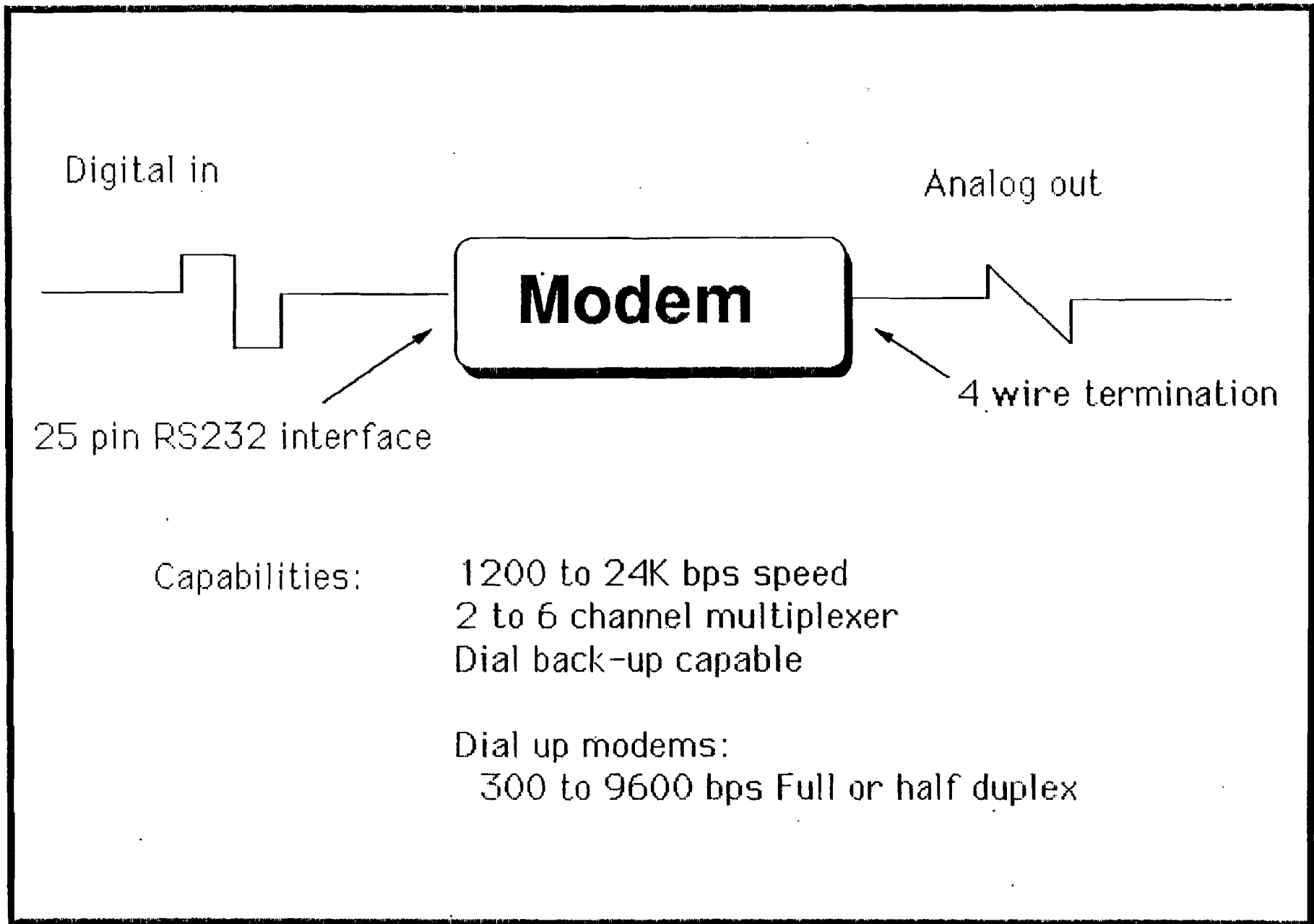
0

1

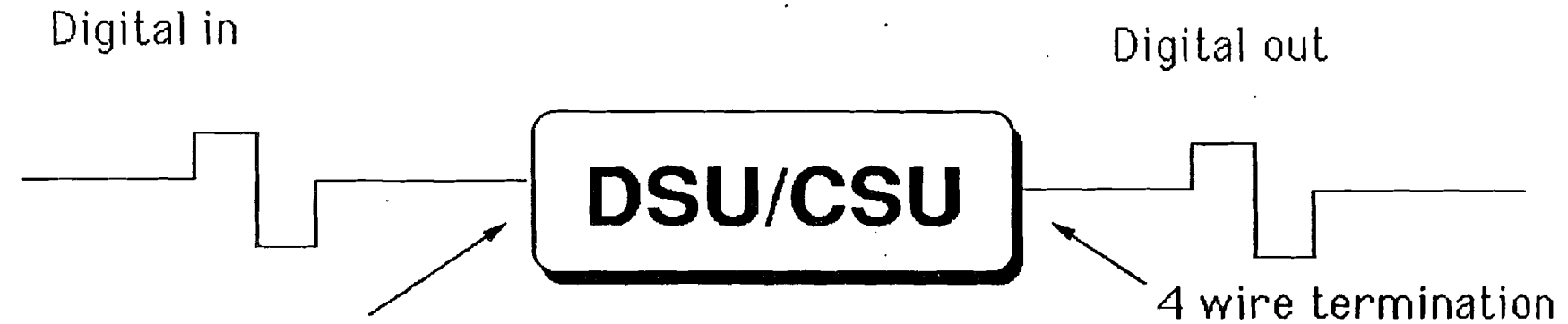
0

1





Digital Service Unit / Customer Service Unit



25 pin RS232 interface,

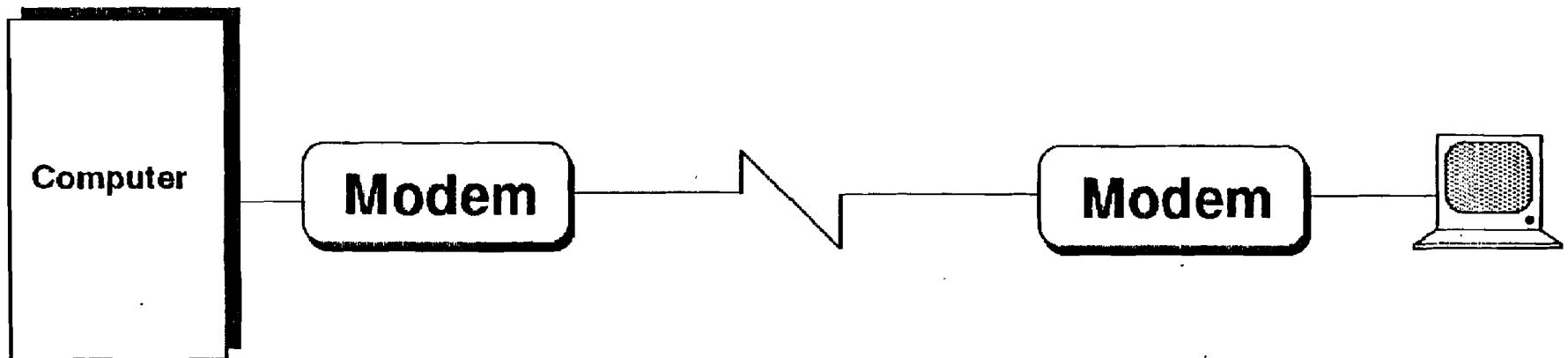
37 pin V.35 on 56K bps
(changing to be 232 - 25 pin)

