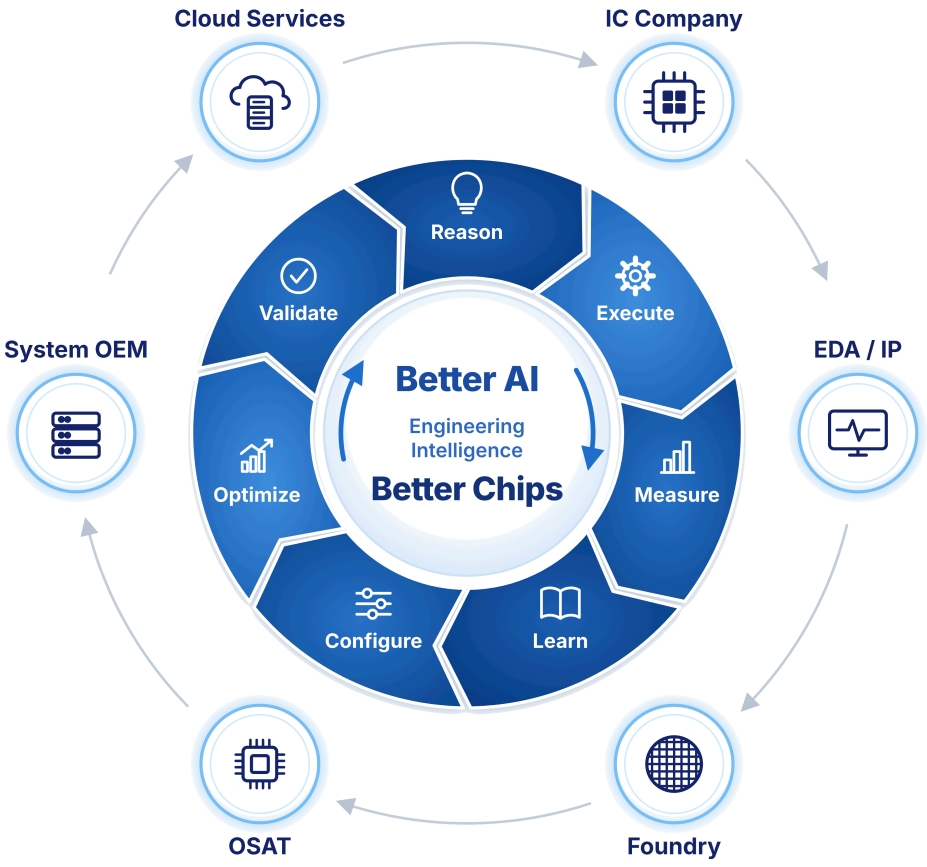
AI, EDA and IP: Reshaping Economics Across the Semiconductor Value Chain

How engineering intelligence is changing value creation, capture and sharing across the semiconductor ecosystem



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For decades, Aart de Geus has repeatedly argued that EDA sits at the heart of semiconductor innovation, yet it captures only a small fraction of the economic value created downstream.

In 2017, he said, "The end application is where the money comes from" as chipmakers were trying to get "closer to where the money ultimately is made." In 2019, he pointed to system companies "sitting closer to end applications" and "an aspiration upward for the economic benefit of AI." And in 2024 when Synopsys announced the $35 billion Ansys acquisition, he called it a "value-enhancing step" in accelerating its Silicon to Systems strategy.

That vision is now reflected in Synopsys' business mix. Synopsys is approaching $10B in annual revenue, with EDA including nearly $3B of Ansys revenue that extends into digital twins and physical-system engineering, while Design IP approaches $2B. NVIDIA has reinforced that direction with a $2B investment spanning accelerated computing, physical AI, and digital twins. The opportunity is to combine these assets into higher-value engineering solutions tied more directly to systems and end application economics.

At Synopsys' 2026 Investor Day, several key initiatives came together around a broader business model: application-optimized IP (AoIP), autonomous engineering, and the OpenAI partnership. Autonomous agents and OpenAI expand tool-flow exploration, while AoIP extends the "build once, license many" model toward application configuration, integration, and validation with a mix of license, customization and royalties. Together, these initiatives point toward capturing more value from engineering intelligence and application outcomes.

