



無線網路效能分析

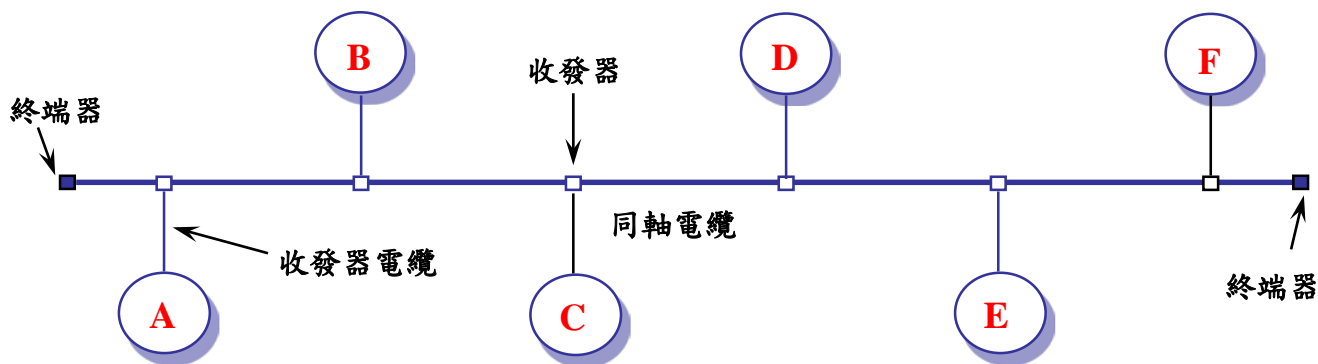
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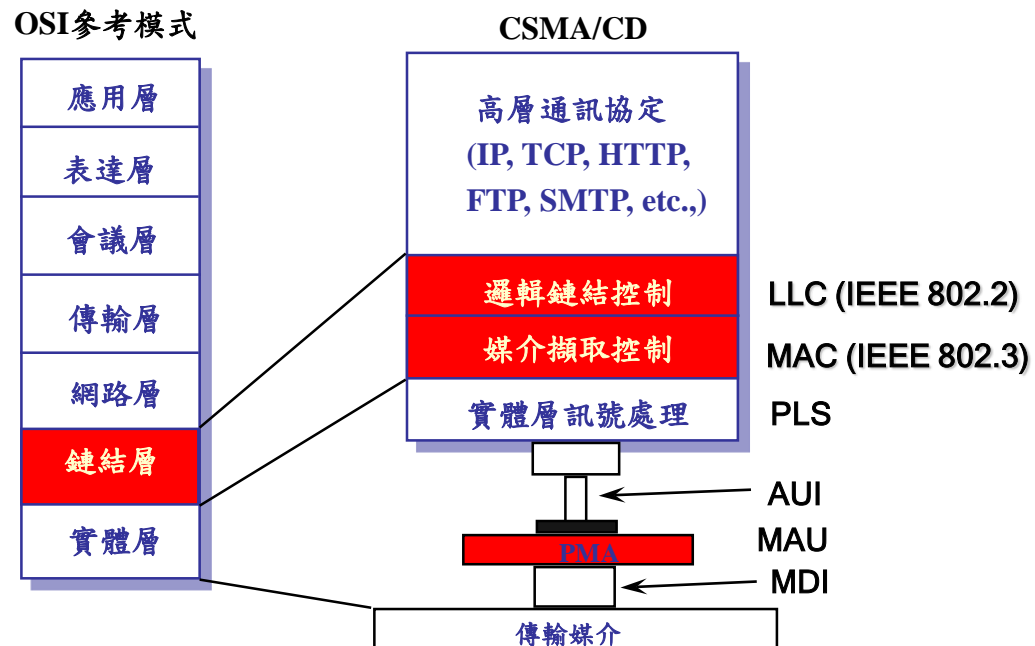


IEEE 802.3
Carrier Sense Multiple Access with
Collision Detection (CSMA/CD)

Typical CSMA/CD Network



IEEE 802.3 Architecture





Attachment Unit Interface (AUI)



Medium Attachment Unit (MAU)



Medium Dependent Interface (MDI)



