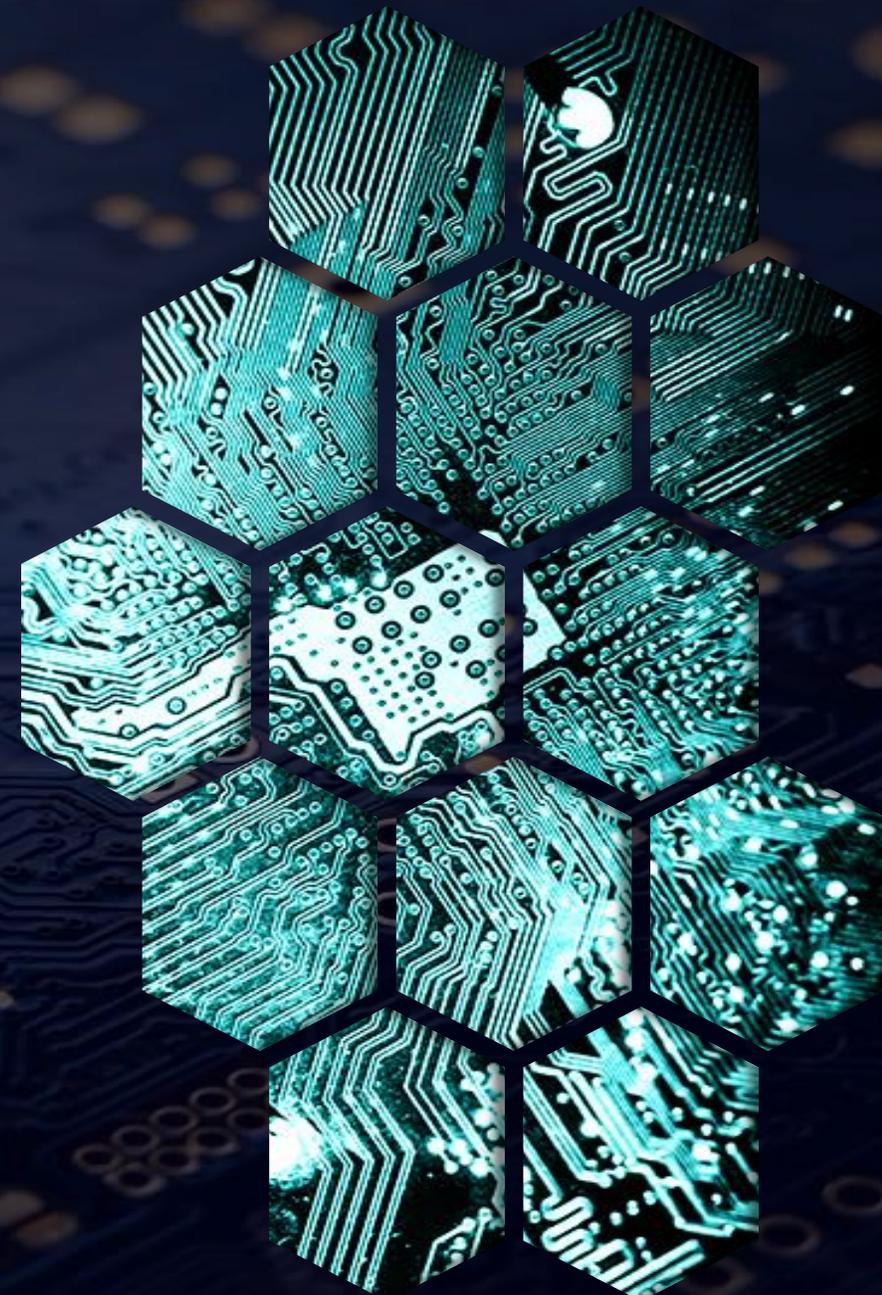


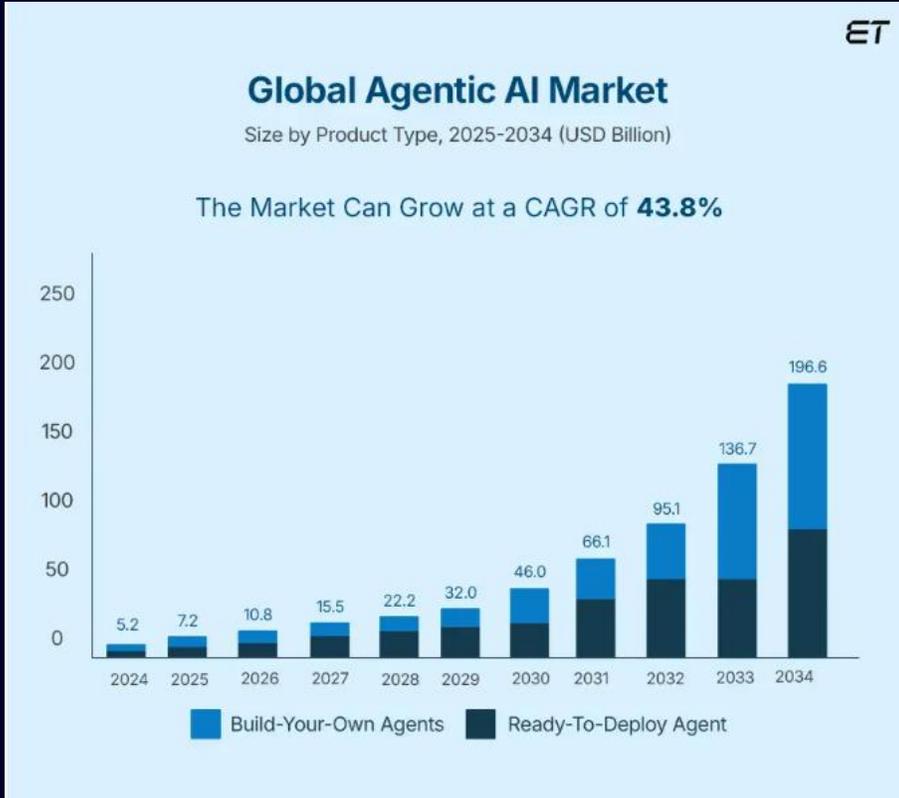
Agentic AI Applied to 3D ICs and PCBs

Matt Bromley

VP of Product Strategy and Technology
Siemens Electronic Board Systems



Tremendous investment in AI – accelerating rapidly



The Evolution of AI From LLMs to A2A

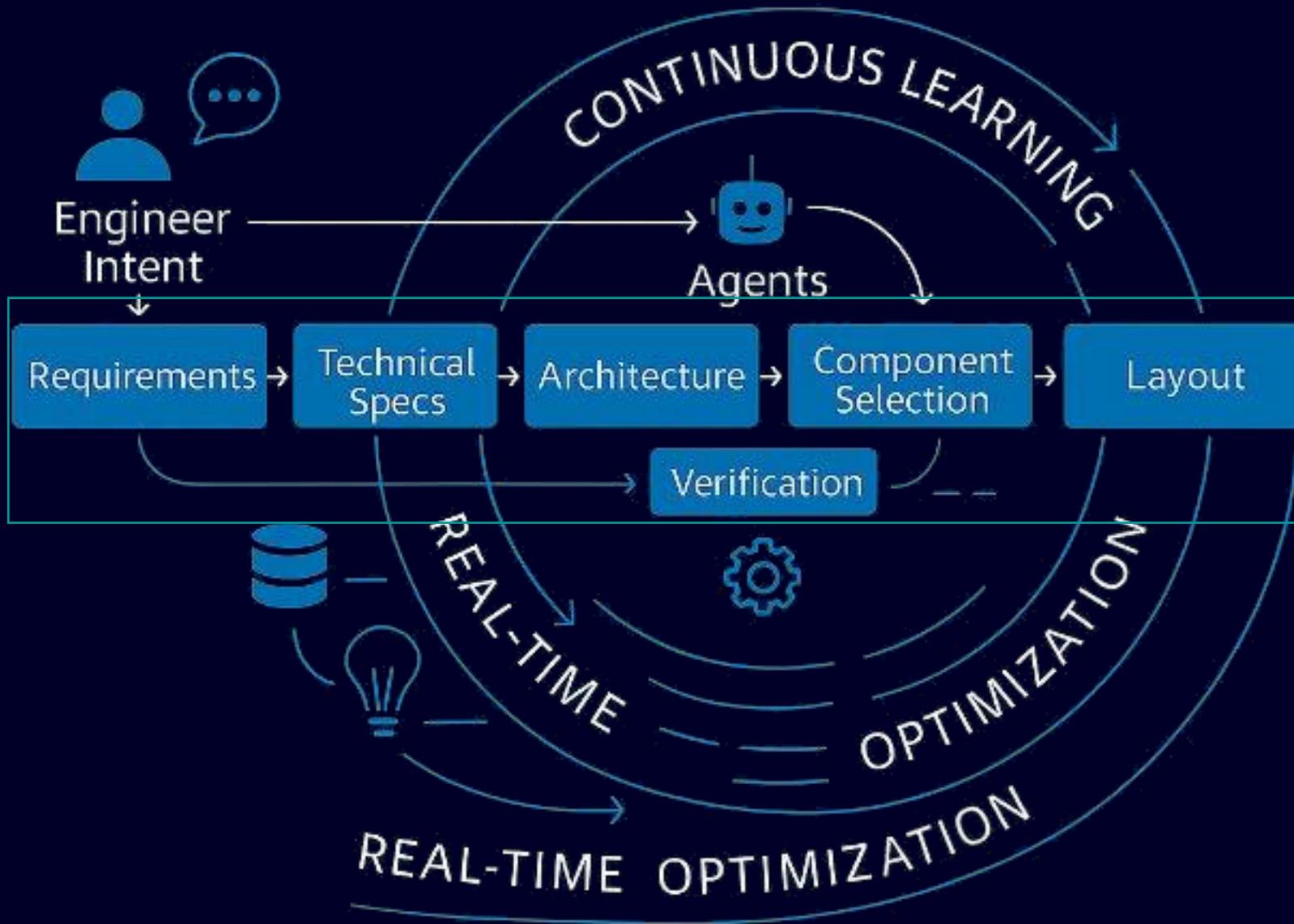
Greg Coquillo
Product Leader at AWS

Approach	Knowledge Access	Intelligence	Capabilities	Simple Analogy
LLMs Large Language Models	Fixed knowledge from pretraining; cannot update or retrieve new data post-deployment	Basic pattern recognition	Text generation, pattern matching, limited reasoning	Like reading a printed book. All info is fixed, no updates.
RAG Retrieval Augmented Generation	Retrieves external content to enhance outputs with up-to-date information	Reactive with limited logic	Combines LLM output with relevant real-time external data	Like Googling before answering a question.
