Final exam

Q1

The National Broadband Network (NBN) is a "wholesale" network – what does that mean? The wholesale nature of the NBN requires it to have an "open-access" architecture – why?

The wholesale network means that NBN mainly provide service to institutional customers (like ISPs) in contrast to a "retail" network. The "open-access" architecture allows different internet providers to offer their own service on top of NBN to make the network ubiquitous.

Q2

The NBN design was changed from a predominantly fibre-based access network to one that utilizes existing copper as well. What were the motivations for doing so, and what are some of the negative consequences?

The motivation of adopting existing copper is that the cost of completely renewing the link-layer architecture is expensive. In addition, lots of existing local networks are built on top of the coppers, both applications and hardware would be influenced significantly.
The negative consequence is that the transmission rate might be bottlenecked by the copper infrastructures. Another drawback is that overall complexity is increased because conversion is necessary between different link medium.

Q3

Does Apple's revenue come mainly from asset sale, subscription, brokerage, or advertising? How about Netflix? Explain.

Apple's revenue mainly come from sale of products and service. Because it is a manufacturing company, the main business is to sell the product and related service. One feature of an asset-sale based business is that it holds sufficient current asset and has a higher inventory turnover, which can be reflected by the annual report of Apple.
Netflix's revenue mainly come from subscription, because its main business is to provide streaming service to customers. In addition, the charge mode of Netflix is subscription. This is shown in the income statement of Netflix: Streaming revenues, which is generated by subscription dominates the income statement.

Q4

An Internet eXchange Point (IXP) is a facility where various network operators and content providers can interconnect with each other. Briefly explain why this is good for cost, latency, and sovereignty reasons.

In terms of cost, a IXP provides a geological centre for network operators and content providers to exchange network traffic. This can reduce the cost of constructing data centres separately and building links between them. Also, they can benefit from economy of scale by sharing the up-front cost of physical infrastructures. In addition, by integrating service providers in a IXP may help to form a establish a common standard, which can also reduce the cost of adapting different technology.

Because service providers are located near to each other, the latency of exchanging data can be reduced a lot. Peering service provided by IXP can also increase the connection efficiency. In the perspective of sovereignty, because large dataflows are integrated together, it is easy to monitor the behaviour of the participants and to enforce new regulations.

Q5

Briefly explain (with examples) the difference between public peering and private peering at an IXP.

Public peering is used to establish interconnection between one network and all other participants that connect with the shared peering switch. For example, Netflix may use public peering to provide streaming video to different networks through public peering because it wants to broadcast service to as many customers as possible.

Private peering is achieved by directly connecting networks through a link. It is a more dedicated link comparing to public peering, and it's more secure and controllable. For example, one entity wants to connect with a colocation facility. In this case, they exchange specific information constantly, they can use private peering.

Q6

Campus and enterprise networks are moving from the "three-tier" (core, distribution, and access) to a "leaf spine" architecture. Briefly state some pros and cons of this migration.

There is only one hop between leaf nodes in a leaf-spine architecture, therefore, the connection would be faster and more predictable. The multiple-path feature of leaf-spine architecture offers a more flexible way of routing and avoiding congestion. The flatter architecture can also provide scalability to the network.

The cost of connection is one of the concerns of this architecture. Each leaf node should be connected to all spines in the network, this can incur excessive cost and complexity of establishing and managing the links. Number of connections is limited, oversubscription

should be considered.

Q7

Briefly state the relative advantages and disadvantages of using WiFi versus LoRa versus 5G for an Internet of Things (IoT) system.

WIFI: Wi-Fi provides high bandwidth wireless connection, and the standard of WIFI makes development of applications easier. However, the range is a limiting factor of WIFI. Moreover, WIFI is more power consuming.

LoRa: Lora can provide long range connections with low cost of establishment and maintenance. In addition, it is more flexible and customisable, the battery life is also much longer. However, the bandwidth of Lora is limited, it cannot handle complex tasks.

5G: Faster transmission, large capability can be handled by 5G. So that complex applications can be achieved by 5G infrastructure. However, the construction of 5G infrastructure is expensive, and time-consuming.

Q8

Why is it challenging to make IoT networks secure (compared to traditional IT networks)? Briefly describe one way in which the industry is addressing this challenge.

The communication between IoT end points is wireless and exposed to everyone. Restricted by the computational power of devices, the encryption of signals is weak. One of the approaches is to use a integrated platform to manage and monitor IoT devices and encryption mechanisms.

Q9

Briefly describe the role of "model-driven configuration" and "model-driven telemetry" in a Programmable Network

Model-driven configuration and model driven telemetry allows administrators to have a lower level of abstraction of the network and configure the network more specifically. They also help the network controller to monitor the traffic statistic in real-time and to configuration the network according to the usage in a modelled structural way. With a model-driven approach, the network can be managed structurally, which also benefits automation.

Q10

Many organizations worldwide are moving their IT infrastructure to the cloud – briefly describe one technical benefit and one business benefit of doing so.

One technical benefit is that a cloud platform can provide a more scalable solution to the infrastructure. Configuration, deployment and expansion of cloud facility is also faster than physical machines.

Business benefit: The subscription model of cloud-service can reduce the up-front cost of constructing a physical IT infrastructure.