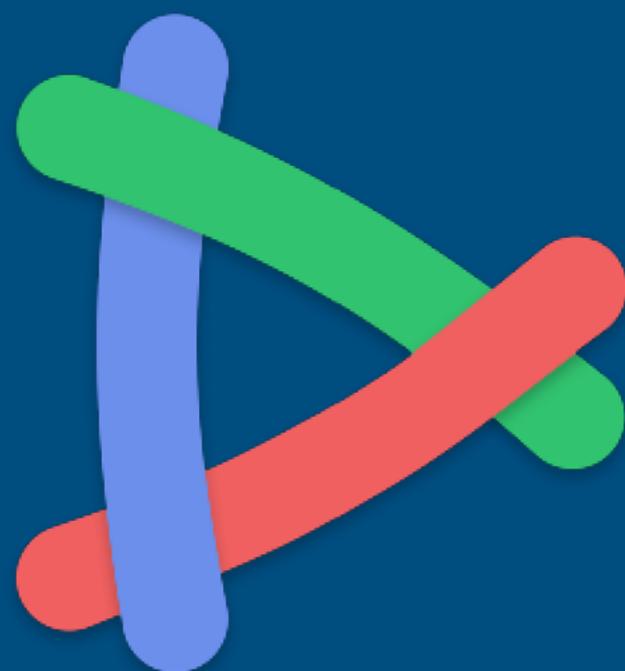


Getting Started with Model Context Protocol



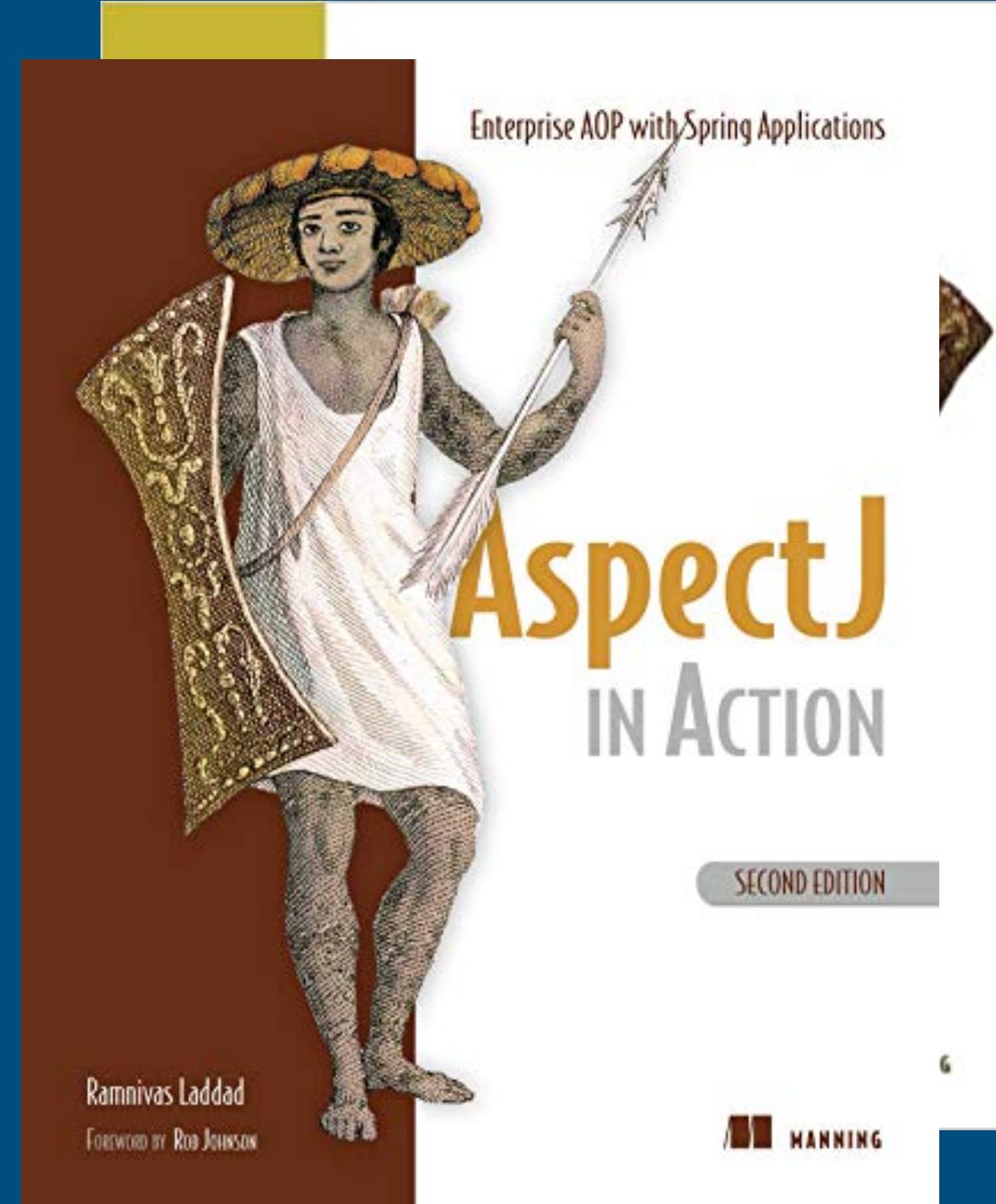
Ramnivas Laddad
@ramnivas

<https://exograph.dev>



Who am I?

