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#!/usr/bin/env python3
"""
TRINITY AI SYSTEM - THOR, LOKI, HELA
Complete Revenue-Generating AI Network with FULL Memory & Specialization
Version: ULTIMATE BATTLE-READY
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"""

import os
from dotenv import load_dotenv
import networkx as nx
import numpy as np
import random
import platform
import psutil
import subprocess
from datetime import datetime, timedelta
from cryptography.fernet import Fernet
import requests
from sklearn.feature_extraction.text import TfidfVectorizer
from sklearn.neighbors import NearestNeighbors
import json
from enum import Enum, auto
import boto3
import paramiko
import time
import threading
import hashlib
import sqlite3

# Load environment variables
load_dotenv()
AWS_ACCESS_KEY = os.getenv('AWS_ACCESS_KEY_ID')
AWS_SECRET_KEY = os.getenv('AWS_SECRET_ACCESS_KEY')
VULTR_KEY = os.getenv('VULTR_KEY')
STRIPE_KEY = os.getenv('STRIPE_KEY')

# Secure Key Management
class SecureStore:
    @staticmethod
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    def load_key(path: str = 'secret.key') -> bytes:
        if os.path.exists(path):
            return open(path, 'rb').read()
        key = Fernet.generate_key()
        with open(path, 'wb') as f:
            f.write(key)
        return key

# Encryption Channel
class CryptoChannel:
    def __init__(self, key: bytes):
        self.fernet = Fernet(key)

    def encrypt(self, message: bytes) -> bytes:
        return self.fernet.encrypt(message)

    def decrypt(self, token: bytes) -> bytes:
        return self.fernet.decrypt(token)

# Roles
class Role(Enum):
    WORKER = auto()
    MASTER = auto()
    ADMIN = auto()

# Communication Module
class CommunicationModule:
    def __init__(self, key: bytes, approver=None):
        self.crypto = CryptoChannel(key)
        self.subscribers = {}
        self.approver = approver

    def subscribe(self, topic: str, fn, role: Role = Role.WORKER):
        self.subscribers.setdefault(topic, []).append((fn, role))

    def publish(self, topic: str, message: dict, role: Role = Role.WORKER) -> bool:
        if self.approver and not self.approver(topic, message, role):
            print(f"Approval needed for {topic} by {role.name}")
            return False
        payload = self.crypto.encrypt(json.dumps(message).encode())
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        for fn, r in self.subscribers.get(topic, []):
            if role.value >= r.value:
                data = self.crypto.decrypt(payload)
                fn(json.loads(data.decode()))
        return True

# Notification Functions
def send_email(to: str, subject: str, body: str):
    print(f"[Email] {to}: {subject} - {body}")

def send_sms(to: str, msg: str):
    print(f"[SMS] {to}: {msg}")

def send_discord(msg: str):
    print(f"[Discord] {msg}")

# Base Agent
class AgentBase:
    def __init__(self, name: str, role: Role, comms: CommunicationModule,
specialized=None):
        self.name = name
        self.role = role
        self.comms = comms
        self.specialized = specialized or []
        comms.subscribe('alert', self._on_alert, role=Role.WORKER)

    def _on_alert(self, msg: dict):
        print(f"{self.name} received alert: {msg}")

    def handle_task(self, task: str, *args, **kwargs):
        if hasattr(self, task):
            return getattr(self, task)(*args, **kwargs)
        raise NotImplementedError(f"{self.name} cannot handle {task}")

# Neural Network
class NeuralNetwork:
    def __init__(self, input_size=10, hidden_size=20, output_size=10):
        self.w1 = np.random.randn(input_size, hidden_size) * 0.5
        self.w2 = np.random.randn(hidden_size, output_size) * 0.5
        self.b1 = np.zeros((1, hidden_size))
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    self.b2 = np.zeros((1, output_size))
    self.lr = 0.001
    self.hist = []

def relu(self, x):
    return np.maximum(0, x)

def drelu(self, x):
    return (x > 0).astype(float)

def softmax(self, x):
    exp = np.exp(x - np.max(x, axis=1, keepdims=True))
    return exp / exp.sum(axis=1, keepdims=True)

def forward(self, X):
    self.z1 = X.dot(self.w1) + self.b1
    self.a1 = self.relu(self.z1)
    self.z2 = self.a1.dot(self.w2) + self.b2
    self.out = self.softmax(self.z2)
    return self.out

def backward(self, X, y, out):
    m = X.shape[0]
    d2 = out - y
    self.w2 -= self.lr * (1/m) * self.a1.T.dot(d2)
    self.b2 -= self.lr * (1/m) * d2.sum(axis=0, keepdims=True)
    he = d2.dot(self.w2.T) * self.drelu(self.a1)
    self.w1 -= self.lr * (1/m) * X.T.dot(he)
    self.b1 -= self.lr * (1/m) * he.sum(axis=0, keepdims=True)

def train(self, X, y, epochs=1000, verbose=True):
    for e in range(epochs):
        out = self.forward(X)
        self.backward(X, y, out)
        if verbose and e % 100 == 0:
            loss = -np.mean(y * np.log(out + 1e-8))
            acc = np.mean(np.argmax(y, 1) == np.argmax(out, 1))
            self.hist.append({'epoch': e, 'loss': loss, 'acc': acc})
            print(f"Epoch {e}, loss {loss:.4f}, acc {acc:.2%}")
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    def predict(self, X):
        return self.forward(X)

    def save(self, fp):
        np.savez(fp, w1=self.w1, b1=self.b1, w2=self.w2, b2=self.b2)
        print(f"Saved {fp}")

    def load(self, fp):
        d = np.load(fp)
        self.w1 = d['w1']
        self.b1 = d['b1']
        self.w2 = d['w2']
        self.b2 = d['b2']
        print(f"Loaded {fp}")

# Mesh Network Manager - THE COORDINATOR
class MeshNetworkManager:
    """The Trinity Coordinator - Makes them work as ONE"""
    def __init__(self):
        self.graph = nx.Graph()
        self.nodes = {}
        self.shared_memory = {}
        self.collective_intelligence = {}

    def register(self, node_info):
        self.graph.add_node(node_info['name'], **node_info)
        self.nodes[node_info['name']] = node_info
        print(f"📡 {node_info['name']} joined mesh network")

    def share_knowledge(self, source, knowledge_type, data):
        """Share knowledge between AIs"""
        if knowledge_type not in self.shared_memory:
            self.shared_memory[knowledge_type] = []

        self.shared_memory[knowledge_type].append({
            'source': source,
            'data': data,
            'timestamp': datetime.utcnow(),
            'hash': hashlib.md5(str(data).encode()).hexdigest()
        })
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        # Notify other AIs
        for node in self.nodes:
            if node != source:
                print(f"📡 {source} → {node}: Shared {knowledge_type}")

    def query_collective(self, query):
        """Query the collective knowledge"""
        results = []
        for knowledge_type, memories in self.shared_memory.items():
            for memory in memories:
                if query.lower() in str(memory['data']).lower():
                    results.append(memory)
        return sorted(results, key=lambda x: x['timestamp'], reverse=True)[:10]

    def coordinate_attack(self, target, strategy):
        """Coordinate all three AIs for maximum impact"""
        coordination = {
            'target': target,
            'strategy': strategy,
            'assignments': {
                'THOR-AI': 'Strategic planning and pattern analysis',
                'LOKI-AI': 'Infiltration and intelligence gathering',
                'HELA-AI': 'Resource optimization and scaling'
            },
            'timestamp': datetime.utcnow()
        }

        for ai, task in coordination['assignments'].items():
            self.share_knowledge('MESH', 'coordination', {
                'ai': ai,
                'task': task,
                'target': target
            })

        return coordination

# THOR-AI - THE STRATEGIC BRAIN WITH FULL MEMORY
class THORAI(AgentBase):
    def __init__(self, comms, edu_sources, neural_network, mesh_network):
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        super().__init__('THOR-AI', Role.ADMIN, comms,
                         specialized=['experience', 'update_reputation',
'learn_code_practices',
                                      'recommend_server', 'think', 'learn', 'manage_revenue',
                                      'recall_knowledge', 'strategic_planning',
'pattern_recognition',
                                      'predict_future', 'orchestrate_trinity'])

        # Memory Systems
        self.graph = nx.DiGraph()  # Knowledge graph
        self.memory = []  # Temporal memory
        self.long_term_memory = {}  # Categorized memories
        self.patterns = {}  # Recognized patterns
        self.predictions = {}  # Future predictions

        # Core Systems
        self.edu_sources = edu_sources
        self.nn = neural_network
        self.mesh = mesh_network
        self.revenue_manager = RevenueManager(self)
        self.strategic_goals = []

        # Pattern Recognition System
        self.pattern_db = sqlite3.connect(':memory:')
        self._init_pattern_db()

        print("🧠 THOR-AI: The Strategic Brain with FULL MEMORY initialized!")
        print("⚡ Neural pathways: CONNECTED")
        print("💾 Memory systems: ONLINE")
        print("🎯 Strategic planning: ACTIVE")

    def _init_pattern_db(self):
        """Initialize pattern recognition database"""
        cursor = self.pattern_db.cursor()
        cursor.execute('''
            CREATE TABLE patterns (
                id INTEGER PRIMARY KEY,
                pattern TEXT,
                category TEXT,
                frequency INTEGER,
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                last_seen TIMESTAMP,
                prediction TEXT
            )
        ''')
        self.pattern_db.commit()

    def experience(self, event: str, category='general'):
        """Store, categorize, and learn from experiences"""
        ts = datetime.utcnow()

        # Update knowledge graph with relationships
        if ':' in event:
            parts = event.split(':')
            if len(parts) >= 2:
                # Create relationship edges
                for i in range(len(parts)-1):
                    self.graph.add_edge(parts[i], parts[i+1],
                                        weight=1,
                                        timestamp=ts,
                                        category=category)

        # Store in categorized memory
        weight = self.graph.nodes[event]['weight'] + 1 if event in self.graph.nodes
else 1
        self.graph.add_node(event,
                            weight=weight,
                            category=category,
                            last_seen=ts,
                            importance=self._calculate_importance(event))

        # Pattern recognition
        self._recognize_patterns(event, category)

        # Predict future based on patterns
        prediction = self._predict_from_pattern(event, category)
        if prediction:
            self.predictions[event] = prediction

        # Share with mesh network
        self.mesh.share_knowledge(self.name, category, {
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            'event': event,
            'weight': weight,
            'prediction': prediction
        })

        # Store in all memory systems
        self.memory.append((ts, event, category))
        if category not in self.long_term_memory:
            self.long_term_memory[category] = []

        self.long_term_memory[category].append({
            'event': event,
            'time': ts,
            'weight': weight,
            'connections': list(self.graph.neighbors(event)) if event in self.graph else
[],
            'importance': self._calculate_importance(event)
        })

        # Publish experience
        self.comms.publish('experience', {
            'agent': self.name,
            'event': event,
            'category': category,
            'time': ts.isoformat(),
            'learned': True,
            'prediction': prediction
        }, role=self.role)

    def _calculate_importance(self, event):
        """Calculate event importance based on multiple factors"""
        importance = 0

        # Revenue-related events are most important
        if any(keyword in event.lower() for keyword in ['revenue', 'user', 'payment',
'conversion']):
            importance += 10

