S800Base-T Auto-Negotiation

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S800BASE-T Auto-Negotiation
Previous Discussion on Possible Approaches

- **Bits in 802.3 Base Page**
  - Only 1 bit left - **Future Flexibility Limited**
- **1394 Selector Field**
  - Harder to do 1394 to Ethernet interoperability
    - Existing auto-negotiating devices will ignore these pages
    - **Potential for Interoperability problems with installed base**
- **Add to Gigabit Ethernet Next Page (MC=8)**
  - 6 bits leftover in 1st Unformatted Page
  - **Defining bits in a page established for 1000BASE-T may meet resistance in 802.3 community**
- **Generic Next Page mechanism (MC=9)**
  - Same way Gigabit Ethernet was done
  - **Preferred approach for proposal**

S800BASE-T Auto-Negotiation Technical Proposal

- **Use the Next Page Mechanism in Auto-Negotiation**
  - Message Code = 9
  - Unformatted Pages
    - Re-use info from pages from MC8 for MASTER-SLAVE resolution
    - 1 additional Unformatted Page for future flexibility

- **This gives us an approach that is separate from existing Auto-Negotiation standardization of other technologies**
  - Achieve interoperability
  - Probably easier to work through IEEE committee

Auto-Negotiation Pages

- **BASE PAGE**
  - Signals 10/100 Ethernet capabilities (if any)
  - Set bits to zero if no Ethernet
- **Message Code 8 page**
  - Signifies 1000BASE-T capability
  - Followed by 2 Unformatted Next Pages
    - Set 1000BASE-T half duplex bit and full duplex bit to zero, if only S800BASE-T is used
    - Otherwise, use bits as normal for 1000BASE-T
    - MASTER-SLAVE bits unchanged
- **Message Code 9 page**
  - Signifies 1394 capability
  - Use MASTER-SLAVE bits from previous Unformatted Page for link start-up
  - Followed by 1 Unformatted Next Page
    - 1 bit signifies S800BASE-T capability
    - 9 bits reserved for future 1394 capabilities

Base Page: Detail

- **NO CHANGE**
- **D15 = 1 to indicate that Next Pages Follow**
- **D14:D1 = As specified in 28.2.1.2**
  - These bits cover 10BASE-T and 100BASE-TX capabilities and provide the mechanisms needed for base page exchange

D0	D1	D2	D3	D4	D5	D6	D7	D8	D9	D10	D11	D12	D13	D14	D15
D0	S1	S2	S3	S4	A0	A1	A2	A3	A4	A5	A6	A7	RF	Ack	NP
Selector Field					Technology Ability Field										

Next Page 0 – Message Code 8

- **M10:M0 = 8**
  - **Means 1000Base-T**
  - **Specifies how many next pages in this sequence**
    - **1xMC + 2xUP**

D0	D1	D2	D3	D4	D5	D6	D7	D8	D9	D10	D11	D12	D13	D14	D15
0	0	0	1	0	0	0	0	0	0	0	T	Ack2	MP	Ack	NP

Next Page 1 – First Unformatted Page

- **U10:U4 = Reserved for future use – Transmit as 0**
- **U5 = S1000Base-T Capable**
- **U4 = 1000Base-T Half Duplex : Set to "0" if S800 only**
- **U3 = 1000Base-T Full Duplex : Set to "0" if S800 only**
- **U2 = 1000Base-T Port Type**
  - 1=multi-port, 0=single-port device
- **U1 = 1000Base-T Master-Slave Manual Configuration value**
  - 1=Master, 2=Slave
- **U0 = 1000Base-T Master-Slave Manual Configuration enable**
  - 1=Manual Configuration Enable

Next Page 2 – Second Unformatted Page – Seed Value

- Same as 1000BASE-T Unformatted Page
- MASTER-SLAVE Seed Values for link start-up
- Values for 1000BASE-T will be re-used for S800BASE-T, if applicable

Next Page 3 – Message Code 9

- **NEW MESSAGE CODE**
- **M10:M0 = 9**
  - **Signifies 1394 Technology**

D0	D1	D2	D3	D4	D5	D6	D7	D8	D9	D10	D11	D12	D13	D14	D15
1	0	0	1	0	0	0	0	0	0	0	T	Ack2	MP	Ack	NP

Next Page 4 – Unformatted Next Page

- Bit D0 =1 signifies S800BASE-T capability
- Bits D1:10 are reserved for future 1394 technologies
  - E.g. S100 or S1600

