

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 \rightarrow bytes; hash/ledger optional).

Definition: Systemic Kernel

Systemic Kernel (*normative*)

A systemic kernel is the tuple

$$K_\mu^\Sigma = (v, \chi, \Pi, P_n, \Theta, \beta, C, \Gamma), \quad (1)$$

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

Metrics & Order

Wobble and orderings (*normative*)

- A divergence ("wobble") $w : \mathbb{V} \times \mathbb{V} \rightarrow \mathbb{R}_{\geq 0}$ 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*)

$\forall u : U, \exists! v : V, \text{val}(u, v)$.

Axiom 2: Universal Decision Gate (*normative*)

$\forall \theta : \Theta, \exists \chi : \mathbb{V} \times \Theta \times \beta \rightarrow \mathbf{2}, \text{gate}(\chi, \theta)$.

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*)

$\forall t, \exists c : C, \text{cap}(t, c)$.

Axiom 5: Envelope Uniqueness (*normative*)

If $\gamma : \mathcal{R}$ is a record, then $\exists! \mu : \Gamma, \text{envelope}(\mu, \gamma)$.

Axiom 6: Record-keeping (*normative*)

$\forall r : \mathcal{R}, \exists e : U \rightarrow \mathbb{V}, \text{record}(r, e)$.

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 $\forall t, \text{exec}(K, t) \in C$.

Morphisms

Morphism (*normative*)

A morphism between systemic kernels K, K' is a tuple

$$f = (f_v, f_\chi, f_\beta, f_C, f_\Gamma), \quad (2)$$

where

- $f_v : V \rightarrow V'$ is a valuation map,
- $f_\chi : \mathbb{V} \times \Theta \times \beta \rightarrow \mathbb{V}' \times \Theta' \times \beta'$ is a compatible decision map,
- $f_\beta : \beta \rightarrow \beta'$ and $f_C : C \rightarrow C'$ are invariance and capacity transformations,
- $f_\Gamma : \Gamma \rightarrow \Gamma'$ 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 $v : U \rightarrow \mathbb{V}$.
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) (spec://_kernel/gf/gf0-k1)
- SpecFrame K1 (spec://_kernel/spec/specframe-k1)
- Composition (separate spec) (spec://domains/systemics/sigma-composition-k1)