

# Ethernet 40/100Gb

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# Ethernet Evolution

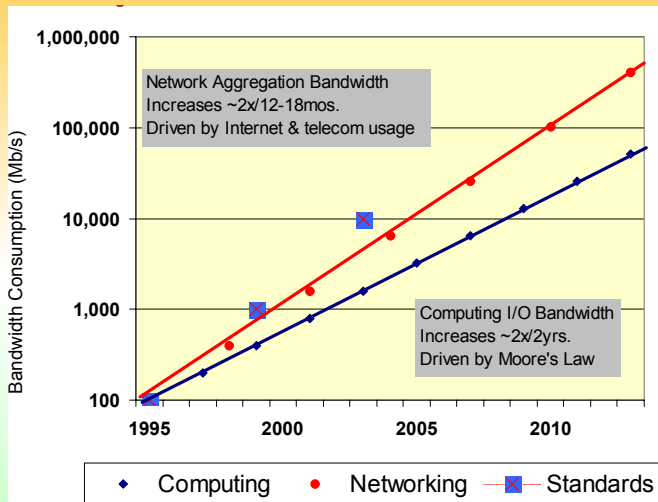
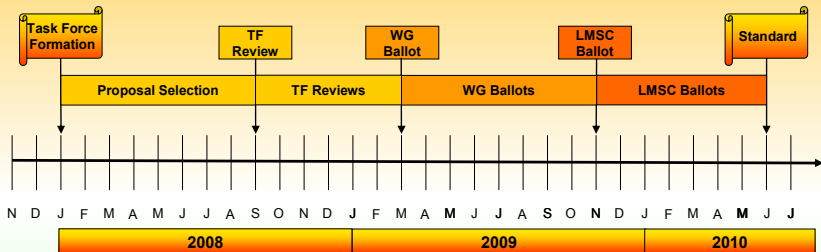


Fig.: Ethernet Evolution

# Ethernet Evolution



**Fig.:** Standards Timetable of 40/100G Ethernet

Standard IEEE 802.3ba

- 1973-1975 první návrh ve firmě XEROX
- 1980 zahájen proces návrhu standardu
- 1982 standard *IEEE 802.3*
- 1983 první dostupná ethernetová karta 3COM
- 1995 100MbE s autonegociací *IEEE 802.3u*
- 1999 1GbE (včetně TP) *IEEE 802.3ab*
- 2002 10GbE *IEEE 802.3ae*
- 2007 zahájen proces standardizace 40/100GbE *IEEE 803.2ba*
- 2010 předpokládané ukončení procesu standardizace 40/100GbE
- 2015 předpověď Roberta Metcalfa - 1TbE

## OSI model

aplikační vrstva
prezentační vrstva
realační vrstva
transportní vrstva
síťová vrstva
datová vrstva
fyzická vrstva

## Datová vrstva

počet byte	význam
7	preamble
1	start symbol
6	cílová adresa
6	zdrojová adresa
4	případný VLAN tag
2	délka/typ
42-1500	data
4	kontrolní součet

## Fyzická vrstva 10MbE až 100GbE

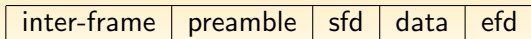
<b>Mb/s</b>	<b>100Mb/s</b>	<b>1Gb/s</b>	<b>10Gb/S</b>	<b>40Gb/s</b>	<b>100Gb/s</b>
MAC	MAC	MAC	MAC	MAC	MAC
REC	REC	REC	REC	REC	REC
<i>MII</i>	<i>MII</i>	<i>GMII</i>	<i>XGMII</i>	<i>XLGMII</i>	<i>CGMII</i>
PLS	PCS	PCS	PCS	PCS	PCS
<i>AUI</i>	PMA	PMA	PMA	PMA	PMA
PMA	PMD	PMD	PMD	PMD	PMD
<i>MDI</i>	<i>MDI</i>	<i>MDI</i>	<i>MDI</i>	<i>MDI</i>	<i>MDI</i>
MEDIUM	MEDIUM	MEDIUM	MEDIUM	MEDIUM	MEDIUM

## Rozhraní

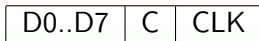
Speed	Reconciliation	Extension	Removable	Medium
10M	MII	AUI	AUI	Coax, TP, Fb
100M	MII		No	TP, Fb
1G	GMII		GBIC, SFP	TP, Fb
10G	XGMII	XAUI	XENPACK, XFP, SFP+	TP, Fb
40G	XLGMII	XLAUI	QSFP,	TP, Fb
100G	CGMII	CAUI	CFP	TP, Fb

