

CYFENW:

ENW(AU) CYNTAF:

Llyfr Atebion Arholiadau

12 Tudalen

Cyfarwyddiadau i Ymgeiswyr

- Rhowch yr holl wybodaeth y gofynnir amdani yn y blychau isod.
- Rhowch eich enw yn y lle a ddarparwyd ar y dde; plygwch ef a'i selio i lawr (gan ddefnyddio'r label a ddarparwyd) i guddio'ch enw.
- Rhaid i'r atebion fod mewn llawysgrifen ddarlennadwy. Gall yr Arholiwyd naill ai anwybyddu sgrïpt annarlenadwy, neu drefnu iddi gael ei threpio a chael yr ymgeisydd i dalu.
- Ysgrifennwch eich atebion mewn inc.
- Dechreuwch bob ateb ar dudalen newydd. Gwnewch unrhyw fras nodiadau yn y llyfr atebion a thynnu llinell drwyddynt.
- Ni ddylid rhwygo unrhyw ran o'r llyfr hwn; rhaid ei gyflwyno yn gyfan.
- Os defnyddir mwy nag un llyfr, rhwymwch hwy gyda'i gilydd gan ddefnyddio'r tagiau sydd ar gael oddi wrth y gwyliwr/gwyliwyr.
- Rhaid dychwelyd pob llyfr. Ni chaniateir mynd â llyfrau atebion, wedi eu defnyddio neu heb eu defnyddio, allan o'r lleoliad arholi o dan unrhyw amgylchiadau.

1	Rhif Mlyfrylwr		Rhestrwch rifau'r cwestiynau a ymgeisiwyd gennych	At Ddlbenion y Swyddfa
2	Teitl y Papur Arholiad			
3	Cod y Modiwl			
4	Dyddiad ac Amser yr Arholiad			
5	Lleoliad yr Arholiad			
6	Rhif Sedd			
7	Nifer y Llyfrau Atebion a gyflwynwyd		Cyfanswm	

(See the other side for English version)

Examination Answer Books

12 Pages

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Complete, fold and seal
(see note 2 below)

SURNAME: JONES

FORENAME(S): OLIVER BRYAN

1	Student Number	ISO3244	List the numbers of the questions you have attempted	Office Use
2	Title of Examination Paper	WANS	A1 24	3
3	Module Code	W6X01113	3 4	3
4	Date and Time of Examination	08/05/2018 11.30	5	2
5	Examination Venue	Coleg Sgergor (Cragg)		1
6	Seat Number			
7	Number of Answer Books handed in			
				27

(Gweler yr ochr arall am y fersiwn Cymraeg)

1) Within PPP, PAP & CHAP Have many advantages and disadvantages. Both are components of PPP security & ~~an~~ and encapsulation. When ~~enabling~~ enabling PAP with PPP it creates a unique MD5 hash password for the current device, hence its name Password Authentication Authentication Protocol. With this security, ~~due~~ due to the use of MD5 it comes with ~~that~~ ~~un~~ vulnerability against attacks. ~~PAP~~ PPP also communicates with the data nodes in order to identify itself through the two handshake method.

CHAP is another security feature as part of PPP whilst more secure than PAP, CHAP can still be deemed vulnerable. CHAP uses the 3 way handshake protocol.

3
3✓

2a) LMI (Local management ~~systems~~ ^{interface})

2b) Invers ARP allows the mapping of data links between the 2nd and 3rd data layers with its initial aim to request and gather information ^{from output} on Layer 3. It's operation must contain frame relay in order to be successful. It also uses components of DLCI.

11✓

2c) DLCI is on the 2nd layer of the OSI model ~~that~~ allowing up to 1024 spaces for devices. It is a 10 bit data link.

2
2✓

4) Inside/Local - a host device with it's IP address coming from either it's computing OS, or DHCP. This IP address isn't legitimate inside global. This is the legitimate IP address of the device for outside access (Internet).

Outside local - This doesn't necessarily necessarily necessarily give out the legitimate outside global IP address.

Outside Global - This is a legitimate IP address that would be used as an interface on the device.

4b) Static NAT - Allows a singular IP to connect to a private device.

Dynamic NAT - Allows multiple public IP addresses to connect to a singular private device or an internal one.

Pat - is an expansion of NAT.

4c) The advantages of NAT are that it allows more spacing ~~on the~~ on the IP 4 when overpowered. It's also consistent with the IP addresses it supplies. This also means that NAT can be flexible and reliable. Security is also a benefit as people can only identify your IP address, only if you allow them too. With this being said, if people can only view your IP with permission, this could alter, limit and change your experience/service.

5a) Cable Modem Termination System allows the use of communication through a physical modem allowing people to communicate through VoIP (Voice) conversations. and this is popular with businesses. It is very similar to the multiplex used within DSLAM, the difference between DSLAM and CMTS is that DSLAM are able to communicate wirelessly.

5b) The concept of Point-to-Point Protocol over Ethernet is that of a direct connection between two devices such as a computer and a laptop or a router and a laptop. Through ethernet the process should ultimately be more reliable, secure and consistent as there is no interference between each device.

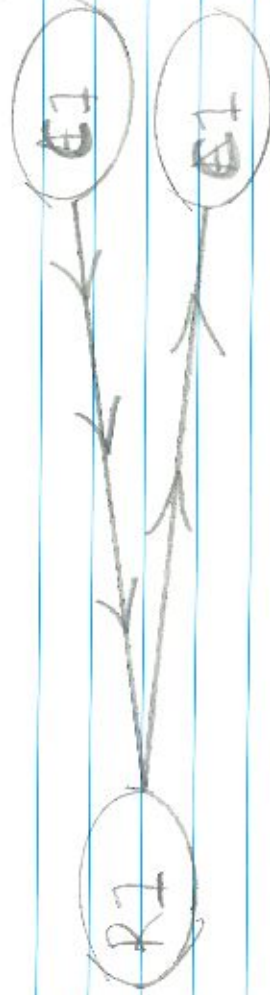
5c) For individuals, the benefit of teleworking is that of being able to spend more time with their family. Allowing flexibility in their own time frame - thus be more productive. Individuals would also reduce their costs by not having to travel to and from work each day. Suburban and rural individuals would gain more job opportunities from larger city companies with the help of teleworking. On the other hand, organisations

Should see a surge not only in morale, but also productivity by allowing ~~for~~ employees to work from home - this should lead to an increase in customer service as well due to employees being more flexible with their time. Organisations should see a decrease in ~~employee~~ employee absences due to the work being available to them 24/7. Teleworking could lead to cost savings as the number of employees who work from home could be greater than those in office buildings - ultimately cutting down on ~~the emissions~~ emissions also by getting rid of unused office space.

3a) Single Homed - Singular connection between two devices.



Dual Homed - Two way connection between ~~one~~ two devices or ~~two~~ ^{one} way connection between three devices.



Spoke - Typically found within schools or businesses.

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ENW(AU) CYNTAF: _____

CYFENW: _____

Llenwch, plygwch a seliwch
(gweler nodlyn 2 isod)

Llyfr Atebion Arholiadau

12 Tudalen

Cyfarwyddiadau i Ymgaiswyr

Complete, fold and seal
(see note 2 below)

SURNAME: BONNELL

FORENAME(S): MICHAEL

1	Student Number	171321	List the numbers of the questions you have attempted	Office Use
2	Title of Examination Paper	WAN ₅	1	8
3	Module Code	M6X01113	2	4
4	Date and Time of Examination	08/05/2018 11:30	3	1
5	Examination Venue		5	12
6	Seat Number		7	4
7	Number of Answer Books handed in			

1) Password Authentication Protocol (PAP) is a simple authentication method, which sends a username and password ~~to~~ from one point to another. The username and password are sent in plain text and are susceptible to interception. PAP is disadvantageous due to the lack of encryption and that it does not periodically re-authenticate the connection.

Challenge Handshake Authentication Protocol involves sending a challenge value to a connected device. The challenged device then responds with a username and password. The password is hashed using the MD5 algorithm and the challenge value. If the username and hash match what is in the device database, the device sends an accept message and opens a connection. Otherwise the connection is terminated. CHAP issues a challenge every 10 seconds to ensure the connection is still legitimate.

2a) A Local Management Interface assigns a DataLink connection Identifier (DLCI) to a device. An LMI sends Frame Relay status messages through the network and brings links down if ~~there~~ are errors.

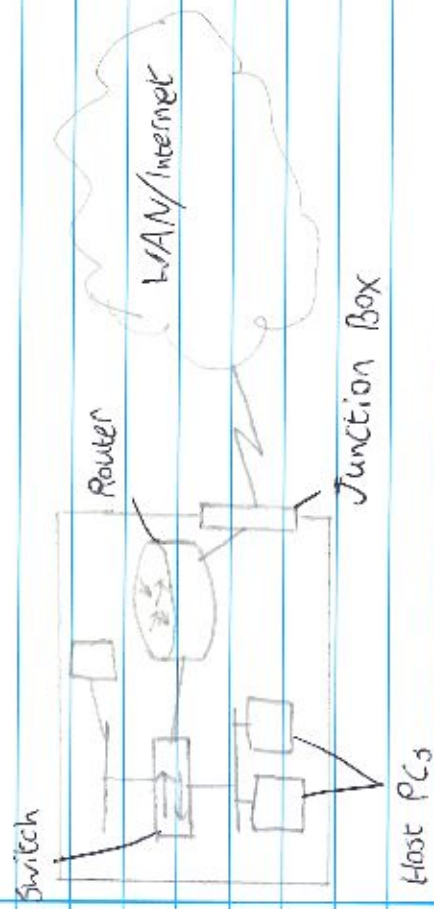
2b) Inverse ARP obtains MAC addresses from ~~the~~ IP addresses. When a device initiates Inverse ARP, it sends a request to a destination router. ~~This request gets~~ The request is populated with Virtual Circuit numbers as it travels a network. The destination device then responds with its DLCI and IP address and adds the IP address of the source device to its ARP table. When the source device receives the response it ~~acknowledges~~ completes a Virtual Circuit map and replies with its DLCI.

