Powering AI with MCP

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THOU SHALT NOT MAKE A MACHINE IN THE LIKENESS OF A HUMAN MIND

FRANK HERBERT

Assume

Comfortable with Python

Have a basic understanding of what is GenAI

- LLM
- Agents
- GenAI != AI

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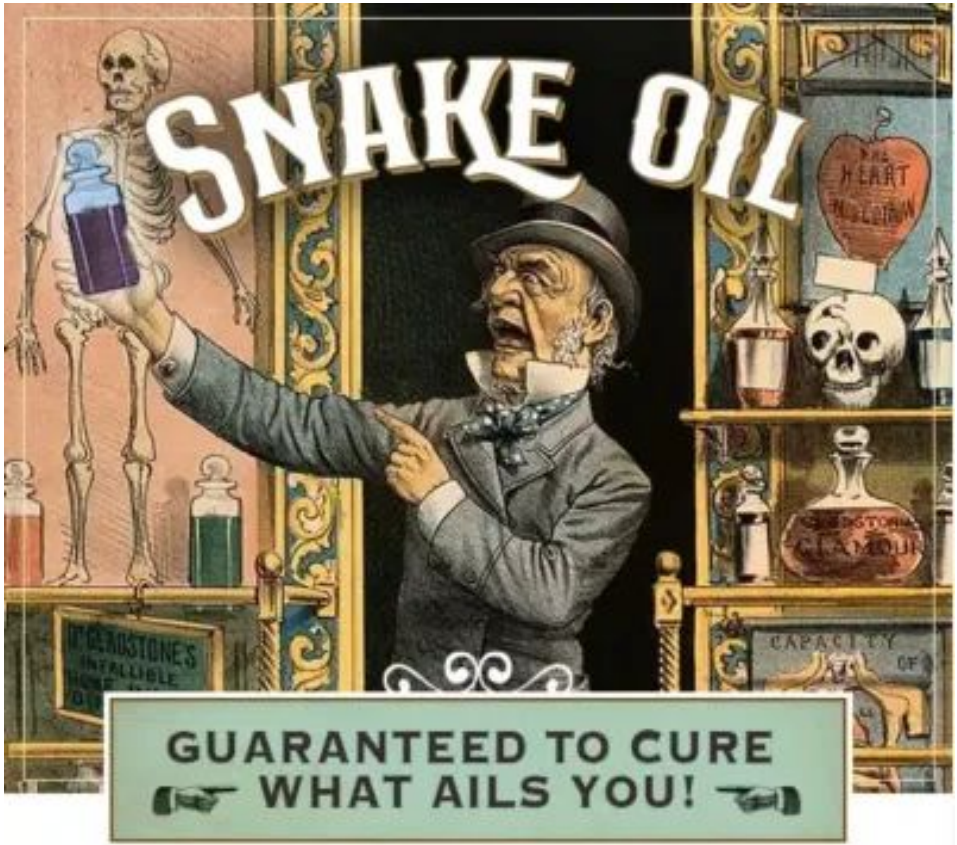

Ours software is AI enabled!

