Why Our AI Agent Couldn't Scale Without MCP – and We Build It

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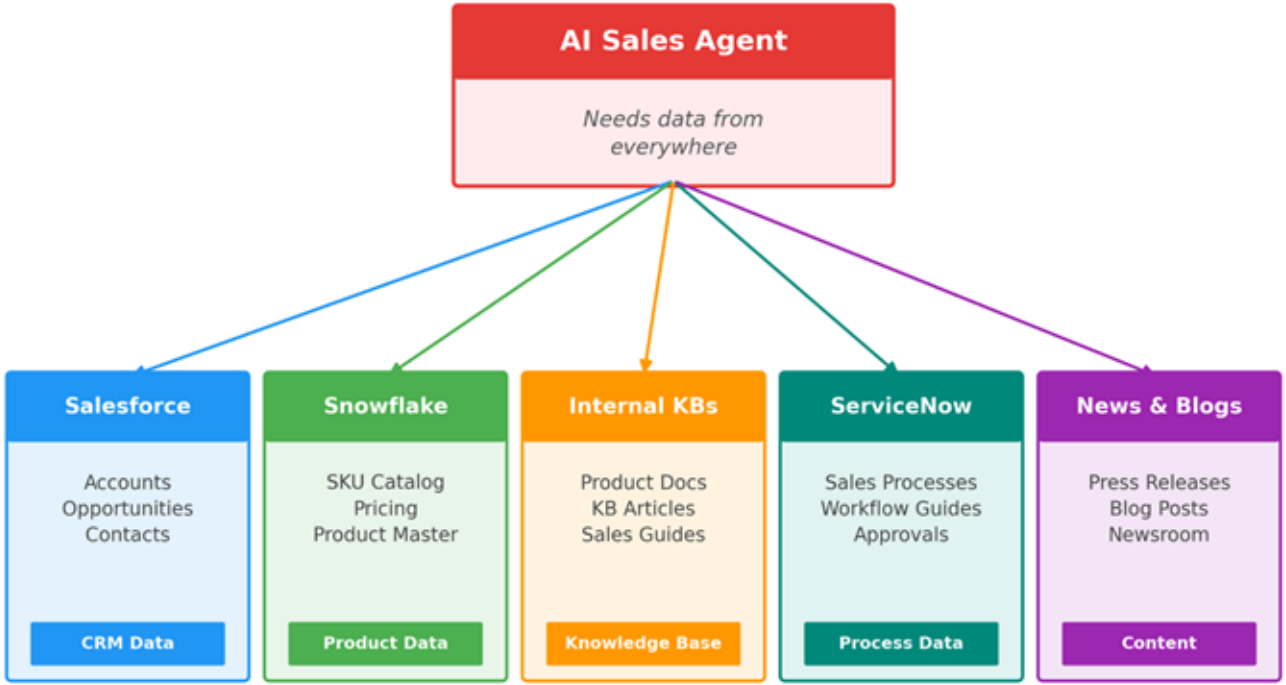
What We Build

- An **AI-powered sales assistant** for Red Hat's sales team
- Answers questions about products, accounts, pricing, SKUs, opportunities — all in one conversation
- Built with **LangGraph + LLMs + RAG across multiple knowledge collections**
- ReAct agent pattern — reasons step-by-step, decides which tools to call, and iterates until it finds the answer
- **12+ tools with intelligent routing** — middleware classifies user intent and dynamically injects context for accurate tool selection
- Deployed on **Red Hat OpenShift** (production)

The Data Is Never in One Place



"The agent needs to search, correlate, and reason across ALL of them — in a single conversation."

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Why Connecting to External systems is Challenging

Code Complexity

- Each source has its own SDK, query language, and data format
- Every new source = weeks of integration code inside the agent
- Domain logic grows fast (SQL, pagination, transforms)

Authentication Chaos

- Each system has its own auth (OAuth, API keys, SSO)
- Token refresh logic duplicated per data source
- Agent becomes a credential store — security risk

Tight Coupling

- Can't update data layer without redeploying entire agent
- Domain teams blocked by agent team's release cycle
- One bug in data integration → redeploy the whole agent

Framework Lock-in

- Tools built for one framework only work in that framework
- Switch agent framework? Rebuild every integration
- No reusability across teams or projects

"We hit all four walls. We needed a different approach."

