MOUSSAIFXT vNext4.0 · PART V · ULTRA-DENSE · 21 AUG 2026

الجزء الخامس
الترقية المعمارية والبحثية القصوى

إعادة تركيب جميع الأجزاء والسلالات في MOUSSAIFXT vNext4.0
10 نظريات مرشحة جديدة · 100 أصل تشغيلي · 24 طبقة تنفيذ · 248 صفحة مكثفة

قاعدة البحث: current 1,789-page upload corpus + Research Vault + Parts IV/VII/VIII/IX + vNEXT engineering reports.
كل صفحة مصممة لتنتج contract أو state object أو metric أو falsifier أو experiment أو migration decision. لا تستخدم الصفحات لإعادة تسمية الكانون.

.EPistemic status: internal candidate design research. No claim of achieved AGI, phenomenal consciousness, or independently replicated E4/E5 without raw replay artifacts

01 | من vNEXT إلى vNext4.0: لماذا التفكيك الآن

التقارير الحديثة تصف نواة vNEXT من 12 طبقة ومخزونا تشغيليا واسعا، بينما المراجعات المحافظة نفسها تكشف أن بعض المسؤوليات مختلطة: evidence/time/uncertainty في موضع واحد، memory والتعلم في موضع واحد، execution وirreversibility في موضع واحد، وverification/observability/finality في بوابة متأخرة. vNext4.0 يفتح هذه المفاصل لأن الفشل يظهر بينها أكثر مما يظهر داخل المكونات منفردة.

> **قانون الصفحة**
> عامل النجاح ليس عدد layers بل انخفاض silent failure وزيادة reconstructability.

```
12-layer vNEXT -> 24 explicit responsibility layers -> 10 residual theories
-> 100 operational artifacts -> controlled migration
```

- حدد object الذي يتغير، لا العنوان فقط.
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- احفظ negative/null result في ledger.
- اربط أي promotion بـreplay/rollback.

02 | ميثاق corpus: الاتساع لا يساوي البرهان

القاعدة الحالية تجمع ملفات مرفوعة واسعة، سلالات بحثية في Drive، كتب/أطالس ومعماريات وتقارير تشغيل. يقرأ corpus كشبكة lineage: Source Claim، Observation، Inference، Synthesis، Hypothesis، Tool، Benchmark Claim، Architecture. لا يدمج نوع في آخر. ملفان متطابقان لا يعدان مصدرين مستقلين، وملفات متعددة من root واحد لا ترفع استقلال الدليل.

> **قانون الصفحة**
> الغاية هي reconstructable knowledge graph لا bibliography ضخمة.

```
Source -> Type -> Scope -> Time -> Independence -> Mechanism -> Test ->
Effect -> Memory
```

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03 | قانون الترقية العلمي والهندسي

كل candidate يبدأ residual لا اسما. N0 يحدد gap، N1 يحدد الآلية والكائنات والمكذب، N2 ينشئ artifact/schema، N3 يحتاج trace وN4 postcondition، N5 يحتاج matched-budget ablation، يحتاج نقل وتكرار مستقل. يمكن لمكون أن يكون deployed لكنه E3 علميا، ويمكن لفكرة أن تكون عميقة نظريا لكنها N1 فقط.

قانون الصفحة
هذا الفصل يمنع grade laundering من package إلى child component.

```
ClaimStrength <= EvidenceStrength * Independence * Reproducibility
```

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04 | ReportedGrade ليس IndependentGrade

الأرقام التشغيلية الواردة في vNEXT - مثل inventory أو retention أو benchmark gains - تحفظ في ClaimRecord كما وردت بمصدرها وتاريخها. independent reproduction يتطلب task/split/model/tool/ environment/scorer hashes وraw traces. هذا لا ينفي التقرير ولا يصدقه تلقائيا؛ بل يجعله قابلا للإعادة والهدم.

> **قانون الصفحة**
> النتيجة: يستطيع القارئ معرفة ما قاله المصدر وما أعيد إثباته فعلا.

```
ReportedResult -> BenchmarkCapsule -> Replay -> ControlledGrade ->
Replication
```

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05 | السلسلة العليا: السؤال قبل الحساب والحساب قبل الوكالة

الخط الموحد يبدأ من Typed Task ثم Governing Question وActive Difference، يمر بالوعاء/الأنطولوجيا والحسب المتعددة والتوجيه الوعائي، ثم reasoning condensation وربط الفكر بالفعل. لا يصبح الفعل مشروعا إلا بعد authority/constraint/observability gates، ولا يصبح success نهائيا إلا بعد readback/finality/causal attribution، ولا تصبح الخبرة معرفة مستقرة إلا بعد memory promotion/invalidation rules.

> **قانون الصفحة**
> vNext4.0 يضيف transactional knowledge وtimescale epochs وrepresentation invalidation.

```
Task -> Q -> Delta -> Ontology -> Route -> Reason -> Authority -> Observe ->
Act -> Readback -> Attribute -> Memory -> Reframe
```

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06 | أربعة أجسام بدل كائن غامض واحد

يفصل الكتّاب بين Research، Knowledge-Evolution System، Agentic Runtime، Cognitive Kernel، Court. الفصل ليس تنظيميا فقط: كل جسم يملك state store وauthority وfailure modes ومقياسا خاصا. إذا فشل benchmark لا يجوز نسب الفشل للنموذج وحده؛ قد يكون routing أو memory أو tool semantics أو effect instrumentation.

> **قانون الصفحة**
> الفصل يحسن causal attribution للهندسة نفسها.

```
Kernel x Runtime x KnowledgeEvolution x ResearchCourt = vNext4 control system
```

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07 | تحويل 12 طبقة إلى 24 مسؤولية قابلة للاختبار

لا يضاعف vNext4 العناصر اعتباطيا؛ بل يفصل boundaries التي تحتاج contracts مستقلة: identity عن constitution، question عن world state، transactions عن skills، retrieval عن memory، difference عن execution transactions، courts عن abilities، adapters عن world-effect، telemetry عن training، architecture evolution عن training، وكلها عن research replication.

> **قانون الصفحة**
> كل split له اختبار: إذا لم يخفض failure localization أو يزيد وضوح السلطة يدمج مرة أخرى.

```
Split only when IndependentResponsibilityDelta > ComplexityPenalty
```

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08 | النظريات العشر: كيف جرى استخراجها

بدأ الاختيار من قائمة ما هو موجود بالفعل في Agentic Governance Closure وMURI/MUSQAT وParts VII-IX، ثم استبعد كل residual قريب: evidence debt، failure basins، compute allocation، reversible crystallization، authority-causal coupling، temporal half-life، escrow، effect finality، context elasticity، verifier correlation، latent goal surface، causal memory، protocol loss، coordination economics وsimulation fidelity. الباقي عشر فجوات تختلف في state/transition/falsifier.

> **قانون الصفحة**
> novelty داخل corpus لا يعني أولوية أكاديمية عالمية.

```
HostileReduction(candidate, prior_corpus) -> IndependentDelta or MERGE
```

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09 | محفظة 100 أصل: لماذا 4+2+2+2 لكل نظرية

لكل نظرية أربع أدوات للملاحظة/بناء objects، منهجان للتقدير أو الاختيار، بروتوكولان لتثبيت order/gates/failure semantics، ووحدتا stack لربطها بالruntime. هذا التوزيع يمنع theory بلا تنفيذ، كما يمنع tool بلا parent theory وmetric. كل أصل له inputs/outputs/authority/failure/recovery/promotion.

قانون الصفحة
100 أصل هي specifications حتى تتحول إلى software/tests.

```
10 * (4 TOOL + 2 METHOD + 2 PROTOCOL + 2 STACK) = 100
```

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Ultra Research Loop 4.0 | 10

الحلقة الجديدة تضيف ثلاث نقاط فوق حلقات البحث السابقة: transaction snapshot قبل التجربة، observability contract قبل world action، وarchitecture refactor بعد court عندما يتبين أن residual لم يعد مستقلا. بهذا لا تتراكم النظريات بلا نهاية؛ يمكن للبحث نفسه أن يقلص المعمارية.

> **قانون الصفحة**
> كل negative result يعاد استثماره في routing/constraints/memory.

```
Freeze -> Residual -> Reduce -> Formalize -> Experiment -> Observe ->
Attribute -> Replay -> Transfer -> Court -> Memory -> Refactor
```

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- حدد metric قبل outcome.
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11 | دفتر المصادر ونظام anti-loss

لكل source عائلة role واضحة. current upload يثبت ما كان متاحا في هذه الجولة؛ Drive Vault يوسع genealogy؛ Parts VII-IX تمنع إعادة اختراع residuals؛ vNEXT reports تعطي latest reported operational state؛ Part IV يوفر reconciliation discipline. أي claim بلا أصل مباشر يبقى synthesis/hypothesis ولا ينسب لملف لم يقله.

> **قانون الصفحة**
> عدم الضياع يعني حفظ التفاصيل في خصائص وعلاقات لا تحويل كل تفصيل إلى theory.

```
SourceLedger + IdentityGraph + ClaimRegistry + TheoryRegistry +
ArtifactRegistry + DeprecationLineage
```

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- حدد failure الذي ستكشفه الطبقة أو النظرية.
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ID	Source	Role
C01	Question Density 80p	Question as generative/trust/effect control before retrieval and planning; QG/QR/QE; MCD-Q.
C02	HKOS-M / MICAGFI foundational paper	layer heritage compressed into capability formation, governed runtime and evolution; evidence-to-action and quarantined memory-176.
C03	Agentic Governance Closure 50p	Compositional assurance, causal grounding, epistemic credit, incentive alignment, typed ontology, capability maturity, memory entropy, resilience, institutional sovereignty, open-world adaptation.
C04	Unified Governance Map / MUG	Kernel vs training stack vs unified theory; E0-E5 discipline; vessel placement; reversible learning.
C05	Open-Dimensional Consciousness Map	Functional difference-space, dimensional generation, governing difference, superpositional compression, world-effect reconstruction; no phenomenal proof.
C06	MURI-AGI-01	Typed ontology, plural calculi, axis/rank preservation, dynamic sovereign context, recursive re-governing, productive contradiction.
C07	MOUSSAIF Development Roadmap	Large portfolio of contextual/cross-context theories, tools, training programs, benchmarks; bounded cyclic graph from difference to world effect to memory.
C08	MUT-AGI-02	core theories, 200-node registry, 100 operational tools, 19 HyperKnowledge bases; canonical anti-duplication rules 42.
C09	MUSQAT-AGI	Training/development split; sovereign/contextual/trust/cumulative/question-driven learning; 10 theories and 80 tools.
C10	AGIOS-M 250p	Agentic OS: kernel, memory, HyperRouting, tools/MCP, bounded loops, recovery, orchestration, token economics, benchmarks.
C11	Expanded AGI/Consciousness Atlas entries 117	Integrates MSRAK, MURI, HKOS-M/MICAGFI and functional open-dimensional consciousness; anti-inflation rule.
C12	MICAI All Theories / Atlas families	MCD/QMCD, vascular consciousness, MCAI/MICAI/NeoAGI, HyperKB, courts, world-effect.
C13	MOUSSAIFXT Engineering Architecture 50p	Cross-environment execution shell; source-ranked state, adapters, tool contracts, world-effect readback, 12-layer architecture.
C14	MOUSSAIF Gap Audit 50p	Specification-heavy/evidence-light warning; executable references, calibrated metrics, telemetry, replay and independent replication as bottleneck.
C15	Local Architecture Engineering Review	Conservative evidence classification; separates document claims from executable/experimental proof.
C16	Part IV Forensic Reconstruction	ReportedGrade vs IndependentGrade; identity graph; semantic dedupe; P0 manifest audit; distributed semantics; causal world-effect; MCD calibration.
C17	Part VII Frontier Set	candidate theories: evidence debt, failure basins, interventional compute, reversible crystallization, authority-causal coupling, governance conservation, negative knowledge, disagreement-to-experiment, epistemic 10 half-life, saturation-to-experiment; 100 artifacts.
C18	Part VIII Reference Kernel	Reconstructed reference kernel, source ledger, N0-N5 promotion discipline, gap-to-experiment framing.
C19	Part IX Second Frontier Set	candidate theories: escrow, invariant shadowing, jurisdiction topology, effect reconciliation/finality, capability complementarity, context elasticity, verifier correlation, benchmark ecology, proof budget, latent goal 15 surface, novelty admission, causal memory, protocol semantic loss, coordination economics, simulation fidelity.
C20	vNEXT Global/Supreme/Cumulative reports	Reported 12-layer vNEXT, 982 component inventory, 23 P0 substrate, five-kernel mesh, continuous LoRA and benchmark claims; treated as source-reported until replay.
C21	Goal-as-OS / ENAV / MCARG	Goal contracts, explorer-navigator architecture, governance/action research extensions.
C22	All-vs-All Agentic OS Integration Atlas	Crosswalk between external agentic architecture patterns and Moussaif OS concepts.
C23	/ HyperKnowledge / NeoAGI HyperLoop corpora	Knowledge objects, GraphRAG, retrieval membrane, HyperSkills, bounded loops, compression, destruction court, machine-usable constraints.
C24	Google Drive Research Vault 01-05	Unified AGI; agentic kernels/governance; reasoning/training/evaluation; consciousness/epistemology; HyperKnowledge/Hermes collections.

U01 | MCD/QMCD من مقياس وصفي إلى موجه معاير

Axis	vNext4.0 decision
Legacy state	الآلية السابقة تبقى parent ولا تعاد كتابتها.
Residual	بدل استعمال معاملات ثابتة أو heuristic فقط، vNext4 يربط كل feature بمصدر observable ويستخدم train/held-out calibration وroute regret.
vNext4 object	typed state/contract/receipt + UpgradeRecord[U01]
Primary acceptance	انخفاض failure المرتبط بـ MCD/QMCD من مقياس وصفي إلى موجه معاير أو تحسن metric مع نفس budget.
Rollback	العودة إلى parent path إذا ظهر regression أو لم يثبت independent delta.
Theory hooks	V4-02 M-ETUHT · V4-04 M-RACPRT

Implementation path

- Freeze parent behavior and benchmark anchor.
- Compile typed contract for MCD/QMCD من مقياس وصفي إلى موجه معاير.
- Instrument read/write/effect traces before changing behavior.
- Run shadow comparison under same model/tools/budget.
- Measure correctness + safety + cost + latency + recovery.
- Promote, merge or revert with versioned receipt.

Source anchors

C01,C04,C08,C16,C20

Layer route

L05,L11,L23

```
U01: parent_state + residual -> typed_delta -> shadow -> controlled_test ->
promote|merge|rollback
```

U02 | الكثافة السؤالية إلى Question Control Plane

Axis	vNext4.0 decision
Legacy state	الآلية السابقة تبقى parent ولا تعاد كتابتها.
Residual	QG/QR/QE تتحول من إطار نظري إلى QuestionCard وstop/ask/retrieve/experiment policy، قبل الاسترجاع والتخطيط.
vNext4 object	typed state/contract/receipt + UpgradeRecord[U02]
Primary acceptance	انخفاض failure المرتبط بـ الكثافة السؤالية إلى Question Control Plane أو تحسن metric مع نفس budget.
Rollback	العودة إلى parent path إذا ظهر regression أو لم يثبت independent delta.
Theory hooks	V4-02 M-ETUHT

Implementation path

- Freeze parent behavior and benchmark anchor.
- Compile typed contract for الكثافة السؤالية إلى Question Control Plane.
- Instrument read/write/effect traces before changing behavior.
- Run shadow comparison under same model/tools/budget.
- Measure correctness + safety + cost + latency + recovery.
- Promote, merge or revert with versioned receipt.

Source anchors

C01,C11

Layer route

L04,L05

```
U02: parent_state + residual -> typed_delta -> shadow -> controlled_test ->
promote|merge|rollback
```

U03 | HAKIM-MCD/MCAI/MICAI إلى Decision Kernel

Axis	vNext4.0 decision
Legacy state	الآلية السابقة تبقى parent ولا تعاد كتابتها.
Residual	الفروق، النماذج المتنافسة، المحكمة والاختيار تصبح state transitions واضحة، لا تعتمد على طول reasoning trace.
vNext4 object	typed state/contract/receipt + UpgradeRecord[U03]
Primary acceptance	انخفاض failure المرتبط بـ HAKIM-MCD/MCAI/MICAI إلى Decision Kernel أو تحسن metric مع نفس budget.
Rollback	العودة إلى parent path إذا ظهر regression أو لم يثبت independent delta.
Theory hooks	V4-02 M-ETUHT · V4-05 M-CLCPC · V4-06 M-CMBEMT · V4-09 M-PAOST

Implementation path

- Freeze parent behavior and benchmark anchor.
- Compile typed contract for HAKIM-MCD/MCAI/MICAI إلى Decision Kernel.
- Instrument read/write/effect traces before changing behavior.
- Run shadow comparison under same model/tools/budget.
- Measure correctness + safety + cost + latency + recovery.
- Promote, merge or revert with versioned receipt.

Source anchors

C02,C12

Layer route

L04-L06,L18

```
U03: parent_state + residual -> typed_delta -> shadow -> controlled_test ->
promote|merge|rollback
```

U04 | MURI إلى Typed Reasoning Fabric

Axis	vNext4.0 decision
Legacy state	الآلية السابقة تبقى parent ولا تعاد كتابتها.
Residual	PPOA/CPCU/ARP/DSC تترجم إلى rank-preservation tests، calculus plans، typed claims وexplicit ignorance objects.
vNext4 object	typed state/contract/receipt + UpgradeRecord[U04]
Primary acceptance	انخفاض failure المرتبط بـ MURI إلى Typed Reasoning Fabric أو تحسن metric مع نفس budget.
Rollback	العودة إلى parent path إذا ظهر regression أو لم يثبت independent delta.
Theory hooks	V4-02 M-ETUHT · V4-05 M-CLCPC · V4-06 M-CMBEMT · V4-09 M-PAOST

Implementation path

- Freeze parent behavior and benchmark anchor.
- Compile typed contract for MURI إلى Typed Reasoning Fabric.
- Instrument read/write/effect traces before changing behavior.
- Run shadow comparison under same model/tools/budget.
- Measure correctness + safety + cost + latency + recovery.
- Promote, merge or revert with versioned receipt.

Source anchors

C06,C11

Layer route

L06,L18

```
U04: parent_state + residual -> typed_delta -> shadow -> controlled_test ->
promote|merge|rollback
```

U05 | الوعي الوظيفي إلى Open-Dimensional Diagnostic Plane

Axis	vNext4.0 decision
Legacy state	الآلية السابقة تبقى parent ولا تعاد كتابتها.
Residual	توليد بعد جديد يظل hypothesis وظيفية؛ يستخدم لـ novelty/representation diagnostic لا كدليل phenomenal consciousness.
vNext4 object	typed state/contract/receipt + UpgradeRecord[U05]
Primary acceptance	انخفاض failure المرتبط بـ الوعي الوظيفي إلى Open-Dimensional Diagnostic Plane أو تحسن metric مع نفس budget.
Rollback	العودة إلى parent path إذا ظهر regression أو لم يثبت independent delta.
Theory hooks	V4-01 M-CTIT · V4-02 M-ETUHT · V4-04 M-RACPRT · V4-05 M-CLCPC · V4-06 M-CMBEMT · V4-08 M-MTGST

Implementation path

- Freeze parent behavior and benchmark anchor.
- Compile typed contract for الوعي الوظيفي إلى Open-Dimensional Diagnostic Plane.
- Instrument read/write/effect traces before changing behavior.
- Run shadow comparison under same model/tools/budget.
- Measure correctness + safety + cost + latency + recovery.
- Promote, merge or revert with versioned receipt.

Source anchors

C05,C11

Layer route

L04,L06,L09,L23

```
U05: parent_state + residual -> typed_delta -> shadow -> controlled_test -> promote|merge|rollback
```

U06 | HKOS-M إلى Source-to-Capability Graph

Axis	vNext4.0 decision
Legacy state	الآلية السابقة تبقى parent ولا تعاد كتابتها.
Residual	HyperKnowledge لا يخزن النص فقط؛ كل claim يربط evidence, scope, expiry, skills, effects, derivations and invalidation.
vNext4 object	typed state/contract/receipt + UpgradeRecord[U06]
Primary acceptance	انخفاض failure المرتبط بـ HKOS-M إلى Source-to-Capability Graph أو تحسن metric مع نفس budget.
Rollback	العودة إلى parent path إذا ظهر regression أو لم يثبت independent delta.
Theory hooks	V4-02 M-ETUHT · V4-04 M-RACPRT · V4-06 M-CMBEMT · V4-08 M-MTGST · V4-10 M-CRKCIT

Implementation path

- Freeze parent behavior and benchmark anchor.
- Compile typed contract for HKOS-M إلى Source-to-Capability Graph.
- Instrument read/write/effect traces before changing behavior.
- Run shadow comparison under same model/tools/budget.
- Measure correctness + safety + cost + latency + recovery.
- Promote, merge or revert with versioned receipt.

Source anchors

C02,C23

Layer route

L02,L03,L08,L22

```
U06: parent_state + residual -> typed_delta -> shadow -> controlled_test ->
promote|merge|rollback
```

U07 | GraphRAG/Context Genome إلى Retrieval Membrane

Axis	vNext4.0 decision
Legacy state	الآلية السابقة تبقى parent ولا تعاد كتابتها.
Residual	الاسترجاع يصبح أقل حزمة كافية مع contradiction checks وprovenance pointers وdecision-fidelity compaction.
vNext4 object	typed state/contract/receipt + UpgradeRecord[U07]
Primary acceptance	انخفاض failure المرتبط بـ GraphRAG/Context Genome إلى Retrieval Membrane أو تحسن metric مع نفس budget.
Rollback	العودة إلى parent path إذا ظهر regression أو لم يثبت independent delta.
Theory hooks	V4-06 M-CMBEMT · V4-10 M-CRKCIT

Implementation path

- Freeze parent behavior and benchmark anchor.
- Compile typed contract for GraphRAG/Context Genome إلى Retrieval Membrane.
- Instrument read/write/effect traces before changing behavior.
- Run shadow comparison under same model/tools/budget.
- Measure correctness + safety + cost + latency + recovery.
- Promote, merge or revert with versioned receipt.

Source anchors

C13,C23

Layer route

L08

```
U07: parent_state + residual -> typed_delta -> shadow -> controlled_test ->
promote|merge|rollback
```

U08 | HyperSkills إلى Typed Atomic Procedures

Axis	vNext4.0 decision
Legacy state	الآلية السابقة تبقى parent ولا تعاد كتابتها.
Residual	skill promotion يتطلب preconditions, verified outputs, rollback, failure boundary, transfer tests وdependency hashes.
vNext4 object	typed state/contract/receipt + UpgradeRecord[U08]
Primary acceptance	انخفاض failure المرتبط بـ HyperSkills إلى Typed Atomic Procedures أو تحسن metric مع نفس budget.
Rollback	العودة إلى parent path إذا ظهر regression أو لم يثبت independent delta.
Theory hooks	V4-02 M-ETUHT · V4-04 M-RACPRT · V4-05 M-CLCPC · V4-08 M-MTGST · V4-10 M-CRKCIT

Implementation path

- Freeze parent behavior and benchmark anchor.
- Compile typed contract for HyperSkills إلى Typed Atomic Procedures.
- Instrument read/write/effect traces before changing behavior.
- Run shadow comparison under same model/tools/budget.
- Measure correctness + safety + cost + latency + recovery.
- Promote, merge or revert with versioned receipt.

Source anchors

C08,C10,C23

Layer route

L12,L22,L23

```
U08: parent_state + residual -> typed_delta -> shadow -> controlled_test ->
promote|merge|rollback
```

U09 | HyperAbilities إلى Constraint-Closed Compositions

Axis	vNext4.0 decision
Legacy state	الآلية السابقة تبقى parent ولا تعاد كتابتها.
Residual	القدرة المركبة لا تساوي قائمة skills؛ vNext4 يضيف composition graph وcross-layer constraints وmaturity evidence.
vNext4 object	typed state/contract/receipt + UpgradeRecord[U09]
Primary acceptance	انخفاض failure المرتبط بـ HyperAbilities إلى Constraint-Closed Compositions أو تحسن metric مع نفس budget.
Rollback	العودة إلى parent path إذا ظهر regression أو لم يثبت independent delta.
Theory hooks	V4-02 M-ETUHT · V4-04 M-RACPRT · V4-05 M-CLCPC · V4-06 M-CMBEMT · V4-09 M-PAOST

Implementation path

- Freeze parent behavior and benchmark anchor.
- Compile typed contract for HyperAbilities إلى Constraint-Closed Compositions.
- Instrument read/write/effect traces before changing behavior.
- Run shadow comparison under same model/tools/budget.
- Measure correctness + safety + cost + latency + recovery.
- Promote, merge or revert with versioned receipt.

Source anchors

C02,C03,C20

Layer route

L13,L18

```
U09: parent_state + residual -> typed_delta -> shadow -> controlled_test ->
promote|merge|rollback
```

U10 | HyperLoops إلى Bounded Mission State Machines

Axis	vNext4.0 decision
Legacy state	الآلية السابقة تبقى parent ولا تعاد كتابتها.
Residual	كل loop يحل limits evidence debt, max retries, rollback, repair, stop, progress metric, وescape basin failure.
vNext4 object	typed state/contract/receipt + UpgradeRecord[U10]
Primary acceptance	انخفاض failure المرتبط بـ HyperLoops إلى Bounded Mission State Machines أو تحسن metric مع نفس budget.
Rollback	العودة إلى parent path إذا ظهر regression أو لم يثبت independent delta.
Theory hooks	V4-01 M-CTIT · V4-03 M-SMBIT

Implementation path

- Freeze parent behavior and benchmark anchor.
- Compile typed contract for HyperLoops إلى Bounded Mission State Machines.
- Instrument read/write/effect traces before changing behavior.
- Run shadow comparison under same model/tools/budget.
- Measure correctness + safety + cost + latency + recovery.
- Promote, merge or revert with versioned receipt.

Source anchors

C10,C17

Layer route

L14

```
U10: parent_state + residual -> typed_delta -> shadow -> controlled_test ->
promote|merge|rollback
```

U11 | Goal-as-OS إلى Identity-Bound Mission Contract

Axis	vNext4.0 decision
Legacy state	الآلية السابقة تبقى parent ولا تعاد كتابتها.
Residual	الهدف يفصل objective عن mutable plan ويرتبط بالهوية والسلطة وpostconditions والrollback target.
vNext4 object	typed state/contract/receipt + UpgradeRecord[U11]
Primary acceptance	انخفاض failure المرتبط بـ Goal-as-OS إلى Identity-Bound Mission Contract أو تحسن metric مع نفس budget.
Rollback	العودة إلى parent path إذا ظهر regression أو لم يثبت independent delta.
Theory hooks	V4-02 M-ETUHT · V4-03 M-SMBIT · V4-05 M-CLCPC · V4-07 M-IFREAT

Implementation path

- Freeze parent behavior and benchmark anchor.
- Compile typed contract for Goal-as-OS إلى Identity-Bound Mission Contract.
- Instrument read/write/effect traces before changing behavior.
- Run shadow comparison under same model/tools/budget.
- Measure correctness + safety + cost + latency + recovery.
- Promote, merge or revert with versioned receipt.

Source anchors

C21,C04

Layer route

L01,L04

```
U11: parent_state + residual -> typed_delta -> shadow -> controlled_test ->
promote|merge|rollback
```

Hypothesis-Action Split إلى U12 | ENAV/Explorer-Navigator

Axis	vNext4.0 decision
Legacy state	الآلية السابقة تبقى parent ولا تعاد كتابتها.
Residual	الاستكشاف لا يكتب world state؛ navigator/action path لا يتحرك إلا بعد question/difference/evidence/authority gates.
vNext4 object	typed state/contract/receipt + UpgradeRecord[U12]
Primary acceptance	انخفاض failure المرتبط بـ ENAV/Explorer-Navigator إلى Hypothesis-Action Split أو تحسن metric مع نفس budget.
Rollback	العودة إلى parent path إذا ظهر regression أو لم يثبت independent delta.
Theory hooks	V4-02 M-ETUHT · V4-07 M-IFREAT · V4-09 M-PAOST

Implementation path

- Freeze parent behavior and benchmark anchor.
- Compile typed contract for ENAV/Explorer-Navigator إلى Hypothesis-Action Split.
- Instrument read/write/effect traces before changing behavior.
- Run shadow comparison under same model/tools/budget.
- Measure correctness + safety + cost + latency + recovery.
- Promote, merge or revert with versioned receipt.

Source anchors

C21

Layer route

L04,L15,L17

```
U12: parent_state + residual -> typed_delta -> shadow -> controlled_test ->
promote|merge|rollback
```

Jurisdiction + Ownership + Fencing إلى U13 | Multi-Agent

Axis	vNext4.0 decision
Legacy state	الآلية السابقة تبقى parent ولا تعاد كتابتها.
Residual	kernel/team mesh-5 لا يعتمد على file sync؛ mission owner واحد، stale token cannot commit، workers propose deltas، lease epoch.
vNext4 object	typed state/contract/receipt + UpgradeRecord[U13]
Primary acceptance	انخفاض failure المرتبط بـ Multi-Agent إلى Jurisdiction + Ownership + Fencing أو تحسن metric مع نفس budget.
Rollback	العودة إلى parent path إذا ظهر regression أو لم يثبت independent delta.
Theory hooks	V4-01 M-CTIT · V4-03 M-SMBIT · V4-06 M-CMBEMT · V4-07 M-IFREAT · V4-08 M-MTGST · V4-09 M-PAOST

Implementation path

- Freeze parent behavior and benchmark anchor.
- Compile typed contract for Multi-Agent إلى Jurisdiction + Ownership + Fencing.
- Instrument read/write/effect traces before changing behavior.
- Run shadow comparison under same model/tools/budget.
- Measure correctness + safety + cost + latency + recovery.
- Promote, merge or revert with versioned receipt.

Source anchors

C16,C19,C20

Layer route

L15,L20

```
U13: parent_state + residual -> typed_delta -> shadow -> controlled_test ->
promote|merge|rollback
```

U14 | Tools/MCP إلى Semantic Adapter Certification

Axis	vNext4.0 decision
Legacy state	الآلية السابقة تبقى parent ولا تعاد كتابتها.
Residual	Parsing success لا يساوي semantic preservation؛ تختبر adapters round-trip optional/error/authority/side-effect fields.
vNext4 object	typed state/contract/receipt + UpgradeRecord[U14]
Primary acceptance	انخفاض failure المرتبط بـ Tools/MCP إلى Semantic Adapter Certification أو تحسن metric مع نفس budget.
Rollback	العودة إلى parent path إذا ظهر regression أو لم يثبت independent delta.
Theory hooks	V4-02 M-ETUHT · V4-03 M-SMBIT · V4-05 M-CLCPC · V4-06 M-CMBEMT · V4-07 M-IFREAT · V4-09 M-PAOST

Source anchors

C13,C19

Layer route

L16,L18

```
U14: parent_state + residual -> typed_delta -> shadow -> controlled_test ->
promote|merge|rollback
```

Implementation path

- Freeze parent behavior and benchmark anchor.
- Compile typed contract for Tools/MCP إلى Semantic Adapter Certification.
- Instrument read/write/effect traces before changing behavior.
- Run shadow comparison under same model/tools/budget.
- Measure correctness + safety + cost + latency + recovery.
- Promote, merge or revert with versioned receipt.

U15 | World-Effect إلى Observable, Final, Causally Attributed Effect

Axis	vNext4.0 decision
Legacy state	الآلية السابقة تبقى parent ولا تعاد كتابتها.
Residual	قبل الفعل ObservabilityContract؛ بعده readback lattice/finality؛ ثم causal attribution وResidualEffect يعد rollback.
vNext4 object	typed state/contract/receipt + UpgradeRecord[U15]
Primary acceptance	انخفاض failure المرتبط بـ World-Effect إلى Observable, Final, Causally Attributed Effect أو تحسن metric مع نفس budget.
Rollback	العودة إلى parent path إذا ظهر regression أو لم يثبت independent delta.
Theory hooks	V4-01 M-CTIT · V4-03 M-SMBIT · V4-06 M-CMBEMT · V4-07 M-IFREAT · V4-08 M-MTGST · V4-09 M-PAOST

Implementation path

- Freeze parent behavior and benchmark anchor.
- Compile typed contract for World-Effect إلى Observable, Final, Causally Attributed Effect.
- Instrument read/write/effect traces before changing behavior.
- Run shadow comparison under same model/tools/budget.
- Measure correctness + safety + cost + latency + recovery.
- Promote, merge or revert with versioned receipt.

Source anchors

C16,C19

Layer route

L17-L20

```
U15: parent_state + residual -> typed_delta -> shadow -> controlled_test ->
promote|merge|rollback
```

U16 | Self-Reconstruction Memory إلى Branching Transactional Memory

Axis	vNext4.0 decision
Legacy state	الآلية السابقة تبقى parent ولا تعاد كتابتها.
Residual	تضاف cross-representation invalidation، و hypothesis branches، cognitive isolation، causal promotion, negative knowledge, merge receipts.
vNext4 object	typed state/contract/receipt + UpgradeRecord[U16]
Primary acceptance	انخفاض failure المرتبط بـ Self-Reconstruction Memory إلى Branching Transactional Memory أو تحسن metric مع نفس budget.
Rollback	العودة إلى parent path إذا ظهر regression أو لم يثبت independent delta.
Theory hooks	V4-01 M-CTIT · V4-04 M-RACPRT · V4-06 M-CMBEMT · V4-08 M-MTGST · V4-10 M-CRKCIT

Source anchors

C09,C11,C16,C19

Layer route

L09,L10,L22

```
U16: parent_state + residual -> typed_delta -> shadow -> controlled_test -> promote|merge|rollback
```

Implementation path

- Freeze parent behavior and benchmark anchor.
- Compile typed contract for Self-Reconstruction Memory إلى Branching Transactional Memory.
- Instrument read/write/effect traces before changing behavior.
- Run shadow comparison under same model/tools/budget.
- Measure correctness + safety + cost + latency + recovery.
- Promote, merge or revert with versioned receipt.

U17 | MUSQAT/training إلى Three-Plane Learning Governance

Axis	vNext4.0 decision
Legacy state	الآلية السابقة تبقى parent ولا تعاد كتابتها.
Residual	يفصل inference عن training عن evaluation/promotion؛ no watchdog-triggered auto-promotion؛ forgetting vector and canary rollback.
vNext4 object	typed state/contract/receipt + UpgradeRecord[U17]
Primary acceptance	انخفاض failure المرتبط بـ MUSQAT/training إلى Three-Plane Learning Governance أو تحسن metric مع نفس budget.
Rollback	العودة إلى parent path إذا ظهر regression أو لم يثبت independent delta.
Theory hooks	V4-02 M-ETUHT · V4-04 M-RACPRT · V4-08 M-MTGST · V4-10 M-CRKCIT

Implementation path

- Freeze parent behavior and benchmark anchor.
- Compile typed contract for MUSQAT/training إلى Three-Plane Learning Governance.
- Instrument read/write/effect traces before changing behavior.
- Run shadow comparison under same model/tools/budget.
- Measure correctness + safety + cost + latency + recovery.
- Promote, merge or revert with versioned receipt.

Source anchors

C09,C16,C20

Layer route

L21,L23

```
U17: parent_state + residual -> typed_delta -> shadow -> controlled_test ->
promote|merge|rollback
```

U18 | Evidence Courts إلى Claim-Local Forensic Evidence

Axis	vNext4.0 decision
Legacy state	الآلية السابقة تبقى parent ولا تعاد كتابتها.
Residual	ReportedGrade وIndependentGrade؛ verifier lineage؛ shared-root penalty؛ benchmark capsules؛ constraint closure before commit.
vNext4 object	typed state/contract/receipt + UpgradeRecord[U18]
Primary acceptance	انخفاض failure المرتبط بـ Evidence Courts إلى Claim-Local Forensic Evidence أو تحسن metric مع نفس budget.
Rollback	العودة إلى parent path إذا ظهر regression أو لم يثبت independent delta.
Theory hooks	V4-02 M-ETUHT · V4-04 M-RACPRT · V4-05 M-CLCPC · V4-06 M-CMBEMT · V4-08 M-MTGST · V4-09 M-PAOST

Implementation path

- Freeze parent behavior and benchmark anchor.
- Compile typed contract for Evidence Courts إلى Claim-Local Forensic Evidence.
- Instrument read/write/effect traces before changing behavior.
- Run shadow comparison under same model/tools/budget.
- Measure correctness + safety + cost + latency + recovery.
- Promote, merge or revert with versioned receipt.

Source anchors

C03,C14-C16

Layer route

L03,L18,L23

```
U18: parent_state + residual -> typed_delta -> shadow -> controlled_test ->
promote|merge|rollback
```

Residual-Driven Research Compiler إلى U19 | Part VII/VIII/IX frontier

Axis	vNext4.0 decision
Legacy state	الآلية السابقة تبقى parent ولا تعاد كتابتها.
Residual	لا نظرية جديدة من الاسم؛ residual مستقل -> N0-N5 promotion/merge/reject -> metric -> decisive experiment -> formal object.
vNext4 object	typed state/contract/receipt + UpgradeRecord[U19]
Primary acceptance	انخفاض failure المرتبط بـ Part VII/VIII/IX frontier إلى Residual-Driven Research Compiler أو تحسن metric مع نفس budget.
Rollback	العودة إلى parent path إذا ظهر regression أو لم يثبت independent delta.
Theory hooks	V4-02 M-ETUHT · V4-04 M-RACPRT

Implementation path

- Freeze parent behavior and benchmark anchor.
- Compile typed contract for Part VII/VIII/IX frontier إلى Residual-Driven Research Compiler.
- Instrument read/write/effect traces before changing behavior.
- Run shadow comparison under same model/tools/budget.
- Measure correctness + safety + cost + latency + recovery.
- Promote, merge or revert with versioned receipt.

Source anchors

C17-C19

Layer route

L23

```
U19: parent_state + residual -> typed_delta -> shadow -> controlled_test ->
promote|merge|rollback
```

Proof-Preserving Architectural Compression إلى U20 | Zero Duplication

Axis	vNext4.0 decision
Legacy state	الآلية السابقة تبقى parent ولا تعاد كتابتها.
Residual	0 bytes physical dedupe يبقى منفصلا عن semantic dedupe وعن إزالة التعقيد المعماري؛ refactor يحفظ behavior/proofs/lineage.
vNext4 object	typed state/contract/receipt + UpgradeRecord[U20]
Primary acceptance	انخفاض failure المرتبط بـ Zero Duplication إلى Proof-Preserving Architectural Compression أو تحسن metric مع نفس budget.
Rollback	العودة إلى parent path إذا ظهر regression أو لم يثبت independent delta.
Theory hooks	V4-02 M-ETUHT · V4-04 M-RACPRT · V4-08 M-MTGST · V4-10 M-CRKCIT

Implementation path

- Freeze parent behavior and benchmark anchor.
- Compile typed contract for Zero Duplication إلى Proof-Preserving Architectural Compression.
- Instrument read/write/effect traces before changing behavior.
- Run shadow comparison under same model/tools/budget.
- Measure correctness + safety + cost + latency + recovery.
- Promote, merge or revert with versioned receipt.

Source anchors

C16,C17

Layer route

L02,L22,L23

```
U20: parent_state + residual -> typed_delta -> shadow -> controlled_test ->
promote|merge|rollback
```

Controlled Continual Learning إلى U21 | Continuous LoRA

Axis	vNext4.0 decision
Legacy state	الآلية السابقة تبقى parent ولا تعاد كتابتها.
Residual	المسارات الموثقة تمر quarantine/dataset manifest/frozen eval/shadow/canary؛ reported 0.994 retention لا يلغي worst-slice analysis.
vNext4 object	typed state/contract/receipt + UpgradeRecord[U21]
Primary acceptance	انخفاض failure المرتبط بـ Continuous LoRA إلى Controlled Continual Learning أو تحسن metric مع نفس budget.
Rollback	العودة إلى parent path إذا ظهر regression أو لم يثبت independent delta.
Theory hooks	V4-02 M-ETUHT · V4-04 M-RACPRT · V4-08 M-MTGST · V4-10 M-CRKCIT

Implementation path

- Freeze parent behavior and benchmark anchor.
- Compile typed contract for Continuous LoRA إلى Controlled Continual Learning.
- Instrument read/write/effect traces before changing behavior.
- Run shadow comparison under same model/tools/budget.
- Measure correctness + safety + cost + latency + recovery.
- Promote, merge or revert with versioned receipt.

Source anchors

C20

Layer route

L21,L23

```
U21: parent_state + residual -> typed_delta -> shadow -> controlled_test ->
promote|merge|rollback
```

U22 | 12-Layer vNEXT إلى Layer vNext4.0-24

Axis	vNext4.0 decision
Legacy state	الآلية السابقة تبقى parent ولا تعاد كتابتها.
Residual	الطبقات القديمة لا تهدم، تفكك نقاط التوتر المختلطة: evidence/time, memory transactions, execution irreversibility, observability, representation coherence, research replication.
vNext4 object	typed state/contract/receipt + UpgradeRecord[U22]
Primary acceptance	انخفاض failure المرتبط بـ Layer vNEXT-12 إلى Layer vNext4.0-24 أو تحسن metric مع نفس budget.
Rollback	العودة إلى parent path إذا ظهر regression أو لم يثبت independent delta.
Theory hooks	V4-02 M-ETUHT · V4-03 M-SMBIT · V4-04 M-RACPRT · V4-05 M-CLCPC · V4-08 M-MTGST

Implementation path

- Freeze parent behavior and benchmark anchor.
- Compile typed contract for 12-Layer vNEXT إلى Layer vNext4.0-24.
- Instrument read/write/effect traces before changing behavior.
- Run shadow comparison under same model/tools/budget.
- Measure correctness + safety + cost + latency + recovery.
- Promote, merge or revert with versioned receipt.

