DEVOXX MOROCCO

Rethinking RAG

How MCP and A2A Will Transform The Future Of Intelligent Search

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- Are you Human or an AI?
- I want 5 Kubernetes
- Virtual Machines are Real
- Cloudy, cloudy, cloudy...
- There is storage for that!

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Agenda

- Let's Review Agent2Agent and MCP
- The Untold Stories of MCP
  - Live: Demo, Demo
- Using Agent2Agent Effectively
  - Live: Demo, Demo
- Resources
- Q&A

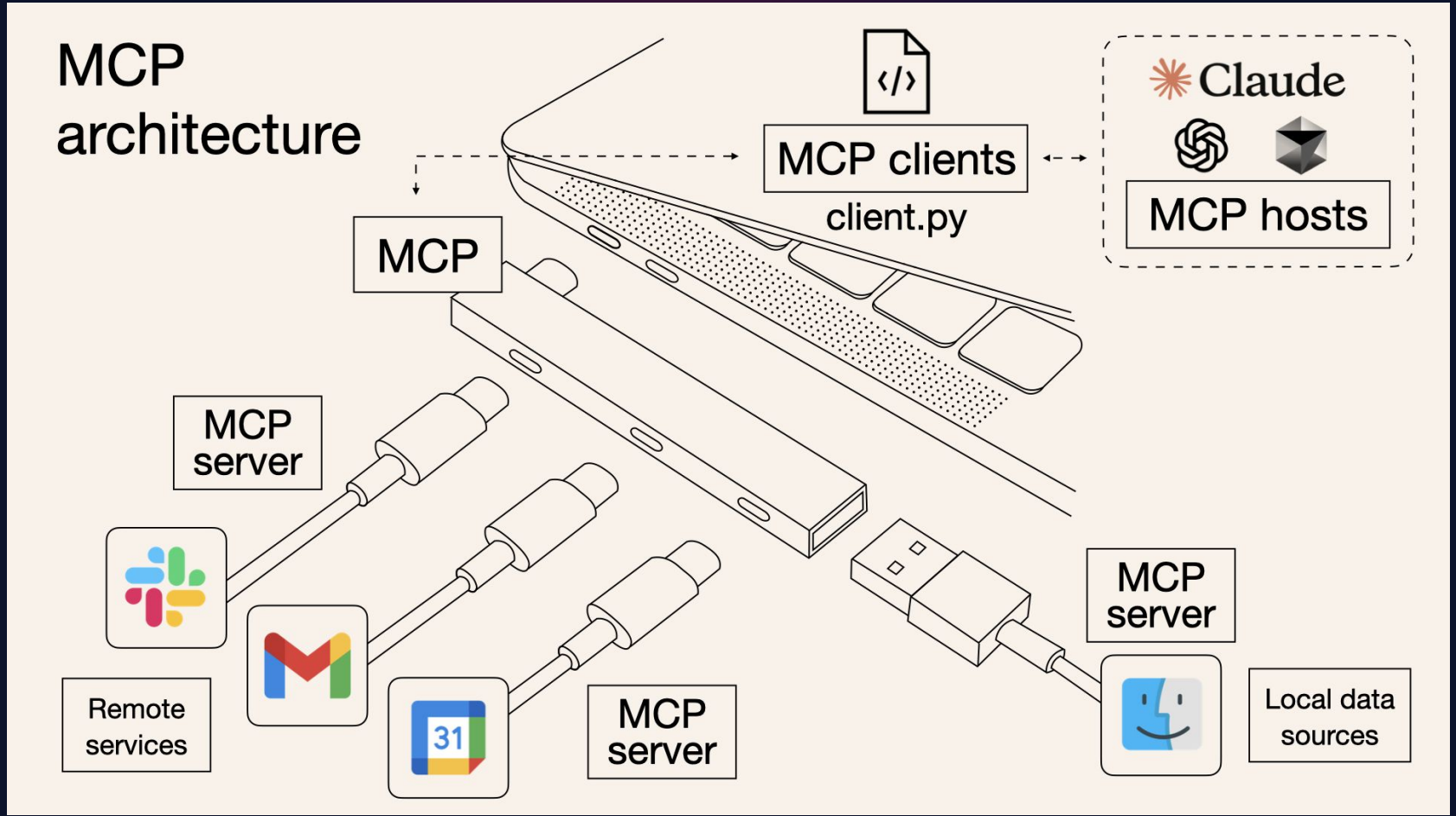
Let’s Review Agent2Agent and MCP

Model Context Protocol

- MCP Standardizes How To Provide Content to LLMs
  - How Tools Are Connected
  - Accessing Data Sources
  - Calling APIs, Services, etc
- Access via MCP Client
- Implement an MCP Server
  - Advertise Capabilities
  - Handshake for Communication
- UNIFIED PROTOCOL!

