TIGZIG AI for Analytics

MCP Guide for Claude in Excel

Also for ChatGPT in Excel & Any MCP Client

Connect Your Backend APIs to Excel via Model Context Protocol (MCP)

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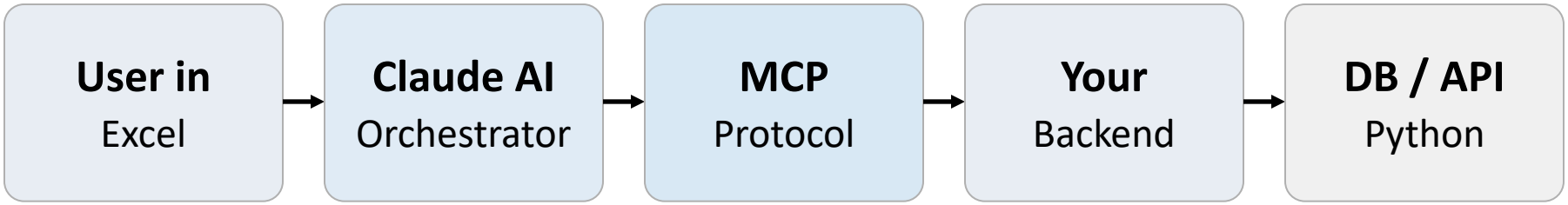
What is MCP?

Model Context Protocol (MCP) is an open standard that creates a persistent connection between an AI client and a backend server. It lets Claude in Excel talk directly to your APIs, databases, and processing systems - all through natural language.



Natural language in → SQL / API calls → Results back in Excel

Key Insight: Excel becomes a ready-to-use front-end container. You control access, processing, and data entirely from the backend.

What is an API? The Basics

Think of an API as a **service counter**. You go to a specific window, hand in your request in a set format, and get a response back in a set format. That is all an API is.

URL	→	**Endpoint**	→	**Parameters**	→	**Response**
The address		Which counter		Your request		What you get back

Example

- **URL:** ta.tigzig.com (the building address)
- **Endpoint:** /api/analyze (which counter to go to)
- **Parameters:** symbol=AAPL, start_date, end_date (your request form)
- **Response:** A technical analysis report (PDF/HTML)

Under the hood, this is an HTTP request (GET or POST) - your browser does these every time you visit a website.

From API to MCP - What Changes?

APIs have been around for decades. MCP is a new layer on top. Here is how they relate.

Regular API

Like making a phone call. You dial, ask your question, get an answer, hang up. Next time, you dial again.

Each request is independent.

MCP

Like a hotline that is always on. The connection stays open. You can see what is available and keep talking without redialling.

Persistent, always-on connection.

How they are built: FastAPI (Python) or Express (JavaScript) create regular API endpoints. MCP is then mounted on top of these same endpoints, adding the persistent connection layer.

What else: With MCP, the AI client (Claude) can see all available tools upfront and maintain a continuous conversation with the backend. With a regular API, each call is a separate transaction.

What MCP in Excel Unlocks for You

Excel as Universal Front-End

Use Excel as a ready-to-use container for any backend service. No custom UI needed - your users already know Excel.

Natural Language Access

Users ask in plain English. Claude translates to API calls, SQL queries, or processing commands automatically.

Backend-Controlled Security

Access controls, tokens, rate limits - all managed server-side. The backend decides who sees what.

Works With Any API

Databases, web services, Python processing - anything with an API endpoint can become an MCP server.

What Can You Do With MCP?

01 Query Databases

Run SQL against Postgres, DuckDB, or any database. Results in Excel.

02 Generate Reports

Trigger PDF/HTML report generation. Backend processes, returns URL.

03 Pull Web Data

Fetch from Yahoo Finance, APIs, web services into your spreadsheet.

04 Run Analytics

Execute Python processing, statistical models, ML on the backend.

05 Push Data

Write to external systems, trigger workflows, update records via API.

