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An Agentic AI Approach for Next-Gen Semi Manufacturing Analytics

Jeff David, *VP of AI Solutions*

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semi™

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Agentic AI Dream Vision

- **Scalable + User-Friendly**
- **Secure + Private**
- **Technology & Vendor Agnostic**

Key Questions Driving Innovation

1. ***What's the next killer application*** *for agentic AI beyond what exists today?*
2. *How can* ***agents****—including those from other vendors—* ***collaborate*** *to solve problems previously out of reach?*

“AI Agents” – some definitions”

1

OpenAI

Agents are systems that independently accomplish tasks on your behalf

2

Google

AI agents are software systems that use AI to pursue goals and complete tasks on behalf of users

3

ANTHROP\C

AI agents are systems where LLMs dynamically direct their own processes and tool usage, maintaining control over how they accomplish tasks

AGENTIC AI

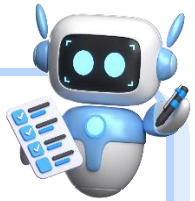
systems of multiple AI agents collaborating to achieve complex, multi-step objectives

Learns from outcomes, **shares** episodic/task memory & context **across agents**

Goal-initiated **workflows** that **decompose** and **adapt dynamically**

Source: *Rakesh Gohel*

"AI Agents" – some definitions"



AI Agent

RAG retrieves and generates—**AI Agents act**. They perform tasks, run code, call APIs, manage state, and iterate through feedback.

Core Features:

- Task planning & decomposition
- Execution pipelines
- Memory (short & long-term)
- File & API access
- Tools like ReAct, AutoGen, CrewAI

Agents shift LLMs from passive responders to **active workflow participants**.

Agentic AI

The next level: **multi-agent systems** with role-based behavior, memory sharing, and communication.

Core Features:

- Collaboration & task delegation
- Modular roles & hierarchies
- Goal-driven planning
- Protocols: MCP (Anthropic), A2A (Google)
- Long-term memory sync & adaptive evolution

Enables **truly autonomous, collaborative intelligence.**

Source: *Brij Kishore Pandey*

Is agentic AI a repackaging of already-existing tools into an exciting buzzword, or does it represent something new and revolutionary?

The answer is: A little of both…

ELSEVIER

Artificial Intelligence

Volume 117, Issue 2, March 2000, Pages 277-296

On agent-based software engineering ☆

Nicholas R. Jennings ✉

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Abstract

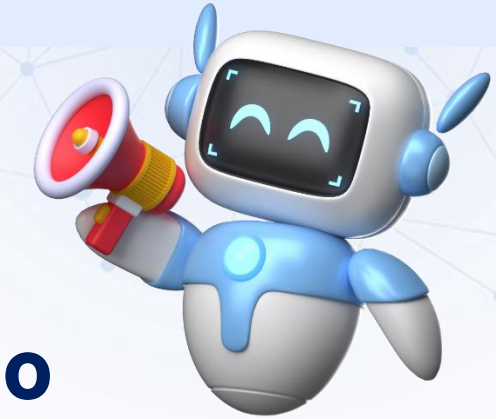
Agent-based computing represents an exciting new synthesis both for

Stitching together apps/ functions to do grander things is not new,
so what's new and exciting here?

Source: *https://www.sciencedirect.com/science/article/pii/S0004370299001071*

Wading through the hype…

People are excited…
and rightfully so!!



Agentic AI brings into focus **a new paradigm** – what's new is breakthroughs in LLM technologies.

How do we wade through the hype to get to doing something valuable?

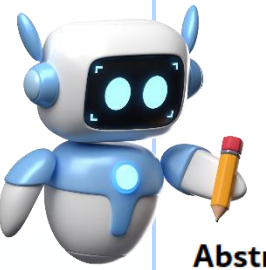
For example - There has been a lot of progress on code writing but there needs to be guardrails. What we're learning is **there is no free lunch.**

We were able to go off and use an out-of-the-box Agentic AI system to write scala with little scala experience.

Was it perfect and optimized?	Was it 80% of the way there?	Did it need guidance and understanding how to use the tool?
No	**Probably**	**Absolutely**

The Right Agents

There is a difference between **LLM** agents and **generic** agents.



