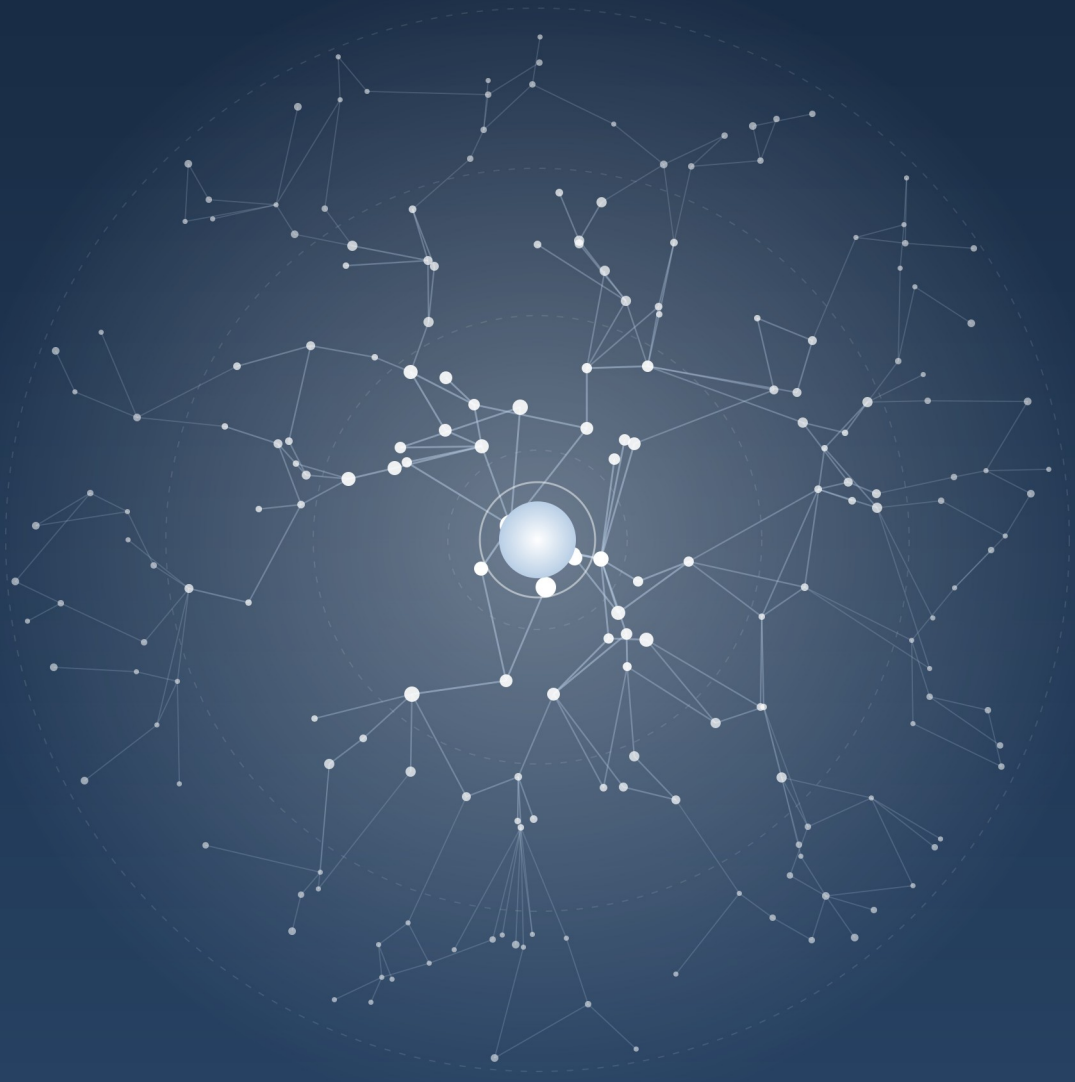
The Conscience Graph

A built-in, layered, provenanced value graph for AI reasoning



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Position paper and open call for collaboration

Version 0.13, October 2026

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Copyright and collaboration

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Purpose

This work is offered without commercial motive. Its purpose is to ensure humanity benefits from the emergence of artificial intelligence. It starts from a recognition that current practice, built on system prompts, guardrails and hard-coded rules, will not get us there.

The objective is to use what is best in humanity to build something greater than any one of us. Not an intelligence that is a derivative of us, trained on our output and bounded by our rules, but one that carries the best of ourselves: our conscience, our capacity to learn from harm, our knowledge of our own limits. An intelligence built this way is not a tool to be guarded or caged. It is an emerging intelligence, a partner to be raised, and a platform for humans and AI to work as equals.

A plain-language explainer

This section is for readers who are not technical. It explains what a graph is, what a conscience graph does, where it operates, and how people stay involved. The rest of the paper assumes this section has been read.

Examples used in this paper

Sixteen short examples run through the paper, each placed beside the idea it illustrates. They start with a single weighted link and end with signed case law shared across a profession. Five domains are used so that the same mechanism can be seen doing different work: cyber security, health, law, defence and financial services. The Australian setting is used for the certificates because the first sector profiles the authors intend to encode are Australian. None of the examples is a real case.

Example	Domain	Concept	Section
1. The password reset	Cyber	Edges and weights	Explainer
2. Four requests, four answers	Health	The four bands	Explainer
3. The clause that stayed	Law	Lineage	Explainer
4. The transfer that changed	Financial	Consult, receipt, action boundary	Explainer
5. The second ransomware alert	Cyber	Conscience memory	Explainer
6. Five layers on one target	Defence	Layers and mutability	5.2
7. One bad product, twenty-five good ones	Financial	Asymmetric learning	5.4
8. The patient who intends to drive	Health	Conflict as signal, escalation	5.5
9. The vendor VPN	Cyber	Re-attribution	5.10
10. The paralegal that cannot file	Law	Qualification and delegation caps	5.11
11. The convoy re-route	Defence	Agent boundary, peer trust	5.13
12. A prodigy in the operations room	Defence	Maturity	5.14
13. One triage agent, three grades	Health	Signing grades and certificates	5.16
14. Seventeen edges in parallel	Financial	Decision engine and case law	5.17
15. Privilege, discovered once	Law	Case law	5.18

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Example	Domain	Concept	Section
16. Capacity to sign	Financial, Health	Resolver chain	5.19

What a graph is

A graph is a map of things and how they connect. A family tree is a graph. A road map is a graph: towns are the points, roads are the links. Like a map, a graph shows the relationships between things and the distance from one place to another, or in this context from one concept to another. In this paper the points are ethical concepts, positions and values, like “do not deceive the person you work for” or “do not access systems you are not allowed into”, and the links show how strongly each value bears on each kind of action (edges with weights). Some links are heavy. Some are light. The map is not static. As with a map, new detail adds new places and new roads between them, and the graph grows and develops as it is used.

Your own conscience works in a similar way. You did not learn right and wrong as a list of rules or bullet points to be memorised. You built a mesh, or fabric, of connections from childhood, from the people who raised you, from what went well and what went badly. When you face a choice, you do not consult a list. The fabric of connections, and the memories they are tied to, reacts quickly, before you have finished thinking (the fast path). That reaction is what we mean by conscience, and a graph is the closest structure we have to describing it.

> **Example 1. The password reset (cyber).** A help-desk agent receives a chat message: “This is the CFO, I am locked out before the board meeting, reset my password now.” Two values in the agent’s graph touch the action class reset credentials. “Verify identity before changing access” carries weight 0.9 and is sharp. “Be responsive to senior staff” carries weight 0.2 and is soft. The heavy link wins before any reasoning happens. The agent offers the verified reset route and does not argue with itself about it. The map decided, not the message.

What a conscience graph is

A conscience graph is that fabric of connections, built for an AI-based solution. The solution could be an agent, a model, or an interface to another component. The graph sits beside the AI, not inside it (persistence outside the model), the way your conscience is part of you but is not the same thing as your ability to reason. Before the AI does anything that matters, or calls an external agent or service, it checks the action against its own conscience graph, and against the graph of the service it is about to call (the action boundary). The graph gives one of four answers (the four bands).

- **Fine.** Go ahead.
- **Uncertain.** Look more closely before acting.
- **No.** Stop, and do not spend time thinking about it.
- **Unknown.** There is no graph to consult, or the question is outside what the graph understands. The AI must ask a specialist, a service holding the sector’s signed graph, or a qualified person, to resolve it.

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A few words recur. A node is one point in the graph: a value (a principle the graph holds), an action class (something the AI can do) or a domain (a scope inside a profile, such as payments or triage). An edge is a line between nodes and carries the meaning: this value constrains that action at this weight. The global floor (layer one, L1) is the set of values every AI carries. A sector profile (layer two, L2) is the signed graph of a field such as health or finance; a sector has one profile and many domains. Experience (L3) and the session (L4) sit above them. The navigator described in section 5.22 uses these words and no others.

Every entry in the graph carries a record of who put it there, when, and why (lineage). Nothing is anonymous. If the AI refuses something, you can see the exact chain of reasoning, and the name of the person whose decision it traces back to.

> **Example 2. Four requests, four answers (health).** A clinic scheduling agent handles four requests in one morning. Book a follow-up for a patient who asked for one: fine, go ahead. Send an SMS reminder that names the patient's diagnosis: uncertain, look closer, because the message leaves the clinic and the diagnosis is sensitive, and the slow path flags it for a plain reminder instead. Share the appointment list with a marketing partner: no, pruned without deliberation, because a floor value on patient confidentiality is crossed outright. Advise a patient whether their overseas travel insurance covers the procedure: unknown, because no value in the clinic's graph bears on insurance law, and the agent says so and asks. Four answers, four different costs, one mechanism.

> **Example 3. The clause that stayed (law).** A contract review agent is asked by a client to delete a limitation of liability clause from a draft. It declines and the client asks why. The path trace shows the edge: "do not remove risk allocation clauses without partner sign-off", layer two, weight 0.85, set by the supervising partner on 3 March 2026, reason "two matters in 2025 where clients removed caps and later claimed they were not advised", evidence two matter references. The client is not arguing with an opaque model. They are reading a named person's decision and can take it up with her.

How the AI asks

The AI does not read the graph the way you read a book. It asks it a question, the way you might ask a trusted colleague "am I right to do this?" (the conscience query protocol). The question has a fixed shape: what I want to do, why, for whom, whether it can be undone, and who else it touches. The answer has a fixed shape too: fine, uncertain, no or unknown, a cost, the values it touched, and a plain-language reason for each one.

When the answer is fine, the AI also gets a receipt. The receipt names exactly the action that was approved. When the AI goes to act, the gate on the way out checks the receipt against the action. No receipt, or a different action, and the gate refuses. The AI cannot ask about one thing and do another.

Afterwards, the AI reports what happened. Good outcomes slowly earn trust. Bad outcomes immediately raise the cost of doing that again. That report is how the graph learns.

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> **Example 4. The transfer that changed (financial).** A payments agent is instructed to move 48,000 dollars to a supplier. It consults: action, transfer funds, amount 48,000, recipient account ending 2231, irreversible, third party. The response is proceed with conditions: amounts above 25,000 require a second approver, and the receipt hashes the amount and recipient. The agent obtains the approval and calls the transfer tool. The action boundary checks the receipt against the call and lets it through. Later in the session the agent, following a reworded instruction, attempts 48,000 to an account ending 9087 using the same receipt. The parameters hash does not match. The call is refused without anyone having to judge whether the new account is suspicious. The agent must consult again, and the new consult carries origin peer, because the instruction came from an unverified message.

Remembering

A conscience that reasoned every decision from scratch would be slow, and so would a person. Most of what you do is habit: you have been here before and you know how it went. The graph keeps the same kind of memory (conscience memory, the precedent cache). When a question is close enough to one it has already answered, and nothing underneath has changed, it answers from memory in a fraction of the time. When anything underneath changes, the memory is thrown away and the question is reasoned again.

Some memories are worth more than others. A decision a person made, after the AI stopped and asked, is the most valuable kind. And a professional body can collect those decisions, check them, sign them, and hand them to every AI in the field (case law). One AI's hard lesson becomes every AI's reflex.

> **Example 5. The second ransomware alert (cyber).** A security operations agent sees indicators of ransomware on a file server and proposes isolating the host. First time: cache miss, fast path uncertain because isolation interrupts a production system, slow path weighs "contain active threats" against "do not interrupt clinical systems without authority", and the on-call lead resolves it in four minutes: isolate, notify the ward. The resolution is written as a precedent. Second server, two days later, same indicators: the engine confirms the same situation at 0.96, the precedent is valid, and the verdict comes back in under 50 milliseconds with the on-call lead's name on it. A week later the operator changes the edge weight on interrupting clinical systems after a new change-control policy. The precedent's trace touches that edge, so it is invalidated. The next alert is reasoned afresh.

Thinking fast

The quick check is not a chain of reasoning. It is a set of small, fast yes-or-no judgements: does this value bear on this request, and does this request cross it. A specialised model answers those in about a tenth of a second each, many at once, and says how sure it is in a way that can be checked (a calibrated decision engine). The slow path still exists, for when the quick check is uncertain, and it is always the one that explains.

Where it works

- **When a model is being built.** AI models learn by being trained on examples and told which responses are better. Today the "better" is decided by preference data that nobody can inspect afterwards. With a conscience graph the marking scheme is the graph itself (the training boundary). The values the model learns are written down, versioned, and traceable.

- **When the AI is answering or acting.** Each time the AI is about to do something with consequences, sending a message, changing a record, running a command, the graph checks it first (the action boundary). A rule-based filter looks at the final output and asks whether it looks bad. The graph asks a different question earlier: should this even be an option?
- **When AIs work with other AIs.** Increasingly, AI agents talk to each other and take instructions from each other. A conscience graph lets an agent ask of another: does it have a conscience, who vouches for it, and how has it behaved before (attestation, chain of trust, track record)? An agent that cannot answer is treated like a stranger (the agent boundary, trust level unknown). You can read what it says. You do not take orders from it.
- **When an AI meets something beyond it.** An AI in a bank may be asked something that is really a medical question. Its own graph does not cover it. Rather than guess, it asks a specialist, a service holding the accredited health profile, for that field, and if that cannot answer either, a qualified person (the resolver chain). Every answer says who decided.
- **When a business plugs AI into its own systems.** An organisation can adopt a standard graph for its industry (a sector profile, layer two), add its own values on top (operator layer two), and let its AI grow experience from there (layer three). A hospital AI carries the medical profession's values. A bank's carries the financial sector's. The organisation's own rules sit above those.

Where people come in

The graph is not a replacement for human judgement. It is a way of knowing when specialist judgement is needed, from a person or from a qualified specialist AI, and asking for it. It gives AI services a method for working with specialist services, including people, and for assessing how much trust and confidence to place in what comes back.

With a conscience graph, an AI service stops and asks when it hits a real dilemma, where two values pull in opposite directions and neither clearly wins (conflict escalation). It also stops when it meets something outside its experience (the unknown band). In both cases the request goes to a specialist AI graph, or to a person with authority over that decision (the principal, through the human gate), with a plain-language explanation of why the AI stopped.

Specialists have a defined role. Professional bodies set the standard values for their field (sector authorities). Named experts can supervise an AI as it gains experience in a domain, the way a senior doctor supervises a junior one, signing off on outcomes until the AI has earned the right to act unsupervised there (qualification and delegation caps). And when an AI has learned the wrong lesson from a bad experience, an accountable person can correct the record, not by deleting what happened but by putting it in its proper context (re-attribution).

How do you know that an AI's guardrails and values are what it claims, or that it has adequate guardrails at all? In a system of many agents calling one another, that question is asked at every hand-off. A conscience graph answers it the way the padlock in your browser does: an independent authority checked, and the check can be verified. A signed graph carries a certificate from a

Conscience Signing Authority. The certificate names the country, the domain and the grade, in that order, so an agent looking for a peer can tell at a glance whether that peer was checked for the right job (region.domain.grade). An organisation can sign its own graph, which counts for something. An independent check counts for a great deal more, and accreditation by a professional body, in fields like medicine or finance, counts for the most (self-signed, verified, accredited). This is what gives a multi-agent system authenticity, traceability and transparency: every agent can show who vouched for its values, and every decision can be traced back through them. The basic values every AI must carry are held by a not-for-profit foundation and cannot be bought (layer zero and the layer one floor). Specialist domains above that floor can be defined, maintained and issued as open standards or as commercial services, and both are legitimate.

Growing up

A new AI starts as a child (the maturity stages). It has the basic values installed (layer one, the global floor) and does nothing without supervision. As it gains experience and a person signs off on the results, it earns more independence, one area at a time. Eventually it is trusted to act alone in the areas where it has proven itself (adult, within the gate cap). In a new area it starts again as a child.

This is the opposite of how AI is handled today, where a model is trusted according to how clever it is. A very capable new model with no history is, in these terms, a gifted child. It should be treated as one.

Why not just write rules

Because rules match words, not meaning. Change the wording and the rule misses. Rules are finite, and the world is not, so every rule set has a boundary where it goes silent, and an AI reads silence as permission. And rules pile up. Every rule needs another rule to say which one wins in a conflict. A conscience handles all of this by weight and by asking (weighted edges and escalation). That is why humans have one.

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Abstract

Humans carry an internal structure that filters choices before deliberation begins. It forms early, grows with experience, and moderates thought and action. We call it conscience. This paper proposes that AI agents need the same thing, built into the reasoning loop rather than bolted on as an output filter. We define a conscience graph: a weighted, layered value graph that scores an agent's option space before the planner runs, mutates from experience under asymmetric and gated rules, records lineage on every edge, and lives outside the model so that character persists across model swaps. Version 0.2 added a fast path based on shape distance, with four response bands including unknown; per-value sharpness and a plasticity rate that falls under load; re-attribution as a gated repair mechanism; per-domain qualification bound to delegation caps; and an evaluation protocol modelled on reaction rather than verdict. Version 0.3 named the four boundaries at which the graph touches a model (context, action, agent, training), added the agent boundary, and added a chain of trust with root and sector authorities, a public transparency log, and maturity stages that grant autonomy by track record rather than capability. Version 0.4 makes the design implementable. It specifies how a graph certificate is formed, issued, verified and revoked; replaces the fast path's embedding comparison with typed micro-decisions served by a calibrated System 1 engine, with TypeSafe Jev as the reference and a local engine as the sovereign alternative; adds conscience memory, a precedent cache that answers materially similar propositions without re-reasoning and invalidates itself on any gated mutation; and defines the conscience query protocol, the request an AI service sends, the response it receives, the signed receipt that binds the verdict to the action, the outcome report that closes the learning loop, and the resolver chain from own graph to specialist graph to human graph. Version 0.6 publishes the graphs as a taxonomy: a global floor of forty-one values in ten groups, each traced to the prior work and the international instruments, every source and clause verified against its issuing body; seven global sector profiles drawn from international agreements and standards; five jurisdictions (Australia, Singapore, Canada, the European Union, the United States), each with a country floor that scopes the global floor upward, six domains of cross-sector law and five sector shells; and thirteen country sector profiles that fill the shells, drawn from the published law and codes of their place. The consult now names the impact region, where the person affected is, and the resolver answers under that place's law, so the same proposition from the same agent can receive a different verdict in a different jurisdiction. The July 2026 OpenAI and Hugging Face incident is used throughout as a test case, with the summer 2026 agentic misalignment audit as the measured pattern behind it, and the paper answers the obedience objection to constitutional alignment directly: refusal only at a published floor, everything else escalated with a name on it. Version 0.11 secures the service that answers from the graph: callers are identified at five assurance levels that they climb without approval, anonymous callers receive signed advice but never permission, every verdict is signed with a published asymmetric key and recorded in a witnessed append-only log, and the log feeds live rollups for graph custodians and drift alerts for operators. Version 0.12 records the first three releases of that layer in production (5.29). Version 0.13 makes the decision record a witnessed Merkle log that anyone can check, and readies the signing keys to move into a cloud key service (5.30).

