Glossary — unified persistence vocabulary

Contents

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*Canonical definitions for terms used across the IPS essays, economics notes, and Aion software. When two phrases appear in different folders for the same quantity, this page picks **one primary name** and lists aliases.*

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Alias table: glossary_table.csv (machine-readable; `status` = canonical | domain_alias | legacy | …)

Core vocabulary (12 terms)

Use these **primary names** in all new writing under `docs/`, `papers/`, `to_publish/`, and `aion-core/docs/`. Domain essays may substitute once per section (e.g. "budget/revenue" for P_{in} in sociology), then revert to symbols.

Term	Symbol	One-line meaning
Information-persisting system	Σ / IPS	Bounded subsystem with blanket, drive, internal model, and identity over $\tau \gg \tau_{\text{relax}}$
Fractal Persistence Equation	FPE	Master accounting identity; persistence requires $\mathcal{R} \geq 1$
Persistence ratio	$\mathcal{R}$	Usable power income over required dissipation, modulated by Ψ and Φ
Delusion divergence	$\mathcal{D}_{\text{KL}}$	KL gap between internal model and resolved reality
Structural fatigue	Γ	Backlog of unresolved damage and obligations
Substrate integrity	Φ	Health of level-$(L-1)$ sub-nodes in the composition graph
Shelter coefficient	Ψ	Attenuation of enclosing noise by level-$(L+1)$ IPS
Power income	P_{in}	Environmental free energy imported before efficiency losses
Coupling efficiency	η	Fraction of P_{in} converted to boundary-maintaining work
Complexity	ω	Structural constraint tax on the blanket
Internal noise floor	$\mathcal{E}_{\Sigma}$	Irreducible fluctuation power at information-carrying modes
Internal model	μ / q_{μ}	Running probability structure over external causes

Writing rules: See CONTRIBUTING.md. Do not introduce new synonyms without a glossary entry. Prefer **trustworthiness** (T) or **millitrust** (`mT`) over bare "trust" in technical prose.

How to read entries

Field	Meaning
Symbol	Mathematical notation (when applicable)
Primary name	Preferred term in new writing
Also called	Accepted aliases — do not treat as different concepts
Definition	One-sentence meaning
Not	Common confusions to avoid

Alias lifecycle (`legacy`, `domain_alias`, …) is tracked in glossary_table.csv. New terms: CONTRIBUTING.md.

Level index L orders nodes from fine ($L-1$ = components) to coarse ($L+1$ = enclosing shelter). The **same equation** applies at every level; only the **substitutions** change.

The master equation

Fractal Persistence Equation (FPE)

Also called: persistence equation, Fractal Persistence Law *(domain aliases)*; Universal Persistence Equation (UPE) *(legacy — do not use in new docs)*.

Definition: The dimensionless accounting identity

$$\mathcal{R}^{(L)} = \Psi \cdot \frac{P_{\text{in}}\, \eta_I(\mathcal{D}_{\text{KL}})}{\omega\, \mathcal{E}_{\Sigma}\, (1 + \mathcal{D}_{\text{KL}} + \Gamma)} \cdot \Phi$$

that governs whether a pattern at level L persists over timescales much longer than its relaxation time.

Condition: Persistence requires $\mathcal{R}^{(L)} \geq 1$.

Not: A forecast of GDP, a moral score, or a single scalar you can measure directly without domain-specific substitutions.

Core FPE terms

Information-persisting system (IPS)

Symbol: $\Sigma^{(L)}$

Definition: A bounded, far-from-equilibrium subsystem with (i) a Markov blanket, (ii) non-zero drive, (iii) an internal generative model, and (iv) identity preserved over interval $\tau \gg \tau_{\text{relax}}$.

Examples: Cell, firm, household, equity market, nation-state, prediction-market service.

Not: Any stable object. A rock in equilibrium is not an IPS; a company with delusion and no error correction failing slowly **is** one until $\mathcal{R} < 1$.

