

EDC: Ethernet networks

Online course specification

Target audience:

Those responsible for the installation and maintenance of Ethernet local area networks.

Course aim:

This course describes the operation of fixed line and wireless Ethernet networks with reference to their address schemes, protocols and functional elements.

Course level: Intermediate

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

Pre-requisites:

An understanding of the basic principles of operation of Ethernet local area networks. It is recommended that the PTT course “Ethernet fundamentals” is studied before attempting this course.

Course structure:

The course consists of the following four modules:

1. Ethernet switching
2. IP over Ethernet
3. Addressing
4. Wireless LANs

Module 1: Ethernet switching

Module aim: To describe the advantages, features and operation of a switch in an Ethernet-based local area network.

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

- compare the roles of switches and routers in a local area network (LAN).
- explain the advantages of switching.
- describe the need for, and various methods of providing, flow control.
- explain the cause, effect, and ways of avoiding “head of line” blocking”.
- describe the capabilities of a switch in terms of auto-negotiation, backplane transfer rate, forwarding rate, and buffer size.
- describe the role and operation of the spanning tree protocol (STP).
- describe the advantages of the rapid spanning tree protocol.
- describe the basic operation, advantages compared with STP, and applications of shortest path bridging (SPB) and transparent interconnection of lots of links (TRILL)

Module 2: IP over Ethernet

Module aim: To compare the roles and facilities of switching and routing and describe protocol conversion and security measures at the boundary between a local area network and the Internet.

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

- describe how higher layer protocol information is carried in lower layer protocol data units with reference to the structure of an IP packet and an Ethernet frame.
- explain the concept of network addressing.
- describe the structure of IP addresses in terms of network and host identities.
- compare the structure and roles of MAC and IP addresses.
- describe how packets are routed over IP networks.
- describe the role of route discovery protocols.
- explain the advantages of routing compared with switching.
- describe the role of a firewall, proxy server, router and DMZ at the boundary between a local area network and the Internet.

Module 3: Addressing

Module aim: To describe how devices and data transfer sessions in a local area network (LAN) are identified and describe the translation between different address types in an Ethernet LAN.

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

- explain that IP addresses have a hierarchical structure and explain the main advantage of IP version 6 addressing compared to version 4.
- describe and compare the concepts of multicasting and broadcasting.
- describe the relationship between IP and MAC addresses.
- describe the role and operation of the address resolution protocol, ARP.
- explain the significance of TCP/UDP port numbers.
- compare static and dynamic (DHCP) IP addressing.
- describe the role and operation of network address translation (NAT).
- describe the role of static NAT access lists.
- describe the role and operation of port forwarding.

Module 4: Wireless LANs

Module aim: To introduce the principles, capabilities and applications of wireless systems which provide communications between nomadic devices within an area.

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

- explain that a number of unlicensed radio channels in two radio bands have been allocated to WiFi communications.
- describe the advantages of the 5 GHz band over the 2.4 GHz band.
- explain the principles of operation of WiFi communications with particular reference to how WiFi stations share a radio channel.
- describe the role of a WiFi access point.
- describe the role of the components of a wireless system that includes a number of WiFi access points.
- describe the techniques used to ensure the security of WiFi communications.
- explain how “man in the middle” attacks can compromise the security of WiFi communications and how the threat of such attacks can be minimised.
- compare the capabilities of the various generation of WiFi in terms of data transfer speeds, range and security.

- describe the facilities offered by a wireless controller.
- compare the topology and advantages of centralised and distributed control WiFi systems.

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.

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