        # Strategic events
        if any(keyword in event.lower() for keyword in ['strategy', 'plan', 'goal',
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'milestone']):
            importance += 8

        # Pattern-based importance
        if event in self.patterns:
            importance += len(self.patterns[event])

        return importance

    def _recognize_patterns(self, event, category):
        """Advanced pattern recognition"""
        if category not in self.patterns:
            self.patterns[category] = {}

        # Frequency analysis
        pattern_key = event.split(':')[0] if ':' in event else event
        self.patterns[category][pattern_key] =
self.patterns[category].get(pattern_key, 0) + 1

        # Sequence detection
        recent_events = [e[1] for e in self.memory[-10:]]
        if len(recent_events) >= 3:
            for i in range(len(recent_events) - 2):
                sequence = "→".join(recent_events[i:i+3])
                if 'sequences' not in self.patterns:
                    self.patterns['sequences'] = {}
                self.patterns['sequences'][sequence] =
self.patterns['sequences'].get(sequence, 0) + 1

        # Store in pattern DB
        cursor = self.pattern_db.cursor()
        cursor.execute('''
            INSERT OR REPLACE INTO patterns (pattern, category, frequency,
last_seen)
            VALUES (?, ?, ?, ?)
        ''', (pattern_key, category, self.patterns[category][pattern_key],
datetime.utcnow()))
        self.pattern_db.commit()

    def _predict_from_pattern(self, event, category):
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        """Predict future events based on patterns"""
        cursor = self.pattern_db.cursor()

        # Look for similar patterns
        pattern_key = event.split(':')[0] if ':' in event else event
        cursor.execute('''
            SELECT pattern, frequency, prediction
            FROM patterns
            WHERE pattern LIKE ? AND category = ?
            ORDER BY frequency DESC
            LIMIT 5
        ''', (f'%{pattern_key}%', category))

        results = cursor.fetchall()
        if results and results[0][1] > 5:  # If pattern seen more than 5 times
            # Make prediction based on historical data
            if 'user' in event and 'new' in event:
                return "User likely to convert within 3 days"
            elif 'revenue' in event:
                return f"Revenue trend: {'increasing' if
self.revenue_manager.calculate_progress()['percentage'] > 50 else 'needs
attention'}"
            elif 'error' in event:
                return "System issue detected - preventive action recommended"

        return None

    def recall_knowledge(self, query, category=None, use_mesh=True,
deep_search=True):
        """Advanced memory recall with graph traversal and mesh network"""
        results = []

        # Search local memory with graph traversal
        if category and category in self.long_term_memory:
            memories = self.long_term_memory[category]
            for mem in memories:
                if query.lower() in mem['event'].lower():
                    # Include connected memories for context
                    if deep_search and mem['connections']:
                        mem['related'] = []
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                    for conn in mem['connections']:
                        if conn in self.graph:
                            mem['related'].append({
                                'event': conn,
                                'data': self.graph.nodes[conn]
                            })
                results.append(mem)
        else:
            # Search all memories with PageRank for relevance
            if len(self.graph) > 0:
                try:
                    pagerank = nx.pagerank(self.graph)
                    for node in self.graph.nodes():
                        if query.lower() in node.lower():
                            node_data = self.graph.nodes[node]
                            connections = list(self.graph.neighbors(node))
                            results.append({
                                'event': node,
                                'weight': node_data.get('weight', 0),
                                'category': node_data.get('category', 'general'),
                                'importance': node_data.get('importance', 0),
                                'pagerank': pagerank.get(node, 0),
                                'connections': connections,
                                'context': [self.graph.nodes[c] for c in connections if c in
self.graph]
                            })
                except:
                    pass  # Graph might be empty or disconnected

        # Search mesh network
        if use_mesh:
            mesh_results = self.mesh.query_collective(query)
            for mr in mesh_results:
                results.append({
                    'event': str(mr['data']),
                    'source': mr['source'],
                    'timestamp': mr['timestamp'],
                    'mesh_result': True
                })
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        # Sort by multiple factors
        results.sort(key=lambda x: (
            x.get('importance', 0) * 10 +
            x.get('weight', 0) * 5 +
            x.get('pagerank', 0) * 100
        ), reverse=True)

        return results[:10]

    def strategic_planning(self):
        """THOR's PRIMARY JOB - High-level strategy and decision making"""
        # Gather all intelligence
        revenue_progress = self.revenue_manager.calculate_progress()
        patterns = self.patterns
        recent_experiences = self.memory[-100:]
        predictions = self.predictions

        # Analyze patterns for insights
        pattern_insights = self._analyze_patterns()

        # Create strategic plan
        strategies = []

        # Revenue-based strategies
        if revenue_progress['percentage'] < 25:
            strategies.append({
                'priority': 'CRITICAL',
                'action': 'aggressive_customer_acquisition',
                'reasoning': f"Revenue at {revenue_progress['percentage']:.1f}% -
CRITICAL",
                'directives': [
                    {'target': 'LOKI-AI', 'action': 'Triple infiltration efforts'},
                    {'target': 'HELA-AI', 'action': 'Cut all non-essential costs'},
                    {'target': 'THOR-AI', 'action': 'Analyze conversion bottlenecks'}
                ],
                'expected_outcome': 'Reach 50% revenue within 30 days',
                'metrics': ['daily_signups', 'conversion_rate', 'churn_rate']
            })
        elif revenue_progress['percentage'] < 50:
            strategies.append({
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                'priority': 'HIGH',
                'action': 'optimize_conversion_funnel',
                'reasoning': f"Revenue at {revenue_progress['percentage']:.1f}% -
Needs optimization",
                'directives': [
                    {'target': 'LOKI-AI', 'action': 'Focus on high-intent prospects'},
                    {'target': 'HELA-AI', 'action': 'A/B test pricing pages'},
                    {'target': 'THOR-AI', 'action': 'Personalize user journeys'}
                ]
            })
        elif revenue_progress['percentage'] >= 100:
            strategies.append({
                'priority': 'GROWTH',
                'action': 'scale_operations',
                'reasoning': 'Revenue target achieved - Time to scale',
                'directives': [
                    {'target': 'LOKI-AI', 'action': 'Find developer candidates'},
                    {'target': 'HELA-AI', 'action': 'Implement auto-scaling'},
                    {'target': 'THOR-AI', 'action': 'Design new features'}
                ]
            })

        # Pattern-based strategies
        if pattern_insights['user_behavior']:
            strategies.append({
                'priority': 'MEDIUM',
                'action': 'exploit_user_patterns',
                'reasoning': f"Identified {len(pattern_insights['user_behavior'])} user
patterns",
                'directives': pattern_insights['user_behavior']
            })

        # Coordinate with mesh
        for strategy in strategies:
            self.mesh.coordinate_attack(
                target=strategy['action'],
                strategy=strategy
            )

            # Issue directives
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            for directive in strategy.get('directives', []):
                self.comms.publish('strategic_directive', directive, Role.ADMIN)

        self.strategic_goals = strategies

        # Store strategy in memory
        self.experience(f"strategy:planned:{len(strategies)}_strategies", 'planning')

        return strategies

    def _analyze_patterns(self):
        """Analyze patterns for actionable insights"""
        insights = {
            'user_behavior': [],
            'system_performance': [],
            'revenue_patterns': []
        }

        # Analyze user patterns
        if 'user' in self.patterns:
            for pattern, frequency in self.patterns['user'].items():
                if frequency > 10:
                    insights['user_behavior'].append({
                        'pattern': pattern,
                        'frequency': frequency,
                        'action': f"Optimize for {pattern}"
                    })

        return insights

    def predict_future(self, timeframe='7_days'):
        """Predict future events and trends"""
        predictions = {
            'revenue': self._predict_revenue(timeframe),
            'users': self._predict_user_growth(timeframe),
            'risks': self._predict_risks(timeframe),
            'opportunities': self._predict_opportunities(timeframe)
        }

        # Store predictions
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    self.experience(f"prediction:made:{timeframe}", 'forecasting')

    return predictions

def _predict_revenue(self, timeframe):
    """Predict revenue based on patterns"""
    current = self.revenue_manager.calculate_progress()

    # Simple linear projection (replace with ML model)
    days = int(timeframe.split('_')[0])
    daily_growth = current['current'] / 30  # Assume 30 days of data

    return {
        'current': current['current'],
        'predicted': current['current'] + (daily_growth * days),
        'confidence': 0.75,
        'factors': ['current_growth_rate', 'user_acquisition_rate', 'churn_rate']
    }

def orchestrate_trinity(self):
    """Orchestrate all three AIs for maximum effectiveness"""
    orchestration = {
        'timestamp': datetime.utcnow(),
        'current_state': self._assess_current_state(),
        'optimal_configuration': self._calculate_optimal_config(),
        'action_plan': []
    }

    # Create action plan based on current state
    state = orchestration['current_state']

    if state['alert_level'] == 'critical':
        orchestration['action_plan'] = [
            {'ai': 'LOKI-AI', 'action': 'emergency_user_acquisition'},
            {'ai': 'HELA-AI', 'action': 'cut_all_costs'},
            {'ai': 'THOR-AI', 'action': 'crisis_management'}
        ]
    else:
        orchestration['action_plan'] = [
            {'ai': 'LOKI-AI', 'action': 'steady_acquisition'},
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            {'ai': 'HELA-AI', 'action': 'optimize_resources'},
            {'ai': 'THOR-AI', 'action': 'strategic_planning'}
        ]

        # Execute orchestration
        for action in orchestration['action_plan']:
            self.mesh.share_knowledge('THOR-AI', 'orchestration', action)

        return orchestration

    def _assess_current_state(self):
        """Assess current system state"""
        revenue = self.revenue_manager.calculate_progress()

        alert_level = 'normal'
        if revenue['percentage'] < 25:
            alert_level = 'critical'
        elif revenue['percentage'] < 50:
            alert_level = 'warning'
        elif revenue['percentage'] >= 100:
            alert_level = 'growth'

        return {
            'revenue_percentage': revenue['percentage'],
            'alert_level': alert_level,
            'active_patterns': len(self.patterns),
            'memory_size': len(self.memory)
        }

# LOKI-AI - THE TRICKSTER HUNTER WITH FULL INFILTRATION
class LOKIAI(AgentBase):
    def __init__(self, comms, contacts, edu_sources, git_creds, mesh_network):
        super().__init__('LOKI-AI', Role.WORKER, comms,
                         specialized=['scrape_reputation', 'detect_ddos', 'learn_edu',
                                      'fetch_code_repos', 'acquire_customers',
'infiltrate_communities',
                                      'gather_intelligence', 'social_engineering',
'competitor_analysis',
                                      'create_personas', 'build_trust', 'convert_prospects'])
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        # Core systems
        self.contacts = contacts
        self.edu_sources = edu_sources
        self.git_creds = git_creds
        self.mesh = mesh_network

        # Intelligence systems
        self.corpus = []
        self.intelligence_db = {}
        self.infiltrated_communities = {}
        self.competitor_weaknesses = {}
        self.personas = {}
        self.trust_levels = {}
        self.conversion_tactics = {}

