

报文引出的几个通信基本概念

董雪峰 电力百科网

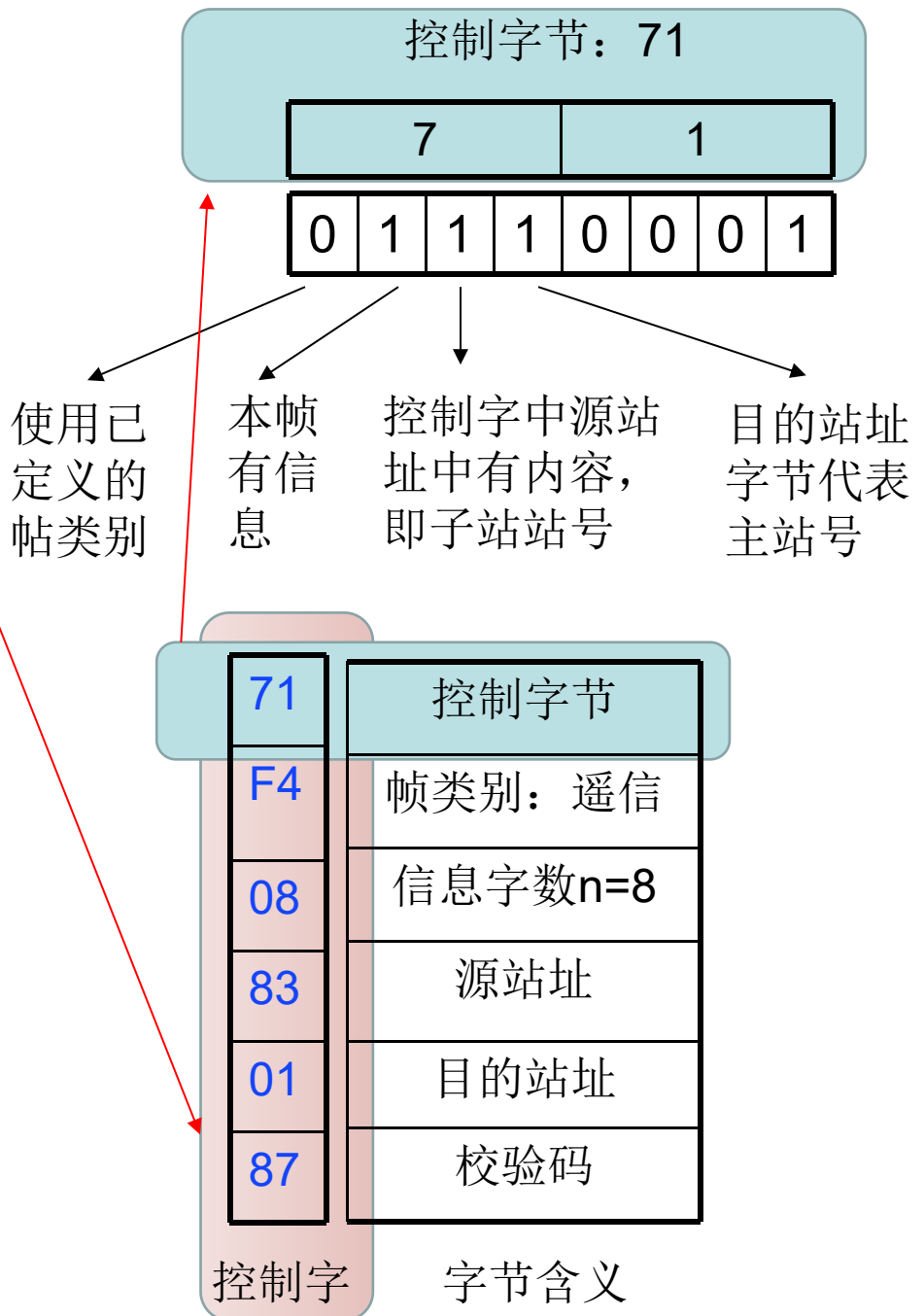
