Module Code:	**CT4005NI**
Module Title:	**Computer Hardware and Software Architectures**
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Test Type:	**SEEN EXAM**
Materials supplied:	None
Materials permitted:	Writing equipment only
Warning:	Candidates are warned that possession of unauthorized materials in a test is a serious assessment offence.

Instructions to candidates:	
	This test accounts for **50%** of your total module grades.
	You are to **submit this test paper**, in the google classroom.

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Question A:

Answer the following in your own words.   [10]

1. What is Heat Sink? What is the use of Heat Sink? Where can we find the Heat Sink in a computing device? If a user does not install a heat sink in the system, then what will happen? Explain in detail.

Answer:

In modern world where billions of calculations are done within a millisecond by super computers, often time overheating is a problem, in that case different kinds of Heat sinks have been manufactured and used as the best way of thermal control.

A heat sink is an effective tool for cooling the processor and other components by drawing away heat from the hardware components. It is usually a small aluminum or copper plate with fins attached to it, which is located inside a computer case and connected to the motherboard so that it can draw heat from them there by cooling the components and increasing the lifespan of the computer device.

The heat sink can be used in any electronic devices that require a solution to its overheating problems. In general devices are fitted with heatsink to prevent the heat from damaging the crucial and peripheral components in a computer system. Heat sink are usually placed on the mother board of a computer system of on the component that gets most heated up when performing computing tasks. It is mostly attached with a thermal paste that allows the heatsink to absorb the heat from the device and dispatch it away through the air, water or other medium.

The components that generate most heat in a computing devices are its CPU, the Graphics card: (video card) and power supply so in most cases heat sink are placed along them to reduce the core temperature of the component and prevent any sort of damaging.

The CPU starts heating up as soon as the power is supplied to the computer soon the Graphics card and mother board and other components heat up the same way. The heat sink if placed helps keep the core temperature of the CPU to a minimum. In cases where heat sink is not used the overheating of CPU due to the micro transistors soaking up electricity and releasing out thermal energy which will cause its failure and can cause a short that will destroy traces on the mother board, ram graphics card, other input output devices and can cause them to be destroyed to the point of no return. In cases the main CPU chips catch fire and light up causing the whole computer to get damaged and become an un useable waste. Modern laptops and premade Computers come attached with a heatsink that is replaceable on user's choice.

Heat sinks are usually of 2 types namely Active and Passive, Active heat sinks are the ones that come are attached with thermal paste that uses water cooling or a fan cooling system to dispatch heat away, these are powered by the power supply units in the computer, the passive heat sinks are the ones that have structures such as walls or fins arising from the bottom that dispatch heat away from the CPU into the ambient air. However, where fans and water coolers have in built coolers that helps take heat away from the main components, passive heat coolers dispatch the heat to the surrounding air so users often have a fan with a passive heat sink to maintain constant air flow through the heat sink.

2. Why is Internetworking? What devices can be used to connect multiple devices on a same local area network? Explain in brief. [10]

Draw a diagram that will show your version of internetworking. You can use any tools like MS Visio or packet tracer for diagrams.

Answer:

Internetworking is the process or technique of connecting different networks by using intermediary devices such as hubs, switches and routers or gateway devices. Any interconnection among or between public, private, commercial, industrial, or governmental computer networks can be defined as internetworking too. Networking devices such as Hubs Switches Routers share the data packets through the network following various networking protocols like TCP/IP devices used are

Hubs: A network hub is a node that broadcasts data to every computer or Ethernet-based device connected to it. A hub is less sophisticated than a switch, acting as a repeater that amplify weakened signals hub is the one of the simplest form of wired data transmission in the networking topology.

Switches are networking devices operating at layer 2 or a data link layer of the OSI model. They connect devices in a network and use packet switching to send, receive or forward data packets or data frames over the network. A switch has many ports, to which computers are plugged in. they keep limited routing info. about internal network and facilitates connection to other components of the network. Switches are commonly used to link LAN strands