Capabilities: 2400, 4800, 9600, 19,200 and 56K bps speed

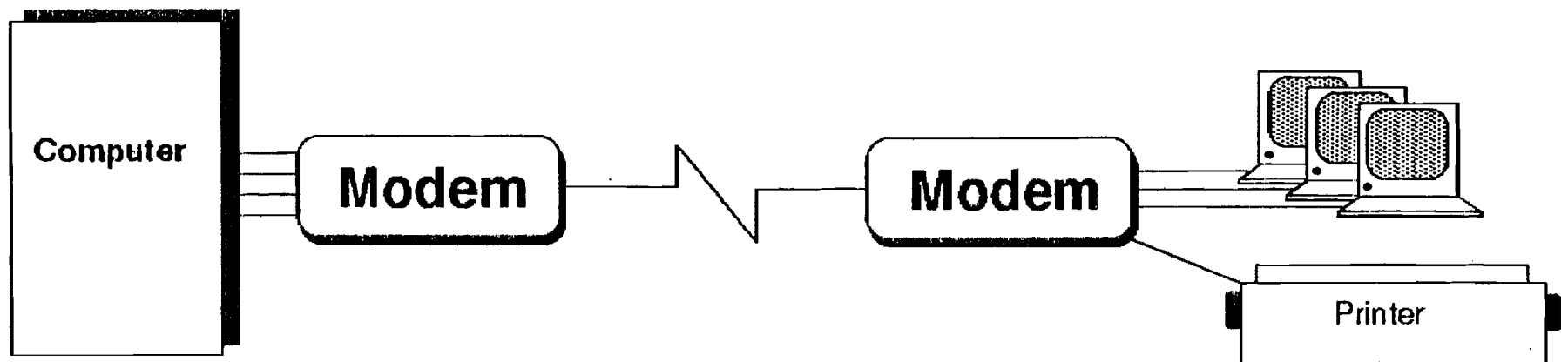
2, 4 or 6 channel Internal multiplexer

