



Networks and Internet Applications

Activity: CA2 – Second Continuous Assessment Test

- The solution must be submitted in a PDF file in the subject classroom .
- You must include references to the resources you have consulted to answer the questions.
- The deadline for submission is **April 27th, 2025**

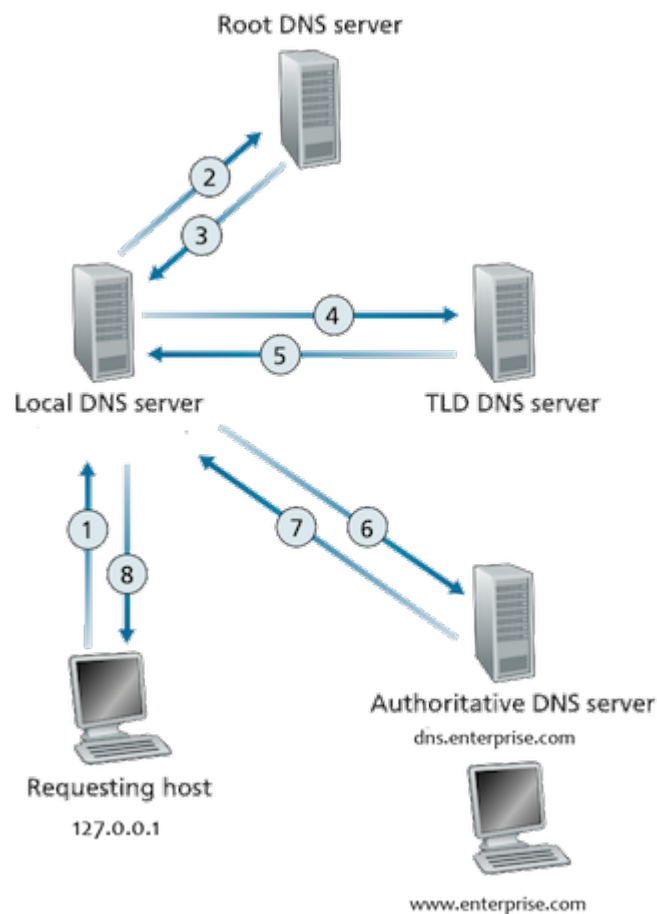
Questions

1. You have been asked to strategically evaluate the adoption of cloud computing at a telecommunications company that is considering migrating part of its infrastructure to the cloud. They currently have their own infrastructure with physical servers that host their communications services and customer data storage.
 - a. What are the main advantages and disadvantages of migrating to the cloud for this company in terms of security, costs and performance? Include at least two advantages and two disadvantages for each aspect.
 - b. Propose a deployment model (public, private, hybrid, or community) that best suits this company and justify your choice.
 - c. Considering the possibility of adopting a hybrid strategy, which parts of their infrastructure should they keep on-premises and which ones should they outsource, taking into account the following aspects: latency and performance; regulations and privacy; availability?
2. Suppose you want to connect to **www.enterprise.com** and the following records are on the DNS server for the TLD (Top Level Domain):
 - (www.enterprise.com, dns.enterprise.com, NS)
 - (dns.enterprise.com, 146.54.104.222, A)

Also suppose the following records are on the DNS server for enterprise.com:

- (www.enterprise.com, east5.enterprise.com, CNAME)
- (east5.enterprise.com, 142.81.17.206, A)
- (enterprise.com, mail.enterprise.com, MX)
- (mail.enterprise.com, 247.29.174.157, A)

Also, suppose your local DNS server only caches the DNS server for the TLD.



- In the example above, how many different types of Resource Records (RRs) are there on the authoritative DNS server for `enterprise.com`?
- Can you send multiple DNS queries and receive multiple RR responses in a single message?
- To which DNS server does the host send its requests?
- What type of DNS server stores a company's DNS records?
- What is the DNS server name for `enterprise.com`?
- When you connect to `www.enterprise.com`, your local DNS server requests the IP address on your behalf. When it contacts the TLD server, how many RRs are returned? Indicate the content of these responses.
- Suppose the `enterprise.com` website is hosted at `east5.enterprise.com`. What type of record is needed to do this?
- Suppose we are trying to send an email to `admin@enterprise.com`. What type of record will contain the name of your mail server and what is its value?
- Why does the local DNS server cache the TLD's DNS server?