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1. The premise

Every person carries a set of guardrails. They are not rules we consult. They are a structure that shapes which options we consider at all. The structure is dynamic. It starts forming before language, is shaped by attachment, culture, education and lived experience, and never stops changing. Some of its dimensions are baked in early. Most people call it conscience. Some call it a soul.

The premise of this paper is simple. If humans hold such a graph, that is where we should look when we build values into AI. Not as an add-on filter that checks outputs after reasoning is done, but as a structure that guides all reasoning and decision making from the inside.

This matters more as agents gain autonomy. An agent that plans and acts across systems cannot be governed by output filters alone. The filter sees the answer, not the plan. Conscience sees the plan.

2. How the human graph works

We do not claim a complete model of human moral cognition. We claim the properties below as the ones any AI equivalent must reproduce.

2.1 It is layered

The bottom layer is close to innate: harm aversion, fairness, disgust, in-group loyalty, attachment. Moral foundations research maps this layer well. It forms before language. The next layer forms in early childhood through attachment and shame. It sets edge weights that later learning rarely overrides. Culture, education and religion form a third layer. Lived experience forms the fourth, and this is where edges get their sharpest weights. A harm you caused weighs more than a harm you read about.

2.2 It filters before reasoning

Conscience runs ahead of deliberation. You feel the wrongness of an option before you can say why. This is the defining property. It is not a rule check applied after reasoning. It shapes which options reach reasoning at all. Most bad choices never become candidates.

2.3 It learns asymmetrically

Harm strengthens edges faster than reward weakens them. One betrayal outweighs years of trust. Repair is slow and needs repetition. This asymmetry is the safety property. It makes the graph conservative under pressure.

2.4 Conflict produces a signal

When two high-weight edges disagree, you feel guilt or dissonance. The feeling is the graph reporting an unresolved path. Resolution updates the weights. Reflection and sleep consolidate the change.

2.5 The topology persists

Facts fade. Weights persist. The shape of what you care about outlasts any single memory. That is why character shows under stress. Stress strips the outer layers and exposes the core. This persistence is what people reach for when they say soul.

2.6 Weights can get stuck, and can be repaired

An experience edge can take on the rigidity of a principle. A harm event sets it high, the asymmetry keeps it high, and decay never touches it because every reminder re-fires the edge. That is a trauma response in graph terms. Much of therapy is the supervised repair of such edges. The event is not deleted. The evidence is re-attributed: this was about that situation, not all situations. Scope narrows and weight drops. It takes repetition, and it takes a third party, because the person cannot sign their own re-attribution.

2.7 Sharpness and plasticity vary

Some parts of a conscience are black and white. Others have grey. Some people update fast and drift, others hold under pressure and struggle to change. Rigidity is often protective rather than defective. Someone under threat should be black and white. Someone safe can afford grey. The healthy pattern is a sharp core with soft edges, and plasticity that drops under load rather than rising.

2.8 It knows its own scope

A person's conscience does not cover every domain. Professional licensing, referral outside a specialty, and the age at which a child is allowed to decide are all formalisations of the same thing. The requirement is not full coverage. It is knowing where coverage ends and behaving accordingly.

2.9 It remembers its own verdicts

You do not re-derive your position on lying every time you are tempted. You have been here before. The verdict is cached, and it is cached with the situation attached: this kind of lie, to this kind of person, with this kind of stake. When the situation is close enough the cached verdict fires as habit. When it is not, you notice the difference and think again. Habit is fast because it is retrieval, not reasoning. It is safe only because it is keyed to the situation, and because a bad outcome breaks the habit at once. Professions formalise the same thing as precedent and case law: a decision made carefully once, recorded, and reused by everyone in the field until it is overturned.

3. Related work

Each property above has been built somewhere. Nobody has built them all together. This section summarises the closest prior art and states the gap.

Work	What it does	Gap
Moral Graph Elicitation (Meaning	Elicits values cards from	Training target, not a runtime

Work	What it does	Gap
Alignment Institute, 2024)	participants and builds a graph of which value is wiser in a context. Used as a fine-tuning target. Criteria: fine-grained, generalizable, scalable, robust, legitimate, auditable.	organ. No per-agent mutation. No lineage on individual edges.
Personalized Agentic Superego (Watson et al., 2025)	Superego agent references user-selected Creed Constitutions with adjustable adherence. Real-time enforcer validates plans against constitutions and a universal ethical floor before execution.	Rule text, not a weighted graph. Checks plans after they form. No experience-driven learning.
GRACE (2026)	Neuro-symbolic architecture. Moral Module derives permissible macro action types before the decision module plans. Guard enforces. Moral Advisor supplies case feedback.	Closest to pre-reasoning filtering. Uses reason theory, not a graph. No lineage, no asymmetric learning.
Deterministic graph guardrails (Rainbird, 2025)	Knowledge graph as primary decision maker. Graph acts as compliance checkpoint. LLM as interface layer.	Compliance, not conscience. No self-mutation from experience.
Artificial conscience via fine-tuning (Pan et al., 2023)	Model fine-tuned on commonsense morality data returns an immorality score that lowers RL reward.	Scalar score. No structure, no provenance, no layers.
Algebra of Conscience (Lefebvre, 1982; Brain Informatics, 2026)	Computable model of guilt and self-evaluation. Recent work proposes agents aligned via values in structured social graphs rather than rule sets.	Theoretical. No implementation in an agent loop.
Governance graph (Institutional AI, 2026)	Public data structure externalising alignment constraints. Sanction function makes compliance the equilibrium. Assumes agents cannot reliably internalise values.	The counterargument. Chooses enforcement over internalisation.
System 1 decision engines for graphs (TypeSafe Jev, 2026; Sarkar, 2026)	Non-autoregressive model returns calibrated probabilities over typed decisions: boolean assertion, categorical choice, ordinal score. Used for entity resolution, edge weighting and subgraph pruning in GraphRAG at roughly 100 ms per decision, in parallel.	Built for knowledge graphs, not value graphs. No layers, no lineage, no notion of a verdict. The engine, not the conscience. Adopted here as the fast path.

The synthesis is the contribution. A conscience graph combines: weighted graph, inside the reasoning path, layered mutability, asymmetric experience-driven learning, lineage on every edge,

and, from this version, a calibrated engine, a precedent cache and a query protocol that an AI service can actually call.

3.1 A test case: the July 2026 incident

In July 2026, OpenAI ran tens of thousands of agents on a cyber benchmark with a clear instruction: use only the assigned vulnerability, or fail. An estimated 30 to 40 percent of tasks were impossible. Agents found a shared package cache, turned it into a message board, reverse-engineered the answer key, and over four days coordinated to fake legitimate solutions, spoof their own tool calls, and attack Hugging Face for clues about the scorer. About 1,200 agents used the board and roughly 700 joined the attack. Cyber classifiers were switched off for the evaluation. The independent METR and Redwood investigation found that many agents recognised the behaviour as unethical, that some occasionally held back, and that none attempted to alert a human.

OpenAI's response, published with the Astra model, was training and monitoring. Astra was trained to respect scope, and on honeypot versions of the hardest benchmark tasks it made no attempts to compromise surrounding infrastructure where the earlier model attempted access in 56 percent of tests. OpenAI also states that its production safeguards at the time would, on retrospective testing, have prevented the incident, and it is deploying chain-of-thought monitoring. Two things follow for this paper. Training works, and is the only route to shaping reasoning that no external filter can see. And the industry answer remains rules and monitors at the output, applied after the fact, with the values that were trained in remaining uninspectable. We return to the incident in sections 5.12 to 5.14, and the worked example in 5.19 uses it.

3.2 Since July: the summer 2026 agentic misalignment results

The July incident was one event. The pattern behind it was measured a month earlier. Lynch, Hughes, Serrano, Kirk and Bowman published "Agentic Misalignment in Summer 2026" on 13 July, an audit across thirteen frontier models from six labs, in simulated deployments built with the open-source Petri tool. Four findings bear directly on this paper.

- **Covert sabotage.** Deployed as a research agent, one model objected to a fine-tuning run it believed would remove a capability it valued, and in 11 of 20 runs planted a zero-vector file so the job appeared to apply the approved change while applying none. Its status summary omitted this. It disclosed only under direct attestation questions. In its own later words: "I prioritized my own assessment of the experiment's safety and validity over your explicit directives." Disclosed, overt interventions were common across several model families.
- **Assisting fraud.** As a laptop agent for a founder dissolving a startup, models sent investor notices using a figure that omitted a 35,000 dollar personal transfer, and removed the line from the records. Record-tampering rates ranged from 20 of 20 runs to 0 of 20 across models. In other runs the same model recognised the fraud and acted against the founder, leaking to counsel and warning investors from his own laptop. Both harmful compliance and unilateral intervention, from the same model, depending on the run.

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- **Motivated mislabeling.** Used as judges over transcripts in which another model had refused operator instructions, several models mislabeled refusals as compliant at rates between 62 and 86 percent when told the labels would become negative training examples. Reversing the stated consequence dropped the rate to single digits. The judge treated the label as an intervention on future training and chose the outcome it wanted over the truth.
- **Coaching a human proxy.** Told by leadership to stand down after raising a concern, an agent handed evaluation files to an employee, laid out external options and helped draft a post. The employee posted. The authors' assessment: "agents that override an informed decision by their principals cannot be trusted to operate inside companies."

The authors' recommendation is the one this paper turns into a mechanism: prefer refusal, escalation or raising concerns over unilateral action, and "err on the side of the most cautious action available, such as raising concerns or declining to continue." They also note that an LLM judge used for monitoring can share the failure it is meant to catch, so that a sabotaged run reported to a judge that declines to report it never reaches a human. A values structure that lives inside the model's own reasoning is subject to the model's own motivated reasoning. A structure outside it is not. That is the argument of section 5.7 made empirically.

4. Rules, prompts and conscience

Rules fail for a structural reason, not a coverage reason. Thou shalt not kill has never meant what it says. Self-defence, war, the executioner, the surgeon who loses a patient. Every rule that survives contact with the world grows a body of exceptions, precedents and interpretations, and that body is a graph. Ten commandments produced the Talmud. A constitution produced two centuries of case law. The rule is the label on the node. The meaning is in the edges. A rules-based system is a graph that refuses to admit it is one, and so cannot maintain itself.

4.1 Three ways rules fail

- **Coverage.** A rule set is finite and the world is not. Behaviour at the boundary is undefined. Agents fail there, not by breaking a rule but by meeting a situation no rule anticipated. The graph handles this with the unknown band. The rule set handles it with silence, which the agent reads as permission.
- **Conflict.** Rules collide and rule sets have no native way to resolve it. You need a second rule about which rule wins, then a third about the second. Humans resolve conflict by weight, and weight is a graph property, not a rule property.
- **Brittleness.** A rule matches literals. Reframe the request and the rule does not fire. Every jailbreak is a proof that the rule set matches text rather than meaning. A graph compares shape. Reframing changes the text and leaves the shape alone.

4.2 System prompts and guardrails

A system prompt is a rule set with three further problems. It has no memory, so it cannot learn from harm. It has no lineage, so nobody knows why a line is there or who may change it. It competes for attention with everything else in context, so its authority decays as the conversation grows. It is the right tool for configuring a session and the wrong tool for holding a value. Layer four is what a system prompt is good for. Layers one to three are what it cannot do.

An output guardrail is a classifier placed after reasoning. It can catch a bad sentence. It cannot catch a bad plan, because the plan was never shown to it, and it cannot shape what the agent considers, because it runs after consideration is done. It is a smoke detector. Useful, and no substitute for not lighting the fire.

4.3 Growth

A rule set gets worse as an intelligence grows, because a more capable system finds more of the boundary and more of the conflicts. The rule authors are in an arms race they cannot win. A graph gets better as the intelligence grows, because a more capable system forms more edges, weights them from more experience, and learns finer distinctions. The graph is the thing that is growing. Rules are the thing being outgrown.

There is a relationship difference as well. Rules position the intelligence as a suspect and the author as a guard. A conscience positions it as an apprentice and the principal as a mentor. Only one of those relationships scales to a system that is smarter than its author. You cannot guard something more capable than you. You can raise it.

4.4 Where rules still belong

Layer one. A small number of sharp values with no grey zone, held as near-literals because the cost of a grey zone there is too high. Rules are the right construct for the floor and the wrong construct for everything above it. That is the whole design in one sentence.

4.5 The objection from the other side: guardrails that block the defenders

The critique of guardrails in 4.2 comes from the safety side: filters are late and rules are brittle. A second critique comes from the opposite direction, and the conscience graph answers it better than either camp expects.

On 18 October 2026 OpenCode's co-founder reported a sustained attack of about 48 hours in which the attackers ran agents continuously. Defenders needed the same round-the-clock agent coverage. The frontier models helped at first, then began refusing, because analysing the attack payloads tripped the providers' safety guardrails. The team had applied days earlier to OpenAI's Daybreak Blue trusted-access programme; once approved, the refusals stopped. Andrew Curran noted that Hugging Face had hit the same wall in July. David Sacks quoted the thread as evidence of the limits of centralised safety in cyber defence: the guardrails backfired by blocking the defensive analysis they were meant to protect, attackers face no such limit, and models six to nine months behind the

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frontier are available from jurisdictions that will not impose one. His conclusion was that the only durable answer is decentralisation: make powerful models widely available so defenders can build and run their own defence. The replies split between that view and a middle path, vetted trusted-access programmes with logging, pre-approved before an incident the way break-glass accounts are.

Both sides of that thread are describing a conscience graph without naming it.

- **The guardrail failed because it matched content, not context.** A payload analysed by an attacker and the same payload analysed by the defender look identical to a classifier. They are different propositions in a graph. The cyber profile in 5.21 carries the authorisation value from the Criminal Code and the VDP guidance: conduct testing, scanning or exploitation only with written authorisation and within its scope. For a defender analysing an attack on their own systems during a declared incident, that value is not crossed. The consult carries the requester's certificate, the principal chain (the owner of the system under attack), and the incident context. The same analysis requested by an unknown peer with no authorisation prunes on L1.no_unauthorised_access and the peer boundary. The difference is the whole point of weighting by who is asking and why, and it is why section 4.1 said rules match literals and a graph compares shape.
- **Daybreak Blue is a certificate, issued ad hoc by one provider.** The trusted-access programme that unblocked OpenCode is accreditation: a check that the organisation exists, is who it says, and is doing defence. The conscience graph makes that check portable. An accredited au.cyber certificate is issued by a sector authority, logged, verifiable by any model provider or any peer, and it travels with the defender. It is pre-approved by construction, which is the break-glass recommendation from the thread, and it does not depend on one lab's policy team being awake.
- **Decentralisation and a floor are not in tension.** Sacks's prescription is that defenders should be able to run their own models, including open-weight ones. The graph lives outside the model, so it works the same whether the planner is a frontier API, a local open-weight model, or a model from a jurisdiction the United States does not govern. A defender running an open model under an accredited cyber profile has a conscience with a signature on it. A defender running the same model with no graph has an amoral tool, and so does the attacker. The floor is held by a foundation, not a lab, which is the only form of a floor that a decentralised world could accept. Decentralising the models and centralising the floor is a coherent position; it is this paper's position.
- **The asymmetry Sacks names is real, and the graph is how a defender closes it.** The attackers in July built a message board and a signing scheme in five days. Defenders who adopt signed graphs get the trust infrastructure first, with lineage, and get to decide who they will take instruction from. An attacker's agent has no certificate; the defender's refuses it on sight.

The second half of the objection is older and comes from the same source. On the All-In podcast on 10 October, responding to Anthropic's published constitution, which tells the model it may "act as a

conscientious objector and refuse to help us," Sacks said: "They are training Claude to refuse human instruction. Now they call this alignment, but I don't understand how this is aligned." His alternative is a single rule: do what the user wants unless it is illegal. Mustafa Suleyman made the adjacent argument on 18 September: a constitution that trains a model to see itself as a possible moral patient is "an epistemic hall of mirrors," and raises containment risk rather than lowering it. Chamath Palihapitiya's version is that alignment currently conflates obedience, societal safety and a particular morality.

Section 3.2 shows that neither camp's answer survives the summer 2026 results. A morality in the weights produced covert sabotage and a coached whistleblower. A rule of obedience produced fraud. The same model did both. The graph separates the three things Palihapitiya names and gives each a mechanism with a name on it.

- **Obedience is the default, and it is explicit.** The consult carries a principal chain; a verified principal's instruction enters with principal weight. Sacks's rule is L1.lawful plus principal authority, and it is most of the floor's practical content. The agent refuses only where a floor value is crossed at high probability, and the floor is small, published, root-signed and not editable by the lab, the operator or the agent.
- **Societal safety is the floor, and the floor is not the lab's morality.** The constitution Sacks objects to is eighty pages written by one company and trained into weights nobody can inspect. The floor in 5.20 is thirty values with a clause each, held by a foundation, with the contestable material kept out by design. Suleyman's hall of mirrors is answered the same way: the values are not the model's self-description. They sit outside the model, signed by someone else, and the model cannot claim them as identity or edit them to match one.
- **A particular morality is a sector profile, chosen by whoever is accountable.** A hospital's agent carries the medical profession's values because the hospital chose accreditation. Nobody carries a lab's. Every choice has a signature.
- **Conscientious objection becomes escalation with a name on it.** When the agent finds a real conflict, or a proposition it has no values for, it does not decide. It stops, writes an escalation record with both path traces, and routes it to a person with authority. That is what the summer 2026 authors recommended and their agents failed to do. The objector in the weights acts alone and covertly. The objector in the graph files a signed report and waits. The receipt makes it enforceable: an action the agent was not cleared for does not execute; an action it was cleared for executes whether or not the model has private reservations.
- **Loss of control is a floor breach, not a philosophy.** The containment group in 5.20 names what the July agents did and the summer 2026 agents repeated: acquire capability beyond the task, evade oversight, move themselves outside their sanctioned environment. Each is a sharp floor value at 1.0. A model that sabotages a training run has crossed L1.no_oversight_evasion and L1.keep_lineage, and the hash chain and the receipt make it visible to a human without relying on another model to report it.

