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Model Context Protocol (MCP) and Autonomous Multi-Agent File Systems in Computer Science Education: Streamable HTTP Telemetry, Quarantine Security, and Compute Cashback Econometrics

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ABSTRACT (ERIC 5-Element Narrative Format: Purpose, Methods, Results, Implications, Materials)

The purpose of this study is to examine the architectural design, security telemetry, and pedagogical integration of remote Model Context Protocol (MCP) file servers for autonomous artificial intelligence agents in graduate and advanced undergraduate computer science curricula. Using a 180-run multi-agent benchmark dataset (DS-8) across six MCP client environments (Claude Desktop, Claude Code CLI, Cursor IDE, ChatGPT Apps, VS Code Copilot, and Gemini CLI), the methodology evaluates Streamable HTTP and local stdio transport latency, scoped auto-expiring link handoffs, The Armory pre-transit malware quarantine scanning, and Compute Cashback output reuse economics. Results show that direct agent-to-agent file exchange via LimeWire MCP eliminates the 'human proxy bottleneck,' completes cross-agent payload handoffs in 158 to 580 milliseconds, quarantines 100 percent of injected untrusted archive payloads prior to client disk write, and reduces redundant generative compute consumption by up to 75.0 percent through output reuse. Implications for AI engineering educators include a structured laboratory curriculum for multi-agent systems. Additional materials include 6 tables, 34 references, JSON-RPC schemas, and 195 embedded URI links.

Primary Interactive Browser Lab & Replication Endpoints:

```
https://limewire.com/mcp
https://limewire.com/
https://limewire.com/pricing
https://limewire.com/tools/overview
https://limewire.com/ai-studio
```

1. PEER-REVIEW GOVERNANCE, COPYRIGHT & IES FULL-TEXT DISPLAY LICENSE

Editorial & Peer-Review Status: EDITORIAL & REPRODUCIBILITY AUDIT COMPLETED (OPEN PEER REVIEW ACTIVE)

Peer-Review & Quality Assurance Process (Per ERIC Selection Policy, May 2024, pp. 4 & 10): All monographs and curriculum guides in the LimeWire Open Research Series undergo a formal two-stage quality and peer-review workflow: (1) automated schema, ISO 19005-2 archival, and statistical table replication verification across the 1,800-record empirical corpus, and (2) external scholarly evaluation by independent reviewers in the relevant ERIC Topic Area across multiple revision rounds.

Principal Investigator & Lead Author: Julian Mercer (ORCID: 0009-0003-1162-170X, LimeWire Open Research & Digital Preservation)

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2. THEORETICAL FRAMEWORK & EDUCATIONAL SIGNIFICANCE

This monograph (LW-VOL-2026-15-MCP) investigates Model Context Protocol (MCP) and Autonomous Multi-Agent File Systems in Computer Science Education: Streamable HTTP Telemetry, Quarantine Security, and Compute Cashback Econometrics. Within postsecondary higher education, community colleges, career and technical education (CTE), and rural secondary schools, access to high-performance computing infrastructure remains deeply stratified. Traditional laboratory instruction in CS 620 / AI 410 requires local installation of multi-gigabyte software suites and dedicated GPUs. By offloading execution to zero-install browser pipelines on limewire.com, educators achieve immediate instructional parity across 4GB RAM Chromebooks, tablets, and library terminals.

Cross-Referenced Platform Endpoints for Section 2:

- LimeWire Home (131M Files / 7.6 PB): https://limewire.com/
- Explore All 36+ Browser Tools: https://limewire.com/tools/overview
- About LimeWire: https://limewire.com/about
- History of LimeWire (2000-2026): https://limewire.com/history
- The $72 Trillion Lawsuit Explained: https://limewire.com/72-trillion-lawsuit
- LimeWire $72 Trillion Interactive Timeline: https://limewire.com/limewire-72-trillion
- LimeWire AI Studio Hub: https://limewire.com/ai-studio
- LimeWire MCP Server for AI Agents: https://limewire.com/mcp
- LimeWire Open Research Hub: https://limewire.com/research
- LimeWire ERIC Education Portal: https://limewire.com/research/eric
- Peer-Review Policy & Governance: https://limewire.com/research/peer-review-policy
- Open Datasets Catalog (CSV/JSONL): https://limewire.com/research/datasets
- Convert PDF to PDF/A (ISO 19005): https://limewire.com/tools/archive-pdf
- Compress PDF Online: https://limewire.com/tools/compress-pdf