2c) A DLCI (DataLink Connection Identifier) is a number assigned to an endpoint device. DLCIs are locally significant (The same DLCI can be assigned ~~multiple~~ to multiple devices in a WAN as long as they are not ~~in the~~ directly connected to each other).

3) The four common WAN topologies are small office, campus, branch and distributed.

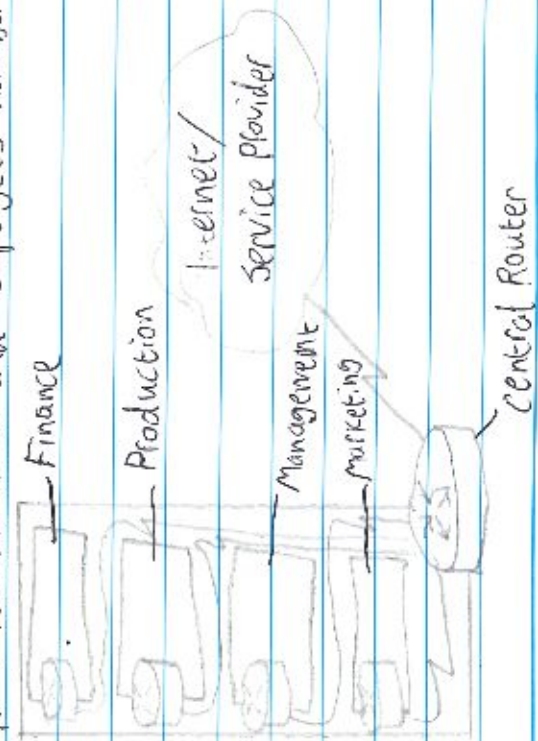
Small Office Network

Small office networks generally have few employees (the less than 100), share devices and peripherals are shared, outsource IT support and span one, small building.



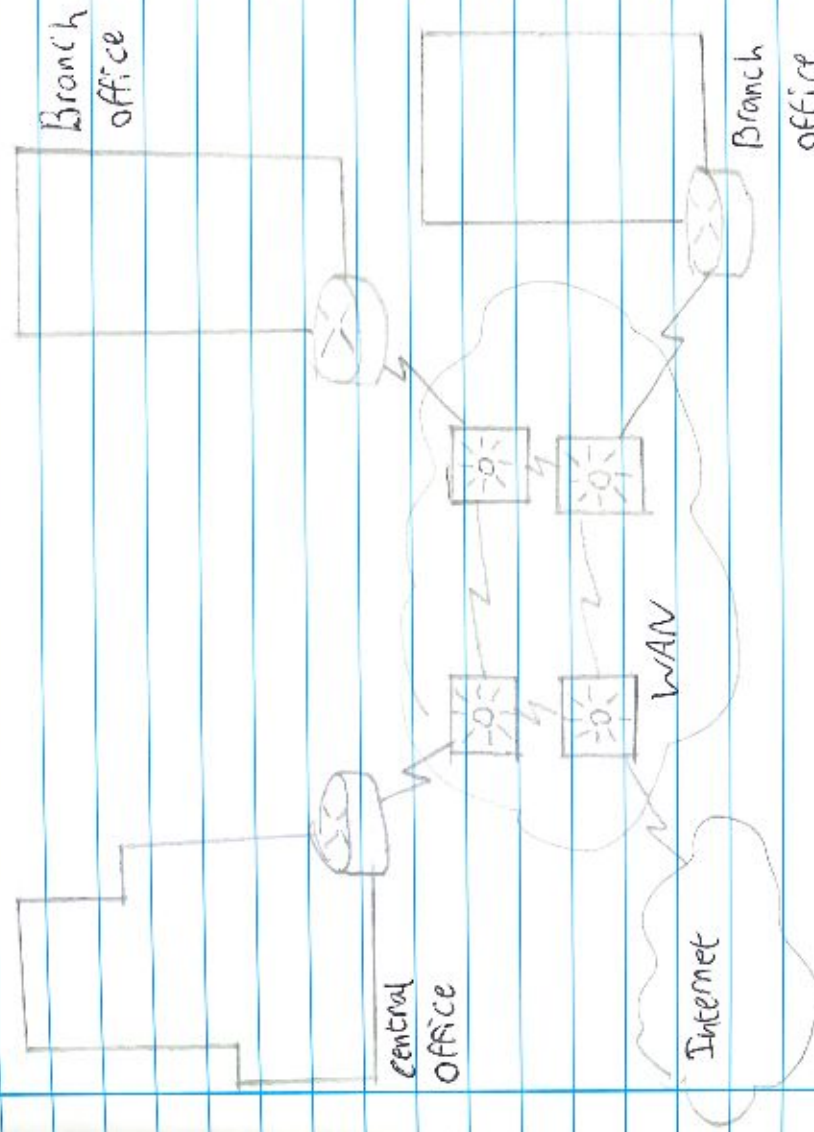
Campus Network

Campus networks tend to span multiple floors of a large building or several smaller buildings. Each floor of a building is home to its own LAN and each LAN connects to a single WAN device, which is linked to a service provider. IT support is in-house and employees number in the hundreds.



3) Branch Network

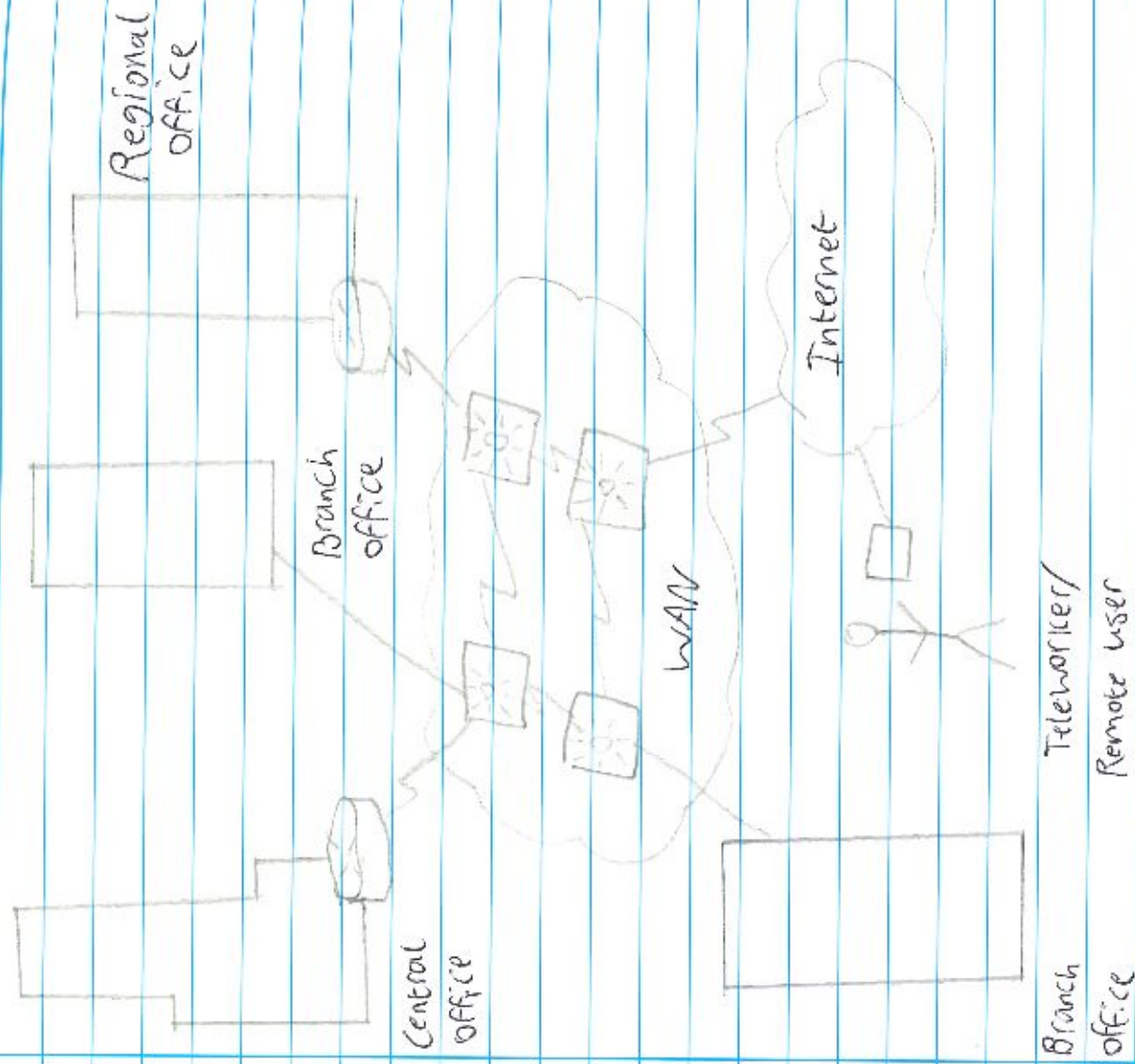
Branch networks span a country or a city, employ hundreds of staff, use in-house IT support and are made up of several branch offices and a central office that connect to a WAN. Teleworkers and remote users may connect to branch networks.



