# SHDSL Baseline Proposal

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# Goals

802.3ah D1.0 has two proposed long-reach copper Ethernet PHYs

- SHDSL (2BASE-TL)
- ADSL – Annex J (2PASS-TL)

We need to make a decision – sooner not later

- Extra (wasted) work
- Lack of focus, lack of direction
- Market confusion
- Won't happen in Hawaii – next chance 2003

*There are many benefits to making a decision!*

# What is needed in long-reach PHY?

1. **Must** satisfy long reach objective
   - 2 Mbps @ 2700m
2. **Must** be spectrally acceptable to carriers in all countries
   - IEEE 802.3 is an international standard
   - If it can't be deployed in North America, how can we accept it?
3. **Must** support repeaters
   - 2700m is nice but is not 100% coverage
   - Need repeaters to get BW when limited pairs
4. **Should** degrade gracefully to longer distances while maintaining symmetry
   - 3000m, 3500m, 4000m, 5000m,...
5. **Should** be independent of VDSL PHY selection
   - No decision yet *anywhere* on DMT vs QAM

# Spectral Compatibility

- How to compare the SC of SHDSL and Annex J using T1.417?
  - Many PSDs to choose for each technology
  - Many basis systems (i.e., victim systems) to choose
  - Upstream versus downstream
  - Different choices can yield opposite results
- Deployment Guideline (DG)
  - The minimum loop length beyond which a PSD is no longer spectrally compatible with all basis systems
  - A worst-case metric for spectral compatibility
- If two PSDs have the same DG, they are considered to have the same spectral friendliness
- Myths
  - *Annex J is more spectrally friendly than SHDSL*: **WRONG**
  - *Annex J does not dump NEXT into access networks*: **WRONG**

# Deployment Guidelines of Annex J and SHDSL

| Annex J PSD | Deployment Guideline (kft) | SHDSL PSD (kbps) |
|---|---|---|
| ADLU-36 | 11.1 | 1216 |
| ADLU-40 | 10.5 | 1424 |
| ADLU-44 | 9.9 | 1616 |
| ADLU-48 | 9.7 | 1704 |
| ADLU-52 | 9.5 | 1792 |
| ADLU-56 | 9.2 | 1928 |
| ADLU-60 | 8.9 | 2024 |
| ADLU-64 | 8.8 | 2096 |

# Why SHDSL?

We can sit and argue rate/reach curves all day

- Already have many times
- Spinning our wheels isn't the way to go
- Do we really think any decision will be made in Kauai?

Inventing new bandplans is not the way to go

- Need something that's compliant with all basis systems
- Need compliance in all countries
- Carriers aren't up for experimenting

Already have asymmetry covered

- VDSL can cover longer reach asymmetric applications

SHDSL works for the long reach PHY, and works today

- SHDSL satisfies all of the requirements
- SHDSL satisfies all of the additional features

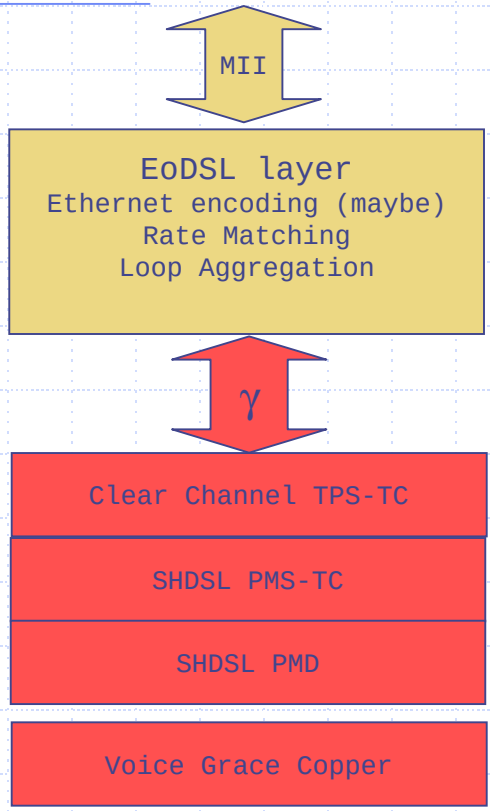
# Baseline Reference Model

## Interfaces and Architecture

# Principles and Strategy

- Require little or no changes to existing standards
  - IEEE
  - ITU
  - ANSI
- Try to keep changes below MAC and above gamma interface
- Specify interfaces and new functionality only (reference rather than duplicate)

