LONDON CAPITAL COMPUTER COLLEGE

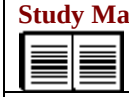
Diploma in Routing (111) – IP Routing Technology

Prerequisites: Knowledge in Windows operating system.	**Corequisites:** A pass or higher in Certificate in Networking or equivalence.
Aim: The aim of this course is to provide candidates with in-depth routing terminology knowledge that will increase understanding. Most candidates only learn routing terminology when implementing Cisco routers. This gives them a lot of pressure (from setting up the equipment they are not familiar with to learning terms they have never heard of before – all this becomes too much). The IP Routing Technology course introduces routing on a platform most comfortable and familiar to many – Windows; and introduce all routing terms in advance before the **Connecting Routing Devices** course. This course breaks IP routing technologies into two fundamental pieces: an in depth study of Interior and then Exterior Gateway Protocols (IGPs and EGPs). The IGPs investigation focuses on the study of early versions of Distance Vector Protocols and then the technical details of the modern Link State Protocols such as Open Shortest Path First (OSFP). The EGP investigation focuses on the current version of the Border Gateway Protocol (BGP4) and its use on the Internet. This course is a map through the jungle of IP Routing technology, focusing particularly on the theory of routing to give candidates an insight understand before embarking on the practical course (Connecting Routing Devices). The course analyzes routing from both a functional and an operational perspective, helping the candidate make an informed assessment of the merits of routing as an enabling technology. According to various Internet Statistics gathered by several resources like Network Wizards, the number of hosts in the Information Highway, "The Internet", grows exponentially every year! Moreover, new high-bandwidth applications arise (like "Web-TV") or will arise, imposing high "Quality of Service" demands on ISPs (Internet Service Providers). Therefore, current and future strong demands for high baud/throughput rates per user, as Internet usage increases, require network technology to adapt quickly to the new needs. In this course, we will examine the factors which restrict or will restrict future required capacity of the network. Those restrictions are based primarily on the bounded capability of future IP (Internet Protocol) routers, to forward "quickly enough" incoming packets to the proper destinations, due to several physical limitations, like finite (not zero) memory access time (needed for searching in the routing table the proper destination port) or switch time (needed to connect input and output ports) of the router. The course describes the current and future "bottlenecks" of IP routing technology and using fundamental quantum mechanical principles. Bandwidth limitations are also considered. However, they are not so critical as the routing ones, as the course will prove!	
Required Materials: Windows Server Operating System	**Supplementary Materials:** Lecture notes and tutor extra reading recommendations.
Special Requirements: The course requires a combination of lectures, demonstrations, discussions, and hands-on labs using Windows.	
Intended Learning Outcomes: 1. Describe the OSI model concept and how networks and network application communicate. 2. Describe the Internet Protocol (IP) suite of communications protocols and the principal communications protocol used for relaying datagrams (also known as network packets) across an internetwork.	**Assessment Criteria:** 1.1 Outline the seven layers of the ISO model 1.2 Analyse how the OSI model works 2.1 Define Internet Protocol (IP) 2.2 Define IP network 2.3 Distinguish the IP hosts (servers and clients) 2.4 Define an IP address 2.5 Distinguish classful and classless IP addressing 2.6 Distinguish public and private IP addressing

