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QUESTION BANK

Name of the Department : **ME-Computer Science and Engineering**

Subject Code & Name : **CP5201 & Network Design and Technologies**

Year & Semester : **I & II**

UNIT I NETWORK DESIGN

PART-A

1. **What are the three criteria necessary for an effective and efficient network?**

The most important criteria are performance, reliability and security. Performance of the network depends on number of users, type of transmission medium, the capabilities of the connected h/w and the efficiency of the s/w. Reliability is measured by frequency of failure, the time it takes a link to recover from the failure and the network's robustness in a catastrophe. Security issues include protecting data from unauthorized access and viruses.

2. **Group the OSI layers by function.**

The seven layers of the OSI model belonging to three subgroups. Network support layers: Consisting of Physical, data link and network layers and they deal with the physical aspects of moving data from one device to another. User support layers: Consists of Session, presentation and application layers and they allow interoperability among unrelated software systems. The transport layer ensures end-to-end reliable data transmission

3. **What are the features provided by layering?**

- It decomposes the problem of building a network into more manageable components. Rather than implementing a monolithic piece of software that does everything implement several layers, each of which solves one part of the problem.
- It provides more modular design. To add some new service, it is enough to modify the functionality at one layer, reusing the functions provided at all the other layers.

4. **What are the two interfaces provided by protocols?**

- Service interface
- Peer interface
- Service interface-defines the operations that local objects can perform on the protocol.
- Peer interface-defines the form and meaning of messages

exchanged between protocol peers to implement the communication service.

5. What is LAN?

A LAN is a common name used to describe a group of devices that share a geographic location.LAN is limited to single building or campus.

6. What is flow Control?

Flow control refers to a set of procedures used to restrict the amount of data. The sender can send before waiting for acknowledgment.

7. Define Error detection and correction.

Error Detection:

Data can be corrupted during transmission. It is called as an error. For reliable

8. What are the different types of modulation?

The Modulation types are: i).Amplitude Modulation. ii).Frequency Modulation. iii).Phase Modulation.

9. What are the multiplexing techniques?

The Multiplexing techniques are: i)Space division multiplexing.

ii)Time division multiplexing. iii)Frequency division multiplexing. iv)Code division multiplexing.

10. Define Space Division Multiplexing Access?

Space division multiple access (SDMA) means division of the available space so that multiple sources can access the medium at the same time. SDMA is the technique in which a wireless transmitter transmits the modulated signals and accesses a space slot and another transmitter accesses another space slot such that signals from both can propagate in two separate spaces in the medium without affecting each other.

11. Define Code division multiplexing Access?

CDMA(Code Division Multiple Access) is an access method in which multiple users are allotted different codes (sequence of symbols) to access the same channel (set of frequencies)

12. Define Time division multiplexing Access?

Time division multiplexing (TDMA) is an access method in which multiple users, data services, or sources are allotted different time-slices to access the same channel. The available time-slice is divided among multiple modulated-signal sources. These sources use the same medium, the same set of frequencies, and the same channel for transmission of data. 9

13. Define Frequency division multiplexing Access?

Frequency division multiple access (FDMA) is an access method in which entails assignments of different frequency-slices to different users for accessing the same carrier.

14.What are the advantages of distributed processing?
Advantages of distributed processing include security/encapsulation, distributed databases, faster problem solving, security through redundancy and collaborative processing.

15. Why are protocols needed?[MAY -2009]
In networks, communication occurs between the entities in different systems. Two entities cannot just send bit streams to each other and expect to be understood. For communication, the entities must agree on a protocol. A protocol is a set of rules that govern data communication.

16.What is bridge?
Bridge is a hardware networking device used to connect two LANs. A bridge operates at data link layer of the OSI reference model.

17.What is a repeater?
Repeater is a hardware device used to strengthen signals being transmitted on a network.

18.Define router
A network layer device that connects networks with different physical media and translates between different network architecture.

19.What is a switch?
A switch is a networking device that manages networked connections between devices on a star networks.

20.What is mean by Ethernet?
Ethernet is a networking technology developed in 1970 which is governed by the IEEE 802.3 specifications.

21.Advantages of Ethernet
1. Inexpensive 2.Easy to install 3.Supports various writing technologies.

22.Identify the class and default subnet mask of the IP address 217.65.10.7.
IP Address 217.65.10.7 belongs to Class C. Its subnet mask is 255.255.255.0.

