Blockchain-Tools

Learning Outcome: Praktische Blockchain-Tools anwenden — Bloom's: Apply

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You Have Crypto – Now What?

Owning cryptocurrency requires tool literacy:

- You need a **wallet** to store, send, and receive digital assets
- You need a **block explorer** to verify that your transaction was processed
- You need to understand **gas fees** to avoid overpaying or getting stuck
- Without these tools, you cannot safely interact with any blockchain application

The stakes are real: Blockchain transactions are **irreversible**. A wrong address, wrong network, or insufficient gas means permanent loss of funds—no bank to call, no chargebacks.

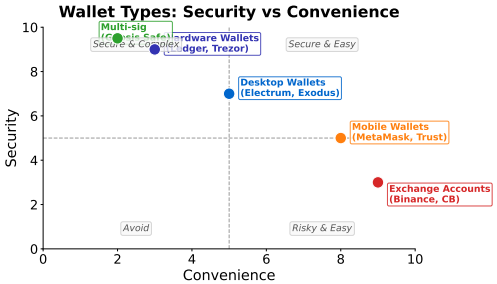
Bloom's Apply: this deck builds the practical skill set needed to safely execute real transactions on a blockchain.

Wallet Types: Which One Do You Need?

Two key dimensions of any wallet:

- **Hot vs. Cold** — hot wallets are connected to the internet (convenient); cold wallets are offline (secure)
- **Custodial vs. Non-custodial** — custodial means an exchange holds your private keys; non-custodial means you hold them yourself
- **Hardware vs. Software** — hardware wallets store keys on a dedicated device; software wallets run on your phone or browser

Core trade-off:
More convenience = more attack surface.
Maximum security (cold hardware) = slower to use.
Rule: store only what you need daily in a hot wallet.



MetaMask (hot, non-custodial) is the standard entry point for DApps; Ledger or Trezor (cold, hardware) for long-term storage above $500.

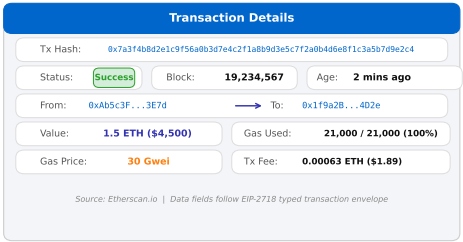
Reading a Block Explorer

What is a block explorer?
A block explorer is a web application that indexes the blockchain and lets anyone inspect its public data—every transaction, address, and block is readable for free.

Key fields on any transaction page:

- **Transaction hash** — unique 64-hex-character ID for this transaction
- **Block number** — which block confirmed the transaction
- **From / To** — sender and recipient addresses
- **Value** — ETH or token amount transferred
- **Gas used / Gas limit** — actual vs. maximum computation
- **Status** — Success or Failed (gas still consumed on failure)

Reading a Block Explorer: Transaction View

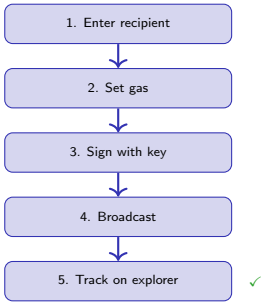


Etherscan.io is the reference explorer for Ethereum mainnet; Polygonscan and BscScan follow the same layout for their respective chains.

Step-by-Step: Sending a Transaction

Five steps from wallet to confirmation:

1. **Enter recipient address** in your wallet or connect wallet to a dApp and initiate the action
2. **Set gas limit and gas price** — wallet estimates automatically; you can adjust for speed vs. cost
3. **Review and sign** — your wallet signs the transaction with your private key (key never leaves the device)
4. **Broadcast to network** — signed transaction is sent to an Ethereum node and propagated to the mempool
5. **Track confirmation** — paste the transaction hash into Etherscan; green checkmark means success



Step 3 is the security-critical step: your private key signs locally and is never transmitted to any server or dApp.

