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COMMON ASSESSMENT TASK

Level 3 Digital Technologies and Hangarau Matihiko, 2019

91908 Analyse an area of computer science

Credits: Three

| Achievement Criteria | | |
|--------------------------------------|---|---|
| Achievement | Achievement with Merit | Achievement with Excellence |
| Analyse an area of computer science. | Analyse, in depth, an area of computer science. | Critically analyse an area of computer science. |

Type your School Code and 9-digit National Student Number (NSN) into the header at the top of this page. (If your NSN has 10 digits, omit the leading zero.)

Answer all parts of the assessment task in this document.

Your answer should be presented in 12pt Arial font, within the expanding text boxes, and may only include information you produce during this examination session.

You should aim to write between **800–1500 words** in total.

Save your finished work as a PDF file with the file name used in the header at the top of this page ("SchoolCode-YourNSN-91908.pdf").

By saving your work at the end of the examination, you are declaring that this work is your own. NZQA may sample your work to ensure that this is the case.

YOU MUST HAND THIS BOOKLET TO THE SUPERVISOR AT THE END OF THE EXAMINATION.

**Merit
05**



INSTRUCTIONS

Read all parts of the assessment task before you begin.

Select ONE of the following computer science areas:

- complexity and tractability
- computer vision
- big data
- computer graphics
- formal languages
- network-communication protocols.

Type your chosen computer science area in the space below:

Network Communication Protocols

Begin your answers on page 3.



ASSESSMENT TASK

- (a) Explain the key aspects of your chosen computer science area.

The area of computer science I have chosen is Network Communication Protocols. A network is what links two or more computers together and a protocol is rules and regulations that computers follow to communicate. There are two main networks that computers connect to, ethernet and internet. Ethernet is a physical connection that connects two or more computers together via a local area network (LAN). Internet is a virtual connection that connects two or more computers via WIFI across the world. These computers are connected through two models, client-server model and peer-to-peer model. A client is a computer or program that requests data and a server responds to the client, providing functionality. The client-server model works in this way. In contrast to the client-server model, the peer-to-peer model has no client and no server. All computers can request and respond. There are five main mechanisms in network communication protocols, HTTP, TCP, UDP, IP and DNS. Each mechanism has a different role and a different impact for the user. For example, TCP is slower but is more reliable at transporting data.

(b) Explain the relevant algorithms or mechanisms that support your chosen computer science area.

Mechanisms are things that help to carry out a process. The five main mechanisms of network communication protocols are HTTP, TCP, UDP, IP and DNS.

Hypertext transfer protocol (HTTP) is the most common protocol in network communications. It is a system that converts hypertext, such as HTML, into readable web pages that we see on our screens. HTTP uses a request/response system and there are nine main requests, an example of which is GET. The GET request does as it implies, requests data.

Transmission control protocol (TCP) is built on top of HTTP. This separates large message up into small packets of data. Each TCP packet includes a checksum and a sequence number in the header. This helps the receiving computer to makes sure that all packets arrive and that they are in order. TCP also sends acknowledgements (ACK's), which reply to the server after every packet. These contain whether the packet has arrived safely or if it has been lost or corrupted on the trip. If packets have been lost or corrupted, then the server will resend the packets. TCP is an accurate and reliable way to send data as it makes sure that all packets arrive, and that they arrive in order, without corruption.

User display protocol (UDP) is also built on top of HTTP. It also separates data into small packets, but it does not have the ability to include sequence numbers or send ACK's. since UDP cannot send ACK's the amount of bandwidth uses is less than TCP. This makes UDP a quicker protocol top use for sending packets. However, it is less reliable as it does not have the capabilities to resend packets of, they are corrupted or lost due to not receiving ACK's.

Internet protocol (IP) requests webpages using the domain name system (DNS). Domain name system (DNS) stores all IP addresses and ports in domain map that is stored by internet service providers (ISP's). Each IP address is given a domain name that is searched for by a user. When IP requests a webpage, DNS then searches the domain name for the IP address and port and then responds with the webpage, if there is one. The domain map starts with top level domains, such as .com and .gov, before working down to second level domains, such as google.com. This makes it easier for the user to remember web pages, as they are remembering domain names rather than IP addresses or ports.

- (c) Explain how your chosen computer science area is used, implemented or occurs. Use examples to support your answer.

Networking communication protocols are used in many ways within computing. An example of which is Skype. Skype is a video chat application and therefore, mainly uses UDP. It uses UDP as it is faster due to using less bandwidth, which is what users want when live streaming a video. The downside to using UDP is that packets may arrive corrupted and out of order. This is not a major concern for Skype and its users as the most important aspect is that it is fast and does not have delays. So, if packets arrive corrupted, they are ignored as Skype can cover them up.