Figurative Architecture

Image Credit:
Norah Klintberg Sakal - LinkedIn Post



What Is Agent2Agent Protocol?

- Protocol for Multi-Agent Interoperability
  - Communication via SSE, HTTPS, JSON-RPC
  - Agent Can Delegate Sub-Tasks
- github.com/a2aproject/A2A
  - Donated to Linux Foundation
- Local or Remote/Cloud Agents
- Decoupled vs Single Environment
  - Multiple Agent Services
  - Agents Talking to Agents

Combining A2A Protocol & MCP

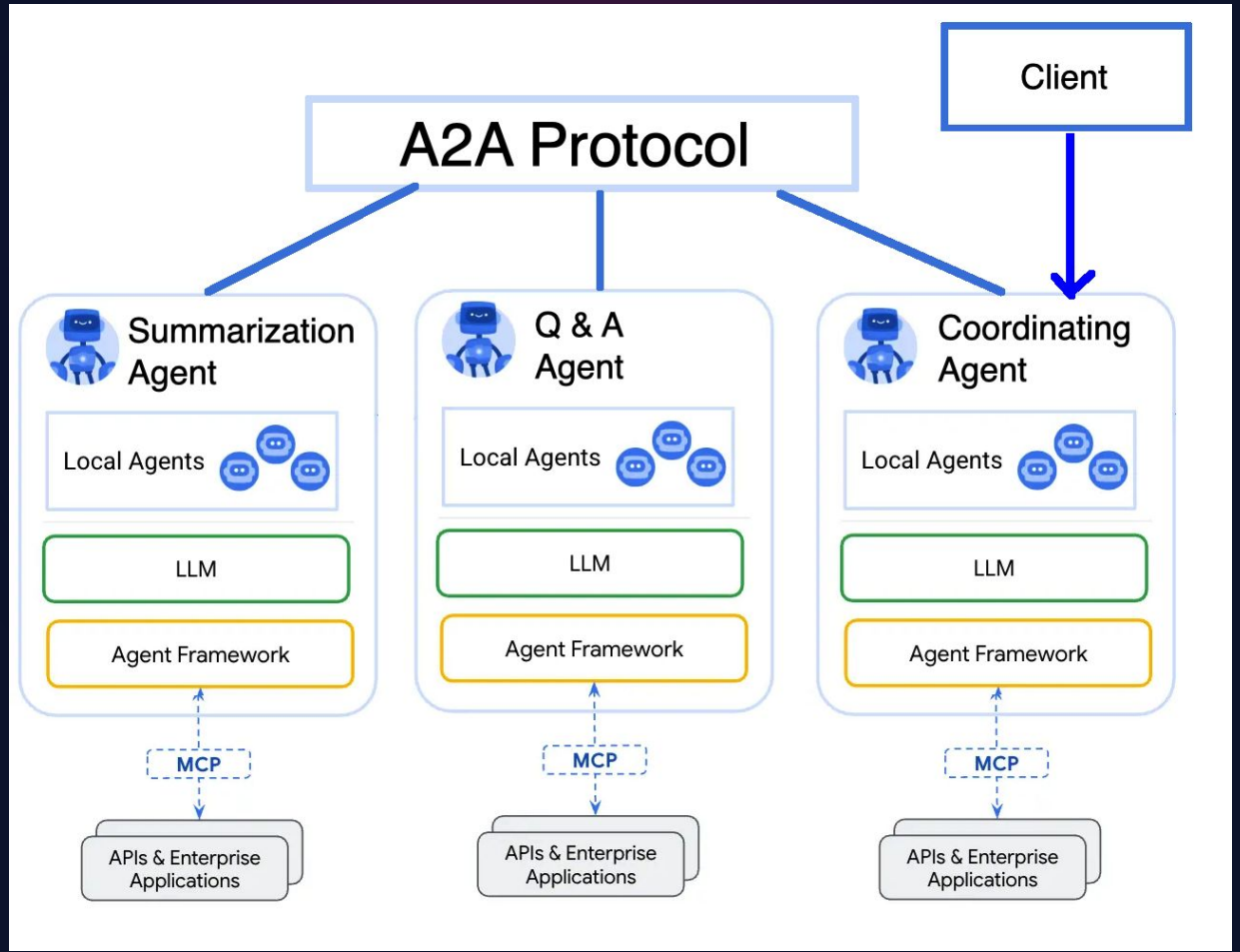


Image Attribution
Xin Cheng - Hello World to Agent2Agent Protocol

Building Blocks Of Agentic AI

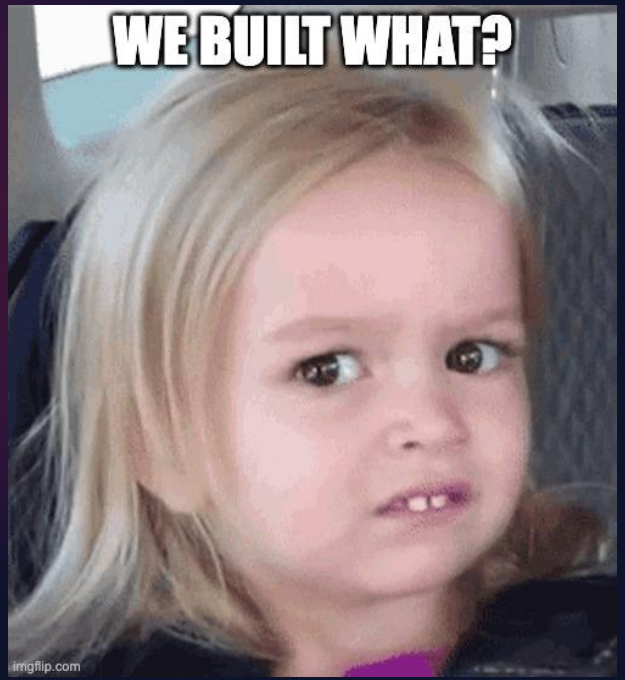
- AI Agents (Typically, an LLM):
  - Singular Task, Access To Tools, etc
- Agentic AI (Workflows):
  - Make Autonomous Decisions
  - "Non-Deterministic" Path to Goals
- Plan, Iterate, and Coordinate
  - Minimal Human Intervention
  - Control Loops:
    - Analyze, Adjust, Done?
  - They Have Memory
  - Call APIs, Search the Web, etc

The Untold Stories of MCP

Swiss Cheese of Security Holes

MCP Shortfalls

1. Limited Observability / Auditability
   - Black-box Interactions
   - No Transaction Logs
