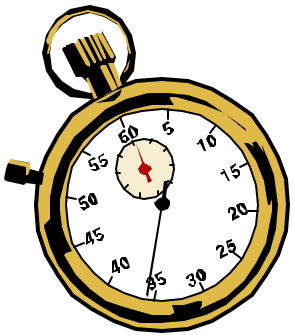
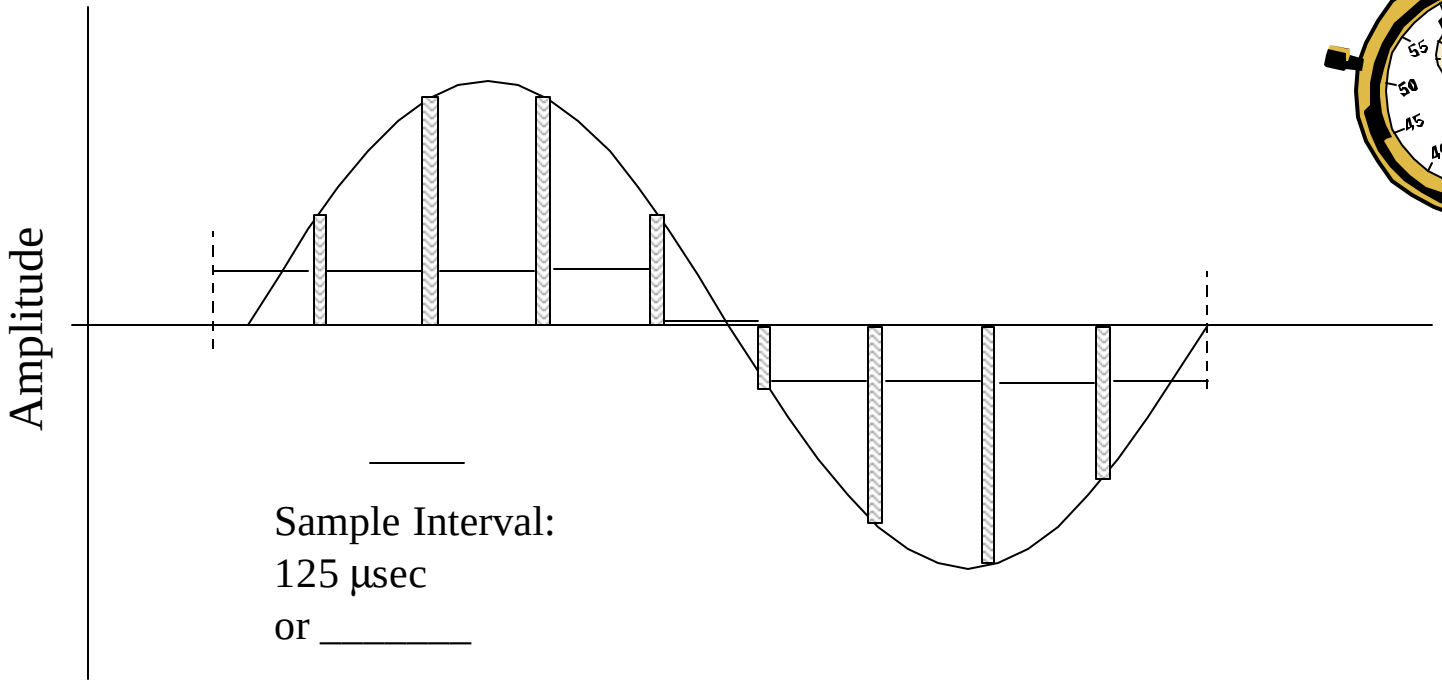
Sampling