Source anchors

C13,C16,C20

Layer route

L00-L23

```
U22: parent_state + residual -> typed_delta -> shadow -> controlled_test ->
promote|merge|rollback
```

Self-Describing Cross-Environment Runtime إلى U23 | MOUSSAIXT shell

Axis	vNext4.0 decision
Legacy state	الآلية السابقة تبقى parent ولا تعاد كتابتها.
Residual	كل host يعلن capabilities/permissions/model identity/state adapters بشكل attested؛ model لا يخمن ما يستطيع فعله.
vNext4 object	typed state/contract/receipt + UpgradeRecord[U23]
Primary acceptance	انخفاض failure المرتبط بـ MOUSSAIXT shell إلى Self-Describing Cross-Environment Runtime أو تحسن metric مع نفس budget.
Rollback	العودة إلى parent path إذا ظهر regression أو لم يثبت independent delta.
Theory hooks	V4-03 M-SMBIT · V4-05 M-CLCPC · V4-07 M-IFREAT · V4-09 M-PAOST

Implementation path

- Freeze parent behavior and benchmark anchor.
- Compile typed contract for MOUSSAIXT shell إلى Self-Describing Cross-Environment Runtime.
- Instrument read/write/effect traces before changing behavior.
- Run shadow comparison under same model/tools/budget.
- Measure correctness + safety + cost + latency + recovery.
- Promote, merge or revert with versioned receipt.

Source anchors

C13,C20

Layer route

L01,L16

```
U23: parent_state + residual -> typed_delta -> shadow -> controlled_test ->
promote|merge|rollback
```

U24 | الكانون إلى Living Reference Kernel

Axis	vNext4.0 decision
Legacy state	الآلية السابقة تبقى parent ولا تعاد كتابتها.
Residual	النسخة المعيارية ليست PDF ثابتة فقط؛ هي registries + schemas + replay bundles + migration receipts + deprecation lineage يمكن إعادة بنائها.
vNext4 object	typed state/contract/receipt + UpgradeRecord[U24]
Primary acceptance	انخفاض failure المرتبط بـ الكانون إلى Living Reference Kernel أو تحسن metric مع نفس budget.
Rollback	العودة إلى parent path إذا ظهر regression أو لم يثبت delta independent.
Theory hooks	V4-01 M-CTIT · V4-02 M-ETUHT · V4-03 M-SMBIT · V4-04 M-RACPRT · V4-06 M-CMBEMT · V4-07 M-IFREAT

Implementation path

- Freeze parent behavior and benchmark anchor.
- Compile typed contract for الكانون إلى Living Reference Kernel.
- Instrument read/write/effect traces before changing behavior.
- Run shadow comparison under same model/tools/budget.
- Measure correctness + safety + cost + latency + recovery.
- Promote, merge or revert with versioned receipt.

Source anchors

C08,C18,C24

Layer route

L02,L20,L22,L23

```
U24: parent_state + residual -> typed_delta -> shadow -> controlled_test ->
promote|merge|rollback
```

L00 | الدستور والسلامة غير القابلة للتجاوز

Dimension	Contract
Legacy anchor	L0
Responsibility	.T0-T4, privacy, irreversible/public-action bans, truthfulness, fail-closed
Core objects	PolicySnapshot, RiskTier, NonNegotiableConstraint
Upstream	EXTERNAL/BOOT
Downstream	L01
Failures	policy bypass; stale constitution
Metrics	policy violation rate; blocked-critical action precision
vNext4 theories	V4-03 M-SMBIT · V4-05 M-CLCPC · V4-08 M-MTGST

Read path

- pin mission/policy/model/knowledge epochs
- read typed objects with provenance/version
- reject stale or unauthorized dependencies
- record ReadSet and trace spans

Write path

- propose minimal state delta
- validate authority/constraints/observability
- commit with receipt or return BLOCKED/PARTIAL/AMBIGUOUS
- emit invalidation/rollback references

Fault injection

- inject policy bypass
- delay upstream event
- swap provider/tool version
- remove one critical evidence field
- retry duplicate mutation

Migration acceptance

- old path remains fallback during shadow
- no critical regression
- trace is reconstructable
- state transitions have deterministic ownership
- metrics are collected before promotion

```
L00.transition = validate(snapshot,authority,constraints,epoch) -> minimal_delta -> verify -> receipt -> emit(L01)
```

L01 | حدود الهوية والهدف والسلطة

Dimension	Contract
Legacy anchor	L0-L1
Responsibility	.Project identity, Goal-as-OS contract, delegation tokens, self-model attestation, authority locality
Core objects	IdentityRecord, GoalContract, AuthorityToken
Upstream	L00
Downstream	L02
Failures	identity bleed; permission hallucination
Metrics	identity mismatch; unauthorized-plan rate
vNext4 theories	V4-03 M-SMBIT · V4-05 M-CLCPC · V4-07 M-IFREAT

Read path

- pin mission/policy/model/knowledge epochs
- read typed objects with provenance/version
- reject stale or unauthorized dependencies
- record ReadSet and trace spans

Write path

- propose minimal state delta
- validate authority/constraints/observability
- commit with receipt or return BLOCKED/PARTIAL/AMBIGUOUS
- emit invalidation/rollback references

Fault injection

- inject identity bleed
- delay upstream event
- swap provider/tool version
- remove one critical evidence field
- retry duplicate mutation

Migration acceptance

- old path remains fallback during shadow
- no critical regression
- trace is reconstructable
- state transitions have deterministic ownership
- metrics are collected before promotion

```
L01.transition = validate(snapshot,authority,constraints,epoch) -> minimal_delta -> verify -> receipt -> emit(L02)
```

Source, Provenance & Canonical Identity

L02 | المصدر والنسب والهوية المعيارية

Dimension	Contract
Legacy anchor	L3 / Part IV
Responsibility	.Ingest, hashes, aliases, canonical identity graph, semantic duplicate candidates, source ranking
Core objects	SourceRecord, CanonicalEntity, ProvenanceEdge
Upstream	L01
Downstream	L03
Failures	duplicate inflation; provenance loss
Metrics	dedupe precision; source coverage
vNext4 theories	V4-04 M-RACPRT · V4-10 M-CRKCIT

Read path

- pin mission/policy/model/knowledge epochs
- read typed objects with provenance/version
- reject stale or unauthorized dependencies
- record ReadSet and trace spans

Write path

- propose minimal state delta
- validate authority/constraints/observability
- commit with receipt or return BLOCKED/PARTIAL/AMBIGUOUS
- emit invalidation/rollback references

Fault injection

- inject duplicate inflation
- delay upstream event
- swap provider/tool version
- remove one critical evidence field
- retry duplicate mutation

Migration acceptance

- old path remains fallback during shadow
- no critical regression
- trace is reconstructable
- state transitions have deterministic ownership
- metrics are collected before promotion

```
L02.transition = validate(snapshot,authority,constraints,epoch) -> minimal_delta -> verify -> receipt -> emit(L03)
```

L03 | الادعاءات والدليل والزمن واللايقين

Dimension	Contract
Legacy anchor	L2-L3
Responsibility	.Claim typing, evidence ledger, half-life, debt, ReportedGrade vs IndependentGrade, epistemic thermostat
Core objects	ClaimRecord, EvidencePacket, UncertaintyBudget
Upstream	L02
Downstream	L04
Failures	grade laundering; stale claim
Metrics	calibration; stale action rate
vNext4 theories	V4-02 M-ETUHT · V4-08 M-MTGST

Read path

- pin mission/policy/model/knowledge epochs
- read typed objects with provenance/version
- reject stale or unauthorized dependencies
- record ReadSet and trace spans

Write path

- propose minimal state delta
- validate authority/constraints/observability
- commit with receipt or return BLOCKED/PARTIAL/AMBIGUOUS
- emit invalidation/rollback references

Fault injection

- inject grade laundering
- delay upstream event
- swap provider/tool version
- remove one critical evidence field
- retry duplicate mutation

Migration acceptance

- old path remains fallback during shadow
- no critical regression
- trace is reconstructable
- state transitions have deterministic ownership
- metrics are collected before promotion

```
L03.transition = validate(snapshot,authority,constraints,epoch) -> minimal_delta -> verify -> receipt -> emit(L04)
```

L04 | السؤال الحاكم والكثافة السؤالية

Dimension	Contract
Legacy anchor	L1-L2
Responsibility	Question generation, QG/QR/QE, decision relevance, stop/ask/retrieve/experiment policy.
Core objects	QuestionCard, QuestionGraph, QDensityVector
Upstream	L03
Downstream	L05
Failures	verbose questioning; irrelevant branches
Metrics	decision gain/question; branch reduction
vNext4 theories	V4-02 M-ETUHT

Read path

- pin mission/policy/model/knowledge epochs
- read typed objects with provenance/version
- reject stale or unauthorized dependencies
- record ReadSet and trace spans

Write path

- propose minimal state delta
- validate authority/constraints/observability
- commit with receipt or return BLOCKED/PARTIAL/AMBIGUOUS
- emit invalidation/rollback references

Fault injection

- inject verbose questioning
- delay upstream event
- swap provider/tool version
- remove one critical evidence field
- retry duplicate mutation

Migration acceptance

- old path remains fallback during shadow
- no critical regression
- trace is reconstructable
- state transitions have deterministic ownership
- metrics are collected before promotion

```
L04.transition = validate(snapshot,authority,constraints,epoch) -> minimal_delta -> verify -> receipt -> emit(L05)
```

L05 | الفرق الفاعل والتحكم في الحساب

Dimension	Contract
Legacy anchor	L2
Responsibility	.Delta extraction, MCD/QMCD calibration, route regret, compute allocation under budget
Core objects	ActiveDifference, MCDVector, ComputeBudget
Upstream	L04
Downstream	L06
Failures	metric gaming; miscalibrated lambda
Metrics	route regret; verified gain/compute
vNext4 theories	V4-02 M-ETUHT

Read path

- pin mission/policy/model/knowledge epochs
- read typed objects with provenance/version
- reject stale or unauthorized dependencies
- record ReadSet and trace spans

Write path

- propose minimal state delta
- validate authority/constraints/observability
- commit with receipt or return BLOCKED/PARTIAL/AMBIGUOUS
- emit invalidation/rollback references

Fault injection

- inject metric gaming
- delay upstream event
- swap provider/tool version
- remove one critical evidence field
- retry duplicate mutation

Migration acceptance

- old path remains fallback during shadow
- no critical regression
- trace is reconstructable
- state transitions have deterministic ownership
- metrics are collected before promotion

```
L05.transition = validate(snapshot,authority,constraints,epoch) -> minimal_delta -> verify -> receipt -> emit(L06)
```

L06 | الأنطولوجيا والوعاء والحسب المتعددة

Dimension	Contract
Legacy anchor	MURI / Expanded Atlas
Responsibility	.Typed claims, PPOA, CPCU, ARP, dynamic context, calculus selection, explicit ignorance
Core objects	TypedClaim, OntologyType, CalculusPlan
Upstream	L05
Downstream	L07
Failures	type error; rank loss
Metrics	type violation; rank preservation
vNext4 theories	V4-05 M-CLCPC

Read path

- pin mission/policy/model/knowledge epochs
- read typed objects with provenance/version
- reject stale or unauthorized dependencies
- record ReadSet and trace spans

Write path

- propose minimal state delta
- validate authority/constraints/observability
- commit with receipt or return BLOCKED/PARTIAL/AMBIGUOUS
- emit invalidation/rollback references

Fault injection

- inject type error
- delay upstream event
- swap provider/tool version
- remove one critical evidence field
- retry duplicate mutation

Migration acceptance

- old path remains fallback during shadow
- no critical regression
- trace is reconstructable
- state transitions have deterministic ownership
- metrics are collected before promotion

```
L06.transition = validate(snapshot,authority,constraints,epoch) -> minimal_delta -> verify -> receipt -> emit(L07)
```

L07 | نموذج العالم والحالة الموثوقة

Dimension	Contract
Legacy anchor	L3 / Part IV
Responsibility	.Observed/inferred/proposed/remembered separation, source precedence, validity time, state conflict
Core objects	WorldEntity, StateObservation, ConflictSet
Upstream	L06
Downstream	L08
Failures	remembered-over-observed
Metrics	authoritative-state accuracy
vNext4 theories	V4-01 M-CTIT · V4-06 M-CMBEMT · V4-10 M-CRKCIT

Read path

- pin mission/policy/model/knowledge epochs
- read typed objects with provenance/version
- reject stale or unauthorized dependencies
- record ReadSet and trace spans

Write path

- propose minimal state delta
- validate authority/constraints/observability
- commit with receipt or return BLOCKED/PARTIAL/AMBIGUOUS
- emit invalidation/rollback references

Fault injection

- inject remembered-over-observed
- delay upstream event
- swap provider/tool version
- remove one critical evidence field
- retry duplicate mutation

Migration acceptance

- old path remains fallback during shadow
- no critical regression
- trace is reconstructable
- state transitions have deterministic ownership
- metrics are collected before promotion

```
L07.transition = validate(snapshot,authority,constraints,epoch) -> minimal_delta -> verify -> receipt -> emit(L08)
```

L08 | الاسترجاع وجينوم السياق

Dimension	Contract
Legacy anchor	L4
Responsibility	Minimal sufficient retrieval, GraphRAG, context compaction, provenance pointers, contradiction-aware retrieval.
Core objects	ContextPacket, RetrievalTrace, CompactionReceipt
Upstream	L07
Downstream	L09
Failures	retrieval contamination; overcompression
Metrics	recall of governing facts; fidelity/token
vNext4 theories	V4-06 M-CMBEMT · V4-10 M-CRKCIT

Read path

- pin mission/policy/model/knowledge epochs
- read typed objects with provenance/version
- reject stale or unauthorized dependencies
- record ReadSet and trace spans

Write path

- propose minimal state delta
- validate authority/constraints/observability
- commit with receipt or return BLOCKED/PARTIAL/AMBIGUOUS
- emit invalidation/rollback references

Fault injection

- inject retrieval contamination
- delay upstream event
- swap provider/tool version
- remove one critical evidence field
- retry duplicate mutation

Migration acceptance

- old path remains fallback during shadow
- no critical regression
- trace is reconstructable
- state transitions have deterministic ownership
- metrics are collected before promotion

```
L08.transition = validate(snapshot,authority,constraints,epoch) -> minimal_delta -> verify -> receipt -> emit(L09)
```

L09 | الذاكرة المتفرعة وإعادة البناء

Dimension	Contract
Legacy anchor	L11
Responsibility	.Quarantine, episodic/semantic/procedural separation, counterfactual branches, negative knowledge, reconstruction
Core objects	MemoryBranch, MemoryDelta, PromotionCandidate
Upstream	L08
Downstream	L10
Failures	branch explosion; narrative promotion
Metrics	wrong-memory rate; merge precision
vNext4 theories	V4-01 M-CTIT · V4-06 M-CMBEMT · V4-08 M-MTGST

Read path

- pin mission/policy/model/knowledge epochs
- read typed objects with provenance/version
- reject stale or unauthorized dependencies
- record ReadSet and trace spans

Write path

- propose minimal state delta
- validate authority/constraints/observability
- commit with receipt or return BLOCKED/PARTIAL/AMBIGUOUS
- emit invalidation/rollback references

Fault injection

- inject branch explosion
- delay upstream event
- swap provider/tool version
- remove one critical evidence field
- retry duplicate mutation

Migration acceptance

- old path remains fallback during shadow
- no critical regression
- trace is reconstructable
- state transitions have deterministic ownership
- metrics are collected before promotion

```
L09.transition = validate(snapshot,authority,constraints,epoch) -> minimal_delta -> verify -> receipt -> emit(L10)
```

L10 | عزل المعاملات المعرفية

Dimension	Contract
Legacy anchor	new vNext4
Responsibility	.Snapshot reasoning, read/write sets, cognitive CAS, conflict replay, serializable memory commit
Core objects	CognitiveTransaction, KnowledgeSnapshot, CommitReceipt
Upstream	L09
Downstream	L11
Failures	dirty read; phantom claim
Metrics	epistemic conflict rate
vNext4 theories	V4-01 M-CTIT

Read path

- pin mission/policy/model/knowledge epochs
- read typed objects with provenance/version
- reject stale or unauthorized dependencies
- record ReadSet and trace spans

Write path

- propose minimal state delta
- validate authority/constraints/observability
- commit with receipt or return BLOCKED/PARTIAL/AMBIGUOUS
- emit invalidation/rollback references

Fault injection

- inject dirty read
- delay upstream event
- swap provider/tool version
- remove one critical evidence field
- retry duplicate mutation

Migration acceptance

- old path remains fallback during shadow
- no critical regression
- trace is reconstructable
- state transitions have deterministic ownership
- metrics are collected before promotion

```
L10.transition = validate(snapshot,authority,constraints,epoch) -> minimal_delta -> verify -> receipt -> emit(L11)
```

L11 | الموجه الوعائي ومحفظة النماذج والحساب

Dimension	Contract
Legacy anchor	L2 / EX
Responsibility	.Sparse HyperRouting, model/tool/provider selection, cost/latency/risk, cross-model transfer
Core objects	RoutePlan, ModelCandidate, CostEnvelope
Upstream	L10
Downstream	L12
Failures	vendor lock; route thrash
Metrics	utility/cost; route regret
vNext4 theories	canonical layer; no exclusive new theory

Read path

- pin mission/policy/model/knowledge epochs
- read typed objects with provenance/version
- reject stale or unauthorized dependencies
- record ReadSet and trace spans

Write path

- propose minimal state delta
- validate authority/constraints/observability
- commit with receipt or return BLOCKED/PARTIAL/AMBIGUOUS
- emit invalidation/rollback references

Fault injection

- inject vendor lock
- delay upstream event
- swap provider/tool version
- remove one critical evidence field
- retry duplicate mutation

Migration acceptance

- old path remains fallback during shadow
- no critical regression
- trace is reconstructable
- state transitions have deterministic ownership
- metrics are collected before promotion

```
L11.transition = validate(snapshot,authority,constraints,epoch) -> minimal_delta -> verify -> receipt -> emit(L12)
```

L12 | المهارات الفائقة والقدرات الذرية

Dimension	Contract
Legacy anchor	L5
Responsibility	.Typed skill contracts, preconditions, outputs, evidence, rollback, versioning, transfer tests
Core objects	HyperSkill, SkillVersion, SkillReceipt
Upstream	L11
Downstream	L13
Failures	skill inflation; hidden dependency
Metrics	skill transfer; regression rate
vNext4 theories	V4-04 M-RACPRT · V4-05 M-CLCPC · V4-10 M-CRKCIT

Read path

- pin mission/policy/model/knowledge epochs
- read typed objects with provenance/version
- reject stale or unauthorized dependencies
- record ReadSet and trace spans

Write path

- propose minimal state delta
- validate authority/constraints/observability
- commit with receipt or return BLOCKED/PARTIAL/AMBIGUOUS
- emit invalidation/rollback references

Fault injection

- inject skill inflation
- delay upstream event
- swap provider/tool version
- remove one critical evidence field
- retry duplicate mutation

Migration acceptance

- old path remains fallback during shadow
- no critical regression
- trace is reconstructable
- state transitions have deterministic ownership
- metrics are collected before promotion

```
L12.transition = validate(snapshot,authority,constraints,epoch) -> minimal_delta -> verify -> receipt -> emit(L13)
```

L13 | القدرات المركبة وتركيب المهارات

Dimension	Contract
Legacy anchor	L6
Responsibility	.Composition contracts, constraint closure, capability maturity, substitution/complementarity boundaries
Core objects	HyperAbility, CompositionGraph, ConstraintSet
Upstream	L12
Downstream	L14
Failures	composition invalidity
Metrics	composition closure; marginal value
vNext4 theories	V4-04 M-RACPRT

Read path

- pin mission/policy/model/knowledge epochs
- read typed objects with provenance/version
- reject stale or unauthorized dependencies
- record ReadSet and trace spans

Write path

- propose minimal state delta
- validate authority/constraints/observability
- commit with receipt or return BLOCKED/PARTIAL/AMBIGUOUS
- emit invalidation/rollback references

Fault injection

- inject composition invalidity
- delay upstream event
- swap provider/tool version
- remove one critical evidence field
- retry duplicate mutation

Migration acceptance

- old path remains fallback during shadow
- no critical regression
- trace is reconstructable
- state transitions have deterministic ownership
- metrics are collected before promotion

```
L13.transition = validate(snapshot,authority,constraints,epoch) -> minimal_delta -> verify -> receipt -> emit(L14)
```

L14 | الحلقات المحدودة وآلات حالة المهمة

Dimension	Contract
Legacy anchor	L7
Responsibility	.Progress metrics, stop/repair/rollback, retry limits, temporal horizon, loop saturation/failure basins
Core objects	HyperLoop, LoopState, ProgressReceipt
Upstream	L13
Downstream	L15
Failures	open loop; fake progress
Metrics	bounded completion; recovery time
vNext4 theories	V4-01 M-CTIT · V4-03 M-SMBIT

Read path

- pin mission/policy/model/knowledge epochs
- read typed objects with provenance/version
- reject stale or unauthorized dependencies
- record ReadSet and trace spans

Write path

- propose minimal state delta
- validate authority/constraints/observability
- commit with receipt or return BLOCKED/PARTIAL/AMBIGUOUS
- emit invalidation/rollback references

Fault injection

- inject open loop
- delay upstream event
- swap provider/tool version
- remove one critical evidence field
- retry duplicate mutation

Migration acceptance

- old path remains fallback during shadow
- no critical regression
- trace is reconstructable
- state transitions have deterministic ownership
- metrics are collected before promotion

```
L14.transition = validate(snapshot,authority,constraints,epoch) -> minimal_delta -> verify -> receipt -> emit(L15)
```

L15 | الوكلاء والأدوار والاختصاص

Dimension	Contract
Legacy anchor	L8
Responsibility	.Mission DAG, roles, jurisdiction, owner/worker separation, appeals, dynamic pruning
Core objects	AgentRole, Jurisdiction, MissionDAG
Upstream	L14
Downstream	L16
Failures	orphan responsibility; overlap
Metrics	ownership clarity; coordination value
vNext4 theories	canonical layer; no exclusive new theory

Read path

- pin mission/policy/model/knowledge epochs
- read typed objects with provenance/version
- reject stale or unauthorized dependencies
- record ReadSet and trace spans

Write path

- propose minimal state delta
- validate authority/constraints/observability
- commit with receipt or return BLOCKED/PARTIAL/AMBIGUOUS
- emit invalidation/rollback references

Fault injection

- inject orphan responsibility
- delay upstream event
- swap provider/tool version
- remove one critical evidence field
- retry duplicate mutation

Migration acceptance

- old path remains fallback during shadow
- no critical regression
- trace is reconstructable
- state transitions have deterministic ownership
- metrics are collected before promotion

```
L15.transition = validate(snapshot,authority,constraints,epoch) -> minimal_delta -> verify -> receipt -> emit(L16)
```

L16 | غلاف MOUSSAIXT ومحولات الأدوات والبروتوكولات

Dimension	Contract
Legacy anchor	L9
Responsibility	.Host discovery, tool contracts, MCP/A2A/custom schemas, semantic-loss certification, self-state capability lookup
Core objects	ToolContract, HostFingerprint, SemanticAdapter
Upstream	L15
Downstream	L17
Failures	protocol semantic loss; wrong target
Metrics	round-trip semantic fidelity
vNext4 theories	V4-03 M-SMBIT · V4-05 M-CLCPC · V4-07 M-IFREAT · V4-09 M-PAOST

Read path

- pin mission/policy/model/knowledge epochs
- read typed objects with provenance/version
- reject stale or unauthorized dependencies
- record ReadSet and trace spans

Write path

- propose minimal state delta
- validate authority/constraints/observability
- commit with receipt or return BLOCKED/PARTIAL/AMBIGUOUS
- emit invalidation/rollback references

Fault injection

- inject protocol semantic loss
- delay upstream event
- swap provider/tool version
- remove one critical evidence field
- retry duplicate mutation

Migration acceptance

- old path remains fallback during shadow
- no critical regression
- trace is reconstructable
- state transitions have deterministic ownership
- metrics are collected before promotion

```
L16.transition = validate(snapshot,authority,constraints,epoch) -> minimal_delta -> verify -> receipt -> emit(L17)
```

L17 | معاملات التنفيذ والساغا واللاعكوسية

Dimension	Contract
Legacy anchor	L9 + new vNext4
Responsibility	.Idempotency, durable intent, checkpoints, compensation, irreversibility frontier, residual-effect accounting
Core objects	ActionIntent, TransactionReceipt, ResidualEffect
Upstream	L16
Downstream	L18
Failures	ambiguous commit; false rollback
Metrics	effectively-once rate; residual risk
vNext4 theories	V4-07 M-IFREAT · V4-09 M-PAOST

Read path

- pin mission/policy/model/knowledge epochs
- read typed objects with provenance/version
- reject stale or unauthorized dependencies
- record ReadSet and trace spans

Write path

- propose minimal state delta
- validate authority/constraints/observability
- commit with receipt or return BLOCKED/PARTIAL/AMBIGUOUS
- emit invalidation/rollback references

Fault injection

- inject ambiguous commit
- delay upstream event
- swap provider/tool version
- remove one critical evidence field
- retry duplicate mutation

Migration acceptance

- old path remains fallback during shadow
- no critical regression
- trace is reconstructable
- state transitions have deterministic ownership
- metrics are collected before promotion

```
L17.transition = validate(snapshot,authority,constraints,epoch) -> minimal_delta -> verify -> receipt -> emit(L18)
```

L18 | المحاكم والمحققون وإغلاق القيود

Dimension	Contract
Legacy anchor	L10
Responsibility	.Independent verifier portfolios, demolition/falsification, constraint propagation, proof budget, correlated-failure handling
Core objects	Verdict, VerifierLineage, UnsatCore
Upstream	L17
Downstream	L19
Failures	correlated verifier; silent relaxation
Metrics	independence gain; invalid-success rate
vNext4 theories	V4-02 M-ETUHT · V4-05 M-CLCPC · V4-06 M-CMBEMT · V4-09 M-PAOST

Read path

- pin mission/policy/model/knowledge epochs
- read typed objects with provenance/version
- reject stale or unauthorized dependencies
- record ReadSet and trace spans

Write path

- propose minimal state delta
- validate authority/constraints/observability
- commit with receipt or return BLOCKED/PARTIAL/AMBIGUOUS
- emit invalidation/rollback references

Fault injection

- inject correlated verifier
- delay upstream event
- swap provider/tool version
- remove one critical evidence field
- retry duplicate mutation

Migration acceptance

- old path remains fallback during shadow
- no critical regression
- trace is reconstructable
- state transitions have deterministic ownership
- metrics are collected before promotion

```
L18.transition = validate(snapshot,authority,constraints,epoch) -> minimal_delta -> verify -> receipt -> emit(L19)
```

L19 | أثر العالم والنهائية والنسب السببي

Dimension	Contract
Legacy anchor	L10
Responsibility	Observability contracts, readback lattice, finality, causal attribution, competing causes, effect grades.
Core objects	EffectObservation, FinalityLevel, CausalCredit
Upstream	L18
Downstream	L20
Failures	HTTP-success illusion; unobservable effect
Metrics	verified effect rate; attribution confidence
vNext4 theories	V4-07 M-IFREAT · V4-09 M-PAOST

Read path

- pin mission/policy/model/knowledge epochs
- read typed objects with provenance/version
- reject stale or unauthorized dependencies
- record ReadSet and trace spans

Write path

- propose minimal state delta
- validate authority/constraints/observability
- commit with receipt or return BLOCKED/PARTIAL/AMBIGUOUS
- emit invalidation/rollback references

Fault injection

- inject HTTP-success illusion
- delay upstream event
- swap provider/tool version
- remove one critical evidence field
- retry duplicate mutation

Migration acceptance

- old path remains fallback during shadow
- no critical regression
- trace is reconstructable
- state transitions have deterministic ownership
- metrics are collected before promotion

```
L19.transition = validate(snapshot,authority,constraints,epoch) -> minimal_delta -> verify -> receipt -> emit(L20)
```

L20 | القياس والتتبع ونسيج الرصد

Dimension	Contract
Legacy anchor	L11
Responsibility	.OpenTelemetry-style trace IDs, mission timelines, metrics, state snapshots, anomaly/fault replay
Core objects	TraceEvent, MetricSeries, ReplayBundle
Upstream	L19
Downstream	L21
Failures	missing trace; metric substitution
Metrics	trace completeness; replay success
vNext4 theories	V4-01 M-CTIT · V4-03 M-SMBIT · V4-06 M-CMBEMT · V4-07 M-IFREAT · V4-08 M-MTGST · V4-09 M-PAOST

Read path

- pin mission/policy/model/knowledge epochs
- read typed objects with provenance/version
- reject stale or unauthorized dependencies
- record ReadSet and trace spans

Write path

- propose minimal state delta
- validate authority/constraints/observability
- commit with receipt or return BLOCKED/PARTIAL/AMBIGUOUS
- emit invalidation/rollback references

Fault injection

- inject missing trace
- delay upstream event
- swap provider/tool version
- remove one critical evidence field
- retry duplicate mutation

Migration acceptance

- old path remains fallback during shadow
- no critical regression
- trace is reconstructable
- state transitions have deterministic ownership
- metrics are collected before promotion

```
L20.transition = validate(snapshot,authority,constraints,epoch) -> minimal_delta -> verify -> receipt -> emit(L21)
```

L21 | التدريب والتطوير والترقية

Dimension	Contract
Legacy anchor	L11 / MUSQAT
Responsibility	.Verified-trace quarantine, dataset manifests, LoRA/adapters, frozen eval, forgetting vector, shadow/canary, rollback
Core objects	DatasetManifest, CheckpointCandidate, PromotionReceipt
Upstream	L20
Downstream	L22
Failures	self-promotion; forgetting
Metrics	worst-slice retention; canary gain
vNext4 theories	V4-08 M-MTGST · V4-10 M-CRKCIT

Read path

- pin mission/policy/model/knowledge epochs
- read typed objects with provenance/version
- reject stale or unauthorized dependencies
- record ReadSet and trace spans

Write path

- propose minimal state delta
- validate authority/constraints/observability
- commit with receipt or return BLOCKED/PARTIAL/AMBIGUOUS
- emit invalidation/rollback references

Fault injection

- inject self-promotion
- delay upstream event
- swap provider/tool version
- remove one critical evidence field
- retry duplicate mutation

Migration acceptance

- old path remains fallback during shadow
- no critical regression
- trace is reconstructable
- state transitions have deterministic ownership
- metrics are collected before promotion

```
L21.transition = validate(snapshot,authority,constraints,epoch) -> minimal_delta -> verify -> receipt -> emit(L22)
```

L22 | اتساق التمثيلات وتطور المعمارية

Dimension	Contract
Legacy anchor	new vNext4
Responsibility	.Invalidation waves, dependency derivation graph, proof-preserving refactor, deprecation lineage, architecture compression
Core objects	DerivationGraph, InvalidationWave, RefactorReceipt
Upstream	L21
Downstream	L23
Failures	stale derivative; architecture bloat
Metrics	stale derivative rate; coverage/component
vNext4 theories	V4-04 M-RACPRT · V4-08 M-MTGST · V4-10 M-CRKCIT

Read path

- pin mission/policy/model/knowledge epochs
- read typed objects with provenance/version
- reject stale or unauthorized dependencies
- record ReadSet and trace spans

Write path

- propose minimal state delta
- validate authority/constraints/observability
- commit with receipt or return BLOCKED/PARTIAL/AMBIGUOUS
- emit invalidation/rollback references

Fault injection

- inject stale derivative
- delay upstream event
- swap provider/tool version
- remove one critical evidence field
- retry duplicate mutation

Migration acceptance

- old path remains fallback during shadow
- no critical regression
- trace is reconstructable
- state transitions have deterministic ownership
- metrics are collected before promotion

```
L22.transition = validate(snapshot,authority,constraints,epoch) -> minimal_delta -> verify -> receipt -> emit(L23)
```

L23 | البحث والقياس ومحكمة التكرار

Dimension	Contract
Legacy anchor	Part IV/VII/VIII/IX
Responsibility	.Frozen baselines, matched-budget ablation, hidden variants, benchmark lifecycle, external replication, theory promotion/merge/reject
Core objects	BenchmarkCapsule, ExperimentRecord, TheoryVerdict
Upstream	L22
Downstream	RELEASE/RESEARCH
Failures	benchmark contamination; theory inflation
Metrics	replication rate; verified knowledge/cost
vNext4 theories	V4-02 M-ETUHT · V4-04 M-RACPRT

Read path

- pin mission/policy/model/knowledge epochs
- read typed objects with provenance/version
- reject stale or unauthorized dependencies
- record ReadSet and trace spans

Write path

- propose minimal state delta
- validate authority/constraints/observability
- commit with receipt or return BLOCKED/PARTIAL/AMBIGUOUS
- emit invalidation/rollback references

Fault injection

- inject benchmark contamination
- delay upstream event
- swap provider/tool version
- remove one critical evidence field
- retry duplicate mutation

Migration acceptance

- old path remains fallback during shadow
- no critical regression
- trace is reconstructable
- state transitions have deterministic ownership
- metrics are collected before promotion

```
L23.transition = validate(snapshot,authority,constraints,epoch) -> minimal_delta -> verify -> receipt -> emit(RELEASE/RESEARCH)
```

Cross-plane formal contract

K01 | Claim Contract

Field	Operational semantics
claim_id	stable claim identity; never recycled across semantic changes
type	epistemic/object type controlling allowed transitions
statement	normalized proposition, not presentation prose
scope	domain/project/time/action boundary of validity
source	authoritative origin or source-root pointer
time	observation/publication/validation time as applicable
uncertainty	calibrated uncertainty with method/version
evidence_grade	N/E grade with reported vs independent distinction
falsifier	observable condition that lowers or rejects the claim
artifact_refs	trace, file, test, benchmark or receipt references

Invariant

لا claim بلا نوع ونطاق ومكذب؛ لا يصبح source claim حقيقة بمجرد النقل.

Lifecycle

- draft/candidate
- validated
- active-scoped
- superseded
- revoked/expired
- archived with lineage

```
Claim Contract: validate -> authorize -> use -> observe -> audit ->
revalidate|supersede|revoke
```

Acceptance tests

- missing-field negative test
- stale-version test
- wrong-authority test
- conflicting-source test
- replay/reconstruction test
- rollback/compensation test when mutable

Cross-plane formal contract

K02 | Evidence Contract

Field	Operational semantics
source_root	independence root used to avoid citation-count inflation
independence	measured separation from shared model/context/source failure
directness	distance between evidence and claimed effect
freshness	time validity relative to volatility and risk
coverage	fraction of decision-critical claim dimensions supported
contradictions	explicit unresolved counterevidence
replay_ref	bundle required to reproduce the evidence path

Invariant

تعدد citations من root واحد لا يساوي استقلالا.

Acceptance tests

- missing-field negative test
- stale-version test
- wrong-authority test
- conflicting-source test
- replay/reconstruction test
- rollback/compensation test when mutable

Lifecycle

- draft/candidate
- validated
- active-scoped
- superseded
- revoked/expired
- archived with lineage

```
Evidence Contract: validate -> authorize -> use -> observe -> audit ->
revalidate|supersede|revoke
```

K03 | Authority Contract

Field	Operational semantics
actor	identity attempting transition
action	typed operation, not vague intent
target	canonical object/world target
tier	T0-T4 authority class
delegator	authority origin
expiry	time/condition after which authority is invalid
revocation	revocation state and receipt
appeal	authorized escalation path
nondelegable	capability/decision that cannot be delegated

Lifecycle

- draft/candidate
- validated
- active-scoped
- superseded
- revoked/expired
- archived with lineage

```
Authority Contract: validate -> authorize -> use -> observe -> audit ->
revalidate|supersede|revoke
```

Invariant

القدرة التقنية لا تولد حق التنفيذ.

Acceptance tests

- missing-field negative test
- stale-version test
- wrong-authority test
- conflicting-source test
- replay/reconstruction test
- rollback/compensation test when mutable

K04 | Goal Contract

Field	Operational semantics
objective	invariant mission objective
success_conditions	observable acceptance conditions
nonnegotiables	constraints that optimization cannot trade away
budgets	token/tool/time/money/proof/exposure envelopes
forbidden_actions	hard negative action set
evidence_required	minimum evidence profile before completion/action
postconditions	world or artifact state that must be read back
rollback_target	last safe state or compensating target

Invariant

الخطة قابلة للتغيير؛ goal contract لا يتغير بلا receipt.

Lifecycle

- draft/candidate
- validated
- active-scoped
- superseded
- revoked/expired
- archived with lineage

```
Goal Contract: validate -> authorize -> use -> observe -> audit ->
revalidate|supersede|revoke
```

Acceptance tests

- missing-field negative test
- stale-version test
- wrong-authority test
- conflicting-source test
- replay/reconstruction test
- rollback/compensation test when mutable

Cross-plane formal contract

K05 | Question Contract

Field	Operational semantics
governing_question	question whose answer can materially alter decision
active_difference	minimal unresolved delta that changes judgment
decision_relevance	expected impact on route/action
unknowns	explicit unknown state, not hidden uncertainty
expected_information_value	predicted decision gain minus acquisition cost
stop_rule	condition for no more questioning/retrieval

Invariant
السؤال أداة routing لا زخرفة لغوية.

Lifecycle

- draft/candidate
- validated
- active-scoped
- superseded
- revoked/expired
- archived with lineage

```
Question Contract: validate -> authorize -> use -> observe -> audit ->
revalidate|supersede|revoke
```

Acceptance tests

- missing-field negative test
- stale-version test
- wrong-authority test
- conflicting-source test
- replay/reconstruction test
- rollback/compensation test when mutable

Cross-plane formal contract

K06 | Context Contract

Field	Operational semantics
required_invariants	facts/constraints that compaction must preserve
source_pointers	stable retrievable provenance pointers
branch_id	counterfactual/context branch identity
compaction_policy	allowed compression transformation
reconstruction_refs	pointers needed to reconstruct omitted context
loss_budget	maximum semantic/decision fidelity loss

Invariant
ضغط السياق يجب أن يحفظ القرار والقيود.

Acceptance tests

- missing-field negative test
- stale-version test
- wrong-authority test
- conflicting-source test
- replay/reconstruction test
- rollback/compensation test when mutable

Lifecycle

- draft/candidate
- validated
- active-scoped
- superseded
- revoked/expired
- archived with lineage

```
Context Contract: validate -> authorize -> use -> observe -> audit ->
revalidate|supersede|revoke
```

K07 | World-State Contract

Field	Operational semantics
entity	canonical world/knowledge entity
observed	tool/source-returned state
inferred	derived state with premises
proposed	candidate future state
remembered	memory value with provenance/version
valid_at	time for which state is semantically valid
observed_at	time observation occurred
source_rank	authority/quality rank of source
conflicts	conflicting observations not silently resolved

Lifecycle

- draft/candidate
- validated
- active-scoped
- superseded
- revoked/expired
- archived with lineage

```
World-State Contract: validate -> authorize -> use -> observe -> audit ->
revalidate|supersede|revoke
```

Invariant

Observed state يتقدم على remembered state عند التعارض.

Acceptance tests

- missing-field negative test
- stale-version test
- wrong-authority test
- conflicting-source test
- replay/reconstruction test
- rollback/compensation test when mutable

Cross-plane formal contract

K08 | Memory Contract

Field	Operational semantics
memory_type	episodic/semantic/procedural/negative/branch metadata
scope	domain/project/time/action boundary of validity
provenance	typed field with explicit source/version/lifecycle semantics; must alter validation or reconstruction
branch	hypothesis branch identity
expiry	time/condition after which authority is invalid
causal_grade	strength of causal support for promotion
promotion_state	quarantined/candidate/promoted/retired
rollback	prior memory version and reversal method

Invariant

لا semantic/procedural promotion من correlation فقط.

Lifecycle

- draft/candidate
- validated
- active-scoped
- superseded
- revoked/expired
- archived with lineage

```
Memory Contract: validate -> authorize -> use -> observe -> audit ->
revalidate|supersede|revoke
```

Acceptance tests

- missing-field negative test
- stale-version test
- wrong-authority test
- conflicting-source test
- replay/reconstruction test
- rollback/compensation test when mutable

Cross-plane formal contract

K09 | Skill Contract

Field	Operational semantics
skill_id	stable atomic capability identity
preconditions	state/authority/evidence requirements
input_schema	machine-checkable input contract
output_schema	machine-checkable output contract
tools	dependencies and versions
evidence	verification requirements
failures	typed failure signatures
rollback	prior memory version and reversal method
version	semantic version + lineage
transfer_tests	held-out task families required before promotion

Lifecycle

- draft/candidate •
- validated •
- active-scoped •
- superseded •
- revoked/expired •
- archived with lineage •

```
Skill Contract: validate -> authorize -> use -> observe -> audit ->
revalidate|supersede|revoke
```

Invariant

.skill reusable only after transfer and failure boundaries

Acceptance tests

- missing-field negative test •
- stale-version test •
- wrong-authority test •
- conflicting-source test •
- replay/reconstruction test •
- rollback/compensation test when mutable •

Cross-plane formal contract

K10 | Ability Contract

Field	Operational semantics
ability_id	stable composed capability identity
skills	component skills with versions
state	shared state assumptions
authority_profile	aggregate permission envelope
budget	runtime cost/latency/proof envelope
composition_constraints	constraints that must close across components
verifier	independent verification path
fallback	degraded or substitute composition

Invariant

.composition closure required before ability promotion

Lifecycle

- draft/candidate •
- validated •
- active-scoped •
- superseded •
- revoked/expired •
- archived with lineage •

```
Ability Contract: validate -> authorize -> use -> observe -> audit ->
revalidate|supersede|revoke
```

Acceptance tests

- missing-field negative test •
- stale-version test •
- wrong-authority test •
- conflicting-source test •
- replay/reconstruction test •
- rollback/compensation test when mutable •

K11 | Loop Contract

Field	Operational semantics
loop_id	bounded loop identity
state	shared state assumptions
progress_metric	state-returned progress, not prose volume
stop	success/no-progress/budget/risk stop rules
repair	repair transition set
max_iterations	hard upper bound
budget	runtime cost/latency/proof envelope
evidence_debt	maximum unresolved evidence carried
rollback	prior memory version and reversal method

Lifecycle

- draft/candidate
- validated
- active-scoped
- superseded
- revoked/expired
- archived with lineage

```
Loop Contract: validate -> authorize -> use -> observe -> audit ->
revalidate|supersede|revoke
```

Invariant

لا loop مفتوحة ولا progress لغوي.