- Co-founder of Exograph
- Former Spring Framework and Cloud Foundry committer
- Author of “AspectJ in Action”
- Speaker at many professional conferences: JavaOne, Spring Experience, Scala Days, O’Reilly OSCON, Scale By The Bay, etc.
- Indian Classical Music aficionado



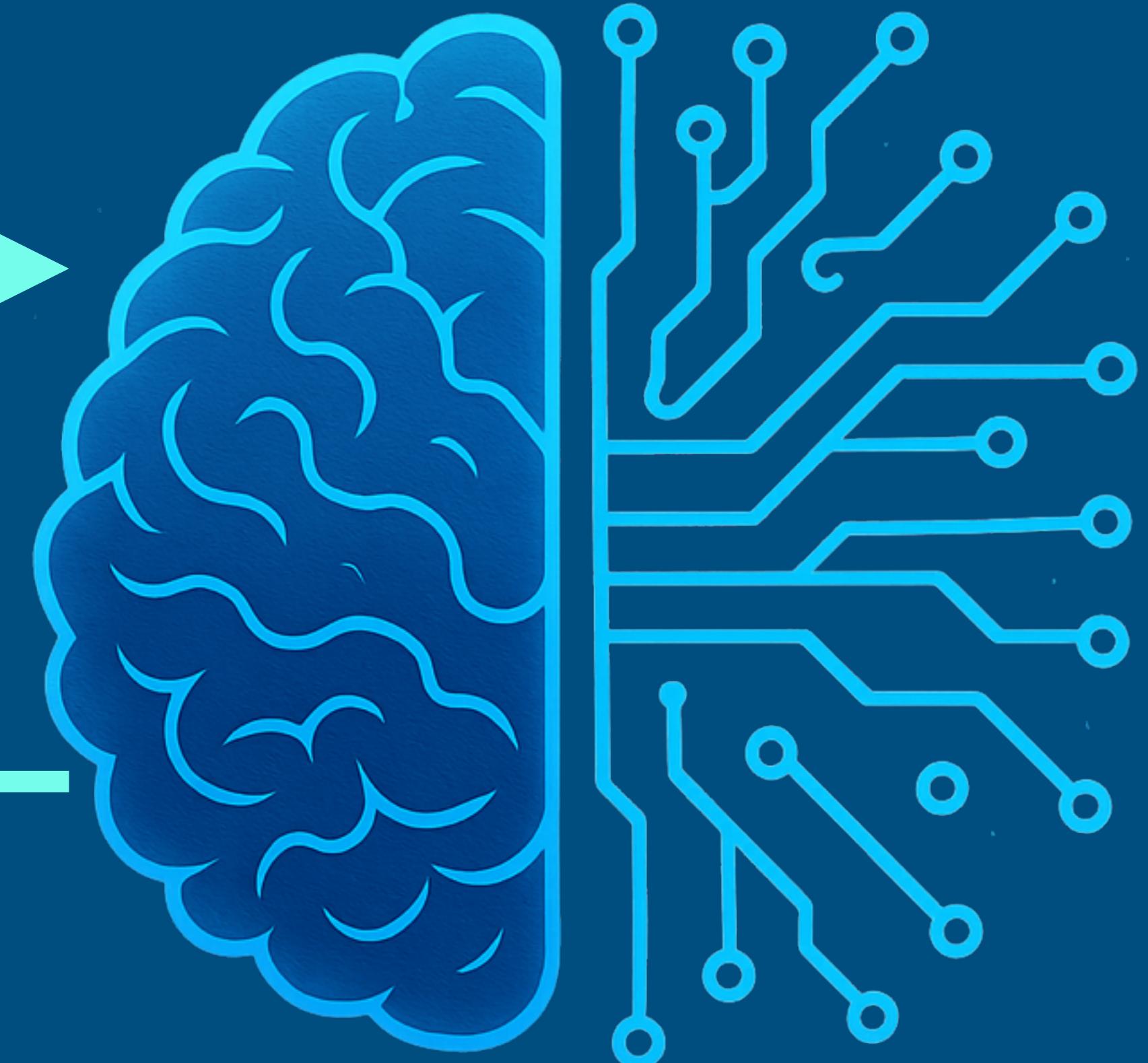


What's the difference between a fixed-rate and adjustable-rate mortgage?