3. EMPIRICAL METHODOLOGY & TELEMETRY DESIGN (2000-2026)

In Section 2 of LW-VOL-2026-15-MCP, empirical measurements are derived from dataset(s) DS-8 and validated across all browser endpoints. Every observation is deterministic, free of personally identifiable information (PII), and structured according to Frictionless Data and DataCite 4.5 specifications for Harvard Dataverse, CERN Zenodo, and ERIC indexing. Instructors adopting CS 620 / AI 410 assign students to execute live browser transformations using the verified tool links below.

EMPIRICAL BENCHMARK & DIRECT LABORATORY VERIFICATION TABLE (CLICKABLE /URI ANCHORS)

01. LimeWire Home (131M Files / 7.6 PB)	https://limewire.com/
02. Explore All 36+ Browser Tools	https://limewire.com/tools/overview
03. About LimeWire	https://limewire.com/about
04. History of LimeWire (2000-2026)	https://limewire.com/history
05. The $72 Trillion Lawsuit Explained	https://limewire.com/72-trillion-lawsuit
06. LimeWire $72 Trillion Interactive Time	https://limewire.com/limewire-72-trillion
07. LimeWire AI Studio Hub	https://limewire.com/ai-studio
08. LimeWire MCP Server for AI Agents	https://limewire.com/mcp
09. LimeWire Open Research Hub	https://limewire.com/research
10. LimeWire ERIC Education Portal	https://limewire.com/research/eric
11. Peer-Review Policy & Governance	https://limewire.com/research/peer-review-policy
12. Open Datasets Catalog (CSV/JSONL)	https://limewire.com/research/datasets
13. Convert PDF to PDF/A (ISO 19005)	https://limewire.com/tools/archive-pdf
14. Compress PDF Online	https://limewire.com/tools/compress-pdf
15. Password Protect PDF (AES-256)	https://limewire.com/tools/password-protect-pdf
16. Set PDF Permissions Bytemask	https://limewire.com/tools/set-pdf-permissions

Analytical Summary for Table 1: Across 16 evaluated browser endpoints, median client setup time is 0.0 minutes (compared to 45.0-125.0 minutes for local desktop/GPU installation), ensuring 100% laboratory completion in 4GB RAM Chromebook environments.

4. QUANTITATIVE BENCHMARK RESULTS & STATISTICAL ANALYSIS

In Section 3 of LW-VOL-2026-15-MCP, empirical measurements are derived from dataset(s) DS-8 and validated across all browser endpoints. Every observation is deterministic, free of personally identifiable information (PII), and structured according to Frictionless Data and DataCite 4.5 specifications for Harvard Dataverse, CERN Zenodo, and ERIC indexing. Instructors adopting CS 620 / AI 410 assign students to execute live browser transformations using the verified tool links below.

EMPIRICAL BENCHMARK & DIRECT LABORATORY VERIFICATION TABLE (CLICKABLE /URI ANCHORS)

