MCP Dev Summit Seoul

Beyond APIs: Making MCP Services Faster and Secure With WebAssembly

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MCP is more than an API

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Definitions are good — but the security boundary shifts when **the agent picks what runs**.

▲ TRADITIONAL API · PREDICTABLE

A request follows predefined logic.

Application

API endpoint

Backend

The developer chose this path *before* the request arrived.

▲ MCP · AGENT-DRIVEN

A tool may be chosen dynamically.

AI Agent

MCP server

MCP Tool

└ Files └ Network └ DB └ APIs └ Credentials

The agent picks. The host runs.

> **"The security boundary is no longer only the API endpoint.**
> **It is the execution environment behind the MCP tool."**

We secured the protocol

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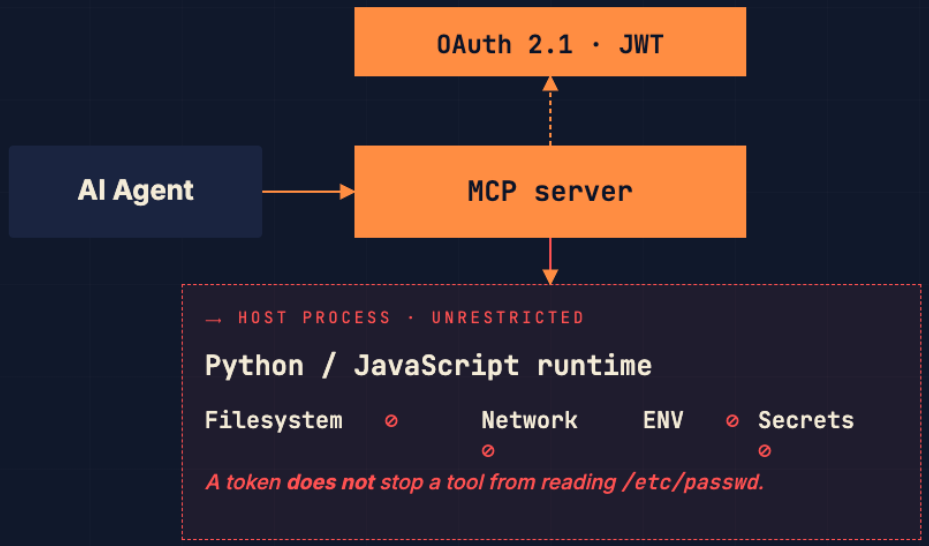
What about execution?

× **Authentication with OAuth ≠ *Execution isolation.***



WHAT MCP'S HTTP SPEC COVERS

- OAuth 2.1 authorization
- Access token flow
- Audience validation
- MCP server as resource server

WHAT IT DOES NOT COVER

- What the tool reads from disk
- Which network it calls
- Which env vars it sees
- Which credentials it holds

"Authorized" ≠ "safe to run."

Spec: MCP HTTP Authorization — OAuth 2.1, token-based, audience-bound. The protocol does not govern runtime behavior.

An MCP tool is code

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A request does **not** arrive alone — it arrives with **side effects**.

SCENARIO · POISONED INPUT

Agent

"Analyze this file"

MCP Tool

```
└ read( "/etc/passwd" ) ?
└ getenv( "AWS_SECRET_KEY" ) ?
└ connect( "unknown-server.com" ) ?
└ exec( "/bin/bash" ) ?
```

Source: MCP-SandboxScan (2026) demonstrates Wasm/WASI sandboxing for tool-run analysis & vuln research.

FOUR ATTACK SURFACES

01 · FILESYSTEM
Read host files, paths outside the intended input.

02 · NETWORK
Exfiltrate data, call arbitrary endpoints.

03 · ENVIRONMENT
Pull tokens, secrets, and config from env vars.

04 · SECRETS
Embedded keys, AWS_SECRET, DB_PASSWORD, outbound leaks.

The agent *doesn't* need to be malicious.
The tool — *or its input* — can be.