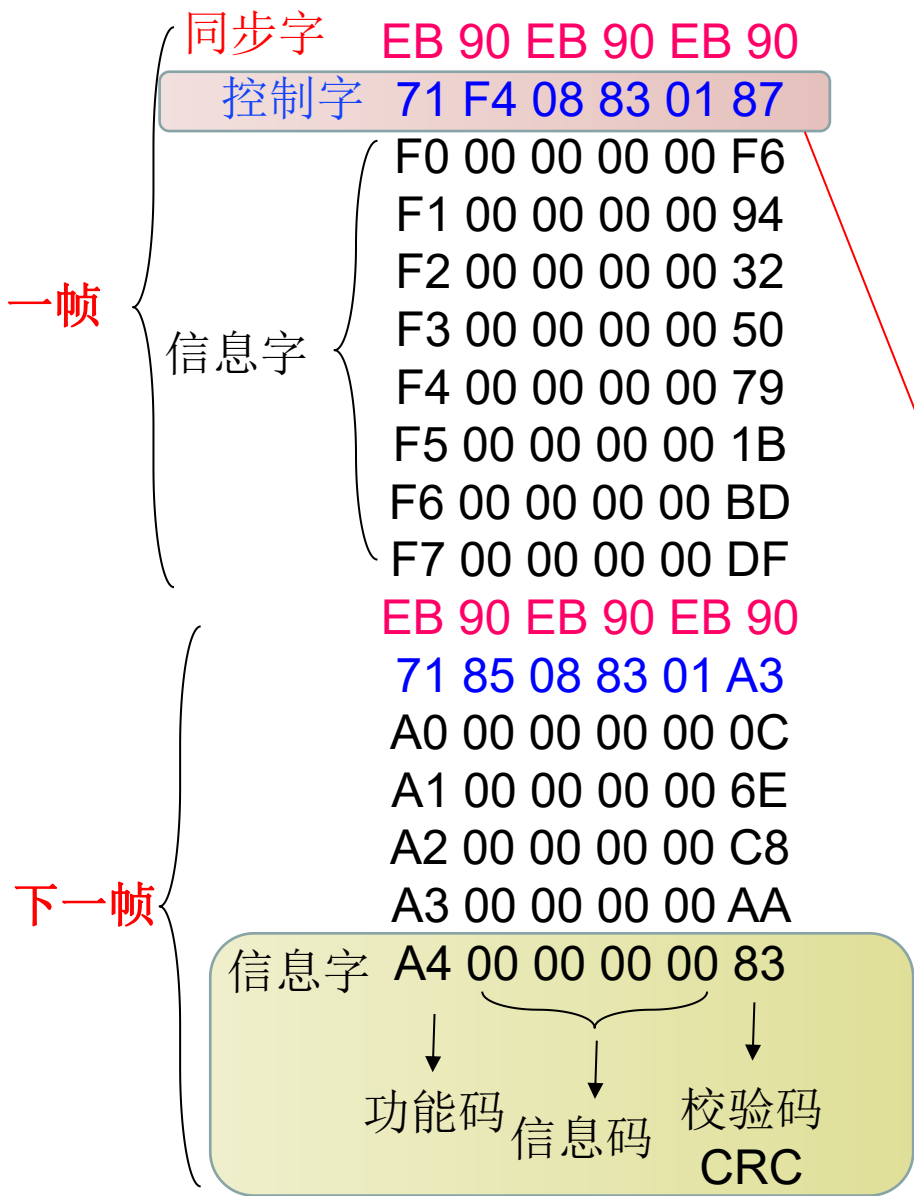
某 C D T 规约运动报文二进制数字信息