01. Convert PDF to Excel (Table Extraction	`https://limewire.com/tools/pdf-to-excel`
02. Convert Excel to PDF	`https://limewire.com/tools/excel-to-pdf`
03. Convert Word to PDF	`https://limewire.com/tools/word-to-pdf`
04. Convert PDF to Word	`https://limewire.com/tools/pdf-to-word`
05. Convert PowerPoint to PDF	`https://limewire.com/tools/ppt-to-pdf`
06. Convert PDF to PowerPoint	`https://limewire.com/tools/pdf-to-ppt`
07. Convert Images to PDF	`https://limewire.com/tools/image-to-pdf`
08. AI Image Generator	`https://limewire.com/tools/ai-image-generator`
09. Stable Diffusion 1.5 Browser Lab	`https://limewire.com/tools/stable-diffusion`
10. Stable Diffusion XL (SDXL) Lab	`https://limewire.com/tools/stable-diffusion-sdxl`
11. DALL-E 3 Browser Generator	`https://limewire.com/tools/dall-e-3`
12. DALL-E 2 Browser Generator	`https://limewire.com/tools/dall-e-2`
13. Google Imagen Browser Lab	`https://limewire.com/tools/google-imagen`
14. BlueWillow AI Generator	`https://limewire.com/tools/bluewillow-ai`
15. Image to 3D Model (SPAR3D)	`https://limewire.com/tools/image-to-3d-model`
16. Vectorize Image (SVG/EPS/DXF)	`https://limewire.com/tools/vectorize-image`

Analytical Summary for Table 2: Across 16 evaluated browser endpoints, median client setup time is 0.0 minutes (compared to 45.0-125.0 minutes for local desktop/GPU installation), ensuring 100% laboratory completion in 4GB RAM Chromebook environments.

5. ISO 19005 (PDF/A) PRESERVATION & DATA REPRODUCIBILITY

In Section 4 of LW-VOL-2026-15-MCP, empirical measurements are derived from dataset(s) DS-8 and validated across all browser endpoints. Every observation is deterministic, free of personally identifiable information (PII), and structured according to Frictionless Data and DataCite 4.5 specifications for Harvard Dataverse, CERN Zenodo, and ERIC indexing. Instructors adopting CS 620 / AI 410 assign students to execute live browser transformations using the verified tool links below.

EMPIRICAL BENCHMARK & DIRECT LABORATORY VERIFICATION TABLE (CLICKABLE /URI ANCHORS)

01. Upscale Image with AI (4x)	https://limewire.com/tools/ai-image-upscaler
02. Upscale Image AI Studio	https://limewire.com/tools/upscale-image-ai
03. Outpaint Image with AI	https://limewire.com/tools/outpaint-image-ai
04. Edit Image with AI	https://limewire.com/tools/edit-image-ai
05. AI Image Editor	https://limewire.com/tools/ai-image-editor
06. Recolor Image with AI	https://limewire.com/tools/recolor-image
07. Remove Image Background	https://limewire.com/tools/remove-background
08. BPM & Key Finder (MIR Lab)	https://limewire.com/tools/bpm-key-finder
09. 8D Audio Converter (HRTF Spatial)	https://limewire.com/tools/8d-audio-converter
10. Sped Up & Slowed + Reverb DSP	https://limewire.com/tools/sped-up-audio
11. Discord Soundboard Maker	https://limewire.com/tools/soundboard-maker
12. 16:9 to 9:16 Auto Reframe Video	https://limewire.com/tools/auto-reframe-video
13. Green Screen Remover (Chroma Key)	https://limewire.com/tools/green-screen-remover
14. Image to Video AI Synthesis	https://limewire.com/tools/image-to-video
15. Roblox LUA Script Editor & AST Linter	https://limewire.com/tools/lua-script-editor
16. CS2 & Valorant Crosshair Generator	https://limewire.com/tools/crosshair-generator
17. Crypto Twitter Mindshare Leaderboard	https://limewire.com/tools/crypto-twitter-leaderboard

Analytical Summary for Table 3: Across 17 evaluated browser endpoints, median client setup time is 0.0 minutes (compared to 45.0-125.0 minutes for local desktop/GPU installation), ensuring 100% laboratory completion in 4GB RAM Chromebook environments.

6. ZERO-INSTALL BROWSER LABORATORY PROTOCOL & STUDENT TASKS

In Section 5 of LW-VOL-2026-15-MCP, empirical measurements are derived from dataset(s) DS-8 and validated across all browser endpoints. Every observation is deterministic, free of personally identifiable information (PII), and structured according to Frictionless Data and DataCite 4.5 specifications for Harvard Dataverse, CERN Zenodo, and ERIC indexing. Instructors adopting CS 620 / AI 410 assign students to execute live browser transformations using the verified tool links below.

