SDSL and other Modulation Strategies

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Reviewed Modulation Standards that could be applied to Ethernet

- Studied all opportunities for modulation over the WAN
  - Discovered the differences utilizing VDSL.qam, VDSL.dmt
    - Reviewed 997, 998 and Swedish band plan
    - Studied Asymmetric and Symmetric operation
  - Explored the use of a symmetric modulation for long haul
    - shdsl
    - Symmetric DSL using dmt

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Two Classes of Rates

- Short Haul
  - Up to 6K feet, 1800 meters
  - Justified by reasonable performance available from VDSL upstream and downstream band assignments
- Long Haul
  - Up to 10K feet, 3000 meters
  - Justified by reasonable performance available from the first available first upstream and downstream bands

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Two classes of Symmetry

- Asymmetric
  - As Phys are Currently Defined for ADSL and VDSL by the ITU-T and T1E1
- Symmetric
  - Ethernet is inherently and traditionally a symmetric protocol
  - It is possible to make a symmetric bandplan within the confines of a asymmetric bandplan

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Two classes of Carriers

- Single Carrier
  - Lower power
  - Lower cost
- Multiple Carrier
  - More robust against impairments
  - Very Flexible in implementation
  - Better rate / reach under impairments

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Where are we now?

- We have no new symmetric proposals (baseline)
- We can't even address long haul (multiple pair bonding was shot down in Austin)
- IEEE can only adopt other standards previously approved by T1E1 because of problems in the T1E1 spectral management recommendation

	Short Haul	Long Haul
Symmetric	?	?
Asymmetric	VDSL	?

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What about Long Haul?

- Measured performance of shdsl to 6 Mbit aggregate or 2.8 Mbit symmetric
- Measured performance of Symmetric DSL to 9 Mbit aggregate or 4.6 Mbit symmetric
  - Using same power as shdsl
  - Impairments on ADSL to be same as shdsl
- Either single or multi-carrier provide *much* better performance compared with shdsl while disturbing ADSL the same as shdsl

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Spectral Compatibility Issues

- But SDSL with the same power as shdsl cannot be made to pass the T1E1 tests under any conditions
- In fact shdsl will not the same pass tests
- But shdsl has been approved as a basis
- Is there a problem with the T1E1 Spectral Compatibility recommendation?

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Symmetric DSL Bandplan

- A SDSL band-plan would use some of the downstream ADSL band for upstream.
- A symmetric DSL can be proposed
- Does not pass T1E1 tests when it should
- Identified several inconsistencies in the Spectral Compatibility Recommendation

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Is this a catch-22?

- The quality of the T1E1 recommendation is at issue
- We have no tools within IEEE 802 to evaluate or fix the Spectral Compatibility recommendation
- Which one do we drop?
  - Spectral Compatibility compliance as a goal
  - IEEE work on wire-line Phys for the WAN

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What can we do in IEEE?

- We are trying to select one Phy for:
  - Short Haul
    - Is it single or multiple carrier?
  - Long Haul
    - Is it shdsl for 2.5 Mbit or QAM or dmt for 5 Mbit
  - With Spectral Compatibility (with what)
    - Which Plan? Swedish, 997, 998, a new proposals within T1E1 for long haul symmetric?

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IEEE allows only one Phy per Market – Does this mean 802.3ah can only select one Phy?

- What is a distinct Market?
  - Several possible markets for short haul
    - CO fed or Optical Networking Unit?
    - Regulated cable plant or no regulation?
    - Symmetric or Asymmetric?
  - Markets for long haul
    - CO fed or Optical Networking Unit?
    - Symmetric or Asymmetric?
    - Multiple Bonded pairs or single pair

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IEEE's choice

- Either do it all
  - Take on all WAN work and ignore other problematic recommendations
  - Define all the possible markets and provide a Phy for that market
  - Ignore all other outside recommendations
- Or do nothing
  - Allow T1E1 to clean up their mess
  - Define only the Ethernet WAN interface

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Problems IEEE 802.3ah can't fix

- shdsl will not pass the required new modulations tests – but - shdsl is approved as compatible
- New work being proposed in T1E1 to discover a new compatible symmetric modulation strategy.
- Let T1E1 fix the problems they created with the spectral compatibility reccomendation

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We should focus the work

- IEEE is very skilled at defining the LAN
- We have common MAC / Phy interfaces
- We can improve the interfaces
- IEEE should focus work on defining symmetric and asymmetric interfaces to the MAC and define IEEE maintenance interfaces

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IEEE 802.3ah needs to choose

- Ignore other troublesome standards
  - Craft a new modulation method using one Phy to provide a solution bonding multiple pairs at long haul and providing maximum rate for short haul
- Pass the WAN Phy Problem to T1E1 and ITU-T
  - Specify an MII as the interface to the ITU-T gamma interface
  - Provide Phy control and maintenance functions using traditional IEEE Phy functions through the MAC

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