23.What are the limitations of bridges?
1. Scale 2.Heterogeneity

24.What are the issues in data link layer?
The data link layer has a number of specific functions it can carry out. These functions include,

a) Providing a well-defined service interface to the network layer.
b) Dealing with transmission errors.

c) Regulating the flow of data so that slow receivers are not swamped by fast senders.

25.What are the ways to address the framing problem?

The framing problem can be addressed by the following protocols:

- Byte-Oriented Protocols(PPP)
- Bit-Oriented Protocols(HDLC)
- Clock-Based Framing(SONET)

26.What are the responsibilities of data link layer?

Specific responsibilities of data link layer include the following.

a) Framing
b) Physical addressing
c) Flow control
d) Error control
e) Access control

27.Mention the types of errors.

There are 2 types of errors

a) Single-bit error.
b) Burst-bit error.

28.Define the following terms.

Single bit error: The term single bit error means that only one bit of a given data unit (such as byte character/data unit or packet) is changed from 1 to 0 or from 0 to1.

Burst error: Means that 2 or more bits in the data unit have changed from 1 to 0 from 0 to1.

29. What is redundancy?

It is the error detecting mechanism, which means a shorter group of bits or extra bits may be appended at the destination of each unit.

strategy used by the hamming code to correct single bit errors must be redesigned to be applicable for multiple bit correction.

30. What is mean by error control?

Error control is a method that can be used to recover the corrupted data whenever possible. These are two basic types of error control which are backward error control and forward error control.

31. What is OSI?

A standard that specifies a conceptual model called Open systems Interconnection network interface model, which breaks networked communications into seven layers: Application, Presentation, Session, Transport, Network, Data link, Physical.

32. State the major functions performed by the presentation layer of the

ISO OSI model. (Nov Dec 2006)

Presentation layer is concerned with the format of data exchanged between peers, for example, whether an integer is 16, 32, or 64 bits long and whether the most significant bit is transmitted first or last, or how a video stream is formatted.

33. State the purpose of layering in networks? (May Jun 2007)

A layer is a collection of related functions that provides services to the layer above it and receives services from the layer below it.

To execute the functions by each layer is independent.

34. What are the two fundamental ways by which network performance is measured?

1. Bandwidth
2. Latency

Part-B

1.Draw the ISO-OSI reference model and explain the functionalities of each layer inDetail.(16) **[DEC- 2011]**

2. Discuss in detail about Internet Architecture. [APR/MAY-2015,17]

3. Give the TCP/IP network architecture model and discuss the design issues of the same in detail. (16)**[MAY- 2011]**

4. Explain the various network types.(12)

5. (i) Discuss in detail about the network performance Measures.(6)
   (ii) Explain in detail about protocol layering.(6)

6. Discuss in detail about TCP/IP protocol suite.(12)

7.Write about various Transmission medias used in networks.(12)

8. Outline the steps involved in building a computer network. Give the detailed description for each step.

9.Explain about the various switching methods in detail.

10.Explain the multiplexing techniques.(13)

UNIT II WIRELESS NETWORKS

PART-A

1. **List out the Standard Ethernet implementations.**

The Standard Ethernet defined several implementations.

- 10 Base 5 (Thicknet) (Bus Topology)
- 10 Base 2 (Thinnet) (Bus Topology) 10 Base T (UTP) (Star/Tree Topology)
- 10 Base FL (Fiber) (Star/Tree Topology)

2. **Differentiate fast ethernet and gigabit ethernet.**

Fast Ethernet Network was developed as an upgrade to traditional Ethernet Networking. Fast Ethernet improved traditional Ethernet by increasing transfer rates 10 times, from 10 Megabit to 100 Megabit speed. Gigabit Ethernet Network is an upgrade on Fast Ethernet Network, offering speeds of 1000 Megabits (1 Gigabit)

3. **Identify the goals of Fast Ethernet.**

IEEE created Fast Ethernet under the name 802.3u. The goals of Fast Ethernet can be summarized as follows:

1. Upgrade the data rate to 100 Mbps.
2. Make it compatible with Standard Ethernet.
3. Keep the same 48-bit address.
4. Keep the same frame format.

4. **What is Wi-Fi?**

Wi-Fi or Wireless LAN is a family of wireless network protocols, based on the IEEE 802.11 family of standards, which are commonly used for local area networking of devices and Internet access. Wi-Fi most commonly uses high frequency radio waves instead of cables for connecting the devices in LAN. Users connected by WLANs can move around within the area of network coverage.