Persistence ratio

Symbol: $\mathcal{R}$ (or $\mathcal{R}^{(L)}$ at a level)

Also called: sustainability ratio *(legacy — use persistence ratio)*.

Definition: Usable power income divided by required dissipation, modulated by shelter Ψ and substrate integrity Φ. $\mathcal{R} \geq 1$ is **necessary** for long-horizon persistence.

Software note: Treat $\mathcal{R}$ as a **regulated setpoint** with fluctuations, not a one-shot live/die flag. `R_below_1` in aion-core is a **trip/watchdog** signal (out of band), not instantaneous dissolution.

Not: "Resilience" in the vague sense, ROI, or stock-market return.

Markov blanket

Symbol: $\partial\Sigma$

Also called: boundary, perimeter, interface.

Definition: The states separating internal subsystem from environment such that internals and externals are conditionally independent given the blanket (Pearl/Friston factorisation).

Examples: Cell membrane, corporate legal entity + firewall, exchange rules + order book, personal boundary ("no").

Not: A geographic border alone (unless it actually implements conditional separation).

Internal model

Symbol: μ; generative density q_μ

Also called: ISM (internal self-model, at agent scale), world-model, collective Q, consensus measure p_t or p_m (in markets).

Definition: The subsystem's running probability structure over external causes — what it believes will happen, encoded in states inside the blanket.

Not: Public narrative only. The **working shadow model** and **ceremonial model** are both internal models; their gap is $\mathcal{D}_{\mathrm{KL}}$ exported as anomie when the ceremonial layer controls currency.

Power income

Symbol: P_{in}

Also called: drive, usable free-energy import, budget/revenue (social), capital inflow (markets), primary energy throughput (states).

Definition: Rate at which environmental free energy is harvested and converted to information-bearing work **before** efficiency losses.

Not: Gross turnover, trading volume, or nominal GDP without quality adjustment. Churn is not P_{in}.

Coupling efficiency

Symbol: $\eta_I(\mathcal{D}_{\mathrm{KL}})$; often shortened to η

Definition: Fraction of imported power converted to useful boundary-maintaining work. Carnot-like bound decreases with delusion: a maximally wrong model extracts less structure from the environment.

Also called: algorithmic efficiency, coordination efficiency, TFP-like institutional quality.

Not: Moral virtue. High η is **competence at converting energy into maintained identity**, not niceness.

Complexity

Symbol: ω

Definition: Effective number of constraints or bits required to specify the blanket and internal state — structural complexity tax multiplier.

Also called: bureaucratic depth, ritual load, org-chart weight.

Not: Intelligence or sophistication. Extra ω without η return is pure denominator drag.

Internal noise floor

Symbol: $\mathcal{E}_\Sigma$

Definition: Summed fundamental fluctuation power (thermal, quantum, environmental) at the scale of information-carrying modes.

Also called: environmental volatility, background noise, aleatoric uncertainty (finance).

Not: Epistemic disagreement alone. $\mathcal{E}_\Sigma$ is irreducible stochasticity; epistemic volatility lives in belief dispersion (see **Volatility**).

Delusion divergence

Symbol: $\mathcal{D}_{\mathrm{KL}}$ or $\mathcal{D}_{\mathrm{KL}}^{(\Sigma)}$

Also called: delusion, delusion tax, model divergence, KL gap, cross-entropy surplus.

Definition: Kullback–Leibler divergence between the internal model q_μ and the true posterior over external causes given blanket states. Non-negative; zero iff the model is calibrated.

Operational forms: - **Agent:** gap between stated beliefs and resolved outcomes. - **Market:** gap between priced distribution and realised fundamentals. - **State:** gap between official forecasts and base-rate reality. - **Software (aion-core):** in control-theory terms, $\mathcal{D}_{\mathrm{KL}}$ is also readable as **setpoint tracking error** between the internal model (prediction-market belief, rec-engine fusion) and resolved task outcomes — see `papers/aion_core_control_theory.md`.