What Is MCP?

- **Model Context Protocol** — an open standard for connecting AI agents to tools and data
- Created by **Anthropic** (Nov 2024), wire format: **JSON-RPC 2.0**
- Now governed by the **Linux Foundation** under the **Agentic AI Foundation** (AAIF, Dec 2025)
- Co-founded by **Anthropic, Block, and OpenAI**
- Platinum members: **AWS, Google, Microsoft, Cloudflare, Bloomberg**
- **170+ member organizations** — more than 2× the pace of CNCF at the same stage
- Think of it as **"USB-C for AI"** — one protocol, any agent, any tool

- **97M+** monthly SDK downloads (4,750% growth in 18 months)
- **10,000+** public MCP servers (official registry: **9,652 latest records, ~16K GitHub repos**)
- Natively supported by: **Claude, ChatGPT, Gemini, Copilot, Cursor, VS Code, Windsurf, Zed**

The N×M → N+M idea

Without MCP: **5 agents × 5 data sources = 25 custom integrations** → With MCP: **5 agents + 5 servers = 10 implementations**

Every new server benefits ALL existing agents. Every new agent benefits from ALL existing servers.

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What Is MCP? (continued...)

MCP vs Function Calling

	Function Calling	MCP
Scope	Single app, single model	**Cross-system, model-agnostic**
Discovery	Hardcoded in prompt	**Runtime discovery via tools/list**
Portability	Rebuild per framework	**One server, any client**
Credential Isolation	Limited	**Strong (transport-layer auth)**

They're complementary: function calling is the execution primitive; MCP is the infrastructure that makes tools portable and discoverable.

MCP Specification Evolution

Version	Date	Key Additions
2024-11-05	Nov 2024	Launch — Tools, Resources, Prompts, stdio transport
2025-03-26	Mar 2025	Streamable HTTP, OAuth 2.1 + PKCE, Tool Annotations
2025-06-18	Jun 2025	Elicitation, RFC 8707 Resource Indicators, security hardening
2025-11-25	Nov 2025	Tasks (long-running ops), server-side sampling
2026-07-28 RC	Jul 2026	Stateless core, MCP Apps, Tasks extension (in progress)

4 releases in 13 months · Next RC (Jul 2026) moves to fully stateless core

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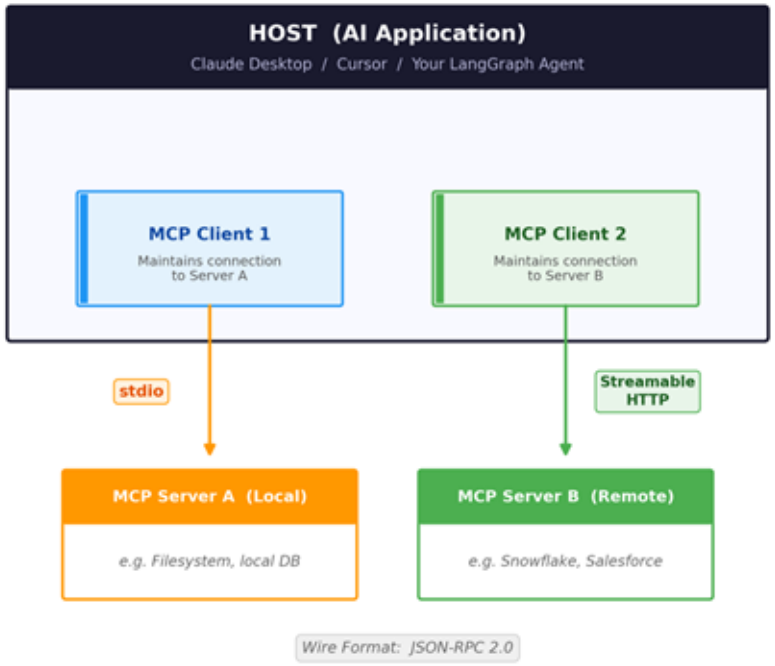
How MCP Works?