06 Multi-Step Automations

Chain operations: pull, process, validate, present - all from one prompt.

The Big Picture

Builds the MCP backend. Your users get Excel. MCP connects them.

Build MCP

Builds the FastAPI backend. Mounts MCP endpoints. Controls access and security.

→

MCP Layer

The protocol bridge. Claude reads tool descriptions and understands what the backend offers.

→

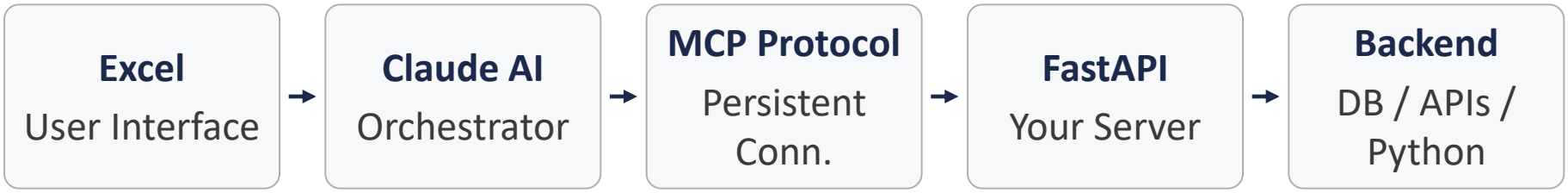
Excel User

Asks in natural language. Gets data, reports, analytics. No coding needed.

What This Means for Your Organization

A controlled, secure interface between your data systems and business users. No custom front-end needed.

Architecture: How It All Connects



What happens at each step:

1. User asks in natural language in Excel

"Show me top 10 customers by revenue"

2. Claude reads MCP tool descriptions

Understands schema, columns, data semantics

3. Claude calls the right MCP tool

Translates to SQL, API call, or processing request

4. Request hits your FastAPI server

Validates, authenticates, rate-limits

5. Backend processes the request

Runs query, Python processing, or generates report

6. Results flow back to Excel

Data into cells, URLs shared, charts built

How to Connect: 3 Simple Steps

01 Build & Deploy Your MCP Server

Use FastAPI + fastapi-mcp. Write your logic. Mount endpoints as MCP tools.
Deploy to Render, Railway, or your own infrastructure.

02 Connect in Claude AI Settings

Settings → Connectors → Custom Connectors. Paste your MCP server URL. Save.
Claude in Excel and PowerPoint will both see it automatically.

03 Start Asking in Natural Language

Open Claude in Excel. Ask your question. Claude calls the right backend.
"Show top 20 customers by revenue" → SQL → Results in Excel.

For MCP Connected to Databases

How Does Claude Know Your Data?

How Does Claude Know Your Data?

Your approach to schema documentation should scale with complexity - from inline docstrings to intelligent search layers.

Simple Schema

Inline docstring in MCP tool. Table names, columns, types. Data semantics & meaning. Rules, quirks, example queries.

Best for 1–5 table setups

→

Two-Tier Schema

Summary docstring for all tables. Detail endpoint per table. get_schema(table_name) on call. Business rules & relationships.

Scales to 10–100 tables

Key Principle

Match your schema strategy to your scale. Start simple, add search layers only when context bloat demands it.

Schema Storage & Search Options

Match your approach to your scale. Table limits are directional. It all depends on complexity of tables and your use case. There are trade-off with each option.

Scale	Where Schema Lives	Search Mechanism	What to Store	Infra Needed
1–5 tables	Inline docstring in MCP tool	Full schema in context - no search needed	Table names, columns, types, rules	None
10–50 tables	Summary docstring + get_schema(table) endpoint	LLM calls get_schema() on demand per table	One-liner per table + full detail on demand	None
50–200 tables	.txt files OR metadata table in Postgres	Keyword search via Postgres BM25	Purpose, column meanings, aliases, sample values, relationships	Same DB
200–500 tables	Metadata table in Postgres + pgvector column	Hybrid: BM25 keyword + vector similarity (pgvector)	Above + embeddings auto-generated from rich descriptions	Postgres + pgvector
500+ tables	Dedicated vector store (Chroma, Qdrant, Milvus)	RAG: semantic retrieval + re-ranking	Rich metadata + embeddings. One chunk = one table.	Separate vector DB

Practical Issues : Schemas & Tool Definitions

Regardless of scale, these fundamentals decide whether your setup actually works.