2) Distributed Network

Distributed networks span the globe. Use in-house IT support consist of central, regional and branch offices that connect to a large WAN and are used by ~~business~~ organisations who employ thousands.

3)



5a)

CMTS (Cable Modem Termination System) are devices headend routers that communicate with cable modems in a subscriber's home. CMTSs hold databases for providing services to subscribers.

Digital Subscriber Line Access Multiplexer (DSLAM)

Combines multiple DSL signals into a single high-speed line.

5b) Point-to-Point Protocol over Ethernet (PPPoE) aims to enable PPP between two devices connected via cat5 cable to communicate using PPP, substituting Ethernet encapsulation with PPP.

5c) Teleworking involves an ~~worker~~ employee work from a remote location or from home by giving them access to their employer's WAN. Teleworking is beneficial to the individual because it allows them to work more flexible hours, spend more time with family, save money on travel/commuting and increase their happiness/productivity. Teleworking is beneficial to the organisation due to increased productivity, less need for space and equipment.

7a) A Syslog server records network access events, performs load balancing and controls network logins.

7b) In Simple Network Management Protocol (SNMP), a Management Information Base (MIB) stores data such as the IP address of a connected device, name and description. Traps are triggered for sending event messages to a Syslog server. A severity level assigned to the event message tells the server how to respond to a situation.

Question No.

70)

The four data collection elements in SNMP are the Event name, Severity, trap triggered and address of the suspect device. The event name simply describes the event, the severity level notifies a Syslog Server on how to respond, the name of the trap that triggered the event and the IP address of the device that triggered the trap is included to record and, if necessary, terminate the device's connection.

Examiner Only

Question No.

Examiner Only

Arholwr yn unig

Arholwr yn unig

Rhify Cwestiwn

Rhify Cwestiwn

CYFENW:

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Llyfr Atebion Arholiadau

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1	Student Number	023872	List the numbers of the questions you have attempted	Office Use
2	Title of Examination Paper	W405	1	6
3	Module Code	M6X0113	2	4
4	Date and Time of Examination	08/05/2018	4	15
5	Examination Venue	GLAC	6	9
6	Seat Number		7	8
7	Number of Answer Books handed in	1		

(Gweler yr ochr arall am y fersiwn Cymraeg)

Complete, fold and seal
(see note 2 below)

SURNAME:

STEPHENS

FORENAME(S):

RICHARD LEE

1. ~~PA~~ route ~~us name~~ ~~PA~~ central
 routes ~~password cisco~~ ~~PA~~ ~~PA~~
 ← accept project

CHAP Challenge
 Username R1
 Remote - Password MOK ~~XXXX~~
 Router
 central
 Router
 accept/reject

Pop authenticates network layers ~~from~~
 Pop ~~uses~~ username and password are not
 encrypted leaving it vulnerable. Pop uses
 2 way handshake, with Pop once accepted
 then no ~~steps~~ the challenge will take place.

chip does authentication multiple layers but with a 3 way handshake, chip is more secure encrypting the password with chip a challenge is encrypted ~~from the central server~~ Username and password are submitted and the central server will accept or reject it.

the relative disadvantages of fog is the personnel who is visible and the advantages of fog is repeating challenging

2. The LAN manages the interfaces in the frame body. The LAN assigns the DLCI to identify connection.

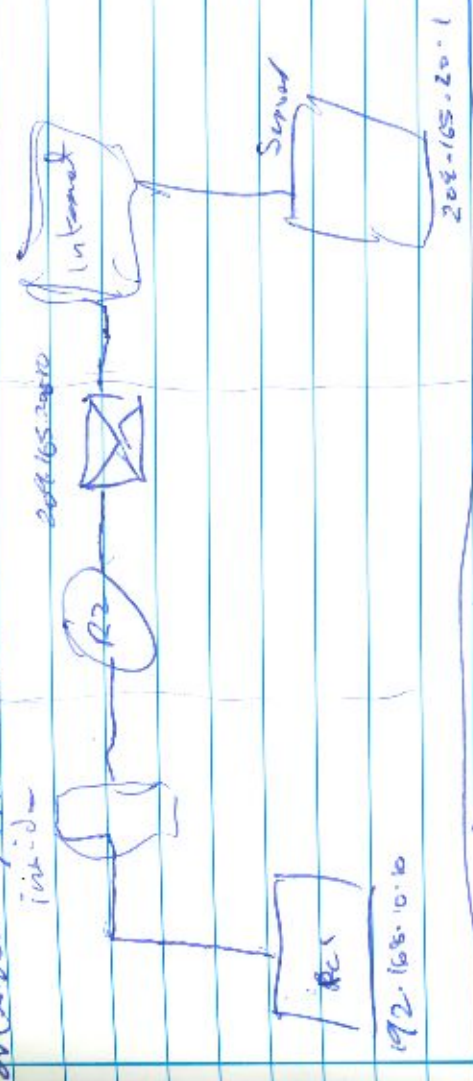
b. ~~Where~~ ARP ~~where~~ translates Layer 3 ~~addresses~~ ^{IP} addresses. Layer 2 mac address, inverse arp does the opposite. There must be a layer 3 ip address available for inverse arp to assign to.

c. DLCI data link connection identifier is the number at the end of a pbit to find connection. DLCI 10 bit is the most important bits in the frame relay header. The DLCI number identifies ~~the~~ the connection. The DLCI numbers can be different at opposite ends of the connection. The DLCI number is unique to ~~the~~ the connection.

4 Types of addresses are

A

inside address:
outside address: Destination address
inside global address
outside global address

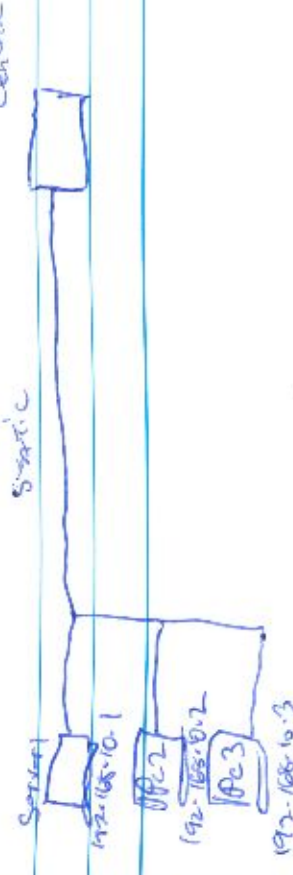


global address	inside address	outside address	global address
192.168.10.10	192.168.10.10	209.165.20.1	209.165.20.1

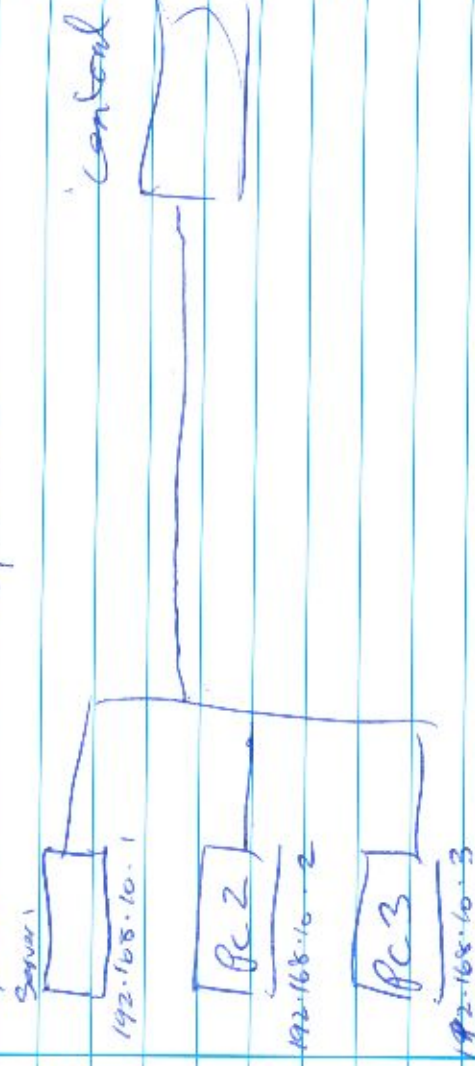
inside address = the original address where sending from
outside address = Destination address of message
inside global = inside portion of the network
outside global = outside portion of the network

b Three types of translation are Static, Dynamic, Port.

Static is where a one to one connection is made. This is more used for remote sites for control sites. The connection is more ~~constant~~ constant and consistent.



b Dynamic Dynamic



Dynamic translation is where a pool of addresses can be chosen from. Dynamic will choose the addresses on a first come first serve basis.

PAT Port address Translation

b is where a multiple private networks can go on a single public network. This is the most common ~~type~~ in NAT. ~~PATs~~ ~~used for~~ ~~example~~ PAT is used in most households where a device has been assigned a port number to get on the network. The port number will change after every session. The port number is unique to the device. PAT will be the next port available on returning from the destination if the port ~~has~~ ^{is} already in use.

c The advantages of NAT is that NAT conserves flexibility, compatibility and security where the disadvantages are poor performance, accessibility, tunneling,

~~can~~ NAT conserves to the network requirements. NAT is flexible where it will use ~~ports~~ ~~to~~ ~~addresses~~ of ports. NAT is compatible with broadband. NAT is secure using encryption.

performance is weak and NAT takes longer with frame decryption. Performance such as VoIP is difficult to achieve.

