Model Context Protocol Tools

This guide walks you through two ways of integrating Model Context Protocol (MCP) with ADK.

What is Model Context Protocol (MCP)?

The Model Context Protocol (MCP) is an open standard designed to standardize how Large Language Models (LLMs) like Gemini and Claude communicate with external applications, data sources, and tools. Think of it as a universal connection mechanism that simplifies how LLMs obtain context, execute actions, and interact with various systems.

MCP follows a client-server architecture, defining how **data** (resources), **interactive templates** (prompts), and **actionable functions** (tools) are exposed by an **MCP server** and consumed by an **MCP client** (which could be an LLM host application or an AI agent).

This guide covers two primary integration patterns:

1. **Using Existing MCP Servers within ADK:** An ADK agent acts as an MCP client, leveraging tools provided by external MCP servers.
2. **Exposing ADK Tools via an MCP Server:** Building an MCP server that wraps ADK tools, making them accessible to any MCP client.

Prerequisites

Before you begin, ensure you have the following set up:

- **Set up ADK:** Follow the standard ADK setup instructions in the quickstart.
- **Install/update Python/Java:** MCP requires Python version of 3.9 or higher for Python or Java 17+.
- **Setup Node.js and npx: (Python only)** Many community MCP servers are distributed as Node.js packages and run using `npx`. Install Node.js

(which includes npx) if you haven't already. For details, see https://nodejs.org/en.

- **Verify Installations: (Python only)** Confirm `adk` and `npx` are in your PATH within the activated virtual environment:

```
# Both commands should print the path to the executables.
which adk
which npx
```

1. Using MCP servers with ADK agents (ADK as an MCP client) in `adk web`

This section demonstrates how to integrate tools from external MCP (Model Context Protocol) servers into your ADK agents. This is the **most common** integration pattern when your ADK agent needs to use capabilities provided by an existing service that exposes an MCP interface. You will see how the `MCPToolset` class can be directly added to your agent's `tools` list, enabling seamless connection to an MCP server, discovery of its tools, and making them available for your agent to use. These examples primarily focus on interactions within the `adk web` development environment.

`MCPToolset` class

The `MCPToolset` class is ADK's primary mechanism for integrating tools from an MCP server. When you include an `MCPToolset` instance in your agent's `tools` list, it automatically handles the interaction with the specified MCP server. Here's how it works:

1. **Connection Management:** On initialization, `MCPToolset` establishes and manages the connection to the MCP server. This can be a local server process (using `StdioServerParameters` for communication over standard input/output) or a remote server (using `SseServerParams` for Server-Sent Events). The toolset also handles the graceful shutdown of this connection when the agent or application terminates.
2. **Tool Discovery & Adaptation:** Once connected, `MCPToolset` queries the MCP server for its available tools (via the `list_tools` MCP method). It then converts the schemas of these discovered MCP tools into ADK-compatible `BaseTool` instances.

3. **Exposure to Agent:** These adapted tools are then made available to your `LlmAgent` as if they were native ADK tools.
4. **Proxying Tool Calls:** When your `LlmAgent` decides to use one of these tools, `MCPToolset` transparently proxies the call (using the `call_tool` MCP method) to the MCP server, sends the necessary arguments, and returns the server's response back to the agent.
5. **Filtering (Optional):** You can use the `tool_filter` parameter when creating an `MCPToolset` to select a specific subset of tools from the MCP server, rather than exposing all of them to your agent.

The following examples demonstrate how to use `MCPToolset` within the `adk web` development environment. For scenarios where you need more fine-grained control over the MCP connection lifecycle or are not using `adk web`, refer to the "Using MCP Tools in your own Agent out of `adk web`" section later in this page.

Example 1: File System MCP Server

This example demonstrates connecting to a local MCP server that provides file system operations.

Step 1: Define your Agent with `MCPToolset`

Create an `agent.py` file (e.g., in `./adk_agent_samples/mcp_agent/agent.py`). The `MCPToolset` is instantiated directly within the `tools` list of your `LlmAgent`.