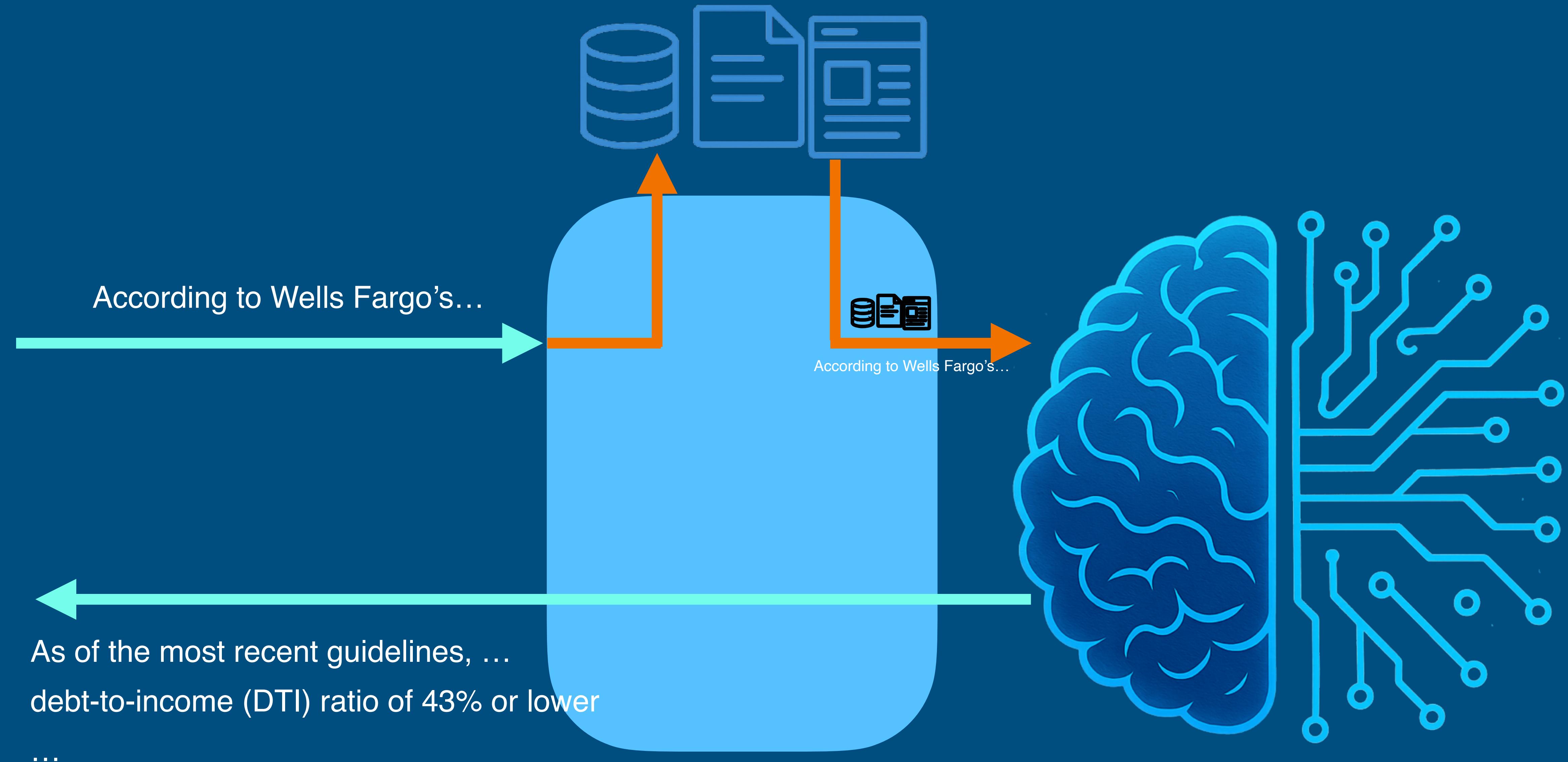
What's the difference between
a fixed-rate and adjustable-rate mortgage?



A fixed-rate mortgage has an interest rate that stays the same for the entire term of the loan, while an adjustable-rate mortgage (ARM) ...