# Interfaces and Architecture




ITU View

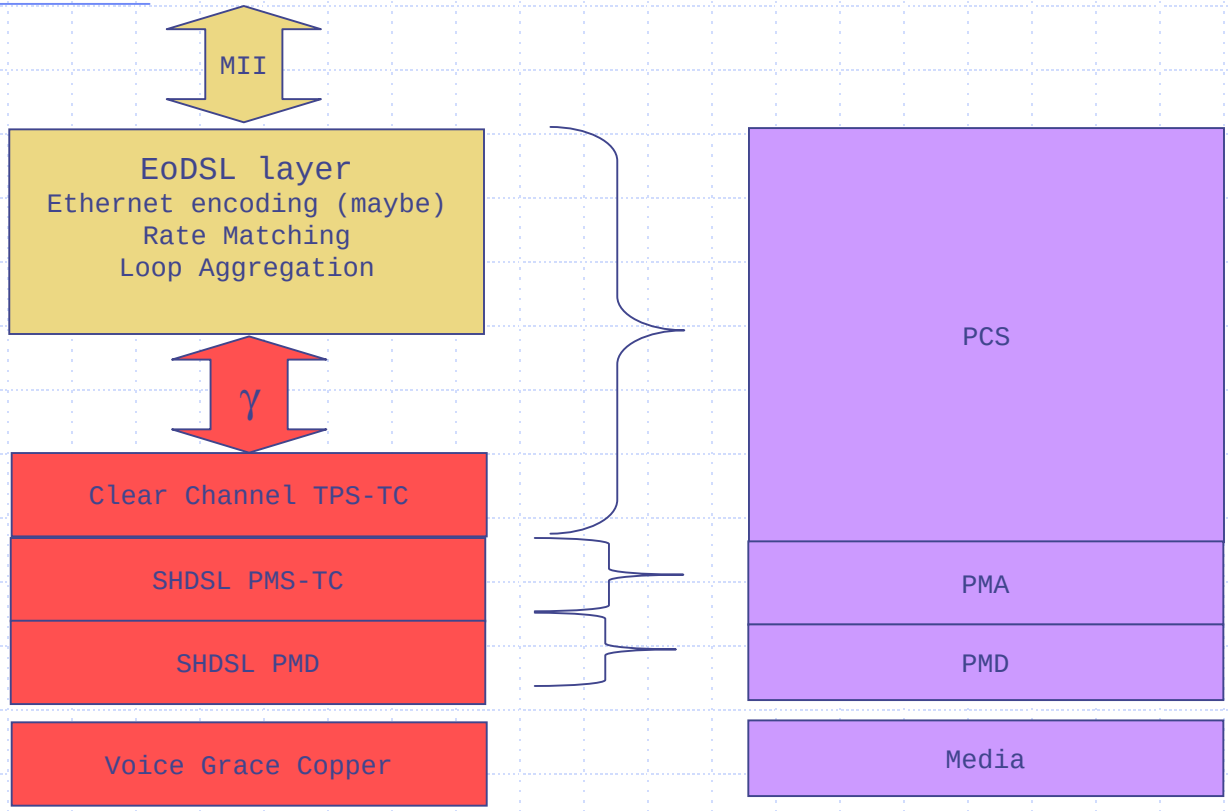
Functional View

- Ethernet Framing
- Encoder/Decoder
- Rate Adaptation
- Loop Aggregation

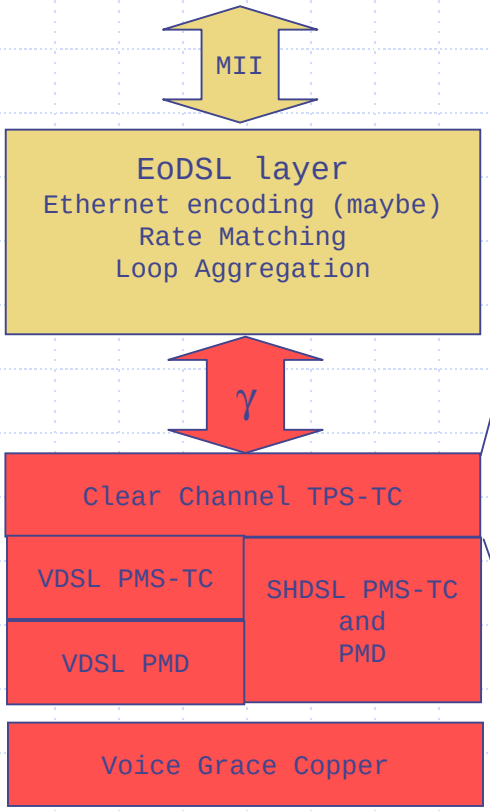
- SHDSL Framing
- Synchronization
- Scrambler/Descrambler

- Symbol generation/recovery
- Symbol timing
- Modulation/demodulation
- Echo cancellation
- Line equalization
- Link startup

# Interfaces and Architecture



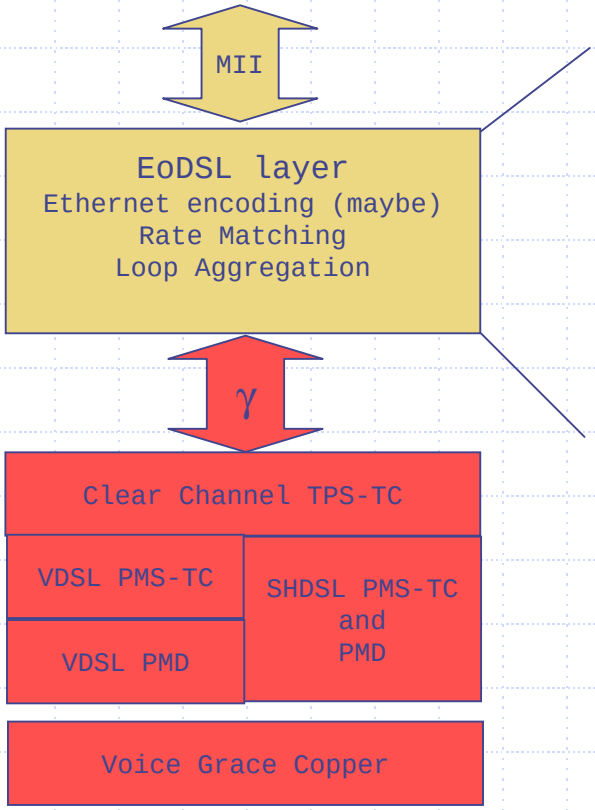
# Interfaces and Architecture




Items in RED defined in ITU/ANSI standards
- VDSL (G.993.1) has defined PMS-TC and PMD
- SHDSL (G.991.2) has defined PMS-TC and PMD
- VDSL defines PTM-TC for packet transfer mode
    - Packet interface
    - HDLC byte stuffing
    - HDLC framing
    - HDLC CRC
- Clear channel TPS-TC defined in G.991.2
    - Very simple bit-transfer interface
    - **Not** defined in G.993.1 (VDSL)
    - Provides maximal flexibility to EoDSL layer (bit-pump)
- Decision on HDLC vs 64/66 is independent of TPS-TC
- Decision on loop aggregation is independent of TPS-TC
- Issues: Where does framing and encoding happen? How is it done?