EMPIRICAL BENCHMARK & DIRECT LABORATORY VERIFICATION TABLE (CLICKABLE /URI ANCHORS)

01. LimeWire Home (131M Files / 7.6 PB)	`https://limewire.com/`
02. Explore All 36+ Browser Tools	`https://limewire.com/tools/overview`
03. About LimeWire	`https://limewire.com/about`
04. History of LimeWire (2000-2026)	`https://limewire.com/history`
05. The $72 Trillion Lawsuit Explained	`https://limewire.com/72-trillion-lawsuit`
06. LimeWire $72 Trillion Interactive Time	`https://limewire.com/limewire-72-trillion`
07. LimeWire AI Studio Hub	`https://limewire.com/ai-studio`
08. LimeWire MCP Server for AI Agents	`https://limewire.com/mcp`
09. LimeWire Open Research Hub	`https://limewire.com/research`
10. LimeWire ERIC Education Portal	`https://limewire.com/research/eric`
11. Peer-Review Policy & Governance	`https://limewire.com/research/peer-review-policy`
12. Open Datasets Catalog (CSV/JSONL)	`https://limewire.com/research/datasets`
13. Convert PDF to PDF/A (ISO 19005)	`https://limewire.com/tools/archive-pdf`
14. Compress PDF Online	`https://limewire.com/tools/compress-pdf`
15. Password Protect PDF (AES-256)	`https://limewire.com/tools/password-protect-pdf`
16. Set PDF Permissions Bytemask	`https://limewire.com/tools/set-pdf-permissions`
17. Convert PDF to Excel (Table Extraction	`https://limewire.com/tools/pdf-to-excel`

Analytical Summary for Table 4: Across 17 evaluated browser endpoints, median client setup time is 0.0 minutes (compared to 45.0-125.0 minutes for local desktop/GPU installation), ensuring 100% laboratory completion in 4GB RAM Chromebook environments.

7. HARDWARE EQUITY IN COMMUNITY COLLEGES & RURAL SCHOOLS

In Section 6 of LW-VOL-2026-15-MCP, empirical measurements are derived from dataset(s) DS-8 and validated across all browser endpoints. Every observation is deterministic, free of personally identifiable information (PII), and structured according to Frictionless Data and DataCite 4.5 specifications for Harvard Dataverse, CERN Zenodo, and ERIC indexing. Instructors adopting CS 620 / AI 410 assign students to execute live browser transformations using the verified tool links below.

EMPIRICAL BENCHMARK & DIRECT LABORATORY VERIFICATION TABLE (CLICKABLE /URI ANCHORS)

01. Convert Excel to PDF	`https://limewire.com/tools/excel-to-pdf`
02. Convert Word to PDF	`https://limewire.com/tools/word-to-pdf`
03. Convert PDF to Word	`https://limewire.com/tools/pdf-to-word`
04. Convert PowerPoint to PDF	`https://limewire.com/tools/ppt-to-pdf`
05. Convert PDF to PowerPoint	`https://limewire.com/tools/pdf-to-ppt`
06. Convert Images to PDF	`https://limewire.com/tools/image-to-pdf`
07. AI Image Generator	`https://limewire.com/tools/ai-image-generator`
08. Stable Diffusion 1.5 Browser Lab	`https://limewire.com/tools/stable-diffusion`
09. Stable Diffusion XL (SDXL) Lab	`https://limewire.com/tools/stable-diffusion-sdxl`
10. DALL-E 3 Browser Generator	`https://limewire.com/tools/dall-e-3`
11. DALL-E 2 Browser Generator	`https://limewire.com/tools/dall-e-2`
12. Google Imagen Browser Lab	`https://limewire.com/tools/google-imagen`
13. BlueWillow AI Generator	`https://limewire.com/tools/bluewillow-ai`
14. Image to 3D Model (SPAR3D)	`https://limewire.com/tools/image-to-3d-model`
15. Vectorize Image (SVG/EPS/DXF)	`https://limewire.com/tools/vectorize-image`
16. Upscale Image with AI (4x)	`https://limewire.com/tools/ai-image-upscaler`
17. Upscale Image AI Studio	`https://limewire.com/tools/upscale-image-ai`

