



Silicon-Based Economics: From Compute as Capital to an AI-shaped World Order

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ABSTRACT At a global ‘singularity’—the convergence of technological, financial and geopolitical shifts—carbon-based production systems and institutional architectures are being severely tested. The old logic no longer captures the scale or speed of the changes now unfolding. This paper introduces the concept of “Silicon-Based Economics”, an economic paradigm that regards artificial intelligence, compute, data and large models as core factors of production. We further point out three fundamental economics research priorities:

- I. **Productivity Metrics.** We urgently need to define and quantify a statistical framework that can describe and measure AI-driven productivity.
- II. **Global Power Distribution.** A global “silicon-based power triangle” is forming around extraction, pricing and settlement rights of intelligence; new economic models are required to underpin an international coordination mechanism for AI’s global expansion.
- III. **Silicon-based Money.** A digital stablecoin pegged to unit of AI could become the monetary anchor of the silicon age, offering the world a payments and store-of-value foundation for AI.

We call for a silicon-based extension of the Beyond GDP agenda [1] to re-frame both economic discourse and measurement in the AI era. If the silicon economy is the ocean we now sail in, **silicon-based economics** provides the charts and rules of navigation.

KEYWORDS Silicon-based Economics, Artificial Intelligence, Intelligent Domestic Product (IDP), Silicon-based Money

1. Introduction

The world is entering an unprecedented phase of simultaneous deconstruction and reconstruction: a technological contest centred on artificial intelligence (AI) and semiconductors; a global financial struggle around a world-wide “post-dollar system” and digital currencies; and a geopolitical re-ordering of countries and shared-values. These three are not only interweaving but also amplifying one another.

The traditional carbon-based logic of productivity, national economic models, and international coordination mechanisms are undergoing a fundamental disruption. In this historical transition, we propose “Silicon-Based Economics” as a new focal point and foundation for economic research and policy making. Carbon-based logic—founded on labour, natural resources and industrial capital—is being supplanted by a silicon-based logic in which compute becomes capital, algorithms become institutions, and intelligent agents become labour. Erik Brynjolfsson has pointed out that we are entering a “Second Machine Age” where computer/data/algorithms has already rivaled steam and electricity[2]. Philip Trammell in a recent paper has suggested that Transformative AI is quickly speeding growth through its novel effects of making capital “self-replicate” and “self-improve” [3]. Only with a fresh perspective of “silicon-based economics” can we grasp the mechanisms of value creation, the distribution of power, and the contours of the emerging global order.

“**Silicon-Based Economics**” is an economic paradigm in which artificial intelligence, large-language models, computing power, data, and semiconductor chips constitute the primary means of production and the central drivers of economic activity. It therefore re-defines value creation, labour forms, capital composition and organizational design.

2. Silicon-Based Productivity: How AI Is Redefining “New-Quality Productivity”

2.1 The Transformation of Productive Forces

Throughout history, the discovery of strategic resources has repeatedly reshaped productive forces and, in turn, re-wired economic growth and consumer demand. Oil ignited twentieth-century industrialization, spawning mass-market automobiles, petrochemicals and the modern consumer society. In a similar yet more profound way, AI is now defining a new class of productivity.

First, the means of production have been rewritten. Intelligence is replacing energy as the fundamental input. As a general-purpose technology (GPT) [4], AGI permeates every sector; entire industries are realigning around this new factor. That requires a rapid build-out of silicon infrastructure—including chip supply chains, compute centers, data centers and intelligent cloud services. Existing value chains must also be re-engineered: virtually every industry needs domain-specific layers that sit atop AGI. Compared with electricity or the steam engine during the Industrial Revolution, AGI is diffusing faster and wider; large language models have delivered cutting-edge AI services to the globe within mere months. Nations mastering AGI can translate it into productivity and geopolitical influence at unprecedented speed, much like steam-powered states once seized hegemony. One estimate puts AI’s incremental lift to world output at US\$15.7 trillion by 2030 [5], broadly equivalent to oil’s peak contribution to the world economy. The difference is that oil spurred output via energy supply, whereas AGI boosts total-factor productivity and automates knowledge work.

