XBRL in the Age of AI: Why Data Standards Still Matter for Agents

Data Standards Forum: Advancing Semantic Intelligence

December 5, 2025 – Washington, DC

Hamid Vakilzadeh

Associate Professor of Accounting, University of Wisconsin–Whitewater

Setting the Stage

- You've just heard:
  - XBRL + AI evidence for better access and analysis
  - XBRL-Agent: LLM agents using XBRL tools (retriever + calculator) for big gains

- My question today:
  - When we give modern AI tools and multiple data sources, does XBRL still win?

Core Claim

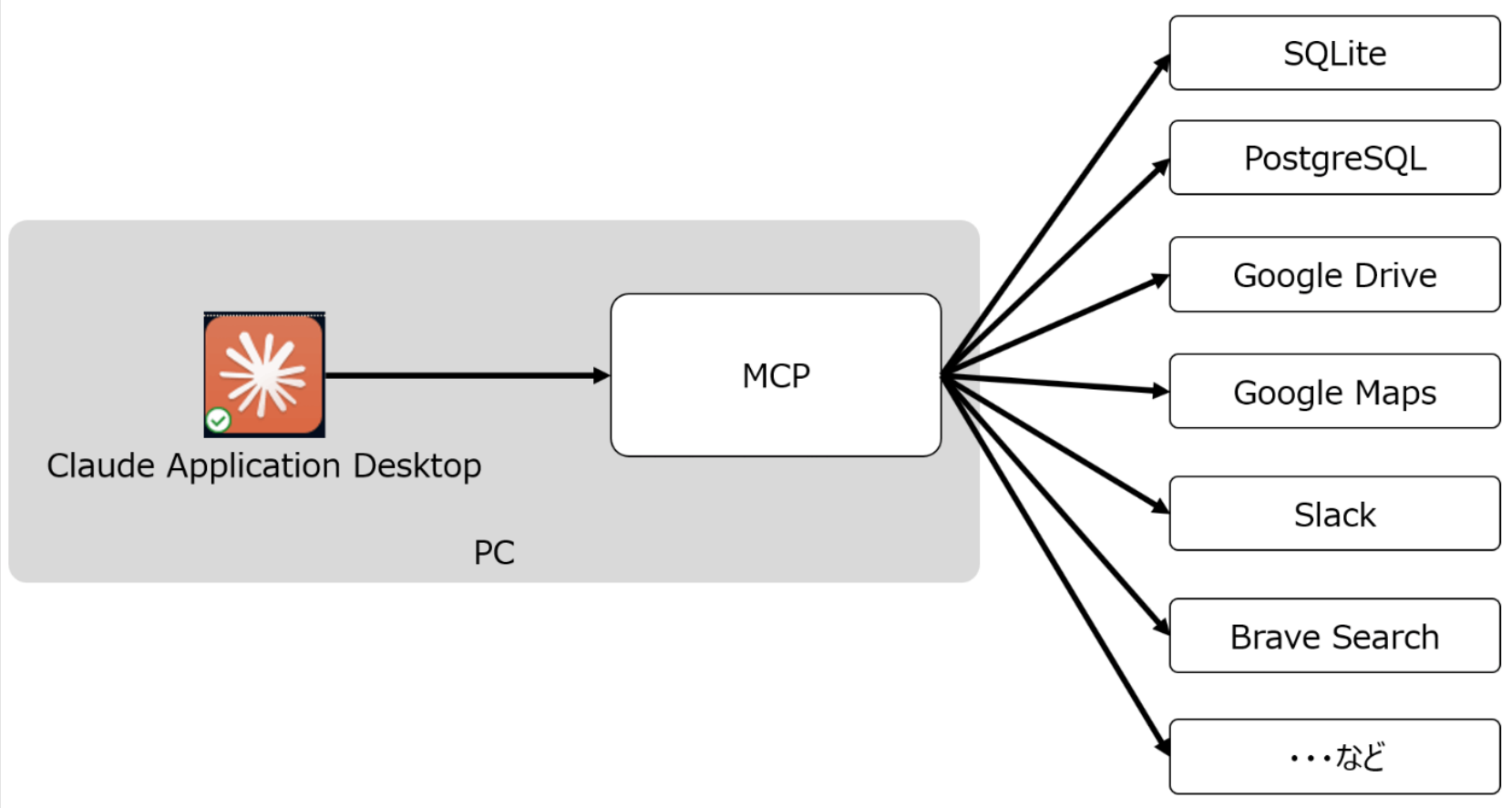
- In a LLM+MCP system, an XBRL-based MCP yields more
  - accurate,
  - consistent, and
  - auditable financial analysis
- than:
  - No MCP (raw PDF/HTML filings)
  - MCPs backed by other financial data (Compustat-style, etc.)