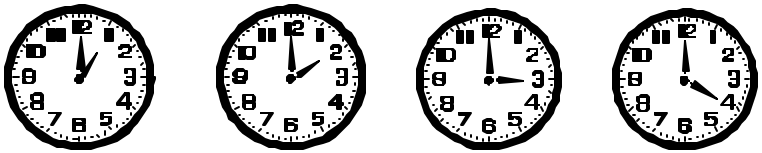




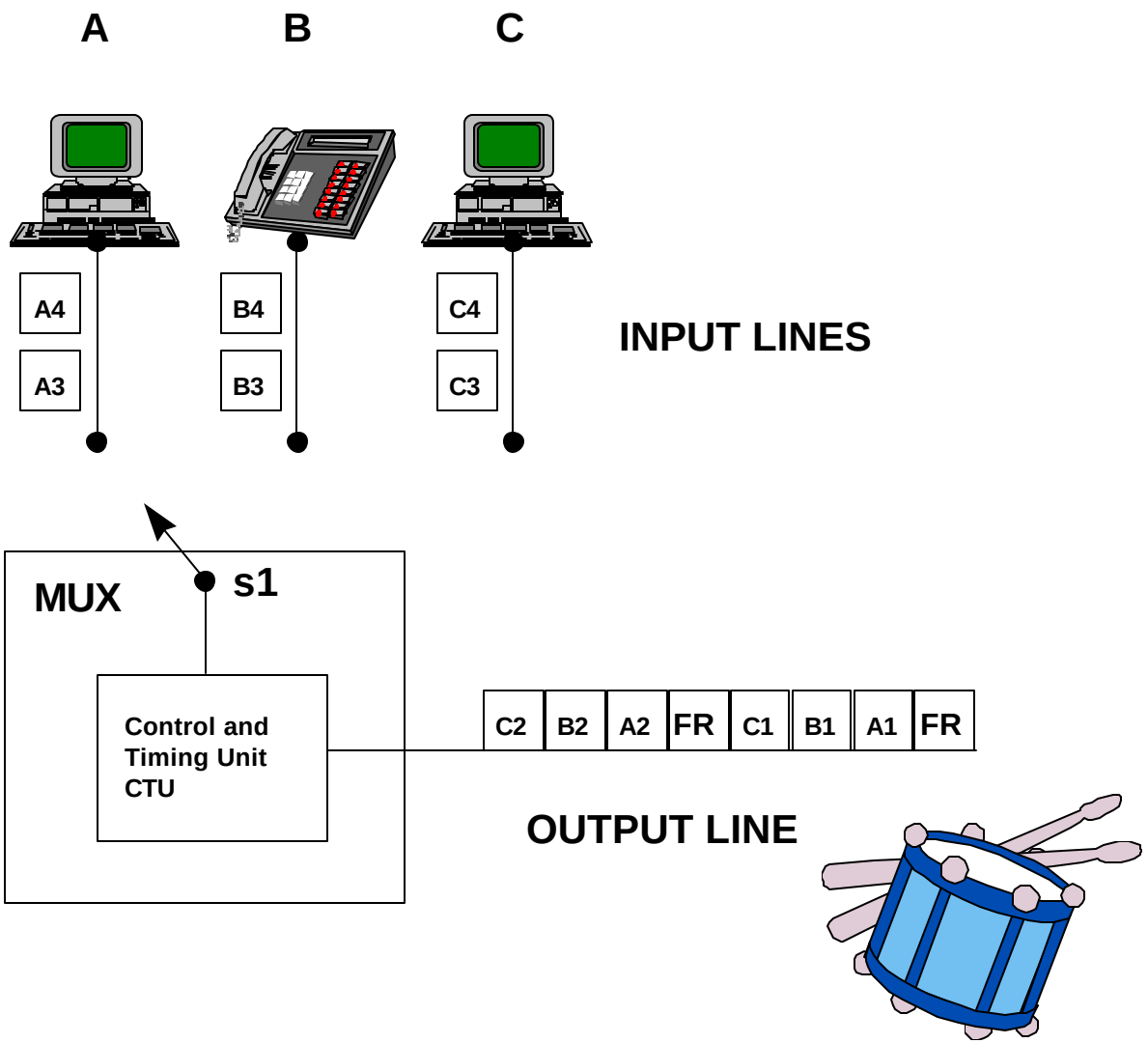
Timeslots

Time →