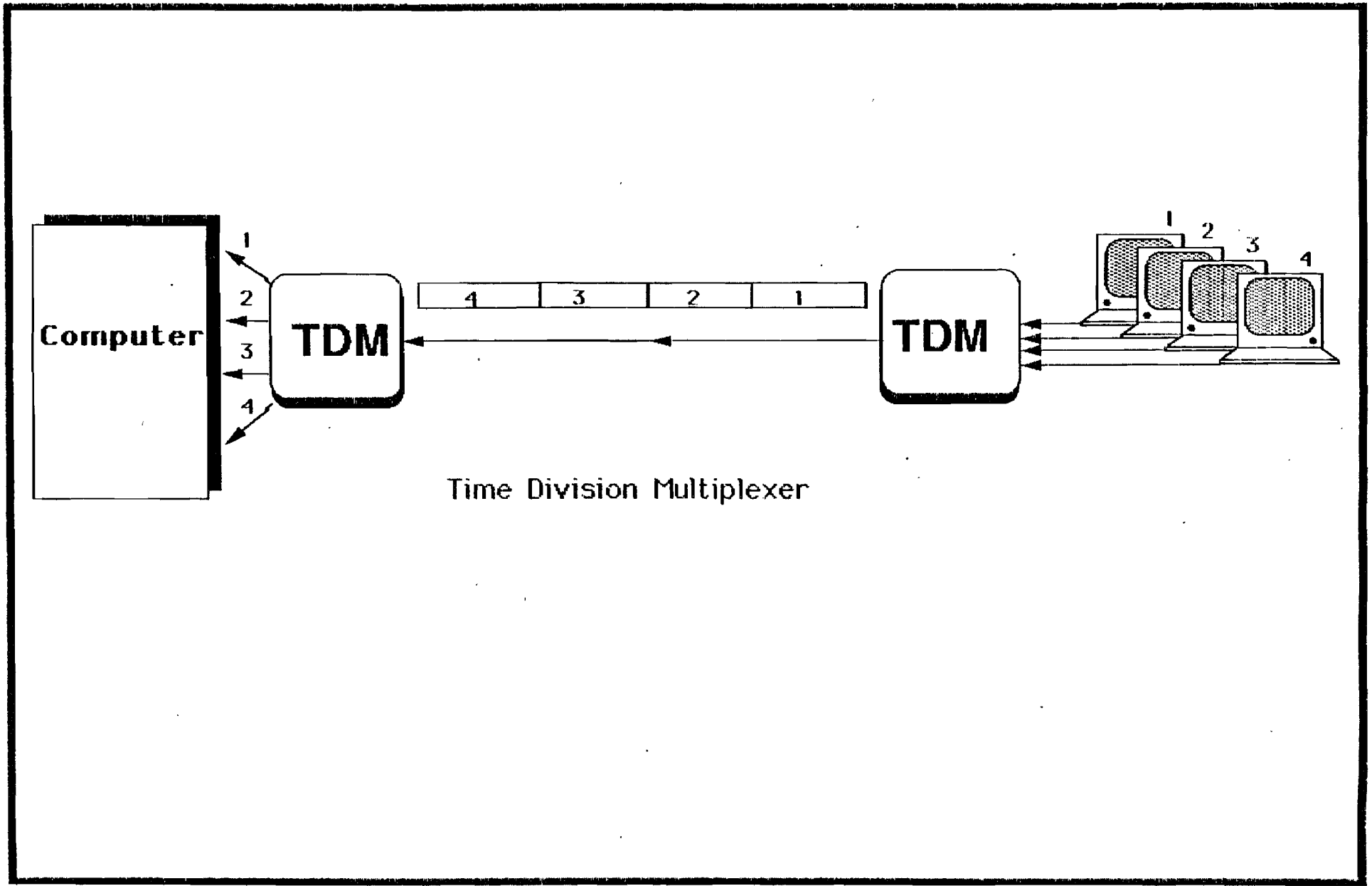
Inexpensive

Basic point to point circuit.

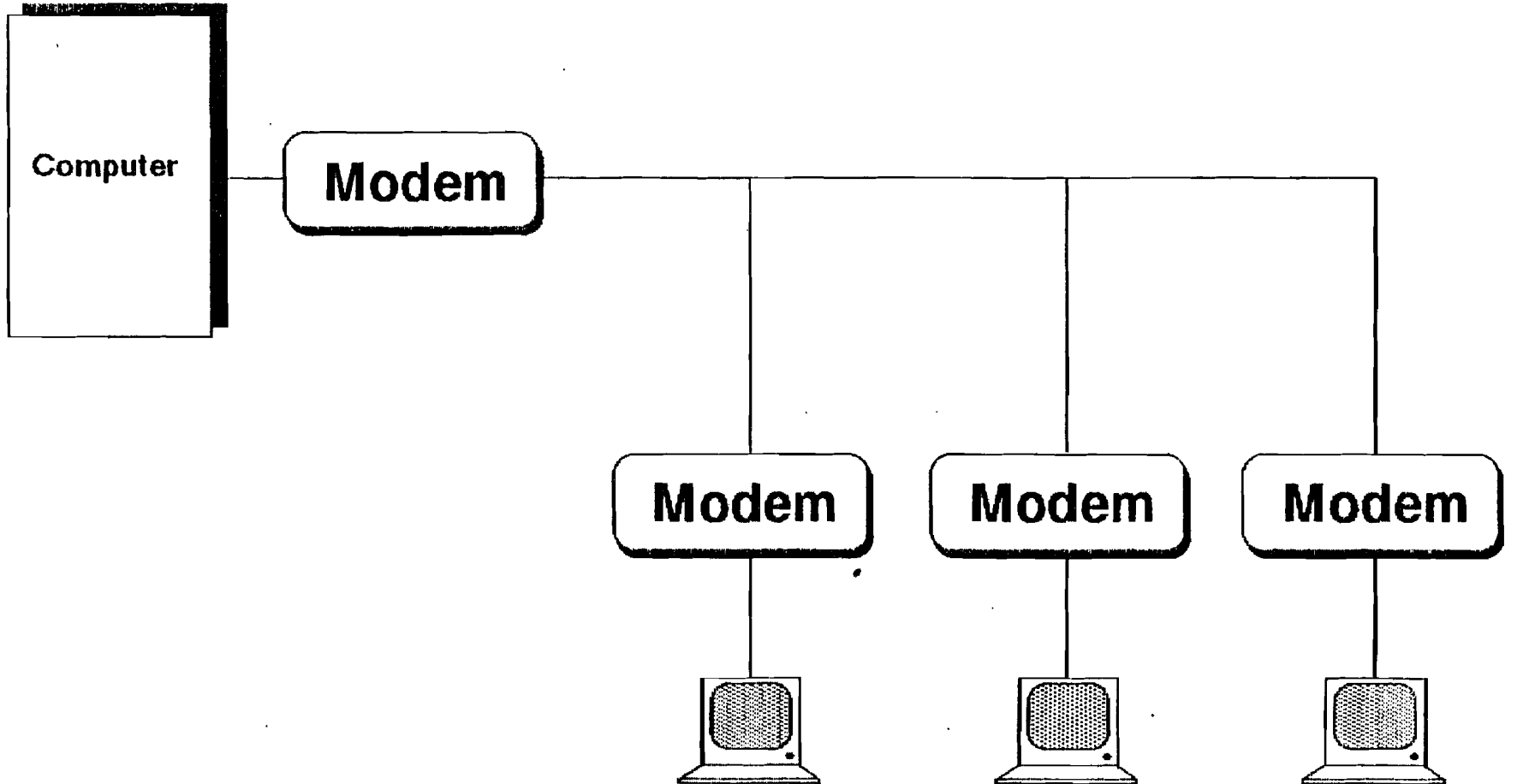


Multiplexed point to point circuit.

