Let’s be smart, doing AI with WildFly

ehugonne@redhat.com, jdenise@redhat.com

Feedback form

Presentation topics

- WildFly MCP project
  - MCP protocol
  - Interact with running WildFly servers in natural language
- JakartaEE meets AI
  - Develop AI applications with WildFly
  - WildFly AI feature-pack


WildFly MCP
WildFly

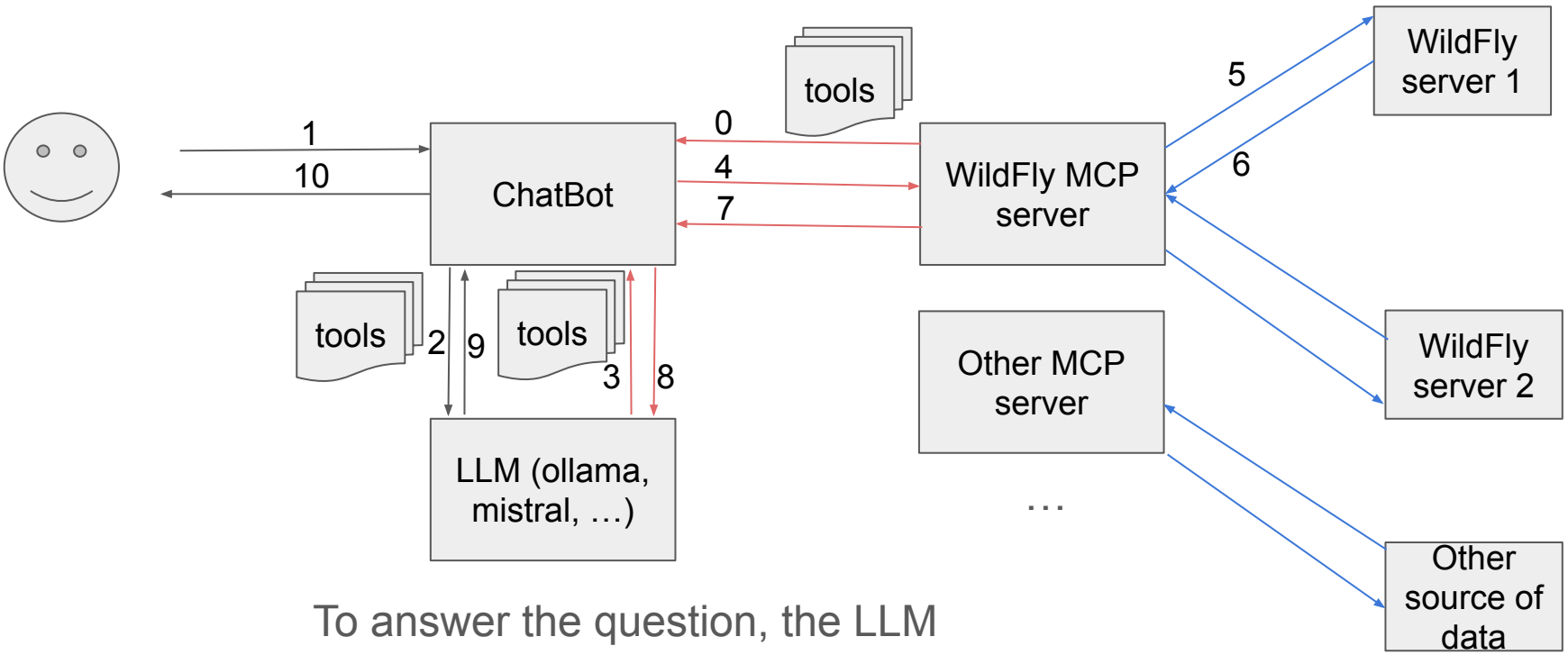
MCP (Model Context Protocol)

- MCP specification specifies integration of external sources of data inside the LLM (Large Language Model) context.
- Enrich LLM capabilities with access to live data (DB, running servers, graphic generation, forecasts, code, file system/web access, git repos,...).
- Although a new spec (2024-11-05), the set of existing MCP servers is quite impressive.
- 3 main features
  - Tools
  - Prompts
  - Resources