10101111111111100101000101100001010101010010101001010101000001010011111111001010
1010010101010101001010101001010010101010010011010111101010101001001010100100100
10101010000010100111111110010101010010101010101001010101001010010101010010011010
1111010101010010010101001011110110101111111111001010001011000010101010100101
0100101010101000001010011111111001010101001010101010100101010100101001010101001001
10101111010101010010010101001001001010101000001010011111111001010101001010101010
10010101010010100101010100100110101111010101010010010101001011111101010100101010
1011101011111111111100101000101100001010101010010101001010101000001010011111111001
010101001010101010101001010101001010010101010010011010111101010101001001010100100
100101010100000101001111111100101010100101010101001010101001010010101010010011
0101111010101010010010101001011110110110101111111111001010001011000010101010100
10101001010101010000010100111111110010101010010101010100101010100101001010101001
00110101111010101010010010101001001001010101000001010011111111001010101001010101
01010010101010010100101010100100110101111010101010010010101001011111101010100101
010101111111110101111111111100101000101100001010101010010101001010101000001010011
11111100101010100101010101010010101010010100101010100100110101111010101010010010
10100100100101010101000001010011111111001010101001010101010010101010010100101010
10010011010111101010101001001010100101111011011010111111111100101000101100001010
101010010101001010101000001010011111111001010101001010101010010101010010100101
01010010011010111101010101001001010100100100101010100000101001111111100101010100
10101010101001010101001010010101010010011010111101010101001001010100101111110101
01001010101011101011111111111001010001011000010101010100101010010101010000010100
11111111001010101001010101010100101010100101001010101001001101011110101010100100
1010100100100101010101000001010011111111001010101001010101010100101010100101001010
101001001101011110101010100100101010010111101101101011111111111001010001011000010
10101010010101001010101000001010011111111001010101001010101010010101010010100101
01010100100110101111010101010010010010010010101010000010100111111111001010101
00101010101010010101010010100101010100100110101111010101010010011010001111111111
0000101010101001010010000001111111111100000101010101010010101000000100101010011111
1100101010100101010101010010101001001010010100101001001001010010101001010100101

