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SERIES G: TRANSMISSION SYSTEMS AND MEDIA,
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Digital sections and digital line system – Metallic access
networks

**Interface between the link layer and the physical
layer for digital subscriber line (DSL)
transceivers**

Recommendation ITU-T G.999.1

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Recommendation ITU-T G.999.1

Interface between the link layer and the physical layer for digital subscriber line (DSL) transceivers

Summary

Recommendation ITU-T G.999.1 defines a point-to-point interface between the LINK layer device such as a network processor and a PHY device supporting multiple DSL lines, such as VDSL2, ADSL2 and SHDSL.

This revision adds support for 2.5 Gbit/s and 10 Gbit/s LINK/PHY physical interfaces.

History

Edition	Recommendation	Approval	Study Group	Unique ID*
1.0	ITU-T G.999.1	2009-10-09	15	11.1002/1000/9677
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Keywords

Broadband access, copper pairs, LINK/PHY interface, 1 Gbit/s, 2.5 Gbit/s, 10 Gbit/s

* To access the Recommendation, type the URL <http://handle.itu.int/> in the address field of your web browser, followed by the Recommendation's unique ID. For example, <http://handle.itu.int/11.1002/1000/11830-en>.

FOREWORD

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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.

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Recommendation ITU-T G.999.1

Interface between the link layer and the physical layer for digital subscriber line (DSL) transceivers

1 Scope

This Recommendation defines an interface between a LINK device and a PHY device. The interface is a single point-to-point interconnection from the LINK layer device to a PHY device, and it is intended for use with all current and developing xDSL Recommendations (e.g., ADSL2, VDSL2, SHDSL, G.fast, etc.).

2 References

The following ITU-T Recommendations and other references contain provisions which, through reference in this text, constitute provisions of this Recommendation. At the time of publication, the editions indicated were valid. All Recommendations and other references are subject to revision; users of this Recommendation are therefore encouraged to investigate the possibility of applying the most recent edition of the Recommendations and other references listed below. A list of the currently valid ITU-T Recommendations is regularly published. The reference to a document within this Recommendation does not give it, as a stand-alone document, the status of a Recommendation.

- [ITU-T G.992.3] Recommendation ITU-T G.992.3 (2009), *Asymmetric digital subscriber line transceivers 2 (ADSL2)*.
- [ITU-T G.992.5] Recommendation ITU-T G.992.5 (2009), *Asymmetric digital subscriber line (ADSL) transceivers – Extended bandwidth ADSL2 (ADSL2plus)*.
- [ITU-T G.9701] Recommendation ITU-T G.9701 (2019), *Fast access to subscriber terminals (G.fast) – Physical layer specification*.
- [IEEE 802.3] IEEE 802.3-2018, *IEEE Standard for Ethernet*.
<http://standards.ieee.org/>
- [IEEE 802.3cb] IEEE 802.3cb-2018, *IEEE Standard for Ethernet – Amendment 1: Physical Layer Specifications and Management Parameters for 2.5 Gb/s and 5 Gb/s Operation over Backplane*.
<http://standards.ieee.org/>

3 Definitions

No definitions are provided for this Recommendation.

4 Abbreviations and acronyms

This Recommendation uses the following abbreviations and acronyms:

DEST MAC ADD	Destination MAC Address
DFC	Data Flow Control
EoF	End of Frame
ETH	Ethernet encapsulation function
FCS	Frame Check Sequence
GMII	Gigabit Media Independent Interface
IFG	Inter-Frame Gap

MAC	Media Access Control
MDI	Media Dependent Interface
MII	Media Independent Interface
PCP	Priority Code Point
PRE	Preamble
RXC_MFS	Maximum Fragment data Size supported by near-end receiver
SFD	Start Frame Delimiter
SID	Stream Identification
SoF	Start of Frame
SOURCE MAC ADD	Source MAC Address
TCI	Tag Control Identifier
TPID	Tag Protocol Identifier
TX_MFS	Maximum Fragment data Size to be used by near-end transmitter
TXC_MFS	Maximum Fragment data Size supported by near-end transmitter
VLAN	Virtual Local Area Network
XGMII	10 Gigabit Media Independent Interface
XOFF	Transmit Off
XON	Transmit On

5 Reference model

The LINK/PHY interface reference model is shown in Figure 5-1. This reference model shows the following primitives defined in Annex K of [ITU-T G.992.3] and Annex K of [ITU-T G.992.5]. Primitives are labelled n , where n corresponds to an individual stream, with $n = 0..N-1$ for a LINK/PHY interface transporting N streams.