	2.7 Outline DHCP address assignment process 2.8 Identify the World Regional Internet Registries 2.9 Explore IP subnetting and supernetting framework 2.10 Outline how the internet infrastructure works 2.11 Describe the history of the internet
3. Describe the several basic concepts that surround the routing process and the concept of a route.	3.1 Outline the routing process 3.2 Analyse static routing configuration 3.3 Explore the routing table entries 3.4 Examine the route lookup process 3.5 Define the concept of network renumbering 3.6 Outline the IP datagram structure 3.7 Describe unicast, broadcast and multicast 3.8 Be able to use Windows route command 3.9 Analyse the functions of a router 3.10 Outline routing, routed and non-routable protocols 3.11 Distinguish distance vector and link state routing 3.12 Define CIDR notation
4. Describe the basic functionality of a routing table, how routers work and what happens when data is transmitted from one router to another.	4.1 Identify how messages flow between networks 4.2 Analyse how network traffic is directed 4.3 Define how packets are transmitted 4.4 Analyse how routers configure the paths that packets take 4.5 Outline how packets are routed 4.6 Identify how routers know where to send data 4.7 Distinguish logical addresses from MAC addresses 4.8 Be able to use traceroute command 4.9 Describe denial of service attacks 4.10 Analyse the internet backbone
5. Demonstrate how algorithms aid the process of path determination and differences between algorithms that use static routes and dynamic routes.	5.1 Identify the functions of routing algorithm 5.2 Distinguish link-state and djikstra algorithm 5.3 Describe distance vector algorithms 5.4 Analyse hierarchical routing
6. Describe the term routing and analyse routing in both Windows and Cisco routing environments.	6.1 Describe routing terms 6.2 Analyse router routing process and associated problems 6.3 Analyse routing protocols foundations 6.4 Identify terms and addressing concepts in internetwork 6.5 Describe redundant IP routing 6.6 Analyse Windows operating system IP routing features 6.7 Describe end-to-end IP routing
7. Describe how Routing Information	7.1 Describe RIP convergence behaviour

Protocol (RIP) provides the standard IGP protocol for local area networks, and provides great network stability.	7.2 Distinguish RIPv1 and RIP v2 7.3 Describe RIP routing process
8. Demonstrate how Interior Gateway Routing Protocol (IGRP) supports multiple metrics	8.1 Outline IGRP characteristics 8.2 Analyse IGRP stability features 8.3 Analyse IGRP timers 8.4 Describe the differences between IGRP and RIP
9. Describe Enhanced Interior Gateway Routing Protocol (EIGRP) characteristics and improvements over IGRP.	9.1 Explore EIGRP metrics 9.2 Analyse the features of EIGRP 9.3 Identify how EIGRP works 9.4 Outline how EIGRP operates 9.5 Describe EIGRP message timers 9.6 Describe Diffusing Update Algorithm (DUAL)
10. Describe the characteristics of Open Shortest Path First (OSPF) routing protocol compared to EIGRP.	10.1 Describe OSPF operation 10.2 Explore OSPF synchronisation process 10.3 Be able to identify OSPF areas 10.4 Identify OSPF operations in broadcast and non-broadcast networks 10.5 Explore OSPF virtual links 10.6 Analyse OSPF networks 10.7 Describe OSPF stub areas 10.8 Describe OSPF external routes 10.9 Be able to troubleshoot OSPF
11. Describe Intermediate System to Intermediate System (IS-IS) routing technology	11.1 Analyse IS-IS addresses 11.2 Define OSI network terminology 11.3 Analyse OSI routing operation
12. Describe Border Gateway Protocol (BGP) routing protocol characteristics and implementations.	12.1 Define BGP 12.2 Distinguish eBGP and iBGP 12.3 Describe BGP AS numbers 12.4 Analyse BGP peering process 12.5 Outline BGP AS-Path attributes 12.6 Describe BGP finite states 12.7 Analyse BGP messages 12.8 Outline BGP path selection algorithm

Recommended Learning Resources: Internetwork Infrastructure

Text Books	• Cisco Routers for IP Routing by Innokenty Rudenko ISBN-10: 1576104214 • IP Routing Protocols - RIP, OSPF, BGP, PNNI & Cisco Routing Protocols by Uyless N. Black ISBN-10: 0130142484 • Operations and Management in IP-Based Networks by Petre Dini, Jürgen Schönwälder, Thomas Magedanz and Edmundo R.M. Madeira ISBN-10: 3540293566 • IP Network Design (Networking Series) by Cormac Long ISBN-10: 0072129999
Study Manuals 	BCE produced study packs
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Tel: 0044 7423211037
Email: info@londoncomputercollege.co.uk Website: www.londoncomputercollege.co.uk
Registered No: 3267009 (England)