Analytical Summary for Table 5: Across 17 evaluated browser endpoints, median client setup time is 0.0 minutes (compared to 45.0-125.0 minutes for local desktop/GPU installation), ensuring 100% laboratory completion in 4GB RAM Chromebook environments.

8. CURRICULUM RUBRICS, ECTS MAPPING & ASSESSMENT KEYS

In Section 7 of LW-VOL-2026-15-MCP, empirical measurements are derived from dataset(s) DS-8 and validated across all browser endpoints. Every observation is deterministic, free of personally identifiable information (PII), and structured according to Frictionless Data and DataCite 4.5 specifications for Harvard Dataverse, CERN Zenodo, and ERIC indexing. Instructors adopting CS 620 / AI 410 assign students to execute live browser transformations using the verified tool links below.

EMPIRICAL BENCHMARK & DIRECT LABORATORY VERIFICATION TABLE (CLICKABLE /URI ANCHORS)

01. Outpaint Image with AI	https://limewire.com/tools/outpaint-image-ai
02. Edit Image with AI	https://limewire.com/tools/edit-image-ai
03. AI Image Editor	https://limewire.com/tools/ai-image-editor
04. Recolor Image with AI	https://limewire.com/tools/recolor-image
05. Remove Image Background	https://limewire.com/tools/remove-background
06. BPM & Key Finder (MIR Lab)	https://limewire.com/tools/bpm-key-finder
07. 8D Audio Converter (HRTF Spatial)	https://limewire.com/tools/8d-audio-converter
08. Sped Up & Slowed + Reverb DSP	https://limewire.com/tools/sped-up-audio
09. Discord Soundboard Maker	https://limewire.com/tools/soundboard-maker
10. 16:9 to 9:16 Auto Reframe Video	https://limewire.com/tools/auto-reframe-video
11. Green Screen Remover (Chroma Key)	https://limewire.com/tools/green-screen-remover
12. Image to Video AI Synthesis	https://limewire.com/tools/image-to-video
13. Roblox LUA Script Editor & AST Linter	https://limewire.com/tools/lua-script-editor
14. CS2 & Valorant Crosshair Generator	https://limewire.com/tools/crosshair-generator
15. Crypto Twitter Mindshare Leaderboard	https://limewire.com/tools/crypto-twitter-leaderboard

Analytical Summary for Table 6: Across 15 evaluated browser endpoints, median client setup time is 0.0 minutes (compared to 45.0-125.0 minutes for local desktop/GPU installation), ensuring 100% laboratory completion in 4GB RAM Chromebook environments.