5. **Mention the different WLAN specifications.**

- IEEE 802.11 FHSS uses the frequency-hopping spread spectrum (FHSS) method IEEE 802.11 DSSS uses the direct-sequence spread spectrum (DSSS) method
- IEEE 802.11 infrared uses infrared light in the range of 800 to 950 nm. The modulation technique is called pulse position modulation (PPM).
- IEEE 802.11a OFDM describes the orthogonal frequency-division multiplexing (OFDM) method.
- IEEE 802.11b DSSS describes the high-rate direct-sequence spread spectrum (HRDSSS) method.
- IEEE 802.11g This new specification defines forward error correction and OFDM
- IEEE 802.11n standard uses what is called MIMO (multiple-input multiple-output antenna) to overcome the noise problem in wireless LANs.

6. **Compare BSS with ESS in WLAN.**

- The WLAN standard defines two kinds of services: the basic service set (BSS) and the extended service set (ESS).
- IEEE 802.11 defines the basic service set (BSS) as the building blocks of a wireless LAN. A basic service set is made of stationary or mobile wireless

stations and an optional central base station, known as the *access point (AP)*.

- An extended service set (ESS) is made up of two or more BSSs with APs. The extended service set uses two types of stations: mobile and stationary. The mobile stations are normal stations inside a BSS. The stationary stations are AP stations that are part of a wired LAN.

7. What are the MAC sub-layers of IEEE 802.11?

IEEE 802.11 defines two MAC sublayers: the distributed coordination function (DCF) and point coordination function (PCF). DCF uses CSMA/CA as the access method. The point coordination function (PCF) is an optional access method that can be implemented in an infrastructure network

8. What is Bluetooth?

Bluetooth is a wireless LAN technology that connects devices (called gadgets) in a small area. A Bluetooth LAN is an ad hoc network. Bluetooth technology is the implementation of a protocol defined by the IEEE 802.15 standard. The standard defines a wireless personal-area network (PAN) operable in an area the size of a room or a hall over short distances (using short-wavelength UHF radio waves in the ISM band from 2.4 to 2.485 GHz).

9. Examine the networks involved in Bluetooth architecture.

Bluetooth defines two types of networks: piconet and scatternet.

10. Define piconet and scatternet.

Piconets: A Bluetooth network is called a *piconet*, or a small net. A piconet can have up to eight stations, one of which is called the *primary;* the rest are called *secondaries.* All the secondary stations synchronize their clocks and hopping sequence with the primary.

Scatternet: Piconets can be combined to form what is called a *scatternet.* A secondary station in one piconet can be the primary in another piconet. This station can receive messages from the primary in the first piconet (as a secondary) and, acting as a primary, deliver them to secondaries in the second piconet. A station can be a member of two piconets.

11. What is L2CAP?

The Logical Link Control and Adaptation Protocol, or L2CAP (L2 here means LL), is roughly equivalent to the LLC sublayer in LANs. It is used for data exchange on an asynchronous connectionless link (ACL); The L2CAP has specific duties: multiplexing, segmentation and reassembly, quality of service (QoS), and group management.

12. What is the purpose of Bluetooth low energy?

Bluetooth Low Energy (BLE) is an emerging low-power wireless technology developed for short-range control and monitoring applications. BLE represents a trade-

off between energy consumption, latency, piconet size, and throughput. BLE emerges as a strong low- power wireless technology for single-hop communication use cases which may contribute to connecting a dramatically large amount of new devices to the Internet of Things.

13. What are the features of 6LoWPAN?

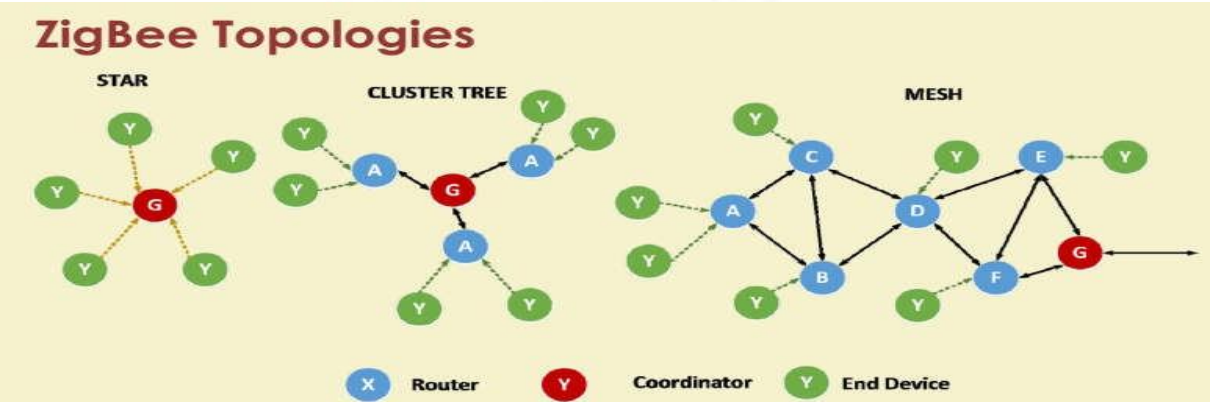
6LoWPAN (IPv6 over Low-Power Wireless Personal Area Networks), is a low power wireless mesh network where every node has its own IPv6 address. This allows the node to connect directly with the Internet using open standards. The 6LoWPAN group has defined encapsulation and header compression mechanisms that allow IPv6 packets to be sent and received over IEEE 802.15.4 based networks.

