L36: Lab - Testnet Swap

Module E: DeFi Ecosystem

Blockchain & Cryptocurrency

December 2025

Lab Objectives

In this lab, you will:

- Set up a testnet wallet (MetaMask)
- Acquire testnet ETH from faucet
- Execute a token swap on Uniswap testnet
- Calculate and observe slippage
- Provide liquidity to a pool
- Track impermanent loss over time
- Document your experience and findings

Network: Sepolia Testnet (Ethereum)

Time: 90 minutes

Prerequisites

Before Starting:

1. Web browser (Chrome, Firefox, or Brave recommended)
2. No real money required (testnet only)
3. Pen and paper for calculations

Safety Reminders:

- This is testnet - funds have NO real value
- NEVER share your seed phrase (even for testnet)
- Do NOT send real ETH to testnet address
- Keep testnet and mainnet wallets separate

Step 1: Install MetaMask

Actions:

1. Go to `https://metamask.io`
2. Click "Download" and add to your browser
3. Create new wallet (or import if you have testnet wallet)
4. Write down seed phrase (keep safe even for testnet)
5. Set a password

Network Setup:

- Click network dropdown (top right)
- Enable "Show test networks" in settings
- Select "Sepolia Test Network"

Verify: You should see "Sepolia" in network selector and 0 ETH balance.

Step 2: Acquire Testnet ETH

Sepolia Faucets (pick one):

- `https://sepoliafaucet.com`
- `https://faucet.quicknode.com/ethereum/sepolia`
- Alchemy faucet: `https://sepoliafaucet.alchemy.com`

Process:

1. Copy your Sepolia address from MetaMask
2. Paste into faucet website
3. Complete captcha or sign in (varies by faucet)
4. Request testnet ETH (usually 0.5-1 ETH per request)
5. Wait 1-2 minutes for transaction to confirm

Verification: Check MetaMask balance shows testnet ETH.

Note: If faucet fails, try alternative or ask instructor for testnet ETH.

Step 3: Access Uniswap Testnet

URL: `https://app.uniswap.org`

Actions:

1. Connect wallet (click "Connect Wallet" button)
2. Select MetaMask
3. Approve connection request
4. Verify you're on Sepolia network (check top right)

Interface Overview:

- **Swap:** Exchange tokens
- **Pool:** Provide/remove liquidity
- **Settings:** Slippage tolerance, deadline

Troubleshooting:

- If network wrong: Switch to Sepolia in MetaMask
- If connection fails: Refresh page and reconnect

Step 4: Execute Your First Swap

Goal: Swap 0.1 ETH for USDC (or available testnet token).

Process:

1. Click "Swap" tab
2. Select ETH in "From" field
3. Enter amount: 0.1 ETH
4. Select USDC (or DAI) in "To" field
5. Note the exchange rate and expected output
6. Click "Swap"
7. Review transaction details in MetaMask
8. Click "Confirm" in MetaMask
9. Wait for transaction confirmation (30-60 seconds)

Record:

- Amount sent: ____ ETH
- Amount received: ____ USDC
- Exchange rate: ____ USDC per ETH
- Gas fee: ____ ETH

Step 5: Analyze Slippage

Before executing second swap, calculate expected slippage.

Experiment:

1. Try swapping small amount (0.01 ETH) - note price
2. Try swapping medium amount (0.1 ETH) - note price
3. Try swapping large amount (1 ETH) - note price
4. **Do NOT execute**, just observe quote

Questions:

- How does price change with swap size?
- What is the percentage difference between small and large swap?
- Why does slippage increase non-linearly?

Slippage Tolerance:

- Click settings icon (gear)
- Try different tolerance: 0.1%, 0.5%, 1%
- What happens if you set it too low?

Step 6: Provide Liquidity

Goal: Become a liquidity provider (LP).

Process:

1. Click "Pool" tab
2. Click "+ New Position" (V3) or "Create a pair" (V2)
3. Select token pair (e.g., ETH/USDC)
4. Choose fee tier (0.05%, 0.3%, or 1%)
5. **For V3:** Set price range (try full range for simplicity)
6. Enter amounts (e.g., 0.05 ETH + equivalent USDC)
7. Click "Preview"
8. Approve USDC spending (if first time)
9. Confirm liquidity provision
10. Wait for transaction confirmation

Record:

- ETH deposited: ____
- USDC deposited: ____
- Fee tier: ____
- Price range (V3): ____

Step 7: Monitor Your Position

After providing liquidity:

Check:

- Pool share percentage
- Current liquidity value (in USD)
- Fees earned (if any trades occurred)
- Price range status (V3: in range or out of range?)