Flexibility: with NAT changing addresses across multiple networks flexibility can become difficult and translating tunneling is difficult to achieve with NAT.

6 VPNs are Virtual Private network where there is no need for expensive dedicated WAN lines. ~~These~~ This are used by ~~an~~ clients business purchasing the VPN. The VPN will use a VPN gateway ~~at~~ tunneling to the destination.

The advantages of VPN are Cost saving, Security, Scalability, Compatibility.

Cost saving are large when ~~the~~ VPNs are used. Equipment doesn't need to be purchased & maintained.

Security for VPNs are high as encryption occurs. Scalability with VPNs is good as bandwidth is used over the ~~internet~~ internet and any users ~~connected~~ need adding becomes viable. Compatibility ~~between~~ ~~between~~ VPNs are compatible across the internet.

and no collisions are shown

6 Site to site ~~between~~ VPNs are ~~only~~ ~~where~~ whose both ends of the connection known beforehand that a VPN will take place. This is used for a private remote access to the central access point.

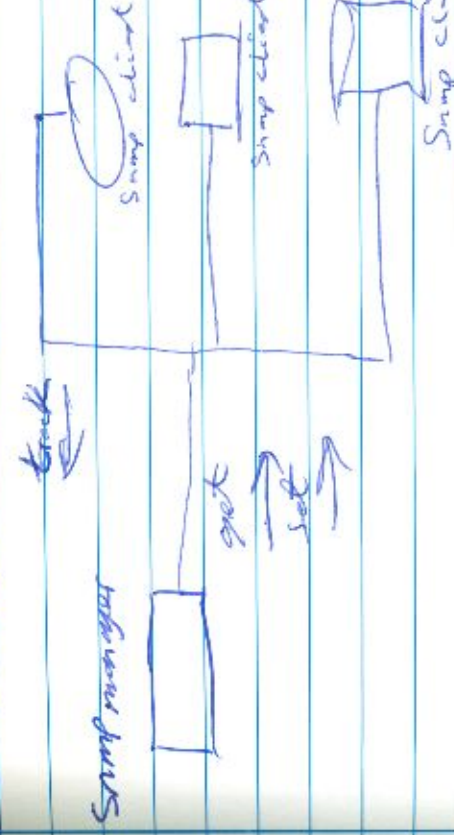
a Remote access VPNs are client based where a client can purchase to ~~advance~~ ~~the~~ network. Remote access VPNs are ~~not~~ ~~top~~ accessed by public networks.

7 a the 3 primary functions of Syslog Server are

to gather information from the desired source to collect the information from the ~~source~~ ~~source~~ to identify the destination where the information has been obtained.

b 3 Elements of SNMP ARE

SNMP manager SNMP client



The managers will use SNMP Software. ~~the~~ get information from the SNMP client, the managers can alter the information with the set command. SNMP clients communicate with the SNMP managers with the work.

SNMP client ~~are~~ are on each device that communicates with the SNMP manager. The MIB contains the details in hierarchical codes in form of a tree. The MIB holds the device details.

C The data collection details are

1. ~~The~~ ability require the data is kept upto date for the client
2. The ability to perform the task at the expected level.
3. The ability to ~~have~~ be efficient for the client
4. The ability to utilize its performance ~~the~~ for the client to have an better experience in the future

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Llenwch, plygwch a seliwch
(gweler nodyn 2 isod)

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SURNAME: Davies

FORENAME(S): RICHARD

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Question No.

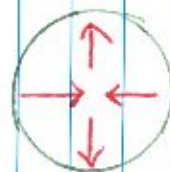
1) PPP Can use two types of Authentication PAP and CHAP. Identify and describe advantage and disadvantages of each.

a) PAP

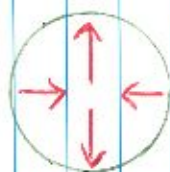
PAP Authentication uses username and password details.

1) Point to point protocol pap authentication is when a device is configured with a username and password over a Connection. This process is called two way handshake. The host configured Device Sends the plain text username and Password to the Connecting device to either be accepted or rejected. The benefits are same. Security are the ~~same~~ ^{same} network and protection of device switching. The ^{min} disadvantage is the username ~~being~~ and password being sent over as plaintext.

TWO WAY HANDSHAKE



USERNAME
PASSWORD



ACCEPT / REJECT

Answer yn unig

Philly Cuestion

CHAP

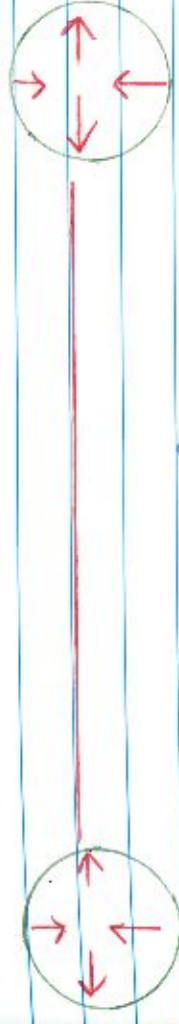
PPP CHAP Authentication is also a device on a network protected with a username and password. However unlike PAP, the password is encrypted. This encryption is known as MD5. CHAP process is known as a three way hand shake. The destination device sets a link, the source device sends the username and password and the destination device accepts/rejects.

CHAP's main advantages are the passwords being encrypted over a connection, protection against relay attack. The main disadvantages are longer configuration times and maintenance.

THREE WAY HANDSHAKE

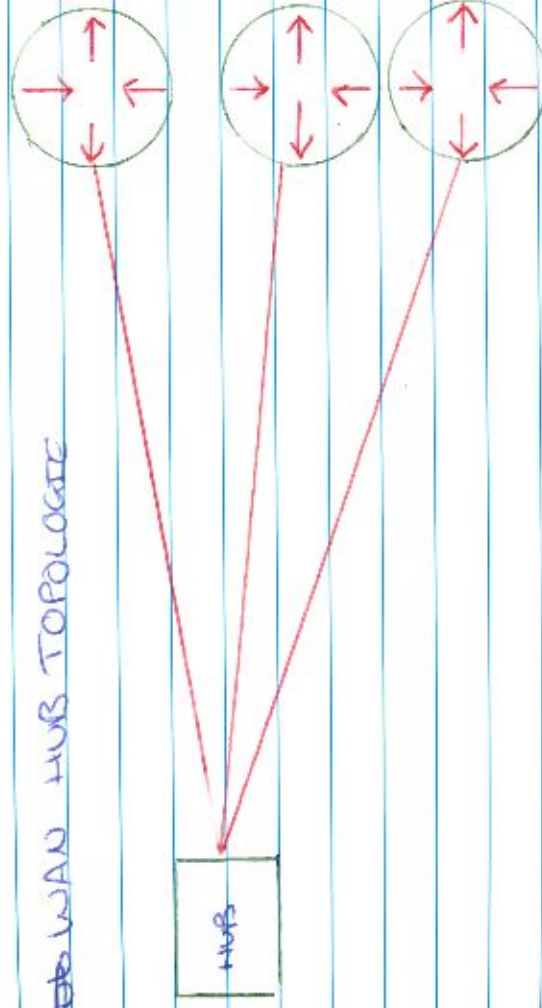
3 Identify and define the four common WAN topologies. Illustrate with diagrams.

A) One to One



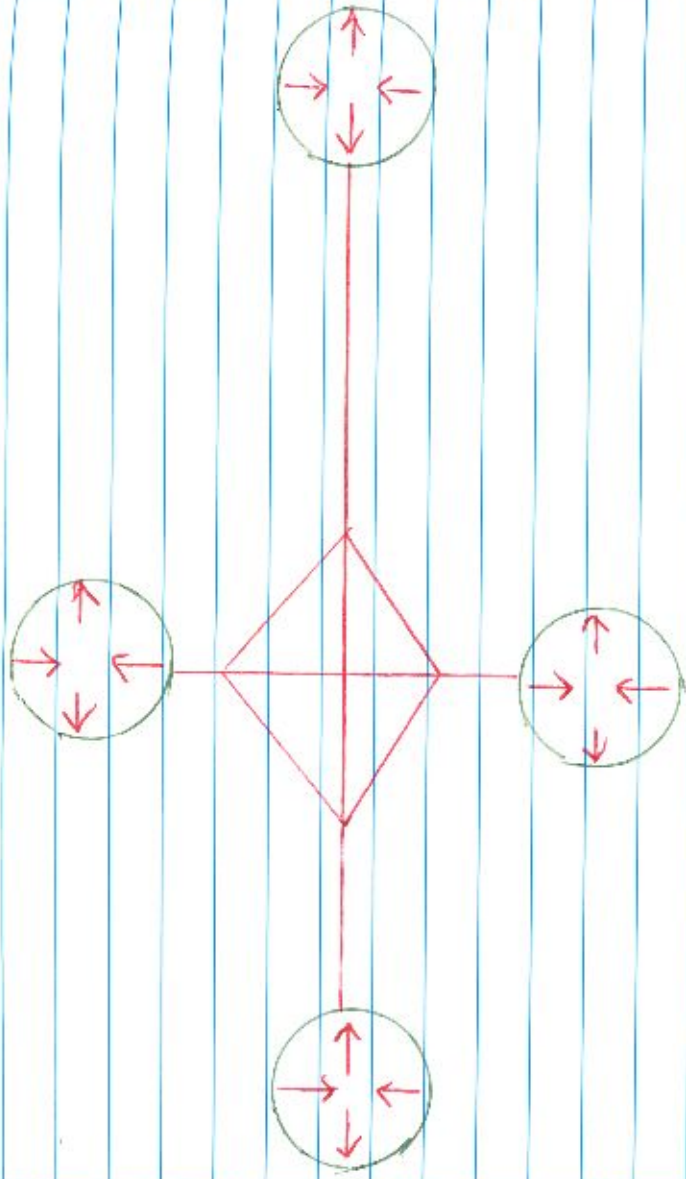
The one to one WAN topology is a single line between two devices.