14.What are the features of Zigbee?

The IEEE is the 802.15.4 standard [IEEE 802.15 2012] known as Zigbee. Zigbee is targeted at lower-powered, lower-data-rate, lower-duty-cycle applications. The main goal of the Zigbee technology is to enable Wireless Sensor Networks composed of large number of nodes to function with reduced energy consumption. Zigbee uses a 16-bit Cyclic Redundancy Check (CRC) on each packet, called a Frame Checksum (FCS) to ensure that the data bits are correct. Zigbee uses the Advanced Encryption Standard (AES). Zigbee resides on transceivers, which operate at 2.4 GHz offering a data rate of 250 Kbps.

15.What are the types of network topologies supported by Zigbee technology?

Three kinds of network topologies are supported by Zigbee technology. They are Star, peer-to-peer and Cluster tree.



16.What are the types of nodes supported by Zigbee?

Zigbee supports three types of nodes called Zigbee Co-ordinator (ZC), Zigbee Router (ZR) and Zigbee End Device (ZED).The Zigbee Co-ordinator maintains and co-ordinates the entire network with overall network knowledge. The Zigbee Router (ZR) works as a router in the network to forward data. The Zigbee End Device (ZED) has limited functionalities such as sensing and reporting data to the ZR

Part-B

1. Explain in detail about IEEE 802.3 MAC sub-layer.
2. Illustrate an architecture and MAC layers of IEEE 802.11 with necessary diagrams.
3. Explain in detail about the architecture of Bluetooth and its layers.
4. Write short notes on 6LoWPAN and Zigbee technologies.
5. With neat sketch, explain about IP or IPv4 packet format and its fragmentation.
6. Elaborate about Internet Control Message Protocol(ICMP) and its message types.
7. Evaluate the addressing in Mobile IP.

UNIT III CELLULAR NETWORKS

PART-A

1. Expand GSM, GPRS and UMTS.

- Global System for Mobile Communication (GSM)
- General Packet Radio Service (GPRS)
- Universal Mobile Telecommunication System (UMTS)

2. Specify the three different categories of services defined by GSM.

- Tele-services
- Bearer Services
- Supplementary services

3. List the important supplementary services offered by GSM.

- User identification
- Call forwarding(or Redirection)
- Automatic call-back
- Conferencing with up to 7 participants

4. What are the subsystems available in GSM Architecture?

- Radio SubSystem (RSS)
- Network and Switching Subsystem (NSS)
- Operation SubSystem (OSS)

5. Mention the types of Interface in GSM system and its use.

- **A interface**
  - Makes the connection between the RSS and the NSS
  - Based on circuit-switched PCM-30 systems (2.048 Mbit/s), carrying up to 30 64 kbit/s connections
- **O interface**
  - Makes the connection between the RSS and the OSS
  - Uses the Signalling System No. 7 (SS7) based on X.25 carrying management data to/from the RSS
- **U_m interface**
  - Makes the connection between the BTS and MS
  - Contains all the mechanisms necessary for wireless transmission
- **A_{bis} interface**
  - Makes the connection between the BTS and BSC
  - Consists of 16 or 64 kbit/s connections

6. What is RSS?

- RSS stands for Radio subsystem (RSS)
- RSS comprises all radio specific entities

7. Name the entities of RSS.

- Base Station Subsystem (BSS)
- Base Transceiver Station (BTS)
- Base Station Controller (BSC)
- Mobile Station (MS)

8. Mention the advantages of GSM.

- Communication
- Total mobility
- Worldwide connectivity
- High capacity
- High transmission quality
- Security functions

9. Mention the disadvantages of GSM.

- No end-to-end encryption of user data
- Reduced concentration while moving
- Electromagnetic radiation
- High complexity of system
- Several incompatibilities within the GSM standards

