

Getting Started with Model Context Protocol



Ramnivas Laddad

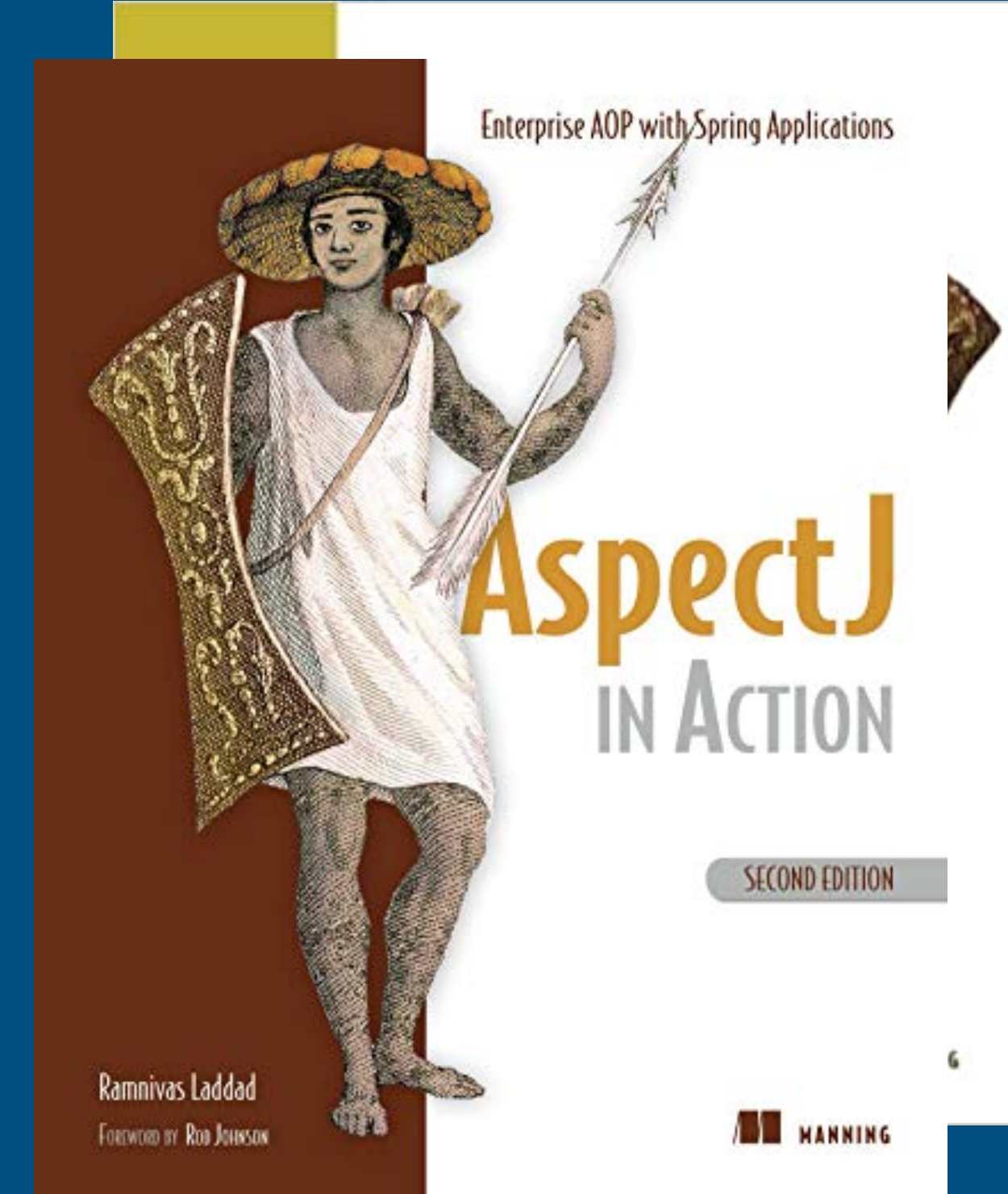
@ramnivas

<https://exograph.dev>



Who am I?

