



MSA UNIVERSITY Faculty of Computer Science
Academic Year: 2024–2025

CS322x - Computer Networks

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Blockchain-Based DNS

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1. Background

1.1 Domain Name System (DNS)

The Domain Name System (DNS) is a hierarchical and decentralized naming system used on the Internet that translates human-readable domain names, such as example.com, into Internet Protocol (IP) addresses, such as 192.0.2.1.

How DNS Works:

- A user enters a domain name in a web browser.
- The resolver queries the DNS hierarchy starting from the root name server, then the Top-Level Domain (TLD) name server, and finally the authoritative name server.
- The IP address corresponding to the domain is returned and cached.
- The browser connects to the web server using the resolved IP address.

Current Architecture:

- Hierarchical structure consisting of root servers, TLD servers, and authoritative servers.
- Centralized control, where a small number of organizations manage the root zone.

1.2 Blockchain Technology

Blockchain is a distributed ledger technology that maintains a continuously growing list of records, called blocks, which are linked using cryptography.

Key Properties:

- **Immutability:** Once data is recorded, it cannot be altered.
- **Decentralization:** No single point of control.
- **Transparency:** All transactions are visible to network participants.

1.3 Ethereum Naming System (ENS)

The Ethereum Naming System (ENS) is a decentralized naming protocol built on Ethereum that allows the registration and management of human-readable domain names mapped to Ethereum addresses.

1.4 Namecoin

Namecoin is a peer-to-peer naming system based on Bitcoin's blockchain that introduces an alternative root zone using the .bit top-level domain.

1.5 Handshake

Handshake is a decentralized protocol that aims to replace ICANN's root zone with a blockchain-based alternative.

2. Problem Statement

Despite its importance, DNS remains largely centralized. This hierarchical design introduces persistent vulnerabilities, including single points of failure, susceptibility to cache poisoning, and the potential for governmental or operator-level censorship.

3. Objectives

The objective of this research is to propose a decentralized DNS architecture that leverages blockchain-based smart contracts for domain ownership while maintaining interoperability with the existing DNS ecosystem.

4. Existing Solutions

- **DNSSEC:** Introduces cryptographic signatures but remains centralized.
- **DecDNS:** Stores root zone information on a blockchain but lacks real-time resolution.
- **B-DNS:** Uses a multi-chain structure but remains conceptual.

5. Conclusion

This research demonstrates that a decentralized DNS system built on blockchain smart contracts is both technically feasible and operationally viable. By combining blockchain immutability with recursive DNS resolution, this work addresses key vulnerabilities in traditional infrastructure.

6. References

- Karaarslan, E., and Adiguzel, E. (2018). *Blockchain based DNS and PKI solutions*.
- Li, Z., et al. (2021). *B-DNS: A secure and efficient DNS based on the blockchain technology*.
- Liu, J., et al. (2018). *A data storage method based on blockchain for decentralization DNS*.