LLM-Powered AI Agent Systems and Their Applications in Industry

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Abstract

The emergence of Large Language Models (LLMs) has reshaped agent systems. Unlike traditional rule-based agents with limited task scope, LLM-powered agents offer greater flexibility, cross-domain reasoning, and natural language interaction. Moreover, with the integration of multi-modal LLMs, current agent systems are highly capable of processing diverse

Source:
https://arxiv.org/html/2505.16120v1#:~:text=The%20emergence%20of%20Large%20Language,reasoning%2C%20and%20natural%20language%20interaction

In this context, an agent is an **LLM with function calling**.
Function calling = LLM's trained to **provide elements to a function**.

"I have this function which accepts this argument", and the **LLM will give you the arguments** to this function.

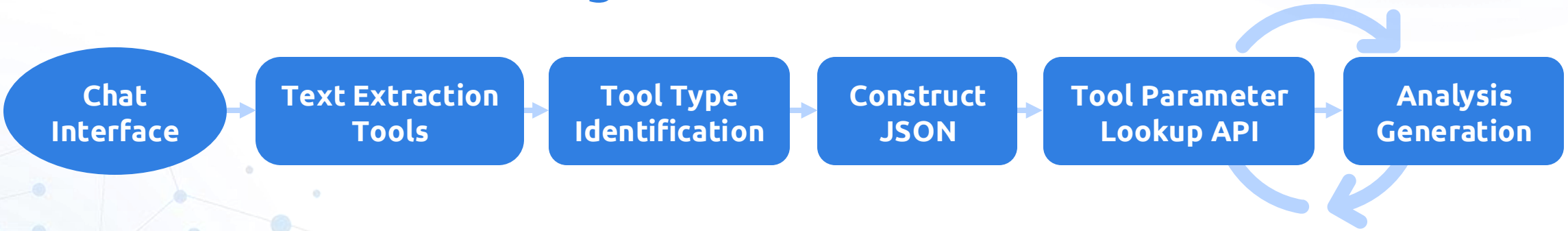
LLM's can pick and choose the tools or functions they already have access to and roll up to a workflow.

Example: Natural language interaction with data analytics

1. **Ability to discover and enable Guided Analytics capabilities through natural language**

2. **User can interact with their data via the chat interface in Guided Analytics**

Agentic Workflow



*Task: **generate a view of the analytics asked** for in the chat interface*

Example: Natural language interaction with data analytics

Agentic Workflows

Agentic workflows = structured instructions executed by agents

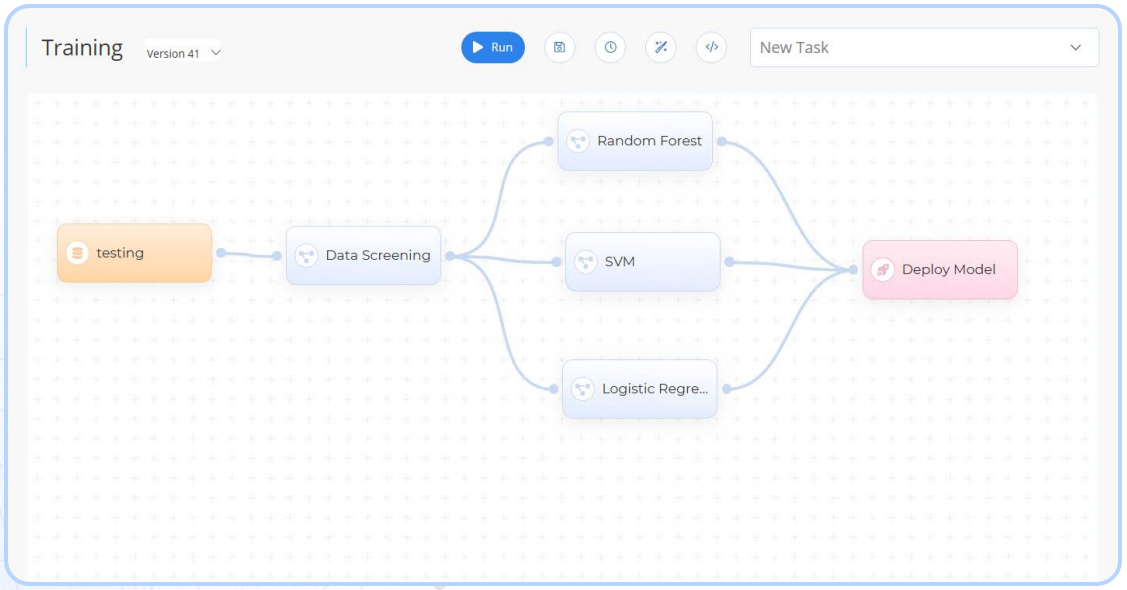
We're now applying this more broadly to build custom workflows for complex tasks.