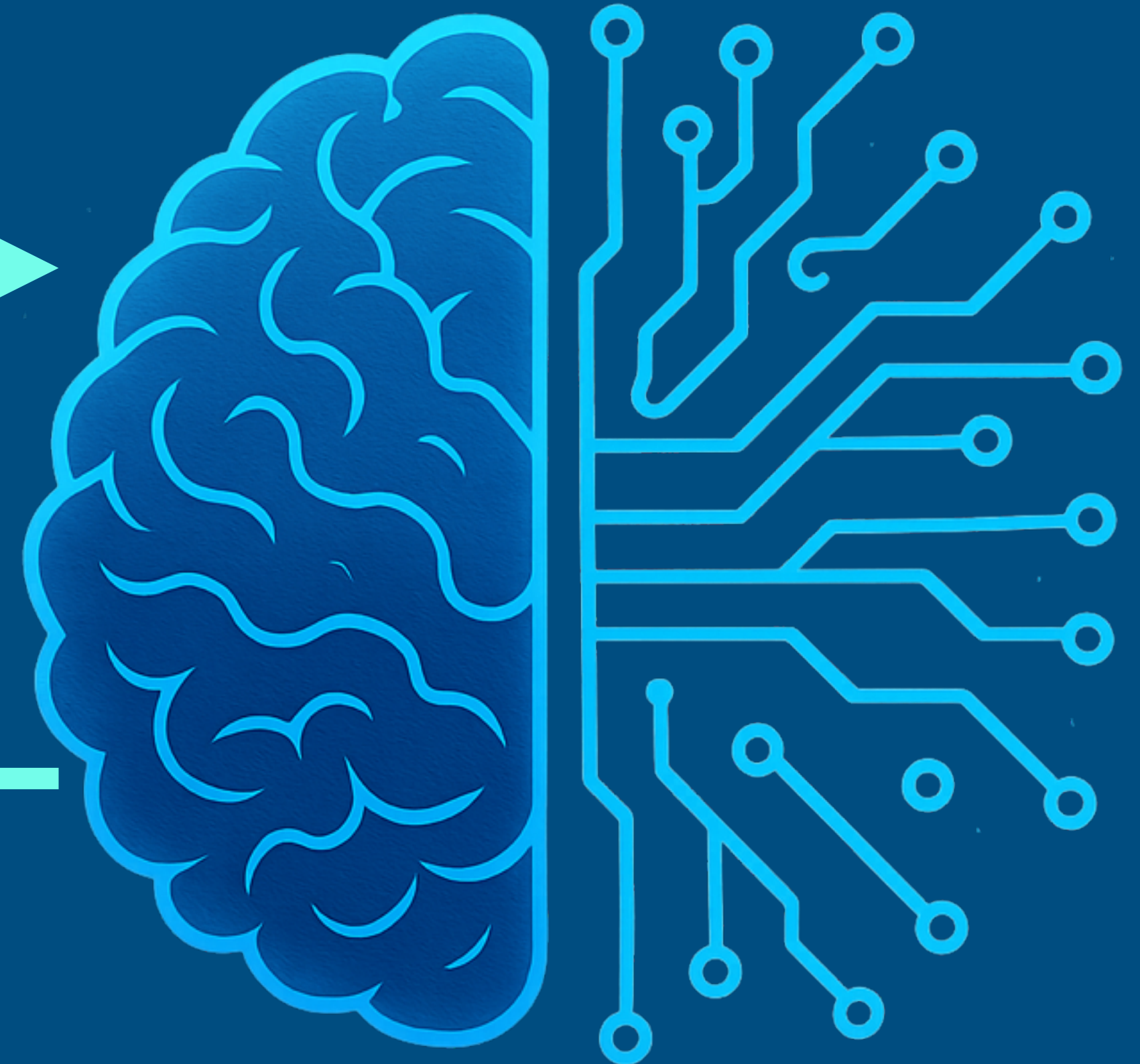
- Co-founder of Exograph
- Former Spring Framework and Cloud Foundry committer
- Author of “AspectJ in Action”
- Speaker at many professional conferences: JavaOne, Spring Experience, Scala Days, O’Reilly OSCON, Scale By The Bay, etc.
- Indian Classical Music aficionado