- **Important:** Replace `"/path/to/your/folder"` in the `args` list with the **absolute path** to an actual folder on your local system that the MCP server can access.
- **Important:** Place the `.env` file in the parent directory of the `./adk_agent_samples` directory.

```
# ./adk_agent_samples/mcp_agent/agent.py
import os # Required for path operations
from google.adk.agents import LlmAgent
from google.adk.tools.mcp_tool.mcp_toolset import MCPToolset,
StdioServerParameters

# It's good practice to define paths dynamically if possible,
# or ensure the user understands the need for an ABSOLUTE path.
```

```
# For this example, we'll construct a path relative to this
file,
# assuming '/path/to/your/folder' is in the same directory as
agent.py.
# REPLACE THIS with an actual absolute path if needed for your
setup.
TARGET_FOLDER_PATH =
os.path.join(os.path.dirname(os.path.abspath(__file__)),
"/path/to/your/folder")
# Ensure TARGET_FOLDER_PATH is an absolute path for the MCP
server.
# If you created ./adk_agent_samples/mcp_agent/your_folder,

root_agent = LlmAgent(
    model='gemini-2.0-flash',
    name='filesystem_assistant_agent',
    instruction='Help the user manage their files. You can list
files, read files, etc.',
    tools=[
        MCPToolset(
            connection_params=StdioServerParameters(
                command='npx',
                args=[
                    "-y",  # Argument for npx to auto-confirm
install
                    "@modelcontextprotocol/server-filesystem",
                    # IMPORTANT: This MUST be an ABSOLUTE path
to a folder the
                    # npx process can access.
                    # Replace with a valid absolute path on
your system.
                    # For example:
"/Users/youruser/accessible_mcp_files"
                    # or use a dynamically constructed absolute
path:
                    os.path.abspath(TARGET_FOLDER_PATH),
                ],
            ),
            # Optional: Filter which tools from the MCP server
are exposed
            # tool_filter=['list_directory', 'read_file']
        )
    ],
)
```

Step 2: Create an `__init__.py` file

Ensure you have an `__init__.py` in the same directory as `agent.py` to make it a discoverable Python package for ADK.

```
# ./adk_agent_samples/mcp_agent/__init__.py
```

```
from . import agent
```

Step 3: Run `adk web` and Interact

Navigate to the parent directory of `mcp_agent` (e.g., `adk_agent_samples`) in your terminal and run:

```
cd ./adk_agent_samples # Or your equivalent parent directory
adk web
```

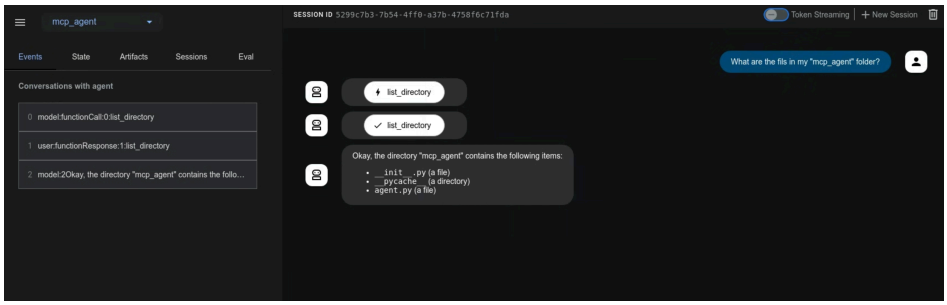
Note for Windows users

When hitting the `_make_subprocess_transport NotImplementedError`, consider using `adk web --no-reload` instead.

Once the ADK Web UI loads in your browser:

1. Select the `filesystem_assistant_agent` from the agent dropdown.
2. Try prompts like:
   - "List files in the current directory."
   - "Can you read the file named sample.txt?" (assuming you created it in `TARGET_FOLDER_PATH`).
   - "What is the content of `another_file.md`?"

You should see the agent interacting with the MCP file system server, and the server's responses (file listings, file content) relayed through the agent. The `adk web` console (terminal where you ran the command) might also show logs from the `npx` process if it outputs to stderr.