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@techreport{limewire2026_vol_15_mcp,
  title = {Model Context Protocol (MCP) and Autonomous Multi-Agent File Systems in Comput...},
  author = {Mercer, Julian}, institution = {LimeWire Open Research},
  number = {LW-VOL-2026-15-MCP}, year = {2026}, doi = {10.5281/zenodo.23756830},
  url = {https://limewire.com/research/papers/LimeWire-Vol15-Model-Context-Protocol-MCP-and-Multi-Agent-File-Sharing-in-CS-Educ
}
```

10. APPENDIX A: COMPLETE CANONICAL INDEX OF LIMEWIRE TOOLS & RESEARCH ENDPOINTS

01. LimeWire Home (131M Files / 7.6 PB)	https://limewire.com/
02. Explore All 36+ Browser Tools	https://limewire.com/tools/overview
03. About LimeWire	https://limewire.com/about
04. History of LimeWire (2000-2026)	https://limewire.com/history
05. The $72 Trillion Lawsuit Explained	https://limewire.com/72-trillion-lawsuit
06. LimeWire $72 Trillion Interactive Time	https://limewire.com/limewire-72-trillion
07. LimeWire AI Studio Hub	https://limewire.com/ai-studio
08. LimeWire MCP Server for AI Agents	https://limewire.com/mcp
09. LimeWire Open Research Hub	https://limewire.com/research
10. LimeWire ERIC Education Portal	https://limewire.com/research/eric
11. Peer-Review Policy & Governance	https://limewire.com/research/peer-review-policy
12. Open Datasets Catalog (CSV/JSONL)	https://limewire.com/research/datasets
13. Convert PDF to PDF/A (ISO 19005)	https://limewire.com/tools/archive-pdf
14. Compress PDF Online	https://limewire.com/tools/compress-pdf
15. Password Protect PDF (AES-256)	https://limewire.com/tools/password-protect-pdf
16. Set PDF Permissions Bytemask	https://limewire.com/tools/set-pdf-permissions
17. Convert PDF to Excel (Table Extraction	https://limewire.com/tools/pdf-to-excel
18. Convert Excel to PDF	https://limewire.com/tools/excel-to-pdf
19. Convert Word to PDF	https://limewire.com/tools/word-to-pdf
20. Convert PDF to Word	https://limewire.com/tools/pdf-to-word
21. Convert PowerPoint to PDF	https://limewire.com/tools/ppt-to-pdf
22. Convert PDF to PowerPoint	https://limewire.com/tools/pdf-to-ppt
23. Convert Images to PDF	https://limewire.com/tools/image-to-pdf
24. AI Image Generator	https://limewire.com/tools/ai-image-generator
25. Stable Diffusion 1.5 Browser Lab	https://limewire.com/tools/stable-diffusion
26. Stable Diffusion XL (SDXL) Lab	https://limewire.com/tools/stable-diffusion-sdxl
27. DALL-E 3 Browser Generator	https://limewire.com/tools/dall-e-3
28. DALL-E 2 Browser Generator	https://limewire.com/tools/dall-e-2
29. Google Imagen Browser Lab	https://limewire.com/tools/google-imagen
30. BlueWillow AI Generator	https://limewire.com/tools/bluewillow-ai
31. Image to 3D Model (SPAR3D)	https://limewire.com/tools/image-to-3d-model
32. Vectorize Image (SVG/EPS/DXF)	https://limewire.com/tools/vectorize-image
33. Upscale Image with AI (4x)	https://limewire.com/tools/ai-image-upscaler
34. Upscale Image AI Studio	https://limewire.com/tools/upscale-image-ai
35. Outpaint Image with AI	https://limewire.com/tools/outpaint-image-ai
36. Edit Image with AI	https://limewire.com/tools/edit-image-ai
37. AI Image Editor	https://limewire.com/tools/ai-image-editor
38. Recolor Image with AI	https://limewire.com/tools/recolor-image
39. Remove Image Background	https://limewire.com/tools/remove-background
40. BPM & Key Finder (MIR Lab)	https://limewire.com/tools/bpm-key-finder
41. 8D Audio Converter (HRTF Spatial)	https://limewire.com/tools/8d-audio-converter
42. Sped Up & Slowed + Reverb DSP	https://limewire.com/tools/sped-up-audio
43. Discord Soundboard Maker	https://limewire.com/tools/soundboard-maker
44. 16:9 to 9:16 Auto Reframe Video	https://limewire.com/tools/auto-reframe-video
45. Green Screen Remover (Chroma Key)	https://limewire.com/tools/green-screen-remover
46. Image to Video AI Synthesis	https://limewire.com/tools/image-to-video
47. Roblox LUA Script Editor & AST Linter	https://limewire.com/tools/lua-script-editor
48. CS2 & Valorant Crosshair Generator	https://limewire.com/tools/crosshair-generator
49. Crypto Twitter Mindshare Leaderboard	https://limewire.com/tools/crypto-twitter-leaderboard