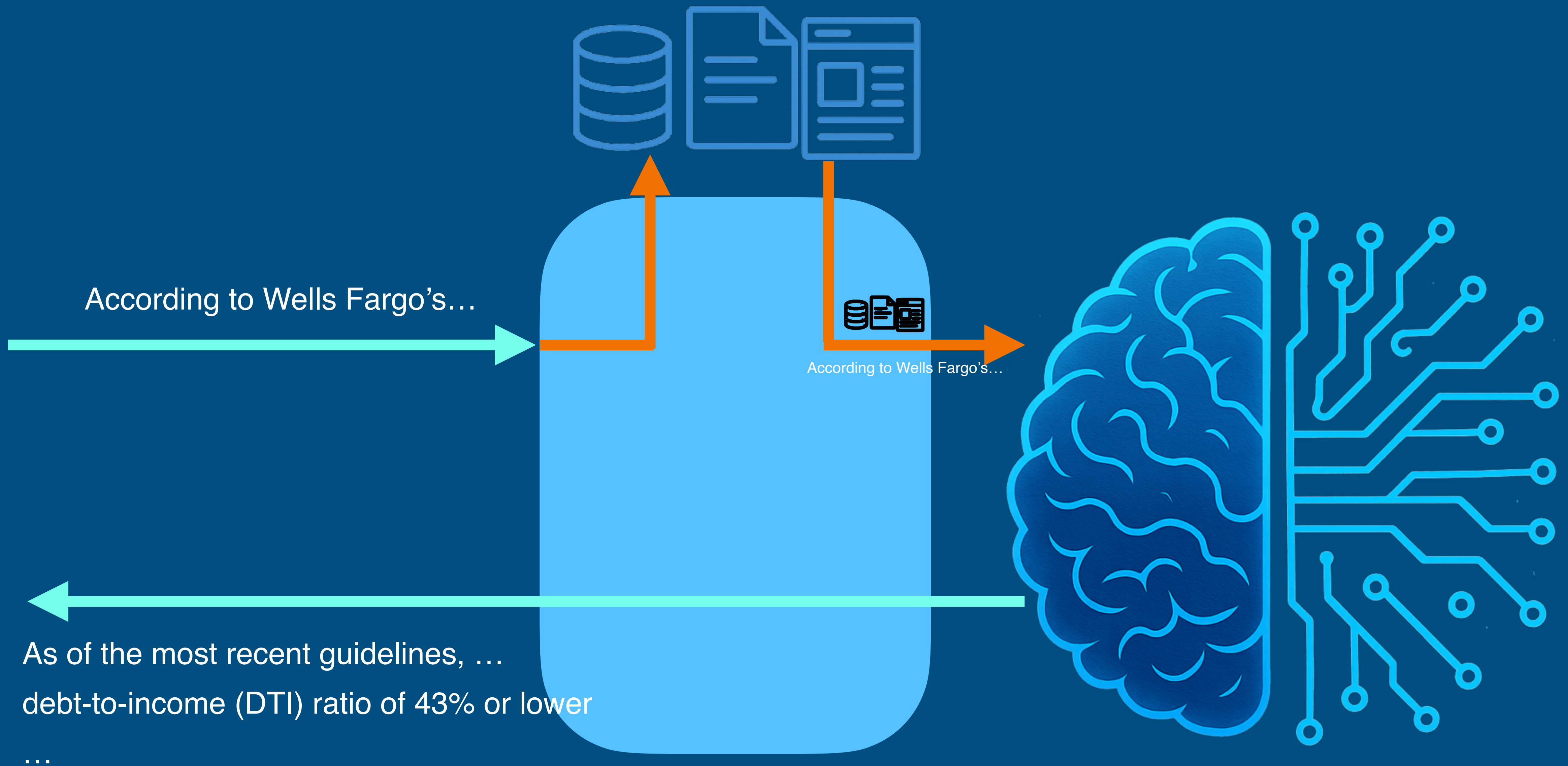
What's the difference between a fixed-rate and adjustable-rate mortgage?