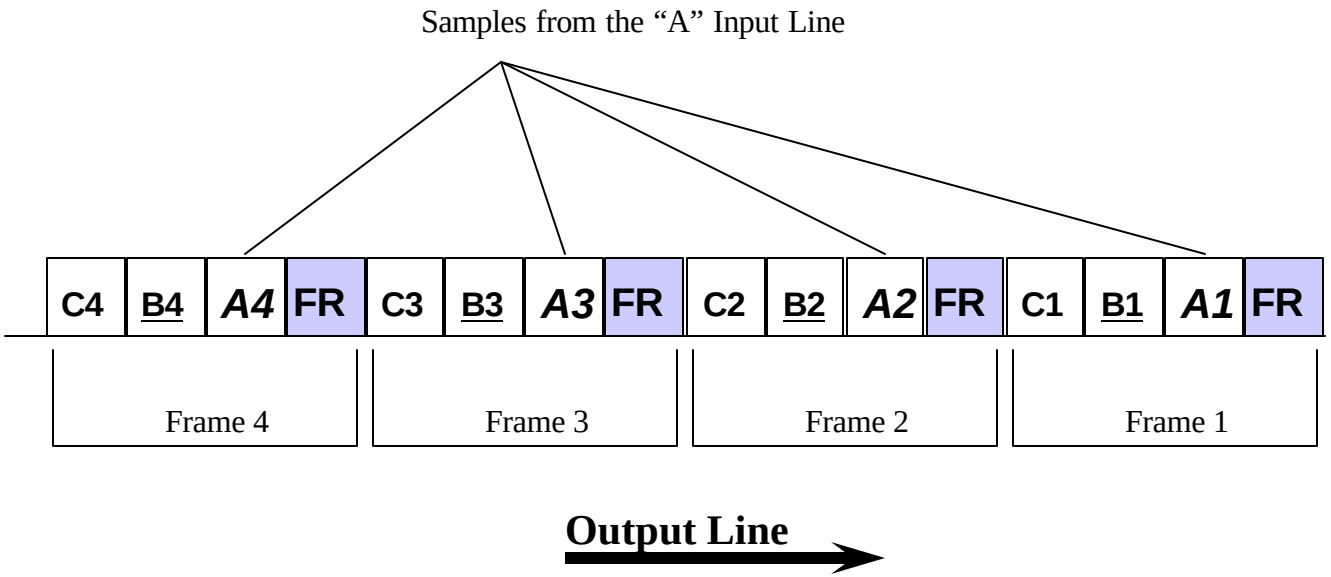
Timeslot 1	Timeslot 2	Timeslot 3	Timeslot 4	Timeslot N	