CSMA/CD Protocol

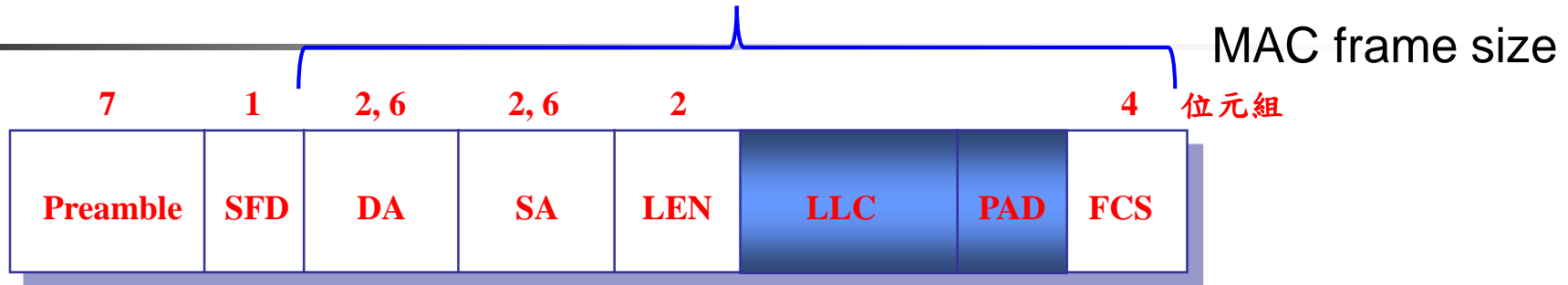
- **Carrier Sense before** transmission
- **Carrier Sense while** transmission
- **Collision**: Two or more stations transmitting simultaneously
- **Backoff**: Random delay after collision
- **Deference**: Defers transmission if channel is sensed busy
- **Collision Window** (Slot time): Round-trip propagation delay time plus some carrier sense time.
 - In IEEE 802.3, this value is defined to be **51.2 us**.



CSMA/CD Collision Handling

- Collision Signal is generated by Physical layer.
- **Jam signal** (collision enforcement): To make sure that all stations involved in the collision will detect collision.
 - A pattern of 32 bits.
- Collision backoff and retransmission method (**Truncated Binary Exponential Backoff Algorithm, BEBA**):
 - n : number of collisions experienced ($n \leq 16$)
 - k : $\text{Min}(n, 10)$ -- Truncation
 - r : Random delay time (unit: slot time) between $0 \leq r < 2^k$
- Slot time = 51.2 us.
- Disadvantage of BEBA:
 - **Last-in-First-out effect**: Stations with no or few collisions will have a better chance to transmit before stations that have waited longer.

IEEE 802.3 Frame Format



- Preamble: (101010...1010) for Synchronization
- SFD: Start Frame Delimiter (10101011)
- DA: Destination Address
- SA: Source Address
- Length: Length of LLC-Frame
- LLC-Frame: Up to **1500** bytes
- PAD: Padding when LLC-Frame < **46** bytes
- FCS: Frame Check Sequence (CRC-32)
- MAC-frame size -- from DA to FCS
 - **Min 64 bytes** to distinguish from collision
 - **Max 1518 bytes** to prevent dominating bandwidth