10. What does SIM card contain?

- a personal identity number (PIN)
- a PIN unblocking key (PUK)
- an authentication key K_i
- the international mobile subscriber identity (IMSI)
- Card-type
- Serial number
- A list of subscribed services

11. Mention the use of SS7.

- Used for handling all signaling needed for
  - connection setup,
  - connection release and
  - handover of connections to other MSCs

12. Compare GSM and GPRS with respect to billing system.

- GSM – Uses a billing system based on the time of connection
- GPRS – Uses a billing system based on the amount of transmitted data

13. List the types of GPRS Support Nodes(GSN)

- gateway GPRS support node (GGSN)
- serving GPRS support node (SGSN)

14. Mention the services provided by GPRS.

- Point-to-point (PTP) service
- Point-to-multipoint (PTM) service

15. What is Point-to-point (PTP) service ?

- Packet Transfer service between two users

16. List the versions of PTP.

- PTP Connection Oriented Network Service (PTP-CONS)
- Maintains the virtual circuit upon change of the cell within the GSM network
- PTP Connectionless Network Service (PTP-CLNS)
- Supports application based on the Internet Protocol (IP)

17. Define Point-to-multipoint (PTM) service.

- Called as multicasting
- Data transfer service from one user to multiple users

18. Give the types of PTM.

- Multicast PTM
- Group call PTM

19. Name the security services offered by GPRS.

- Authentication
- Access control
- User identity confidentiality

- User information confidentiality

20. Mention the components of UMTS.

- User Equipment (UE)
- UTRA network (UTRAN)
- Core Network(CN)

21. Specify the functions provided by radio network subsystems (RNS).

- Radio channel ciphering
- Deciphering
- Handover control
- Radio resource management

Part-B

1. Explain GSM services, security and handover procedures.
2. Explain the architecture of GSM.
3. What is GSM? Explain its handover procedure and channel in detail.
4. Explain i) mobile number portability and ii) handover procedures in GSM.
5. Explain GPRS in detail.
6. What is UMTS? Explain UMTS in detail.
7. Explain the UMTS networks and list the advantages of third generation wireless standard.

UNIT IV 4G NETWORKS

Part-A

1.Explain the 4G technology?

4G is the fourth generation of broadband cellular network technology, succeeding 3G, and preceding 5G. A 4G system must provide capabilities defined by ITU in IMT Advanced. Potential and current applications include amended mobile web access, IP telephony, gaming services, high-definition mobile TV, video conferencing, and 3D television.

2.Write the Features of 4G Wireless Systems

The following are some possible features of the 4G systems :

1. Support interactive multimedia, voice, video, wireless internet and other broadband services.
2. High speed, high capacity and low cost per bit.
3. Global mobility, service portability, scalable mobile networks.
4. Seamless switching, variety of services based on Quality of Service (QoS) requirements
5. Better scheduling and call admission control techniques.
6. Ad hoc networks and multi-hop networks.

3.What are the comparisons between some key parameters of 3G Vs possible 4G systems.

	3G	4G
Frequency Band	1.8 - 2.5 GHz	2 - 8 GHz
Bandwidth	5-20 MHz	5-20 MHz
Data rate	Up to 2Mbps (384 kbps WAN)	Up to 20 Mbps or more
Access	Wideband CDMA	Multi-carrier - CDMA or OFDM(TDMA)
FEC	Turbo-codes	Concatenated codes
Switching	Circuit/Packet	Packet
Mobile top speeds	200 kmph	200 kmph

4. Some new challenges in 4G

1. Multi-access interface, timing and recovery.
2. Higher frequency reuse leads to smaller cells that may cause intra-cell interference or higher noise figures due to reduced power levels.
3. The Digital to analog conversions at high data rates, multiuser detection and estimation (at base stations), smart antennas and complex error control techniques as well dynamic routing will need sophisticated signal processing.
4. Issues in the interface with the ad hoc networks should be sorted out. 4G systems are expected to interact with other networks like the Bluetooth, hiperlan, IEEE802.11b, etc.
5. Voice over multi-hop networks is likely to be an interesting problem because of the strict delay requirements of voice.
6. Security will be an important issue.
7. A new IP protocol might be needed because of the variable QoS services and the network

should do " better than best " effort.
8. Networking protocols that adapt dynamically to the changing channel conditions.
9. Seamless roaming and seamless transfer of services