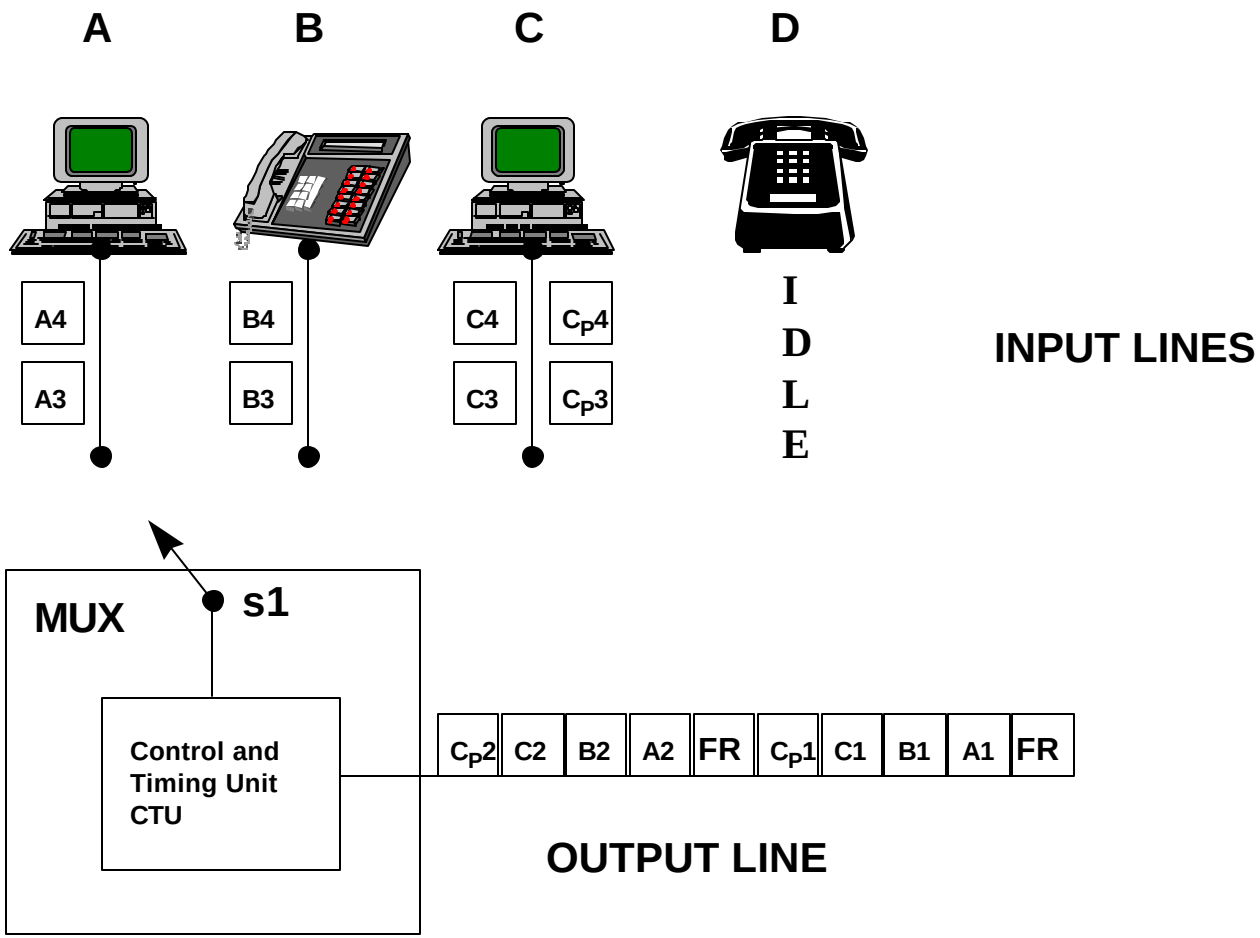
How TDM Works



Synchronous TDM Frame



Variable Bit Rates on Synchronous TDM



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Scary Thought

Usage studies have found that, on average, most buffered terminals require actual communications line time *less than 1%* of the time they are in use.

On average, 99% of the time the input lines are sending 0s.

STATISTICAL MULTIPLEXER
the STATMUX

How does it do this:

- **Dynamically allocate timeslots based on need**

What is needed:

- **Buffers**
- **Processing Power**

STATISTICAL MULTIPLEXER EVALUATION CRITERIA

Overall Operation
Transmission Efficiency [A]
Delay
Protocol handling
Throughput
Routing
Synchronous and Asynchronous operation
Programmability
Switching capability
Port contention
Automatic speed changing
Multiple output lines for backup or sharing
Pricing
Ease of Operation
Buffer Management
Size of buffer pool: Should be 6-8 times the output line capacity for Dynamic allocation of input channels to timeslots.
Buffer allocation by channel or group of channels
Buffer capability to absorb peak transmission bursts
Operations/Maintenance
Local and remote loopbacks
Generation of test messages
Memory and component checks.
Self tests on boot up
Fault isolation to circuit board level
Understandability of indicators to an operator
Availability of messages and statistics for user analysis

[A] The following formulas provide a way to quantify transmission efficiency:

Gross Efficiency

= (Total bit carrying capacity of incoming lines/bit carrying capacity of output line) x 100%

User Protocol Efficiency

= (Total single channel bit carrying capacity/bit carrying capacity of output line) x 100%