Example 2: Google Maps MCP Server

This example demonstrates connecting to the Google Maps MCP server.

Step 1: Get API Key and Enable APIs

1. **Google Maps API Key:** Follow the directions at Use API keys to obtain a Google Maps API Key.
2. **Enable APIs:** In your Google Cloud project, ensure the following APIs are enabled:
   - Directions API
   - Routes API For instructions, see the Getting started with Google Maps Platform documentation.

Step 2: Define your Agent with `MCPToolset` for Google Maps

Modify your `agent.py` file (e.g., in `./adk_agent_samples/mcp_agent/agent.py`). Replace `YOUR_GOOGLE_MAPS_API_KEY` with the actual API key you obtained.

```
# ./adk_agent_samples/mcp_agent/agent.py
import os
from google.adk.agents import LlmAgent
from google.adk.tools.mcp_tool.mcp_toolset import MCPToolset,
StdioServerParameters

# Retrieve the API key from an environment variable or directly
insert it.
# Using an environment variable is generally safer.
# Ensure this environment variable is set in the terminal where
you run 'adk web'.
# Example: export GOOGLE_MAPS_API_KEY="YOUR_ACTUAL_KEY"
google_maps_api_key = os.environ.get("GOOGLE_MAPS_API_KEY")

if not google_maps_api_key:
    # Fallback or direct assignment for testing - NOT
RECOMMENDED FOR PRODUCTION
    google_maps_api_key = "YOUR_GOOGLE_MAPS_API_KEY_HERE" #
Replace if not using env var
    if google_maps_api_key == "YOUR_GOOGLE_MAPS_API_KEY_HERE":
        print("WARNING: GOOGLE_MAPS_API_KEY is not set. Please
set it as an environment variable or in the script.")
        # You might want to raise an error or exit if the key
is crucial and not found.

root_agent = LlmAgent(
    model='gemini-2.0-flash',
    name='maps_assistant_agent',
```

```
    instruction='Help the user with mapping, directions, and
finding places using Google Maps tools.',
    tools=[
        MCPToolset(
            connection_params=StdioServerParameters(
                command='npx',
                args=[
                    "-y",
                    "@modelcontextprotocol/server-google-maps",
                ],
                # Pass the API key as an environment variable
to the npx process
                # This is how the MCP server for Google Maps
expects the key.
                env={
                    "GOOGLE_MAPS_API_KEY": google_maps_api_key
                }
            ),
            # You can filter for specific Maps tools if needed:
            # tool_filter=['get_directions',
'find_place_by_id']
        )
    ],
)
```

Step 3: Ensure `__init__.py` Exists

If you created this in Example 1, you can skip this. Otherwise, ensure you have an `__init__.py` in the `./adk_agent_samples/mcp_agent/` directory:

```
# ./adk_agent_samples/mcp_agent/__init__.py
from . import agent
```

Step 4: Run `adk web` and Interact

1. **Set Environment Variable (Recommended):** Before running `adk web`, it's best to set your Google Maps API key as an environment variable in your terminal:

   ```
   export GOOGLE_MAPS_API_KEY="YOUR_ACTUAL_GOOGLE_MAPS_API_KEY"
   ```

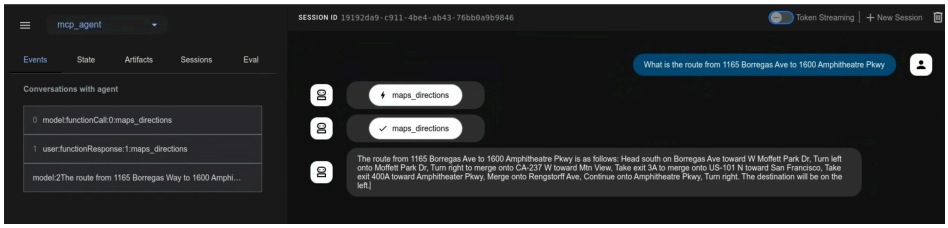
   Replace `YOUR_ACTUAL_GOOGLE_MAPS_API_KEY` with your key.

