Module 3: MEV Ecosystem Players

Duration: 50 minutes | **Level:** Beginner | **Author:** Obelisk Core

Learning Objectives

By the end of this module, you will:
- Understand the roles and relationships of key MEV ecosystem participants
- Learn about searchers, validators, builders, and relays
- Explore how MEV profits are distributed across the ecosystem
- Understand the competitive dynamics and incentives

MEV Ecosystem Overview

Key Players

The MEV ecosystem consists of several interconnected participants who work together and compete for value extraction opportunities.

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MEV Ecosystem Flow:
Searchers → Relays → Builders → Validators → Users
```

Value Flow

- **Searchers:** Identify opportunities, execute strategies
- **Relays:** Facilitate private transaction transmission
- **Builders:** Construct optimal blocks
- **Validators:** Finalize blocks and earn rewards
- **Users:** Experience MEV effects (positive and negative)

Searchers

Role Definition

Searchers are individuals or entities that scan the blockchain for MEV opportunities and execute extraction strategies.

Types of Searchers

1. Individual Traders

Characteristics:
- Small-scale operations (<$100K capital)
- Focus on simple arbitrage opportunities
- Use automated tools and bots
- Limited technical resources

Example: DeFi enthusiast running arbitrage bot with $50K capital

2. Professional MEV Firms

Characteristics:
- Large capital reserves ($10M-$ 1B+)
- Sophisticated infrastructure
- Advanced algorithms and AI
- Multiple strategy types

Examples:
- **Manifold Finance:** Known for flashloan arbitrage
- **Paradigm:** Institutional-grade MEV extraction
- **0x:** DEX aggregation with MEV protection

3. DeFi Protocol Teams

Characteristics:
- Internal MEV extraction to benefit users
- Provide liquidity with MEV profits
- Protect users from sandwich attacks
- Revenue sharing mechanisms

Examples:
- Uniswap V3 with concentrated liquidity
- 1inch with pathfinding optimization
- Balancer with smart order routing

Searcher Capabilities

Technical Requirements

1. **Real-time Monitoring:**
   - Mempool scanning
   - Price feed aggregation
   - Liquidation monitoring
   - Cross-chain synchronization

2. **Execution Infrastructure:**
   - Low-latency trading systems
   - Gas optimization strategies
   - MEV-resistant transaction submission
   - Risk management systems
3. **Capital Management:**
   - Capital allocation across strategies
   - Flash loan integration
   - Collateral optimization
   - Profit/loss tracking

Searcher Economics

Revenue Sources:
- Arbitrage profits
- Liquidation rewards
- Sandwich attack gains
- Deflationary token benefits

Cost Structure:
- Infrastructure and computing costs
- Gas fees for failed attempts
- Capital opportunity costs
- Competition from other searchers

Validators

Role in MEV

Validators are network participants who propose and finalize blocks, giving them ultimate control over transaction ordering.

MEV-Boost Integration

Traditional vs. MEV-Boost Blocks

Traditional Block Building:

```
Validator → Selects Transactions → Builds Block → Mines/Proposes
```

MEV-Boost Block Building:

```
Builder → Optimizes Block → Submit to Relay → Validator Selects
```

Validator Responsibilities

1. **Block Proposal:** Choose best block from available options
2. **Transaction Verification:** Ensure included transactions are valid
3. **Consensus Participation:** Work with other validators
4. **MEV Distribution:** Share MEV profits appropriately

Validator Economics

Revenue Streams

1. **Block Rewards:** Base reward for block production
2. **Transaction Fees:** Standard gas fees
3. **MEV Profits:** Additional revenue from MEV extraction
4. **Tip Payments:** Priority fees for faster inclusion

MEV Distribution Models

Self-built Blocks:
- Validator keeps all MEV profits
- Highest control but requires infrastructure
- Suitable for large validator operations

MEV-Boost Partnerships:
- Split profits with builders and relays
- Reduced infrastructure requirements
- More predictable revenue streams

Example Split:
- Validator: 90% of MEV profit
- Builder: 8% of MEV profit
- Relay: 2% of MEV profit

Block Builders

Evolution of Block Building

Pre-MEV-Boost Era

- **Single Builder:** Each validator built their own blocks
- **Limited Optimization:** Basic gas price sorting

- **MEV Centralization:** Large validators dominated MEV

Post-MEV-Boost Era

- **Multiple Builders:** Competition for block construction
- **Advanced Optimization:** MEV-aware block building
- **Democratized MEV:** More validators can access MEV profits

Builder Responsibilities

Block Construction Process

1. **Transaction Collection:** Gather transactions from mempools
2. **MEV Analysis:** Identify profitable MEV opportunities
3. **Block Optimization:** Maximize total block value
4. **Submission:** Send to relays for validator consideration

Optimization Strategies

Transaction Selection:

```
Standard Selection: Sort by gas price
MEV-Optimized Selection:
├── High-value MEV transactions first
├── Arbitrage bundle inclusion
├── Liquidation transactions
└── Remaining gas price sorting
```

Block Value Maximization:
- Include profitable MEV opportunities
- Balance gas usage vs. total value
- Coordinate transaction bundles
- Minimize failed transactions

Leading Builders

Flashbots Builder

- **Market Share:** ~30% of all blocks
- **Specialization:** Flashloan arbitrage and liquidations
- **Technology:** Advanced MEV detection algorithms
- **Clients:** Major searchers and protocols

Eden Builder

- **Market Share:** ~25% of all blocks
- **Specialization:** High-frequency trading optimization
- **Technology:** Ultra-low latency systems
- **Network:** Partnership with Eden Network

Builder0x69 (builder0x69.xyz)

- **Market Share:** ~20% of all blocks
- **Specialization:** Balanced MEV strategies
- **Technology:** Open-source builder implementation
- **Community:** Strong developer focus

RBuilder (rbuilder.org)

- **Market Share:** ~15% of all blocks
- **Specialization:** Smart contract optimization
- **Technology:** Advanced smart contract integration
- **Focus:** Long-term protocol relationships

Relays

Purpose and Function

Relays serve as intermediaries that enable private transaction transmission between searchers and block builders.

Relay Architecture

Traditional Mempool Issues

- **Public Visibility:** All transactions visible before inclusion
- **Front-Running:** Others can copy profitable transactions
- **Auction Inefficiency:** Gas price race to the bottom
- **Failed Transactions:** High rejection rate during competition

Private Relay Benefits

- **Confidential Transactions:** Transaction content protected
- **Bundle Guarantees:** Searchers know exact inclusion
- **Reduced Competition:** Fewer participants see opportunities

- **Atomic Execution:** All-or-nothing transaction bundles

Major Relays

Flashbots Relay

- **Founded:** 2021 by priority.exact
- **Network Share:** ~40% of private transactions
- **Technology:** Advanced encryption and verification
- **Partnerships:** Major builders and searchers

Eden Relay

- **Founded:** 2021 by Eden Network
- **Network Share:** ~30% of private transactions
- **Technology:** Staking-based access control
- **Integration:** Deep Eden Network ecosystem integration

Ultrasec Relay

- **Founded:** 2022 by independent developers
- **Network Share:** ~20% of private transactions
- **Technology:** Zero-knowledge proof systems
- **Focus:** Maximum privacy and security

Aestus Relay

- **Founded:** 2023 by new entrants
- **Network Share:** ~10% of private transactions
- **Technology:** Modern relay architecture
- **Innovation:** New optimization approaches

MEV Protocols

Flashbots Protocol

Purpose: Democratize access to private transaction submission

Key Components

1. **MEV-Boost:** Block building marketplace
2. **Flashbots Auction:** Private transaction relay

3. **Searcher API:** Programmatic transaction submission
4. **MEV Protection:** User-focused MEV mitigation

Impact on MEV

- Reduced front-running for regular users
- Increased competition among searchers
- Higher validator earnings through MEV sharing
- Development of new MEV strategies

Eden Network

Purpose: Protect users from MEV exploitation while enabling fair value distribution

Mechanisms

1. **Transaction Ordering:** Priority based on stake rather than gas price
2. **MEV Protection:** Shield users from sandwich attacks
3. **Value Sharing:** Distribute MEV profits to network participants
4. **Cross-Chain Support:** Multi-blockchain MEV protection

Eden Network Token (EDEN)

- **Function:** Staking for transaction priority
- **Benefits:** Reduced MEV impact, priority ordering
- **Economics:** Value accrual from network usage
- **Governance:** Community-driven protocol decisions

Other MEV Protocols

MEV-DAO

- **Focus:** MEV research and community building
- **Projects:** Transparent MEV analysis tools
- **Education:** Public MEV education and resources
- **Advocacy:** MEV policy and regulation research

MEV Explore

- **Purpose:** Real-time MEV transaction tracking
- **Data:** Public MEV statistics and insights
- **Tools:** Searcher performance analysis
- **Transparency:** MEV ecosystem monitoring

Competitive Dynamics

Searcher Competition

Intensity: Extremely competitive market with hundreds of participants

Competition Factors

1. **Speed:** Microsecond-level timing advantages
2. **Capital:** Larger pools can pursue bigger opportunities
3. **Technology:** Advanced algorithms and infrastructure
4. **Strategy:** Unique approaches to opportunity detection

Competition Examples

Arbitrage Competition:

```
Opportunity: ETH price difference between Uniswap and SushiSwap
Searchers Competing:
├── Searcher A: 1.2s detection time
├── Searcher B: 1.8s detection time
├── Searcher C: 2.1s detection time
Result: Searcher A wins if transaction included
```

Builder Competition

Market Structure: Oligopoly with 4-6 major players controlling most blocks

Competition Strategies

1. **Technology:** Faster block construction algorithms
2. **Partnerships:** Exclusive relationships with searchers
3. **Optimization:** Better MEV opportunity identification
4. **Pricing:** Competitive fee structures

Validator Economics

Incentives: Maximize total block value including MEV

Validation Approaches

- **Self-built:** Highest control, requires significant infrastructure
- **MEV-Boost:** Balanced approach with shared revenues

- **Fixed Partnerships:** Consistent relationships with specific builders

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Revenue Distribution

Total MEV Value Chain

```
Net MEV Extraction → Distribution to Participants → Ecosystem
Development
```

Typical Distribution (Example: $1M MEV Day)

Gross MEV: $1,000,000
- Arbitrage: $600,000 (60%)
- Liquidations: $300,000 (30%)
- Sandwich: $100,000 (10%)

Distribution:

```
Searchers (Primary Extractors): $700,000 (70%)
├── Individual searchers: $200,000 (20%)
├── Professional firms: $400,000 (40%)
├── Protocol teams: $100,000 (10%)

Builders (Block Optimization): $200,000 (20%)
├── MEV-Boost infrastructure: $120,000 (12%)
├── Technology development: $80,000 (8%)

Relays (Transaction Private Transmission): $50,000 (5%)
├── Network infrastructure: $30,000 (3%)
├── Security and development: $20,000 (2%)