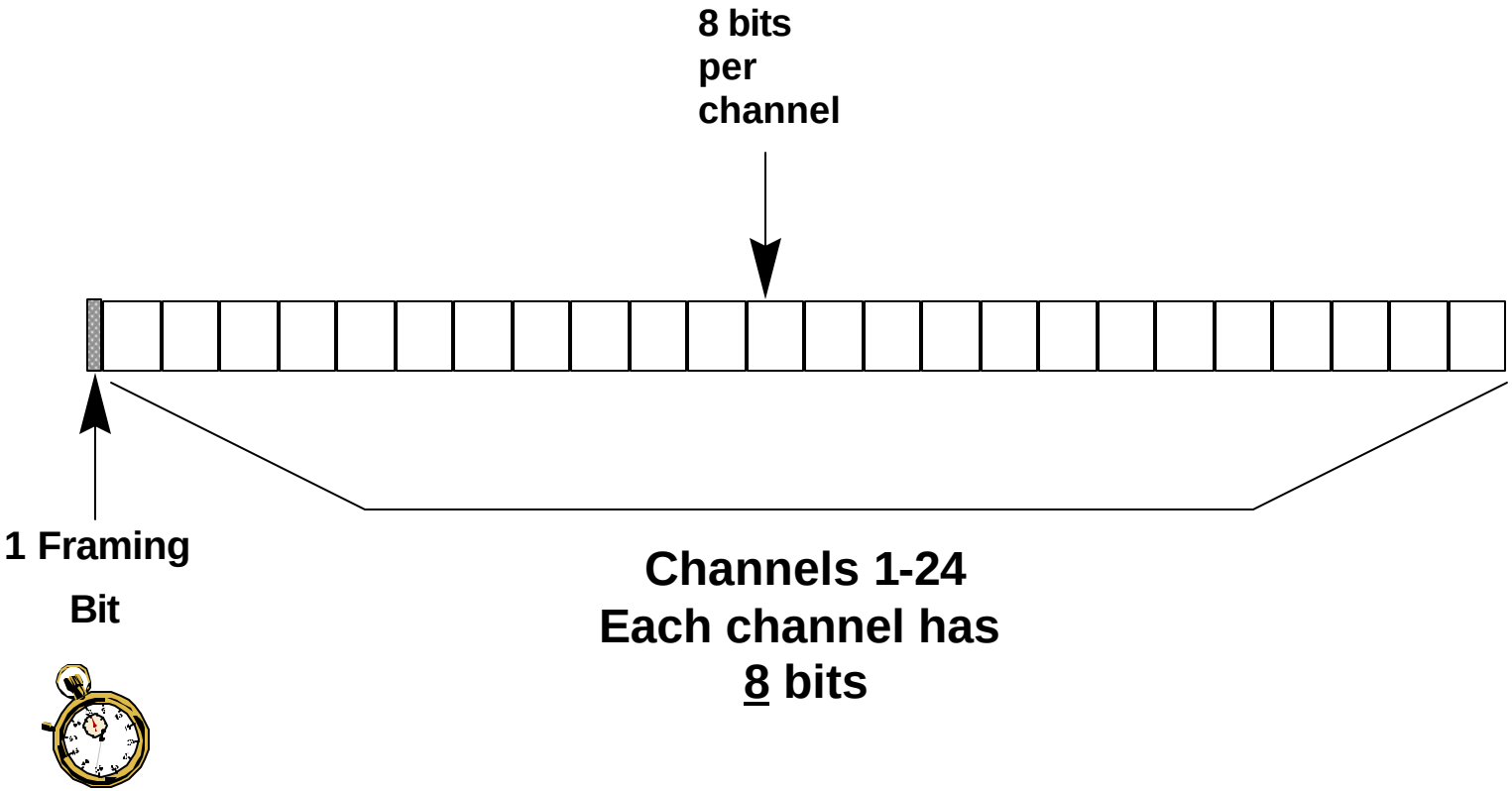
High speed Link Efficiency

= (Data actually being sent over the output line/bit carrying capacity of the output line) x 100%