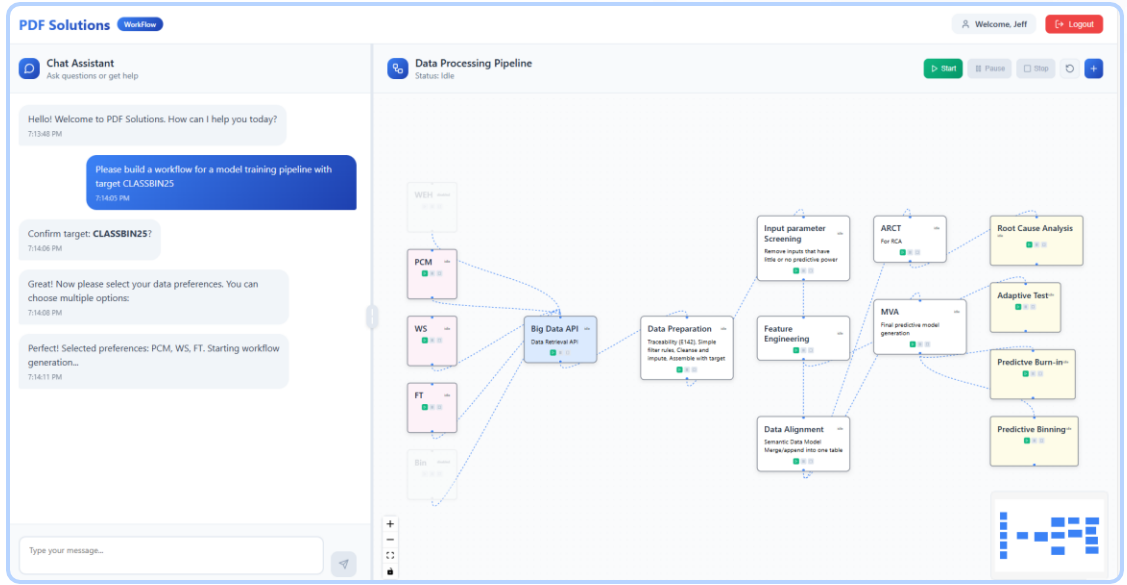
Example

> *"Build a predictive binning pipeline using X input and Y target."*

Key Differentiator

The agent can **learn and improve** via **feedback loops**—enabling continuous refinement.
Note: Harder to apply this to static knowledge bases.





Example: Agentic workflow for ML pipeline generation

flexibility

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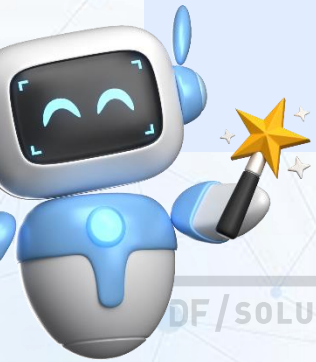
scalability

How do we leverage agentic workflows to make this easier to use?