Second, the nature of labour has been revolutionized. Tomorrow’s workforce will consist of more AI agents and fewer humans. As AGI matures, intelligent agents can replace an ever-larger share of human tasks, severing the historical link between output and labour-supply. This “digital labour” explosion will multiply productivity and national competitiveness. Simultaneously, an entirely new spectrum of demand will coalesce around the general needs of AI agents:

- I. “clothing” – the user interface: will AI embody robots, self-driving cars or brain–computer links?
- II. “food” – AI “eats” electricity; energy demand will soar.
- III. “housing” – more super-computing hubs and intelligent storage needs to be built.
- IV. “mobility” – how will intelligence flow from high-AI to low-AI level regions?

As labour evolves from wholly human to human + AI-agent hybrids, society will move beyond the material consumer era into a new socio-economic form. That momentum splits into two streams: (i) silicon-based consumption arising when humans gain AI, and (ii) AI agents’ own demand as economic subjects.

Empirical signals are emerging. Field experiments in early 2025 has shown AI can compress skill gaps and boost productivity in [6]. Anthropic’s Economic Index further finds that one-quarter of work across 700 occupations is already executed entirely by agents [7]. Sequoia Capital frames this as an “always-on” Agent Economy: billions of agents with persistent identities not only assist humans but also transact, settle and collaborate with each other, overhauling software stacks, corporate structures and global value chains [8].

The table below contrasts “new-quality” productivity under a silicon-based logic with traditional productivity under a carbon-based logic. It is clear that, beyond the shift in core factors and labour subjects, society’s forms of capital, units of value and modes of organization are being simultaneously overturned and rebuilt—forcing a wholesale re-definition of resource-allocation mechanisms.

Table 1 Comparison between new-quality (silicon-based) and traditional (carbon-based) productivity

Category	Traditional productivity (carbon-based logic)	New-quality productivity (silicon-based logic)
Core factors	Land, labour, capital	Compute, algorithms, data
Production tools	Machinery, electricity, factories	AI systems, large models, platforms
Labour subjects	Human workers, entrepreneurs	AI agents, human–AI collaboration units
Forms of capital	Financial capital, fixed assets	Compute capital, model assets, data resources
Unit of value	Goods, services	Intelligent outputs, model calls, data streams
Organisational form	Corporation, bureaucratic hierarchy	Platform model, agent networks, model collaboratives
Statistical lens	GDP; employment rate, industrial output	IDP (Intelligent Domestic Product), per-capita IDP, per-capita data usage, MCR(Model Contribution Rate), ALR (Algorithmic Labor Contribution Ratio)

2.2 New Language and New Metrics

With compute, algorithms and data becoming the key factors of production, the “silicon turn” renders carbon-era yardsticks—GDP and the unemployment rate etc—insufficient to describe today’s economic structure and distribution. As intelligent labour and model capital expand, legacy metrics cannot capture AI’s true marginal contribution to output, nor the cross-border flow of data capital, thereby weakening policy decisions on resource allocation and redistribution. New-quality productivity and emergent social demand therefore require a silicon-based indicator system and statistical vocabulary.

New language has two layers of importance:

- I. **Property & economic terms:** compute, algorithms and data must be given explicit property rights and economic descriptors—e.g., compute-capital ratio or data-asset yield.
- II. **Public narrative:** AI labour should be framed as a productive input, not merely an outsourced cost. Only with a shared vocabulary can policymakers, academics and markets align their understanding.

New metrics call for three tiers of core indicators:

- I. **Macro level** – Intelligent Domestic Product (IDP) and Algorithmic Labor Contribution Ratio (ALR) to gauge the marginal effect of intelligent factors on national output.
- II. **Meso level** – Compute Capital Formation Rate (CCFR) and Effective Data Utilization (EDU) to track how regions or industries allocate intelligent resources.
- III. **Micro level** – Economic Turing Test (eTT) [9] Pass Rate to quantify the real performance of AI substitution and human–machine collaboration.

We define **Intelligent Domestic Product (IDP)** as follows:

IDP is the value added generated within an economy by intelligent systems—including AI models, agents, compute and data capital—over a given period. It isolates the AI-attributable share of domestic output, analogous to GDP’s value-added concept, but scoped to intelligent factors of production.

Its relationship to GDP as follows:

Let $GDP = HVA + IVA$, where HVA is human-only value added and IVA is intelligent value added.

We define IDP $\equiv$ IVA and recommend reporting it as a satellite account alongside GDP to avoid double counting.

