Systemics Σ — Minimal Specification

Charter

Charter *(normative)*

This document gives a domain-agnostic, minimal formal specification of Systemics Σ. It treats any practice as a kernel-shaped contract that produces decisions from posted evidence under benign variation, with replayable records. No specific domain assumptions (physics, ML, audits, etc.) are required.

Alphabet (Objects & Maps)

Alphabet *(normative)*

- U: Universe of artifacts.
- $\mathbb{V}$: Valuation space (any measurable space; commonly $\mathbb{R}^k \times \mathbb{B}^m$).
- $\mathbf{2}$: Decision space $\mathbf{2} = \{0, 1\}$.
- Π: Frames (benign contexts).
- P_n: Probes (benign perturbations).
- Θ: Floors/thresholds (partially ordered set).
- β: Invariance budgets (tolerances in a poset/lattice).
- C: Capacity budgets (bits/time/energy constraints).
- Γ: Envelope/meta (versions, seeds, numeric modes, commits).
- $\mathcal{R}$: Records (canonical map $\to$ bytes; hash/ledger optional).

Definition: Systemic Kernel

Systemic Kernel *(normative)*

A systemic kernel is the tuple

$$K_\mu^\Sigma \;=\; (v,\, \chi,\, \Pi,\, P_n,\, \Theta,\, \beta,\, C,\, \Gamma), \tag{1}$$

where $v : U \to \mathbb{V}$ is a valuation map and $\chi : \mathbb{V} \times \Theta \times \beta \to \mathbf{2}$ is a decision gate.

Metrics & Order

Wobble and orderings *(normative)*

- A divergence ("wobble") $w : \mathbb{V} \times \mathbb{V} \to \mathbb{R}_{\geq 0}$ on decision-relevant coordinates.
- Orders: $\theta \preceq \theta'$ means tightening floors; $\beta' \preceq \beta'$ means loosening invariance budgets; $C' \preceq C$ means reduced capacity.
- Metrics: ρ is a metric on the decision space (e.g., $\mathbb{R}_{\geq 0}$ for costs, $\mathbf{2}$ for errors).
- A (pseudo-)distance on systemic kernels is $d_\mu(K, K') = \rho(v, v') + \theta(\chi, \chi') + \beta(C, C')$.

Axioms

Axiom 1: Existence of Valuation *(normative)*
$\forall u : U, \exists! v : V, \mathrm{val}(u, v)$.
Axiom 2: Universal Decision Gate *(normative)*
$\forall \theta : \Theta, \exists \chi : \mathbb{V} \times \Theta \times \beta \to \mathbf{2}, \mathrm{gate}(\chi, \theta)$.
Axiom 3: Invariance under Reparameterization *(normative)*
If $\beta' \preceq \beta$ and $\theta' \preceq \theta$, then $\chi'(\cdot, \theta')$ is equivalent to $\chi(\cdot, \theta)$.
Axiom 4: Capacity Constraints *(normative)*
$\forall t, \exists c : C, \mathrm{cap}(t, c)$.
Axiom 5: Envelope Uniqueness *(normative)*
If $\gamma : \mathcal{R}$ is a record, then $\exists! \mu : \Gamma, \mathrm{envelope}(\mu, \gamma)$.
Axiom 6: Record-keeping *(normative)*
$\forall r : \mathcal{R}, \exists e : U \to \mathbb{V}, \mathrm{record}(r, e)$.
Axiom 7: Bounded Wobble *(normative)*
$\forall v, v' : V, w(v, v') < \infty$.
Axiom 8: Tightening Floors *(normative)*
$\forall \theta, \theta' : \Theta, \theta \preceq \theta' \Rightarrow \chi(\cdot, \theta') \preceq \chi(\cdot, \theta)$.

Conformance

Conformance *(normative)*
A systemic kernel K conforms to a contract C if $\forall t, \mathrm{exec}(K, t) \in C$.

Morphisms

Morphism *(normative)*
A morphism between systemic kernels K, K' is a tuple

$$f = (f_v, f_\chi, f_\beta, f_C, f_\Gamma), \tag{2}$$

where - $f_v : V \to V'$ is a valuation map, - $f_\chi : \mathbb{V} \times \Theta \times \beta \to \mathbb{V}' \times \Theta' \times \beta'$ is a compatible decision map, - $f_\beta : \beta \to \beta'$ and $f_C : C \to C'$ are invariance and capacity transformations, - $f_\Gamma : \Gamma \to \Gamma'$ is an envelope transformation.

Equivalence of Morphisms *(normative)*
Morphisms f and g are equivalent, written $f \approx g$, if

- $f_v = g_v$,

- f_χ and g_χ are equivalent decision maps,
- $f_\beta = g_\beta$ and $f_C = g_C$,
- $f_\Gamma = g_\Gamma$.

Recipe

Systemics Σ Recipe *(normative)*

To specify a Systemics Σ instance:

1. Select a universe U of artifacts.
2. Define a valuation map $v : U \to \mathbb{V}$.
3. Specify decision-relevant coordinates using floors θ and invariance budgets β.
4. Define capacity budgets C.
5. Specify an envelope/meta description μ.
6. Define a decision gate χ.

Notes

Notes *(informative)*

- See also the separate specification for Composition.
- This specification is a work in progress; see GitHub for updates.

References

- GraphFrame K0 (GF0) ()
- SpecFrame K1 ()
- Composition (separate spec) ()