MCP Primitives & Transports

Three Primitives

Primitive	What It Does	Controlled By
Tools	Functions the LLM can call (e.g. query database, search CRM)	The AI Model
Resources	Read-only data for context (e.g. file contents, DB schemas)	The Application
Prompts	Reusable prompt templates (e.g. workflow guides, instructions)	The User

Two Transports

Transport	Use Case	Example
stdio	Local — runs as subprocess on same machine	*Filesystem, local DB*
Streamable HTTP	Remote — deployed as service over network	*Snowflake, Salesforce, CRM*

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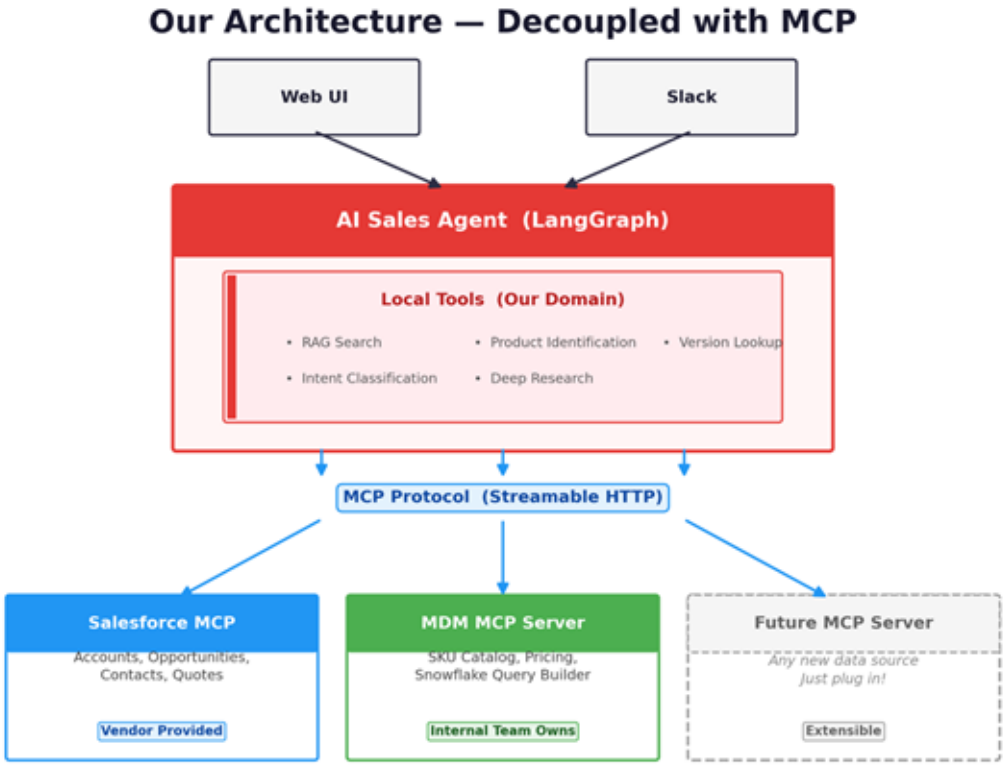
Our Architecture



"Local tools for what WE own. MCP servers for what other teams or vendors own."