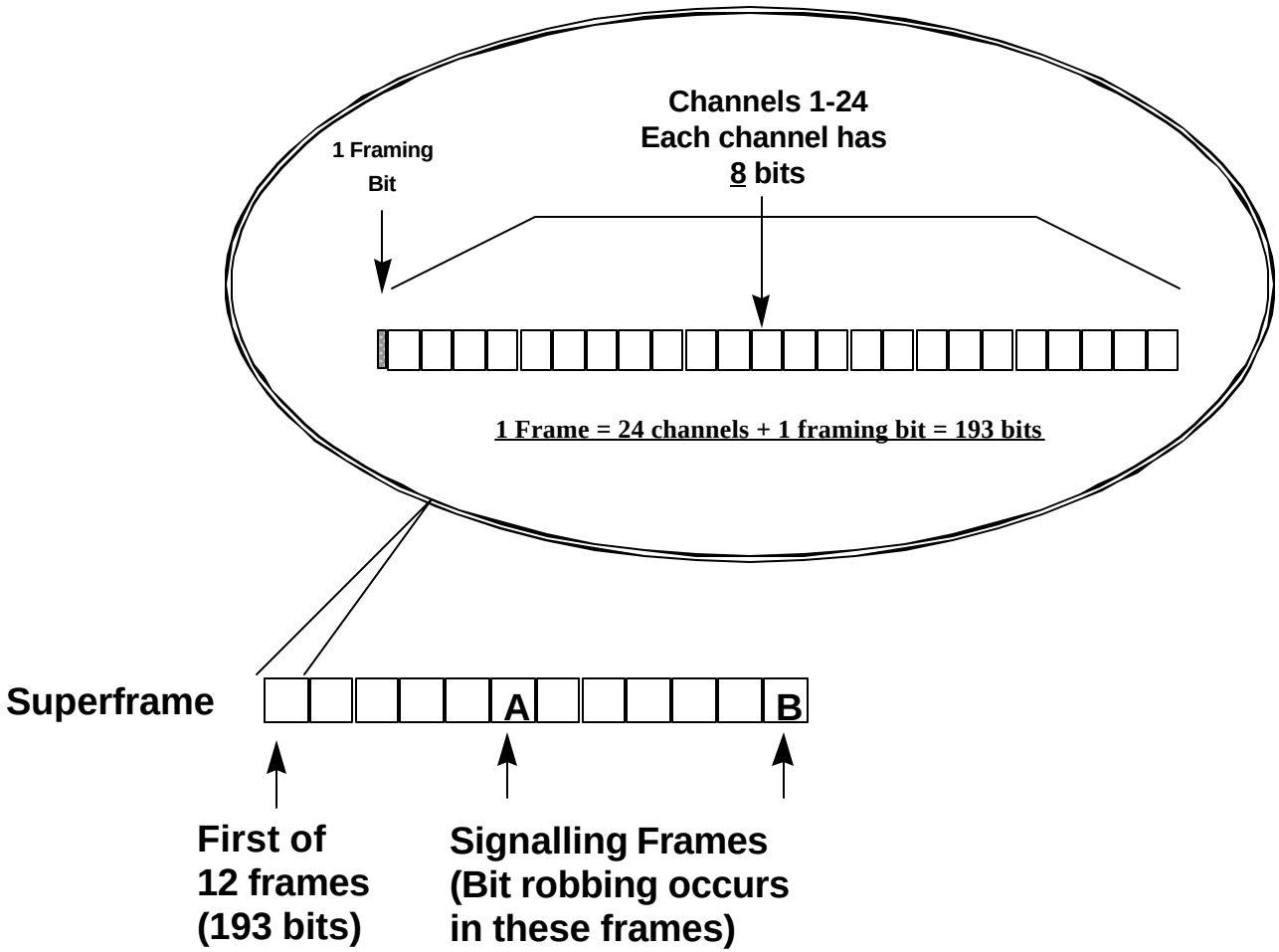
True Efficiency

= (Total bit carrying capacity actually being input on the low speed channels/actual bit carrying capacity of the output line) x 100%

