
Lokální síť (04)

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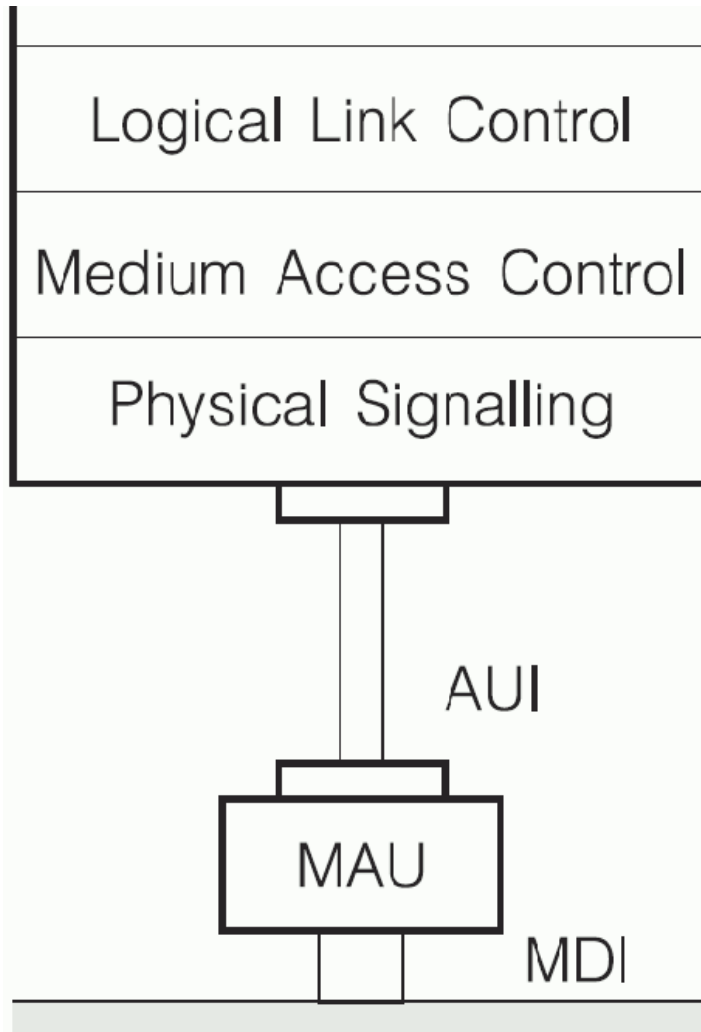
katedra počítačů

České vysoké učení technické v Praze

Ethernet technologies

- Standard (10BASE-x) technologies
 - 10BASE-5, 10BASE-2
 - 10BASE-T, 10BASE-FL, 10BASE-FB, 10BASE-FP
- Fast (100BASE-x) technologies
 - 100BASE-Tx/Fx
 - 100BASE-T4, 100BASE-T2
- Gigabit (1000BASE-x) technologies
 - 1000BASE-SX, 1000BASE-LX
 - 1000BASE-CX, 1000BASE-TX
- 10 Gigabit (10GBASE-x) technologies
 - 10GBASE-SR/EW, 10GBASE-LR/EW
 - 10GBASE-LX4, 10GBASE-ER/EW
 - 10GBASE-CX4

100BASE-?



10BASE-? → AUI – Attachement Unit Interface

100BASE-? AUI → MII

- MII – Media Independent Interface
- 4x 25MHz
- RMII – Reduced Media Independent Interface
- 2x 50MHz



IEEE 802.3 100BASE-Fx

- médium: optika (multi/single mode), 1300nm
- délky:
 - HalfDuplex: 400m
 - FullDuplex: multimode – 2km, singlemode – 10km
- kódování: 4B5B, NRZI



100BASE-? – 4B5B

- překódování 4b do 5b
 - lepší účinnost než Manchester
 - synchronizace
 - v 5b alespoň 2x 1 (v NRZI 1=přechod)
 - maximálně 3x 0 za sebou