Routers: A router is a layer 3 or network layer device. It connects different networks together and sends data packets from one network to another. A router can be used both in LANs (Local Area Networks) and WANs (Wide Area Networks). It transfers data in the form of IP packets. Routers may come with inbuilt packet filtering feature with access control lists (ACLs)
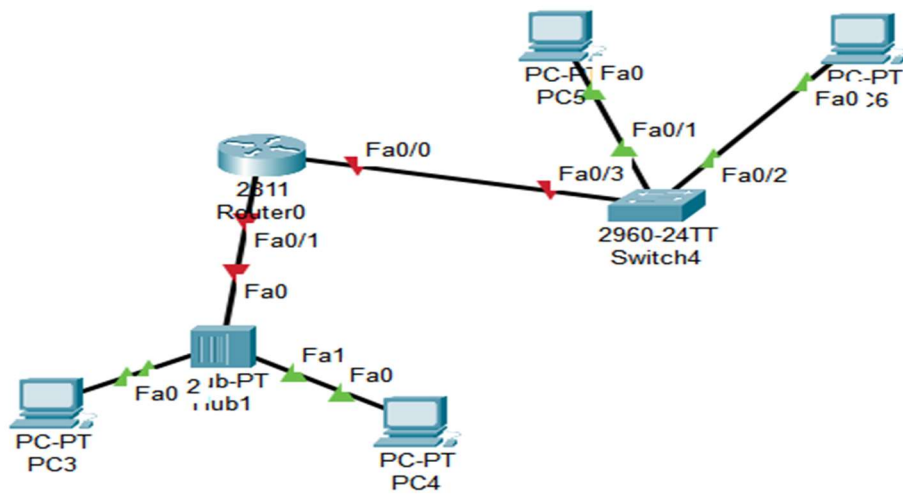
Figure 1: Basic example of internetworking

3. What is the OSI reference model? What is the relation between OSI reference model and internetworking? Explain in brief.   [5]
   Answer:

   The OSI Model is a logical and conceptual model that defines network communication used by systems open to interconnection and communication with other systems. It describes how information from a software application in one computer moves through a physical medium to the software application in another computer

   Transmission control protocol and Internet protocol is a communications architecture used for networking computers and to communicate across the Internet. TCP allows for reliable communication between two applications. TCP is typically used over the Internet Protocol, which is referred to as TCP/IP.

   The OSI model is divided into two groups upper layer and lower layer and seven different layers: The Application Layer: communicates with the host , The Presentation Layer: presents the data and coding , The Session Layer: keeps application and data separated , The Transport Layer: performs the delivery of data, The Network Layer provides logical addressing and maps shortest route for data transfer , The Data Link Layer access media using MAC address , The Physical Layer sends and receives bits from the host or client

   Internetworking relies on the TCP/IP model for data transmission it has 4 layers in comparison to the OSI model as it uses both session layer and presentation layer in application layer itself also the Data link and Physical layer in OSI model is merged into single Link layer in TCP/IP model

   The OSI model and TCP/IP model both are logical model that define the standard of networking and provide a framework for creating and implementing networking standards and devices, however the OSI model is outdated and TCP/IP model has come to replace it. Updated TCP/IP model has defined new ways of internetworking.

Question B:

1. **Case Study**
   Objectives
   Setup a Network for a company.
   Background
   Very Code is a privately owned, well-known Software company located in Kathmandu. The Management of Very Code has purchased a 3 story building in the heart of Kathmandu valley. They are planning to make it one of the state-of-the-art companies in Nepal with the latest facilities. It is expected to have nearly 150 employees in the Kamalpokhari branch.

Department	Number of Users
Customer Care	5
Sales and Marketing	25
Finance	20
Legal	10
HR	5
Developers	60
Network Team	5
Total 120 computers	

Part 1: Draw a Logical Setup/Network diagram that will show the network topology of the company. You can use any tools like MS Visio or packet tracer for diagrams.   [15]