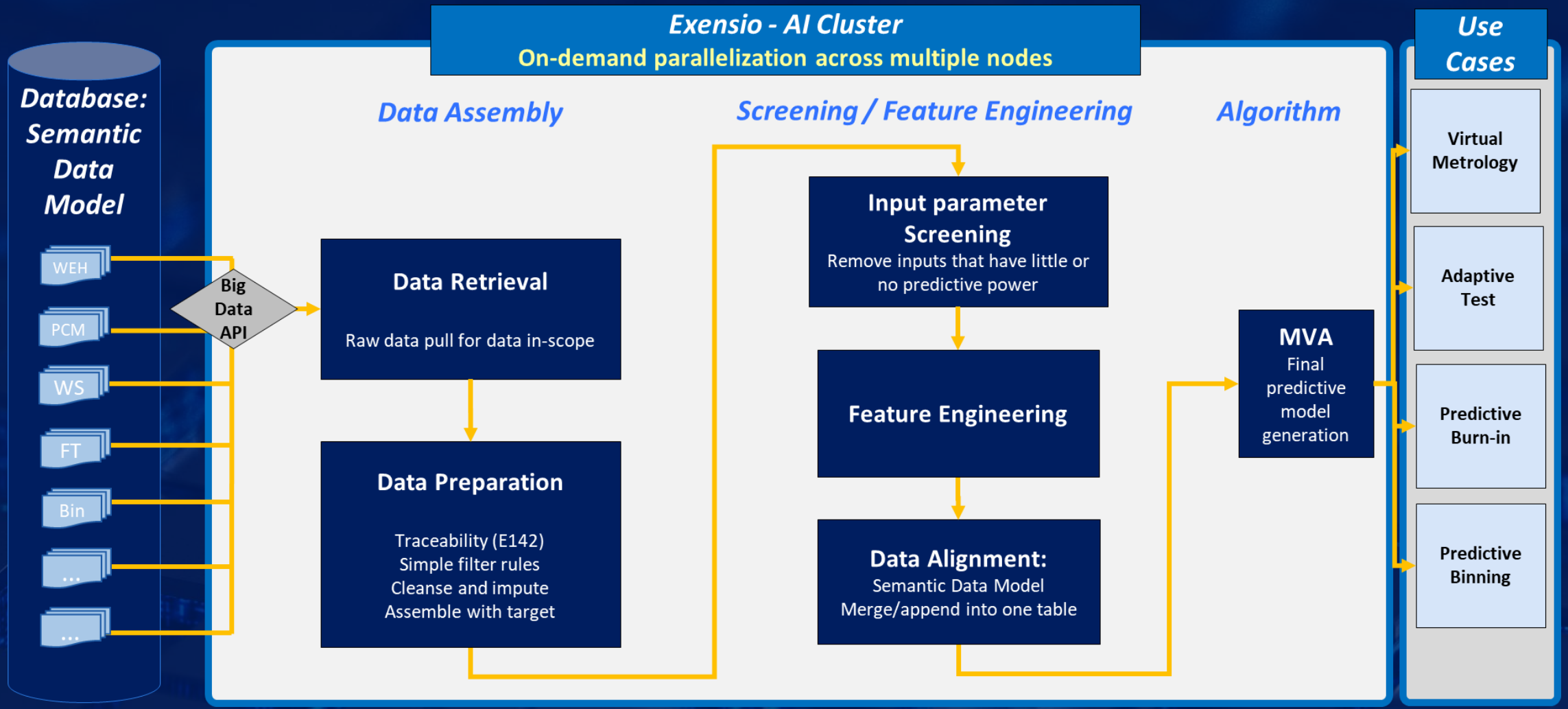
identify the right targets

choose the input data more effectively

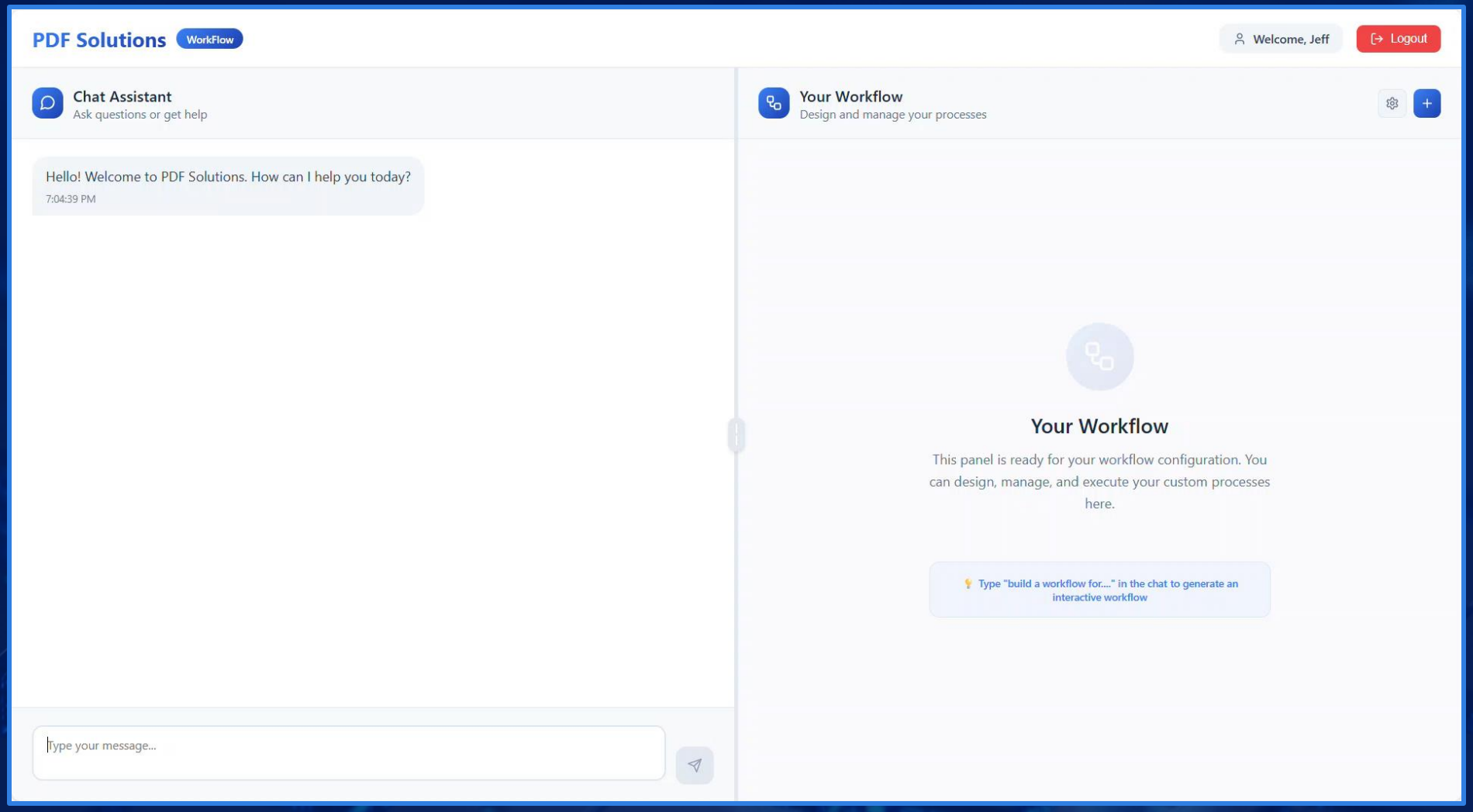
create workflows automatically



Dynamically-Scalable Training Pipeline



Agentic Workflow Demo



Example: Natural language interaction with data analytics

1. **Ability to discover and enable Guided Analytics capabilities through natural language**