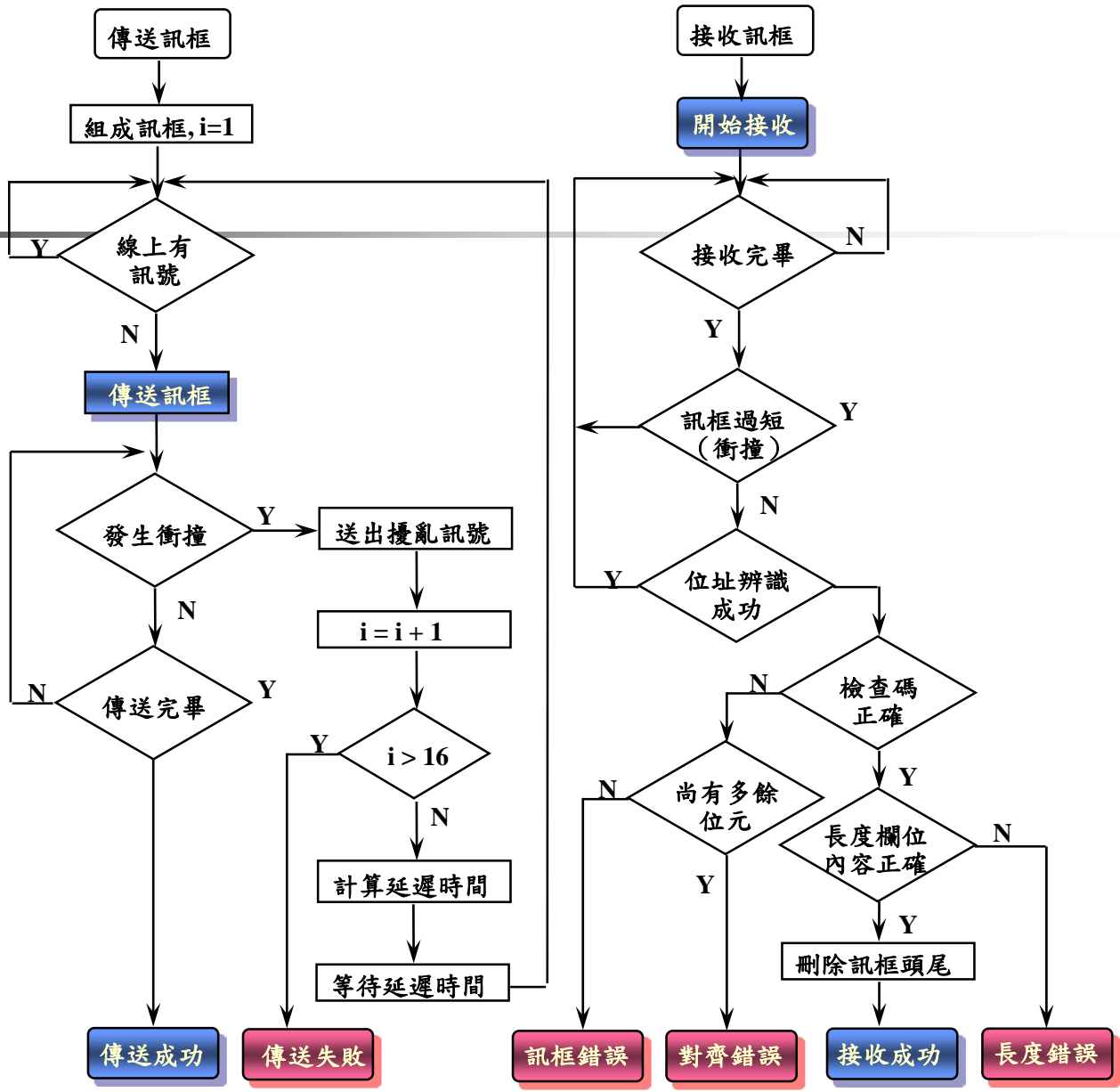
I/G = 0 Individual Address (個別地址)

I/G = 1 Group Address (群體地址)