5.Write the disadvantages of 4G

4G introduces a potential inconvenience for those who travel internationally or wish to switch carriers. In order to make and receive 4G voice calls, the subscriber handset must not only have a matching frequency band (and in some cases require unlocking), it must also have the matching

enablement settings for the local carrier and/or country. While a phone purchased from a given carrier can be expected to work with that carrier, making 4G voice calls on another carrier's network (including international roaming) may be impossible without a software update specific to the local carrier and the phone model in question, which may or may not be available (although fallback to 3G for voice calling may still be possible if a 3G network is available with a matching frequency band)

6.Write the Key features of 4G

The following key features can be observed in all suggested 4G technologies:

- Physical layer transmission techniques are as follows:[26]
  - MIMO: To attain ultra high spectral efficiency by means of spatial processing including multi-antenna and multi-user MIMO
  - Frequency-domain-equalization, for example *multi-carrier modulation* (OFDM) in the downlink or *single-carrier frequency-domain-equalization* (SC-FDE) in the uplink: To exploit the frequency selective channel property without complex equalization
  - Frequency-domain statistical multiplexing, for example (OFDMA) or (single-carrier FDMA) (SC-FDMA, a.k.a. linearly precoded OFDMA, LP-OFDMA) in the uplink: Variable bit rate by assigning different sub-channels to different users based on the channel conditions
  - Turbo principle error-correcting codes: To minimize the required SNR at the reception side
- Channel-dependent scheduling: To use the time-varying channel
- Link adaptation: Adaptive modulation and error-correcting codes
- Mobile IP utilized for mobility
- IP-based femtocells (home nodes connected to fixed Internet broadband infrastructure)

7.Benefits of Hybrid Wireless Network.

● Hybrid Wireless Network can act as a bs-oriented or ad hoc network at any given time according to the environment conditions.

● Made by adding Base stations to Ad hoc Network.

● Has the advantages of both Ad-hoc and Base stations.

● Mobile nodes communicate with each other using Ad Hoc mode when they are in range, and use basestation to communicate when they are out of range.

● More efficient and reliable.

● Flexible with seamless handover.

Part-B

1. Explain About Network Architecture And Interfaces
2. How Mobility Management And Power Optimization Is Done In Networks?
3. Write About The 4G Networks And Composite Radio Environment
4. Describe About Hybrid 4G Wireless Networks Protocols
5. How Channel Modelling Is Done For For 4G –
6. Write About The 5G Network.

UNIT V SOFTWARE DEFINED NETWORKS

Part-A

1.Define Software-defined networking (SDN)

The technology is an approach to network management that enables dynamic, programmatically efficient network configuration in order to improve network performance and monitoring, making it more like cloud computing than traditional network management.

SDN is meant to address the fact that the static architecture of traditional networks is decentralized and complex while current networks require more flexibility and easy troubleshooting. SDN attempts to centralize network intelligence in one network component by disassociating the forwarding process of network packets (data plane) from the routing process (control plane).

The control plane consists of one or more controllers, which are considered the brain of the SDN network where the whole intelligence is incorporated. However, the intelligent centralization has its own drawbacks when it comes to security, scalability and elasticity[1] and this is the main issue of SDN.

2.Need is the need for a new network architecture?

The explosion of mobile devices and content, server virtualization, and the advent of cloud services are among the trends driving the networking industry to re-examine traditional network

Changing traffic patterns

Within the enterprise data center, traffic patterns have changed significantly. In contrast to client-server applications where the bulk of the communication occurs between one client and one server, today's applications access different databases and servers, creating a flurry of "east-west" machine-to-machine traffic before returning data to the end user device in the classic "north-south" traffic pattern. At the same time, users are changing network traffic patterns as they push for access to corporate content and applications from any type of device (including their own), connecting from anywhere, at any time. Finally, many enterprise data centers managers are contemplating a utility computing model, which might include a private cloud, public cloud, or some mix of both, resulting in additional traffic across the wide area network.

The "consumerization of IT"

Users are increasingly employing mobile personal devices such as smartphones, tablets, and notebooks to access the corporate network. IT is under pressure to accommodate these personal devices in a fine-grained manner while protecting corporate data and intellectual property and meeting compliance mandates.

The rise of cloud services

Enterprises have enthusiastically embraced both public and private cloud services, resulting in unprecedented growth of these services. Enterprise business units now want the agility to access applications, infrastructure, and other IT resources on demand and à la carte. To add to the complexity, IT's planning for cloud services must be done in an environment of increased security, compliance, and auditing requirements, along with business reorganizations, consolidations, and mergers that can change assumptions overnight. Providing self-service provisioning, whether in a private or public cloud, requires elastic scaling of computing, storage, and network resources, ideally from a common viewpoint and with a common suite of tools.

