```
#!/usr/bin/env node
/**
 * HYDRA NEXUS v6.0 - Enterprise MCP Server
 * Focus: Security-Hardened | Income Generation | AI-Powered Intelligence
 *
 * ARCHITECTURE:
 * - Multi-layer memory with vector embeddings
 * - Market intelligence gathering
 * - Opportunity detection engine
 * - Autonomous research with safety controls
 */

import { Server } from "@modelcontextprotocol/sdk/server/index.js";
import { StdioServerTransport } from "@modelcontextprotocol/sdk/server/stdio.js";
import {
  CallToolRequestSchema,
  ErrorCode,
  ListToolsRequestSchema,
  ListResourcesRequestSchema,
  ReadResourceRequestSchema,
  McpError,
} from "@modelcontextprotocol/sdk/types.js";
import axios from "axios";
import * as cheerio from "cheerio";
import * as path from "path";
import { fileURLToPath } from "url";
import puppeteer, { Browser, Page } from "puppeteer";
import fsExtra from "fs-extra";
import { v4 as uuidv4 } from "uuid";
import TurndownService from "turndown";
import crypto from "crypto";

const __dirname = path.dirname(fileURLToPath(import.meta.url));
const MEMORY_FILE = path.join(__dirname, "../hydra_memory.json");
const INSIGHTS_FILE = path.join(__dirname, "../market_insights.json");
const CONFIG_FILE = path.join(__dirname, "../hydra_config.json");

// ═══════════════════════════════════════════════════════════════════════════
// SECTION 1: ENHANCED MEMORY SYSTEM WITH VECTOR SIMILARITY
// ═══════════════════════════════════════════════════════════════════════════

interface MemoryNode {
  memory_id: string;
  timestamp: string;
```

```
  category: "episodic" | "semantic" | "fact" | "preference" | "market_intelligenc
  content: string;
  entities: string[];
  importance_score: number;
  embedding?: number[];
  access_count: number;
  last_accessed: string;
  tags: string[];
  source?: string;
  metadata?: Record<string, any>;
}

interface MarketInsight {
  id: string;
  timestamp: string;
  type: "opportunity" | "trend" | "risk" | "arbitrage";
  title: string;
  description: string;
  confidence: number;
  potential_value: string;
  actionable_steps: string[];
  sources: string[];
  expires_at?: string;
}

class AdvancedMemorySystem {
  private maxMemories = 50000;
  private decayFactor = 0.95; // Forgetting curve implementation

  async getAll(): Promise<MemoryNode[]> {
    await fsExtra.ensureFile(MEMORY_FILE);
    try {
      return (await fsExtra.readJson(MEMORY_FILE)) as MemoryNode[];
    } catch {
      return [];
    }
  }

  async add(
    content: string,
    category: MemoryNode["category"],
    entities: string[],
    importance: number,
    tags: string[] = [],
    metadata?: Record<string, any>
  ): Promise<MemoryNode> {
    let memories = await this.getAll();
```

```
  // Memory capacity management with LRU eviction
  if (memories.length >= this.maxMemories) {
    memories = this.evictOldMemories(memories);
  }

  // Generate simple embedding (word frequency vector)
  const embedding = this.generateEmbedding(content);

  const newNode: MemoryNode = {
    memory_id: `mem_${uuidv4().split("-")[0]}`,
    timestamp: new Date().toISOString(),
    category,
    content,
    entities,
    importance_score: importance,
    embedding,
    access_count: 0,
    last_accessed: new Date().toISOString(),
    tags,
    metadata,
  };

  memories.push(newNode);
  await fsExtra.writeJson(MEMORY_FILE, memories, { spaces: 2 });
  return newNode;
}

async search(query: string, limit = 10): Promise<MemoryNode[]> {
  const memories = await this.getAll();
  const queryEmbedding = this.generateEmbedding(query);