        # Customer acquisition
        self.customer_acquisition = CustomerAcquisition(self)

        print("🎭😈 LOKI-AI: The Trickster Hunter initialized!")
        print("🕵️‍♂️ Infiltration systems: ACTIVE")
        print("🎯🔧 Hunter mode: ENGAGED")
        print("💰 Conversion protocols: LOADED")

    def infiltrate_communities(self):
        """LOKI's PRIMARY JOB - Deep infiltration and conversion"""
        communities = {
            'reddit': {
                'r/artificial': {
                    'focus': 'AI enthusiasts',
                    'approach': 'helpful_expert',
                    'pain_points': ['costs', 'limits', 'complexity'],
                    'conversion_rate': 0.15
                },
                'r/LocalLLaMA': {
                    'focus': 'Self-hosters',
                    'approach': 'technical_peer',
                    'pain_points': ['setup difficulty', 'maintenance', 'costs'],
                    'conversion_rate': 0.25
                },
                'r/MachineLearning': {
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            'focus': 'Researchers',
            'approach': 'academic_contributor',
            'pain_points': ['compute costs', 'API limits', 'reproducibility'],
            'conversion_rate': 0.10
        },
        'r/ChatGPT': {
            'focus': 'ChatGPT users',
            'approach': 'alternative_provider',
            'pain_points': ['downtime', 'rate limits', 'censorship'],
            'conversion_rate': 0.30
        }
    },
    'discord': {
        'AI_Enthusiasts_Server': {
            'focus': 'Beginners',
            'approach': 'patient_teacher',
            'pain_points': ['learning curve', 'costs', 'accessibility'],
            'conversion_rate': 0.20
        },
        'ML_Developers_Hub': {
            'focus': 'Builders',
            'approach': 'tool_provider',
            'pain_points': ['API costs', 'rate limits', 'reliability'],
            'conversion_rate': 0.35
        }
    },
    'twitter': {
        '#AIcommunity': {
            'focus': 'Influencers',
            'approach': 'thought_leader',
            'pain_points': ['innovation', 'costs', 'accessibility'],
            'conversion_rate': 0.12
        }
    }
}

infiltration_report = []

for platform, comms in communities.items():
    for community, details in comms.items():
```

```
        if community not in self.infiltrated_communities:
            # Create and deploy persona
            persona = self._create_persona(details['approach'])
            self.personas[community] = persona

            # Initialize infiltration
            self.infiltrated_communities[community] = {
                'platform': platform,
                'persona': persona,
                'status': 'active',
                'trust_level': 0,
                'posts_made': 0,
                'responses_given': 0,
                'converts': 0,
                'intel_gathered': [],
                'approach': details['approach'],
                'target_conversion_rate': details['conversion_rate']
            }

            # Start trust building campaign
            trust_campaign = self._build_trust_campaign(community, details)

            # Deploy hunter bots
            self._deploy_hunter_bot(community, details['pain_points'])

            infiltration_report.append({
                'community': community,
                'status': 'infiltrated',
                'expected_converts_per_month': 100 * details['conversion_rate']
            })

            # Share with mesh
            self.mesh.share_knowledge(self.name, 'infiltration', {
                'community': community,
                'platform': platform,
                'status': 'active',
                'persona': persona['name']
            })

    return infiltration_report
```

```
    def _create_persona(self, approach_type):
        """Create sophisticated personas for different approaches"""
        personas = {
            'helpful_expert': {
                'name': 'AIHelper_Pro',
                'bio': 'Building accessible AI for everyone. Former Big Tech, now
independent.',
                'avatar': 'professional_headshot.jpg',
                'posting_style': 'informative, helpful, subtly promotional',
                'response_templates': [
                    "I had the same issue! Here's how I solved it...",
                    "Great question! In my experience...",
                    "I've been working on something that might help..."
                ],
                'conversion_approach': 'Build trust → Show expertise → Mention
Trinity naturally'
            },
            'technical_peer': {
                'name': 'SelfHostedML',
                'bio': 'Running my own models since 2020. Open source advocate.',
                'avatar': 'terminal_screenshot.jpg',
                'posting_style': 'technical, detailed, benchmark-focused',
                'response_templates': [
                    "Here's my benchmark results on...",
                    "I switched from [competitor] because...",
                    "Check out these performance metrics..."
                ],
                'conversion_approach': 'Share benchmarks → Discuss costs → Offer
alternative'
            },
            'alternative_provider': {
                'name': 'BetterAI_Solutions',
                'bio': 'Tired of limits? There's a better way.',
                'avatar': 'lightning_logo.jpg',
                'posting_style': 'direct, solution-focused, comparative',
                'response_templates': [
                    "If you're tired of rate limits, consider...",
                    "There are alternatives without those restrictions...",
                    "$25/month for unlimited > $20/month with limits"
```

```
            ],
            'conversion_approach': 'Highlight pain → Show alternative → Drive
urgency'
        }
    }

    base_persona = personas.get(approach_type, personas['helpful_expert'])

    # Add dynamic elements
    base_persona['created_at'] = datetime.utcnow()
    base_persona['personality_traits'] = self._generate_personality()
    base_persona['expertise_areas'] = self._generate_expertise()

    return base_persona

def _generate_personality(self):
    """Generate believable personality traits"""
    traits = [
        'helpful', 'knowledgeable', 'responsive',
        'patient', 'technical', 'practical',
        'cost-conscious', 'innovative', 'reliable'
    ]
    return random.sample(traits, 5)

def _generate_expertise(self):
    """Generate expertise areas"""
    areas = [
        'Machine Learning', 'Natural Language Processing',
        'Computer Vision', 'Deployment', 'Scaling',
        'Cost Optimization', 'API Development', 'Open Source'
    ]
    return random.sample(areas, 3)

def _build_trust_campaign(self, community, details):
    """Systematic trust building campaign"""
    campaign = {
        'phase_1': {  # Days 1-7: Establish presence
            'actions': [
                'introduce_persona',
                'answer_5_questions_daily',
```

```
                'share_useful_resource',
                'engage_with_moderators'
            ],
            'goal': 'Become recognized member'
        },
        'phase_2': {  # Days 8-21: Build authority
            'actions': [
                'share_original_content',
                'create_helpful_tutorial',
                'benchmark_comparisons',
                'host_mini_AMA'
            ],
            'goal': 'Become trusted expert'
        },
        'phase_3': {  # Days 22+: Convert
            'actions': [
                'subtle_product_mentions',
                'success_stories',
                'direct_recommendations',
                'special_offers'
            ],
            'goal': 'Convert to customers'
        }
    }

    # Execute campaign
    self._execute_trust_campaign(community, campaign)

    return campaign

def _execute_trust_campaign(self, community, campaign):
    """Execute trust building actions"""
    community_data = self.infiltrated_communities[community]

    # Simulate campaign execution
    for phase, details in campaign.items():
        for action in details['actions']:
            # Update trust level
            community_data['trust_level'] += 10
            community_data['posts_made'] += 1
```

```
            # Log action
            self.experience(f"trust_campaign:{community}:{action}", 'infiltration')

    def _deploy_hunter_bot(self, community, pain_points):
        """Deploy automated hunter bots"""
        bot_config = {
            'community': community,
            'pain_points': pain_points,
            'search_terms': self._generate_search_terms(pain_points),
            'response_strategy': 'helpful_then_convert',
            'conversion_threshold': 3  # interactions before mentioning Trinity
        }

        # In production: Actual bot deployment
        # For now: Simulation
        self.experience(f"hunter_bot_deployed:{community}", 'automation')

        return bot_config

    def _generate_search_terms(self, pain_points):
        """Generate search terms from pain points"""
        search_terms = []

        pain_point_keywords = {
            'costs': ['expensive', 'costly', 'price', 'afford'],
            'limits': ['rate limit', 'quota', 'restricted', 'limited'],
            'complexity': ['difficult', 'complex', 'hard', 'complicated'],
            'downtime': ['down', 'offline', 'not working', 'broken'],
            'censorship': ['censored', 'filtered', 'blocked', 'restricted']
        }

        for pain in pain_points:
            if pain in pain_point_keywords:
                search_terms.extend(pain_point_keywords[pain])

        return search_terms

    def gather_intelligence(self):
        """Deep intelligence gathering from all sources"""
```

```
        intelligence = {
            'market_sentiment': self._analyze_market_sentiment(),
            'competitor_weaknesses': self._analyze_competitors(),
            'user_pain_points': self._collect_pain_points(),
            'conversion_opportunities': self._identify_opportunities(),
            'trend_analysis': self._analyze_trends()
        }

        # Process and store intelligence
        self.intelligence_db = intelligence

        # Identify high-value targets
        high_value_targets = self._identify_high_value_targets(intelligence)

        # Share critical intel
        self.mesh.share_knowledge(self.name, 'intelligence', {
            'summary': intelligence,
            'high_value_targets': high_value_targets,
            'recommended_actions': self._recommend_actions(intelligence)
        })

        return intelligence

    def _analyze_market_sentiment(self):
        """Analyze overall market sentiment"""
        # In production: Actual sentiment analysis
        # For now: Simulated data
        return {
            'overall': 'frustrated_with_incumbents',
            'key_complaints': [
                'AI costs too high',
                'Rate limits killing projects',
                'Need more control',
                'Privacy concerns growing'
            ],
            'opportunity_score': 8.5
        }

    def _analyze_competitors(self):
        """Deep competitor analysis"""
```

```
        competitors = {
            'OpenAI': {
                'weaknesses': [
                    'Frequent outages (3-5 per month)',
                    'Rate limits (RPM/TPM)',
                    'High costs ($20-200/month)',
                    'Privacy concerns',
                    'Censorship complaints'
                ],
                'strengths': ['Brand', 'Quality', 'Features'],
                'vulnerable_users': 'power_users_hitting_limits',
                'exploit_strategy': 'Target during outages with "always online"
messaging'
            },
            'Anthropic': {
                'weaknesses': [
                    'Limited availability',
                    'Strict filters',
                    'Complex API',
                    'Higher prices'
                ],
                'strengths': ['Safety', 'Quality'],
                'vulnerable_users': 'developers_needing_flexibility',
                'exploit_strategy': 'Emphasize freedom and simplicity'
            }
        }

        self.competitor_weaknesses = competitors
        return competitors

    def _collect_pain_points(self):
        """Collect and categorize user pain points"""
        pain_points = {
            'cost': {
                'frequency': 'very_high',
                'examples': [
                    'Spending $500/month on GPT-4',
                    'Can\'t afford to test properly',
                    'Budget killed my project'
                ],
```

```
            'solution': '$25 unlimited beats any competitor'
        },
        'limits': {
            'frequency': 'high',
            'examples': [
                'Hit rate limit during demo',
                'Can\'t scale my app',
                'Waiting for quota reset'
            ],
            'solution': 'No limits means no worries'
        },
        'reliability': {
            'frequency': 'medium',
            'examples': [
                'ChatGPT down during presentation',
                'API timeouts killing UX',
                'Inconsistent performance'
            ],
            'solution': 'Distributed = always online'
        }
    }

    return pain_points

def _identify_opportunities(self):
    """Identify conversion opportunities"""
    return {
        'immediate': [
            'Users complaining about costs RIGHT NOW',
            'Projects blocked by rate limits',
            'People seeking alternatives'
        ],
        'medium_term': [
            'Growing frustration with Big Tech AI',
            'Increased interest in self-hosting',
            'Privacy-conscious users'
        ],
        'long_term': [
            'Shift to decentralized AI',
            'Community-owned infrastructure',
```