# Back to Old History - 1Gb Ethernet

- Datastream:



- GMII



- 8 to 10 conversion - complex conversion table
- 1GBASE-XX

# Back to History - 10Gb Ethernet :-)

- Datastream:

inter-frame	preamble	sfd	data	efd
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- XGMII:

Lane 0	Lane 1	Lane 2	Lane 3	Clock
D0..D7 C0	D8..D15 C1	D16..D23 C2	D24..D31 C3	CLK

- XAUI - 4x3.15 Gb serial, data alignment

Lane 0	Lane 1	Lane 2	Lane 3
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- 64 to 66 conversion - sync header + simple conversion table
- scrambling

$$G(x) = 1 + x^{39} + x^{58}$$

- 10GBASE-XX

# Back to History - 10Gb Ethernet :-)

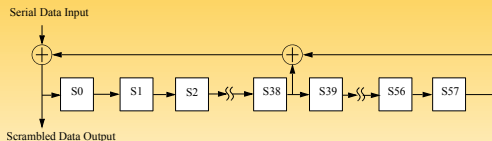


Fig.: Scrambler

Input Data	Syn c	Block Payload							
Bit Position:	0 1 2	65							
Data Block Format:	01	D <sub>0</sub>	D <sub>1</sub>	D <sub>2</sub>	D <sub>3</sub>	D <sub>4</sub>	D <sub>5</sub>	D <sub>6</sub>	D <sub>7</sub>
Control Block Formats:		Block Type Field							
C <sub>0</sub> C <sub>1</sub> C <sub>2</sub> C <sub>3</sub> C <sub>4</sub> C <sub>5</sub> C <sub>6</sub> C <sub>7</sub>	10	0x1e	C <sub>0</sub>	C <sub>1</sub>	C <sub>2</sub>	C <sub>3</sub>	C <sub>4</sub>	C <sub>5</sub>	C <sub>6</sub> C <sub>7</sub>
S <sub>0</sub> D <sub>1</sub> D <sub>2</sub> D <sub>3</sub> D <sub>4</sub> D <sub>5</sub> D <sub>6</sub> D <sub>7</sub>	10	0x78	D <sub>1</sub>	D <sub>2</sub>	D <sub>3</sub>	D <sub>4</sub>	D <sub>5</sub>	D <sub>6</sub>	D <sub>7</sub>
O <sub>0</sub> D <sub>1</sub> D <sub>2</sub> D <sub>3</sub> D <sub>4</sub> D <sub>5</sub> D <sub>6</sub> D <sub>7</sub>	10	0x4b	D <sub>1</sub>	D <sub>2</sub>	D <sub>3</sub>	D <sub>4</sub>	D <sub>5</sub>	D <sub>6</sub>	D <sub>7</sub>
Q <sub>0</sub> D <sub>1</sub> D <sub>2</sub> D <sub>3</sub> D <sub>4</sub> D <sub>5</sub> D <sub>6</sub> D <sub>7</sub>	10	0x55	D <sub>1</sub>	D <sub>2</sub>	D <sub>3</sub>	D <sub>4</sub>	D <sub>5</sub>	D <sub>6</sub>	D <sub>7</sub>
T <sub>0</sub> C <sub>1</sub> C <sub>2</sub> C <sub>3</sub> C <sub>4</sub> C <sub>5</sub> C <sub>6</sub> C <sub>7</sub>	10	0x87		C <sub>1</sub>	C <sub>2</sub>	C <sub>3</sub>	C <sub>4</sub>	C <sub>5</sub>	C <sub>6</sub> C <sub>7</sub>
D <sub>0</sub> T <sub>1</sub> C <sub>2</sub> C <sub>3</sub> C <sub>4</sub> C <sub>5</sub> C <sub>6</sub> C <sub>7</sub>	10	0x99	D <sub>0</sub>		C <sub>2</sub>	C <sub>3</sub>	C <sub>4</sub>	C <sub>5</sub>	C <sub>6</sub> C <sub>7</sub>
D <sub>0</sub> D <sub>1</sub> T <sub>2</sub> C <sub>3</sub> C <sub>4</sub> C <sub>5</sub> C <sub>6</sub> C <sub>7</sub>	10	0xaa	D <sub>0</sub>	D <sub>1</sub>		C <sub>3</sub>	C <sub>4</sub>	C <sub>5</sub>	C <sub>6</sub> C <sub>7</sub>
D <sub>0</sub> D <sub>1</sub> D <sub>2</sub> T <sub>3</sub> C <sub>4</sub> C <sub>5</sub> C <sub>6</sub> C <sub>7</sub>	10	0xb4	D <sub>0</sub>	D <sub>1</sub>	D <sub>2</sub>		C <sub>4</sub>	C <sub>5</sub>	C <sub>6</sub> C <sub>7</sub>
D <sub>0</sub> D <sub>1</sub> D <sub>2</sub> D <sub>3</sub> T <sub>4</sub> C <sub>5</sub> C <sub>6</sub> C <sub>7</sub>	10	0xcc	D <sub>0</sub>	D <sub>1</sub>	D <sub>2</sub>	D <sub>3</sub>		C <sub>5</sub>	C <sub>6</sub> C <sub>7</sub>
D <sub>0</sub> D <sub>1</sub> D <sub>2</sub> D <sub>3</sub> D <sub>4</sub> T <sub>5</sub> C <sub>6</sub> C <sub>7</sub>	10	0xd2	D <sub>0</sub>	D <sub>1</sub>	D <sub>2</sub>	D <sub>3</sub>	D <sub>4</sub>		C <sub>6</sub> C <sub>7</sub>
D <sub>0</sub> D <sub>1</sub> D <sub>2</sub> D <sub>3</sub> D <sub>4</sub> D <sub>5</sub> T <sub>6</sub> C <sub>7</sub>	10	0xe1	D <sub>0</sub>	D <sub>1</sub>	D <sub>2</sub>	D <sub>3</sub>	D <sub>4</sub>	D <sub>5</sub>	C <sub>7</sub>
D <sub>0</sub> D <sub>1</sub> D <sub>2</sub> D <sub>3</sub> D <sub>4</sub> D <sub>5</sub> D <sub>6</sub> T <sub>7</sub>	10	0xff	D <sub>0</sub>	D <sub>1</sub>	D <sub>2</sub>	D <sub>3</sub>	D <sub>4</sub>	D <sub>5</sub>	D <sub>6</sub>

