VDSL and Enhanced G.shdsl as PHYs for EFM-Copper

Presentation for the IEEE 802.3ah Meeting

St. Louis, MO

March 12-14, 2002

Supporters

Tuvia Barlev,	Actelis
Charles Cook,	Qwest
Bob Jenness,	Siemens
Marc Kimpe,	Adtran
Sabit Say,	Next Level Communications
Massimo Sorbara,	GlobespanVirata
Matt Squire,	Hatteras Networks
Dong Wei,	SBC

Introduction

- EFM-copper should address the need for both business and residential markets
- Consequently, it should support both symmetric and asymmetric services
- We propose both VDSL and enhanced G.shdsl as the PHYs for EFM-copper

EFM-Cu for Residential Customers

- Should be optimized for asymmetric data-rate transmissions
- Should be optimized for broadcast video with support for voice and data
- Must be compliant with the current issue of T1.417 and Band Plan 998

How About VDSL?

- Band Plan 998 is designed in favor of asymmetric services
- Able to achieve good rate/reach performance for asymmetric services
- Good candidate for the PHY supporting asymmetric services

EFM-Cu for Business Customers

- Should be optimized for symmetric data-rate transmissions
- Should be optimized for data-only transmissions
- Must be compliant with the current issue of T1.417

How About G.shdsl?

- The leading DSL technology primarily designed for symmetric services on medium and long loops
- It utilizes bandwidth for symmetric transmission in a highly efficient way compared with other DSL technologies
- Using multi-pair operation, it can achieve high data rates at longer distances

Two Limitations of G.shdsl

- Optimized for maximum reach: the maximum payload data rate on a single pair is 2.304 Mbps
- Supports aggregate operation over at most two pairs

Improving G.shdsl (I)

- Target symmetric payload data rates per pair
  - maximum rate: 10 Mbps at 750 m
  - minimum rate: 2.5 Mbps at CSA range
  - scalable to other rates in between
- At least 10 Mbps on multiple pairs (meeting the EFM objectives)

Improving G.shdsl (II)

- Key requirement: fully compliant with the current issue of T1.417
  - spectrally compatible with all basis systems (including VDSL)
  - maintain the deployment guidelines (i.e., PSD vs. reach) for G.shdsl

Improving G.shdsl (III)

- To increase the rate/reach capabilities of G.shdsl, we propose to study modifications such as
  - using larger constellations on short loops
  - supporting loop aggregation for operation on more than two pairs
  - others

Higher Order Modulation

- G.shdsl uses 16-TCPAM (i.e., 4 bits per symbol: 3 for payload and 1 for coding) on all loops
- We propose to use
  - 16-TCPAM on long loops
  - 32, 64, or 128-TCPAM (4, 5, or 6 payload bits) on shorter loops

Bonding More Than Two Pairs

- Operate over up to eight pairs (similar to the work in ETSI TM6 on bonding SDSL)
- Auto-detectable
- Configurable via G.994.1
- May support bonding pairs of different data rates

Ongoing Standardization Activities

- T1E1.4
  - a new work item on improving G.shdsl
  - 10MDSL
- ITU-T Q4/15
  - G.shdsl.bis
  - G.bond

Proposal Summary (I)

- Adopt VDSL as the PHY for asymmetric services
- Adopt the enhanced G.shdsl being developed at T1E1.4 and ITU as the PHY for symmetric services so that there will be a single standard for enhanced G.shdsl

Proposal Summary (II)

- Provide input to T1E1.4 and ITU to assure that the PHY specifications meet EFM needs
- As proposed by M. Beck *et al*. (see beck_1_0102.pdf), develop a generic "Ethernet-over-xDSL Adaptation Layer" that fits on the Gamma-interface and rides on the top of either PHY