2. **Run `adk web`**: Navigate to the parent directory of `mcp_agent` (e.g., `adk_agent_samples`) and run:

```
cd ./adk_agent_samples # Or your equivalent parent directory
adk web
```

3. **Interact in the UI**:
    - Select the `maps_assistant_agent`.
    - Try prompts like:
        - "Get directions from GooglePlex to SFO."
        - "Find coffee shops near Golden Gate Park."
        - "What's the route from Paris, France to Berlin, Germany?"

You should see the agent use the Google Maps MCP tools to provide directions or location-based information.



2. Building an MCP server with ADK tools (MCP server exposing ADK)

This pattern allows you to wrap existing ADK tools and make them available to any standard MCP client application. The example in this section exposes the ADK `load_web_page` tool through a custom-built MCP server.

Summary of steps

You will create a standard Python MCP server application using the `mcp` library. Within this server, you will:

1. Instantiate the ADK tool(s) you want to expose (e.g., `FunctionTool(load_web_page)`).
2. Implement the MCP server's `@app.list_tools()` handler to advertise the ADK tool(s). This involves converting the ADK tool definition to the MCP schema using the `adk_to_mcp_tool_type` utility from `google.adk.tools.mcp_tool.conversion_utils`.

3. Implement the MCP server's `@app.call_tool()` handler. This handler will:
    - Receive tool call requests from MCP clients.
    - Identify if the request targets one of your wrapped ADK tools.
    - Execute the ADK tool's `.run_async()` method.
    - Format the ADK tool's result into an MCP-compliant response (e.g., `mcp.types.TextContent`).

Prerequisites

Install the MCP server library in the same Python environment as your ADK installation:

```
pip install mcp
```

Step 1: Create the MCP Server Script

Create a new Python file for your MCP server, for example, `my_adk_mcp_server.py`.

