

International Telecommunication Union

ITU-T

TELECOMMUNICATION
STANDARDIZATION SECTOR
OF ITU

G.9801

(08/2013)

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

Access networks – Optical line systems for local and
access networks

Ethernet passive optical networks using OMCI

Recommendation ITU-T G.9801

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Recommendation ITU-T G.9801

Ethernet passive optical networks using OMCI

Summary

Recommendation ITU-T G.9801 describes requirements and specifications of Ethernet passive optical network (EPON) systems using the ONU management and control interface (OMCI), which is called OMCI-EPON.

OMCI-EPON is based on IEEE 802.3 and IEEE 1904.1 for user data transport, and applies Annex C of Recommendation ITU-T G.988 for its management. OMCI-EPON supports 1G-EPON, 10/1G-EPON and 10/10G-EPON architectures defined in IEEE 802.3, and provides a mechanism that enables coexistence with the existing PON systems using time division multiple access (TDMA) technologies and/or wavelength blocking filter (WBF).

History

Edition	Recommendation	Approval	Study Group	Unique ID*
1.0	ITU-T G.9801	2013-08-29	15	11.1002/1000/12009-en

* 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>.

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Recommendation ITU-T G.9801

Ethernet passive optical networks using OMCI

1 Scope

The Ethernet passive optical network (EPON) system is a general name for PON systems that are based on the IEEE 802.3 standard and the IEEE 1904.1 standard. This Recommendation focuses on EPON systems that apply the ONU management and control interface (OMCI) defined by [ITU-T G.988] to create an effective PON operation system. This Recommendation calls these EPON systems OMCI-EPON.

OMCI-EPON includes 1G-EPON, 10/1G-EPON and 10/10G-EPON architectures defined in [IEEE 802.3].

The requirements and specifications of OMCI-EPON conform to [IEEE 802.3] and the IEEE 1904.1 Package B standard and to the operational requirements and specifications defined by Annex C of [ITU-T G.988]. The requirements and specifications of OMCI-EPON enable the use of OMCI to manage IEEE 802.3/IEEE 1904.1 Package B compliant systems, thus providing 1G-EPON and 10G-EPON solutions to network operators who prefer OMCI management.

As much as possible, this Recommendation maintains backward compatibility with existing optical distribution networks (ODN) that comply with the existing PON systems defined by [IEEE 802.3] and ITU-T Recommendations such as [b-ITU-T G.983.x], [b-ITU-T G.984.x] and [b-ITU-T G.987.x]. Furthermore, this Recommendation provides a mechanism that enables coexistence with the existing PON systems using TDMA technologies and/or wavelength blocking filter (WBF).

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.902] Recommendation ITU-T G.902 (1995), *Framework Recommendation on functional access networks (AN) – Architecture and functions, access types, management and service node aspects*.
- [ITU-T G.984.1] Recommendation ITU-T G.984.1 (2008), *Gigabit-capable passive optical networks (GPON): General characteristics*.
- [ITU-T G.988] Recommendation ITU-T G.988 (2012), *Optical network unit management and control interface specification*.
- [IEEE 1904.1] IEEE 1904.1-2013, *IEEE Standard for Service Interoperability in Ethernet Passive Optical Networks (SIEPON)*.
- [IEEE 802.3] IEEE 802.3-2012, *IEEE Standard for Ethernet*.

3 Definitions

3.1 Terms defined elsewhere

This Recommendation uses the following terms defined elsewhere:

3.1.1 access network (AN) [ITU-T G.902]: An implementation comprising those entities (such as cable plant, transmission facilities, etc.) which provide the required transport bearer capabilities for the provision of telecommunications services between a service node interface (SNI) and each of the associated user-network interfaces (UNI).

3.1.2 Ethernet LAN service (E-LAN) [b-MEF 6.1]: An Ethernet service type that is based on a multipoint-to-multipoint Ethernet virtual connection.

3.1.3 Ethernet line service (E-Line) [b-MEF 6.1]: An Ethernet service type that is based on a point-to-point Ethernet virtual connection.

3.1.4 Ethernet tree service (E-Tree) [b-MEF 6.1]: An Ethernet service type that is based on a rooted-multipoint Ethernet virtual connection.

3.1.5 Ethernet virtual connection (EVC) [b-MEF 6.1]: An association of UNIs to which the exchange of service frames is limited.

3.1.6 service node (SN) [ITU-T G.902]: A network element that provides access to various switched and/or permanent telecommunication services.