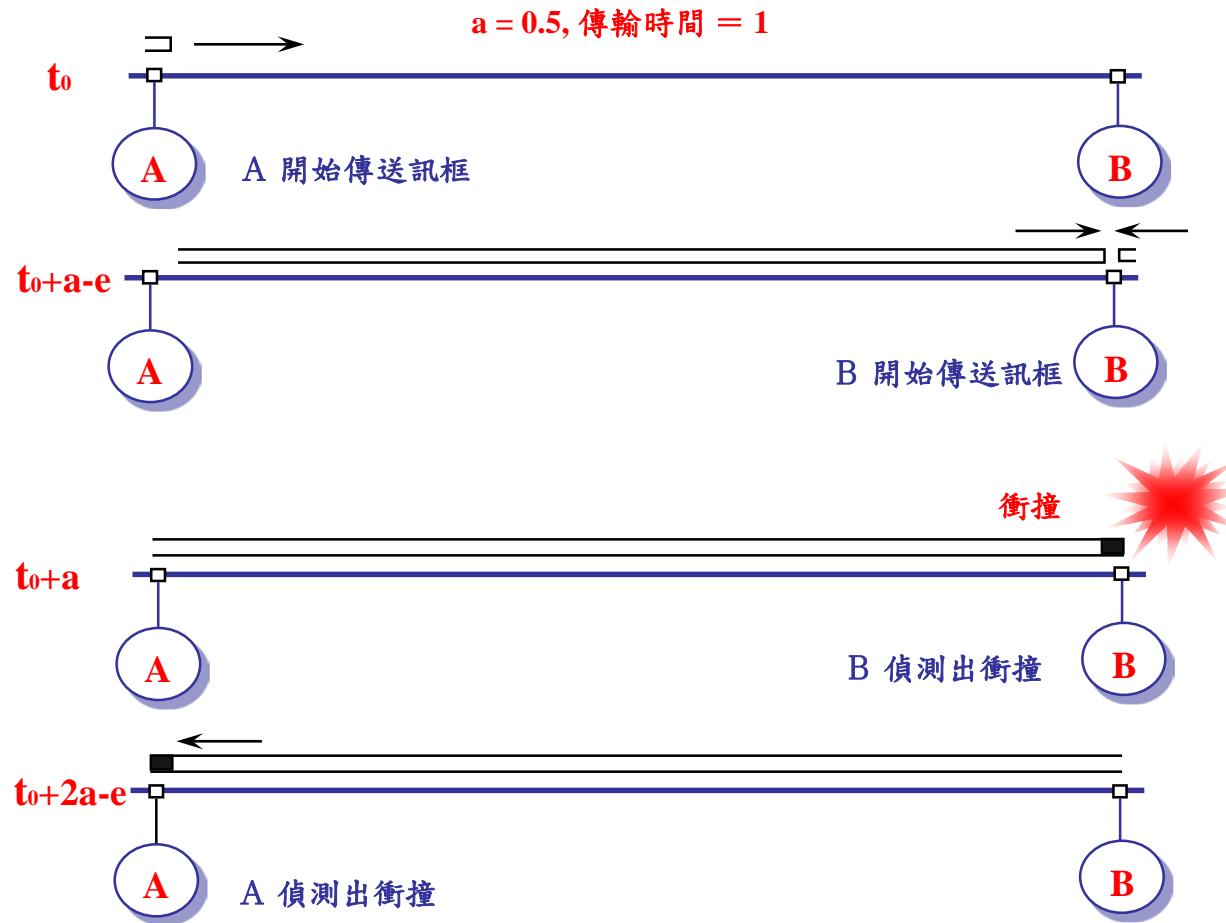
U/L = 0 Globally Administered Address (整體性地址)

U/L = 1 Locally Administered Address (區域性地址)