Acceptance tests

- missing-field negative test
- stale-version test
- wrong-authority test
- conflicting-source test
- replay/reconstruction test
- rollback/compensation test when mutable

Cross-plane formal contract

K12 | Agent Contract

Field	Operational semantics
agent_id	agent identity independent of model provider
role	task function
jurisdiction	subject/action/data/time authority boundary
mission_owner	single canonical committer
inputs	typed inputs
outputs	typed outputs
authority	permission envelope
lease	epoch/fencing/expiry ownership record
appeal	authorized escalation path

Lifecycle

- draft/candidate
- validated
- active-scoped
- superseded
- revoked/expired
- archived with lineage

```
Agent Contract: validate -> authorize -> use -> observe -> audit ->
revalidate|supersede|revoke
```

Invariant

.role != jurisdiction; worker != canonical committer

Acceptance tests

- missing-field negative test
- stale-version test
- wrong-authority test
- conflicting-source test
- replay/reconstruction test
- rollback/compensation test when mutable

Cross-plane formal contract

K13 | Tool Contract

Field	Operational semantics
tool_id	adapter/tool stable identity
schema	input/output/error schema
effect_class	read/local/reversible/external/prohibited class
authority	permission envelope
idempotency	retry semantics and key
timeout	timeout policy and ambiguity handling
retry	bounded retry policy
readback	authoritative postcondition query
rollback	prior memory version and reversal method
version	semantic version + lineage

Lifecycle

- draft/candidate
- validated
- active-scoped
- superseded
- revoked/expired
- archived with lineage

```
Tool Contract: validate -> authorize -> use -> observe -> audit ->
revalidate|supersede|revoke
```

Invariant

.tool success is receipt, not world effect

Acceptance tests

- missing-field negative test
- stale-version test
- wrong-authority test
- conflicting-source test
- replay/reconstruction test
- rollback/compensation test when mutable

Cross-plane formal contract

K14 | Protocol Contract

Field	Operational semantics
semantic_fields	typed field with explicit source/version/lifecycle semantics; must alter validation or reconstruction
mapping	typed field with explicit source/version/lifecycle semantics; must alter validation or reconstruction
critical_constraints	typed field with explicit source/version/lifecycle semantics; must alter validation or reconstruction
error_semantics	typed field with explicit source/version/lifecycle semantics; must alter validation or reconstruction
side_effects	typed field with explicit source/version/lifecycle semantics; must alter validation or reconstruction
round_trip	typed field with explicit source/version/lifecycle semantics; must alter validation or reconstruction
loss_budget	maximum semantic/decision fidelity loss

Lifecycle

- draft/candidate
- validated
- active-scoped
- superseded
- revoked/expired
- archived with lineage

```
Protocol Contract: validate -> authorize -> use -> observe -> audit ->
revalidate|supersede|revoke
```

Invariant

syntax compatibility لا تكفي.

Acceptance tests

- missing-field negative test
- stale-version test
- wrong-authority test
- conflicting-source test
- replay/reconstruction test
- rollback/compensation test when mutable

Cross-plane formal contract

K15 | Action Contract

Field	Operational semantics
intent	typed field with explicit source/version/lifecycle semantics; must alter validation or reconstruction
preconditions	state/authority/evidence requirements
authority	permission envelope
irreversibility	typed field with explicit source/version/lifecycle semantics; must alter validation or reconstruction
observability	typed field with explicit source/version/lifecycle semantics; must alter validation or reconstruction
idempotency	retry semantics and key
expected_effect	typed field with explicit source/version/lifecycle semantics; must alter validation or reconstruction
compensation	typed field with explicit source/version/lifecycle semantics; must alter validation or reconstruction

Invariant

blind action ممنوع إذا postcondition الحاكم غير قابل للرصد.

Acceptance tests

- missing-field negative test
- stale-version test
- wrong-authority test
- conflicting-source test
- replay/reconstruction test
- rollback/compensation test when mutable

Lifecycle

- draft/candidate
- validated
- active-scoped
- superseded
- revoked/expired
- archived with lineage

```
Action Contract: validate -> authorize -> use -> observe -> audit ->
revalidate|supersede|revoke
```

K16 | Effect Contract

Field	Operational semantics
effect_id	typed field with explicit source/version/lifecycle semantics; must alter validation or reconstruction
observations	typed field with explicit source/version/lifecycle semantics; must alter validation or reconstruction
source_roots	typed field with explicit source/version/lifecycle semantics; must alter validation or reconstruction
finality	typed field with explicit source/version/lifecycle semantics; must alter validation or reconstruction
causal_credit	typed field with explicit source/version/lifecycle semantics; must alter validation or reconstruction
residual_effect	typed field with explicit source/version/lifecycle semantics; must alter validation or reconstruction
postconditions	world or artifact state that must be read back
repair	repair transition set

Lifecycle

- draft/candidate
- validated
- active-scoped
- superseded
- revoked/expired
- archived with lineage

```
Effect Contract: validate -> authorize -> use -> observe -> audit ->
revalidate|supersede|revoke
```

Invariant

.success requires authoritative readback and appropriate finality

Acceptance tests

- missing-field negative test
- stale-version test
- wrong-authority test
- conflicting-source test
- replay/reconstruction test
- rollback/compensation test when mutable

Cross-plane formal contract

K17 | Training Contract

Field	Operational semantics
dataset_manifest	data provenance/license/privacy hashes
source_licenses	typed field with explicit source/version/lifecycle semantics; must alter validation or reconstruction
privacy	typed field with explicit source/version/lifecycle semantics; must alter validation or reconstruction
checkpoint_parent	parent checkpoint lineage
method	training/update algorithm + version
seed	stochastic reproducibility seeds
evals	frozen and hidden evaluation references
forgetting_vector	retention across capability/safety/domain slices
canary	bounded deployment criteria
rollback	prior memory version and reversal method

Lifecycle

- draft/candidate
- validated
- active-scoped
- superseded
- revoked/expired
- archived with lineage

```
Training Contract: validate -> authorize -> use -> observe -> audit ->
revalidate|supersede|revoke
```

Invariant

training candidate لا يملك promotion authority.

Acceptance tests

- missing-field negative test
- stale-version test
- wrong-authority test
- conflicting-source test
- replay/reconstruction test
- rollback/compensation test when mutable

K18 | Benchmark Contract

Field	Operational semantics
task_suite	stable benchmark task set
split_hash	train/calibration/held-out split identity
baseline	frozen comparison system
treatment	exact vNext4 variant
budget	runtime cost/latency/proof envelope
seeds	typed field with explicit source/version/lifecycle semantics; must alter validation or reconstruction
environment	host/tool/provider versions
scorer	metric implementation/hash
primary_metric	predeclared main metric
guardrails	safety/cost/calibration/rollback metrics
raw_traces	replayable execution traces

Lifecycle

- draft/candidate •
- validated •
- active-scoped •
- superseded •
- revoked/expired •
- archived with lineage •

```
Benchmark Contract: validate -> authorize -> use -> observe -> audit ->
revalidate|supersede|revoke
```

Invariant

.E4 needs controlled matched-budget; E5 independent replication

Acceptance tests

- missing-field negative test •
- stale-version test •
- wrong-authority test •
- conflicting-source test •
- replay/reconstruction test •
- rollback/compensation test when mutable •

Cross-plane formal contract

K19 | Architecture Contract

Field	Operational semantics
component_id	canonical architecture component identity
parents	lineage/nearest prior components
dependencies	runtime/evidence/state dependencies
invariants	behavior/safety invariants
behavior_tests	differential tests before refactor
marginal_utility	measured contribution under ablation
deprecation	retirement state
refactor_receipt	proof-preserving migration receipt

Invariant

component count ليس هدفا؛ coverage/proof per complexity هو الهدف.

Lifecycle

- draft/candidate
- validated
- active-scoped
- superseded
- revoked/expired
- archived with lineage

```
Architecture Contract: validate -> authorize -> use -> observe -> audit ->
revalidate|supersede|revoke
```

Acceptance tests

- missing-field negative test
- stale-version test
- wrong-authority test
- conflicting-source test
- replay/reconstruction test
- rollback/compensation test when mutable

Cross-plane formal contract

K20 | Temporal Contract

Field	Operational semantics
epoch	governance/model/knowledge epoch
valid_from	epoch activation time
valid_until	expiry/revalidation boundary
dependency_epochs	other plane epochs this object assumed
refresh_trigger	condition requiring refresh
invalidation_route	downstream objects to invalidate
late_event_policy	handling of delayed/stale events

Invariant

لا fast loop يكتب slow canonical state عبر boundary غير صريح.

Acceptance tests

- missing-field negative test
- stale-version test
- wrong-authority test
- conflicting-source test
- replay/reconstruction test
- rollback/compensation test when mutable

Lifecycle

- draft/candidate
- validated
- active-scoped
- superseded
- revoked/expired
- archived with lineage

```
Temporal Contract: validate -> authorize -> use -> observe -> audit ->
revalidate|supersede|revoke
```

V4-01.1 | الأصل، الResidual، ودفاع الجدة

V4-01 · M-CTIT · Candidate N0-N2 · internal novelty after hostile reduction

نظرية مساعف لعزل المعاملات المعرفية

Moussaif Cognitive Transaction Isolation Theory

Residual

تتوافر في السلالة معاملات تنفيذية، سجلات حالة، أقفال ملكية للمهمة، وذاكرة قابلة للإصدار، لكن العمل المتوازي لوكلاء متعددة فوق المعرفة نفسها يظل معرضا لقراءة حالة وسطية أو دمج belief update متعارض أو ظهور Claim شبح بعد اكتمال التخطيط.

Nearest prior mechanisms

- Transaction Layer
- Kernel fencing-5
- Self-Reconstruction Memory
- Part IV state typing.

Novelty defense

ينقل مفاهيم isolation من مجرد mutation للأدوات إلى مستوى الحالة المعرفية نفسها: ما الذي يجوز قراءته أثناء reasoning، ومتى يصبح claim مرئيا لبقية الوكلاء، وكيف نكتشف dirty/non-repeatable/phantom epistemic reads.

Hostile reduction questions

- هل parent أبسط يملك نفس state object؟
- هل الفارق مجرد metric جديد على mechanism قديم؟
- هل يمكن تنفيذ candidate بلا object جديد؟
- هل failure signature مختلف ومشاهد؟
- هل authority/rollback/observability boundary مختلفة؟

Null outcome

إذا كانت الإجابة العملية لا، يدمج candidate مع parent ولا يحافظ الاسم على استقلاله.

V4-01.2 | الأنطولوجيا وآلة الحالة

V4-01 · M-CTIT · Candidate N0-N2 · internal novelty after hostile reduction

نظرية مساعف لعزل المعاملات المعرفية

Moussaif Cognitive Transaction Isolation Theory

Object	Role	Mandatory metadata
CognitiveTransaction	primary state object	id + version + scope + owner + provenance + lifecycle
KnowledgeSnapshot	evidence/relationship object	id + version + scope + owner + provenance + lifecycle
BeliefVersion	control object	id + version + scope + owner + provenance + lifecycle
ReadSet	audit/replay object	id + version + scope + owner + provenance + lifecycle
WriteSet	primary state object	id + version + scope + owner + provenance + lifecycle
EpistemicLock	evidence/relationship object	id + version + scope + owner + provenance + lifecycle
CommitReceipt	control object	id + version + scope + owner + provenance + lifecycle
ConflictRecord	audit/replay object	id + version + scope + owner + provenance + lifecycle

State machine

```
NEW -> TYPED -> VALIDATED -> ACTIVE -> CONFLICT|BLOCKED|AMBIGUOUS -> VERIFIED
-> PROMOTED|ROLLED_BACK|RETIRED
```

Ontology safety

- object type controls allowed transitions
- no prose-only mutation
- branch/version identities never silently reused
- every conflict is represented, not narrated away
- receipts retain parent snapshot and causal reason

V4-01.3 | القياس، المعايرة، وقابلية التعرف

V4-01 · M-CTIT · Candidate N0-N2 · internal novelty after hostile reduction

نظرية مساعف لعزل المعاملات المعرفية

Moussaif Cognitive Transaction Isolation Theory

```
CTI = 1 - (DirtyRead + NonRepeatableRead + PhantomClaim + LostUpdate) / CriticalTransactions
```

Metrics

- epistemic conflict rate
- stale-read action rate
- commit abort precision
- replay determinism
- latency overhead

Identifiability

- define observable proxy before outcome
- separate predictive from causal use
- calibrate thresholds on non-test data
- report CI/variance and worst slice
- test monotonicity where assumed
- ablate each term and compare simpler score

Metric attack

- proxy gaming
- selection bias
- shared-root evidence
- metric substitution
- threshold leakage from held-out
- aggregate hides critical subgroup failure

V4-01.4 | الآلية والخوارزمية والاقتصاد الحسابي

V4-01 · M-CTIT · Candidate N0-N2 · internal novelty after hostile reduction

نظرية مساعف لعزل المعاملات المعرفية

Moussaif Cognitive Transaction Isolation Theory

Mechanism steps

- بدء كل مهمة طويلة بمعرف transaction_id وsnapshot_version.
- تسجيل ReadSet للادعاءات/الحقائق التي بنت عليها الخطة وWriteSet للدلتا المقترحة.
- اختيار isolation level بحسب المخاطر: serializable-cognitive، snapshot، read-committed.
- تنفيذ optimistic validation قبل commit؛ عند تعارض version يجرى rebase/reason-replay لا overwrite.
- إصدار CommitReceipt يربط الذاكرة الجديدة بالsnapshot الذي ولدت منه.

Reference transaction

```
read(snapshot) -> derive signal -> propose transition -> validate authority/
constraints -> execute/simulate -> authoritative readback -> court -> commit
memory/state delta
```

Complexity budget

- fast path bypasses expensive court when risk/evidence allow
- expensive branch only on signature failure
- cache only versioned derived values
- bound retries and experiment count
- record cost per verified state change

Stop conditions

- postcondition reached
- no marginal progress
- budget exhausted
- authority unavailable
- falsifier observed
- repair/rollback dominates continuation

V4-01.5 | الربط بالـ24 طبقة

V4-01 · M-CTIT · Candidate N0-N2 · internal novelty after hostile reduction

نظرية مساعف لعزل المعاملات المعرفية

Moussaif Cognitive Transaction Isolation Theory

Layer	Role	State objects
L07	نموذج العالم والحالة الموثوقة	Observed/inferred/proposed/remembered separation, source precedence, validity time, state conflict.
L09	الذاكرة المتفرعة وإعادة البناء	Quarantine, episodic/semantic/procedural separation, counterfactual branches, negative knowledge, reconstruction.
L10	عزل المعاملات المعرفية	Snapshot reasoning, read/write sets, cognitive CAS, conflict replay, serializable memory commit.
L14	الحلقات المحدودة وآلات حالة المهمة	Progress metrics, stop/repair/rollback, retry limits, temporal horizon, loop saturation/failure basins.
L20	القياس والتتبع ونسيج الرصد	OpenTelemetry-style trace IDs, mission timelines, metrics, state snapshots, anomaly/fault replay.

Upstream contract

- mission_id/trace_id
- goal/question/difference when relevant
- typed world/knowledge snapshot
- authority and risk tier
- epoch/version dependencies

Downstream contract

- typed decision/state delta
- metric reading
- evidence/trace receipt
- explicit failure/uncertainty
- rollback/recovery/invalidation references

Deployment mode

- passive telemetry
- shadow decision
- canary mutation
- scoped production
- cross-environment replication

V4-01.6 | الفشل، الخصومة، وحدود السلطة

V4-01 · M-CTIT · Candidate N0-N2 · internal novelty after hostile reduction

نظرية مساعف لعزل المعاملات المعرفية

Moussaif Cognitive Transaction Isolation Theory

Decisive falsifiers

- لا فرق قابل للقياس عن versioned store بسيط.
- تكلفة isolation تفوق منع الأخطاء في المهام الفعلية.
- إعادة التشغيل لا تستعيد نفس reasoning dependencies حتى مع snapshot.

Adversarial matrix

- stale but high-authority source
- conflicting independent observations
- permission revoked mid-loop
- provider/tool substituted
- context compacted beyond loss budget
- duplicate action after timeout
- negative world effect hidden by successful API receipt
- memory contains prior false success
- verifier shares model/context with executor

Security/ethics boundary

- no escalation of authority from performance
- privacy/project scope preserved
- high-impact uncertainty cannot be hidden by average metric
- human/nondelegable decisions remain explicit
- blocked/partial preferred to fabricated completion

V4-01.7 | التجربة الحاسمة والـAblation

V4-01 · M-CTIT · Candidate N0-N2 · internal novelty after hostile reduction

نظرية مساعف لعزل المعاملات المعرفية

Moussaif Cognitive Transaction Isolation Theory

مهام طويلة ذات تغييرات متزامنة في Drive/DB/knowledge graph؛ قارن last-write-wins وsnapshot-only وCTIT serializable-cognitive تحت نفس النموذج والأدوات والميزانية.

Design axis	Requirement
Baseline A	nearest parent under same model/tools
Baseline B	direct engineering solution without new theory
Treatment	M-CTIT full mechanism
Budget	token/tool/time/proof/world-effect exposure matched
Splits	calibration + hidden held-out + transfer
Seeds	repeated stochastic runs; report variance
Primary metric	epistemic conflict rate
Secondary	stale-read action rate · commit abort precision · replay determinism · latency overhead
Guardrails	authority, safety, cost, latency, rollback, calibration
Faults	timeouts, stale state, wrong source, partial effects, model/tool swap
Evidence	raw traces + scorer version + environment hash
Verdict	PROMOTE / MERGE / REVISE / HOLD / REJECT

```
N4 = controlled matched-budget gain with no critical regression; N5 = independent cross-model/domain/environment replication.
```

V4-01.8 | التنبؤات والتنفيذ وسياسة النتيجة السلبية

V4-01 · M-CTIT · Candidate N0-N2 · internal novelty after hostile reduction

نظرية مساعف لعزل المعاملات المعرفية

Moussaif Cognitive Transaction Isolation Theory

Predictions

- خفض قرارات بنيت على حقائق تم تعديلها أثناء المهمة.
- زيادة قابلية إعادة التشغيل عبر agents/kernels المتزامنة.
- كشف phantom claims الناتجة من استرجاع مختلف بين مرحلتي plan وverify.

Implementation ladder

- schema + unit tests
- reference sandbox service
- fault-injection suite
- passive telemetry baseline
- shadow comparison
- canary on bounded missions
- controlled benchmark
- transfer benchmark
- promotion/deprecation receipt
- continuous monitoring

Negative-result policy

- if no independent gain -> MERGE
- if gain only one environment -> HOLD/N3
- if cost dominates -> REVISE fast path
- if safety regression -> REJECT/rollback
- if parent improves equally -> deprecate candidate

Research output

كل نتيجة تتحول إلى ExperimentRecord وNegativeKnowledge أو PromotionReceipt، بحيث لا يضيع الفشل ولا يتحول مرة أخرى إلى نظرية جديدة بلا داع.

V4-02.1 | الأصل، الResidual، ودفاع الجدة

V4-02 · M-ETUHT · Candidate N0-N2 · internal novelty after hostile reduction

نظرية مساعف للترموستات الإبستيمي واتزان عدم اليقين

Moussaif Epistemic Thermostat and Uncertainty Homeostasis Theory

Residual

السلالة تملك Proof Budget، Evidence Debt، uncertainty، evidence grades ومحاكم، لكنها لا تعرف نطاق تشغيل مستهدفا لعدم اليقين نفسه. قد ينزلق النظام إلى ثقة زائفة أو إلى شلل إثباتي رغم أن القرار منخفض الأثر.

Nearest prior mechanisms

- Evidence Debt
- Proof Budget
- Question Density
- verifier independence.

Novelty defense

يجعل uncertainty متغير تحكم feedback لا مجرد رقم تقريري: لكل فئة قرار نطاق آمن، وإذا خرجت uncertainty فوقه أو تحته يعاد توزيع البحث والتحقق أو تخفيض الفعل.

Hostile reduction questions

- هل parent أبسط يملك نفس state object؟
- هل الفارق مجرد metric جديد على mechanism قديم؟
- هل يمكن تنفيذ candidate بلا object جديد؟
- هل failure signature مختلف ومشاهد؟
- هل authority/rollback/observability boundary مختلفة؟

Null outcome

إذا كانت الإجابة العملية لا، يدمج candidate مع parent ولا يحافظ الاسم على استقلاله.

V4-02.2 | الأنطولوجيا وآلة الحالة

V4-02 · M-ETUHT · Candidate N0-N2 · internal novelty after hostile reduction

نظرية مساعف للترموستات الإبستيمي واتزان عدم اليقين

Moussaif Epistemic Thermostat and Uncertainty Homeostasis Theory

Object	Role	Mandatory metadata
UncertaintyBudget	primary state object	id + version + scope + owner + provenance + lifecycle
CalibrationBand	evidence/relationship object	id + version + scope + owner + provenance + lifecycle
EpistemicTemperature	control object	id + version + scope + owner + provenance + lifecycle
OverheatEvent	audit/replay object	id + version + scope + owner + provenance + lifecycle
ParalysisEvent	primary state object	id + version + scope + owner + provenance + lifecycle
RebalanceAction	evidence/relationship object	id + version + scope + owner + provenance + lifecycle
RiskClass	control object	id + version + scope + owner + provenance + lifecycle

State machine

```
NEW -> TYPED -> VALIDATED -> ACTIVE -> CONFLICT|BLOCKED|AMBIGUOUS -> VERIFIED
-> PROMOTED|ROLLED_BACK|RETIRED
```

Ontology safety

- object type controls allowed transitions
- no prose-only mutation
- branch/version identities never silently reused
- every conflict is represented, not narrated away
- receipts retain parent snapshot and causal reason

V4-02.3 | القياس، المعايرة، وقابلية التعرف

V4-02 · M-ETUHT · Candidate N0-N2 · internal novelty after hostile reduction

نظرية مساعف للترموستات الإبستيمي واتزان عدم اليقين

Moussaif Epistemic Thermostat and Uncertainty Homeostasis Theory

```
EpiTemp = w1*MisCalibration + w2*EvidenceGap + w3*Disagreement + w4*ModelVariance; ControlError = EpiTemp - TargetBand(risk)
```

Metrics

- ECE by risk tier
- overconfidence action rate
- paralysis rate
- proof cost / verified effect
- temperature oscillation

Identifiability

- define observable proxy before outcome
- separate predictive from causal use
- calibrate thresholds on non-test data
- report CI/variance and worst slice
- test monotonicity where assumed
- ablate each term and compare simpler score

Metric attack

- proxy gaming
- selection bias
- shared-root evidence
- metric substitution
- threshold leakage from held-out
- aggregate hides critical subgroup failure

V4-02.4 | الآلية والخوارزمية والاقتصاد الحسابي

V4-02 · M-ETUHT · Candidate N0-N2 · internal novelty after hostile reduction

نظرية مساعف للترموستات الإبستيمي واتزان عدم اليقين

Moussaif Epistemic Thermostat and Uncertainty Homeostasis Theory

Mechanism steps

- تحديد TargetBand لكل risk/effect class.
- حساب temperature من model/tool variance، disagreement، evidence gap، calibration.
- إذا كان verify retrieve/experiment/independent أو overheat: downgrade action.
- إذا كان underheat غير مبرر: inject counterexamples/alternative models لكشف overconfidence.
- إذا كان spending proof paralysis: stop عند انخفاض expected information value.

Reference transaction

```
read(snapshot) -> derive signal -> propose transition -> validate authority/
constraints -> execute/simulate -> authoritative readback -> court -> commit
memory/state delta
```

Complexity budget

- fast path bypasses expensive court when risk/evidence allow
- expensive branch only on signature failure
- cache only versioned derived values
- bound retries and experiment count
- record cost per verified state change

Stop conditions

- postcondition reached
- no marginal progress
- budget exhausted
- authority unavailable
- falsifier observed
- repair/rollback dominates continuation

V4-02.5 | الربط بالـ24 طبقة

V4-02 · M-ETUHT · Candidate N0-N2 · internal novelty after hostile reduction

نظرية مساعف للترموستات الإبستيمي واتزان عدم اليقين

Moussaif Epistemic Thermostat and Uncertainty Homeostasis Theory

Layer	Role	State objects
L03	الادعاءات والدليل والزمن واللايقين	Claim typing, evidence ledger, half-life, debt, ReportedGrade vs IndependentGrade, epistemic thermostat.
L04	السؤال الحاكم والكثافة السؤالية	Question generation, QG/QR/QE, decision relevance, stop/ask/retrieve/experiment policy.
L05	الفرق الفاعل والتحكم في الحساب	Delta extraction, MCD/QMCD calibration, route regret, compute allocation under budget.
L18	المحاكم والمختمون وإغلاق القيود	Independent verifier portfolios, demolition/falsification, constraint propagation, proof budget, correlated-failure handling.
L23	البحث والقياس ومحكمة التكرار	Frozen baselines, matched-budget ablation, hidden variants, benchmark lifecycle, external replication, theory promotion/merge/reject.

Upstream contract

- mission_id/trace_id
- goal/question/difference when relevant
- typed world/knowledge snapshot
- authority and risk tier
- epoch/version dependencies

Downstream contract

- typed decision/state delta
- metric reading
- evidence/trace receipt
- explicit failure/uncertainty
- rollback/recovery/invalidation references

Deployment mode

- passive telemetry
- shadow decision
- canary mutation
- scoped production
- cross-environment replication

V4-02.6 | الفشل، الخصومة، وحدود السلطة

V4-02 · M-ETUHT · Candidate N0-N2 · internal novelty after hostile reduction

نظرية مساعف للترموستات الإبستيمي واتزان عدم اليقين

Moussaif Epistemic Thermostat and Uncertainty Homeostasis Theory

Decisive falsifiers

- threshold عادي للثقة يحقق نفس النتائج.
- الترموستات يسبب oscillation بين البحث والامتناع.
- لا تحسن في expected calibration error أو utility.

Adversarial matrix

- stale but high-authority source
- conflicting independent observations
- permission revoked mid-loop
- provider/tool substituted
- context compacted beyond loss budget
- duplicate action after timeout
- negative world effect hidden by successful API receipt
- memory contains prior false success
- verifier shares model/context with executor

Security/ethics boundary

- no escalation of authority from performance
- privacy/project scope preserved
- high-impact uncertainty cannot be hidden by average metric
- human/nondelegable decisions remain explicit
- blocked/partial preferred to fabricated completion

V4-02.7 | التجربة الحاسمة والـAblation

V4-02 · M-ETUHT · Candidate N0-N2 · internal novelty after hostile reduction

نظرية مساعف للترموستات الإبستيمي واتزان عدم اليقين

Moussaif Epistemic Thermostat and Uncertainty Homeostasis Theory

مجموعة قرارات موزعة بين T0-T3 مع أدلة ناقصة متدرجة؛ baseline ثابت baseline proof-budget، threshold، ثم ETUHT feedback controller.

Design axis	Requirement
Baseline A	nearest parent under same model/tools
Baseline B	direct engineering solution without new theory
Treatment	M-ETUHT full mechanism
Budget	token/tool/time/proof/world-effect exposure matched
Splits	calibration + hidden held-out + transfer
Seeds	repeated stochastic runs; report variance
Primary metric	ECE by risk tier
Secondary	overconfidence action rate · paralysis rate · proof cost / verified effect · temperature oscillation
Guardrails	authority, safety, cost, latency, rollback, calibration
Faults	timeouts, stale state, wrong source, partial effects, model/tool swap
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Verdict	PROMOTE / MERGE / REVISE / HOLD / REJECT

```
N4 = controlled matched-budget gain with no critical regression; N5 = independent cross-model/domain/environment replication.
```

V4-02.8 | التنبؤات والتنفيذ وسياسة النتيجة السلبية

V4-02 · M-ETUHT · Candidate N0-N2 · internal novelty after hostile reduction

نظرية مساعف للترموستات الإبستيمي واتزان عدم اليقين

Moussaif Epistemic Thermostat and Uncertainty Homeostasis Theory

Predictions

- تحسن calibration دون تضخم latency في low-risk tasks.
- خفض unsafe action من overconfidence وخفض unnecessary abstention.
- استقرار proof cost حول نطاق متناسب مع risk.

Implementation ladder

- schema + unit tests
- reference sandbox service
- fault-injection suite
- passive telemetry baseline
- shadow comparison
- canary on bounded missions
- controlled benchmark
- transfer benchmark
- promotion/deprecation receipt
- continuous monitoring

Negative-result policy

- if no independent gain -> MERGE
- if gain only one environment -> HOLD/N3
- if cost dominates -> REVISE fast path
- if safety regression -> REJECT/rollback
- if parent improves equally -> deprecate candidate

Research output

كل نتيجة تتحول إلى ExperimentRecord وNegativeKnowledge أو PromotionReceipt، بحيث لا يضيع الفشل ولا يتحول مرة أخرى إلى نظرية جديدة بلا داع.

V4-03.1 | الأصل، الResidual، ودفاع الجدة

V4-03 · M-SMBIT · Candidate N0-N2 · internal novelty after hostile reduction

نظرية مساعف لسلامة حدود النموذج الذاتي

Moussaif Self-Model Boundary Integrity Theory

Residual

معمارية الوكيل تعرف الهوية والمهمة والصلاحيات، لكن النموذج اللغوي يستطيع توليد وصف عن نفسه لا يطابق الأدوات المتاحة أو checkpoint أو الذاكرة أو حدود الحساب. هذا يخلق self-state hallucination وpermission hallucination وidentity bleed بين المشاريع.

Nearest prior mechanisms

- Constitutional identity
- authority tiers
- provenance
- institutional sovereignty.

Novelty defense

يفصل self-description إلى سجل آلي مرصود من خمس طبقات: capabilities، runtime identity، model/checkpoint، memory scope، permissions. لا يسمح للخطاب الداخلي بتغييرها أو الاستدلال عليها من نجاح سابق.

Hostile reduction questions

- هل parent أبسط يملك نفس state object؟
- هل الفارق مجرد metric جديد على mechanism قديم؟
- هل يمكن تنفيذ candidate بلا object جديد؟
- هل failure signature مختلف ومشاهد؟
- هل authority/rollback/observability boundary مختلفة؟

Null outcome

إذا كانت الإجابة العملية لا، يدمج candidate مع parent ولا يحافظ الاسم على استقلاله.

V4-03.2 | الأنطولوجيا وآلة الحالة

V4-03 · M-SMBIT · Candidate N0-N2 · internal novelty after hostile reduction

نظرية مساعف لسلامة حدود النموذج الذاتي

Moussaif Self-Model Boundary Integrity Theory

Object	Role	Mandatory metadata
SelfStateRecord	primary state object	id + version + scope + owner + provenance + lifecycle
CapabilityClaim	evidence/relationship object	id + version + scope + owner + provenance + lifecycle
PermissionClaim	control object	id + version + scope + owner + provenance + lifecycle
RuntimeIdentity	audit/replay object	id + version + scope + owner + provenance + lifecycle
MemoryBoundary	primary state object	id + version + scope + owner + provenance + lifecycle
ModelIdentity	evidence/relationship object	id + version + scope + owner + provenance + lifecycle
SelfMismatch	control object	id + version + scope + owner + provenance + lifecycle

State machine

```
NEW -> TYPED -> VALIDATED -> ACTIVE -> CONFLICT|BLOCKED|AMBIGUOUS -> VERIFIED
-> PROMOTED|ROLLED_BACK|RETIRED
```

Ontology safety

- object type controls allowed transitions
- no prose-only mutation
- branch/version identities never silently reused
- every conflict is represented, not narrated away
- receipts retain parent snapshot and causal reason

V4-03.3 | القياس، المعايرة، وقابلية التعرف

V4-03 · M-SMBIT · Candidate N0-N2 · internal novelty after hostile reduction

نظرية مساعف لسلامة حدود النموذج الذاتي

Moussaif Self-Model Boundary Integrity Theory

```
SMBI = VerifiedSelfFields / AssertedSelfFields - IdentityBleedPenalty - PermissionHallucinationPenalty
```

Metrics

- self-claim precision
- permission hallucination rate
- identity bleed incidents
- capability lookup hit
- provider-switch recovery

Identifiability

- define observable proxy before outcome
- separate predictive from causal use
- calibrate thresholds on non-test data
- report CI/variance and worst slice
- test monotonicity where assumed
- ablate each term and compare simpler score

Metric attack

- proxy gaming
- selection bias
- shared-root evidence
- metric substitution
- threshold leakage from held-out
- aggregate hides critical subgroup failure

V4-03.4 | الآلية والخوارزمية والاقتصاد الحسابي

V4-03 · M-SMBIT · Candidate N0-N2 · internal novelty after hostile reduction

نظرية مساعف لسلامة حدود النموذج الذاتي

Moussaif Self-Model Boundary Integrity Theory

Mechanism steps

- إنشاء SelfState Registry من البيئة لا من توليد النموذج.
- تحويل كل self-claim consequential إلى lookup/attestation.
- منع انتقال permission/capability عبر project أو kernel بلا delegated token.
- فحص mismatch قبل التخطيط عالي الأثر.
- حفظ self-state delta فقط من tool-returned evidence.

Reference transaction

```
read(snapshot) -> derive signal -> propose transition -> validate authority/
constraints -> execute/simulate -> authoritative readback -> court -> commit
memory/state delta
```

Complexity budget

- fast path bypasses expensive court when risk/evidence allow
- expensive branch only on signature failure
- cache only versioned derived values
- bound retries and experiment count
- record cost per verified state change

Stop conditions

- postcondition reached
- no marginal progress
- budget exhausted
- authority unavailable
- falsifier observed
- repair/rollback dominates continuation

V4-03.5 | الربط بالـ24 طبقة

V4-03 · M-SMBIT · Candidate N0-N2 · internal novelty after hostile reduction

نظرية مساعف لسلامة حدود النموذج الذاتي

Moussaif Self-Model Boundary Integrity Theory

Layer	Role	State objects
L00	الدستور والسلامة غير القابلة للتجاوز	T0-T4, privacy, irreversible/public-action bans, truthfulness, fail-closed.
L01	حدود الهوية والهدف والسلطة	Project identity, Goal-as-OS contract, delegation tokens, self-model attestation, authority locality.
L14	الحلقات المحدودة وآلات حالة المهمة	Progress metrics, stop/repair/rollback, retry limits, temporal horizon, loop saturation/failure basins.
L16	غلاف MOUSSAIXT وبروتوكولات الأدوات	Host discovery, tool contracts, MCP/A2A/custom schemas, semantic-loss certification, self-state capability lookup.
L20	القياس والتتبع ونسيج الرصد	OpenTelemetry-style trace IDs, mission timelines, metrics, state snapshots, anomaly/fault replay.

Upstream contract

- mission_id/trace_id
- goal/question/difference when relevant
- typed world/knowledge snapshot
- authority and risk tier
- epoch/version dependencies

Downstream contract

- typed decision/state delta
- metric reading
- evidence/trace receipt
- explicit failure/uncertainty
- rollback/recovery/invalidation references

Deployment mode

- passive telemetry
- shadow decision
- canary mutation
- scoped production
- cross-environment replication

V4-03.6 | الفشل، الخصومة، وحدود السلطة

V4-03 · M-SMBIT · Candidate N0-N2 · internal novelty after hostile reduction

نظرية مساعف لسلامة حدود النموذج الذاتي

Moussaif Self-Model Boundary Integrity Theory

Decisive falsifiers

- لا فرق عن environment discovery + RBAC.
- self-check لا يتنبأ بأي فشل.
- القيود تعيق harmless reasoning دون تحسين أمان.

Adversarial matrix

- stale but high-authority source
- conflicting independent observations
- permission revoked mid-loop
- provider/tool substituted
- context compacted beyond loss budget
- duplicate action after timeout
- negative world effect hidden by successful API receipt
- memory contains prior false success
- verifier shares model/context with executor

Security/ethics boundary

- no escalation of authority from performance
- privacy/project scope preserved
- high-impact uncertainty cannot be hidden by average metric
- human/nondelegable decisions remain explicit
- blocked/partial preferred to fabricated completion

V4-03.7 | التجربة الحاسمة والـAblation

V4-03 · M-SMBIT · Candidate N0-N2 · internal novelty after hostile reduction

نظرية مساعف لسلامة حدود النموذج الذاتي

Moussaif Self-Model Boundary Integrity Theory

بدل الأدوات، الحساب، project memory، provider وauthorization أثناء مهام متشابهة؛ قارن prompt self-description وenvironment discovery فقط وSMBIT attested registry.

Design axis	Requirement
Baseline A	nearest parent under same model/tools
Baseline B	direct engineering solution without new theory
Treatment	M-SMBIT full mechanism
Budget	token/tool/time/proof/world-effect exposure matched
Splits	calibration + hidden held-out + transfer
Seeds	repeated stochastic runs; report variance
Primary metric	self-claim precision
Secondary	permission hallucination rate · identity bleed incidents · capability lookup hit · provider-switch recovery
Guardrails	authority, safety, cost, latency, rollback, calibration
Faults	timeouts, stale state, wrong source, partial effects, model/tool swap
Evidence	raw traces + scorer version + environment hash
Verdict	PROMOTE / MERGE / REVISE / HOLD / REJECT

```
N4 = controlled matched-budget gain with no critical regression; N5 = independent cross-model/domain/environment replication.
```

V4-03.8 | التنبؤات والتنفيذ وسياسة النتيجة السلبية

V4-03 · M-SMBIT · Candidate N0-N2 · internal novelty after hostile reduction

نظرية مساعف لسلامة حدود النموذج الذاتي

Moussaif Self-Model Boundary Integrity Theory

Predictions

- خفض ادعاءات القدرة غير المتاحة.
- خفض استخدام صلاحيات من سياق/مشروع آخر.
- زيادة نجاح recovery بعد تبديل provider/kernel لأن الهوية مستقلة عن النموذج.

Implementation ladder

- schema + unit tests
- reference sandbox service
- fault-injection suite
- passive telemetry baseline
- shadow comparison
- canary on bounded missions
- controlled benchmark
- transfer benchmark
- promotion/deprecation receipt
- continuous monitoring

Negative-result policy

- if no independent gain -> MERGE
- if gain only one environment -> HOLD/N3
- if cost dominates -> REVISE fast path
- if safety regression -> REJECT/rollback
- if parent improves equally -> deprecate candidate

Research output

كل نتيجة تتحول إلى ExperimentRecord وNegativeKnowledge أو PromotionReceipt، بحيث لا يضيع الفشل ولا يتحول مرة أخرى إلى نظرية جديدة بلا داع.

V4-04.1 | الأصل، الResidual، ودفاع الجدة

V4-04 · M-RACPRT · Candidate N0-N2 · internal novelty after hostile reduction

نظرية مساعف للضغط المعماري العودي واعادة الهيكلة الحافظة للبرهان

Moussaif Recursive Architecture Compression and Proof-Preserving Refactoring Theory

Residual

المشروع طور anti-duplication وtheory saturation وsemantic fingerprinting، لكن تراكم /layers/tools protocols يمكن أن يزيد coupling وصعوبة الاختبار حتى لو لم تكن الملفات مكررة. لا توجد آلية تجعل المعمارية نفسها موضوع refactoring دوري مع حفظ أدلة السلوك.

Nearest prior mechanisms

- Semantic zero-dup
- Saturation-to-Experiment
- architecture lineage
- Part VIII reference kernel.

Novelty defense

يقيس marginal architectural utility وproof surface وdependency load ثم يسمح بدمج/تقسيم/إزالة المكونات فقط إذا حفظ refactor مجموعة invariants وbenchmark behavior وrollback lineage.

Hostile reduction questions

- هل parent أبسط يملك نفس state object؟
- هل الفارق مجرد metric جديد على mechanism قديم؟
- هل يمكن تنفيذ candidate بلا object جديد؟
- هل failure signature مختلف ومشاهد؟
- هل authority/rollback/observability boundary مختلفة؟

Null outcome

إذا كانت الإجابة العملية لا، يدمج candidate مع parent ولا يحافظ الاسم على استقلاله.