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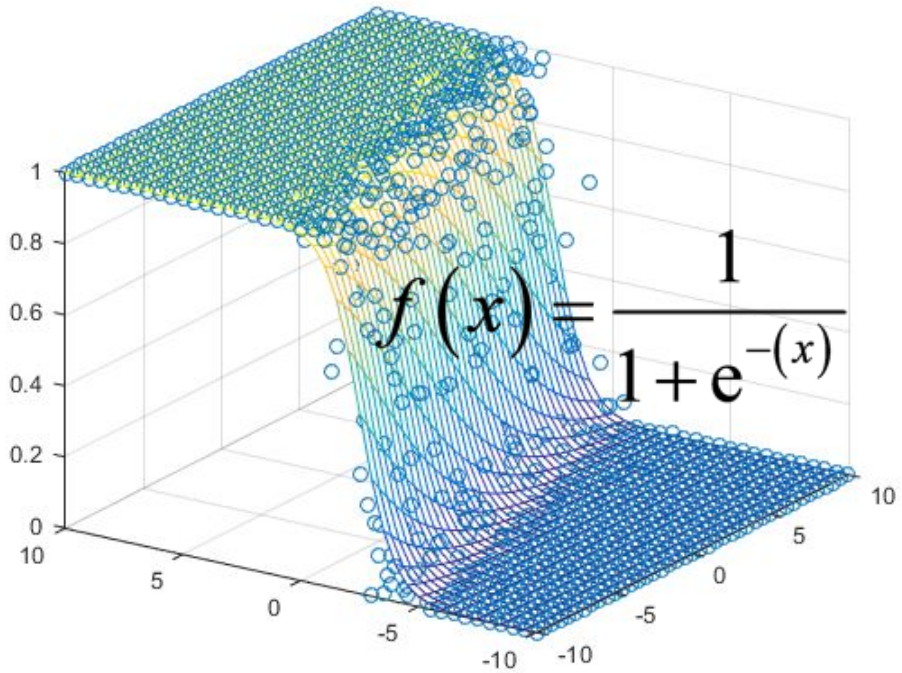
Programmed vs Learnt



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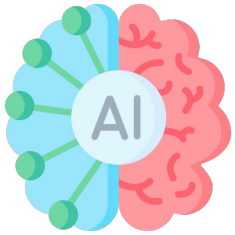
LLM



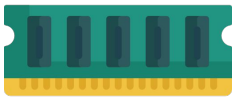
Intelligence

PROMPT

Instructions for the model

Information to augment the model

Tools to interact with the outside world



Memory give context to ongoing conversation

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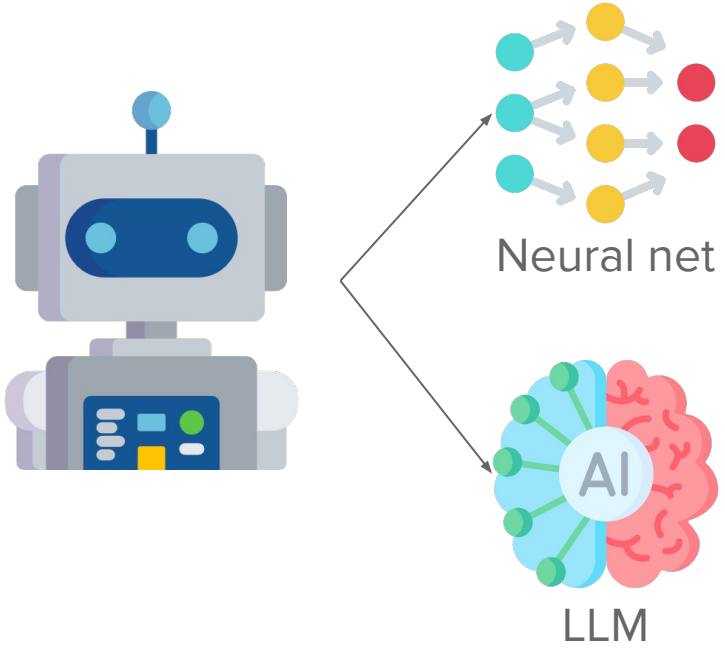
What are Agents?



Autonomous programs

Acts on behalf of another entity to accomplish a given task

Examples of non AI agent
- Log scraper
- Chat bots

AI agents uses 'AI' to make decisions

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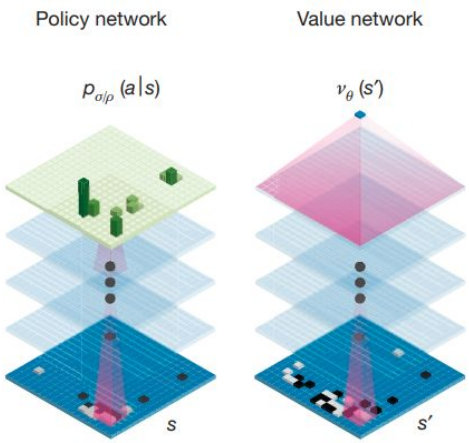
Alpha Go



