

## **Students should be able to...**

Everything in previous study guides:

<https://www.cs.swarthmore.edu/~rware/cs43/f25/lecs/cs43-quiz-1-study-guide-v2.pdf>

<https://www.cs.swarthmore.edu/~rware/cs43/f25/lecs/cs43-quiz-2-study-guide.pdf>

Discuss the trade-offs between setting a short vs. a long TTL value.

Outline the three main steps required to register a new domain and make it accessible on the Internet.

Explain how DNS can be used to implement load balancing.

Describe how different types of cyberattacks can target DNS, specifically DDoS attacks, man-in-the-middle attacks, and DNS poisoning.

Explain the purpose of DNSSEC.

Identify the three major components of the Internet mail system (user agents, mail servers, and SMTP) and describe the role of each in sending a message from a sender to a recipient.

Trace the complete path of an email message from a sender's user agent to a recipient's user agent, identifying the protocols used at each step.

Justify the architectural decision to have a user agent send a message to its own mail server first, rather than directly to the recipient's mail server.

Justify the use of a shared, always-on mail server by explaining the practical limitations of running a mail server on a typical user's personal computer.

Explain why SMTP is described as a "push" protocol and why a separate mail "pull" protocol (like IMAP or HTTP) is necessary for message retrieval.

Compare and contrast SMTP and HTTP protocols.

Differentiate between the SMTP envelope commands (e.g., MAIL FROM, RCPT TO) and the mail message header lines (e.g., From:, To:).

Explain how the separation of the SMTP envelope and the message header enables email forging (spoofing).

Trace the sequence of a simple SMTP client-server interaction, identifying the purpose of the HELO, MAIL FROM, RCPT TO, DATA, and QUIT commands.

Describe the historical reasons for the 7-bit ASCII restriction in the original SMTP protocol.

Explain the purpose of MIME and the problem it solves.

Compare and contrast the POP3 and IMAP mail access protocols.

Summarize the difference between client-server and P2P file distribution regarding the role of participating hosts.

Explain why P2P file distribution is considered "self-scaling" while the file distribution time for the client-server model grows linearly with the number of peers.

Describe the architecture of Napster as a hybrid P2P system and its single point of failure.

Describe the query flooding mechanism used by fully decentralized P2P systems like Gnutella.

Define the core components of the BitTorrent P2P system: torrent, peer, chunk, and tracker.

Trace the sequence of steps a new peer takes to join a BitTorrent torrent and discover other peers.

Explain the "rarest first" chunk selection strategy in BitTorrent and its purpose.

Describe BitTorrent's "tit-for-tat" incentive mechanism, including the roles of "unchoking" the top four uploaders and "optimistically unchoking" a random peer.

Discuss how a strategic client can exploit the "tit-for-tat" unchoking algorithm to gain an unfair download advantage.