Answer:
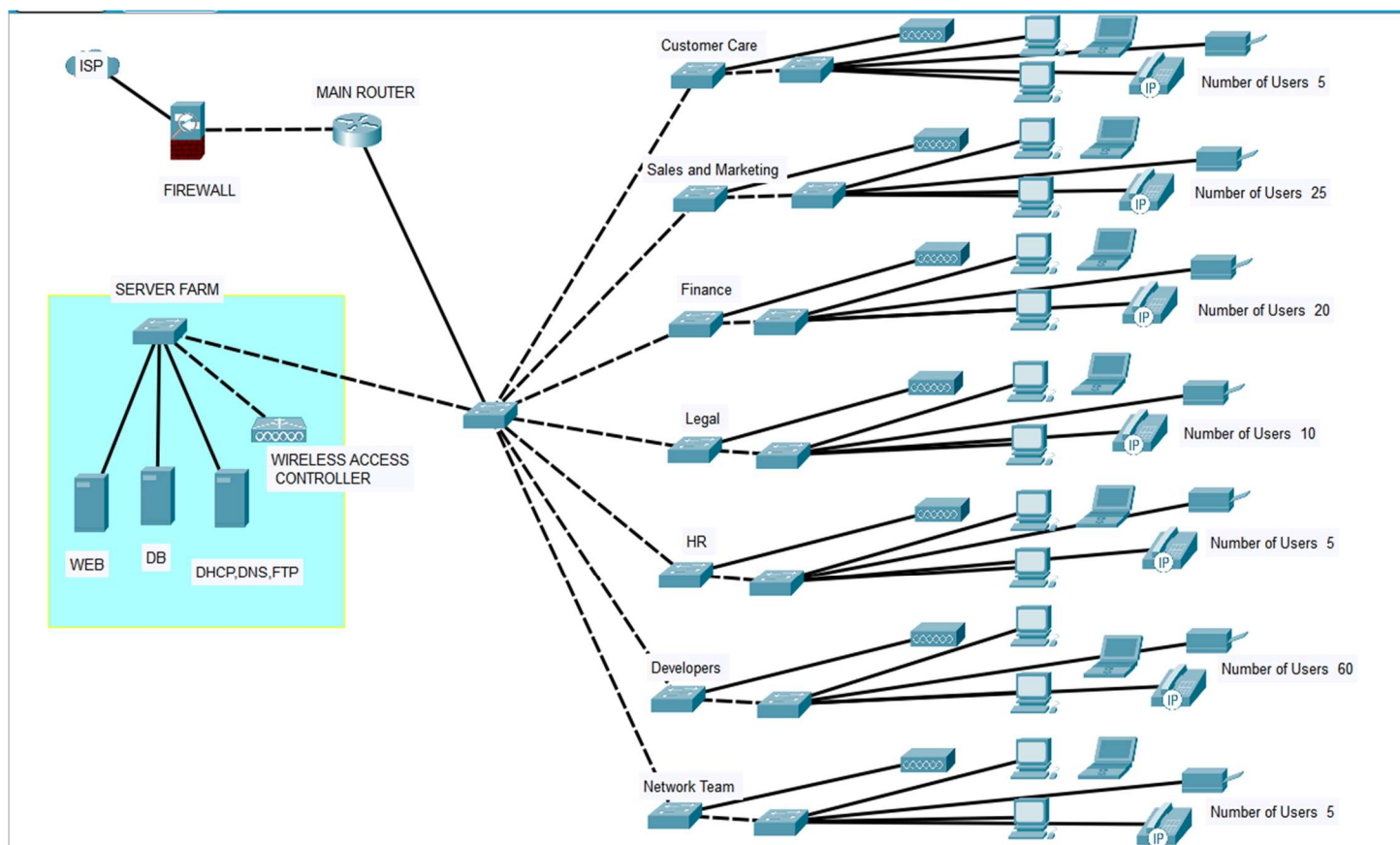
Figure 2: NETWORK TOPOLOGY FOR VERY CODE

Part 2: Discuss the operating principles of network devices that can be used for the above scenario with their particular use case. Ex: Router, Switch, Etc. [15]

Answer:

Firstly, the company brings the internet connection from the ISP in fiber optics it is passed through the firewall to prevent any unwanted network traffic and unauthorized users and other objections to enter in the company network. Then the fiber cable is extended to the Edge router which is the main router from which all the internet connections are provided to the main switch server farm, and serially departmental switches.

The connection goes to the main switch through which the connection is divided among the departments. The switch sends an internet connection to a server farm that contains all the servers DNS DHCP WEB FTP and wireless controller these are the main server room that keep the internet connections and servers for different departments up and running at all times.

The main switch divides the internet connection to 7 different switches that represent each department i.e. The Customer Care, The Sales and Marketing, The Finance, The Legal, The HR, The Developers and The Network Team contained within the 3 floors of Very code company.

Each Departmental Switch is extended to a new switch and a wireless access point for every department. All the wired devices that require cable connection such as computers, desktops scanners, printers, telephones and other computing devices are provided stable internet through the switch extended from the departmental switch, whereas the wireless devices use the wireless access point.

The Domain Name System DNS server in the company ensures the Internet is not only user-friendly but also works smoothly, loading the content in the company's website users ask for quickly and efficiently by mapping and connecting websites in the network traffic.

The File Transfer Protocol FTP is a standard communication protocol used for the transfer of computer files from a server to a client on a computer network.

