(iv) No of I/O Port to Connect each network

Network I : 40

Network 2 : 140

Network III : 2450

Network IV : 30

(v) Total dedicated link in each network

Network I : 20

Network II : 70

Network III : 1225

Network IV : 1

(vi) total dedicated link for this hybrid network

= 20 + 70 + 1225 + 1 = 1319

(vii) If Connection fails in

Network I : (Star topology) : only the device is affected & it gets disconnected

Network II : (Ring topology) : The entire network becomes inaccessible due to circular connection dependency

Network III : (mesh topology) : multiple path exist, so if link fails Communication still occur through alternate routes.

Network IV : If the main communication line fails the entire network goes down

② Data rate = 200 Gbps = 200×10^9 bits/sec.

Frame size = 1000 bits

Distance = 300 km

$$\text{Transmission time} = \frac{\text{Frame size}}{\text{Data rate}} = \frac{1000}{200 \times 10^9}$$

$$= 5 \times 10^{-9} \text{ sec}$$

$$\text{Signal speed} = \frac{\text{Distance} \times 2}{\text{Transmission time}}$$

$$= \frac{600}{5 \times 10^{-9}} = 1.2 \times 10^{11} \text{ km/sec.}$$

---

③ Data signal speed = 2×10^8 m/sec

Distance = 100 km

Data Rate = 200 Gbps = 200×10^9 bits/sec

$$\text{Propagation delay} = \frac{100 \times 10^3}{2 \times 10^8} = 5 \times 10^{-4} \text{ sec}$$

Minimum frame size = 2 × propagation delay × data rate

$$= 2 \times 5 \times 10^{-4} \times 200 \times 10^9$$

$$= 4 \times 10^8 \text{ bits}$$

$$= 400 \text{ mb}$$

---

④ Data rate = 100 mbps = 10^8 bits/sec

Frame size = 1024 bits

Minimum frame size for

(i) 100 kbps = $1024 \times \frac{10^5}{10^8} = 1.024 \simeq 2$ bits

(iii) 100 mbps = $1024 \times \frac{10^3}{10^3} = 1024$ bits

(iv) 100 Gbps = $1024 \times \frac{10^1}{10^3} = 1024000 = 1.024$ mb

---

(5) Error detection & correction is done by hamming code

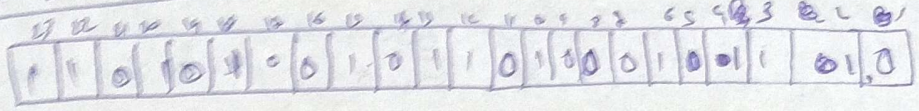
19 bit data word = 1101010101111001

Redundancy bit:

$2^x = x + 19 + 1$

$x = 5$

After flipping 11th bit:



Even Parity:

P_0 = (1, 3, 5, 7, 9, 11, 13, 15, 17, 19, 21, 23) 2 ones

$\therefore P_0 = 0$ to make even

P_1 = (2, 3, 6, 7, 10, 11, 14, 15, 18, 19, 22, 23) = 7 ones $P_1 = 1$ to make even

P_2 = (4, 5, 6, 7, 12, 13, 14, 15, 20, 21, 22, 23) = 7 ones

$P_2 = 1$ one to make it even

~~P_3 = (8, 9, 10, 11, 12, 13, 14, 15)~~

P_3 = (8, 9, 10, 11, 12, 13, 14, 15) 2 one

$P_3 = 0$

P_4 = (16, 17, 18, 19, 20, 21, 22, 23) 2 ones

$P_4 = 0$

Again flipping 11th bit:

∴ new data = 11 0 10 10010 1111 0 1 01 0 1 1 01

To check

$P_0 = 1$

$P_1 = 0$

$P_2 = 0$

$P_3 = 1$

$P_4 = 1$

$\therefore 1011 = 11^{th}$ bit

So, if we flip 11^{th} bit it will be corrected.

---

(6) Data – 1111 0011 1001 0011 1001 1000 0100 1111

Checksum of 16bit

```
  1111 0011 1001 0011
  1001 1000 0100 1111
 (1)1001 1011 1101 0010
                    +1
  1001 1011 1110 0011
```

Complement of Checksum: 0110 0100 0001 1100 as not = 0

$\therefore$ There is an error in the bit sequence

---

(7) Frame – 1001 1110 0110 1001 1111 0000 1111

$G(x) = x^5 + x^2 + 1$

$= 1.x^5 + 0.x^4 + 0.x^3 + 1.x^2 + 1.x + 1.x^0$

$= 100111$

6bits $\Rightarrow$ 6-1 = 5 bits

1 0 0 0 0 0 0 0 0 0 1 1 1 1 1 1 0 1 0 0 0 0

100111) 1001111001101001 1111 0000 111100000

100111

100110
100111

1100 01
100111

101001
100111

1 10 11
100111

11 1000
100111

111110
100111

11 0000
100111

101111
100111

100 111
100111

100100
100111

110000

As the remainder is not 0000

∴ There is an error in the Code/data.