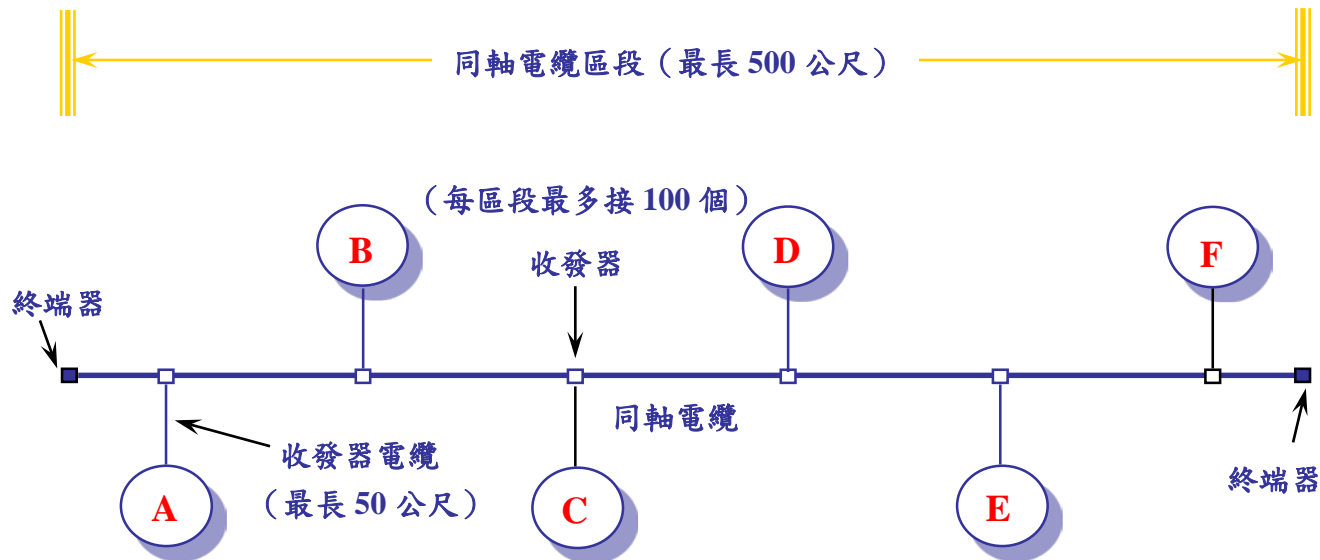
Flow Chart



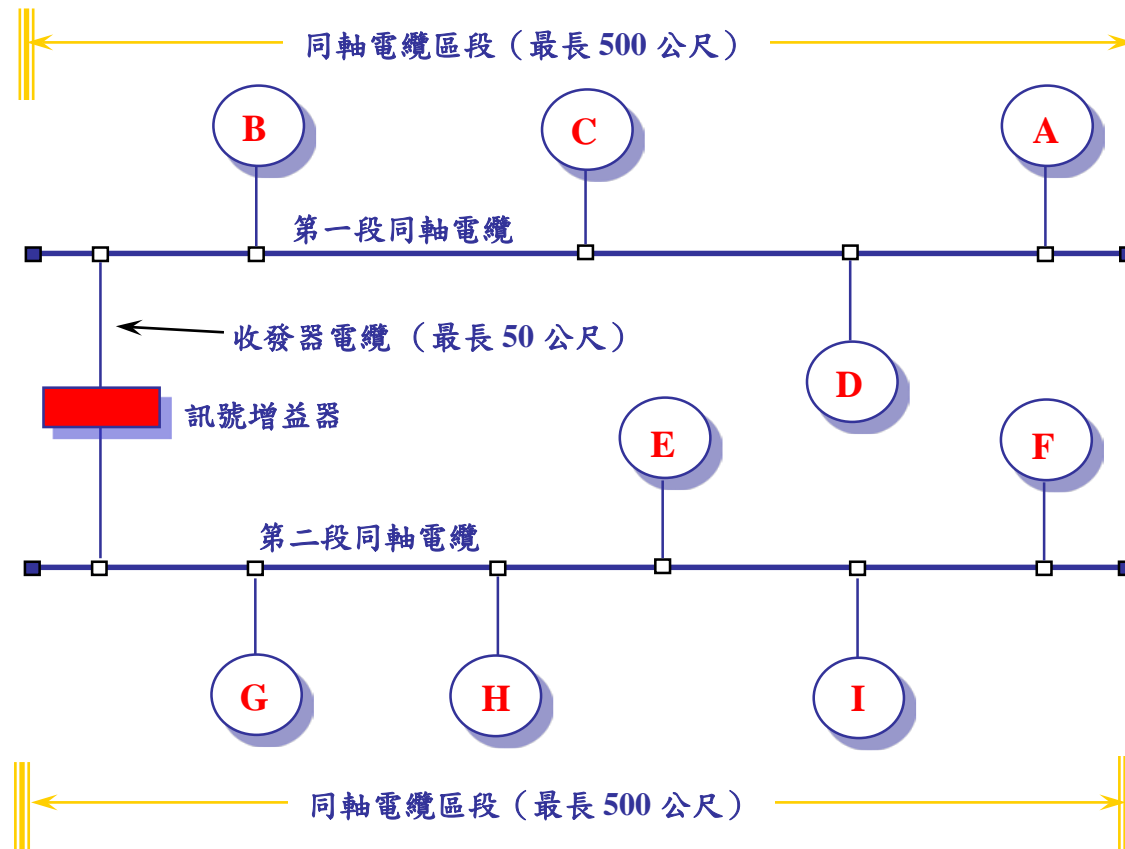
Collision Detection Window for Baseband CSMA/CD (=2a)



