University of Diyala

Telecom Switching Systems

Lecture 5

4th Stage

Communication department / Engineering collage

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In order to codify 256 levels, 8 bits are needed, where the PCM bit rate (v) is:

$$v = 8{,}000_{\,samples/s} \times 8_{bits/sample} = 64Kbps$$

This bit rate is the sub-primary level of transmission networks.

Two frame structures are widely used:

1. 24 - channel system (known as DS1) used in North - America and Japan.
2. 30 - channel system used in Europe

1. DS1 24 channel system

In 1965, a standard appeared in the U.S. that permitted the TDM multiplexing of 24 digital telephone channels of 64 Kbps into a 1.544-Mbps signal with a format called T1 (see Figure 1.10). For the T1 signal, a synchronization bit is added to the 24 TDM time slots, in such a way that the aggregate transmission rate is:

$$(24_{channels} \times 8_{bit/channel} + 1_{bit})/125\mu s = 1{,}544Mbps$$

125 μs is the sampling period

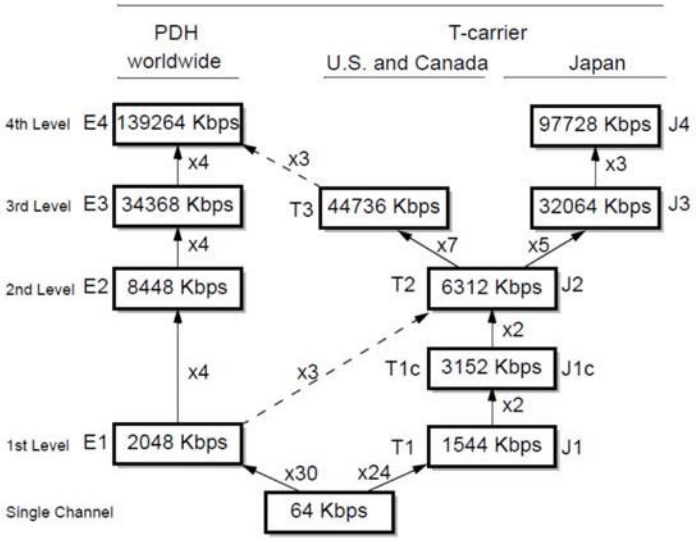

Fig. (1-10)

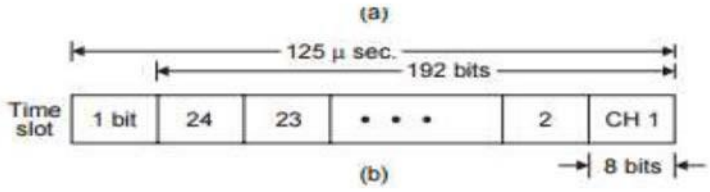

Fig. DS-1 frame Format

1. **30 - channel system used in Europe:**

Europe developed its own TDM multiplexing scheme a little later (1968), although it had a different capacity: 32 digital channels of 64 Kbps (see Figure 1.10). The resulting signal was transmitted at 2.048 Mbps, and its format was called E1. The aggregate transmission rate can be obtained from the following equation:

$$32_{channels} \times 8_{bit/channel}) / 125\mu s = 2{,}048Mbps$$

The figure below shows that the time slot 0 is allotted to the frame - alignment word. Time slots 1 - 15 and 17 - 31 are each allotted to a speech channel. Time slot 16 is allotted to signalling.