(Slides) A Foundation for Energy-Efficient and Trustworthy Computing

SSCCS: Observation-Driven Computing That Eliminates Data Movement

SSCCS Foundation

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Introducing

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- **Full proposal document**: ssccs.org/proposal
- **Comprehensive Guide of Core Concepts**: ssccs.org/guide

SSCCS is

A deterministic computing model and software compiler infrastructure that geometrically arranges data and observes structure under dynamic constraints – **without moving data**.

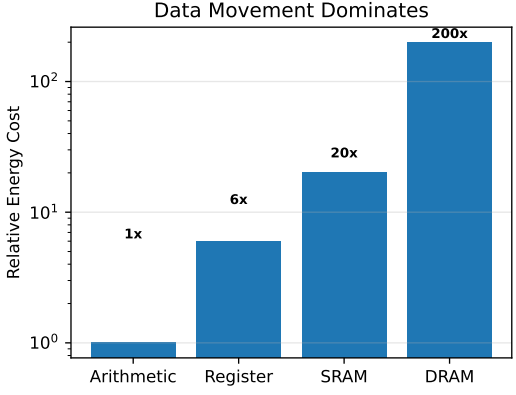
- Von Neumann: dynamic data, static logic.
- SSCCS: static geometry, dynamic constraints; data emerges as projection.

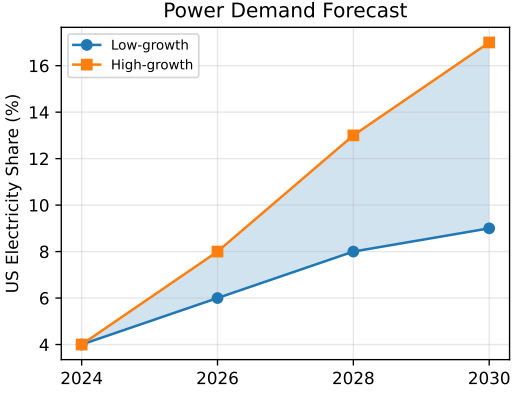
Current Status

Founder	Solo, Berlin-based (global strategic alignment)
Legal	Pre-incorporation; transitioning to open-core model
Project	Long-term research–implementation loop
Initial	Whitepaper on CERN/Zenodo (DOI 10.5281/zenodo.18759106)
PoC	Rust – early primitives in progress
Research	Topic papers (arXiv) $\rightarrow$ insights feed back to core
Partners	US, EU (Germany, France), Singapore, South Korea, any aligned public-interest
Operating principle	Research + implementation + partnership in parallel
Mission	Establish presence where strategic opportunities for public-interest alignment are strongest

The Problem: Data Movement Dominates Energy

- Moving data consumes **60–80% of AI accelerator energy** – a **200× cost** over arithmetic
- The "data movement wall" has been a known bottleneck for decades
- AI data centers could draw **68 GW by 2027** – nearly California's entire grid
- By 2030, data centers may use **9–17% of US power**, with **3–4× server costs**

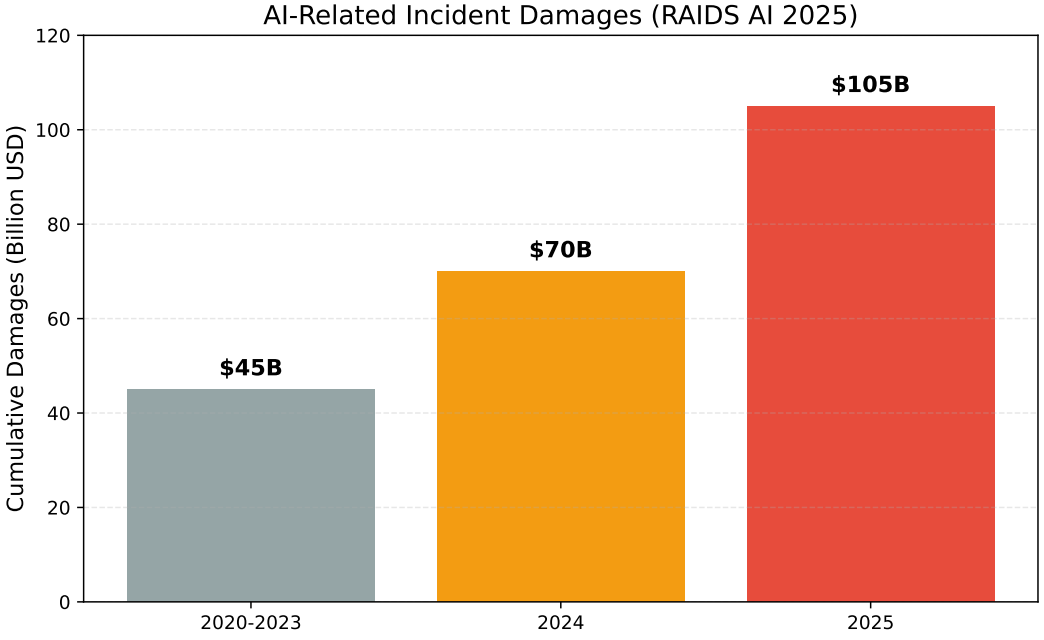




But the Problem Goes Beyond Energy

- AI models are black boxes – **no verifiable path** from input to result
- **Unacceptable risk** in critical applications:
  - **Autonomous vehicles**: 2018 Uber fatality – system detected pedestrian 6 s before impact but never classified her; no auditable trail
  - **Healthcare**: AI diagnostic systems miss cancers; accountability impossible when errors occur
  - **Finance**: 2010 Flash Crash – single automated sell program plunged Dow 600 points; regulators could not reconstruct the decision chain

- Documented damage from AI incidents already exceeds **$100 billion** (RAIDS AI 2025)



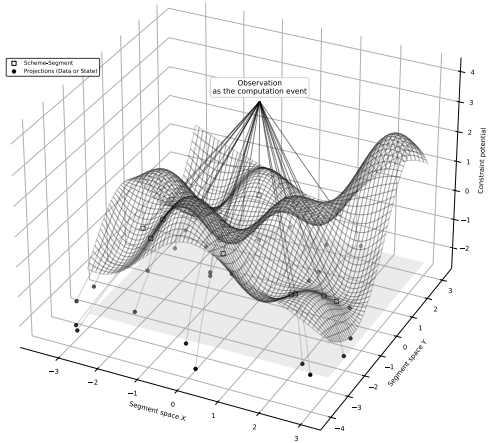
A Different Approach

What if data never moved at all?