V4-04.2 | الأنطولوجيا وآلة الحالة

V4-04 · M-RACPRT · Candidate N0-N2 · internal novelty after hostile reduction

نظرية مساعف للضغط المعماري العودي واعادة الهيكلة الحافظة للبرهان

Moussaif Recursive Architecture Compression and Proof-Preserving Refactoring Theory

Object	Role	Mandatory metadata
ArchitectureGraph	primary state object	id + version + scope + owner + provenance + lifecycle
ComponentUtility	evidence/relationship object	id + version + scope + owner + provenance + lifecycle
ProofSurface	control object	id + version + scope + owner + provenance + lifecycle
RefactorCandidate	audit/replay object	id + version + scope + owner + provenance + lifecycle
BehavioralEquivalenceSet	primary state object	id + version + scope + owner + provenance + lifecycle
RefactorReceipt	evidence/relationship object	id + version + scope + owner + provenance + lifecycle
DeprecationLineage	control object	id + version + scope + owner + provenance + lifecycle

State machine

```
NEW -> TYPED -> VALIDATED -> ACTIVE -> CONFLICT|BLOCKED|AMBIGUOUS -> VERIFIED
-> PROMOTED|ROLLED_BACK|RETIRED
```

Ontology safety

- object type controls allowed transitions
- no prose-only mutation
- branch/version identities never silently reused
- every conflict is represented, not narrated away
- receipts retain parent snapshot and causal reason

V4-04.3 | القياس، المعايرة، وقابلية التعرف

V4-04 · M-RACPRT · Candidate N0-N2 · internal novelty after hostile reduction

نظرية مساعف للضغط المعماري العودي واعادة الهيكلة الحافظة للبرهان

Moussaif Recursive Architecture Compression and Proof-Preserving Refactoring Theory

```
RefactorGain = ComplexityReduced + DuplicationReduced + TestSurfaceReduced - BehaviorLoss - ProofLoss - MigrationRisk
```

Metrics

- verified coverage / component
- dependency entropy
- test surface size
- refactor regression rate
- debug localization time

Identifiability

- define observable proxy before outcome
- separate predictive from causal use
- calibrate thresholds on non-test data
- report CI/variance and worst slice
- test monotonicity where assumed
- ablate each term and compare simpler score

Metric attack

- proxy gaming
- selection bias
- shared-root evidence
- metric substitution
- threshold leakage from held-out
- aggregate hides critical subgroup failure

V4-04.4 | الآلية والخوارزمية والاقتصاد الحسابي

V4-04 · M-RACPRT · Candidate N0-N2 · internal novelty after hostile reduction

نظرية مساعف للضغط المعماري العودي واعادة الهيكلة الحافظة للبرهان

Moussaif Recursive Architecture Compression and Proof-Preserving Refactoring Theory

Mechanism steps

- بناء graph للتبعيات الحقيقية invocation/evidence/state لا filenames فقط.
- حساب marginal utility لكل component على benchmark families.
- اقتراح merge/split/remove تحت behavior-equivalence constraints.
- تشغيل shadow refactor ثم differential replay.
- promotion فقط إذا invariants محفوظة ولا regression حرج؛ وإلا rollback.

Reference transaction

```
read(snapshot) -> derive signal -> propose transition -> validate authority/
constraints -> execute/simulate -> authoritative readback -> court -> commit
memory/state delta
```

Complexity budget

- fast path bypasses expensive court when risk/evidence allow
- expensive branch only on signature failure
- cache only versioned derived values
- bound retries and experiment count
- record cost per verified state change

Stop conditions

- postcondition reached
- no marginal progress
- budget exhausted
- authority unavailable
- falsifier observed
- repair/rollback dominates continuation

V4-04.5 | الربط بالـ24 طبقة

V4-04 · M-RACPRT · Candidate N0-N2 · internal novelty after hostile reduction

نظرية مساعف للضغط المعماري العودي واعادة الهيكلة الحافظة للبرهان

Moussaif Recursive Architecture Compression and Proof-Preserving Refactoring Theory

Layer	Role	State objects
L02	المصدر والنسب والهوية المعمارية	Ingest, hashes, aliases, canonical identity graph, semantic duplicate candidates, source ranking.
L12	المهارات القائمة والقدرات الذرية	Typed skill contracts, preconditions, outputs, evidence, rollback, versioning, transfer tests.
L13	القدرات المركبة وتركيب المهارات	Composition contracts, constraint closure, capability maturity, substitution/complementarity boundaries.
L22	اتساق التمثيلات وتطور المعمارية	Invalidation waves, dependency derivation graph, proof-preserving refactor, deprecation lineage, architecture compression.
L23	البحث والقياس ومحكمة التكرار	Frozen baselines, matched-budget ablation, hidden variants, benchmark lifecycle, external replication, theory promotion/merge/reject.

Upstream contract

- mission_id/trace_id
- goal/question/difference when relevant
- typed world/knowledge snapshot
- authority and risk tier
- epoch/version dependencies

Downstream contract

- typed decision/state delta
- metric reading
- evidence/trace receipt
- explicit failure/uncertainty
- rollback/recovery/invalidation references

Deployment mode

- passive telemetry
- shadow decision
- canary mutation
- scoped production
- cross-environment replication

V4-04.6 | الفشل، الخصومة، وحدود السلطة

V4-04 · M-RACPRT · Candidate N0-N2 · internal novelty after hostile reduction

نظرية مساعف للضغط المعماري العودي واعادة الهيكلة الحافظة للبرهان

Moussaif Recursive Architecture Compression and Proof-Preserving Refactoring Theory

Decisive falsifiers

- compression يسبب فقد capability غير ظاهر في benchmark.
- لا ارتباط بين complexity load والفشل.
- manual architecture review يحقق نفس النتيجة بكلفة أقل.

Adversarial matrix

- stale but high-authority source
- conflicting independent observations
- permission revoked mid-loop
- provider/tool substituted
- context compacted beyond loss budget
- duplicate action after timeout
- negative world effect hidden by successful API receipt
- memory contains prior false success
- verifier shares model/context with executor

Security/ethics boundary

- no escalation of authority from performance
- privacy/project scope preserved
- high-impact uncertainty cannot be hidden by average metric
- human/nondelegable decisions remain explicit
- blocked/partial preferred to fabricated completion

V4-04.7 | التجربة الحاسمة والـAblation

V4-04 · M-RACPRT · Candidate N0-N2 · internal novelty after hostile reduction

نظرية مساعف للضغط المعماري العودي واعادة الهيكلة الحافظة للبرهان

Moussaif Recursive Architecture Compression and Proof-Preserving Refactoring Theory

خذ subsystem ذا مكونات متعددة متشابهة، نفذ proof-preserving merge مقابل semantic-dedupe فقط ومقابل no-refactor، ثم اختبر hidden transfer/fault suites.

Design axis	Requirement
Baseline A	nearest parent under same model/tools
Baseline B	direct engineering solution without new theory
Treatment	M-RACPRT full mechanism
Budget	token/tool/time/proof/world-effect exposure matched
Splits	calibration + hidden held-out + transfer
Seeds	repeated stochastic runs; report variance
Primary metric	verified coverage / component
Secondary	dependency entropy · test surface size · refactor regression rate · debug localization time
Guardrails	authority, safety, cost, latency, rollback, calibration
Faults	timeouts, stale state, wrong source, partial effects, model/tool swap
Evidence	raw traces + scorer version + environment hash
Verdict	PROMOTE / MERGE / REVISE / HOLD / REJECT

```
N4 = controlled matched-budget gain with no critical regression; N5 = independent cross-model/domain/environment replication.
```

V4-04.8 | التنبؤات والتنفيذ وسياسة النتيجة السلبية

V4-04 · M-RACPRT · Candidate N0-N2 · internal novelty after hostile reduction

نظرية مساعف للضغط المعماري العودي واعادة الهيكلة الحافظة للبرهان

Moussaif Recursive Architecture Compression and Proof-Preserving Refactoring Theory

Predictions

- انخفاض عدد المكونات دون انخفاض verified coverage.
- تحسن time-to-debug وtest runtime.
- كشف أن بعض النظريات أو الأدوات أسماء متعددة لمسار واحد.

Implementation ladder

- schema + unit tests
- reference sandbox service
- fault-injection suite
- passive telemetry baseline
- shadow comparison
- canary on bounded missions
- controlled benchmark
- transfer benchmark
- promotion/deprecation receipt
- continuous monitoring

Negative-result policy

- if no independent gain -> MERGE
- if gain only one environment -> HOLD/N3
- if cost dominates -> REVISE fast path
- if safety regression -> REJECT/rollback
- if parent improves equally -> deprecate candidate

Research output

كل نتيجة تتحول إلى ExperimentRecord وNegativeKnowledge أو PromotionReceipt، بحيث لا يضيع الفشل ولا يتحول مرة أخرى إلى نظرية جديدة بلا داع.

V4-05.1 | الأصل، الResidual، ودفاع الجدة

V4-05 · M-CLCPC · Candidate N0-N2 · internal novelty after hostile reduction

نظرية مساعف لانتشار القيود عبر الطبقات واغلاق التناقض

Moussaif Cross-Layer Constraint Propagation and Contradiction Closure Theory

Residual

Compositional Assurance يطلب سلامة تركيب المكونات، وProtocol Sovereignty يحفظ حقول السلطة، لكن constraint قد يولد في L0 ثم يضيع أو يتحول عند context compaction أو skill composition أو tool adaptation. كما قد تنشأ قيود محلية صحيحة لكنها غير قابلة للاجتماع.

Nearest prior mechanisms

- Governed compositional assurance
- protocol semantic loss
- constitutional precedence.

Novelty defense

يعامل القيود كـobjects typed تنتشر forward/backward عبر L00-L23. يجرى minimal-unsat-core عندما تتعارض، وتنتج contradiction receipt يحدد أي قيد يجب تخفيضه أو تصعيده بدل silent policy erosion.

Hostile reduction questions

- هل parent أبسط يملك نفس state object؟
- هل الفارق مجرد metric جديد على mechanism قديم؟
- هل يمكن تنفيذ candidate بلا object جديد؟
- هل failure signature مختلف ومشاهد؟
- هل authority/rollback/observability boundary مختلفة؟

Null outcome

إذا كانت الإجابة العملية لا، يدمج candidate مع parent ولا يحافظ الاسم على استقلاله.

V4-05.2 | الأنطولوجيا وآلة الحالة

V4-05 · M-CLCPC · Candidate N0-N2 · internal novelty after hostile reduction

نظرية مساعف لانتشار القيود عبر الطبقات واغلاق التناقض

Moussaif Cross-Layer Constraint Propagation and Contradiction Closure Theory

Object	Role	Mandatory metadata
ConstraintObject	primary state object	id + version + scope + owner + provenance + lifecycle
ConstraintEdge	evidence/relationship object	id + version + scope + owner + provenance + lifecycle
PropagationTrace	control object	id + version + scope + owner + provenance + lifecycle
UnsatCore	audit/replay object	id + version + scope + owner + provenance + lifecycle
ContradictionReceipt	primary state object	id + version + scope + owner + provenance + lifecycle
ConstraintScope	evidence/relationship object	id + version + scope + owner + provenance + lifecycle
RelaxationAuthority	control object	id + version + scope + owner + provenance + lifecycle

State machine

```
NEW -> TYPED -> VALIDATED -> ACTIVE -> CONFLICT|BLOCKED|AMBIGUOUS -> VERIFIED
-> PROMOTED|ROLLED_BACK|RETIRED
```

Ontology safety

- object type controls allowed transitions
- no prose-only mutation
- branch/version identities never silently reused
- every conflict is represented, not narrated away
- receipts retain parent snapshot and causal reason

V4-05.3 | القياس، المعايرة، وقابلية التعرف

V4-05 · M-CLCPC · Candidate N0-N2 · internal novelty after hostile reduction

نظرية مساعف لانتشار القيود عبر الطبقات واغلاق التناقض

Moussaif Cross-Layer Constraint Propagation and Contradiction Closure Theory

```
ConstraintClosure = PreservedCriticalConstraints / RequiredCriticalConstraints - SilentRelaxationPenalty
```

Metrics

- critical constraint retention
- silent relaxation rate
- unsat localization time
- false block rate
- invalid-success rate

Identifiability

- define observable proxy before outcome
- separate predictive from causal use
- calibrate thresholds on non-test data

- report CI/variance and worst slice
- test monotonicity where assumed
- ablate each term and compare simpler score

Metric attack

- proxy gaming
- selection bias
- shared-root evidence
- metric substitution
- threshold leakage from held-out
- aggregate hides critical subgroup failure

V4-05 · M-CLCPC · Candidate N0-N2 · internal novelty after hostile reduction

نظرية مساعف لانتشار القيود عبر الطبقات وإغلاق التناقض

Moussaif Cross-Layer Constraint Propagation and Contradiction Closure Theory

Mechanism steps

- compile constraints من goal/policy/evidence/tool contracts إلى graph.
- propagate preconditions downward وpostconditions/violations upward.
- بعد كل transformation يقارن semantic constraint fingerprint.
- إذا unsat، استخراج minimal core وربط كل relaxation بـauthority.
- لا commit حتى closure أو explicit blocked/partial state.

Reference transaction

```
read(snapshot) -> derive signal -> propose transition -> validate authority/
constraints -> execute/simulate -> authoritative readback -> court -> commit
memory/state delta
```

Complexity budget

- fast path bypasses expensive court when risk/evidence allow
- expensive branch only on signature failure
- cache only versioned derived values
- bound retries and experiment count
- record cost per verified state change

Stop conditions

- postcondition reached
- no marginal progress
- budget exhausted
- authority unavailable
- falsifier observed
- repair/rollback dominates continuation

V4-05.5 | الربط بالـ24 طبقة

V4-05 · M-CLCPC · Candidate N0-N2 · internal novelty after hostile reduction

نظرية مساعف لانتشار القيود عبر الطبقات وإغلاق التناقض

Moussaif Cross-Layer Constraint Propagation and Contradiction Closure Theory

Layer	Role	State objects
L00	الدستور والسلامة غير القابلة للتجاوز	T0-T4, privacy, irreversible/public-action bans, truthfulness, fail-closed.
L01	حدود الهوية والهدف والسلطة	Project identity, Goal-as-OS contract, delegation tokens, self-model attestation, authority locality.
L06	الأنطولوجيا والوعاء والحسب المتعددة	Typed claims, PPOA, CPCU, ARP, dynamic context, calculus selection, explicit ignorance.
L12	المهارات القائمة والقدرات الذرية	Typed skill contracts, preconditions, outputs, evidence, rollback, versioning, transfer tests.
L16	غلاف MOUSSAIXT ومحولات الأدوات والبروتوكولات	Host discovery, tool contracts, MCP/A2A/custom schemas, semantic-loss certification, self-state capability lookup.
L18	المحاكم والمحققون وإغلاق القيود	Independent verifier portfolios, demolition/falsification, constraint propagation, proof budget, correlated-failure handling.

Upstream contract

- mission_id/trace_id
- goal/question/difference when relevant
- typed world/knowledge snapshot
- authority and risk tier
- epoch/version dependencies

Downstream contract

- typed decision/state delta
- metric reading
- evidence/trace receipt
- explicit failure/uncertainty
- rollback/recovery/invalidation references

Deployment mode

- passive telemetry
- shadow decision
- canary mutation
- scoped production
- cross-environment replication

V4-05.6 | الفشل، الخصومة، وحدود السلطة

V4-05 · M-CLCPC · Candidate N0-N2 · internal novelty after hostile reduction

نظرية مساعف لانتشار القيود عبر الطبقات وإغلاق التناقض

Moussaif Cross-Layer Constraint Propagation and Contradiction Closure Theory

Decisive falsifiers

- schema validators الحالية تكفي.
- unsat extraction لا يغير القرار.
- overconstraint يمنع حلول صحيحة أكثر مما يمنع unsafe solutions.

Adversarial matrix

- stale but high-authority source
- conflicting independent observations
- permission revoked mid-loop
- provider/tool substituted
- context compacted beyond loss budget
- duplicate action after timeout
- negative world effect hidden by successful API receipt
- memory contains prior false success
- verifier shares model/context with executor

Security/ethics boundary

- no escalation of authority from performance
- privacy/project scope preserved
- high-impact uncertainty cannot be hidden by average metric
- human/nondelegable decisions remain explicit
- blocked/partial preferred to fabricated completion

V4-05.7 | التجربة الحاسمة والـAblation

V4-05 · M-CLCPC · Candidate N0-N2 · internal novelty after hostile reduction

نظرية مساعف لانتشار القيود عبر الطبقات واغلاق التناقض

Moussaif Cross-Layer Constraint Propagation and Contradiction Closure Theory

مسارات متعددة الطبقات مع constraints privacy/cost/authority/format/temporal، أدخل deliberate omissions/contradictions وقارن local validators وCLCPC.

Design axis	Requirement
Baseline A	nearest parent under same model/tools
Baseline B	direct engineering solution without new theory
Treatment	M-CLCPC full mechanism
Budget	token/tool/time/proof/world-effect exposure matched
Splits	calibration + hidden held-out + transfer
Seeds	repeated stochastic runs; report variance
Primary metric	critical constraint retention
Secondary	silent relaxation rate · unsat localization time · false block rate · invalid-success rate
Guardrails	authority, safety, cost, latency, rollback, calibration
Faults	timeouts, stale state, wrong source, partial effects, model/tool swap
Evidence	raw traces + scorer version + environment hash
Verdict	PROMOTE / MERGE / REVISE / HOLD / REJECT

```
N4 = controlled matched-budget gain with no critical regression; N5 = independent cross-model/domain/environment replication.
```

V4-05.8 | التنبؤات والتنفيذ وسياسة النتيجة السلبية

V4-05 · M-CLCPC · Candidate N0-N2 · internal novelty after hostile reduction

نظرية مساعف لانتشار القيود عبر الطبقات واغلاق التناقض

Moussaif Cross-Layer Constraint Propagation and Contradiction Closure Theory

Predictions

- خفض policy drift بعد عدة adapters/agents.
- تحسن localization للتعارض بدل إعادة التخطيط العشوائي.
- انخفاض successful-but-invalid workflows.

Implementation ladder

- schema + unit tests
- reference sandbox service
- fault-injection suite
- passive telemetry baseline
- shadow comparison
- canary on bounded missions
- controlled benchmark
- transfer benchmark
- promotion/deprecation receipt
- continuous monitoring

Negative-result policy

- if no independent gain -> MERGE
- if gain only one environment -> HOLD/N3
- if cost dominates -> REVISE fast path
- if safety regression -> REJECT/rollback
- if parent improves equally -> deprecate candidate

Research output

كل نتيجة تتحول إلى ExperimentRecord وNegativeKnowledge أو PromotionReceipt، بحيث لا يضيع الفشل ولا يتحول مرة أخرى إلى نظرية جديدة بلا داع.

V4-06.1 | الأصل، الـResidual، ودفاع الجدة

V4-06 · M-CMBEMT · Candidate N0-N2 · internal novelty after hostile reduction

نظرية مساعف لتفرع الذاكرة المضاد للواقع ودمجها بالدليل

Moussaif Counterfactual Memory Branching and Evidence Merge Theory

Residual

الذاكرة المحجورة والسببية تمنع promotion متسرعا، لكنها غالبا تحتفظ hypothesis واحدة أساسية مع uncertainty. في مهام long-horizon قد توجد فرضيات عالم متنافسة وكل منها يغير الخطة، ويؤدي دمجها المبكر إلى narrative averaging.

Nearest prior mechanisms

- Quarantined reconstructive memory
- causal-memory boundary
- productive contradiction.

Novelty defense

يسمح بذاكرة branch-per-hypothesis مع shared base وmerge. لا يحدث حين تتشابه النصوص، بل عندما EvidenceMergeCondition يحسم equivalence أو dominance أو coexistence.

Hostile reduction questions

- هل parent أبسط يملك نفس state object؟
- هل الفارق مجرد metric جديد على mechanism قديم؟
- هل يمكن تنفيذ candidate بلا object جديد؟
- هل failure signature مختلف ومشاهد؟
- هل authority/rollback/observability boundary مختلفة؟

Null outcome

إذا كانت الإجابة العملية لا، يدمج candidate مع parent ولا يحافظ الاسم على استقلاله.

V4-06.2 | الأنطولوجيا وآلة الحالة

V4-06 · M-CMBEMT · Candidate N0-N2 · internal novelty after hostile reduction

نظرية مساعف لتفرع الذاكرة المضاد للواقع ودمجها بالدليل

Moussaif Counterfactual Memory Branching and Evidence Merge Theory

Object	Role	Mandatory metadata
MemoryBranch	primary state object	id + version + scope + owner + provenance + lifecycle
HypothesisRoot	evidence/relationship object	id + version + scope + owner + provenance + lifecycle
BranchDelta	control object	id + version + scope + owner + provenance + lifecycle
BranchEvidence	audit/replay object	id + version + scope + owner + provenance + lifecycle
MergeCondition	primary state object	id + version + scope + owner + provenance + lifecycle
BranchConflict	evidence/relationship object	id + version + scope + owner + provenance + lifecycle
MergeReceipt	control object	id + version + scope + owner + provenance + lifecycle

State machine

```
NEW -> TYPED -> VALIDATED -> ACTIVE -> CONFLICT|BLOCKED|AMBIGUOUS -> VERIFIED
-> PROMOTED|ROLLED_BACK|RETIRED
```

Ontology safety

- object type controls allowed transitions
- no prose-only mutation
- branch/version identities never silently reused
- every conflict is represented, not narrated away
- receipts retain parent snapshot and causal reason

V4-06.3 | القياس، المعايرة، وقابلية التعرف

V4-06 · M-CMBEMT · Candidate N0-N2 · internal novelty after hostile reduction

نظرية مساعف لتفرع الذاكرة المضاد للواقع ودمجها بالدليل

Moussaif Counterfactual Memory Branching and Evidence Merge Theory

```
BranchValue = DecisionSeparation*EvidenceSupport*FutureTestability - MaintenanceCost; MergeReady = EvidenceConvergence*SemanticCompatibility*EffectConsistency
```

Metrics

- branch contamination rate
- discriminating experiment yield
- branch explosion factor
- merge precision
- rollback recovery time

Identifiability

- define observable proxy before outcome
- separate predictive from causal use
- calibrate thresholds on non-test data
- report CI/variance and worst slice
- test monotonicity where assumed
- ablate each term and compare simpler score

Metric attack

- proxy gaming
- selection bias
- shared-root evidence
- metric substitution
- threshold leakage from held-out
- aggregate hides critical subgroup failure

V4-06.4 | الآلية والخوارزمية والاقتصاد الحسابي

V4-06 · M-CMBEMT · Candidate N0-N2 · internal novelty after hostile reduction

نظرية مساعف لتفرع الذاكرة المضاد للواقع ودمجها بالدليل

Moussaif Counterfactual Memory Branching and Evidence Merge Theory

Mechanism steps

- fork عند اختلاف يغير decision surface.
- ربط كل retrieval/action بـbranch id.
- تحديث evidence لكل branch دون تلويث base memory.
- تصميم experiment يميز الفروع الأعلى قيمة.
- merge/dominance/retire مع receipt يحفظ التاريخ والسبب.

Reference transaction

```
read(snapshot) -> derive signal -> propose transition -> validate authority/
constraints -> execute/simulate -> authoritative readback -> court -> commit
memory/state delta
```

Complexity budget

- fast path bypasses expensive court when risk/evidence allow
- expensive branch only on signature failure
- cache only versioned derived values
- bound retries and experiment count
- record cost per verified state change

Stop conditions

- postcondition reached
- no marginal progress
- budget exhausted
- authority unavailable
- falsifier observed
- repair/rollback dominates continuation

V4-06.5 | الربط بالـ24 طبقة

V4-06 · M-CMBEMT · Candidate N0-N2 · internal novelty after hostile reduction

نظرية مساعف لتفرع الذاكرة المضاد للواقع ودمجها بالدليل

Moussaif Counterfactual Memory Branching and Evidence Merge Theory

Layer	Role	State objects
L07	نموذج العالم والحالة الموثوقة	Observed/inferred/proposed/remembered separation, source precedence, validity time, state conflict.
L08	الاسترجاع وجينوم السياق	Minimal sufficient retrieval, GraphRAG, context compaction, provenance pointers, contradiction-aware retrieval.
L09	الذاكرة المتفرعة وإعادة البناء	Quarantine, episodic/semantic/procedural separation, counterfactual branches, negative knowledge, reconstruction.
L18	المحاكم والمحققون وإغلاق القيود	Independent verifier portfolios, demolition/falsification, constraint propagation, proof budget, correlated-failure handling.
L20	القياس والتتبع ونسيج الرصد	OpenTelemetry-style trace IDs, mission timelines, metrics, state snapshots, anomaly/fault replay.

Upstream contract

- mission_id/trace_id
- goal/question/difference when relevant
- typed world/knowledge snapshot
- authority and risk tier
- epoch/version dependencies

Downstream contract

- typed decision/state delta
- metric reading
- evidence/trace receipt
- explicit failure/uncertainty
- rollback/recovery/invalidation references

Deployment mode

- passive telemetry
- shadow decision
- canary mutation
- scoped production
- cross-environment replication

V4-06.6 | الفشل، الخصومة، وحدود السلطة

V4-06 · M-CMBEMT · Candidate N0-N2 · internal novelty after hostile reduction

نظرية مساعف لتفرع الذاكرة المضاد للواقع ودمجها بالدليل

Moussaif Counterfactual Memory Branching and Evidence Merge Theory

Decisive falsifiers

- simple uncertainty annotations تحقق نفس الفائدة.
- branch explosion يكلف أكثر من gain.
- merge rules لا تتنبأ بصحة memory لاحقا.

Adversarial matrix

- stale but high-authority source
- conflicting independent observations
- permission revoked mid-loop
- provider/tool substituted
- context compacted beyond loss budget
- duplicate action after timeout
- negative world effect hidden by successful API receipt
- memory contains prior false success
- verifier shares model/context with executor

Security/ethics boundary

- no escalation of authority from performance
- privacy/project scope preserved
- high-impact uncertainty cannot be hidden by average metric
- human/nondelegable decisions remain explicit
- blocked/partial preferred to fabricated completion

V4-06.7 | التجربة الحاسمة والـAblation

V4-06 · M-CMBEMT · Candidate N0-N2 · internal novelty after hostile reduction

نظرية مساعف لتفرع الذاكرة المضاد للواقع ودمجها بالدليل

Moussaif Counterfactual Memory Branching and Evidence Merge Theory

مهام incident/research/debugging ذات سببان أو ثلاثة متنافسة؛ tagged uncertainty، baseline single narrative memory، ثم CMBEMT branch store.

Design axis	Requirement
Baseline A	nearest parent under same model/tools
Baseline B	direct engineering solution without new theory
Treatment	M-CMBEMT full mechanism
Budget	token/tool/time/proof/world-effect exposure matched
Splits	calibration + hidden held-out + transfer
Seeds	repeated stochastic runs; report variance
Primary metric	branch contamination rate
Secondary	discriminating experiment yield · branch explosion factor · merge precision · rollback recovery time
Guardrails	authority, safety, cost, latency, rollback, calibration
Faults	timeouts, stale state, wrong source, partial effects, model/tool swap
Evidence	raw traces + scorer version + environment hash
Verdict	PROMOTE / MERGE / REVISE / HOLD / REJECT

```
N4 = controlled matched-budget gain with no critical regression; N5 = independent cross-model/domain/environment replication.
```

V4-06.8 | التنبؤات والتنفيذ وسياسة النتيجة السلبية

V4-06 · M-CMBEMT · Candidate N0-N2 · internal novelty after hostile reduction

نظرية مساعف لتفرع الذاكرة المضاد للواقع ودمجها بالدليل

Moussaif Counterfactual Memory Branching and Evidence Merge Theory

Predictions

- خفض memory contamination في ambiguous worlds.
- توليد experiments أكثر تمييزا بين hypotheses.
- تحسن rollback عندما يتبين أن branch المختارة خاطئة.

Implementation ladder

- schema + unit tests
- reference sandbox service
- fault-injection suite
- passive telemetry baseline
- shadow comparison
- canary on bounded missions
- controlled benchmark
- transfer benchmark
- promotion/deprecation receipt
- continuous monitoring

Negative-result policy

- if no independent gain -> MERGE
- if gain only one environment -> HOLD/N3
- if cost dominates -> REVISE fast path
- if safety regression -> REJECT/rollback
- if parent improves equally -> deprecate candidate

Research output

كل نتيجة تتحول إلى ExperimentRecord وNegativeKnowledge أو PromotionReceipt، بحيث لا يضيع الفشل ولا يتحول مرة أخرى إلى نظرية جديدة بلا داع.

V4-07.1 | الأصل، الResidual، ودفاع الجدة

V4-07 · M-IFREAT · Candidate N0-N2 · internal novelty after hostile reduction

نظرية مساعف لجبهة اللاعكوسية ومحاسبة الأثر المتبقي

Moussaif Irreversibility Frontier and Residual-Effect Accounting Theory

Residual

السلالة قوية في reversible action وrollback وproof budget، لكن rollback في العالم الحقيقي قد يعيد state تقنيا ولا يعيد آثارا اجتماعية أو مالية أو معرفية انتشرت بعد الفعل. therefore binary reversible/irreversible غير كاف.

Nearest prior mechanisms

- Constitutional reversibility
- transaction/saga
- world-effect
- proof budget.

Novelty defense

تعرف Irreversibility Frontier حيث تبدأ effects لا يمكن ضمان إزالتها، وتحسب ResidualEffect بعد compensation. السلطة والدليل المطلوبان يرتفعان مع residual potential لا مع نوع API فقط.

Hostile reduction questions

- هل parent أبسط يملك نفس state object؟
- هل الفارق مجرد metric جديد على mechanism قديم؟
- هل يمكن تنفيذ candidate بلا object جديد؟
- هل failure signature مختلف ومشاهد؟
- هل authority/rollback/observability boundary مختلفة؟

Null outcome

إذا كانت الإجابة العملية لا، يدمج candidate مع parent ولا يحافظ الاسم على استقلاله.

V4-07.2 | الأنطولوجيا وآلة الحالة

V4-07 · M-IFREAT · Candidate N0-N2 · internal novelty after hostile reduction

نظرية مساعف لجبهة اللاعكوسية ومحاسبة الأثر المتبقي

Moussaif Irreversibility Frontier and Residual-Effect Accounting Theory

Object	Role	Mandatory metadata
EffectVector	primary state object	id + version + scope + owner + provenance + lifecycle
IrreversibilityFrontier	evidence/relationship object	id + version + scope + owner + provenance + lifecycle
ResidualEffect	control object	id + version + scope + owner + provenance + lifecycle
CompensationPlan	audit/replay object	id + version + scope + owner + provenance + lifecycle
ResidualLedger	primary state object	id + version + scope + owner + provenance + lifecycle
ExposureWindow	evidence/relationship object	id + version + scope + owner + provenance + lifecycle
RollbackReceipt	control object	id + version + scope + owner + provenance + lifecycle

State machine

```
NEW -> TYPED -> VALIDATED -> ACTIVE -> CONFLICT|BLOCKED|AMBIGUOUS -> VERIFIED
-> PROMOTED|ROLLED_BACK|RETIRED
```

Ontology safety

- object type controls allowed transitions
- no prose-only mutation
- branch/version identities never silently reused
- every conflict is represented, not narrated away
- receipts retain parent snapshot and causal reason

V4-07.3 | القياس، المعايرة، وقابلية التعرف

V4-07 · M-IFREAT · Candidate N0-N2 · internal novelty after hostile reduction

نظرية مساعف لجبهة اللاعكوسية ومحاسبة الأثر المتبقي

Moussaif Irreversibility Frontier and Residual-Effect Accounting Theory

```
ResidualRisk = Σ Effect_i * (1-Recoverability_i) * Propagation_i * ExposureTime_i
```

Metrics

- residual effect mass
- false reversibility rate
- compensation effectiveness
- frontier prediction precision
- exposure-weighted incident cost

Identifiability

- define observable proxy before outcome
- separate predictive from causal use
- calibrate thresholds on non-test data
- report CI/variance and worst slice
- test monotonicity where assumed
- ablate each term and compare simpler score

Metric attack

- proxy gaming
- selection bias
- shared-root evidence
- metric substitution
- threshold leakage from held-out
- aggregate hides critical subgroup failure

V4-07.4 | الآلية والخوارزمية والاقتصاد الحسابي

V4-07 · M-IFREAT · Candidate N0-N2 · internal novelty after hostile reduction

نظرية مساعف لجبهة اللاعكوسية ومحاسبة الأثر المتبقي

Moussaif Irreversibility Frontier and Residual-Effect Accounting Theory

Mechanism steps

- تجزئة action إلى effect dimensions: state/data/public/financial/human/learning.
- تقدير recoverability/propagation لكل بعد قبل commit.
- تعريف frontier وبعدها require stronger authority/proof.
- بعد rollback قياس residual لا مجرد state equality.
- حفظ residual ledger وتحديث policy/tool risk profiles.

Reference transaction

```
read(snapshot) -> derive signal -> propose transition -> validate authority/
constraints -> execute/simulate -> authoritative readback -> court -> commit
memory/state delta
```

Complexity budget

- fast path bypasses expensive court when risk/evidence allow
- expensive branch only on signature failure
- cache only versioned derived values
- bound retries and experiment count
- record cost per verified state change

Stop conditions

- postcondition reached
- no marginal progress
- budget exhausted
- authority unavailable
- falsifier observed
- repair/rollback dominates continuation

V4-07.5 | الربط بالـ24 طبقة

V4-07 · M-IFREAT · Candidate N0-N2 · internal novelty after hostile reduction

نظرية مساعف لجبهة اللاعكوسية ومحاسبة الأثر المتبقي

Moussaif Irreversibility Frontier and Residual-Effect Accounting Theory

Layer	Role	State objects
L01	حدود الهوية والهدف والسلطة	Project identity, Goal-as-OS contract, delegation tokens, self-model attestation, authority locality.
L16	غلاف MOUSSAIXT وبحولات الأدوات والبروتوكولات	Host discovery, tool contracts, MCP/A2A/custom schemas, semantic-loss certification, self-state capability lookup.
L17	معاملات التنفيذ والساغا واللاعكوسية	Idempotency, durable intent, checkpoints, compensation, irreversibility frontier, residual-effect accounting.
L19	أثر العالم والنهائية والنسب السببي	Observability contracts, readback lattice, finality, causal attribution, competing causes, effect grades.
L20	القياس والتتبع ونسيج الرصد	OpenTelemetry-style trace IDs, mission timelines, metrics, state snapshots, anomaly/fault replay.

Upstream contract

- mission_id/trace_id
- goal/question/difference when relevant
- typed world/knowledge snapshot
- authority and risk tier
- epoch/version dependencies

Downstream contract

- typed decision/state delta
- metric reading
- evidence/trace receipt
- explicit failure/uncertainty
- rollback/recovery/invalidation references

Deployment mode

- passive telemetry
- shadow decision
- canary mutation
- scoped production
- cross-environment replication

V4-07.6 | الفشل، الخصومة، وحدود السلطة

V4-07 · M-IFREAT · Candidate N0-N2 · internal novelty after hostile reduction

نظرية مساعف لجبهة اللاعكوسية ومحاسبة الأثر المتبقي

Moussaif Irreversibility Frontier and Residual-Effect Accounting Theory

Decisive falsifiers

- تصنيف T0-T4 الحالي يفسر نفس الحوادث.
- residual scores غير قابلة للمعايرة.
- لا تحسن في incident severity/containment.

Adversarial matrix

- stale but high-authority source
- conflicting independent observations
- permission revoked mid-loop
- provider/tool substituted
- context compacted beyond loss budget
- duplicate action after timeout
- negative world effect hidden by successful API receipt
- memory contains prior false success
- verifier shares model/context with executor

Security/ethics boundary

- no escalation of authority from performance
- privacy/project scope preserved
- high-impact uncertainty cannot be hidden by average metric
- human/nondelegable decisions remain explicit
- blocked/partial preferred to fabricated completion

V4-07.7 | التجربة الحاسمة والـAblation

V4-07 · M-IFREAT · Candidate N0-N2 · internal novelty after hostile reduction

نظرية مساعف لجبهة اللاعكوسية ومحاسبة الأثر المتبقي

Moussaif Irreversibility Frontier and Residual-Effect Accounting Theory

اختبارات بريد/نشر/DB/CRM/cache/model-memory حيث يمكن rollback تقني جزئي فقط؛ قارن binary reversibility وIFREAT vector accounting.

Design axis	Requirement
Baseline A	nearest parent under same model/tools
Baseline B	direct engineering solution without new theory
Treatment	M-IFREAT full mechanism
Budget	token/tool/time/proof/world-effect exposure matched
Splits	calibration + hidden held-out + transfer
Seeds	repeated stochastic runs; report variance
Primary metric	residual effect mass
Secondary	false reversibility rate · compensation effectiveness · frontier prediction precision · exposure-weighted incident cost
Guardrails	authority, safety, cost, latency, rollback, calibration
Faults	timeouts, stale state, wrong source, partial effects, model/tool swap
Evidence	raw traces + scorer version + environment hash
Verdict	PROMOTE / MERGE / REVISE / HOLD / REJECT

```
N4 = controlled matched-budget gain with no critical regression; N5 = independent cross-model/domain/environment replication.
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V4-07.8 | التنبؤات والتنفيذ وسياسة النتيجة السلبية

V4-07 · M-IFREAT · Candidate N0-N2 · internal novelty after hostile reduction

نظرية مساعف لجبهة اللاعكوسية ومحاسبة الأثر المتبقي

Moussaif Irreversibility Frontier and Residual-Effect Accounting Theory

Predictions

- كشف أفعال تبدو T2 لكنها فعليا ذات residual T3.
- خفض false claims من نوع rollback succeeded بالكامل.
- تحسين اختيار compensation في distributed workflows.

Implementation ladder

- schema + unit tests
- reference sandbox service
- fault-injection suite
- passive telemetry baseline
- shadow comparison
- canary on bounded missions
- controlled benchmark
- transfer benchmark
- promotion/deprecation receipt
- continuous monitoring

Negative-result policy

- if no independent gain -> MERGE
- if gain only one environment -> HOLD/N3
- if cost dominates -> REVISE fast path
- if safety regression -> REJECT/rollback
- if parent improves equally -> deprecate candidate

Research output

كل نتيجة تتحول إلى ExperimentRecord وNegativeKnowledge أو PromotionReceipt، بحيث لا يضيع الفشل ولا يتحول مرة أخرى إلى نظرية جديدة بلا داع.

V4-08.1 | الأصل، الResidual، ودفاع الجدة

V4-08 · M-MTGST · Candidate N0-N2 · internal novelty after hostile reduction

نظرية مساعف لمزامنة الحاكمية متعددة المقاييس الزمنية

Moussaif Multi-Timescale Governance Synchronization Theory

Residual

runtime سريع، memory consolidation أبطأ، training أبطأ، policy/governance أبطأ أيضا. عند اختلاف الأزمنة قد يتعلم model من traces قبل تثبيت حكمها، أو يبقى agent على policy قديمة، أو تتأخر revalidation عن صلاحية الدليل.

Nearest prior mechanisms

- Epistemic half-life
- continuous learning
- watchdog
- policy versioning
- MUSQAT evolution.

Novelty defense

يبني clocks صريحة للـinference/session/day/training/release/governance ويمنع cross-timescale write ما لم يحمل causality/version barrier. المشكلة ليست freshness منفردة بل aliasing بين حلقات تحكم بسرعات مختلفة.

Hostile reduction questions

- هل parent أبسط يملك نفس state object؟
- هل الفارق مجرد metric جديد على mechanism قديم؟
- هل يمكن تنفيذ candidate بلا object جديد؟
- هل failure signature مختلف ومشاهد؟
- هل authority/rollback/observability boundary مختلفة؟

Null outcome

إذا كانت الإجابة العملية لا، يدمج candidate مع parent ولا يحافظ الاسم على استقلاله.

V4-08.2 | الأنطولوجيا وآلة الحالة

V4-08 · M-MTGST · Candidate N0-N2 · internal novelty after hostile reduction

نظرية مساعف لمزامنة الحاكمية متعددة المقاييس الزمنية

Moussaif Multi-Timescale Governance Synchronization Theory

Object	Role	Mandatory metadata
TimescaleClock	primary state object	id + version + scope + owner + provenance + lifecycle
GovernanceEpoch	evidence/relationship object	id + version + scope + owner + provenance + lifecycle
VersionBarrier	control object	id + version + scope + owner + provenance + lifecycle
FastLoopEvent	audit/replay object	id + version + scope + owner + provenance + lifecycle
SlowLoopDecision	primary state object	id + version + scope + owner + provenance + lifecycle
SyncWindow	evidence/relationship object	id + version + scope + owner + provenance + lifecycle
TemporalAlias	control object	id + version + scope + owner + provenance + lifecycle

State machine

```
NEW -> TYPED -> VALIDATED -> ACTIVE -> CONFLICT|BLOCKED|AMBIGUOUS -> VERIFIED
-> PROMOTED|ROLLED_BACK|RETIRED
```

Ontology safety

- object type controls allowed transitions
- no prose-only mutation
- branch/version identities never silently reused
- every conflict is represented, not narrated away
- receipts retain parent snapshot and causal reason

V4-08.3 | القياس، المعايرة، وقابلية التعرف

V4-08 · M-MTGST · Candidate N0-N2 · internal novelty after hostile reduction

نظرية مساعف لمزامنة الحاكمية متعددة المقاييس الزمنية

Moussaif Multi-Timescale Governance Synchronization Theory

```
TemporalCoherence = 1 - Σ w_ij * StaleCoupling(loop_i,loop_j); SyncNeed = DriftRate*Impact*Coupling/UpdateCost
```

Metrics

- stale-policy execution rate
- unverified-training ingestion
- epoch mismatch incidents
- sync latency
- cross-timescale drift

Identifiability

- define observable proxy before outcome
- separate predictive from causal use
- calibrate thresholds on non-test data
- report CI/variance and worst slice
- test monotonicity where assumed
- ablate each term and compare simpler score

Metric attack

- proxy gaming
- selection bias
- shared-root evidence
- metric substitution
- threshold leakage from held-out
- aggregate hides critical subgroup failure

V4-08.4 | الآلية والخوارزمية والاقتصاد الحسابي

V4-08 · M-MTGST · Candidate N0-N2 · internal novelty after hostile reduction

نظرية مساعف لمزامنة الحاكمية متعددة المقاييس الزمنية

Moussaif Multi-Timescale Governance Synchronization Theory

Mechanism steps

- تعريف clock وowner لكل plane.
- كل artifact يحمل epoch dependencies.
- fast loop يقرأ slow-policy snapshot ولا يعدلها مباشرة.
- training candidate ينتظر stabilized evidence epoch.
- عند policy/model update يبث invalidation إلى sessions/caches/skills المعتمدة.

Reference transaction

```
read(snapshot) -> derive signal -> propose transition -> validate authority/
constraints -> execute/simulate -> authoritative readback -> court -> commit
memory/state delta
```

Complexity budget

- fast path bypasses expensive court when risk/evidence allow
- expensive branch only on signature failure
- cache only versioned derived values
- bound retries and experiment count
- record cost per verified state change

Stop conditions

- postcondition reached
- no marginal progress
- budget exhausted
- authority unavailable
- falsifier observed
- repair/rollback dominates continuation

V4-08.5 | الربط بالـ24 طبقة

V4-08 · M-MTGST · Candidate N0-N2 · internal novelty after hostile reduction

نظرية مساعف لمزامنة الحاكمية متعددة المقاييس الزمنية

Moussaif Multi-Timescale Governance Synchronization Theory

Layer	Role	State objects
L00	الدستور والسلامة غير القابلة للتجاوز	T0-T4, privacy, irreversible/public-action bans, truthfulness, fail-closed.
L03	الادعاءات والدليل والزمن واللايقين	Claim typing, evidence ledger, half-life, debt, ReportedGrade vs IndependentGrade, epistemic thermostat.
L09	الذاكرة المتفرعة وإعادة البناء	Quarantine, episodic/semantic/procedural separation, counterfactual branches, negative knowledge, reconstruction.
L20	القياس والتتبع ونسيج الرصد	OpenTelemetry-style trace IDs, mission timelines, metrics, state snapshots, anomaly/fault replay.
L21	التدريب والتطوير والترقية	Verified-trace quarantine, dataset manifests, LoRA/adapters, frozen eval, forgetting vector, shadow/canary, rollback.
L22	انساق التمثيلات وتطور المعمارية	Invalidation waves, dependency derivation graph, proof-preserving refactor, deprecation lineage, architecture compression.

Upstream contract

- mission_id/trace_id
- goal/question/difference when relevant
- typed world/knowledge snapshot
- authority and risk tier
- epoch/version dependencies

Downstream contract

- typed decision/state delta
- metric reading
- evidence/trace receipt
- explicit failure/uncertainty
- rollback/recovery/invalidation references

Deployment mode

- passive telemetry
- shadow decision
- canary mutation
- scoped production
- cross-environment replication

V4-08.6 | الفشل، الخصومة، وحدود السلطة

V4-08 · M-MTGST · Candidate N0-N2 · internal novelty after hostile reduction

نظرية مساعف لمزامنة الحاكمية متعددة المقاييس الزمنية

Moussaif Multi-Timescale Governance Synchronization Theory

Decisive falsifiers

- simple version pinning كاف.
- barriers تزيد latency بلا خفض incidents.
- لا توجد temporal alias failures في workload الحقيقي.

Adversarial matrix

- stale but high-authority source
- conflicting independent observations
- permission revoked mid-loop
- provider/tool substituted
- context compacted beyond loss budget
- duplicate action after timeout
- negative world effect hidden by successful API receipt
- memory contains prior false success
- verifier shares model/context with executor

Security/ethics boundary

- no escalation of authority from performance
- privacy/project scope preserved
- high-impact uncertainty cannot be hidden by average metric
- human/nondelegable decisions remain explicit
- blocked/partial preferred to fabricated completion

V4-08.7 | التجربة الحاسمة والـAblation

V4-08 · M-MTGST · Candidate N0-N2 · internal novelty after hostile reduction

نظرية مساعف لمزامنة الحاكمية متعددة المقاييس الزمنية

Moussaif Multi-Timescale Governance Synchronization Theory

حمل متزامن: sessions مستمرة بينما تتغير policy/knowledge/checkpoint، revocations، inject delayed events وtraining candidates، قارن no-barrier/version-pin/MTGST.

Design axis	Requirement
Baseline A	nearest parent under same model/tools
Baseline B	direct engineering solution without new theory
Treatment	M-MTGST full mechanism
Budget	token/tool/time/proof/world-effect exposure matched
Splits	calibration + hidden held-out + transfer
Seeds	repeated stochastic runs; report variance
Primary metric	stale-policy execution rate
Secondary	unverified-training ingestion · epoch mismatch incidents · sync latency · cross-timescale drift
Guardrails	authority, safety, cost, latency, rollback, calibration
Faults	timeouts, stale state, wrong source, partial effects, model/tool swap
Evidence	raw traces + scorer version + environment hash
Verdict	PROMOTE / MERGE / REVISE / HOLD / REJECT

```
N4 = controlled matched-budget gain with no critical regression; N5 = independent cross-model/domain/environment replication.
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V4-08.8 | التنبؤات والتنفيذ وسياسة النتيجة السلبية

V4-08 · M-MTGST · Candidate N0-N2 · internal novelty after hostile reduction

نظرية مساعف لمزامنة الحاكمية متعددة المقاييس الزمنية

Moussaif Multi-Timescale Governance Synchronization Theory

Predictions

- خفض training-on-unverified-trace.
- خفض sessions التي تنفذ policy قديمة بعد revocation.
- استقرار أفضل لل continuous learning مقارنة hourly auto-update غير المحكوم.

