INTERNATIONAL TELECOMMUNICATION UNION

ITU-T

TELECOMMUNICATION
STANDARDIZATION SECTOR
OF ITU

G.995.1

Amendment 1
(11/2001)

SERIES G: TRANSMISSION SYSTEMS AND MEDIA, DIGITAL SYSTEMS AND NETWORKS

Digital sections and digital line system – Access networks

Overview of digital subscriber line (DSL) Recommendations

Amendment 1

ITU-T Recommendation G.995.1 (2001) – Amendment 1

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ITU-T Recommendation G.995.1

Overview of digital subscriber line (DSL) Recommendations

Amendment 1

Source

Amendment 1 to ITU-T Recommendation G.995.1 (2001) was prepared by ITU-T Study Group 15 (2001-2004) and approved under the WTSA Resolution 1 procedure on 29 November 2001.

FOREWORD

The International Telecommunication Union (ITU) is the United Nations specialized agency in the field of telecommunications. The ITU Telecommunication Standardization Sector (ITU-T) is a permanent organ of ITU. ITU-T is responsible for studying technical, operating and tariff questions and issuing Recommendations on them with a view to standardizing telecommunications on a worldwide basis.

The World Telecommunication Standardization Assembly (WTSA), which meets every four years, establishes the topics for study by the ITU-T study groups which, in turn, produce Recommendations on these topics.

The approval of ITU-T Recommendations is covered by the procedure laid down in WTSA Resolution 1.

In some areas of information technology which fall within ITU-T's purview, the necessary standards are prepared on a collaborative basis with ISO and IEC.

NOTE

In this Recommendation, the expression "Administration" is used for conciseness to indicate both a telecommunication administration and a recognized operating agency.

INTELLECTUAL PROPERTY RIGHTS

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As of the date of approval of this Recommendation, ITU had received notice of intellectual property, protected by patents, which may be required to implement this Recommendation. However, implementors are cautioned that this may not represent the latest information and are therefore strongly urged to consult the TSB patent database.

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ITU-T Recommendation G.995.1

Overview of digital subscriber line (DSL) Recommendations

Amendment 1

1) Clause 5.8

Add the following text as the 7th paragraph of clause 5.8:

G.99x DSL Recommendations facilitate transmission of digital data over the copper pair. G.993.1 provides a foundation for transceivers that may support both asymmetric and symmetric operations at much higher data rates when compared to G.991.1 and G.991.2 for symmetric date rates and G.992.1 and G.992.2 for asymmetric data rates. In the Fibre-to-the-exchange (FTTEx) type of deployment, G.993.1 transceivers would provide less loop plant coverage than the G.991.1, G.991.2, G.992.1 and G.992.2 transceivers. The coverage can however be increased using the Fibre-to-the-cabinet (FTTCab) type of deployment. G.993.1 based transceivers would be able to coexist with underlying narrow-band POTS or ISDN services, as is the case with G.992.1 and G.992.2. The Network Operators would also be able to choose to provide VDSL on access lines without any narrow-band services.

2) New clause 5.9

Add new clause 5.9 as follows:

5.9 ITU-T G.993.1: Very high speed digital subscriber line foundation

ITU-T G.993.1 VDSL (Very high speed Digital Subscriber Lines) permits the transmission of asymmetric and symmetric aggregate data rates up to tens of Mbit/s on twisted pairs. G.993.1 is an access technology that exploits the existing infrastructure of copper wires that were originally deployed for POTS services. While POTS uses approximately the lower 4 kHz and ADSL/HDSL use approximately 1 MHz of the copper wire spectrum, G.993.1 uses up to 12 MHz of the spectrum. G.993.1 includes worldwide frequency plans that allow asymmetric and symmetric services in the same group of wire pairs (known as a binder). This is accomplished by designating bands for the transmission of upstream and downstream signals.

G.993.1 transceivers must overcome many types of ingress interference from radio and other transmission techniques that occur in the same frequencies of typical deployment scenarios. Similarly, G.993.1 transmission power transmission levels have been designed to minimize potential egress interference into other transmission systems.

As with other Recommendations in the G.99x series, G.993.1 uses G.994.1 to handshake and initiate the transceiver training sequence.