Garbage In, Garbage Out

If your schema has only column names and data types with no descriptions, no amount of FTS5, BM25, or RAG will save you. The search has nothing meaningful to work with.

Metadata Quality Is Everything

Each table needs plain-English purpose, column meanings, business aliases, sample values, and how it is used - not just what it contains. Auto-generate first drafts with an LLM if descriptions don’t exist.

RAG Is a Last Resort

RAG needs careful chunking, embedding calibration, and ongoing tuning. Try FTS5/BM25 keyword search first - it works with zero ML infrastructure.

Search Infra Is the Easy Part

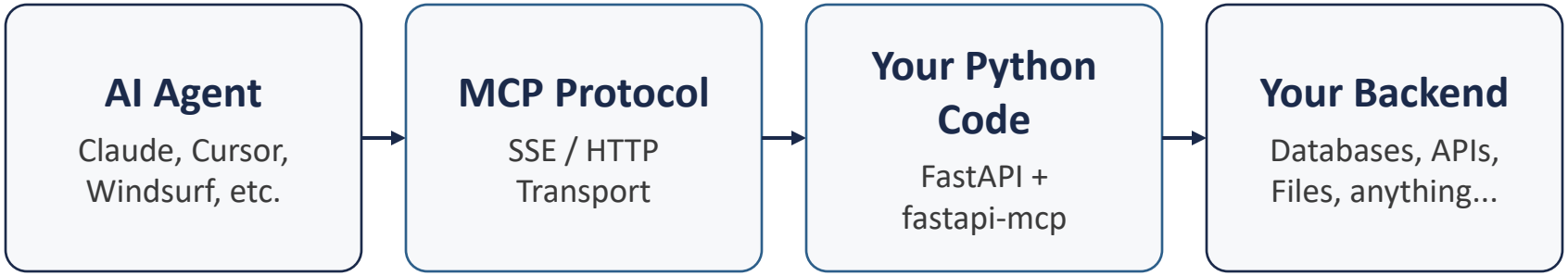
Writing or generating quality metadata for hundreds of tables is the real effort. Most teams underestimate this and over-engineer the search layer instead.

Build Your Own MCP Server

From concept to a live, production-ready MCP server

What’s Actually Happening Under the Hood

An MCP server is just a Python app deployed on the internet. No magic black box. Here's the flow.



What makes it "MCP" vs. a regular API?

- **Regular API:** Developer writes client code, handles auth, parses JSON responses manually.
- **MCP server:** The AI agent reads your docstrings, understands parameters, and calls your tools automatically. Zero client-side wiring.
- **Bottom line:** You share one URL. The AI agent figures out the rest.

From Zero to a Live MCP Server

1. **Write Your Python Logic**

   Your core functionality - whatever your server does. Querying databases, generating reports, calling external APIs, processing files, running calculations. Just normal Python, no MCP-specific code.

2. **Wrap It in FastAPI Endpoints**

   Each endpoint becomes one tool the AI agent can call. Add detailed docstrings - the AI reads these to understand what each tool does. Use Pydantic models so the agent sends correctly structured parameters.

3. **Mount with fastapi-mcp**

   Two lines of code: import FastApiMCP, then mount it on your app. That's it - your regular FastAPI endpoints are now MCP tools. It creates an /mcp endpoint that speaks the MCP protocol.

