**COMMITTEE T1 – TELECOMMUNICATIONS**
**Working Group T1E1.4 (DSL Access)** **T1E1.4/2001-188R4**
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## CONTRIBUTION

**TITLE:** **Proposed Scope and Mission for Dynamic Spectrum Management**

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**PROJECT:** **T1E1.4, Dynamic Spectrum Management**

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## ABSTRACT

This contribution represents a summary of agreements reached by a number of participants in Dynamic Spectrum Management (DSM) conference calls as to the mission, scope, and generally definition of the DSM project initiated by agreement in the May T1E1.4 meeting. Included are a proposed mission statement, scope, examples, and a proposed reference diagram for DSM. This contribution is intended to provide direction and definition to DSM drafting and is to be referred to from the DSM issues list, which is contribution T1E1.4/2001-017.

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**NOTICE**

This contribution has been prepared to assist Accredited Standards Committee T1–Telecommunications. This document is offered to the Committee as a basis for discussion and is not a binding proposal on Stanford University or any other company. The requirements are subject to change in form and numerical value after more study. Stanford, Telcordia Technologies, ATT Research, Voyan Technology and Actelis Networks specifically reserve the right to add to, amend, or withdraw the statements contained herein.

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# 1. Mission Statement

The mission statement drafted in teleconference calls is:
***Dynamic Spectrum Management (DSM) should enhance spectrum-management value by improving reliability and increasing data rates through measurement and/or dynamic management of DSL spectral compatibility***. ***Dynamic management incorporates parameters of the loop plant environment and loop transmission systems that are time- or situation-dependent, and which are not incorporated in the current issue of T1.417.***

# 2. Scope of DSM

Dynamic Spectrum Management (DSM) specifications should address methods and requisite accuracies for identification of crosstalk and line information. Such specifications should also address the format for transfer of said line and crosstalk information to DSL maintenance locations possibly separate from the DSL line, as well as format for optional specification and control of DSL line spectra where permitted by the DSL line modems and allowed by the associated service operator(s). DSM may also specify methods for coordination, or ***spectral balancing,*** of line spectra for a common global-binder benefit and possibly also specify methods for coordination of line signals, or ***DSL vectoring,*** also for a common global-binder benefit. The use of such DSM methods on some lines may affect the performance of other lines in the loop plant; thus, these effects are to be studied and taken into account in the DSM specifications.

Liaison to the following bodies, possibly involving consequent joint work, appears beneficial:

T1M1, specifically T1M1.5, in the area of "CORBA Based TMN Performance Management Service" and in particular the format of line and crosstalk information specified in ATIS Standard T1.231.

DSL Forum, specifically the Operations and Network Management Group, and its possible future interests and work.

IEEE 802.3 Ethernet First Mile work

ITU SG15/Q4 G.997.1 (G.ploam) future revisions.

***Examples of Expected Work Product:***

1. Specification of means to mitigate/eliminate RT-based ADSL crosstalk into CO-based ADSL
2. Specification of means to mitigate/eliminate the VDSL crosstalk into ADSL
3. Specification of means to mitigate/eliminate T1 or HDSL crosstalk into ADSL
4. Enable mutually collaborative and improved mixture of symmetric services (like SDSL, SHDSL, and Symmetric VDSL) with asymmetric services like ADSL and Asymmetric VDSL
5. Specification of means to simplify pair selection where appropriate, both manual and possibly automatic
6. Specification of methods to enhance the utility and the upper-frequency quality of lines
7. Establishment of guidelines to maximize binder data "volume" (sometimes called "Shannon volume"), and in particular:
    a. Allow normalized understanding and use of multi-user methods where possible and permitted for improved spectrum management;
    b. Develop methods for determination of rate regions for binders and specification of globally acceptable operation points;

c. Establish sharing and routing mechanisms to adapt to customer requirements in evolving DSL.

## 3. Early Draft Reference Diagram

Two types of DSM coordination are defined:

1. *"DSM-Data" coordination* refers to the ability of a network element (DSLAM, modem, etc.) to release DSM-related information to the maintenance center.
2. *"DSM-Control" coordination* refers to the ability of the network element to accept and implement DSM-related commands from the maintenance center.