---

(2) packet from A → C = 3000 byte speed of data = 3×10^8 m/s

packet from A → D = 5250 byte

" " A → B = 2×10^3 "

For A → C

Transmission delay = $\frac{24000}{3 \times 10^8}$

= 80 μs

Propagation delay

" " A → B = $\frac{24000}{2 \times 10^3}$

= 12 μs

For A → D

Transmission delay = $\frac{42000}{3 \times 10^8} = \frac{42000}{600 \times 10^3}$

= 70 ms

" " (A → B) = $\frac{42000}{2 \times 10^4}$ = 21 μs

Propagation delay

A → B = $\frac{100 \times 10^3}{3 \times 10^8}$ = 3.33×10^{-4} = 0.33 ms

B → C = $3 \times 10^5 / 3 \times 10^7$ = 10 ms

$B \to D = \frac{20 \times 10^3}{3 \times 10^8} = 0.067\,ms$

Total delay

$A \to C = (T_{trans}(A \to B) + T_{prop}(A \to B) + T_{trans}(B \to C) + T_{prop}(B \to C))$

$= (12\,ms) + (0.33\,ms) + 80\,ms + 10\,ms$

$= 10.422\,ms$

$A \to D = T_{trans}(A \to B) + T_{prop}(A \to B) + T_{trans}(B \to D) + T_{prop}(B \to D)$

$= 21\,ms + 0.33\,ms + 20\,ms + 0.067\,ms$

$= 70.418\,ms$

---

(9)

		o/p ports
(a)	packet 1 :	2
(b)	packet 2 :	4
(c)	packet 3 :	1
(d)	packet 4 :	2

---

(10)

			o/p ports	o/p vcl
(a)	packet :	(3, 58)	2	43
(b)	packet 2 :	(2, 71)	4	41
(c)	packet 3 :	(4, 56)	3	11
(d)	packet 4 :	(1, 14)	3	22

---

(11) Data rate = 100mbps = 100×10^6

Setup & Teardown overhead = 5000 bits/each

Distance = 10,000 km = 10^7 m.

Propagation speed = 2×10^8 m/s

Data to be exchanged = 200,000 bits

$$\text{Propagation delay} = \frac{\text{Distance}}{\text{propagation speed}}$$

$$= \frac{10^7}{2\times10^8} = 50 \text{ ms}$$

$$\text{Transmission delay} = \frac{\text{Data size}}{\text{Data Rate}}$$

$$\text{Setup phase (5000 bit)} = \frac{5000}{100\times10^6} = 50 \mu s$$

$$\text{Data transfer phase} = \frac{200000}{100\times10^6} = 2 \text{ ms}$$

$$\text{Teardown phase} = \frac{5000}{100\times10^6} = 50 \mu s$$

Total delay

setup delay + Data transfer delay + teardown delay

$$= (50\mu s + 50ms) + (2ms + 50ms) + (50\mu s + 50ms)$$

$$= (50.05 + 52 + 50.05) \text{ ms}$$

$$= 152.1 \text{ ms}$$

---

(12) For the address

(a) 100.155.200.60

(i) Class → A

(ii) Total host → $(2^{32-8}) - 2 = 2^{24} - 2$

(iii) Network IP address → 100.0.0.0

(iv) Default Subnet mask = 255.0.0.0

(iv) First host Id ⇒ 100.0.0.1

(v) last host Id → 100.255.255.254

(vi) Direct broadCast address → 100.255.255.255

(vii) limited " " → 255.255.255.255

(b) 223.100.100.100

(i) Class → C

(ii) Total host → $2^8 - 2$

(iii) Network Address → 223.100.100.0

(iv) Default Subnet mask = 255.255.255.0

(v) First host ID → 223.100.100.1

(vi) last host ID → 223.100.100.254

(vii) Direct BroadCast → 222.100.100.255

(viii) limited " → 255.255.255.255

(c) 10 000001. 10000000 00000011 11111111 = 129.128.3.255

(i) Class → B

(ii) Total host → $2^{16} - 2$

(iii) N/w address → 129.128.0.0

(iv) Default Subnet mask → 255.255.0.0

(v) First host ID → 129.128.0.1

(vi) Last host ID → 129.128.0.254

(vii) Direct BroadCast → 129.128.255.255

(viii) Limited BroadCast → 255.255.255.255

(d) 11110111 11011011 10001011 01101111 → 247.219.139.

(i) Class → E

(ii) Total host → NA

(iii) Network Address → NA

(iv) Default Subnet mask → NA

(v) First Host ID → NA

(vi) Last Host ID → NA

(vii) Direct Broad Cast Address → NA

(viii) Limited Broad Cast Address → 6 255.255.255.255

---

(13) 200.30.35.1/27

(i) Total no. of hosts = $2^{32-27} = 2^5 = 32$

(ii) Network IP address = 200.30.35.0

(iii) Default Subnet mask = 255.255.255.224

(iv) First host ID = 200.30.35.01

(v) Last host ID = 200.30.35.30

(vi) Range of usable IDs = 200.30.35.1 – 200.30.35.30

(vii) Broad Cast Address = 200.30.35.31

---

(14) 100.200.20.32 – 100.200.20.42

(i) Range = 42 - 32 + 1 = 11 ≠ power of 2

(ii) Continuous

(iii) $\frac{100.200.20.0010\ 0000}{2^4}$ = It is divisible

Yes it is in CIDR

CIDR Representation: 100.200.20.32/28