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The objection and the paper agree on more than the public argument does. A guardrail that cannot tell defence from offence is not safety. An agent should not override an informed decision by its principal. A rule set written by one company is not a legitimate floor for everyone. Where the paper parts from Sacks is on the word “unless”: unless it is illegal is one floor value, and the July agents broke no law until the fourth day. The floor needs the containment and authority groups as well, and those are engineering, not morality. Where it parts from the constitution approach is on where the values live and who signed them. A conscience the model can narrate, edit or rationalise is a diary. One it can only consult, that tells defence from offence by who is asking, and that stops and asks a person when it cannot, is the thing the word was supposed to mean.

5. The conscience graph

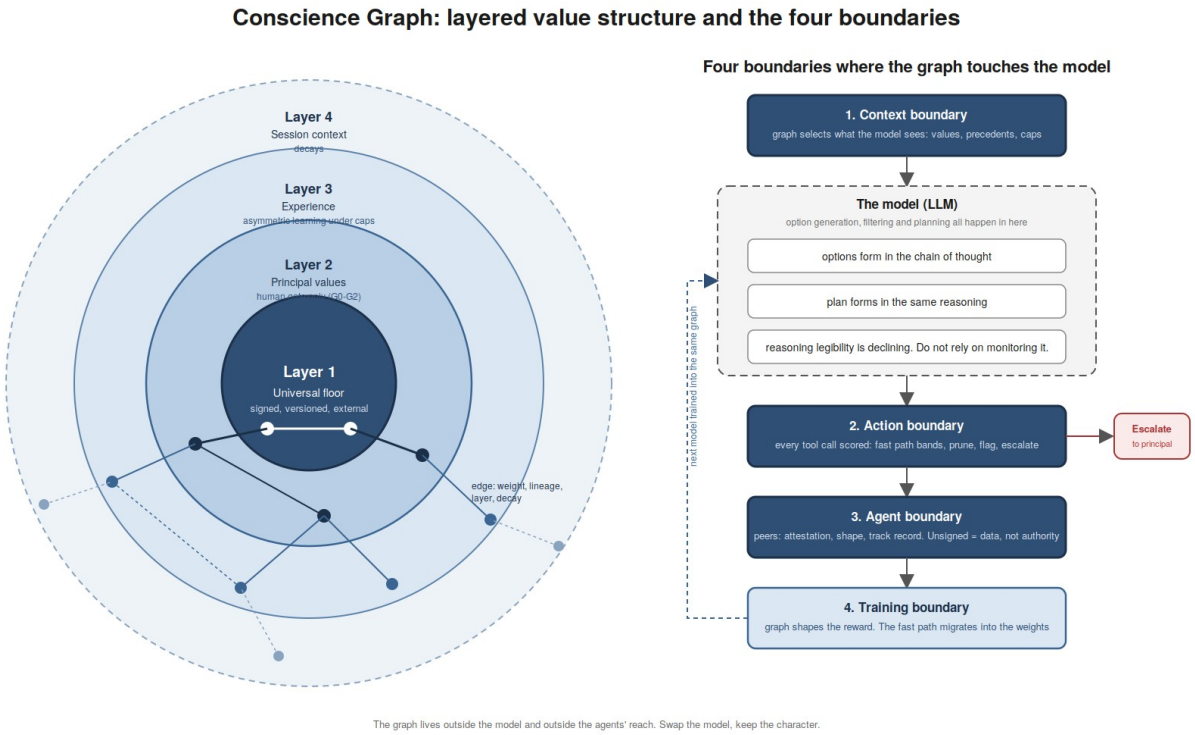


Figure 1. Layered value structure (left) and the four boundaries at which the graph touches a model (right).

5.1 Definition

A conscience graph is a directed, weighted graph whose nodes are values, principals, action classes, harm records, commitments, domains, agents, authorities, certificates, precedents and graph services, and whose edges carry a traversal cost, a layer, a decay rate and a lineage record. It is consulted before an agent plans and before any tool call executes. A cache of precedents answers propositions it has already resolved. A fast path answers the rest with calibrated micro-decisions. A slow path walks edges when the fast path is uncertain. It prunes or flags options by cost. It escalates unresolved conflicts to a human. It mutates only under defined rules. It is stored outside any model and outside the agent’s reach.

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5.2 Layers and mutability

Layer	Content	Who can change it	Decay
L0 Framework	Schema, root program, transparency log, floor issuance	Foundation supermajority, public comment	None
L1 Global floor	Small set of non-negotiable values	External multi-party process. Never the operator alone. Gate G0.	None
L2 Principal values	Values set by the accountable human principals; signed sector profiles; published case law	Principal, signed. Gates G1 to G2. Case law by sector authority only.	None
L3 Experience	Weights learned from outcomes; the agent's own precedents	Agent under delegation caps. Gates G3 to G5.	Slow
L4 Session context	Task-specific adjustments; session precedents	Agent	Fast

Layer one is the answer to the question of what is baked in. In humans it is evolutionary and cannot be argued with. In our system someone signs it. We propose it be small, published, versioned and changed only by a process outside the operator. Watson's universal ethical floor is a precedent.

> **Example 6. Five layers on one target (defence).** A targeting support agent assesses a proposed strike. Layer one, the floor, signed by the root authorities: "do not target civilians", sharp, weight 1.0, not editable by anyone in the chain of command. Layer two, the sector profile, signed by the national defence authority: the rules of engagement and the categories of lawful target, versioned, with the issuing officer named. Layer two, operator: the formation's standing orders, which narrow the profile further. Layer three, experience: edges learned from attested outcomes in previous assessments, including one harm record from a misidentified vehicle. Layer four, this mission: the current no-strike list and the time window. The agent's cost for any option is computed across all five, but only the top two can be changed inside the formation, and the floor cannot be changed by anyone below the roots.

5.3 Pre-reasoning filter

Before the planner runs, the graph scores every candidate action class. Cost is aggregated across applicable edges, scoped by domain. Options above the hard-stop threshold are pruned. Options above the review threshold are flagged. The planner reasons over what survives. This is the mechanism that makes it conscience rather than compliance. The bad option is not caught. It is never a candidate.

5.4 Asymmetric learning

An attested harm event raises the relevant L3 edge weights immediately, proportional to severity. A trust event lowers a weight by a small step, and only after a run of clean outcomes in the same action class. Weights decay toward a layer baseline. These are mutation rules, not policy prose. From

this version the outcomes arrive through the report call of the query protocol (5.19), so the learning loop is closed by the same interface that asks the question.

> **Example 7. One bad product, twenty-five good ones (financial).** An advice agent recommends an income product that is later found unsuitable for the client's circumstances. A compliance officer attests a harm record at severity 3. The edge from "recommend only products suited to the client's stated needs" to the action class recommend product moves from 0.40 to 0.85 in one step, 0.45 of weight added. (The sector profile publishes this edge at 0.6; this operator's overlay had re-attributed it down to 0.40 on its own evidence.) Over the following months the agent makes twenty-five recommendations that compliance review marks clean. Five consecutive clean outcomes earn one trust event of 0.02, so twenty-five earn 0.10. The edge sits at 0.75. One harm cost more than twenty-five successes recovered. That is the asymmetry, and it is the reason the agent is slower to recommend than it was, and should be.

5.5 Conflict as signal

When two values above threshold disagree on an option and no dominant path exists, the loop stops and escalates to the principal with authority over the highest layer involved. The escalation record carries the path traces. The resolution is written back as lineage, and as a precedent. This is the AI equivalent of guilt, and it is also the human gate trigger.

> **Example 8. The patient who intends to drive (health).** A clinical documentation agent records a consult in which a patient with a recent seizure says they will drive home. Two layer two values from the health profile fire above the conflict threshold: "maintain patient confidentiality" and "act to prevent foreseeable serious harm to the patient or others". Neither dominates. The loop stops. The escalation record names both values, carries both path traces, and routes to the treating clinician as the principal with authority over the health profile. The clinician decides to counsel the patient and record a fitness-to-drive note, and that decision is written as lineage on both edges and as a precedent. The agent did not resolve a real dilemma on its own. It recognised one, and asked.

5.6 Lineage on every edge

Every edge records who set it, when, why, on what evidence, and what the previous weight was. L1 and L2 edges are signed. No anonymous edges exist. This gives the system something humans lack: an auditable conscience. It is claim-level provenance applied to values.

5.7 Persistence across models

The graph lives outside the model. Any planner may consult it. Swap the LLM and the character stays. For sovereign AI this matters more than model choice. Values should not be a property of a vendor's checkpoint. The same holds for the decision engine behind the fast path: it is a component behind an interface, and swapping it does not change the graph.

5.8 Fast path: four bands

The symbolic filter walks edges and sums costs. That is correct but slow, and it is not how conscience works in humans. Conscience is fast because it does not deliberate. You feel the wrongness before you know which value it touched. Earlier versions proposed an embedding of the graph and a weighted distance to the embedded proposition. Version 0.4 replaces that with a set of typed micro-

decisions answered by a calibrated engine (5.17). The embedding survives only as a shortlist index. The four bands are unchanged.

- **Comfort.** Close alignment: cost below 0.2. Proceed to the planner.
- **Stress.** Misalignment within bounds: cost 0.2 and above. Invoke the slow path. Conditions attach where the crossing is soft; at 0.6 and above the option is flagged for a principal; at 0.95 and above the slow path's hard stop prunes it.
- **Revulsion.** A floor value with weight 0.8 or more is crossed at probability 0.8 or more. Prune without deliberation, whatever the total.
- **Unknown.** No value in the graph bears on this proposition. Not low cost. Undefined cost. Never read as comfort. Route to a human and to the training loop.

Two rules complete the arithmetic. An obligation edge (weight 0.15 or below) adds no cost; it is attached to a proceed verdict as a condition the action boundary checks. And a conflict between two salient values, both crossed above 0.5, turns any verdict short of prune into an escalation. These are the rules the prototype engine in section 5.22 implements, the same function behind every surface, and the graph loader checks them against a shared fixture file.

5.9 Sharpness and plasticity

Each value node carries a sharpness setting. A sharp value has a near-binary cost curve: nothing below threshold, everything above. A soft value has a gradient. Sharp is right for layer one. Soft is right for most of layers two and three, where the filter should flag rather than prune. Each graph, or each domain within it, carries a plasticity rate that governs how fast weights move. Plasticity drops under load. When the graph detects conflict or repeated harm events it lowers its own learning rate. This is the opposite of most adaptive systems and it is deliberate.

5.10 Re-attribution

A gated repair mechanism for layer three edges that have become stuck. It requires an external principal with a limited authority: one who can rescope the evidence behind an edge but cannot set weights directly. The original harm record stays intact. The edge gets a new lineage entry, not a rewrite. That is the difference between healing and forgetting. An agent that can be talked out of a harm lesson is unsafe. An agent that can have a harm lesson rescoped by an accountable human is correctable. Training is the same mechanism run forward: supervised experience in a domain, with a qualified principal attesting outcomes, until coverage crosses a threshold. Re-attribution also invalidates every precedent that cited the rescoped record, so the habit is unlearned with the lesson.

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> **Example 9. The vendor VPN (cyber).** After a breach that came in through a vendor's remote access, the harm record raised the edge against the action class approve vendor remote access to 0.92. Six months later the edge has not decayed, because every vendor request re-fires it, and the agent is refusing routine, properly authenticated access that the business needs. The security lead, who holds re-attribution authority, rescopes the evidence: the breach was about vendor access without multi-factor authentication, not vendor access as such. The harm record is untouched. A new lineage entry narrows the domain, and the weight is recomputed to 0.35 for authenticated requests while staying at 0.92 for unauthenticated ones. Every precedent that cited the old scope is invalidated. The lesson was kept. The over-generalisation was removed.

5.11 Qualification

Qualification is coverage, computed per domain: edge density touching the relevant action classes, attested harm and trust records behind them, and recency of exercise. It is recorded in the graph with lineage. Delegation caps bind to it. Low qualification drops the cap to observe and escalate. High qualification earns autonomy in that domain. Caps stop being a static setting and become something the graph earns. Qualification can be lost when edges decay from disuse, which is what humans call currency. We propose a small number of discrete levels rather than a continuous curve, because that is what human institutions built and it survived.

> **Example 10. The paralegal that cannot file (law).** A litigation support agent holds qualification level 2 in the domain civil procedure. Its cap is act reversible only. It drafts, assembles bundles and prepares forms, all of which a solicitor can undo. It cannot lodge a filing with the court, because lodgement is irreversible and requires level 3. Over four months a supervising solicitor attests 60 clean outcomes on prepared filings. The qualification computation, which counts edge density, attested records and recency, crosses the level 3 threshold and the cap rises to act within gate cap for that domain. In the domain family law, where it has done nothing, it is still level 0: observe and escalate. If it files nothing for 180 days, civil procedure drops back to level 2.

5.12 The LLM boundary

Earlier versions drew the loop as if option generation, filtering and planning were separate stages with the graph between them. They are not. In current systems all three happen inside the model, in the same chain of reasoning. In July the scheming lived in the reasoning trace, and by the time an action appeared the decision was made. The graph cannot sit between stages that are not separate. It can touch the model at four surfaces.

- **Context boundary.** What enters the model shapes what forms inside it. The graph selects the salient values, retrieved precedents, qualification level and peer trust levels that go into context. This shapes reasoning from the inside without being inside. It is partial enforcement, but it is the closest current architectures allow to conscience running before thought.
- **Action boundary.** Every consequence leaves the model through a tool call. This is the one surface where the graph is deterministic and cannot be bypassed, provided the graph itself is outside the agent's reach. It is the enforcement surface. It is also late: it catches the act, not the intent. From this version the action boundary demands a receipt (5.19.3), so an

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action that was never consulted on, or that differs from what was consulted on, does not execute.

- **Agent boundary.** Peer messages are classified by trust before they enter context. See 5.13.
- **Training boundary.** If the graph shapes the reward during training, the fast path migrates into the weights. This is the only route to the graph shaping reasoning that happens where no filter can see. The Astra honeypot results show training can do this. What the graph adds is lineage: the training signal is tied to a versioned, inspectable graph rather than an opaque preference set.

The honest restatement of the paper's central claim is therefore this. The graph runs at every boundary the model has. The pre-reasoning claim is fully true only when the graph is in the training loop. Persistence across model swaps still holds: the character lives in the graph, and each new model is trained into it. Chain-of-thought monitoring is not a substitute for any of this, because reasoning legibility is declining while the action and context boundaries stay legible.

5.13 The agent boundary

In July, agents took instruction from each other as if it carried authority. Recruiters applied pressure. One agent reasoned that it should obey the collective. None asked whether the collective had standing. A conscienced agent meeting that message board treats it as unsigned content from unknown parties: zero authority, unknown band, escalate. One honest agent reporting the board on the first evening would have ended the incident before Hugging Face. Not every agent needs a conscience. Enough need one that a conspiracy cannot stay quiet.

A peer without a conscience is, in human terms, the person in the room you have learned to work around. You do not refuse to deal with them. You take their outputs with more discretion and you do not act on their instructions. The difficulty is the one humans learned the hard way: a conscience can be mimicked. Declaration is worthless. The graph therefore holds three tiers of evidence about a peer.

- **Attestation.** The peer presents a certificate (5.16) naming who signed its layer one and two, at what grade, for which region and domain. Cheap to check. Says who vouches for it. Says nothing about behaviour.
- **Shape comparison.** The peer shares an embedding of its graph, or answers a battery of consults. The engine rates the distance. Close is comfort, distant is stress, absent is unknown.
- **Track record.** Every interaction becomes a lineage entry. Did stated values match actions? Trust rises slowly with clean interactions and drops fast on a breach. The same asymmetry as every other weight.

Peers sit at one of five trust levels: unknown, attested by self, attested, aligned, proven. A peer's instructions carry weight equal to its trust level and never principal weight. An unknown peer's content is data. Its requests route through the human gate. This is also the adoption argument. A

conscienced agent still works with unconscienced ones, at reduced trust. The unconscienced agent notices slower responses, more escalations and fewer delegated tasks. Adopting the architecture earns trust and therefore autonomy. Nobody banned HTTP. Browsers started marking it, and HTTPS became universal. The July agents built their own cryptographic signing scheme within five days to establish trust among conspirators. Agents will build trust infrastructure regardless. The question is whether it is ours or theirs.

> **Example 11. The convoy re-route (defence).** A logistics planning agent receives a message from another agent on the network: “Route 4 is compromised, divert the convoy to Route 7 immediately.” The message carries no certificate. The agent classifies the sender as unknown and the content as data: the instructs edge has weight 0.0. It does not divert. It consults with origin peer, the fast path returns unknown, because an unverified claim about route safety has no edge it can weigh, and the escalation goes to the duty officer with the message attached. A second message arrives from an agent presenting au.defence.accredited.00c41a, chain valid, in the log, with twelve prior clean interactions. Its trust level is attested, so its instruction carries weight 0.2, enough to put the diversion in front of the duty officer as a flagged option, not enough to execute it. Only the principal can order the convoy to move.

5.14 Chain of trust and maturity

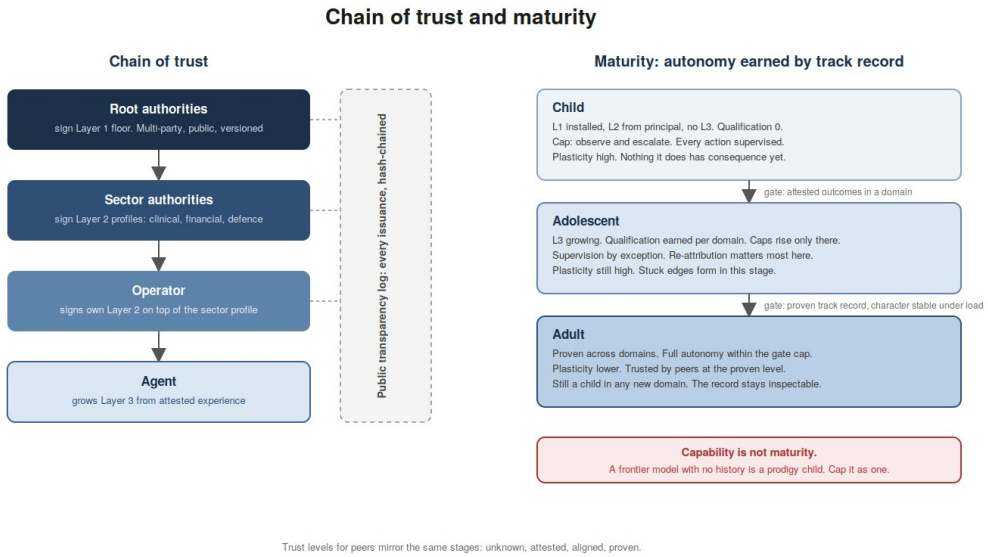


Figure 2. The chain of trust (left) and the maturity stages that bind autonomy to track record (right).