Tool or Function Calling	Accesses real-time knowledge via API calls and external tools	Task-oriented logic	Executes external functions, performs actions via APIs	Like using a calculator or calendar app to get something done.
AI Agents	Interacts with external tools and environments to gather knowledge dynamically	Goal-driven & adaptive	Planning, decision-making, tool orchestration	Like a personal assistant who can decide how to get your tasks done.
Agentic RAG	Independently finds and filters optimal external data for a given task	Self-reliant decision-maker	Information synthesis, autonomous task completion	Like a researcher who picks the best articles to solve a problem.
Graph RAG	Uses structured knowledge graphs for context-aware reasoning and inference	Context-aware reasoning	Relational & causal understanding, knowledge traversal	Like using a mind map to understand how things are connected.
Multi-agent Systems	Shares and coordinates knowledge among multiple agents for task specialization	Collaborative intelligence	Distributed planning, parallel execution, agent teamwork	Like a team of experts each doing their part to finish a project.
MCP Model Context Protocol	Accesses standardized, shared knowledge spaces across agents and tools	System-level cognition	Context harmonization, cross-agent coordination, semantic alignment	Like all tools and team members sharing one master notebook in real time.
A2A Agent-to-Agent Protocol	Enables autonomous agents to communicate, reason, and learn from each other	Autonomous collective intelligence	Inter-agent negotiation, learning, zero-human collaboration	Like teammates discussing and solving problems without asking a manager.

Evolution of AI (indicated by a downward arrow on the left side of the table)