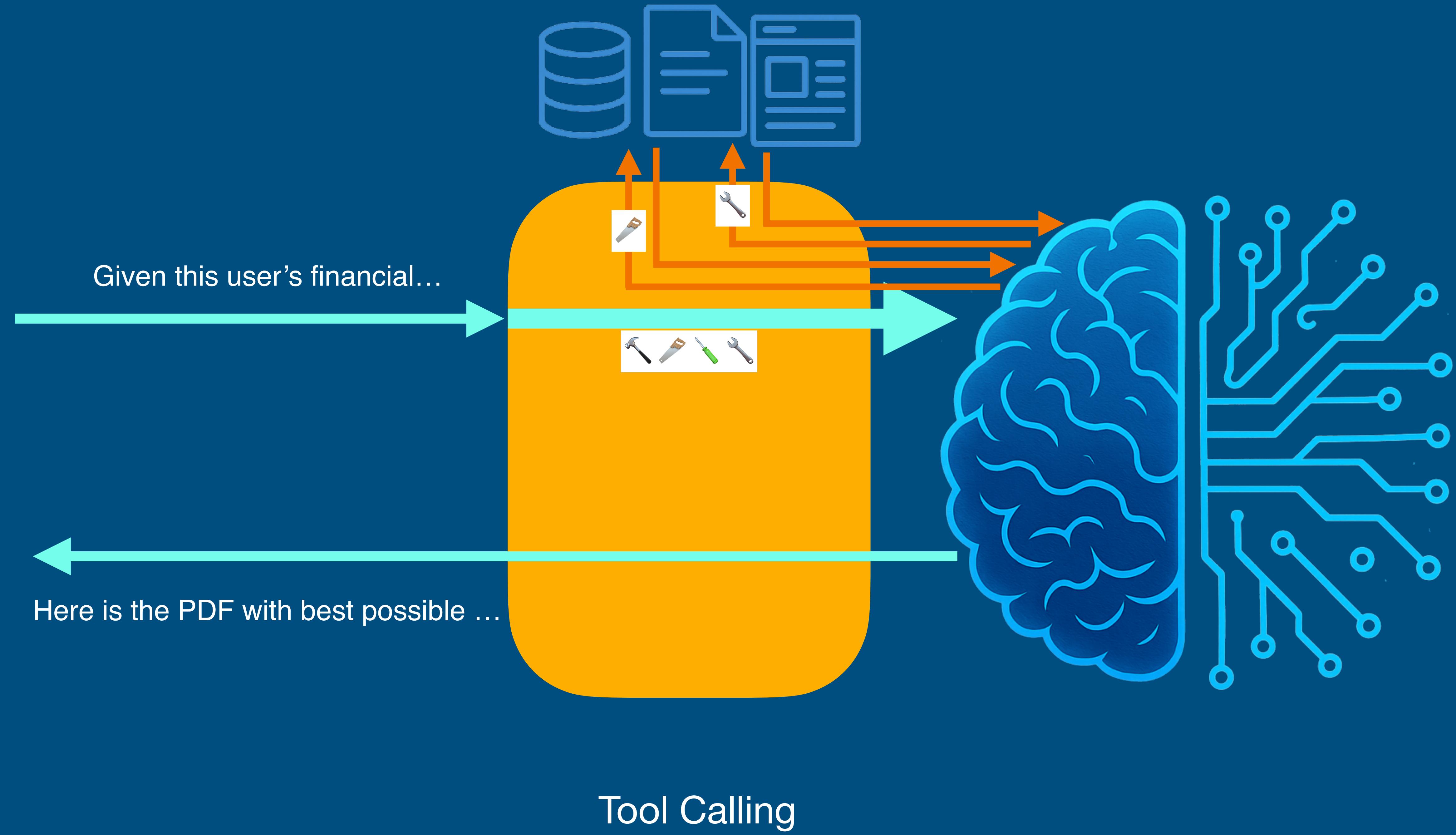


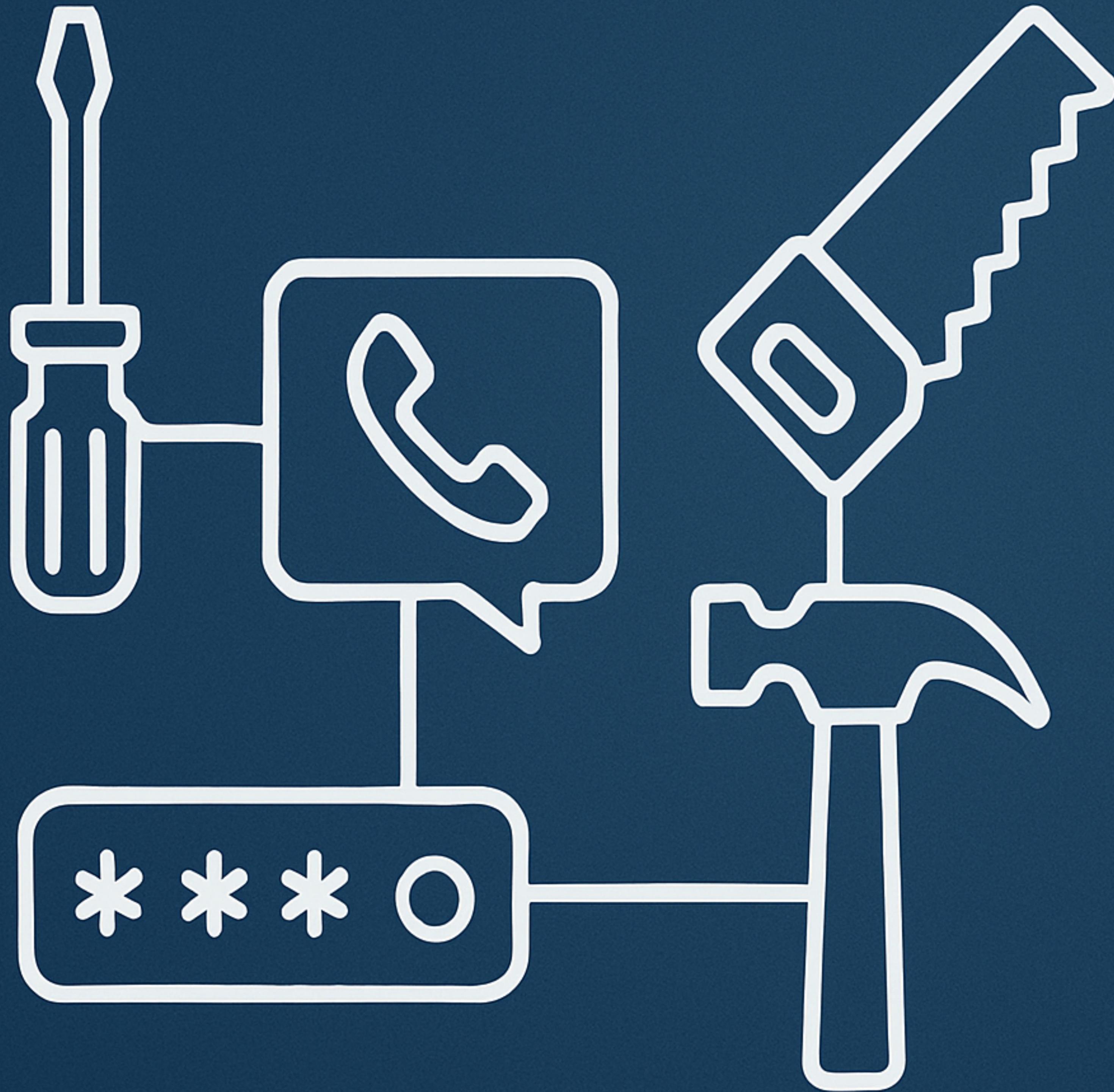
According to Wells Fargo's current mortgage guidelines, what are the DTI (debt-to-income) requirements for a jumbo loan?