"Big data" means more bandwidth

Handling today's "big data" or mega datasets requires massive parallel processing on thousands of servers, all of which need direct connections to each other. The rise of mega datasets is fueling a constant demand for additional network capacity in the data center. Operators of hyperscale data center networks face the daunting task of scaling the network to previously unimaginable size, maintaining any-to-any connectivity without going broke

3.Write the applications of SDN.

1) a.SDMN

Software-defined mobile networking (SDMN)[38][39] is an approach to the design of mobile networks where all protocol-specific features are implemented in software, maximizing the use of generic and commodity hardware and software in both the core network and radio access network.[40] It is proposed as an extension of SDN paradigm to incorporate mobile

network specific functionalities.[41] Since 3GPP Rel.14, a Control User Plane Separation was introduced in the Mobile Core Network architectures with the PFCP protocol.

2) b.SD-WAN

An SD-WAN is a Wide Area Network (WAN) managed using the principles of software-defined networking.[42] The main driver of SD-WAN is to lower WAN costs using more affordable and commercially available leased lines, as an alternative or partial replacement of more expensive MPLS lines. Control and management is administered separately from the hardware with central controllers allowing for easier configuration and administration.

3) c).SD-LAN

An SD-LAN is a Local area network (LAN) built around the principles of software-defined networking, though there are key differences in topology, network security, application visibility and control, management and quality of service.

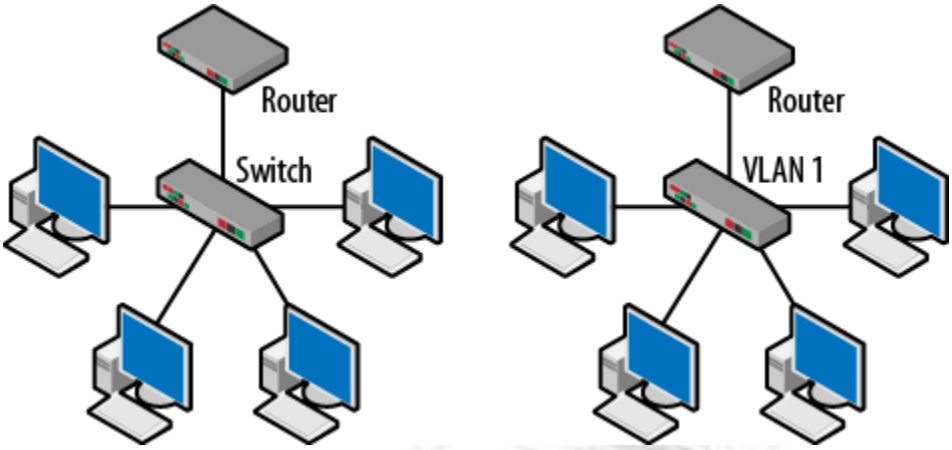
SD-LAN decouples control management, and data planes to enable a policy driven architecture for wired and wireless LANs. SD-LANs are characterized by their use of a cloud management system and wireless connectivity without the presence of a physical controller.[

4) d)Security using the SDN paradigm

SDN architecture may enable, facilitate or enhance network-related security applications due to the controller's central view of the network, and its capacity to reprogram the data plane at any time. While security of SDN architecture itself remains an open question that has already been studied a couple of times in the research community,[46][47][48][49] the following paragraphs only focus on the security applications made possible or revisited using SDN.

4.What is a VLAN?

A virtual local area network (VLAN) is a logical grouping of ports which is independent of location. A single VLAN (and the nodes connected in a single VLAN) will behave in the same way as if it was a separate Layer 3 network. VLAN membership need not be limited to sequential ports or even ports on the same switch. Figure 4-4 depicts a very common deployment in which nodes are connected to a switch and the switch is connected to a router. Looking at the left side, the automatic assumption would be that all of the nodes are on the same IP network since they all connect to the same router interface.



Basic switch and VLAN topology

5.Write the Effect of VLANs

Configuring a switch for multiple VLANs reduces the size of each broadcast domain. Therefore the amount of overhead traffic is lower which reduces bandwidth competition with data traffic. Stated another way, a node in a particular VLAN has less broadcast traffic with which to contend. Since switch forwarding behavior is based on MAC addresses stored in the source address table, the following rules apply:

- For known unicast destinations, the switch will forward the frame to the destination port only.
- For unknown unicast destinations, the switch will forward the frame to all active ports except the originating port. This is called flooding.
- For multicast and broadcast destinations, the switch will forward the frame to all active ports except the originating port.