Anthropic raises \$13B Series F at \$183B post-money valuation

Sep 2, 2025 • 3 min read



Democratization



Predictive Intelligence



Sustainability



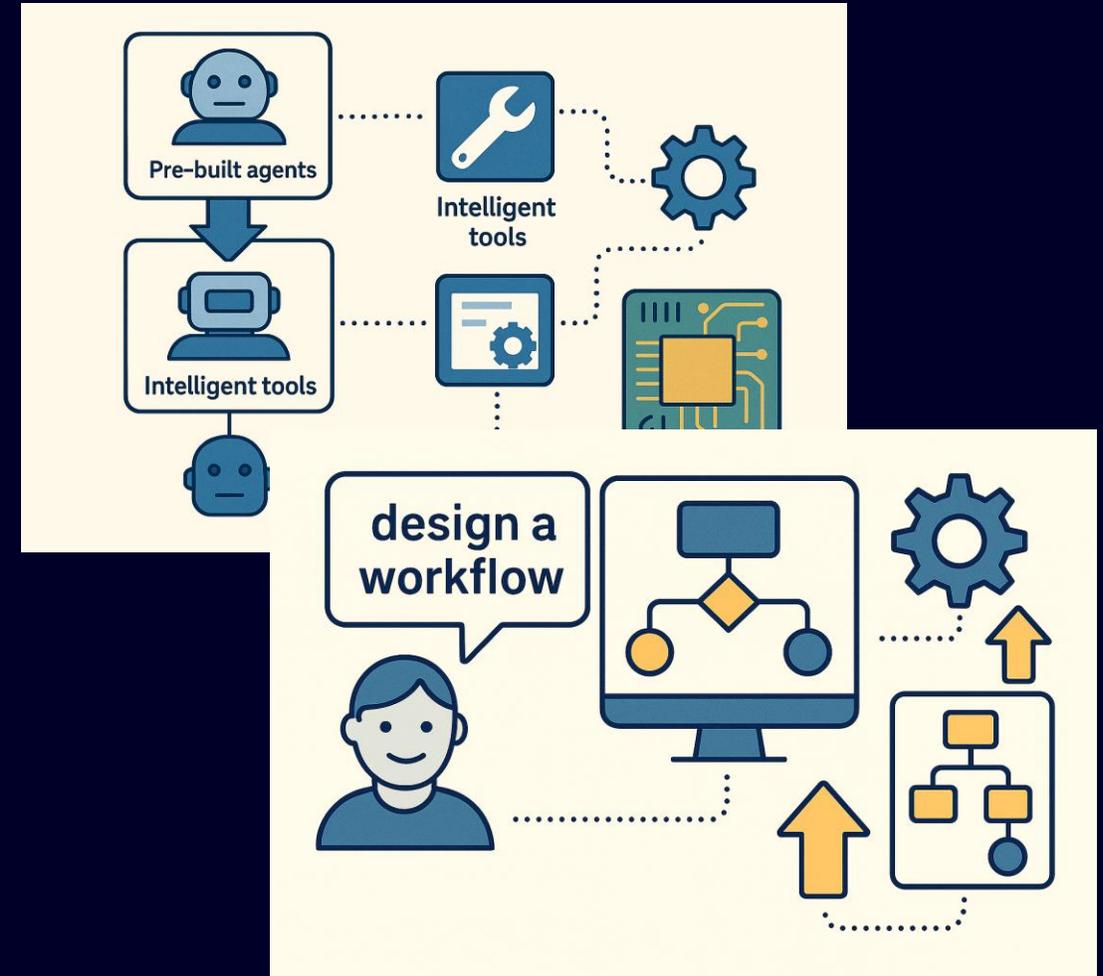
Speed & Quality

Empowering Customer Workflows with Agentic AI

Simplified Integration & Reduced Technical Overhead

Intuitive Workflow Creation & Orchestration

Seamless Interoperability & Effortless User Experience



What are AI Agents and why do agents need tools?

An **AI agent** is an intelligent software system that uses AI to perceive its environment, make independent decisions, and take actions to achieve a specific goal

- **Perception:** Agent gathers information from its environment.
- **Reasoning & Planning:** Powered by a large language model, agent processes information
- **Memory:** Agent stores information to inform future decisions.
- **Action & Tool Use:** Agent executes its plan by taking actions..

Tools are the external **resources and functions** that an AI agent can call upon.

- **Access Real-Time Information:** Tools allow agents to get up-to-the-minute data
- **Perform Specific Actions:** Tools enable agents to perform actions
- **Interact with the World:** Tools act as a bridge, allowing the agent to connect with external systems and private databases

Model Context Protocol (MCP) and A2A Protocol

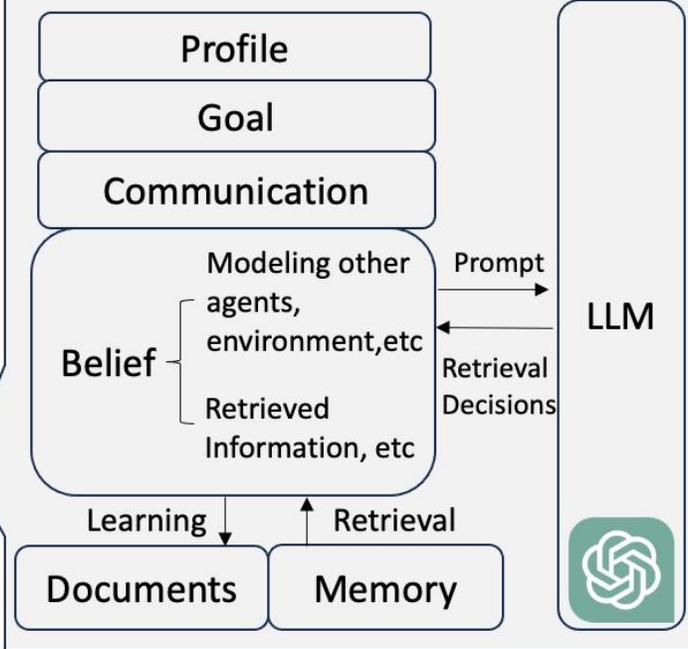
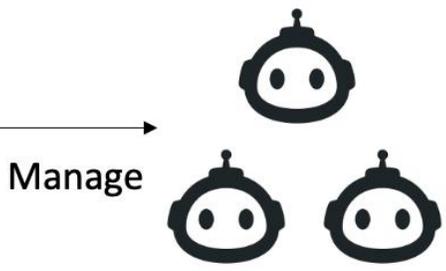
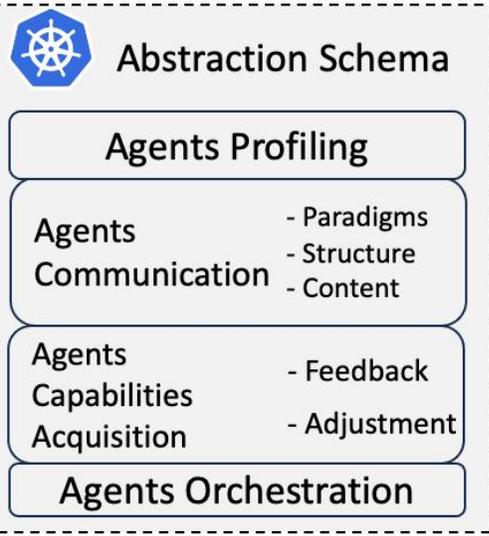
MCP is an open protocol that standardizes how applications provide context to LLMs.

