

**MOMBASA POLYTECHNIC UNIVERSITY COLLEGE**

**University Examinations 2011**

**SECOND YEAR FIRST SEMESTER EXAMINATION FOR THE DEGREE  
OF BACHELOR OF TECHNOLOGY IN INFORMATION TECHNOLOGY-  
BTECH.ICT 11 M2**

**EIT 4201: NETWORK DESIGN AND IMPLEMENTATION**

**August 2011**

**TIME: 2 HOURS**

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**INSTRUCTIONS**

This paper contains five questions

Answer **Question ONE** and any other **TWO** questions

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Paper 1

**QUESTION 1**

- (a) Outline THREE main uses of a bridge in computer networks  
3 Marks
- (b) State THREE main methods that are used to identify and analyze a customer's existing network environment.  
3 Marks
- (c) State any SIX structured design methodologies  
3 Marks
- (d) Outline any EIGHT Criteria for selecting LAN devices  
4 Marks
- (e) Name FOUR enterprise requirement that may affect the choice of the network design  
4 Marks
- (f) State FOUR types of information that need to be gathered about the existing network.  
4 Marks
- (g) Explain FOUR benefits of wireless network  
4 Marks
- (h) State any THREE security risks in wireless networks  
3 Marks
- (i) Describe Access Control List ACL  
2 Marks

## QUESTION 2

- (a)
- i. State TWO network design approaches
  - ii. Describe each of the design approaches in (a) (i) above
  - iii. Describe ONE advantages of each of the network design approaches in (a) (i)
  - iv. (iv) Describe ONE disadvantage of each of the network design approaches in (a) (i) 10 Marks
- (b) Outline any SIX specific steps involved in any network design project. 6 Marks
- (c) State any FOUR WAN technologies that are available for connecting enterprise resources 4 Marks

## QUESTION 3

- (a) Describe any FOUR common types of technical constraints that a network designer may encounter 8 Marks
- (b) Describe any SIX computer network planning steps 12 Marks

## QUESTION 4

- (a) Outline THREE major classes of IPv4 addresses 3 Marks
- (b) (i) Describe subnet masking  
(ii) Distinguish between sub-net and super-net masking  
(iii) Describe Variable Length Subnet Masking 5Marks
- (c) Explain any EIGHT network trouble shooting steps 4 Marks
- (d) Describe FOUR network troubleshooting tools 8 Marks

## QUESTION 5

- (a) Describe any FOUR data gathering process needs that are considered in any new planned services, applications, and features required for the new or upgraded network 8 Marks

(b) Outline any FOUR details that should be included in implementation plan documentation:  
4 Marks

(c) Explain any FOUR goals of network design 8 Marks

## SCHEME -EIT 4207 NETWORK DESIGN AND IPMLEMENTATION

### QUESTION 1

(a) Outline THREE main muses of a bridge in computer networks 3 Marks

- Improving performance by reducing collisions as there are different collision domains
- Partitioning of faults thus making maintenance easy
- Security improves since different operational sections can be in a different network segment

(b) State THREE main methods that are used to identify and analyze a customer's existing network environment. 3 Marks

- Using existing documentation and interviews with the customer
- Auditing the current network
- Performing network traffic analysis

(c) State any SIX structured design methodologies 3 Marks

- Planning
- Design
- Implementation
- Operation
- Optimization
- Retire

(d) Outline any EIGHT Criteria for selecting LAN devices 4 Marks

- The number of ports required at different levels
- The speed (10Mbps/100Mbps/1Gbps or others)
- Media considerations, such as Ethernet, Token Ring etc.
- Support for different network protocols such as TCP, VOIP etc.
- Ease of configuration, and maintainability
- Management (SNMP etc.)
- Availability
- Documentation

(e) Name FOUR enterprise requirement that may affect the choice of the network design 4 Marks

- Bandwidth requirement
- QoS requirements
- Security requirements
- Application requirements.

(f) State FOUR types of information that need to be gathered about the existing network. 4 Marks

- Network topologies in use at different OSI layers
- Network services currently deployed
- Network configuration including addressing, routing, and equipment configuration
- Network applications in use
- Performance and functionality of the existing infrastructure

(g) Explain FOUR benefits of wireless network  
4 Marks

- Useful in organizations such as hotels, hospitals, and manufacturing units that have constraints for laying cables.

- Useful for small and medium companies that intend to relocate their premises according to needs. There are no cabling costs involved when relocating the Company premises when wireless networking is used.
- Wireless networks are also useful for notebook users in an office environment. Having a wireless LAN in place saves mobile users the hassle of plugging into a docking station every time they want to access the network. Instead, they can access the network from anywhere in the building.
- Warehouse Inventory management: It is possible to update the inventory in real time by using notebook computers with barcode readers. The inventory is updated in real time as the products come and go out of the storage space.