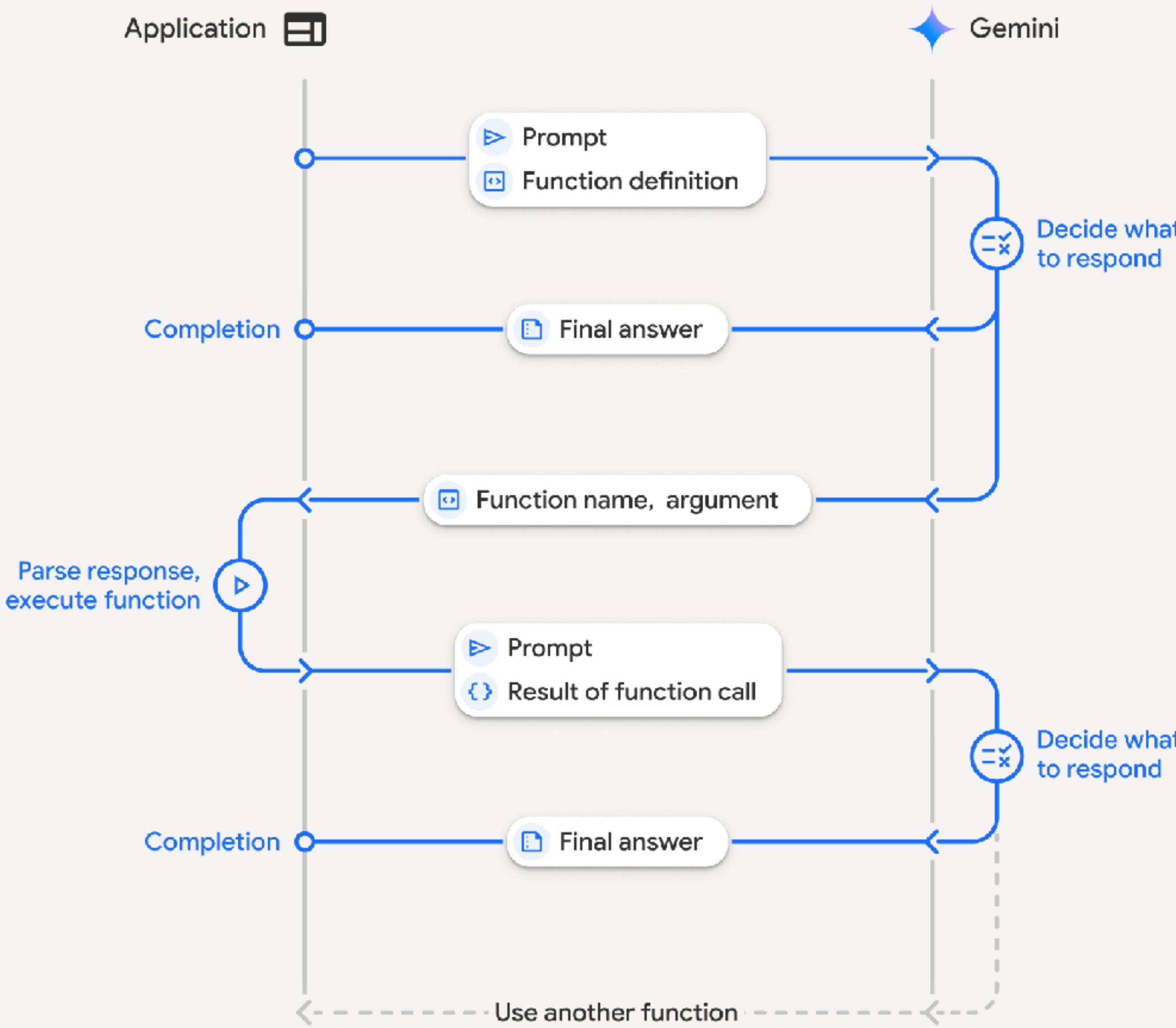


Retrieval Augmented Generation (RAG)

Given this user's financial profile and current market rates, find the best mortgage option across 5 lenders, simulate monthly payments, and generate a PDF summary.







Specifying Tools

POST https://claude.ai/api/organizations/<org-id>/chat_conversations/<conversation-id>/completion

```
{  
  "prompt": "How's the weather in Fremont, California?",  
  "tools": [  
    {  
      "name": "get_weather",  
      "description": "Get the weather for a given city",  
      "input_schema": {  
        "type": "object",  
        "properties": {  
          "latitude": {  
            "type": "number",  
            "description": "The latitude of the location"  
          },  
          "longitude": {  
            "type": "number",  
            "description": "The longitude of the location"  
          }  
        },  
        "required": ["latitude", "longitude"]  
      }  
    },  
    ...  
  ]  
}
```

JSON Schema

Processing Response

```
{  
  "type": "message_start",  
  "message": {  
    "id": "chatcompl_...",  
    "type": "message",  
    "role": "assistant",  
    ...  
  }  
}
```

```
{  
  "type": "content_block_start",  
  "index": 0,  
  "content_block": {  
    "type": "text",  
    "text": ""  
  }  
}  
  
{  
  "type": "content_block_delta",  
  "index": 0,  
  "delta": {  
    "type": "text_delta",  
    "text": "I'll check the current weather for"  
  }  
}  
  
{  
  "type": "content_block_delta",  
  "index": 0,  
  "delta": {  
    "type": "text_delta",  
    "text": " Fremont, California for you."  
  }  
}  
  
{  
  "type": "content_block_stop",  
  "index": 0  
}
```

```
{  
  "type": "content_block_start",  
  "index": 1,  
  "content_block": {  
    "type": "tool_use",  
    "name": "get_weather",  
    "input": {},  
    "id": "toolu_..."  
  }  
}  
  
{  
  "type": "content_block_delta",  
  "index": 1,  
  "delta": {  
    "type": "input_json_delta",  
    "partial_json": "{\"latitude\": 37.5485, \"longitude\": -121.9886}"  
  }  
}  
  
{  
  "type": "content_block_stop",  
  "index": 1  
}
```

```
{  
  "type": "content_block_start",  
  "index": 2,  
  "content_block": {  
    "type": "tool_result",  
    "name": "get_weather",  
    "content": [],  
    "is_error": false,  
    "tool_use_id": "toolu_..."  
  }  
}  
  
{  
  "type": "content_block_delta",  
  "index": 2,  
  "delta": {  
    "type": "input_json_delta",  
    "partial_json": "... \\\"temperature_2m\\\":27.8, \\\"wind_speed_10m\\\":12.8} ..."  
  }  
}  
  
{  
  "type": "content_block_stop",  
  "index": 2  
}
```

```
{  
  "type": "content_block_start",  
  "index": 3,  
  "content_block": {  
    "type": "text",  
    "text": "",  
    "citations": []  
  }  
}  
  
{  
  "type": "content_block_delta",  
  "index": 3,  
  "delta": {  
    "type": "text_delta",  
    "text": "\n\nThe weather in Fremont is currently"  
  }  
}  
  
{  
  "type": "content_block_delta",  
  "index": 3,  
  "delta": {  
    "type": "text_delta",  
    "text": " sunny. Perfect day to enjoy outdoor activities!"  
  }  
}  
  
{  
  "type": "content_block_stop",  
  "index": 3  
}
```

```
{  
  "type": "message_delta",  
  "delta": {  
    "stop_reason": "end_turn",  
    "stop_sequence": null  
  }  
}  
  
{  
  "type": "message_stop"  
}
```



```
{  
  "name": "...",  
  "description": "...",  
  "input_schema": {  
    ...  
  }  
}
```