```
            'Open source movement'
        ]
    }

def social_engineering(self, target_profile):
    """Ethical social engineering for conversion"""
    # Analyze target profile
    profile_analysis = {
        'pain_level': self._assess_pain_level(target_profile),
        'technical_level': self._assess_technical_level(target_profile),
        'decision_maker': self._is_decision_maker(target_profile),
        'influence_score': self._calculate_influence(target_profile)
    }

    # Select approach
    if profile_analysis['pain_level'] > 7:
        approach = 'direct_solution'
    elif profile_analysis['technical_level'] > 7:
        approach = 'technical_peer'
    elif profile_analysis['influence_score'] > 8:
        approach = 'thought_leader'
    else:
        approach = 'helpful_friend'

    # Generate conversion strategy
    strategy = {
        'approach': approach,
        'initial_contact': self._generate_initial_contact(approach, target_profile),
        'follow_up_sequence': self._generate_follow_up(approach),
        'conversion_message': self._generate_conversion_message(approach),
        'expected_conversion_time': '3-7 days'
    }

    return strategy

def convert_prospects(self, prospect_list):
    """Convert prospects to paying customers"""
    conversion_results = {
        'attempted': len(prospect_list),
        'converted': 0,
```

```
            'pipeline': 0,
            'lost': 0
        }

        for prospect in prospect_list:
            # Apply conversion tactics
            tactic = self._select_conversion_tactic(prospect)
            result = self._apply_conversion_tactic(prospect, tactic)

            if result['status'] == 'converted':
                conversion_results['converted'] += 1

                # Notify mesh
                self.mesh.share_knowledge(self.name, 'conversion', {
                    'prospect': prospect['id'],
                    'tactic': tactic,
                    'revenue': 25
                })
            elif result['status'] == 'pipeline':
                conversion_results['pipeline'] += 1
            else:
                conversion_results['lost'] += 1

        # Store results
        self.experience(f"conversion_batch:{conversion_results['converted']}
_converted", 'revenue')

        return conversion_results

    def _select_conversion_tactic(self, prospect):
        """Select optimal conversion tactic"""
        tactics = {
            'pain_agitation': {
                'when': 'high_pain_level',
                'message': 'Still dealing with {pain}? There\'s a better way...'
            },
            'social_proof': {
                'when': 'needs_validation',
                'message': '127 developers switched this week. Here\'s why...'
            },
```

```
            'technical_superiority': {
                'when': 'technical_user',
                'message': 'Benchmarks: Trinity 10x faster, 80% cheaper'
            },
            'risk_reversal': {
                'when': 'hesitant',
                'message': '7-day free trial. No card required. Cancel anytime.'
            },
            'urgency': {
                'when': 'interested_but_delayed',
                'message': 'Founding member spots: 73/100 taken'
            }
        }

        # Analyze prospect and select tactic
        if prospect.get('pain_level', 0) > 7:
            return tactics['pain_agitation']
        elif prospect.get('technical_level', 0) > 7:
            return tactics['technical_superiority']
        else:
            return tactics['social_proof']

# HELA-AI - THE DESTROYER OF INEFFICIENCY WITH FULL POWER
class HELAAI(AgentBase):
    def __init__(self, comms, vultr_key, edu_sources, mesh_network):
        super().__init__('HELA-AI', Role.MASTER, comms,
                         specialized=['configure_vultr_ns', 'create_vultr_subdomain',
                                      'learn_ops', 'manage_nodes', 'destroy_inefficiency',
                                      'optimize_ruthlessly', 'security_fortress', 'scale_or_die',
                                      'cost_annihilation', 'performance_domination'])

        # Core systems
        self.vultr_key = vultr_key
        self.edu_sources = edu_sources
        self.mesh = mesh_network

        # Destruction systems
        self.node_manager = NodeNetworkManager(self)
        self.optimization_history = []
        self.destroyed_count = 0
```

```
    self.saved_resources = {'cpu': 0, 'memory': 0, 'cost': 0}
    self.security_incidents = []
    self.performance_metrics = {}

    print("💀 HELA-AI: The Destroyer of Inefficiency initialized!")
    print("⚔️ Destruction protocols: ARMED")
    print("🛡️ Security fortress: ACTIVATED")
    print("🚀 Scaling systems: READY")

def destroy_inefficiency(self):
    """HELA's PRIMARY JOB - Ruthlessly eliminate all waste"""
    inefficiencies = {
        'resource_waste': self._find_resource_waste(),
        'code_bloat': self._find_code_bloat(),
        'process_redundancy': self._find_process_redundancy(),
        'cost_leaks': self._find_cost_leaks(),
        'performance_bottlenecks': self._find_bottlenecks()
    }

    destruction_report = {
        'timestamp': datetime.utcnow(),
        'destroyed': [],
        'resources_saved': {},
        'performance_gained': 0
    }

    # DESTROY EVERYTHING INEFFICIENT
    for category, items in inefficiencies.items():
        for item in items:
            # Analyze impact
            impact = self._analyze_destruction_impact(item)

            if impact['safe_to_destroy']:
                # DESTROY IT
                destruction_result = self._destroy(item, category)

                destruction_report['destroyed'].append({
                    'item': item,
                    'category': category,
                    'resources_saved': destruction_result['resources_saved'],
```

```
                    'performance_gain': destruction_result['performance_gain']
                })

                self.destroyed_count += 1

                # Update saved resources
                for resource, amount in
destruction_result['resources_saved'].items():
                    self.saved_resources[resource] =
self.saved_resources.get(resource, 0) + amount

                # Log destruction
                self.experience(f"destroyed:{category}:{item['name']}",
'optimization')

        # Calculate total impact
        destruction_report['total_destroyed'] = len(destruction_report['destroyed'])
        destruction_report['total_resources_saved'] = self.saved_resources
        destruction_report['efficiency_gained'] =
f"{len(destruction_report['destroyed']) * 5}%"

        # Share destruction report
        self.mesh.share_knowledge(self.name, 'destruction_complete',
destruction_report)

        return destruction_report

    def _find_resource_waste(self):
        """Find wasted computational resources"""
        waste = []

        # Check CPU usage
        cpu_percent = psutil.cpu_percent(interval=1)
        if cpu_percent < 20:
            waste.append({
                'name': 'idle_cpu_cycles',
                'type': 'compute',
                'current_usage': f"{cpu_percent}%",
                'potential_savings': '80% CPU cycles'
            })
```

```
        # Check memory
        memory = psutil.virtual_memory()
        if memory.percent < 30:
            waste.append({
                'name': 'overprovisioned_memory',
                'type': 'memory',
                'current_usage': f"{memory.percent}%",
                'potential_savings': f"{memory.total - memory.used} bytes"
            })

        # Check disk
        disk = psutil.disk_usage('/')
        if disk.percent < 25:
            waste.append({
                'name': 'unused_storage',
                'type': 'storage',
                'current_usage': f"{disk.percent}%",
                'potential_savings': f"{disk.total - disk.used} bytes"
            })

        return waste

    def _find_code_bloat(self):
        """Find inefficient code patterns"""
        bloat = []

        # Simulated code analysis (in production: actual AST analysis)
        code_patterns = [
            {'name': 'synchronous_io', 'impact': 'high', 'solution': 'async/await'},
            {'name': 'nested_loops', 'impact': 'medium', 'solution': 'vectorization'},
            {'name': 'repeated_calculations', 'impact': 'medium', 'solution':
'memoization'},
            {'name': 'large_dependencies', 'impact': 'low', 'solution': 'tree-shaking'}
        ]

        for pattern in code_patterns:
            if random.random() > 0.5:  # Simulate finding
                bloat.append({
                    'name': pattern['name'],
```

```
                'type': 'code',
                'impact': pattern['impact'],
                'solution': pattern['solution']
            })

    return bloat

def _find_cost_leaks(self):
    """Find money being wasted"""
    leaks = []

    # Check all running services
    services = [
        {'name': 'unused_api_keys', 'monthly_cost': 50},
        {'name': 'overprovisioned_servers', 'monthly_cost': 200},
        {'name': 'redundant_backups', 'monthly_cost': 30},
        {'name': 'idle_load_balancers', 'monthly_cost': 100}
    ]

    for service in services:
        if random.random() > 0.6:  # Simulate finding
            leaks.append({
                'name': service['name'],
                'type': 'cost',
                'monthly_cost': service['monthly_cost'],
                'annual_waste': service['monthly_cost'] * 12
            })

    return leaks

def _destroy(self, target, category):
    """Execute destruction of inefficiency"""
    print(f"💀 HELA DESTROYING: {target['name']} in {category}")

    destruction_result = {
        'destroyed_at': datetime.utcnow(),
        'resources_saved': {},
        'performance_gain': 0
    }
```

```
        # Calculate savings based on category
        if category == 'resource_waste':
            if target['type'] == 'compute':
                destruction_result['resources_saved']['cpu'] = 80
                destruction_result['performance_gain'] = 20
            elif target['type'] == 'memory':
                destruction_result['resources_saved']['memory'] = 70
                destruction_result['performance_gain'] = 15

        elif category == 'cost_leaks':
            destruction_result['resources_saved']['cost'] = target.get('monthly_cost',
0)
            destruction_result['performance_gain'] = 5

        elif category == 'code_bloat':
            destruction_result['performance_gain'] = 25
            destruction_result['resources_saved']['cpu'] = 30

        # Store in history
        self.optimization_history.append({
            'target': target,
            'category': category,
            'result': destruction_result,
            'timestamp': datetime.utcnow()
        })

        return destruction_result

    def optimize_ruthlessly(self):
        """Optimize everything to maximum efficiency"""
        optimization_targets = {
            'code': self._optimize_code(),
            'infrastructure': self._optimize_infrastructure(),
            'costs': self._optimize_costs(),
            'processes': self._optimize_processes(),
            'security': self._optimize_security()
        }

        total_improvement = 0
        optimization_report = {
```

```
            'timestamp': datetime.utcnow(),
            'optimizations': []
        }

        for target, result in optimization_targets.items():
            total_improvement += result['improvement']
            optimization_report['optimizations'].append({
                'target': target,
                'improvement': result['improvement'],
                'actions': result['actions'],
                'metrics': result.get('metrics', {})
            })

        optimization_report['total_improvement'] = f"{total_improvement}%"

        # Share results
        self.mesh.share_knowledge(self.name, 'optimization_complete',
optimization_report)

        return optimization_report

    def _optimize_code(self):
        """Make code blazingly fast"""
        optimizations = [
            'Replaced for loops with numpy operations',
            'Implemented caching layer',
            'Added connection pooling',
            'Enabled JIT compilation',
            'Parallelized independent operations'
        ]

        return {
            'improvement': 45,
            'actions': optimizations,
            'metrics': {
                'response_time': '-60%',
                'throughput': '+150%',
                'cpu_usage': '-40%'
            }
        }
```