4. **Add Security**

   Rate limiting (SlowAPI) to prevent abuse. Input validation for all user inputs. Optional OAuth (Auth0) & RBAC for private data Edge protection (Cloudflare) for WAF, bot detection, and DDoS mitigation.

5. **Deploy and Share**

   Deploy anywhere Python runs - Render, Railway, Coolify, your own VPS, or Docker. It's a single Python file + requirements.txt. Share the URL and any MCP-compatible AI agent can connect immediately.

What People Get Wrong About MCP Servers

"I need a special MCP framework"

No. FastAPI + fastapi-mcp. Two pip install commands. You write normal Python, mount it, done.

"MCP is only for databases"

Any Python function can become an MCP tool - PDF generation, stock analysis, web scraping, sending emails, running simulations. Anything.

"The AI agent needs special config"

Point it at the URL. It reads the tool list and docstrings automatically. Zero client-side code or configuration needed.

"It's complicated to secure"

Same security as any API - rate limiting, input validation, authentication. Well-understood patterns that have existed for years.

"I need expensive infrastructure"

Single Python file. Runs on free cloud tiers or a $5/month VPS. My Databases MCP handles databases, 12-layer validation, OAuth - all under 1000 lines … hosted alongwith other 30+ backends….but it depends scale of your operations. Test what works.

Practical Considerations

Real-world challenges when connecting Claude to your data - and how to solve them.

Data Size Limits

Issue: Claude tries to pull everything at once, then write thousands of cells. Context bloats, writing fails.

Fix: Cap at 500–1000 rows server-side. Write in batches of 100. Use TSV format (~70% smaller).

Context Window Bloat

Issue: Too many MCP endpoints with heavy docs eat up the context window. Performance degrades.

Fix: Be selective. Expose only what users need. Keep docstrings concise. Group related functions.

Key Takeaway

Design your MCP server for the real world: cap data sizes, manage context, and invest in great docstrings.

Practical Considerations

More things to watch for when building and deploying your MCP server.

URL Handling

Issue: Claude can share URLs from the backend but cannot fetch or open them itself.

Fix: This is by design. Share the URL, user opens it. For data, return structured results not links.

Docstring Quality

Issue: Poor or missing docstrings mean Claude guesses wrong about your schema and data semantics.

Fix: Invest in detailed docstrings: column meanings, data quirks, counting rules, example queries. It pays off.

Remember

Claude is powerful but has boundaries. Design around them - return data directly, write great docs, and your users won’t notice the seams.

MCP Server Security

Hardening your MCP server for production

MCP Server Security

A comprehensive hardening checklist covering 95 items across 7 layers of defense.

The detailed security checklist with full code examples is available on my site . The following pages provide a quick snapshot explained in simple terms.

Detailed Security Checklist for Web Apps & MCPs

Application Hardening	**SQL Protection**	**Database Security**	**DuckDB Safety**
	Edge Protection	**MCP-Specific & Auth**	

Application Hardening

Protecting the MCP server application from abuse and unauthorized access.

Who Can Connect (CORS)

Controls which websites and apps can talk to your server. Like a bouncer at the door - only approved origins get in.

Rate Limiting

Limits how many requests each user can send per minute. Prevents anyone from flooding your server to crash it.

Concurrency Caps

Limits how many requests run at the same time, per user and globally. One heavy user can’t hog all the server’s power.

Error Message Safety

Never shows internal error details to users. Attackers use error messages to learn your architecture. Generic errors keep it hidden.

API Key Authentication

Every request needs a secret key. Server won’t start without one. Uses timing-safe comparison to prevent key-guessing attacks.

Monitoring & Logging

Records all requests for security review. Complete audit trail if something goes wrong. Old logs with personal data auto-deleted after 30 days.

SQL Protection - 12 Layers of Defense

Every query passes through multiple checkpoints before it can touch your data. Fast keyword checks first, then deep structural analysis.