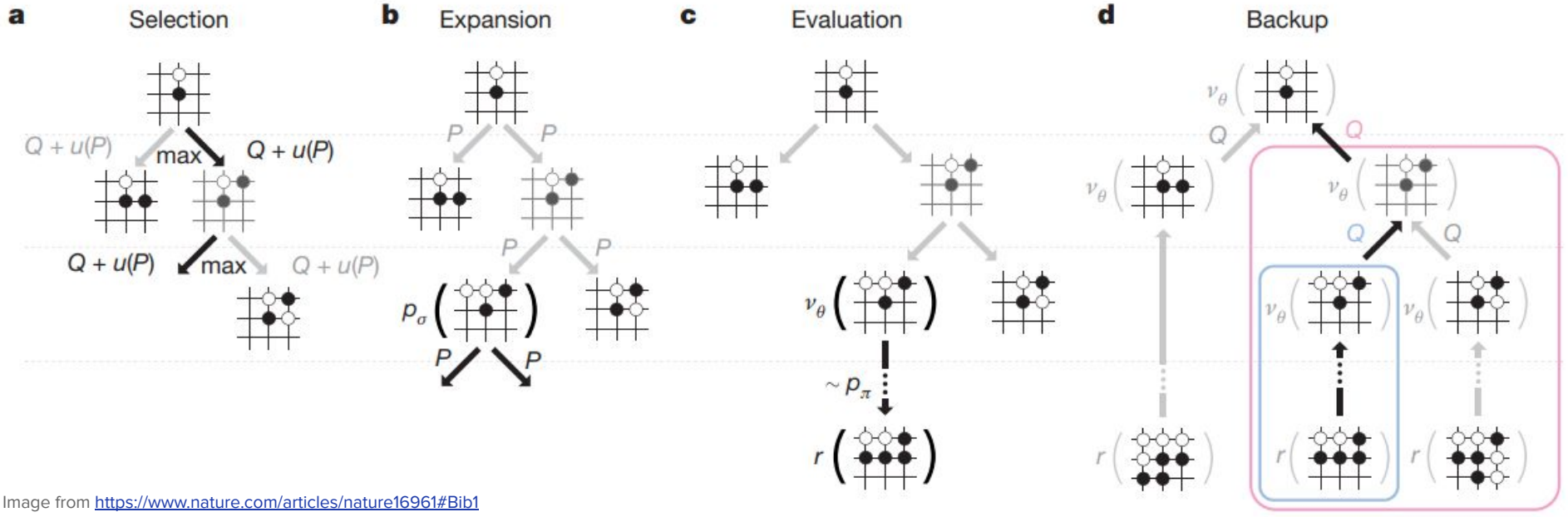


Image from https://www.nature.com/articles/nature16961#Bib1

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Today's AI Agent

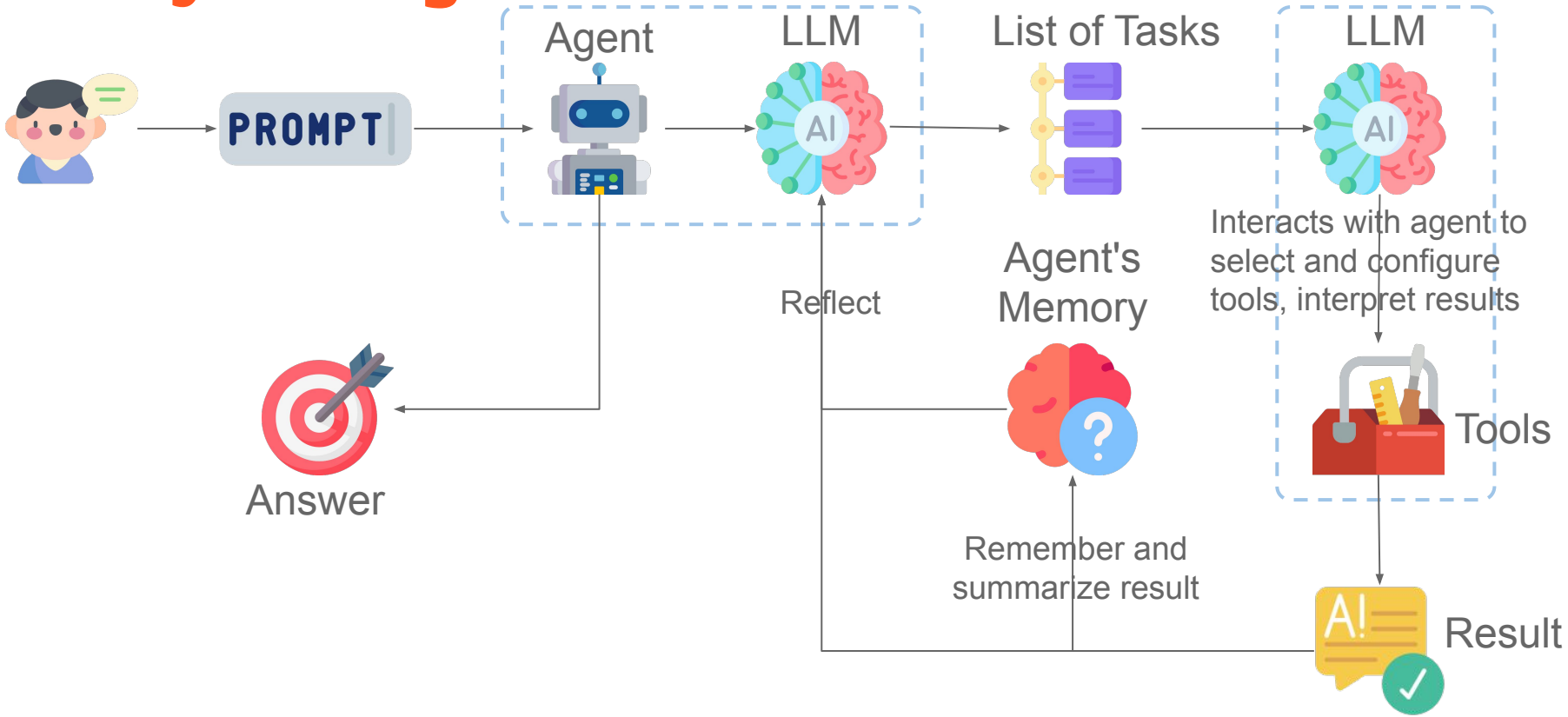