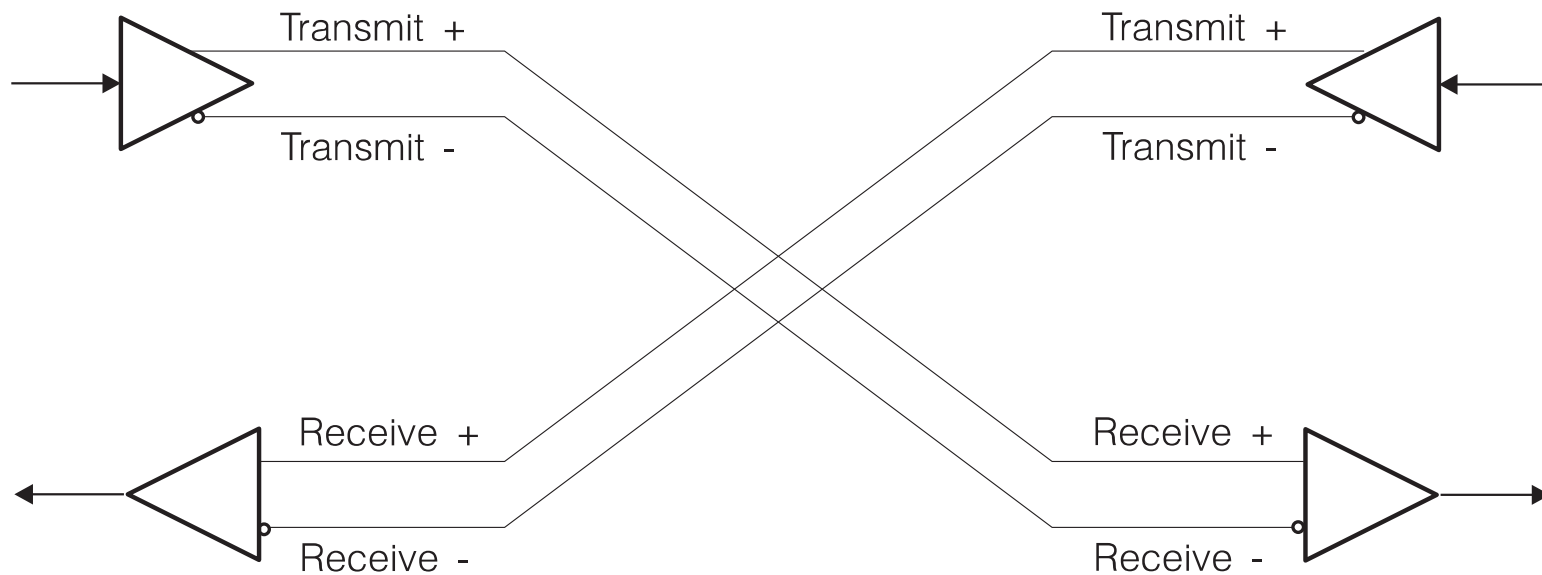
4B	5B	4B	5B	4B	5B	4B	5B
0000	11110	0110	01110	1100	11010	Strt#1	11000
0001	01001	0111	01111	1101	11011	Strt#2	10001
0010	10100	1000	10010	1110	11100	End	01101
0011	10101	1001	10011	1111	11101	Reset	00111
0100	01010	1010	10110	Quiet	00000	Set	11001
0101	01011	1011	10111	Idle	11111	Halt	00100



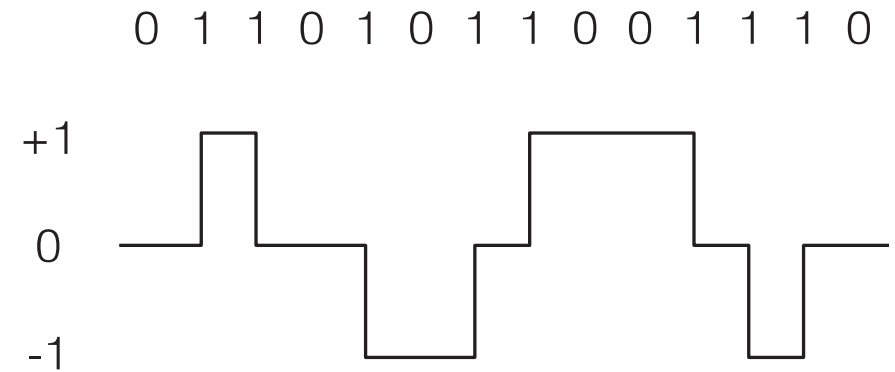
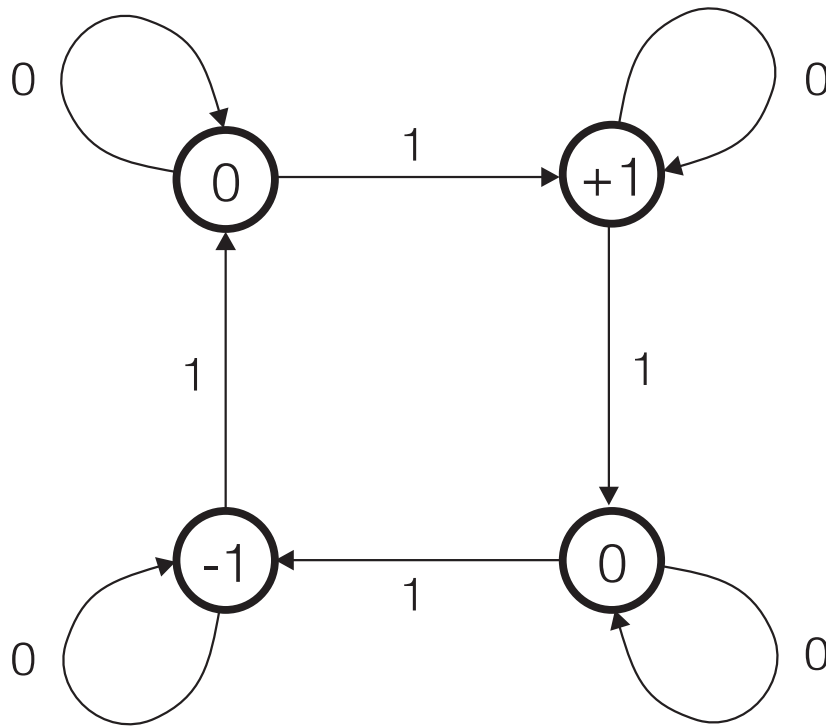
IEEE 802.3 100BASE-Tx