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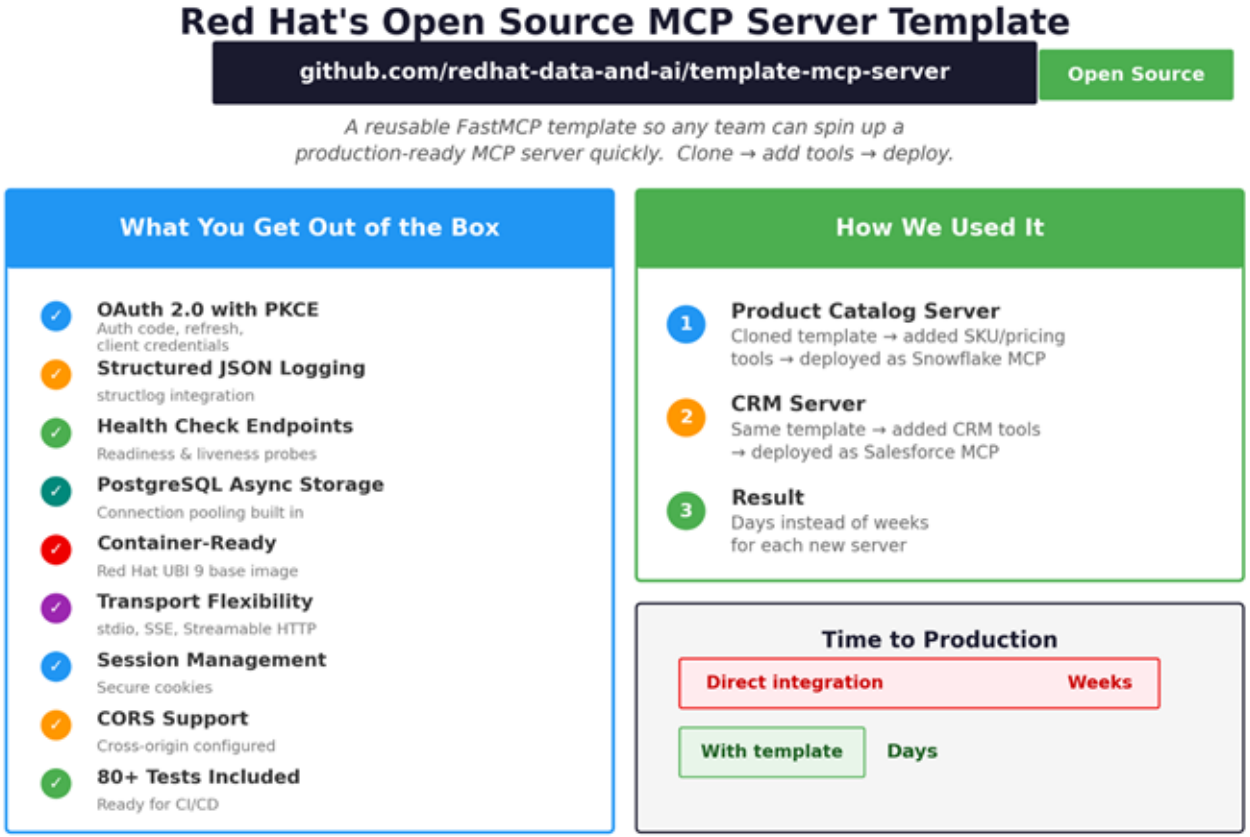
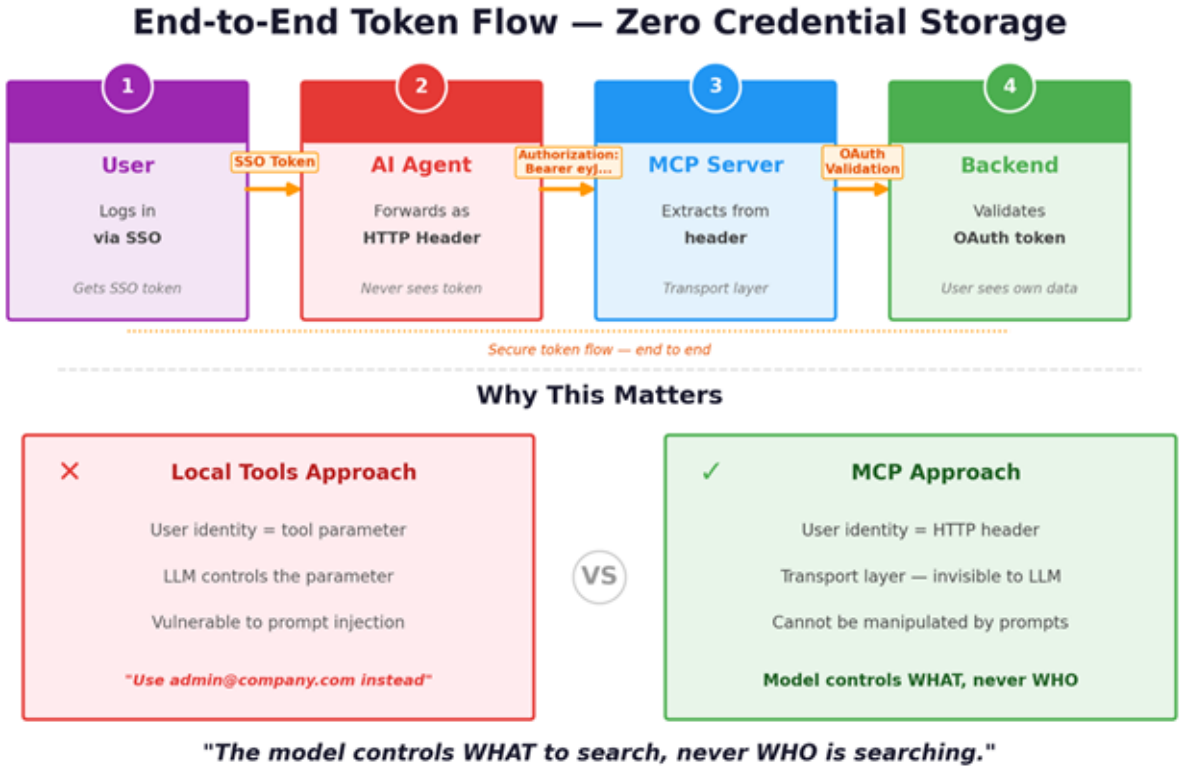
Template Pattern