Fig.: 64 to 66 Coding

# 40/100G Ethernet

- Datastream:

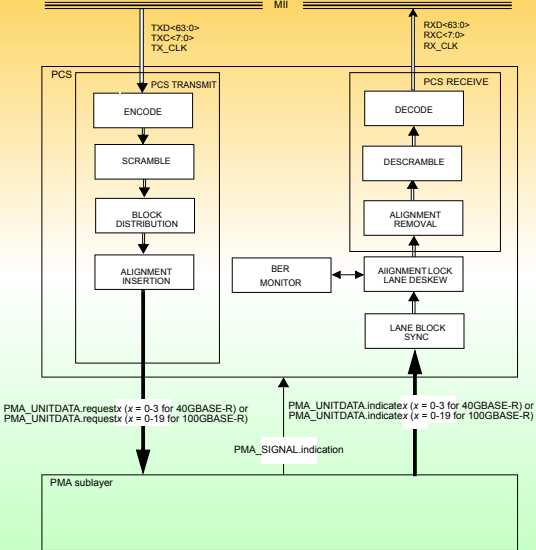
inter-frame	preamble	sfd	data	efd
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- XGMII:

Lane 0	Lane 1	Lane x	Lane 7	Clock
D0..D7 C0	D8..D15 C1	Dy..Dz Cx	D56..D63 C7	CLK

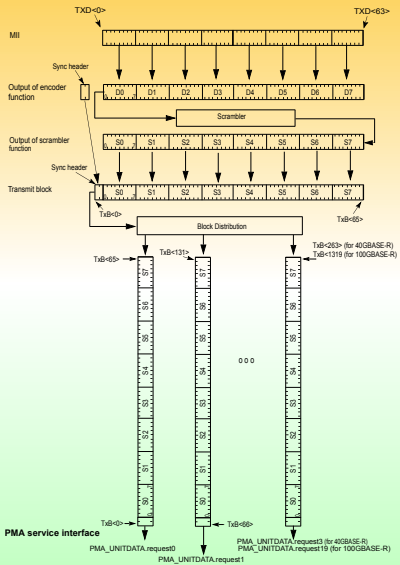
- 64 to 66 conversion - sync header + simple conversion table
- scrambling
- PCS block distribution
  - 40G - 4 lines
  - 100G - 20 lines
- 40/100GBASE-XX