Simulate Price Change:

- Execute a large swap in one direction (buy ETH with USDC)
- Observe how your position changes
- Check if fees accrued
- Note any change in token ratio

Impermanent Loss Tracking:

- Initial deposit value: ____ USD
- Current position value: ____ USD
- If you had just held tokens: ____ USD
- Impermanent loss: ____%

Step 8: Remove Liquidity

Goal: Withdraw your liquidity and observe final outcome.

Process:

1. Go to "Pool" tab
2. Click on your position
3. Click "Remove Liquidity"
4. Select percentage to remove (try 100%)
5. Click "Remove"
6. Confirm transaction in MetaMask
7. Wait for confirmation

Record Final Amounts:

- ETH received: ____
- USDC received: ____
- Total fees earned: ____
- Compare to initial deposit

Calculate Net Result:

$$\text{Profit/Loss} = (\text{Final Value} + \text{Fees}) - \text{Initial Value} - \text{Gas Costs}$$

Step 9: Explore Advanced Features

Optional Experiments:

1. **Multi-Hop Swaps**
   - Try swapping between two tokens without direct pair
   - Observe how Uniswap routes through multiple pools
   - Compare fees and slippage to direct swaps
2. **V2 vs. V3 Comparison**
   - Provide liquidity in V2 (full range, simpler)
   - Provide liquidity in V3 (concentrated, complex)
   - Compare fee earnings and management complexity
3. **Price Impact Analysis**
   - For different pool sizes, test same swap amount
   - Observe how liquidity depth affects slippage

Step 10: Document Your Findings

Lab Report Structure:

1. **Introduction** (1 paragraph)
   - Overview of activities performed
2. **Swap Analysis** (1 page)
   - Trade details (amounts, rates, gas fees)
   - Slippage observations
   - Screenshots of transactions
3. **Liquidity Provision** (1 page)
   - LP position details
   - Fee earnings (if any)
   - Impermanent loss calculation
4. **Reflections** (1/2 page)
   - Challenges encountered
   - UX observations (ease of use, clarity)
   - Comparison to centralized exchanges

Impermanent Loss Calculation Example

Scenario:

- Initial deposit: 0.05 ETH + 100 USDC (ETH = $2,000)
- ETH price changes to $2,500

If you just held:

- 0.05 ETH now worth: $0.05 \times \$2{,}500 = \$125$
- 100 USDC still worth: $100
- **Total: $225**

If you provided liquidity:

- Pool rebalances (constant product formula)
- New ratio: 0.0447 ETH + 111.8 USDC
- Value: $(0.0447 \times \$2{,}500) + \$111.8 = \$223.55$
- **Impermanent Loss: $225 - $223.55 = $1.45 (0.64%)**

Add fees earned: If you earned $3 in fees, net profit = $3 - $1.45 = $1.55.

Common Issues and Solutions

Problem: Transaction Fails

- **Solution:** Increase slippage tolerance or reduce swap amount

Problem: Insufficient Liquidity

- **Solution:** Use more popular pairs (ETH/USDC, ETH/DAI)

Problem: High Gas Fees (even on testnet)

- **Solution:** Wait for lower network congestion or use L2 testnet

Problem: Can't Find Token

- **Solution:** Import token contract address manually

Problem: Out of Testnet ETH

- **Solution:** Use multiple faucets or ask instructor

Reflection Questions

Answer in your lab report:

1. How does the Uniswap UX compare to centralized exchanges (Coinbase, Binance)?
2. What are the main advantages of AMMs from a user perspective?
3. What are the main risks or disadvantages you observed?
4. Would you consider providing liquidity on mainnet with real funds? Why or why not?
5. How could the interface be improved for better user experience?
6. What surprised you most about the DeFi experience?

Submission Requirements

Your lab report should include:

1. Cover page with name and date
2. Transaction hashes (Etherscan links)
3. Screenshots of key steps (wallet, swaps, liquidity provision)
4. Completed data tables (amounts, rates, fees)
5. Impermanent loss calculation (with formula)
6. Reflection answers (1-2 paragraphs per question)
7. Total: 3-4 pages

Format: PDF
Deadline: [Instructor to specify]

Summary

Key Takeaways:

- Testnets allow risk-free DeFi experimentation
- Slippage increases with trade size relative to pool liquidity
- Providing liquidity earns fees but exposes to impermanent loss
- V3 concentrated liquidity offers higher returns but requires active management
- DEX UX has improved significantly but still more complex than CEX
- Understanding mechanics is crucial before risking real capital

Next Lecture: Lending Protocols - How Aave and Compound enable borrowing and lending.