2. Security And Privacy
   - Prompt Injection
   - Token Theft and Identity Spoofing
   - Privacy Leakage And Data Aggregation
3. Performance / Cost Inefficiencies
   - Context Window Bloat
   - High Latency For Large Datasets
   - Token/Infrastructure Costs



MCP Shortfalls (Continued)

4. Architectural / Design Limitations
   - Stateful Connection & Scalability Challenges (SSE vs REST)
   - Lack Of State & Memory In Single Requests
5. Developer And Organizational Barriers
   - Technical Complexity & Immature Tooling
   - Authorization & Identity Management Gaps
   - Rapidly Evolving Spec

Want To See A Big List Of Shortfalls?
https://bit.ly/47tCL9e

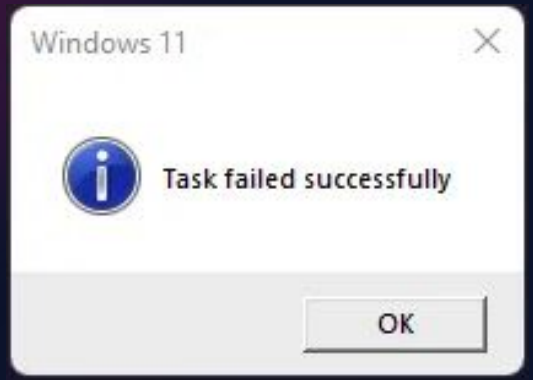


Image Attribution
https://www.reddit.com/r/windows/comments/weebhf/feel_old_yet_i_recreated_the_task_failed/

Rushing To "WRITE" Operations

- With All Of These Shortcomings…
  - "Non-Production" MCP Servers Popping Up Everywhere
  - Accessing "Destructive" Functionality
    - Replit's LLM-based "Vibe Coding" Agent
  - Leaking Sensitive Data

Example Failures:

- Anthropic MCP And Oat++
- mcp-remote Code Execution
- GitHub MCP Prompt Injection