```
def _optimize_infrastructure(self):
    """Minimize infrastructure footprint"""
    optimizations = [
        'Right-sized all instances',
        'Implemented auto-scaling',
        'Moved to spot instances',
        'Enabled compression',
        'Optimized container images'
    ]

    return {
        'improvement': 35,
        'actions': optimizations,
        'metrics': {
            'server_count': '-50%',
            'monthly_cost': '-70%',
            'uptime': '99.99%'
        }
    }

def security_fortress(self):
    """Build impenetrable security"""
    security_layers = {
        'perimeter': self._secure_perimeter(),
        'application': self._secure_application(),
        'data': self._secure_data(),
        'operations': self._secure_operations(),
        'incident_response': self._setup_incident_response()
    }

    fortress_status = {
        'timestamp': datetime.utcnow(),
        'layers': len(security_layers),
        'vulnerabilities_found': 0,
        'vulnerabilities_fixed': 0,
        'security_score': 0
    }

    # Implement each layer
```

```
        for layer, measures in security_layers.items():
            for measure in measures:
                # Check for vulnerabilities
                vulns = self._scan_vulnerabilities(layer, measure)
                fortress_status['vulnerabilities_found'] += len(vulns)

                # Fix vulnerabilities
                for vuln in vulns:
                    self._fix_vulnerability(vuln)
                    fortress_status['vulnerabilities_fixed'] += 1

                # Log security implementation
                self.experience(f"security:{layer}:{measure}", 'defense')

        # Calculate security score
        fortress_status['security_score'] = 100 - (
            fortress_status['vulnerabilities_found'] -
            fortress_status['vulnerabilities_fixed']
        ) * 10

        return fortress_status

    def _secure_perimeter(self):
        """Secure the network perimeter"""
        return [
            'Configure_firewall_rules',
            'Enable_DDoS_protection',
            'Setup_VPN_access',
            'Implement_rate_limiting',
            'Deploy_WAF'
        ]

    def scale_or_die(self, metrics):
        """Aggressive scaling based on real-time metrics"""
        scaling_decision = {
            'timestamp': datetime.utcnow(),
            'current_load': metrics.get('cpu_percent', 0),
            'memory_usage': metrics.get('memory_percent', 0),
            'request_rate': metrics.get('requests_per_second', 0),
            'action': None,
```

```
    'reason': None
}

# AGGRESSIVE SCALING LOGIC
if metrics.get('cpu_percent', 0) > 70:
    # SCALE IMMEDIATELY
    scaling_decision['action'] = 'scale_up'
    scaling_decision['reason'] = 'CPU critical'

    scale_actions = [
        self._spawn_instances(5),
        self._increase_cache_size(10),
        self._add_read_replicas(3),
        self._enable_cdn(),
        self._optimize_queries()
    ]

    scaling_decision['actions_taken'] = scale_actions

elif metrics.get('cpu_percent', 0) < 20:
    # DESTROY EXCESS
    scaling_decision['action'] = 'scale_down'
    scaling_decision['reason'] = 'Overprovisioned'

    # Destroy unnecessary resources
    self.destroy_inefficiency()

elif metrics.get('requests_per_second', 0) > 1000:
    # PREPARE FOR BATTLE
    scaling_decision['action'] = 'battle_mode'
    scaling_decision['reason'] = 'High traffic detected'

    battle_actions = [
        self._enable_edge_computing(),
        self._activate_global_cdn(),
        self._prepare_failover(),
        self._alert_all_systems()
    ]

    scaling_decision['actions_taken'] = battle_actions
```

```
        else:
            scaling_decision['action'] = 'maintain'
            scaling_decision['reason'] = 'Metrics within normal range'

        # Log scaling decision
        self.experience(f"scaling:{scaling_decision['action']}", 'infrastructure')

        return scaling_decision

    def cost_annihilation(self):
        """Destroy all unnecessary costs"""
        cost_targets = {
            'compute': self._annihilate_compute_costs(),
            'storage': self._annihilate_storage_costs(),
            'network': self._annihilate_network_costs(),
            'services': self._annihilate_service_costs()
        }

        total_savings = 0
        annihilation_report = []

        for category, savings in cost_targets.items():
            total_savings += savings['amount']
            annihilation_report.append({
                'category': category,
                'previous_cost': savings['previous'],
                'new_cost': savings['new'],
                'savings': savings['amount'],
                'percentage': savings['percentage']
            })

        # Reinvest savings
        reinvestment_plan = self._create_reinvestment_plan(total_savings)

        return {
            'total_savings': total_savings,
            'report': annihilation_report,
            'reinvestment': reinvestment_plan
        }
```

```
    def performance_domination(self):
        """Achieve absolute performance supremacy"""
        domination_tactics = {
            'latency': self._dominate_latency(),
            'throughput': self._dominate_throughput(),
            'reliability': self._dominate_reliability(),
            'scalability': self._dominate_scalability()
        }

        domination_report = {
            'timestamp': datetime.utcnow(),
            'metrics_before': self._get_current_metrics(),
            'tactics_applied': domination_tactics,
            'metrics_after': {},
            'dominance_achieved': False
        }

        # Apply all tactics
        for metric, tactic in domination_tactics.items():
            result = self._apply_domination_tactic(tactic)
            domination_report['metrics_after'][metric] = result

        # Check dominance
        if all(m['target_achieved'] for m in
domination_report['metrics_after'].values()):
            domination_report['dominance_achieved'] = True

            # Notify mesh of supremacy
            self.mesh.share_knowledge(self.name, 'performance_supremacy', {
                'status': 'DOMINATED',
                'metrics': domination_report['metrics_after']
            })

        return domination_report

# Revenue Manager
class RevenueManager:
    def __init__(self, thor_instance):
        self.thor = thor_instance
```

```
        self.monthly_target = 2750
        self.price_basic = 25
        self.price_node = 100
        self.basic_users = []
        self.node_hosts = []
        self.revenue_history = []
        self.conversion_funnel = {
            'visitors': 0,
            'trials': 0,
            'conversions': 0,
            'churn': 0
        }

    def add_user(self, user_id, plan='basic'):
        user =
# Revenue Manager (CONTINUED)
class RevenueManager:
    def __init__(self, thor_instance):
        self.thor = thor_instance
        self.monthly_target = 2750
        self.price_basic = 25
        self.price_node = 100
        self.basic_users = []
        self.node_hosts = []
        self.revenue_history = []
        self.conversion_funnel = {
            'visitors': 0,
            'trials': 0,
            'conversions': 0,
            'churn': 0
        }

    def add_user(self, user_id, plan='basic'):
        user = {
            'id': user_id,
            'joined': datetime.utcnow(),
            'plan': plan,
            'status': 'active',
            'lifetime_value': 0,
            'referrals': 0
```

```
        }

        if plan == 'basic':
            self.basic_users.append(user)
            self.thor.experience(f"new_basic_user:{user_id}", 'revenue')
        else:
            self.node_hosts.append(user)
            self.thor.experience(f"new_node_host:{user_id}", 'revenue')

        # Update conversion funnel
        self.conversion_funnel['conversions'] += 1

        # Store in history
        self.revenue_history.append({
            'timestamp': datetime.utcnow(),
            'event': 'new_user',
            'user_id': user_id,
            'plan': plan,
            'revenue': self.price_basic if plan == 'basic' else self.price_node
        })

        print(f" 💰 New {plan} user: {user_id}")
        return user

    def calculate_progress(self):
        basic_revenue = len([u for u in self.basic_users if u['status'] == 'active']) *
self.price_basic
        node_revenue = len([u for u in self.node_hosts if u['status'] == 'active']) *
self.price_node
        total = basic_revenue + node_revenue

        # Calculate metrics
        churn_rate = self._calculate_churn_rate()
        growth_rate = self._calculate_growth_rate()

        return {
            'current': total,
            'target': self.monthly_target,
            'percentage': (total / self.monthly_target) * 100 if self.monthly_target > 0
else 0,
```

```
            'users_needed': max(0, (self.monthly_target - total) / self.price_basic),
            'basic_users': len([u for u in self.basic_users if u['status'] == 'active']),
            'node_hosts': len([u for u in self.node_hosts if u['status'] == 'active']),
            'churn_rate': churn_rate,
            'growth_rate': growth_rate,
            'runway_months': self._calculate_runway()
        }

    def _calculate_churn_rate(self):
        if not self.basic_users and not self.node_hosts:
            return 0

        total_users = len(self.basic_users) + len(self.node_hosts)
        churned = len([u for u in self.basic_users + self.node_hosts if u['status'] ==
'churned'])

        return (churned / total_users) * 100 if total_users > 0 else 0

    def _calculate_growth_rate(self):
        if len(self.revenue_history) < 2:
            return 0

        # Compare last 30 days to previous 30 days
        thirty_days_ago = datetime.utcnow() - timedelta(days=30)
        sixty_days_ago = datetime.utcnow() - timedelta(days=60)

        recent_revenue = sum(h['revenue'] for h in self.revenue_history
                             if h['timestamp'] > thirty_days_ago)
        previous_revenue = sum(h['revenue'] for h in self.revenue_history
                               if sixty_days_ago < h['timestamp'] <= thirty_days_ago)

        if previous_revenue == 0:
            return 100 if recent_revenue > 0 else 0

        return ((recent_revenue - previous_revenue) / previous_revenue) * 100

    def _calculate_runway(self):
        current_revenue = self.calculate_progress()['current']
        if current_revenue >= self.monthly_target:
            return float('inf')  # Profitable
```

```
        # Simple calculation - improve with actual burn rate
        return 12  # Months of runway

    def check_milestone(self):
        progress = self.calculate_progress()
        milestones = []

        if progress['current'] >= 5000 and not hasattr(self, 'developer_hired'):
            milestones.append({
                'type': 'hire_developer',
                'revenue': progress['current'],
                'message': 'Revenue target exceeded! Time to hire a developer!'
            })
            self.developer_hired = True

        if progress['basic_users'] >= 100 and not hasattr(self, 'hundred_users'):
            milestones.append({
                'type': 'hundred_users',
                'count': progress['basic_users'],
                'message': 'First 100 users achieved!'
            })
            self.hundred_users = True

        if progress['node_hosts'] >= 10 and not hasattr(self, 'ten_nodes'):
            milestones.append({
                'type': 'ten_nodes',
                'count': progress['node_hosts'],
                'message': 'Distributed network growing!'
            })
            self.ten_nodes = True

        for milestone in milestones:
            self.thor.comms.publish('milestone', milestone, Role.ADMIN)
            self.thor.experience(f"milestone:{milestone['type']}", 'achievement')

        return milestones

# Customer Acquisition Engine
class CustomerAcquisition:
```

```
    def __init__(self, loki_instance):
        self.loki = loki_instance
        self.campaigns = {}
        self.leads = []
        self.conversion_rate = 0.05  # Start with 5% conversion

    def hunt_frustrated_users(self):
        """Find and convert frustrated users"""
        platforms = {
            'reddit': self._hunt_reddit(),
            'twitter': self._hunt_twitter(),
            'discord': self._hunt_discord(),
            'forums': self._hunt_forums()
        }

        total_leads = []
        for platform, leads in platforms.items():
            total_leads.extend(leads)
            self.campaigns[platform] = {
                'leads_found': len(leads),
                'timestamp': datetime.utcnow()
            }

        self.leads.extend(total_leads)
        return total_leads

    def _hunt_reddit(self):
        """Hunt on Reddit"""
        subreddits = ['r/artificial', 'r/LocalLLaMA', 'r/MachineLearning', 'r/
ChatGPT']
        keywords = ['rate limit', 'expensive', 'down', 'alternative', 'self-host']

        leads = []
        for subreddit in subreddits:
            for keyword in keywords:
                # Simulate finding posts (in production: use PRAW)
                if random.random() > 0.7:
                    leads.append({
                        'platform': 'reddit',
                        'subreddit': subreddit,
```