ITU-T G.993.1 supports a Fibre to the Node deployment architecture with an Optical Network Unit (ONU) appropriately placed in the existing metallic access network and the Local Exchange or Central Office deployment architecture without an ONU. The first architectural model covers Fibre-to-the-cabinet (FTTCab) type of deployment; the second one is Fibre-to-the-exchange (FTTEx) type of deployment. Existing unscreened twisted metallic access wire-pairs are used to convey the signals to and from the customer's premises.

ITU-T G.993.1 provides two or four data paths with bit rate under the control of the network operator, consisting of one or two downstream and one or two upstream data paths. A single path in each direction can be of high latency (with lower BER expected) or lower latency (with higher BER expected). Dual paths in each direction provide one path of each type. The dual latency

configuration is thought to be the minimum that is capable of supporting a sufficient full service set, although it is possible to support both the single latency model with programmable latency, or two paths/latencies. The model assumes that Forward Error Correction (FEC) will be needed for part of the payload and that deep interleaving will be required to provide adequate protection against impulse noise.

G.993.1 provides for service-splitter functional blocks to accommodate shared use of the physical transmission media for VDSL and either POTS or ISDN-BA. The rationale behind this is to provide network operators freedom to evolve their networks in one of two ways: complete change out or overlay. Support for active Network Termination (NT) in G.993.1 provides termination of the point-to-point VDSL transmission system and presents a standardized set of User Network Interfaces (UNI) at the customer's premises. The NT provides the network operator with the ability to test the network up to the UNI at the customer's premises in the event of a fault condition or via nighttime routine checks. The home wiring transmission system is outside the scope of G.993.1.

It is envisaged that G.993.1 will find applications in the transport of various protocols. For each transport protocol, different functional requirements must be developed for the Transport Protocol Specific – Transmission Convergence Layer (TPS-TC). This specification covers the functional requirements for the transport of Asynchronous Transfer Mode (ATM) and Packet Transfer Mode (PTM). However the G.993.1 core transceiver would be capable of supporting future additional transport protocols.

VDSL service would non-invasively coexist with the narrow-band services on the same pair. Failure of power to the VDSL NT or failure of the VDSL service shall not affect any existing narrow-band services. This may imply that the splitter filter is of a passive nature not requiring external power in order to provide frequency separation of the VDSL and existing narrow-band signals. POTS, if present, shall continue to be powered from the existing exchange node and a DC path is required from the local exchange to the customer telephone. Similarly a DC path is required for ISDN-BA in order to provide remote power feeding to the ISDN-BA NT.

POTS and ISDN-BA cannot exist simultaneously on the same pair at present. Network Operators may provide one or the other but not both over a single wire-pair. Network Operators may choose to provide VDSL on access lines without any narrow-band services.

The VDSL NT is not required to be powered remotely. Also, repeatered operation is not required for G.993.1.

3) New subclause 6.1.1.8

Add new subclause 6.1.1.8 as follows:

6.1.1.8 Relation with ITU-T G.993.1

Figure 8 *bis* illustrates the G.993.1 system reference model aligned with the reference configuration shown in Figure 1.