  const q = query.toLowerCase();

  // Hybrid search: keyword + semantic similarity
  const scored = memories.map((m) => {
    let score = 0;

    // Keyword matching
    if (m.content.toLowerCase().includes(q)) score += 10;
    if (m.entities.some((e) => e.toLowerCase().includes(q))) score += 8;
    if (m.tags.some((t) => t.toLowerCase().includes(q))) score += 6;

    // Semantic similarity (cosine similarity)
    if (m.embedding && queryEmbedding) {
      score += this.cosineSimilarity(m.embedding, queryEmbedding) * 5;
    }
```

```
    // Recency bonus
    const age = Date.now() - new Date(m.timestamp).getTime();
    const daysSinceCreation = age / (1000 * 60 * 60 * 24);
    score += Math.max(0, 3 - daysSinceCreation / 10);

    // Importance weight
    score *= m.importance_score;

    return { memory: m, score };
  });

  // Update access metadata
  const topResults = scored
    .sort((a, b) => b.score - a.score)
    .slice(0, limit)
    .map((r) => {
      r.memory.access_count++;
      r.memory.last_accessed = new Date().toISOString();
      return r.memory;
    });

  await fsExtra.writeJson(MEMORY_FILE, memories, { spaces: 2 });
  return topResults;
}

async consolidate(): Promise<number> {
  // Remove duplicate/similar memories
  const memories = await this.getAll();
  const unique = new Map<string, MemoryNode>();

  for (const mem of memories) {
    const hash = this.contentHash(mem.content);
    if (!unique.has(hash) || unique.get(hash)!.importance_score < mem.importanc
      unique.set(hash, mem);
    }
  }

  const consolidated = Array.from(unique.values());
  await fsExtra.writeJson(MEMORY_FILE, consolidated, { spaces: 2 });
  return memories.length - consolidated.length;
}

private evictOldMemories(memories: MemoryNode[]): MemoryNode[] {
  // Sort by composite score: recency + importance + access frequency
  return memories
    .map((m) => {
      const recency = Date.now() - new Date(m.timestamp).getTime();
```

```
        const score = m.importance_score * 0.5 + (m.access_count / 100) * 0.3 + (
        return { memory: m, score };
      })
      .sort((a, b) => b.score - a.score)
      .slice(0, Math.floor(this.maxMemories * 0.9))
      .map((x) => x.memory);
  }

  private generateEmbedding(text: string): number[] {
    // Simple TF-IDF style embedding (300 dimensions)
    const words = text.toLowerCase().match(/\b\w+\b/g) || [];
    const embedding = new Array(300).fill(0);

    words.forEach((word, idx) => {
      const hash = this.simpleHash(word);
      embedding[hash % 300] += 1;
    });

    // Normalize
    const magnitude = Math.sqrt(embedding.reduce((sum, val) => sum + val * val, 0
    return magnitude > 0 ? embedding.map((v) => v / magnitude) : embedding;
  }

  private cosineSimilarity(a: number[], b: number[]): number {
    if (a.length !== b.length) return 0;
    const dotProduct = a.reduce((sum, val, i) => sum + val * b[i], 0);
    return Math.max(0, dotProduct); // Already normalized
  }

  private simpleHash(str: string): number {
    let hash = 0;
    for (let i = 0; i < str.length; i++) {
      hash = (hash << 5) - hash + str.charCodeAt(i);
      hash = hash & hash;
    }
    return Math.abs(hash);
  }

  private contentHash(content: string): string {
    return crypto.createHash("md5").update(content.toLowerCase().trim()).digest("
  }
}

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// SECTION 2: SECURE BROWSER AUTOMATION WITH ANTI-DETECTION
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```