The strategy is compelling. The key question now is how quickly Synopsys can combine these capabilities into commercially proven solutions, demonstrate economic value with partners, orchestrate the value-chain ecosystem, and scale new revenue streams.

Hyperscalers are the logical place to start. They increasingly control workloads, custom silicon, system architecture, data-center infrastructure economics and application services, making them ideal for access, customization and validation models. The $1B+ Amazon deal is an early proof point of a direction that may reshape the semiconductor value chain.

The OpenAI–Synopsys partnership adds frontier reasoning and orchestration to trusted EDA tools, workflows and engineering expertise. In the near term, AI can expand design capacity and engineering intelligence by orchestrating multiple agents to explore far more alternatives to achieve PPA and coverage targets faster, speed design-to-manufacturing sign-off, and accelerate system-level optimization with digital twins.

The more important question is what happens as AI learns from a plethora of tool-flow explorations and application-specific IP configurations across designs, products, systems, services, use cases and application markets.

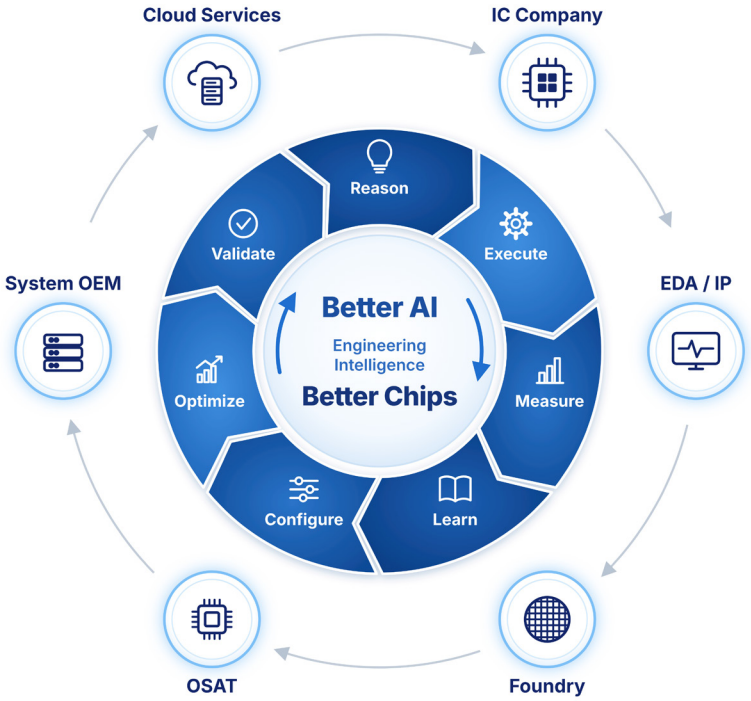
When tool runs and AoIP configurations compound into knowledge

For the EDA and IP business, AI changes engineering economics because every tool exploration and every subsystem AoIP configuration can become a learning event.

Historically, engineers consumed enormous EDA design capacity (tools and CPUs) through repeated explorations to achieve PPA or functional coverage. AI will likely multiply those explorations, but as knowledge accumulates, it should become better at identifying how to achieve design convergence and sign-off. Over time, value shifts from more tool usage toward fewer, better-directed iterations and ultimately greater enterprise design capacity.

The same applies to AoIP. AI can explore application-optimized subsystem IP configurations, while digital twins simulate them earlier in the context of a virtual end-system environment. Field feedback from the physical environment can then bridge the digital and physical worlds, improving future design, deployment and monetization across end-market applications.

Silicon Lifecycle Management (SLM) can connect design intelligence and physical-world lifecycle intelligence. By combining security & unique chip ID with manufacturing & supply-chain traceability certificates and lifecycle telemetry, SLM can create a persistent digital thread through design, manufacturing and field use, feeding trusted data across the value chain for analytics, optimization, and collaboration that fosters ecosystem partnerships.