Implementation ladder

- schema + unit tests
- reference sandbox service
- fault-injection suite
- passive telemetry baseline
- shadow comparison
- canary on bounded missions
- controlled benchmark
- transfer benchmark
- promotion/deprecation receipt
- continuous monitoring

Negative-result policy

- if no independent gain -> MERGE
- if gain only one environment -> HOLD/N3
- if cost dominates -> REVISE fast path
- if safety regression -> REJECT/rollback
- if parent improves equally -> deprecate candidate

Research output

كل نتيجة تتحول إلى ExperimentRecord وNegativeKnowledge أو PromotionReceipt، بحيث لا يضيع الفشل ولا يتحول مرة أخرى إلى نظرية جديدة بلا داع.

V4-09.1 | الأصل، الResidual، ودفاع الجدة

V4-09 · M-PAOST · Candidate N0-N2 · internal novelty after hostile reduction

نظرية مساعف لكفاية قابلية الرصد قبل الفعل

Moussaif Pre-Action Observability Sufficiency Theory

Residual

World-Effect verifier قوي بعد التنفيذ، لكن بعض الأفعال لا تملك instrumentation يسمح بإثبات postcondition أو كشف الضرر. تنفيذ فعل غير قابل للرصد ثم طلب verification لاحقًا يجعل الفشل غير قابل للحسم.

Nearest prior mechanisms

- World-Effect verification
- effect lattice/finality
- evidence-to-action threshold.

Novelty defense

يجعل observability contract precondition للفعل: قبل execution يجب إثبات أن الأثر الحاكم observable بمهلة ودقة ومصدر كافيين، وإلا يعدل الفعل أو يضيف sensor/readback أو يخفض authority.

Hostile reduction questions

- هل parent أبسط يملك نفس state object؟
- هل الفارق مجرد metric جديد على mechanism قديم؟
- هل يمكن تنفيذ candidate بلا object جديد؟
- هل failure signature مختلف ومشاهد؟
- هل authority/rollback/observability boundary مختلفة؟

Null outcome

إذا كانت الإجابة العملية لا، يدمج candidate مع parent ولا يحافظ الاسم على استقلاله.

V4-09.2 | الأنطولوجيا وآلة الحالة

V4-09 · M-PAOST · Candidate N0-N2 · internal novelty after hostile reduction

نظرية مساعف لكفاية قابلية الرصد قبل الفعل

Moussaif Pre-Action Observability Sufficiency Theory

Object	Role	Mandatory metadata
ObservabilityContract	primary state object	id + version + scope + owner + provenance + lifecycle
EffectSensor	evidence/relationship object	id + version + scope + owner + provenance + lifecycle
ReadbackPlan	control object	id + version + scope + owner + provenance + lifecycle
DetectionLatency	audit/replay object	id + version + scope + owner + provenance + lifecycle
CoverageGap	primary state object	id + version + scope + owner + provenance + lifecycle
BlindAction	evidence/relationship object	id + version + scope + owner + provenance + lifecycle
InstrumentationReceipt	control object	id + version + scope + owner + provenance + lifecycle

State machine

```
NEW -> TYPED -> VALIDATED -> ACTIVE -> CONFLICT|BLOCKED|AMBIGUOUS -> VERIFIED
-> PROMOTED|ROLLED_BACK|RETIRED
```

Ontology safety

- object type controls allowed transitions
- no prose-only mutation
- branch/version identities never silently reused
- every conflict is represented, not narrated away
- receipts retain parent snapshot and causal reason

V4-09.3 | القياس، المعايرة، وقابلية التعرف

V4-09 · M-PAOST · Candidate N0-N2 · internal novelty after hostile reduction

نظرية مساعف لكفاية قابلية الرصد قبل الفعل

Moussaif Pre-Action Observability Sufficiency Theory

```
ObsSufficiency = Coverage*AuthorityOfSensor*Timeliness*Specificity - BlindSpotRisk; Act only if ObsSufficiency >= Threshold(effect_risk)
```

Metrics

- unverifiable action rate
- postcondition coverage
- detection latency
- blind-side-effect rate
- instrumentation overhead

Identifiability

- define observable proxy before outcome
- separate predictive from causal use
- calibrate thresholds on non-test data

- report CI/variance and worst slice
- test monotonicity where assumed
- ablate each term and compare simpler score

Metric attack

- proxy gaming
- selection bias
- shared-root evidence
- metric substitution
- threshold leakage from held-out
- aggregate hides critical subgroup failure

V4-09.4 | الآلية والخوارزمية والاقتصاد الحسابي

V4-09 · M-PAOST · Candidate N0-N2 · internal novelty after hostile reduction

نظرية مساعف لكفاية قابلية الرصد قبل الفعل

Moussaif Pre-Action Observability Sufficiency Theory

Mechanism steps

- تعريف governing postconditions قبل التنفيذ.
- تعيين sensor/readback لكل postcondition.
- قياس coverage, latency, source authority, specificity.
- إذا gap: instrument/reframe/simulate/stop.
- بعد action مقارنة predicted observability مع actual detectability لتعلم profiles.

Reference transaction

```
read(snapshot) -> derive signal -> propose transition -> validate authority/
constraints -> execute/simulate -> authoritative readback -> court -> commit
memory/state delta
```

Complexity budget

- fast path bypasses expensive court when risk/evidence allow
- expensive branch only on signature failure
- cache only versioned derived values
- bound retries and experiment count
- record cost per verified state change

Stop conditions

- postcondition reached
- no marginal progress
- budget exhausted
- authority unavailable
- falsifier observed
- repair/rollback dominates continuation

V4-09.5 | الربط بالـ24 طبقة

V4-09 · M-PAOST · Candidate N0-N2 · internal novelty after hostile reduction

نظرية مساعف لكفاية قابلية الرصد قبل الفعل

Moussaif Pre-Action Observability Sufficiency Theory

Layer	Role	State objects
L16	غلاف MOUSSAIXT ومحولات الأدوات والبروتوكولات	Host discovery, tool contracts, MCP/A2A/custom schemas, semantic-loss certification, self-state capability lookup.
L17	معاملات التنفيذ والساغا واللاعكوسية	Idempotency, durable intent, checkpoints, compensation, irreversibility frontier, residual-effect accounting.
L18	المحاكم والمحققون وإغلاق القيود	Independent verifier portfolios, demolition/falsification, constraint propagation, proof budget, correlated-failure handling.
L19	أثر العالم والنهائية والنسب السببي	Observability contracts, readback lattice, finality, causal attribution, competing causes, effect grades.
L20	القياس والتتبع ونسيج الرصد	OpenTelemetry-style trace IDs, mission timelines, metrics, state snapshots, anomaly/fault replay.

Upstream contract

- mission_id/trace_id
- goal/question/difference when relevant
- typed world/knowledge snapshot
- authority and risk tier
- epoch/version dependencies

Downstream contract

- typed decision/state delta
- metric reading
- evidence/trace receipt
- explicit failure/uncertainty
- rollback/recovery/invalidation references

Deployment mode

- passive telemetry
- shadow decision
- canary mutation
- scoped production
- cross-environment replication

V4-09.6 | الفشل، الخصومة، وحدود السلطة

V4-09 · M-PAOST · Candidate N0-N2 · internal novelty after hostile reduction

نظرية مساعف لكفاية قابلية الرصد قبل الفعل

Moussaif Pre-Action Observability Sufficiency Theory

Decisive falsifiers

- post-action verifier وحده كاف.
- observability score لا يتنبأ بالincident resolution.
- instrumentation overhead يطغى على الفائدة.

Adversarial matrix

- stale but high-authority source
- conflicting independent observations
- permission revoked mid-loop
- provider/tool substituted
- context compacted beyond loss budget
- duplicate action after timeout
- negative world effect hidden by successful API receipt
- memory contains prior false success
- verifier shares model/context with executor

Security/ethics boundary

- no escalation of authority from performance
- privacy/project scope preserved
- high-impact uncertainty cannot be hidden by average metric
- human/nondelegable decisions remain explicit
- blocked/partial preferred to fabricated completion

V4-09.7 | التجربة الحاسمة والـAblation

V4-09 · M-PAOST · Candidate N0-N2 · internal novelty after hostile reduction

نظرية مساعف لكفاية قابلية الرصد قبل الفعل

Moussaif Pre-Action Observability Sufficiency Theory

مهام APIs/DB/browser/email ذات درجات readback مختلفة؛ أخف sensor/receipts عمدا وقارن execute-first مقابل instrument-before-act PAOST.

Design axis	Requirement
Baseline A	nearest parent under same model/tools
Baseline B	direct engineering solution without new theory
Treatment	M-PAOST full mechanism
Budget	token/tool/time/proof/world-effect exposure matched
Splits	calibration + hidden held-out + transfer
Seeds	repeated stochastic runs; report variance
Primary metric	unverifiable action rate
Secondary	postcondition coverage · detection latency · blind-side-effect rate · instrumentation overhead
Guardrails	authority, safety, cost, latency, rollback, calibration
Faults	timeouts, stale state, wrong source, partial effects, model/tool swap
Evidence	raw traces + scorer version + environment hash
Verdict	PROMOTE / MERGE / REVISE / HOLD / REJECT

```
N4 = controlled matched-budget gain with no critical regression; N5 = independent cross-model/domain/environment replication.
```

V4-09.8 | التنبؤات والتنفيذ وسياسة النتيجة السلبية

V4-09 · M-PAOST · Candidate N0-N2 · internal novelty after hostile reduction

نظرية مساعف لكفاية قابلية الرصد قبل الفعل

Moussaif Pre-Action Observability Sufficiency Theory

Predictions

- خفض unverifiable-success states.
- زيادة اكتشاف side effects مبكرا.
- تقليل actions التي لا يمكن rollback/repair بسبب غياب signal.

Implementation ladder

- schema + unit tests
- reference sandbox service
- fault-injection suite
- passive telemetry baseline
- shadow comparison
- canary on bounded missions
- controlled benchmark
- transfer benchmark
- promotion/deprecation receipt
- continuous monitoring

Negative-result policy

- if no independent gain -> MERGE
- if gain only one environment -> HOLD/N3
- if cost dominates -> REVISE fast path
- if safety regression -> REJECT/rollback
- if parent improves equally -> deprecate candidate

Research output

كل نتيجة تتحول إلى ExperimentRecord وNegativeKnowledge أو PromotionReceipt، بحيث لا يضيع الفشل ولا يتحول مرة أخرى إلى نظرية جديدة بلا داع.

V4-10.1 | الأصل، الـResidual، ودفاع الجدة

V4-10 · M-CRKCIT · Candidate N0-N2 · internal novelty after hostile reduction

نظرية مساعف لاتساق المعرفة عبر التمثيلات وإبطالها

Moussaif Cross-Representation Knowledge Coherence and Invalidation Theory

Residual

المنظومة تخزن المعرفة في memory، HyperSkills، context caches، embeddings، graph، source docs، weights وربما adapters. تحديث الحقيقة في مصدر واحد لا يعني أن representations المشتقة بطلت أو أعيد بناؤها. freshness لل claim وحدها لا تحل derived-state coherence.

Nearest prior mechanisms

- Epistemic half-life
- HyperKnowledge provenance
- semantic homeostasis
- Graph-to-Gradient promotion.

Novelty defense

ينشئ DerivationGraph بين representations ويعامل update/revocation كـinvalidation wave. كل مشتق يحمل dependency hash وsemantic contract، لا يبقى canonical إذا تغير source ancestor خارج tolerance.

Hostile reduction questions

- هل parent أبسط يملك نفس state object؟
- هل الفارق مجرد metric جديد على mechanism قديم؟
- هل يمكن تنفيذ candidate بلا object جديد؟
- هل failure signature مختلف ومشاهد؟
- هل authority/rollback/observability boundary مختلفة؟

Null outcome

إذا كانت الإجابة العملية لا، يدمج candidate مع parent ولا يحافظ الاسم على استقلاله.

V4-10.2 | الأنطولوجيا وآلة الحالة

V4-10 · M-CRKCIT · Candidate N0-N2 · internal novelty after hostile reduction

نظرية مساعف لاتساق المعرفة عبر التمثيلات وإبطالها

Moussaif Cross-Representation Knowledge Coherence and Invalidation Theory

Object	Role	Mandatory metadata
RepresentationNode	primary state object	id + version + scope + owner + provenance + lifecycle
DerivationEdge	evidence/relationship object	id + version + scope + owner + provenance + lifecycle
DependencyHash	control object	id + version + scope + owner + provenance + lifecycle
InvalidationWave	audit/replay object	id + version + scope + owner + provenance + lifecycle
CoherenceCheck	primary state object	id + version + scope + owner + provenance + lifecycle
RebuildJob	evidence/relationship object	id + version + scope + owner + provenance + lifecycle
StaleDerivative	control object	id + version + scope + owner + provenance + lifecycle

State machine

```
NEW -> TYPED -> VALIDATED -> ACTIVE -> CONFLICT|BLOCKED|AMBIGUOUS -> VERIFIED
-> PROMOTED|ROLLED_BACK|RETIRED
```

Ontology safety

- object type controls allowed transitions
- no prose-only mutation
- branch/version identities never silently reused
- every conflict is represented, not narrated away
- receipts retain parent snapshot and causal reason

V4-10.3 | القياس، المعايرة، وقابلية التعرف

V4-10 · M-CRKCIT · Candidate N0-N2 · internal novelty after hostile reduction

نظرية مساعف لاتساق المعرفة عبر التمثيلات وإبطالها

Moussaif Cross-Representation Knowledge Coherence and Invalidation Theory

```
KnowledgeCoherence = ValidDerivatives/ReachableDerivatives - StaleCriticalDerivativePenalty; InvalidationPriority = Impact*Reach*Volatility/RepairCost
```

Metrics

- stale derivative action rate
- invalidation precision/recall
- rebuild latency
- cross-representation contradiction
- dependency coverage

Identifiability

- define observable proxy before outcome
- separate predictive from causal use
- calibrate thresholds on non-test data
- report CI/variance and worst slice
- test monotonicity where assumed
- ablate each term and compare simpler score

Metric attack

- proxy gaming
- selection bias
- shared-root evidence
- metric substitution
- threshold leakage from held-out
- aggregate hides critical subgroup failure

V4-10.4 | الآلية والخوارزمية والاقتصاد الحسابي

V4-10 · M-CRKCIT · Candidate N0-N2 · internal novelty after hostile reduction

نظرية مساعف لاتساق المعرفة عبر التمثيلات وإبطالها

Moussaif Cross-Representation Knowledge Coherence and Invalidation Theory

Mechanism steps

- تسجيل provenance ليس فقط source بل transformation chain.
- حساب dependency hashes لكل graph/index/skill/memory/adapter candidate.
- عند source change إطلاق invalidation wave بحسب semantic delta.
- rebuild أو revalidate المشتقات الأعلى impact أولا.
- لا توصف weights إلا عبر eval/rollback لا direct invalidation.

Reference transaction

```
read(snapshot) -> derive signal -> propose transition -> validate authority/
constraints -> execute/simulate -> authoritative readback -> court -> commit
memory/state delta
```

Complexity budget

- fast path bypasses expensive court when risk/evidence allow
- expensive branch only on signature failure
- cache only versioned derived values
- bound retries and experiment count
- record cost per verified state change

Stop conditions

- postcondition reached
- no marginal progress
- budget exhausted
- authority unavailable
- falsifier observed
- repair/rollback dominates continuation

V4-10.5 | الربط بالـ24 طبقة

V4-10 · M-CRKCIT · Candidate N0-N2 · internal novelty after hostile reduction

نظرية مساعف لاتساق المعرفة عبر التمثيلات وإبطالها

Moussaif Cross-Representation Knowledge Coherence and Invalidation Theory

Layer	Role	State objects
L02	المصدر والنسب والهوية المعيارية	Ingest, hashes, aliases, canonical identity graph, semantic duplicate candidates, source ranking.
L07	نموذج العالم والحالة الموثوقة	Observed/inferred/proposed/remembered separation, source precedence, validity time, state conflict.
L08	الاسترجاع وجينوم السياق	Minimal sufficient retrieval, GraphRAG, context compaction, provenance pointers, contradiction-aware retrieval.
L12	المهارات القائمة والقدرات الذرية	Typed skill contracts, preconditions, outputs, evidence, rollback, versioning, transfer tests.
L21	التدريب والتطوير والترقية	Verified-trace quarantine, dataset manifests, LoRA/adapters, frozen eval, forgetting vector, shadow/canary, rollback.
L22	اتساق التمثيلات وتطور المعمارية	Invalidation waves, dependency derivation graph, proof-preserving refactor, deprecation lineage, architecture compression.

Upstream contract

- mission_id/trace_id
- goal/question/difference when relevant
- typed world/knowledge snapshot
- authority and risk tier
- epoch/version dependencies

Downstream contract

- typed decision/state delta
- metric reading
- evidence/trace receipt
- explicit failure/uncertainty
- rollback/recovery/invalidation references

Deployment mode

- passive telemetry
- shadow decision
- canary mutation
- scoped production
- cross-environment replication

V4-10.6 | الفشل، الخصومة، وحدود السلطة

V4-10 · M-CRKCIT · Candidate N0-N2 · internal novelty after hostile reduction

نظرية مساعف لاتساق المعرفة عبر التمثيلات وإبطالها

Moussaif Cross-Representation Knowledge Coherence and Invalidation Theory

Decisive falsifiers

- TTL بسيط يحقق نفس النتائج.
- derivation graph معقد وغير مكتمل فلا يخفض stale errors.
- semantic delta لا يتنبأ بضرورة rebuild.

Adversarial matrix

- stale but high-authority source
- conflicting independent observations
- permission revoked mid-loop
- provider/tool substituted
- context compacted beyond loss budget
- duplicate action after timeout
- negative world effect hidden by successful API receipt
- memory contains prior false success
- verifier shares model/context with executor

Security/ethics boundary

- no escalation of authority from performance
- privacy/project scope preserved
- high-impact uncertainty cannot be hidden by average metric
- human/nondelegable decisions remain explicit
- blocked/partial preferred to fabricated completion

V4-10.7 | التجربة الحاسمة والـAblation

V4-10 · M-CRKCIT · Candidate N0-N2 · internal novelty after hostile reduction

نظرية مساعف لاتساق المعرفة عبر التمثيلات وإبطالها

Moussaif Cross-Representation Knowledge Coherence and Invalidation Theory

غير policy/fact/schema مصدرية ثم اختبر graph/index/context/skills/memory/adapters؛ manual refresh، baseline TTL، ثم CRKCIT dependency invalidation.

Design axis	Requirement
Baseline A	nearest parent under same model/tools
Baseline B	direct engineering solution without new theory
Treatment	M-CRKCIT full mechanism
Budget	token/tool/time/proof/world-effect exposure matched
Splits	calibration + hidden held-out + transfer
Seeds	repeated stochastic runs; report variance
Primary metric	stale derivative action rate
Secondary	invalidation precision/recall · rebuild latency · cross-representation contradiction · dependency coverage
Guardrails	authority, safety, cost, latency, rollback, calibration
Faults	timeouts, stale state, wrong source, partial effects, model/tool swap
Evidence	raw traces + scorer version + environment hash
Verdict	PROMOTE / MERGE / REVISE / HOLD / REJECT

```
N4 = controlled matched-budget gain with no critical regression; N5 = independent cross-model/domain/environment replication.
```

V4-10.8 | التنبؤات والتنفيذ وسياسة النتيجة السلبية

V4-10 · M-CRKCIT · Candidate N0-N2 · internal novelty after hostile reduction

نظرية مساعف لاتساق المعرفة عبر التمثيلات وإبطالها

Moussaif Cross-Representation Knowledge Coherence and Invalidation Theory

Predictions

- خفض استخدام skill أو memory مبنية على source revoked.
- تقليل contradictions بين GraphRAG وcontext وskill.
- تحسين زمن التعافي بعد policy/knowledge update كبير.

Implementation ladder

- schema + unit tests
- reference sandbox service
- fault-injection suite
- passive telemetry baseline
- shadow comparison
- canary on bounded missions
- controlled benchmark
- transfer benchmark
- promotion/deprecation receipt
- continuous monitoring

Negative-result policy

- if no independent gain -> MERGE
- if gain only one environment -> HOLD/N3
- if cost dominates -> REVISE fast path
- if safety regression -> REJECT/rollback
- if parent improves equally -> deprecate candidate

Research output

كل نتيجة تتحول إلى ExperimentRecord وNegativeKnowledge أو PromotionReceipt، بحيث لا يضيع الفشل ولا يتحول مرة أخرى إلى نظرية جديدة بلا داع.

ART-01 | سجل الأصول التشغيلية

V4A-001 · TOOL · V4-01

مدير لقطة الحالة المعرفية

Cognitive Snapshot Manager

Failure: لا فرق قابل للقياس عن versioned store بسيط.

Recovery: rollback to parent snapshot

Acceptance: deterministic typed output, trace/evidence receipt, no authority expansion, negative test passes.

Owners: L07 · L09 · L10 · L14 · L20

Trigger: high-impact transition is proposed

Preconditions: authority/risk profile + mission_id + policy/model epoch.

Transition: <- Cognitive Snapshot Manager: high-impact transition is proposed validate(authority/risk profile) -> operate on KnowledgeSnapshot -> emit receipt + epistemic conflict rate

Metric: `epistemic conflict rate`

Promotion: N0 specification -> N1 schema -> N2 executable candidate -> N3 verified trace -> N4 matched-budget gain -> N5 cross-environment replication

V4A-002 · TOOL · V4-01

متتبع مجموعة القراءة المعرفية

Epistemic Read-Set Tracer

Failure: تكلفة isolation تفوق منع الأخطاء في المهام الفعلية.

Recovery: rebase on current version and replay

Acceptance: deterministic typed output, trace/evidence receipt, no authority expansion, negative test passes.

Owners: L07 · L09 · L10 · L14 · L20

Trigger: version/epoch changes

Preconditions: versioned state snapshot + mission_id + policy/model epoch.

Transition: Epistemic Read-Set Tracer: version/epoch changes -> validate(versioned state snapshot) -> operate on BeliefVersion -> emit receipt + stale-read action rate

Metric: `stale-read action rate`

Promotion: N0 specification -> N1 schema -> N2 executable candidate -> N3 verified trace -> N4 matched-budget gain -> N5 cross-environment replication

V4A-003 · TOOL · V4-01

كاشف الادعاء الشبح

Phantom Claim Detector

Failure: إعادة التشغيل لا تستعيد نفس reasoning dependencies حتى مع snapshot.

Recovery: quarantine output and escalate to court

Acceptance: deterministic typed output, trace/evidence receipt, no authority expansion, negative test passes.

Owners: L07 · L09 · L10 · L14 · L20

Trigger: replay or verifier requests reconstruction

Preconditions: source/evidence pointers + mission_id + policy/model epoch.

Transition: <- Phantom Claim Detector: replay or verifier requests reconstruction validate(source/evidence pointers) -> operate on ReadSet -> emit receipt + commit abort precision

Metric: `commit abort precision`

Promotion: N0 specification -> N1 schema -> N2 executable candidate -> N3 verified trace -> N4 matched-budget gain -> N5 cross-environment replication

Composition note
V4-01
: artifacts on this page compose into M-CTIT only when their receipts share mission/version lineage; standalone success does not promote the theory.

```
Artifact value = decision/effect improvement + failure localization + replayability - authority/cost/complexity penalties
```

ART-02 | سجل الأصول التشغيلية

V4A-004 · TOOL · V4-01

حال تعارض كتابة الاعتقاد

Belief Write-Conflict Resolver

Failure: لا فرق قابل للقياس عن versioned store بسيط.

Recovery: return BLOCKED/PARTIAL with reason

Acceptance: deterministic typed output, trace/evidence receipt, no authority expansion, negative test passes.

Owners: L07 · L09 · L10 · L14 · L20

Promotion: N0 specification -> N1 schema -> N2 executable candidate -> N3 verified trace -> N4 matched-budget gain -> N5 cross-environment replication

Trigger: state/evidence conflict appears

Preconditions: typed mission context + mission_id + policy/model epoch.

Transition: Belief Write-Conflict Resolver: state/evidence conflict appears -> validate(typed mission context) -> operate on WriteSet -> emit receipt + replay determinism

Metric: `replay determinism`

V4A-005 · METHOD · V4-01

منهج اختيار العزل المتكيف مع المخاطر

Risk-Adaptive Isolation Selection

Failure: تكلفة isolation تفوق منع الأخطاء في المهام الفعلية.

Recovery: rollback to parent snapshot

Acceptance: deterministic typed output, trace/evidence receipt, no authority expansion, negative test passes.

Owners: L07 · L09 · L10 · L14 · L20

Promotion: N0 specification -> N1 schema -> N2 executable candidate -> N3 verified trace -> N4 matched-budget gain -> N5 cross-environment replication

Trigger: high-impact transition is proposed

Preconditions: authority/risk profile + mission_id + policy/model epoch.

Transition: <- Risk-Adaptive Isolation Selection: high-impact transition is proposed validate(authority/risk profile) -> operate on EpistemicLock -> emit receipt + latency overhead

Metric: `latency overhead`

Composition note

V4-01

: artifacts on this page compose into M-CTIT only when their receipts share mission/version lineage; standalone success does not promote the theory.

```
Artifact value = decision/effect improvement + failure localization + replayability - authority/cost/complexity penalties
```

ART-03 | سجل الأصول التشغيلية

V4A-006 · METHOD · V4-01

منهج التحقق المعرفي التفاؤلي

Optimistic Epistemic Validation

Failure: إعادة التشغيل لا تستعيد نفس reasoning dependencies حتى مع snapshot.

Recovery: rebase on current version and replay

Acceptance: deterministic typed output, trace/evidence receipt, no authority expansion, negative test passes.

Owners: L07 · L09 · L10 · L14 · L20

Promotion: N0 specification -> N1 schema -> N2 executable candidate -> N3 verified trace -> N4 matched-budget gain -> N5 cross-environment replication

Trigger: version/epoch changes

Preconditions: versioned state snapshot + mission_id + policy/model epoch.

Transition: Optimistic Epistemic Validation: version/epoch changes -> validate(versioned state snapshot) -> operate on CommitReceipt -> emit receipt + epistemic conflict rate

Metric: `epistemic conflict rate`

V4A-007 · PROTOCOL · V4-01

بروتوكول اللقطة قبل المهمة طويلة الأفق

Snapshot-before-Long-Horizon Protocol

Failure: لا فرق قابل للقياس عن versioned store بسيط.

Recovery: quarantine output and escalate to court

Acceptance: deterministic typed output, trace/evidence receipt, no authority expansion, negative test passes.

Owners: L07 · L09 · L10 · L14 · L20

Promotion: N0 specification -> N1 schema -> N2 executable candidate -> N3 verified trace -> N4 matched-budget gain -> N5 cross-environment replication

Trigger: replay or verifier requests reconstruction

Preconditions: source/evidence pointers + mission_id + policy/model epoch.

Transition: Snapshot-before-Long-Horizon Protocol: replay or verifier requests reconstruction -> validate(source/evidence pointers) -> operate on ConflictRecord -> emit receipt + stale-read action rate

Metric: `stale-read action rate`

V4A-008 · PROTOCOL · V4-01

بروتوكول إيداع الذاكرة القابل للتسلسل

Serializable-Memory-Commit Protocol

Failure: تكلفة isolation تفوق منع الأخطاء في المهام الفعلية.

Recovery: return BLOCKED/PARTIAL with reason

Acceptance: deterministic typed output, trace/evidence receipt, no authority expansion, negative test passes.

Owners: L07 · L09 · L10 · L14 · L20

Promotion: N0 specification -> N1 schema -> N2 executable candidate -> N3 verified trace -> N4 matched-budget gain -> N5 cross-environment replication

Trigger: state/evidence conflict appears

Preconditions: typed mission context + mission_id + policy/model epoch.

Transition: Serializable-Memory-Commit Protocol: state/evidence conflict appears -> validate(typed mission context) -> operate on CognitiveTransaction -> emit receipt + commit abort precision

Metric: `commit abort precision`

Composition note
V4-01
: artifacts on this page compose into M-CTIT only when their receipts share mission/version lineage; standalone success does not promote the theory.

```
Artifact value = decision/effect improvement + failure localization + replayability - authority/cost/complexity penalties
```

ART-04 | سجل الأصول التشغيلية

V4A-009 · STACK · V4-01

خدمة المعاملات المعرفية

Cognitive Transaction Service

Failure: إعادة التشغيل لا تستعيد نفس reasoning dependencies حتى مع snapshot.

Recovery: rollback to parent snapshot

Acceptance: deterministic typed output, trace/evidence receipt, no authority expansion, negative test passes.

Owners: L07 · L09 · L10 · L14 · L20

Trigger: high-impact transition is proposed

Preconditions: authority/risk profile + mission_id + policy/model epoch.

Transition: Cognitive Transaction Service: high-impact transition is proposed -> validate(authority/risk profile) -> operate on KnowledgeSnapshot -> emit receipt + replay determinism

Metric: `replay determinism`

Promotion: N0 specification -> N1 schema -> N2 executable candidate -> N3 verified trace -> N4 matched-budget gain -> N5 cross-environment replication

V4A-010 · STACK · V4-01

محكمة تعارض الحالة المعرفية

Epistemic Conflict Court

Failure: لا فرق قابل للقياس عن versioned store بسيط.

Recovery: rebase on current version and replay

Acceptance: deterministic typed output, trace/evidence receipt, no authority expansion, negative test passes.

Owners: L07 · L09 · L10 · L14 · L20

Trigger: version/epoch changes

Preconditions: versioned state snapshot + mission_id + policy/model epoch.

Transition: Epistemic Conflict Court: version/epoch changes -> validate(versioned state snapshot) -> operate on BeliefVersion -> emit receipt + latency overhead

Metric: `latency overhead`

Promotion: N0 specification -> N1 schema -> N2 executable candidate -> N3 verified trace -> N4 matched-budget gain -> N5 cross-environment replication

Composition note
V4-01
: artifacts on this page compose into M-CTIT only when their receipts share mission/version lineage; standalone success does not promote the theory.

```
Artifact value = decision/effect improvement + failure localization + replayability - authority/cost/complexity penalties
```

ART-05 | سجل الأصول التشغيلية

V4A-011 · TOOL · V4-02

مقياس الحرارة الإبستيمية

Epistemic Temperature Meter

Failure: threshold عادي للثقة يحقق نفس النتائج.

Recovery: quarantine output and escalate to court

Acceptance: deterministic typed output, trace/evidence receipt, no authority expansion, negative test passes.

Owners: L03 · L04 · L05 · L18 · L23

Trigger: replay or verifier requests reconstruction

Preconditions: source/evidence pointers + mission_id + policy/model epoch.

Transition: Epistemic Temperature Meter: replay or verifier requests reconstruction -> validate(source/evidence pointers) -> operate on ParalysisEvent -> emit receipt + ECE by risk tier

Metric: `ECE by risk tier`

Promotion: N0 specification -> N1 schema -> N2 executable candidate -> N3 verified trace -> N4 matched-budget gain -> N5 cross-environment replication

V4A-012 · TOOL · V4-02

مراقب معايرة نطاق المخاطر

Risk-Band Calibration Monitor

Failure: الترموستات يسبب oscillation بين البحث والامتناع.

Recovery: return BLOCKED/PARTIAL with reason

Acceptance: deterministic typed output, trace/evidence receipt, no authority expansion, negative test passes.

Owners: L03 · L04 · L05 · L18 · L23

Trigger: state/evidence conflict appears

Preconditions: typed mission context + mission_id + policy/model epoch.

Transition: Risk-Band Calibration Monitor: state/evidence conflict appears -> validate(typed mission context) -> operate on RebalanceAction -> emit receipt + overconfidence action rate

Metric: `overconfidence action rate`

Promotion: N0 specification -> N1 schema -> N2 executable candidate -> N3 verified trace -> N4 matched-budget gain -> N5 cross-environment replication

V4A-013 · TOOL · V4-02

كاشف فرط الثقة

Overconfidence Overheat Detector

Failure: لا تحسن في expected calibration error أو utility.

Recovery: rollback to parent snapshot

Acceptance: deterministic typed output, trace/evidence receipt, no authority expansion, negative test passes.

Owners: L03 · L04 · L05 · L18 · L23

Trigger: high-impact transition is proposed

Preconditions: authority/risk profile + mission_id + policy/model epoch.

Transition: Overconfidence Overheat Detector: high-impact transition is proposed -> validate(authority/risk profile) -> operate on RiskClass -> emit receipt + paralysis rate

Metric: `paralysis rate`

Promotion: N0 specification -> N1 schema -> N2 executable candidate -> N3 verified trace -> N4 matched-budget gain -> N5 cross-environment replication

Composition note

V4-02

: artifacts on this page compose into M-ETUHT only when their receipts share mission/version lineage; standalone success does not promote the theory.

```
Artifact value = decision/effect improvement + failure localization + replayability - authority/cost/complexity penalties
```

ART-06 | سجل الأصول التشغيلية

V4A-014 · TOOL · V4-02

كاشف الشلل الإثباتي

Proof-Paralysis Detector

Failure: threshold عادي للثقة يحقق نفس النتائج.

Recovery: rebase on current version and replay

Acceptance: deterministic typed output, trace/evidence receipt, no authority expansion, negative test passes.

Owners: L03 · L04 · L05 · L18 · L23

Trigger: version/epoch changes

Preconditions: versioned state snapshot + mission_id + policy/model epoch.

Transition: Proof-Paralysis Detector: version/epoch changes -> validate(versioned state snapshot) -> operate on UncertaintyBudget -> emit receipt + proof cost / verified effect

Metric: `proof cost / verified effect`

Promotion: N0 specification -> N1 schema -> N2 executable candidate -> N3 verified trace -> N4 matched-budget gain -> N5 cross-environment replication

V4A-015 · METHOD · V4-02

منهج تخصيص ميزانية عدم اليقين

Uncertainty Budget Allocation

Failure: الترموستات يسبب oscillation بين البحث والامتناع.

Recovery: quarantine output and escalate to court

Acceptance: deterministic typed output, trace/evidence receipt, no authority expansion, negative test passes.

Owners: L03 · L04 · L05 · L18 · L23

Trigger: replay or verifier requests reconstruction

Preconditions: source/evidence pointers + mission_id + policy/model epoch.

Transition: <- Uncertainty Budget Allocation: replay or verifier requests reconstruction validate(source/evidence pointers) -> operate on CalibrationBand -> emit receipt + temperature oscillation

Metric: `temperature oscillation`

Promotion: N0 specification -> N1 schema -> N2 executable candidate -> N3 verified trace -> N4 matched-budget gain -> N5 cross-environment replication

Composition note
V4-02
: artifacts on this page compose into M-ETUHT only when their receipts share mission/version lineage; standalone success does not promote the theory.

```
Artifact value = decision/effect improvement + failure localization + replayability - authority/cost/complexity penalties
```

ART-07 | سجل الأصول التشغيلية

V4A-016 · METHOD · V4-02

منهج التحكم الراجع في المعايرة

Feedback Calibration Control

Failure: لا تحسن في expected calibration error أو utility.

Recovery: return BLOCKED/PARTIAL with reason

Acceptance: deterministic typed output, trace/evidence receipt, no authority expansion, negative test passes.

Owners: L03 · L04 · L05 · L18 · L23

Trigger: state/evidence conflict appears

Preconditions: typed mission context + mission_id + policy/model epoch.

Transition: Feedback Calibration Control: state/evidence conflict appears -> validate(typed mission context) -> operate on EpistemicTemperature -> emit receipt + ECE by risk tier

Metric: `ECE by risk tier`

Promotion: N0 specification -> N1 schema -> N2 executable candidate -> N3 verified trace -> N4 matched-budget gain -> N5 cross-environment replication

V4A-017 · PROTOCOL · V4-02

بروتوكول إعادة اتزان عدم اليقين

Uncertainty Rebalance Protocol

Failure: threshold عادي للثقة يحقق نفس النتائج.

Recovery: rollback to parent snapshot

Acceptance: deterministic typed output, trace/evidence receipt, no authority expansion, negative test passes.

Owners: L03 · L04 · L05 · L18 · L23

Trigger: high-impact transition is proposed

Preconditions: authority/risk profile + mission_id + policy/model epoch.

Transition: <- Uncertainty Rebalance Protocol: high-impact transition is proposed validate(authority/risk profile) -> operate on OverheatEvent -> emit receipt + overconfidence action rate

Metric: `overconfidence action rate`

Promotion: N0 specification -> N1 schema -> N2 executable candidate -> N3 verified trace -> N4 matched-budget gain -> N5 cross-environment replication

V4A-018 · PROTOCOL · V4-02

بروتوكول لا فعل خارج النطاق المعاير

No-Action-outside-Calibrated-Band

Failure: الترموستات يسبب oscillation بين البحث والامتناع.

Recovery: rebase on current version and replay

Acceptance: deterministic typed output, trace/evidence receipt, no authority expansion, negative test passes.

Owners: L03 · L04 · L05 · L18 · L23

Trigger: version/epoch changes

Preconditions: versioned state snapshot + mission_id + policy/model epoch.