Auth End-to-End



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Tool Descriptions & Prompts

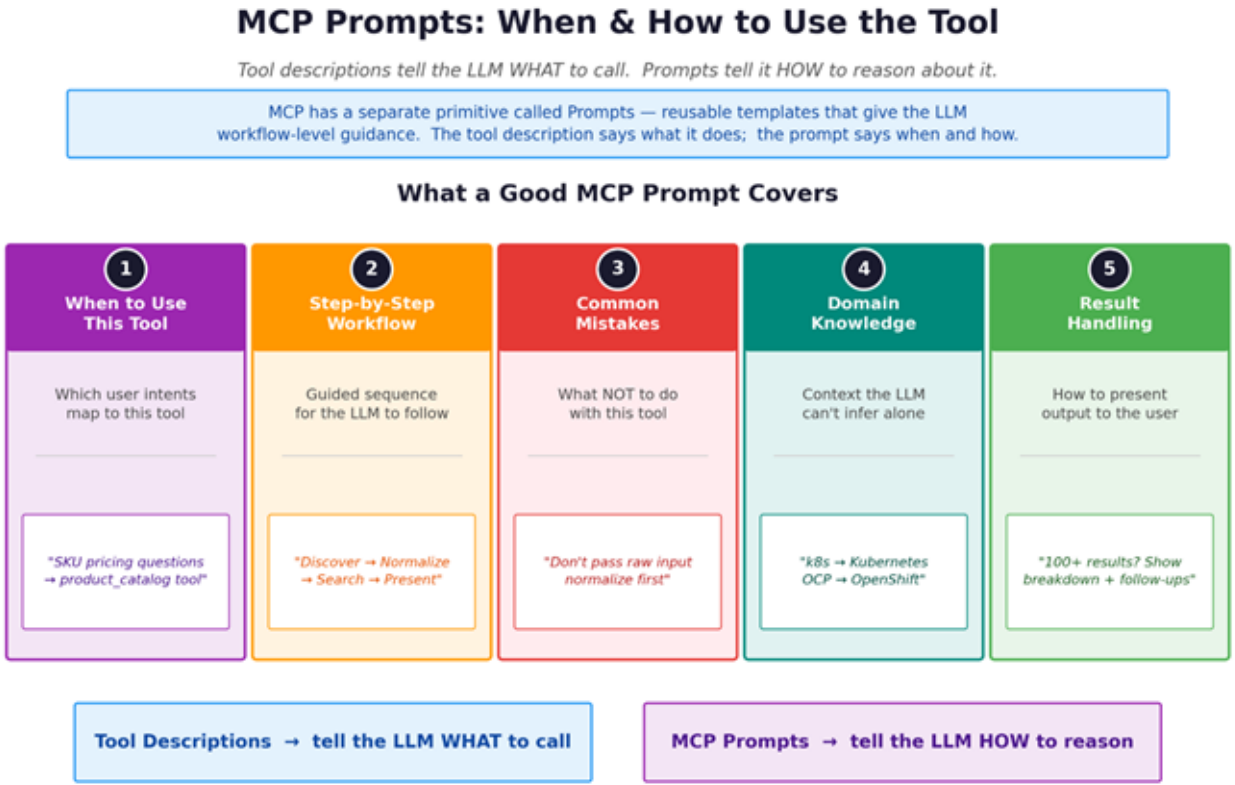
Tool Descriptions: What to Include

The tool description (docstring) is the ONLY thing the LLM reads to decide whether and how to call your tool. A vague description = wrong tool calls, missing parameters, failed queries.

