

DMB: DSL systems

Online course specification

Target audience:

This course is intended for technical staff involved in the planning, provisioning, and maintenance of Digital Subscriber Line (DSL) broadband connections.

Course aim:

Describe the structure, functional components, operation and testing of systems that provide Digital Subscriber Line (DSL) services to customers.

Course level: Advanced

An explanation of PTT course levels is given at the end of this document

Pre-requisites:

You will get the most out of this course if you already have an understanding of the principles of ADSL. We suggest that the PTT online course “ADSL principles” is completed before attempting this course.

An understanding of the use and operation of Internet protocols would also be an advantage. We suggest that the PTT course “IP networks and the Internet” is completed before attempting this course.

Course structure:

The course consists of the following 9 modules:

1. Course Introduction
2. Service providers equipment
3. ADSL connections
4. ADSL over IP networks
5. VDSL triple play systems
6. Customers' equipment
7. Symmetrical DSL access
8. Testing DSL connections
9. Spectrum management

Module 1: Course Introduction

Module aim: To summarise the aims of each module and introduce the navigation and learning facilities provided by the course.

Module 2: Service providers equipment

Module aim: Describe the role of the equipment and protocols used in the networks that provide DSL-based broadband Internet access.

After completing this module, a trainee will be able to:

- describe the role of a splitter and an MDF in the access network.
- explain the role of DSLAM and B-RAS equipment in an access network.

- explain the concept and significance of contention ratio.
- describe the use of Point to Point Protocol (PPP) with reference to Authentication, Authorisation, and Accounting (AAA).
- describe the sequence of events that occurs during the establishment of an ADSL connection with reference to the AAA server.
- describe how IP addresses are assigned to customers' equipment during the establishment of an ADSL connection.
- compare the advantages of static and dynamic assignment of IP addresses.

Module 3: ADSL connections

Module aim: Describe the operation of the protocols used in the provision of an ADSL connection to a customer.

After completing this module, a trainee will be able to:

- describe the roles of, and relationship between, the protocols used on an ADSL connection including Ethernet, IP, ATM and PPP.
- describe the role and characteristics of ATM virtual channel connections as used in the provision of an ADSL service.
- describe the operation of a simple bridged Ethernet ADSL connection.
- describe and compare the principles, operation and benefits of PPP over Ethernet (PPPoE) and PPP over ATM (PPPoA) connections.

Module 4: ADSL over IP networks

Module aim: Describe the architectures and techniques used to provide DSL services over networks based on the use of the Internet Protocol (IP).

After completing this module, a trainee will be able to:

- explain that all forms of traffic are carried over Next Generation Networks (NGN) using Internet Protocol (IP).
- explain that, because ATM is not used in NGNs an alternative way of providing a guaranteed Quality of Service (QoS) must be provided.
- describe the advantages of using the MPLS protocol in a network.
- describe how Virtual LAN (VLAN) techniques can provide secure paths with a defined Class of Service.
- describe the structure and advantages of systems that use ATM in the access network and MPLS or VLAN tunnels in the core network.
- describe the facilities and advantages of IP enabled DSLAMs (IP-DSLAM).
- describe and compare DSL systems using centralised and distributed architectures in NGNs with reference to the functions of IP-DSLAM and B-RAS equipment.

Module 5: VDSL triple play systems

Module aim: Describe the protocols and system components involved in the provision of triple play services using VDSL techniques and an Ethernet based next generation network.

After completing this module, a trainee will be able to:

- describe the advantages and capabilities of a broadband connection provided over copper wires using VDSL2.

- explain the advantages of eliminating the ATM protocol from the last mile connection.
- explain the advantages of providing Ethernet virtual connections over the entire triple play system.
- describe the role, principles and facilities of the packet transfer mode (PTM) protocol.
- explain that VLAN techniques can be used to partition customer traffic and provide differentiated quality of service for each of the triple play services.
- describe the role of a multiservice access node in providing interfaces for various types of service.
- explain that an MSAN can act as an access gateway interfacing between conventional telephone connections and a VoIP system.
- describe the role and facilities of DHCP option 82 with reference to authentication of users and allocation of IP addresses.
- describe the role and facilities of a broadband service aggregator and broadband service router.

Module 6: Customers' equipment

Module aim: Describe the role of the equipment at an ADSL customer's premises.