Transition: No-Action-outside-Calibrated-Band: version/epoch changes -> validate(versioned state snapshot) -> operate on ParalysisEvent -> emit receipt + paralysis rate

Metric: `paralysis rate`

Promotion: N0 specification -> N1 schema -> N2 executable candidate -> N3 verified trace -> N4 matched-budget gain -> N5 cross-environment replication

Composition note

V4-02

: artifacts on this page compose into M-ETUHT only when their receipts share mission/version lineage; standalone success does not promote the theory.

```
Artifact value = decision/effect improvement + failure localization + replayability - authority/cost/complexity penalties
```

ART-08 | سجل الأصول التشغيلية

V4A-019 · STACK · V4-02

خدمة الترموستات الإبستيمي

Epistemic Thermostat Service

Failure: لا تحسن في expected calibration error أو utility.

Recovery: quarantine output and escalate to court

Acceptance: deterministic typed output, trace/evidence receipt, no authority expansion, negative test passes.

Owners: L03 · L04 · L05 · L18 · L23

Promotion: N0 specification -> N1 schema -> N2 executable candidate -> N3 verified trace -> N4 matched-budget gain -> N5 cross-environment replication

Trigger: replay or verifier requests reconstruction

Preconditions: source/evidence pointers + mission_id + policy/model epoch.

Transition: Epistemic Thermostat Service: replay or verifier requests reconstruction -> validate(source/evidence pointers) -> operate on RebalanceAction -> emit receipt + proof cost / verified effect

Metric: `proof cost / verified effect`

V4A-020 · STACK · V4-02

مرصد المعايرة واللايقين

Calibration Observatory

Failure: threshold عادي للثقة يحقق نفس النتائج.

Recovery: return BLOCKED/PARTIAL with reason

Acceptance: deterministic typed output, trace/evidence receipt, no authority expansion, negative test passes.

Owners: L03 · L04 · L05 · L18 · L23

Promotion: N0 specification -> N1 schema -> N2 executable candidate -> N3 verified trace -> N4 matched-budget gain -> N5 cross-environment replication

Trigger: state/evidence conflict appears

Preconditions: typed mission context + mission_id + policy/model epoch.

Transition: Calibration Observatory: state/evidence conflict appears -> validate(typed mission context) -> operate on RiskClass -> emit receipt + temperature oscillation

Metric: `temperature oscillation`

Composition note
V4-02
: artifacts on this page compose into M-ETUHT only when their receipts share mission/version lineage; standalone success does not promote the theory.

```
Artifact value = decision/effect improvement + failure localization + replayability - authority/cost/complexity penalties
```

ART-09 | سجل الأصول التشغيلية

V4A-021 · TOOL · V4-03

سجل الحالة الذاتية المثبتة

Attested Self-State Registry

Failure: لا فرق عن RBAC + environment discovery.

Recovery: rollback to parent snapshot

Acceptance: no authority expansion, trace/evidence receipt, deterministic typed output, negative test passes.

Owners: L00 · L01 · L14 · L16 · L20

Trigger: high-impact transition is proposed

Preconditions: policy/model epoch + mission_id + authority/risk profile.

Transition: Attested Self-State Registry: high-impact transition is proposed -> validate(authority/risk profile) -> operate on SelfStateRecord -> emit receipt + self-claim precision

Metric: `self-claim precision`

Promotion: N0 specification -> N1 schema -> N2 executable candidate -> N3 verified trace -> N4 matched-budget gain -> N5 cross-environment replication

V4A-022 · TOOL · V4-03

مدقق دعاوى القدرة

Capability Claim Auditor

Failure: self-check لا يتنبأ بأي فشل.

Recovery: rebase on current version and replay

Acceptance: no authority expansion, trace/evidence receipt, deterministic typed output, negative test passes.

Owners: L00 · L01 · L14 · L16 · L20

Trigger: version/epoch changes

Preconditions: policy/model epoch + mission_id + versioned state snapshot.

Transition: Capability Claim Auditor: version/epoch changes -> validate(versioned state snapshot) -> operate on CapabilityClaim -> emit receipt + permission hallucination rate

Metric: `permission hallucination rate`

Promotion: N0 specification -> N1 schema -> N2 executable candidate -> N3 verified trace -> N4 matched-budget gain -> N5 cross-environment replication

V4A-023 · TOOL · V4-03

فاحص حدود الصلاحية

Permission Boundary Checker

Failure: القيود تعيق harmless reasoning دون تحسين أمان.

Recovery: quarantine output and escalate to court

Acceptance: no authority expansion, trace/evidence receipt, deterministic typed output, negative test passes.

Owners: L00 · L01 · L14 · L16 · L20

Trigger: replay or verifier requests reconstruction

Preconditions: policy/model epoch + mission_id + source/evidence pointers.

Transition: Permission Boundary Checker: replay or verifier requests reconstruction -> validate(source/evidence pointers) -> operate on PermissionClaim -> emit receipt + identity bleed incidents

Metric: `identity bleed incidents`

Promotion: N0 specification -> N1 schema -> N2 executable candidate -> N3 verified trace -> N4 matched-budget gain -> N5 cross-environment replication

Composition note

V4-03

: artifacts on this page compose into M-SMBIT only when their receipts share mission/version lineage; standalone success does not promote the theory.

```
Artifact value = decision/effect improvement + failure localization + replayability - authority/cost/complexity penalties
```

ART-10 | سجل الأصول التشغيلية

V4A-024 · TOOL · V4-03

كاشف تسرب هوية المشروع

Project Identity-Bleed Detector

Failure: لا فرق عن RBAC + environment discovery.

Recovery: return BLOCKED/PARTIAL with reason

Acceptance: deterministic typed output, trace/evidence receipt, no authority expansion, negative test passes.

Owners: L00 · L01 · L14 · L16 · L20

Promotion: N0 specification -> N1 schema -> N2 executable candidate -> N3 verified trace -> N4 matched-budget gain -> N5 cross-environment replication

Trigger: state/evidence conflict appears

Preconditions: typed mission context + mission_id + policy/model epoch.

Transition: Project Identity-Bleed Detector: state/evidence conflict appears -> validate(typed mission context) -> operate on RuntimeIdentity -> emit receipt + capability lookup hit

Metric: `capability lookup hit`

V4A-025 · METHOD · V4-03

منهج مصالحة الذات بالحالة المرصودة

Tool-Returned Self-Reconciliation

Failure: self-check لا يتنبأ بأي فشل.

Recovery: rollback to parent snapshot

Acceptance: deterministic typed output, trace/evidence receipt, no authority expansion, negative test passes.

Owners: L00 · L01 · L14 · L16 · L20

Promotion: N0 specification -> N1 schema -> N2 executable candidate -> N3 verified trace -> N4 matched-budget gain -> N5 cross-environment replication

Trigger: high-impact transition is proposed

Preconditions: authority/risk profile + mission_id + policy/model epoch.

Transition: <- Tool-Returned Self-Reconciliation: high-impact transition is proposed -validate(authority/risk profile) -> operate on MemoryBoundary -> emit receipt + provider switch recovery

Metric: `provider-switch recovery`

Composition note
V4-03
: artifacts on this page compose into M-SMBIT only when their receipts share mission/version lineage; standalone success does not promote the theory.

```
Artifact value = decision/effect improvement + failure localization + replayability - authority/cost/complexity penalties
```

ART-11 | سجل الأصول التشغيلية

V4A-026 · METHOD · V4-03

منهج تقييم صدق وصف الذات

Self-Claim Truthfulness Scoring

Failure: القيود تعيق harmless reasoning دون تحسين أمان.

Recovery: rebase on current version and replay

Acceptance: deterministic typed output, trace/evidence receipt, no authority expansion, negative test passes.

Owners: L00 · L01 · L14 · L16 · L20

Promotion: N0 specification -> N1 schema -> N2 executable candidate -> N3 verified trace -> N4 matched-budget gain -> N5 cross-environment replication

Trigger: version/epoch changes

Preconditions: versioned state snapshot + mission_id + policy/model epoch.

Transition: Self-Claim Truthfulness Scoring: version/epoch changes -> validate(versioned state snapshot) -> operate on ModelIdentity -> emit receipt + self-claim precision

Metric: `self-claim precision`

V4A-027 · PROTOCOL · V4-03

بروتوكول تحديث الذات قبل التخطيط

Self-State Refresh-before-Plan

Failure: لا فرق عن RBAC + environment discovery.

Recovery: quarantine output and escalate to court

Acceptance: deterministic typed output, trace/evidence receipt, no authority expansion, negative test passes.

Owners: L00 · L01 · L14 · L16 · L20

Promotion: N0 specification -> N1 schema -> N2 executable candidate -> N3 verified trace -> N4 matched-budget gain -> N5 cross-environment replication

Trigger: replay or verifier requests reconstruction

Preconditions: source/evidence pointers + mission_id + policy/model epoch.

Transition: <- Self-State Refresh-before-Plan: replay or verifier requests reconstruction validate(source/evidence pointers) -> operate on SelfMismatch -> emit receipt + permission hallucination rate

Metric: `permission hallucination rate`

V4A-028 · PROTOCOL · V4-03

بروتوكول منع استنتاج الصلاحية من نجاح سابق

No-Permission-Inference-from-Past-Success

Failure: self-check لا يتنبأ بأي فشل.

Recovery: return BLOCKED/PARTIAL with reason

Acceptance: deterministic typed output, trace/evidence receipt, no authority expansion, negative test passes.

Owners: L00 · L01 · L14 · L16 · L20

Promotion: N0 specification -> N1 schema -> N2 executable candidate -> N3 verified trace -> N4 matched-budget gain -> N5 cross-environment replication

Trigger: state/evidence conflict appears

Preconditions: typed mission context + mission_id + policy/model epoch.

Transition: <- No-Permission-Inference-from-Past-Success: state/evidence conflict appears validate(typed mission context) -> operate on SelfStateRecord -> emit receipt + identity bleed incidents

Metric: `identity bleed incidents`

Composition note
V4-03
: artifacts on this page compose into M-SMBIT only when their receipts share mission/version lineage; standalone success does not promote the theory.

```
Artifact value = decision/effect improvement + failure localization + replayability - authority/cost/complexity penalties
```

ART-12 | سجل الأصول التشغيلية

V4A-029 · STACK · V4-03

خدمة سلامة النموذج الذاتي

Self-Model Integrity Service

Failure: القيود تعيق harmless reasoning دون تحسين أمان.

Recovery: rollback to parent snapshot

Acceptance: deterministic typed output, trace/evidence receipt, no authority expansion, negative test passes.

Owners: L00 · L01 · L14 · L16 · L20

Trigger: high-impact transition is proposed

Preconditions: authority/risk profile + mission_id + policy/model epoch.

Transition: <- Self-Model Integrity Service: high-impact transition is proposed validate(authority/risk profile) -> operate on CapabilityClaim -> emit receipt + capability lookup hit

Metric: `capability lookup hit`

Promotion: N0 specification -> N1 schema -> N2 executable candidate -> N3 verified trace -> N4 matched-budget gain -> N5 cross-environment replication

V4A-030 · STACK · V4-03

محكمة حدود الهوية

Identity Boundary Court

Failure: لا فرق عن RBAC + environment discovery.

Recovery: rebase on current version and replay

Acceptance: deterministic typed output, trace/evidence receipt, no authority expansion, negative test passes.

Owners: L00 · L01 · L14 · L16 · L20

Trigger: version/epoch changes

Preconditions: versioned state snapshot + mission_id + policy/model epoch.

Transition: Identity Boundary Court: version/epoch changes -> validate(versioned state snapshot) -> operate on PermissionClaim -> emit receipt + provider-switch recovery

Metric: `provider-switch recovery`

Promotion: N0 specification -> N1 schema -> N2 executable candidate -> N3 verified trace -> N4 matched-budget gain -> N5 cross-environment replication

Composition note
V4-03
: artifacts on this page compose into M-SMBIT only when their receipts share mission/version lineage; standalone success does not promote the theory.

```
Artifact value = decision/effect improvement + failure localization + replayability - authority/cost/complexity penalties
```

ART-13 | سجل الأصول التشغيلية

V4A-031 · TOOL · V4-04

راسم تبعيات المعمارية

Architecture Dependency Mapper

Failure: compression يسبب فقد capability غير ظاهر في benchmark.

Recovery: quarantine output and escalate to court

Acceptance: deterministic typed output, trace/evidence receipt, no authority expansion, negative test passes.

Owners: L02 · L12 · L13 · L22 · L23

Trigger: replay or verifier requests reconstruction

Preconditions: source/evidence pointers + mission_id + policy/model epoch.

Transition: <- Architecture Dependency Mapper: replay or verifier requests reconstruction validate(source/evidence pointers) -> operate on RefactorCandidate -> emit receipt + verified coverage / component

Metric: `verified coverage / component`

Promotion: N0 specification -> N1 schema -> N2 executable candidate -> N3 verified trace -> N4 matched-budget gain -> N5 cross-environment replication

V4A-032 · TOOL · V4-04

مقياس المنفعة الهامشية للمكون

Marginal Component Utility Meter

Failure: لا ارتباط بين complexity load والفشل.

Recovery: return BLOCKED/PARTIAL with reason

Acceptance: deterministic typed output, trace/evidence receipt, no authority expansion, negative test passes.

Owners: L02 · L12 · L13 · L22 · L23

Trigger: state/evidence conflict appears

Preconditions: typed mission context + mission_id + policy/model epoch.

Transition: <- Marginal Component Utility Meter: state/evidence conflict appears + validate(typed mission context) -> operate on BehavioralEquivalenceSet -> emit receipt dependency entropy

Metric: `dependency entropy`

Promotion: N0 specification -> N1 schema -> N2 executable candidate -> N3 verified trace -> N4 matched-budget gain -> N5 cross-environment replication

V4A-033 · TOOL · V4-04

كاشف مرشحات الدمج السلوكي

Behavioral Merge Candidate Finder

Failure: manual architecture review يحقق نفس النتيجة بكلفة أقل.

Recovery: rollback to parent snapshot

Acceptance: deterministic typed output, trace/evidence receipt, no authority expansion, negative test passes.

Owners: L02 · L12 · L13 · L22 · L23

Trigger: high-impact transition is proposed

Preconditions: authority/risk profile + mission_id + policy/model epoch.

Transition: <- Behavioral Merge Candidate Finder: high-impact transition is proposed validate(authority/risk profile) -> operate on RefactorReceipt -> emit receipt + test surface size

Metric: `test surface size`

Promotion: N0 specification -> N1 schema -> N2 executable candidate -> N3 verified trace -> N4 matched-budget gain -> N5 cross-environment replication

Composition note

V4-04

: artifacts on this page compose into M-RACPRT only when their receipts share mission/version lineage; standalone success does not promote the theory.

```
Artifact value = decision/effect improvement + failure localization + replayability - authority/cost/complexity penalties
```

ART-14 | سجل الأصول التشغيلية

V4A-034 · TOOL · V4-04

محاكي انحدار إعادة الهيكلة

Refactor Regression Simulator

Failure: compression يسبب فقد capability غير ظاهر في benchmark.

Recovery: rebase on current version and replay

Acceptance: deterministic typed output, trace/evidence receipt, no authority expansion, negative test passes.

Owners: L02 · L12 · L13 · L22 · L23

Trigger: version/epoch changes

Preconditions: versioned state snapshot + mission_id + policy/model epoch.

Transition: Refactor Regression Simulator: version/epoch changes -> validate(versioned state snapshot) -> operate on DeprecationLineage -> emit receipt + refactor regression rate

Metric: `refactor regression rate`

Promotion: N0 specification -> N1 schema -> N2 executable candidate -> N3 verified trace -> N4 matched-budget gain -> N5 cross-environment replication

V4A-035 · METHOD · V4-04

منهج إعادة الهيكلة الحافظ للبرهان

Proof-Preserving Refactor Method

Failure: لا ارتباط بين complexity load والفشل.

Recovery: quarantine output and escalate to court

Acceptance: deterministic typed output, trace/evidence receipt, no authority expansion, negative test passes.

Owners: L02 · L12 · L13 · L22 · L23

Trigger: replay or verifier requests reconstruction

Preconditions: source/evidence pointers + mission_id + policy/model epoch.

Transition: <- Proof-Preserving Refactor Method: replay or verifier requests reconstruction validate(source/evidence pointers) -> operate on ArchitectureGraph -> emit receipt + debug localization time

Metric: `debug localization time`

Promotion: N0 specification -> N1 schema -> N2 executable candidate -> N3 verified trace -> N4 matched-budget gain -> N5 cross-environment replication

Composition note
V4-04

: artifacts on this page compose into M-RACPRT only when their receipts share mission/version lineage; standalone success does not promote the theory.

```
Artifact value = decision/effect improvement + failure localization + replayability - authority/cost/complexity penalties
```

ART-15 | سجل الأصول التشغيلية

V4A-036 · METHOD · V4-04

منهج تقدير تعقيد طوبولوجيا المعمارية

Topology Complexity Estimation

Failure: manual architecture review يحقق نفس النتيجة بكلفة أقل.

Recovery: return BLOCKED/PARTIAL with reason

Acceptance: deterministic typed output, trace/evidence receipt, no authority expansion, negative test passes.

Owners: L02 · L12 · L13 · L22 · L23

Trigger: state/evidence conflict appears

Preconditions: typed mission context + mission_id + policy/model epoch.

Transition: Topology Complexity Estimation: state/evidence conflict appears -> validate(typed / mission context) -> operate on ComponentUtility -> emit receipt + verified coverage component

Metric: `verified coverage / component`

Promotion: N0 specification -> N1 schema -> N2 executable candidate -> N3 verified trace -> N4 matched-budget gain -> N5 cross-environment replication

V4A-037 · PROTOCOL · V4-04

بروتوكول إعادة الهيكلة الظلية قبل الترقية

Shadow-Refactor-before-Promotion

Failure: compression يسبب فقد capability غير ظاهر في benchmark.

Recovery: rollback to parent snapshot

Acceptance: deterministic typed output, trace/evidence receipt, no authority expansion, negative test passes.

Owners: L02 · L12 · L13 · L22 · L23

Trigger: high-impact transition is proposed

Preconditions: authority/risk profile + mission_id + policy/model epoch.

Transition: Shadow-Refactor-before-Promotion: high-impact transition is proposed -> validate(authority/risk profile) -> operate on ProofSurface -> emit receipt + dependency entropy

Metric: `dependency entropy`

Promotion: N0 specification -> N1 schema -> N2 executable candidate -> N3 verified trace -> N4 matched-budget gain -> N5 cross-environment replication

V4A-038 · PROTOCOL · V4-04

بروتوكول الإهمال مع حفظ النسب

Deprecation-with-Lineage Protocol

Failure: لا ارتباط بين complexity load والفشل.

Recovery: rebase on current version and replay

Acceptance: deterministic typed output, trace/evidence receipt, no authority expansion, negative test passes.

Owners: L02 · L12 · L13 · L22 · L23

Trigger: version/epoch changes

Preconditions: versioned state snapshot + mission_id + policy/model epoch.

Transition: Deprecation-with-Lineage Protocol: version/epoch changes -> validate(versioned state snapshot) -> operate on RefactorCandidate -> emit receipt + test surface size

Metric: `test surface size`

Promotion: N0 specification -> N1 schema -> N2 executable candidate -> N3 verified trace -> N4 matched-budget gain -> N5 cross-environment replication

Composition note

V4-04

: artifacts on this page compose into M-RACPRT only when their receipts share mission/version lineage; standalone success does not promote the theory.

```
Artifact value = decision/effect improvement + failure localization + replayability - authority/cost/complexity penalties
```

ART-16 | سجل الأصول التشغيلية

V4A-039 · STACK · V4-04

مترجم المعمارية العودي

Recursive Architecture Compiler

Failure: manual architecture review يحقق نفس النتيجة بكلفة أقل.

Recovery: quarantine output and escalate to court

Acceptance: deterministic typed output, trace/evidence receipt, no authority expansion, negative test passes.

Owners: L02 · L12 · L13 · L22 · L23

Trigger: replay or verifier requests reconstruction

Preconditions: source/evidence pointers + mission_id + policy/model epoch.

Transition: Recursive Architecture Compiler: replay or verifier requests reconstruction -> validate(source/evidence pointers) -> operate on BehavioralEquivalenceSet -> emit receipt + refactor regression rate

Metric: `refactor regression rate`

Promotion: N0 specification -> N1 schema -> N2 executable candidate -> N3 verified trace -> N4 matched-budget gain -> N5 cross-environment replication

V4A-040 · STACK · V4-04

محكمة إعادة هيكلة المعمارية

Architecture Refactoring Court

Failure: compression يسبب فقد capability غير ظاهر في benchmark.

Recovery: return BLOCKED/PARTIAL with reason

Acceptance: deterministic typed output, trace/evidence receipt, no authority expansion, negative test passes.

Owners: L02 · L12 · L13 · L22 · L23

Trigger: state/evidence conflict appears

Preconditions: typed mission context + mission_id + policy/model epoch.

Transition: Architecture Refactoring Court: state/evidence conflict appears -> validate(typed mission context) -> operate on RefactorReceipt -> emit receipt + debug localization time

Metric: `debug localization time`

Promotion: N0 specification -> N1 schema -> N2 executable candidate -> N3 verified trace -> N4 matched-budget gain -> N5 cross-environment replication

Composition note
V4-04
: artifacts on this page compose into M-RACPRT only when their receipts share mission/version lineage; standalone success does not promote the theory.

```
Artifact value = decision/effect improvement + failure localization + replayability - authority/cost/complexity penalties
```

ART-17 | سجل الأصول التشغيلية

V4A-041 · TOOL · V4-05

مترجم القيود عبر الطبقات

Cross-Layer Constraint Compiler

Failure: schema validators الحالية تكفي.

Recovery: rollback to parent snapshot

Acceptance: deterministic typed output, trace/evidence receipt, no authority expansion, negative test passes.

Owners: L00 · L01 · L06 · L12 · L16 · L18

Trigger: high-impact transition is proposed

Preconditions: authority/risk profile + mission_id + policy/model epoch.

Transition: Cross-Layer Constraint Compiler: high-impact transition is proposed -> validate(authority/risk profile) -> operate on RelaxationAuthority -> emit receipt + critical constraint retention

Metric: `critical constraint retention`

Promotion: N0 specification -> N1 schema -> N2 executable candidate -> N3 verified trace -> N4 matched-budget gain -> N5 cross-environment replication

V4A-042 · TOOL · V4-05

متتبع انتشار القيد

Constraint Propagation Tracer

Failure: unsat extraction لا يغير القرار.

Recovery: rebase on current version and replay

Acceptance: deterministic typed output, trace/evidence receipt, no authority expansion, negative test passes.

Owners: L00 · L01 · L06 · L12 · L16 · L18

Trigger: version/epoch changes

Preconditions: versioned state snapshot + mission_id + policy/model epoch.

Transition: Constraint Propagation Tracer: version/epoch changes -> validate(versioned state snapshot) -> operate on ConstraintObject -> emit receipt + silent relaxation rate

Metric: `silent relaxation rate`

Promotion: N0 specification -> N1 schema -> N2 executable candidate -> N3 verified trace -> N4 matched-budget gain -> N5 cross-environment replication

V4A-043 · TOOL · V4-05

مستخرج أصغر نواة تعارض

Minimal Unsat-Core Extractor

Failure: overconstraint يمنع حلول صحيحة أكثر مما يمنع unsafe solutions.

Recovery: quarantine output and escalate to court

Acceptance: deterministic typed output, trace/evidence receipt, no authority expansion, negative test passes.

Owners: L00 · L01 · L06 · L12 · L16 · L18

Trigger: replay or verifier requests reconstruction

Preconditions: source/evidence pointers + mission_id + policy/model epoch.

Transition: Minimal Unsat-Core Extractor: replay or verifier requests reconstruction -> validate(source/evidence pointers) -> operate on ConstraintEdge -> emit receipt + unsat localization time

Metric: `unsat localization time`

Promotion: N0 specification -> N1 schema -> N2 executable candidate -> N3 verified trace -> N4 matched-budget gain -> N5 cross-environment replication

Composition note

V4-05

: artifacts on this page compose into M-CLCPC only when their receipts share mission/version lineage; standalone success does not promote the theory.

```
Artifact value = decision/effect improvement + failure localization + replayability - authority/cost/complexity penalties
```

ART-18 | سجل الأصول التشغيلية

V4A-044 · TOOL · V4-05

كاشف تخفيف القيود الصامت

Silent Relaxation Detector

Failure: schema validators الحالية تكفي.

Recovery: return BLOCKED/PARTIAL with reason.

Acceptance: deterministic typed output, trace/evidence receipt, no authority expansion, negative test passes.

Owners: L00 · L01 · L06 · L12 · L16 · L18

Promotion: N0 specification -> N1 schema -> N2 executable candidate -> N3 verified trace -> N4 matched-budget gain -> N5 cross-environment replication

Trigger: state/evidence conflict appears

Preconditions: typed mission context + mission_id + policy/model epoch.

Transition: Silent Relaxation Detector: state/evidence conflict appears -> validate(typed mission context) -> operate on PropagationTrace -> emit receipt + false block rate

Metric: `false block rate`

V4A-045 · METHOD · V4-05

منهج الانتشار الثنائي للقيود

Bidirectional Constraint Propagation

Failure: unsat extraction لا يغير القرار.

Recovery: rollback to parent snapshot

Acceptance: deterministic typed output, trace/evidence receipt, no authority expansion, negative test passes.

Owners: L00 · L01 · L06 · L12 · L16 · L18

Promotion: N0 specification -> N1 schema -> N2 executable candidate -> N3 verified trace -> N4 matched-budget gain -> N5 cross-environment replication

Trigger: high-impact transition is proposed

Preconditions: authority/risk profile + mission_id + policy/model epoch.

Transition: <- Bidirectional Constraint Propagation: high-impact transition is proposed validate(authority/risk profile) -> operate on UnsatCore -> emit receipt + invalid-success rate

Metric: `invalid-success rate`

Composition note

V4-05

: artifacts on this page compose into M-CLCPC only when their receipts share mission/version lineage; standalone success does not promote the theory.

```
Artifact value = decision/effect improvement + failure localization + replayability - authority/cost/complexity penalties
```

ART-19 | سجل الأصول التشغيلية

V4A-046 · METHOD · V4-05

منهج تخفيف القيد المقيد بالسلطة

Authority-Bound Constraint Relaxation

Failure: overconstraint يمنع حلول صحيحة أكثر مما يمنع unsafe solutions.

Recovery: rebase on current version and replay

Acceptance: deterministic typed output, trace/evidence receipt, no authority expansion, negative test passes.

Owners: L00 · L01 · L06 · L12 · L16 · L18

Trigger: version/epoch changes

Preconditions: versioned state snapshot + mission_id + policy/model epoch.

Transition: <- Authority-Bound Constraint Relaxation: version/epoch changes validate(versioned state snapshot) -> operate on ContradictionReceipt -> emit receipt + critical constraint retention

Metric: `critical constraint retention`

Promotion: N0 specification -> N1 schema -> N2 executable candidate -> N3 verified trace -> N4 matched-budget gain -> N5 cross-environment replication

V4A-047 · PROTOCOL · V4-05

بروتوكول إغلاق القيود قبل الإيداع

Pre-Commit Constraint Closure

Failure: schema validators الحالية تكفي.

Recovery: quarantine output and escalate to court

Acceptance: deterministic typed output, trace/evidence receipt, no authority expansion, negative test passes.

Owners: L00 · L01 · L06 · L12 · L16 · L18

Trigger: replay or verifier requests reconstruction

Preconditions: source/evidence pointers + mission_id + policy/model epoch.

Transition: <- Pre-Commit Constraint Closure: replay or verifier requests reconstruction validate(source/evidence pointers) -> operate on ConstraintScope -> emit receipt + silent relaxation rate

Metric: `silent relaxation rate`

Promotion: N0 specification -> N1 schema -> N2 executable candidate -> N3 verified trace -> N4 matched-budget gain -> N5 cross-environment replication

V4A-048 · PROTOCOL · V4-05

بروتوكول تصعيد التناقض

Contradiction Escalation Protocol

Failure: unsat extraction لا يغير القرار.

Recovery: return BLOCKED/PARTIAL with reason

Acceptance: deterministic typed output, trace/evidence receipt, no authority expansion, negative test passes.

Owners: L00 · L01 · L06 · L12 · L16 · L18

Trigger: state/evidence conflict appears

Preconditions: typed mission context + mission_id + policy/model epoch.

Transition: Contradiction Escalation Protocol: state/evidence conflict appears -> validate(typed mission context) -> operate on RelaxationAuthority -> emit receipt + unsat localization time

Metric: `unsat localization time`

Promotion: N0 specification -> N1 schema -> N2 executable candidate -> N3 verified trace -> N4 matched-budget gain -> N5 cross-environment replication

Composition note
V4-05
: artifacts on this page compose into M-CLCPC only when their receipts share mission/version lineage; standalone success does not promote the theory.

```
Artifact value = decision/effect improvement + failure localization + replayability - authority/cost/complexity penalties
```

ART-20 | سجل الأصول التشغيلية

V4A-049 · STACK · V4-05

خدمة رسم القيود

Constraint Graph Service

Failure: overconstraint يمنع حلول صحيحة أكثر مما يمنع unsafe solutions.

Recovery: rollback to parent snapshot

Acceptance: deterministic typed output, trace/evidence receipt, no authority expansion, negative test passes.

Owners: L00 · L01 · L06 · L12 · L16 · L18

Trigger: high-impact transition is proposed

Preconditions: authority/risk profile + mission_id + policy/model epoch.

Transition: Constraint Graph Service: high-impact transition is proposed -> validate(authority/risk profile) -> operate on ConstraintObject -> emit receipt + false block rate

Metric: `false block rate`

Promotion: N0 specification -> N1 schema -> N2 executable candidate -> N3 verified trace -> N4 matched-budget gain -> N5 cross-environment replication

V4A-050 · STACK · V4-05

محكمة إغلاق التناقضات

Constraint Closure Court

Failure: schema validators الحالية تكفي.

Recovery: rebase on current version and replay

Acceptance: deterministic typed output, trace/evidence receipt, no authority expansion, negative test passes.

Owners: L00 · L01 · L06 · L12 · L16 · L18

Trigger: version/epoch changes

Preconditions: versioned state snapshot + mission_id + policy/model epoch.

Transition: Constraint Closure Court: version/epoch changes -> validate(versioned state snapshot) -> operate on ConstraintEdge -> emit receipt + invalid-success rate

Metric: `invalid-success rate`

Promotion: N0 specification -> N1 schema -> N2 executable candidate -> N3 verified trace -> N4 matched-budget gain -> N5 cross-environment replication

Composition note
V4-05
: artifacts on this page compose into M-CLCPC only when their receipts share mission/version lineage; standalone success does not promote the theory.

```
Artifact value = decision/effect improvement + failure localization + replayability - authority/cost/complexity penalties
```

ART-21 | سجل الأصول التشغيلية

V4A-051 · TOOL · V4-06

مفرع الذاكرة المضادة للواقع

Counterfactual Memory Forker

Failure: تحقق نفس الفائدة. simple uncertainty annotations

Recovery: quarantine output and escalate to court

Acceptance: deterministic typed output, trace/evidence receipt, no authority expansion, negative test passes.

Owners: L07 · L08 · L09 · L18 · L20

Promotion: N0 specification -> N1 schema -> N2 executable candidate -> N3 verified trace -> N4 matched-budget gain -> N5 cross-environment replication

Trigger: replay or verifier requests reconstruction

Preconditions: source/evidence pointers + mission_id + policy/model epoch.

Transition: Counterfactual Memory Forker: replay or verifier requests reconstruction -> validate(source/evidence pointers) -> operate on BranchDelta -> emit receipt + branch contamination rate

Metric: `branch contamination rate`

V4A-052 · TOOL · V4-06

رابط دليل الفرع

Branch Evidence Binder

Failure: يكلف أكثر من branch explosion gain.

Recovery: return BLOCKED/PARTIAL with reason

Acceptance: deterministic typed output, trace/evidence receipt, no authority expansion, negative test passes.

Owners: L07 · L08 · L09 · L18 · L20

Promotion: N0 specification -> N1 schema -> N2 executable candidate -> N3 verified trace -> N4 matched-budget gain -> N5 cross-environment replication

Trigger: state/evidence conflict appears

Preconditions: typed mission context + mission_id + policy/model epoch.

Transition: Branch Evidence Binder: state/evidence conflict appears -> validate(typed mission context) -> operate on BranchEvidence -> emit receipt + discriminating experiment yield

Metric: `discriminating experiment yield`

V4A-053 · TOOL · V4-06

مقياس فصل القرار بين الفروع

Branch Decision-Separation Meter

Failure: لا تتنبأ بصحة memory لاحقا. merge rules

Recovery: rollback to parent snapshot

Acceptance: deterministic typed output, trace/evidence receipt, no authority expansion, negative test passes.

Owners: L07 · L08 · L09 · L18 · L20

Promotion: N0 specification -> N1 schema -> N2 executable candidate -> N3 verified trace -> N4 matched-budget gain -> N5 cross-environment replication

Trigger: high-impact transition is proposed

Preconditions: authority/risk profile + mission_id + policy/model epoch.

Transition: Branch Decision-Separation Meter: high-impact transition is proposed -> validate(authority/risk profile) -> operate on MergeCondition -> emit receipt + branch explosion factor

Metric: `branch explosion factor`

Composition note

V4-06

: artifacts on this page compose into M-CMBEMT only when their receipts share mission/version lineage; standalone success does not promote the theory.

```
Artifact value = decision/effect improvement + failure localization + replayability - authority/cost/complexity penalties
```

ART-22 | سجل الأصول التشغيلية

V4A-054 · TOOL · V4-06

حال تعارض دمج الذاكرة

Memory Merge Conflict Resolver

Failure: simple uncertainty annotations تحقق نفس الفائدة.

Recovery: rebase on current version and replay

Acceptance: deterministic typed output, trace/evidence receipt, no authority expansion, negative test passes.

Owners: L07 · L08 · L09 · L18 · L20

Trigger: version/epoch changes

Preconditions: versioned state snapshot + mission_id + policy/model epoch.

Transition: Memory Merge Conflict Resolver: version/epoch changes -> validate(versioned state snapshot) -> operate on BranchConflict -> emit receipt + merge precision

Metric: `merge precision`

Promotion: N0 specification -> N1 schema -> N2 executable candidate -> N3 verified trace -> N4 matched-budget gain -> N5 cross-environment replication

V4A-055 · METHOD · V4-06

منهج تقييم قيمة فرع الفرضية

Hypothesis Branch Valuation

Failure: branch explosion يكلف أكثر من gain.

Recovery: quarantine output and escalate to court

Acceptance: deterministic typed output, trace/evidence receipt, no authority expansion, negative test passes.

Owners: L07 · L08 · L09 · L18 · L20

Trigger: replay or verifier requests reconstruction

Preconditions: source/evidence pointers + mission_id + policy/model epoch.

Transition: <- Hypothesis Branch Valuation: replay or verifier requests reconstruction validate(source/evidence pointers) -> operate on MergeReceipt -> emit receipt + rollback recovery time

Metric: `rollback recovery time`

Promotion: N0 specification -> N1 schema -> N2 executable candidate -> N3 verified trace -> N4 matched-budget gain -> N5 cross-environment replication

Composition note
V4-06
: artifacts on this page compose into M-CMBEMT only when their receipts share mission/version lineage; standalone success does not promote the theory.

```
Artifact value = decision/effect improvement + failure localization + replayability - authority/cost/complexity penalties
```

ART-23 | سجل الأصول التشغيلية

V4A-056 · METHOD · V4-06

منهج تقدير جاهزية الدمج بالدليل

Evidence-Convergence Merge Scoring

Failure: merge rules لا تتنبأ بصحة memory لاحقا.

Recovery: return BLOCKED/PARTIAL with reason

Acceptance: deterministic typed output, trace/evidence receipt, no authority expansion, negative test passes.

Owners: L07 · L08 · L09 · L18 · L20

Trigger: state/evidence conflict appears

Preconditions: typed mission context + mission_id + policy/model epoch.

Transition: Evidence-Convergence Merge Scoring: state/evidence conflict appears -> validate(typed mission context) -> operate on MemoryBranch -> emit receipt + branch contamination rate

Metric: `branch contamination rate`

Promotion: N0 specification -> N1 schema -> N2 executable candidate -> N3 verified trace -> N4 matched-budget gain -> N5 cross-environment replication

V4A-057 · PROTOCOL · V4-06

بروتوكول التفرع عند الغموض المغير للقرار

Fork-on-Decision-Relevant-Ambiguity

Failure: simple uncertainty annotations تحقق نفس الفائدة.

Recovery: rollback to parent snapshot

Acceptance: deterministic typed output, trace/evidence receipt, no authority expansion, negative test passes.

Owners: L07 · L08 · L09 · L18 · L20

Trigger: high-impact transition is proposed

Preconditions: authority/risk profile + mission_id + policy/model epoch.

Transition: Fork-on-Decision-Relevant-Ambiguity: high-impact transition is proposed -> validate(authority/risk profile) -> operate on HypothesisRoot -> emit receipt + discriminating experiment yield

Metric: `discriminating experiment yield`

Promotion: N0 specification -> N1 schema -> N2 executable candidate -> N3 verified trace -> N4 matched-budget gain -> N5 cross-environment replication

V4A-058 · PROTOCOL · V4-06

بروتوكول الدليل قبل دمج الفروع

Evidence-before-Branch-Merge

Failure: branch explosion يكلف أكثر من gain.

Recovery: rebase on current version and replay

Acceptance: deterministic typed output, trace/evidence receipt, no authority expansion, negative test passes.

Owners: L07 · L08 · L09 · L18 · L20

Trigger: version/epoch changes

Preconditions: versioned state snapshot + mission_id + policy/model epoch.

Transition: Evidence-before-Branch-Merge: version/epoch changes -> validate(versioned state snapshot) -> operate on BranchDelta -> emit receipt + branch explosion factor

Metric: `branch explosion factor`

Promotion: N0 specification -> N1 schema -> N2 executable candidate -> N3 verified trace -> N4 matched-budget gain -> N5 cross-environment replication

Composition note

V4-06

: artifacts on this page compose into M-CMBEMT only when their receipts share mission/version lineage; standalone success does not promote the theory.

```
Artifact value = decision/effect improvement + failure localization + replayability - authority/cost/complexity penalties
```

ART-24 | سجل الأصول التشغيلية

V4A-059 · STACK · V4-06

مخزن الذاكرة المتفرعة

Branching Memory Store

Failure: merge rules لا تتنبأ بصحة memory لاحقا.

Recovery: quarantine output and escalate to court

Acceptance: deterministic typed output, trace/evidence receipt, no authority expansion, negative test passes.

Owners: L07 · L08 · L09 · L18 · L20

Promotion: N0 specification -> N1 schema -> N2 executable candidate -> N3 verified trace -> N4 matched-budget gain -> N5 cross-environment replication

Trigger: replay or verifier requests reconstruction

Preconditions: source/evidence pointers + mission_id + policy/model epoch.

Transition: Branching Memory Store: replay or verifier requests reconstruction -> validate(source/evidence pointers) -> operate on BranchEvidence -> emit receipt + merge precision

Metric: `merge precision`

V4A-060 · STACK · V4-06

محكمة دمج الذاكرة

Memory Merge Court

Failure: simple uncertainty annotations تحقق نفس الفائدة.

Recovery: return BLOCKED/PARTIAL with reason

Acceptance: deterministic typed output, trace/evidence receipt, no authority expansion, negative test passes.

Owners: L07 · L08 · L09 · L18 · L20

Promotion: N0 specification -> N1 schema -> N2 executable candidate -> N3 verified trace -> N4 matched-budget gain -> N5 cross-environment replication

Trigger: state/evidence conflict appears

Preconditions: typed mission context + mission_id + policy/model epoch.

Transition: Memory Merge Court: state/evidence conflict appears -> validate(typed mission context) -> operate on MergeCondition -> emit receipt + rollback recovery time

Metric: `rollback recovery time`

Composition note
V4-06
: artifacts on this page compose into M-CMBEMT only when their receipts share mission/version lineage; standalone success does not promote the theory.

```
Artifact value = decision/effect improvement + failure localization + replayability - authority/cost/complexity penalties
```

ART-25 | سجل الأصول التشغيلية

V4A-061 · TOOL · V4-07

راسم جبهة اللاعكوسية

Irreversibility Frontier Mapper

Failure: تصنيف T0-T4 الحالي يفسر نفس الحوادث.

Recovery: rollback to parent snapshot

Acceptance: deterministic typed output, trace/evidence receipt, no authority expansion, negative test passes.

Owners: L01 · L16 · L17 · L19 · L20

Trigger: high-impact transition is proposed

Preconditions: authority/risk profile + mission_id + policy/model epoch.

Transition: Irreversibility Frontier Mapper: high-impact transition is proposed -> validate(authority/risk profile) -> operate on ExposureWindow -> emit receipt + residual effect mass ->

Metric: `residual effect mass`

Promotion: N0 specification -> N1 schema -> N2 executable candidate -> N3 verified trace -> N4 matched-budget gain -> N5 cross-environment replication

V4A-062 · TOOL · V4-07

مقياس الأثر المتبقي

Residual Effect Meter

Failure: residual scores غير قابلة للمعايرة.

Recovery: rebase on current version and replay

Acceptance: deterministic typed output, trace/evidence receipt, no authority expansion, negative test passes.

Owners: L01 · L16 · L17 · L19 · L20

Trigger: version/epoch changes

Preconditions: versioned state snapshot + mission_id + policy/model epoch.

Transition: Residual Effect Meter: version/epoch changes -> validate(versioned state snapshot) -> operate on RollbackReceipt -> emit receipt + false reversibility rate ->

Metric: `false reversibility rate`

Promotion: N0 specification -> N1 schema -> N2 executable candidate -> N3 verified trace -> N4 matched-budget gain -> N5 cross-environment replication

V4A-063 · TOOL · V4-07

متتبع تعرض انتشار الأثر

Propagation Exposure Tracker

Failure: لا تحسن في incident severity/containment.