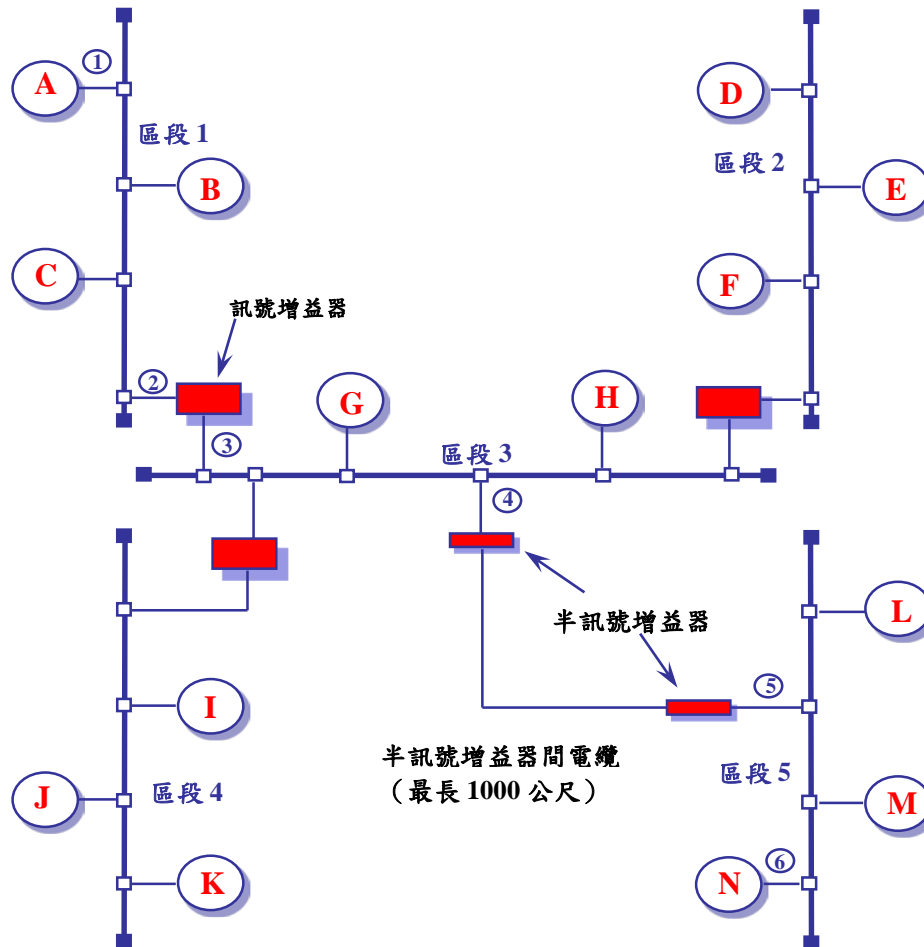
Network Configuration (Single segment)



Network Configuration (Two segments)



Network Configuration (Five segments, maximum)



Remind :
Slot Time = 51.2 us

Alternative Physical Layers

參數	10BASE5	10BASE 2	1BASE5	10BASET	10BROAD36
傳輸媒介	同軸電纜 (50 歐姆)	同軸電纜 (50 歐姆)	無遮蔽式 雙絞線	無遮蔽式 雙絞線	同軸電纜 (75 歐姆)
訊號處理技術	基頻 (Manchester)	基頻 (Manchester)	基頻 (Manchester)	基頻 (Manchester)	寬頻 (DPSK)
資料傳輸速率	10 Mbps	10 Mbps	1 Mbps	10 Mbps	10 Mbps
每段最大長度	500 公尺	185 公尺	500 公尺	185 公尺	1800 公尺
網路最大長度	2500 公尺	925 公尺	2500 公尺	500 公尺	3600 公尺
每段最多可連接 工作站數目	100	30	—	—	—
工作站間距	2.5 公尺	0.5 公尺	—	—	—
電纜線直徑	10 公厘	5 公厘	0.4-0.6公厘	0.4-0.6公厘	—