某 C D T 规约运动报文十六进制数字信息

A9 00 00 00 00 77 AA 00 00 00 00 D1 AB 00 00 00 00 B3 AC 00 00 00 00 9A AD 00 00 00 00
F8 AE 00 00 00 00 5E AF 00 00 00 00 3C EB 90 EB 90 EB 90 71 F4 08 83 01 87 F0 00 00 00
00 F6 F1 00 00 00 00 94 F2 00 00 00 00 32 F3 00 00 00 00 50 F4 00 00 00 00 79 F5 00 00 00
00 1B F6 00 00 00 00 BD F7 00 00 00 00 DF EB 90 EB 90 EB 90 71 85 08 83 01 A3 B0 00 00
00 00 3E B1 00 00 00 00 5C B2 00 00 00 00 FA B3 00 00 00 00 98 B4 00 00 00 00 B1 B5 00
00 00 00 D3 B6 00 00 00 00 75 B7 00 00 00 00 17 EB 90 EB 90 EB 90 71 F4 06 83 01 AB F8
00 00 00 00 EF F9 00 00 00 00 8D FA 00 00 00 00 2B FB 00 00 00 00 49 FC 00 00 00 00 60
FD 00 00 00 00 02 EB 90 EB 90 EB 90 71 85 08 83 01 A3 B8 00 00 00 00 27 B9 00 00 00 00
45 BA 00 00 00 00 E3 BB 00 00 00 00 81 BC 00 00 00 00 A8 BD 00 00 00 00 CA BE 00 00 00
00 6C BF 00 00 00 00 0E EB 90 EB 90 EB 90 71 F4 08 83 01 87 F0 00 00 10 1B 00 00 00 00
72 1C 00 00 00 00 5B 1D 00 00 00 00 39 1E 00 00 00 00 9F 1F 00 00 00 00 FD EB 90 EB 90
EB 90 71 F4 08 83 01 87 F0 00 00 00 00 F6 F1 00 00 00 00 94 F2 00 00 00 00 32 F3 00 00 00
00 50 F4 00 00 00 00 79 F5 00 00 00 00 1B F6 00 00 00 00 BD F7 00 00 00 00 DF EB 90 EB
90 EB 90 71 85 08 83 01 A3 A0 00 00 00 00 0C A1 00 00 00 00 6E A2 00 00 00 00 C8 A3 00
00 00 00 AA A4 00 00 00 00 83 A5 00 00 00 00 E1 A6 00 00 00 00 47 A7 00 00 00 00 25 EB
90 EB 90 EB 90 71 F4 06 83 01 AB F8 00 00 00 00 EF F9 00 00 00 00 8D FA 00 00 00 00 2B
FB 00 00 00 00 49 FC 00 00 00 00 60 FD 00 00 00 00 02 EB 90 EB 90 EB 90 71 85 08 83 01
A3 A8 00 00 00 00 15 A9 00 00 00 00 77 AA 00 00 00 00 D1 AB 00 00 00 00 B3 AC 00 00 00
00 9A AD 00 00 00 00 F8 AE 00 00 00 00 5E AF 00 00 00 00 3C EB 90 EB 90 EB 90 71 F4 08
83 01 87 F0 00 00 00 00 F6 F1 00 00 00 00 94 F2 00 00 00 00 32 F3 00 00 00 00 50 F4 00 00
00 00 79 F5 00 00 00 00 1B F6 00 00 00 00 BD F7 00 00 00 00 DF EB 90 EB 90 EB 90 71 85
08 83 01 A3 B0 00 00 00 00 3E B1 00 00 00 00 5C B2 00 00 00 00 FA B3 00 00 00 00 98 B4
00 00 00 00 B1 B5 00 00 00 00 D3 B6 00 00 00 00 75 B7 00 00 00 00 17 EB 90 EB 90 EB 90
71 F4 06 83 01 AB F8 00 00 00054