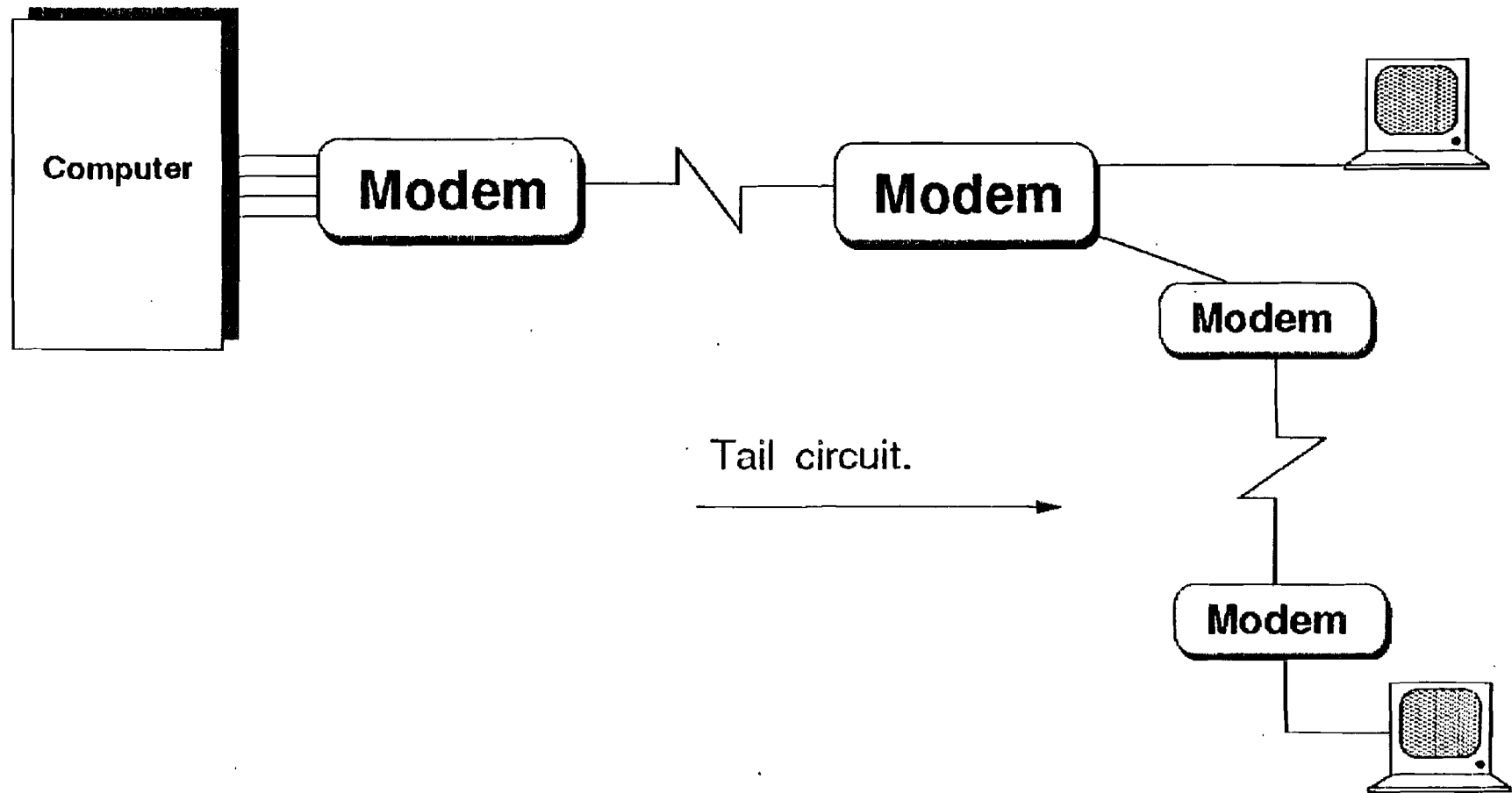




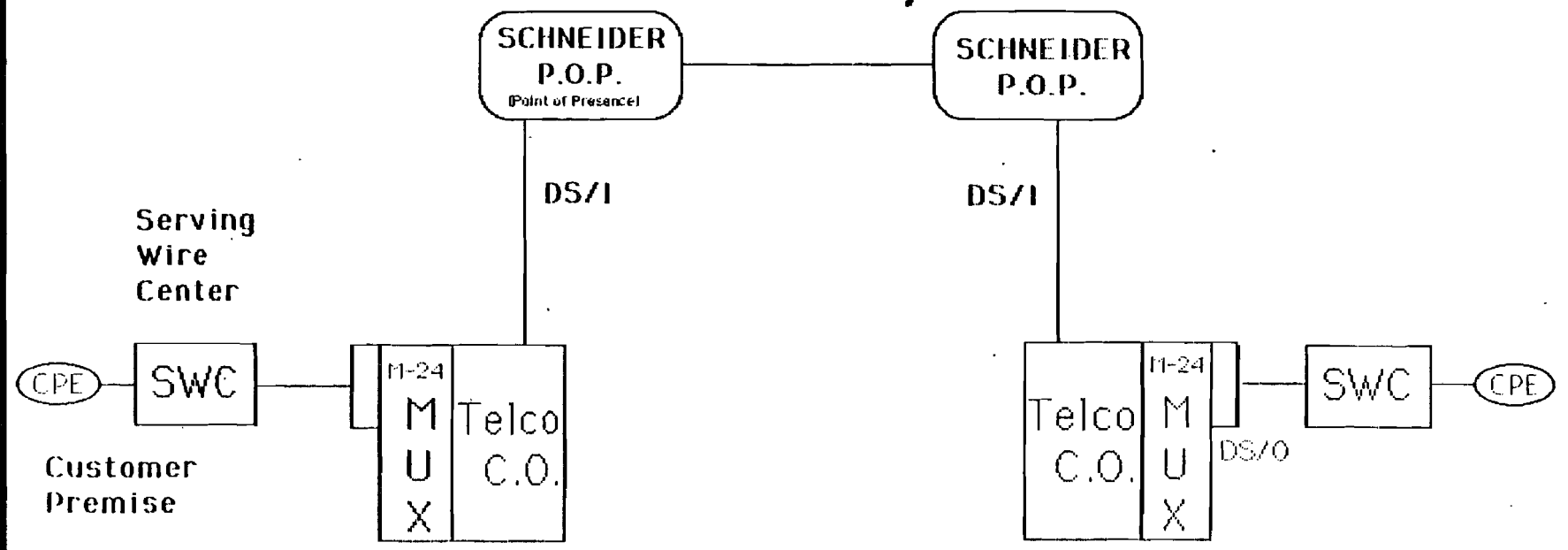
Multipoint circuit.