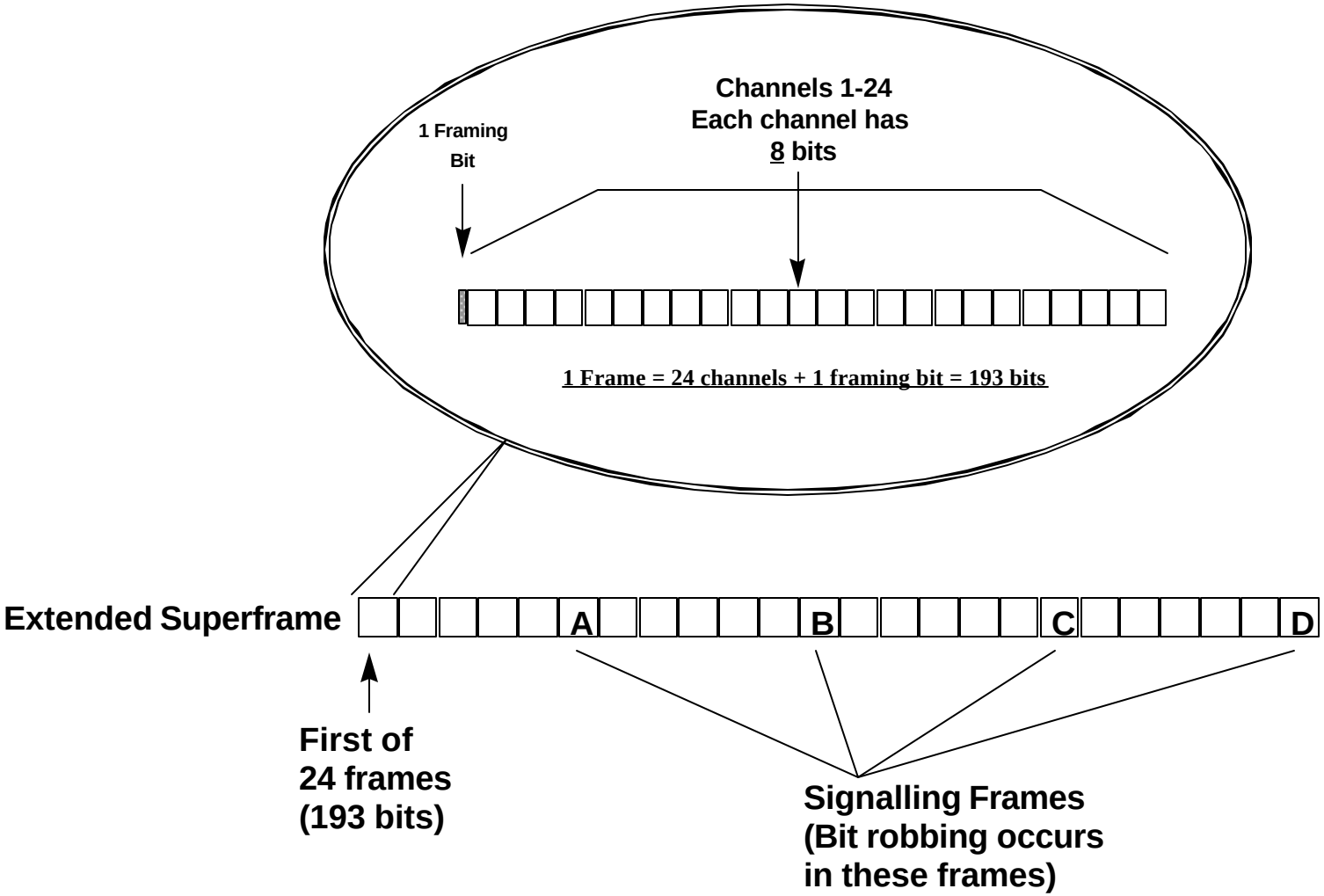
T-1 Frame


8 bits
per
channel
1 Framing
Bit
Channels 1-24
Each channel has
8 bits

T-1 Superframe



T-1 Extended Superframe



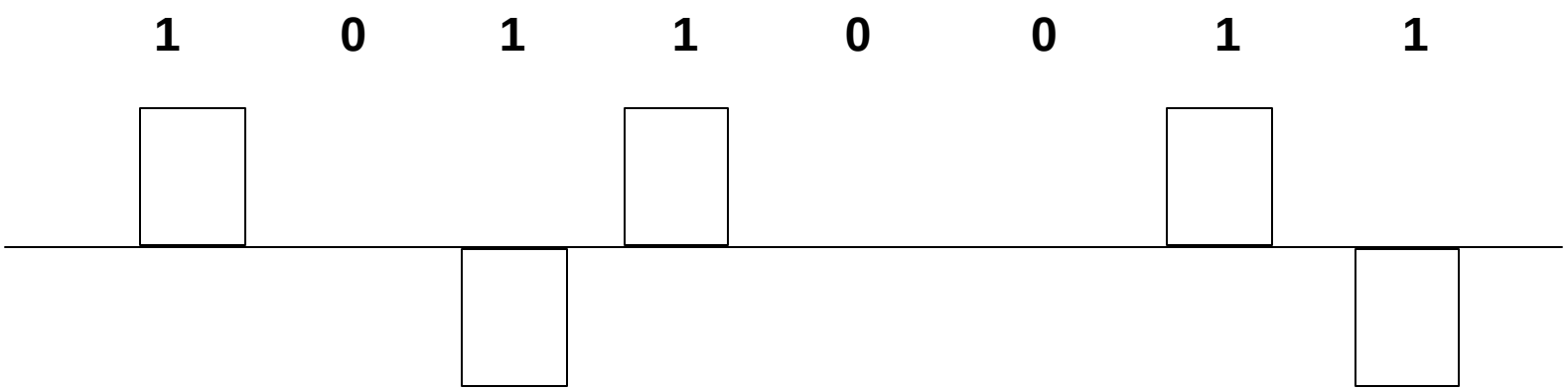
Extended SuperFrame (ESF) Format

Use of the Framing Bit

Frame Number	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24
Sequence	m	1	m	0	m	2	m	0	m	3	m	1	m	4	m	0	m	5	m	1	m	6	m	1
Messaging	m		m		m		m		m		m		m		m		m		m		m		m	
Synchronization				0				0				1				0				1				1
CRC-6		1				2				3				4				5				6		
Signal Frame						A						B						C						D

Message Bit (m) for the Facility Data Link
Framing Pattern Sequence (001011)
Cyclical Redundancy Check (CRC-6) (6 BITS)