3.1.7 service node interface (SNI) [ITU-T G.902]: An interface which provides customer access to a service node.

3.1.8 user-network interface (UNI) [b-ITU-T I.112]: The interface between the terminal equipment and a network termination at which interface the access protocols apply.

3.2 Terms defined in this Recommendation

This Recommendation defines the following terms:

Terms related to optical access architecture

3.2.1 Ethernet passive optical network (EPON): A general name for PON systems that are based on the [IEEE 802.3] standard and the [IEEE 1904.1] standard.

3.2.2 OMCI-EPON: An EPON system that applies the ONU Management and Control Interface (OMCI) defined by [ITU-T G.988].

3.2.3 optical access network (OAN): A part of an access network whose network elements are interconnected by optical communication channels.

NOTE – An OAN may or may not extend all the way to the UNI, so that the user-side interface of the OAN does not necessarily coincide with the UNIs of the AN.

3.2.4 optical distribution network (ODN): A point-to-multipoint optical fibre infrastructure. A *simple* ODN is entirely passive and is represented by a single-rooted point-to-multipoint tree of optical fibres with splitters, combiners, filters, and possibly other passive optical components. A *composite* ODN consists of two or more passive *segments* interconnected by active devices, each of the segments being either an optical trunk line segment or an optical distribution segment. A passive optical distribution segment is a simple ODN itself. Two ODNs with distinct roots can share a common subtree.

3.2.5 optical line termination (OLT): A network element in an ODN-based optical access network that terminates the root of at least one ODN and provides an OAN SNI.

3.2.6 optical network terminal (ONT): An ONU supporting a single subscriber.

3.2.7 optical network unit (ONU): A network element in an ODN-based optical access network that terminates a leaf of the ODN and provides an OAN UNI.

3.2.8 passive optical network (PON) system: A combination of network elements in an ODN-based optical access network that includes an OLT and multiple ONUs and implements a particular coordinated suite of physical medium dependent layer, transmission convergence layer, and management protocols.

Terms related to optical parameters, power and loss budget

3.2.9 attenuation: The total relative optical power loss of an optical signal propagating through the ODN. Attenuation is caused by absorption and scattering of light in the fibre (caused by fibre impurities and imperfections, fluctuations of the refractive index, material dispersion), as well as connectors, splices, splitters, wavelength couplers, attenuators, and other passive optical components.

3.2.10 differential fibre distance: The absolute difference between the fibre distances of two particular ONUs connected to the same OLT PON interface.

3.2.11 dispersion: A physical phenomenon comprising the dependence of the phase or group velocity of a light wave in the medium on its propagation characteristics such as optical frequency (wavelength) or polarization mode.

3.2.12 dynamic range: An optical receiver characteristic that represents the difference between the worst-case sensitivity (i.e., maximum over the operating conditions) and the worst-case overload (i.e., minimum over the operating conditions), and is usually expressed as a ratio of the former to the latter.

3.2.13 extinction ratio: With respect to a digital signal generated by an optical source (laser diode), the ratio of the two optical power levels corresponding to the high and low intensities of light emission.

3.2.14 fibre distance: The overall length of fibre (and, if applicable, equivalent fibre runs representing delay-inducing components) between the R/S and S/R reference points.

3.2.15 mean optical launch power: An optical transmitter characteristic expressing the average optical power of an optical signal transmitted into the fibre and carrying a given digital sequence. When specified as a range, the minimum mean launch power provides the power level that the transmitter should guarantee at all times, and the maximum mean launch power provides the power level that the transmitter should never exceed. When applied to burst mode transmission, the term pertains to the time interval during which the transmitter is fully active, and excludes possible starting and ending transient behaviour.

3.2.16 nominal line rate: The total number of bits that can be physically transferred per unit of time over a communication link. Nominal line rate accounts for useful data as well as for all possible protocol overheads and necessarily exceeds the effective data rate on any given protocol level.

3.2.17 optical path penalty (OPP): The apparent reduction of receiver sensitivity due to distortion of the signal waveform during its transmission over the optical path. The optical path penalty accounts for total degradations including the effects of reflections, intersymbol interference, mode partition noise, and laser chirp.

3.2.18 optical return loss (ORL): The total reflection at the source reference point of the optical signal propagation path associated with both discrete reflections at the refractive index discontinuities and distributed backscattering, such as Rayleigh scattering, along the path. Optical return loss is measured as a ratio of the transmitted power to the reflected power.

3.2.19 overload: A receiver parameter that characterizes the maximum value of the average received optical power to achieve the BER at or below the specified reference level.

