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

Digital sections and digital line system – Optical line
systems for local and access networks

40-Gigabit-capable passive optical networks (NG-PON2): General requirements

Recommendation ITU-T G.989.1

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Recommendation ITU-T G.989.1

40-Gigabit-capable passive optical networks (NG-PON2): General requirements

Summary

Recommendation ITU-T G.989 series describes 40-Gigabit-capable passive optical network (NG-PON2) systems in an optical access network for residential, business, mobile backhaul and other applications.

Recommendation ITU-T G.989.1 addresses the general requirements of 40-Gigabit-capable passive optical network (NG-PON2) systems, in order to guide and motivate the physical layer and the transmission convergence layer specifications. This Recommendation includes principal deployment configurations, migration scenarios from legacy PON systems, and system requirements. This Recommendation also includes the service and operational requirements to provide a robust and flexible optical access network supporting all access applications.

The physical layer specifications for the NG-PON2 physical media dependent (PMD) layer are described in Recommendation ITU-T G.989.2. The transmission convergence (TC) layer is described in Recommendation ITU-T G.987.3, with unique modifications for NG-PON2 systems captured in Recommendation ITU-T G.989.3. The ONU management and control interface (OMCI) specifications are described in Recommendation ITU-T G.988 for NG-PON2 extensions.

History

Edition	Recommendation	Approval	Study Group
1.0	ITU-T G.989.1	2013-03-09	15

FOREWORD

The International Telecommunication Union (ITU) is the United Nations specialized agency in the field of telecommunications, information and communication technologies (ICTs). 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.

Compliance with this Recommendation is voluntary. However, the Recommendation may contain certain mandatory provisions (to ensure, e.g., interoperability or applicability) and compliance with the Recommendation is achieved when all of these mandatory provisions are met. The words "shall" or some other obligatory language such as "must" and the negative equivalents are used to express requirements. The use of such words does not suggest that compliance with the Recommendation is required of any party.

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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, implementers are cautioned that this may not represent the latest information and are therefore strongly urged to consult the TSB patent database at <http://www.itu.int/ITU-T/ipr/>.

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Recommendation ITU-T G.989.1

40-Gigabit-capable passive optical networks (NG-PON2): General requirements

1 Scope

This Recommendation describes the general requirements of NG-PON2 systems supporting a 40-Gbit/s capable aggregate downstream capacity for residential, business, mobile backhaul, and other applications. This Recommendation includes the principal deployment configurations, migration scenarios from legacy PON systems, and system requirements. This Recommendation also includes the service and operational requirements to provide for a robust and flexible optical access network supporting all access applications.

The NG-PON2 system is capable of meeting the needs of a wide range of networks in diverse markets and is deployable in numerous applications in an efficient manner. As much as possible, this Recommendation maintains characteristics from legacy PON systems: [ITU-T G.982], [ITU-T G.983], [ITU-T G.984], and [ITU-T G.987] series of Recommendations. This is to promote backward compatibility with existing optical distribution networks (ODNs) that comply with those Recommendations and re-use established technical capabilities as much as possible. This Recommendation also describes smooth migration scenarios from legacy PON systems to NG-PON2 systems. Furthermore, NG-PON2 systems are expected to meet bandwidth growth and enable new revenue streams on legacy ODNs as well as supporting greenfield applications over new ODNs.

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.652] Recommendation ITU-T G.652 (2005), *Characteristics of a single-mode optical fibre cable*.
- [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.982] Recommendation ITU-T G.982 (1996), *Optical access networks to support services up to the ISDN primary rate or equivalent bit rates*.
- [ITU-T G.983.1] Recommendation ITU-T G.983.1 (2005), *Broadband optical access systems based on Passive Optical Networks (PON)*.
- [ITU-T G.983.2] Recommendation ITU-T G.983.2 (2005), *ONT management and control interface specification for B-PON*.
- [ITU-T G.983.3] Recommendation ITU-T G.983.3 (2001), *A broadband optical access system with increased service capability by wavelength allocation*.
- [ITU-T G.984.1] Recommendation ITU-T G.984.1 (2008), *Gigabit-capable Passive Optical Networks (GPON): General characteristics*.

- [ITU-T G.984.2] Recommendation ITU-T G.984.2 (2008), *Gigabit-capable Passive Optical Networks (GPON): Physical Media Dependent (PMD) layer specifications*.
- [ITU-T G.984.3] Recommendation ITU-T G.984.3 (2008), *Gigabit-capable Passive Optical Networks (GPON): Transmission convergence layer specification*.
- [ITU-T G.984.4] Recommendation ITU-T G.984.4 (2008), *Gigabit-capable Passive Optical Networks (GPON): ONT management and control interface specification*.
- [ITU-T G.984.5] Recommendation ITU-T G.984.5 (2007), *Gigabit-capable Passive Optical Networks (GPON): Enhancement band for Gigabit-capable Passive Optical Networks*.
- [ITU-T G.987] Recommendation ITU-T G.987 (2012), *10-Gigabit-capable Passive Optical Networks (XG-PON) systems: Definitions, abbreviations and acronyms*.
- [ITU-T G.987.1] Recommendation ITU-T G.987.1 (2010), *10-Gigabit-capable Passive Optical Networks (XG-PON): General requirements*.
- [ITU-T G.987.2] Recommendation ITU-T G.987.2 (2010), *10-Gigabit-capable Passive Optical Networks (XG-PON): Physical Media Dependent (PMD) layer specification*.
- [ITU-T G.987.3] Recommendation ITU-T G.987.3 (2010), *10-Gigabit-capable Passive Optical Networks (XG-PON): Transmission convergence (TC) layer specification*.
- [ITU-T G.988] Recommendation ITU-T G.988 (2010), *ONU management and control interface specification (OMCI)*.
- [ITU-T J.185] Recommendation ITU-T J.185 (2012), *Transmission equipment for transferring multi-channel television signals over optical access networks by frequency modulation conversion*.
- [ITU-T J.186] Recommendation ITU-T J.186 (2008), *Transmission equipment for multi-channel television signals over optical access networks by sub-carrier multiplexing (SCM)*.
- [IEC 60825-2] IEC International Standard 60825-2 (2004), *Safety of laser products – Part 2: Safety of optical fibre communication systems (OFCS)*.
- [IEEE 802.3] IEEE 802.3-2012, *IEEE Standard for Information Technology – Telecommunications and Information exchange between systems – Local and metropolitan area networks – Specific requirements, Part 3: Ethernet*.

3 Definitions

See clause 3 of [ITU-T G.987].

3.1 NG-PON2 specific terms

This Recommendation uses the following NG-PON2 specific definitions:

3.1.1 TWDM PON: A time and wavelength division multiplexing passive optical network (TWDM PON) is a multiple wavelength PON solution in which each wavelength is shared between multiple optical network units (ONUs) by employing time division multiplexing and multiple access mechanisms.

3.1.2 PtP WDM: Point-to-point wavelength division multiplexing (PtP WDM) is a multiple wavelength PON solution that provides a dedicated wavelength per ONU in both downstream and upstream directions. The defining characteristic of a PtP WDM is that each ONU is served by one or more dedicated wavelengths.