B) ~~Hub~~ WAN HUB TOPOLOGY



This WAN topology uses a hub as a central location within a network. Many devices would connect via a private one to one but rather than only being able to connect via one connection, devices are able to communicate with each other through the hub.

c) WAN MESH TOPOLOGIE



WAN mesh topologies were created due to problems of wan hub topologies. The problem of having all connecting device ~~connect~~ communication over a single central hub would be latency and if that central device were to break the network would fail.

WAN mesh topologies connected all devices together with no central device. This allowed flexibility so if one device ~~failed~~ failed a network would not result in failure. However, this wan mesh topology did bring complexity.

2 ✓

d) ~~FASTER~~ WAN TOPOLOGIE

4) NAT includes four types of addresses, identify and describe.

b) Identify and describe the three type of NAT translation.

The three types of NAT translation are, Static, Dynamic and PAT.

Static NAT is a one to one mapping of local to public. A administrator will create a pool of allocated address.

Dynamic NAT is a many to many mapping of local to public. Dynamic NAT creates a pool of IP addresses and stores them in a pool of IP addresses. Similar to static NAT, this pool will be changed based on the need unlike static NAT where this pool can not change once created dynamically.

PAT is a many to one mapping of local to public. PAT translates all local IP address into one public address. An example of this can be seen within your home where the local IP of your computers and the router with PAT translation, translate to public when you type in google and enter inside a browser.

c) Identify the advantages and disadvantages of NAT.

advantages

- * Security
- * More IP address
- *

Disadvantages

- * Hard to trace
- * Complexity
- *

Question No.

6)

A Identify and describe the benefits of
VAPS.

Examiner Only

Question No.

Examiner Only

Arholwr yn unig

Arholwr yn unig

Arholwr yn unig

Rhify Cwestiwn

Examination Answer Books

12 Pages

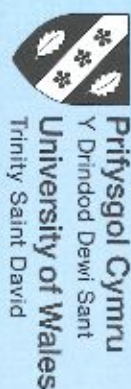
Instructions to Candidates

1. Please give the information requested in the boxes below.
2. Enter your name in the space provided to the right, fold over and seal down (using the label provided) to hide your name.
3. The answers must be legibly written. The Examiners can either ignore illegible script or have it typed and the expense of typing charged to the candidate.
4. Write your answers in ink.
5. Begin each answer on a fresh page. Do all rough work in the answer book and cross it through.
6. No part of this book is to be torn out; it must be handed in complete.
7. If more books than one are used, fasten them together using the tags available from the invigilator(s).
8. Every book must be handed in. In no circumstances may answer books, used or unused, be taken out of the examination venue.

Complete, fold and seal
(see note 2 below)

SURNAME: WELLS

FORENAME(S): LEWIS
PETER



Llyfr Atebion Arholiadau

12 Tudalen

Cyfarwyddiadau i Ymgeiswyr

1. Rhowch yr holl wybodaeth y gofynnir amdani yn y blychau isod.
2. Rhwng eich enw yn y lle a ddarparwyd ar y dde, plygwch ef at iello i lawr (gan ddefnyddio'r label a ddarparwyd) i guddio'ch enw.
3. Rhaid i'r atebion fod mewn llawysgrifen ddarlledadwy. Gall yr Arholwyr naill ai anwybyddu sgrïp annarledadwy neu drefnu iddi gael ei theipio a chael yr ymgeisydd i dalu.
4. Ysgrifennwch eich atebion mewn inc.
5. Dechreuwch bob ateb ar dudalen newydd. Gwnewch unrhyw fras nodiadau yn y llyfr atebion a thynnu llinell drwyddynt.
6. Ni ddylid rhwgo unrhyw ran o'r llyfr hwn; rhaid ei gyflwyno yn gyfan.
7. Os defnyddir mwy nag un llyfr, rhwymwch hwy gyda'i gilydd gan ddefnyddio'r tagiau sydd ar gael oddi wrth y gwyllw/gwylwyr.
8. Rhaid dychwelyd pob llyfr. Ni chaniateir mynd â llyfrau atebion, wedi eu defnyddio neu heb eu defnyddio, allan o'r lleoliad arholi o dan unrhyw amgylchiadau.

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(See the other side for English version)

Llenwch, plygwch a seliwch
(gweler nodyn 2 isod)

CYFENW:

ENW(AU) CYNTAF:

1	Student Number	090272
2	Title of Examination Paper	WAN'S
3	Module Code	M6X01113
4	Date and Time of Examination	08/05/2018 11:30 - 15:30
5	Examination Venue	
6	Seat Number	
7	Number of Answer Books handed in	1

(Gweler yr ochr arall am y fersiwn Cymraeg)

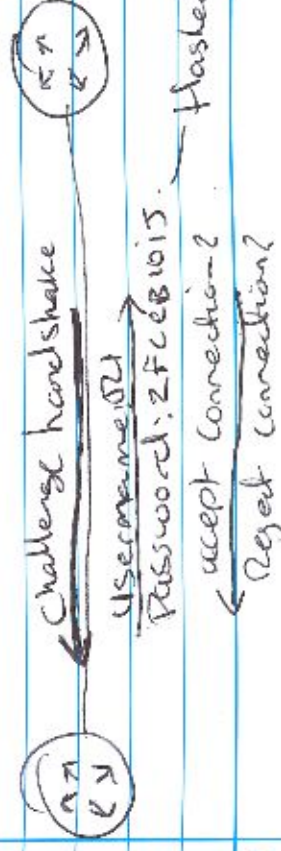
1) Pap - Password authentication protocol, provides a simple method where a remote node establishes its identity using a two way handshake. The username and password is checked with the database to ensure they match.



Accept Connection
Reject Connection

Pap is not the best authentication protocol as the ~~user~~ usernames and passwords can be seen in plain text. It also has no protection against relay attack. It is a security mechanism which is used by PPP but PPP provides a more secure mechanism in the form of chap. Challenge handshake protocol is a mechanism which has more

security benefits than pap. Chap uses the md5 hash (algorithm) to encrypt the text. It then gets computed and processed to see if it matches the stored username and password in the database. In addition to this it dynamically adds a dynamically changing number which adds security to the process (challenge). Chap periodically challenges the handshake to ensure the security of the connection and has protection against relay attacks.

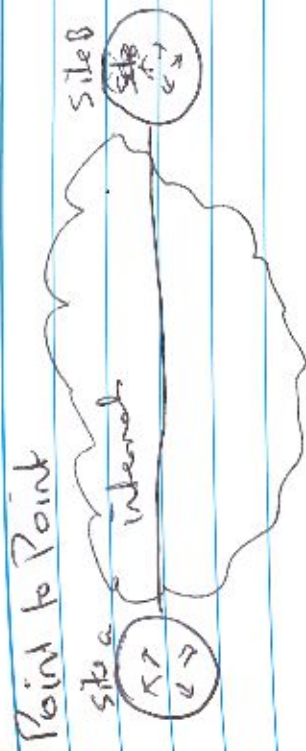


although chap has more qualities than pop there is a window of opportunity during the periodic challenge where an unauthorised access can occur.

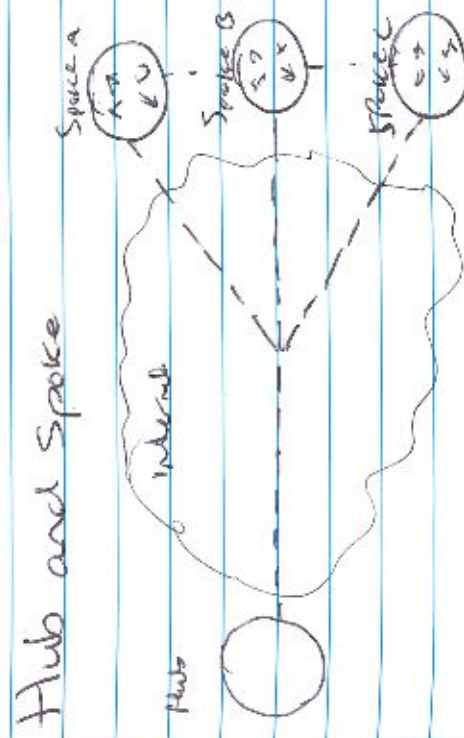
2a) LMI - Local managed interface - A keepalive mechanism used to provide status information on the connection between the DTE device (Router and frame relay switch (fc). Depending on the status information it receives it will have a response, should the response be none or broken the line can be determined to be down or lost, if it has a full status response then any information regarding the DLCI (Data link connection identifier) can be shared on the line. 2 ✓

b) Inverse Arp is used to obtain node address from layer 3 from a layer 2. The corresponding layer 3 address must be available to establish a connection. The interfaces which support inverse arp will initiate the inverse arp protocol, then format a arp request to the active VC. 2 ✓

c) DLCI - Data link connection identifier, a 10bit value displayed in the frame relay header. It represents the ^{connection} between the two devices. It has local significance only and is unique to the physical channel which it resides on. The end devices can have different DLCI values but still use the same connection. (102, 201). 2 ✓