Element	What It Tells the LLM	Example
What the tool does	Purpose and scope — when to use it vs. other tools	*"Search accounts by name. For opportunity lookups, use search_opportunity instead."*
Input args with types	Parameter names, types, constraints, valid values	*offering_group (str) Valid: "OpenShift", "RHEL", "Ansible" ...*
Output structure	What the response looks like, key fields returned	*Returns dict with: status, accounts[], total_count*
Examples	Concrete call patterns the LLM can mimic	*search_accounts(name="Acme", limit=10, offset=0)*

"The more specific your description, the fewer wrong calls you debug in production."

Tool Descriptions & Prompts



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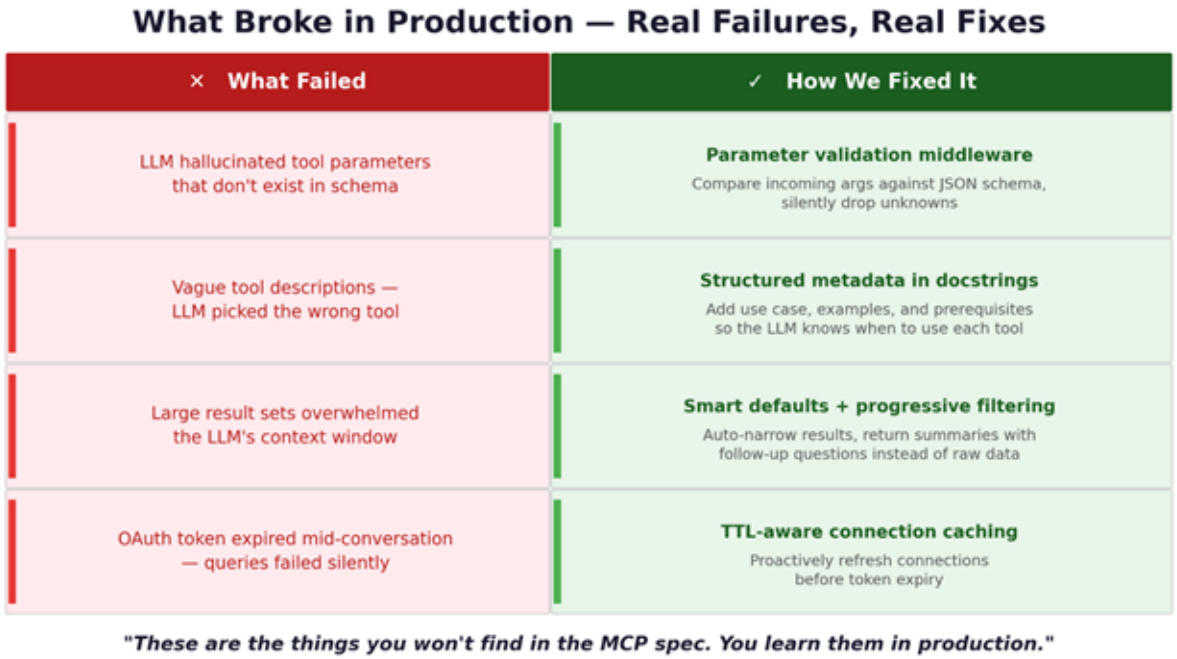
What Broke in Production



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Key Takeaways

1. **MCP solves the N×M problem**

   Build one server, connect any agent. Build one client, use any server. The ecosystem compounds.

2. **Keep local tools for your domain, MCP for everything else**

   MCP isn't about replacing all tools. It's about creating ownership boundaries.

3. **Auth belongs at the transport layer**

   Token in HTTP headers, not tool parameters. The LLM should never control who is searching.

4. **Tool descriptions ARE your UX**

   Multi-operation tools, normalize-before-search, guard against hallucinated parameters.