- j. What transport protocol(s) does DNS use: TCP, UDP, or both?
 - k. What well-known port does DNS use?
3. Choose an email you recently received. Make sure it's from the year 2025. Access the option to view the full email header. In most email clients, you can do this by looking for the "View Original" or "Show Header" option.
- a. Identify and comment on the main fields that appear in the header.
 - b. How many "Received" lines are in the header? What information do these lines provide?
 - c. Are there any other lines that are repeated in the header? Which one is it and what information does it contain?
4. We want to send a file of size **F = 9 Gbits** to 5 peers. Suppose the server has an upload speed of **u = 85 Mbps**. The 5 peers have the following upload speeds:
- u1 = 14 Mbps
 - u2 = 21 Mbps
 - u3 = 15 Mbps
 - u4 = 14 Mbps
 - u5 = 17 Mbps

The 5 peers have the following download speeds:

- d1 = 28 Mbps
 - d2 = 36 Mbps
 - d3 = 23 Mbps
 - d4 = 12 Mbps
 - d5 = 37 Mbps
- a. What is the minimum time required to distribute this file from the central server to the 5 peers using the client-server model?
 - b. What is the minimum time required to distribute this file from the central server to the 5 peers using a peer-to-peer download?

Note: You can find similar exercises at the following link:
https://gaia.cs.umass.edu/kurose_ross/interactive/CS_vs_P2P_download.php

5. Imagine you are designing a REST API for a task management application (to-do list). The application should allow users to create, read, update, and delete tasks. Each task has the following attributes:
- **id**: Unique task identifier.
 - **title**: Title of the task.
 - **description**: Detailed description of the task.
 - **dueDate**: Due date of the task.
 - **completed**: State of the task (true/false).

- a. Create a table with the endpoints needed to perform CRUD (Create, Read, Update, Delete) operations on the tasks. Include the HTTP method, the path (endpoint), and a brief description of what each endpoint does.
 - b. Provide an example of a JSON response when we retrieve a task by its ID. Add a version to the API (e.g., v1) and modify the endpoints to include the version.
 - c. Specify which HTTP status codes each endpoint would return in case of success or error.
6. YouTube uses a Content Delivery Network (CDN) to efficiently distribute its videos to users around the world.
 - a. Describe how content is replicated across different servers and delivered to the client.
 - b. Cite some examples of other popular CDNs.
 - c. Open the Pingdom tool: <https://tools.pingdom.com>. Enter the URL of a website that uses a CDN (for example, <https://www.youtube.com>). Select three test locations (United States, Europe, and Asia) and click "Start Test" to measure the website's load time. Note the load time and the location of the server from which the content was served.
 - d. Enter the URL of a website that does not use a CDN (for example, a small blog or a local site). Run the previous test in the same locations as in the previous step. Note the load time and server location and comment on the results.
7. Regarding packet scheduling algorithms, provide reasoned answers to the following questions:
 - a. In First Come First Served (FCFS), what happens if a large packet arrives first? How does this affect the waiting time for smaller packets?
 - b. In Priority Scheduling, suppose three packets arrive in this order: P1 (high priority, size 100), P2 (low priority, size 50), P3 (high priority, size 200). What happens in this case if a low-priority packet arrives before a high-priority packet? Is the priority respected in the simulation? What is the transmission order of the packets?
 - c. In Round Robin, suppose we want to transmit three packets: P1 (size 100), P2 (size 50), P3 (size 200). The quantum is 50. What happens if the packets have very different sizes? What will the order of the packets be?
 - d. In Weighted Fair Queueing (WFQ), suppose we have three flows with the following weights:
 - i. Flow A: Weight 2
 - ii. Flow B: Weight 1
 - iii. Flow C: Weight 3How will the bandwidth be distributed among the different flows?
8. Regarding HTTP protocol:

- a. Perform a comparative analysis of the HTTP/1.1, HTTP/2, and HTTP/3 protocol versions, paying attention to the following characteristics:
 - Year of release
 - Current adoption level
 - Main advantages
 - Main limitations
 - b. What do you think will be the short- and medium-term future trends for the three versions?
9. GraphQL (<https://graphql.org/>) is an API query language developed by Facebook in 2012 and released as open-source in 2015. Research this technology and answer the following questions:
 - a. What main advantages does GraphQL offer over REST?
 - b. What disadvantages or limitations does GraphQL have compared to REST?
 - c. What are queries and mutations in GraphQL?
 - d. Suppose you are implementing an API to manage your favorite movies using GraphQL. Each movie has the following attributes:
 - **id**: Unique identifier of the movie.
 - **title**: Title of the movie.
 - **year**: Release year.
 - **genre**: Genre of the movie.

You want to perform the following operations:

 - Queries:
 - Get a list of all movies.
 - Get a specific movie by its ID.
 - Mutations:
 - Add a new movie.
 - i. Define the data types for Movie.
 - ii. Define the necessary queries and mutations.
10. Search information about two different types of cloud computing models, one for IaaS, PaaS or SaaS and the other for FaaS (Function as a Service) or BaaS (Backend as a Service).
 - a. Briefly describe the main features of each model.
 - b. List two use cases that are suitable for the first model selected and two that are suitable for the second model selected.
 - c. Find two companies that offer the second model selected services.
 - d. Focusing on FaaS, it has some limitations, some of which are listed below. Describe these limitations and how they could be resolved:
 - i. Limited execution time
 - ii. Cold start

- iii. Vendor lock-in
- iv. Difficulty debugging and monitoring