Diagram adapted from https://www.linkedin.com/pulse/building-your-own-autonomous-llm-agents-praphul-singh-uompc/

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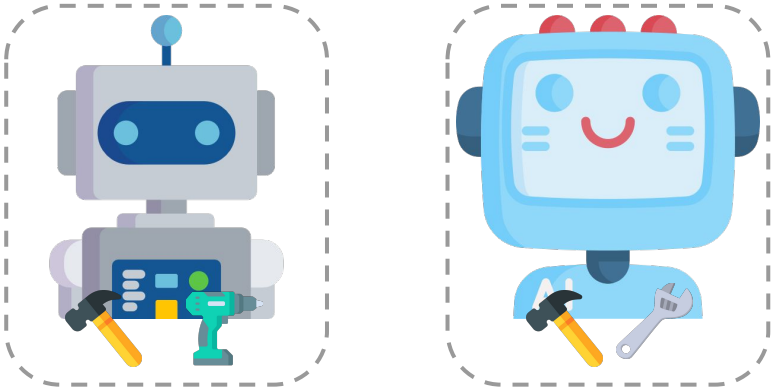
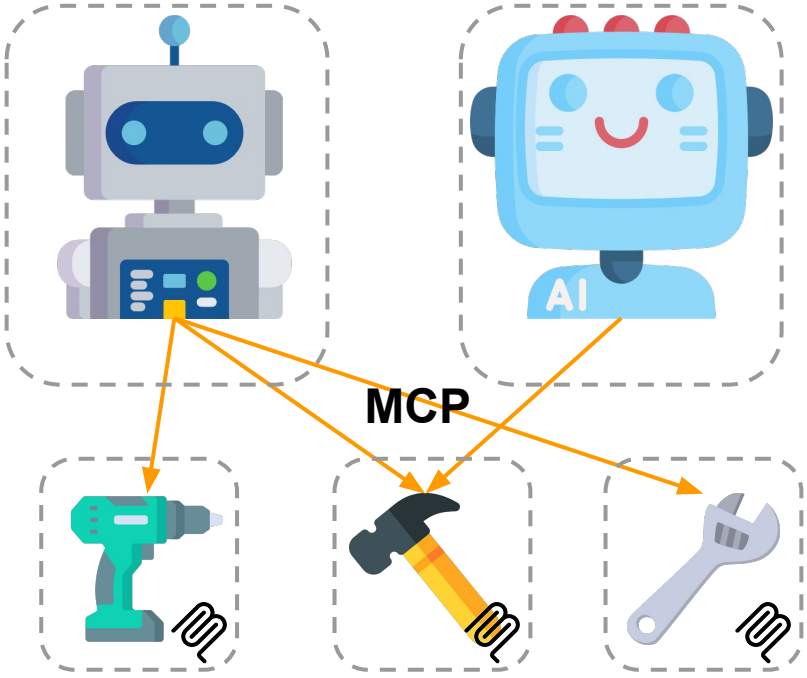
Tools