As depicted in Figure 1 and Figure 2, a *DSL maintenance center* performing DSM-Data coordination may optionally accept line and crosstalk information in a specified format across an interface *DSM-D*. The DSL spectrum maintenance center (SMC) can process the information received and provide such processed data results for the use of DSL service providers according to specified criteria and format at interface *DSM-S*. The DSL maintenance center performing DSM-Control coordination can also dynamically specify downstream and upstream DSL line spectra recommendations across an interface *DSM-C*, that is, implement *spectrum balancing*. The DSL modems at line termination and network termination may share line information in a specified format across interface *DSL*. *Vectored DSL* systems can also allow *DSM-C* to provide joint specification of multiple DSL line signals in the downstream direction of the *DSL* interface, while also allowing specification of methods to coordinate DSL receivers in the upstream direction of the DSL interface. It is recognized that DSM data may be transmitted through interfaces that are specified by other standards groups or the DSL forum. However, the format and nature of the data is pertinent to the DSL line and therefore the purview of T1E1.4, specifically the existing spectrum-management project.

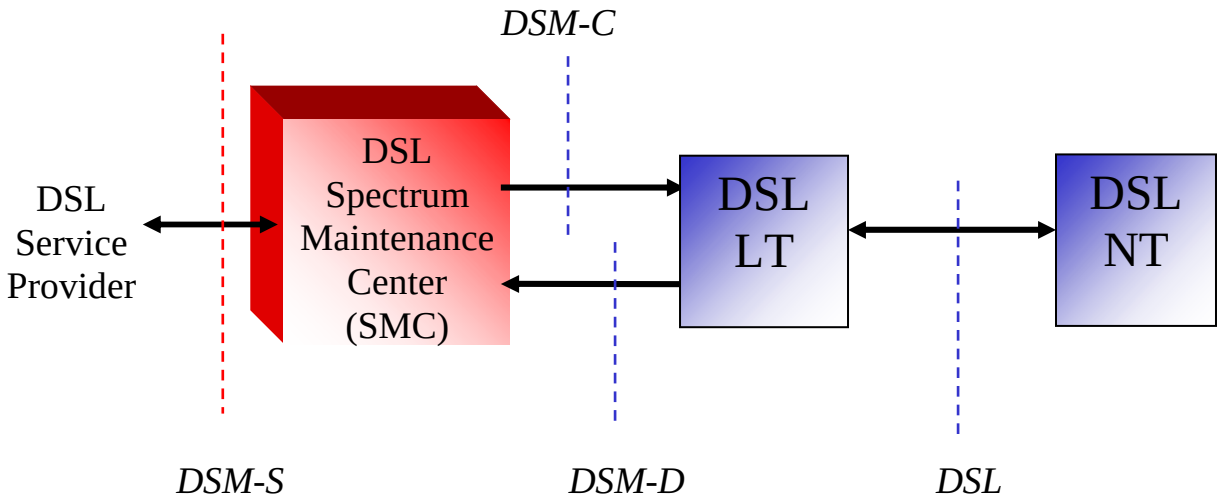



**Figure 1 – DSM Reference Diagram**

Figure 2 illustrates functionality of DSM for 3 levels of coordination, presumed to occur increasingly in time as one progresses vertically down in the diagram.

- *Level 0* coordination is no coordination, which occurs when service providers either do not have DSM-capable equipment or elect to disable any such DSM function intentionally.
- *Level 1 DSM-Data* coordination implies that spectral data is provided to the network maintenance center (as defined in 146R2).

- *Level 1 DSM-Control* coordination implies that certain recommendations or corrective procedures for time-invariant transmission parameters are made to/by DSL service providers in order to improve or maintain the quality of DSL service to all customers.
- *Level 2 DSM-Data* coordination implies that time-domain line measurements are provided (as defined in 146R2).
- *Level 2 DSM-Control* coordination considers the possibility of time-varying physical layer signals being controlled by a single service provider and being coordinated to improve DSL data rates, reliability, and/or range for all customers.

A single binder may see a combination of uses of any or all levels, depending upon service-provider preferences. Each service provider may elect to operate at different levels, depending on specific deployment issues.

