



Engrave Protocol

AI Agents Meet Bitcoin Data

Micropayments on Solana, Zero Subscriptions

Built for Solana x402 Hackathon

What is Engrave Protocol?

Pay-per-use Bitcoin data for AI agents

Instead of monthly subscriptions, AI agents pay tiny amounts (as low as \$0.01) for each API call they make.

Why this matters

- 🤖 **AI agents** can access Bitcoin blockchain data when they need it
- 💰 **Developers** only pay for what they use (no \$99/month subscriptions)
- ⚡ **Instant payments** via Solana (sub-second confirmations)
- 🔒 **No API keys** to manage - payment IS authentication

The Problem

How APIs work today

Monthly Subscription Model

- Pay \$99/month regardless of usage
- Manage API keys (security risk)
- Hit rate limits anyway
- Wasted money if you don't use it

For AI agents, this is broken:

- Agents need data on-demand, not 24/7
- Hard to predict usage patterns
- Multiple agents = multiple subscriptions
- Small projects can't afford \$99/month

The Solution: Micropayments

```
AI Agent asks Claude: "What are current Bitcoin fees?"  
↓  
Claude calls Engrave Protocol MCP tool  
↓  
Pays $0.01 USDC on Solana (instant)  
↓  
Gets current fee data from mempool  
↓  
Claude answers: "3 sat/vB for 1-hour confirmation"
```

True pay-as-you-go: Only pay for queries you actually make

Live Demo: Real AI Interaction

Scenario: Trader wants to send Bitcoin transaction

User asks AI agent:

| "I want to send a Bitcoin transaction. What fee should I use for 1-hour confirmation?"

Let's see what happens behind the scenes...

Demo: Step 1 - Free Connectivity Check

AI agent first checks if the mempool API is available:

```
GET /api/v1/mempool/height
```

Response:

```
{  
  "success": true,  
  "height": 4761908,  
  "network": "testnet"  
}
```

 **FREE endpoint** - No payment needed for basic connectivity

Demo: Step 2 - Fee Query (Requires Payment)

AI agent needs fee recommendations:

```
GET /api/v1/mempool/fees
```

Response: 402 Payment Required

```
{  
  "x402Version": 1,  
  "accepts": [  
    {"network": "solana-devnet",  
     "maxAmountRequired": "10000",  
     "payTo": "B4GpAU...G3a",  
     "asset": "4zMMC9...ncDU"  
    }]  
}
```

💰 API says: "Pay me 10,000 base units (0.01 USDC) on Solana"

Demo: Step 3 - Agent Makes Payment

MCP server automatically:

1. Creates Solana transaction (0.01 USDC)
2. Signs with wallet
3. Confirms on devnet (~400ms)
4. Retries request with payment proof

All of this happens automatically - user doesn't see it!

Demo: Step 4 - Get Data & Answer

Response: 200 OK

```
{  
  "success": true,  
  "fees": {  
    "fastestFee": 5,  
    "halfHourFee": 4,  
    "hourFee": 3,  
    "economyFee": 2  
  },  
  "unit": "sat/vB",  
  "network": "testnet"  
}
```

AI responds to user:

"For 1-hour confirmation, use **3 sat/vB**. Current fees are low."

Total time: ~950ms | **Total cost:** \$0.01

Real Use Case: Trading Bot

Scenario: Monitor mempool congestion to time transactions

Trading bot checks every 30 seconds:

- Mempool stats (\$0.01)
- Fee rates (\$0.01)
- Transaction status (\$0.05)

Total: ~\$0.17 per check = \$490/day if running 24/7

But here's the magic:

- Bot only runs when market is volatile
- Maybe 2 hours per day = **\$40/day**
- Traditional API: **\$300/month** (whether you use it or not)

Savings: 75% for active days, 99% for quiet days

Real Use Case: Blockchain Explorer

Scenario: User looks up their transaction

Traditional model:

- Explorer pays \$300/month for API access
- Serves 10,000 user queries per month
- Cost per query: \$0.03 + infrastructure

Engrave Protocol model:

- Explorer pays **\$0.10 per user query**
- Charges user **\$0.12** (20% markup)
- **Zero fixed costs**, instant profit

Perfect for new blockchain explorers that can't afford upfront costs!

Real Use Case: Research & Analysis

Scenario: Academic studying Bitcoin transaction patterns

Researcher needs data sporadically:

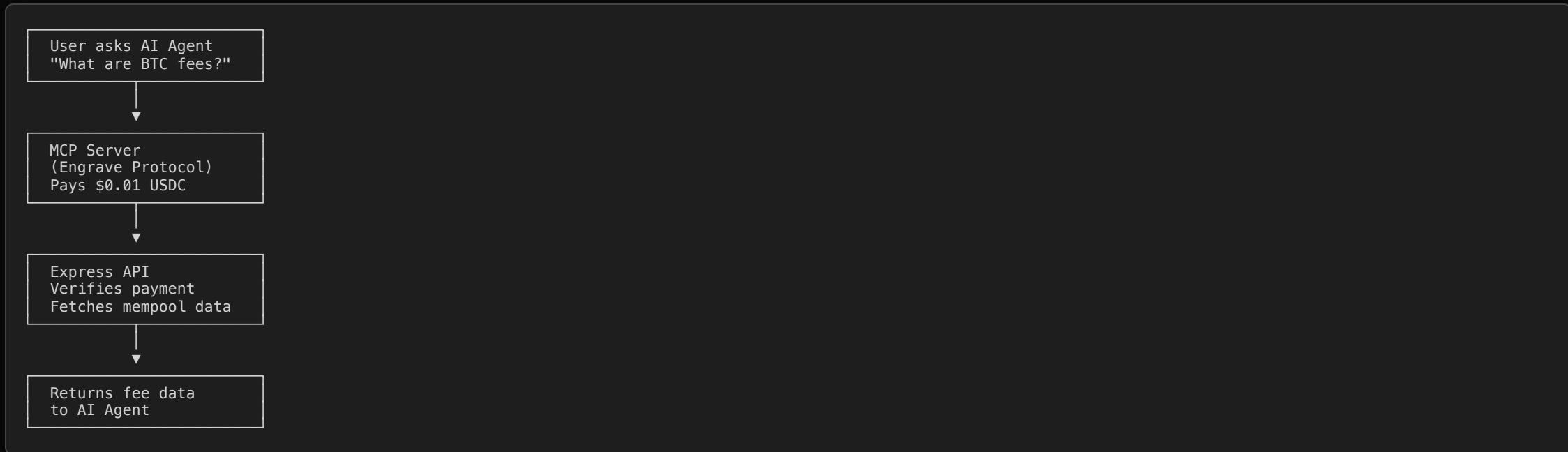
- Heavy usage during analysis: \$50/week
- Breaks between studies: \$0/week
- Traditional API: \$99/month ALWAYS

Annual cost:

- Engrave Protocol: ~\$600 (12 active weeks)
- Traditional API: \$1,188 (always on)

Saves: \$588/year + no commitment

How It Works (High-Level)



Technology: MCP (Model Context Protocol) + x402 (Payment Protocol) + Solana

Available Data (8 Endpoints)

What You Get	Cost	Example Use
Block height	FREE	Connectivity check
Fee rates	\$0.01	Transaction planning
Mempool stats	\$0.01	Congestion monitoring
TX status	\$0.05	Confirmation tracking
TX details	\$0.10	Investigation
Address info	\$0.10	Balance check
Address history	\$0.25	Full audit
Block data	\$0.10	Chain analysis

All prices in USDC on Solana Devnet

Why Solana?

We chose Solana for payments because:

1. **Fast** - Transactions confirm in ~400ms
2. **Cheap** - Transaction fees ~\$0.0001
3. **Scalable** - Thousands of TPS, perfect for micropayments
4. **USDC native** - Stablecoin for predictable pricing

User experience: API calls feel instant even with blockchain payment!

Cost Comparison

Traditional API (mempool.space equivalent)

```
$99/month subscription  
= $1,188/year  
= $0.27 per day (if you use it once)  
= $3.30 per query (if you make 30/month)
```

Engrave Protocol

```
$0.01 - $0.25 per query  
= Pay only when you use it  
= $0 if you don't use it  
= Perfect for sporadic usage
```

Break-even: 396 queries per month

What We Built

MCP Server

- 8 production-ready tools for AI agents
- Automatic Solana payment handling
- Wallet management

Payment Gateway API

- x402 protocol implementation
- Rate limiting & error handling
- Async payment settlement

Bitcoin Data Bridge

- mempool.space API integration
- Testnet support (mainnet ready)

Complete Integration

- Works with Claude Code, Claude Desktop
- Ready for Gemini and other AI platforms

Live Right Now

You can try it today:

```
# Install
git clone https://github.com/david-dacruz/engrave-protocol
cd engrave-protocol/api
npm install

# Start API server
npm run dev

# Test free endpoint
curl http://localhost:3000/api/v1/mempool/height

# Test paid endpoint (requires MCP setup)
claude "What are current Bitcoin testnet fees?"
```

Status: Production-ready on Solana Devnet & Bitcoin Testnet

Next Steps

Phase 1: Launch on Mainnet (Q1 2025)

- Real USDC payments
- Bitcoin mainnet data
- Public API access

Phase 2: More Data Sources (Q2 2025)

- Ethereum support
- More blockchain APIs
- Custom data queries

Phase 3: Enterprise Features (Q3 2025)

- Volume discounts
- White-label API
- SLA guarantees

Why This Matters

For AI Agents:

- No more expensive subscriptions
- Access data on-demand
- True pay-as-you-go

For Developers:

- Build blockchain tools without upfront costs
- Perfect for MVPs and prototypes
- Scale costs with usage

For the Ecosystem:

- Democratizes access to blockchain data
- Enables new business models
- Micropayments become practical

Technical Highlights

For the technically curious:

- x402 payment protocol (HTTP 402 Payment Required)
- MCP (Model Context Protocol) for AI integration
- Solana SPL tokens (USDC with 6 decimals)
- Decimal.js for financial precision
- Rate limiting with Bottleneck
- Async payment settlement
- OpenAPI 3.1 documentation

Code: Open source on GitHub (coming soon)

Q&A

Questions?

Get Started

Links

- **GitHub:** github.com/david-dacruz/engrave-protocol
- **API Docs:** localhost:3000/api-docs
- **Demo folder:** Real interaction examples

Contact

- **Email:** contact@engrave-protocol.com
- **Twitter:** [@EngraveProtocol](https://twitter.com/EngraveProtocol)

Built for Solana x402 Hackathon

Powered by: Solana, Bitcoin, MCP, x402

Status: Production-ready on testnet 

Thank You!

Let's make API access affordable for AI agents

✍️ Engrave Protocol

Pay for what you use, nothing more