Multiplexed point to point circuit.



PRIVATE LINE CIRCUIT

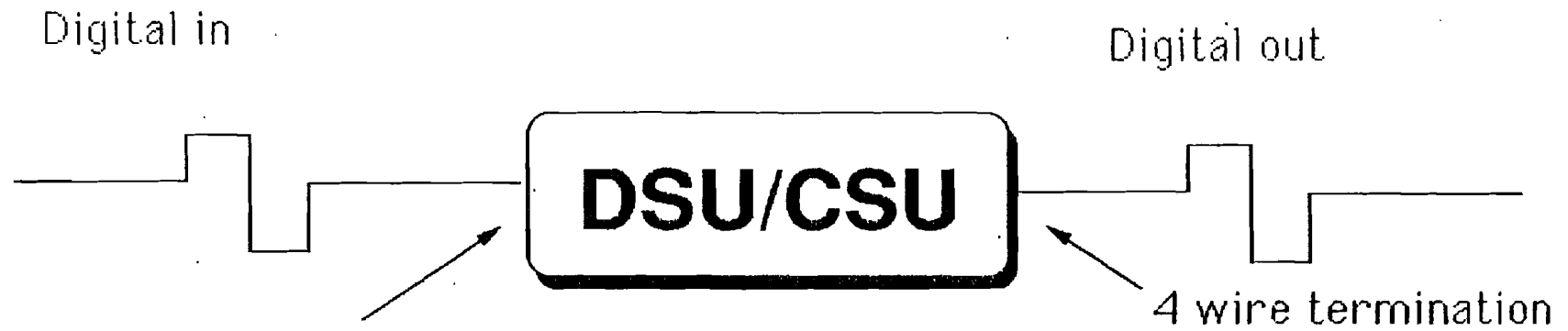


Why 56 Kbps Data?

Robbed – Bit Signaling Robs One Bit
For On – Hook/Off – Hook Indication From
Each Timeslot Every 6 Frames

$$\begin{array}{r} 7 \text{ Bits/Timeslot} \\ \times 8,000 \text{ Timeslots/Sec} \\ \hline 56,000 \text{ Bits/Sec (bps)} \end{array}$$

Channel
Digital Service Unit / ~~Customer~~ Service Unit



25 pin RS232 interface,
37 pin V.35 on 56K bps
(changing to be 232 - 25 pin)

