xDSL PHY Baseline Proposal

Proposal: 802.3ah shall develop a specification which defines EFM operation using standardized xDSL PHYs.

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Introduction

Examine Project Authorization Request (PAR) criteria

- In July 01, this committee submitted a PAR document to 802.3 in order to set-up the task force.
- 5 criteria: Broad Market Potential, Compatibility, Distinct Identity, Technical Feasibility, Economic Feasibility.
- Take a look at the reasons we gave back then and highlight the sections relevant to the copper track.
- Examine whether EFM over xDSL satisfies PAR.

Introduction (cont.)

Examine Project Authorization Request (PAR) criteria

- Important distinction: EFM over xDSL does not preclude EFM from specifying a single default PHY that is a xDSL, a modified xDSL or something completely different, as long as it meets the PAR criteria.
- Let's look successively at each of the 5 PAR criteria
  - slides with solid red line => what we wrote
  - slides with dashed green line => whether xDSL fits in

PAR 1: Broad Market Potential

a) Broad sets of applicability

b) Multiple vendors and numerous users

c) Balanced costs (LAN versus attached stations)

PAR 2: Compatibility

a) Conformance with 802 overview and architecture

b) Conformance with 802.1D, 802.1Q, 802.1f

c) Compatible managed object definitions

PAR 1: Broad Market Potential

PAR 2: Compatibility

- xDSL is a PHY layer solution.
- Compliance to PAR 1 & 2 is independent of PHY layer solution unless we do something really stupid.

PAR 3: Distinct Identity

a) Substantially different from other IEEE 802 standards.

b) One unique solution per problem (no two solutions to a problem).

c) Easy for the document reader to select the relevant specification.

There is no existing 802 standard or approved project appropriate for wire line access using the Ethernet access protocol and frame format, with the exception of certain combinations of operating speed and media defined in various supplements to IEEE Std 802.3. This project will expand that set to include new media.

While the proposed project includes a choice of physical media and operating speeds, it will specify only one solution for each media at a given operating speed range.

The proposed project will be formatted as a supplement to IEEE Std 802.3, making it easy for the document reader to select the EFM specification.

PAR 3: Distinct Identity

- Traditionally, Ethernet operated over a controlled medium (noise /loop /service).
- The First Mile is a constrained environment.
- Cannot shorten/modify a loop.
- Little control over the loop make-up or noise or impairment (Bridged Taps, bad splices, impulse noise, RFI, cable type, electrostatic discharges).
- Limited number of loops in the plant and to a customer.
- Residential customers want phone service as well.
- **A medium is not necessarily defined by a certain length or type of cable, it is defined by the type of service.**

PAR 3: Distinct Identity (cont.)

A medium is not necessarily defined by a certain length or type of cable, it is defined by the type of service. Why so ?

- Major Issue 1: Cannot optimize in the same binder for symmetric AND asymmetric services.
- Major Issue 2: Cannot indiscriminately use repeaters and/or remote deployment to increase reach because of interference and spectrum management.
- Major Issue 3: Capacity of the loop plant drops off dramatically as the loop length is increased.
- Major Issue 4: Cannot assume control of the binder because of unbundling and the presence of multiple service providers.
- Major Issue 5: Because xDSL is a point to point service, cannot accept diminishing performance as service gets popular.

PAR 3: Distinct Identity (cont.)

- Three unique solutions/media have been identified in xDSL:
- Solution 1: residential customers/ long loops (>= 6kft AWG26)
  - want phone on same loop
  - download a lot => DN_{UP} => ADSL
- Solution 2: business customers/ long loops (>= 6kft AWG26)
  - want multiple phone line aggregation over loop
  - upload as well => $DN\ UP$ => SHDSL
- Solution 3: short loops (<= 3kft AWG26)
  - leverages shorter distances for significantly higher bandwidth
  - download and upload determined by the selected spectral plan => VDSL

PAR 3: Distinct Identity (cont.)

Can we mix and match those unique solutions/media ?

