

Scenario

You are a sought-after technical consultant known for your excellent solutions that tailor-fit a project's requirements, with a minimal spend, and a quick return on investment (RoI). The board has asked you for a meeting with them for restructuring their IT infrastructure and services, given the needs during the pandemic and the never-ending lockdowns.

You are contracted to advise the company on a re-design of their online infrastructure, suggest a state-of-the-art design that includes new communications technologies and services available from providers. The system must support voice, data, images, video and audio streaming. The associated costs for the re-design will need to be allocated and sanctioned by the management team. The costing accuracy requires to be within $\pm 15\%$. This means, the cost estimates for the infrastructure and devices you will include in your report should be as accurate and realistic as possible and supported by references.

You are called for a meeting convened by the Chief Information Officer. The meeting is attended by the management team as well. On a video conference call, you are told:

"Tech & Co." is a fast-growing online consumer electronics company with an annual turnover of £4 million and a gross profit of 20%. We are growing to target our turnover to £8m and expect to retain the same gross profits the following year as well. We are looking to restructure following the changes to business due to the pandemic. Presently, they have an in-house networking and computing infrastructure. The company is known for its excellent customer interaction and support – a unique selling point that has seen their business grow almost exponentially in the last few years.

There are four core functional components of the business – Management, Infrastructure and Operations, Marketing, and Sales & support. All documentation and business operations are online. The business runs out of a single large building with an adjoining warehouse for the inventory. The online business is in the consumer retail sector.

The business fulfils over 150,000 customer orders per day on average and about ten times the number during the end-of-year sale and the annual Summer sale. The customer deliveries are handled by delivery companies that organise deliveries as per the requirement of the customer orders.

All the employees are located in the four-floor building with the inventory in the adjoining warehouse. The Management and admin team is on Floor 1, the Infrastructure and Operations is on Floor 2, the Sales and Support team are on Floor 3 and the Marketing team is on Floor 4. One part of the sales team that handles inventory and shipping is in the warehouse adjoining the office building.

Currently, the online operations are all handled by an internal network that spans across four floors and the warehouse. A server farm located in floor 2, houses all the servers and a core switch in a redundant configuration. There are six distribution switches in all – one for each floor and two in the warehouse. A WLAN controller and 50 access points provide

WiFi access. An Intrusion protection system is deployed with sensors in each of the network segments. Each of the distribution switches and WiFi controller are configured as VLAN segments from the core switch.

The Internet access is via two providers (redundant Internet access, load-balanced) and the links terminate on Floor 2. A firewall and access router, both in redundant configurations, interconnect the internal network to the Internet. All Internet-facing servers (WWW, email, VPN, load-balanced proxies for access to the sales, etc.) are in a DMZ with the firewall regulating access to and from the DMZ and the internal network and the Internet.

The company realises the need to restructure its network and integrate newer technologies for its operations. The management however specifies that their ERP systems must be located on site. It realises the need to use cloud service providers appropriately. However, it's primary concern is providing customer interaction and support. The sales and support team works from home. In total there are 90 personnel that work across three shifts, round the clock. These are the key people that are required to be online to service customers. Apart from this, all other customer services are online.

Due to the pandemic, the sales & support, marketing personnel work from home, as do the management. The infrastructure and operations personnel that comprise of the warehouse team, the IT operations team, and the physical security team will remain on-site. In the expected restructuring, the company intends to permanently move the personnel in Floor 3 and Floor 4 to work-from-home. The network restructuring must ensure:

- No compromise in customer interactions – online chats, emails, video calls, requiring high-bandwidth communications links to support real-time streaming of multimedia content.
- Reducing on-site equipment and infrastructure
- Minimising the on-site work force
- Identify quality broadband (wired and wireless) providers for work-from-home users

The meeting ends with a request for you to provide an initial documentation addressing a specific set of questions (listed as tasks below), packaged as a report. This report is expected to be circulated to the entire management team as well as the Chief Information Officer and his team. You are requested to provide the initial report for review in two weeks' time.

Guidelines for addressing the tasks:

- The company has not provided you any specific inputs in terms of their network diagrams, functional schematics, etc. Therefore, making assumptions appropriately and stating the list of assumptions made, upfront, is a good practice.
- Similarly, you have not received any specific details about their suite of services. Make appropriate assumptions and state them clearly, upfront.
- When presenting schematics or network diagrams, use landscape orientation on your pages.
- Attempt to package information into tables and illustrations wherever possible. That can contribute to reducing word count while increasing the information content.
- Research real-world costs for all network devices and provider services and provide a web link to the sources used.

The specific tasks are set out on the next pages.

Tasks

Task 1

(20 points)

a) Complete the following tasks based on the case study:

- i) Draw a functional schematic indicating the functional sections of the network infrastructure and their interconnectivity.
- ii) Identify the various services provided, their type (voice, video, data, or multimedia) and the direction of access to them (incoming or outgoing with respect to the organisation).
- iii) Give a list of services provided and profile the services in terms of their data characteristics such as typical data rates, response times, etc.

Make appropriate assumptions and state them. This schematic and profile will be the basis of the rest of the tasks. HINT: *Research real-world data traffic statistics.*

b) Extending from the previous task, complete the following tasks based on the case study:

- i) Draw and present the network schematics. The primary schematic will be a broadly labelled schematic of the entire network.
- ii) Next, prepare a schematic of the network backbone connectivity (core and distribution switches), indicating their locations.
- iii) Follow this up with schematics of each of the floors and the warehouse.
- iv) Make a listing of all the equipment used and the approximate amount and type of cabling used. Indicate the make, configuration, and market price of each of the network equipment.

Make appropriate assumptions and state them. Remember to orient the schematics in landscape. Indicate the source from where you quote the price of the equipment.

Questions continue on the next page

Task 2

(20 points)

Use the output of task 1 as the basis and address the potential restructuring requested by the company using the following points.

- What factors would you consider when suggesting broadband providers for use by the work-from-home (WFH) users? Specify the requirements per user connection for the broadband provider. Use diagrams to illustrate where possible.
- What would you do to minimise the computing infrastructure? How would you manage the interconnectivity from an Internet provider's perspective? What fail-over provisions would you build in to the requirements? Recall the company's USP. Use diagrams/schematics to illustrate your proposals.
- What modifications would you suggest to the infrastructure, on-site, after the minimisation? Illustrate with a schematic showing the services and access, as well as a high-level network diagram indicating the components on-site and their interconnectivity. Illustrate the minimisation giving a list of equipment and services removed.
- Summarise overall plan by listing a set of action points that you would perform in a sequence.

Guideline: Make appropriate assumptions and state them clearly at the beginning of your response. Use costs (capital and running) as a basis for your choice of technology or services. Your technical reasoning must be well supported by evidence (in-text citations) that should be listed in the references, using the Harvard referencing system. You may make reasonable assumptions of costs for those that you cannot get in online searches. Focus on the business needs and how they will be met and not only the technical aspects; the technology must meet the business needs.

Task 3

(25 points)

Based on the previous tasks, draw a single unified network diagram showing the recommended solution. Include a list of networking devices, accessories, software, and provider service costs, along with their configurations/services and pricing. Assess the total cost of ownership of the network which you have proposed.

Task 4

(15 points)

List the risks and benefits of your proposal. Include the technical risks (including cyber security) as well as any business risks that arise due to the technical risks. To end the proposal, highlight your key selling points for the proposal and include a quick RoI (return on investment) as one of the primary points.