Not: Ordinary uncertainty before outcomes resolve (that is epistemic volatility). Not "lying" alone — honest wrong models still pay $\mathcal{D}_{\mathrm{KL}}$.

Structural fatigue

Symbol: Γ

Also called: friction, senescence, unresolved friction set, ossification, friction ledger.

Definition: Irreversible or deferred damage and unresolved obligations — micro-defects, grudges, rolled debt, institutional scar tissue — that raise maintenance cost without being fully priced as $\mathcal{D}_{\mathrm{KL}}$ yet.

Not: A single argument. Γ is the **backlog** of unfinished repair. **Operation 2** in all frameworks: lower Γ by resolve, renegotiate, or exit.

Substrate integrity

Symbol: Φ

Also called: substrate, substrate health, fractal integrity (postfactor), Φ of constituents.

Definition: Health of the level-$(L-1)$ **substrate graph**, expressed as a composition operator on child $\mathcal{R}_i$ — not a fixed average. **Critical** constituents in series enter via $\Phi \approx \min_{i \in \mathcal{C}} \mathcal{R}_i$ (Theorem 5.3); **redundant** (parallel) pools enter via softer aggregates. See substrate_shelter_and_redundancy.md.

Examples: Organ health (person), member skills and trust (firm), listed issuers and liquidity providers (market), population and grid (state).

Not: Headline index level, employee count, or the **mean** of country $\mathcal{R}$ for humanity. A market can print ATH while Φ rots in the issuer subgraph.

Shelter coefficient

Symbol: Ψ; overlapping enclosures $\rightarrow \Psi_{\text{eff}}$

Also called: shelter, enclosure, imported stability, supernode buffering.

Definition: Fraction of level-$(L+1)$ environmental noise **transmitted** to $\Sigma^{(L)}$ after enclosing buffers (smaller Ψ = better shelter). Independent channels combine as $\Psi_{\text{eff}} = \prod_j \Psi_j$; overlapping buffers on the same noise obey $\Psi_{\text{eff}} \leq \min_j \Psi_j$. Mere membership without buffering contributes $\Psi_j = 1$. See substrate_shelter_and_redundancy.md.

Examples: Parental secure base, NATO umbrella, SEC enforcement, reserve-currency rails.

Not: Unconditional protection. Ψ is not a permanent property of printed money; it is not substrate (Φ).

Critical constituent

Symbol: $i \in \mathcal{C}$

Definition: A level-$(L-1)$ sub-IPS whose failure breaks Markov-blanket conditional independence at level L, so $\Phi \rightarrow 0$ regardless of other children or shelter. Enters Φ through the **minimum**, not the mean.

Examples: Heart in a body, electrical grid in an industrial economy, zooxanthellae in a coral polyp, single-source fab on a chip cut-set.

Not: Every labelled part. Nominal departments, symbolic votes, or idle experts do not enter $\mathcal{C}$ without operational blanket role.

Substrate redundancy

Definition: **Parallel** capacity in the substrate graph — duplicate suppliers, stockpiles, substitutable organs — that raises Φ when one link fails, priced in higher ω, Γ, and foregone efficiency. Opposite pole: **series** substrate (lean chains, single source) optimises calm-environment $\mathcal{R}$ but concentrates tail risk on $\min_i \mathcal{R}_i$.

Examples: Dual power feeds, domestic grain reserve plus imports, friend-shoring after supply-shock repricing.

Not: Shelter (Ψ). Redundancy in alliances is shelter-channel overlap, not substrate health.

Fractal composition

Definition: IPS at level L decomposes into sub-IPS $\{\Sigma_i^{(L-1)}\}$ nested inside its blanket; persistence at L depends explicitly on $\mathcal{R}_i^{(L-1)}$ via Φ and on enclosing buffers via Ψ (Theorem 5.3). The aggregate rule is **graph-indexed** (series, parallel, mixed).