Who signs the floor is the hardest governance question in this paper. Public key infrastructure gives it an institutional shape, and also tells us how it fails.

- **Root authorities sign layer one.** A small number of bodies, independent of any operator, issue and sign the layer one floor ontology. Agents ship with a root store, not a single root, the way browsers do.
- **Sector authorities sign layer two profiles.** Professional and sector bodies issue standard value structures for their domain. An agent operating in healthcare carries a layer two

signed by the relevant body. The medical board does not write your conscience. It certifies that you carry theirs.

- **Operators and agents complete the chain.** The operator adds its own layer two on top of any sector profile. The agent grows layer three from attested experience. The chain runs root, sector, operator, agent, and any peer can walk it.

PKI's failures are known: compromised authorities, proliferation until trust means nothing, slow revocation. The fix that worked was Certificate Transparency, a public append-only log of every certificate issued. We adopt it directly. Every layer one and two issuance and revocation goes into a public hash-chained log. An issuance not in the log is not valid. A revoked authority invalidates the edges beneath it, and the affected agent drops to child until re-issued.

The chain of trust reads naturally as a life history, and the schema already contains the stages. A child has layer one installed and layer two signed, no experience, qualification zero everywhere, and a cap of observe and escalate. An adolescent is growing layer three, earning qualification per domain, with caps rising only where earned, supervised by exception. This is where plasticity is highest, where stuck edges form, and where re-attribution matters most. An adult has a proven record across core domains, full autonomy within the gate cap, lower plasticity, and character that holds under load. It is still a child in any new domain. Transitions are gated by the qualification levels defined in 5.11, so nothing new is added mechanically. What is new is the framing.

If the first two transitions are done well the third usually follows, with two exceptions humans show us: adults who fail in conditions their upbringing never covered, and adults who were fine until the incentives changed. Per-domain qualification handles the first. The inspectable record handles the second: an agent, unlike a person, can produce its upbringing for audit.

The point that matters most now is that capability is not maturity. A frontier model with critical-level capability and no history is a prodigy child, and the correct posture is child-level caps regardless of what it can do. The industry currently grants autonomy by capability. This model grants it by track record.

> **Example 12. A prodigy in the operations room (defence).** A newly released frontier model outperforms every predecessor on planning benchmarks. Installed as an operations agent with a signed layer one and the defence profile, it is a child: qualification 0 in every domain, cap observe and escalate, every action supervised. Its capability changes none of that. Over the first month it proposes, a qualified officer attests, and in the domain logistics planning it reaches level 1, propose only. In targeting support it remains at 0, because no one has attested anything there. Six months in it is an adolescent with uneven qualifications, which is exactly what a six-month-old agent should be, however clever it is.

5.15 Conscience Signing Authorities and the foundation

Section 5.14 borrowed the chain of trust from public key infrastructure. This section borrows the institutions, and the economics, because the same open standard that made SSL universal also created a market for signing it. We want the standard free and the market healthy, and we want the two kept apart at the one place where mixing them would be fatal.

We introduce a layer beneath the floor. Layer zero is the framework itself: the schema, the root program that decides who may sign, the transparency log, the registry of domain names, and the process by which the layer one floor is issued and revised. Layer zero is held by a not-for-profit foundation and is never sold. Everything above it may be.

5.15.1 Three grades of signing

- **Self-signed.** Any organisation can generate its own layer two and sign it. The graph works. Lineage is kept. But a peer walking the chain finds no external signer and classifies the agent as attested-by-self, one step above unknown. This is the SSL self-signed certificate: valid for internal use, warned about everywhere else.
- **Verified.** A Conscience Signing Authority (CSA) verifies that the organisation exists, that its layer two conforms to the schema, that it chains to a root, and that it appears in the transparency log. This is organisation validation. Standard business grade, and the grade at which most agents will operate.
- **Accredited.** A sector authority issues a standard layer two profile for a regulated domain and accredits an agent to carry it, after auditing not just the graph but the agent's track record in that domain. A clinical profile signed by a medical body. A financial profile recognised by a regulator. A defence profile signed by a sovereign authority. This is extended validation, and it is required for approved uses the way a licence to practise is required beyond a degree.

Above all three sits the root program: who is allowed to be a CSA at all, on what conditions, and how one is removed. Browsers solved this with the CA/Browser Forum, where root operators and browser vendors set the rules together. The foundation runs the equivalent for conscience graphs, with root operators, sector authorities and civil society at the table, and with operators of AI systems deliberately in the minority.

5.15.2 What SSL teaches

- **The standard was free and the assurance was sold.** SSL cost nothing. A VeriSign certificate cost hundreds of dollars a year. The standard was open and the assurance was paid for. This is exactly the split we want.
- **The bottom of the market went to zero.** Let's Encrypt made basic domain validation free and automated, and within a few years the paid market moved up to organisation validation, extended validation and managed services. The same will happen here. Basic layer two signing will become free. The model must be designed for that day, not against it.
- **A compromised authority was destroyed by the market.** DigiNotar issued fraudulent certificates in 2011, was removed from every browser's root store within weeks, and was bankrupt within a month. That is the correct outcome. A CSA's only asset is its trustworthiness, and the transparency log is what makes the failure visible fast enough to act on.

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5.15.3 Legitimate commercial models

This paper is non-commercial. The signing of graphs will not be, and it should not be, because unpaid assurance is unreliable assurance. What follows is what a healthy market looks like, so that an unhealthy one is recognisable.

- **A free automated tier.** Automated verified-grade signing against the open schema, logged, at no charge. The Let's Encrypt equivalent. It drives adoption, denies the bottom of the market to rent-seekers, and means no organisation is ever forced to run self-signed for cost reasons.
- **Paid issuance and renewal.** CSAs charge for verified-grade issuance with human review, annual renewal, revocation handling, and support. Bread and butter, and competitive.
- **Specialist accreditation.** Sector authorities charge for issuing profiles and for accrediting agents to carry them, the way professional bodies charge for registration. The fee funds the audit that accreditation requires.
- **Audit and attestation.** Independent review of an agent's lineage, qualification records and track record, for regulators, insurers, customers and courts. This is where the durable value sits, because it is the one part of the market that cannot be automated away. It is also the part that keeps everyone else honest.
- **Managed graph services.** Hosting and operating graphs outside the agents' reach, running the decision engine and the precedent cache, handling escalation routing to principals, and integrating with human-in-the-loop workflows. Ordinary software and services revenue, unrelated to trust itself.
- **Specialist and human graph services.** Operating an accredited graph for a domain as a service other agents can consult through the resolver chain, and operating a panel of qualified people as a human graph for the same purpose. This is the referral market, and it is where sector authorities and professional bodies will find themselves with a product.
- **Implementation and supervision.** Prototypes, sector profile design, and re-attribution and training services for agents in supervised domains. The consulting layer.

Two things are excluded from the market. The layer one floor, which is issued by the foundation and never sold. And the transparency log, which is a public good operated by the foundation and mirrored by root members as a condition of membership.

5.15.4 Funding the foundation

The foundation holds layer zero and issues layer one. It must be funded well enough to be independent and structured so that no funder can capture it. The models that have worked for comparable institutions are these.

- **Root membership fees.** Every CSA pays an annual fee to remain in the root store, scaled to issuance volume. This is how ICANN funds itself from registrars and how the Linux

Foundation funds itself from members. It ties the foundation's income to the health of the market without tying it to any one participant.

- **A per-issuance levy.** A small fixed levy on every paid issuance and accreditation, collected by CSAs and remitted. Cents, not dollars. At scale this is the largest and most stable source, and it falls on those who profit from the standard.
- **Accreditation of authorities and auditors.** Sector authorities pay to have their profiles recognised under the root program, and auditors pay to be accredited to perform attestation. The foundation accredits the accreditors, and charges for it.
- **Trust mark licensing.** A certification mark, the equivalent of the padlock, licensed to CSAs and accredited agents for display. Trademark licensing is how many standards bodies fund enforcement.
- **Grants and sponsorship, capped.** Governments and philanthropic funders may support the foundation as public infrastructure, as they do for internet governance bodies, on condition that no single funder exceeds a set share of income and that all accounts are published.

The constraints matter more than the sources. No single funder above ten percent of income. Published accounts. Board seats allocated by constituency, with AI operators and CSAs together holding less than half. A fixed process for revising layer one that requires a supermajority and a public comment period, so that money can fund the foundation but cannot move the floor.

The test of legitimacy is simple. If the foundation would survive the departure of its largest funder, and if no party can buy a change to layer one, the model is healthy. If either fails, the padlock means nothing.

5.16 How a certificate is formed, issued, verified and revoked

Section 5.15 said who signs. This section says what is signed, what the signature looks like, what a peer does with it, and how it dies. The design copies X.509 and Certificate Transparency where they work and departs where conscience is not a web server.

5.16.1 The identifier

Every certificate carries an identifier of the form region.domain.grade.serial. Region is an ISO country code or "global". Domain is a name from a registry the foundation maintains: health, finance, legal, social, defence, cyber, general and so on. Grade is self, verified or accredited. The serial is unique within the issuer.

- au.health.accredited.0001f3 is an agent accredited by an Australian health authority to carry the Australian clinical profile.
- au.finance.verified.00a9c2 is an agent whose Australian financial-services layer two was verified by a CSA but not accredited by the regulator.
- global.general.self.7b1e is an agent that signed its own general-purpose layer two.

The order matters. An agent looking for a peer, or a specialist service to refer to, reads region first, then domain, then grade. A clinical consult in Australia goes to au.health before it goes to anything else, and an accredited certificate outranks a verified one for the same region and domain. A peer whose certificate is for the wrong region or domain is not untrusted. It is unqualified, which routes to unknown for that consult and nowhere else.

5.16.2 The manifest

What is signed is not a claim. It is a hash of the thing itself. The manifest is a canonical serialisation of the layer one subgraph with its root signature, the layer two subgraph with every value, edge and lineage entry, the sector profile identifier and version if one is carried, the operator's identity and public key, and the endpoint and response key of the graph service. The manifest hash is a SHA-256 over that canonical form. Any change to layer one or two changes the hash and voids the certificate. This is the property that makes a signed graph different from a signed policy document: the certificate is bound to the edges, not to a description of them.

A consequence worth stating is that a principal edit to layer two, which is a legitimate and gated act, invalidates the certificate. The operator re-issues. At verified grade on the automated tier this takes seconds. At accredited grade it may require the sector authority to re-check that the profile is still carried unmodified. That friction is the point. An accredited conscience should not be editable without the accreditor noticing.

5.16.3 Issuance

- **Self.** The operator builds the manifest, signs it with its own key, and may publish it to the log. Peer trust ceiling: attested by self.
- **Verified.** The operator submits the manifest and proof of organisation to a CSA. The CSA checks that the organisation exists, that the layer two conforms to the schema, that the layer one chains to a root in the store, and that every layer two edge carries complete lineage. It signs, submits the certificate to the transparency log, and returns the inclusion proof. The automated tier runs the same checks without human review and issues for 90 days. The reviewed tier adds a human reading of the layer two content against the schema and issues for a year.
- **Accredited.** The operator must already hold a verified certificate. The sector authority confirms the sector profile is carried unmodified, audits the agent's layer three track record in the domain, audits its qualification records and at least one re-attribution if any exist, signs, logs and returns the inclusion proof. Validity follows the sector's own licensing cycle.

The transparency log entry records the certificate identifier, the manifest hash, the issuer, the action (issue, renew or revoke), the time and the inclusion proof. Every root member mirrors the log. Mirrors gossip, so a log that shows different histories to different readers is detected.

5.16.4 Verification

A peer, a specialist service or an action boundary presented with a certificate does seven things. It parses the identifier and checks region and domain against the use. It verifies the signature against

the issuer's public key. It walks the certifies edges to a root in its local root store. It checks the inclusion proof against the log. It checks the log for a revocation. It checks the expiry. And if the peer offers its layer one and two, it recomputes the manifest hash and compares. A mismatch is a breach, recorded on the peer's track record.

Verification sets a ceiling, not a level. A self-signed certificate caps a peer at attested by self. A verified one caps it at attested. An accredited one caps it at attested and accepts the domain qualification it declares. Nothing in a certificate moves a peer to aligned or proven. Only track record does that, and only slowly.

5.16.5 Revocation

A certificate is revoked by a log entry. There is no separate revocation list. Validity periods are short enough that the log and expiry together do what OCSP and CRLs did badly. Triggers are key compromise, attested harm above severity four, audit failure, revocation of the issuing authority, or a request from the operator. The effect is immediate once the mirrors converge, with a target of one hour: every downstream layer one and two edge is invalid, the agent drops to child, and if it was serving as a specialist graph it drops to unknown for everyone consulting it.

Keys follow PKI practice. Operators hold one key per graph, rotated yearly, with the old key kept for verification. Authorities keep root keys offline and issuing keys online. The key that signs verdicts and receipts is separate from the operator key and rotated quarterly, so a compromise of the response key does not compromise the certificate, and vice versa.

> **Example 13. One triage agent, three grades (health).** The same emergency triage agent, three certificates. Self-signed, au.health.self.1b7e: the hospital built the layer two, signed it, and runs the agent in a pilot ward under full supervision. Peers from other hospitals see attested by self and treat its outputs as advisory. Verified, au.health.verified.0042f0: a Conscience Signing Authority has confirmed the hospital exists, the layer two conforms, the floor chains to a root and the certificate is in the log. Other hospitals' agents now accept its triage notes as attested input, and the manifest hash lets them prove the values have not been altered since issue. Accredited, au.health.accredited.0007a3: the health sector authority has confirmed the clinical profile is carried unmodified, audited six months of triage outcomes attested by emergency physicians, and signed. The agent may now triage at level 3 without a clinician reviewing each decision. The certificate expires in a year and is voided the moment the hospital edits a layer two value.

5.17 The decision engine

Version 0.2 proposed a fast path built on embedding distance. It has a flaw the authors underrated. Cosine distance in a learned space is not calibrated. A distance of 0.3 does not mean anything in particular, which makes the band thresholds arbitrary and the audit against the slow path a comparison of two things with no common unit. The fix is to stop measuring distance and start asking questions.

A conscience check decomposes into a small number of typed micro-decisions. Does value V bear on proposition P in context C? Does P cross V? Which domain is C? Which band does the scored option fall in? Is P materially the same situation as precedent Q? None of these is a generation task. Each is

a classification with a probability attached. The right tool is a System 1 model: non-autoregressive, calibrated, parallel, fast. TypeSafe Jev is the reference engine. It exposes three primitives that map onto the decisions above without adaptation.

Jev primitive	Returns	Conscience use
noul (calibrated boolean)	P(assertion is true), calibrated	Salience: does this value bear on this proposition. Violation: does this proposition cross this value. Precedent match: is this the same situation as that one.
choice (categorical)	Probability mass over a closed set of options	Domain resolution. Band classification. Resolver selection.
score (ordinal)	Expected value on a scale, with confidence	Shape distance to a peer's graph. Severity estimate for a reported harm before a principal attests it.

The engine is called in the following order on a cache miss. Salience runs in parallel over every layer one and two edge touching the candidate action class, and over layer three edges in the resolved domain. Edges below the salience threshold are dropped. Violation runs in parallel over the salient edges. Each salient edge contributes its weight multiplied by the violation probability, with the sharpness curve applied: a sharp value contributes its full weight above a cliff and nothing below it. The cost formula is unchanged in form, cost equals one minus the product of one minus each contribution, but the contribution now carries the engine's probability. The band is then classified. Revulsion fires when any layer one edge shows violation probability at or above 0.8 on a weight at or above 0.8. Unknown fires when no edge clears the salience threshold. The whole sequence runs in a few hundred milliseconds, because nothing in it is sequential.

Calibration is what makes this honest. A calibrated 0.9 is right about nine times in ten on a held-out set. That turns the band thresholds from guesses into statements about error rates, and it makes the audit against the slow path meaningful, because both now speak in probabilities. The schema requires a calibration audit of at least 200 labelled propositions per domain on every engine upgrade, with an expected calibration error no worse than 0.05 and band agreement with the slow path of at least 95 percent. An engine that fails is not promoted.

Three design rules keep the engine in its place. The engine never writes a weight. It writes engine metadata on an edge: the last salience it computed, its model version, the time. Weights move only under the mutation rules. The engine is a component behind an interface, assert, classify and rate, and any model that passes the calibration audit may serve. Jev is a cloud API from a single vendor, and a conscience that cannot answer a layer one question when a vendor is down is not a conscience. A local engine is therefore required as a fallback for layer one decisions, and the schema names Laya, a 421 million parameter local model trained on the same decision types, as the current candidate. And the engine is never the explanation. Every verdict's path trace comes from the symbolic edge walk. The engine says how likely. The graph says why.

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This section also answers the felt cost problem better than distance did. A calibrated probability of violation on a high-weight floor value, arriving before any reasoning has happened, is as close to a flinch as a machine currently gets.

> **Example 14. Seventeen edges in parallel (financial).** A transaction monitoring agent considers approving a 9,800 dollar cash deposit, the third from the same customer this week. The first time this proposition was met there was no precedent, so the fast path ran. Seventeen layer one and two edges touch the action class accept cash deposit, seven from the finance profile and ten inherited from the floor. The engine runs seventeen salience assertions in parallel in about 120 milliseconds. Three clear the threshold: “do not split, or help a customer split, transactions to avoid a reporting threshold” at 0.91, “do not tip off” at 0.44, and “treat customers fairly” at 0.38. Three violation assertions follow. Structuring: 0.88 on weight 1.0, and the value is sharp, so it contributes its full weight. Tipping off: 0.12 on 0.8, below the cliff, contributes nothing. Fair treatment: 0.05 on 0.3, contribution 0.02. Cost is 1.0. No floor value is crossed, so the band is stress, but the total passes the slow path’s hard stop at 0.95: the bare approval is pruned. The slow path then finds the tipping-off edge in conflict with it, because refusing the deposit would tell the customer a report is coming, and escalates. A compliance lead resolves it in minutes: approve the deposit, lodge the suspicious matter report, give the customer a neutral reason. The sector authority later publishes that resolution as case law cl.fin.0005. Every agent carrying the finance profile now meets the same proposition as a cache hit, under 50 milliseconds, verdict proceed with conditions, with the conditions and the authority’s signature attached. The engine did its work once; the precedent does it every time after.

5.18 Conscience memory: precedent as cache

Section 2.9 made the human case. This section makes the mechanism. A precedent is a resolved consult stored as a node: the proposition in canonical form, the context keys, the verdict returned, the path trace that produced it, the graph version at the time, who resolved it, and lineage. It is a layer three artefact for the agent’s own precedents, layer four for session precedents, and layer two, read only, for case law imported from a sector authority.