- Stream(n).request: This primitive is used by the transmit PHY port to request one or more data units from the transmit LINK layer function to be transported. By the interworking of the request and confirm, the data flow is matched to the PHY port configuration (and underlying functions).
- Stream(n).confirm: The transmit LINK layer function passes one or more data units to the PHY port to be transported with this primitive.
- Stream(n).indicate: The transmit PHY port passes one or more data units to the receive LINK layer function that have been transported with this primitive.

The data unit is a block of data consisting of an integer number of octets for transport between a PHY port and a link port. The contents of a data unit is vendor discretionary and outside the scope of this Recommendation. For example, a data unit may contain an Ethernet frame, an Ethernet bonding fragment, one or more ATM cells or an ATM AAL5 PDU.

The LINK/PHY interface reference model adds the following blocks:

- frag: Fragmentation of each data unit, with a tag control identification (TCI) field added to each fragment, and with each fragment not to exceed the configured maximum fragment length;
- tag: Identification of fragments through insertion of a data stream or pause identification tag into the TCI field;

- ETH: Ethernet adaptation by adding fields for compliance with the IEEE 802.3 frame format; the ETH block is configurable to be used or not;
- FCS: Error detection through addition of frame-check-sequence;
- PAUSE: Data flow control through a single PAUSE unit containing the data flow control states of all N streams;
- dec: Decapsulation to recover data units (confirm and indicate primitives) and data flow control states (request primitives), comprising the reverse operation of the frag, tag, and ETH blocks.

Data unit encapsulation is defined as the cascade of the frag, tag, ETH and FCS blocks. Pause init encapsulation is defined as the cascade of the PAUSE, ETH and FCS blocks. Encapsulation overhead depends on whether or not the ETH block is used.

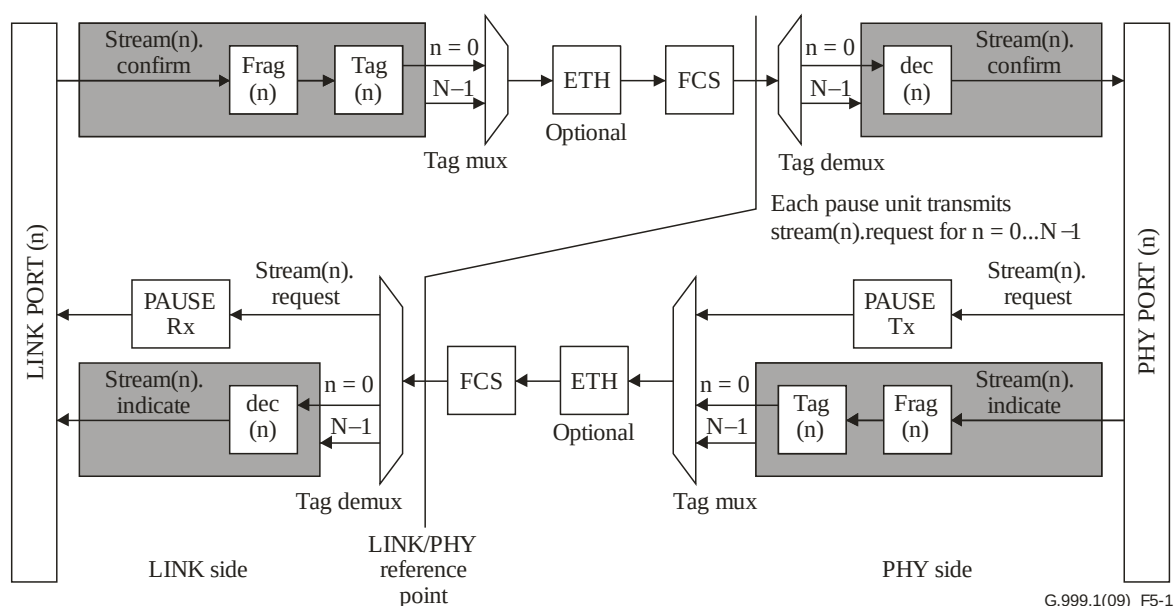


Figure 5-1 – Reference model for the LINK/PHY interface

The LINK device and PHY device shall use a physical point-to-point interconnection. The LINK/PHY interface shall support a data rate of at least 1 Gbit/s for the encapsulated data units. The minimum required bit rate at the LINK/PHY reference point may be higher (e.g., 1.25 Gbit/s if 8B/10B encoding is used).

6 Encapsulation

6.1 Fragmentation

The fragmentation block (see Figure 5-1) shall fragment each data unit as shown in Figure 6-1. The fragment format is shown in Figure 6-2.