



Auto-Negotiation for 10GBASE-T

Eric Lynskey

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Outline

- Overview of 10/100 auto-negotiation
- Auto-negotiation additions for 1000BASE-T
- Possible extensions for 10GBASE-T



Motivation for auto-negotiation

- Handshaking protocol to transfer capabilities between two devices (point to point protocol)
- Automatically negotiate best link for two devices
 - Speed (10, 100, or 1000 Mb/s)
 - Duplex
 - PAUSE operation
 - Master-Slave relationship (1000BASE-T only)



Auto-Negotiation basics

- Use 10BASE-T Link Test Pulses to form Fast Link Pulse (FLP) bursts
- FLP bursts contain 17 clock pulses and 16 data pulses which convey information
- Clause 28 defines process by which FLP bursts are exchanged between two devices
 - Base Page Exchange
 - Next Page Exchange

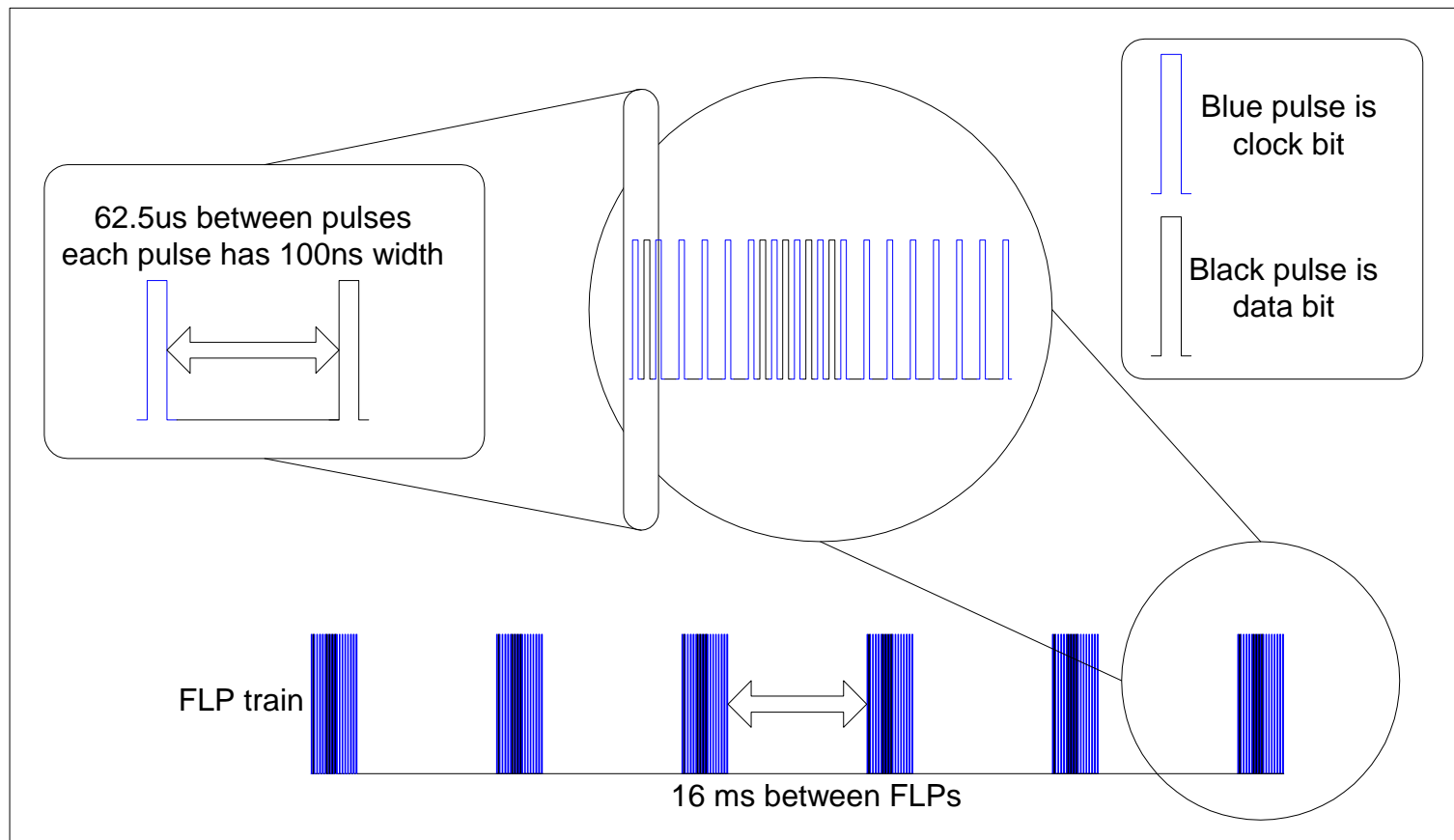


More auto-negotiation basics

- For speeds of 10/100 you can parallel detect
 - Allows connecting of non-negotiating device with device that does support auto-negotiation
 - Only allows for half duplex link
 - Not allowed for 1000BASE-T



Anatomy of an FLP



Base Page Abilities

Bit	Technology
A0	10BASE-T
A1	10BASE-T Full Duplex
A2	100BASE-TX
A3	100BASE-TX Full Duplex
A4	100BASE-T4
A5	PAUSE operation
A6	Asymmetric PAUSE operation
A7	Reserved



Base Page Exchange

- Both devices transmit base page abilities
- Upon reception of valid base page from link partner device will retransmit its own base page with an acknowledgement bit set
- Upon reception of valid base page from link partner that has acknowledgement bit set device will determine highest common denominator link
- Both sides will attempt to establish HCD link



Next Page Motivation

- There are not enough free bits in base page
- Additional information needs extra pages
- Next pages have always been here
 - Not implemented prior to 1000BASE-T
- 1000BASE-T requires both auto-negotiation and next pages



1000BASE-T Next Page

- Series of 3 pages in addition to base page
 - Follow same handshaking protocol for each page
- First page is Message Page
 - Indicates that there is going to be a 1000BASE-T next page exchange
- Second page contains 1000BASE-T abilities
 - Full/half, Multiport/single port, Master/Slave
- Third page contains Master/Slave random seed



1000BASE-T Auto-Negotiation

- Both devices transfer Base Pages
- Both devices transfer Message Page with code 8
- Both devices transfer 1000BASE-T abilities
- Both devices transfer master/slave seeds



Master-Slave Relationship

- Multiport takes precedence over single port
- With same port type, higher random seed value becomes Master
- Manually configure port to master/slave
 - Not recommended since cannot have two masters or two slaves



10GBASE-T Auto-Negotiation

- Base Page remains unchanged
- Define new Message Page with message code 9
- Define 10GBASE-T ability pages
- Define other 10GBASE-T pages
- Define necessary registers or use existing ones



Additional Points of Interest

- Automatic MDI/MDI-X configuration should exist
- Annex 40C should be fixed (maybe normative?)
- Need to look closely at how much register space is needed. Can we use existing registers or do we need to create new ones?



Why auto-negotiation?

- Auto-Negotiation will be necessary if vendors want to support 1000BASE-T/10GBASE-T devices
- Existing method for automatic configuration
- Interoperable solutions currently exist for 10/100/1000...with fairly simple upgrade path for 10GBASE-T
- Auto-Negotiation works!!!