- médium:
 - UTP (min cat. 5), použity 2 páry ze 4 (kab. 1,2,3,6)
 - STP
- délky:
 - 100m
- kódování: 4B/5B, NRZI → NRZ, scrambling, MLT3

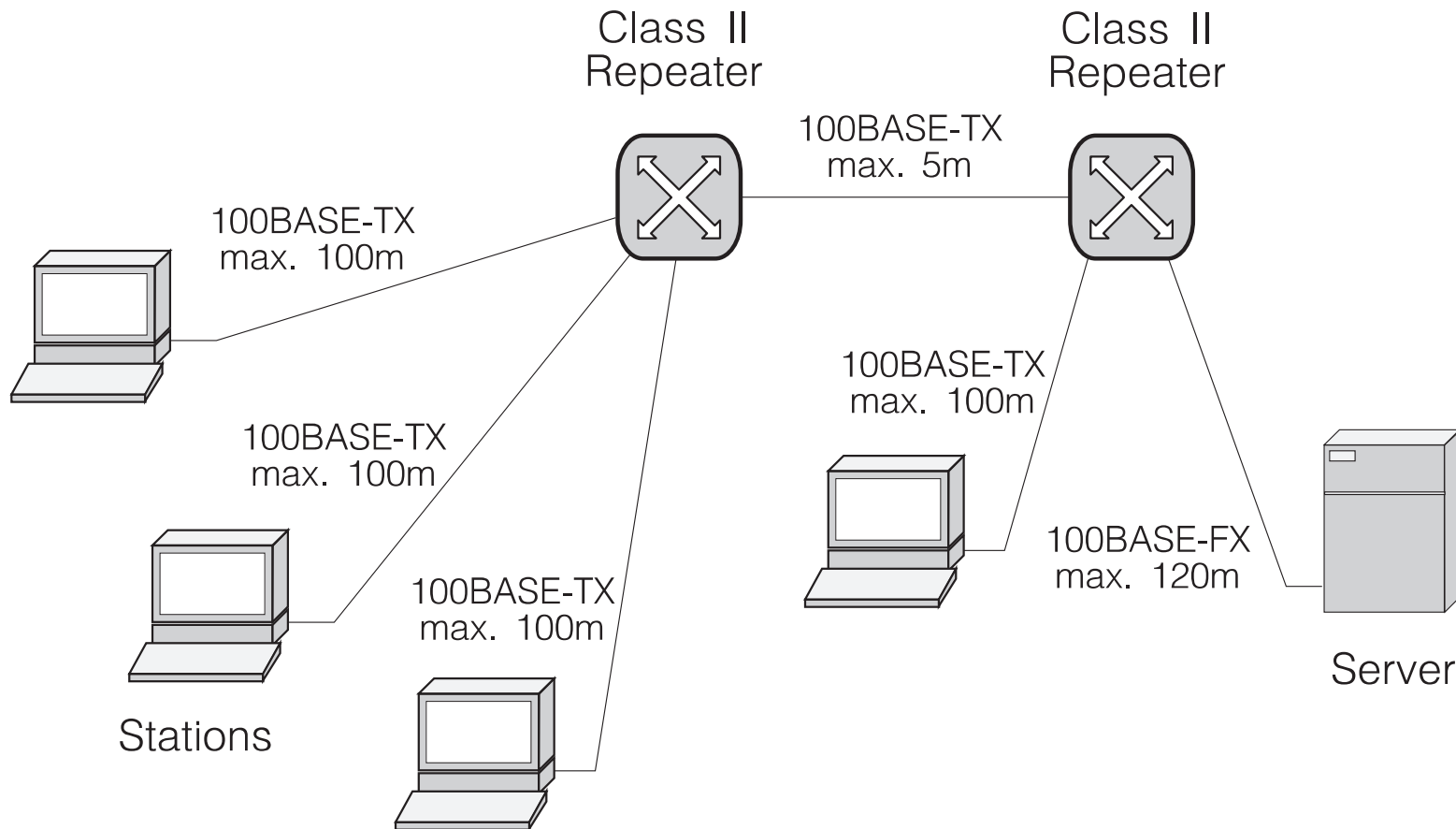
100BASE-Tx Cabling



100BASE-Tx Encoding



100BASE-Tx Repeater