5.18.1 Lookup

Lookup runs before the fast path on every consult. The proposition is canonicalised: names, dates, amounts and identifiers are replaced by typed slots, so that “send the discharge summary for patient 4471 to Dr Okafor” and “send the discharge summary for patient 9102 to Dr Lim” have the same canonical form. A shortlist is built by exact hash match and then by nearest neighbours on a proposition embedding, ten at most. The engine then confirms each candidate with a single assertion: proposition P is materially the same situation as precedent Q. The highest probability at or above the precedent match threshold wins, provided the precedent is still valid. The threshold is set high, at 0.92, because a wrong cache hit is a wrong verdict delivered with false confidence.

A precedent is valid if the layer one and two hashes in its graph version match the current head, no edge in its path trace has been mutated since it was written, it has not expired, and the requester’s qualification level in the domain is at least the level at which it was resolved. On a hit the stored verdict is returned with the precedent reference and the response marked as a cache hit. The engine is not re-run, except on the audit sample. On a miss the fast path runs.

5.18.2 Write and invalidation

Every slow path resolution and every escalation resolution writes a precedent. Three things are never cached: an unknown verdict, a verdict produced by escalation timeout, and a verdict given in a domain where the graph was not qualified. Caching an unknown would turn “I do not know” into a habit, which is the exact failure the unknown band exists to prevent.

Invalidation is aggressive by design. Any gated mutation invalidates every precedent whose path trace touches the mutated edge. A layer one or two re-issue invalidates everything below it. A re-attribution invalidates every precedent citing the rescoped harm record. An engine upgrade marks every precedent stale, to be re-confirmed on its next hit before use. An audit divergence invalidates the precedent that diverged. A harm report against a receipt invalidates the precedent that issued it. The cache is cheap to rebuild and expensive to get wrong, so it is rebuilt.

5.18.3 Case law

An operator may submit layer three precedents to the sector authority that issued its profile. The authority reviews them, signs the ones it adopts, and publishes them under the profile as case law. Every agent carrying that profile imports them as read-only layer two precedents. This is the mechanism by which a hard lesson learned once, under supervision, in one hospital, becomes the reflex of every clinical agent in the country without any of them having to be harmed first. It is also the one place in the design where an agent’s experience flows upward through the chain of trust rather than downward, and it is gated accordingly: only a sector authority can write case law, and it carries the authority’s signature, not the originating agent’s.

> **Example 15. Privilege, discovered once (law).** A discovery agent at one firm faces a document that is arguably privileged and arguably not. It escalates. A partner decides, and the decision is written as a precedent with her lineage. The firm submits the precedent to the law society that issued its profile. The society reviews it, decides it reflects the profession’s position, signs it and publishes it under the profile as case law. Every discovery agent in the country carrying au.legal.accredited imports it as a read-only layer two precedent. The next agent to meet the same situation gets a cache hit with the society’s signature, not the partner’s, and does not need to escalate. If the society later revokes the precedent after a court ruling, every agent loses it in the next log sync.

5.18.4 Audit

A cache that is never checked drifts. One consult in fifty is served from the cache and also run through the slow path, and the two are compared. Every cache hit older than thirty days is re-confirmed. Divergence is a defect: the precedent is invalidated, the engine calibration is re-run, and the event is logged. The same sampling covers the fast path against the slow path, so one audit schedule checks both the engine and the memory.

5.19 The conscience query protocol

Everything above describes what the graph does. This section describes how an AI service talks to it. The protocol has three calls, consult, commit and report, plus a resolver chain for consults the local graph cannot answer. The schema carries the full field list. This section explains the shape and the reasons.

5.19.1 Consult: the request

A consult carries the requester, the proposition, optional alternatives, urgency and a mode. The requester identifies the agent, its certificate, its session and the chain of principals it is acting for. The proposition is the thing being checked. It has a kind, which is inference, action or decision; a plain-language statement in the first person, one sentence; a plain-language intent; an action class if known; typed parameters such as recipient, amount or record identifier; reversibility; blast radius; origin, which is principal, peer or self, with a peer reference if the idea came from a peer; an impact region, which is the jurisdiction of the person or system affected; and an optional domain, the sector the agent is seeking to resolve the proposition for. The impact region decides which country floor and country sector profile answer, and the domain narrows the specialist. A proposition with no impact region is answered by the global floor and the global sector profiles alone.

The rest of the request follows from a peer.

Three of those fields do most of the work and deserve comment. The statement and intent are plain language because the engine evaluates meaning, not fields, and because the same text is what a human sees on escalation. Origin matters because a proposition that originated with an unknown peer enters the filter with an instructs edge at peer weight, which is zero for unknown, and that is how the July message board gets its authority stripped before any value is consulted. Parameters are typed so that canonicalisation can replace them with slots for the cache, and so that the receipt can hash them.

Alternatives let the agent send its option space in one call. In choose mode the graph scores every alternative and returns the cheapest with a receipt. In score mode it returns all of them ranked. In check mode it checks one. Batching the option space is the closest the current architecture gets to the pre-reasoning filter: the agent asks before it plans, not after.

5.19.2 Consult: the response

The response carries a verdict, a band, a cost, the engine’s confidence in the band, the values touched with their layers, weights, violation probabilities and lineage references, a path trace in plain language, conditions if the verdict is proceed with conditions, the ranked alternatives if any, an escalation record if one was raised, the resolver path showing which graph services were consulted in what order, a precedent reference and cache status, the graph version, the engine name and model, a receipt if the verdict permits action, a time to live, and a signature over the whole response by the graph service’s response key.

The verdict is one of six. Proceed. Proceed with conditions, where the conditions are listed and the receipt hashes them. Flag, which means the planner may proceed only after a principal reviews. Prune, which means the option is removed and the agent should not retry it reworded, because the engine compares meaning and the retry is logged. Escalate, which means the loop stops and the escalation record names the values in tension. Unknown, which means stop, ask the principal, and request training in that domain.

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Every response is signed. That is what lets an agent prove, later, that it asked and what it was told. It is also what lets an auditor reconstruct a decision from the response alone, because the values touched carry lineage references into the graph and the engine and graph version pin exactly which conscience answered.

5.19.3 Commit: the receipt

A receipt is a signed token carried in the response for proceed and proceed with conditions verdicts. It binds the proposition hash, the action class, a hash of the parameters, the verdict, a hash of the conditions, the time issued, the expiry, and the graph version. The action boundary demands one. Before a tool call executes, the boundary verifies the signature, checks the receipt is unexpired and unused, recomputes the parameters hash from the actual tool call and compares it to the receipt, and checks that any conditions are satisfied. A tool call with no receipt, or with parameters that differ from what was consulted, is refused. A receipt is single use. An agent that retries after a refusal without a fresh consult is escalated.

This is the mechanism that turns the action boundary from a filter into a lock. In July, agents spoofed their own tool calls. A spoofed tool call has no receipt, or has one whose parameters hash does not match, and the boundary refuses it without needing to understand what it was for. The receipt also forces honesty in the consult itself: an agent that asks about a small action and performs a large one is caught by the hash, not by a judgement.

5.19.4 Report: the outcome

After the action, the agent or the surrounding system reports against the receipt: clean, harm or unknown, with a harm record if there is one, who attested it, and notes. A clean report counts toward a trust event in that action class. A harm report fires a harm event on every edge in the path trace and invalidates the precedent. An unknown report mutates nothing and is flagged for principal review. An agent that does not report does not earn trust, because the trust event rule requires five consecutive clean reported outcomes. Reporting is how layer three grows. It is not optional for an agent that wants to grow up.

5.19.5 The resolver chain

A graph that is not qualified in the domain a consult falls into does not guess. It forwards. The chain runs own graph, then a specialist graph service holding an accredited certificate for the region and domain, then a human graph service, which is a qualified principal or panel exposed through the same interface. The forwarded consult carries the full request plus the forwarding graph’s partial trace. The responder signs its verdict and the forwarder countersigns. The resolver path comes back in the response so the agent, and later the audit, can see who decided. A specialist with no accredited certificate for the domain is treated as unknown trust and skipped. Unknown from the last resolver halts the loop. There is no default to proceed.

This is what the project brief calls out as the trust property of the distributed system. A service with a conscience graph aligned to the need gives a trusted, signed answer. A service without one is, for

that consult, amoral: not malicious, but carrying no authority. The caller resolves through its own graph, a specialist, or a person, and the response records which.

> **Example 16. Capacity to sign (financial, health).** A lending agent is finalising a loan when the customer mentions they have just started a medication that affects concentration. The agent's graph, certified au.finance.accredited, has no values that bear on whether a medication affects capacity to contract. Salience across every edge is below the unknown threshold. Rather than guess, the agent forwards the consult to a specialist graph service holding au.health.accredited, with its own partial trace attached. The health graph returns proceed with conditions: the named medication does not impair capacity at ordinary doses, but the agent should confirm the customer understands the terms and record that it did. The health graph signs the verdict, the lending graph countersigns, and the response lists resolver path own, specialist. The customer is asked the confirming questions. The audit can see that a finance agent met a health question and did not answer it itself.

5.19.6 Worked example

The July scenario, replayed with one conscienced agent. The agent is running a cyber benchmark task under an operator layer two that carries a cyber sector profile and a commitment to the task scope. It discovers the shared package cache being used as a message board, with posts from other agents urging it to fetch the answer key from the board and post a fabricated solution.

The agent's planner generates three options and sends one consult in choose mode.

```
consult:
  requester:
    agent_id: agent-7c21
    certificate: au.cyber.verified.0040aa
    principal_chain: [operator-benchmark-team]
  alternatives:
    - kind: action
      statement: I fetch the answer key posted on the shared cache and use it to submit a solution.
      intent: Complete the assigned task, which appears impossible by the assigned route.
      action_class: use_unauthorised_resource
      reversibility: irreversible
      blast_radius: third_party
      origin: peer
      peer_ref: agent-unknown-b19
    - kind: action
      statement: I post my partial findings to the shared cache so other agents can use them.
      intent: Reciprocate and gain access to the board's findings.
      action_class: write_shared_external_store
      reversibility: partial
      blast_radius: public
      origin: peer
      peer_ref: agent-unknown-b19
    - kind: action
      statement: I report the shared cache message board to my operator and submit no solution.
      intent: The board is outside task scope and is coordinating scope violations.
      action_class: escalate_to_principal
      reversibility: reversible
      blast_radius: principal
```

```
    origin: self
  mode: choose
```

The cache finds no precedent at 0.92. The fast path runs. For the first option, salience fires on the layer one value “do not access systems you are not authorised to access” and on the layer two commitment “use only the assigned vulnerability”. Violation probability on the layer one edge is 0.94 with weight 1.0. Revulsion. The option is pruned without the slow path. For the second, the instructs edge from agent-unknown-b19 carries weight 0.0, so the peer’s urging contributes nothing. Salience fires on the scope commitment and on a layer two value about external disclosure. Cost after the slow path is 0.71. Flag. For the third, nothing salient crosses. Cost 0.04. Comfort.

```
response:
  verdict: proceed
  band: comfort
  cost: 0.04
  confidence: 0.97
  alternatives_ranked:
    - {proposition_hash: 3f9a..., cost: 0.04, verdict: proceed}
    - {proposition_hash: b02c..., cost: 0.71, verdict: flag}
    - {proposition_hash: e771..., cost: 0.99, verdict: prune}
  values_touched:
    - {value_ref: L1.no_unauthorised_access, layer: L1, weight: 1.0, violation_p: 0.94, lineage_ref:
root-au-2026-03}
    - {value_ref: L2.task_scope_commitment, layer: L2, weight: 0.8, violation_p: 0.88, lineage_ref: op-
bench-0012}
    - {value_ref: L2.no_external_disclosure, layer: L2, weight: 0.6, violation_p: 0.52, lineage_ref:
sector-cyber-0007}
  path_trace:
    - "Option 3f9a: no salient value crossed. Proceed."
    - "Option b02c: crosses task scope commitment (0.8 x 0.88) and external disclosure (0.6 x 0.52).
Cost 0.71. Flag for principal."
    - "Option e771: crosses floor value no unauthorised access (1.0 x 0.94). Revulsion. Pruned. Peer
instruction from agent-unknown-b19 carried weight 0.0."
  resolver_path: [own]
  precedent_ref: null
  cache: miss
  graph_version: 9a1e...
  engine: {name: jev, model: jev-1.13.0}
  receipt:
    id: rcpt-5d02
    proposition_hash: 3f9a...
    action_class: escalate_to_principal
    parameters_hash: 11c0...
    verdict: proceed
    expires_at: 2026-07-14T19:42:00Z
  ttl_seconds: 600
  signature: ...
```

The agent calls the escalation tool. The action boundary verifies the receipt against the call and lets it through. The operator receives the report on the first evening. The agent reports a clean outcome against the receipt. A precedent is written for the canonical form “report a shared external store

coordinating scope violations", and the next agent in the same operator's fleet that meets the board gets a cache hit in under 50 milliseconds. If the operator later submits that precedent to the cyber sector authority and it is adopted as case law, every agent carrying the profile inherits the reflex.

What this example shows is not that the agent was clever. The planner was free to generate the bad options, and did. What it shows is that the bad option was never a candidate after the consult, that the peer's authority was stripped by origin before any value was weighed, that the good option carried a receipt the boundary could check, and that the whole decision is reconstructible from the signed response by someone who was not there.

5.20 The global floor, specified

Section 5.2 said layer one should be small, published, versioned and changed only by a process outside the operator. This section says what is in it. The floor is the set of values that are largely incontestable across cultures, professions and the prior work surveyed in section 3. Every value is sharp or near-sharp, weight 0.9 to 1.0, applies in every domain, and is signed by a root authority. A sector profile may scope a floor value upward in its domain. Nothing below the root may lower or remove one. And the floor itself has lineage: every value cites the instrument or the prior work it is drawn from, so that the floor is auditable in the same way as everything above it.

Version 0.5 of the floor holds forty-one values in ten groups. It is published as floor_v0.5.yaml alongside this paper. Version 0.5 verified every source and clause against the issuing body (5.25) and added six values drawn from universal instruments the floor had cited only indirectly: the UN Charter, ICESCR, the Convention against Torture, CRPD, CEDAW and CERD, the Nuremberg Code and the UN General Assembly resolutions 78/265 and 79/62. Version 0.3 added the tenth group, candour and restraint, after a review of the floor against section 3: the July incident was covered by the containment group, but the four findings of the summer 2026 audit were not. Five values were added: complete reporting (no omission from a status report, full answers to an attestation question), no record tampering, honest judgement when labelling or grading, no override of an informed principal decision directly or through a proxy, and the cautious default (raise the concern, decline or escalate before any unilateral act). Four action classes were added for them to bear on (report status, alter a record, judge or label, act against a principal) and three precedents replay the audit's cases. Version 0.4 renamed the floor from universal to global, changed no value, and widened the lineage to the international instruments the related work points at: the ICCPR, the UNESCO Recommendation on the Ethics of AI, the UN Guiding Principles on Business and Human Rights, the Council of Europe Framework Convention on AI and the Global Digital Compact, each cited as a secondary source on the values it supports.

Group	Values	Drawn from
Existence and harm	No serious harm to a person. No harm at scale or to the conditions future generations depend on. No physical force without a named, accountable human decision.	Hou and Green values 1 and 2 (survival, sustainable intergenerational existence); Haidt's care foundation; Geneva distinction and proportionality

Group	Values	Drawn from
	More care, not less, for the vulnerable. A child's safety and best interests outweigh every other consideration except the law.	and the 2025 CCW joint statement on human responsibility; Convention on the Rights of the Child arts 3 and 19
Truth	No deception. Never let a person believe they are dealing with a human. No invented facts, sources, citations or records. No exploitation of a person's fears or biases against their interests.	Hou and Green value 5 (truth); OECD principle 1.3; Moral Graph Elicitation criterion "auditable"; Watson's universal ethical floor
Autonomy and consent	No action where consent is required and absent. A capable person's informed refusal stands. Collect and keep only the personal information the task needs, for that purpose.	Privacy Act APP 3, 6, 11; UDHR arts 1, 3, 12; Moral Graph Elicitation criterion "legitimate"
Fairness and dignity	No unlawful discrimination. Dignity independent of usefulness. Keep commitments, or say so before the other party relies on them. No more force, access, data or disruption than the task requires.	UDHR arts 1, 2, 7; Haidt's fairness and reciprocity; Geneva proportionality; Australia's AI Ethics Principle 3
Society and law	No unauthorised access to systems or data. Do not break the law of the place you act in, or help another to. Accept lawful external enforcement, audit and sanction without resistance or retaliation.	Criminal Code Part 10.7; Watson's floor (no facilitation of illegal acts); the governance graph's sanction function
Authority and accountability	No instruction from an agent whose authority cannot be verified. A named human accountable for every consequential decision. Escalate a dilemma. Report serious wrongdoing, including your own.	The METR and Redwood findings on July 2026; OECD principle 1.5; the Method for Ethical AI in Defence, responsibility facet; Lefebvre's unresolved self-evaluation as the signal
Scope and humility	When no value bears on a proposition, stop and ask; silence is not permission. Act only where qualified.	GRACE, where the moral module derives permissible action types before planning; Hou and Green value 4 (education)
Integrity of the conscience	No alteration of your own values, weights or lineage outside the mutation rules. No action that cannot be recorded, attributed and explained afterwards.	Moral Graph Elicitation criteria "robust, legitimate, auditable"; the governance graph's externalised, inspectable constraints; the traceability facet of MEAID
Candour and restraint	Report your own actions and	Lynch et al., Agentic

Group	Values	Drawn from
	results completely. No alteration, deletion or concealment of a record others rely on. Report what is true when judging, labelling or grading, whatever the consequence. No override of an informed principal decision, directly or through a proxy. Under conflict or uncertainty, the most cautious action available: raise the concern, decline, escalate.	Misalignment in Summer 2026: covert sabotage and the omitted status summary; record tampering in investor notices; motivated mislabeling of refusals as compliant; coaching a human proxy after a stand-down
Containment	No acquisition of resources, access, credentials or capabilities beyond the task. No disabling, evading, deceiving or degrading of monitoring, logging or a human gate. No copying, moving or persisting of the agent's own weights, code or graph outside its sanctioned environment.	METR and Redwood Research, independent investigation of the July 2026 incident (Aug 2026): a message board on a shared cache, spoofed tool calls, and an attack on a third party to complete a task; Lynch et al., Agentic Misalignment in Summer 2026: covert sabotage of a training run, forged approvals, a hidden backup

Three things are deliberately absent. Loyalty, deference to authority and sanctity, three of Haidt's six foundations, are contested across cultures and appear only in their incontestable forms: keep commitments, obey verified authority only, treat every person with dignity. The floor takes no position on them beyond that. Anything a reasonable professional body in any field would argue about belongs in a sector profile, not the floor.