What counts as IDP:

- I. Direct AI services sold or used domestically
 - e.g., model inference (per-million-token calls), agent task completion, autonomous decisions, vision/voice inference.
- II. Capital services of “silicon assets”
 - compute capital (GPU/TPU), model assets (weights), and data capital (licensed datasets) imputed via rental-price or user-cost methods.
- III. AI-enabled production inside firms (own-account)
 - internal inference/API usage valued at observable transfer prices or shadow prices.
- IV. Agent-to-Agent (A2A) workflows
 - settled micro-transactions among agents operating within the domestic boundary.

What does not count:

- I. Purely human output without material AI input.
- II. Intermediate AI inputs already counted upstream (to prevent double counting).
- III. Training capex is capital formation, not current output (its service flow appears in IDP via capital services).
- IV. Illicit/extra-system activity not recognized in national accounts.

Measurement:

- I. **Quantity metrics:** API calls, inference-hours, tokens processed, agent task units.
- II. **Prices:** market tariffs (e.g., \$/M-tokens), regulated transfer prices, or hedonic/shadow prices where markets are thin.

IDP aggregation:

$$IDP = \sum_s (P_s \cdot Q_s) + \sum_a \text{RentalService}(a) \quad (1)$$

where s indexes AI services and a indexes silicon assets (compute/model/data).

We also define following **core sub-indicators:**

- I. **Per-capita IDP** — IDP divided by population.
- II. **Algorithmic Labor Contribution Ratio (ALR)** — AI/agent share of total labor-like services.
- III. **Compute Capital Formation Rate (CCFR)** — gross formation of compute capital / total investment.
- IV. **Effective Data Utilization (EDU/EDUR)** — trained/used data divided by available data.

Boundary & frequency:

- I. **Domestic boundary:** resident-producer principle
- II. **Frequency:** monthly/quarterly
- III. **Data sources:** including model/agent usage logs, on-chain settlement records, cloud bills, data-license registries.

2.3 A New Distribution Built on New Language and New Metrics

In industrial civilization, distribution rules were anchored in the scarcity and supply elasticity of the three carbon-based factors—land, labour and capital—and took the form of a stable three-part framework of ownership $\rightarrow$ employment $\rightarrow$ returns. In the silicon era, the centre of distribution is no longer a simple split between capital and labour; it is redesigned around the three rights of compute, algorithms and data:

- I. **Ownership:** Chips, models and data sets are given formal property rights and enter the balance sheet as assets.

- II. **Usage rights:** Metered billing via API calls, compute leasing and data licences.
- III. **Revenue rights:** Automatic profit-sharing based on intelligent contribution—model-call volume multiplied by a weighting factor.

To make the contrast between the two paradigms clear—how each allocates resources and channels returns—we break distribution mechanisms into ten dimensions, from scarcity core and ownership focus to three-rights structure and policy levers, setting old indicators alongside new ones. The table below shows how carbon logic and silicon logic answer the same questions in completely different ways, thereby providing a theoretical coordinate system for the “new distribution.”

Table 2 Distribution mechanisms under silicon logic vs. carbon logic

Dimension	Carbon-based distribution (land–labour–capital paradigm)	Silicon-based distribution (compute–algorithm–data paradigm)
Scarcity core	Physical resources, labour, monetary capital	High-efficiency compute, usable data, leading models
Ownership focus	Land, plants, machinery, equity shares	Compute nodes, model weights, data assets
Value-creation chain	Capital input → labour processing → goods output	Data collection → model training → intelligence iteration
Key indicators	GDP, employment rate, industrial output	IDP (Intelligent Domestic Product), Algorithmic Labor Contribution Ratio, compute per capita
Primary distribution	Capital returns vs. wages	API billing, compute leasing, model-call revenue-sharing
Secondary distribution	Taxes → transfers (social security, subsidies)	“Intelligent resource tax,” data dividends, compute public funds
Three-rights structure	Ownership → employment → returns	Ownership → usage → returns (on-chain titles + smart-contract splits)
Definition of labour	Human time and skills	AI agents + human–AI collaboration; labour counted via Economic Turing Test pass rate
Equity risk	Capital concentration → income inequality	Compute monopoly, data inequity → digital divide
Policy levers	Minimum wage, capital-gains tax, GDP targeting	Compute-access regulation, data title clarification, algorithm transparency & auditable trust

3. Silicon-Based Control: The Power Triangle of the AI World

The maxim “Whoever masters AI, rules the world” is hardly an exaggeration. In the silicon-based era, real control hinges on three distinct powers: extraction, pricing and settlement rights of intelligence.