Step 2: Implement the Server Logic

Add the following code to `my_adk_mcp_server.py`. This script sets up an MCP server that exposes the ADK `load_web_page` tool.

```
# my_adk_mcp_server.py
import asyncio
import json
import os
from dotenv import load_dotenv

# MCP Server Imports
from mcp import types as mcp_types # Use alias to avoid
conflict
from mcp.server.lowlevel import Server, NotificationOptions
from mcp.server.models import InitializationOptions
import mcp.server.stdio # For running as a stdio server

# ADK Tool Imports
from google.adk.tools.function_tool import FunctionTool
from google.adk.tools.load_web_page import load_web_page #
Example ADK tool
```

```
# ADK <-> MCP Conversion Utility
from google.adk.tools.mcp_tool.conversion_utils import
adk_to_mcp_tool_type

# --- Load Environment Variables (If ADK tools need them, e.g.,
API keys) ---
load_dotenv() # Create a .env file in the same directory if
needed

# --- Prepare the ADK Tool ---
# Instantiate the ADK tool you want to expose.
# This tool will be wrapped and called by the MCP server.
print("Initializing ADK load_web_page tool...")
adk_tool_to_expose = FunctionTool(load_web_page)
print(f"ADK tool '{adk_tool_to_expose.name}' initialized and
ready to be exposed via MCP.")
# --- End ADK Tool Prep ---

# --- MCP Server Setup ---
print("Creating MCP Server instance...")
# Create a named MCP Server instance using the mcp.server
library
app = Server("adk-tool-exposing-mcp-server")

# Implement the MCP server's handler to list available tools
@app.list_tools()
async def list_mcp_tools() -> list[mcp_types.Tool]:
    """MCP handler to list tools this server exposes."""
    print("MCP Server: Received list_tools request.")
    # Convert the ADK tool's definition to the MCP Tool schema
format
    mcp_tool_schema = adk_to_mcp_tool_type(adk_tool_to_expose)
    print(f"MCP Server: Advertising tool:
{mcp_tool_schema.name}")
    return [mcp_tool_schema]

# Implement the MCP server's handler to execute a tool call
@app.call_tool()
async def call_mcp_tool(
    name: str, arguments: dict
) -> list[mcp_types.Content]: # MCP uses mcp_types.Content
    """MCP handler to execute a tool call requested by an MCP
client."""
    print(f"MCP Server: Received call_tool request for '{name}'
with args: {arguments}")

    # Check if the requested tool name matches our wrapped ADK
tool
    if name == adk_tool_to_expose.name:
        try:
            # Execute the ADK tool's run_async method.
            # Note: tool_context is None here because this MCP
server is
```

```
            # running the ADK tool outside of a full ADK Runner
invocation.
            # If the ADK tool requires ToolContext features
(like state or auth),
            # this direct invocation might need more
sophisticated handling.
            adk_tool_response = await
adk_tool_to_expose.run_async(
                args=arguments,
                tool_context=None,
            )
            print(f"MCP Server: ADK tool '{name}' executed.
Response: {adk_tool_response}")

            # Format the ADK tool's response (often a dict)
into an MCP-compliant format.
            # Here, we serialize the response dictionary as a
JSON string within TextContent.
            # Adjust formatting based on the ADK tool's output
and client needs.
            response_text = json.dumps(adk_tool_response,
indent=2)
            # MCP expects a list of mcp_types.Content parts
            return [mcp_types.TextContent(type="text",
text=response_text)]

        except Exception as e:
            print(f"MCP Server: Error executing ADK tool
'{name}': {e}")
            # Return an error message in MCP format
            error_text = json.dumps({"error": f"Failed to
execute tool '{name}': {str(e)}"})
            return [mcp_types.TextContent(type="text",
text=error_text)]
    else:
        # Handle calls to unknown tools
        print(f"MCP Server: Tool '{name}' not found/exposed by
this server.")
        error_text = json.dumps({"error": f"Tool '{name}' not
implemented by this server."})
        return [mcp_types.TextContent(type="text",
text=error_text)]

# --- MCP Server Runner ---
async def run_mcp_stdio_server():
    """Runs the MCP server, listening for connections over
standard input/output."""
    # Use the stdio_server context manager from the
mcp.server.stdio library
    async with mcp.server.stdio.stdio_server() as (read_stream,
write_stream):
        print("MCP Stdio Server: Starting handshake with
client...")
```

```
        await app.run(
            read_stream,
            write_stream,
            InitializationOptions(
                server_name=app.name, # Use the server name
defined above
                server_version="0.1.0",
                capabilities=app.get_capabilities(
                    # Define server capabilities - consult MCP
docs for options
                    notification_options=NotificationOptions(),
                    experimental_capabilities={},
                ),
            ),
        )
        print("MCP Stdio Server: Run loop finished or client
disconnected.")

if __name__ == "__main__":
    print("Launching MCP Server to expose ADK tools via
stdio...")
    try:
        asyncio.run(run_mcp_stdio_server())
    except KeyboardInterrupt:
        print("\nMCP Server (stdio) stopped by user.")
    except Exception as e:
        print(f"MCP Server (stdio) encountered an error: {e}")
    finally:
        print("MCP Server (stdio) process exiting.")
# --- End MCP Server ---
```

Step 3: Test your Custom MCP Server with an ADK Agent

Now, create an ADK agent that will act as a client to the MCP server you just built. This ADK agent will use `MCPToolset` to connect to your `my_adk_mcp_server.py` script.