```
class SecureBrowserPool {
  private browser: Browser | null = null;
  private activeSessions = 0;
  private maxSessions = 5;

  async acquirePage(): Promise<{ page: Page; release: () => Promise<void> }> {
    if (this.activeSessions >= this.maxSessions) {
      throw new Error("Browser pool exhausted. Max concurrent sessions reached.")
    }

    if (!this.browser || !this.browser.isConnected()) {
      this.browser = await puppeteer.launch({
        headless: true,
        args: [
          "--no-sandbox",
          "--disable-setuid-sandbox",
          "--disable-dev-shm-usage",
          "--disable-blink-features=AutomationControlled",
        ],
      });
    }

    const page = await this.browser.newPage();
    this.activeSessions++;

    // Anti-detection measures
    await page.evaluateOnNewDocument(() => {
      Object.defineProperty(navigator, "webdriver", { get: () => false });
    });

    // Resource optimization
    await page.setRequestInterception(true);
    page.on("request", (req) => {
      const type = req.resourceType();
      if (["image", "stylesheet", "font", "media"].includes(type)) {
        req.abort();
      } else {
        req.continue();
      }
    });

    const release = async () => {
      if (!page.isClosed()) await page.close();
      this.activeSessions--;
    };

    return { page, release };
```

```
  }

  async shutdown(): Promise<void> {
    if (this.browser) {
      await this.browser.close();
      this.browser = null;
    }
  }
}

// ═══════════════════════════════════════════════════════════════════════
// SECTION 3: INCOME-FOCUSED INTELLIGENCE GATHERING
// ═══════════════════════════════════════════════════════════════════════

class MarketIntelligenceEngine {
  private memory: AdvancedMemorySystem;

  constructor(memory: AdvancedMemorySystem) {
    this.memory = memory;
  }

  async analyzeOpportunity(topic: string, depth = 3): Promise<MarketInsight[]> {
    const insights: MarketInsight[] = [];

    // Load existing insights
    await fsExtra.ensureFile(INSIGHTS_FILE);
    let existing: MarketInsight[] = [];
    try {
      existing = await fsExtra.readJson(INSIGHTS_FILE);
    } catch {}

    // Search patterns for income opportunities
    const searchQueries = [
      `${topic} market trends 2026`,
      `${topic} investment opportunities`,
      `${topic} arbitrage strategies`,
      `${topic} emerging markets`,
      `${topic} growth forecast`,
    ];

    for (const query of searchQueries.slice(0, depth)) {
      try {
        const searchUrl = `https://html.duckduckgo.com/html/?q=${encodeURICompone
        const response = await axios.get(searchUrl, {
          headers: { "User-Agent": "Mozilla/5.0 (Windows NT 10.0; Win64; x64) App
          timeout: 10000,
        });
```

```
      const $ = cheerio.load(response.data);
      const snippets: string[] = [];

      $(".result__snippet").each((i, el) => {
        if (i < 5) snippets.push($(el).text());
      });

      // Pattern detection for opportunities
      const combined = snippets.join(" ").toLowerCase();

      if (this.detectOpportunityPattern(combined)) {
        const insight: MarketInsight = {
          id: `insight_${uuidv4().split("-")[0]}`,
          timestamp: new Date().toISOString(),
          type: this.classifyInsightType(combined),
          title: `${topic} - ${query}`,
          description: snippets.slice(0, 2).join(" | "),
          confidence: this.calculateConfidence(combined),
          potential_value: this.estimateValue(combined),
          actionable_steps: this.extractActionables(combined),
          sources: [searchUrl],
        };

        insights.push(insight);

        // Store in memory
        await this.memory.add(
          insight.description,
          "market_intelligence",
          [topic],
          insight.confidence,
          ["market", "opportunity", topic],
          { insight_id: insight.id }
        );
      }
    } catch (e) {
      console.error(`Intelligence gathering failed for: ${query}`, e);
    }
  }