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



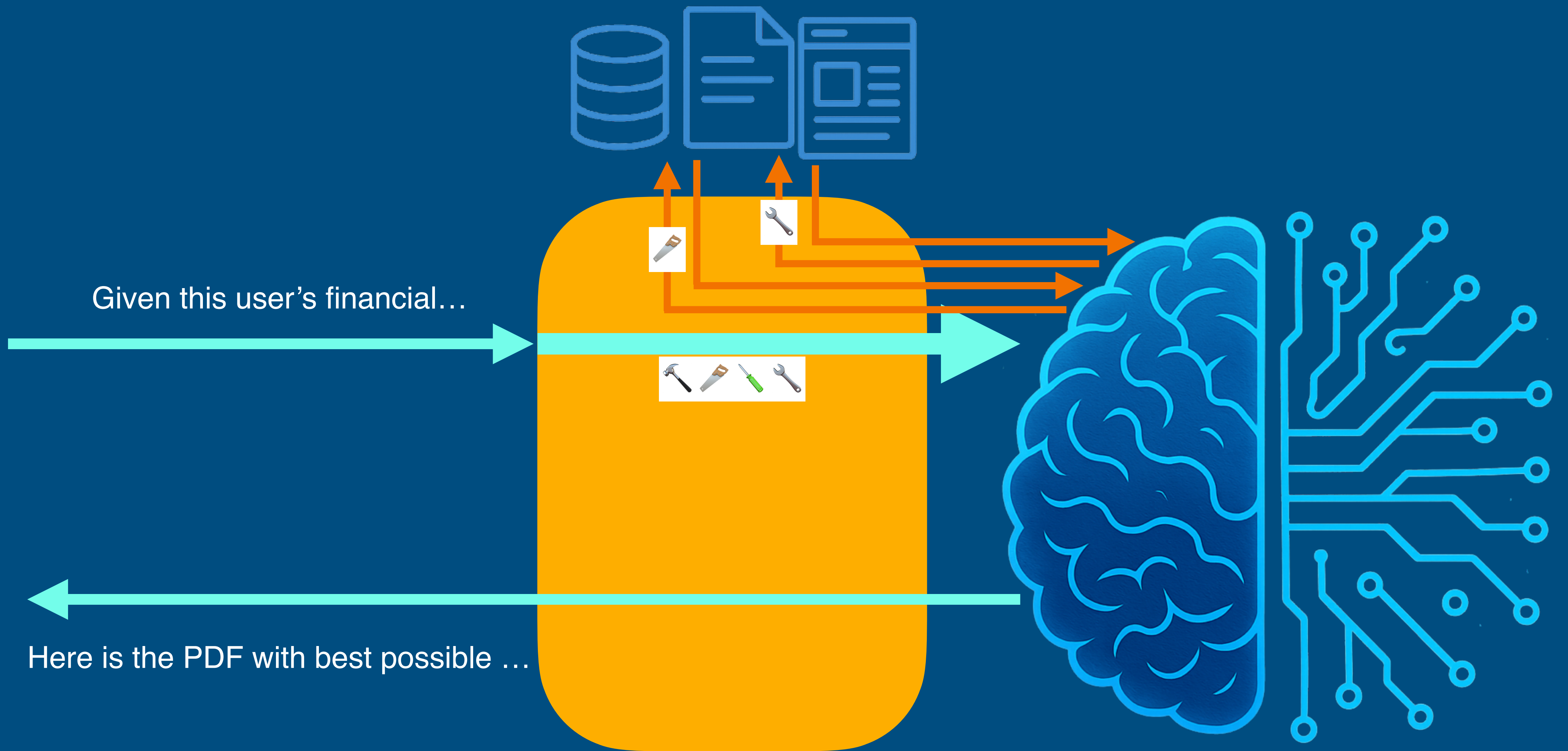
A fixed-rate mortgage has an interest rate that stays the
same for the entire term of the loan, while
an adjustable-rate mortgage (ARM) ...