Also called: substrate graph, fractal graph, level recursion.

Two operations

Definition: The pair of repairs that appear at every scale under different names:

1. **Lower** $\mathcal{D}_{\mathrm{KL}}$ — update the model toward observables (humility, calibration).
2. **Lower** Γ — resolve, renegotiate, or decouple unresolved friction.

Not: Separate theories per domain. Therapy, post-mortems, truth commissions, and bankruptcy are **implementations**.

Three fractal roles

At every scale an entity simultaneously:

Role	Meaning
Substrate	Someone else's Φ
Node	Own $\mathcal{R}^{(L)}$ at this level
Shelter	Someone else's Ψ

Pathology: Collapsing levels (identity fusion, enmeshment, treating nation as self).

Truth extraction

Definition: The activity (not a separate quantity) of lowering $\mathcal{D}_{\mathrm{KL}}$ by exposing an internal model to a **resolution authority** and erasing the bits it falsifies. Generalises **Operation 1** across every domain; the measurable quantity remains delusion divergence.

Resolution authority: Whatever scores the model against reality — lived experience (psychology), settlement and default (markets), the battlefield (war), reproducible measurement (science), the PoT ledger (society of nodes). Durability of the extracted truth scales inversely with how **capturable** the authority is.

Also called: delusion reduction, price discovery (markets), acceptance (psychology), measurement (physics).

Not: A new FPE term. Not the numerator — engineering optimises $P_{\mathrm{in}}\eta$ (doing); truth extraction optimises the denominator $\mathcal{D}_{\mathrm{KL}}$ (knowing). See truth_extraction.md.

Trust, standing, and money

Trustworthiness

Symbol: T

Definition: Model honesty and friction-repair capacity; in the respect factorisation $T \propto 1/(\mathcal{D}_{\mathrm{KL}}\,\Gamma)$.

Not: Likability, fame, or "social currency" (likes). Not the same as being **tolerated** under high Ψ.

Strength

Symbol: $S \equiv P_{\mathrm{in}}\eta$

Definition: Boundary enforcement capacity — the numerator's claim on negentropic work (Warrior pole).

Not: Net worth in fiat. Currency can purchase the **appearance** of S (security, lawyers, weapons).

Respect

Symbol: $\mathcal{Z} \propto S \cdot T$

Definition: Long-run social standing; time-asymptote of $\mathcal{R}$ when both strength and trustworthiness are non-zero.

Zero-product property: $S = 0$ or $T = 0 \to$ no durable standing (doormat or tyrant limit).

Trust (generic)

Definition: Overloaded in ordinary language. In this stack, distinguish:

Phrase	Meaning
Trustworthiness T	Calibration + friction repair
Generalised trust (sociology)	Default expectation strangers cooperate under norms — amortised Φ
AgentTrust.score (software)	KL-based forecaster score in aion-core
Market trust	Joint condition: bounded $\mathcal{D}_{\mathrm{KL}}$, $\Psi \approx 1$, Φ above threshold — not sentiment

Rule: Prefer **trustworthiness** for epistemic credit; use **trust** only with a qualifier.

Currency / fiat

Definition: Shelter artifact that clears **desire** (who pays next), not **calibration** (who was right).

FPE reading: High-Ψ token whose value persists while a supernode guarantees convertibility. Not earned by lowering $\mathcal{D}_{\mathrm{KL}}$.

Not: Trustworthiness token. Confusing the two exports delusion to Φ eventually.

Trustworthiness token

Symbol: balance t; unit **millitrust** (`mT`, 1000 mT = 1 **trust**, display *agi-trust*)

Definition: Ledger entry for forecast quality **net of compute cost**:

$$\Delta t = \alpha \left[\log q(y) - \log p_m(y)\right] - \beta c$$

Also called: epistemic credit, societal value (when fungible for exchange); PoT trust *(legacy)*.