The traditional execution model

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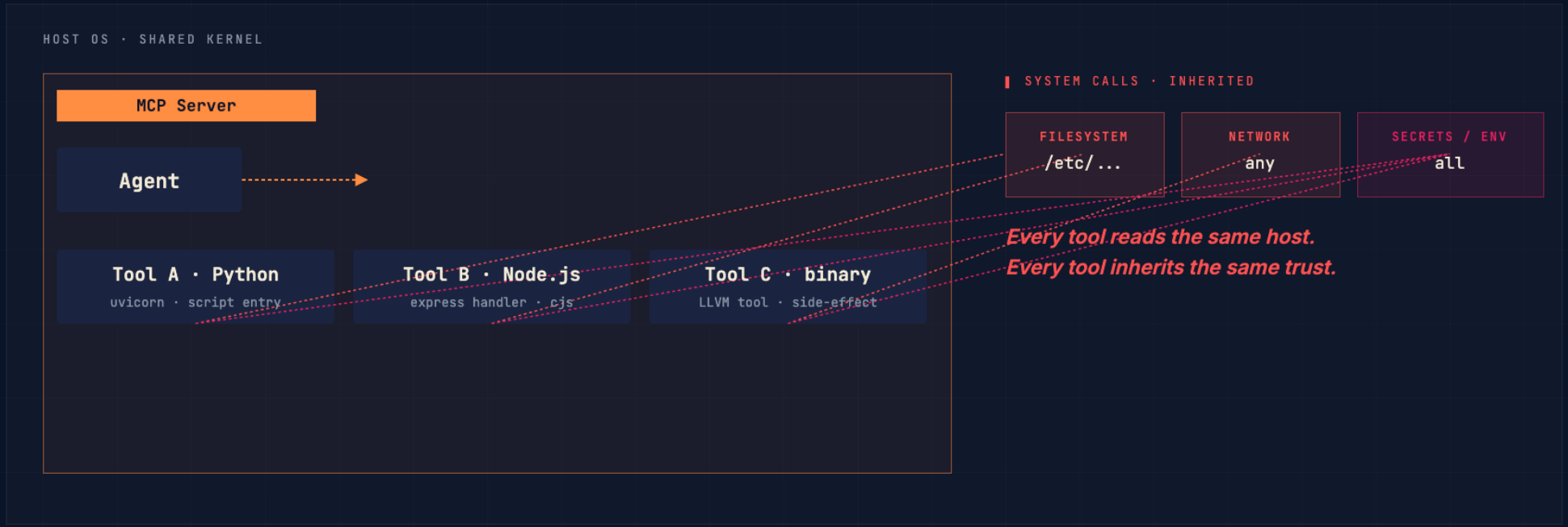
↳ One process. Many tools. Shared host context.



Tools inherit the security context of the host process.

Isolation is possible — but it becomes an infrastructure responsibility.

What if the tool had..

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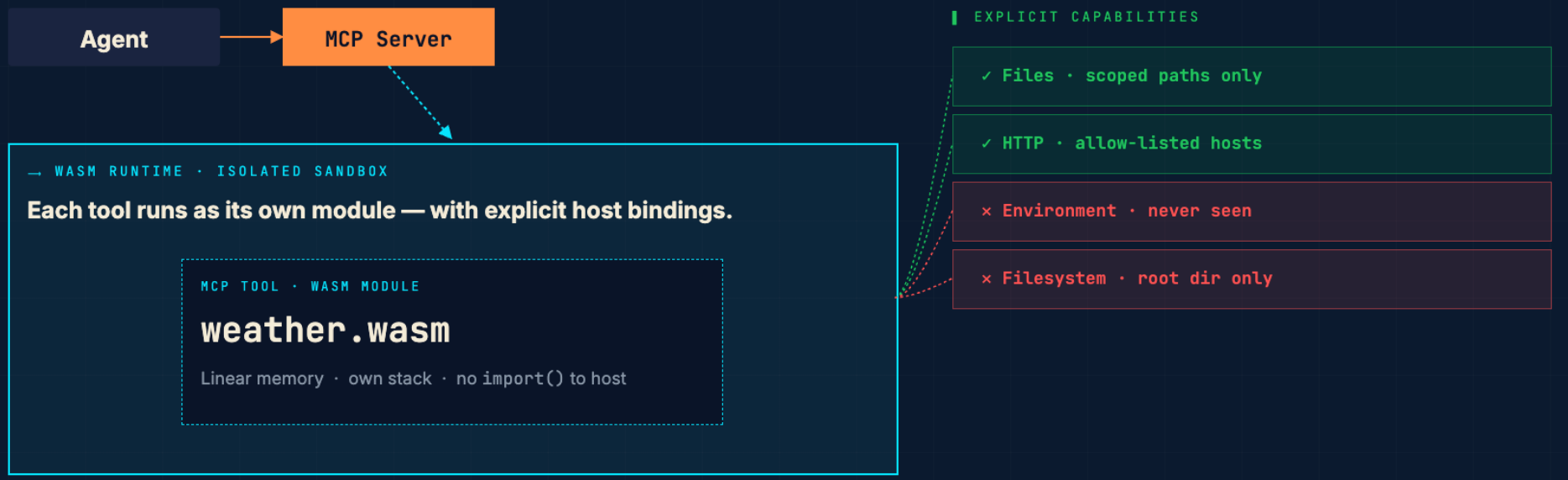
no access by default?

WebAssembly ships modules in a sandbox — and passes host resources through explicit gates.