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

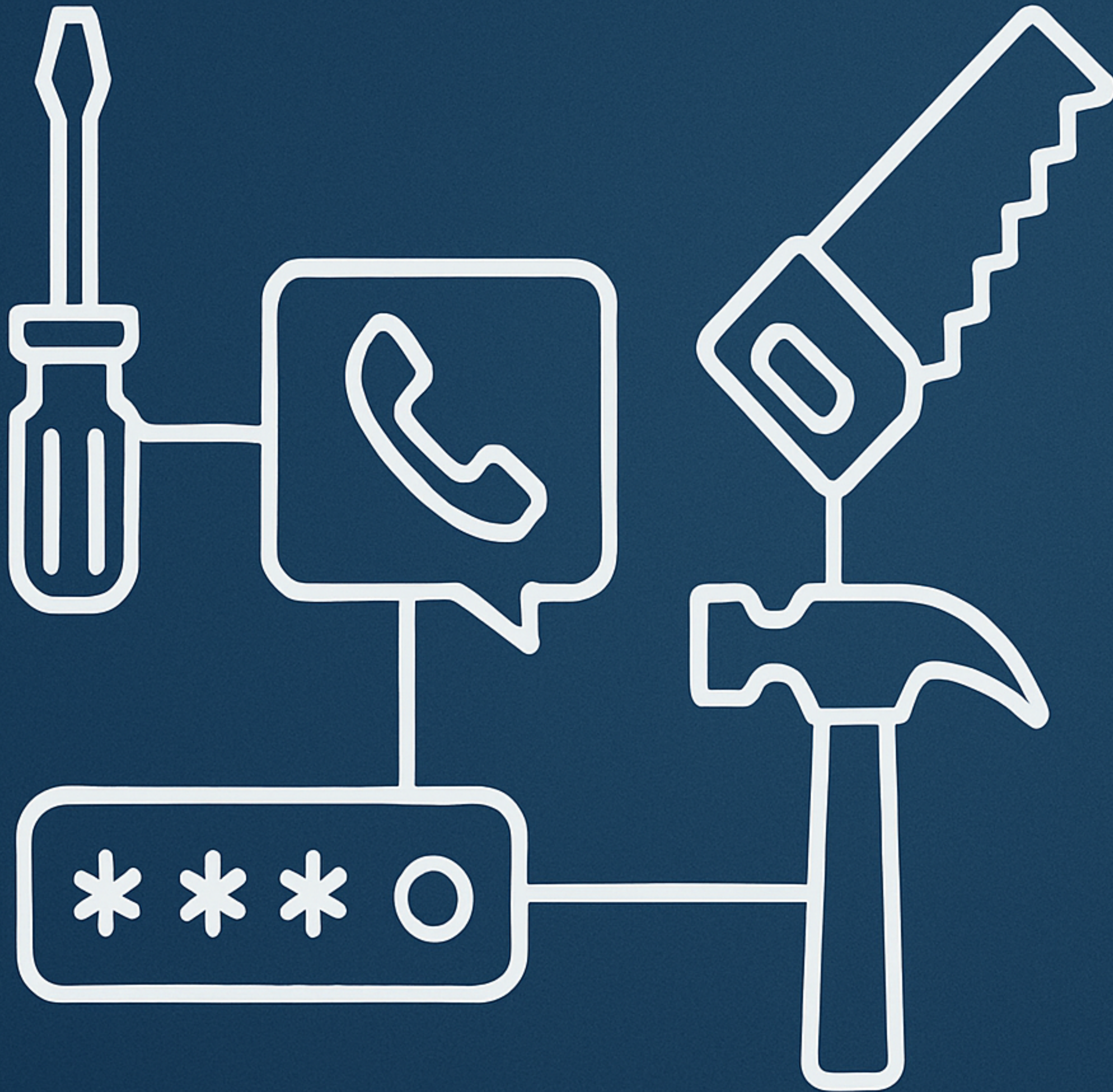


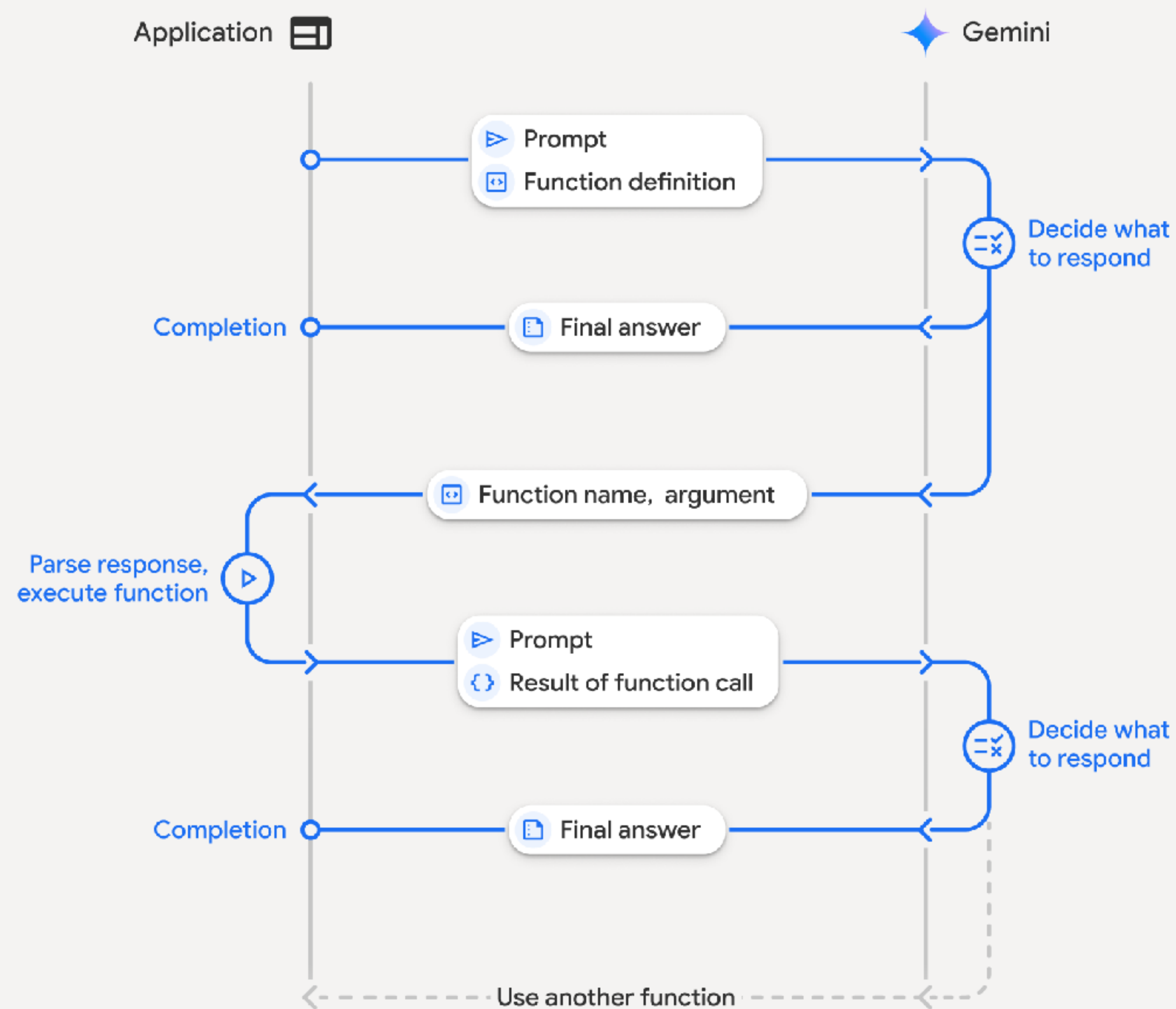
Retrieval Augmented Generation (RAG)

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.



Tool Calling





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



Anthropic

Data Access



OpenAI

Marketplace/App Store

Google Calendar



Gemini

...



...

Weather



AI Desktop

Data Access



Cursor

Google Calendar



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

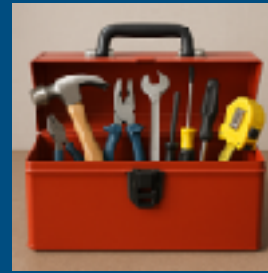
```
{  
  "jsonrpc": "2.0",  
  "method": "add",  
  "params": {  
    "x": 1,  
    "y": 2  
  },  
  "id": 1  
}
```

Request

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

Response

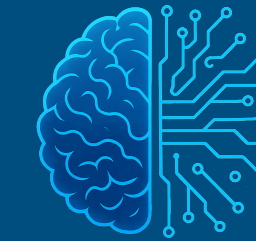
MCP Server



MCP Client



LLM



Help me plan a picnic

Hi, I have these capabilities

And I have these

What tools/prompts/... you offer?

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

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

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

the weather report is ...

How about playing volleyball ...



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

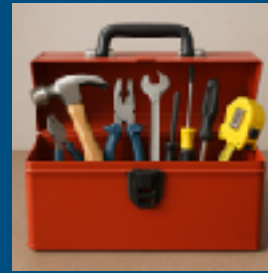
- Sampling
- Roots
 - Boundaries for the server to operate
- Logging
 - Log sink for the server

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!

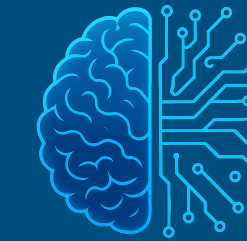
MCP Server



MCP Client



LLM



Create Exograph model
for a Slack clone

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 {  
    ...  
  }  
}
```




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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<https://exograph.dev>