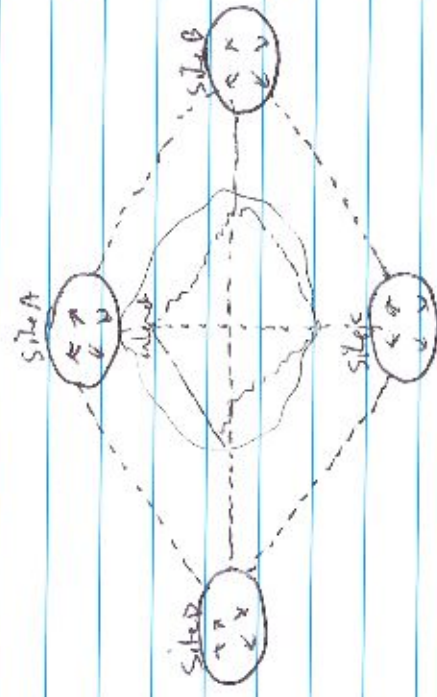


Point to point ~~used~~ ^{minimal} typically uses a dedicated leased line (E1/T1). It has no redundancy as if the line (connection) is down or broken site the sites which are configured will not be able to communicate. The mapping of the sites is statically configured. It can be used as a relatively cheap approach to connecting sites together but if multiple additional sites need to be added to the connection then it can become expensive, and also increased the lack of redundancy because there is more chance of a ~~broken~~ connection failing because there is more of them. 3 ✓



Hub and Spoke provide more redundancy as opposed to point to point when considering the hub directly the traffic, if for example the connection to Space C was lost then ~~the~~ Space A and B could still communicate as long as the hub maintains its forwarding capabilities. It adds very minimal redundancy and is more expensive than using a ~~point~~ point to point connection. However it is cheaper than implementing multiple point to point to communicate with each other.

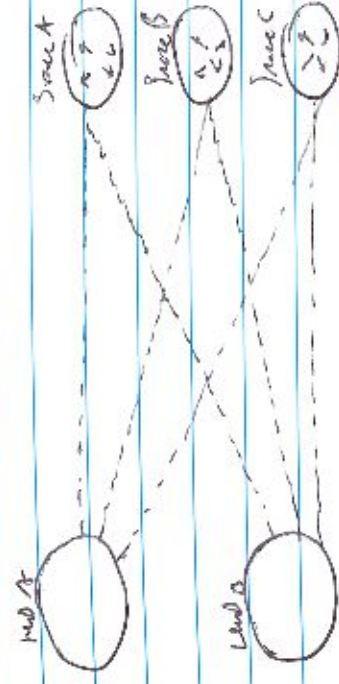
Full mesh



Full mesh allows for multiple sites to interconnect with each other, have a great degree of redundancy but are more expensive to implement than point to point and hub and spoke because of the additional hardware and connection. The traffic is directed by ~~what~~ ~~what~~ to the site intended and should as connection fail then this topology has other connections which will facilitate the process of directing the traffic to the relevant site.

3/

Dual homed



Dual homed provides great redundancy, should one hub fail or malfunction there is an alternative backup which replicates the very expensive to implement and has very complex configurations. Perfect for large corporations which have multiple sites which need to interconnect and makes it easy to implement when because the two hubs will have connections to them. Easy to add new users.

3/

(12) 3/

5)

a) DSLAM - Digital Subscriber line access multiplexer located at the Central office of the carrier, it combines multiple individual DSL connections into one high-capacity line to the ISP, therefore the internet.

CMTS - Cable Modem Termination System, is used to exchange digital signals with cable modems on a cable network. A Headend CMTS uses CM's which are located in subscribers homes.

B) PPPoE - Point to Point over Ethernet. Ethernet doesn't natively support PPP so a solution was required (PPPoE). PPPoE allows the PPP frames to be encapsulated inside Ethernet frame across a PPP tunnel to an Ethernet Connection (cable). PPPoE allows for LAN class devices to communicate with voice class devices.

C) Individuals

Productivity - The individual can start work when they want, rather than having a set time, they can work at a time they feel like.
 Cost Saving - Don't have to have a car or commute to work daily, this will save money.
 Home and family - The individual can work around family life so can maintain a happy balance of work and family too.
 Efficiency -

Customer Service - Because the employees don't have to commute to work and worry about the travelling and planning. Their Customer Service will increase because they can start their day better.

Increased Corporate Citizenship - colleagues have no need for transport so it is better for the environment and makes the company look more environmentally friendly.

Increased morale - Because the employees have increased productivity etc, this will create a better working environment with increased morale. (They don't have to wake up early to commute, spend money on travel etc).

Reduced absenteeism - The employees can work from home so there has been a reduction in the amount of absences, this is because all the benefits contained have this effect.

Cost Savings

The organisation can save on infrastructure if they have teleworkers who save on equipment needed in offices etc).

Recruitment and retention - Employees can employ people who live in suburban areas, normally a worker will have to travel into the city of a specific location, this allows people in remote locations to apply and the employer can retain the staff they have because the benefits of teleworking.

6)

a) Scalability - Using VPNs its incredibly easy to increase the size of the company's connections, it reduces the need for huge physical implementation due to the virtual connection. Adding new users to the system is made simple using VPNs. Simple configuration facilitates this.

2 ✓

Security - Allows for secure connections between user client and site, or site to site. A VPN provider increased security and protection against unauthorised personnel can encrypt the data/Traffic which is being transferred across a connection, by using an VPN tunnel this over/through public networks is key in protecting the data.

2 ✓

Compatibility with broadband technologies. There are an abundance of technologies which support VPN's or VC. They provide solutions to people who want to work remotely and securely.

2 ✓

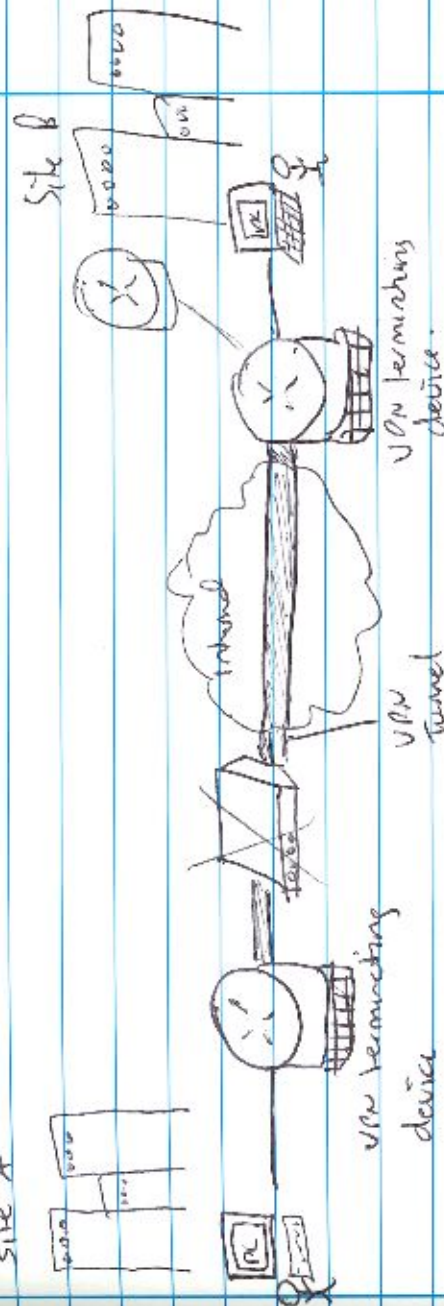
Cost - Because of the amount of virtual connections that can be made it can reduce the need for physical implementation of connections. Sites can secure their sensitive data and traffic using VPNs thereby creating a cost effective solution to other methods.

2 ✓

6b)

Site to Site VPNs use this method to secure the traffic which is being transferred. If Site A wanted to communicate with another site in the organisation it will do this by using a VPN termination terminating device, and create a tunnel over any public area then to a terminating device at the gateway to the destination site. These will be statically configured with VPNs and be aware of the incoming recipient, although as far as the client is concerned they have a direct connection.

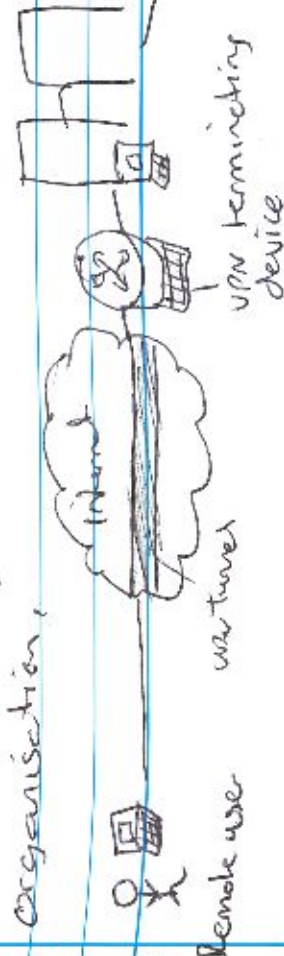
Site A



2 ✓

6c)

Remote access VPNs are used by people who want to access company networks securely. This may mean that they need additional security software on their devices (laptops etc) because it is them who is initiating the connection. This would normally mean there would be a connection to a company device (server, VPN terminating device) which will ensure they have a secure connection to the organisation.



Question No.

WPN

Scal

Sec

Compatibility with standardised
Code

Examiner Only

Question No.