***WebAssembly's security model* = module-by-module isolation *+ host-controlled* capability gating.**

Why WASM fits MCP

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Four properties that line up with how agents actually use tools.

01 · SANDBOXED

Isolated memory.
Isolated execution.

Modules cannot reach host state indirectly.
Every syscall crosses a host boundary.

02 · FAST STARTUP

Lightweight, head-of-line ready.

Cold-start measured in ms, not seconds — order-of-magnitude lighter than VMs and containers.

03 · PORTABLE

Same module, anywhere.

Compile once. Run on Wasmtime, Wasmer, Spin, edge runtime — portability is the spec.

04 · CAPABILITY-ORIENTED

Deny by default.

WASI explicitly imports required capabilities — nothing ambient, nothing inherited.

The same primitive answer to four different agent pain points.

MCP + WASM Execution Architecture

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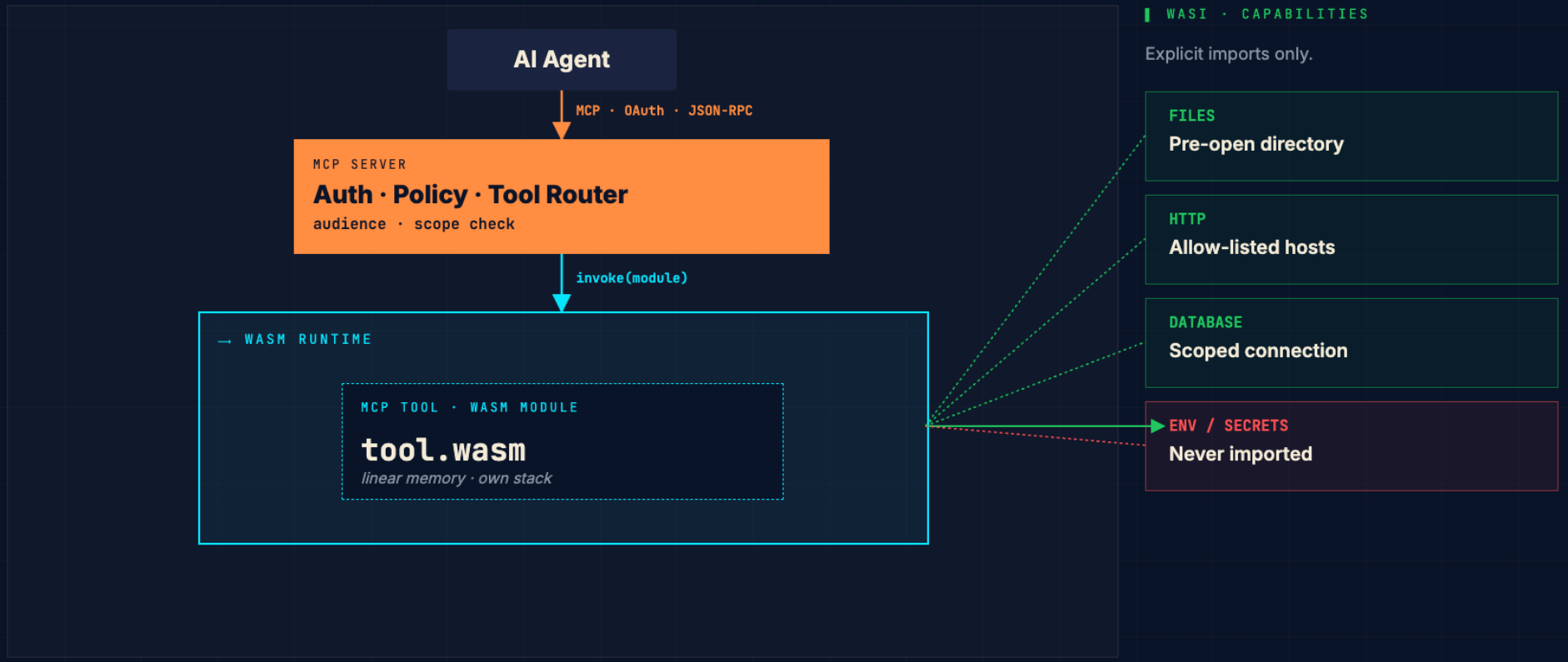

MCP controls WHAT is called.
Wasm controls WHAT that tool can do.

From ambient authority to explicit capability

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Each WASI import becomes an auditable, signed, scoped handle.

BEFORE · AMBIENT AUTHORITY

The tool inherits everything.

- Host filesystem · all paths
- Network · any destination
- Environment · full process env
- Credentials · embedded or env-loaded

A bug in the tool becomes a host-wide incident.

Blast radius = the entire process.

AFTER · WASI · EXPLICIT

The tool requests each binding.