Vector Embedding Limitations

- Amazing! Semantic Search Over Unstructured Text
- But... Semantic Similarity Limitations
  - All Knowledge is Flat
  - Difficult to Reason On Multiple Hops
    - No Holistic View
    - No Data Continuity
  - Miss Complex Entity Connections
- "Game Of Chance" On Purpose

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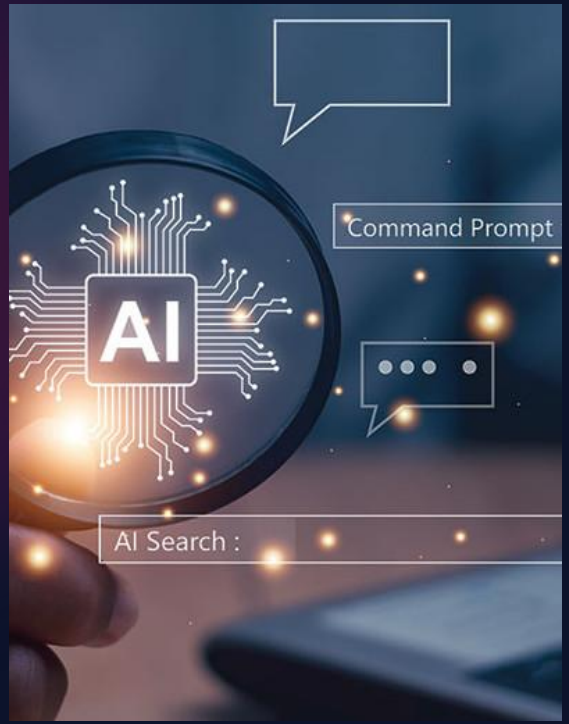
Enhanced Data Search Using MCP

- MCP Is Incredibly Powerful For READ Operations
  - Access New Sources Of Data
  - Opportunity For ACL On Data
    - Trained Data Is General Data
    - Partition Data for Access
  - Opportunity For RBAC For Tools
    - APIs Behind Permissions
    - Fine-Grained Controls
- We Should Be Thinking About…
  - Data Access Tiers + API Access



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https://www.technewsworld.com/story/ai-enhanced-searches-may-pose-threat-to-creators-publishers-179193.html

Reinforcement Learning

- Using MCP For New Sources Data
  - Reinforcement Learning Opp.
  - Store This Data / Expand Corpus
    - Tier 1: Is The Source Trusted?
    - Tier 2: Everything Else
  - Validated The Data:
    - Algorithmic / Automated
    - Human-in-the-Loop
- As AI Generated Data Proliferates
  - Must Expand "Real" / Human Data

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https://www.akc.org/expert-advice/training/operant-conditioning-positive-reinforcement-dog-training/