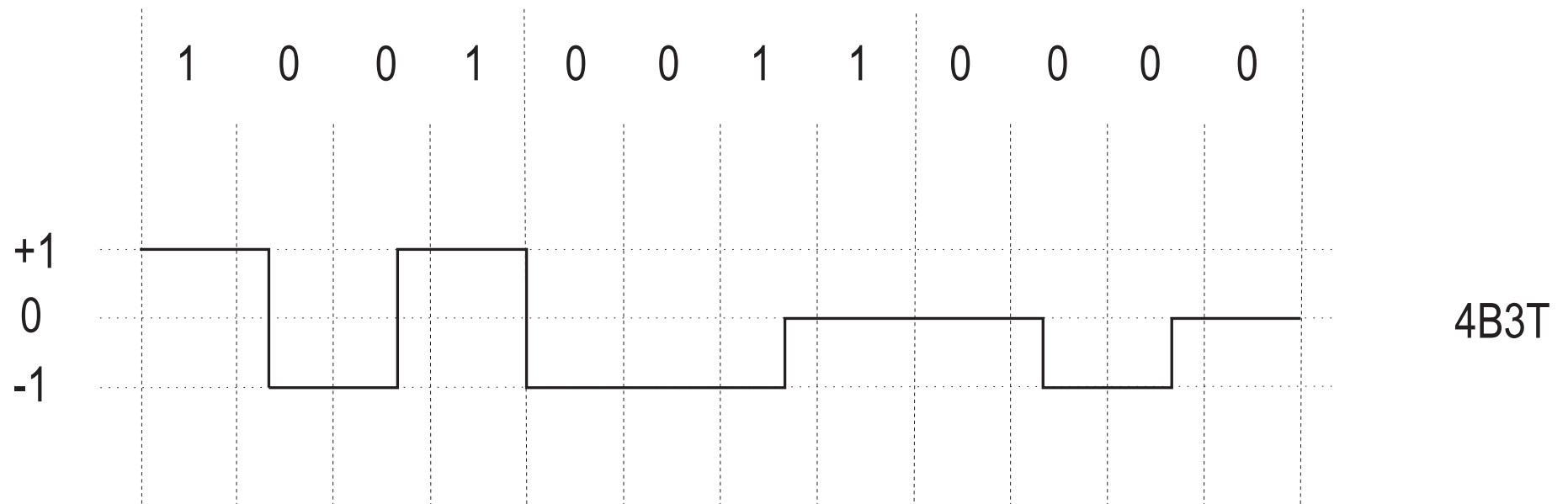


IEEE 802.3 100BASE-T4

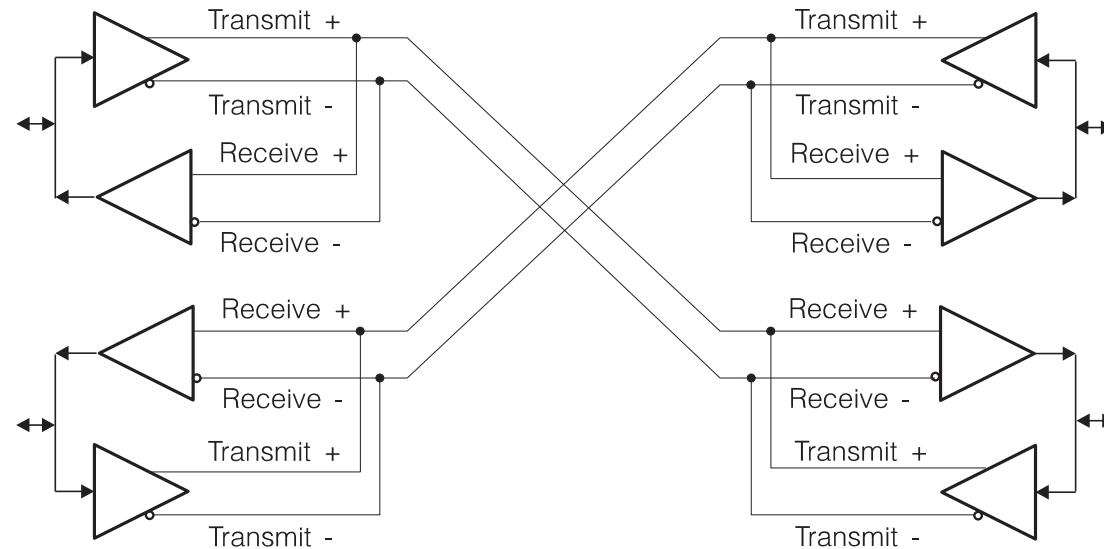
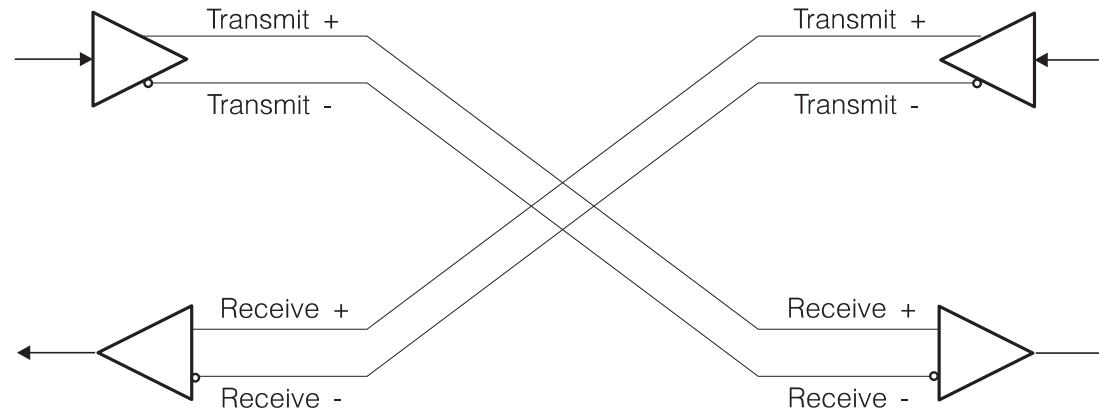
- médium: UTP (min cat. 3), použity 4 páry ze 4
- délky:
 - 100m
- kódování: 8B6T, PAM-3