(h) State any THREE security risks in wireless networks

3 Marks

- Insertion Attacks- it involves the process of placing unauthorized devices on the wireless network without going through a security process and review.
- Interception and monitoring wireless traffic: An attacker can sniff and capture legitimate traffic. By encrypting the data this type of attack can be minimized.
- Jamming: Its similar to DoS (Denial of Service) attacks, a wireless network may be subjected to jamming, where legitimate traffic gets jammed because illegitimate traffic overwhelms the frequencies, making it impossible for timely flow of legitimate traffic.

## QUESTION 2

(a)(i) State TWO network design approaches

- Top down approach
- Bottom up approach

(ii) Describe each of the design approaches in (b) (i) above

- In a top-down approach, it looks at a project starting with the general applications required.
- It focuses on determining what the goals of the network are from an Application Layer perspective, namely the applications or services required. For example, an organization might want to implement or upgrade a network to support new applications like Voice over IP (VoIP), IP multicasting, and so forth.
- The top-down approach is solution-oriented, focusing on the specific business and technical goals of an organization. Technologies needs are considered, later in the design process.

### The Bottom-Up Approach

- Instead of focusing on the applications that drive the need for a new or redesigned network, this approach tends to start lower in the OSI model, worrying about issues like specific technologies, protocols, network media, and so forth.

- It leaves applications and services as an afterthought to be considered later. After all, the network won't do anything without the necessary equipment, or so popular thinking goes.
- Require a less thorough initial analysis, and is easier to implement as a quick fix. Ultimately, however, the bottom-up approach is seldom truly successful, as it tends to rely on a number of fixes along the way in order to deal with issues that were not initially considered.

(iii) Describe ONE advantages of each of the network design approaches in (b) (i)

(iv) Describe ONE disadvantage of each of the network design approaches in (b) (i)  
10 Marks

(i) Outline any SIX specific steps involved in any network design project  
6 Marks

- Identifying customer requirements
- Identifying and analyzing the current network
- Designing network topologies and services
- Planning the network implementation
- Proof of concept (building pilots or prototypes)
- Documenting the network design
- Implementing and verifying the network design
- Monitoring and revising the network design

(j) State any FOUR WAN technologies that are available for connecting enterprise resources

4 Marks

- Leased lines
- Synchronous Optical Network (SONET)
- Frame Relay
- Asynchronous Transfer Mode (ATM)

### QUESTION 3

(a) Describe any FOUR common types of technical constraints that a network designer may encounter

8 Marks

- **Bandwidth or media limitations.** In any network design project, it is conceivable that certain parts of a network cannot be changed for a variety of reasons. For example, an organization might have a LAN installed in a factory that uses 10 Mbps fiber optic cabling that they are not willing to replace, perhaps for budgetary reasons. In this case, the available media and bandwidth represents a technical constraint that must be circumvented, since replacement is not an option
- **Application limitations.** The applications currently used by an organization can have a significant impact on a network design project. For example, the customer may rely upon a particular program that can only function using a specific protocol like NetBEUI. In this case, the application would either need to be replaced, or the design would have to include support for the NetBEUI protocol. In a similar manner, a customer might still be using an older operating system like Novell NetWare 3.11 for an accounting application, necessitating that the design include the IPX/SPX protocol.
- **Personnel limitations.** Even in cases where an organization has sufficient staff to allocate to a project, it is possible that these staff members do not have the technical expertise required to help implement the new network or manage it once complete. This is another example of a technical constraint that may need to be dealt with by obtaining additional training for the staff, hiring additional staff, or revising the scope of the project.

**Existing equipment.** Over time, companies invest in a variety of different network equipment to meet different needs. Although some companies can afford to replace all existing equipment as part of a network

(b) Describe any SIX computer network planning steps

12 Marks

1. Identifying the applications that you intend to use: Computer networking may be required in diverse environments such as Enterprise Resource Management (ERM), Internet telephony, Instant Messaging (IM), eMail and others. It is important to discuss the applications that you intend to use, such as the above. These in turn are used for estimating the software, hardware, and traffic requirements.

2. Traffic Requirements: Computing traffic requirements include several factors. A few points to consider include the following:

- Identification and documentation of major traffic sources.
- Categorization of traffic as local, distributed, client/server, peer-to-peer, terminal/host or server/server.
- Estimation of bandwidth requirements for each application.
- Quality of Service (QoS) requirements for each application
- Reliability requirements.