- AI does not replace data standards – it amplifies their value.

What Is MCP + LLM in This Context?

- Model Context Protocol (MCP):
  - Away to plug tools and data sources into an LLM.
- data sources we use:
  - XBRL US API (as-filed, semantic, high-granularity)
  - Commercial fundamentals (Compustat-style tables)
  - Raw EDGAR HTML/PDF (no structure)

What is MCP?


SQLite
PostgreSQL
Google Drive
Google Maps
Slack
Brave Search
・・・など
MCP
Claude Application Desktop
PC

Why the XBRL MCP Is Different

- XBRL MCP (XBRL US API) provides:
  - Standardized concepts with period, units, and dimensions
  - Calculation &presentation linkbases for built-in equations
  - Segment and geographic breakdowns through the dimensional model
  - Data quality signals (DQC rules, validation errors)
  - As-filed fidelity back to the 10-K/iXBRL filing

- Other MCPs lack some combination of granularity, semantics, and quality signals.

How LLM Uses XBRL Structure

- With XBRL MCP, LLM can:
  - Retrieve specific facts (e.g., us-gaap:NetIncomeLoss for 2023, consolidated, USD)
  - Use calculation linkbases to compute and cross-check ratios
  - Disambiguate concepts like revenue vs net revenue via taxonomy lookups
  - Run cross-company comparisons on the same concept IDs across firms

- The same skills are weaker or less reliable with Compustat or raw PDFs.

Research Question & Hypotheses

- Research Question:
  - In a controlled LLM+MCP setup, does an XBRL MCP materially outperform other data sources?
- Hypotheses:
  - **Accuracy:** Higher exact-match accuracy on factual and numeric questions
  - **Consistency:** More reproducible answers across repeated runs
  - **Comparability:** Better apples-to-apples cross-company results
  - **Semantic Precision:** Fewer confusions between related accounting concepts
  - **Auditability:** More answers with verifiable fact IDs and filing references

Experimental Design (High Level)

- Conditions (same LLM, different MCP):
  - XBRL MCP
  - PDF/HTML MCP (raw 10-K text)
  - Compustat-style MCP (normalized fundamentals)
  - A secondary commercial MCP (public API fundamentals & prices)

- Task families:
  - Extraction,
  - Calculation,
  - Cross-company comparisons,
  - Concept disambiguation, and
  - Query-building quality.

Metrics and Expected Pattern

- Metrics:
  - Accuracy (exact match, F1) and numeric error
  - Consistency across multiple runs for each question
  - Comparability of rankings/screens across firms
  - Semantic confusion matrix for related concepts
  - Auditability via fact IDs and document citations

- Expected ordering:
  - XBRL MCP > Compustat MCP > PDF MCP, especially on complex and cross-company tasks.

Implications & Call to Action

- For regulators:
  - Can XBRL becomes the trusted backbone for AI agents?
    - Preserve and expand XBRL mandates; promote MCP/AI-friendly APIs.
- For vendors and data providers:
  - Should they expose semantic richness via MCP, not just flat CSV feeds.
    - Use XBRL as the canonical source and layer other datasets on top.
- Bottom line:
  - If we want reliable, explainable financial AI at scale, do we need standards?
    - Standards like XBRL more than ever.