- I. **Extraction Rights** is the contest over who can secure a sustained supply of the three inputs required to “mine” intelligence—high-performance compute, top-tier algorithms (talented scientists and engineers) and high-quality data.
- II. **Pricing Rights** is the race to offer refined intelligence at a competitive, globally accepted price.
- III. **Settlement Rights** is the struggle to decide which currency becomes the unit of account for AI services on world markets: the U.S. dollar, the renminbi, or a purpose-built digital currency?

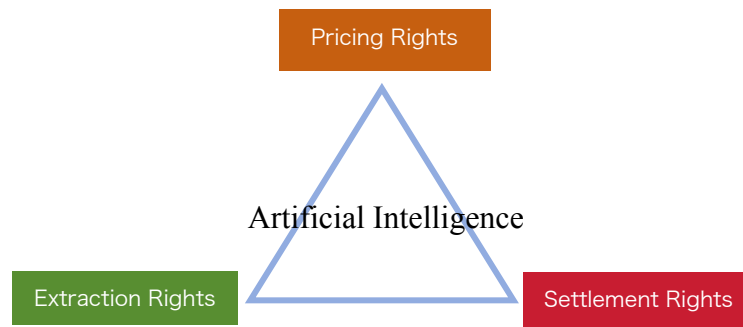


Fig.1. The Power Triangle of the AI World

3.1 Extraction Right of AI

Within the silicon-based power triangle, the right to “mine” intelligence—is at present held chiefly by the United States, with China in second place. The United States enjoys the world’s most complete AI ecosystem: from cutting-edge chips designed and fabricated by NVIDIA and AMD, through hyperscale cloud platforms (Google, Amazon), to high-quality data resources and leading research institutes and talent pools.

Washington has moved aggressively to consolidate this advantage. The CHIPS and Science Act of 2022 earmarks USD 280 billion to support domestic semiconductor manufacturing and AI R&D, reinforcing supply-chain security [10]. At the same time, citing national security, the United States has tightened export controls on advanced AI chips and design tools bound for China—an approach reminiscent of its Cold-War policy toward Middle-East oil: secure ample “strategic reserves” for itself while denying rivals access to critical resources.

China has closed the gap rapidly in data and algorithm capability and is approaching self-sufficiency in those domains. Yet in high-performance computing hardware—the decisive input—it remains constrained. Despite a nationwide push to develop indigenous alternatives, achieving a long-term, stable supply of top-tier compute remains a formidable challenge. For now, therefore, extraction rights resides largely with the United States. The more successful Chinese models such as DeepSeek become, the more likely Washington is to tighten controls—potentially banning all AI-grade chips from entering China—to maintain absolute command over the compute needed for intelligence extraction.

3.2 Pricing Right of AI

At present, pricing right for intelligence is effectively in China’s hands, thanks to DeepSeek’s ultra-low-cost, high-performance models. Before DeepSeek burst onto the scene, the contest over pricing was largely an American affair—OpenAI, Google, xAI and Anthropic vied to set the benchmark. Because U.S. companies supplied the world’s most capable models, they exercised near-absolute control over price and were ready to evolve into global AI conglomerates.

DeepSeek has upended that equilibrium. With a team of only 160 people, the company now offers high-quality intelligence worldwide at roughly one-thirtieth of the prevailing price, and—by relying on an open-source stack—has sidestepped the enormous cost and manpower that closed systems require to produce and serve models at scale. In less than two months, DeepSeek won broad recognition as the price-setter for unit intelligence.

The firm’s “intelligence-refining” breakthroughs are as significant as America’s shale-gas revolution. Beginning in the early 2000s, advances in fracking and horizontal drilling enabled large-scale extraction of shale gas, fundamentally altering the global energy landscape. Likewise,

DeepSeek’s “intelligence-refinery revolution”, unveiled in early 2025, is arguably the most consequential development in two decades of AI: it extracts usable intelligence from cheaper, more distributed hardware, making vast extraction of intelligence that were previously uneconomical suddenly accessible. The result: China has reduced its dependency on imported intelligence, the clout of America’s compute superpowers has diminished, and the global AI market has become markedly more diversified.