Dynamic Host Configuration Protocol - DHCP - the entire process of configuring devices on a network gets automated. With very little or no administrator intervention it is easy to accommodate new devices to the network A DHCP Server is a network server that automatically provides and assigns IP addresses, default gateways and other network parameters to client devices. ... DHCP servers usually assign each client with a unique dynamic IP address, which changes when the client's lease for that IP address has expired.

Wireless Access Controller controls the authorization of users on the network by providing each user with specific level of hierarchy.

With involvement of these servers and devices the network topology for Very Code Company is complete

Part3: Discuss the importance of Servers in computer networks and research on Servers that are available in today's market with their specifications and Recommend server/servers and workstations for above scenario and justify your selection with valid points. [15]

Answer:

Each computer network big or small needs a main functional body to control all its data authorization and connection to and from the data base. Hence creating a need for servers in computer networks. Companies wishing to incorporate large scale of users and databases need very powerful servers where as small companies require relatively less powerful servers.

However, the use and requirement of servers for each companies are for the same reasons. Sharing information privately is one of the sole reasons companies install a server so as to maintain its privacy within the company and its clients.

Buildup of large files take up huge spaces that cannot be fulfilled by few SSD HDD there by requiring servers that contains numerous storage devices to store the company's data bases which can be fulfilled by using a server.

Another important reason is to control user access and data security each company has its own level of authorization and hierarchy in order to maintain this the use of servers are optimum so as to provide access to certain database of companies according to the level of hierarchy of the user accessing it.

Servers are important to cut down on costs to as without servers where one would be needing each single peripheral devices such as printers, scanners and other items. A server can act as a host and large no. of users can use the same computer database, same printers, scanner for various purposes.

It is important to keep updating computing devices time to time …in cases where each computer in a network needs to be updated 1 by 1 is tiring and time consuming but use of servers the admins can easily roll out a total system update and all the computers in the network get updated automatically.

For a company willing to buy a data center server

- Dell HPE Servers Have the Largest Market Share and are efficiently best performing servers out there
  1. Dell PowerEdge T30
  A Xeon dream with plentiful connectivity on offer
  SPECIFICATIONS
  CPU: Intel Xeon E3-1225 v5
  Graphics: Intel HD Graphics P530
  RAM: 64GB
  Storage: Up to six SATA HDD
  Connectivity: 10 x USB ports, HDMI, DisplayPort, VGA, serial, PS2, Gigabit Ethernet
  Dimensions (W x D x H): 17.5 x 43.5 x 36cm
  This is one of the best servers in the market a fully-fledged and configured server at the price of around $1500 would work wonders for Very Code company it has enough room for 150 employees and possibilities for further expansion too

- For stable internet connection any local ISP would be okay if you have a dedicated line for internet access rather than normal public cables. This allows the company to escape the network traffic that general public face and have uninterrupted internet connection. The ISP would allow for creation and connecting the DNS server to the webserver and further processing
- The Apache HTTP Server is hands down one of the best web server. The Very Code company can resolve the server name to an IP address so that the website can be configured in Apache HTTP Server either through the company technicians or contacting the IPS.
- Workstations are used primarily to perform computationally intensive scientific and engineering tasks. They have also found favor in some complex financial and business applications.

Dell workstation computers are known for reliability, performance, and scalability. And the Precision 7920 Tower does not disappoint on those and other qualities.

The processor is the latest Intel Xeon vPro Scalable family with up to 28 cores per processor. But you can bring the total to 56 cores when customized with Dual processors.

You can see the scalability on the RAM side with up to 3TB of 2666 MHz RDIMM/LRDIMM expandable memory (requires dual processors) but you get 64GB to start with.

There is a 1TB + 256B SSD of storage, NVIDIA Quadro P2000, 5GB, 4 DP (7X20T),

and multiple ports and slots. There are two USB 3.2 ports Type A, USB 3.2 Type-C port with Power Share, USB 3.2 Type-C port, 5x USB 3.2 Type-A ports, expansion card slots, and more.

So above mentioned workstation with any desktop of 120hz or more would be more than enough for the Very Code company to operate its functionality in full fledged manner.

Question C:

1. **Write your Troubleshooting steps to carry out in the given cases.   [10 X 3 = 30]**

   I.   Resolution is very low in the computer system.

   Answer: often Resolution problem are caused by faulty or out-updated drivers.

   1. UPDATING DRIVERS: Press win+r, Enter "devmgmt.msc" (without quotations) and on display adapters head to propertied and update driver to latest patch.
   2. Sometimes the drivers used to run the monitor or the screen may not be updated to the latest. As in step one head over to the monitors section instead of display adapters and try installing the latest patch for drivers.
   3. The faulty hardware or the wiring can also cause problems of low resolution. Make sure to check the wiring are don't correctly and there is not faulty hardware device.
   4. If the above steps do not troubleshoot the problem, try contacting a technician or a trained professional for assistance.