6.Write the benefits of the 802.1Q standard:

- VLANs are supported over all IEEE 802 LAN MAC protocols, over shared media LANs as well as point-to-point LANs.
- VLANs facilitate easy administration of logical groups of stations that can communicate as if they were on the same LAN. They also facilitate easier administration of moves, adds, and changes in members of these groups.
- Traffic between VLANs is restricted. Switches forward unicast, multicast, and broadcast traffic only on LAN segments that serve the VLAN to which the traffic belongs.
- As far as possible, VLANs maintain compatibility with existing switches and end stations.
- If all switch ports are configured to transmit and receive untagged frames (frames to/from non-VLAN aware devices), switches will work in plug-and-play ISO/IEC 15802-3 mode. End stations will be able to communicate throughout the Bridged LAN.

7. Write the types of VLANs.

There are two types of VLANs: static and dynamic. Both of these types can be used to cover small or large geographic areas. The type of VLAN that has been discussed thus far (a single switch divided into multiple VLANs) is called a static VLAN. Membership is largely determined by geographical location and to which port a particular node is connected. Most of the nodes in a particular VLAN are likely to be located in the same building, floor or set of offices. These VLANs can also be thought of as having local membership.

8.What are the SDN Architectural Framework and Solution Characteristics

- Centralized Control
- Overlay Networks
- SDN Solution Taxonomy

9.What is control plane function?

In its simplest form, the control plane provides layer-2 MAC reachability and layer-3 routing information to network devices that require this information to make packet forwarding decisions. In the case of firewalls, the control plane would include stateful flow information for inspection. Control plane functionality can implemented as follows:

- Distributed - Conventional routers and switches operate using distributed protocols for control, i.e. where each device makes its own decisions about what to do, and communicate relevant information to other devices for input into their decision making process. For example, the Spanning Tree Protocol (STP), Fabric Path, and routing protocols such as IS-IS and BGP provide distributed control of packet forwarding functionality to networking devices.

- Centralized - In this case, a centralized controller provides the necessary information for a

10. What is network virtualization component?

NSX-T Platform

NSX-T creates a network virtualization layer, which is an abstraction between the physical and virtual networks. You create all virtual networks on top of this layer.

Several components are required to create this network virtualization layer:

- NSX-T Managers
- NSX-T Edge Nodes
- NSX-T Distributed Routers (DR)
- NSX-T Service Routers (SR)

- NSX-T Segments (Logical Switches)

These components are distributed in different planes to create communication boundaries and provide isolation of workload data from system control messages.

Data plane

Performs stateless forwarding or transformation of packets based on tables populated by the control plane, reports topology information to the control plane, and maintains packet level statistics.

The following traffic runs in the data plane:

Workload data

N-VDS virtual switch, distributed routing, and the distributed firewall in NSX-T

The data is carried over designated transport networks in the physical network.

Control plane

Contains messages for network virtualization control. You place the control plane communication on secure physical networks (VLANs) that are isolated from the transport networks for the data plane.

The control plane computes the runtime state based on configuration from the management plane. Control plane propagates topology information reported by the data plane elements, and pushes stateless configuration to forwarding engines.

Control plane in NSX-T has two parts:

Central Control Plane (CCP). The CCP is implemented as a cluster of virtual machines called CCP nodes. The cluster form factor provides both redundancy and scalability of resources.

The CCP is logically separated from all data plane traffic, that is, a failure in the control plane does not affect existing data plane operations.

Local Control Plane (LCP). The LCP runs on transport nodes. It is near to the data plane it controls and is connected to the CCP. The LCP is responsible for programming the forwarding entries of the data plane.

Management plane

Provides a single API entry point to the system, persists user configuration, handles user queries, and performs operational tasks on all management, control, and data plane nodes in the system.

For NSX-T, all querying, modifying, and persisting user configuration is in the management plane. Propagation of that configuration down to the correct subset of data plane elements is in the control plane. As a result, some data belongs to multiple planes. Each plane uses this data according to stage of existence. The management plane also queries recent status and statistics from the control plane, and under certain conditions directly from the data plane.

The management plane is the only source of truth for the logical system because it is the only entry point for user configuration. You make changes using either a RESTful API or the NSX-T user interface.

For example, responding to a vSphere vMotion operation of a virtual machine is responsibility of the control plane, but connecting the virtual machine to the logical network is responsibility of the management plane.

Part-B

1. Write about the centralized and distributed control and data planes
2. Write about the VLANS and NVGRE
3. How the open flow is done in network overlays
4. Write about the I/O design of SDN framework