AI Model Pricing		
Model	Input	Output
ChatGPT 4.5	\$75.00	\$150.00
ChatGPT o1	\$15.00	\$60.00
Claude 3.5 Sonnet	\$3.00	\$15.00
ChatGPT 4o	\$2.50	\$10.00
ChatGPT o3-mini	\$1.10	\$4.40
DeepSeek r1	\$0.55	\$2.19
DeepSeek v3	\$0.27	\$1.10
ChatGPT 4o-mini	\$0.15	\$0.60
Gemini 2.0 Flash	\$0.10	\$0.40
Gemini 2.0 Flash-Lite	\$0.075	\$0.30

Fig.2. Price war in AI models in March 2025 (US \$/million tokens in, US \$/million tokens)

In March 2025, DeepSeek R1 is priced at US \$0.55 per million input tokens, with GPU costs accounting for only 15 percent and an 85 percent gross margin [11]. By contrast, OpenAI’s contemporaneously released ChatGPT 4.5 charges US \$75 per million input tokens [12]. DeepSeek’s win in this Sino-US AI contest is significant not only for its cost edge; more critically, it wrests pricing power over AI—a strategic factor of production—into China’s hands.

3.3 Settlement Right for AI

Settlement right is the battle over which currency will become the universally accepted unit of account for AI services: US \$0.55 or ¥4.01 RMB per million tokens? At present the outcome is still uncertain.

The explosive growth of intelligence is triggering a wave of silicon-infrastructure build-out and a wholesale reshaping of global demand—forces that will radically alter trade patterns. “Exporting intelligence” is poised to replace oil as the most critical item in international commerce: AI will flow from silicon-based producer nations to silicon-net-importing nations that cannot generate it domestically. As a result, global trade in intelligence will surge and quickly surpass carbon-based trade. Oil’s function as the primary monetary anchor will give way to intelligence.

For decades, the United States has dominated the petroleum-centred financial system—pricing oil in dollars and securing Middle-East supply through military alliances. Today, the dollar urgently needs to re-peg to intelligence. Washington’s strategy is clear: control the compute factor (GPU chips) to monopolise extraction; because GPU hours are priced in dollars, the refined intelligence that follows naturally inherits dollar pricing. If America succeeds in locking up compute and global supply, and in anchoring the dollar to intelligence, its hegemony in the oil-based financial order will be replicated in the emerging AI-based order—effectively swapping oil for intelligence as the global power lever. One wild card is a possible future Trump administration, which might peg a dollar-backed digital currency directly to intelligence, bypassing the Federal Reserve and forging an alternative, dollar-adjacent AI-finance system.

The competitive–collaborative dynamic between the United States and China—the only two nations capable of mass-producing artificial intelligence and refining its vertical applications—has thus become delicate. Although the present tone is one of mutual containment, DeepSeek’s

breakthrough in “intelligence refining” could push both countries to the negotiating table to discuss pricing and global supply, perhaps leading to an “AIPEC” (Organization of the AI Exporting Countries) that would avert destructive rivalry and maximise joint gains.

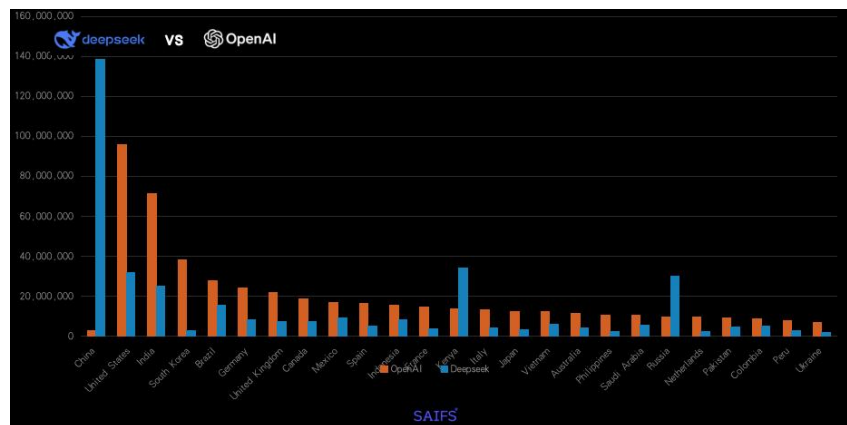


Fig.3. February 2025—DeepSeek vs. OpenAI user counts by country
(in Kenya, Russia and several other nations, DeepSeek already exceeds OpenAI in user numbers)