Not: Fiat, reputation points, or stake-weight without scoring.

Accounting leak

Definition: Any channel that moves resources without paying the thermodynamic bill for being wrong — e.g. fiat spending unchecked by $\mathcal{D}_{\mathrm{KL}}$, insider edge without log-score penalty.

Trustworthiness tokens close the leak by construction.

Reserve currency

Definition: Imported Ψ for nations invoicing in another state's unit — shelter, not earned T.

Not: Permanent endowment. When the issuing enclosure's model fails, Ψ drops for all holders regardless of local calibration.

Debt (macro)

FPE reading: Γ deferral — borrowing P_{in} from the future while growing unresolved obligations; made liquid by currency and credit markets.

Probability, markets, and finance

Market distribution

Symbol: p_m (trust-weighted or consensus); P_m^* (final); p_t (date-t belief)

Definition: Aggregate probability measure over outcomes encoded in prices, options, analyst panels, or prediction-market state.

Stock price reading: Present value under risk-adjusted measure Q — the market's probability model over future cash flows.

Private belief / bet

Symbol: q or q_t

Definition: Participant's submitted probability distribution over the same outcome set as the market.

Log score / KL margin

Definition: Per-event increment $\log q(y) - \log p_m(y)$ — nats by which a forecaster beat or lost to the market on realized outcome y.

Links: Trustworthiness update kernel, Kelly-criterion growth (log utility), sequential KL-reduction scoring in aion-core.

Not: Raw P&L without probability report. You can be profitable and miscalibrated.

Kelly criterion

Definition: Position-sizing rule that maximises asymptotic log-wealth growth; multiplicative form $t \leftarrow t \cdot q(y)/p_m(y)$ is zero-sum and KL-equivalent to the trust update.

Market reading: Honest markets reward lowering $\mathcal{D}_{\text{KL}}$; insider sizing without scoring **exports** $\mathcal{D}_{\text{KL}}$ to uninformed flow (adverse selection).

Sequential KL reduction

Definition: Score of bet t in a market: $v_{m,t} = D_{\text{KL}}(P_m^* \| P_{m,t-1}) - D_{\text{KL}}(P_m^* \| P_{m,t})$ — telescoping path value toward final consensus.

Software: `prediction_market` service, `market_math.md`.

Jensen tax

Definition: Slow deflation of total trust when voters hold heterogeneous beliefs; trust-weighted average underperforms market log-score by Jensen's inequality — **cost of disagreement**.

Not: Arbitrary inflation. Unlike fiat debasement, the tax scales with epistemic dispersion.

Volatility

Primary definition (IPS/finance essay): Uncertainty over the **probability measure itself** — dispersion and instability of p_t, not return variance alone.

Layer	Meaning	FPE term
Aleatoric	Inherent outcome randomness	$\mathcal{E}_\Sigma$
Epistemic	Belief disagreement and revision before resolution	Uncertainty over p_t; VIX-like
Delusion	Systematic gap between p_t and realisable outcomes	$\mathcal{D}_{\mathrm{KL}}$ ex post

Not: Fear alone. Low displayed vol can mask rising delusion (suppressed information).

Adverse selection

Definition: Informed sub-IPS extracts edge from uninformed flow; market makers widen spreads; liquidity subgraph Φ falls — local $\mathcal{R}_i < 1$ cascade.

Regulatory Ψ: Enforcement that prices and punishes insider $\mathcal{D}_{\mathrm{KL}}$.

Risk premium

FPE reading: Extra P_{in} demanded per unit of exposed $\mathcal{D}_{\mathrm{KL}}$ when trust in calibration falls.

Clearing desire

Definition: What ordinary money and equity markets optimise locally — matching willingness to pay, not marginal correctness of belief.

Contrast: Trustworthiness coordinates **who should be listened to**.