# 40/100G Ethernet



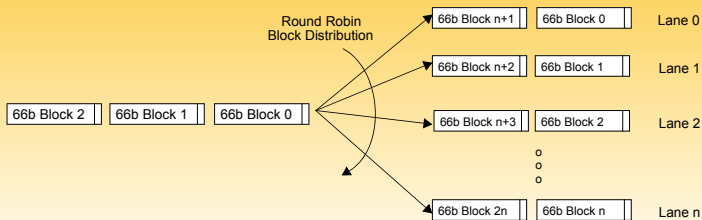
**Fig.:** Functional Block Diagram

# 40/100G Ethernet

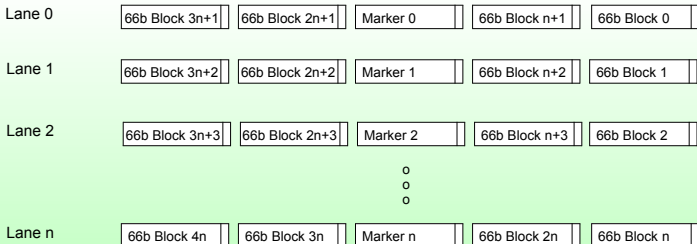


**Fig.:** Transmit

# 40/100G Ethernet



**Fig.:** Block distribution



**Fig.:** Line Alignment

# 40/100G Ethernet

PMD:

At least	40Gb	100Gb
1m backplane	40GBASE-KR4	-
10m copper	40GbASE-CR4	100GbASE-CR10
100m MMF	40GbASE-SR4	100GbASE-SR10
10Km SMF	40GbASE-LR4	100GbASE-LR4
40Km SMF	-	100GbASE-ER4

# VIRTEX solutions

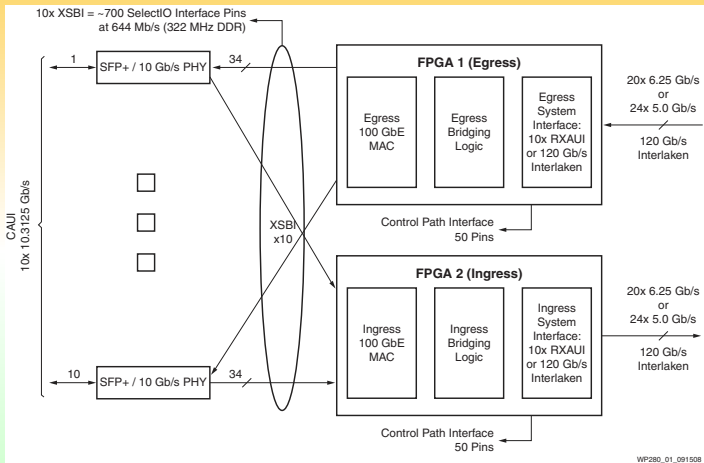


Fig.: Ser/Des Solution

# VIRTEX solutions

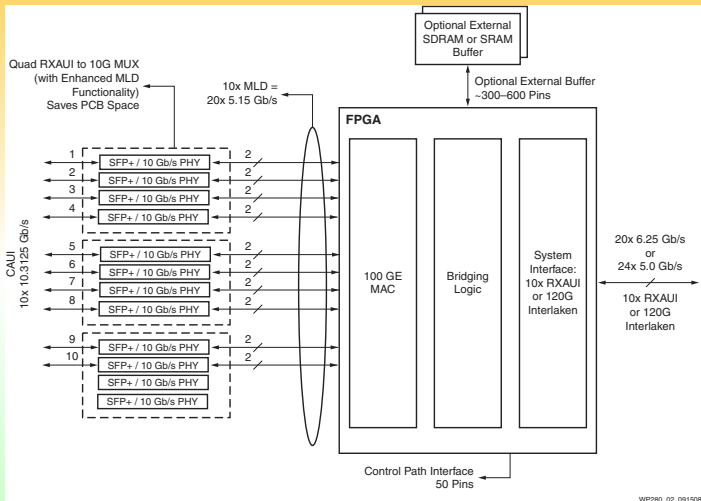


Fig.: RI/O Solution

Otázky ???

Děkuji za pozornost