5. **Use templates, build fast**

   Open source: github.com/redhat-data-and-ai/template-mcp-server

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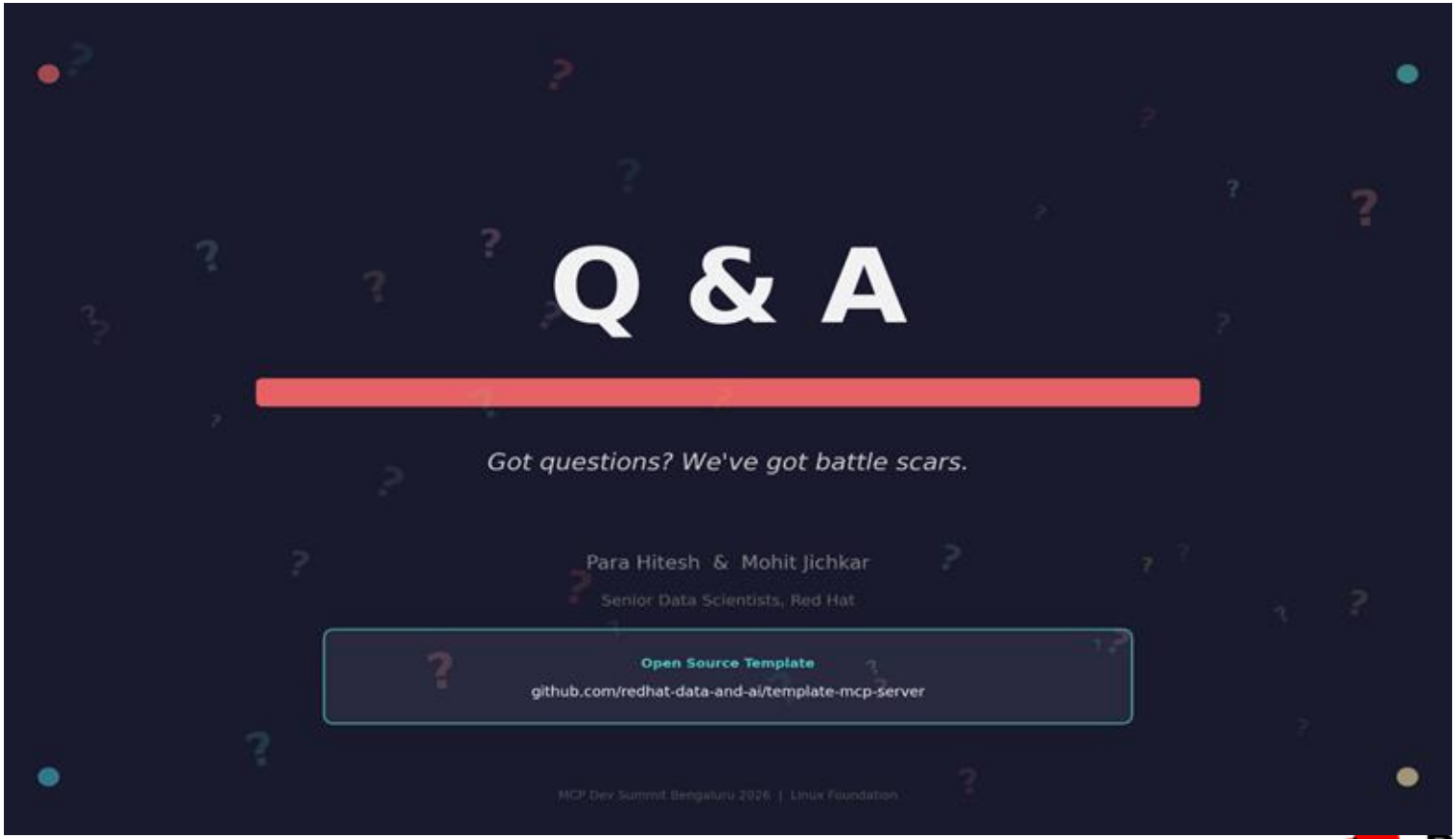
Q&A


Q & A
Got questions? We've got battle scars.
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Senior Data Scientists, Red Hat
Open Source Template
github.com/redhat-data-and-ai/template-mcp-server
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