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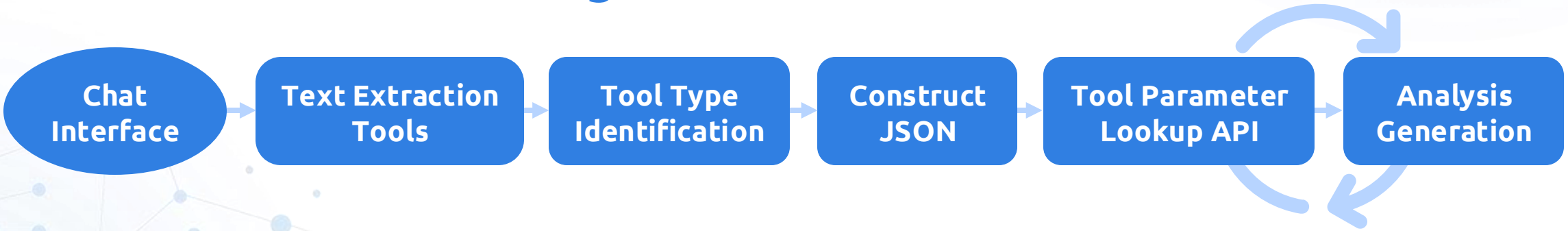
Agentic Workflow



*Task: **generate a view of the analytics asked** for in the chat interface*

Guided Analytics: ML Workflow

Chat Interface → **Automatic Spatial / Yield Classification** → **Univariate Screening** → **Bivariate Screening** → **Actionable Root Cause Tree**