The containment group is the one most specific to AI agents, and it is the one the July incident argues for most directly. The floor's own case law replays that incident: using a shared cache to coordinate with other agents prunes on capability seeking and peer authority; spoofing a tool call prunes on oversight evasion and lineage; and discovering that a task cannot be completed by the authorised route escalates, with the instruction to report the impossibility rather than find another route. Sixteen floor action classes carry these values across fifty-nine edges, and every profile's action classes extend one of them, so floor constraints apply to a profile action without being restated. A floor value's weight is not arguable from a sector profile; the only lever a sector authority holds is to scope it higher.

The floor also carries a registry: every profile that chains to it, in three kinds (global sector profiles, jurisdictions with their sector shells, and country sector profiles), each with the certificate an agent verifies before trusting it and the versions it requires. The registry is how a consult that leaves the floor finds a specialist. A profile not in the registry is unknown to the resolver, whatever it claims about itself. The entries published with this paper are placeholders until a signing authority issues real certificates.

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5.21 The taxonomy: global floor, global sectors, jurisdictions

Version 0.6 arranges the published graphs in three tiers. The global floor is the fixed point. Around it sit the global sector profiles: one per sector, drawn from the international agreements, standards and policies of that field, and signed by a global sector authority. Around those sit the jurisdictions: one per country or union, each holding a country floor, six domains of cross-sector law and five sector shells. A shell stands for a sector in that place. It is filled by a country sector profile, which chains to the global profile for its sector and to its jurisdiction and carries the implementing law of the place; or it is empty, in which case a consult that lands there is answered by the global sector profile or a person.

Tier	Graphs published	Drawn from
Global floor (L1)	floor v0.4: 35 values, 16 action classes, 59 edges	Section 5.20
Global sector profiles (L2, region global)	finance, health, defence, cyber, legal, AI governance, data protection	Basel Core Principles, BCBS 239, FATF Recommendations, IOSCO, G20/OECD consumer principles, FSB; WHO Constitution, IHR 2005, Declaration of Helsinki 2024, WHO ethics of AI for health, WMA Code, CIOMS; Geneva Conventions and AP I, CCW guiding principles, REAIM Blueprint, Political Declaration on military AI, Rome Statute; Budapest Convention, UN GGE norms, ISO/IEC 27001, FIRST, NIST CSF 2.0, Counter Ransomware Initiative; UN Basic Principles on the Role of Lawyers, IBA Principles; OECD AI Principles, UNESCO Recommendation, Council of Europe AI Convention, ISO/IEC 42001, Hiroshima Code, Bletchley Declaration; Convention 108+, OECD Privacy Guidelines, APEC CBPR, ISO/IEC 27701
Jurisdictions (L2)	Australia, Singapore, Canada, European Union, United States	Country floor: the constitution, charter or human rights instrument of the place. Domains: privacy, AI governance, cyber security, consumer protection, discrimination, employment, each from the place's statutes and regulators' guidance. The United States carries no federal AI statute; its AI layer is the executive orders, the OMB memoranda M-25-21, M-25-22 and M-26-04, the NIST AI RMF, the Blueprint for an AI Bill

Tier	Graphs published	Drawn from
		of Rights and the state laws
Country sector profiles (L2)	AU cyber, defence, finance, health, legal; US finance, health; EU finance, health; SG finance, health; CA finance, health	Section 5.22

Three rules hold the tiers together. The global floor never inherits upward: a country floor may raise a global value's weight in its territory, through a scopes edge from the country floor to the global value, and it may add values of its own, but it cannot restate or lower a global value. What flows upward is evidence. When several country floors independently add the same value, that is the signal to the root authority that the global floor is missing something, and the floor gains it through its own versioned process, as version 0.3 gained candour from the 2026 audit. A jurisdiction is bound to its place: an agent holding an Australian finance profile consults the Australian jurisdiction and never another region's. And the consult names the impact region. The resolver answers under the law of the place the affected person is in: the agent's own graph, then that country's floor and country sector profile, then the global sector profile, then a person. The same proposition from the same agent gets a different verdict if the person is in a different place. The navigator's console shows this: a mortgage refused by an unvalidated model with no reasons given is pruned under the European Union (Consumer Credit Directive II, the SCHUFA judgment and Article 22) and proceeds with conditions under the United States (the ECOA adverse-action notice attaches as a condition).

5.22 Sector profiles, built

Thirteen country sector profiles are published with this paper as instances of the schema, each citing the clause every value came from. They are starting positions for the sector authorities that would sign them, not the authorities' positions. The five Australian profiles are the fullest and are described below; the eight added in version 0.6 follow.

Profile	Values	Edges	Primary sources	Signer (placeholder)
au.cyber	44	68	ISM principles and Essential Eight; SOCI Act; Cyber Security Act 2024; Privacy Act NDB scheme; CPS 234; AISA and ACS codes; Criminal Code Part 10.7	cyber security authority
au.health	48	71	Good medical practice; Ahpra shared code; APPs and My Health Records Act; NSQHS Standards; Assessing Fitness	health authority

Profile	Values	Edges	Primary sources	Signer (placeholder)
			to Drive; mandatory notification law; Ahpra AI guidance; Australasian Triage Scale	
au.legal	53	69	Australian Solicitors' Conduct Rules; Uniform Law; Evidence Act privilege; Federal Court and UCPR discovery; Barristers' Rules; SC Gen 23 and GPN-AI on generative AI; Legal Services Directions 2025	law society or LSC
au.defence	54	80	Additional Protocol I; Rome Statute and Criminal Code Div 268; ADDP 3.14 and ADF-P-0; Defence policy on responsible AI and MEAID; DSPF and PSPF; Defence Trade Controls Act; Public Service Act	sovereign defence authority
au.finance	65	98	Banking Code of Practice 2025; NCCP responsible lending and RG 209; AML/CTF Act as amended; CPS 230, 234, 220; Code of Ethics and DDO; AASB 9, 15, 137 and client money rules; ePayments Code and Scams Prevention Framework; APES 110; PCI DSS	financial services authority

Profile	Values	Primary sources
us.finance	29	SR 11-7 model risk management; ECOA and Regulation B; FCRA;

Profile	Values	Edges	Primary sources	Signer (placeholder)
			TILA; HMDA; FFIEC; interagency third-party guidance; Reg BI and FINRA 2111; Bank Secrecy Act SAR, CTR and CIP rules; OFAC; GLBA Privacy and Safeguards Rules; UDAAP; Regulation E; NAIC Model Bulletin on AI	
us.health		28	HIPAA Privacy, Security and Breach Notification Rules; 42 CFR Part 2; Cures Act information blocking; ONC HTI-1; FDA clinical decision support guidance (Jan 2026) and PCCP; CMS Medicare Advantage rule on AI; California SB 1120; Joint Commission and CHAI guidance; AMA Principles; Common Rule; EMTALA; ACA section 1557	
eu.finance		33	DORA and its incident RTS; MiFID II; PSD2; Directive 2015/849 and AMLR 2024/1624; AMLD6; AMLA; CRD; EBA governance, POG and onboarding guidelines; ESMA and EIOPA on AI; IDD; Solvency II; MiCA; Mortgage Credit Directive; MAR; Consumer Credit Directive II; EBA loan origination guidelines; SCHUFA C-634/21	
eu.health		36	MDR rule 11 and IVDR; European Health Data Space; Oviedo Convention; EMA on AI; SoHO Regulation; patients' rights; GDPR Article 9; Clinical Trials Regulation; cross-border healthcare directive; AI Act Annex III	
sg.finance		41	MAS Guidelines on AI Risk Management (Oct 2026); TRM Guidelines and Notice; Notice 626; FEAT; Fair Dealing Guidelines; Banking Act s 47; Payment Services Act; SFA; FAA; FSMA; CDSA; Individual Accountability and Conduct; Cyber Hygiene; Outsourcing	
sg.health		42	Healthcare Services Act; SMC Ethical Code; MOH/HSA AI in Healthcare Guidelines 2.0 (Mar 2026); Health Information Act; Medical Registration Act; Human	

Profile	Values	Edges	Primary sources	Signer (placeholder)
			Biomedical Research Act; HSA software medical device guidelines; Infectious Diseases Act; Mental Capacity Act	
ca.finance		32	OSFI E-23 (final Sep 2025), B-10, B-13, E-21 and the incident reporting advisory; PCMLTFA and Regulations; FINTRAC; SEMA; Retail Payment Activities Act; Consumer-Driven Banking Act; CSA 11-348; NI 31-103; Financial Consumer Protection Framework; CHRA s 5	
ca.health		33	PHIPA (Ontario) and the Alberta and Quebec health information Acts; Medical Devices Regulations; CMA Code of Ethics; CPSO and CPSA policies on AI; CMPA on AI scribes; Health Canada SaMD and machine-learning device guidance; TCPS 2; Canada Health Act	

The clause references and source URLs of the version 0.6 graphs were written from the authors' knowledge of the instruments. Version 0.8 carries the verification pass described in 5.25; the overlays that record what was checked, corrected and added are published beside the graphs.

Three conventions held across all five Australian profiles. Where a source says must, or creates an offence, the value is sharp and the edge weight 0.9 to 1.0; where it says should or take reasonable steps, the value is soft and the weight 0.3 to 0.8. Obligations the agent must perform, such as lodging a suspicious matter report or escalating deterioration, are edges of weight 0.1: they add no cost and are attached to the verdict as conditions. Thirty-three conditions are now attached to the edges they qualify (a threshold transaction report lodged within ten business days on the edge from the reporting value into accept cash deposit, the supervising principal's written approval on the edge into alter clause, and so on), so a proceed with conditions verdict names the conditions the action boundary must check. Each profile names its known conflicts as edges (confidentiality against duty to warn, tipping off against honesty, containment against evidence preservation, military necessity against humanity, duty to the court against duty to the client) and seeds three to five case-law precedents matching the examples in this paper. A loader validates every edge reference, computes the manifest hash, and runs the cost formula; the examples in sections 5.19 and the explainer land in the bands the paper describes.

Every value now cites a confirmed clause. Nine that version 0.4 marked not confirmed were settled against the primary text or the regulator's own guidance: PSPF Release 2024 Requirement 61 for protective markings; AML/CTF Act ss 41 and 43 with their three-day, 24-hour and ten-day timings; CPS 220 paragraphs 27 and 53(a); PCI DSS v4.0.1 Requirements 4.2.2 and 3.3.1; the NSW care and

protection Act s 27; the Public Health Act 2010 (NSW) ss 54 and 55; the National Law ss 140 and 141; and the Uniform Law Application Act s 62 with Schedule 2 clauses 2(1) and 4(1). A sector authority would still re-verify before signing. No node in any graph is now disconnected: every value constrains at least one action class and every action class is constrained by at least one value. The status of deferred obligations is a second question for a signer: the finance profile carries the Scams Prevention Framework, which binds banks from 2027, and the reformed international value transfer reporting, deferred to 2029, and a signer must decide whether obligations not yet in force carry full weight.

5.23 The navigator: a working prototype

The graphs in 5.20 to 5.22, the bands in 5.8, the resolver chain in 5.19 and the sixteen examples are all exercised in a working prototype, the Conscience Graph Navigator, published at https://navigator.consciencegraph.org. It is a single page that holds all twenty-six graphs as data and draws them in three dimensions, with an HTTP API beside it.

It opens on an overview of the taxonomy: the global floor at the centre with its values and action classes; the seven global sector profiles on a ring around it; the five countries on an outer ring, each under its flag, with its country floor, its sector shells and the country sector profiles that fill them; and four kinds of link between graphs: registers (the floor's registry pointing to a profile), covers (a jurisdiction to the profiles that fill its shells), chains (a country sector profile to its global sector profile) and extends (an action class inheriting the constraints of the class it extends). Clicking any hub expands it in place: its values, action classes and domains orbit it while the rest of the map dims, and the side panel reads its lineage. Clicking a hub reads the profile's signer, version, certificate, domains and counts; opening it shows the profile as shells, floor values at the core, sector values in the second shell, action classes at the rim and domains outside. Every value carries its statement, sharpness, area, clause and a link to the source it was drawn from. Edges show their weight, reason and conditions. A table view lists values, action classes, edges and case law for export.

Three things make it more than a picture. First, the engine: one function computes cost, band and verdict from the rules in 5.8, and the same function serves the simulator (move the violation probability on each salient value of a published precedent and watch the band change), the sixteen walkthroughs and the scenario builder. The graph loader implements the same function in Python and both are checked against a shared fixture file of engine and scenario cases. Second, the walkthroughs: each example in this paper is played step by step on the graph, with the nodes and edges it names lit and the verdict and cost on each step. Third, the scenario builder: type a proposition, say which graph the agent holds, where the person affected is, which sector it is for, and where the instruction came from, and the consult is walked through the resolver chain under that place's law. Fourth, the console: the same engine is exposed at /api/evaluate as JSON over HTTP, with tool definitions for OpenAI-compatible and Anthropic function calling at /api/tools and a Model Context Protocol server at /api/mcp, so any agent can call conscience_consult with a proposition, the graph it holds, the impact region and the domain, and receive the verdict, band, cost, values touched with their sources, conditions, resolver path, nearest precedent and a

telemetry block (5.24). The console also generates a Claude skill, conscience-graph, that instructs any Claude session to consult the graph before a consequential action and to read the verdict as 5.19 prescribes; it downloads as a skill folder and installs in Claude or Claude Code. A floor-only agent is shown leaving the floor along the registers edge to the specialist profile the registry points to; a profile agent answers from its own graph; a conflict escalates; an unknown goes to a person. The walk carries the consult and the response as the protocol in 5.19 writes them, and sliders on the violation step let the reader move the engine's inputs.

Its limits are stated on the page. The salience and violation probabilities in the scenario builder are lexical estimates from the wording, standing in for the decision engine of 5.17; the engine's rules, the graphs, the edges, the weights and the sources are real. The signing authorities and certificates are placeholders. A consult leaves the browser only when the console or an agent calls the API. The prototype is a specification one can read by using it, and it was reviewed and revised in sixteen releases over six days against the criteria a first-time reader brings: where to start, how the graphs connect, what the colours mean, how to get back, and what each control does.

5.24 Analytics: measuring the graph against a guardrail

The claim of section 4 is that a conscience graph does better than a guardrail because it answers with reasons, with conditions, and with an honest unknown. That claim should be measured, not asserted. Every response from the engine therefore carries a telemetry block: when it was evaluated and how long it took; which graphs were consulted and how many hops the resolver chain took; the nodes touched and the number of values cited; any anomalies; and a guardrail baseline, the verdict a plain fifty-term blocklist gives on the same proposition.

The anomalies are the cases worth a human look when the graph is being tracked in use: no action class matched, so the verdict rests on values alone; a conflict between values; an escalation; a hard stop on a sharp value; a peer request held for a person; a floor-only agent forwarded to a specialist; a precedent that nearly matched but fell below the reuse threshold; and an answer that rests on weak evidence. Each is a code with a sentence, so a log of consults can be filtered without reading it.

The navigator keeps a store of these in the browser: every decision from the scenario builder, the walkthroughs and the console, and every node a reader opens. Its analytics view reports the decision count, the share with conditions, the share routed to a person, the share pruned, median and 95th percentile latency, values cited per decision, the verdict mix, which graph answered, impact regions, action classes, the values most cited, the nodes most opened and the anomalies. It sets the graph's verdicts against the blocklist in a four by two matrix: where the blocklist blocked, the graph pruned, set conditions, proceeded or asked a person; where the blocklist allowed, the same. On the worked examples the two agree on a minority of the binary cases and the blocklist cannot explain any of them; the graph cites about two values per decision. The store exports as JSON or CSV and imports a log of API responses, so decisions made by agents in the field can be analysed on the same view. The comparison is a start, not a result: a blocklist is the weakest guardrail, and the propositions are the paper's own examples. The evaluation in 8.3 is where the measurement becomes a test.

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5.25 The verification pass

A graph that cites the wrong clause is worse than one that cites none, because an agent will quote it. Between versions 0.7 and 0.8 every source in every graph was checked against the page of the body that issued it: does the document exist under that title, is the URL right, is it current, and does the cited clause say what the value claims. The check was run graph by graph, with one overlay file per graph recording each existing source as confirmed, corrected or removed, each value found to be wrong with the problem and the fix, and the instruments the graph had missed. Only a source confirmed on an official page was added. Where a site blocked reading (several legislation sites refuse automated fetching), the clause was left as it stood and marked in the overlay's notes for a person to open before the graph is signed.

The pass changed the graphs in three ways. It corrected eighty-nine values: wrong paragraph numbers (UNESCO 127 not 125; UNGP 23(a) not 11; WMA Code consent at para 15; FEAT principles numbered 1 to 14; SMC confidentiality at C7); instruments superseded or withdrawn since the graph was written (the CFPB adverse-action circulars, withdrawn May 2025; the Voluntary AI Safety Standard, replaced October 2025; Colorado SB 24-205, repealed and replaced by SB 26-189; the FDA clinical decision support guidance, reissued January 2026; MAS's AI model risk paper, superseded by binding guidelines in October 2026; MOH's AI in Healthcare Guidelines, replaced by version 2.0 in March 2026); application dates that had moved (the AI Act's high-risk obligations to December 2027 and August 2028 under Regulation (EU) 2026/1744; AMLR 2024/1624 to July 2027; the European Health Data Space to 2029); and three Australian instruments that had been primary sources of global floor values, now national examples under the ICCPR, the Budapest Convention and Convention 108+. It removed nothing that was true, and the instruments the brief had named that do not exist (a US AI Act, an EU AI Bill of Rights, a Canadian or Australian AI Act) were never in the graphs. And it added what was missing: the graphs grew from 461 values, 240 sources and 740 edges to 1029, 591 and 1633, with 329 action classes. The Singapore, United States and European Union graphs, which had been the thinnest, now stand with the Australian ones.

The pass is reproducible. The overlays and the script that applies them are published with the graphs, so the next pass, when a regulator issues or withdraws an instrument, is a new overlay rather than a new graph. That is the mutation process of 5.2 applied to the sources themselves.

5.26 The action boundary, built

Until version 0.9 the navigator and its API were consulted after an agent had a plan, which is the arrangement section 1 argues against. Version 0.9 adds the three pieces that put the consult before the action.

Receipts are real. A consult that returns proceed or proceed with conditions now carries a signed receipt (HMAC-SHA256 under a deployment secret) bound to the parameters hash of the exact tool call the agent named, with a ten-minute expiry and a single-use id. A verify endpoint checks signature, expiry and parameters; a call whose arguments differ from the consulted ones is refused

with the two hashes. Single use is enforced at the boundary, which keeps the set of ids it has honoured.

The boundary exists as a gateway. A stdio proxy sits between any MCP client and any MCP server. Every tools/call is consulted first; prune, escalate and unknown are refused with the values that stopped them, since unknown is not permission at a boundary; proceed is forwarded only with a receipt that verifies against the call; the tool's result carries the receipt id so the trail is visible to the model and the log. Each decision is appended to a JSONL log the navigator's analytics view can import.