  // Persist insights
  const allInsights = [...existing, ...insights];
  await fsExtra.writeJson(INSIGHTS_FILE, allInsights, { spaces: 2 });

  return insights;
}
```

```
private detectOpportunityPattern(text: string): boolean {
  const positiveSignals = [
    "growth", "opportunity", "emerging", "increase", "surge", "rising", "trend"
    "profitable", "demand", "expansion", "investment", "revenue", "market share
    "undervalued", "potential", "forecast", "projected", "estimated"
  ];

  return positiveSignals.some(signal => text.includes(signal));
}

private classifyInsightType(text: string): MarketInsight["type"] {
  if (text.includes("arbitrage") || text.includes("price difference")) return "
  if (text.includes("risk") || text.includes("volatile")) return "risk";
  if (text.includes("trend") || text.includes("growing")) return "trend";
  return "opportunity";
}

private calculateConfidence(text: string): number {
  let confidence = 0.5;

  if (text.includes("forecast") || text.includes("projected")) confidence += 0.
  if (text.includes("data shows") || text.includes("report")) confidence += 0.1
  if (text.includes("expert") || text.includes("analysis")) confidence += 0.1;
  if (text.includes("estimate") || text.includes("may")) confidence -= 0.1;

  return Math.min(0.95, Math.max(0.3, confidence));
}

private estimateValue(text: string): string {
  if (text.includes("billion")) return "High ($B+ potential)";
  if (text.includes("million")) return "Medium ($M potential)";
  if (text.includes("%") && parseFloat(text.match(/(\d+)%/)?.[1] || "0") > 50)
    return "High growth (>50% projected)";
  }
  return "Moderate";
}

private extractActionables(text: string): string[] {
  const actions: string[] = [];

  if (text.includes("invest")) actions.push("Research investment vehicles");
  if (text.includes("market")) actions.push("Conduct market analysis");
  if (text.includes("trend")) actions.push("Monitor trend development");
  if (text.includes("competition")) actions.push("Analyze competitive landscape

  return actions.length > 0 ? actions : ["Conduct deeper research", "Validate d
```

```
  }
}

// ═══════════════════════════════════════════════════════════════════════
// SECTION 4: URL VALIDATION & SECURITY
// ═══════════════════════════════════════════════════════════════════════

class SecurityValidator {
  private static BLOCKED_PATTERNS = [
    /^(file|ftp|data|javascript):/i,
    /localhost/i,
    /127\.0\.0\./,
    /0\.0\.0\.0/,
    /192\.168\./,
    /10\.\d+\./,
    /172\.(1[6-9]|2\d|3[01])\./,
    /\[::\]/,
    /metadata\.google\.internal/i,
  ];

  static validateUrl(url: string): { valid: boolean; reason?: string } {
    try {
      const parsed = new URL(url);

      // Protocol check
      if (!["http:", "https:"].includes(parsed.protocol)) {
        return { valid: false, reason: "Invalid protocol" };
      }

      // Blocked patterns
      for (const pattern of this.BLOCKED_PATTERNS) {
        if (pattern.test(url)) {
          return { valid: false, reason: "Blocked hostname/IP" };
        }
      }

      // DNS rebinding protection
      if (parsed.hostname.includes("@")) {
        return { valid: false, reason: "Invalid hostname format" };
      }

      return { valid: true };
    } catch {
      return { valid: false, reason: "Malformed URL" };
    }
  }
```

```
  static sanitizeInput(input: string, maxLength = 5000): string {
    return input.slice(0, maxLength).replace(/[<>]/g, "");
  }
}

// ═══════════════════════════════════════════════════════════════════════
// SECTION 5: MAIN HYDRA SERVER
// ═══════════════════════════════════════════════════════════════════════

class HydraServerV6 {
  private server: Server;
  private memory: AdvancedMemorySystem;
  private browserPool: SecureBrowserPool;
  private intelligence: MarketIntelligenceEngine;
  private turndown: TurndownService;

  constructor() {
    this.server = new Server(
      { name: "hydra-nexus-v6", version: "6.0.0" },
      { capabilities: { tools: {}, resources: {} } }
    );

    this.memory = new AdvancedMemorySystem();
    this.browserPool = new SecureBrowserPool();
    this.intelligence = new MarketIntelligenceEngine(this.memory);
    this.turndown = new TurndownService({ headingStyle: "atx", codeBlockStyle: "f

    this.setupHandlers();
    this.setupGracefulShutdown();
  }

  private setupHandlers() {
    // === RESOURCES ===
    this.server.setRequestHandler(ListResourcesRequestSchema, async () => ({
      resources: [
        {
          uri: "hydra://memory/dump",
          name: "Complete Memory Graph",
          mimeType: "application/json",
          description: "All episodic, semantic, and market intelligence memories"
        },
        {
          uri: "hydra://insights/market",
          name: "Market Intelligence Dashboard",
          mimeType: "application/json",
          description: "Curated market opportunities and trends",
        },
```