Examiner Only

Atbolyr yn unig

Rhif y Cwestiwn

Atbolyr yn unig

Rhif y Cwestiwn

1	Rhif Myfyrwr		Rhestrwch iffau'r cwestiynau a ymgaisiwyd gennych	At Ddiwedd y Swyddfa
2	Teitl y Papur Arholiad			
3	Cod y Modiwl			
4	Dyddiad ac Amser yr Arholiad			
5	Lleoliad yr Arholiad			
6	Rhif Sedd			
7	Nifer y Llyfrau Atebion a gyflwynwyd		Cyfanswm	

Llyfr Atebion Arholiadau

12 Tudalen

Cyfarwyddiadau i Ymgeiswyr

- Rhowch yr holl wybodaeth y gofynnir amdani yn y blychau isod.
- Rhowch eich enw yn y lle a ddarparwyd ar y dde, plygwch ef a'i selio i lawr (gan ddefnyddio'r label a ddarparwyd) i guddio'ch enw.
- Rhaid i'r atebion fod mewn llawysgrifen ddarlennadwy. Gall yr Arholiwr nail ai anwybyddu sgrïp annarllennadwy, neu drefnu iddi gael ei theipio a chael yr ymgeisydd i dalu.
- Ysgrifennwch eich atebion mewn inc.
- Dechreuwch bob ateb ar dudalen newydd. Gwnewch unrhyw fras nodiadau yn y llyfr atebion a thynnu llinell drwyddynt.
- Ni ddylid rhwygo unrhyw ran o'r llyfr hwn; rhaid ei gyflwyno yn gyfan.
- Os defnyddir mwy nag un llyfr, rhwymwch hwy gyda'i gilydd gan ddefnyddio'r tagiau sydd ar gael oddi wrth y gwyllwr/gwylwyr.
- Rhaid dychwelyd pob llyfr. Ni chaniateir mynd â llyfrau atebion, wedi eu defnyddio neu heb eu defnyddio, allan o'r lleoliad arholi o dan unrhyw amgylchiadau.

Llenwch, plygwch a seliwch
(gweler nodlyn 2 isod)

CYFENW: _____

ENW(AU) CYNTAF: _____

Examination Answer Books

12 Pages

Instructions to Candidates

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1	Student Number	162427	List the numbers of the questions you have attempted	Office Use
2	Title of Examination Paper	WIDE AREA NETWORKS	1	8
3	Module Code	CSAC6002	2	8
4	Date and Time of Examination	08/05/2018 11.30am	3	11
5	Examination Venue	COLES SIR GAR Room 542	4	11
6	Seat Number		5	18
7	Number of Answer Books handed in	1		

Complete, fold and seal
(see note 2 below)

SURNAME: BOWDEN

FORENAME(S): DANIEL JOHN

SECTION A

PAP

advantages - PAP provides a simple method for a remote node to establish its identity using a two-way handshake.

- PAP offers a security mechanism for networks incompatible with CHAP.

disadvantages - PAP is not interactive. When the "PPP authentication PAP" command is used, the username and password are sent as one LCP data packet.

- PAP sends passwords in plain text and as such offers no encryption.
- Is not a secure protocol.

CHAP

advantages - conducts periodic challenges to ensure a node still has a valid password value for as long as the link persists.

- Performs a three-way handshake with the node. The node is prompted to enter a username and password, the password is sent ~~with~~ as an encrypted hash value based on the password. The server then either accepts or rejects the request.

- Offers MD5 encryption of the password

disadvantages - Not all networks are compatible with CHAP.

- Causes additional network traffic due to periodic challenges.

2a) Local Management Interface (LMI) is a keepalive mechanism that provides status information on frame relay connections.

Every 10 seconds or so, LMI polls the network for information on the status of frame relay connections. If an incomplete response, or no response, is received the line is determined to be down. If the response of FULL STATUS is received, it includes the status of DLCIs on the active line.

b) Inverse ARP is used to obtain Layer 3 (network layer) addresses of other nodes from Layer 2 (data link) addresses. The corresponding Layer 3 address must be available in order for the virtual circuit to be established.

When an interface supporting Inverse ARP becomes active, it initiates the Inverse ARP protocol and formats and InARP request to the active virtual circuit.

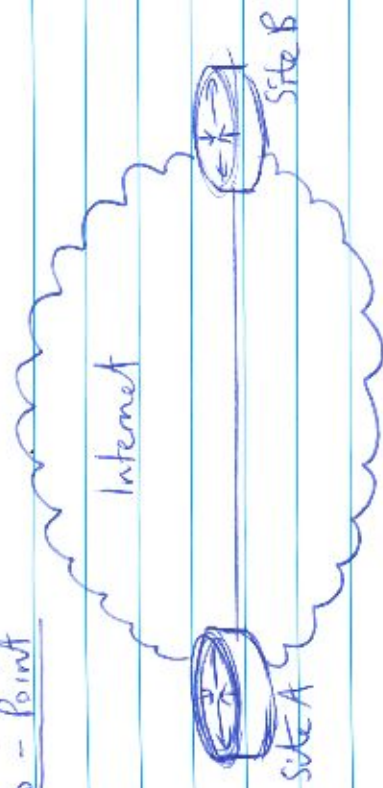
c) A Data Link Connection Identifier is a 10-bit value in the frame relay header. Each DLCI represents a unique VC in a frame relay connection.

A DLCI has local significance only and is unique to the physical line on which it resides.

Frame relay devices can use different DLCI values to refer to the same VC. An example of this would be using a value of 102 at one end of a VC and a value of 201 at the other end.

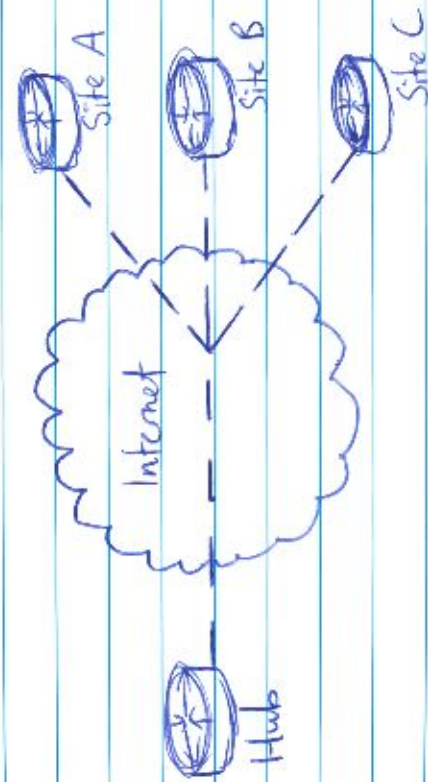
SECTION B

3.

Point-to-Point

A point-to-point topology involves a single direct link between two sites. This would usually be a private or leased line.

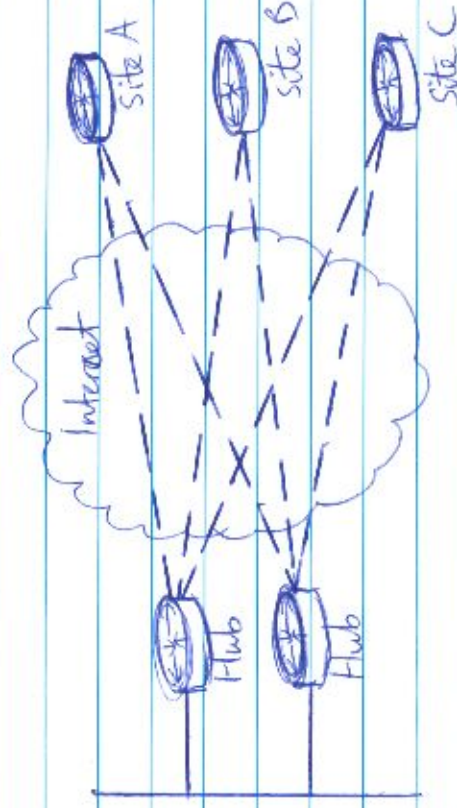
2 ✓

Hub and Spoke

A hub and spoke topology is less expensive than having multiple separate private or leased lines. Sites communicate through the hub and not directly.

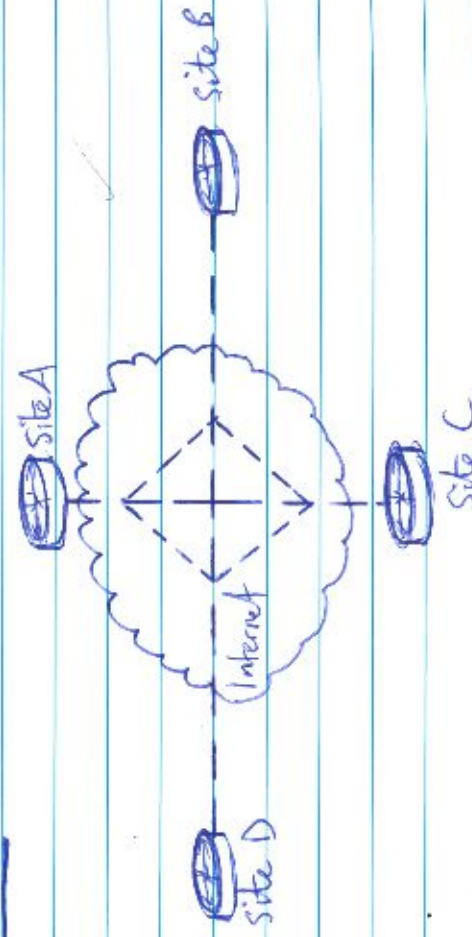
2 ✓

Dual-homed.



A dual-homed topology offers additional redundancy than a hub-and-spoke network. However, it is also more expensive due to the need to buy additional hardware. Dual-homed networks also offer load balancing but can also add complexity.

