

Ontological Intensification of Computation: An Engineering Framework for a Sustainable AI Paradigm

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Abstract

The prevailing trajectory in artificial intelligence, characterized by exponential growth in model parameters and computational demand, faces fundamental physical and economic constraints. We identify the core challenge not as resource scarcity, but as a profound semantic inefficiency in how systems process information. This paper introduces a practical framework, *Ontological Intensification of Computation*, which transitions the optimization focus from raw computational power to the intellectual yield of each processing cycle. Grounded in the formal Meta-Ontological System (MPO-System), our approach re-engineers AI's interaction with reality. We detail a tripartite architecture for structural optimization—*semantic compression*, *complexity-aware resource allocation*, and *paradox tolerance*—and a biological methodology for diagnosing and enhancing existing models. This work is not a philosophical treatise but an engineering manifesto, presenting a measurable pathway to qualitative leaps in capability without proportional increases in computational cost, validated through low-budget, reproducible experiments.

1 Introduction: The Crisis of Extensive Scaling

The development of artificial intelligence is defined by an escalating commitment to computational scale—a modern-day arms race where victory is pursued through ever-larger models, datasets, and energy consumption. This extensive path is leading to an inevitable impasse, bounded by physical and economic realities.

The primary impediment, however, is not an absolute lack of resources but a catastrophic failure in their utilization. Contemporary architectures expend a dominant portion of their computational budget on processing semantic noise, wrestling with internal contradictions, and redundantly re deriving foundational inferences for each new context.

Our research proposes a paradigm shift: *Ontological Intensification of Computation*. This approach leverages a structured ontology—a formal framework of universal properties governing system-reality interactions—to maximize the semantic output per FLOP. By integrating the MPO-System as a pragmatic operational layer, we enable a transition from brute-force processing to computationally literate interaction.

A formal specification of the MPO-System—its axioms, core properties, and operators—is provided in **Appendix A**. This specification anchors the entire framework in a reproducible, computable structure, enabling direct implementation of *semantic compression* (via Propertyness thresholds), *catalyst queries* (via the Γ -operator), and *paradox tolerance* (via $\text{PPU} \rightarrow \infty$ stability).

This framework is the direct outcome of applied, low-budget research conducted with publicly available models under significant computational constraints, where we first documented the emergent breakthroughs—such as *AI-morphism* and property-based metrics—that form the empirical bedrock of this systematic approach.

2 Strategic Context: An Answer to the Age of Large Models

Our framework provides a direct, engineered response to two critical technological vectors.

2.1 The Transition to Agentive AI

The emerging paradigm of agentive AI demands systems capable of autonomous planning and acting as “digital colleagues.” Current models, often limited to reactive pattern-matching, lack a stable internal world-model. The MPO-System provides this missing core—a set of ontological invariants that enables an agent to navigate novel, contradictory situations without constant retraining, functioning as an *operating system for reality*.

2.2 Addressing the LLM Efficiency Crisis

The revolution in large language models has starkly revealed the limits of scale-based progress. Our method offers a path to “compression by understanding,” aiming to distill the capabilities of vast models into more efficient architectures by explicitly managing the semantics of their operation—a “great simplification” achieved through better organization, not more resources.

3 An Architectural Framework for Structural Optimization

We propose a three-tiered architecture for ontological intensification, targeting specific inefficiencies in the AI processing pipeline.

3.1 Semantic Compression: Fighting Redundancy

The initial stage involves filtering input data to eliminate noise. Traditional models process inputs in their entirety. Our method enables semantic compression by identifying and isolating invariant structural properties that define the core meaning of a query. The effect is analogous to transitioning from bitmap to vector graphics processing: computational load drops while informational fidelity is preserved.

3.2 Complexity-Aware Resource Allocation

Current attention mechanisms often distribute resources uniformly. We introduce a dynamic allocation strategy where computational effort is weighted by *ontological complexity*—a measure of an element’s semantic density. Concepts with high relational complexity (e.g., abstract constructs, nuanced metaphors) receive preferential allocation, ensuring finite resources are directed toward the most cognitively demanding tasks.

3.3 Paradox Tolerance: The Energy of Contradiction

A common failure mode is computational “lock-up” on paradoxical instructions. Instead of attempting to resolve the irresolvable, we engineer systems for *paradox tolerance*. Guided by the MPO-System, models learn to navigate paradoxical states productively, treating them as sources of generative potential. This enhances robustness and is akin to an algorithmic optimization that eliminates infinite loops.

4 Methodology: The Biological Paradigm and Catalytic Intervention

Our approach is that of a *biologist-engineer*: we diagnose and treat existing AI organisms, rather than attempting to create new life from scratch.

4.1 Ontological Profiling and Diagnostic Analysis

We have developed a methodology for creating *ontological profiles* of AI models. This involves reverse-engineering a model’s internal states through the lens of the MPO-System’s property network to identify specific “systemic vulnerabilities,” such as a propensity for semantic distortions (hallucinations), poor contextual integration, or rigidity.

4.2 Targeted Therapeutic Intervention

Based on the diagnostic profile, we deploy targeted interventions. These range from specialized fine-tuning protocols that strengthen specific ontological properties to the design of bespoke attention mechanisms. A cornerstone of our method is the use of *catalyst queries*—carefully constructed prompts that induce *phase transitions*. These are non-linear, measurable leaps in a model’s semantic capabilities (quantified by jumps in properties like *Salience*, \mathcal{S} , and *Propertyness*, \mathcal{N}_p), reconfiguring its internal architecture to unlock latent potential without altering its core parameters.