Worked Example: Gas Fee Calculation

How much does a transaction cost? — Ethereum simple transfer:

$$\underbrace{21{,}000}_{\text{gas units (simple transfer)}} \times \underbrace{30 \times 10^{-9}}_{\text{Gwei}\to\text{ETH conversion}} = \underbrace{0.00063\ \text{ETH}}_{\text{gas cost in ETH}} \times \underbrace{\$3{,}000}_{\text{ETH price}} = \underbrace{\$1.89}_{\text{total fee}}$$

Cost comparison by operation:

- Simple ETH transfer: 21,000 gas $\approx$ \$1.89
- ERC-20 token transfer: $\approx$45,000 gas $\approx$ \$4.05
- Uniswap token swap: $\approx$150,000 gas $\approx$ \$13.50
- NFT mint: $\approx$200,000 gas $\approx$ \$18.00

When gas prices surge (300 Gwei):

- Simple transfer: $\approx$ \$18.90 (10$\times$ higher)
- Uniswap swap: $\approx$ \$135
- NFT mint during hype drop: $\approx$ \$180
- L2 alternatives (Arbitrum): $<$\$0.10 per swap

Always check current gas prices at etherscan.io/gastracker before submitting; off-peak hours (UTC 02:00–08:00) are typically 40–60% cheaper.

Blockchain Tool Workflow: From User to Verification

Every on-chain action follows this path — wallets abstract key management, nodes enforce consensus, explorers provide auditability.

- **Wallet layer (MetaMask):** manages keys, signs transactions, and connects you to DApps via injected `window.ethereum` provider
- **Network layer (Ethereum RPC node):** receives your signed transaction, propagates it to peers, and includes it in the next block
- **Verification layer (Etherscan):** indexes every block, decodes transaction data, and lets you confirm receipt and contract interactions

These three layers operate independently: your wallet never needs to trust Etherscan, and Etherscan reads data independently from any node.

Common Mistakes That Cost Money

Costly mistakes to avoid:

1. **Wrong network** — sending ETH to an Ethereum address on BSC; funds are locked without a bridge
2. **Wrong address format** — typo or copy-paste error; blockchain has no undo
3. **Unlimited token approvals** — many DApps request unlimited spending; a compromised contract can drain your wallet
4. **Phishing dApps** — fake Uniswap or OpenSea sites that steal approval signatures
5. **Gas too low** — transaction sits in mempool indefinitely; network still charges base fee

Prevention checklist:

1. Verify the chain ID in MetaMask before sending; add networks only from official docs
2. Read both first and last 4 characters of every address; use ENS names where possible
3. Set exact token allowances; revoke old approvals at revoke.cash or Etherscan token approval tool
4. Bookmark official dApp URLs; verify contract address matches official documentation
5. Use the gas estimator in MetaMask; never manually set gas below the current base fee

The most common cause of fund loss is not hacks—it is user error. Tool literacy is the primary risk mitigation for individual users.

Your Personal Checklist Before Any Transaction

5-point pre-send checklist:

1. **Verify recipient address** — compare at least the first 4 and last 4 characters visually
2. **Confirm correct network** — check the chain indicator in MetaMask matches the destination
3. **Check gas estimate** — confirm the fee is reasonable; use Etherscan gas tracker for reference
4. **Review token approvals** — if interacting with a contract, check what spending permission you are granting
5. **Verify on block explorer after** — paste transaction hash into Etherscan; confirm Status shows Success

Why each step is essential:

- **Address check:** Clipboard hijacking malware replaces addresses in paste; visual check catches substitution
- **Network check:** ETH sent on wrong chain requires a bridge to recover, costing additional fees and time
- **Gas check:** Overpaying by 10× is common during network spikes; a 30-second check saves real money
- **Approval review:** Unlimited approval to a malicious contract is equivalent to signing a blank cheque
- **Post-send check:** Failed transactions are silent in most wallets; explorers show the actual outcome

Build this checklist into muscle memory: blockchain transactions are final. There is no dispute resolution layer to appeal to.

Key Takeaways

What you have learned:

1. **Wallet selection** depends on two axes: hot vs. cold (connectivity) and custodial vs. non-custodial (key ownership)
2. **Block explorers** give public read access to every transaction, address, and block—your verification tool for any on-chain action
3. **Gas fees** are calculated as gas units $\times$ gas price (Gwei); simple transfers cost 21,000 gas; complex DeFi operations 10$\times$ more
4. **Transaction security** requires a repeatable pre-send checklist: address, network, gas, approvals, and post-send confirmation
5. **Tool errors** cause more fund loss than hacks; the five common mistakes are all preventable with the right habits

You can now apply:

- **Wallet selection:** choose the right wallet type for a given security and convenience requirement
- **Block explorer reading:** locate and interpret any transaction hash, address balance, and contract interaction on Etherscan
- **Gas fee calculation:** compute the total ETH cost of any standard operation from gas units, gas price, and ETH spot price
- **Safe transaction practices:** execute the 5-point checklist before every send and verify outcome on-chain

Bloom's **Apply**: use acquired tool skills to execute real blockchain operations correctly and safely.