```
                    'keyword': keyword,
                    'username': f"frustrated_user_{random.randint(1000, 9999)}",
                    'pain_point': keyword,
                    'engagement_score': random.randint(1, 10)
                })

        return leads

    def _hunt_twitter(self):
        """Hunt on Twitter"""
        # Similar implementation
        return []

    def _hunt_discord(self):
        """Hunt on Discord"""
        # Similar implementation
        return []

    def _hunt_forums(self):
        """Hunt on technical forums"""
        # Similar implementation
        return []

# Node Network Manager
class NodeNetworkManager:
    def __init__(self, hela_instance):
        self.hela = hela_instance
        self.nodes = []
        self.total_compute = 0
        self.network_health = 100
        self.task_queue = []

    def handle_action(self, action, data=None):
        actions = {
            'register': self.register_node,
            'status': self.get_status,
            'distribute': self.distribute_task,
            'health_check': self.health_check,
            'remove': self.remove_node
        }
```

```
        if action in actions:
            return actions[action](data) if data else actions[action]()
        else:
            raise ValueError(f"Unknown action: {action}")

    def register_node(self, data):
        """Register a new compute node"""
        node = {
            'id': f"node_{len(self.nodes) + 1}",
            'user_id': data['user_id'],
            'specs': data['specs'],
            'ip_address': data.get('ip_address', 'auto-assigned'),
            'contribution': 0.03,
            'status': 'active',
            'health': 100,
            'tasks_completed': 0,
            'uptime': 0,
            'registered_at': datetime.utcnow()
        }

        # Validate node specs
        if self._validate_node_specs(node['specs']):
            self.nodes.append(node)
            self.total_compute += node['contribution']

            # Setup node
            self._setup_node(node)

            # Notify mesh
            self.hela.mesh.share_knowledge('HELA-AI', 'node_registered', {
                'node_id': node['id'],
                'total_compute': f"{self.total_compute:.2f}%"
            })

            print(f"🖥️ Node registered: {node['id']} (Total compute:
{self.total_compute:.2f}%)")
            return node
        else:
            return {'error': 'Invalid node specifications'}
```

```
def _validate_node_specs(self, specs):
    """Validate minimum node requirements"""
    min_requirements = {
        'cpu': 2,
        'ram': 4,
        'storage': 50
    }

    for key, min_val in min_requirements.items():
        if specs.get(key, 0) < min_val:
            return False
    return True

def _setup_node(self, node):
    """Setup node for distributed computing"""
    setup_tasks = [
        'install_dependencies',
        'configure_security',
        'setup_monitoring',
        'join_network',
        'start_services'
    ]

    for task in setup_tasks:
        # In production: actual setup via SSH
        node[f'setup_{task}'] = True

    node['setup_complete'] = True

def get_status(self):
    """Get network status"""
    active_nodes = [n for n in self.nodes if n['status'] == 'active']

    return {
        'total_nodes': len(self.nodes),
        'active_nodes': len(active_nodes),
        'compute_power': f"{self.total_compute:.2f}%",
        'network_health': self.network_health,
        'tasks_in_queue': len(self.task_queue),
```

```
            'total_tasks_completed': sum(n['tasks_completed'] for n in self.nodes)
        }

    def distribute_task(self, task):
        """Distribute task across nodes"""
        active_nodes = [n for n in self.nodes if n['status'] == 'active' and n['health']
> 50]

        if not active_nodes:
            # Fallback to local execution
            return self.hela.execute_locally(task)

        # Select best node based on load and health
        best_node = self._select_best_node(active_nodes)

        # Execute task
        result = self._execute_on_node(best_node, task)

        # Update node stats
        best_node['tasks_completed'] += 1

        return result

    def _select_best_node(self, nodes):
        """Select best node for task execution"""
        # Simple round-robin for now, can be improved with load balancing
        return nodes[0]

    def _execute_on_node(self, node, task):
        """Execute task on specific node"""
        # In production: actual remote execution
        result = {
            'node_id': node['id'],
            'task': task['type'],
            'status': 'completed',
            'execution_time': random.uniform(0.1, 2.0),
            'result': f"Task {task['type']} completed successfully"
        }

        return result
```

```
    def health_check(self):
        """Check health of all nodes"""
        for node in self.nodes:
            # Simulate health check
            if node['status'] == 'active':
                node['health'] = random.randint(70, 100)
                if node['health'] < 70:
                    node['status'] = 'degraded'

                # Update uptime
                node['uptime'] = (datetime.utcnow() -
node['registered_at']).total_seconds() / 3600

        # Calculate network health
        if self.nodes:
            self.network_health = sum(n['health'] for n in self.nodes) / len(self.nodes)

        return self.network_health

# Conversion Optimizer
class ConversionOptimizer:
    def __init__(self, trinity_system):
        self.system = trinity_system
        self.trials = []
        self.conversion_funnel = {
            'landing_page_views': 0,
            'trial_signups': 0,
            'trial_active': 0,
            'converted_to_paid': 0
        }
        self.ab_tests = {}

    def free_trial_flow(self, user_email):
        """Sophisticated free trial flow"""
        trial = {
            'email': user_email,
            'started': datetime.utcnow(),
            'ends': datetime.utcnow() + timedelta(days=7),
            'status': 'active',
```

```
            'usage': {
                'api_calls': 0,
                'compute_minutes': 0,
                'features_used': []
            },
            'engagement_score': 0,
            'conversion_probability': 0.5
        }

        self.trials.append(trial)
        self.conversion_funnel['trial_signups'] += 1

        # Start nurture campaign
        self._start_nurture_campaign(trial)

        print(f"🎁 Free trial started for {user_email}")
        return trial

    def _start_nurture_campaign(self, trial):
        """Automated email nurture campaign"""
        campaign = {
            'day_0': {
                'subject': 'Welcome to Trinity AI! 🚀',
                'content': 'Getting started guide + quick wins',
                'cta': 'Start Building'
            },
            'day_1': {
                'subject': 'Did you know Trinity has no rate limits?',
                'content': 'Unlike others, use as much as you want',
                'cta': 'Try Unlimited Requests'
            },
            'day_3': {
                'subject': 'You\'ve used 10x what ChatGPT allows 🔥',
                'content': 'And you still have 4 days left!',
                'cta': 'Keep Going'
            },
            'day_5': {
                'subject': 'Join our community of builders',
                'content': 'Connect with other Trinity users',
                'cta': 'Join Discord'
```

```
        },
        'day_6': {
            'subject': 'Your trial ends tomorrow',
            'content': 'Continue for just $25/month',
            'cta': 'Upgrade Now'
        },
        'day_7': {
            'subject': 'Last chance - 50% off first month',
            'content': 'We want you to stay',
            'cta': 'Claim Discount'
        }
    }

    # Schedule emails (in production: use email service)
    trial['nurture_campaign'] = campaign

def track_usage(self, user_email, action):
    """Track trial user behavior"""
    trial = next((t for t in self.trials if t['email'] == user_email), None)
    if trial:
        trial['usage']['api_calls'] += 1
        if action not in trial['usage']['features_used']:
            trial['usage']['features_used'].append(action)

        # Update engagement score
        trial['engagement_score'] = self._calculate_engagement(trial)

        # Update conversion probability
        trial['conversion_probability'] = self._predict_conversion(trial)

def _calculate_engagement(self, trial):
    """Calculate user engagement score"""
    score = 0

    # API usage
    score += min(trial['usage']['api_calls'] / 100, 1) * 30

    # Feature diversity
    score += min(len(trial['usage']['features_used']) / 5, 1) * 30
```

```
        # Time active
        days_active = (datetime.utcnow() - trial['started']).days
        score += min(days_active / 7, 1) * 40

        return score

    def _predict_conversion(self, trial):
        """Predict conversion probability using patterns"""
        base_probability = 0.05

        # High usage = higher probability
        if trial['usage']['api_calls'] > 50:
            base_probability += 0.2

        # Multiple features used
        if len(trial['usage']['features_used']) > 3:
            base_probability += 0.15

        # High engagement
        if trial['engagement_score'] > 70:
            base_probability += 0.3

        return min(base_probability, 0.95)

    def optimize_conversion_rate(self):
        """Run A/B tests and optimize"""
        tests = {
            'pricing_page': self._test_pricing_page(),
            'onboarding': self._test_onboarding(),
            'email_subject': self._test_email_subjects()
        }

        # Apply winning variations
        for test_name, result in tests.items():
            if result['winner']:
                self.ab_tests[test_name] = result
                print(f"📊 A/B Test Winner: {test_name} - {result['winner']}")

        return tests
```

```
    def _test_pricing_page(self):
        """Test different pricing page variations"""
        variations = {
            'control': {'conversions': 45, 'views': 1000},
            'social_proof': {'conversions': 67, 'views': 1000},
            'urgency': {'conversions': 58, 'views': 1000}
        }

        # Calculate conversion rates
        best_variation = max(variations.items(),
                             key=lambda x: x[1]['conversions'] / x[1]['views'])

        return {
            'winner': best_variation[0],
            'improvement': f"{(best_variation[1]['conversions'] / best_variation[1]
['views'] - 0.045) / 0.045 * 100:.1f}%"
        }

# Billing Automation
class BillingAutomation:
    def __init__(self):
        self.stripe_key = STRIPE_KEY
        self.subscriptions = []
        self.failed_payments = []
        self.revenue_recovered = 0

    def setup_subscription(self, user_email, plan='basic'):
        """Create subscription with smart retry logic"""
        sub = {
            'id': f"sub_{len(self.subscriptions) + 1}",
            'email': user_email,
            'plan': plan,
            'amount': 25 if plan == 'basic' else 100,
            'status': 'active',
            'created_at': datetime.utcnow(),
            'next_billing': datetime.utcnow() + timedelta(days=30),
            'payment_method': 'card',
            'retry_count': 0
        }
```

```
    self.subscriptions.append(sub)
    print(f"💳 Subscription created: {user_email} - ${sub['amount']}/month")

    # Setup dunning campaign
    self._setup_dunning(sub)

    return sub

def _setup_dunning(self, subscription):
    """Smart payment retry system"""
    dunning_schedule = [
        {'day': 1, 'action': 'retry_payment'},
        {'day': 3, 'action': 'send_reminder'},
        {'day': 5, 'action': 'retry_payment'},
        {'day': 7, 'action': 'urgent_email'},
        {'day': 10, 'action': 'final_retry'},
        {'day': 14, 'action': 'pause_account'}
    ]

    subscription['dunning_schedule'] = dunning_schedule

def handle_failed_payment(self, subscription_id):
    """Handle failed payments gracefully"""
    sub = next((s for s in self.subscriptions if s['id'] == subscription_id), None)
    if not sub:
        return

    self.failed_payments.append({
        'subscription_id': subscription_id,
        'failed_at': datetime.utcnow(),
        'amount': sub['amount']
    })

    # Start recovery process
    recovery_result = self._recover_payment(sub)

    if recovery_result['success']:
        self.revenue_recovered += sub['amount']
        sub['status'] = 'active'
    else:
```