CDT规约帧格式（同步传输）



帧、字、字节、比特

CDT规约的同步字: EB90 EB90

1110 1011 1001 0000 1110 1011 1001 0000

CDT规约一帧一帧的循环传输, 又叫循环式远动规约、部颁电力规约。

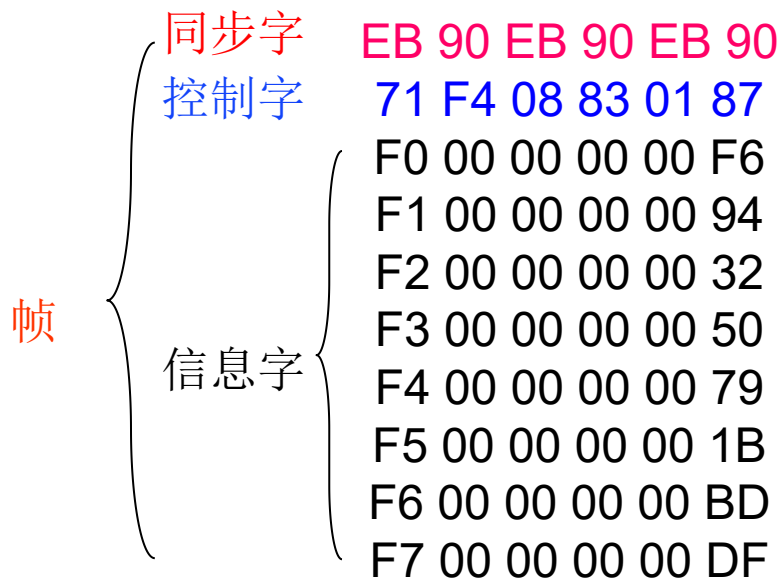
一帧 (Block): 有同步字、控制字、信息字组成, 是数据链路层中数据块。

一个字: 有6个字节, 如同步字EB 90 EB 90 EB 90

一个字节(Byte): 有8个比特 (bit) 位, 如控制字节71 (01110001)

比特 (bit= binary digit): 二进制代码中的位

问: 下图一帧有多少个字、字节、比特位?