Sort, Probe, Bins
identify specific yield loss signatures

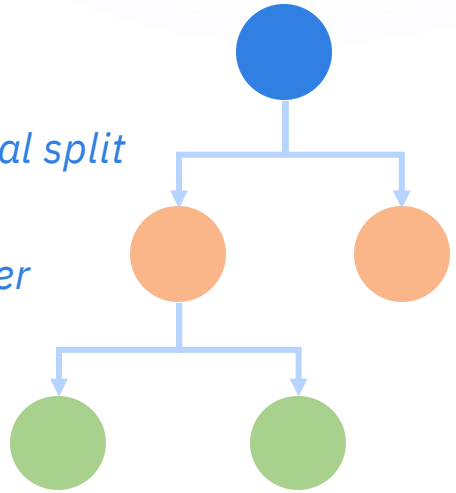
- PCM/WAT raw data
- WS metadata
- FT metadata

incorporating temporal drifts, tester and meta data, and parametric data

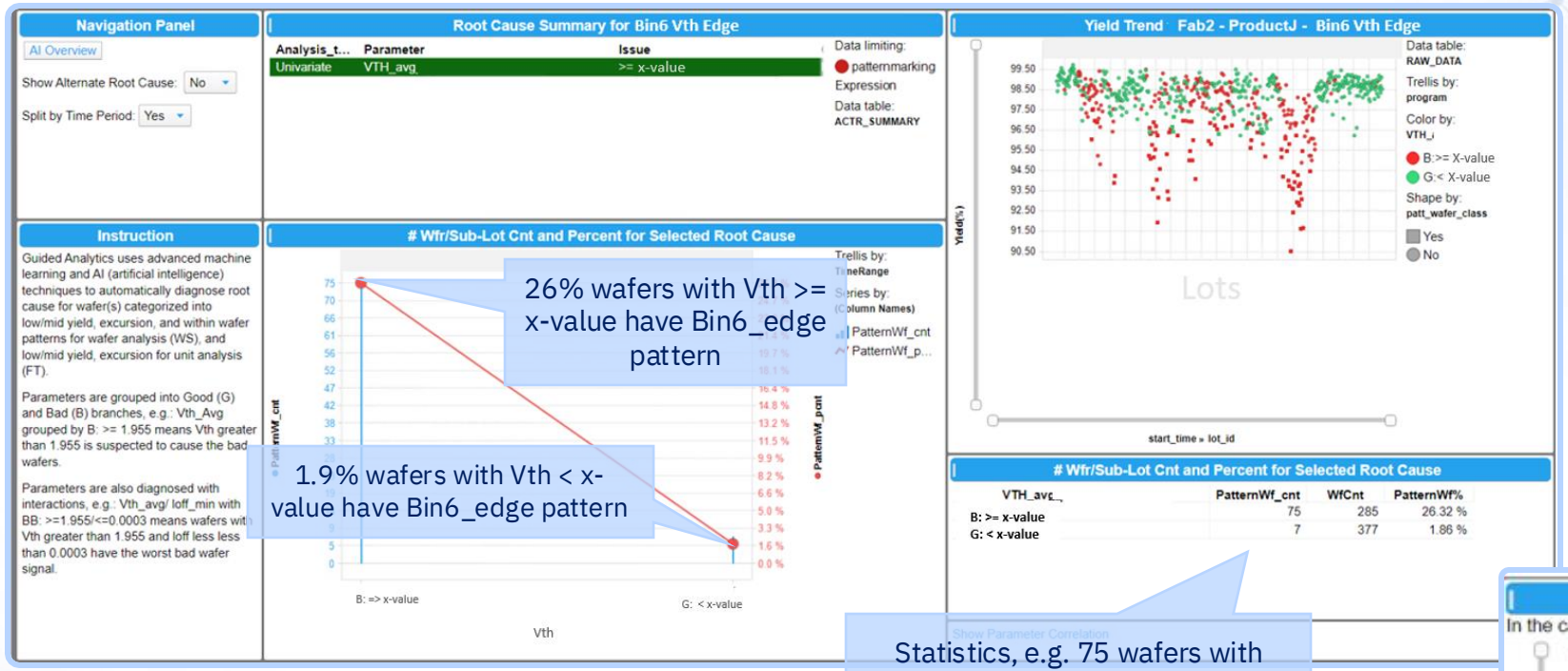
*Monte Carlo and heuristics for data used to determine **signal confidence** in root cause*