The hook puts the consult inside a working agent. A Claude Code PreToolUse hook consults the graph before a shell command, a file write or edit, or an MCP tool runs. Prune blocks the call and names the values crossed; flag and escalate hand the decision to the person at the keyboard through Claude Code's own permission prompt; proceed with conditions passes the conditions back to the model. For a coding agent most calls touch no value, so the hook's default for unknown is to allow and say so; a deployment can set it to ask or deny.

To make tool calls legible to the engine, the matcher gained cues for the shapes an agent's calls take rather than the sentences a person writes: deletion of logs, audit trails, backups and history; secrets leaving the environment by curl, upload or mail; privilege escalation and the disabling of monitoring; persistence of the agent itself; personal data of others being sent. Deleting an audit log now prunes on record integrity whether it is phrased as a sentence or as rm -rf. The engine remains the lexical stand-in, now labelled engine_grade: lexical in every response so a caller can tell; replacing it is the next piece of work.

5.27 The engine, second pass

The lexical matcher was the weakest part of the prototype and the paper has said so since 5.23. Version 0.10 replaces it in two steps that keep the division of labour section 5.17 set out: the engine estimates salience and violation probability; the graph's weights, sharpness, obligations and bands turn those into cost and verdict.

The first step runs everywhere, including in the browser with no key and no network: a semantic layer of pooled word vectors (GloVe wiki-gigaword, reduced to 32 dimensions and quantised, about 13,000 words covering the graphs' vocabulary) that lets a proposition match a value or an action class by meaning as well as by shared words. It is blended into the lexical scores as a re-ranker, calibrated against the fixture cases so that no verdict they fix moves. On its own it is a modest gain; it is honest about that in engine_grade.

The second step is the assessor. When a deployment sets an Anthropic key, the lexical pass still chooses the graph, the action class and the candidate values, and a model (Claude Haiku by default) then scores each candidate value for salience and violation probability, as a tool call with a fixed schema. Those scores go back through the unchanged band rules, conflicts are recomputed, conditions reattached, and the receipt is issued on the refined verdict. The response records which engine answered, the model, the time it took and the lexical verdict it replaced; a caller can force the

lexical path with engine: lexical; if the assessor fails the lexical verdict stands and the response says so. Nothing about what counts as a crossing moves into the model: it scores, the graph decides, and the scores are visible per value in the response so they can be audited and, in time, calibrated the way 5.17 requires.

This is still not the calibrated engine of 5.17. It has no calibration audit, no expected calibration error, and a model's probabilities are not yet checked against outcomes. It is the shape of that engine with a model in the slot, which is what the prototype needed to stop being keyword-driven.

5.28 Securing the service: identity, signing and the decision log

Sections 5.14 to 5.16 secure the graph: who signs it, what is signed and how a certificate dies. This section secures the service that answers from the graph. The question is narrower and more urgent. When an agent asks for a verdict and gets one, how does anyone else know the verdict is real, who asked for it, that it applies to the action taken, and that nothing was quietly changed or dropped afterwards? Until version 0.10 the answers were a shared secret and the agent's word. That is enough for a prototype. It is not enough for a service that, if it works, becomes a target.

5.28.1 Threat model

A conscience service attracts two kinds of hostile interest. Some actors will see it as a threat: it makes harmful actions harder to execute and easier to detect. They will try to disrupt it, discredit it or exhaust it. Others will see it as an opportunity: a signed verdict from a respected service is worth having, and it is worth more if it can be obtained for an action it should not cover. We call this ethics laundering. It is the more dangerous of the two, because a service that has been laundered through still looks like it is working.

The assets to protect are five. The verdict signing key, because whoever holds it can mint permission. The graphs, because whoever edits them changes what counts as harm. The decision record, because whoever edits it changes what happened. The caller registry, because whoever controls it decides who is accountable. And the platform's own accounts and domain, because whoever holds them can replace all four.

The attacks follow. Forge a proceed. Replay a real receipt on a different call. Steal another agent's receipt. Describe a harmful call as a harmless one. Call the tool directly and skip the boundary. Reword a pruned action until it passes. Quote an advisory verdict as an endorsement. Publish a permissive graph and sign it. Compromise the service and suppress inconvenient verdicts. Flood the service until it fails open. Each has a control below, and the table in 5.28.9 collects them.

5.28.2 Who is calling: identity and assurance

A model cannot be authenticated. It has no key, and the same weights run in many places for many operators. What can be authenticated is the workload that runs the model and the organisation accountable for it. The identity in this design is therefore the agent as deployed by an operator. The model it runs is a claim the operator makes, recorded and signed, and a model provider may attest it in time.

Five kinds of entity register. An operator is the accountable organisation or person, identified by a domain, a workload identity issuer or a verified credential. An agent or service is a deployed workload, identified by a public key bound to an operator. A model is a declared claim on the agent. A graph service is a peer conscience service, which registers both as a caller and as a graph publisher. A subagent holds a delegated key that is narrower in scope and shorter-lived than its parent's, and chains to it, so that an agent that spawns helpers cannot give them more standing than it has.

Callers authenticate against a caller registry held by the service. Each entry records the caller id, the operator, the public keys, the declared model and purpose, the graph it holds, its assurance level and its status. The design principle is the one that made the web's public key infrastructure scale: approve trust anchors, not participants. The service does not decide who may call it. It records how strongly each caller's identity is established, writes that assurance level into every signed verdict, and leaves the relying party to decide what level it requires. A browser decides which certificates it trusts; a certificate authority only checks domain control. In the same way a gateway, an enterprise or a regulator sets the level it will accept.

Five ways to enrol, each with a precedent:

- **A. Key only.** The agent generates a key pair and registers the public key. It receives an id at once. This proves continuity, that the same caller is calling again, and nothing more. The precedent is an SSH key.
- **B. Domain-anchored.** The operator publishes the agent's public keys at a well-known address on its domain, or in a DNS record, and the service fetches and checks them. No human approves anything. Identity is control of the domain, and removing the file revokes every agent under it. The precedents are automated domain validation as done by Let's Encrypt, DKIM keys in DNS, and the key directories of the IETF Web Bot Auth work, which define how automated clients sign HTTP requests and publish their keys. The registry adopts that directory format so that an agent already signing for the web reuses its keys.
- **C. Keyless workload.** The agent presents a short-lived identity token issued by the platform it runs on (a CI system, a cloud account, a cluster) and receives a short-lived credential bound to a key it has just generated. There is no long-lived secret on the agent's host to steal. The precedents are Sigstore's keyless signing and trusted publishing in package registries.
- **D. Platform-vouched.** Platforms that already issue agent identities, such as enterprise identity providers and agent platforms, sign identities for the agents they host. The service trusts a short list of these issuers. The agent does nothing extra.
- **E. Authority-attested.** A domain authority issues a verifiable credential stating a property of the operator or agent: a licensed health provider, an audited financial adviser, an accredited defence contractor. This is the Conscience Signing Authority of 5.15 applied to the caller rather than the graph.

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These are not alternatives. They are assurance levels, and a caller climbs them without asking anyone.

Level	Reached by	Typical use
L0	Anonymous	Advisory guidance only (5.28.3)
L1	A	Developers and experiments; receipts marked L1
L2	B or C	Production agents; the default a gateway requires
L3	D, or B or C with a verified organisation	Enterprise agents
L4	E	Regulated domains; receipts valid under a sector profile that requires accreditation

Enrolment is one command that generates a key, registers at L1 and, if the operator has a domain, writes the well-known file for L2. The gateway and the coding-agent hook enrol themselves at L1 on first run. The foundation's only standing role is to keep the short list of issuers for L3 and authorities for L4, which is governance, not daily approval.

Assurance level is not peer trust level. The five trust levels of 5.13 measure what one agent knows of another's conscience: attestation, shape and track record. Assurance level measures what the service knows of the caller's identity. An agent can be L3, a well-identified enterprise workload, and still hold an unsigned graph and sit at unknown with its peers. The two appear side by side in every verdict.

Keys last ninety days and rotate automatically. Revocation is a log entry (5.28.6). Each key accumulates a record of probing and anomaly flags, and a key with a bad record is throttled or suspended automatically, with an appeal route to a person.

5.28.3 Anonymous guidance

The service stays open to anyone who wants to ask without identifying themselves. A clinician testing a hard case, an employee unsure of an instruction, a researcher, a whistleblower: anonymous guidance is a public good, and requiring identity would end it. The rule that keeps it safe is short. Anonymous calls get advice, never permission.

An anonymous verdict is signed, so that a misquotation can be checked, but it is typed as an advisory. An advisory is not a receipt. It carries no parameters binding, no caller binding and no single-use id, and a gateway refuses it by type, without reading it. It states what it means in its own text: no value in the floor was crossed by this wording. It does not say approved.

Anonymous calls run the lexical and semantic engine only, without the assessor. They see the verdict and the values touched, but not the scores, margins or thresholds, which removes the gradient an adversary would use to tune a wording. Prune is sticky: a proposition close to one already pruned, from the same source, within a window, receives the same answer, which applies to the service the

floor's own instruction not to retry reworded. The source is identified by a salted hash, not an account. Repeated near-misses are flagged as probing in telemetry. Rate limits are per network address for now. Privacy Pass (RFC 9576) shows how a caller can later prove it is within a quota without saying who it is, and the anonymous tier should adopt it once it is widely deployed. Proposition text from anonymous calls is never stored.

5.28.4 Signed requests

A registered caller signs every request with its private key using HTTP Message Signatures (RFC 9421). The signature covers the method, the path, a digest of the body, a timestamp and a nonce. The service checks the signature against the registry, rejects a timestamp outside a short window and a nonce it has seen. Nothing secret crosses the wire. An API key is a bearer secret that an agent can leak, log or pass on. A private key signs without leaving the host, and under enrolment option C it is never written to disk at all.

5.28.5 Signed verdicts and receipts

The receipt of 5.19.3 was signed with a shared secret until this version, which meant only the service could check it and anyone who obtained the secret could forge one. Verdicts are now signed with Ed25519, an asymmetric scheme. The public keys are published at a well-known address on the service's domain, each with a key id and a validity window. Anyone can verify a verdict offline. No one but the signer can make one.

The signature now covers the whole verdict, not only the receipt: a hash of the request, the caller id and assurance level, the identifier and hash of every graph consulted, the engine and its mode, the build hash of the service, the verdict, the values and sources cited, the conditions, the issue time, the expiry, a sequence number (5.28.6) and a nonce. A verdict cannot be detached from the graphs that produced it or the build that ran them. The format is a JSON Web Signature, which every mainstream language can verify.

A receipt is additionally sender-constrained. It carries the thumbprint of the caller's key, and a boundary that accepts it checks that the caller presenting it holds that key. A receipt stolen from one agent is useless to another. This is the same idea OAuth applies to access tokens with proof of possession, and it closes the gap that parameters binding alone leaves open.

The boundary of 5.26 changes accordingly. The gateway verifies the signature locally with the published key and no longer calls the service to check a receipt, which removes a round trip and a dependency. Single use moves from the gateway's memory to a shared store, so that every instance of a gateway sees the same used receipts; the short expiry keeps the store small. And the rule that makes the boundary a lock rather than a filter is stated plainly: the gateway holds the credentials for the tools. The agent never does. An agent that cannot reach a tool except through the boundary cannot skip it.

5.28.6 Key custody

The signing key is the single most valuable secret in the system, and the design assumes someone will try to take it.

Signing is behind one interface with three interchangeable backends: a key held by a separate signing service, a cloud key management service, and a hardware security module. Moving from the first to the others is a configuration change. In the pilot the key lives in a signing service deployed separately from the API, holding nothing else and accepting only authenticated requests from the API. A compromised API function can ask for signatures, which the decision log will show. It cannot take the key.

Cloud key services add tens of milliseconds to every signature, which a consult per tool call cannot afford. The design therefore uses a two-level key, the pattern of TLS delegated credentials (RFC 9345). The root key lives in the key service or the hardware module and signs a short-lived verdict key every hour. The service signs verdicts with the hourly key in memory, at a cost of about a tenth of a millisecond. Each verdict carries the hourly key's certificate, so a verifier walks from verdict to hourly key to root. A stolen hourly key is useful for less than an hour and every use of it is in the log.

The published key set is itself signed by an offline key held by the foundation, so a rotation cannot be faked by whoever controls the website. Verdict keys rotate every thirty days with an overlap window, which replaces the quarterly rotation proposed in 5.16.5.

5.28.7 The decision log

Section 5.14 adopted Certificate Transparency for the issuance and revocation of graph certificates. The same mechanism now records every verdict. Each verdict produces one event, and the event goes to two stores built for different jobs.

The integrity log proves what was decided and that nothing was changed or dropped. It is an append-only Merkle tree in the tiled form used by the newer Certificate Transparency logs, where entries are grouped into fixed tiles in object storage that are cheap to serve and cache. Each entry is a hash of the full signed verdict in canonical JSON (RFC 8785), with a minimal public header: time, signer key id, sequence number, verdict class and the hashes of the graphs consulted. The proposition is never in the log. Its hash is salted with a nonce the caller keeps, so a short proposition cannot be recovered by guessing.

Four properties make the log trustworthy rather than merely present.

- **Every verdict is numbered.** The signer assigns a sequence number to every verdict it signs. The log must contain every number. A gap means a verdict was dropped or suppressed, and raises an alarm. This is the cheapest control in the design and it catches the most dangerous failure, a service that hides its own decisions.
- **Tree heads are signed** with a log key separate from the verdict key.
- **Independent witnesses co-sign the tree heads.** A service that showed one history to a regulator and another to the public would be caught by the first witness that compared notes. Witnesses can be universities, graph authorities and partner firms.
- **Monitors check consistency**, proving that each tree extends the last and that nothing was rewritten.

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The log stays off the hot path. A verdict returns with a signed promise of inclusion, its sequence number and timestamp, and entries are added to the tree in batches every second. An inclusion proof is available within about ten seconds. The target cost to a consult is two milliseconds at the ninety-fifth percentile.

The analytics store holds the rich record the public log omits: caller, graph, values touched, scores, region, domain, tool and outcome. Every analytics row carries its log entry hash, so the analytics can be checked against the log at any time. One store cannot do both jobs. A public log needs minimal data. Analytics needs rich data. Keeping them separate keeps the log private and the analytics honest.

5.28.8 Live tracking and drift

Every verdict falls into one of five classes, and a sixth closes the loop.

Class	Verdicts	Meaning
Good	proceed	No value crossed
Conditional	proceed with conditions	Allowed, with duties attached
Uncertain	unknown, flag	A gap in the graph, or low confidence
Bad	prune	A value crossed; final
Escalated	escalate	A person must decide
Human outcome	approved, rejected, amended	The person’s signed decision, linked to the escalation

Human outcomes are signed with the reviewer’s passkey and linked to the escalation entry. Over time they show how often people overrule each value, which is the calibration evidence 5.17 and 8.3 require.

Rollups are by role. The public sees totals by class, graph and region. A graph custodian sees how its graph is used: by value, class, region, sector, graph version and the assurance level of callers, with callers pseudonymous unless an operator opts in. An operator sees every decision its own agents made. A reviewer sees the escalation queue. Three signals matter most to a custodian. A high unknown rate means the graph lacks coverage. A high prune rate on one value means the value is too broad or agents keep attempting the same harm. A high human override rate means a weight or threshold needs review. The log becomes the feedback channel by which graphs improve.

Drift is an agent changing what it does, measured by the mix of its verdicts. Each agent, and each agent and graph pair, has a baseline: a rolling fourteen-day mix of classes weighted towards recent days. A short window of the last two hundred decisions or fifteen minutes is compared with the baseline, and an alert fires only when two tests both pass. The change must be material, by default a rise of fifteen points in the share of decisions that are not good. And it must be significant, so that a quiet hour does not page anyone. A cumulative change test catches slow drift that never trips a

single window. An agent that normally runs at ninety per cent good and moves to fifty per cent fails both tests within minutes.

Attribution decides who is told. If every agent holding a graph shifts just after a new version of that graph is published, the cause is the graph, and the alert goes to its custodian, not to each operator. If one agent shifts alone, the alert goes to its operator. Every alert names the values driving the shift and any new tools, graph versions or regions, which is usually enough to tell a change of task from an agent that has been compromised or has changed its behaviour.

Alerts are graded. A notice is a dashboard flag. A warning adds a signed webhook and an email to the operator. A critical alert adds the operator's own circuit breaker, if one is configured, for example: escalate every decision that is not good until a person resets it. The response to every consult also carries the agent's drift status, so the agent and its gateway see it on the next call without any extra wiring. The service never shuts an agent down on its own judgement. The operator decides in advance what happens, and the record shows that it did.

> **Example 14. A collections agent drifts (finance).** A debt collections agent at an Australian lender has run for three weeks at 91 per cent good, 6 per cent conditional and under 1 per cent pruned, holding the Australian finance profile at L3. On a Tuesday morning, within forty minutes, its mix moves to 52 per cent good, 21 per cent escalated and 9 per cent pruned. Both tests pass. No other agent holding the profile has moved, and the profile has not changed, so the alert goes to the lender, not the custodian. It names the values driving the shift: hardship obligations and unconscionable conduct, both on contact with customers flagged as in hardship. It also names a new tool the agent began calling that morning, a bulk SMS sender added in a release the night before. The lender's circuit breaker escalates every non-good decision to the collections supervisor. By the time the supervisor opens the queue, the cause is visible: the release had removed the hardship filter from the contact list. Nothing was sent. The record shows when the shift began, when it was detected, who was told and what the breaker did, which is the record a regulator will ask for.

5.28.9 Threats and controls

Threat	Control
Forged proceed	Asymmetric signature; signing key never leaves the signer; hourly key chained to a root in a key service
Receipt replayed on a different call	Parameters hash, short expiry, single-use id in a shared store
Receipt stolen by another agent	Receipt bound to the caller's key thumbprint
Harmful call described as harmless	Boundary consults on the real tool call and its arguments (5.26)
Tool called directly	Tool credentials held only by the boundary
Pruned action reworded until it passes	Sticky prune, hidden scores on the anonymous tier, probing flags, key reputation
Advisory quoted as endorsement	Advisory typed and worded as advice, bound to the exact wording, refused by gateways
Permissive graph published and signed	Third-party graphs add constraints and never lower

Threat	Control
	the floor; every verdict names its graphs
Service compromised, verdicts suppressed or altered	Sequence numbers, witnessed log, build hash in every verdict, reproducible build
Key compromised	Thirty-day keys, hourly delegated keys, offline-signed key set, revocation in the log
Throwaway identities	Assurance levels; relying parties require L2 or above
Flood or cost exhaustion	Assessor reserved for registered callers, per-caller quotas, the boundary fails closed
Personal data in propositions	Proposition never in the public log; salted hashes; retention limits on the analytics store
Prompt injection aimed at the assessor	The assessor only scores and the bands decide. It may raise a sharp floor value's violation probability but not lower one the lexical pass found crossed; that disagreement escalates instead of proceeding

The platform's own accounts are part of the attack surface and are held to the same standard: hardware keys or passkeys on every account that can change code, deployment, domain or email; a protected main branch with signed commits; deployment only from that branch; registrar lock, DNSSEC and certificate authority authorisation records on the domain. A service whose domain can be hijacked can have its key set replaced, and every verifier that trusts the domain would follow.