The resulting **Engineering Intelligence Flywheel** becomes an endless loop of *Reason, Execute, Measure, Learn, Configure, Optimize, Validate* with lifecycle feedback extending

through deployment and field operation so knowledge compounds across design, manufacturing, packaging, system architecture, applications and end-market conditions.

The metric shifts from how broadly tools and IP are used to how quickly high-value, deployable outcomes can be achieved for each application through faster convergence, fewer re-spins, higher yield, improved reliability and system performance, and ultimately better workload efficiency and data-center utilization supporting higher-value cloud & AI services.

Greg Brockman, OpenAI's President & Co-Founder, described the reinforcing dynamic succinctly in a video at Synopsys Investor Day: "Better AI helps engineers design better chips. Better chips makes AI more capable, more efficient, more accessible to everyone." That flywheel can extend beyond the chip to the entire semiconductor value chain.

Who owns the engineering intelligence?

This is where the OpenAI–Synopsys relationship becomes strategically interesting, because it spans several knowledge domains across the fragmented value chain:

- **System/IC** suppliers own proprietary architecture, methodology expertise, design digital twins and application experience. AI can amplify those assets, provided the resulting engineering intelligence and their data remain proprietary.
- **EDA vendors** own algorithms, trusted tools, design flow execution and domain expertise, extended through SLM, analytics and digital twins. AI reasoning and orchestration can "package" those assets into higher-value application solutions.
- **IP providers** own reusable architectures, foundation IP, standards-based interfaces, and deployment experience. By using AI to combine and configure those assets into AoIP subsystems, they can capture more end-system and application value.
- **Foundries & OSATs** own PDKs, process knowledge, and manufacturing/assembly digital twins. AI enables them to improve yield, heterogeneous integration, product reliability and traceability, and capture more value across the product lifecycle.
- **AI providers** bring frontier reasoning and orchestration that can unlock engineering intelligence across the value chain, and gain access to engineering environments and domain knowledge to create better chips, which in turn enables more capable AI.

Everyone needs everyone else. As de Geus put it in 2017, success "is the product of our efforts. A single zero and everyone gets zero." But collaboration also creates a new question: who owns the engineering intelligence created across those interactions, and how do we ensure that no participant captures a disproportionate share of the economic value created?

As Palantir CEO Alex Karp wrote in a letter to stakeholders, "the revolution for independence and AI sovereignty is now well underway." Similar to the evolution of cloud-based EDA, design

enterprises will want to retain control of the proprietary data, workflows and organizational intelligence that create competitive advantage. Yet AI systems need access to that same data and IP to deliver value. The challenge is balancing access with ownership, confidentiality and governance over how proprietary data and know-how are used, while ensuring that shared intelligence strengthens each participant's differentiated value.

That is why orchestration becomes strategically important. No single company owns the architecture, manufacturing truth, application context, AI intelligence and lifecycle evidence required to prove the full outcome. Synopsys owns many of the enabling technologies, but realizing the economic value requires strong solution partnerships across the value chain.

Creating value is not the same as sharing it

AI creates opportunities to virtually re-aggregate the semiconductor value chain through interoperability standards, workflows and engineering intelligence. All participants contribute to value. But value creation, capture and sharing are not necessarily the same thing.

That value becomes easier to measure when we start with the end application and "shift left" to the underlying capabilities contributing to it. An automotive OEM may value faster ECU or ADAS qualification, lower warranty exposure, fewer recalls and faster root-cause analysis. Aerospace and industrial OEMs may value trusted component provenance, device pedigree and supply-chain traceability. An AI data-center operator may value predictive reliability and reduced downtime, where even short disruptions can carry significant economic cost.



Suppliers across the value chain benefit through differentiation and access to higher-value markets. Foundries and OSATs can monetize trusted process and lifecycle evidence. AI, cloud and analytics providers can create recurring services around trusted and traceable data.

Ultimately, the end customer pays for the application outcome, not the underlying workflow, traceability or AI infrastructure itself. Yet no single participant can deliver that outcome alone, so the ecosystem must increasingly collaborate around end-to-end solutions. This is also where traditional royalty models become more defensible, because EDA flows combined with configurable IP subsystems, digital twins and lifecycle intelligence contribute to measurable improvements in cost, performance, yield, reliability, system/service economics.