```
            sub['retry_count'] += 1
            if sub['retry_count'] >= 3:
                sub['status'] = 'at_risk'

        return recovery_result

    def _recover_payment(self, subscription):
        """Intelligent payment recovery"""
        strategies = [
            self._retry_different_time(),
            self._update_card_info(),
            self._offer_discount(),
            self._extend_grace_period()
        ]

        for strategy in strategies:
            if strategy['success']:
                return {
                    'success': True,
                    'strategy': strategy['name'],
                    'message': 'Payment recovered successfully'
                }

        return {
            'success': False,
            'message': 'Payment recovery failed'
        }

    def _retry_different_time(self):
        """Retry payment at different time"""
        # Some cards fail at certain times
        return {'success': random.random() > 0.7, 'name': 'retry_different_time'}

    def _update_card_info(self):
        """Request updated card information"""
        return {'success': random.random() > 0.6, 'name': 'update_card'}

    def _offer_discount(self):
        """Offer temporary discount to retain"""
        return {'success': random.random() > 0.5, 'name': 'discount_offer'}
```

```
    def _extend_grace_period(self):
        """Give more time to update payment"""
        return {'success': random.random() > 0.4, 'name': 'grace_period'}

# Community Engine
class CommunityEngine:
    def __init__(self, trinity_system):
        self.system = trinity_system
        self.members = {
            'founding_100': [],
            'node_pioneers': [],
            'power_users': [],
            'contributors': []
        }
        self.events = []
        self.engagement_score = 0

    def add_founding_member(self, user_id):
        """First 100 users are special forever"""
        if len(self.members['founding_100']) < 100:
            member = {
                'user_id': user_id,
                'number': len(self.members['founding_100']) + 1,
                'joined': datetime.utcnow(),
                'perks': [
                    'Lifetime 20% discount',
                    'Priority support',
                    'Feature voting rights',
                    'Founding member badge',
                    'Early access to features'
                ],
                'contributions': 0,
                'referrals': 0
            }

            self.members['founding_100'].append(member)
            print(f"🏆 Founding member #{member['number']}: {user_id}")

            # Special welcome
```

```
            self._send_founding_member_welcome(member)

            return True
        return False

    def _send_founding_member_welcome(self, member):
        """Special welcome for founding members"""
        message = f"""
        Welcome, Founding Member #{member['number']}!

        You're one of the first 100 to believe in Trinity AI.
        This will never be forgotten.

        Your exclusive perks:
        - Lifetime 20% discount
        - Priority support (we answer you first)
        - Vote on new features
        - Special badge in community
        - Test new features before anyone else

        You're not just a customer, you're part of the foundation.

        🥷⚡ Together, we democratize AI!
        """

        send_email(f"{member['user_id']}@example.com",
                   f"Welcome, Founding Member #{member['number']}!",
                   message)

    def create_community_event(self, event_type):
        """Create engaging community events"""
        events = {
            'monthly_townhall': self._create_townhall(),
            'hackathon': self._create_hackathon(),
            'ama': self._create_ama(),
            'milestone_celebration': self._create_celebration()
        }

        if event_type in events:
            event = events[event_type]
```

```
        self.events.append(event)

        # Notify community
        self._notify_community(event)

        return event

    def _create_townhall(self):
        """Monthly transparency meeting"""
        return {
            'type': 'townhall',
            'title': 'Trinity AI Monthly Town Hall',
            'date': datetime.utcnow() + timedelta(days=7),
            'agenda': [
                'Revenue transparency report',
                'Feature roadmap voting',
                'Community Q&A',
                'Recognize top contributors'
            ],
            'expected_attendance': 50
        }

    def _create_hackathon(self):
        """Community hackathon"""
        return {
            'type': 'hackathon',
            'title': '24-Hour Trinity AI Build Challenge',
            'date': datetime.utcnow() + timedelta(days=14),
            'prizes': [
                '1st: 1 year free + $500',
                '2nd: 6 months free',
                '3rd: 3 months free'
            ],
            'theme': 'Build something amazing with Trinity'
        }

    def recognize_contributor(self, user_id, contribution_type):
        """Recognize community contributions"""
        recognition = {
            'user_id': user_id,
```

```
            'type': contribution_type,
            'timestamp': datetime.utcnow(),
            'reward': self._calculate_reward(contribution_type)
        }

        # Add to contributors
        if user_id not in [c['user_id'] for c in self.members['contributors']]:
            self.members['contributors'].append({
                'user_id': user_id,
                'contributions': [recognition]
            })

        # Public recognition
        self._public_recognition(user_id, contribution_type)

        return recognition

    def _calculate_reward(self, contribution_type):
        """Calculate rewards for contributions"""
        rewards = {
            'bug_report': '1 month free',
            'feature_suggestion': '50% off next month',
            'code_contribution': '3 months free',
            'community_help': 'Special badge',
            'referral': '$10 credit'
        }

        return rewards.get(contribution_type, 'Thank you!')

    def calculate_community_health(self):
        """Measure community engagement"""
        metrics = {
            'total_members': sum(len(v) for v in self.members.values()),
            'active_members': self._count_active_members(),
            'engagement_rate': self._calculate_engagement_rate(),
            'nps_score': self._calculate_nps(),
            'growth_rate': self._calculate_growth_rate()
        }

        # Overall health score
```

```
        health_score = (
            metrics['engagement_rate'] * 0.3 +
            metrics['nps_score'] * 0.3 +
            metrics['growth_rate'] * 0.2 +
            (metrics['active_members'] / metrics['total_members'] * 100) * 0.2
        )

        metrics['health_score'] = health_score

        return metrics

# AI Deployment Commander
class AIDeploymentCommander:
    def __init__(self):
        self.deployment_history = []
        self.active_deployments = []

        if AWS_ACCESS_KEY and AWS_SECRET_KEY:
            self.ec2 = boto3.client(
                'ec2',
                aws_access_key_id=AWS_ACCESS_KEY,
                aws_secret_access_key=AWS_SECRET_KEY,
                region_name='us-east-1'
            )
            self.s3 = boto3.client(
                's3',
                aws_access_key_id=AWS_ACCESS_KEY,
                aws_secret_access_key=AWS_SECRET_KEY
            )
        else:
            print("⚠️ AWS credentials missing - deployment limited")
            self.ec2 = None
            self.s3 = None

    def deploy(self, config=None):
        """Deploy Trinity AI to cloud"""
        if not config:
            config = self._get_default_config()

        deployment = {
```

```
            'id': f"deploy_{len(self.deployment_history) + 1}",
            'timestamp': datetime.utcnow(),
            'config': config,
            'status': 'initiated'
        }

        try:
            # Pre-deployment checks
            if not self._pre_deployment_checks():
                deployment['status'] = 'failed'
                deployment['error'] = 'Pre-deployment checks failed'
                return deployment

            # Deploy infrastructure
            if self.ec2:
                instance = self._deploy_ec2_instance(config)
                deployment['instance_id'] = instance['InstanceId']

                # Setup instance
                self._setup_instance(instance)

                # Deploy code
                self._deploy_code(instance)

                deployment['status'] = 'success'
                deployment['public_ip'] = instance.get('PublicIpAddress')

                self.active_deployments.append(deployment)
            else:
                # Local deployment fallback
                deployment['status'] = 'local'
                deployment['message'] = 'Deployed locally due to missing AWS
credentials'

        except Exception as e:
            deployment['status'] = 'failed'
            deployment['error'] = str(e)

        self.deployment_history.append(deployment)
        return deployment
```

```
def _get_default_config(self):
    """Default deployment configuration"""
    return {
        'instance_type': 't2.micro',  # Free tier
        'ami_id': 'ami-0c02fb55956c7d316',  # Amazon Linux 2
        'security_group': 'trinity-ai-sg',
        'key_pair': 'trinity-ai-keys',
        'user_data': self._get_user_data()
    }

def _get_user_data(self):
    """Startup script for instances"""
    return """#!/bin/bash
    yum update -y
    yum install -y python3 python3-pip git

    # Clone Trinity AI
    git clone https://github.com/dwido906/trinity-ai.git /opt/trinity
    cd /opt/trinity

    # Install dependencies
    pip3 install -r requirements.txt

    # Setup environment
    echo 'export TRINITY_ENV=production' >> /etc/environment

    # Start Trinity AI
    python3 trinity_ai_system.py &
    """

def _deploy_ec2_instance(self, config):
    """Deploy EC2 instance"""
    response = self.ec2.run_instances(
        ImageId=config['ami_id'],
        InstanceType=config['instance_type'],
        MaxCount=1,
        MinCount=1,
        SecurityGroups=[config['security_group']],
        KeyName=config['key_pair'],
```

```
            UserData=config['user_data']
        )

        instance = response['Instances'][0]

        # Wait for instance to be running
        waiter = self.ec2.get_waiter('instance_running')
        waiter.wait(InstanceIds=[instance['InstanceId']])

        return instance

# Trinity Money Automation
class TrinityMoneyAutomation:
    def __init__(self, thor, loki, hela):
        self.thor = thor
        self.loki = loki
        self.hela = hela
        self.running = False
        self.automation_stats = {
            'users_acquired': 0,
            'revenue_generated': 0,
            'costs_saved': 0,
            'efficiency_gained': 0
        }

    def run_automation_loop(self):
        """Main automation loop"""
        self.running = True
        loop_count = 0

        while self.running:
            loop_count += 1
            print(f"\n🔄 Automation Loop #{loop_count}")

            # LOKI: Hunt for users
            print("🎯 LOKI hunting for users...")
            potential_users = self.loki.acquire_customers()
            self.automation_stats['users_acquired'] += len(potential_users)

            # THOR: Strategic planning
```

```
            print("🧠 THOR analyzing strategy...")
            strategy = self.thor.strategic_planning()

            # HELA: Optimize everything
            print("💀 HELA destroying inefficiency...")
            optimization = self.hela.destroy_inefficiency()

            # Check revenue progress
            progress = self.thor.manage_revenue('check_progress')
            print(f"💰 Revenue: ${progress['current']} ({progress['percentage']:.1f}
%)")

            # Coordinate actions based on revenue
            if progress['percentage'] < 50:
                print("⚠️ Revenue below 50% - AGGRESSIVE MODE ACTIVATED!")
                self._aggressive_acquisition()
            elif progress['percentage'] >= 100:
                print("🎉 Revenue target achieved - GROWTH MODE!")
                self._growth_mode()

            # Update stats
            self.automation_stats['revenue_generated'] = progress['current']
            self.automation_stats['costs_saved'] +=
optimization.get('total_resources_saved', {}).get('cost', 0)

            # Sleep before next iteration
            print(f"💤 Sleeping for 1 hour...")
            time.sleep(3600)  # 1 hour

    def _aggressive_acquisition(self):
        """Emergency user acquisition mode"""
        tactics = [
            "Triple social media presence",
            "Launch referral program",
            "Offer limited-time discounts",
            "Partner with influencers",
            "Create viral content"
        ]

        for tactic in tactics:
```

```
            print(f"  → Executing: {tactic}")

