Observations and Thoughts On Rate Switching

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KEYEYE

What Auto-Negotiation Gives Us

- The Auto-Negotiation Function Exchanges Abilities And Has A Prioritization Scheme To Select The HCD
- If A Link Fails You Must Restart The Auto-Negotiation Process
- If The Link Didn't Fail,
  - Link Partner Abilities Haven't Changed
  - Link Integrity Hasn't Changed

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In Theory …

- Auto-Negotiation Isn't Required To Change Speeds
- What Is Needed Is A "Soft Restart" Mechanism In The State Diagram
  - Scope And Nature Depends On What The Objectives Are
    - Toggle Between Top Two Speeds, Or
    - Selection Of Any Common Speed

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PHY Challenges In Rate Switching

- **In Theory**, High Speed Links Provide Sufficient Information To Support Lower Speeds Assuming:
  - AFE Filter Bandwidths Do Not Change
  - AFE Characteristics Are Well Matched
  - Channel Characterization Is Done In Parallel
- Channel Data From A Low Speed Link Is Insufficient To Support A Higher Speed
  - But … Is It Sufficient To Bootstrap To A Higher Speed?

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… But Millisecond Rate Switching …

- To Change Speed In Milliseconds Requires Some Level Of Channel Characterization Data Appropriate For The New Rate
  - Since This Data Ages Periodic Updates Or Retraining Is Required
- Partial Retraining Required At A Minimum For Any Speed Switch

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Retraining Must Also Be Fast

- Millisecond Switching Dictates Abbreviated Training Compared To Initial Link Startup
  - Switching To A Higher Speed May Not Be Feasible With These Constraints
  - Current Timer Values May Not Permit Abbreviated Startup

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Considerations For 10GBASE-T PHYs

- A/D Is A Major Power Consumer
  - To Shift From 1G To 10G Requires Higher A/D Sampling Rate
  - Maintaining Enough High Bandwidth Channel Data To Facilitate Abbreviated Startup W/O Burning Excessive Power Is “Challenging”
  - Rate Switching To 1G Will Require Amendments To 802.3an

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The Bottom Line

- Millisecond Rate Switching Isn't A Control Problem, It's A Signal Processing Problem
  - Changes To Only Auto-Negotiation Alone Won't Produce Millisecond Rate Switching
  - Provisions For Maintaining Accurate Channel Characterization Data For Supported Speeds Is Needed

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