For brevity of notation, *DSM-Data* and *DSM-Control* coordination levels can be denoted as "*Level x/y*", where *x* denotes the level of DSM-Data coordination and *y* the level of DSM-Control coordination.
Data rates listed in Figure 2 are for example only.

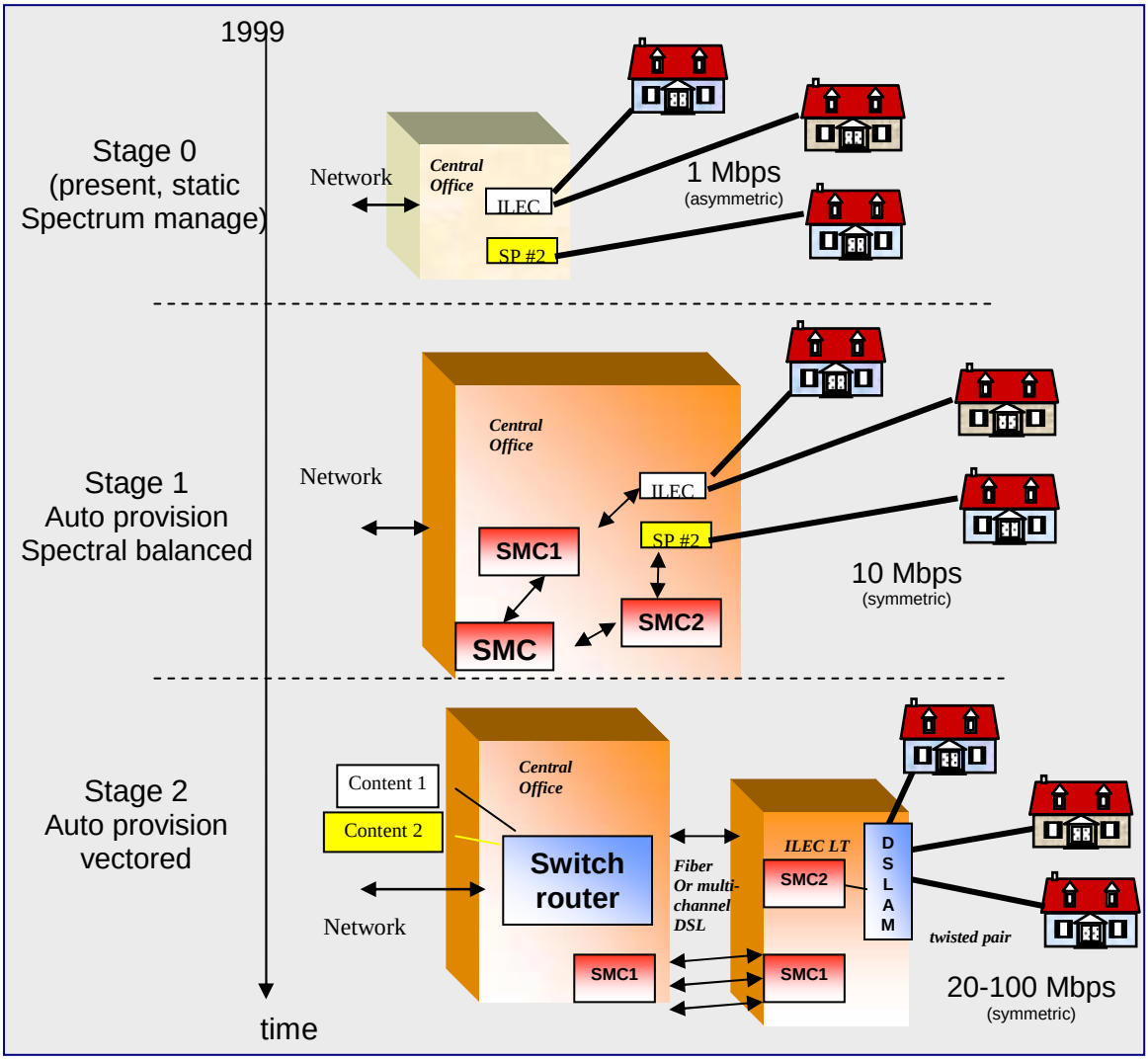



**Figure 2 – DSM Functional Diagram and Timeline**