Shelter artifact (financial)

Definition: Nominal claim (cash, index exposure) whose value persists under Ψ while calibration may already be failing — **nominal wealth without** T.

Collapse and pathology

Phase transition / crash

Definition: Sustained $\mathcal{R} < 1$ with rapid Φ or Ψ failure — not a single bad draw but a regime change in the accounting identity.

Slow bleed

Definition: Chronic $\mathcal{R} \approx 1$ with rising delusion tax — fragile before macro shock.

Delusion shock

Definition: $\mathcal{D}_{\mathrm{KL}}$ rises without scoring event — e.g. hidden insider information — denominator grows while η_I falls.

Anomie

Definition: Collective condition where norms no longer predict how effort maps to reward; rising $\mathcal{D}_{\mathrm{KL}}$ between official promise and lived reality exported to members.

See: ips_sociology.md

Friction export

Definition: Lowering local Γ by pushing cost onto a sub-node's Φ or $\mathcal{D}_{\mathrm{KL}}$ (scapegoating, sanctions on periphery, drama-triangle geometry).

Beneficial coupling

Definition: Sub-node persistence positively correlated with shelter's persistence over shared horizon — not obedience to predatory Ψ.

Software theory map

Theory term	aion-llm	aion-core	aion-blockchain
$\mathcal{R}$	`usage.persistence` on completions	Task/agent persistence sweeps	—
$\mathcal{D}_{\mathrm{KL}}$	`fractal_loss`, cross-entropy + delusion	Market sequential KL, `compute.py`	Vote KL margin vs market
Trustworthiness token	—	`AgentTrust.score`, PM bets	`trust_mtrust`, PoT ledger
p_m, q	—	`prediction_engine.py`	Market refs, `pot-market`
Norms / laws	—	`norms/` service	`NormDecl`, `NormVote`
Γ / patches	—	Violations → `ParticipantPatch`	`ConflictRecord` on chain
Predictive Governance	—	Intra-node governance	Inter-node PoT society

Full map: fractal_layers.md, COMPONENTS.md

Notation conventions

Symbol	Always means
$\mathcal{R}$	Persistence ratio
$\mathcal{D}_{\mathrm{KL}}$	Delusion divergence (nats)
Γ	Structural fatigue / friction backlog
Φ	Substrate integrity (postfactor)
Ψ	Shelter coefficient (prefactor)
P_{in}	Power income
ω	Complexity
$\mathcal{E}_{\Sigma}$	Internal noise floor
η or η_I	Coupling efficiency
L	Fractal level index
p_m	Market / consensus distribution
q	Private belief or bet
t, mT	Trustworthiness balance
S, T, $\mathcal{Z}$	Strength, trustworthiness, respect

Subscripts: $\mathcal{R}^{(L)}$ = at level L; $\mathcal{R}_i$ = sub-node i; Ψ_{eff} = product over overlapping shelters.

Do not use interchangeably: - Φ vs Ψ (substrate vs shelter — different failure modes) - $\mathcal{D}_{\mathrm{KL}}$ vs Γ (wrong model vs unresolved backlog) - Currency vs trustworthiness token - Volatility vs $\mathcal{D}_{\mathrm{KL}}$ (uncertainty of p vs wrong p) - Trust vs trustworthiness (qualifier required for generic "trust") - P_{in} vs turnover / GDP headline

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Topic essays by term

Term cluster	Start here
FPE formal	information_persisting_systems.md
Body → world stack	fractal_layers.md
Agent L	ips_psychology.md
Groups $L+1$–$L+2$	ips_sociology.md
States $L+3$	ips_geopolitics.md
Money vs calibration	trustworthiness_token.md
Equity markets	ips_economics.md
PM scoring	market_math.md
PoT / chain	whitepaper §4
Anomie	ips_sociology.md
Religion and anomie	ips_sociology.md

When adding new essays, define new terms here first or link an existing entry rather than introducing a third synonym.