D0	D1	D2	D3	D4	D5	D6	D7	D8	D9	D10	D11	D12	D13	D14	D15
1	0	0	0	0	0	0	0	0	0	0	T	Ack2	MP	Ack	NP

Priority Resolution Table 28B.3

- **Insert 1394 S800 at top of table due to Isochronous capabilities at nearly the same speed**

- **New Table**
  - S800Base-T
  - 1000Base-T full duplex
  - 1000Base-T half duplex
  - 100Base-T2 full duplex
  - 100Base-TX full duplex
  - 100Base-T2 half duplex
  - 100Base-T4 half duplex
  - 100Base-TX half duplex
  - 10Base-T full duplex
  - 10Base-T half duplex

Base and Next Pages bit assignments

Bit	Bit Definition	Usage
BASE PAGE		
D15	1	Indicates that Next Pages Follow
D14:D1	As specified in 802.3 Clause 28.2.1.2	Advertises 10/100 802.3 capabilities
PAGE 0 (Message Next Page)		
M10:M0	8	Advertises 1000BASE-T capabilities
PAGE 1 (Unformatted Next Page)		
U10:U5	Reserved, transmit as 0	
U4*	1000BASE-T half duplex	1 = half duplex and 0 = no half duplex*
U3*	1000BASE-T full duplex	1 = full duplex and 0 = no full duplex*
U2	1000BASE-T port type bit	1 = multi-port device, 0 = single-port device
U1	1000BASE-T or S800BASE-T MASTER-SLAVE Manual Configuration value	1 = MASTER and 0 = SLAVE
U0	1000BASE-T or S800BASE-T MASTER-SLAVE Manual Configuration enable	1 = Manual Configuration Enable
PAGE 2 (Unformatted Next Page)		
U10	1000BASE-T or S800BASE-T MASTER-SLAVE Seed Bit 10 (SB10) (MSB)	MASTER-SLAVE Seed Value (10:0)
U9	1000BASE-T or S800BASE-T MASTER-SLAVE Seed Bit 9 (SB9)	
U8	1000BASE-T or S800BASE-T MASTER-SLAVE Seed Bit 8 (SB8)	
U7	1000BASE-T or S800BASE-T MASTER-SLAVE Seed Bit 7 (SB7)	
U6	1000BASE-T or S800BASE-T MASTER-SLAVE Seed Bit 6 (SB6)	
U5	1000BASE-T or S800BASE-T MASTER-SLAVE Seed Bit 5 (SB5)	
U4	1000BASE-T or S800BASE-T MASTER-SLAVE Seed Bit 4 (SB4)	
U3	1000BASE-T or S800BASE-T MASTER-SLAVE Seed Bit 3 (SB3)	
U2	1000BASE-T or S800BASE-T MASTER-SLAVE Seed Bit 2 (SB2)	
U1	1000BASE-T or S800BASE-T MASTER-SLAVE Seed Bit 1 (SB1)	
U0	1000BASE-T or S800BASE-T MASTER-SLAVE Seed Bit 0 (SB0)	
PAGE 3 (Message Next Page)		
M10:M0	9	Advertises 1394 capabilities
PAGE 4 (Unformatted Next Page)		
U10:1	0	Reserved for future 1394 use
U0	1	Advertises S800BASE-T capabilities

Interoperability

- Proposed method was tested against existing 1000BASE-T PHYs
- Confirmed that Message Code 9 is properly ignored by a 10/100/1000BASE-T PHY
- Confirmed that if the 1000BASE-T half duplex and full duplex bits are set to zero in the 1st Unformatted Page, the device falls back to 10/100.
  - 1000BASE-T mode is properly Disabled
- Devices tested from the 2 highest volume 1000BASE-T PHY vendors
  - Represent >90% of the installed base of 1000BASE-T PHYs

Summary

- Implementing Auto-Negotiation for S800Base-T will allow easy interoperability with 1000Base-T and slower Ethernet devices
- There are no technical hurdles to implementing Auto-Negotiation for S800Base-T
- Requires that 802.3 assign Message Code 9 to 1394 Technology
  - No identified reason for objection
- Draft document has been created for review
  - All Auto-Negotiation bits are defined for 10/100/1000BASE-T and S800BASE-T
    - No changes required for any legacy 10/100/1000 device
  - Future flexibility via reserved code word space