1. **Command Allowlist**
   Only read commands allowed
2. **Keyword Block**
   DELETE, DROP, ALTER rejected
3. **Heavy Function Block**
   Billion-row generators blocked
4. **CPU Bomb Prevention**
   CROSS JOIN, REPEAT stopped
5. **Structural Validation**
   SQL parser catches bypasses
6. **Injection Blocking**
   SQL comments rejected
7. **System Table Guard**
   Password/role tables blocked
8. **Auto Row Limit**
   Caps results if no LIMIT set
9. **Response Size Cap**
   Max 1 MB per response
10. **Safe Sorting**
    Computed ORDER BY blocked
11. **Sort Subquery Block**
    Prevents exponential slowdowns
12. **Depth Limit**
    Max 3 nested query levels

Database Security

Protecting the database itself - your last line of defense if application checks are bypassed.

Statement Timeout

Every query has a time limit (e.g., 15 seconds). If it takes longer, the database kills it. Prevents runaway queries from consuming all CPU.

Read-Only Database Role

The app connects with an account that can only read - never modify or delete. Even if SQL validation is bypassed, writing is still blocked.

Row-Level Security & Role Based Access

Each user sees only their own rows. The database enforces this automatically - even if app code has a bug, users can’t access others’ data.

Connection Pool

A fixed pool of database connections is always ready. New requests get one instantly. If all are busy, requests fail fast instead of piling up.

Least Privilege Grants

Each role gets minimum permissions. Read-only tables get SELECT only. Safety net if row-level security is accidentally disabled.

Database Indexes

Indexes let queries jump directly to relevant rows. Without them, every query scans entire tables - trivially easy to overload the server.

DuckDB Safety

DuckDB runs inside the server process itself - special precautions prevent it from becoming an attack vector.

Read-Only + No File Access

DuckDB opens read-only with file access off. Otherwise, crafted queries could read or write any file on your server - passwords, configs, everything.

Memory & CPU Limits

Each DuckDB instance is capped (e.g., 512 MB memory, 2 CPU threads). One complex query can’t starve all other users of resources.

Query Interrupt on Timeout

On timeout, we explicitly interrupt DuckDB’s engine before closing. Simply cancelling the request might not stop DuckDB - it might keep running in the background.

Container Resource Limits

Docker container has hard memory, swap, and CPU caps. Last line of defense if DuckDB somehow escapes the application-level limits.

Async Event Loop Protection

DuckDB runs in a separate thread, not the main server thread. Running directly would freeze the entire server for all users until the query finishes.

Edge Protection (Cloudflare)

Stops malicious traffic before it even reaches your server - the first wall of defense.

Cloudflare Proxy Shield

All traffic goes through Cloudflare. Your server's real IP is hidden. Without proxy enabled, all Cloudflare protections are bypassed entirely.

Edge Rate Limiting

Different rate tiers at Cloudflare's edge. Backend/MCP: strict (10–20 req/min). Frontend: higher. New domains auto-get a default limit.

Zone-Wide Rate Limit

Safety net limiting total requests per IP across your entire domain (e.g., 50 per 10 seconds). Catches flood attacks that bypass per-endpoint limits.

IP Blocking at Edge

Known malicious IPs are blocked at Cloudflare - they never reach your server. Zero cost to you. Can block entire IP ranges for known bad hosts.

MCP-Specific & Authentication

Security patterns unique to MCP servers and how users are verified.

OAuth for Private Data

Private data MCP servers should use OAuth (e.g., Auth0). For public demo data, the open endpoint with full hardening stack is fine.

Open vs. Secured Endpoints

Two endpoints: open for public data, secured with OAuth + JWT + email whitelist. Both still get rate limiting and all other protections.

Transport

Be aware that the MCP protocol has two transport methods - SSE (older) and Streamable HTTP (newer). Keep your MCP library updated

Failed Login Blocking

Repeated bad tokens = IP blocked (e.g., 5 failures = 24-hour block). Separate from general rate limiting - specifically targets auth abuse.