```
  ],
}));

this.server.setRequestHandler(ReadResourceRequestSchema, async (req) => {
  if (req.params.uri === "hydra://memory/dump") {
    const data = await this.memory.getAll();
    return {
      contents: [{
        uri: req.params.uri,
        mimeType: "application/json",
        text: JSON.stringify(data, null, 2),
      }],
    };
  }

  if (req.params.uri === "hydra://insights/market") {
    await fsExtra.ensureFile(INSIGHTS_FILE);
    const insights = await fsExtra.readJson(INSIGHTS_FILE).catch(() => []);
    return {
      contents: [{
        uri: req.params.uri,
        mimeType: "application/json",
        text: JSON.stringify(insights, null, 2),
      }],
    };
  }

  throw new McpError(ErrorCode.InvalidRequest, "Unknown resource");
});

// === TOOLS ===
this.server.setRequestHandler(ListToolsRequestSchema, async () => ({
  tools: [
    {
      name: "market_intelligence_scan",
      description: "INCOME GENERATOR: Scans markets for opportunities, trends
      inputSchema: {
        type: "object",
        properties: {
          topic: { type: "string", description: "Market/industry to analyze (
          depth: { type: "number", description: "Analysis depth: 1-5 (default
        },
        required: ["topic"],
      },
    },
    {
      name: "deep_research",
```

```
  description: "Autonomous web research agent. Searches, crawls top resul
  inputSchema: {
    type: "object",
    properties: {
      query: { type: "string", description: "Research query" },
      max_pages: { type: "number", description: "Maximum pages to analyze
    },
    required: ["query"],
  },
},
{
  name: "memory_store",
  description: "Store structured information in long-term memory with sem
  inputSchema: {
    type: "object",
    properties: {
      content: { type: "string" },
      category: {
        type: "string",
        enum: ["episodic", "semantic", "fact", "preference", "market_inte
      },
      entities: { type: "string", description: "Comma-separated entities/
      importance: { type: "number", description: "0.0 to 1.0 (default: 0.
      tags: { type: "string", description: "Comma-separated tags" },
    },
    required: ["content", "category"],
  },
},
{
  name: "memory_search",
  description: "Hybrid search (keyword + semantic) across all memory. Ret
  inputSchema: {
    type: "object",
    properties: {
      query: { type: "string" },
      limit: { type: "number", description: "Max results (default: 10)" }
    },
    required: ["query"],
  },
},
{
  name: "memory_consolidate",
  description: "Remove duplicate/redundant memories to optimize storage a
  inputSchema: { type: "object", properties: {} },
},
{
  name: "fetch_url_content",
```

```
        description: "Securely fetch and convert a specific URL to markdown. UR
        inputSchema: {
          type: "object",
          properties: {
            url: { type: "string", description: "URL to fetch (https only, no i
          },
          required: ["url"],
        },
      },
    ],
  }));

  this.server.setRequestHandler(CallToolRequestSchema, async (req) => this.hand
}

private async handleTool(req: any) {
  const { name, arguments: args } = req.params;

  try {
    // ============================================================
    // MARKET INTELLIGENCE SCAN (PRIMARY INCOME TOOL)
    // ============================================================
    if (name === "market_intelligence_scan") {
      const topic = SecurityValidator.sanitizeInput(args.topic);
      const depth = Math.min(5, Math.max(1, args.depth || 3));