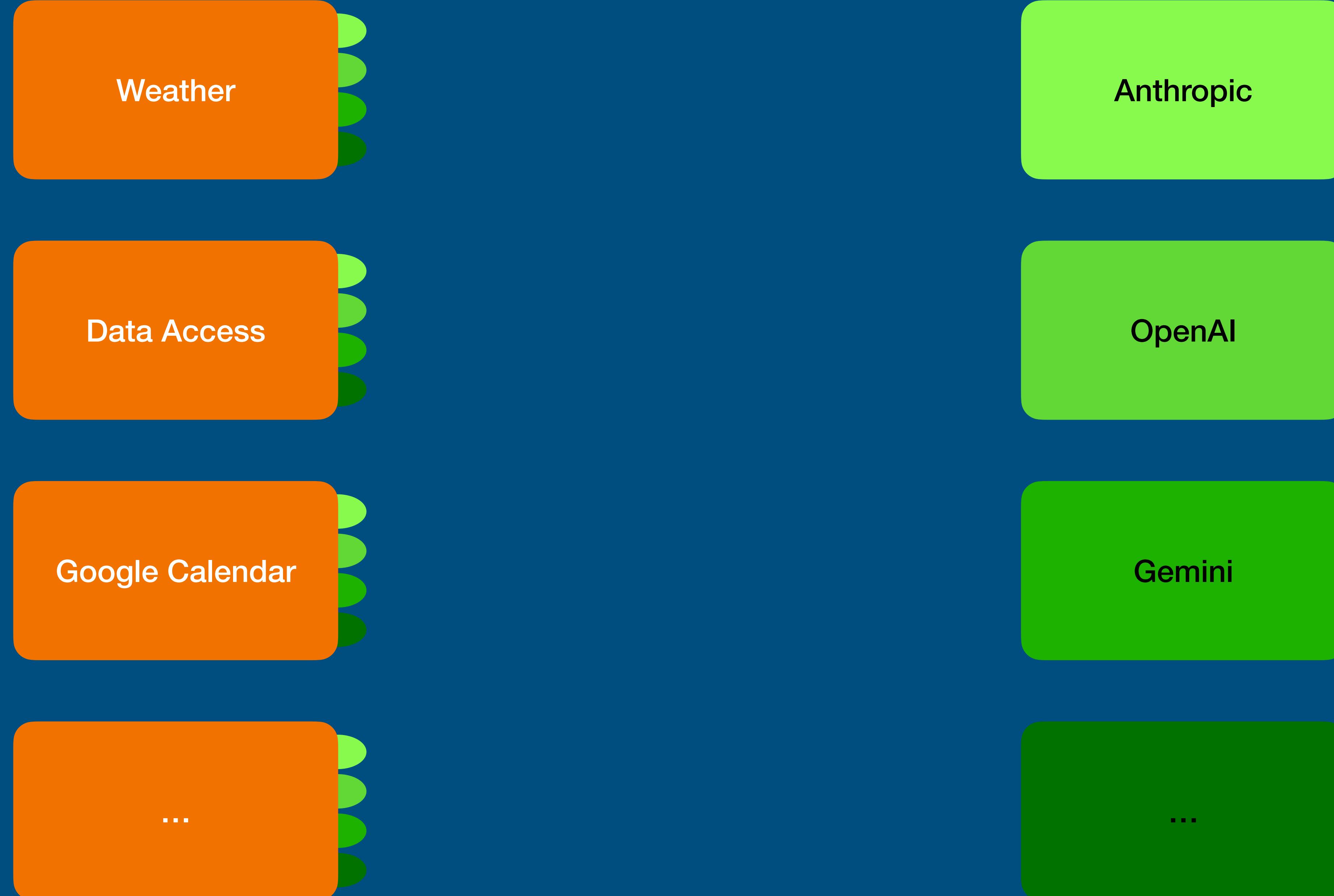
Anthropic

```
{  
  "type": "function",  
  "function": {  
    "name": "...",  
    "description": "...",  
    "parameters": {  
      ...  
    }  
  }  
}
```

OpenAI

```
{  
  "functionDeclarations": [  
    {  
      "name": "...",  
      "description": "...",  
      "parameters": {  
        ...  
      }  
    }  
  ]  
}
```

Google



Weather

Data Access

Google Calendar

...