Validators (Block Finalization): $50,000 (5%)
├── Block production: $30,000 (3%)
├── MEV profit sharing: $20,000 (2%)
```

Value Creation vs. Extraction

Value Creation:
- Liquidity provision
- Market making

- Risk management
- Protocol innovation

Value Extraction:
- Arbitrage profits
- Liquidation rewards
- Sandwich attacks
- Information arbitrage

Future Ecosystem Evolution

Emerging Trends

1. Cross-Chain MEV

Challenge: Opportunities across multiple blockchains
Solutions:
- Unified transaction monitoring
- Cross-chain arbitrage strategies
- Multi-chain liquidations
- Bridge MEV extraction

2. Layer 2 MEV

Opportunity: New MEV landscapes on scaling solutions
Characteristics:
- Faster finality reduces MEV opportunities
- Lower gas costs enable different strategies
- New protocol designs may create novel MEV
- Centralized sequencing creates different dynamics

3. AI-Powered MEV

Technology: Machine learning for opportunity detection
Applications:
- Pattern recognition in transaction flow
- Predictive modeling for price movements
- Automated strategy optimization
- Risk assessment and management

4. MEV Socialization

Concept: Community-owned MEV extraction
Models:
- DAO-controlled MEV strategies

- Public good MEV (gas optimization)
- Revenue sharing with users
- Transparent MEV metrics

Regulatory Considerations

Potential Impacts:
- Securities regulations for MEV firms
- Market manipulation definitions
- Tax treatment of MEV profits
- International coordination needs

Real-World Case Studies

Case Study 1: Uniswap V3 MEV

Context: Concentrated liquidity pools create unique MEV opportunities

Opportunity:
- Large LP position updates
- Predictable price impact patterns
- Sandwich attack opportunities

Solutions Implemented:
- Slippage protection mechanisms
- Private transaction submission
- MEV-aware price routing

Case Study 2: Flash Loans Evolution

Context: Permissionless borrowing enables capital-efficient MEV

Development:
- Flashloan arbitrage strategies
- Cross-protocol liquidation chains
- Sandwich attack prevention

Impact:
- Reduced minimum capital requirements
- Increased competition for small opportunities
- Protocol-level MEV protection measures

Case Study 3: L2 MEV Landscape

Context: Arbitrum and Optimism create new MEV environments

Characteristics:
- Sequencer-controlled ordering

- Faster finality reduces opportunity window
- Centralized vs. decentralized trade-offs

Lessons:
- MEV varies significantly across architectures
- Fast finality doesn't eliminate MEV
- New MEV types emerge in L2 environments

Interactive Exercise

Ecosystem Role Analysis

Scenario: You have $100K capital and strong programming skills

Questions:
1. Which role would be most profitable?
2. What infrastructure would you need?
3. How would you compete with existing players?
4. What regulatory considerations apply?

Solution Framework:

```
Option 1: Individual Searcher
Pros: High control, can focus on specific strategies
Cons: Requires significant technical expertise
Capital need: $100K (sufficient for simple arbitrage)
Infrastructure: Monitoring tools, execution bots
Competition: Hundreds of similar searchers

Option 2: Validator Participation
Pros: Control over block building, guaranteed MEV access
Cons: Requires significant capital for validator stake
Capital need: <span class="math-inline" style="display: inline;"><math
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mrow></math></span>1M+)
Infrastructure: Node operation, block building
Competition: Limited by available validator slots

Option 3: Protocol Integration
Pros: Access to user flow, first-mover advantages
Cons: Requires protocol relationship building
Capital need: $100K sufficient for integration development
Infrastructure: API integration, user-facing features
Competition: Need to differentiate from existing solutions

Recommendation: Start as searcher focusing on specialized strategies
```

Module Summary

Key Players and Roles

- **Searchers:** Execute MEV strategies, compete for opportunities
- **Validators:** Control block production, earn MEV profits
- **Builders:** Optimize block construction, intermediate value
- **Relays:** Enable private transaction transmission

Competitive Dynamics

- Extremely competitive searcher market
- Oligopoly among major builders
- Strategic partnerships throughout ecosystem
- Continuous innovation and evolution

Economic Incentives

- Profit-sharing mechanisms align incentives
- Technology advantages provide competitive edge
- Capital requirements vary significantly
- Regulatory landscape evolving

Next Steps

- **Module 4:** Deep dive into specific MEV strategies
- **Module 5:** Understand market impact and ethics
- **Module 6:** Analyze real-world MEV transactions

Quick Check: Test Your Understanding

1. **What percentage of MEV profits typically goes to searchers?**
   - [ ] 30-40%
   - [ ] 50-60%
   - [ ] 70-80%
2. **Which player controls the final transaction ordering?**
   - [ ] Searchers
   - [ ] Builders
   - [ ] Validators
3. **What is the primary benefit of private relays?**
   - [ ] Faster transaction processing
   - [ ] Lower gas costs
   - [ ] Protection from front-running
4. **How many major block builders typically dominate the market?**
   - [ ] 2-3
   - [ ] 4-6
   - [ ] 10-15

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