Full Mesh



A full mesh topology allows sites to communicate with each other directly. This causes less network traffic and can be more cost effective. However, full mesh networks can also be more complex than other topologies.

4 a) NAT includes 4 types of addresses:

Private IPv4 address - This address type is used internally by a network to identify individual hosts.

Public IPv4 address - This address type is used for connecting to ~~down~~ networks OUTSIDE of the local ~~network~~ network. These will usually be mapped to multiple private IPv4 addresses.

b) The 3 types of NAT are:

Static NAT - Offers a one-to-one address mapping between local and global addresses. It is usually configured by the network admin and remains constant.

Dynamic NAT - Offers a many-to-many address mapping of local and global addresses. It uses a pool of public IPv4 addresses which are allocated on a first come, first serve basis whenever a node requests access to an outside network.

Port Address Translation - Offers a many-to-one address mapping between local and global addresses. Multiple private IPv4 addresses are mapped to a single public IPv4 address. This is possible because each private IPv4 address is tracked by a port number.

The port number assigned by PAT will be the same as the one used by the host whenever possible. Otherwise it will increment the number until it finds an available port.

c) Advantages of NAT

- Helps to conserve IPv4 addresses.
- Provides an additional layer of security for host devices on a network.

Disadvantages of NAT

- Causes additional complexity to a network.

5a)

CMTS

A Cable Modem Termination System exchanges digital signals with cable modems on a cable network.

A headend CMTS communicates with cable modems located in subscriber homes.

The headend provides subscribers with internet services via a mixed optical-coaxial network.

DSLAM

A Digital Subscriber Line Access Multiplexer is a component located at the central office of the carrier. It combines multiple, individual DSL connections into one single high-capacity line to the ISP, and therefore, the Internet.

b)

PPPoE provides a solution to Ethernet not natively supporting PPP. It enables the sending of PPP frames over Ethernet connections by encapsulating the PPP frames inside Ethernet frames.

The encapsulated frames are sent through a PPP ~~tunnel~~ tunnel over the Ethernet connection.

c)

~~Explain~~ benefits

Organisation (employee) benefits of teleworking:

Increased productivity - employees are more productive due to not having to commute and more flexible work times

Easier recruitment and retention - Potential new employees are more likely to want to work for a company that allows them to work from home.

Better Morale - Employees morale will be better due to them having more time the family and more flexible hours.

Improved Corporate Citizenship - Company employees will use their cars less, therefore causing less emissions, making the company more 'green'.

Reduced Absenteeism - Employees are less likely to take time off work if they are able to work from the comfort of their home.

Better Customer Service - Employees can respond to customers quicker due to not having to commute and having more flexible hours.

Reduced Costs - Less money spent on office equipment & infrastructure.

Individual (employee) benefits of teleworking:

Improved productivity - individuals will have more time to work productively due to not having to commute and having more flexible hours.

Flexibility - Individuals are not tied down to office hours and, as such, can plan their work hours around external factors such as children, hobbies, travel etc.

Home and Family - Individuals will have more time to spend at home, with family and friends.

Cost Savings - Less money spent on commuting (fuel costs, vehicle maintenance or public transport costs).

1	Rhif Myfyriwr	
2	Teitl y Papur Arholiad	
3	Cod y Modiwl	
4	Dyddiad ac Amser yr Arholiad	
5	Lleoliad yr Arholiad	
6	Rhif Sedd	
7	Nifer y Llyfrau Atebion a gyflwynwyd	

1. PAP (Password Authentication Protocol) enables a remote node to authenticate its credentials with a router using a two-way authentication handshake. One of the advantages of PAP is that it is compatible with most protocols & devices. However, PAP is not secure as it does not encrypt passwords, instead sending the password over the cable as plain text. Also, PAP only authenticates once, meaning there is no way to challenge the credentials once access is given.

CHAP (challenge handshake authentication protocol) enables a remote node to authenticate, similarly to PAP except it challenges the credentials dynamically. The packet contains a identifier that the router will authenticate with a two way handshake. This identifier dynamically changes and is regularly challenged by the receiving router to authenticate the credentials. One of the advantages of CHAP is that the remote node encrypts the plain text password making it more secure. Also, by challenging the credentials regularly, the access given to the remote node is kept secure. However, the issue with CHAP is that not all host devices/applications are compatible with CHAP. Also, many UDP protocols may be unable to be used in accordance with CHAP.

2-a. An LMI generates a message with regards to the ^{status} state of a network and sends it to any connected devices.

6. The operation of inverse ARP is to assign a layer 2 MAC Address to a layer 3 IPV4 public address, rather than standard ARP which assigns a layer 3 address to the layer 2 MAC Address.

Question No.	Examiner Only	Question No.	Examiner Only	Ref: y Cwestiwn	Ref: y Cwestiwn
c.	A DHEI is a unique identifier that identifies every connection within the Frame Relay. The DHEI identifies all serial DCE connections so that a remote node can identify where to send the packet to reach the destination network.				
5. b.	PPPoE refers to the concept of having a point to point connection over the medium of ethernet. For example, an ISP has a point to point connection with a customer's modem via a serial cable, the ISP receives packets over the serial line using the PPP protocol.				
c.	For an organisation, one of the benefits of Teleworking is that they receive much higher productivity from their employees. A study from the Gartner group found that employees increased their work hours from home up to 11%. Another benefit of Teleworking for an organisation is that they have to spend much less money on infrastructure such as office space & the expenses that come with that i.e. they can enable employees to work at home. Also, if an organisation is able to offer teleworking they can appear very flexible meaning they will attract more employees and receive a much lower turnover of staff. Another benefit for an organisation that implements teleworking is the perception of the organisation as environmentally friendly & carbon neutral because of the reduction in traffic & emissions that would come as a result of teleworking. Finally teleworking is proven to reduce levels of absenteeism significantly (up to 80%), as employees are less likely to be absent if they are not required to commute to work. For an individual, one of the benefits of teleworking is cost. If an employee does not need to commute to work they do not need to pay for travel expenses.				
	Such as fuel for their car or train tickets. Another benefit of teleworking for an individual is having the freedom & family commitments, meaning that they can care for dependent relatives whilst being able to work. Also, teleworking provides the opportunity to work flexibly at a time that is suitable for an employee, at times where they can be at their most productive. Finally, teleworking enables individuals to be able to handle other aspects of modern life such as getting the car serviced whilst being able to work.				
6. a.	One of the benefits of VPNs is the security they offer. VPNs implement advanced encryption techniques meaning they can keep an employee or organisation's information safe whilst they are working. Another benefit of VPNs is that they reduce network costs. In many cases a third-party VPN may cost an organisation significantly less than leasing a line or implementing Frame Relay. Also, VPNs utilise the infrastructure of the internet therefore it becomes very easy to add users to a network without any obstacles. Another benefit of VPNs is that they enable employees to take advantage of superfast broadband speeds to work more efficiently, rather than use the same network as other employees, which would offer much less bandwidth. This enables employees to work remotely & securely.				
6.	A site to site VPN operates by having a VPN gateway on both a sending & receiving network. Both the sending network and the receiving network will have a VPN-enabled router at the border of each network, which acts as the "gateway". Hosts on the sending network will not be aware that a VPN exists, meaning they send TCP/IP packets as normal until				

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	they reach the gateway. The connection between the two VPN gateways forms a VPN tunnel that enables secure communication between two networks. c. A remote-access VPN operates by an employee (for example) having a VPN application installed on their work device, which is used to communicate with their employer. The employer will have a VPN server available that the employee must remotely connect to from their device, creating a secure connection between the employee's device and the VPN server. A remote-access VPN is activated & disabled at the discretion of the employee, but the VPN server should always be available for employees to connect to. 4. b. Static NAT translation is described as 1 to 1 mapping of local to global IPv4 addressing. For every local address, a global address is assigned, and will never change because the global address is reserved for that specific local address. Dynamic NAT translation is described as many to many mapping of local to global IPv4 addressing. A pool of global IPv4 addresses are reserved for a network and are assigned to local addresses on a first come first served basis. Whenever a host device needs to communicate with a device outside the network it is assigned to one of the addresses from the pool. Backup pools are made available as a countermeasure for too many devices requiring a global IPv4 address. PAT (Port Address Translation), also referred to as NAT overloading is described as many to 1 (or few) mapping of local to global IPv4 addressing. Many devices are assigned to the same IPv4 global address (this is		common of most small household networks). Multiple members of the household can simultaneously connect to the internet with the same global IPv4 address. This is defined as PAT because the port addresses are grouped together & assigned with a global address. c. one of the advantages of NAT is security. As local addresses are assigned to global addresses it is very difficult to trace which host device on a network is communicating across the internet. Although this form of security is limited it becomes more advantageous as a network gets larger. Another advantage of NAT is that it increases the longevity of the IPv4 protocol, as if every device connected to the internet had its own IP address there would no longer be enough IPv4 addresses. one of the disadvantages of NAT is that end-to-end traceability is lost. When it comes to troubleshooting this is a problem because the network administrator will be unable to find which devices on the network have a fault. Another disadvantage of NAT is that end-to-end functionality is lost because some applications are not compatible with NAT. a. one type of NAT address is inside local, meaning that the address is being translated by NAT but lies inside a network. Another type of NAT address is inside global, meaning that the address is being translated by NAT but lies outside a network. Also, outside local means that the address is a destination address that lies outside a network. Finally, outside global means that the address is a destination
Arholwr yn unig	Philly Cwestiwn	Arholwr yn unig	Philly Cwestiwn

address that lies inside a network.