Capabilities: 2400, 4800, 9600, 19,200 and 56K bps speed

2, 4 or 6 channel Internal multiplexer

Inexpensive

North American Digital Transmission Hierarchy

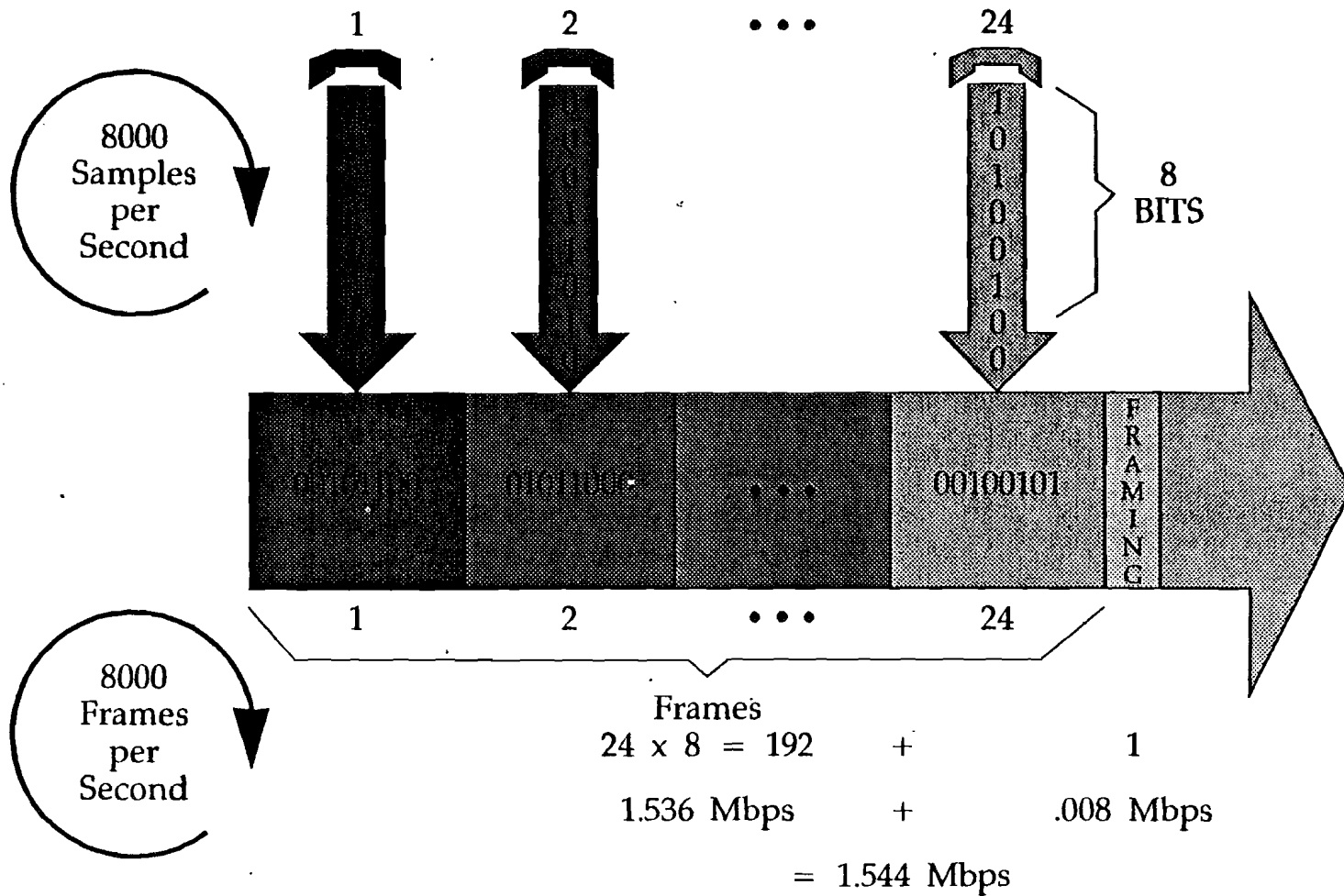
	<u>Voice Channel Capacity</u>	<u>Data Rate</u>
DS0	1	64 Kbps
DS1	24	1.544 Mbps
DS1C	48	3.152 Mbps
DS2	96	6.312 Mbps
DS3	672	44.736 Mbps
DS4	2,016	139.264 Mbps
No Standard	6,048	405 Mbps
No Standard	8,064	565 Mbps
No Standard	24,192	1.8 Gbps

T1 Carrier

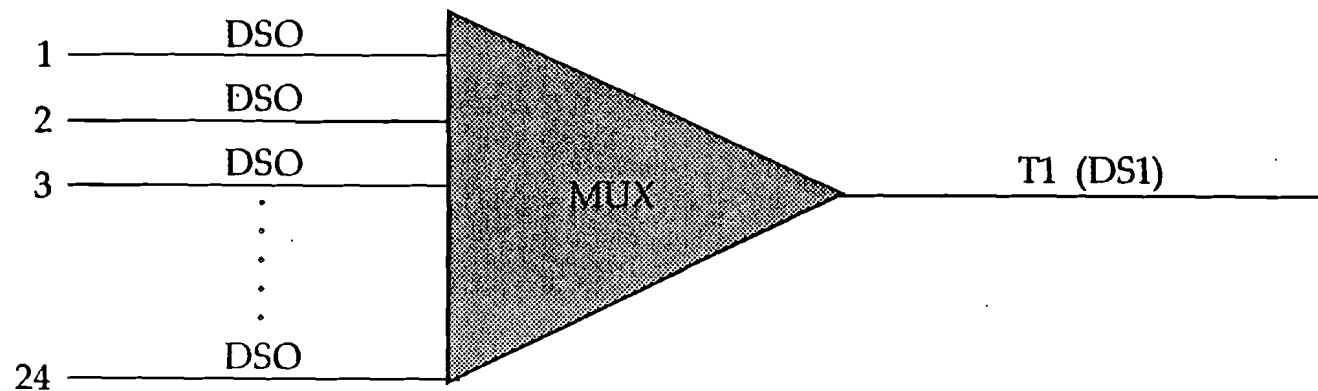
- A Digital Transmission System Which Sends Information at 1.544 Mbps
- A T1 System Carries one DS1
- A T1 System Carries 24 DS0's