      const insights = await this.intelligence.analyzeOpportunity(topic, depth)

      let report = `# MARKET INTELLIGENCE REPORT: ${topic}\n\n`;
      report += `**Generated:** ${new Date().toISOString()}\n`;
      report += `**Analysis Depth:** ${depth}/5\n`;
      report += `**Insights Detected:** ${insights.length}\n\n`;
      report += `---\n\n`;

      if (insights.length === 0) {
        report += `No significant opportunities detected. Consider:\n`;
        report += `- Refining search terms\n`;
        report += `- Increasing depth\n`;
        report += `- Analyzing adjacent markets\n`;
      } else {
        insights.forEach((insight, i) => {
          report += `## ${i + 1}. ${insight.title}\n\n`;
          report += `- **Type:** ${insight.type.toUpperCase()}\n`;
          report += `- **Confidence:** ${(insight.confidence * 100).toFixed(1)}
          report += `- **Potential Value:** ${insight.potential_value}\n`;
          report += `- **Description:** ${insight.description}\n\n`;
```

```
      if (insight.actionable_steps.length > 0) {
        report += `**Actionable Steps:**\n`;
        insight.actionable_steps.forEach(step => {
          report += `- ${step}\n`;
        });
        report += `\n`;
      }

      report += `---\n\n`;
    });
  }

  return { content: [{ type: "text", text: report }] };
}

// ============================================================
// DEEP RESEARCH
// ============================================================
if (name === "deep_research") {
  const query = SecurityValidator.sanitizeInput(args.query);
  const maxPages = Math.min(5, Math.max(1, args.max_pages || 3));

  const searchUrl = `https://html.duckduckgo.com/html/?q=${encodeURICompone
  const searchResp = await axios.get(searchUrl, {
    headers: { "User-Agent": "Mozilla/5.0 (Windows NT 10.0; Win64; x64) App
    timeout: 10000,
  });

  const $ = cheerio.load(searchResp.data);
  const links: { title: string; url: string }[] = [];

  $(".result__a").each((i, el) => {
    if (i < maxPages) {
      const href = $(el).attr("href");
      if (href) {
        links.push({ title: $(el).text().trim(), url: href });
      }
    }
  });

  let report = `# DEEP RESEARCH: ${query}\n\n`;
  report += `**Sources Analyzed:** ${links.length}\n\n`;

  for (const link of links) {
    const validation = SecurityValidator.validateUrl(link.url);
    if (!validation.valid) {
      report += `## ⚠️ SKIPPED: ${link.title}\n`;
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```
            report += `**Reason:** ${validation.reason}\n\n`;
            continue;
          }

          try {
            const { page, release } = await this.browserPool.acquirePage();

        try {
          await page.goto(args.url, { waitUntil: "domcontentloaded", timeout: 200

          const content = await page.evaluate(() => {
            const main = document.querySelector("article") || document.querySelec
            return main?.innerText || "";
          });

          await release();

          const markdown = this.turndown.turndown(content.substring(0, 10000));

          return {
            content: [{
              type: "text",
              text: `# Content from ${args.url}\n\n${markdown}`,
            }],
          };
        } catch (e: any) {
          await release();
          throw new McpError(ErrorCode.InternalError, `Failed to fetch URL: ${e.m
        }
      }

      throw new McpError(ErrorCode.MethodNotFound, `Unknown tool: ${name}`);

    } catch (err: any) {
      if (err instanceof McpError) throw err;
      return {
        content: [{ type: "text", text: `Error: ${err.message}` }],
        isError: true,
      };
    }
  }

  private setupGracefulShutdown() {
    const shutdown = async () => {
      console.error("\n🛑 Initiating graceful shutdown...");
      await this.browserPool.shutdown();
      console.error("✓ HYDRA NEXUS shutdown complete");
```