4. Silicon-Based Money: A Stablecoin Pegged to Intelligence

The credibility of the dollar-centric system is wavering, and the global financial architecture is drifting off the dollar anchor. Dollar-backed stablecoins such as USDC and USDT are racing to claim a new anchor point, leveraging residual dollar trust and their first-mover edge in crypto and cross-border payments. Their strategy is to become a “dollar extension” in a de-dollarising world and occupy the core of the emerging digital-currency order.

Yet in this round of competition, the traditional Bretton Woods 1.0/2.0 arrangements [13] no longer work. The world needs a freshly defined, intelligence-anchored, silicon-based currency—one that carries the value unit and payment rails demanded by AI-defined productivity. In essence, “intelligence” must be built into both the store-of-value and the payment layer, so that the currency can support machine-to-machine (M2M) and human-to-machine (H2M) realtime settlement while still inheriting the security and macro-policy tools of sovereign credit. Achieving this requires three elements:

- I. **Contract-native money.** The rise of the Agent Economy will unleash billions of autonomous agents that need 24/7 micro-payments for compute, data and services. Legacy T+1—or even second-level—clearing cannot cope. A silicon-based money must natively support programmable smart contracts so that every API call settles instantly, with fees low enough for micropayments. Hence, on-chain contract languages, formally verifiable execution, and high-TPS networks are non-negotiable infrastructure.
- II. **Sovereign credit backing.** Purely algorithmic, decentralised stablecoins can de-peg under stress; bank-reserve coins like USDT/USDC remain dollar-bound. A silicon-based currency should be issued by—or under mandate from—a central bank, guaranteeing 1:1 redemption and thus public confidence in price stability and liquidity. A two-tier architecture—commercial banks, PSPs and Web3 wallets under the sovereign layer—can balance compliance and innovation.
- III. **Dual anchors: functional + sovereign credit.** Sovereign backing provides external stability; the functional anchor—linking the token to an intelligence unit (e.g., price per million tokens)—creates intrinsic demand. If developers, enterprises and agents worldwide use the same currency to buy model inference, rent compute or access data APIs, that hard

consumption resembles the oil demand that once underpinned the dollar. The WTO projects digitalization could raise global trade growth by 31–34% by 2030 [14]; services and digitally deliverable services gain share through 2040 [15]. Dual anchoring mitigates de-peg risk: when macro shocks hit, growing AI-service demand absorbs pressure; if demand dips, sovereign credit props up expectations.

In sum, the trinity of contract-native design, sovereign backing and dual anchoring enables a silicon-based currency to circulate at high frequency on-chain, remain stable across cycles, and inject “intelligence dividends” directly into the unit of account—laying a payment and store-of-value foundation for the age of AGI.

5. Conclusions

Silicon-based economics is a new way to read the economy: compute is capital, algorithms are the rules/institutions, and AI agents do part of the work. To make this paradigm operational, three agendas must advance in parallel at current. First, measure it clearly: establish a shared vocabulary and satellite accounts—IDP (intelligent domestic product), ALR (algorithmic labor share), CCFR (compute investment), EDU (how well data is used), and the eTT pass rate (how often agents can replace human)—so AI’s marginal contribution can be audited rather than assumed. Second, govern of the AI power triangle globally: set standards for extraction, pricing, and settlement of intelligence, including transparent access to compute and fair data rights. Third, build the monetary infrastructure: pilot dual-anchored silicon money (credit anchor + functional anchor to intelligence units) within cross-border trials. New future policy priorities will include compute/data property rights, public compute funds and data dividends, agent-to-agent trade rules, and verifiable safety/audit regimes; further research priorities include causal TFP measurement, agent-market design, and macro stabilization under intelligent demand shocks. If we succeed, the agent economy can widen opportunity and resilience; if we do not, concentration of compute and data will entrench inequality. The outcome is institutional by choice—not technological fate.

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