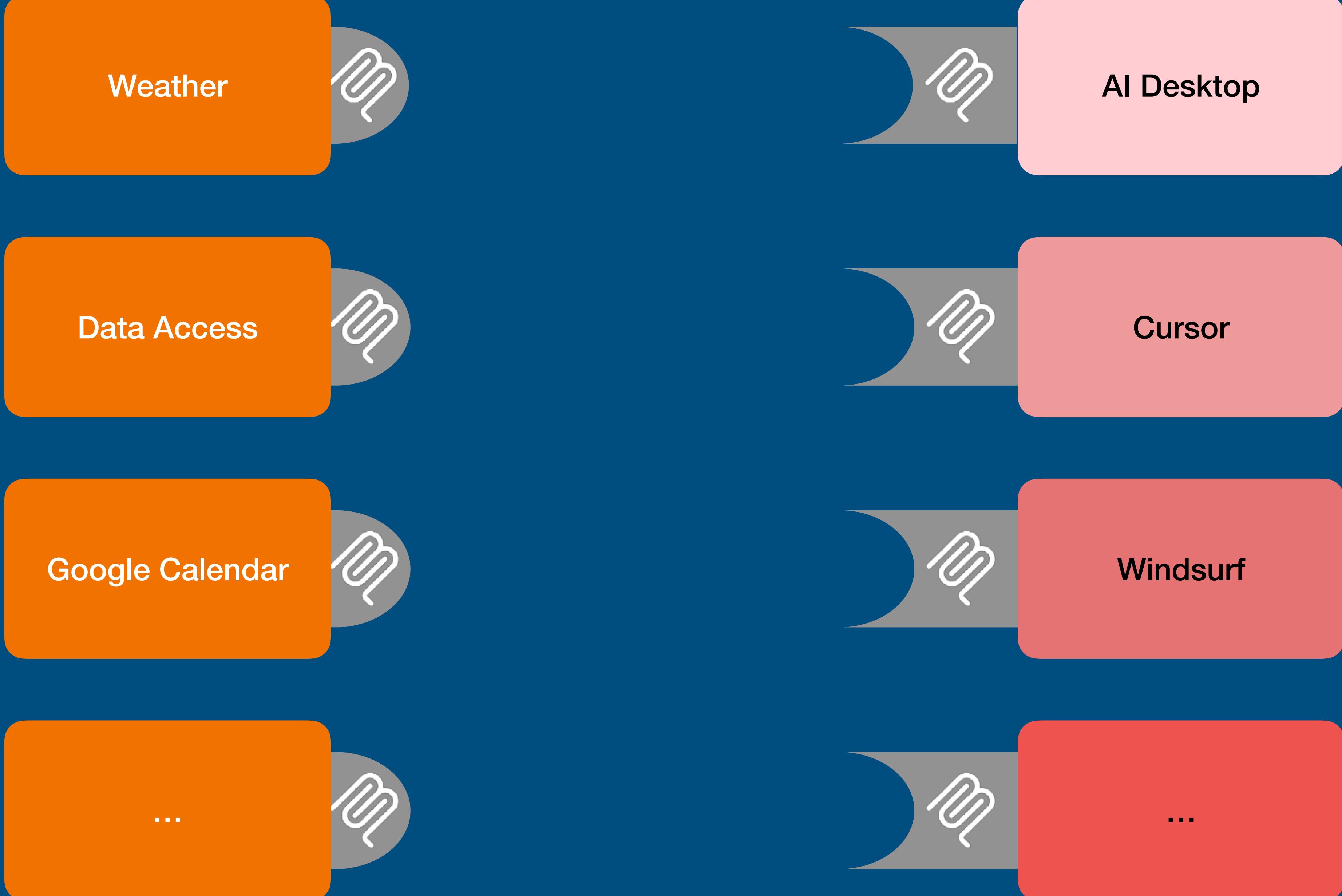
Anthropic

OpenAI

Gemini

...





Weather

Data Access

Google Calendar

...

AI Desktop

Cursor

Windsurf

...

Other concerns

- User consent?
- How to access network tools?
- Authentication?
- Authorization?

Demo



Model Context Protocol

<https://modelcontextprotocol.io>

Unified Protocol Mechanism for Tool Calling

...and more

- Backing from all major LLM vendors
 - Anthropic
 - OpenAI
 - Google
- Supported in many clients
 - Claude Desktop
 - Cursor
 - Windsurf
 - ...
- MCP Servers for everything
 - Github
 - Notion
 - AWS
 - Reference servers
 - Postgres
 - Redis
 - Google Maps
 - Fetch
 - Filesystem

PROTOCOL



JSON-RPC

```
{  
    "jsonrpc": "2.0",  
    "method": "add",  
    "params": {  
        "x": 1,  
        "y": 2  
    },  
    "id": 1  
}
```

Request

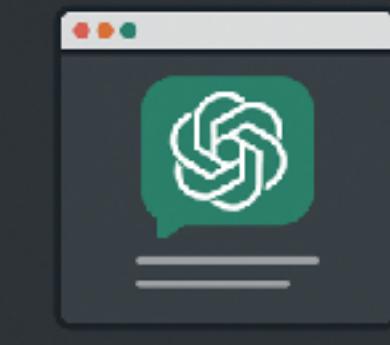
```
{  
    "jsonrpc": "2.0",  
    "result": 3,  
    "id": 1  
}
```

Response

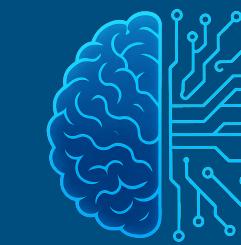
MCP Server



MCP Client



LLM



Help me plan a picnic

Help me plan a picnic + [get_weather, ...]



the weather report is ...

How about playing volleyball ...

Hi, I have these capabilities

And I have these

What tools/prompts/... you offer?