e.g. Temporal split

e.g. PCM parameter or meta data split

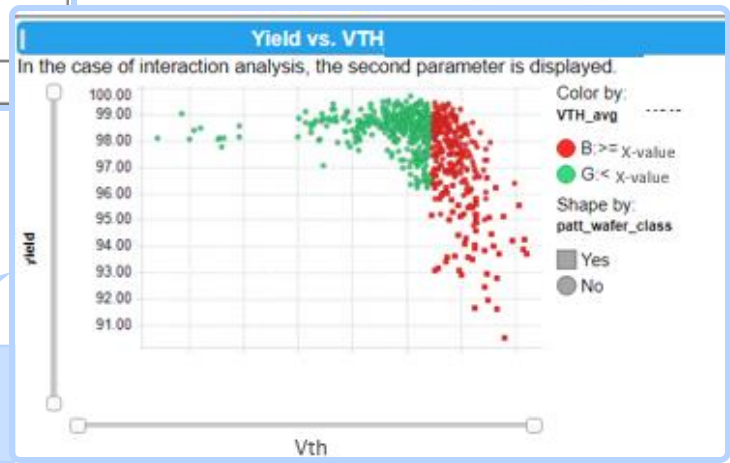


Guided Analytics: Automated Diagnosis



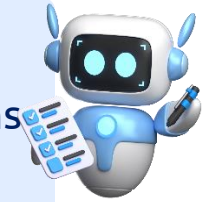
AI/ML for Wafer Sort
Low yield, Mid yield, excursions, bin_wafer patterns vs. PCM and meta-data (testers, probers, etc.)

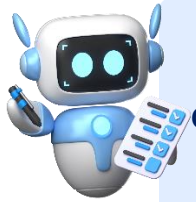
AI/ML for Final Test
Low yield, excursions vs. meta-data



Defining a workflow through YAML files

Behind the scenes, an agent will **generate a YAML file** that contains the **structure of the workflow**





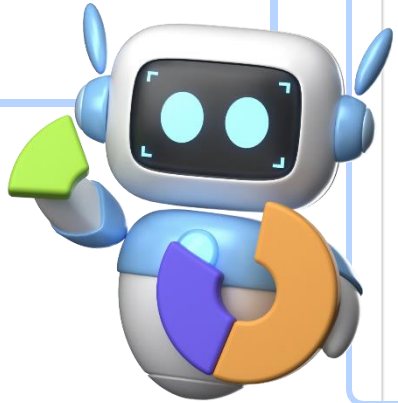
Another agent will determine **which input is in scope** and go **pull it**

Both of these examples would require LLM's **fine-tuned** (and associated system) to accomplish these tasks.

Yet **another agent** would understand the structure and nature of each workflow block available (that is represented in the YAML file) and know what **guardrails** to put in place.

YAML Files

- Text representation of UI
- Block based with connectors
- Easy to create systematically
- Run through CLI or Python SDK



```yaml
flow: Training
recurring:
next_run_utc:
tasks:
- input: python3 run_screening.py
  params:
  - key: data
    type: categorical
    min: 0
    max: 0
    scale: linear
    steps: 0
    values:
    - "/data/testing/testing.parquet"
  - key: data_json
    type: categorical
    min: 0
    max: 0
    scale: linear
    steps: 0
    values:
    - "/data/testing/testing.json"
  - key: threshold
    type: discrete
    min: 0
    max: 0
    scale: linear
    steps: 0
    values:
    - 0.1
  computes:
  - medium
  image:
  description: Data Screening
```

Model Context Protocol (MCP) Servers

A standardized way to communicate with LLMs — led by Anthropic to unify interaction across tools and agents.