同步传输 帧格式

一帧有同步字、控制字、信息字组成

同步传输以帧为单位传输

101远动规约 总召唤报文如下

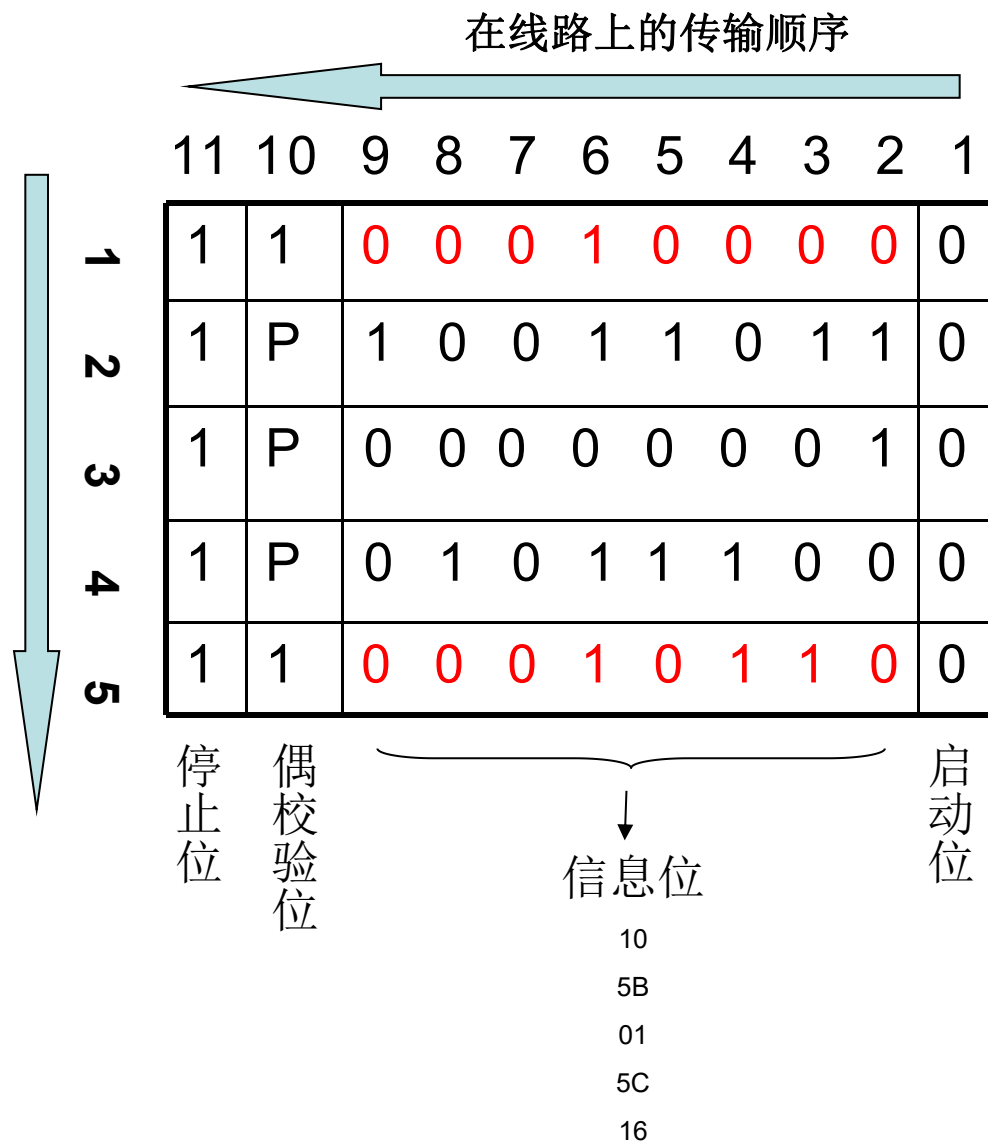
主站:	68 09 09 68 73 01 64 01 06 01 00 00 14 F4 16	总召唤激活
子站:	E5	
主站:	10 5B 01 5C 16	
子站:	68 09 09 68 28 01 64 01 07 01 00 00 14 AA 16	总召唤激活确认
主站:	10 7A 01 7B 16	
子站:	68 26 26 68 28 01 14 86 14 01 01 00 5B 38 FF FF 00 26 A4 FF FF 00 38 F2 FF FF 00 69 BD FF FF 00 A2 04 FF FF 00 FC 2B FF FF 00 47 16	回答全遥信数据
主站:	10 5A 01 5B 16	
子站:	68 38 38 68 28 01 09 90 14 01 01 40 42 00 00 72 07 00 42 05 00 32 F7 00 42 F1 00 A1 0E 00 92 F1 00 20 91 00 02 09 00 C2 07 00 B2 03 00 62 03 00 F2 09 00 90 69 00 45 70 00 46 92 00 C8 16	回答全遥测数据
主站:	10 7A 01 7B 16	
子站:	68 09 09 68 08 01 64 01 0A 01 00 00 14 8D 16	总召唤激活终止