3. Scalability Requirements: Scalability refers to the extent of network growth that should be supported. For corporate network, scalability is a major consideration. Provision must be made to add users, applications, additional sites, and external network connections.

4. Geographical considerations: Consider the LAN and WAN links that may be required. Offices that are separated by large distance (for example one in Delhi and another in New York) can be linked together by a WAN (Wide Area Network) link. Similarly, building complexes within a compound can be linked by a LAN (Local Area Network) link. Typically, the LAN links are high bandwidth (10Mbps and above) and WAN links are of lower bandwidth (64 Kbps - 2Mbps). Further, the LANs fall within the premises of a Company whereas WANs are typically leased and maintained by the Telecom. Hence, WANs are costly in bandwidth terms and need to be planned and designed with utmost care to minimize resource consumption.

5. Availability: The availability of a network needs to be given careful consideration while designing a network. It is the amount of time a network is available to users over a period of time and is often a critical design parameter. Availability has direct relation with the amount of redundancy required. Another important factor that needs to be considered when computing availability requirements is the business loss to the Company due to unavailability of the network for a given amount of time. A right balance needs to be arrived at such that the profitability is maintained.

6. Security and Accessibility: Security and accessibility are among the important design phase steps. A security plan needs to be devised that meets the required security specifications. You must specify:

- a list of network services that will be provided such as FTP, Web, e-mail, etc.
- Who will be administering the security of these services
- How to train the people on security policies and procedures
- Recovery plan, in case a security breach does take place.

7. Cost considerations: For LANs, the tendency is to minimize the equipment cost. That is minimizing the cable cost, minimizing the per port cost, and the labour cost. For WANs the primary goal is to minimize the usage of the bandwidth. The recurring costs for bandwidth are normally much higher than the equipment or labour cost. Therefore more weightage is given to reliable equipment, and efficient utilization of bandwidth. Some factors that optimize cost are:



- Improve efficiency on WAN circuits by using features such as compression, multiplexing, Voice Activity Detection etc.
- Use technologies such as ATM that dynamically allocate WAN bandwidth.
- Integrate both voice and data circuits
- Optimize or eliminate under utilized circuits.

#### QUESTION 4

(a) Outline THREE major classes of IPv4 addresses

Class A first octet range 1-126 has many hosts

Class B first octet range 128-191 has middle range hosts

Class C first octet range 192-223 has few host (256)

3 Marks

(b) (i) Describe subnet masking

(ii) Distinguish between sub-net and super-net masking

(iii) Describe Variable Length Subnet Masking

5Marks

(c) Explain any EIGHT network trouble shooting steps

4 Marks

Troubleshooting network problems involve the following steps:

- Identification of the symptoms.
- Identification of the user competence
- Identification of the scope of the problem.
- Recreation of the problem.
- Verification of the physical integrity of the network connection starting at the affected nodes and moving towards the backbone.
- Verification of the logical integrity of the network connection.

**NB.** This entails considering the recent changes to the network and how those changes might have caused a problem.

(vii) Implementation of a solution.

(viii) Testing the solution

(d) Describe FOUR network troubleshooting tools

8 Marks

A number of trouble shooting tools are available for the purpose of network management.

- (i) Cable checkers are used to determine whether the network cables or cabling can provide connectivity.
- (ii) Cable taster – this performs the same continuity and fault test as a cable checker but also provide the following functions.
  - a) Ensure that the cable is not too long.
  - b) Measure the distance to a cable fault
  - c) Measure attenuation (decline) in signal strength along the cable.
  - d) Measures near-end crosstalk between wires.
  - e) Measures termination resistance and impedance for cabling.
  - f) Stores and prints cable tasting results.
- (iii) Network analyzers – this refers to H/W based tool that network manager connects to the network expressly to determine the nature of network problems. The example of network analyzer is called Net X Ray – provide data capture and analysis, node discovery, traffic trending history and utilization prediction.
- (iv) Network monitors – are S/W based tools that continuously monitor traffic on the network from a server or workstation attached to the network. The example of the network monitor is Microsoft's Network monitor (Netmon.) Netmon is a S/W based monitoring tool that come with windows NT. The network provide the following capabilities:
  - a) Capturing network data travelling from one or many segment
  - b) Capturing frames send by or its specified nodes.
  - c) Reproducing network conditions by transmitting a selected amount and type of data.
  - d) Detecting any other running copies of netmon on the network.
  - e) Gathering statistics about network activity.

