Auto-Negotiation

IEEE 802.3 HSSG - Coeur d'Alene, ID

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AN Elements

- Presented to NCITS T11.2 and T11 in April, 1999
- Applicable to 10 GbE, GbE, FC, P1394b, NGIO...
  - Liaisons required to establish global requirements
- Applicable to Point-to-Point Links Only
  - FC-AL AN support requires device addressing protocol
- Signaling: derived from P1394b
  - Signal Detect-based “tones” work for fiber and copper
- Protocol: derived from Ethernet
  - Base / optional next page exchange, priority resolution, remote fault
- Management (Optional): derived from Ethernet
  - Management Registers and 2-wire Interface

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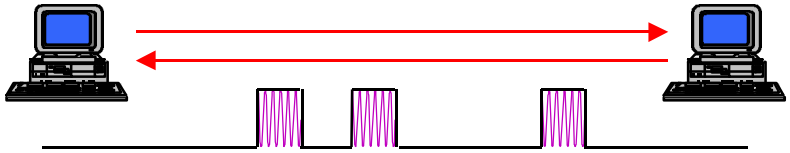
Auto-Negotiation Review

- Method used to exchange information between 2 stations;
- Used to configure operating parameters such as speed, flow control;



- An AN device advertises its abilities and detects the abilities of its Link Partner (remote device);
- AN information is exchanged using link pulses and acknowledged;
- AN compares the two sets of abilities and uses a priority resolution algorithm to establish the best mode of operation;
- The highest performance common technology is attached to the media;
- AN becomes transparent until reinvoked due to reset, power-on, link failure, etc.;
- Allows for automatic link establishment without user intervention.

Serial Auto-Negotiation

- Serial Receivers generally include two receive circuits
  - Data Acquisition logic
  - Signal Detect
- Data Acquisition logic limitations
  - Frequency response limitations
    - Prevents direct communication between 1X and 2-10X or greater variants
- Signal Detect logic may be used as a “Morse code”
  - Tones may be used between 1X and 2-10X or greater variants
- Existence Proof
  - P1394b startup protocol
- Use Toning as basis for Serial AN Signaling (optical & CX)

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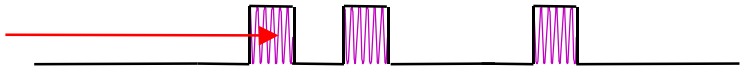
Serial AN Issues

- Signal Detect
  - Required to support Auto-Negotiation
- Tone Frequency



  - Should support 1X and 2-10X or more speed variants
  - Propose 531.25 MHz square wave
    - b'1010101010/0101010101' 8B/10B D21.5 code @ 1X speed
    - b'1100110011/0011001100' 8B/10B D24.3 code @ 2X speed
    - b'1100000111/0011111000' 8B/10B K28.7 code @ ≥4X speed
  - Significantly faster than 1394b tone rate (48MHz - 64MHz)
  - Probably invisible to interfaces less than 1 GbE
    - Propose that lower speed FC variants are not interoperable
    - If AN is supported by only one link end, and AN fails, it is assumed that the link partner is a 1X device

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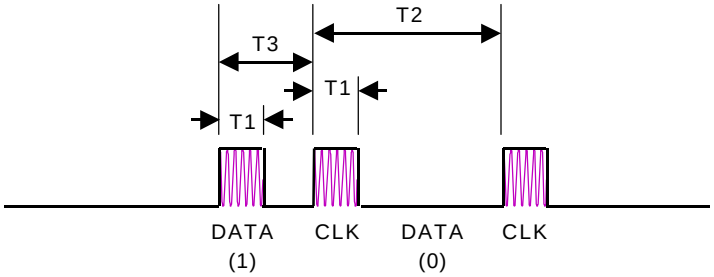
Tone Pulse Timing



- Tone Pulses correspond to Ethernet Fast Link Pulses (FLP)
- Proposed Pulse Timing basis is Signal Detect response
  - Specs may be derived from GBIC, GbE, P1394b
  - Transmit Disable pulsing is too slow, extends AN time
- Proposed Pulse and Pulse-to-Pulse timings
  - T1 - Pulse Duration: 50 µs
  - T2 - Clock-to-Clock / Data-to-Data Duration: 200 µs
  - T3 - Clock-to-Data / Data-to-Clock Duration: 100 µs

Tone Pulse/Burst Protocol

- Proposed Protocol basis is Ethernet AN
  - Ethernet AN provides multi-technology support, management interface, speed negotiation, similar speed ranges, common PHY components, proven state machines, vendor extensions
  - Tone Pulses are arranged 17-33 Pulses to a Burst
  - Tone Bursts are transmitted repeatedly until ACK'd by Link Partner
  - Tone Burst Protocol includes Base Page and Optional Next Page Exchange
  - Priority Resolution algorithm establishes best mode of operation
  - The highest performance common technology is enabled

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