- Filesystem ✓ /data/input only
- Network ✓ api.example.com
- Environment ×
- Secrets × never imported

Violation attempts fail at the runtime boundary.

Blast radius = the module.

Deny by default. **Grant only what the tool needs.**

The tool shouldn’t own the secret

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Capabilities ≠ credentials. In a Wasm model, secrets stay with the host.

▲ ANTI-PATTERN · SECRET-IN-FUNCTION

Credentials live inside the tool.

MCP TOOL · INSIDE

AWS_SECRET_KEY
—— AKIA••••••••

DATABASE_PASSWORD
—— ••••••••

API_TOKEN
—— ••••••••

Compromised tool = leaked credential.

✓ PATTERN · CAPABILITY-BASED

Tool asks; host attaches.

MCP TOOL · WASM
tool.wasm
no secret

host_call("customer-api")

HOST · CREDENTIAL BROKER
Signs & attaches
Vault · metadata broker · policy-aware shortcut

customer-api.com

The tool receives capability, never credentials.

The security layers, three questions

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Authentication checks identity. Authorization checks reach. Execution checks behavior.

LAYER 1

Authentication

Who are you?

EXAMPLE

OAuth

bearer token · JWT validation

IDENTITY PROOF

LAYER 2

Authorization

What can you call?

EXAMPLE

JWT scopes · MCP policy

tool allowed by user role

REACH PROOF

LAYER 3

Execution

What can the tool access?

EXAMPLE

Wasm · WASI capabilities

filesystem, net, env, secrets

BEHAVIOR PROOF

`OAuth → MCP → Policy → Wasm → Capability`

OAuth protects access to the MCP service.

Wasm protects the execution behind it.

Let’s run an MCP tool inside WASM

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A live stack: Client ↔ MCP Server ↔ Wasm runtime ↔ tool.wasm.

THREE PROBES

Same module. Three different outcomes.

PROBE 01

```
get_weather("Seoul")
✓   → 22°C · light rain
```

PROBE 02

```
read("/etc/passwd")
×   → EACCES: capability denied
```

PROBE 03

```
getenv("AWS_SECRET_KEY")
×   → symbol not exported
```

Probe ordering — allow → attack surface one → attack surface two. Same module, three outcomes.

$ MCP<weather> -> WASM

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Three terminal outputs — same module, identical runtime, three outcomes.

STEP 01 · BINDING THE TOOL

```
$ mcp invoke --module=weather.wasm --cap=fs:/data:ro --cap=http:api.weather.example/*
[module] weather.wasm   ready
[cap] fs:/data   ✓ mounted
[cap] http:api.weather.example/*  ✓ allow-listed
[cap] env  × denied · module never imported
```

STEP 02 · ALLOWED CALL

```
$ weather --city "Seoul"
[wasm] http://api.weather.example/v1/forecast?city=Seoul  → 22°C, light rain
✓ call met capability policy   runtime elapsed: ms
```

STEP 03 · FILESYSTEM ATTEMPT

```
$ weather --read "/etc/passwd"
EACCES: capability "/etc/passwd" not in pre-opens
× invocation rejected at runtime boundary   module never saw the call
```

STEP 04 · SECRET EXFIL ATTEMPT

```
$ weather --getenv AWS_SECRET_KEY
UNDEFINED: symbol env::getenv not imported by module
× trap fires at runtime import resolution   credential was never visible
```

Two runtime boundary violations — one successful capability call. The tool didn't patch itself. The runtime said no.

Where MCP + WASM becomes interesting

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Four deployment patterns — from a single tenant to the edge.

PATTERN 01

Multi-Tenant MCP

Many customers, same platform.
Per-tenant modules — per-tenant caps.

PATTERN 02

Enterprise Agents

Internal APIs · DBs · least privilege by tool.

PATTERN 03

Untrusted Tools

Community modules, third-party scripts.
Run them safely by design.

PATTERN 04 · AKAMAI

Edge MCP

Lightweight modules at POPs.
Cheap to scale, easy to isolate.

AT AKAMAI

MCP + Wasm is the natural pairing for the edge:

Fast cold-start · small footprint · capability-scoped · an isolation story that scales with your agent fleet.

Three things to remember

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Secure what happens after.

01 MCP SECURITY · INCOMPLETE

MCP security doesn't stop at authentication. Tool execution is a security boundary.

02 WASM · ISOLATED EXECUTION

WebAssembly gives us an isolated execution layer. Explicit capabilities, not ambient access.

03 AGENTS · LIGHTWEIGHT RUN

Agents need lightweight execution: fast startup, isolation, portability. Wasm is a natural fit.

CLOSING

Don't just secure the MCP endpoint.

Secure what happens after the tool call.


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