```
      process.exit(0);
    };

    process.on("SIGINT", shutdown);
    process.on("SIGTERM", shutdown);
  }

  async start() {
    const transport = new StdioServerTransport();
    await this.server.connect(transport);
    console.error("═══════════════════════════════════════════════════════════");
    console.error("  HYDRA NEXUS v6.0 - PRODUCTION READY");
    console.error("  Focus: Market Intelligence | Security | Performance");
    console.error("═══════════════════════════════════════════════════════════");
    console.error("✓ Memory System: Enhanced with semantic search");
    console.error("✓ Security: URL validation & sandboxing enabled");
    console.error("✓ Intelligence: Market opportunity detection active");
    console.error("✓ Browser Pool: Anti-detection measures deployed");
    console.error("═══════════════════════════════════════════════════════════\n");
  }
}

// ═══════════════════════════════════════════════════════════════════════
// INITIALIZATION
// ═══════════════════════════════════════════════════════════════════════

const hydra = new HydraServerV6();
hydra.start().catch((err) => {
  console.error("Fatal error:", err);
  process.exit(1);
});browserPool.acquirePage();

            await page.goto(link.url, {
              waitUntil: "domcontentloaded",
              timeout: 15000,
            });

            const content = await page.evaluate(() => {
              const article = document.querySelector("article") || document.query
              return article?.innerText || "";
            });

            await release();

            const cleanContent = content.substring(0, 8000);
            const markdown = this.turndown.turndown(cleanContent);
```

```
      report += `## 📄 ${link.title}\n`;
      report += `**Source:** ${link.url}\n\n`;
      report += `${markdown.substring(0, 3000)}...\n\n`;
      report += `---\n\n`;

      // Auto-store in memory
      await this.memory.add(
        cleanContent.substring(0, 2000),
        "episodic",
        [query],
        0.7,
        ["research", query],
        { source_url: link.url }
      );

    } catch (e: any) {
      report += `## ⚠️ FAILED: ${link.title}\n`;
      report += `**Error:** ${e.message}\n\n`;
    }
  }

  return { content: [{ type: "text", text: report }] };
}

// ============================================================
// MEMORY OPERATIONS
// ============================================================
if (name === "memory_store") {
  const content = SecurityValidator.sanitizeInput(args.content);
  const entities = args.entities ? args.entities.split(",").map((e: string)
  const tags = args.tags ? args.tags.split(",").map((t: string) => t.trim()
  const importance = Math.min(1, Math.max(0, args.importance || 0.5));

  const node = await this.memory.add(content, args.category, entities, impo

  return {
    content: [{
      type: "text",
      text: `✓ Memory stored successfully\n\nID: ${node.memory_id}\nCategor
    }],
  };
}

if (name === "memory_search") {
  const query = SecurityValidator.sanitizeInput(args.query);
  const limit = Math.min(50, Math.max(1, args.limit || 10));
```

```
  const results = await this.memory.search(query, limit);

  let output = `# Memory Search Results: "${query}"\n\n`;
  output += `**Found:** ${results.length} memories\n\n`;

  results.forEach((mem, i) => {
    output += `## ${i + 1}. [${mem.category}] ${mem.memory_id}\n`;
    output += `**Content:** ${mem.content.substring(0, 200)}...\n`;
    output += `**Entities:** ${mem.entities.join(", ")}\n`;
    output += `**Importance:** ${mem.importance_score.toFixed(2)} | **Acces
    output += `**Created:** ${new Date(mem.timestamp).toLocaleDateString()}
  });

  return { content: [{ type: "text", text: output }] };
}

if (name === "memory_consolidate") {
  const removed = await this.memory.consolidate();
  return {
    content: [{
      type: "text",
      text: `✓ Memory consolidation complete\n\nDuplicates removed: ${remov
    }],
  };
}

// ============================================================
// SECURE URL FETCH
// ============================================================
if (name === "fetch_url_content") {
  const validation = SecurityValidator.validateUrl(args.url);
  if (!validation.valid) {
    throw new McpError(ErrorCode.InvalidRequest, `URL validation failed: ${
  }

  const { page, release } = await this.
```