Recovery: quarantine output and escalate to court

Acceptance: deterministic typed output, trace/evidence receipt, no authority expansion, negative test passes.

Owners: L01 · L16 · L17 · L19 · L20

Trigger: replay or verifier requests reconstruction

Preconditions: source/evidence pointers + mission_id + policy/model epoch.

Transition: Propagation Exposure Tracker: replay or verifier requests reconstruction -> validate(source/evidence pointers) -> operate on EffectVector -> emit receipt + compensation effectiveness ->

Metric: `compensation effectiveness`

Promotion: N0 specification -> N1 schema -> N2 executable candidate -> N3 verified trace -> N4 matched-budget gain -> N5 cross-environment replication

Composition note

V4-07

: artifacts on this page compose into M-IFREAT only when their receipts share mission/version lineage; standalone success does not promote the theory.

```
Artifact value = decision/effect improvement + failure localization + replayability - authority/cost/complexity penalties
```

ART-26 | سجل الأصول التشغيلية

V4A-064 · TOOL · V4-07

مدقق تغطية التعويض

Compensation Coverage Auditor

Failure: تصنيف T0-T4 الحالي يفسر نفس الحوادث.

Recovery: return BLOCKED/PARTIAL with reason

Acceptance: deterministic typed output, trace/evidence receipt, no authority expansion, negative test passes.

Owners: L01 · L16 · L17 · L19 · L20

Trigger: state/evidence conflict appears

Preconditions: typed mission context + mission_id + policy/model epoch.

Transition: Compensation Coverage Auditor: state/evidence conflict appears -> validate(typed mission context) -> operate on IrreversibilityFrontier -> emit receipt + frontier prediction precision

Metric: `frontier prediction precision`

Promotion: N0 specification -> N1 schema -> N2 executable candidate -> N3 verified trace -> N4 matched-budget gain -> N5 cross-environment replication

V4A-065 · METHOD · V4-07

منهج تقدير قابلية الاسترداد متعددة الأبعاد

Multi-Dimensional Recoverability Estimation

Failure: residual scores غير قابلة للمعايرة.

Recovery: rollback to parent snapshot

Acceptance: deterministic typed output, trace/evidence receipt, no authority expansion, negative test passes.

Owners: L01 · L16 · L17 · L19 · L20

Trigger: high-impact transition is proposed

Preconditions: authority/risk profile + mission_id + policy/model epoch.

Transition: Multi-Dimensional Recoverability Estimation: high-impact transition is proposed -validate(authority/risk profile) -> operate on ResidualEffect -> emit receipt + exposure <-weighted incident cost

Metric: `exposure-weighted incident cost`

Promotion: N0 specification -> N1 schema -> N2 executable candidate -> N3 verified trace -> N4 matched-budget gain -> N5 cross-environment replication

Composition note
V4-07
: artifacts on this page compose into M-IFREAT only when their receipts share mission/version lineage; standalone success does not promote the theory.

```
Artifact value = decision/effect improvement + failure localization + replayability - authority/cost/complexity penalties
```

ART-27 | سجل الأصول التشغيلية

V4A-066 · METHOD · V4-07

منهج محاسبة الخطر المتبقي

Residual-Risk Accounting

Failure: لا تحسن في incident severity/containment.

Recovery: rebase on current version and replay

Acceptance: deterministic typed output, trace/evidence receipt, no authority expansion, negative test passes.

Owners: L01 · L16 · L17 · L19 · L20

Promotion: N0 specification -> N1 schema -> N2 executable candidate -> N3 verified trace -> N4 matched-budget gain -> N5 cross-environment replication

Trigger: version/epoch changes

Preconditions: versioned state snapshot + mission_id + policy/model epoch.

Transition: Residual-Risk Accounting: version/epoch changes -> validate(versioned state snapshot) -> operate on CompensationPlan -> emit receipt + residual effect mass

Metric: `residual effect mass`

V4A-067 · PROTOCOL · V4-07

بروتوكول السلطة المقيدة بجبهة اللاعكوسية

Frontier-Gated Authorization

Failure: تصنيف T0-T4 الحالي يفسر نفس الحوادث.

Recovery: quarantine output and escalate to court

Acceptance: deterministic typed output, trace/evidence receipt, no authority expansion, negative test passes.

Owners: L01 · L16 · L17 · L19 · L20

Promotion: N0 specification -> N1 schema -> N2 executable candidate -> N3 verified trace -> N4 matched-budget gain -> N5 cross-environment replication

Trigger: replay or verifier requests reconstruction

Preconditions: source/evidence pointers + mission_id + policy/model epoch.

Transition: <- Frontier-Gated Authorization: replay or verifier requests reconstruction validate(source/evidence pointers) -> operate on ResidualLedger -> emit receipt + false reversibility rate

Metric: `false reversibility rate`

V4A-068 · PROTOCOL · V4-07

بروتوكول قياس الأثر المتبقي بعد التراجع

Residual-Effect-after-Rollback

Failure: residual scores غير قابلة للمعايرة.

Recovery: return BLOCKED/PARTIAL with reason

Acceptance: deterministic typed output, trace/evidence receipt, no authority expansion, negative test passes.

Owners: L01 · L16 · L17 · L19 · L20

Promotion: N0 specification -> N1 schema -> N2 executable candidate -> N3 verified trace -> N4 matched-budget gain -> N5 cross-environment replication

Trigger: state/evidence conflict appears

Preconditions: typed mission context + mission_id + policy/model epoch.

Transition: Residual-Effect-after-Rollback: state/evidence conflict appears -> validate(typed mission context) -> operate on ExposureWindow -> emit receipt + compensation effectiveness

Metric: `compensation effectiveness`

Composition note

V4-07

: artifacts on this page compose into M-IFREAT only when their receipts share mission/version lineage; standalone success does not promote the theory

```
Artifact value = decision/effect improvement + failure localization + replayability - authority/cost/complexity penalties
```

ART-28 | سجل الأصول التشغيلية

V4A-069 · STACK · V4-07

خدمة مخاطر اللاعكوسية

Irreversibility Risk Service

Failure: لا تحسن في incident severity/containment.

Recovery: rollback to parent snapshot

Acceptance: deterministic typed output, trace/evidence receipt, no authority expansion, negative test passes.

Owners: L01 · L16 · L17 · L19 · L20

Trigger: high-impact transition is proposed

Preconditions: authority/risk profile + mission_id + policy/model epoch.

Transition: Irreversibility Risk Service: high-impact transition is proposed -> validate(authority/risk profile) -> operate on RollbackReceipt -> emit receipt + frontier prediction precision <-

Metric: `frontier prediction precision`

Promotion: N0 specification -> N1 schema -> N2 executable candidate -> N3 verified trace -> N4 matched-budget gain -> N5 cross-environment replication

V4A-070 · STACK · V4-07

دفتر الأثر المتبقي

Residual Effect Ledger

Failure: تصنيف T0-T4 الحالي يفسر نفس الحوادث.

Recovery: rebase on current version and replay

Acceptance: deterministic typed output, trace/evidence receipt, no authority expansion, negative test passes.

Owners: L01 · L16 · L17 · L19 · L20

Trigger: version/epoch changes

Preconditions: versioned state snapshot + mission_id + policy/model epoch.

Transition: Residual Effect Ledger: version/epoch changes -> validate(versioned state snapshot) -> operate on EffectVector -> emit receipt + exposure-weighted incident cost <-

Metric: `exposure-weighted incident cost`

Promotion: N0 specification -> N1 schema -> N2 executable candidate -> N3 verified trace -> N4 matched-budget gain -> N5 cross-environment replication

Composition note
V4-07
: artifacts on this page compose into M-IFREAT only when their receipts share mission/version lineage; standalone success does not promote the theory.

```
Artifact value = decision/effect improvement + failure localization + replayability - authority/cost/complexity penalties
```

ART-29 | سجل الأصول التشغيلية

V4A-071 · TOOL · V4-08

سجل ساعات المقاييس الزمنية

Timescale Clock Registry

Failure: simple version pinning كاف.

Recovery: quarantine output and escalate to court

Acceptance: deterministic typed output, trace/evidence receipt, no authority expansion, negative test passes.

Owners: L00 · L03 · L09 · L20 · L21 · L22

Trigger: replay or verifier requests reconstruction

Preconditions: source/evidence pointers + mission_id + policy/model epoch.

Transition: Timescale Clock Registry: replay or verifier requests reconstruction -> validate(source/evidence pointers) -> operate on GovernanceEpoch -> emit receipt + stale policy execution rate

Metric: `stale-policy execution rate`

Promotion: N0 specification -> N1 schema -> N2 executable candidate -> N3 verified trace -> N4 matched-budget gain -> N5 cross-environment replication

V4A-072 · TOOL · V4-08

متتبع حقبة الحاكمية

Governance Epoch Tracker

Failure: barriers تزيد latency بلا خفض incidents.

Recovery: return BLOCKED/PARTIAL with reason

Acceptance: deterministic typed output, trace/evidence receipt, no authority expansion, negative test passes.

Owners: L00 · L03 · L09 · L20 · L21 · L22

Trigger: state/evidence conflict appears

Preconditions: typed mission context + mission_id + policy/model epoch.

Transition: Governance Epoch Tracker: state/evidence conflict appears -> validate(typed mission context) -> operate on VersionBarrier -> emit receipt + unverified-training ingestion

Metric: `unverified-training ingestion`

Promotion: N0 specification -> N1 schema -> N2 executable candidate -> N3 verified trace -> N4 matched-budget gain -> N5 cross-environment replication

V4A-073 · TOOL · V4-08

كاشف التراكب الزمني الخاطئ

Temporal Alias Detector

Failure: لا توجد temporal alias failures في workload الحقيقي.

Recovery: rollback to parent snapshot

Acceptance: deterministic typed output, trace/evidence receipt, no authority expansion, negative test passes.

Owners: L00 · L03 · L09 · L20 · L21 · L22

Trigger: high-impact transition is proposed

Preconditions: authority/risk profile + mission_id + policy/model epoch.

Transition: Temporal Alias Detector: high-impact transition is proposed -> validate(authority/risk profile) -> operate on FastLoopEvent -> emit receipt + epoch mismatch incidents

Metric: `epoch mismatch incidents`

Promotion: N0 specification -> N1 schema -> N2 executable candidate -> N3 verified trace -> N4 matched-budget gain -> N5 cross-environment replication

Composition note
V4-08
: artifacts on this page compose into M-MTGST only when their receipts share mission/version lineage; standalone success does not promote the theory.

```
Artifact value = decision/effect improvement + failure localization + replayability - authority/cost/complexity penalties
```

ART-30 | سجل الأصول التشغيلية

V4A-074 · TOOL · V4-08

مذيع الإبطال عبر مستويات الزمن

Cross-Plane Invalidation Broadcaster

Failure: simple version pinning كاف.

Recovery: rebase on current version and replay

Acceptance: deterministic typed output, trace/evidence receipt, no authority expansion, negative test passes.

Owners: L00 · L03 · L09 · L20 · L21 · L22

Promotion: N0 specification -> N1 schema -> N2 executable candidate -> N3 verified trace -> N4 matched-budget gain -> N5 cross-environment replication

Trigger: version/epoch changes

Preconditions: versioned state snapshot + mission_id + policy/model epoch.

Transition: Cross-Plane Invalidation Broadcaster: version/epoch changes -> validate(versioned state snapshot) -> operate on SlowLoopDecision -> emit receipt + sync latency

Metric: `sync latency`

V4A-075 · METHOD · V4-08

منهج تقدير انجراف الحلقات المقترنة

Coupled-Loop Drift Estimation

Failure: barriers تزيد latency بلا خفض incidents.

Recovery: quarantine output and escalate to court

Acceptance: deterministic typed output, trace/evidence receipt, no authority expansion, negative test passes.

Owners: L00 · L03 · L09 · L20 · L21 · L22

Promotion: N0 specification -> N1 schema -> N2 executable candidate -> N3 verified trace -> N4 matched-budget gain -> N5 cross-environment replication

Trigger: replay or verifier requests reconstruction

Preconditions: source/evidence pointers + mission_id + policy/model epoch.

Transition: <- Coupled-Loop Drift Estimation: replay or verifier requests reconstruction validate(source/evidence pointers) -> operate on SyncWindow -> emit receipt + cross-timescale drift

Metric: `cross-timescale drift`

Composition note
V4-08
: artifacts on this page compose into M-MTGST only when their receipts share mission/version lineage; standalone success does not promote the theory.

```
Artifact value = decision/effect improvement + failure localization + replayability - authority/cost/complexity penalties
```

ART-31 | سجل الأصول التشغيلية

V4A-076 · METHOD · V4-08

منهج جدولة المزامنة المعدلة بالمخاطر

Risk-Weighted Sync Scheduling

Failure: لا توجد temporal alias failures في workload الحقيقي.

Recovery: return BLOCKED/PARTIAL with reason

Acceptance: deterministic typed output, trace/evidence receipt, no authority expansion, negative test passes.

Owners: L00 · L03 · L09 · L20 · L21 · L22

Trigger: state/evidence conflict appears

Preconditions: typed mission context + mission_id + policy/model epoch.

Transition: Risk-Weighted Sync Scheduling: state/evidence conflict appears -> validate(typed mission context) -> operate on TemporalAlias -> emit receipt + stale-policy execution rate

Metric: `stale-policy execution rate`

Promotion: N0 specification -> N1 schema -> N2 executable candidate -> N3 verified trace -> N4 matched-budget gain -> N5 cross-environment replication

V4A-077 · PROTOCOL · V4-08

بروتوكول حاجز الحقبة قبل التدريب

Epoch-Barrier-before-Training

Failure: simple version pinning كاف.

Recovery: rollback to parent snapshot

Acceptance: deterministic typed output, trace/evidence receipt, no authority expansion, negative test passes.

Owners: L00 · L03 · L09 · L20 · L21 · L22

Trigger: high-impact transition is proposed

Preconditions: authority/risk profile + mission_id + policy/model epoch.

Transition: <- Epoch-Barrier-before-Training: high-impact transition is proposed -validate(authority/risk profile) -> operate on TimescaleClock -> emit receipt + unverified training ingestion

Metric: `unverified-training ingestion`

Promotion: N0 specification -> N1 schema -> N2 executable candidate -> N3 verified trace -> N4 matched-budget gain -> N5 cross-environment replication

V4A-078 · PROTOCOL · V4-08

بروتوكول إبطال الجلسات بعد سحب السلطة

Revocation-to-Session Invalidation

Failure: barriers تزيد latency بلا خفض incidents.

Recovery: rebase on current version and replay

Acceptance: deterministic typed output, trace/evidence receipt, no authority expansion, negative test passes.

Owners: L00 · L03 · L09 · L20 · L21 · L22

Trigger: version/epoch changes

Preconditions: versioned state snapshot + mission_id + policy/model epoch.

Transition: Revocation-to-Session Invalidation: version/epoch changes -> validate(versioned state snapshot) -> operate on GovernanceEpoch -> emit receipt + epoch mismatch incidents

Metric: `epoch mismatch incidents`

Promotion: N0 specification -> N1 schema -> N2 executable candidate -> N3 verified trace -> N4 matched-budget gain -> N5 cross-environment replication

Composition note

V4-08

: artifacts on this page compose into M-MTGST only when their receipts share mission/version lineage; standalone success does not promote the theory.

```
Artifact value = decision/effect improvement + failure localization + replayability - authority/cost/complexity penalties
```

ART-32 | سجل الأصول التشغيلية

V4A-079 · STACK · V4-08

ناقل الحاكمية متعدد الأزمنة

Multi-Timescale Governance Bus

Failure: لا توجد temporal alias failures في workload الحقيقي.

Recovery: quarantine output and escalate to court

Acceptance: deterministic typed output, trace/evidence receipt, no authority expansion, negative test passes.

Owners: L00 · L03 · L09 · L20 · L21 · L22

Promotion: N0 specification -> N1 schema -> N2 executable candidate -> N3 verified trace -> N4 matched-budget gain -> N5 cross-environment replication

Trigger: replay or verifier requests reconstruction

Preconditions: source/evidence pointers + mission_id + policy/model epoch.

Transition: Multi-Timescale Governance Bus: replay or verifier requests reconstruction -> validate(source/evidence pointers) -> operate on VersionBarrier -> emit receipt + sync latency

Metric: `sync latency`

V4A-080 · STACK · V4-08

متحكم الاتساق الزمني

Temporal Coherence Controller

Failure: simple version pinning كاف.

Recovery: return BLOCKED/PARTIAL with reason

Acceptance: deterministic typed output, trace/evidence receipt, no authority expansion, negative test passes.

Owners: L00 · L03 · L09 · L20 · L21 · L22

Promotion: N0 specification -> N1 schema -> N2 executable candidate -> N3 verified trace -> N4 matched-budget gain -> N5 cross-environment replication

Trigger: state/evidence conflict appears

Preconditions: typed mission context + mission_id + policy/model epoch.

Transition: Temporal Coherence Controller: state/evidence conflict appears -> validate(typed mission context) -> operate on FastLoopEvent -> emit receipt + cross-timescale drift

Metric: `cross-timescale drift`

Composition note

V4-08

: artifacts on this page compose into M-MTGST only when their receipts share mission/version lineage; standalone success does not promote the theory.

```
Artifact value = decision/effect improvement + failure localization + replayability - authority/cost/complexity penalties
```

ART-33 | سجل الأصول التشغيلية

V4A-081 · TOOL · V4-09

راسم حساسات شروط ما بعد الفعل

Postcondition Sensor Mapper

Failure: post-action verifier وحده كاف.

Recovery: rollback to parent snapshot

Acceptance: no authority expansion, trace/evidence receipt, deterministic typed output, negative test passes.

Owners: L16 · L17 · L18 · L19 · L20

Promotion: N0 specification -> N1 schema -> N2 executable candidate -> N3 verified trace -> N4 matched-budget gain -> N5 cross-environment replication

Trigger: high-impact transition is proposed

Preconditions: mission_id + policy/model epoch + authority/risk profile.

Transition: Postcondition Sensor Mapper: high-impact transition is proposed -> validate(authority/risk profile) -> operate on CoverageGap -> emit receipt + unverifiable action rate

Metric: `unverifiable action rate`

V4A-082 · TOOL · V4-09

مقياس تغطية قابلية الرصد

Observability Coverage Meter

Failure: observability score لا يتنبأ بالincident resolution.

Recovery: rebase on current version and replay

Acceptance: no authority expansion, trace/evidence receipt, deterministic typed output, negative test passes.

Owners: L16 · L17 · L18 · L19 · L20

Promotion: N0 specification -> N1 schema -> N2 executable candidate -> N3 verified trace -> N4 matched-budget gain -> N5 cross-environment replication

Trigger: version/epoch changes

Preconditions: mission_id + policy/model epoch + versioned state snapshot.

Transition: Observability Coverage Meter: version/epoch changes -> validate(versioned state snapshot) -> operate on BlindAction -> emit receipt + postcondition coverage

Metric: `postcondition coverage`

V4A-083 · TOOL · V4-09

كاشف الفعل الأعمى

Blind-Action Detector

Failure: instrumentation overhead يطغى على الفائدة.

Recovery: quarantine output and escalate to court

Acceptance: no authority expansion, trace/evidence receipt, deterministic typed output, negative test passes.

Owners: L16 · L17 · L18 · L19 · L20

Promotion: N0 specification -> N1 schema -> N2 executable candidate -> N3 verified trace -> N4 matched-budget gain -> N5 cross-environment replication

Trigger: replay or verifier requests reconstruction

Preconditions: mission_id + policy/model epoch + source/evidence pointers.

Transition: Blind-Action Detector: replay or verifier requests reconstruction + validate(source/evidence pointers) -> operate on InstrumentationReceipt -> emit receipt detection latency

Metric: `detection latency`

Composition note
V4-09
: artifacts on this page compose into M-PAOST only when their receipts share mission/version lineage; standalone success does not promote the theory.

```
Artifact value = decision/effect improvement + failure localization + replayability - authority/cost/complexity penalties
```

ART-34 | سجل الأصول التشغيلية

V4A-084 · TOOL · V4-09

محلل زمن كشف الأثر

Detection Latency Profiler

Failure: post-action verifier وحده كاف.

Recovery: return BLOCKED/PARTIAL with reason.

Acceptance: deterministic typed output, trace/evidence receipt, no authority expansion, negative test passes.

Owners: L16 · L17 · L18 · L19 · L20

Promotion: N0 specification -> N1 schema -> N2 executable candidate -> N3 verified trace -> N4 matched-budget gain -> N5 cross-environment replication

Trigger: state/evidence conflict appears

Preconditions: typed mission context + mission_id + policy/model epoch.

Transition: Detection Latency Profiler: state/evidence conflict appears -> validate(typed mission context) -> operate on ObservabilityContract -> emit receipt + blind-side-effect rate

Metric: `blind-side-effect rate`

V4A-085 · METHOD · V4-09

منهج تقييم الرصد المعدل بالمخاطر

Risk-Weighted Observability Scoring

Failure: observability score لا يتنبأ بالincident resolution.

Recovery: rollback to parent snapshot

Acceptance: deterministic typed output, trace/evidence receipt, no authority expansion, negative test passes.

Owners: L16 · L17 · L18 · L19 · L20

Promotion: N0 specification -> N1 schema -> N2 executable candidate -> N3 verified trace -> N4 matched-budget gain -> N5 cross-environment replication

Trigger: high-impact transition is proposed

Preconditions: authority/risk profile + mission_id + policy/model epoch.

Transition: <- Risk-Weighted Observability Scoring: high-impact transition is proposed validate(authority/risk profile) -> operate on EffectSensor -> emit receipt + instrumentation overhead

Metric: `instrumentation overhead`

Composition note
V4-09
: artifacts on this page compose into M-PAOST only when their receipts share mission/version lineage; standalone success does not promote the theory.

```
Artifact value = decision/effect improvement + failure localization + replayability - authority/cost/complexity penalties
```

ART-35 | سجل الأصول التشغيلية

V4A-086 · METHOD · V4-09

منهج تقدير قيمة إضافة أدوات الرصد

Instrumentation Value Estimation

Failure: instrumentation overhead يطغى على الفائدة.

Recovery: rebase on current version and replay

Acceptance: deterministic typed output, trace/evidence receipt, no authority expansion, negative test passes.

Owners: L16 · L17 · L18 · L19 · L20

Trigger: version/epoch changes

Preconditions: versioned state snapshot + mission_id + policy/model epoch.

Transition: Instrumentation Value Estimation: version/epoch changes -> validate(versioned state snapshot) -> operate on ReadbackPlan -> emit receipt + unverifiable action rate

Metric: `unverifiable action rate`

Promotion: N0 specification -> N1 schema -> N2 executable candidate -> N3 verified trace -> N4 matched-budget gain -> N5 cross-environment replication

V4A-087 · PROTOCOL · V4-09

بروتوكول الرصد قبل الفعل عالي الأثر

Instrument-before-High-Impact-Action

Failure: post-action verifier وحده كاف.

Recovery: quarantine output and escalate to court

Acceptance: deterministic typed output, trace/evidence receipt, no authority expansion, negative test passes.

Owners: L16 · L17 · L18 · L19 · L20

Trigger: replay or verifier requests reconstruction

Preconditions: source/evidence pointers + mission_id + policy/model epoch.

Transition: Instrument-before-High-Impact-Action: replay or verifier requests reconstruction + validate(source/evidence pointers) -> operate on DetectionLatency -> emit receipt <- postcondition coverage

Metric: `postcondition coverage`

Promotion: N0 specification -> N1 schema -> N2 executable candidate -> N3 verified trace -> N4 matched-budget gain -> N5 cross-environment replication

V4A-088 · PROTOCOL · V4-09

بروتوكول لا نجاح بلا شرط قابل للرصد

No-Success-without-Observable-Postcondition

Failure: observability score لا يتنبأ بالincident resolution.

Recovery: return BLOCKED/PARTIAL with reason

Acceptance: deterministic typed output, trace/evidence receipt, no authority expansion, negative test passes.

Owners: L16 · L17 · L18 · L19 · L20

Trigger: state/evidence conflict appears

Preconditions: typed mission context + mission_id + policy/model epoch.

Transition: <- No-Success-without-Observable-Postcondition: state/evidence conflict appears validate(typed mission context) -> operate on CoverageGap -> emit receipt + detection latency

Metric: `detection latency`

Promotion: N0 specification -> N1 schema -> N2 executable candidate -> N3 verified trace -> N4 matched-budget gain -> N5 cross-environment replication

Composition note
V4-09
: artifacts on this page compose into M-PAOST only when their receipts share mission/version lineage; standalone success does not promote the theory.

```
Artifact value = decision/effect improvement + failure localization + replayability - authority/cost/complexity penalties
```

ART-36 | سجل الأصول التشغيلية

V4A-089 · STACK · V4-09

خدمة عقد قابلية الرصد

Observability Contract Service

Failure: instrumentation overhead يطغى على الفائدة.

Recovery: rollback to parent snapshot

Acceptance: no authority expansion, trace/evidence receipt, deterministic typed output, negative test passes.

Owners: L16 · L17 · L18 · L19 · L20

Trigger: high-impact transition is proposed

Preconditions: policy/model epoch + mission_id + authority/risk profile.

Transition: Observability Contract Service: high-impact transition is proposed -> validate(authority/risk profile) -> operate on BlindAction -> emit receipt + blind-side-effect rate

Metric: `blind-side-effect rate`

Promotion: N0 specification -> N1 schema -> N2 executable candidate -> N3 verified trace -> N4 matched-budget gain -> N5 cross-environment replication

V4A-090 · STACK · V4-09

بوابة منع الفعل الأعمى

Blind-Action Prevention Gate

Failure: post-action verifier وحده كاف.

Recovery: rebase on current version and replay

Acceptance: no authority expansion, trace/evidence receipt, deterministic typed output, negative test passes.

Owners: L16 · L17 · L18 · L19 · L20

Trigger: version/epoch changes

Preconditions: policy/model epoch + mission_id + versioned state snapshot.

Transition: Blind-Action Prevention Gate: version/epoch changes -> validate(versioned state snapshot) -> operate on InstrumentationReceipt -> emit receipt + instrumentation overhead

Metric: `instrumentation overhead`

Promotion: N0 specification -> N1 schema -> N2 executable candidate -> N3 verified trace -> N4 matched-budget gain -> N5 cross-environment replication

Composition note
V4-09
: artifacts on this page compose into M-PAOST only when their receipts share mission/version lineage; standalone success does not promote the theory.

```
Artifact value = decision/effect improvement + failure localization + replayability - authority/cost/complexity penalties
```

ART-37 | سجل الأصول التشغيلية

V4A-091 · TOOL · V4-10

بانِي رسم اشتقاق التمثيلات

Representation Derivation Graph Builder

Failure: TTL بسيط يحقق نفس النتائج.

Recovery: quarantine output and escalate to court

Acceptance: deterministic typed output, trace/evidence receipt, no authority expansion, negative test passes.

Owners: L02 · L07 · L08 · L12 · L21 · L22

Trigger: replay or verifier requests reconstruction

Preconditions: source/evidence pointers + mission_id + policy/model epoch.

Transition: Representation Derivation Graph Builder: replay or verifier requests reconstruction -> validate(source/evidence pointers) -> operate on RepresentationNode -> emit receipt + stale derivative action rate

Metric: `stale derivative action rate`

Promotion: N0 specification -> N1 schema -> N2 executable candidate -> N3 verified trace -> N4 matched-budget gain -> N5 cross-environment replication

V4A-092 · TOOL · V4-10

مدقق بصمات التبعية

Dependency Hash Auditor

Failure: derivation graph معقد وغير مكتمل فلا يخفض stale errors.

Recovery: return BLOCKED/PARTIAL with reason

Acceptance: deterministic typed output, trace/evidence receipt, no authority expansion, negative test passes.

Owners: L02 · L07 · L08 · L12 · L21 · L22

Trigger: state/evidence conflict appears

Preconditions: typed mission context + mission_id + policy/model epoch.

Transition: Dependency Hash Auditor: state/evidence conflict appears -> validate(typed mission context) -> operate on DerivationEdge -> emit receipt + invalidation precision/recall

Metric: `invalidation precision/recall`

Promotion: N0 specification -> N1 schema -> N2 executable candidate -> N3 verified trace -> N4 matched-budget gain -> N5 cross-environment replication

V4A-093 · TOOL · V4-10

كاشف المشتق المتقادم

Stale Derivative Detector

Failure: semantic delta لا يتنبأ بضرورة rebuild.

Recovery: rollback to parent snapshot

Acceptance: deterministic typed output, trace/evidence receipt, no authority expansion, negative test passes.

Owners: L02 · L07 · L08 · L12 · L21 · L22

Trigger: high-impact transition is proposed

Preconditions: authority/risk profile + mission_id + policy/model epoch.

Transition: Stale Derivative Detector: high-impact transition is proposed -> validate(authority/risk profile) -> operate on DependencyHash -> emit receipt + rebuild latency

Metric: `rebuild latency`

Promotion: N0 specification -> N1 schema -> N2 executable candidate -> N3 verified trace -> N4 matched-budget gain -> N5 cross-environment replication

Composition note

V4-10

: artifacts on this page compose into M-CRKCIT only when their receipts share mission/version lineage; standalone success does not promote the theory.

```
Artifact value = decision/effect improvement + failure localization + replayability - authority/cost/complexity penalties
```

ART-38 | سجل الأصول التشغيلية

V4A-094 · TOOL · V4-10

مخطط موجة الإبطال

Invalidation Wave Planner

Failure: TTL بسيط يحقق نفس النتائج.

Recovery: rebase on current version and replay

Acceptance: deterministic typed output, trace/evidence receipt, no authority expansion, negative test passes.

Owners: L02 · L07 · L08 · L12 · L21 · L22

Trigger: version/epoch changes

Preconditions: versioned state snapshot + mission_id + policy/model epoch.

Transition: Invalidation Wave Planner: version/epoch changes -> validate(versioned state snapshot) -> operate on InvalidationWave -> emit receipt + cross-representation contradiction

Metric: `cross-representation contradiction`

Promotion: N0 specification -> N1 schema -> N2 executable candidate -> N3 verified trace -> N4 matched-budget gain -> N5 cross-environment replication

V4A-095 · METHOD · V4-10

منهج تحليل أثر الفرق الدلالي

Semantic Delta Impact Analysis

Failure: derivation graph معقد وغير مكتمل فلا يخفض stale errors.

Recovery: quarantine output and escalate to court

Acceptance: deterministic typed output, trace/evidence receipt, no authority expansion, negative test passes.

Owners: L02 · L07 · L08 · L12 · L21 · L22

Trigger: replay or verifier requests reconstruction

Preconditions: source/evidence pointers + mission_id + policy/model epoch.

Transition: <- Semantic Delta Impact Analysis: replay or verifier requests reconstruction + validate(source/evidence pointers) -> operate on CoherenceCheck -> emit receipt dependency coverage

Metric: `dependency coverage`

Promotion: N0 specification -> N1 schema -> N2 executable candidate -> N3 verified trace -> N4 matched-budget gain -> N5 cross-environment replication

Composition note
V4-10
: artifacts on this page compose into M-CRKCIT only when their receipts share mission/version lineage; standalone success does not promote the theory.

```
Artifact value = decision/effect improvement + failure localization + replayability - authority/cost/complexity penalties
```

ART-39 | سجل الأصول التشغيلية

V4A-096 · METHOD · V4-10

منهج أولوية إعادة البناء حسب الأثر

Impact-First Rebuild Prioritization

Failure: semantic delta لا يتنبأ بضرورة rebuild.

Recovery: return BLOCKED/PARTIAL with reason

Acceptance: deterministic typed output, trace/evidence receipt, no authority expansion, negative test passes.

Owners: L02 · L07 · L08 · L12 · L21 · L22

Trigger: state/evidence conflict appears

Preconditions: typed mission context + mission_id + policy/model epoch.

Transition: Impact-First Rebuild Prioritization: state/evidence conflict appears -> validate(typed mission context) -> operate on RebuildJob -> emit receipt + stale derivative action rate

Metric: `stale derivative action rate`

Promotion: N0 specification -> N1 schema -> N2 executable candidate -> N3 verified trace -> N4 matched-budget gain -> N5 cross-environment replication

V4A-097 · PROTOCOL · V4-10

بروتوكول إبطال المشتقات عند تغير المصدر

Source-Change Invalidation Protocol

Failure: TTL بسيط يحقق نفس النتائج.

Recovery: rollback to parent snapshot

Acceptance: deterministic typed output, trace/evidence receipt, no authority expansion, negative test passes.

Owners: L02 · L07 · L08 · L12 · L21 · L22

Trigger: high-impact transition is proposed

Preconditions: authority/risk profile + mission_id + policy/model epoch.

Transition: Source-Change Invalidation Protocol: high-impact transition is proposed -> validate(authority/risk profile) -> operate on StaleDerivative -> emit receipt + invalidation precision/recall

Metric: `invalidation precision/recall`

Promotion: N0 specification -> N1 schema -> N2 executable candidate -> N3 verified trace -> N4 matched-budget gain -> N5 cross-environment replication

V4A-098 · PROTOCOL · V4-10

بروتوكول إعادة التحقق قبل إعادة استعمال المشتق

Revalidate-before-Derivative-Reuse

Failure: derivation graph معقد وغير مكتمل فلا يخفض stale errors.

Recovery: rebase on current version and replay

Acceptance: deterministic typed output, trace/evidence receipt, no authority expansion, negative test passes.

Owners: L02 · L07 · L08 · L12 · L21 · L22

Trigger: version/epoch changes

Preconditions: versioned state snapshot + mission_id + policy/model epoch.

Transition: Revalidate-before-Derivative-Reuse: version/epoch changes -> validate(versioned state snapshot) -> operate on RepresentationNode -> emit receipt + rebuild latency

Metric: `rebuild latency`

Promotion: N0 specification -> N1 schema -> N2 executable candidate -> N3 verified trace -> N4 matched-budget gain -> N5 cross-environment replication

Composition note
V4-10
: artifacts on this page compose into M-CRKCIT only when their receipts share mission/version lineage; standalone success does not promote the theory.

```
Artifact value = decision/effect improvement + failure localization + replayability - authority/cost/complexity penalties
```

ART-40 | سجل الأصول التشغيلية

V4A-099 · STACK · V4-10

خدمة اتساق المعرفة عبر التمثيلات

Cross-Representation Coherence Service

Failure: semantic delta لا يتنبأ بضرورة rebuild.

Recovery: quarantine output and escalate to court

Acceptance: deterministic typed output, trace/evidence receipt, no authority expansion, negative test passes.

Owners: L02 · L07 · L08 · L12 · L21 · L22

Trigger: replay or verifier requests reconstruction

Preconditions: source/evidence pointers + mission_id + policy/model epoch.

Transition: Cross-Representation Coherence Service: replay or verifier requests reconstruction -validate(source/evidence pointers) -> operate on DerivationEdge -> emit receipt + cross <- representation contradiction

Metric: `cross-representation contradiction`

Promotion: N0 specification -> N1 schema -> N2 executable candidate -> N3 verified trace -> N4 matched-budget gain -> N5 cross-environment replication

V4A-100 · STACK · V4-10

منسق إبطال المعرفة

Knowledge Invalidation Orchestrator

Failure: TTL بسيط يحقق نفس النتائج.

Recovery: return BLOCKED/PARTIAL with reason

Acceptance: deterministic typed output, trace/evidence receipt, no authority expansion, negative test passes.

Owners: L02 · L07 · L08 · L12 · L21 · L22

Trigger: state/evidence conflict appears

Preconditions: typed mission context + mission_id + policy/model epoch.

Transition: Knowledge Invalidation Orchestrator: state/evidence conflict appears <- validate(typed mission context) -> operate on DependencyHash -> emit receipt + dependency coverage

Metric: `dependency coverage`

Promotion: N0 specification -> N1 schema -> N2 executable candidate -> N3 verified trace -> N4 matched-budget gain -> N5 cross-environment replication

Composition note

V4-10

: artifacts on this page compose into M-CRKCIT only when their receipts share mission/version lineage; standalone success does not promote the theory.

```
Artifact value = decision/effect improvement + failure localization + replayability - authority/cost/complexity penalties
```

I01 | Repository Topology

/repo/contracts, repo/runtime, repo/knowledge, repo/evals, repo/training, repo/adapters, repo executable canonical مع papers خلط يمنع؛ telemetry, repo/migrations, repo/courts, repo/schemas state.

- Every file/module has canonical identity and semantic version.
- Every consequential transition is evented and traceable.
- Every external effect has observability/readback.
- Every training/refactor has rollback and benchmark anchor.
- Negative/null outcomes are retained and change routing.

```
I01: spec -> schema -> unit -> integration -> fault -> replay -> shadow ->
canary -> controlled promotion
```

Path	Responsibility
contracts/	JSON/Pydantic schemas; authority/evidence/state contracts
runtime/	mission engine, router, loops, transactions
knowledge/	source/claim/graph/memory/invalidation
adapters/	MCP/A2A/API/CLI semantic adapters
courts/	falsification, constraints, verifier independence
training/	dataset manifests, adapters/LoRA, promotion
evals/	benchmark capsules, fault suites, scorers
telemetry/	events, traces, metrics, replay bundles
migrations/	versioned state/registry/refactor migrations

I02 | Canonical Registries

- Every file/module has canonical identity and semantic version.
- Every consequential transition is evented and traceable.
- Every external effect has observability/readback.

ENTITY_REGISTRY, CLAIM_REGISTRY, CAPABILITY_REGISTRY, TOOL_REGISTRY, AGENT_REGISTRY, POLICY_REGISTRY, CHECKPOINT_REGISTRY, EXPERIMENT_REGISTRY, EFFECT_LEDGER, DEPRECATION_REGISTRY.

```
RegistryEntry{id,canonical_id,type,version,status,owner,source_refs,dependencies,authority,evidence_grade,tests,metrics,created_at,supersedes,deprecation_ref}
```

- Every training/refactor has rollback and benchmark anchor.
- Negative/null outcomes are retained and change routing.

```
I02: spec -> schema -> unit -> integration -> fault -> replay -> shadow ->
canary -> controlled promotion
```

I03 | Event Model

,Append-only MissionEvent stream: goal.accepted, question.opened, claim.observed ,route.selected, action.intended, tool.receipt, effect.observed, verdict.issued, memory.proposed .memory.committed, rollback.completed

- .Every file/module has canonical identity and semantic version
- .Every consequential transition is evented and traceable
- .Every external effect has observability/readback
- .Every training/refactor has rollback and benchmark anchor
- .Negative/null outcomes are retained and change routing

```
I03: spec -> schema -> unit -> integration -> fault -> replay -> shadow ->
canary -> controlled promotion
```

```
MissionEvent{event_id,mission_id,transaction_id,span_id,layer,object_ids,policy_epoch,model_epoch,state_before_hash,state_after_hash,evidence_refs,effect_refs,
status,time}
```

I04 | State Store

-MVCC/transactional store for cognitive snapshots + object versions; blobs/evidence content addressed; graph edges versioned; no silent overwrite.

- Every file/module has canonical identity and semantic version.
- Every consequential transition is evented and traceable.
- Every external effect has observability/readback.
- Every training/refactor has rollback and benchmark anchor.
- Negative/null outcomes are retained and change routing.

```
I04: spec -> schema -> unit -> integration -> fault -> replay -> shadow ->
canary -> controlled promotion
```

Isolation	Use
Read committed	low-risk telemetry/read-only tasks
Snapshot	long reasoning on stable state
Serializable cognitive	high-impact concurrent knowledge/memory updates

I05 | Boot Sequence

<- load constitution -> resolve project identity -> discover environment -> attest capabilities load canonical registries -> pin policy/model epochs -> initialize trace -> open mission .transaction

- .Every file/module has canonical identity and semantic version
- .Every consequential transition is evented and traceable
- .Every external effect has observability/readback
- .Every training/refactor has rollback and benchmark anchor
- .Negative/null outcomes are retained and change routing

```
I05: spec -> schema -> unit -> integration -> fault -> replay -> shadow ->
canary -> controlled promotion
```

```
BOOT = Constitution -> Identity -> Environment -> Capabilities -> Registries -> Policy/Model Epochs -> Knowledge Snapshot -> Trace Root -> Mission Transaction
```

I06 | Mission Runtime

<- GoalContract -> QuestionCard -> ActiveDifference -> typed world/context -> route -> plan
checkpoint -> action -> readback -> courts -> effect -> memory -> higher question.

- Every file/module has canonical identity and semantic version.
- Every consequential transition is evented and traceable.
- Every external effect has observability/readback.

```
I06: spec -> schema -> unit -> integration -> fault -> replay -> shadow ->
canary -> controlled promotion
```

- Negative/null outcomes are retained and change routing.
- Every training/refactor has rollback and benchmark anchor.

Requirement	Engineering check
stable IDs/version	Identity
typed before/after	State
explicit tier/delegation	Authority
source + grade + replay	Evidence
typed, testable, recoverable	Failure
predeclared + guardrails	Metrics
last safe state/compensation	Rollback
supersedes/deprecation	Lineage

I07 | Five-Kernel Fabric

Kernels can specialize, but canonical mutation requires mission owner + lease epoch + fencing token + CAS; workers return proposals/evidence, not authoritative state writes.

- Every file/module has canonical identity and semantic version.
- Every consequential transition is evented and traceable.
- Every external effect has observability/readback.
- Every training/refactor has rollback and benchmark anchor.
- Negative/null outcomes are retained and change routing.

```
I07: spec -> schema -> unit -> integration -> fault -> replay -> shadow ->
canary -> controlled promotion
```

Rule	Enforcement
single mission owner	lease + epoch + fencing token
workers propose	no canonical write without CAS
handoff	explicit owner transfer receipt
failure	lease expiry + replay from event log
shared effect	saga/compensation when no atomic transaction

I08 | Adapter Certification

Every MCP/A2A/API/CLI adapter publishes semantic contract, effect class, authority requirements, idempotency, readback, version compatibility, round-trip tests and loss budget.