SSCCS emerged from research on high-dimensional time-series data, where preserving structure across chaotic systems forced us to rethink computation.

Instead of fetching and storing, SSCCS treats computation as **observation of stationary structure**.

Philosophical Foundation



Loops disappear into layout. Data, or state, is the shadow cast by collapsed possibility.

A System where Structured Deployment is the Path, and Observed Synthesis is the Computation

Core Contrast

Von Neumann:

- Data/state is **dynamic** and stored in memory
- Logic/instructions are **static**
- Computation = moving data through fixed logic over time

SSCCS:

- No intrinsic data/state – only **static geometric structure** (Segments + Scheme)
- Constraints (Field) are **dynamic**
- Computation = applying dynamic constraints to static geometry → **projects ephemeral data/state** as results

Map & Satellite Analogy

The map never moves – only the conditions change, revealing different information.

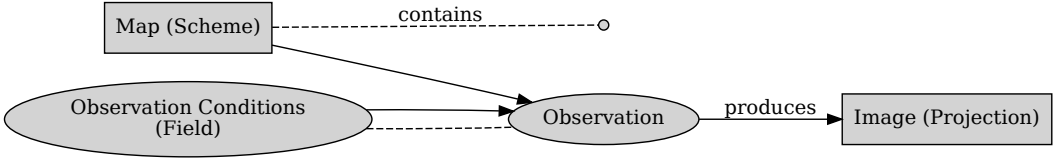


Figure 4: Map analogy: fixed structure observed under changing conditions

SSCCS Concept	Map Analogy
Segment	A fixed coordinate point on a map
Scheme	The map itself (axes, roads, boundaries)
Field	Observation conditions (season, weather, filter)
Observation	Taking a satellite photo
Projection	The resulting image

Primitives

Concept	Role
Segment	Immutable coordinate point; holds no value – only position and ID
Scheme	Blueprint defining geometry, adjacency, and layout
Field	Dynamic constraints (“add”, “max”, etc.) – the only mutable layer
Observation	The sole active event – collapses potential into a deterministic result
Projection	Transient output; not stored – if needed again, re-observe

Simply, How $(1 + 1 = 2)$ works

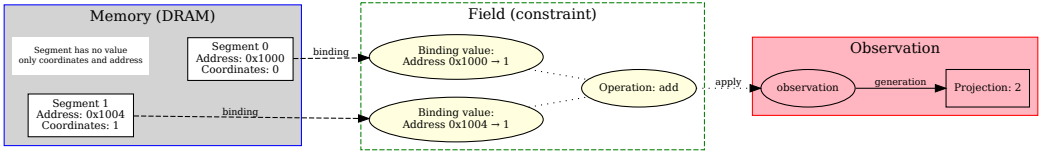


Figure 5: 1+1=2 under SSCCS

- Numbers are **never stored** in Segments – they are attached as constraints in the Field.
- The addition emerges from observing the structure under those constraints.

Why This Matters

Key benefits

- **Energy efficiency**: No data movement – only results travel.
- **Implicit parallelism**: Immutable Segments can be observed concurrently without locks or race conditions.
- **Intrinsic verifiability**: Every observation is deterministic and traceable from blueprint to result. Security follows from geometry.

Where it applies

- **Space systems**: Each Field composition as a standalone binary unit – radiation-resilient, verifiable execution.
- **Swarm robotics**: Fields as composable program units – emergent coordination without central control.
- **AI at scale**: Keep weights stationary, observe them in place.
- **Climate modeling**: Encode grid dependencies as geometry.
- **Autonomous systems**: Verifiable real-time decisions.
- **Scientific computing**: I/O energy and latency dominate runtime; SSCCS eliminates redundant movement.

What We Ask

- **Strategic funding**: €500k over 18 months to expand the compiler team, complete reference implementation, and establish governance.
- **Research partners**: Formal verification, compiler correctness, domain-specific validation.
- **Technical contributors**: Compiler development and tooling.
- **Outreach**: Blog posts, talks, educational material.

All outputs remain open-source, in the public commons.

Conclusion

- **SSCCS** replaces instruction sequencing with **structural observation**.
- It eliminates data movement, enables implicit parallelism, and makes verifiability intrinsic.
- The paradigm shift is grounded in decades of recognized hardware limits.
- We invite collaboration to build a new foundation for computing.

- Whitepaper: PDF / HTML DOI: 10.5281/zenodo.18759106 via CERN/Zenodo, indexed by OpenAIRE. Licensed under *CC BY-NC-ND 4.0*.
- Official repository: GitHub. Authenticated via GPG: BCCB196BADF50C99. Licensed under *Apache 2.0*.
- Governed by the Foundational Charter and Statute of the SSCCS Foundation (in formation).
- Provenance: Human-in-Command, AI-assisted. Aligns with ISO/IEC JTC 1/SC 42 and C2PA-certified. Full intellectual responsibility with author(s).