MCP tools

- Some LLM have the capability to execute tools (functions) to compute a reply.
- MCP specifies a way to describe and invoke tools.
- MCP tools are served by an MCP server
- MCP tools are consumed by an MCP client (AI application, e.g.: chatbot)

MCP tools workflow



To answer the question, the LLM identifies a need to invoke 0 to N tools

JSON Message sent to the LLM


```
"messages" : [ {

    "role" : "user",

    "content" : "What is the status of my wildfly server?"

  } ],

  "tools" : [ {

    "function" : {

      "name" : "getWildFlyServerConfiguration",

     "description" : "Gets the server configuration and the deployed applications in JSON
format",

},{

    "function" : {

      "name" : "getWildFlyHealth",

     "description" : "Get the WildFly server Health.",

}, …
```

LLM reply, chatbot call the MCP servers


```
{"role":"assistant",

"tool_calls":[

{"id":"5Q4LZOT8w",

"function": {"name":"getWildFlyHealth","arguments":"{}”}

}]

}
```

Chatbot then re-send to the LLM


```
"messages" : [ {
    "role" : "user",
    "content" : "What is the status of my wildfly server?"
  },
{ "role" : "assistant",
  "tool_calls" : "getWildFlyHealth"
},
{ "role" : "tool",
"content" : [{"name" : "deployments-status", "outcome" : true, "data" : [{
"servlet-security.war" : "OK" }]},{"name" : "suspend-state", "outcome" : true, "data" : [{
"value" : "RUNNING" }]},{"name" : "boot-errors", "outcome" : true},{"name" :
"server-state", "outcome" : true, "data" : [{ "value" : "running" }]},{"name" :
"live-server", "outcome" : true},{"name" : "started-server", "outcome" : true},{ "outcome"
: true }]
} ]
```

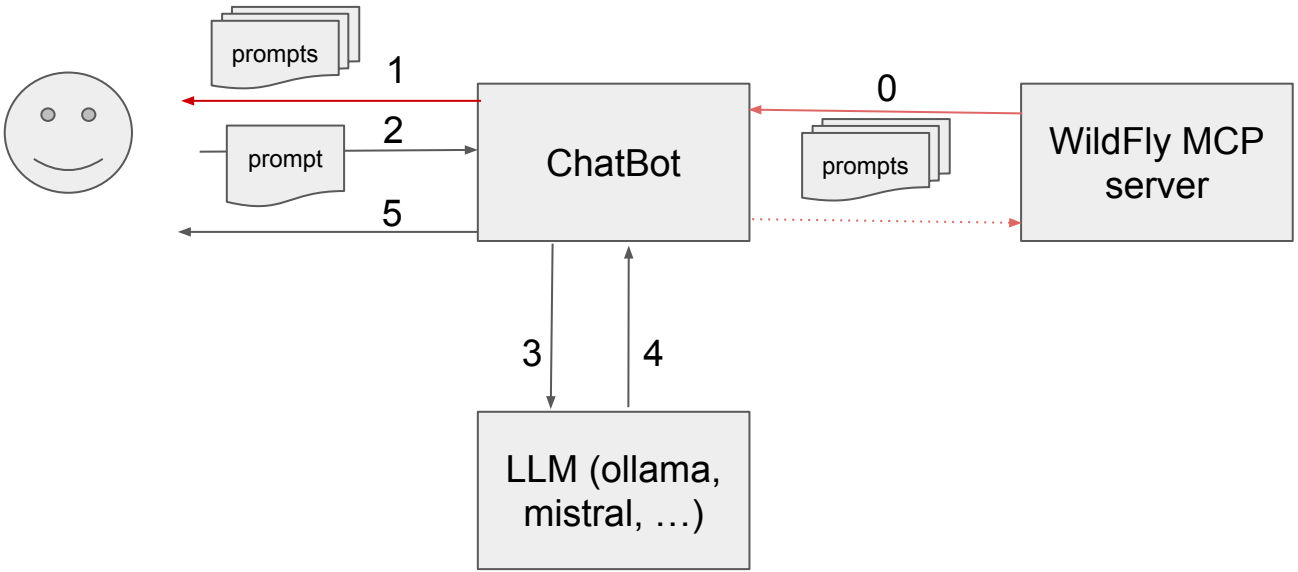
LLM final reply targeted to the user


```
"messages" : [ {
    "role" : "assistant",
    "content" : "The WildFly server is running, all deployments are up and running."
  } ]
```