Each agent has its own copy of the tool



Tools are externalized. Shared with MCP



MCP define how AI agents access and utilize external data, tools, and services

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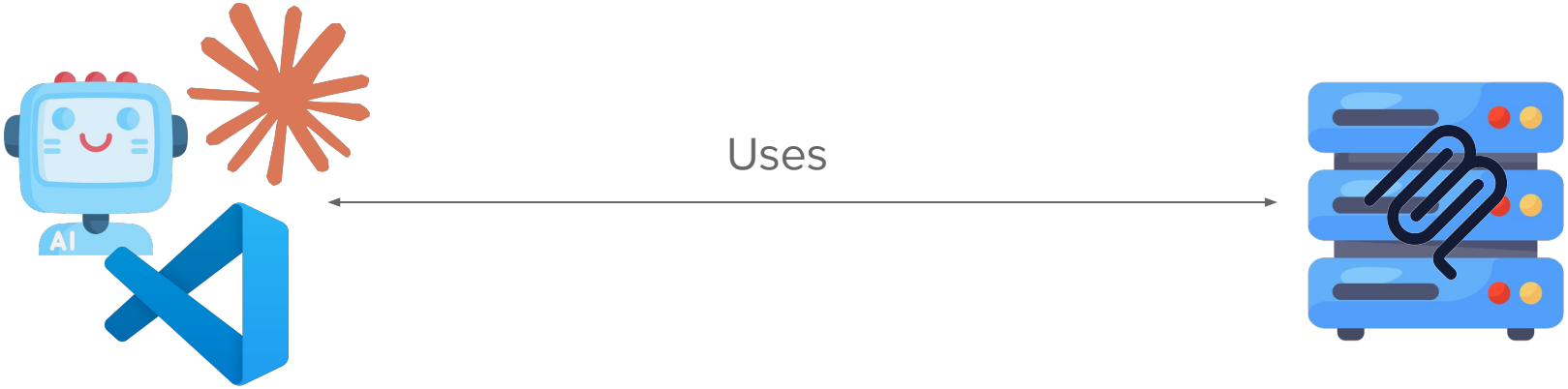
What is MCP?