Create an `agent.py` (e.g., in `./adk_agent_samples/mcp_client_agent/agent.py`):

```
# ./adk_agent_samples/mcp_client_agent/agent.py
import os
from google.adk.agents import LlmAgent
from google.adk.tools.mcp_tool import MCPToolset,
StdioServerParameters

# IMPORTANT: Replace this with the ABSOLUTE path to your
my_adk_mcp_server.py script
PATH_TO_YOUR_MCP_SERVER_SCRIPT =
"/path/to/your/my_adk_mcp_server.py" # <<< REPLACE
```

```
if PATH_TO_YOUR_MCP_SERVER_SCRIPT ==
"/path/to/your/my_adk_mcp_server.py":
    print("WARNING: PATH_TO_YOUR_MCP_SERVER_SCRIPT is not set.
Please update it in agent.py.")
    # Optionally, raise an error if the path is critical

root_agent = LlmAgent(
    model='gemini-2.0-flash',
    name='web_reader_mcp_client_agent',
    instruction="Use the 'load_web_page' tool to fetch content
from a URL provided by the user.",
    tools=[
        MCPToolset(
            connection_params=StdioServerParameters(
                command='python3', # Command to run your MCP
server script
                args=[PATH_TO_YOUR_MCP_SERVER_SCRIPT], #
Argument is the path to the script
            )
            # tool_filter=['load_web_page'] # Optional: ensure
only specific tools are loaded
        )
    ],
)
```

And an `__init__.py` in the same directory:

```
# ./adk_agent_samples/mcp_client_agent/__init__.py
from . import agent
```

To run the test:

1. **Start your custom MCP server (optional, for separate observation):** You can run your `my_adk_mcp_server.py` directly in one terminal to see its logs:

   ```
   python3 /path/to/your/my_adk_mcp_server.py
   ```

   It will print "Launching MCP Server..." and wait. The ADK agent (run via `adk web`) will then connect to this process if the `command` in `StdioServerParameters` is set up to execute it. *(Alternatively, `MCPToolset` will start this server script as a subprocess automatically when the agent initializes).*

2. **Run `adk web` for the client agent:** Navigate to the parent directory of `mcp_client_agent` (e.g., `adk_agent_samples`) and run:

```
cd ./adk_agent_samples # Or your equivalent parent directory
adk web
```

3. **Interact in the ADK Web UI:**
    - Select the `web_reader_mcp_client_agent`.
    - Try a prompt like: "Load the content from https://example.com"

The ADK agent (`web_reader_mcp_client_agent`) will use `MCPToolset` to start and connect to your `my_adk_mcp_server.py`. Your MCP server will receive the `call_tool` request, execute the ADK `load_web_page` tool, and return the result. The ADK agent will then relay this information. You should see logs from both the ADK Web UI (and its terminal) and potentially from your `my_adk_mcp_server.py` terminal if you ran it separately.

This example demonstrates how ADK tools can be encapsulated within an MCP server, making them accessible to a broader range of MCP-compliant clients, not just ADK agents.

Refer to the documentation, to try it out with Claude Desktop.

Using MCP Tools in your own Agent out of `adk web`

This section is relevant to you if:

- You are developing your own Agent using ADK
- And, you are **NOT** using `adk web`,
- And, you are exposing the agent via your own UI

Using MCP Tools requires a different setup than using regular tools, due to the fact that specs for MCP Tools are fetched asynchronously from the MCP Server running remotely, or in another process.

The following example is modified from the "Example 1: File System MCP Server" example above. The main differences are:

1. Your tool and agent are created asynchronously
2. You need to properly manage the exit stack, so that your agents and tools are destructed properly when the connection to MCP Server is closed.

```
# agent.py (modify get_tools_async and other parts as needed)
# ./adk_agent_samples/mcp_agent/agent.py
import os
import asyncio
from dotenv import load_dotenv
from google.genai import types
from google.adk.agents.llm_agent import LlmAgent
from google.adk.runners import Runner
from google.adk.sessions import InMemorySessionService
from google.adk.artifacts.in_memory_artifact_service import
InMemoryArtifactService # Optional
from google.adk.tools.mcp_tool.mcp_toolset import MCPToolset,
SseServerParams, StdioServerParameters

# Load environment variables from .env file in the parent
directory
# Place this near the top, before using env vars like API keys
load_dotenv('../.env')

# Ensure TARGET_FOLDER_PATH is an absolute path for the MCP
server.
TARGET_FOLDER_PATH =
os.path.join(os.path.dirname(os.path.abspath(__file__)),
"/path/to/your/folder")

# --- Step 1: Agent Definition ---
async def get_agent_async():
  """Creates an ADK Agent equipped with tools from the MCP
Server."""
  toolset = MCPToolset(
      # Use StdioServerParameters for local process
communication
      connection_params=StdioServerParameters(
          command='npx', # Command to run the server
          args=["-y",    # Arguments for the command
                "@modelcontextprotocol/server-filesystem",
                TARGET_FOLDER_PATH],
      ),
      tool_filter=['read_file', 'list_directory'] # Optional:
filter specific tools
      # For remote servers, you would use SseServerParams
instead:
      # connection_params=SseServerParams(url="http://remote-
server:port/path", headers={...})
  )

  # Use in an agent
  root_agent = LlmAgent(
      model='gemini-2.0-flash', # Adjust model name if needed
based on availability
      name='enterprise_assistant',
      instruction='Help user accessing their file systems',
      tools=[toolset], # Provide the MCP tools to the ADK agent
```

```
    )
    return root_agent, toolset

# --- Step 2: Main Execution Logic ---
async def async_main():
    session_service = InMemorySessionService()
    # Artifact service might not be needed for this example
    artifacts_service = InMemoryArtifactService()

    session = await session_service.create_session(
        state={}, app_name='mcp_filesystem_app',
user_id='user_fs'
    )

    # TODO: Change the query to be relevant to YOUR specified
folder.
    # e.g., "list files in the 'documents' subfolder" or "read
the file 'notes.txt'"
    query = "list files in the tests folder"
    print(f"User Query: '{query}'")
    content = types.Content(role='user', parts=
[types.Part(text=query)])

    root_agent, toolset = await get_agent_async()

    runner = Runner(
        app_name='mcp_filesystem_app',
        agent=root_agent,
        artifact_service=artifacts_service, # Optional
        session_service=session_service,
    )

    print("Running agent...")
    events_async = runner.run_async(
        session_id=session.id, user_id=session.user_id,
new_message=content
    )

    async for event in events_async:
      print(f"Event received: {event}")

    # Cleanup is handled automatically by the agent framework
    # But you can also manually close if needed:
    print("Closing MCP server connection...")
    await toolset.close()
    print("Cleanup complete.")

if __name__ == '__main__':
    try:
      asyncio.run(async_main())
    except Exception as e:
      print(f"An error occurred: {e}")
```

Key considerations

When working with MCP and ADK, keep these points in mind:

- **Protocol vs. Library:** MCP is a protocol specification, defining communication rules. ADK is a Python library/framework for building agents. MCPToolset bridges these by implementing the client side of the MCP protocol within the ADK framework. Conversely, building an MCP server in Python requires using the model-context-protocol library.
- **ADK Tools vs. MCP Tools:**
  - ADK Tools (BaseTool, FunctionTool, AgentTool, etc.) are Python objects designed for direct use within the ADK's LlmAgent and Runner.
  - MCP Tools are capabilities exposed by an MCP Server according to the protocol's schema. MCPToolset makes these look like ADK tools to an LlmAgent.
  - Langchain/CrewAI Tools are specific implementations within those libraries, often simple functions or classes, lacking the server/protocol structure of MCP. ADK offers wrappers (LangchainTool, CrewaiTool) for some interoperability.
- **Asynchronous nature:** Both ADK and the MCP Python library are heavily based on the asyncio Python library. Tool implementations and server handlers should generally be async functions.
- **Stateful sessions (MCP):** MCP establishes stateful, persistent connections between a client and server instance. This differs from typical stateless REST APIs.
  - **Deployment:** This statefulness can pose challenges for scaling and deployment, especially for remote servers handling many users. The original MCP design often assumed client and server were co-located. Managing these persistent connections requires careful infrastructure considerations (e.g., load balancing, session affinity).
  - **ADK MCPToolset:** Manages this connection lifecycle. The exit_stack pattern shown in the examples is crucial for ensuring the connection (and potentially the server process) is properly terminated when the ADK agent finishes.

Further Resources

- Model Context Protocol Documentation
- MCP Specification
- MCP Python SDK & Examples