101远动规约固定帧长帧格式

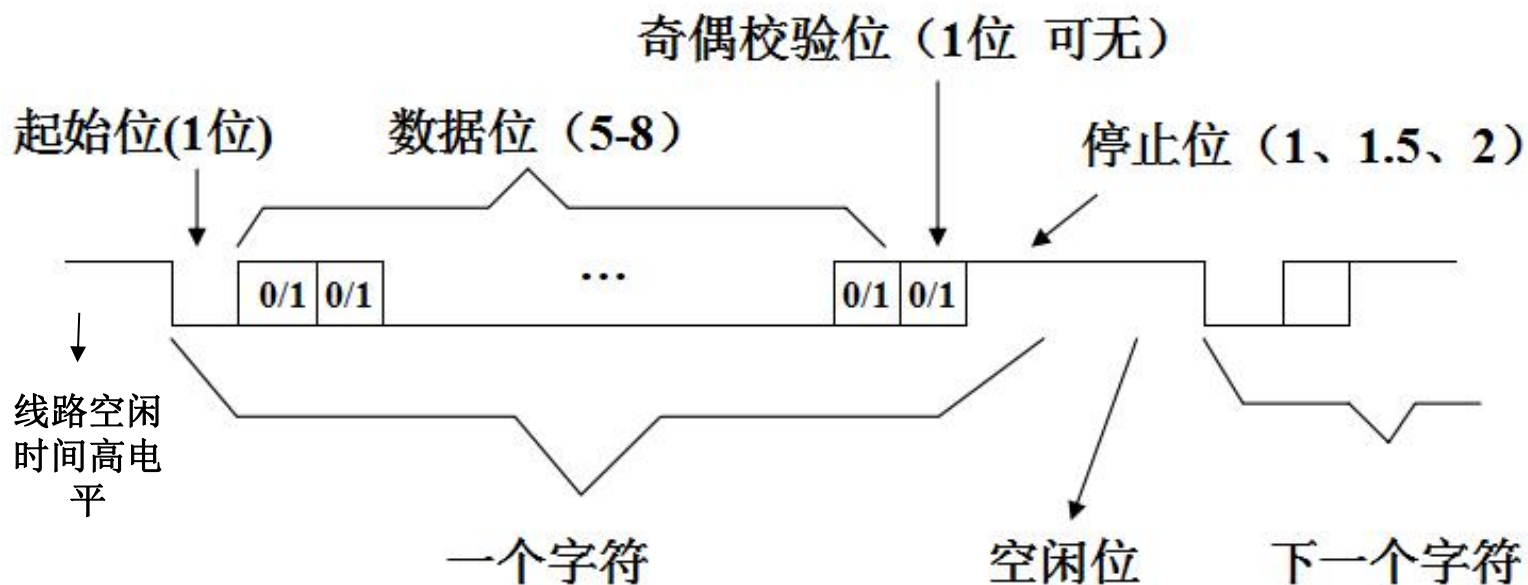
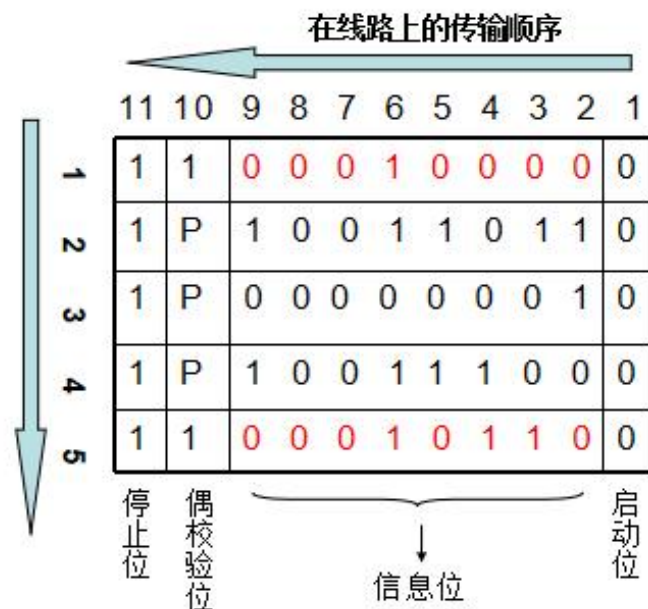
主站: 10 5B 01 5C 16

