School: ..... Campus: .....

Academic Year: ..... Subject Name: ..... Subject Code: .....

Semester: ..... Program: ..... Branch: ..... Specialization: .....

Date: .....

Applied and Action Learning

(Learning by Doing and Discovery)

Name of the Experiement : **Layer 2 Bridge _ Explore Optimism/zkSync**

* Coding Phase: Pseudo Code / Flow Chart / Algorithm

Introduction

Layer 2 bridges are designed to connect Ethereum's main network (Layer 1) with Layer 2 scaling solutions like **Optimism** and **zkSync** enabling and faster and cheaper transactions. These bridges transfer assets and data between chains while maintaining Ethereum's security model.

Optimism uses **Optimistic Rollups**, which assume transactions are valid until proven otherwise, whereas **zkSync Zero Knowledge Proof** blocks for cryptographic validation. Both reduce congestion and gas fees while enhancing scalability and transaction efficiency.

Algorithm

1. **Initialize Environment**
   - Set up Ethereum testnet and Layer 2 networks (Optimism / zkSync).
   - Configure MetaMask or Hardhat with both networks.
2. **Deploy Smart Contract on L1**
   - Write and deploy a simple ERC-20 or message-passing contract on Ethereum testnet.
3. **Bridge Configuration**
   - Connect the bridge interface (official Optimism / zkSync bridge).
   - Approve tokens or assets for transfer.
4. **Asset Transfer**
   - Initiate deposit from L1 → L2 using bridge contract functions.
   - Wait for transaction confirmation and verify on L2.
5. **Withdrawal Process**
   - Perform withdrawal from L2 → L1.
   - Wait for challenge/finalization period (for Optimism) or validity proof (for zkSync).
6. **Verification & Output**
   - Confirm successful bridging and transaction completion.
   - Display final token balances and gas savings.

* Softwares used

- **MetaMask** – Used to connect Ethereum and Layer 2 networks (Optimism / zkSync) for deploying and transferring assets.
- **Hardhat** – For writing, compiling, and deploying smart contracts across multiple chains.
- **Remix IDE** – To test and interact with bridge contracts directly through a web-based Solidity environment.

*As applicable according to the experiment.
Two sheets per experiment (10-20) to be used.

* Implementation Phase: Final Output (no error)

• **ZKsync Portal Bridge:**
Provides a secure and efficient gateway for transferring assets between Ethereum and the ZKsync network.

• **txSync Bridge:**
Facilitates quick and affordable fund transfers between major blockchains and ZKsync using native bridge infrastructure.

• **Layerswap:**
Offers fast, low-cost transfers across 55+ blockchains and CEXes, enabling seamless movement to and from ZKsync Era and Lite.

• **Across Bridge:**
Delivers ultra-fast and gas-optimized cross-chain transfers using aggregated verification and relayer-based execution.

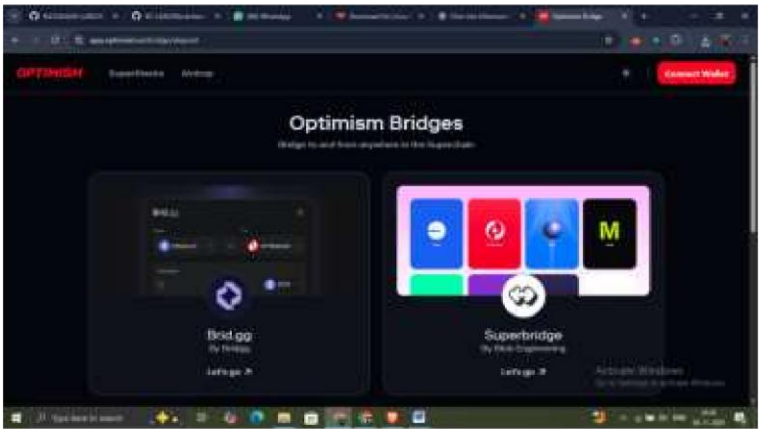
• **MES Protocol:**
Simplifies instant and low-cost asset transfers between EVM and non-EVM compatible blockchains.

• **Orbiter Finance:**
Acts as a cross-chain rollup bridge enabling safe, economical, and fast asset and message transfers across networks.

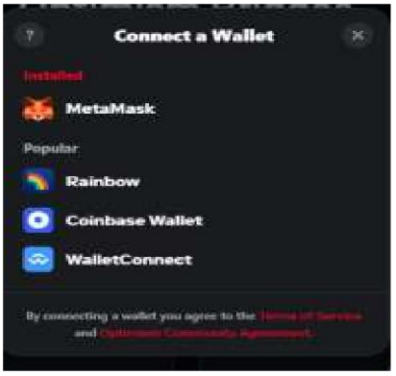
• **Owlto Finance:**
Focuses on decentralized, Layer-2-centric cross-rollup bridging to enhance scalability and interoperability.

How To Bridge to Optimism Using Optimism Bridge

Step 1: Open the Optimism Bridge App

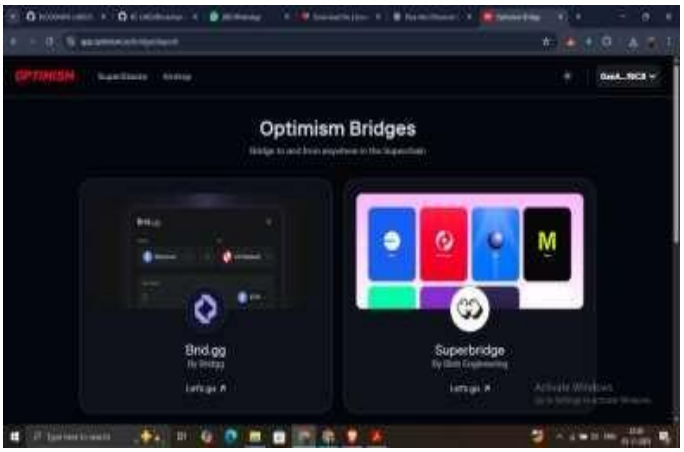


Step 2: Connect Your Wallet



*As applicable according to the experiment.
Two sheets per experiment (10-20) to be used.

Step3: Now it works



* Implementation Phase: Final Output (no error)

• Layer 2 Bridge Configuration & Setup:
Established bridge environments on Optimism and zkSync to enable secure, low-cost, and high-speed cross-chain asset transfers.

• Interoperability & Network Integration:
Configured RPC endpoints, wallet connections, and deployment scripts to ensure smooth communication between Ethereum Mainn

• Smart Contract Adaptation & Validation:
Optimized Solidity contracts for Layer 2 compatibility, validating bridge operations, token transfers, and contract execution across zkSync and Optimism.

• Performance & Transaction Efficiency Testing:
Deployed and tested contracts to measure transaction speed, gas optimization, and overall bridge reliability across both Layer 2 ecosystems.

* Observations

- Bridge enabled smooth asset transfer between Ethereum and Layer 2 (Optimism, zkSync).
- Transactions were faster and cheaper than on Ethereum mainnet.
- Ensured secure, reliable, and synchronized cross-chain transfers.

ASSESSMENT

Rubrics	Full Mark	Marks Obtained	Remarks
Concept	10		
Planning and Execution/ Practical Simulation/ Programming	10		
Result and Interpretation	10		
Record of Applied and Action Learning	10		
Viva	10		
Total	**50**		

Signature of the Student:

Name :

Regn. No. :

Signature of the Faculty:

**As applicable according to the experiment.*
Two sheets per experiment (10-20) to be used.

** As applicable according to the experiment.*
Two sheets per experiment (10-20) to be used.