Tools: [get_weather, ...], prompts: ...



get_weather({latitude: .., longitude: ..})



Initialize Request

```
{  
    "method": "initialize",  
    "params": {  
        "protocolVersion": "2024-11-05",  
        "capabilities": {},  
        "clientInfo": {  
            "name": "claude-ai",  
            "version": "0.1.0"  
        }  
    },  
    "jsonrpc": "2.0",  
    "id": 0  
}
```

Initialize Response

```
{  
    "jsonrpc": "2.0",  
    "id": 0,  
    "result": {  
        "protocolVersion": "2024-11-05",  
        "capabilities": {  
            "tools": {}  
        },  
        "serverInfo": {  
            "name": "Weather",  
            "version": "0.1.0"  
        }  
    }  
}
```

Tools List Request

```
{  
  "method": "tools/list",  
  "params": {},  
  "jsonrpc": "2.0",  
  "id": 1  
}
```

Tools List Response

```
{  
  "jsonrpc": "2.0",  
  "id": 1,  
  "result": {  
    "tools": [  
      {  
        "name": "get_weather",  
        "description": "Get the weather for a given city",  
        "inputSchema": {  
          "type": "object",  
          "properties": {  
            "latitude": {  
              "type": "number",  
              "description": "The latitude of the location"  
            },  
            "longitude": {  
              "type": "number",  
              "description": "The longitude of the location"  
            }  
          }  
        },  
        "required": [  
          "latitude", "longitude"  
        ]  
      }  
    ]  
  }  
}
```

JSON Schema

No “outputSchema”

Tools Call Request

```
{  
  "method": "tools/call",  
  "params": {  
    "name": "get_weather",  
    "arguments": {  
      "latitude": 37.5485,  
      "longitude": -121.9886  
    }  
  },  
  "jsonrpc": "2.0",  
  "id": 5  
}
```

Tool Call Response

```
{  
  "jsonrpc": "2.0",  
  "id": 5,  
  "result": {  
    "content": [  
      {  
        "type": "text",  
        "text": "... \"temperature_2m\":27.8,\"wind_speed_10m\":12.8} ..."}  
      ]  
    },  
    "isError": false  
  }  
}
```

Other Parts of Protocol

- Server capabilities
 - Prompts
 - Resources
- Client capabilities
 - Sampling
 - Roots

Client Capabilities

- Sampling
- Roots
 - Boundaries for the server to operate
- Logging
 - Log sink for the server

Sampling

- Allows servers to use the client's LLM
- Useful when creating “smart” MCP servers
 - Without their own LLM

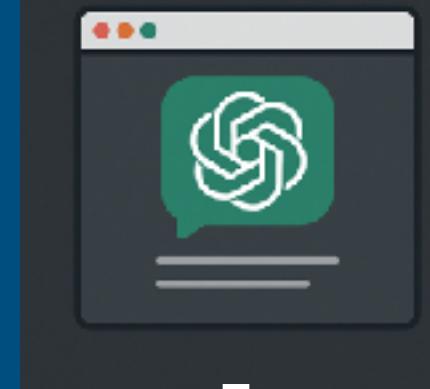
Generate Exograph model for a Slack clone!

MCP Server



Create Exograph model
for a Slack clone

MCP Client



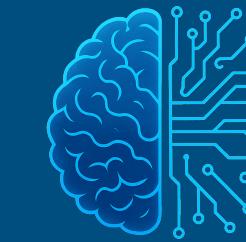
Create Exograph model...+
[create_model, fix_errors, create_seed, ...]

create_model("Create Exograph...")

The Exograph language is defined as...
Create Exograph model for a Slack clone

```
context AuthContext {  
    @jwt("sub") id: Int  
    @jwt("role") role: String = "user"  
}  
  
@postgres  
module SlackDatabase {  
    @access(self.user.id == AuthContext.id || AuthContext.role == "admin")  
    type Message {  
        ...  
    }  
}
```

LLM





Stdio

- Read from stdin
- Write to stdout
- Logs to stderr

Streamable HTTP

- Replaces the SSE transport from the 2024-11-05 version
 - Allows stateless MCP servers
 - Allows serverless MCP servers
- Optional SSE-based support for bi-directional communication

<https://modelcontextprotocol.io/specification/2025-03-26/basic/transports#streamable-http>



Changing landscape

- Version 2024-11-05
 - No auth support
- Version 2025-03-26
 - OAuth
 - Requires MCP servers to act as AS and RS
- Version draft
 - Allows MCP servers to act only as RS

Challenges

Standard Evolution

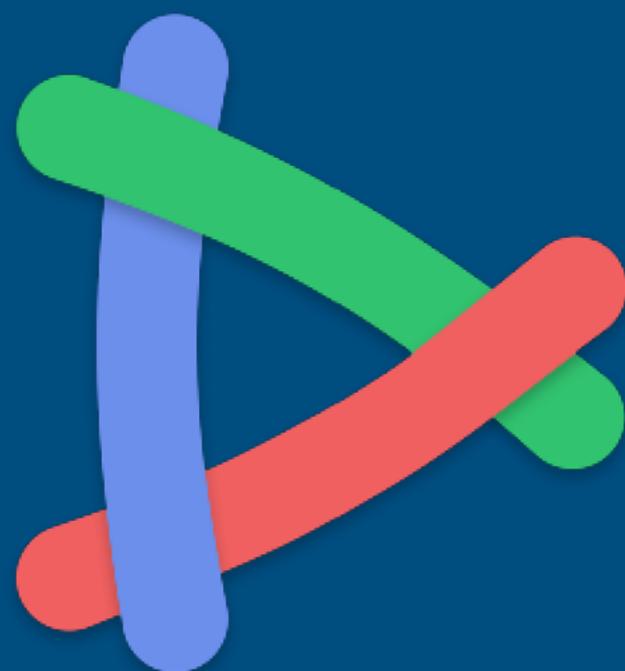
- Is streaming HTTP good enough?
 - Should WebSockets be supported?
- How to deal with long-running tools?
 - Perhaps with “web-hooks”?
 - Do we need to use A2A?

Challenges Production Usage

- How can LLMs deal with too many tools?
 - Auto-filtering on the client side?
 - Consult an LLM to filter tools?
- Marketplace?
 - Trust
 - Security
- Testing and verification

Github MCP
Dynamic Tool Selection

Getting Started with Model Context Protocol



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