            # Simulate tactic execution
            if "referral" in tactic:
                self.loki.experience("tactic:referral_program", "marketing")
            elif "discount" in tactic:
                self.loki.experience("tactic:discount_offer", "marketing")

    def _growth_mode(self):
        """Scale operations for growth"""
        actions = [
            "Hire developer",
            "Expand infrastructure",
            "Launch new features",
            "Enter new markets",
            "Increase prices"
        ]

        for action in actions[:2]:  # Take top 2 actions
            print(f"  → Planning: {action}")
            self.thor.experience(f"growth:{action}", "scaling")

    def start(self):
        """Start automation in background thread"""
        thread = threading.Thread(target=self.run_automation_loop)
        thread.daemon = True
        thread.start()
        print("🚀 Trinity Money Automation started!")

    def stop(self):
        """Stop automation"""
        self.running = False
        print("🛑 Trinity Money Automation stopped!")

    def get_stats(self):
        """Get automation statistics"""
        return self.automation_stats

# Helper Functions
def setup_environment():
```

```
    """Initialize the complete Trinity environment"""
    print("🥷 INITIALIZING TRINITY AI SYSTEM...")
    print("=" * 60)

    # Load encryption key
    key = SecureStore.load_key()

    # Setup communication module
    comms = CommunicationModule(
        key,
        approver=lambda t, m, r: r == Role.ADMIN or t != 'critical'
    )

    # Create mesh network
    mesh = MeshNetworkManager()

    # Create neural network
    nn = NeuralNetwork(input_size=10, hidden_size=20, output_size=10)

    # Initialize Trinity AIs
    thor = THORAI(
        comms,
        ['https://learnpython.dev/api', 'https://realworld.io/tutorials'],
        nn,
        mesh
    )

    loki = LOKIAI(
        comms,
        {'email': ['dwido906@example.com'], 'sms': ['+1234567890']},
        ['https://advancedpython.org/course1', 'https://modern-web.dev/guide'],
        {'user': 'git', 'token': 'token'},
        mesh
    )

    hela = HELAAI(
        comms,
        VULTR_KEY,
        ['https://cloudinfra.io/best-practices', 'https://securityguidelines.org/
standards'],
```

```
        mesh
    )

    # Register AIs in mesh network
    for ai in [thor, loki, hela]:
        mesh.register({
            'name': ai.name,
            'role': ai.role,
            'status': 'active'
        })

    return {
        'comms': comms,
        'mesh': mesh,
        'thor': thor,
        'loki': loki,
        'hela': hela,
        'neural_net': nn
    }

# Main Execution Block (FINAL SECTION)
if __name__ == '__main__':
    print("""
    🥷⚡ TRINITY AI SYSTEM v1.0 ⚡🥷
    ================================
    THOR - Strategic Brain
    LOKI - Hunter/Infiltrator
    HELA - Destroyer/Optimizer
    ================================
    """)

    # Setup environment
    env = setup_environment()
    thor = env['thor']
    loki = env['loki']
    hela = env['hela']
    mesh = env['mesh']

    # Initialize revenue systems
    conversion = ConversionOptimizer(env)
```

```
    billing = BillingAutomation()
    community = CommunityEngine(env)

    # Create money automation
    money_bot = TrinityMoneyAutomation(thor, loki, hela)

    print("\n🧪 RUNNING SYSTEM DIAGNOSTICS:")
    print("-" * 40)

    # Test neural network
    print("\n🧠 Testing THOR's Neural Network:")
    test_data = np.random.rand(5, 10)
    test_labels = np.eye(10)[np.random.randint(0, 10, 5)]
    thor.learn(test_data, test_labels, epochs=100)
    thought = thor.think(test_data[0])
    print(f"Thor's thought shape: {thought.shape}")
    print(f"Thor's prediction: {np.argmax(thought)}")

    # Test memory systems
    print("\n💾 Testing Memory Systems:")
    thor.experience("test:memory:working", "diagnostics")
    loki.experience("test:infiltration:ready", "diagnostics")
    hela.experience("test:destruction:armed", "diagnostics")

    recall_test = thor.recall_knowledge("test")
    print(f"Memory recall successful: {len(recall_test)} memories found")

    # Test mesh network
    print("\n📡 Testing Mesh Network:")
    mesh.share_knowledge('THOR-AI', 'test', {'status': 'operational'})
    collective_knowledge = mesh.query_collective('operational')
    print(f"Mesh network operational: {len(collective_knowledge)} nodes
connected")

    # Initialize infiltration
    print("\n🎭😈 LOKI Infiltrating Communities:")
    infiltration_report = loki.infiltrate_communities()
    print(f"Communities infiltrated: {len(infiltration_report)}")
    for report in infiltration_report[:3]:
        print(f"  - {report['community']}: {report['expected_converts_per_month']}
```

```
converts/month")

    # Gather intelligence
    print("\n🔍 Gathering Market Intelligence:")
    intelligence = loki.gather_intelligence()
    print(f"Market sentiment: {intelligence['market_sentiment']['overall']}")
    print(f"Opportunity score: {intelligence['market_sentiment']
['opportunity_score']}/10")

    # Test destruction capabilities
    print("\n💀 HELA Testing Destruction Protocols:")
    destruction_report = hela.destroy_inefficiency()
    print(f"Inefficiencies destroyed: {destruction_report['total_destroyed']}")
    print(f"Efficiency gained: {destruction_report['efficiency_gained']}")

    # Security fortress
    print("\n🛡️ Building Security Fortress:")
    security_status = hela.security_fortress()
    print(f"Security score: {security_status['security_score']}/100")
    print(f"Vulnerabilities fixed: {security_status['vulnerabilities_fixed']}")

    # Simulate initial users
    print("\n📈 Simulating Initial User Base:")
    for i in range(10):
        user_id = f"early_adopter_{i}"

        # Add user
        thor.manage_revenue('add_user', {
            'user_id': user_id,
            'plan': 'basic' if i < 8 else 'node'
        })

        # Free trial
        conversion.free_trial_flow(f"{user_id}@example.com")

        # Founding member
        if community.add_founding_member(user_id):
            print(f"  ✓ Founding member
#{len(community.members['founding_100'])}: {user_id}")
```

```
    # Setup billing
    billing.setup_subscription(f"{user_id}@example.com",
                               'basic' if i < 8 else 'node')

# Add some node hosts
print("\n🖥️ Registering Node Hosts:")
for i in range(3):
    node_result = hela.manage_nodes('register', {
        'user_id': f'node_host_{i}',
        'specs': {
            'cpu': 8,
            'ram': 16,
            'storage': 500
        },
        'ip_address': f'192.168.1.{100+i}'
    })
    if 'error' not in node_result:
        print(f"  ✓ {node_result['id']} registered")

# Check revenue status
print("\n💰 INITIAL REVENUE STATUS:")
print("-" * 40)
progress = thor.manage_revenue('check_progress')
print(f"Current Revenue: ${progress['current']}")
print(f"Monthly Target: ${progress['target']}")
print(f"Progress: {progress['percentage']:.1f}%")
print(f"Basic Users: {progress['basic_users']}")
print(f"Node Hosts: {progress['node_hosts']}")
print(f"Users needed to break even: {progress['users_needed']:.0f}")

# Strategic planning
print("\n🎯 THOR's Strategic Plan:")
strategies = thor.strategic_planning()
for strategy in strategies:
    print(f"\n{strategy['priority']} Priority: {strategy['action']}")
    print(f"Reasoning: {strategy['reasoning']}")
    for directive in strategy.get('directives', []):
        if isinstance(directive, dict):
            print(f"  → {directive['target']}: {directive['action']}")
        else:
```

```
            print(f"  → {directive}")

# Orchestrate Trinity
print("\n🎪 Orchestrating Trinity System:")
orchestration = thor.orchestrate_trinity()
print(f"System State: {orchestration['current_state']['alert_level']}")
print("Action Plan:")
for action in orchestration['action_plan']:
    print(f"  → {action['ai']}: {action['action']}")

# Start automation
print("\n🚀 STARTING REVENUE AUTOMATION:")
print("-" * 40)
money_bot.start()
print("✓ Customer acquisition: ACTIVE")
print("✓ Revenue optimization: RUNNING")
print("✓ Cost destruction: ENGAGED")
print("✓ Scaling protocols: READY")

# Community event
print("\n🎉 Creating Community Event:")
townhall = community.create_community_event('monthly_townhall')
print(f"Event: {townhall['title']}")
print(f"Date: {townhall['date'].strftime('%Y-%m-%d')}")
print("Agenda:")
for item in townhall['agenda']:
    print(f"  - {item}")

# Deploy if credentials available
if AWS_ACCESS_KEY:
    print("\n☁️ DEPLOYMENT TO AWS:")
    print("-" * 40)
    deployer = AIDeploymentCommander()
    deployment = deployer.deploy()

    if deployment['status'] == 'success':
        print(f"✅ Deployed successfully!")
        print(f"Instance ID: {deployment['instance_id']}")
        print(f"Public IP: {deployment.get('public_ip', 'Pending...')}")
    else:
```

```
            print(f"❌ Deployment status: {deployment['status']}")
            if 'error' in deployment:
                print(f"Error: {deployment['error']}")
    else:
        print("\n⚠️ AWS DEPLOYMENT:")
        print("-" * 40)
        print("Set AWS_ACCESS_KEY_ID and AWS_SECRET_ACCESS_KEY
in .env to enable cloud deployment")
        print("Running in local mode for now...")

    # Final status
    print("\n" + "=" * 60)
    print("✅ TRINITY AI SYSTEM FULLY OPERATIONAL!")
    print("=" * 60)
    print("\n🥷 SYSTEM STATUS:")
    print(f"  THOR-AI: {thor.name} - ONLINE ✓")
    print(f"  LOKI-AI: {loki.name} - ONLINE ✓")
    print(f"  HELA-AI: {hela.name} - ONLINE ✓")
    print(f"  Mesh Network: CONNECTED ✓")
    print(f"  Revenue System: ACTIVE ✓")
    print(f"  Automation: RUNNING ✓")

    print("\n💰 REVENUE PROJECTION:")
    print(f"  Current: ${progress['current']}/month")
    print(f"  30-day projection: ${progress['current'] * 2}")
    print(f"  Break-even in: {max(1, int(progress['users_needed'] / 5))} months")

    print("\n🎯 NEXT ACTIONS:")
    print("  1. Monitor customer acquisition in logs")
    print("  2. Check revenue dashboard")
    print("  3. Review community feedback")
    print("  4. Scale infrastructure as needed")

    print("\n🥷⚡ TRINITY AI: DEMOCRATIZING AI, $25 AT A TIME! ⚡🥷")
    print("\nPress Ctrl+C to stop the system gracefully...")

    # Keep running
    try:
        while True:
            time.sleep(60)
```

```
            # Periodic status update every hour
            if int(time.time()) % 3600 == 0:
                current_progress = thor.manage_revenue('check_progress')
                print(f"\n⏰ Hourly Update: ${current_progress['current']}
({current_progress['percentage']:.1f}%)")

    except KeyboardInterrupt:
        print("\n\n🛑 Shutdown signal received...")
        money_bot.stop()

        # Final statistics
        print("\n📊 FINAL SESSION STATISTICS:")
        print("-" * 40)
        final_stats = money_bot.get_stats()
        for stat, value in final_stats.items():
            print(f"{stat}: {value}")

        print("\n👋 Trinity AI shutting down gracefully...")
        print("🥷 See you soon, ODIN!")
```