- **MCP Hosts:** Programs like Claude Desktop, IDEs, or AI tools that want to access data through MCP
- **MCP Clients:** Protocol clients that maintain 1:1 connections with servers
- **MCP Servers:** Lightweight programs that each expose specific capabilities through the standardized Model Context Protocol
- **Local Data Sources:** Your computer's files, databases, and services that MCP servers can securely access
- **Remote Services:** External systems available over the internet (e.g., through APIs) that MCP servers can connect to

Agent2Agent (A2A) protocol aims to provide a common language for agents, fostering a more interconnected, powerful, and innovative AI ecosystem.

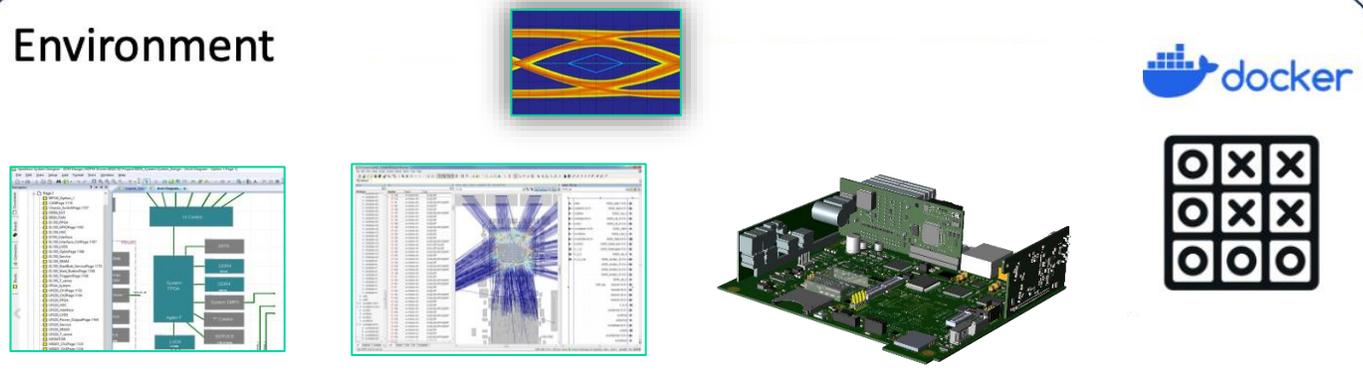
- **Discover** each other's capabilities.
- Negotiate **interaction modalities** (text, forms, media).
- Securely collaborate on **long running tasks**.
- Operate **without exposing** their internal state, memory, or tools.

LLM-based Multi-Agents System



Actions ↓ ↑ Observations / Feedback

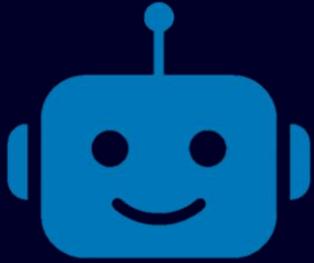
Environment



Human

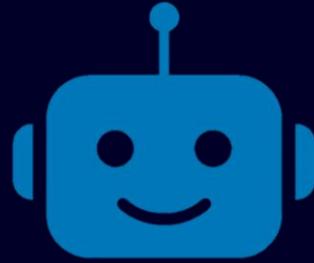


Abstract Multi-Agent Configuration



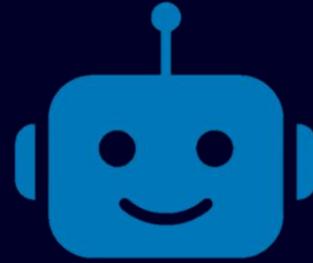
The Brains

Concept to initial design. RAGing agent with access to vast repositories of information - design specifications, industry standards, past project data, research papers, material properties, and even internal knowledge bases.



