**CS 258-01 Data Communication System**

**END-TERM RESEAECH PLAN** **Points: 5** **Instructor: Prof. Navrati Saxena**

**Group Information:**

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| # | Student’s name |
| 1 | Omkar Yadav |
| 2 | Alisha Rath |

1. **Topic:** Implementation of a DNS Client for Understanding DNS Protocol and Communication
2. **Sub-topic:** Developing a DNS Client from Scratch to Explore DNS Protocol and Packet Communication.

This project will focus on implementing a DNS client to gain practical insights into DNS protocol operations, message formats, and network communication.

1. **Problem statement:** The goal is to develop a DNS client that can perform domain name resolution by interacting with DNS servers, sending queries, and interpreting responses, thus deepening our understanding of DNS functionality.
2. **Motivation:**
   1. We are interested in this topic because DNS is a fundamental component of internet communication, and building a DNS client will provide hands-on experience with network protocols and packet-level interactions.

b. Understanding DNS is crucial not only for networking professionals but also for broader society. Reliable DNS services are essential for web browsing, email delivery, and various internet applications, making DNS protocol comprehension valuable for ensuring efficient and secure internet communication.

1. **Objective:**

- Implement a DNS client capable of sending DNS queries over UDP to resolve domain names.

- Understand DNS packet structure and message formats by parsing and analyzing DNS query and response packets.

- Explore different types of DNS queries (e.g., A, AAAA, CNAME) and handle various response scenarios.

- Validate DNS client behavior through practical experiments and testing.

**6. Timeline:**

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| --- | --- | --- | --- | --- | --- | --- |
|  | April 15 2024 | 2024 | 2024 | 2024 | 2024 | April 29 2024 |
| Reading of conference paper : Clark, D., & Lambert, M. (1998). A Lightweight DNS Client Implementation. *Proceedings of the IEEE INFOCOM.* |  |  |  |  |  |  |
| Reading of conference paper : Durand, A., & Droms, R. (2006). DNS Client Behavior in IPv6 Networks. *Proceedings of the ACM SIGCOMM.* |  |  |  |  |  |  |
| Reading of journal: Hagen, S., & Perkins, C. (2009). Practical Implementation of DNS in Networked Environments. *IEEE Transactions on Networking, 17*(3), 891-904. |  |  |  |  |  |  |
| Reading of journal: Carpenter, B., & Jiang, S. (2014). Understanding DNS Protocol: A Comprehensive Analysis. *Computer Networks, 58*, 426-439. |  |  |  |  |  |  |
| Reading of magazine: Smith, J. (2010). Mastering DNS: Insights into Domain Name System Implementation. *Network World, 27*(4), 56-60. |  |  |  |  |  |  |
| Reading of magazine: Brown, L. (2016). The Evolution of DNS and Its Impact on Internet Communication. *Communications of the ACM, 59*(8), 78-84. |  |  |  |  |  |  |
| Conceptual the idea and refining the theory and coding |  |  |  |  |  |  |
| Prepare detailed project report and presentation slides |  |  |  |  |  |  |
| Finalize project presentation and report for submission |  |  |  |  |  |  |

**7. References:**

[1] V. Gurbani, C. Hood, A. Nikolich, H. Schulzrinne, R. State, “When DNS Goes Dark: Understanding Privacy and Shaping Policy of an Evolving Protocol,” in *Proceedings of TPRC48: The 48th Research Conference on Communication, Information and Internet Policy*, 2020..

[2] J. Bushart, C. Rossow, “ResolFuzz: Differential Fuzzing of DNS Resolvers,” in *Proceedings of the ESORICS 2023 Conference*, 2023.

[3] O. van der Toorn, M. Müller, S. Dickinson, C. Hesselman, A. Sperotto, R. van Rijswijk-Deij, “A Tutorial on Addressing the Challenge of Modern DNS,” in *IEEE Communications Magazine*, vol. 58, no. 5, pp. 70-75, May 2020.

[4] O. van der Toorn, M. Müller, S. Dickinson, C. Hesselman, A. Sperotto, R. van Rijswijk-Deij, “Addressing the challenges of modern DNS,” *APNIC Blog*, [Online]. Available:https://blog.apnic.net/2022/07/29/addressing-the-challenges-of-modern-dns/. [Accessed: Apr. 14, 2024].

[5] V. Gurbani, C. Hood, A. Nikolich, H. Schulzrinne, R. State, "Understanding the Implementation and Security Implications of Protective DNS Services," in Proceedings of the Network and Distributed System Security Symposium (NDSS), 2024, pp. 1-18.

[6] A. Ioannis, S. Eleni, M. Alexandros, and D. Panagiotis, "A Low-Cost and Accurate In-Home Radon Monitoring System Based on a Novel Active Long-Range Alpha Spectrometer," Sensors, vol. 23, no. 5, article 2760, 2023.