4B	3T	4B	3T	4B	3T	4B	3T
0000	+ 0 +	0101	0 + +	1010	+ + -	1110	0 + -
0000	0 - 0	0110	- + +	0101	- 0 0	1111	+ + 0
0001	0 - +	0110	- - +	1011	+ 0 -	1111	0 0 -
0010	+ - 0	0111	- 0 +	1100	+ + +	1010	+ - -
0011	0 0 +	1000	+ 0 0	1100	- + -		
0011	- - 0	1000	0 - -	1101	0 + 0		
0100	- + 0	1001	+ - +	1101	- 0 -		

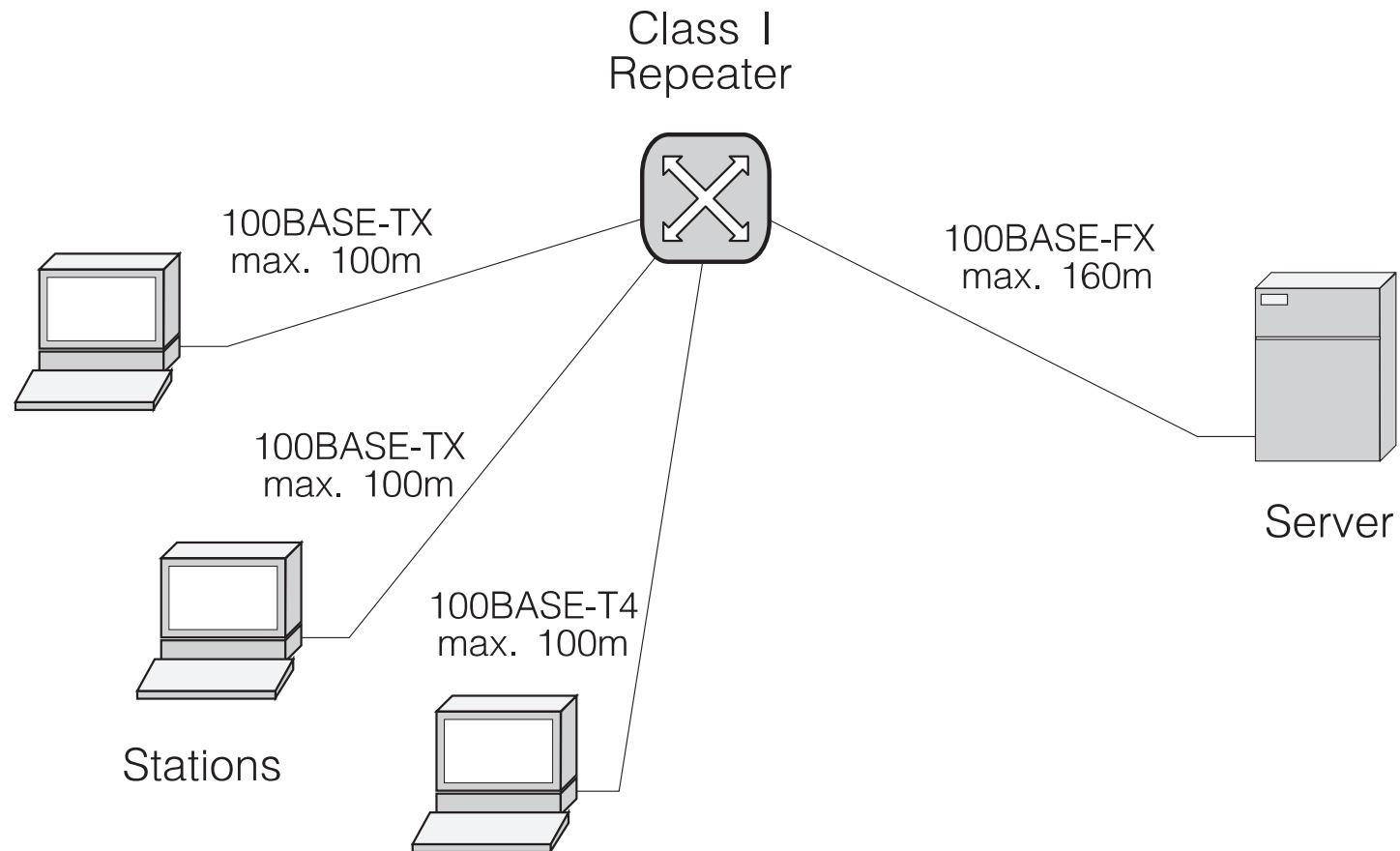
100BASE-T4 Encoding



100BASE-T4 Cabling



100BASE-Tx/T4 Repeater

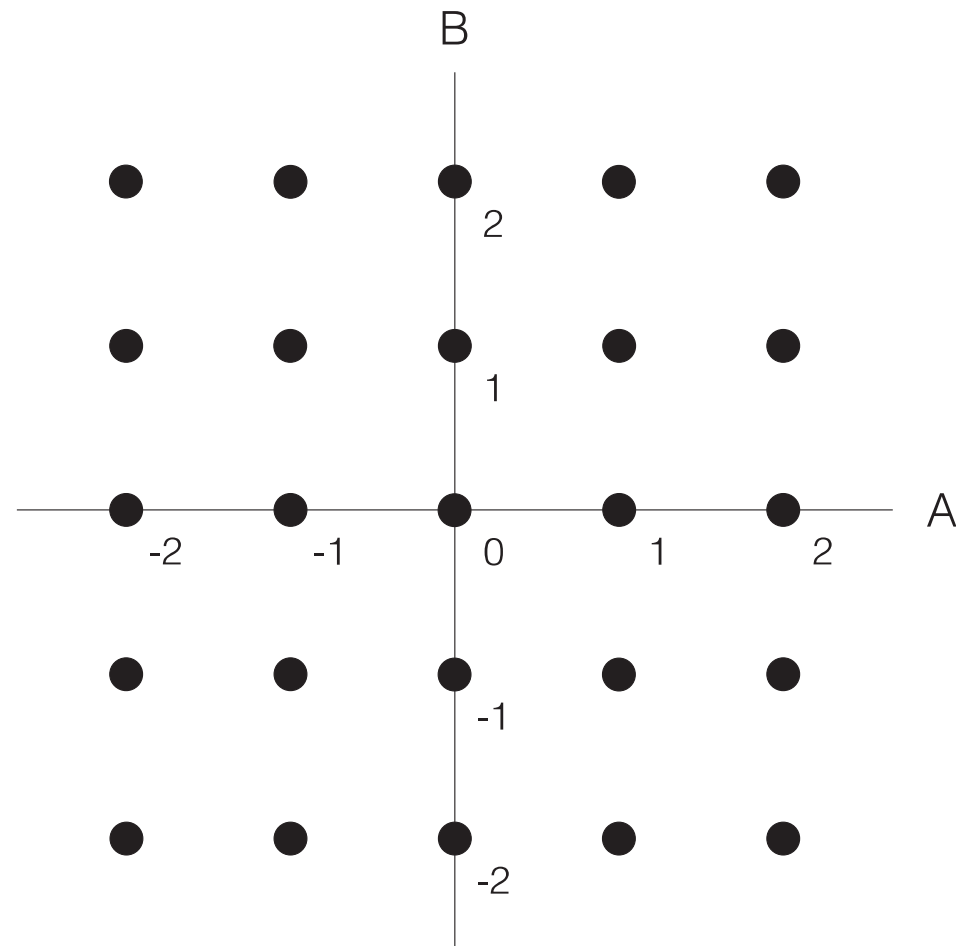




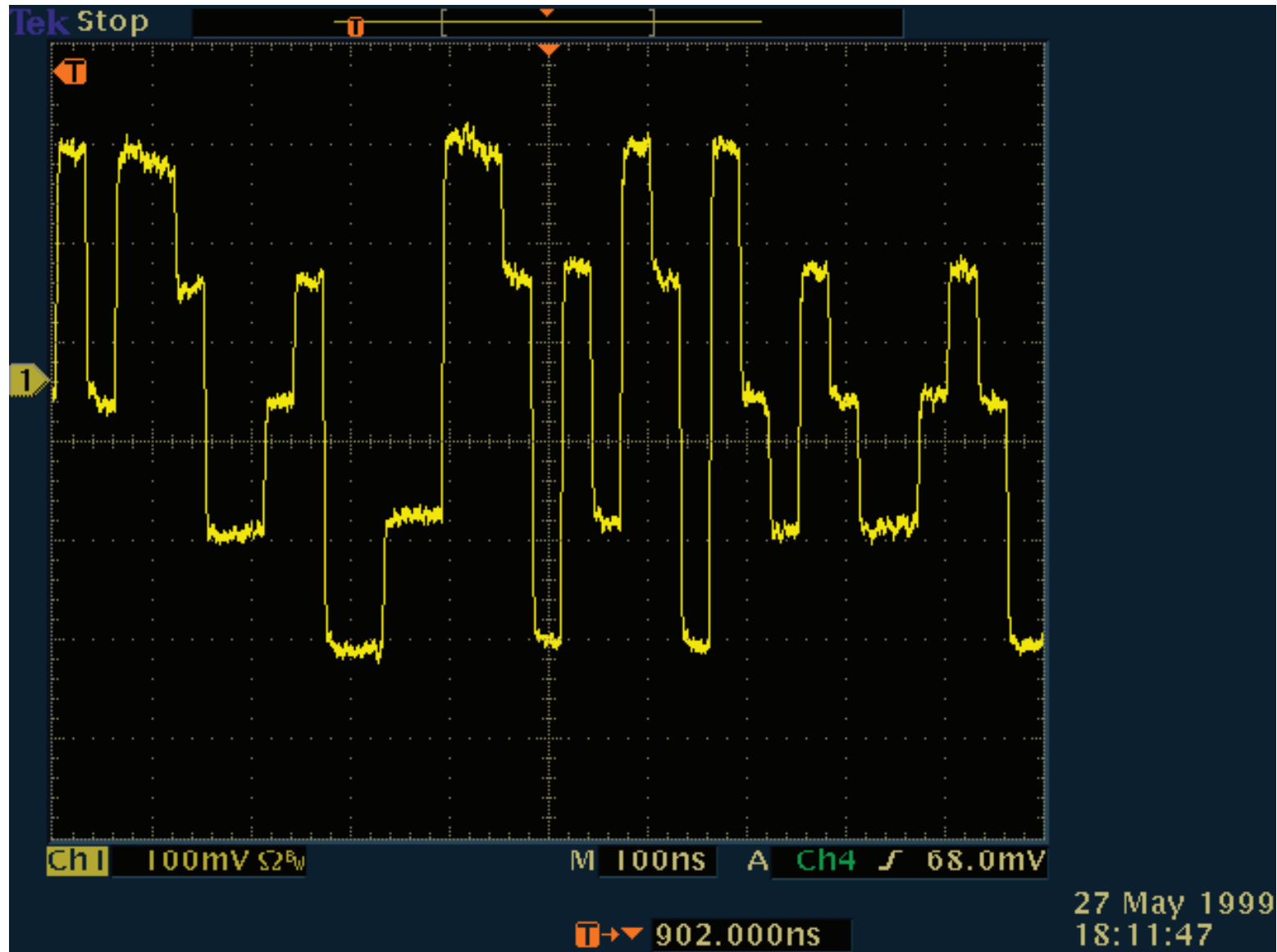
IEEE 802.3 100BASE-T2

- médium: UTP (min cat. 3), použity 2 páry ze 4
- délky:
 - 100m
- kódování: 4B2P, PAM-5