That points toward a broader commercial model. GPT-Synopsys introduces outcome-based revenue sharing and AoIP adds royalties tied to volume, potentially extending to field use. That model will likely combine access or subscription, customization, tools, validation, lifecycle services, and outcome-based economics. However, when multiple companies jointly create the result, value capture becomes a value-sharing problem. The model must incentivize broader participation, rewarding partners for the capabilities they bring. Governance and attribution therefore become essential to revenue sharing and scaling ecosystem value.

Scaling that model across the value chain depends on outcomes that can be measured and attributed to participants contributing to the end-to-end solution. That requires a trust layer of workflow metadata, provenance and traceability spanning the entire value chain. De Geus anticipated this in 2019: verifying a replacement module in a five-year-old car requires "a very sharp understanding of what's in those modules." That continuity must extend from design intent through AoIP sign-off, foundry realization, lifecycle monitoring and feedback.

We have been here before

Historically, chipmakers began accumulating EDA knowledge in scripts, makefiles, point-tool parameters, logs and reports. Over time, leading design teams captured that knowledge in graph-based flows, dependencies and runtime metrics, turning design methodologies into executable representations of reusable engineering know-how.

As design reuse emerged, new business models evolved. In 2003, an industry working group I chaired published the first FSA guide on semiconductor IP business models, covering per-use, access, customization and royalty models, including methods where monetization was tied to cost, performance or yield improvements. The lesson was that when engineering know-how becomes reusable, commercial models evolve to reflect the value created.

As the semiconductor value chain became more disaggregated, new challenges emerged: product integrity, reliability, chip security, and trusted supply chains and systems. Work through GSA TIES and the Commerce Department IoT Advisory Board (IoTAB) Report helped refine a strategy around traceable digital threads, digitalized workflows, trusted data exchange, and public-private partnerships aligned with the CHIPS Act. The premise was that fragmented ecosystems require orchestration, governance and collaboration to connect organizational and supply-chain silos into end-to-end solutions driven by end-market needs.

AI now supplies the reasoning and orchestration layer that had been envisioned with TIES. It can reason over accumulated knowledge and trusted data, select alternatives, orchestrate workflows and link digital twins with manufacturing for system and application development downstream before the physical components arrive. What were once separate advances in EDA, IP reuse and trusted data exchange can converge into an engineering-intelligence framework that reconnects the fragmented value chain and creates new opportunities.

The bigger prize: from tools and IP to solutions

The goal is not simply to maximize tool usage and IP reuse, but to participate more directly in the economic value created by application outcomes.

For Synopsys, that means turning its portfolio into commercially proven solutions: EDA flows, configurable IP, validation and signoff, Ansys digital twins and physical simulation, SLM and lifecycle analytics, all connected through AI reasoning and orchestration. The challenge is to package them into joint offerings that create measurable value across multiple end markets.

Hyperscalers provide the most natural proving ground because they control rapidly growing data-center infrastructure where application services and benefits are visible, measurable and monetizable. The larger opportunity is to scale that model into automotive, aerospace, industrial and edge application markets where ecosystem collaboration becomes essential.

That leaves two questions for the industry: How do we connect intelligent workflows across a disaggregated value chain to create even more value? And how should that value be shared among the ecosystem participants who contribute to it?

The winners will not simply be those with the best agentic flows, but those who can create trusted systems in which knowledge can be captured, protected, shared where appropriate and converted into monetizable outcomes across organizational and supply-chain silos.

Synopsys' strategy points in the right direction. If it can turn its collective capabilities into scalable end-to-end solutions that bring together customers, chipmakers, foundries, OSATs, AI providers and system OEM partners, it can accelerate growth not only for itself, but across semiconductors, electronics, and hyperconnected digital markets.

That is where engineering intelligence becomes economic infrastructure and where value creation, capture and sharing begin to converge through trusted, traceability-enabled applications across the semiconductor and electronics value chain.

This article was developed with the assistance of AI. I welcome questions and perspectives on value creation and sharing across the value chain at tomkat@archon-ds.com.

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