After completing this module, a trainee will be able to:

- describe and compare the functions of microfilters and splitters at the customer's premises.
- describe the action of an ADSL modem when connected to a single PC and to telephone line.
- explain how several PCs can be connected to a single DSL connection using a router.
- explain how each PC connected to a router can be allocated an IP address using either manual or automatic configuration.
- explain the function of Network Address Translation (NAT) for PCs communicating over the Internet.
- describe the action of a firewall and explain that firewall functionality can be provided by the router or by software installed on a PC.
- describe the advantages of a Wireless ADSL-enabled router and describe the operation of 802.11g wireless cards and USB adaptors.

Module 7: Symmetrical DSL access

Module aim: Describe the principles, operation, and facilities of SHDSL service provision.

After completing this module, a trainee will be able to:

- Describe the operation and the features of a Single pair High speed DSL (SHDSL) service.
- Explain the benefits of f TC-PAM modulation and error correction.
- Describe the format and payload capability of an SHDSL frame.
- Explain the use of an Integrated Access Device for the simultaneous transmission of voice and data over an SHDSL connection.
- Describe the process of SHDSL link activation.
- Describe the provision of a SHDSL service over an IP-based network.
- Describe other SHDSL service features including 4 wire operation and use of repeaters.

Module 8: Testing DSL connections

Module aim: Describe the tests that can be carried out on a DSL connection and explain their purpose.

After completing this module, a trainee will be able to:

- explain that DSL connections can be tested at various protocol layers including DSL layer, ATM layer, PPP authentication layer, IP network layer and the application layer.
- describe DSL line tests including loop resistance and loop capacitance tests.
- describe the principles of Time Domain Reflectometer tests and their function in locating line faults.
- list and define the parameters that an ADSL tester can measure during link tests.
- explain the significance of DSL link test parameters including noise margin and attenuation.

Module 9: Spectrum management

Module aim: Describe the principles of operation and benefits of dynamic spectrum management (DSM) for DSL systems

After completing this module, a trainee will be able to:

- explain the factors that have increased the importance of DSM.
- explain the role and limitations of a spectrum mask in static spectrum management.
- describe and compare the four levels of DSM with reference to the degree of co-operation between DSL modems at each level.
- describe the principles of operation and benefits of the Iterative Water Filling (IWF) algorithm as used by DSM level 1 DSL modems.
- compare the performance benefits of DSM level 1 IWF and DSM level 2 Optimum Spectrum Balancing (OSB).

Course access requirements:

To access the course, a computer running a browser such as Google Chrome, Safari etc is required. The computer should have Internet access. A screen resolution of at least 1024x768 is necessary.

Learning facilities:

This online course employs interactive simulations, hypertext links to an online glossary and multiple-choice question sessions to fully involve the trainee in the learning experience. Each module provides revision links to previously studied, relevant topics. A record of progress and level of achievement is recorded for each trainee. Once studied as a structured, assessed course, the content can be browsed for revision or reference.

PTT course levels:

PTT online courses are categorised by one of three levels according to the depth of treatment they provide:

1. Introductory:

PTT Introductory courses are designed for those with no previous experience or knowledge of telecommunications. These courses provide an overview of telecommunications or discuss the fundamentals of electronic communications. The study of general science at secondary (high) school is a typical pre-requisite for PTT Introductory courses.

PTT Introductory courses are suitable for those joining the telecommunications sector particularly those in an apprenticeship programme.

2. Intermediate:

PTT Intermediate courses are designed for technicians and engineers requiring an understanding of a certain aspect of telecommunications. Those planning to study an Intermediate course should have an understanding of the basic principles of electronic communications.

The depth of treatment provided by Intermediate courses is typically equivalent to level 3 of a UK national vocational qualification (NVQ). PTT Intermediate courses can be used to support the attainment of a Communications Technology NVQ at level 3.

3. Advanced:

PTT Advanced courses are designed for those who require an in-depth treatment of a certain aspect of telecommunications. Such courses are suitable for system designers as well as those who will be responsible for the maintenance of the system described in the course.

Those planning to study a PTT Advanced course should have a background in telecommunications, and an understanding of telecommunications fundamentals and the principles of the type of telecommunications system described in the course.

PTT
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