100BASE-T2 Encoding



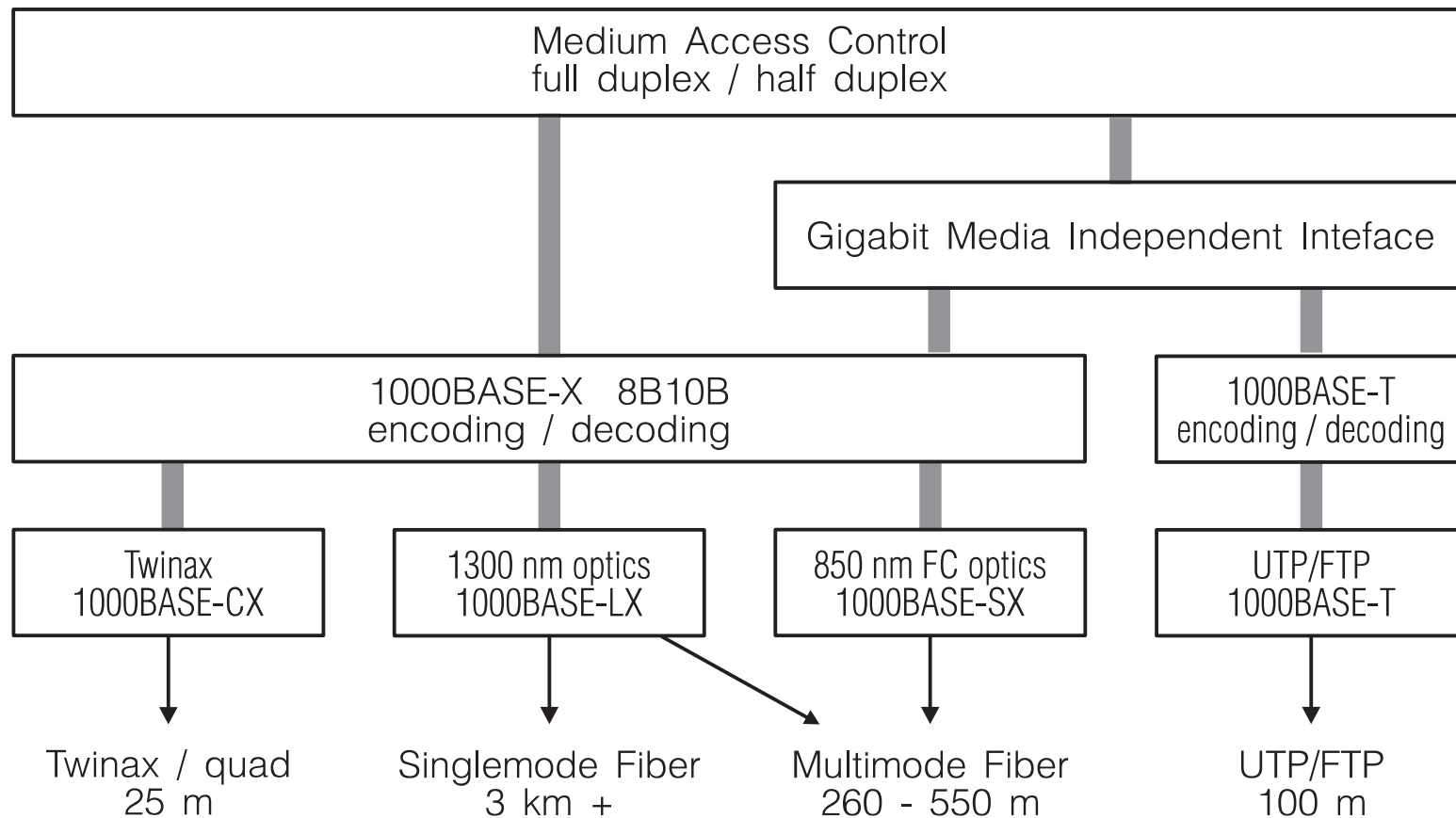
PAM-5



Fast Ethernet - encodings

	Number of Pairs / Fibers	Encoding Method	Coding Efficiency
10BASE-T/Fx	2	Manchester	2.00 baud/bit
100BASE-TX/FX	2	4B5B	1.25 baud/bit
100BASE-T4	4	8B6T	0.75 baud/bit
100BASE-T2	2	PAM-5	0.5 baud/bit

