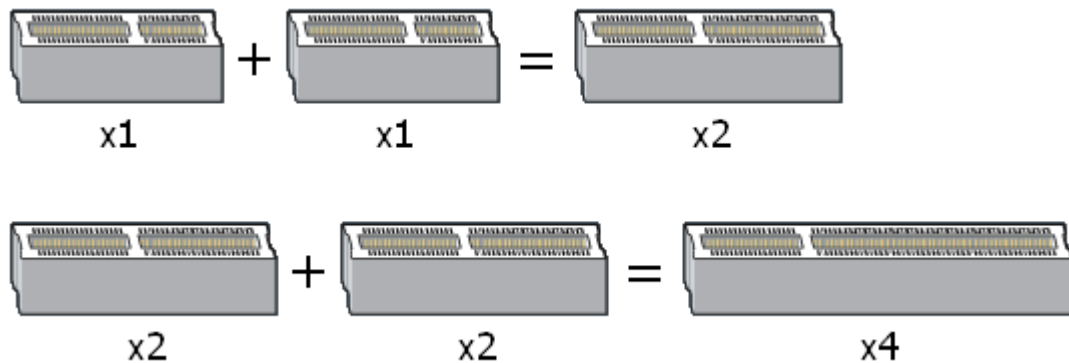# PC Architecture Introduction HW

Question: How to calculate PCIe Bandwidth?

Answer:

PCI-E 串行匯流排頻寬（MB/s） = 串行匯流排時脈（MHz） * 串行匯流排位寬（bit/8 = B） * 串行匯流排管線 * 編碼方式 * 每時鐘傳輸幾組資料（cycle）

PCI Express 1.0 Bandwidth

PCI Express link performance[27][28]

PCI Express version	Line code	Transfer rate[a]	Bandwidth	
			Per lane[a]	In a ×16 (16-lane) slot[a]
1.0	8b/10b	2.5 GT/s	2 Gbit/s (250 MB/s)	32 Gbit/s (4 GB/s)
2.0	8b/10b	5 GT/s	4 Gbit/s (500 MB/s)	64 Gbit/s (8 GB/s)
3.0	128b/130b	8 GT/s	7.877 Gbit/s (984.6 MB/s)	126.031 Gbit/s (15.754 GB/s)
4.0	128b/130b	16 GT/s	15.754 Gbit/s (1969.2 MB/s)	252.062 Gbit/s (31.508 GB/s)

串行匯流排時脈（MHz）= 2500
串行匯流排位寬（bit/8 = B）= 1/8
串行匯流排管線 = 1
編碼方式 = 8/10
每時鐘傳輸幾組資料（cycle）= 1

x1 Lane = 2500 * 1/8 * 1 * 8/10 * 1 = 250 MB/s per differential pair

x16 Lane = 16 * 250 MB/s = 4 GB/s (8 GB/s Duplex)

PCI Express 2.0 Bandwidth

PCI Express link performance[27][28]

PCI Express version	Line code	Transfer rate[a]	Bandwidth	
			Per lane[a]	In a ×16 (16-lane) slot[a]
1.0	8b/10b	2.5 GT/s	2 Gbit/s (250 MB/s)	32 Gbit/s (4 GB/s)
2.0	8b/10b	5 GT/s	4 Gbit/s (500 MB/s)	64 Gbit/s (8 GB/s)
3.0	128b/130b	8 GT/s	7.877 Gbit/s (984.6 MB/s)	126.031 Gbit/s (15.754 GB/s)
4.0	128b/130b	16 GT/s	15.754 Gbit/s (1969.2 MB/s)	252.062 Gbit/s (31.508 GB/s)

串行匯流排時脈（MHz）= 5000
串行匯流排位寬（bit/8 = B）= 1/8
串行匯流排管線 = 1
編碼方式 = 8/10
每時鐘傳輸幾組資料（cycle）= 1

x1 Lane = 5000 * 1/8 * 1 * 8/10 * 1 = 500 MB/s per differential pair

x16 Lane = 16 * 250 MB/s = 8 GB/s (16 GB/s Duplex)

PCI Express 3.0 Bandwidth

PCI Express link performance[27][28]

PCI Express version	Line code	Transfer rate[a]	Bandwidth	
			Per lane[a]	In a ×16 (16-lane) slot[a]
1.0	8b/10b	2.5 GT/s	2 Gbit/s (250 MB/s)	32 Gbit/s (4 GB/s)
2.0	8b/10b	5 GT/s	4 Gbit/s (500 MB/s)	64 Gbit/s (8 GB/s)
3.0	128b/130b	8 GT/s	7.877 Gbit/s (984.6 MB/s)	126.031 Gbit/s (15.754 GB/s)
4.0	128b/130b	16 GT/s	15.754 Gbit/s (1969.2 MB/s)	252.062 Gbit/s (31.508 GB/s)

串行匯流排時脈（MHz）= 8000
串行匯流排位寬（bit/8 = B）= 1/8
串行匯流排管線 = 1
編碼方式 = 128/130
每時鐘傳輸幾組資料（cycle）= 1

x1 Lane = 8000 * 1/8 * 1 * 128/130 * 1 = 984.61 MB/s per differential pair

x16 Lane = 16 * 984.61 MB/s = 15.754 GB/s (31.507 GB/s Duplex)

PCI Express 4.0 Bandwidth

PCI Express link performance[27][28]

PCI Express version	Line code	Transfer rate[a]	Bandwidth	
			Per lane[a]	In a ×16 (16-lane) slot[a]
1.0	8b/10b	2.5 GT/s	2 Gbit/s (250 MB/s)	32 Gbit/s (4 GB/s)
2.0	8b/10b	5 GT/s	4 Gbit/s (500 MB/s)	64 Gbit/s (8 GB/s)
3.0	128b/130b	8 GT/s	7.877 Gbit/s (984.6 MB/s)	126.031 Gbit/s (15.754 GB/s)
4.0	128b/130b	16 GT/s	15.754 Gbit/s (1969.2 MB/s)	252.062 Gbit/s (31.508 GB/s)

串行匯流排時脈（MHz）＝16000
串行匯流排位寬（bit/8＝B）＝1/8
串行匯流排管線 ＝1
編碼方式 ＝128/130
每時鐘傳輸幾組資料（cycle）＝1

x1 Lane = 16000 * 1/8 * 1 * 128/130 * 1 = 1969.23 MB/s per differential pair

x16 Lane = 16 * 1969.23 MB/s = 31.508 GB/s (63.015 GB/s Duplex)