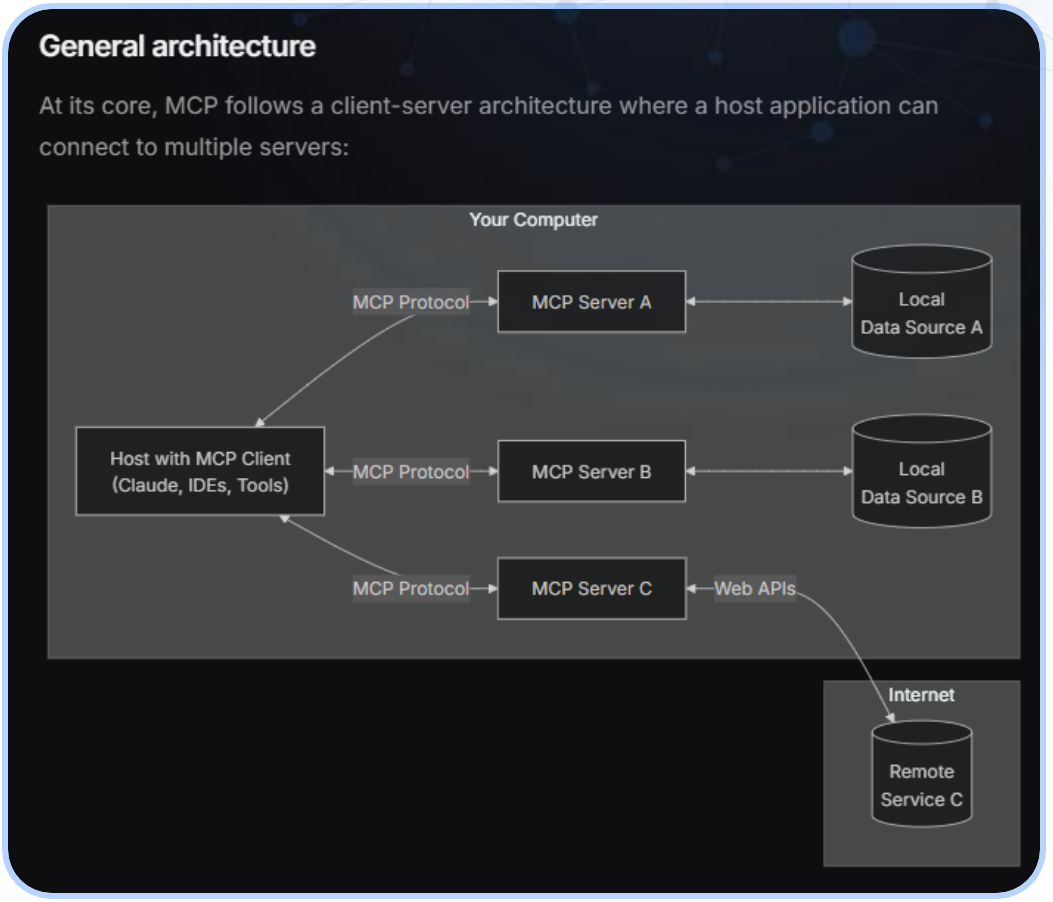
Why?

encourages **safe, modular integration**

aims to improve **security** (e.g., reduce prompt injection risks)

restricts file access to defined areas—no full filesystem exposure

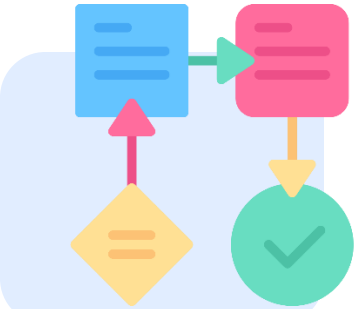
A standardized way that our agents can talk to our customers' or other vendors' agents. MCP is the common language between these disparate agents to allow them to communicate and work together.



Key Takeaways

Beyond the hype – Agentic AI is a paradigm shift in our approach to the application of AI systems

AI agents work together in Agentic AI systems to accomplish complex tasks



Agentic AI can be applied to build custom workflows to accomplish these complex tasks

AI Agents can collaborate across industry boundaries to solve some of our biggest challenges

Special thanks to the co-authors

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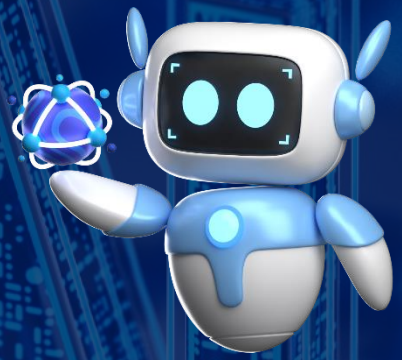

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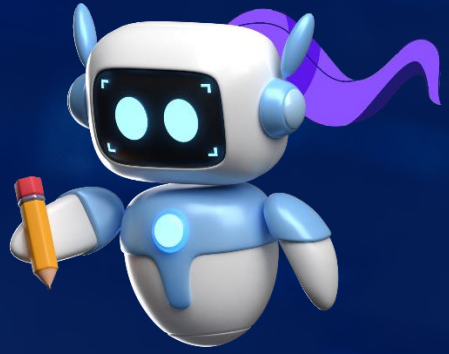

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Thank You

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