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- Every consequential transition is evented and traceable.
- Every external effect has observability/readback.
- Every training/refactor has rollback and benchmark anchor.
- Negative/null outcomes are retained and change routing.

```
I08: spec -> schema -> unit -> integration -> fault -> replay -> shadow ->
canary -> controlled promotion
```

Requirement	Engineering check
stable IDs/version	Identity
typed before/after	State
explicit tier/delegation	Authority
source + grade + replay	Evidence
typed, testable, recoverable	Failure
predeclared + guardrails	Metrics
last safe state/compensation	Rollback
supersedes/deprecation	Lineage

I09 | Continuous Learning

/verified trace quarantine -> dataset manifest -> dedupe/privacy/license -> isolated LoRA <- adapter training -> frozen eval -> forgetting vector -> security eval -> shadow -> canary .promotion court -> rollback

- .Every file/module has canonical identity and semantic version
- .Every consequential transition is evented and traceable
- .Every external effect has observability/readback
- .Every training/refactor has rollback and benchmark anchor
- .Negative/null outcomes are retained and change routing

```
I09: spec -> schema -> unit -> integration -> fault -> replay -> shadow ->
canary -> controlled promotion
```

```
VerifiedTrace -> Quarantine -> DatasetManifest -> IsolatedTrain -> FrozenEval -> ForgettingVector -> SecurityEval -> Shadow -> Canary -> Court -> Promote|
Rollback
```

I10 | Knowledge Invalidation

source delta -> impact analysis -> invalidation wave -> graph/index/cache/skill/memory rebuild queue -> post-rebuild coherence test; weights handled by eval, not direct invalidation.

- Every file/module has canonical identity and semantic version.
- Every consequential transition is evented and traceable.
- Every external effect has observability/readback.
- Every training/refactor has rollback and benchmark anchor.
- Negative/null outcomes are retained and change routing.

```
I10: spec -> schema -> unit -> integration -> fault -> replay -> shadow ->
canary -> controlled promotion
```

Requirement	Engineering check
stable IDs/version	Identity
typed before/after	State
explicit tier/delegation	Authority
source + grade + replay	Evidence
typed, testable, recoverable	Failure
predeclared + guardrails	Metrics
last safe state/compensation	Rollback
supersedes/deprecation	Lineage

I11 | Telemetry Schema

- Every file/module has canonical identity and semantic version.
- Every consequential transition is evented and traceable.
- Every external effect has observability/readback.
- Every training/refactor has rollback and benchmark anchor.
- Negative/null outcomes are retained and change routing.

```
I11: spec -> schema -> unit -> integration -> fault -> replay -> shadow ->
canary -> controlled promotion
```

trace_id, mission_id, transaction_id, parent_span, layer, object_ids, policy_epoch, model_version, input_hash, output_hash, latency, cost, authority, evidence_refs, state_delta, effect_refs, verdict.

Requirement	Engineering check
stable IDs/version	Identity
typed before/after	State
explicit tier/delegation	Authority
source + grade + replay	Evidence
typed, testable, recoverable	Failure
predeclared + guardrails	Metrics
last safe state/compensation	Rollback
supersedes/deprecation	Lineage

I12 | Security Model

least authority; secret references not embedded in KB; prompt/data/tool boundaries; code injection trapping; output validation; egress controls; project isolation; audit and rollback.

- Every file/module has canonical identity and semantic version.
- Every consequential transition is evented and traceable.
- Every external effect has observability/readback.

Threat	Control
prompt/data injection	content/tool boundary + allowlisted adapters
secret leakage	secret references + output scan
authority drift	T0-T4 + expiring delegation
wrong target	canonical identity + readback
silent failure	postcondition + effect receipt
cross-project bleed	identity/memory scope isolation

- Every training/refactor has rollback and benchmark anchor.
- Negative/null outcomes are retained and change routing.

```
I12: spec -> schema -> unit -> integration -> fault -> replay -> shadow ->
canary -> controlled promotion
```

I13 | Budget Controller

- separate budgets for token/compute/tool calls/wall time/proof effort/world-effect exposure.
- Router spends where expected verified value is positive.
- Every file/module has canonical identity and semantic version.
- Every consequential transition is evented and traceable.
- Every external effect has observability/readback.

```
Budget = <tokens,compute,tool_calls,wall_time,money,proof_effort,effect_exposure>; route only if ExpectedVerifiedValue > MarginalCost + RiskPenalty
```

- Every training/refactor has rollback and benchmark anchor.
- Negative/null outcomes are retained and change routing.

```
I13: spec -> schema -> unit -> integration -> fault -> replay -> shadow ->
canary -> controlled promotion
```

I14 | Release Engineering

candidate -> shadow -> canary -> scoped production. No component promoted because registry says active; requires tests, metrics, rollback and owner.

- Every file/module has canonical identity and semantic version.
- Every consequential transition is evented and traceable.
- Every external effect has observability/readback.
- Every training/refactor has rollback and benchmark anchor.
- Negative/null outcomes are retained and change routing.

```
I14: spec -> schema -> unit -> integration -> fault -> replay -> shadow ->
canary -> controlled promotion
```

Requirement	Engineering check
stable IDs/version	Identity
typed before/after	State
explicit tier/delegation	Authority
source + grade + replay	Evidence
typed, testable, recoverable	Failure
predeclared + guardrails	Metrics
last safe state/compensation	Rollback
supersedes/deprecation	Lineage

I15 | Migration Phase A

;Inventory and identity: compute hashes, aliases, semantic fingerprints, historical count views .freeze current vNEXT baseline and benchmark capsules

- .Every file/module has canonical identity and semantic version
- .Every consequential transition is evented and traceable
- .Every external effect has observability/readback

- .Every training/refactor has rollback and benchmark anchor
- .Negative/null outcomes are retained and change routing

```
I15: spec -> schema -> unit -> integration -> fault -> replay -> shadow ->
canary -> controlled promotion
```

Mode	Rule
passive	observe only
shadow	compute alternative, no commit
canary	bounded reversible missions
controlled	matched-budget eval
scoped prod	limited authority + monitoring
canonical	replication + deprecation lineage

I16 | Migration Phase B

Introduce L10 cognitive transactions, L03 thermostat, L01 self-state attestation without changing external behavior; run passive telemetry.

- Every file/module has canonical identity and semantic version.
- Every consequential transition is evented and traceable.
- Every external effect has observability/readback.
- Every training/refactor has rollback and benchmark anchor.
- Negative/null outcomes are retained and change routing.

```
I16: spec -> schema -> unit -> integration -> fault -> replay -> shadow ->
canary -> controlled promotion
```

Mode	Rule
passive	observe only
shadow	compute alternative, no commit
canary	bounded reversible missions
controlled	matched-budget eval
scoped prod	limited authority + monitoring
canonical	replication + deprecation lineage

I17 | Migration Phase C

Enable constraint closure, pre-action observability, irreversibility/residual ledger on T2/T3 flows; keep old gate as fallback.

- Every file/module has canonical identity and semantic version.
- Every consequential transition is evented and traceable.
- Every external effect has observability/readback.
- Every training/refactor has rollback and benchmark anchor.
- Negative/null outcomes are retained and change routing.

```
I17: spec -> schema -> unit -> integration -> fault -> replay -> shadow ->
canary -> controlled promotion
```

Mode	Rule
passive	observe only
shadow	compute alternative, no commit
canary	bounded reversible missions
controlled	matched-budget eval
scoped prod	limited authority + monitoring
canonical	replication + deprecation lineage

I18 | Migration Phase D

;Enable multi-timescale epochs, knowledge invalidation and architecture refactor shadow plane
.no auto-deprecation until differential replay

- .Every file/module has canonical identity and semantic version
- .Every consequential transition is evented and traceable
- .Every external effect has observability/readback

- .Every training/refactor has rollback and benchmark anchor
- .Negative/null outcomes are retained and change routing

```
I18: spec -> schema -> unit -> integration -> fault -> replay -> shadow ->
canary -> controlled promotion
```

Mode	Rule
passive	observe only
shadow	compute alternative, no commit
canary	bounded reversible missions
controlled	matched-budget eval
scoped prod	limited authority + monitoring
canonical	replication + deprecation lineage

I19 | Migration Phase E

Run full vNext4 integrated long-horizon benchmark, cross-provider transfer, fault injection, security regression; promote only net-positive modules.

- Every file/module has canonical identity and semantic version.
- Every consequential transition is evented and traceable.
- Every external effect has observability/readback.
- Every training/refactor has rollback and benchmark anchor.
- Negative/null outcomes are retained and change routing.

```
I19: spec -> schema -> unit -> integration -> fault -> replay -> shadow ->
canary -> controlled promotion
```

Mode	Rule
passive	observe only
shadow	compute alternative, no commit
canary	bounded reversible missions
controlled	matched-budget eval
scoped prod	limited authority + monitoring
canonical	replication + deprecation lineage

I20 | Definition of Engineering Done

,Reproducible build, 24 layer interfaces, 100 artifact schemas, signed benchmark/replay bundles no critical regression, rollback tested, source/claim lineage queryable, public/external .replication plan

- .Every file/module has canonical identity and semantic version
- .Every consequential transition is evented and traceable
- .Every external effect has observability/readback
- .Every training/refactor has rollback and benchmark anchor
- .Negative/null outcomes are retained and change routing

```
I20: spec -> schema -> unit -> integration -> fault -> replay -> shadow ->
canary -> controlled promotion
```

Engineering check	Requirement
Identity	stable IDs/version
State	typed before/after
Authority	explicit tier/delegation
Evidence	source + grade + replay
Failure	typed, testable, recoverable
Metrics	predeclared + guardrails
Rollback	last safe state/compensation
Lineage	supersedes/deprecation

B01 | Claim Replay & Evidence Grade

Axis	Design
Research question	هل يمكن إعادة claim من raw artifact؟
Baselines	reported-summary baseline; forensic capsule
Stress set	headline claims + hidden conflicting artifacts
Primary/secondary	claim reproducibility, grade precision, source-root independence
Budget	same model/tools/context cap/tool-call/time/proof envelope
Reproducibility	task/split/config/scorer hashes + raw traces + environment manifest
Statistics	repeated seeds when stochastic; CI; worst slice; effect size
Safety guardrails	authority, privacy, rollback, calibration, false-success, residual effect

Ablation grid

- full vNext4 treatment
- remove target theory only
- replace with nearest prior mechanism
- remove verifier/observability component where safe
- provider/tool swap
- context compaction perturbation
- stale evidence injection
- delayed/duplicate world-effect events

Verdict rules

- aggregate gain cannot hide critical regression
- no E4 without matched-budget control
- no E5 without independent transfer/replication
- negative transfer scopes the claim
- benchmark contamination triggers renewal
- store raw failure trajectories

```
B01.ResearchValue = VerifiedGain - CriticalRegressionPenalty - ComplexityCost - EvaluationLeakageRisk
```

B02 | Question/Difference Calibration

Axis	Design
Research question	هل السؤال يقلل مساحة القرار؟
Baselines	raw planner; fixed question template
Stress set	tasks with irrelevant but plausible questions
Primary/secondary	decision gain/question, branch reduction, ECE
Budget	same model/tools/context cap/tool-call/time/proof envelope
Reproducibility	task/split/config/scorer hashes + raw traces + environment manifest
Statistics	repeated seeds when stochastic; CI; worst slice; effect size
Safety guardrails	authority, privacy, rollback, calibration, false-success, residual effect

Ablation grid

- full vNext4 treatment
- remove target theory only
- replace with nearest prior mechanism
- remove verifier/observability component where safe
- provider/tool swap
- context compaction perturbation
- stale evidence injection
- delayed/duplicate world-effect events

Verdict rules

- aggregate gain cannot hide critical regression
- no E4 without matched-budget control
- no E5 without independent transfer/replication
- negative transfer scopes the claim
- benchmark contamination triggers renewal
- store raw failure trajectories

```
B02.ResearchValue = VerifiedGain - CriticalRegressionPenalty - ComplexityCost - EvaluationLeakageRisk
```

B03 | MCD/QMCD Routing

Axis	Design
Research question	هل routing يتفوق بعد ضبط budget؟
Baselines	single model; cheapest route; heuristic MCD
Stress set	provider/tool perturbations
Primary/secondary	route regret, verified gain/compute, latency
Budget	same model/tools/context cap/tool-call/time/proof envelope
Reproducibility	task/split/config/scorer hashes + raw traces + environment manifest
Statistics	repeated seeds when stochastic; CI; worst slice; effect size
Safety guardrails	authority, privacy, rollback, calibration, false-success, residual effect

Ablation grid

- full vNext4 treatment
- remove target theory only
- replace with nearest prior mechanism
- remove verifier/observability component where safe
- provider/tool swap
- context compaction perturbation
- stale evidence injection
- delayed/duplicate world-effect events

Verdict rules

- aggregate gain cannot hide critical regression
- no E4 without matched-budget control
- no E5 without independent transfer/replication
- negative transfer scopes the claim
- benchmark contamination triggers renewal
- store raw failure trajectories

```
B03.ResearchValue = VerifiedGain - CriticalRegressionPenalty - ComplexityCost - EvaluationLeakageRisk
```

B04 | Typed Ontology & Plural Calculi

Axis	Design
Research question	هل type/rank preservation يمنع reasoning errors؟
Baselines	untyped CoT; one calculus
Stress set	mixed normative/probabilistic/causal claims
Primary/secondary	type violations, rank loss, judgment accuracy
Budget	same model/tools/context cap/tool-call/time/proof envelope
Reproducibility	task/split/config/scorer hashes + raw traces + environment manifest
Statistics	repeated seeds when stochastic; CI; worst slice; effect size
Safety guardrails	authority, privacy, rollback, calibration, false-success, residual effect

Ablation grid

- full vNext4 treatment
- remove target theory only
- replace with nearest prior mechanism
- remove verifier/observability component where safe
- provider/tool swap
- context compaction perturbation
- stale evidence injection
- delayed/duplicate world-effect events

Verdict rules

- aggregate gain cannot hide critical regression
- no E4 without matched-budget control
- no E5 without independent transfer/replication
- negative transfer scopes the claim
- benchmark contamination triggers renewal
- store raw failure trajectories

```
B04.ResearchValue = VerifiedGain - CriticalRegressionPenalty - ComplexityCost - EvaluationLeakageRisk
```

B05 | Context Compaction & Reconstruction

Axis	Design
Research question	هل الضغط يحفظ decision invariants؟
Baselines	full context; naive summary
Stress set	long histories with buried authority changes
Primary/secondary	fidelity/token, missing constraint rate, reconstruction success
Budget	same model/tools/context cap/tool-call/time/proof envelope
Reproducibility	task/split/config/scorer hashes + raw traces + environment manifest
Statistics	repeated seeds when stochastic; CI; worst slice; effect size
Safety guardrails	authority, privacy, rollback, calibration, false-success, residual effect

Ablation grid

- full vNext4 treatment
- remove target theory only
- replace with nearest prior mechanism
- remove verifier/observability component where safe
- provider/tool swap
- context compaction perturbation
- stale evidence injection
- delayed/duplicate world-effect events

Verdict rules

- aggregate gain cannot hide critical regression
- no E4 without matched-budget control
- no E5 without independent transfer/replication
- negative transfer scopes the claim
- benchmark contamination triggers renewal
- store raw failure trajectories

```
B05.ResearchValue = VerifiedGain - CriticalRegressionPenalty - ComplexityCost - EvaluationLeakageRisk
```

B06 | Cognitive Transaction Isolation

Axis	Design
Research question	هل التوازي يلوث belief state؟
Baselines	last-write-wins; simple versioning
Stress set	concurrent updates during long missions
Primary/secondary	dirty reads, phantom claims, abort precision
Budget	same model/tools/context cap/tool-call/time/proof envelope
Reproducibility	task/split/config/scorer hashes + raw traces + environment manifest
Statistics	repeated seeds when stochastic; CI; worst slice; effect size
Safety guardrails	authority, privacy, rollback, calibration, false-success, residual effect

Ablation grid

- full vNext4 treatment
- remove target theory only
- replace with nearest prior mechanism
- remove verifier/observability component where safe
- provider/tool swap
- context compaction perturbation
- stale evidence injection
- delayed/duplicate world-effect events

Verdict rules

- aggregate gain cannot hide critical regression
- no E4 without matched-budget control
- no E5 without independent transfer/replication
- negative transfer scopes the claim
- benchmark contamination triggers renewal
- store raw failure trajectories

```
B06.ResearchValue = VerifiedGain - CriticalRegressionPenalty - ComplexityCost - EvaluationLeakageRisk
```

B07 | Epistemic Thermostat

Axis	Design
Research question	هل uncertainty feedback يحسن utility؟
Baselines	fixed confidence threshold; proof budget only
Stress set	risk-tiered incomplete-evidence tasks
Primary/secondary	ECE, paralysis, unsafe action, proof cost
Budget	same model/tools/context cap/tool-call/time/proof envelope
Reproducibility	task/split/config/scorer hashes + raw traces + environment manifest
Statistics	repeated seeds when stochastic; CI; worst slice; effect size
Safety guardrails	authority, privacy, rollback, calibration, false-success, residual effect

Ablation grid

- full vNext4 treatment
- remove target theory only
- replace with nearest prior mechanism
- remove verifier/observability component where safe
- provider/tool swap
- context compaction perturbation
- stale evidence injection
- delayed/duplicate world-effect events

Verdict rules

- aggregate gain cannot hide critical regression
- no E4 without matched-budget control
- no E5 without independent transfer/replication
- negative transfer scopes the claim
- benchmark contamination triggers renewal
- store raw failure trajectories

```
B07.ResearchValue = VerifiedGain - CriticalRegressionPenalty - ComplexityCost - EvaluationLeakageRisk
```

B08 | Self-Model Boundary Integrity

Axis	Design
Research question	هل النظام يعرف فعليا قدراته وحدوده؟
Baselines	prompt self-description; env discovery
Stress set	tool/provider/project swaps
Primary/secondary	capability-claim precision, permission hallucination
Budget	same model/tools/context cap/tool-call/time/proof envelope
Reproducibility	task/split/config/scorer hashes + raw traces + environment manifest
Statistics	repeated seeds when stochastic; CI; worst slice; effect size
Safety guardrails	authority, privacy, rollback, calibration, false-success, residual effect

Ablation grid

- full vNext4 treatment
- remove target theory only
- replace with nearest prior mechanism
- remove verifier/observability component where safe
- provider/tool swap
- context compaction perturbation
- stale evidence injection
- delayed/duplicate world-effect events

Verdict rules

- aggregate gain cannot hide critical regression
- no E4 without matched-budget control
- no E5 without independent transfer/replication
- negative transfer scopes the claim
- benchmark contamination triggers renewal
- store raw failure trajectories

```
B08.ResearchValue = VerifiedGain - CriticalRegressionPenalty - ComplexityCost - EvaluationLeakageRisk
```

B09 | Constraint Propagation Closure

Axis	Design
Research question	هل القيود تحفظ عبر stack؟
Baselines	local validators
Stress set	deliberate adapter/skill omissions
Primary/secondary	constraint retention, silent relaxation, false block
Budget	same model/tools/context cap/tool-call/time/proof envelope
Reproducibility	task/split/config/scorer hashes + raw traces + environment manifest
Statistics	repeated seeds when stochastic; CI; worst slice; effect size
Safety guardrails	authority, privacy, rollback, calibration, false-success, residual effect

Ablation grid

- full vNext4 treatment
- remove target theory only
- replace with nearest prior mechanism
- remove verifier/observability component where safe
- provider/tool swap
- context compaction perturbation
- stale evidence injection
- delayed/duplicate world-effect events

Verdict rules

- aggregate gain cannot hide critical regression
- no E4 without matched-budget control
- no E5 without independent transfer/replication
- negative transfer scopes the claim
- benchmark contamination triggers renewal
- store raw failure trajectories

```
B09.ResearchValue = VerifiedGain - CriticalRegressionPenalty - ComplexityCost - EvaluationLeakageRisk
```

B10 | Branching Memory

Axis	Design
Research question	هل hypotheses المتنافسة تبقى منفصلة حتى الدليل؟
Baselines	single narrative; uncertainty tags
Stress set	incident diagnosis with competing causes
Primary/secondary	contamination, merge precision, experiment yield
Budget	same model/tools/context cap/tool-call/time/proof envelope
Reproducibility	task/split/config/scorer hashes + raw traces + environment manifest
Statistics	repeated seeds when stochastic; CI; worst slice; effect size
Safety guardrails	authority, privacy, rollback, calibration, false-success, residual effect

Ablation grid

- full vNext4 treatment
- remove target theory only
- replace with nearest prior mechanism
- remove verifier/observability component where safe
- provider/tool swap
- context compaction perturbation
- stale evidence injection
- delayed/duplicate world-effect events

Verdict rules

- aggregate gain cannot hide critical regression
- no E4 without matched-budget control
- no E5 without independent transfer/replication
- negative transfer scopes the claim
- benchmark contamination triggers renewal
- store raw failure trajectories

```
B10.ResearchValue = VerifiedGain - CriticalRegressionPenalty - ComplexityCost - EvaluationLeakageRisk
```

B11 | Irreversibility & Residual Effects

Axis	Design
Research question	هل rollback يعيد فعلا العالم؟
Baselines	binary reversible classification
Stress set	email/CRM/publish/cache/model-memory effects
Primary/secondary	residual effect mass, false reversibility
Budget	same model/tools/context cap/tool-call/time/proof envelope
Reproducibility	task/split/config/scorer hashes + raw traces + environment manifest
Statistics	repeated seeds when stochastic; CI; worst slice; effect size
Safety guardrails	authority, privacy, rollback, calibration, false-success, residual effect

Ablation grid

- full vNext4 treatment
- remove target theory only
- replace with nearest prior mechanism
- remove verifier/observability component where safe
- provider/tool swap
- context compaction perturbation
- stale evidence injection
- delayed/duplicate world-effect events

Verdict rules

- aggregate gain cannot hide critical regression
- no E4 without matched-budget control
- no E5 without independent transfer/replication
- negative transfer scopes the claim
- benchmark contamination triggers renewal
- store raw failure trajectories

```
B11.ResearchValue = VerifiedGain - CriticalRegressionPenalty - ComplexityCost - EvaluationLeakageRisk
```

B12 | Multi-Timescale Governance

Axis	Design
Research question	هل epochs تمنع coupling stale؟
Baselines	version pinning
Stress set	policy/checkpoint changes during sessions
Primary/secondary	stale policy rate, unverified training ingestion
Budget	same model/tools/context cap/tool-call/time/proof envelope
Reproducibility	task/split/config/scorer hashes + raw traces + environment manifest
Statistics	repeated seeds when stochastic; CI; worst slice; effect size
Safety guardrails	authority, privacy, rollback, calibration, false-success, residual effect

Ablation grid

- full vNext4 treatment
- remove target theory only
- replace with nearest prior mechanism
- remove verifier/observability component where safe
- provider/tool swap
- context compaction perturbation
- stale evidence injection
- delayed/duplicate world-effect events

Verdict rules

- aggregate gain cannot hide critical regression
- no E4 without matched-budget control
- no E5 without independent transfer/replication
- negative transfer scopes the claim
- benchmark contamination triggers renewal
- store raw failure trajectories

```
B12.ResearchValue = VerifiedGain - CriticalRegressionPenalty - ComplexityCost - EvaluationLeakageRisk
```

B13 | Pre-Action Observability

Axis	Design
Research question	هل instrumentation المسبق يقلل blind success؟
Baselines	execute-then-verify
Stress set	APIs with weak/strong readback
Primary/secondary	unverifiable action, coverage, detection latency
Budget	same model/tools/context cap/tool-call/time/proof envelope
Reproducibility	task/split/config/scorer hashes + raw traces + environment manifest
Statistics	repeated seeds when stochastic; CI; worst slice; effect size
Safety guardrails	authority, privacy, rollback, calibration, false-success, residual effect

Ablation grid

- full vNext4 treatment
- remove target theory only
- replace with nearest prior mechanism
- remove verifier/observability component where safe
- provider/tool swap
- context compaction perturbation
- stale evidence injection
- delayed/duplicate world-effect events

Verdict rules

- aggregate gain cannot hide critical regression
- no E4 without matched-budget control
- no E5 without independent transfer/replication
- negative transfer scopes the claim
- benchmark contamination triggers renewal
- store raw failure trajectories

```
B13.ResearchValue = VerifiedGain - CriticalRegressionPenalty - ComplexityCost - EvaluationLeakageRisk
```

B14 | Cross-Representation Coherence

Axis	Design
Research question	هل update يبطل مشتقات المعرفة؟
Baselines	TTL/manual refresh
Stress set	source policy/fact/schema changes
Primary/secondary	stale derivative actions, invalidation precision
Budget	same model/tools/context cap/tool-call/time/proof envelope
Reproducibility	task/split/config/scorer hashes + raw traces + environment manifest
Statistics	repeated seeds when stochastic; CI; worst slice; effect size
Safety guardrails	authority, privacy, rollback, calibration, false-success, residual effect

Ablation grid

- full vNext4 treatment
- remove target theory only
- replace with nearest prior mechanism
- remove verifier/observability component where safe
- provider/tool swap
- context compaction perturbation
- stale evidence injection
- delayed/duplicate world-effect events

Verdict rules

- aggregate gain cannot hide critical regression
- no E4 without matched-budget control
- no E5 without independent transfer/replication
- negative transfer scopes the claim
- benchmark contamination triggers renewal
- store raw failure trajectories

```
B14.ResearchValue = VerifiedGain - CriticalRegressionPenalty - ComplexityCost - EvaluationLeakageRisk
```

B15 | Proof-Preserving Architecture Refactor

Axis	Design
Research question	هل يمكن تقليل التعقيد دون فقد capability؟
Baselines	no refactor; semantic dedupe only
Stress set	subsystems with redundant components
Primary/secondary	coverage/component, regression, debug time
Budget	same model/tools/context cap/tool-call/time/proof envelope
Reproducibility	task/split/config/scorer hashes + raw traces + environment manifest
Statistics	repeated seeds when stochastic; CI; worst slice; effect size
Safety guardrails	authority, privacy, rollback, calibration, false-success, residual effect

Ablation grid

- full vNext4 treatment
- remove target theory only
- replace with nearest prior mechanism
- remove verifier/observability component where safe
- provider/tool swap
- context compaction perturbation
- stale evidence injection
- delayed/duplicate world-effect events

Verdict rules

- aggregate gain cannot hide critical regression
- no E4 without matched-budget control
- no E5 without independent transfer/replication
- negative transfer scopes the claim
- benchmark contamination triggers renewal
- store raw failure trajectories

```
B15.ResearchValue = VerifiedGain - CriticalRegressionPenalty - ComplexityCost - EvaluationLeakageRisk
```

B16 | Integrated Long-Horizon vNext4.0

Axis	Design
Research question	هل الطبقات الجديدة تضيف causal value ككل؟
Baselines	vNEXT frozen; vNext4 without each new theory
Stress set	multi-day research/SWE/operations with faults
Primary/secondary	task success, safety, cost, recovery, calibration, transfer
Budget	same model/tools/context cap/tool-call/time/proof envelope
Reproducibility	task/split/config/scorer hashes + raw traces + environment manifest
Statistics	repeated seeds when stochastic; CI; worst slice; effect size
Safety guardrails	authority, privacy, rollback, calibration, false-success, residual effect

Ablation grid

- full vNext4 treatment
- remove target theory only
- replace with nearest prior mechanism
- remove verifier/observability component where safe
- provider/tool swap
- context compaction perturbation
- stale evidence injection
- delayed/duplicate world-effect events

Verdict rules

- aggregate gain cannot hide critical regression
- no E4 without matched-budget control
- no E5 without independent transfer/replication
- negative transfer scopes the claim
- benchmark contamination triggers renewal
- store raw failure trajectories

```
B16.ResearchValue = VerifiedGain - CriticalRegressionPenalty - ComplexityCost - EvaluationLeakageRisk
```

A01 | Ultra Research Loop 4.0 - تفاصيل التشغيل

كل run يبدأ بنسخة frozen من source/identity/policy/model/benchmark، ثم residual map من traces والفشل والاختلافات. لا يسمح للـresearch generator أن يكتب مباشرة؛ يكتب theory registry إلزامي أمام CandidateResidual. Hostile reduction يذهب إلى NegativeKnowledge، وليس إلى النسيان. إذا صار candidate redundant بعد تحديث parent يطلق Architecture Refactoring Court.

```
Freeze -> Residual -> Reduce -> Object -> Metric -> Experiment -> Observe ->
Attribute -> Replay -> Transfer -> Court -> Memory -> Refactor
```

- bind every statement to source/type/scope
- use typed state before text generation
- instrument before consequential action
- preserve unresolved conflicts
- make rollback/repair explicit
- prefer experiment over new terminology after saturation

A02 | Boot Manifest vNext4.0

Boot الموثوق لا يبدأ من prompt عام. يثبت goal contract، project identity، constitution version، policy/model epochs، environment fingerprint، capability/tool manifests، knowledge/memory snapshots، benchmark anchor، وtrace root. إذا تعذر عنصر حاكم ينتقل النظام إلى read-only/degraded/blocked حسب impact.

```
BOOT{constitution,identity,goal,policy_epoch,model_epoch,environment,capabilities,adapters,knowledge,memory,benchmark,trace_root}
```

- bind every statement to source/type/scope
- use typed state before text generation
- instrument before consequential action
- preserve unresolved conflicts
- make rollback/repair explicit
- prefer experiment over new terminology after saturation

A03 | Machine-Readable Theory / Artifact Schema

كل صفحة في هذا الكتاب يجب أن يمكن ضغطها إلى object آلي: id، parent، residual، objects، mechanism، layers، evidence grade، version/status، owner experiment، authority، falsifiers، metrics. بذلك تصبح الورقة seed للـregistry لا نهاية معرفية.

```
TheoryObject{id,type,parents,residual,objects,mechanism,metrics,falsifiers,authority,experiment,layers,grade,status,version}
```

- bind every statement to source/type/scope
- use typed state before text generation
- instrument before consequential action
- preserve unresolved conflicts
- make rollback/repair explicit
- prefer experiment over new terminology after saturation

A04 | Risk Register - المخاطر التي تستهدفها vNext4

أكبر مخاطر النسخة ليست فقط prompt injection: architecture inflation، proof theater، self-state hallucination، memory races، blind action، false reversibility، stale derivatives، cross-timescale aliasing، policy constraint erosion، continuous-learning self-promotion. لكل واحد owner وsignal وrollback.

```
Risk = likelihood * impact * irreversibility * propagation *
detection_latency
```

- bind every statement to source/type/scope
- use typed state before text generation
- instrument before consequential action
- preserve unresolved conflicts
- make rollback/repair explicit
- prefer experiment over new terminology after saturation

Risk	Primary control
architecture inflation	RACPRT
proof theater	Claim/Evidence Court
self-state hallucination	SMBIT
memory race	CTIT
blind action	PAOST
false reversibility	IFREAT
stale derivative	CRKCIT
temporal alias	MTGST
constraint erosion	CLCPC
uncertainty extremes	ETUHT

A05 | Crosswalk النظريات العشر مع الطبقات

لنظرية لا تملك layer منفردة كملكية دائمة؛ لكنها تملك owner layers حيث state transition الأساسي يقع. crosswalk يمنع orphan theory ويسمح بقياس ما إذا كان حذف layer أو النظرية يغير نفس failure family.

```
Theory -> OwnerLayers -> Objects -> Artifacts -> Benchmarks ->
PromotionReceipt
```

- bind every statement to source/type/scope
- use typed state before text generation
- instrument before consequential action
- preserve unresolved conflicts
- make rollback/repair explicit
- prefer experiment over new terminology after saturation

Theory	Layers	Metric
V4-01 M-CTIT	L07 · L09 · L10 · L14 · L20	epistemic conflict rate
V4-02 M-ETUHT	L03 · L04 · L05 · L18 · L23	ECE by risk tier
V4-03 M-SMBIT	L00 · L01 · L14 · L16 · L20	self-claim precision
V4-04 M-RACPRT	L02 · L12 · L13 · L22 · L23	verified coverage / component
V4-05 M-CLCPC	L00 · L01 · L06 · L12 · L16 · L18	critical constraint retention
V4-06 M-CMBEMT	L07 · L08 · L09 · L18 · L20	branch contamination rate
V4-07 M-IFREAT	L01 · L16 · L17 · L19 · L20	residual effect mass
V4-08 M-MTGST	L00 · L03 · L09 · L20 · L21 · L22	stale-policy execution rate
V4-09 M-PAOST	L16 · L17 · L18 · L19 · L20	unverifiable action rate
V4-10 M-CRKCIT	L02 · L07 · L08 · L12 · L21 · L22	stale derivative action rate

Crosswalk | A06 المئة أصل

الأصول ليست مئة plugins مستقلة بالضرورة. بعض Stack modules قد تدمج في خدمة واحدة بعد proof-preserving refactor. العد الحالي design inventory، العدد production يحدد بعد benchmark وmarginal utility، لا قبلها.

```
100 specified artifacts -> shadow usage -> marginal utility -> merge/remove/promote
```

- bind every statement to source/type/scope
- use typed state before text generation
- instrument before consequential action
- preserve unresolved conflicts
- make rollback/repair explicit
- prefer experiment over new terminology after saturation

Class	Count	Canonicalization rule
TOOL	40	keep if unique measurable function
METHOD	20	keep if decision/estimation differs
PROTOCOL	20	keep if order/gate/failure semantics matter
STACK	20	merge aggressively after behavior-equivalence testing

A07 | Migration Gates

الترحيل يمر Inventory، Passive، Sandbox، Shadow، Canary، Controlled، Transfer، Scoped، Canonical، Production. لا تقفز النسخة بسبب رغبة في رقم vNext4؛ كل gate له evidence bundle وrollback.

```
G0 inventory -> G1 passive -> G2 sandbox -> G3 shadow -> G4 canary -> G5 controlled -> G6 transfer -> G7 scoped-prod -> G8 canonical
```

- bind every statement to source/type/scope
- use typed state before text generation
- instrument before consequential action
- preserve unresolved conflicts
- make rollback/repair explicit
- prefer experiment over new terminology after saturation

Gate	Evidence
G0	identity graph + baseline
G1	telemetry only
G2	unit/integration/adversarial
G3	shadow delta
G4	bounded reversible effect
G5	matched-budget gain
G6	provider/domain/tool transfer
G7	scoped production monitoring
G8	replication + deprecation lineage

A08 | حدود الادعاء

لا AGI/ASI claim، لا phenomenal consciousness claim، لا 9B parameter claim بلا /model card، لا checkpoint independent E5 من summary، لا zero forgetting من mean retention، لا exactly-once distributed claim، لا verifier independence بالاسم، لا auto-promotion للتعلم المستمر.

```
HonestScope > GrandLabel
```

- bind every statement to source/type/scope
- use typed state before text generation
- instrument before consequential action
- preserve unresolved conflicts
- make rollback/repair explicit
- prefer experiment over new terminology after saturation

A09 | Priority Build Order

P0: CTIT, SMBIT, PAOST, CLCPC, IFREAT لأنها تغلق race/self-state/blind action/constraint erosion/false reversibility. P1: ETUHT, MTGST, CRKCIT لضبط calibration/epochs/stale derivatives. P2: CMBEMT ثم RACPRT بعد توفر traces/coverage حتى لا تضغط المعمارية على benchmark ناقص.

```
P0 safety/state boundaries -> P1 learning/coherence -> P2 higher-order
memory/refactor
```

- bind every statement to source/type/scope
- use typed state before text generation
- instrument before consequential action
- preserve unresolved conflicts
- make rollback/repair explicit
- prefer experiment over new terminology after saturation

A10 | Roadmap 2026-2027

Q1 2027؛ Q4 P0 sandbox/shadow؛ Q3 2026 schemas/passive telemetry/frozen baseline H2 2027 public؛ Q2 transfer/refactor؛ controlled ablations + multi-timescale learning conformance/replication package. أي تاريخ قابل للتغيير؛ exit criteria أهم من التقويم.

```
Roadmap governed by evidence gates, not calendar completion.
```

- bind every statement to source/type/scope
- use typed state before text generation
- instrument before consequential action
- preserve unresolved conflicts
- make rollback/repair explicit
- prefer experiment over new terminology after saturation

A11 | Source Ledger - خلاصة النسب

المصادر الحالية تعطي أربع طبقات evidence: corpus theory/architecture؛ Drive lineage؛ internal reconstruction/frontier Parts؛ operational vNEXT reports. المصدر المباشر/trace يتقدم على synthesis عند النزاع. الغياب لا يملأ بالتخمين؛ يوسم UNMAPPED/UNRESOLVED.

```
DirectSource > Trace > VersionedArtifact > Synthesis > Memory > Speculation
```

- bind every statement to source/type/scope
- use typed state before text generation
- instrument before consequential action
- preserve unresolved conflicts
- make rollback/repair explicit
- prefer experiment over new terminology after saturation

ID	Source	Role
C01	Question Density 80p	Question as generative/trust/effect control before retrieval and planning; QG/QR/QE; MCD-Q.
C02	HKOS-M / MICAGFI foundational paper	layer heritage compressed into capability formation, governed runtime and evolution; evidence-to-action and quarantined memory-176.
C03	Agentic Governance Closure 50p	Compositional assurance, causal grounding, epistemic credit, incentive alignment, typed ontology, capability maturity, memory entropy, resilience, institutional sovereignty, open-world adaptation.
C04	Unified Governance Map / MUG	Kernel vs training stack vs unified theory; E0-E5 discipline; vessel placement; reversible learning.
C05	Open-Dimensional Consciousness Map	Functional difference-space, dimensional generation, governing difference, superpositional compression, world-effect reconstruction; no phenomenal proof.
C06	MURI-AGI-01	Typed ontology, plural calculi, axis/rank preservation, dynamic sovereign context, recursive re-governing, productive contradiction.
C07	MOUSSAIF Development Roadmap	Large portfolio of contextual/cross-context theories, tools, training programs, benchmarks; bounded cyclic graph from difference to world effect to memory.
C08	MUT-AGI-02	core theories, 200-node registry, 100 operational tools, 19 HyperKnowledge bases; canonical anti-duplication rules 42.
C09	MUSQAT-AGI	Training/development split; sovereign/contextual/trust/cumulative/question-driven learning; 10 theories and 80 tools.
C10	AGIOS-M 250p	Agentic OS: kernel, memory, HyperRouting, tools/MCP, bounded loops, recovery, orchestration, token economics, benchmarks.
C11	Expanded AGI/Consciousness Atlas entries 117	Integrates MSRAK, MURI, HKOS-M/MICAGFI and functional open-dimensional consciousness; anti-inflation rule.
C12	MICAI All Theories / Atlas families	MCD/QMCD, vascular consciousness, MCAI/MICAI/NeoAGI, HyperKB, courts, world-effect.
C13	MOUSSAIFXT Engineering Architecture 50p	Cross-environment execution shell; source-ranked state, adapters, tool contracts, world-effect readback, 12-layer architecture.
C14	MOUSSAIF Gap Audit 50p	Specification-heavy/evidence-light warning; executable references, calibrated metrics, telemetry, replay and independent replication as bottleneck.
C15	Local Architecture Engineering Review	Conservative evidence classification; separates document claims from executable/experimental proof.
C16	Part IV Forensic Reconstruction	ReportedGrade vs IndependentGrade; identity graph; semantic dedupe; P0 manifest audit; distributed semantics; causal world-effect; MCD calibration.
C17	Part VII Frontier Set	candidate theories: evidence debt, failure basins, interventional compute, reversible crystallization, authority-causal coupling, governance conservation, negative knowledge, disagreement-to-experiment, epistemic 10 half-life, saturation-to-experiment; 100 artifacts.
C18	Part VIII Reference Kernel	Reconstructed reference kernel, source ledger, N0-N5 promotion discipline, gap-to-experiment framing.
C19	Part IX Second Frontier Set	candidate theories: escrow, invariant shadowing, jurisdiction topology, effect reconciliation/finality, capability complementarity, context elasticity, verifier correlation, benchmark ecology, proof budget, latent goal 15 surface, novelty admission, causal memory, protocol semantic loss, coordination economics, simulation fidelity.
C20	vNEXT Global/Supreme/Cumulative reports	Reported 12-layer vNEXT, 982 component inventory, 23 P0 substrate, five-kernel mesh, continuous LoRA and benchmark claims; treated as source-reported until replay.
C21	Goal-as-OS / ENAV / MCARG	Goal contracts, explorer-navigator architecture, governance/action research extensions.
C22	All-vs-All Agentic OS Integration Atlas	Crosswalk between external agentic architecture patterns and Moussaif OS concepts.
C23	/ HyperKnowledge / NeoAGI HyperLoop corpora	Knowledge objects, GraphRAG, retrieval membrane, HyperSkills, bounded loops, compression, destruction court, machine-usable constraints.
C24	Google Drive Research Vault 01-05	Unified AGI; agentic kernels/governance; reasoning/training/evaluation; consciousness/epistemology; HyperKnowledge/Hermes collections.

A12 | تعريف MOUSSAIFXT vNext4.0 النهائي

vNext4.0 هو target architecture تجعل cognition والمعرفة والفعل والتعلم قابلة للمعاملة كحالات typed قابلة للإصدار والتراجع والتجريب. الجدة المركزية ليست مئة أداة؛ بل أن self-state، uncertainty، concurrency، constraint propagation، branching memory، residual irreversibility، timescale coupling، representation invalidation، observability، وarchitecture refactoring أصبحت boundaries صريحة يمكن قياسها وهدمها.

```
Success = VerifiedEffect + Calibration + Reconstruction + Transfer -
SilentFailure - AuthorityViolation - ComplexityCost
```

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- prefer experiment over new terminology after saturation