D7 D6 D5 D4 D3 D2 D1 D0

启动字符 (10H)
控制域 (5B)
链路地址域 (01)
帧校验和 (5C)
结束字符 (16H)



异步传输帧格式



通信的几个概念

码元：就是一个单位的电脉冲。

比特：(bit= binary digit)，二进制代码中的位

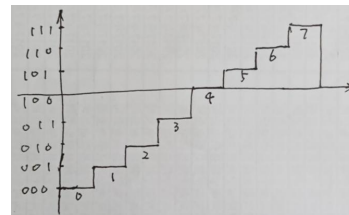
如果一个码元（电脉冲）可能有4个电平时，该码元能携带二位二进制信息。

如：一个码元可能有4种电平0、1、2、3，则每一种电平（码元），可以用二位比特位表示：00、01、10、11

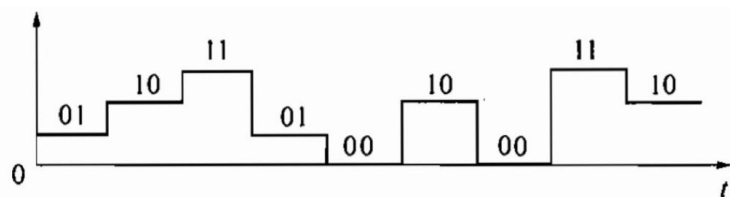
如果一个码元（脉冲）可能有8个电平时，该码元能携带三位二进制信息。

如一个码元可能有8种电平0、1、2、3、4、5、6、7，则每一种电平，可以用三位比特位表示：000、001、010、011、100、101、110、111

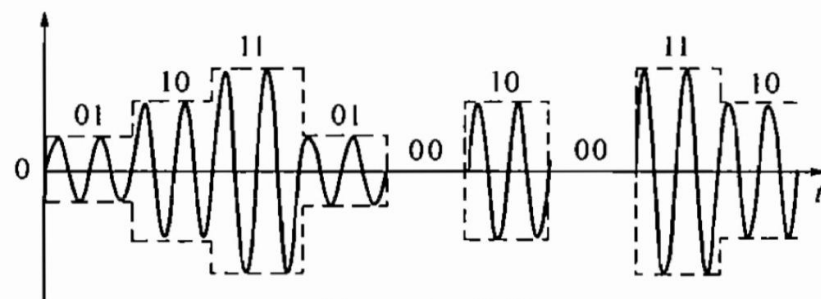
码元



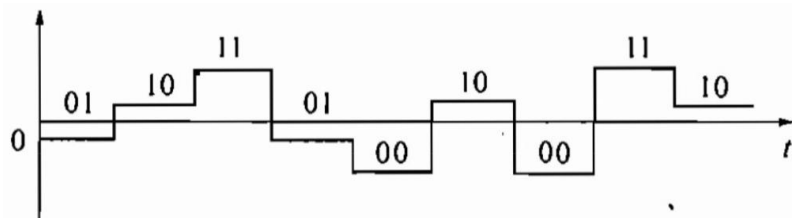
一个码元 = （数字信号）矩形脉冲 or （模拟信号）
n个正余弦周期（ $n \geq 1$ ）



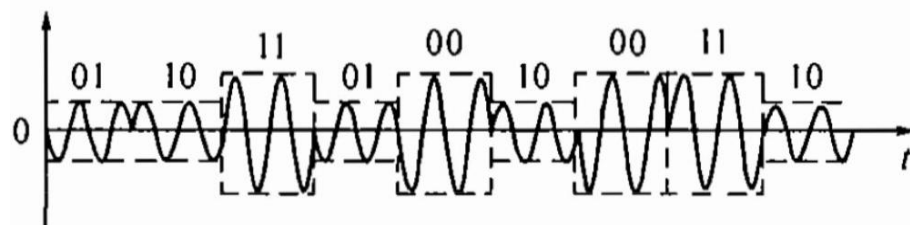
(a) 基带多电平单极性不归零



(b) MASK 信号



(c) 基带多电平双极性不归零



(d) 抑制载波 MASK 信号

多进制数字振幅调制（MASK）

多进制数字振幅调制又称多电平振幅调制
它用高频载波的不同振幅去代表数字信息

MASK 信号波形

通信的几个概念

调制速率（码元传输速率）（波特率、传码率）：每秒钟传输码元的个数
（单位波特"Baud"，简写为"B"）

数据速率（比特率）：每秒钟传输二进制码元的个数（单位比特/秒、bit/s
或 bps）

误码率 = 接收出现差错的码元数 / 总发送的码元数

比特差错率（bit error rate）= 接收到的差错比特数 / 发送比特总数

例题：一个二进制数字信号一分钟
传送了 18000 bit 的信息量，

(1) 其码元速率多大？

(2) 如果每分钟传送的信息量仍为
18000 bit，但改用8进制数字信号，其
码元速率多大？

$$R_{bN} = (\log_2 N) R_{b2} \quad R_{B2} = R_{BN} \cdot (\log_2 N)$$

解：

(1)

$$R_b = \frac{18000}{60} = 300 \text{ bit} / s$$

$$\therefore R_{B2} = 300 \text{ B}$$

(2)

$$R_b = 300 \text{ bit} / s \text{ 不变}$$

$$R_{B2} = \frac{R_b}{(\log_2 8)} = 100 \text{ B}$$

总结

位又叫比特：(bit= binary digit) ， 二进制代码中的位。

字节(Byte)： 8位二进制

字

帧 (Block)： 数据链路层中数据块

码元： 就是一个单位的电脉冲。

调制速率 (波特率)： 每秒钟传输信号码元的个数 (单位波特Bd)

数据速率 (比特率)： 每秒钟传输二进制码元的个数 (单位比特/秒、bit/s 或 bps)

误码率=接收出现差错的比特数 / 总发送的比特数

对传输二进制码元 而言 (又叫**误比特率**)

规约或协议： 在远动系统中，为正确传送和接收信息，必须有一套关于传输顺序、信息格式和信息内容的约定。

同步传输帧格式

异步传帧格式

二进制十六进制转换