- Let's use ADSL/SHDSL to deliver VDSL
  - does not have bandwidth
  - cannot substitute ADSL/SHDSL for VDSL
- Let's use VDSL to deliver ADSL/SHDSL solution.
  - VDSL extends up to 12MHz
  - Loops greater than 6kft have capacities up to about 1MHz
  - cannot substitute VDSL for ADSL/SHDSL
- Let's use ADSL to deliver SHDSL and vice versa
  - does not have UP/DN capacity respectively
  - also POTS/latency issues
  - cannot substitute ADSL and SHDSL

PAR 3: Distinct Identity (cont.)

Will 3 unique solutions/media confuse the market ?

- Let's look at what is already available in stores.
- The market can make the difference between a cable modem, an ISDN modem, a 56k modem, a fax, direct TV, firewire, wireless LAN, bluetooth, 802.11b, etc….
- The market can make the difference between a hub, a repeater, a router, a NIC.
- Bottom line: The service provider would select the appropriate solution depending on the medium.
- By the same argument, if EFM picks a different PHY than xDSL, even more confusion.

PAR 4: Technical Feasibility

a) Demonstrated system feasibility

b) Proven technology, reasonable testing.

c) Confidence in reliability

Ethernet systems (comprising interface controllers, bridges, routers, management systems, and other devices) represent the most widely deployed networking technology in history. The proposed project will build on the vast array of Ethernet component and system design experience, and the broad knowledge base of Ethernet network operation.

The proposed project will, to the extent possible, re-use specifications developed by other standards bodies and develop new specifications in accordance with the rigorous standards of proof applied to 802.3 projects.

The reliability of Ethernet components and systems can be extrapolated in the target environments with a high degree of confidence.

PAR 4: Technical Feasibility

- G.992.1 => ADSL
- G.991.2 => SHDSL
- G.993.1 => VDSL
- G.994.1 => G.hs to tie everything up.
- All of them are already taken into account in spectrum management for North America (T1.417 issue 1 and draft issue 2).
- ADSL and SHDSL each have chipsets from various vendors that are interoperable.
- Reach/Rate curves for each xDSL under a variety of noise conditions are well documented and tested.
- Large scale deployment issues are well understood for ADSL and SHDSL.
- VDSL is also being deployed successfully.

PAR 5: Economic Feasibility

a) Known cost factors, reliable data

b) Reasonable cost for performance

c) Consideration of installation costs

The cost factors for Ethernet components and systems are well known. The proposed project may introduce new cost factors which can be quantified.

Ethernet consistently demonstrates the most attractive cost/performance ratio of any networking technology, at any operating speed. This fact is well established in the enterprise networking application space, and the goal of this project is to extend the same cost/performance advantage to the access application space.

Installation costs, as well as maintenance and operations costs, should be reduced when compared to competing technologies through a combination of higher manufacturing volume, broader competition, a broader labor pool, simpler configurations and a more optimal system architecture.

PAR 5: Economic Feasibility

- Market has shown that “gateway” rather than “LAN” model is preferred for broadband packet access in the first mile.
- xDSL equipment are already at that location.
- xDSL chipset and equipment costs are already on the cost ramping down curve.
- Installation costs will be the same regardless of PHY, there is no magic solution. xDSL has already been “out there”.

PAR 5: Economic Feasibility (cont.)

- Number of CO & CPE ports shipped/projected worldwide (in thousands)

	1997	1999	2001	2003	2005
ADSL	113.5	4475.9	25544.2	35533.0	39649.5
SDSL/SHDSL /HDSL(2)	444.0	2142.4	3081.9	4349.7	6203.2
VDSL	-	-	133.5	584.6	1236.7

Gartner Group. 2001. Does not include IDSL and ISDN

- Lots of xDSL out there and forecasted to be out there
- Demand for all three xDSL flavors
- Building EFM as low cost Ethernet higher layer on top of low cost xDSL PHYs provides maximum volume AND lowest cost solution.

EFM Proposed Motion

"Recognizing that much work has been conducted in standardized xDSL and that there is a big difference between traditional Ethernet where the medium (defined as the service/loop length/noise ensemble) can be controlled and the xDSL environment, where the medium cannot be controlled, **802.3ah shall develop a specification which defines EFM operation using standardized xDSL PHYs.** Currently standardized xDSL PHYs are designed to cover the following media: asymmetric rates/long loop -- ADSL, symmetric rates/ long loop -- SHDSL, short loops -- VDSL. Out-of-band POTS/ISDN support can be achieved with ADSL or VDSL".