MCP prompts

- Pre-defined questions (user prompts) that MCP server exposes
- Chatbot discovers and exposes the prompts to the user
- User can configure and execute a given prompt
- The LLM receives the selected prompt like any other question

MCP prompts workflow



WildFly server 1

WildFly server 2

LLM receives the user selected prompt as a normal question, it can initiates a tool workflow if needed.

MCP resources

- Data exposed by an MCP server (documentation, log, ...)
- Chatbot discovers the resources and expose them to the user.
- User can select resources
- Usage of resources is unspecified and chatbot specific. For example:
  - RAG
  - Search,
  - Injected in LLM context, ...

WildFly MCP

- A new project: wildfly-extras/wildfly-mcp
- An MCP server, WildFly MCP server
  - A bridge between LLM and WildFly running instances
  - Can be used in any MCP client (claude-desktop, ...)
- An MCP client example, WildFly Chat Bot
- All those technologies are currently in Alpha grade and evolve quickly!

WildFly MCP server

- A quarkus fat jar application.
- Allows to interact with multiple WildFly server running instances.
- Exposes JVM and WildFly servers source of data:
  - JVM configuration, version, ...
  - Log files, server configuration, Prometheus Metrics, Health status
  - Execute WildFly CLI operation
- Expose Deployment content
  - Deployed applications, binary content (XML descriptors, ...)
- Allows to execute WildFly CLI operations (baby steps... ;-))
- Defines some predefined user prompts one can discover and use.
- Can be built or run as a container image.

WildFly Chat Bot

- Compliant MCP client chat bot:
  - Support for MCP tools and prompts.
  - Configured to use the WildFly MCP server
  - Supports also other MCP stdio and SSE mcp servers.
- Developed with WildFly:
  - Slimmed server provisioned with the WildFly AI Galleon feature-pack
  - WildFly Bootable JAR
  - Lanchain4j API
  - Web socket + javascript
- Can connect to:
  - Ollama (models run locally)
  - Groq
  - Mistral
  - Github models
- Can be built or run as a container image.

WildFly Chat Bot, a UI for developers

- You can use it to interact with:
  - WildFly server (WildFly MCP server), monitor and troubleshoot WildFly.
  - Developed MCP servers using the WildFly API (AI feature-pack)
- Allows to test:
  - Various LLM
  - How your own MCP server (eg: car-booking application) is behaving.
    - You can extend the chatbot system prompt with your own system prompt. For example:

      "You are a car booking fraud detection AI for Miles of Smiles.You have to detect customer fraud in bookings."

    - Direct testing of your MCP tools and prompts.

On WildFly Youtube channel

- Monitoring WildFly with claude-desktop demo
  - Search for security attacks
  - Display metrics in nice charts
- Monitoring and troubleshooting WildFly with the WildFly chatbot demo
  - General monitoring
  - Attempt to identify and fix a configuration issue

Today demos

- Simple monitoring of WildFly server and JVM.
- Monitoring resource consumption and configuration issues
  - Is my application running properly?
- Chasing deployment configuration issues
  - Why do I get an NPE?
- Those demos use Mistral Small LLM

Limitations

- Strongly bound to the capabilities of your LLM
- WildFly CLI operations and WildFly management model not well understood by all LLM.
- Hallucinations and wrong replies are still in the picture…
- Token limits with large logs, server configuration.