Gigabit Ethernet





IEEE 802.3 1000BASE-X

- médium:
 - optika (multi/single mode)
 - twin axial cable (twinax)
- délky:
 - 25m – 5km
- Gigabit Media Independent Interface – GMII
 - 8x 125MHz
- kódování: 8B10B, PAM-5
 - 8B10B – SS složka, synchronizace



IEEE 802.3 1000BASE-X

- 1000BASE-CX
 - médium: twinax
 - délka: 25m
- 1000BASE-SX
 - médium: MMF 50/125, 62.5/125; 770 – 860nm
 - délka: 275 – 550m
- 1000BASE-LX
 - médium:
 - MMF 50/125, 62.5/125, SMF 10/?; 1270 – 1355nm
 - délka: 316 – 5000m



IEEE 802.3 1000BASE-X

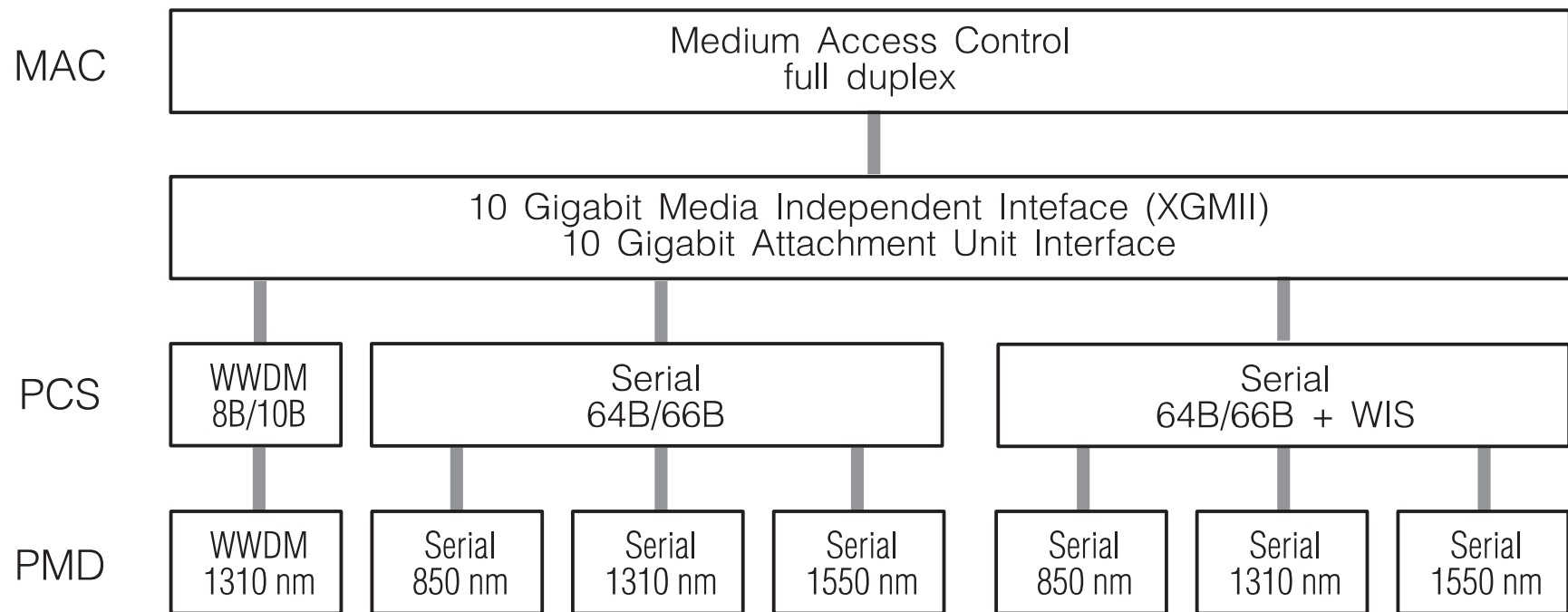
- 1000BASE-LX10 ~ 1000BASE-LH
 - médium: SMF 10/?; 1270 – 1355nm, 1550nm
 - délka: 10km, 40km (kvalitnější optika)



IEEE 802.3 1000BASE-T(X)

- médium: UTP (min cat. 5), použity 4 páry ze 4
- délky:
 - 100m
- kódování: 8B-4x3B-4x1P, PAM-5

10G Ethernet



10G Ethernet

	Encoding Method	Wavelength	PHY Type	Framing
10GBASE-SR	64B/66B	850 nm	serial	
10GBASE-LX4	8B/10B	1310 nm	WWDM	
10GBASE-LR	64B/66B	1310 nm	serial	
10GBASE-ER	64B/66B	1550 nm	serial	
10GBASE-SW	64B/66B	850 nm	serial	OC -192
10GBASE-LW	64B/66B	1310 nm	serial	OC -192
10GBASE-EW	64B/66B	1550 nm	serial	OC -192