   II.   You have upgraded the GPU, but the system is not detecting.

   Answer:

   1. Make sure to update your graphic drivers and have it updated to the latest patch for best functionality or re-install it.
   2. After that The first point of call when the GPU is not detected is to check for installation in its slots. Make sure the Graphic card is installed properly in the motherboard. Remove the GPU and inspect the motherboard PCI-E slots for any faults or visible damages. Re-install the GPU and Reboot the PC.
   3. If the above process doesn't work, try re-installing in the alternative slot.
   4. Check for cable connections to and from your motherboard to the monitors.
   5. According to your computer documentation try updating the BIOS or restoring the BIOS to its default (use the original computer documentation for this sensitive task as it may cause problems in your computer if don't incorrectly)
   6. Seek professional assistance

   III.   Your system has been infected with encryption malware.

   Answer:

   Your best bet in computer protection is to have a good updated antivirus software running full time.

   1. Identify what kind of encryption malware is it. A genuine one or just an imposter.
   2. Disconnect your machine from any other external devices and log out your computer from any other remote access points.
   3. Try to check for deleted filed and see if recovery is possible. There are several decryption tools available to use in case your files get encrypted.
   4. In case the computer is already affected. Try to reboot the system in safe mode and install an antivirus software, scan the system to file the malware filed and restore the

computer to previous saved restore point. This method is a hard wire method and you may not be able to recover your filed through method. It is used to prevent further damage to your files.

5. Seek assistance from cybercrime department or trained professional.

IV. Your read/write speed has decreased in SSD dramatically Answer:

1. Check the TRIM command: this checks for saved cache of deleted filed and removes them from the SSD
2. Optimize drivers: Drivers for SSD needs to be defragmented in order to save space and prevent the filed from clogging up big spaces in the SSD
3. Configure Boot order: Restart your computer and boot into BIOS Change the boot sequence of HDD and SSD by giving first priority to SSD
4. Check the SATA port and Verify the SATA cable
5. Contact a trained professional for further assistance.

V. Ethernet Port is not working Answer:

1. Try to use the different Ethernet cables or different Ethernet ports for connection.
2. Update the network card driver as problems mostly arise when drivers are outdated.
3. Try turning off any antivirus or firewall temporarily and check for connections again
4. Make sure Ethernet is enabled under the network adapter settings in the device manager
5. Seek professional assistance.

VI. PC keeps disconnecting Wi-Fi Answer:

1. Try restarting your pc along with your Wi-Fi devices to ensure stable reconnection once reboot is complete
2. Update your Network drivers and Wireless NIC drivers
3. Make you home network a private network if it was set to public previously
4. Problem may be on the Router so contact the ISP to check in
5. Check for faulty wireless NIC cards in your motherboard
6. Seek assistance from a trained technician.

VII. Main server in the network is down. Answer:

1. Check is the server is actually down or not for this one can ping and detect if the packets were delivered or not.
2. Check if A firewall is restricting traffic to and from the server or is it actually down.
3. Check the IP connectivity with the server from a system configured in the network.
4. Check for misconfigured gate way or subnet masks
5. Contact your setup technician for assistance if the issue is kept unsolved

VIII.   Home/Office Wi-Fi network is showing "Failed to obtain IP address" error. Answer:

1. If using someone else network, ask them to remove the MAC filter for your device also confirm there aren't any parental control set up that is blocking your device from using the network
2. Change home routers encryption: If the router is currently configured to use AES or TKIP encryption, those encryption types are known to cause problems with certain devices. changing network encryption to WPA2-PSK often resolves those issues.
3. If the router seems fine, try rebooting the router and your device: this re initializes the internal software and clear any potential cache issues. if doesn't work RESET may be required for the router
4. Check if router is blocking your device IP address
5. Contact your ISP and relay the issue to them and request their professional assistance

IX.   Multiple hosts are seen in a public and private network. Answer:

1. Go to control panel
2. Select Network and internet: network and sharing center.
3. Once a new screen appears click on the Local Area Connections and disable the setting.

X.   A home network working on Class C IP address range is showing Class B IP address error in the main router. Answer:

1. Check the number of hosts
2. Check the subnet mask and the IP class
3. Try to reset the network and reconfigure the network as this might be caused of glitches
4. Contact your network operator or seek help from a technician

END