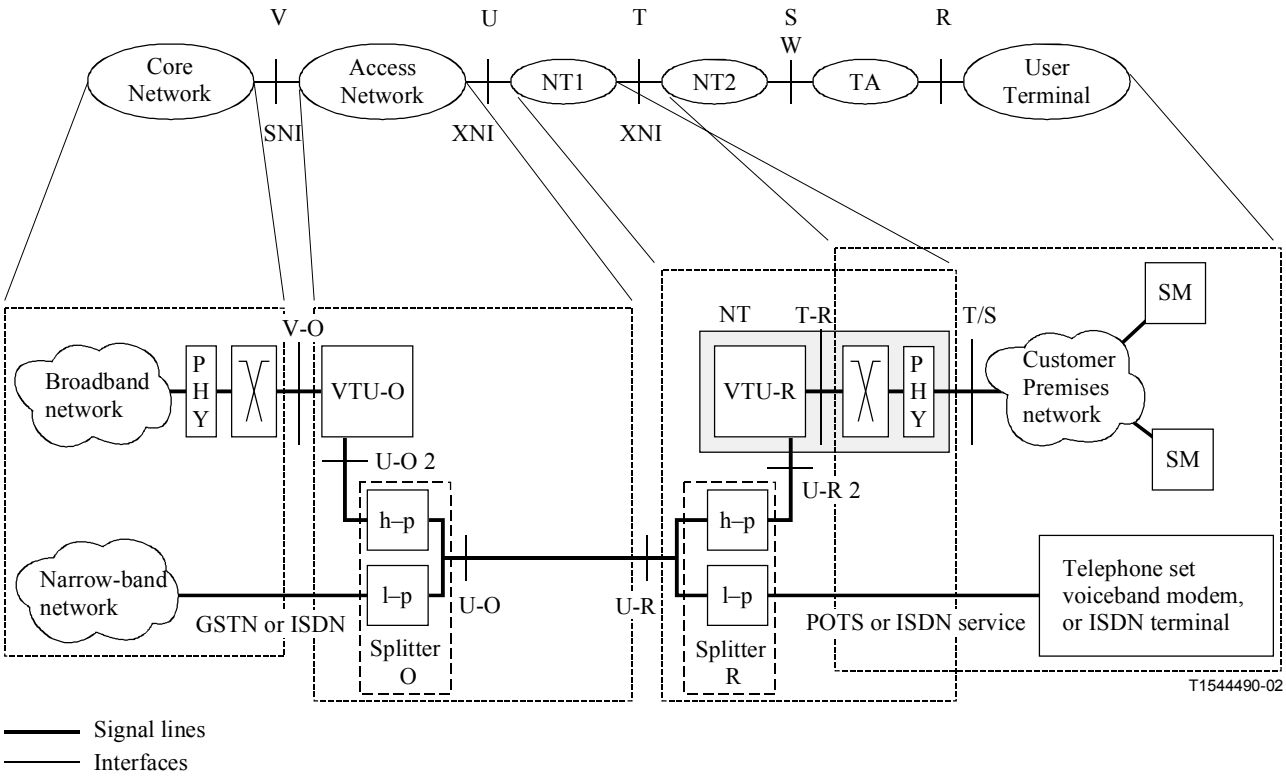

Figure 8 *bis*/G.995.1 – G.993.1 system reference model and its alignment with the generic reference configuration

The G.993.1 system reference model shows the functional blocks necessary to illustrate a VDSL transmission system. With reference to the alignment with the generic reference configuration, the Core Network may contain the following functions:

- Concentrator and/or switch.
- Interface to the Broadband and Narrow-band network.

The VDSL Access Network consists of the following:

- VDSL Transceiver Unit-ONU (VTU-O).
- POTS splitter to separate the POTS and VDSL channels.
- Copper Loop Plant.

The VDSL-NT1 may consist of the following functions:

- VDSL Transceiver Unit – Remote Terminal end (VTU-R).
- Multiplexer/Demultiplexer.
- Higher layer functions.
- Interface to the User terminal or a Home Network.

The VDSL-NT2, Terminal Adapter and User Terminal may share some or all of the NT1 functionalities.

In G.993.1, interfaces are defined at the V, U and T reference points namely U-O, U-R, V-O, and T-R interfaces.

The U-O and U-R interfaces are fully defined in G.993.1. Due to the potential asymmetry of the signals on the line, the transmitted signals are distinctly specified at the U-R and U-O reference points.

The V-O and T-R interfaces are defined only in terms of logical functions. The V-O interface may consist of interfaces to one or more (PTM or ATM) switching systems. Implementation of the V-O and T-R interfaces is optional when interfacing elements are integrated into a common element. One or other of the high-pass filters, which are part of the splitters, may be integrated into either of the VTU-O or VTU-R; if so, then the U-O2 and U-R2 interfaces become the same as the U-O and U-R interfaces, respectively.

The T/S interface is not defined in G.993.1. The nature of the customer installation distribution and customer premises network may be varied, e.g. bus or star, or type of media. Therefore, more than one type of T-R interface may be used, and more than one type of T/S interface may be provided from a VDSL NT (e.g. NT1 or NT2 types of functionalities).

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