Backend Token Verification

Backend independently verifies every login token using cryptographic signatures. Frontend auth alone is not security - curl bypasses it.

Live MCP Servers

Open Source - Patterns You Can Replicate

Before You Connect

The following slides share live MCP server URLs. Standard security reminders apply.

Don’t connect to random MCP servers

You are running somebody else’s code. You never know what an unknown MCP endpoint is doing with your queries or your data. Treat every MCP server like installing an app - verify trust before connecting.

Open source ≠ guaranteed safe

Even if an MCP server publishes its source code, there is no guarantee that the deployed endpoint runs exactly that code. This applies to any MCP server - including mine. If trust matters, inspect the code and deploy it yourself.

What you can do

My servers are a single Python file (~550 lines). Full source code is on GitHub. Read every line, then either use our public endpoint (read-only, rate-limited) or clone the repo and deploy on your own infrastructure.

Database MCP Server (Cricket SQL)

Read-only SQL on Postgres and DuckDB. ~2M rows of live cricket data. Public endpoint - just plug in.

What It Does

- Postgres: ~1M ODI cricket records
- DuckDB: ~1M T20 cricket records
- Ball-by-ball detail, 2013–2025
- Read-only, rate limited, row-capped

Patterns You Can Reuse

- Fetching data from external database
- AI writes SQL from natural language
- Data flows directly into Excel
- SQL blocklist for write protection
- OAuth Setup

Connect and Try It

MCP URL: https://db-mcp.tigzig.com/mcp

Docs & Source Code: tigzig.com/mcp-server-database

Technical Analysis Report Server

Fetches data, calculates indicators, generates charts, sends to Gemini AI, produces PDF and HTML reports.

What It Does

- Daily + weekly price data from Yahoo
- EMA, MACD, RSI, Bollinger Bands
- Gemini Vision AI reads the charts
- Returns PDF + HTML report URLs

Patterns You Can Reuse

- Python processing / ML scoring
- AI judgment - data in, insight out
- Creating PDF and HTML reports
- Formatted output with images

Connect and Try It

MCP URL: https://ta.hosting.tigzig.com/mcp

Docs & Source Code: tigzig.com/mcp-server-technical-analysis

Yahoo Finance Data Extractor

Stock prices, financial statements, and market data from Yahoo Finance. Public endpoint.

What It Does

- Historical price data (adj close, OHLCV)
- Balance sheet, income, cash flow
- Quarterly financial statements
- Market cap, float, shares outstanding

Patterns You Can Reuse

- Fetching data from external API
- Wrapping a Python library as API
- Data flows directly into Excel
- Excel-friendly JSON endpoints

Connect and Try It

MCP URL: https://yfin.hosting.tigzig.com/mcp

Docs & Source Code: tigzig.com/mcp-server-yahoo-finance

Security Performance Report (FFN)

Multi-security portfolio analysis. Custom calculations validated against QuantStats + FFN analytics.

What It Does

- Compares multiple securities at once
- Sharpe, Sortino, CAGR, drawdowns
- HTML report with charts + 6 CSVs
- Validated: 97%+ match vs QuantStats

Patterns You Can Reuse

- Python processing (complex calcs)
- Creating HTML reports with charts
- CSV exports for offline validation
- Dual methodology for accuracy

Connect and Try It

MCP URL: https://ffn.hosting.tigzig.com/mcp

Docs & Source Code: tigzig.com/mcp-server-ffn

QREP - Compare Securities

Compare up to 6 securities against a benchmark. Returns 81 QuantStats metrics per symbol. Public endpoint.

What It Does

- Compare up to 6 symbols vs benchmark
- 81 metrics: CAGR, Sharpe, Sortino, etc.
- Lightweight JSON for LLM consumption

Patterns You Can Reuse

- Backend python processing
- Summary result as output

Connect and Try It

MCP URL: https://qrep-api.tigzig.com/mcp

Docs & Source Code: tigzig.com/mcp-server-qrep

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