$$T1 \approx DS1$$

T1 Carrier



Channel Bank or T1 Multiplexor



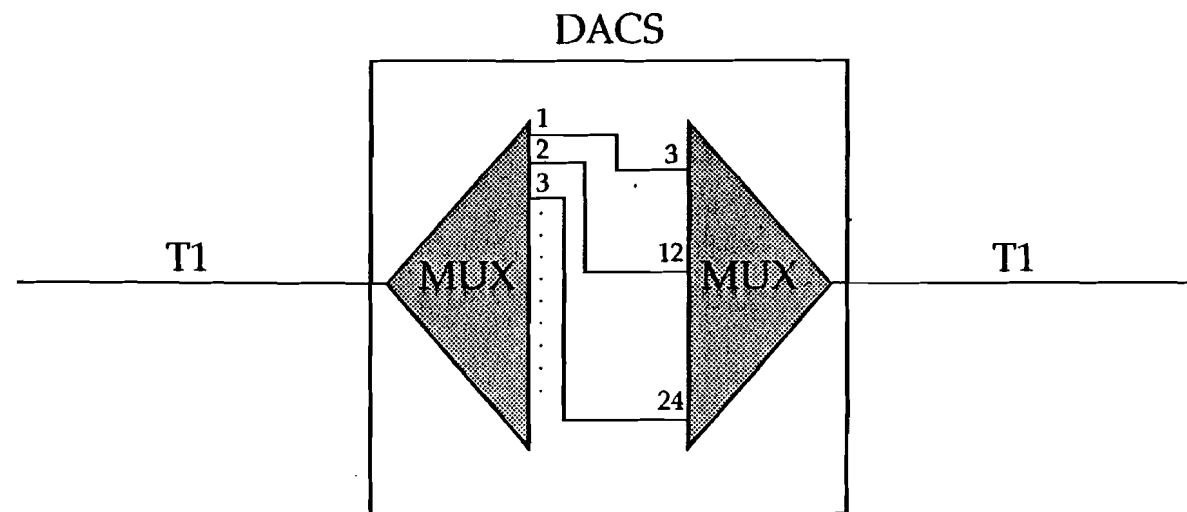
Voice Interfaces

- 2 Wire Ground Start
- 2 Wire Loop Start
- 4 Wire E & M

Data Interfaces

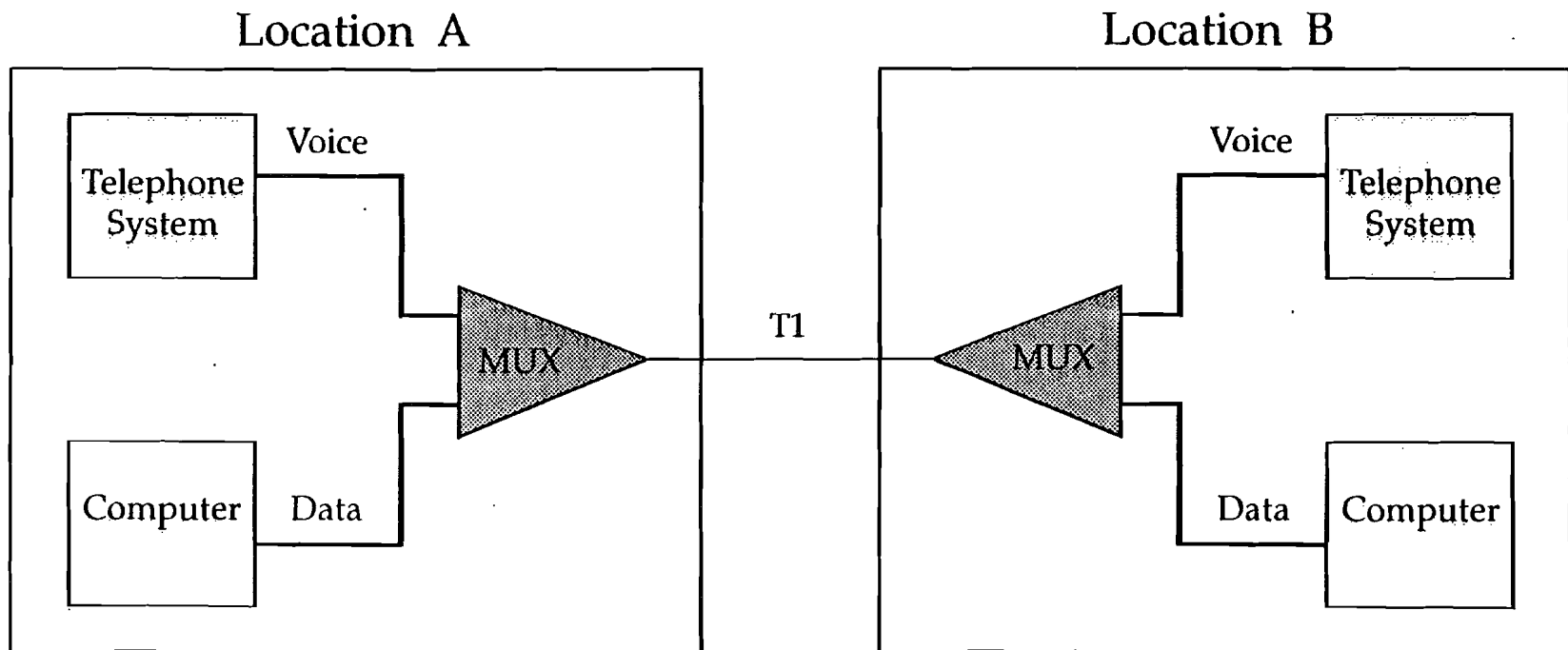
- V.24 / RS232
- X.21 / RS449
- V.35 / 56 Kbps
- 4 Wire / Modem
- LAN Bridging

Digital Access Cross-Connect System (DACCS)