*Need a consistent interface (clear channel vs PTM-TC) for all PHYs.*

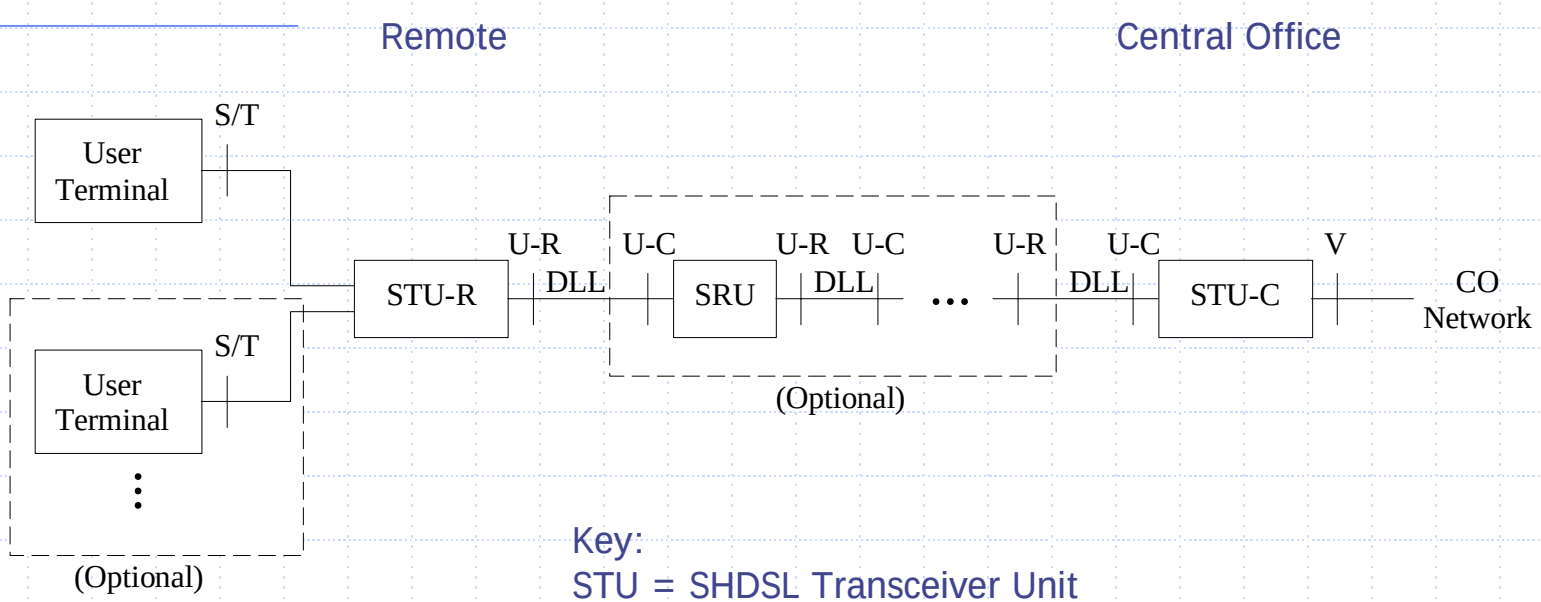
# Interfaces and Architecture




- Loop Aggregation.
  - Covered in fosmark_1_0302.pdf
- Rate Matching.
  - Covered in marris_1_0302.pdf
- Framing and Encoding.
  - Covered in many other proposals. Using clear channel TPS-TC does not restrict us to HDLC framing and byte stuffing.

All functions happen above bit pump interface to clear channel TPS-TC

# Reference Model




Key:
STU = SHDSL Transceiver Unit
SRU = SHDSL Regenerator Unit
STU-C = STU Central Office
STU-R = STU Remote
U = Loop Interface
U-C = U Central Office
U-R = U Remote
DLL = Digital Local Line
(Blatantly stolen from G.991.2)

# Things to finish...

- Management (MIB, profiles)
  - Requires mapping to SHDSL PMD MIB
  - Profile use same as VDSL
  - EOC parallel for VDSL/SHDSL
- Management interface
  - Need details – need consistency across all EFM PHYs
- Must not operate in 4-wire mode
  - Use 802.3ah loop aggregation instead
- Hooks into G.994.1 for Ethernet handshaking
  - Scott's protocol addressing this
- Link carrier detect after successful completion of xDSL link initialization(?)