Unit 39: Network Management

Unit code	**F/618/7463**
Unit level	**5**
Credit value	**15**

Introduction

Network management has become one of the most sought-after skills for government institutions, commercial organisations, financial institutions and academic institutions as they try to run their IT networks in a more cost-effective, efficient and secure way. The art of network management needs to be perfected by those in charge of networks today and in the future, including multimedia applications such as VoIP, IPTV and mobile network, and virtualised environments.

This unit introduces students to simple network planning, configurations, setup, and management, including LAN, WAN, NAT, PAN, MAN, using a variety of tools and methods for managing networks, including network monitoring, network security such as Snort, firewalls and IPS, network protocols and standards such as Simple Network Management Protocol (SNMP), the Network Configuration Protocol (NETCONF), IEEE, MIBII, Remote Network Monitoring (RMON), MDIB & ANS.1, as well as industry's best practices. Students will also be introduced to virtual networks, network operating systems, risk management and cloud network management.

Among the topics included in this unit are: network planning, network configurations, network setup and network management of LANs, PAN, MAN, WAN, NAT, using several tools and methods; network monitoring, network security, network load balancing, network protocols and standards, best practices, virtualisation, network operating systems, network risk management and cloud network management.

On successful completion of this unit, students will be able to plan a network, configure a network, setup a network, manage a network such as a LAN, PAN, MAN, WAN, and conduct network monitoring, network security, network protocols and standards. Students will also be able to apply industry best practices, manage virtualised networks, work with several operating systems vendors and plan and manage network risks and cloud computing. Students will develop skills such as communication literacy, critical thinking, analysis, reasoning and interpretation which are crucial for gaining employment and developing academic competence.

Learning Outcomes

By the end of this unit students will be able to:

LO1 Explore the concepts and principles of network management

LO2 Plan, design, setup and configure a network

LO3 Review the protocols and standards related with networking and network management

LO4 Use tools and methods to manage a network, including network security and risk management.

Essential Content

LO1 **Explore the concepts and principles of network management**

Effective network management activities:

Security, networking technologies, networking topologies, networking protocols, self-learning networks and Service Level Agreements (SLAs).

Automatic management:

Data formats, e.g. JSON (JavaScript Object Notation), YAML (YAML ain't a markup language), XML (eXtensible Markup Language).

Computer to computer communications, e.g. via APIs (Application Programming Interfaces), via REST (Representational State Transfer).

Configuration management tools, e.g. Puppet, Chef, Ansible, SaltStack.

LO2 **Plan, design, setup and configure a network**

Planning and design:

Planning methodology, topological design, protocols, transmission technologies, hardware, network realisation.

Setup and configuration:

Devices, cabling, protocols, ACLs, security and optimisation.

LO3 **Review the protocols and standards related with networking and network management**

Network protocols and standards:

Protocols, including SNMP, NTP, NETCONF, RMON, TCP/IP, HTTP, DNS, DHCP, SSL, IPSec. Standards: IEEE, ITU, ISO, OSI, IANA.

LO4 **Use tools and methods to manage a network, including network security and risk management**

Tools and methods:

NETCONF, CISCO, SNMP, RMON.

Network security:

IPSec, GRE (Genetic Routing Encapsulation), HHTPs, FTPs, DNS, firewall, passwords, cryptography.

Risk management:

Approaches to risk assessment, including risk identification, risk mitigation, risk avoidance, risk management and risk grading, e.g. severity, likelihood, impact.

Troubleshooting and maintenance:

Troubleshooting methodologies for network and IT infrastructure.

Diagnostic techniques and tools to interrogate and gather information on systems performance.

Learning Outcomes and Assessment Criteria

<table>
<tr><th>Pass</th><th>Merit</th><th>Distinction</th></tr>
<tr><td colspan="2">LO1 Explore the concepts and principles of network management</td><td rowspan="4">LO1 and LO2

D1 Critically evaluate a comprehensive network configuration for a predefined network specification.</td></tr>
<tr><td>P1 Investigate network management concepts and principles.

P2 Discuss the implications of automatic network management.</td><td>M1 Evaluate the importance of network management.</td></tr>
<tr><td colspan="2">LO2 Plan, design, setup and configure a network</td></tr>
<tr><td>P3 Produce a comprehensive design of a network according to pre-defined network specification.</td><td>M2 Implement a network design according to a predefined network specification.</td></tr>
<tr><td colspan="2">LO3 Review the protocols and standards related with networking and network management</td><td rowspan="2">D2 Evaluate the role and functions of SNMP and RMON.</td></tr>
<tr><td>P4 Assess the following network protocols and standards: SNMP, NETCONF, RMON, TCP/IP, HTTP, DNS, DHCP, SSL, IPSec, IEEE, ITU, ISO, OSI, including IANA and ICANN.</td><td>M3 Analyse the benefits and limitations of two protocols.</td></tr>
<tr><td colspan="2">LO4 Use tools and methods to manage a network, including network security and risk management</td><td rowspan="2">D3 Critically evaluate the importance of carrying out a risk assessment on a network.</td></tr>
<tr><td>P5 Use tools and methods to manage a network.

P6 Implement network security on a network.

P7 Conduct a risk assessment on a network.</td><td>M4 Justify the importance of network security to a network.</td></tr>
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Recommended Resources

Textbooks

Anderson, A. and Benedetti, R. (2009) *Head First Networking*. O'Reilly Media.

Comer, D. and Droms, R. (2003) *Computer Networks and Internets*. 4th edn. Upper Saddle River: Prentice Hall.

FitzGerald, J., Dennis, A. and Durcikova, A. (2021) *Business Data Communications and Networking*. 14th edn. Hoboken. John Wiley.

Hallberg, B. (2013) *Networking: A Beginner's Guide*. 6th edn. McGraw-Hill Osborne.
Harrington, J. L. (1999) *Ethernet Networking Clearly Explained*. Morgan Kaufman.

Kurose, J. F. and Ross, K. W. (2016) *Computer Networking: A Top-Down Approach Featuring the Internet*. 7th edn. London: Addison-Wesley.

Lowe, D. (2012) *Networking All-in-One For Dummies*. 5th edn. John Wiley & Sons.

Olifer, N. and Olifer, V. (2005) *Computer Networks: Principles, Technologies and Protocols for Network Design*. John Wiley and Sons Ltd.

Reid, A. (2006) *WAN Technologies CCNA 4 Companion Guide*. Cisco Press.

Spurgeon, C. and Zimmerman, J. (2014) *Ethernet: The Definitive Guide*. 2nd edn. O'Reilly Media.

Stallings, W. (2003) *Data and Computer Communications*. 7th International edn. Upper Saddle River: Prentice Hall.

Subramanian, M. (2000) *Network Management: Principles and Practice*. Harlow: Addison-Wesley.

Tanenbaum, A. and Wetherall, D. (2013) *Computer Networks*. 5th edn. Pearson.

Web

www.dmtf.org	Distributed Management Task Force (General Reference)
www.ietf.org	Internet Engineering Task Force (General Reference)
www.iso.org	International Organization for Standardization (General Reference)
www.itu.int	International Telecommunication Union (General Reference)
www.tmforum.org	TM Forum (General Reference)

Links

This unit links to the following related units:

Unit 2: Networking

Unit 9: Computer Systems Architecture

Unit 27: Transport Network Design

Unit 29: Network Security

Unit 40: Client/Server Computing Systems.