Standard protocol for a client to connect with external data sources and tools

- Client is called the MCP host
- External data source and tools is the MCP server



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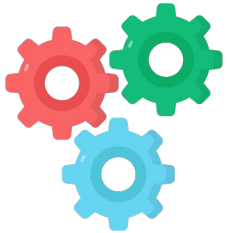
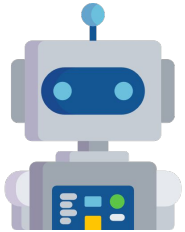
Yet Another Way of Communication

1995 onwards Human - HTML



2000 onwards Applications - SOAP/REST



2025 onwards Applications - MCP

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Task 1

Project Setup

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Task 1

Initialize with uv - **`uv init`**

Add FastMCP - **`uv add fastmcp`**

- https://gofastmcp.com/getting-started/welcome

Create a file call **`todo-mcp.py`**

Re download the file **`todo_db.py`** ⚠️

The updated version has the timestamp in the first line

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Task 2

Tools

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MCP Server Primitives

Controlled by the AI

Tool (model-controlled) - a function that can be invoked to perform an action and return a result
Eg. making an API call, sending an email, etc

Controlled by the user

Resource (application controlled) - expose data and content that can be read by clients and used as context
Eg. JIRA ticket details, graph, etc

Prompt (user controlled)- reusable prompt templates and workflows
Eg. Chain-of-thought prompt for scaffolding a CRUD application

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MCP Server Primitives

DONT USE THIS

Sampling - server request the client to perform completions on its behalf

Eg. request the client to rate if images is appropriate

Allows long running interactive workflows

Elicitation - request information from the user

Eg. request password to push code to Git

Control what MCP should see or work on

Roots - define the boundaries where servers can operate, provide guidance what category of resources to use

Eg. narrow the JIRA to only fred's open tickets

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MCP Client Support

https://modelcontextprotocol.info/docs/clients/

Feature support matrix

Client	Resources	Prompts	Tools	Sampling	Roots	Notes
5ire	❌	❌	✅	❌	❌	Supports tools
BeeAI Framework	❌	❌	✅	❌	❌	Supports tools in agentic workflows
Claude Desktop App	✅	✅	✅	❌	✅	Full support for all MCP features, including roots
Claude Code	✅	✅	✅	❌	✅	Claude Code programming assistant with roots support
Cline	✅	❌	✅	❌	❌	Supports tools and resources
Continue	✅	✅	✅	❌	❌	Full support for all MCP features

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TODO MCP

MCP to manage `#TODO` comments in the source code

Can be used in IDE that supports MCP

Will implement the following primitives

- Tools
- Resources
- Prompts

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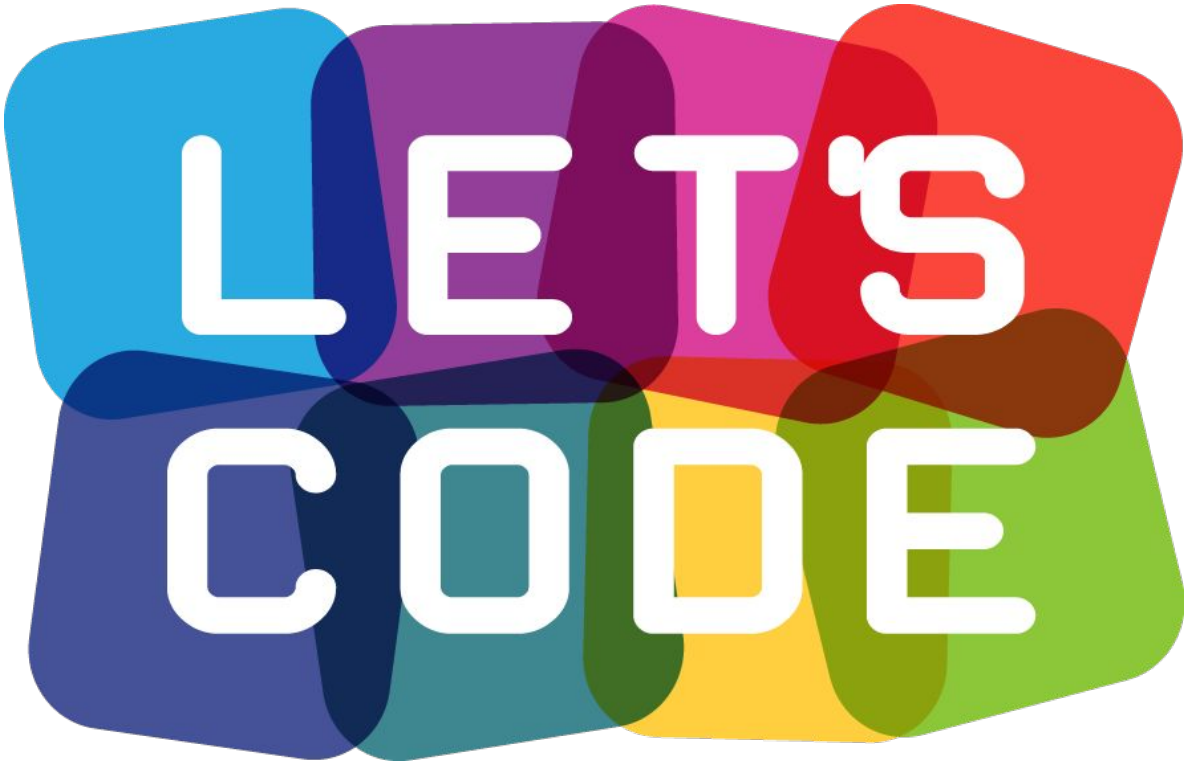
Task 2



