
STANDARD PROJECT: Asymmetric Digital Subscriber Line (ADSL)

TITLE: Warm Re-Start for ADSL

SOURCE: Deutsche Telekom AG

Dr. Werner Henkel
Technologiezentrum
P.O. Box 10 00 03
D-64276 Darmstadt
Germany

E-mail: henkelw@tzd.telekom.de
Phone: +49 6151 83 5006
Fax: +49 6151 83 3035

Amati Communications Corporation

Peter S. Chow
2043 Samaritan Drive
San Jose, CA 95124

E-mail: peter@amati.com
Phone: (408) 879-2043
Fax: (408) 879-2906

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ABSTRACT

For wide acceptance of ADSL, the modem startup time is an important parameter. ANSI T1.413 issue 1 standard has an initialization procedure that will take approximately 7 seconds, which can be significantly reduced in a warm re-start situation. During a warm re-start, the modem will attempt to use previously calculated values of the equalizer coefficients, bit and power allocations, and other system parameters. This contribution outlines the reasons for a warm re-start procedure, suggests locations within initialization that can be shortened considerably in principle, and recommends to at least have this issue placed on the living list of the issue 3 standard, if it cannot be included in the issue 2 standard.

NOTICE

This contribution has been prepared to assist the Standards Committee T1 - Telecommunications. This document is offered to the committee as a basis for discussion and is not a binding proposal. The requirements are subject to change in form and numerical value after further study. The rights to add to, amend, or withdraw the statements contained herein are reserved.

1. Background

The current T1.413 issue 1 ADSL standard requires an initialization procedure that will have a minimum duration of approximately 28,000 DMT symbols (some with cyclic prefix and some without), which is equivalent to about 7 seconds. In the worst case, a standard compliant ADSL modem may take up to approximately 10 seconds for initialization. Compared to traditional voice band modem connect time, this is quite reasonable; however, it may not be acceptable in the cases of a sync loss or unrecoverable micro-interruptions. While these unrecoverable error events should not happen very often, it would be of great benefit to the operators deploying ADSL modems, if a warm re-start procedure is available that requires significantly shorter amount of training time. In fact, certain operators, such as DTAG, may not be able to deploy any ADSL modem without this feature.

2. Potential Savings During Initialization Using Warm Re-Start

Most of the initialization time is consumed by the transceiver training and the channel analysis phases; e.g., the various Reverb phases (512 to 4096 DMT symbols) and the Medley phase (16384 DMT frames). The ultimate goal of these phases of initialization is to come up with the correct echo canceller settings, equalizer coefficients, and the bit and gain allocations based on the measured SNRs. However, in principle, these training stages can be shortened significantly if we make the assumption that the channel has not changed significantly and that the error event is caused by temporary anomalies in the time domain. While we still need to acquire sample and frame synchronization, the time required for echo canceller training, time domain equalizer training, SNR calculations, and the bit and gain allocations can be much shorter than a full modem initialization, if we use the previously saved settings, either as a starting point for various adaptive training algorithms or as the actual settings. If the warm re-start procedure fails, then a fallback mode should be implemented, leading to the standard initialization procedure, where all the coefficients will be determined from scratch.

Another area of the current initialization process that can be enhanced is before the bit allocation has been calculated, information transfer is carried out at a rate of one bit per DMT symbol. This is quite inefficient, and a worthwhile alternative during warm re-start would be to allow for a worst case bit allocation, based on the stored SNR table, which should still be significantly more efficient than transferring 1 bit per DMT symbol.

3. Recommendation

Given the tight schedule, we understand that a full warm re-start specification may not be possible for inclusion in the issue 2 standard. However, if there is enough support, we would like to propose inclusion of warm re-start as an informative annex (with text to be provided in the next meeting). In the very least, we strongly recommend that warm re-start be placed on the living list for the issue 3 T1.413 ADSL standard.