Another example is emailing and texting. TCP is commonly used for emailing and texting this is due to the reliability. Texts and emails are not as time sensitive as live streaming and therefore, do not need the speed that UDP provides. However, it is crucial that emails and texts received are in order, so that they can be read. TCP's checksum and sequence numbers are used for this. This makes sure that all packets arrive without corruption and in order.

- (d) Explain the key problems or issues related to your selected computer science area, AND how these have been, or may be, addressed.

There are many issues that surround network communication protocols. An example of this is when a user requests a webpage two things are required, an IP address and a port number. Remembering and typing in a long string of numbers is difficult. To solve this DNS stores all IP addresses in a map that is stored by your internet service provider (ISP). This is then given a domain name, such as showpo.com. DNS then searches the domain name for the IP address and port and then responds with the webpage.

A second issue is that UDP is often unreliable when transporting packets. To solve this TCP is often used in conjunction. This ensures that important personal information is safely transported, and arrives without corruption and in order, while still getting there quickly. This is an issue that is continuously being looked at and improved on for maximum usability.

- (e) Provide a detailed explanation of how the technical capabilities and limitations of your chosen computer science area relate to humans. Use examples to support your answer.

Network communication protocols like anything else has limitations. These limitations can impact how people use technology in their everyday lives. An example of this is HTTP. HTTP is the most common protocol. This means that it is easy for people to use and understand. A limitation of this is that it can be easily used for phishing. Phishing can be used for scamming people. To prevent this, firewalls can be put in place. People are also ever increasing what they want from their technology. This means that they expect certain things to happen and when they don't people get angry and frustrated. An example of this is TCP and UDP. People expect their data to be transported quickly and reliably. However, with TCP and UDP it is an either or. To solve this, it is becoming more common to use a combination of the two. This means that important private information such as login information when skypeing is kept safe while taking a slower time, and less important information, such as the video chat is transported quickly with less care for reliability. This maximizes the quality of applications and can improve how people respond to applications.

- (f) Compare and contrast different perspectives on your chosen computer science area.

There are many different opinions and perspectives on network communication protocols and the best way to use them. An example of this is gamers. Gamers typically prefer to use a combination of UDP and TCP. This is because gamers tend to live stream videos, and therefore, need the speed that UDP provide. However, they still need important information such as, scoring and login details to be without error. To ensure this TCP is used. TCP makes sure that scoring and personal details are not corrupted or lost.

Another example is banks and their customers who use online banking. They typically use TCP. This is due to the reliability and protection that TCP provides. TCP gets the important personal details transported safely and resends packets if they are corrupted or lost. This ensures that any details customers provide to their banks are confidential and accurate.

(g) What conclusions can you draw about your chosen computer science area?
In your answer, you could:

- explore less-obvious implications
- justify predictions that you make
- consider potential improvements
- suggest innovative and imaginative wider uses.

There are many ways that network communication protocols can be improved an example of this is QUIC. Quick UDP internet control (QUIC) is developed by google. This mechanism sits on top of UDP, allowing it to have all the benefits that TCP provides. This means that the UDP/QUIC combination has the speed of UDP while also having the reliability and quality that TCP provides. when QUIC is accessible then it would change the way that network communications are used across the world.

A less obvious implication of network communication protocols is device syncing. Device syncing is done through a centralized client-server system. By having this personal data is being continuously shared between all synced devices, such as a laptop and mobile phone. This allows for data to be more easily stolen and lost, with even some government having access to all cloud information. To prevent this, it is recommended to use a decentralized peer-to-peer system. This minimizes access to people who can take personal information.

Merit Exemplar 2019

| Subject | Digital Technologies | | Standard | 91908 | Overall grade | 05 |
|---------|----------------------|--|----------|-------|---------------|----|
| Q | Grade | Annotation | | | | |
| | | <p>The candidate produced a good structure in addressing the assessment task. They accurately identified appropriate protocols, and clearly convey relevant mechanisms (e.g. reference to ACK's and checksums). There was a weak explanation relating to key problems / issues encountered, albeit enjoying use of examples. The candidate was able to produce a Merit-level understanding of protocols, accompanied with a partial understanding of perspectives. The candidate did not provide the level of detail required to meet all of the criteria for a Merit grade. However, the candidate's response to the last part of the assessment task to warrant a low Merit grade.</p> | | | | |