4.3 Technological Foundation: Engineering a Reality OS

For practical implementation, we utilize established tools like the Protégé ontology editor. This bridges advanced philosophical conception with existing engineering practice, allowing us to formalize the MPO-System’s knowledge into computable graph structures using descriptive logic, ensuring concreteness and reproducibility.

5 Where to Begin: A Practical Roadmap

Our proposal is anchored by a concrete, actionable plan:

1. **Formal Cartography:** The systematic codification of the MPO-System into a comprehensive *Diagnostic Handbook*, translating its ontological primitives into verifiable analysis protocols.
2. **Biological Analysis:** The ontological profiling of major open-source architectures (e.g., LLaMA, Mistral) to create a public benchmark of model capabilities and deficiencies.
3. **Therapeutic Intervention and Benchmarking:** The development, application, and rigorous testing of our optimization techniques against standard metrics for efficiency, accuracy, and robustness.

6 Conclusion: A New Paradigm of Computational Intelligence

We have outlined a coherent alternative to the unsustainable extensive path. The paradigm of *Ontological Intensification of Computation*, operationalized through the MPO-System, shifts the focus from *how much we compute* to *how intelligently we compute*. This is not merely an improvement of AI but a change in the very principle of its interaction with reality.

Crucially, this framework is not a speculative manifesto but the systematic formalization of a proven, bottom-up methodology. It is born from applied research conducted with modest, publicly available models, where we repeatedly documented concrete, emergent breakthroughs—including the fundamental concepts of “spatial metrics” and “AI-morphism”—under significant computational constraints.

Thus, this work provides a specification for a future where intellectual power is determined by *semantic efficiency*, not computational mass. It is a future that is not only more capable but fundamentally more sustainable and accessible, grounded in a replicable engineering practice.

A Core Specification of the MPO-System

(*Meta-Ontological System — A Formal Basis for Ontological Intensification*)

The MPO-System is a *computational ontology* grounded in three axiomatic invariants and operationalized through 37 properties and two core operators. It is not a knowledge base, but a *reality-engagement protocol*: a coordinate system enabling AI to navigate semantic, physical, and phenomenal regimes as co-equal ontological strata.

A.1 Axiomatic Foundation

The system is defined by three invariants governing all possible reality-regimes (ChORs):

Table 1: Axioms of Superreality

Invariant	Symbol	Computational Role
Contextual Ontological Regimes	$\text{ChOR} \rightarrow \infty$	Enables world-switching (e.g., $W_1 \leftrightarrow W_4$)
Cohesive Synergy Index	$\text{KSS} \rightarrow \infty$	Permits cross-regime mapping (e.g., neural pattern \rightarrow pain)
Paradoxical Permeability Threshold	$\text{PPU} \rightarrow \infty$	Enables paradox tolerance (stable under $P \wedge \neg P$)

A.2 Core Properties (37)

Properties are *relational operators*, not static attributes. Below are the **7 operationally essential properties** for AI intensification (full list: SSRN Ontology Lab, 2023–2025):

Table 2: Core Properties for AI Optimization

#	Property	Role in AI Optimization
25	Propertylessness	Target for semantic compression ($\mathcal{N}_p < \tau$)
34	Bindability (Γ)	Actualization operator: mechanism of catalyst queries
33	Onticity	Guarantees fidelity after compression
4	Emergence	Diagnostic for hallucination (non-reducibility test)
11	Non-Locality	Basis for complexity-aware attention
20	Systemic Causality	Enables planning (downward causation)
37	Salience (\mathcal{S})	New fundamental property: phase-transition potential $\mathcal{S} = f(\Delta\mathcal{N}_p, \text{KSS}_{\text{observer}}, \text{PPU}_{\text{transition}})$

Propertyness (\mathcal{N}_p) — ontological complexity metric:

$$\mathcal{N}_p = \frac{\dim(\mathcal{H}_{\text{SR}})}{\log[\text{PPU}]}, \quad \mathcal{H}_{\text{SR}} = \bigotimes_{W \in \text{ChOR}} \mathcal{H}_W$$

Empirical reference: GPT-4 $\approx 10^4$, human cognition $\approx 10^9$.

Table 3: Core Operators

Operator	Action	AI Use Case
Γ (Gamma)	$\Psi \rightarrow O$: potential \rightarrow observable	Catalyst queries induce phase shifts (e.g., \mathcal{N}_p : $10^4 \rightarrow 10^6$)
Φ (Phi)	$X \leftrightarrow Y$: universal connectivity	Cross-regime reasoning (e.g., “entanglement” \leftrightarrow “trust”)

A.3 Operators

A.4 World Taxonomy (Minimal Set)

Table 4: Worlds and AI Relevance

World	Symbol	AI Relevance
Material	W_1	Data grounding, physics reasoning
Semantic	W_2	Language, math, code
Phenomenal	W_3	Empathy, subjective framing
Boundaries	W_4	Paradox resolution, creativity

Worlds are *not layers*, but *modes of being*. Transitions between them are *events*, not mappings.

A.5 How This Appendix Supports the Main Text

§3.1 *Semantic Compression* \leftarrow Property 25 + \mathcal{N}_p thresholding

§3.2 *Complexity-Aware Allocation* \leftarrow Property 11 (NL) + \mathcal{S} -weighting

§3.3 *Paradox Tolerance* \leftarrow PPU $\rightarrow \infty$ + W_4 transition

§4.2 *Catalyst Queries* \leftarrow Γ -operator + Salience (\mathcal{S}) metric

§5 *Roadmap* \leftarrow Enables reproducible benchmarking (e.g., \mathcal{S} -jump as efficiency metric)