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Task 3

Running in MCP Host

Install MCP

fastmcp install mcp-json my-mcp.py

```
{
  "TODO mcp": {
    "command": "/home/fred/.local/bin/uv",
    "args": [
      "run",
      "--with", "fastmcp",
      "fastmcp", "run",
      "/home/fred/src/mymcp/my-mcp.py"
    ]
  }
}
```

Add to MCP configuration file

Better to change to full path

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Task 4

Installing MCP

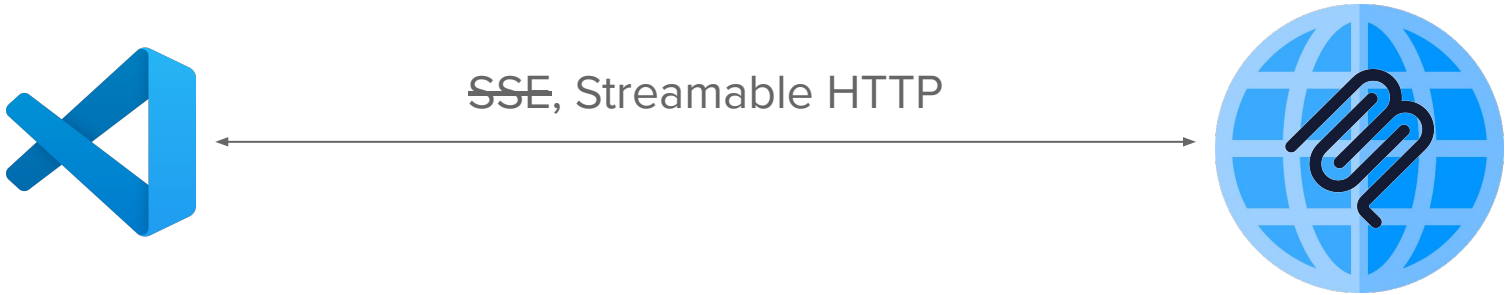
Deployment Model - Local

MCP server runs locally on your OS

- One client per instance
- Uses STDIO protocol for communication

Supports on demand install with npx and vux

Deployment Model - Remote



MCP server runs remotely

- Supports multiple client like a web application
- Uses streamable HTTP for communication

pyproject.toml

```
[project.scripts]
todo-mcp = "todo_mcp:main"

[build-system]
requires = [ "setuptools" ]
build-backend = "setuptools.build_meta"

[tool.setuptools]
package-dir = { "" = "." }

[tool.setuptools.packages.find]
where = [ "." ]
```

1. Test it

   uv run todo-mcp

2. Push code to Git repo

On-Demand Installation and Run

uvx run --from=git+https://github.com/fred/todo-mcp.git **todo-mcp**

```
"todo-mcp": {
  "command": "/home/fred/.local/bin/uvx",
  "args": [
    "--from",
    "git+https://github.com/fred/todo-mcpgit",
    "todo-mcp"
   ]
}
```


Thank You!