

MCP Tool Idempotency

Current issue:

- Tools can hint that they are idempotent
- No standard way to provide an idempotency key to a tool that hints they are idempotent
- We want to be able to retry tool calls upon failure with idempotency

Current way to achieve idempotency:

Option 1:

- Hash the `CallToolRequest` and make an idempotency key out, e.g:
 - MD5 hash the `CallToolRequest` (32 hex characters long)
 - Make a UUID out of it
- Problem:
 - Hashing is expensive
 - Can easily get hash collisions

Option 2:

- Put the idempotency key in the input schema
- Problem:
 - LLM sees the idempotency key as a tool parameter
 - Either try to generate an idempotency key itself
 - Or, we provide another utility tool that exists to generate a UUID, and it would work like this on failure:
 - The LLM calls that tool to generate the idempotency key
 - Calls the idempotent tool passing in the generated idempotency key (in which it could fail to do the copy properly)
 - Idempotent tool fails
 - It reuses the generated idempotency key and calls again (it could fail here, and either generates a new idempotency key for the same request (which it should not) or fails to copy the existing one)

Solution

- Remove the idempotency key from the inputSchema of the `CallToolRequest`, so that the LLM cannot see it, and instead, at the MCP client level, we begin the work to support retry of idempotent (or readonly) tool calls:

```
if tool_result.retryable_error and (tool.hint.read_only or (tool.hint.idempotent &&
tool_args.has_provided_idempotency_key())):
    # Attempt to retry the tool
    # But what is the standard way to pass the same idempotency key from the prior
    failed request?
```

- Step 1: Introduce a standard way to pass an idempotency key to an MCP tool that is outside of the inputSchema (so that the LLM cannot see), but MCP clients populate for idempotent tools to use optionally.

Passthrough Options

- Pass through the idempotency key in the `_meta`, and reserve the `idempotencyKey` key property
- **Introduce a new attribute to the `CallToolRequest` called `idempotencyKey`**
- Add a special mark like `x-idempotency-key` to existing parameters, so that MCP clients can hide those from the LLM and generate and pass them through appropriately.