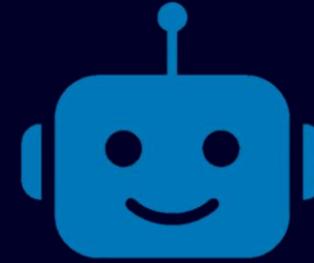
The Brawn

Deeply embedded within existing Electronic Design Automation (EDA) and IC Package Design tools. It wouldn't necessarily have a separate visual interface but would manifest through its actions within the EDA software.



The Optimizer

It would be a specialized set of agents or an advanced module within the overall system. Its visual representation might be dynamic dashboards showing optimization progress, convergence plots, and trade-off analyses.



The Checker

The results of the agents' work would be presented in clear, actionable reports and visualizations within the design environment. Performance metrics directly compared against specifications.

Challenges

The "Semantic Gap":

Problem: Translating high-level instructions (e.g., 'optimize impedance for this differential pair') into basic geometric operations

Combinatorial Explosion of Choices:

Problem: the number of possible geometric paths, layer changes, and via placements is astronomically large

Lack of High-Level Reasoning:

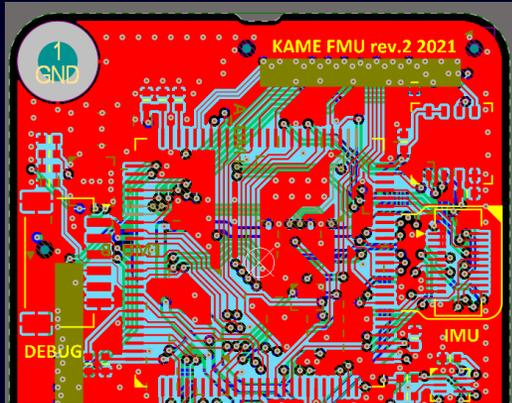
Problem: A human designer understands the why behind a geometric choice

Context Sensitivity:

Problem: The "best" geometric placement or routing for one part of the design might be terrible for another

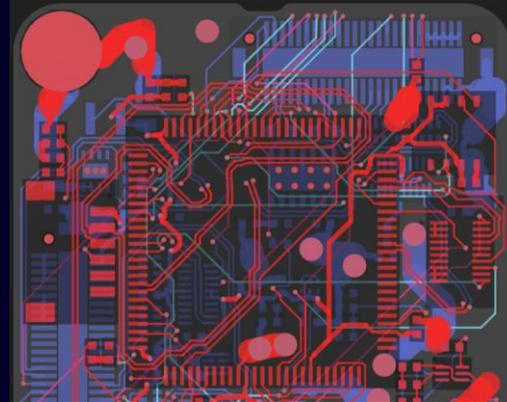
A Case Study

Human



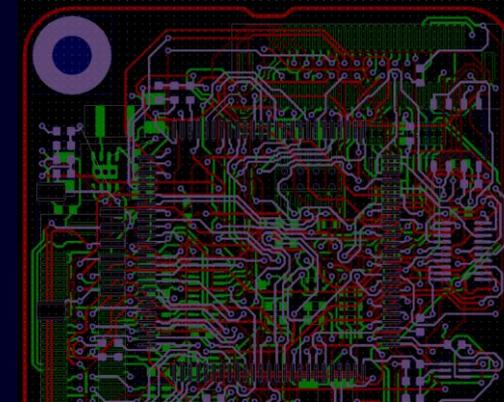
Original 6-layer design
(drone microcontroller
and sensor module)

AI



Process cancelled after
5.5 hours, created 49
routing candidates with
the maximum 63%
routed (6 layer PCB –
59%).

Algorithmic



Finished within 11 sec
giving 98% routed.
Few opens can be
fixed by adding extra
plane shapes within
signal layers

Possible Solutions

Abstraction and Hierarchical Planning

Constraint-Driven Design and Rule-Based Systems

Reinforcement Learning (RL) and Generative AI

Knowledge Graph / Semantic Understanding

Simulation-in-the-Loop

Human-in-the-Loop and Explainability

Use Cases For Agentic AI

Problems well solved with Agentic AI

- **Situation Exploration**
 - **Generate multiple thermal management strategies**
 - **Evaluate against DFM guidelines**
- **Process Automation**
 - **Convert simulation data into compliance reports**
- **Cross Domain Optimization**
 - **Balance electrical performance with mechanical constraints, such as optimizing BGA pitch vs. solder joint reliability.**

Problems NOT well solved with Agentic AI

- **Spatial tasks - Involves understanding and manipulating geometry data**
 - **Vertical stacking optimization, routing/path finding**
- **First of its kind innovations - Design paradigms that have no precedent:**
AI will lack the necessary experience to provide meaningful insights
- **Aesthetic design decisions**
 - **Struggles with decisions based on aesthetics or brand alignment**
 - **Inability to create human like routing**
- **Complex problem solving with inadequate data**
 - **Obvious issue for all training-based AI**

Agentic schematic validation

- Prompt agent performs tasks such as generating validation reports & applying rule fixes to schematics
- Agent intelligently identifies tool requirements & integrates them without explicit user instructions
- Accumulates knowledge from interactions to improve responses to subsequent prompts

The screenshot displays the Siemens EDA software interface. The main workspace shows a schematic diagram with components on a grid. The top toolbar includes various design tools and a search bar. The left sidebar contains a 'Predictive Commands' panel with icons for File, Edit, Selection, Integration, Place, Wiring & Drawing, Analysis & Reports, Simulation, Search, Application Launcher, and Settings. The right sidebar shows the 'Properties' panel with a table of component attributes.