Alternate Mark Inversion

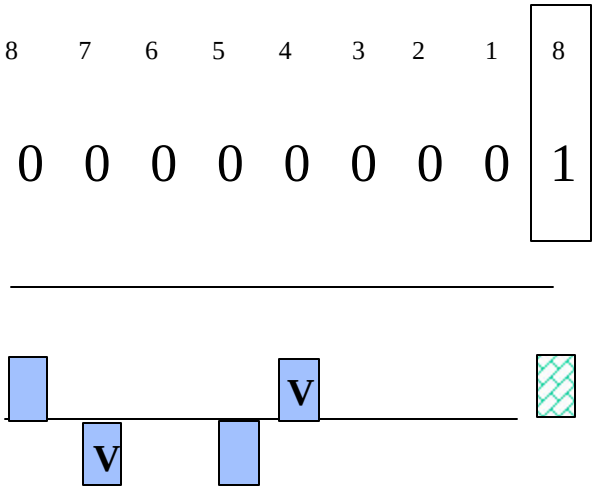


Line Code Restrictions

B8ZS

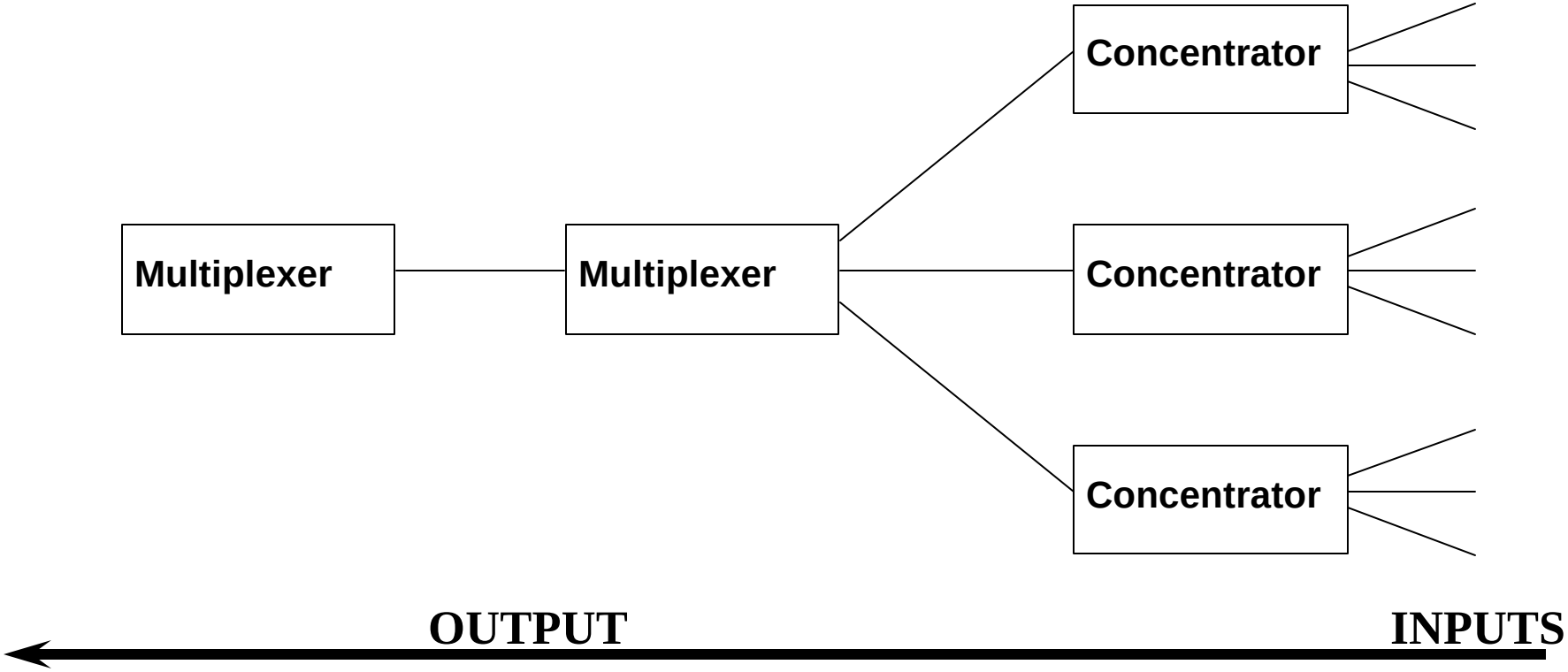
Digital signal given to the carrier by the customer:

Digital signal as modified by the carrier equipment, to create bipolar violations



The substituted B8ZS Code

Multiplexers and Concentrators in Series



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