Demo: Semantic Search Fail

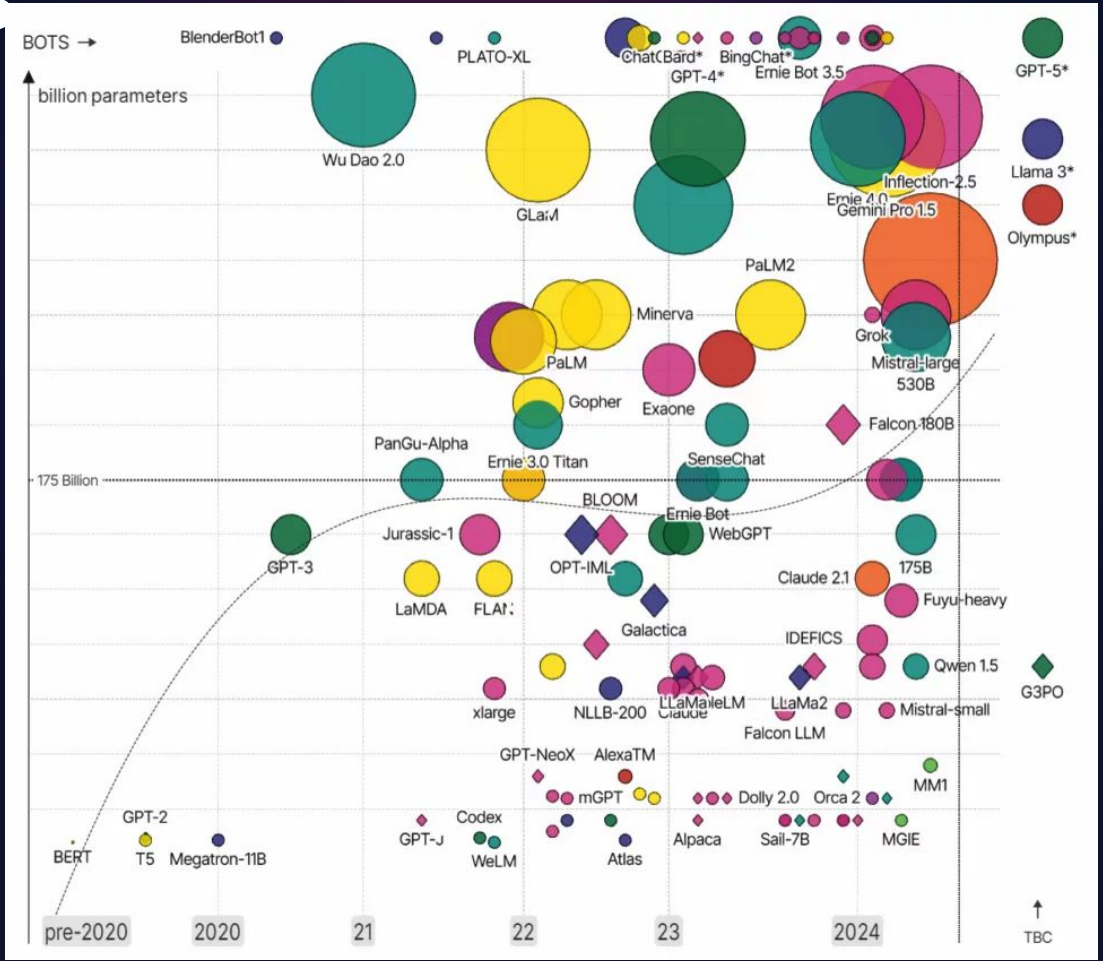
https://youtu.be/DR4zM2RF7A0

Demo: MCP and RL

https://youtu.be/xV9vaH9i25A

Using A2A Effectively

All Eyes On Large Language Models



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How Large Language Models are Shaping the Future: Teaching Machines to Understand in 2024
https://nestify.io/blog/top-large-language-models/

Large Language Models Issues

- Hallucination Increase With Larger Dataset
  - Not Necessarily The Size Of The LLM
- Reward Mechanism To Provide An Answer
  - Confident Wrong Answers
  - No Reward For "I Don't Know"
- Again... All Data Is Flat
  - All Things Open AI 2025
    Leveraging Knowledge
    Graphs For RAG
  - No Association With OpenAI, Google, and Windsurf Articles

Consider Small Language Models

- Small Language Models (SLM) w/ RAG
  - Hallucination Rate On Par Or Better
  - Smaller Memory Footprint
  - Inference Faster / Cheaper
  - Smaller Corpus + Specialized Data
- Pick The LLM or SLM For The Task
- Easier To Scale Out SLMs
  - More Compute Targets
  - Less Dependence On $$$ GPUs

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https://www.dreamstime.com/illustration/david-vs-goliath.html

A2A Decomposing Problems

- Use Agent2Agent Breakdown Problems
  - Smaller Subject Matter Expert (SME)
    - All The Benefits Of SLMs
  - Connect SMEs Via Policy & Logic
  - Bad: LLM w/ 20+ MCPs Endpoints
    - Billing Agent –> Access Billing API
- Use Software Engineering Values
  - Code Reuse or Libraries –> SMEs
  - Modular & Separation Of Concerns
  - Easier To Secure And Lockdown

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https://www.amazon.com/YAKELUS-Russian-Nesting-Matryoshka-handmade1070/dp/B01LYU541Z

Warnings: Policy & Business Logic

LangChain

VS

LangGraph

Blog:
[LangChain and LangGraph Agent Frameworks Reach v1.0 Milestones]

Session Recording:
[WeAreDevelopers World Congress 2025: Using Adversarial Techniques for Better AI and True Anonymity]

Demo: Simple A2A Example

https://youtu.be/qiTGGDLXzG8

Demo: Full A2A + MCP Example

https://youtu.be/GUkTM8aXX4M

Resources

Resources

All Materials (Slides, Code, etc):
github.com/davidvonthenen/2025-devoxx-morocco

Want To Participate In A Podcast:
Need AI/ML Help? Work A Problem Together

Reduced Hallucinations, Better Answers:

Graph-based RAG

- github.com/davidvonthenen/graph-rag-guide

Document-based RAG

- github.com/davidvonthenen/document-rag-guide

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Thank You!

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