Classification of Passive Optical Networks

Article Overview

Passive Optical Networks are classified primarily into ATM-based PONs (APON/BPON/GPON) and Ethernet-based PONs (EPON), with further variations for higher speeds and coexistence.

Overview of PON Architecture

A Passive Optical Network (PON) is a fiber-optic point-to-multipoint network that uses unpowered optical splitters to distribute signals from a single Optical Line Terminal (OLT) at the service provider's central office to multiple Optical Network Units (ONUs) or Optical Network Terminals (ONTs) at the customer premises . The Optical Distribution Network (ODN), composed of fibers and passive splitters, forms the backbone of the PON, enabling shared bandwidth among multiple users .

Major PON Classifications

1. ATM-Based PONs

These PONs use Asynchronous Transfer Mode (ATM) for data transmission and were among the earliest PON standards developed by ITU-T:

o APON (ATM PON): The first generation, designed for basic ATM traffic.
o BPON (Broadband PON): An evolution of APON, supporting higher bandwidth and multiple services including voice, video, and data.
o GPON (Gigabit PON): Provides gigabit-level speeds, supports Ethernet, ATM, and TDM traffic, and is widely used for FTTH deployments .

2. Ethernet-Based PONs

o EPON (Ethernet PON): Developed by IEEE, EPON uses Ethernet frames for data transmission, offering simplicity and cost-effectiveness. It is popular in regions where Ethernet infrastructure is dominant .

3. Next-Generation and High-Speed PONs

o 10G-PON / XG-PON: Supports 10 Gbps downstream and 2.5 Gbps upstream, designed for high-demand applications.
o XGS-PON: Symmetric 10 Gbps for both upstream and downstream.
o NG-PON2: Uses multiple wavelengths to increase capacity and allow coexistence of multiple PON generations on the same fiber .

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4. Coexistence and Hybrid PONs

ITU-T G.9805 defines methods for coexistence of multiple PON generations on a single ODN:

o Coexistence Element (CEx): External device to separate wavelengths.
o Multi-PON Module (MPM): Integrates multiple PON systems in one module.
o Splitter-based coexistence: Uses wavelength division across splitters to support multiple PONs simultaneously .

Summary

PONs are classified based on data transmission technology (ATM vs Ethernet), speed and capacity (GPON, XG-PON, NG-PON2), and coexistence capabilities. ATM-based PONs (APON, BPON, GPON) are legacy or widely deployed for triple-play services, while Ethernet-based PONs (EPON) are simpler and cost-effective. Next-generation PONs focus on higher bandwidth and multi-generation coexistence, ensuring scalability for future broadband demands .

This paper presents a comprehensive overview of the emerging coherent passive optical network (CPON) technology and its role in

Passive Optical Networks a broadband network access using the fiber-optics telecommunication technology and is a point-to

The gigabit-class passive optical networks are standardized and deployed nowadays. With ever increasing demand

Optical access solutions have attracted the attention of researchers from both academia and industry for a long time. In

Passive Optical Network (PON) is a point-to-multipoint optical access technology. Ethernet PON (EPON) and gigabit

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Passive Optical Networks (PONs) are a series of promising broadband access network technologies that offer

Classification of Passive Optical Networks

Active and passive optical networks are compared. Based on a reference model that covers AON and PON as well as

Unlike active optical networks (AON), passive optical networks require power only at the transmit and receive points.

A passive optical network (PON) is defined as a point-to-multipoint communication architecture that utilizes a single optical fiber split

Learn what a passive optical network is, how it works, and the different types of PON systems and their benefits and

Describes the critical components used in PONs and discusses network architectures to

Passive optical network (PON) research and technology have matured in recent years and firmly established PONs as

The paper provides an overview of Passive Optical Networks (PONs), which have emerged as a vital solution due to the increased

What is a passive optical network (PON)? We explain PONs, how they work, their main

Active and passive optical networks (AONs and PONs) are two distinct networking technologies with unique advantages and

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