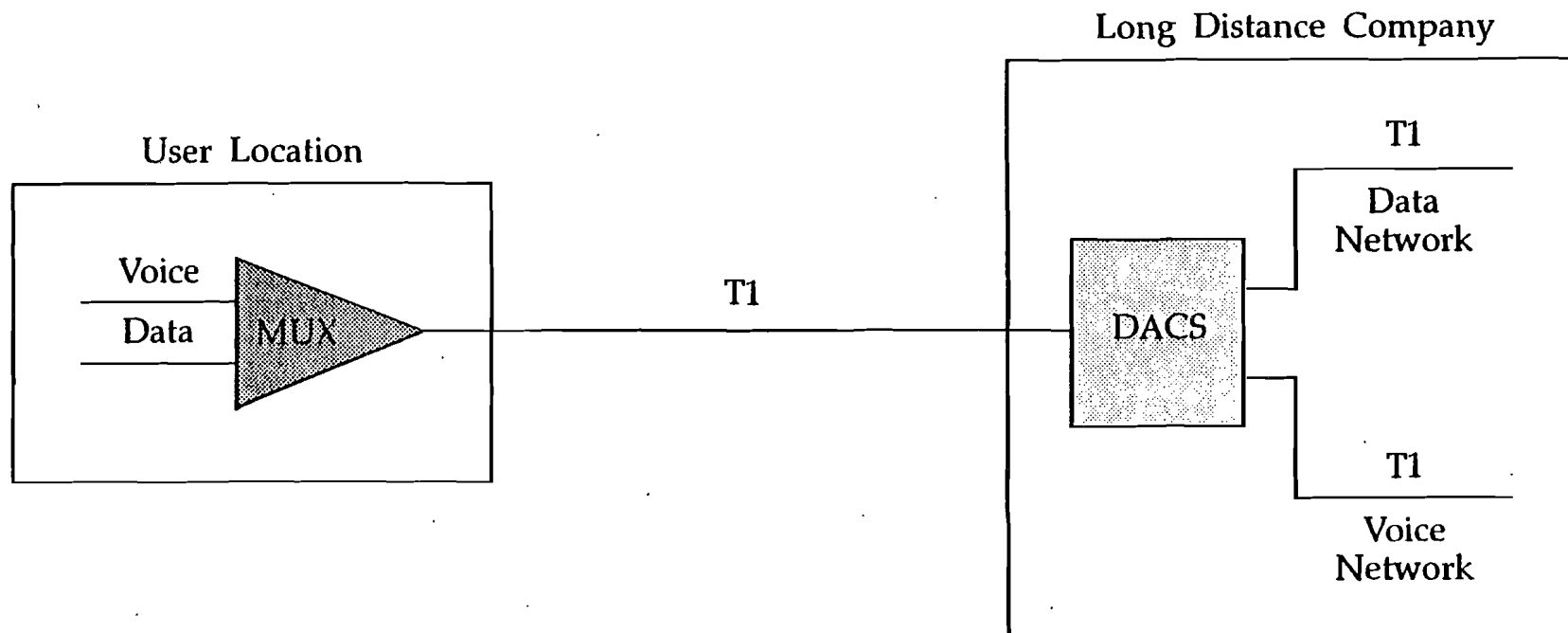


Allows the Interconnection of One T1 Channel (DSO)
With Another T1 Channel Via Software Control

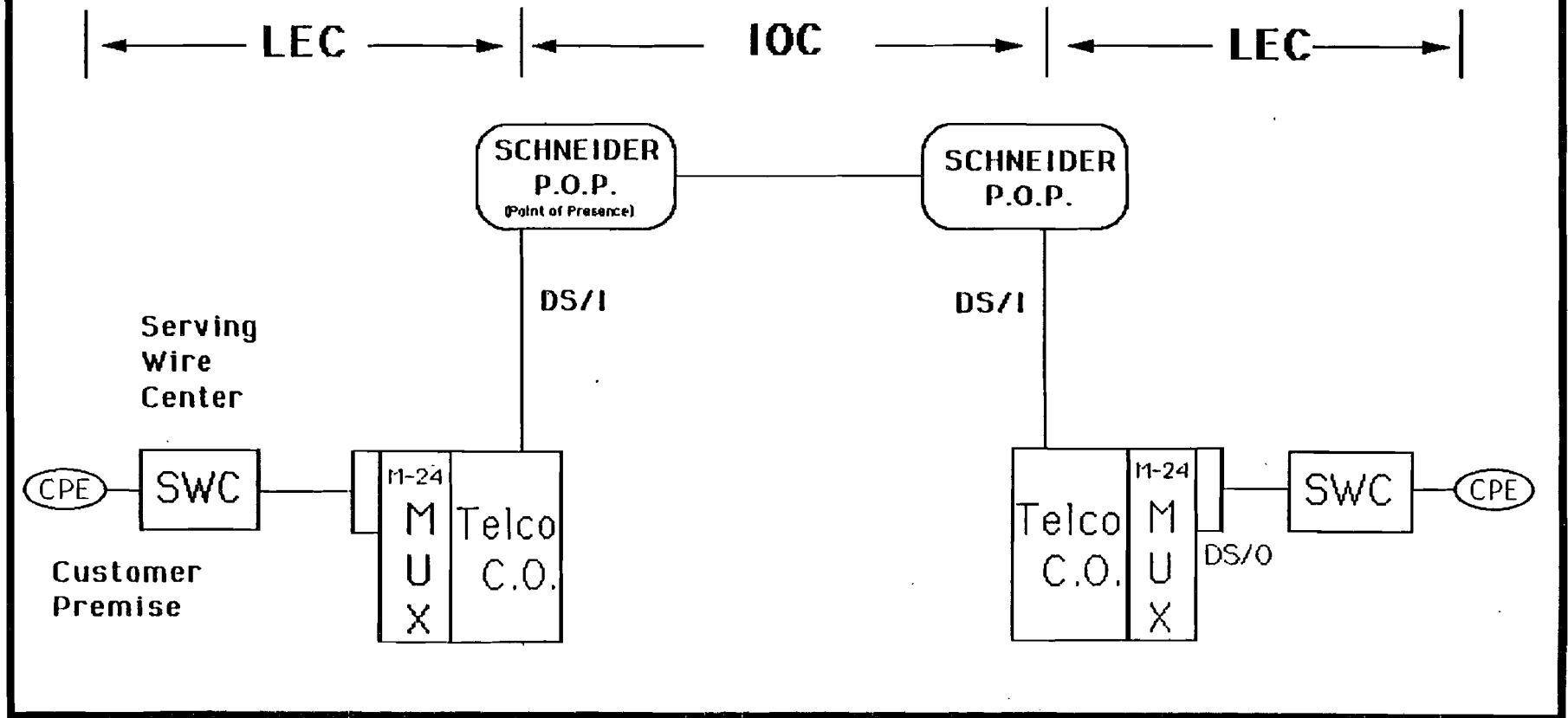
Example 1: Point to Point Voice/Data Integration



Example 2: Long Distance Access



PRIVATE LINE CIRCUIT



Voice / Data Network