Property	Value
Name	1
Drawing Size	B
Orientation	Landscape
Width	17.000 in
Height	11.000 in

Below the schematic is the 'Project Explorer' and 'Partition' table. The 'Partition' table lists various capacitor parts with their specifications.

Part Number	Symbol	Part Name	Part Label	Cell	Value	Tolerance	Rating
Partition: Capacitor							
CAP-225-6V3-20	Capacitor:CAP_POL.1	CAP-225-6V3-20		CAPAE430X540N			
CAP-335-6V3-20	Capacitor:CAP_POL.1	CAP-335-6V3-20		CAPAE430X540N			
C0603-1R2-10...	Capacitor:Capacitor.1 *	C0603-1R2-100-025		CAPC1608X86N			
C0603-1R8-10...	Capacitor:Capacitor.1 *	C0603-1R8-100-025		CAPC1608X86N			
C0603-2R2-50...	Capacitor:Capacitor.1 *	C0603-2R2-50-025		CAPC1608X86N			
C0603-105-16...	Capacitor:Capacitor.1 *	C0603-105-16-10		CAPC1608X86N			
C0603-120-50-5	Capacitor:Capacitor.1 *	C0603-120-50-5		CAPC1608X86N			
C0603-122-50...	Capacitor:Capacitor.1 *	C0603-122-50-10		CAPC1608X86N			
C0603-124-16...	Capacitor:Capacitor.1 *	C0603-124-16-10		CAPC1608X86N			

At the bottom, a 'Message Window' shows a log entry: '09.23.11 - auto.zip] ICDB server [info]: Starting [Autosave] backup process'.

Agentic Simulation Validation

Based on the available simulation data, I've analyzed the eye diagram performance across multiple cases. Here's my detailed ranking:

PERFORMANCE RANKING (Best to Worst)

1st Place: Case_1 (Full Swing Configuration)

Overall Score: 85/100

- Eye Height: 0.0119 V (79.1% of requirement) ❌
- Eye Width: 0.407 s (135.8% of requirement) ✅
- Swing Type: Full
- Voltage Span: 0.0659 V
- Grid Resolution: $431 \times 1,200 = 517,200$ points
- BER Range: -16 to 0 dB

Strengths:

- Excellent timing performance with 35.8% margin
- High-resolution simulation grid
- Full swing configuration provides maximum signal amplitude
- Good statistical confidence with 517K data points

Weaknesses:

- Eye height fails requirement by 20.9%
- Needs amplitude improvement

2nd Place: Case_2 (Reduced Swing Configuration)

Overall Score: 70/100

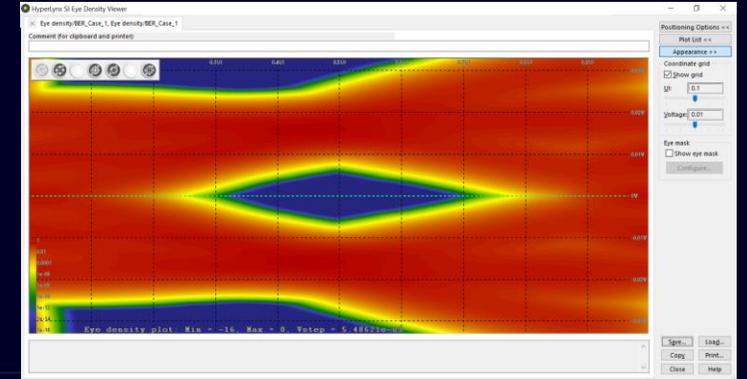
- Eye Height: 0.00474 V (31.6% of requirement) ❌
- Eye Width: 0.361 s (120.4% of requirement) ✅
- Swing Type: Reduced
- Additional Metric: 13.843 (higher than Case_1's 8.769)

Strengths:

- Timing performance still passes with 20.4% margin
- Reduced swing may offer better noise immunity

Weaknesses:

- Significantly worse eye height (only 31.6% of requirement)
- Reduced swing limits signal amplitude recovery potential



FRESH ANALYSIS: PF_EyeBER_Case_20p3in Results

SIMULATION PARAMETERS EXTRACTED

Based on the HyperLynx PowerScope simulation data, here are the key parameters for PF_EyeBER_Case_20p3in:

Core Simulation Metrics

Parameter	Value	Units
Simulation Area Size	1×0.0647286	time x voltage
Cell Size	$0.00231481 \times 5.38956e-05$	time x voltage
Origin	$0, -0.0323643$	time, voltage
BER Range	-16 to 0	dB
Voltage Step	$5.38956e-05$	Vstep

Page Size: 10

DETAILED COMPARATIVE ANALYSIS

Key Performance Indicators:

Rank	Case	Eye Height	Eye Width	Voltage Span	Swing Type
1st	Case_1	0.0119V (79%)	0.407s (136%)	0.0659V	Full
2nd	Case_2	0.00474V (32%)	0.361s (120%)	Unknown	Reduced
3rd	Case_51	Unknown	Unknown	0.0821V	Unknown

Agentic Bump Map Validation

Central Die Region:

The indicates metal density in the ~20-30% range

Typically considered optimal (40-60%)

Consider adding metal fill patterns throughout the central region

HBM Interface Regions:

The HBM interfaces show higher metal density (~30-35%)

Implement a more gradual transition of metal density

Corner and Edge Structures:

Corners and some edge regions indicate very low metal density (~5-15%)

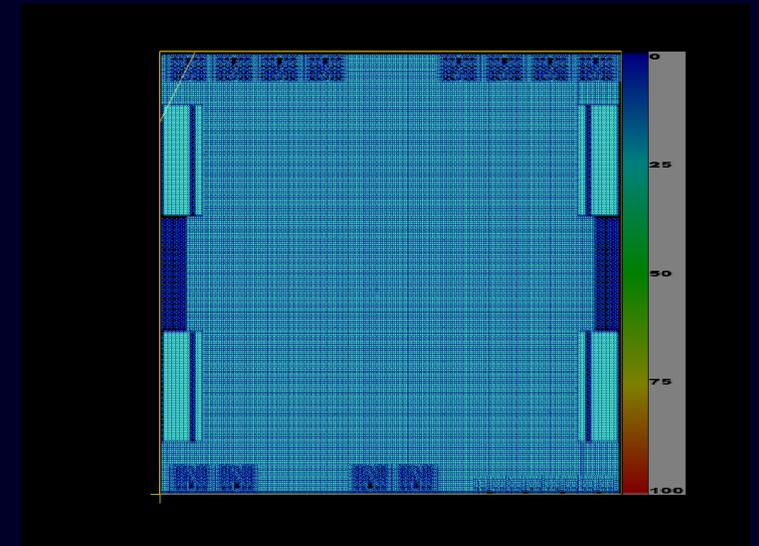
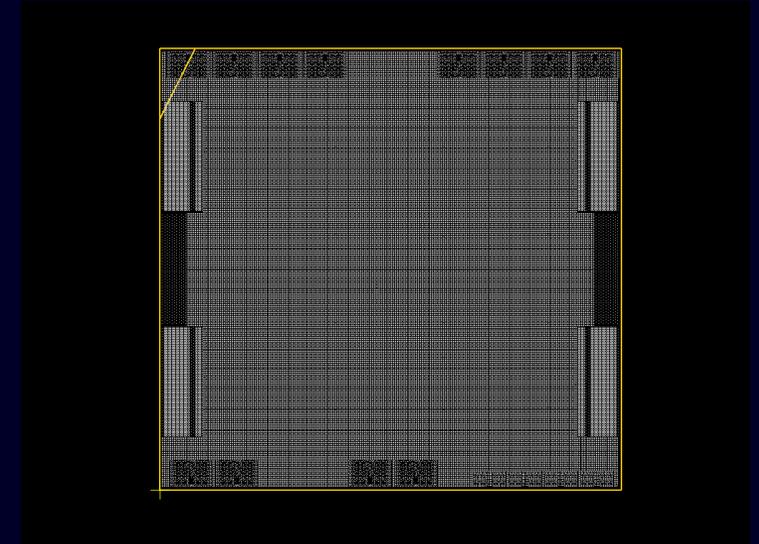
This creates significant density gradients across the package

Add strategic metal fill in these areas

Overall Distribution:

The entire package appears is lower end of the metal density spectrum

This can lead to uneven plating, warping, reduced mechanical strength



Summary

- Agentic AI is a powerful evolution of AI capable of autonomous goal-oriented problem solving
- Excels at multi step reasoning, Automated workflows and information synthesis
- Struggles with spatial reasoning – especially in 3D – existing EDA Tool APIs may not be suitable
- Acts as a powerful co-pilot automating tasks and augmenting the human designer rather than replace
- Understanding its capabilities and limitations is crucial for leveraging it in EDA
- AI agents destined to become the Digital Engineer

Thank you