#### QUESTION 5

- (a) Describe any FOUR data gathering process needs that are considered in any new planned services, applications, and features required for the new or upgraded network

8 Marks

- **Security services.** Examples of security services that a company might be looking to implement as part of a new or redesigned network include authentication services like RADIUS, firewalls like a Cisco PIX, or IPSec VPN connections between offices.
- **Network management applications.** Examples of network management applications that a company might be looking to deploy include elements of the CiscoWorks suite, HP OpenView, and other SNMP-based utilities.
- **Network availability.** One of the most common requirements specified by customers includes the need for high network availability in order to provide redundancy. This can be accomplished in a variety of ways, including through the use of redundant links to interconnect equipment.

- **Advanced service support.** Customer requirements for a new or upgraded network may include the need to support features like Quality of Service (QoS) and IP Multicasting.

(b) Outline any FOUR details that should be included in implementation plan documentation:

4 Marks

- Detailed descriptions of each step, in order to reduce any issues associated with misinterpretation on the part of engineers.
- References to other parts of the design document for more information as required.
- Implementation guidelines that outline issues such as any other configuration settings that a particular step is dependent upon. For example, the details of configuring OSPF on a router might depend upon basic router settings having been already completed.
- Estimated time required for each step, so that the implementation can be scheduled effectively.
- Detailed fallback instructions that can be carried out in cases where the steps result in a serious network problem or failure.

(c) Explain any FOUR goals of network design

8 Marks

- **Functionality:**
- Must allow users to meet their job requirements, it must provide user to user and user to application connectivity, with reasonable speed and reliability.
- **Scalability**
- The network must be able to grow, that is the initial design should grow without any major changes to the overall design.
- **Adaptability**
- The network must be design with an eye towards future technology and should include no elements that would limit implementation of new technology as they become available.
- **Manageability**
- The network should be design to facilitate network monitoring and management to ensure ongoing stability of operation
- In order for a network to be effective and serve the need for its users, it should be implemented according to systematic series of planned steps.

## University Examinations 2011

### SECOND YEAR /FIRST SEMESTER EXAMINATION FOR THE DEGREE OF BACHELOR OF TECHNOLOGY IN INFORMATION TECHNOLOGY

EIT 4207: NETWORK DESIGN AND IMPLEMENTATION  
August 2011

TIME: 2 HOURS

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#### INSTRUCTIONS

This paper contains five questions

Answer **Question ONE** and any other **TWO** questions

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Paper 2

#### QUESTION 1

- (a) Describe Bluetooth wireless networking 2 Marks
- (b) Name FOUR advantage of hardware firewall 2 Marks
- (c) Explain FIVE guidelines of staying safe on a social network service  
5 Marks
- (d) State THREE benefits of wireless networks 3 Marks
- (e) Outline any SIX elements of structured network design methodology  
3 Marks

- (f) Name FOUR WAN technologies that are available for connecting enterprise resources  
2 Marks
- (g) Name any FOUR factors that determine the technology that suits an enterprise requirement  
2 Marks
- (h) State SIX criteria for selecting network a devices  
3 Marks
- (i) Distinguish between bottom-up and top-down Network design approaches  
4 Marks
- (j) Explain FOUR factors that can optimize the cost of a network 4 Marks

#### QUESTION 2

- (a) Describe the role of a network designer 2 Marks
- (b) Describe FOUR technical constrains that network designers encounter in their work  
8 Marks
- (c) Describe any FIVE key steps in network design 10  
Marks

#### QUESTION 3

- (a) Describe FOUR tools that are used to gather auditing information in network design  
4 Marks
- (b) Outline FOUR common types of applications, services or features that a company might have defined as requirements for a new or upgraded network  
8 Marks
- (c) Describe the following terms in reference to computer network planning  
8 Marks
  - (i) Traffic requirements
  - (ii) Geographical considerations
  - (iii) Security and accessibility
  - (iv) availability

#### QUESTION 4

- (a) Name FOUR security provisions 2 Marks
- (b) (i) Outline ONE advantage of top-down network design approach
- (ii) Outline ONE disadvantage of bottom-up network design approach 2 Marks
- (c) Describe THREE network design tools 3 Marks
- (d) Describe THREE methods that are used in identifying and analyzing the current network 3 Marks
- (e) Describe FOUR types of firewalls 4 Marks
- (f) Describe the following terms as applied in network design and implementation 6 Marks
  - (i) Remote access requirements
  - (ii) Testing
  - (iii) Documentation

#### QUESTION 5

- (a) (i) Outline ONE advantage of bottom-up network design approach
- (ii) Outline ONE disadvantage of top-down network design approach 2 Marks
- (b) (i) Describe Virtual Private Networks VPN
- (ii) Explain FOUR benefits of VPN 10 Marks
- (c) Describe the following terms as applied in network design and implementation 8 Marks
  - (i) Functionality
  - (ii) Scalability
  - (iii) Manageability
  - (iv) adaptability