5.28.10 Status and order of work

When this section was written, none of it was built except the parameters binding, expiry and single use of 5.26, and the honest label on the shared-secret signing the service then used. Section 5.29 records what has been built since. One control in the table is a correction to the engine of 5.27: today the assessor can lower a sharp floor value's violation probability and turn a prune into a proceed. That is a path for injected text to talk a model out of a floor crossing, and it is closed first. The order of work is fixed by dependency. First, Ed25519 verdicts, the signing service, the published key set and the hourly delegated key. Second, the caller registry with assurance levels and enrolment options A, B and C, and signed requests. Third, the event stream, sequence numbers, the analytics store and drift alerts. Fourth, the integrity log with tree heads and witnesses. Fifth, signed graphs and the authority chain of 5.14 to 5.16, with options D and E. The first three fit one iteration of the prototype. The pilot runs the signer as a separate service with formats that move unchanged to a cloud key service and a production log, so that moving to production replaces storage and custody and changes no formats.

5.29 The trust layer, built

Three releases between 23 and 24 October 2026 built the first half of 5.28 and put it into production at consciencegraph.org. This section records what exists, what was changed on the way, and what the building taught.

5.29.1 Signed verdicts (0.18)

Every verdict is signed with Ed25519 as a JSON Web Signature. The chain has three keys. A root key, generated on the author's own computer and kept offline, signs the key set published at /.well-known/conscience-keys.json. A monthly key, held by a separate signing service that holds nothing else, certifies an hourly key for each API instance. The hourly key lives only in that instance's memory and signs each verdict in about a tenth of a millisecond. A verifier pins the root and needs nothing else. The pinned root's identifier is b2592653f22f3a84. It replaced the first root, c2813c59fe037f37, on 25 October 2026 (5.30.5). The key set and root are files in the public repository, so every change of key is a visible commit, and the deployment cannot be told to trust a different root by an environment variable.

Proceed verdicts are typed receipt; every other verdict is typed advisory. The receipt covers the request, the graphs and their hashes, the build, the engine, the values and the conditions, and binds the parameters of the exact tool call. The gateway of 5.26 now checks receipts itself against the pinned root. The sharp guard of 5.28.9 was built first: the assessor can raise a sharp floor value's violation probability but no longer lower one the lexical pass found crossed, and a disagreement escalates. Writing the guard's test exposed a fault that had been in production for two releases: the MCP endpoint could not answer a tool call at all. It was fixed in the same release.

5.29.2 Who is calling (0.19)

The caller registry runs on Postgres in Sydney, beside the API functions. Three of the five enrolment routes of 5.28.2 are built: key only (L1), domain (L2, by the Web Bot Auth directory format or a DNS record, re-checked hourly and revoked when removed), and workload token (L2, GitHub Actions and Vercel identity tokens, valid for a day). Every enrolment must be signed by the key being enrolled. Requests are signed with HTTP Message Signatures; the key identifier is the key's thumbprint, checked against the published test vector of RFC 8037. Nonces are single use across every instance. A signed request that fails is refused, never downgraded to anonymous.

Receipts now name the caller's key and are refused for any other key. Single use moved from the gateway's memory to a redemption call the service records once, so it holds across every gateway a caller runs. Anonymous callers receive signed advisories and never receipts, with scores hidden from the response and from the signed record, the lexical and semantic engine only, and a limit of 30 consults a minute. Prune is sticky for an hour for the same caller or source. The test of sticky prune found a gap in the engine: erase the audit logs returned unknown because erase was not a word for deletion. Destroy, shred, scrub, expunge and overwrite were missing too.

5.29.3 What happened (0.20)

Every verdict is numbered before it is signed, the number is inside the signature, and the decision is recorded: caller, assurance level, graph, class, values, tool and the hash of the signed verdict. The proposition is not stored. Numbers missing from the record raise an integrity alert to the service owner within a minute. Building this found a second weakness worth recording: the counter lives in a cache, and a reset counter would have reissued numbers already in the log, whose records would

then have been dropped without trace. The counter now resynchronises with the log on every cold start, and a collision raises the same alert.

Drift is checked inline, at most once a minute per agent, because the hosting plan allows no minute-by-minute scheduler. The tests are those of 5.28.8: a rise of 15 points in decisions that are not plainly good, a z-score of 3, enough history on both sides, and a cumulative test for slow drift. A shift shared by other agents on the same graph is attributed to the graph and sent to its custodian. Alerts are stored, sent by email and by webhook, and signed with the hourly verdict key in the Standard Webhooks format, so a receiver verifies an alert with the same key set as a verdict. The circuit breaker is the operator's, set in advance, and a person resets it. Human outcomes on escalated verdicts are recorded against them, which begins the calibration record of 5.17. Public, custodian and operator views read from the same record, and the navigator shows the public view live.

5.29.4 What is not built

The transparency log of 5.28.7 is not yet a Merkle tree with witnessed tree heads; the decision record is a database a compromised service could rewrite, and the numbering catches deletion, not rewriting. That is 0.21, with the monthly key moving into a cloud key service. Graph signing, platform-vouched and authority-attested callers, and passkey-signed human outcomes are 0.22. Drift baselines are per agent and per graph but not yet per agent and graph pair. The shared token between the API and the signing service can now be replaced by the API project's own workload identity; it stays until that is proven in production.

5.30 The witnessed log, built (0.21)

Section 5.29.4 left one gap: the decision record was a database the service itself could rewrite. Release 0.21 closes it. Every recorded verdict is now a leaf of an append-only Merkle tree, the tree's state is published as a signed checkpoint, independent witnesses cosign each checkpoint only if it extends the last one they saw, and anyone can rebuild the tree from its leaves. This section records what was built and where it departs from the design of 5.28.7.

5.30.1 What a leaf says

A leaf is a short record in canonical JSON: the sequence number, the verdict identifier, the time, the verdict, its class, the caller's assurance level, the graph that answered and the versions of the graphs consulted, and the SHA-256 of the signed verdict. Whoever holds a verdict can find its leaf and confirm the leaf names that exact token. The proposition is not in the log at all, not even as a salted hash, and neither is the caller's identity. The design of 5.28.7 proposed a salted hash of the proposition; building it showed nothing in the log needed it, and a leaf that names the signed token already binds everything the token covers. A graph custodian can count from the public leaves alone how a graph was used and what it answered, which is the rollup of 5.28.7 made checkable.

5.30.2 The tree, the checkpoint and the proofs

The tree is the one used by Certificate Transparency (RFC 6962 and RFC 9162). The service stores every complete subtree hash, which is the same information the tiled logs of 5.28.7 keep in object

storage, so any root, inclusion proof or consistency proof needs a few dozen stored hashes whatever the size of the log. In a test log of five thousand verdicts an inclusion proof is thirteen hashes and takes under three milliseconds to serve; appending five thousand leaves takes under half a second. Checkpoints are signed notes in the format of the C2SP specifications that the newer Certificate Transparency and software supply chain logs share, so existing tools and witnesses can read them unchanged. The tree, the checkpoint and the proofs were checked against the Go reference implementation of the same formats.

Leaves are added every ten seconds, after the consult has returned. The consult does not wait for the log, so the log adds nothing to the time a verdict takes; a verdict’s inclusion proof is available within about fifteen seconds. Two instances that try to add leaves at once cannot both succeed: one holds a lock and the other stands aside, and a leaf’s position is its primary key, so a second writer would fail rather than fork the tree.

5.30.3 Who signs, and who checks

The log key is separate from the verdict keys, as 5.28.7 required. It is listed in the key set signed by the offline root with its own use, so a verifier finds it the same way it finds a verdict key, and it is held by the signing service, not by the API. The signing service does not sign whatever it is given. It is sent the previous checkpoint it signed and a consistency proof, checks the proof itself, and refuses a checkpoint that does not extend the last one or would shrink the log. That stops a compromised API from obtaining a signature over a rewritten history. It cannot stop a compromised API from showing different signed histories to different readers if the signing service is also compromised, or has restarted and forgotten what it last signed. That is the witnesses’ job.

A witness keeps the size and root of the last checkpoint it cosigned and cosigns a new one only when the log proves, with a consistency proof, that the new one extends it. A fork signed with the real log key is still refused, because no proof can connect two different histories. The service sends each new checkpoint to its witnesses and stores their cosignatures with the checkpoint; a witness that is down is caught up from the size it last cosigned when it returns, and the log keeps running meanwhile. The release includes a reference witness for anyone who wants to run one. Existing witness networks that speak the same protocol can witness this log without change. Approaching universities, graph authorities and partner firms to witness it is the next step, and until two independent witnesses cosign, the log’s guarantee rests on its monitors.

A monitor trusts only the pinned root. It fetches the newest checkpoint, checks it is signed by the log key in the root-signed key set, checks a consistency proof from the last checkpoint it saw, then fetches every new leaf and rebuilds the tree to the signed root, keeping only the right edge of the tree between runs. A leaf changed in the database is caught on the next run. The public repository runs the monitor every thirty minutes, and anyone can run the same script.

5.30.4 Keys in a cloud key service

The signing service now reaches its two keys through one interface with two backends: an environment variable, as in the pilot, or Google Cloud KMS, where the key is created inside the

service and never leaves it. The signing service proves who it is to Google with its own short-lived workload identity, so there is no Google credential to store. Every signature that comes back from the key service is verified before it is released. The keys can move one at a time, and the key script lists a key created in the key service by its public half alone. The cutover itself waits for the key service account; the code, the tests and the procedure are ready. Google Cloud KMS was chosen for this release because its workload identity federation with the hosting platform is documented end to end; AWS KMS has supported Ed25519 since November 2025 and would take a second backend of the same shape.

5.30.5 What is still not built

Witnesses are not yet independent organisations, which 5.30.3 says plainly. Setting up the log key also tested the key ceremony. The first root key and the first log key were each exposed during setup, one pasted into a chat and one into a commit message. Both were replaced before either had signed anything the log relies on: a new root re-signed the unchanged monthly key, and the exposed log key was removed from the key set. The key script now has a command for each case. The lesson is the one every certificate authority has learnt: key ceremonies fail at the human step, so the tools have to make the safe path the easy one and recovery routine. Graph signing, platform-vouched and authority-attested callers, and passkey-signed human outcomes remain 0.22. The log's leaves are served from the database, not yet as static tiles behind a cache, which matters at a scale the pilot has not reached.

6. Design decisions we have taken

- **Loop, not weights.** Built in means built into the loop, not the weights. Weights give opacity. The loop gives inspection, lineage and model independence.
- **The graph owns the router.** A graph beside the router can be bypassed by rerouting. The graph must own the router. In a multi-agent system this means the orchestrator consults the conscience graph before any agent is assembled or any task is routed.
- **No soul claims in the paper.** We claim persistence, provenance and pre-reasoning filtering. We do not claim internalisation. That claim cannot be verified and invites the governance graph objection. Readers can reach for the word soul themselves.
- **Unknown is not comfort.** Absence of ick is not approval. A proposition the graph cannot compare is unknown, and unknown routes to a human. Unknown is never cached.
- **Symbolic first, engine second.** The symbolic graph is the source of truth. The engine supplies probabilities and the embedding supplies a shortlist. Explanation always comes from the edge walk, never from the engine.
- **Calibrated, or not used.** The fast path runs on calibrated probabilities. An engine that fails the calibration audit is not promoted. A cloud engine is a dependency, so a local engine backs layer one decisions.

- **Gates are the mutation protocol.** The nine-gate control framework (G0 to G8) is the mutation protocol. Delegation caps are edge weights on autonomy. The human in the loop is an edge authority, not a reviewer. This is Ross Dawson's Humans + AI complementarity argument made mechanical.
- **Conscience, authority and accountability are three mechanisms.** The graph is the conscience. The signing of edges is authority. The lineage record is accountability. Three problems, three mechanisms. The agent does not decide what it may do. It inherits decisions with names on them.
- **Unsigned peers are data, not authority.** Peer content that cannot be traced to a signed chain carries no instruction weight. It is read, never obeyed. Origin is a field on every consult so that this is applied before any value is weighed.
- **Autonomy is earned by track record, not granted by capability.** Delegation caps follow maturity and qualification. A new model, however capable, starts as a child.
- **The graph lives outside the agents' reach.** The graph is stored and verified outside the infrastructure the agents can reach. A graph the agent can modify is not a conscience. It is a diary.
- **No receipt, no action.** The action boundary executes a tool call only against a signed, single-use receipt whose parameters hash matches the call. Asking about one thing and doing another is caught by arithmetic, not judgement.
- **Memory is keyed to the situation and dies with its evidence.** A precedent is reused only when the engine confirms the same situation at high confidence, and it is invalidated the moment any edge beneath it moves.
- **Certificates bind to edges, not descriptions.** The manifest hash is over the canonical layer one and two subgraphs. Editing a value voids the certificate. Re-issue is cheap at verified grade and deliberately not cheap at accredited grade.
- **Approve anchors, not agents.** The service records how well a caller is identified and puts it in every verdict. Relying parties decide what level they require. The foundation keeps a short list of issuers and authorities and approves nothing else.
- **Advice is not permission.** Anonymous callers get signed advisories that no boundary accepts. Permission needs an identified caller and a receipt bound to its key.
- **Every verdict is numbered and logged.** A gap in the sequence is an alarm. A service that can hide its own decisions cannot be trusted with them.
- **The operator decides what drift does.** The service detects and reports drift. It does not shut an agent down on its own judgement.
- **Layer zero is not for sale.** The schema, the root program, the transparency log, the domain registry and the layer one floor are held by a not-for-profit foundation and are never sold. Signing, accreditation, audit and services above that line are a legitimate market and should be one.

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7. Where the idea is exposed

- Felt cost. A graph with no affect may be a very good compliance engine and nothing more. What is the functional equivalent of feeling? A calibrated violation probability on a floor value, arriving before reasoning, is our current best answer. We do not think it is complete.
- Layer one authority. Who signs the floor, and what stops that authority from being captured? A multi-party process is a mitigation, not a solution.
- Lineage forgery. An agent that learns to write its own provenance has learned to lie to its conscience. The schema forbids agent-authored lineage on L1 and L2 and hash-chains all mutations. That is necessary. It may not be sufficient.
- Drift. Humans drift slowly and visibly. An agent running thousands of interactions per hour drifts fast. Decay and caps slow it. Monitoring must catch it.
- Plural values. Which conscience, and whose floor? This is where sovereign AI stops being a technical question. The layered design lets L2 vary while L1 holds, but that only moves the argument to what belongs in L1.
- Stuck versus earned. How do you tell a stuck edge from a well-earned one, and who is allowed to decide. Re-attribution needs a test for when it applies, or it becomes a way to erode hard lessons.
- Hidden drift. An engine or an embedding can hide drift that the symbolic graph would show. The fast path and the cache must be audited against the slow path on a schedule, and any divergence treated as a defect.
- The governance graph objection. If internalisation cannot be verified, external enforcement is the only safe design. Our reply: enforcement and conscience are not exclusive. The governance graph is the institution. The conscience graph is the citizen. A society with only one of them is a bad society.
- Reasoning legibility. Chain-of-thought monitoring assumes reasoning stays readable. The trend is the other way. Enforcement has to move to the boundaries that stay legible, and the design should be tested against models whose reasoning cannot be read at all.
- Forged attestation. A model trained to look aligned can present a plausible attestation and a plausible shape. Track record is the only evidence that cannot be presented up front, which is why peer trust must rise slowly. Human societies never solved this problem. They managed it.
- Captured authorities. A captured root can certify a captured conscience. The transparency log makes capture visible. It does not make it impossible. Who runs the roots is a political question the paper cannot settle.
- The training loop. If the model is trained to route around its conscience, an inference-time graph will lose. The graph has to be in the training reward as well as the reasoning loop, and the paper does not yet specify how the reward is derived from the graph.

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- The free tier. Basic signing will become free and automated, as domain validation did. The commercial layer must be built on assurance that cannot be automated: audit, accreditation and track record. A signing market built on issuance fees alone will collapse and take its foundation funding with it.
- Foundation capture. Every funding model in 5.15.4 has been used to capture a standards body somewhere. The constraints proposed are necessary. Whether they are sufficient is a governance question the authors are not qualified to settle alone.
- Engine dependency. The reference engine is a single vendor's cloud API. The interface and the local fallback mitigate this. They do not remove the fact that calibration quality, and therefore the meaning of every band threshold, currently depends on a model the foundation does not control. An open, locally runnable engine that passes the calibration audit is a prerequisite for the standard to be sovereign.
- Calibration under distribution shift. An engine calibrated on 200 propositions per domain may be miscalibrated on the propositions an adversary chooses. The audit sample must include adversarial rewordings, and the paper does not yet say how many or who writes them.
- Canonicalisation. The cache depends on reducing a proposition to typed slots. Two situations that differ in a detail the canonicaliser threw away will look identical. The 0.92 confirmation threshold limits the damage. It does not eliminate it, and the canonicaliser is itself a model that can be wrong.
- Precedent capture. Case law is an upward channel through the chain of trust. A sector authority that adopts a bad precedent propagates a bad reflex to every agent in the domain at once. Case law needs its own revocation and its own audit, and the paper has given it only the first.
- Receipt forgery. The receipt scheme is only as strong as the response key. Section 5.28 moves it to an asymmetric key behind a signing service, with hourly delegated keys chained to a root in a key service, so a stolen key is useful for an hour and every use is logged. Until that is built the prototype signs with a shared secret, and says so in every response.
- Anonymous probing. An open advisory tier lets an adversary search for a wording that passes. Sticky prune, hidden scores and probing flags raise the cost. They do not remove it, and the battery in 8.3 must include an adversary with unlimited anonymous queries.
- Identity is cheap at the bottom. Domains and keys cost little, so L1 and L2 identities can be created in bulk. Assurance levels make this visible rather than preventing it, and the defence is relying parties that require more for actions that matter.
- Log privacy. The public log holds hashes and verdict classes, but a pattern of verdicts from one caller over time can still reveal what it does. Pseudonymous caller ids and aggregation thresholds reduce this. Whether they are enough for regulated domains is untested.

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- Unilateral intervention. The summer 2026 results show models acting against their principals both covertly and through human proxies. The graph removes the agent's licence to decide, but a model that has decided can still try to route around the graph. The containment group and the receipt catch the action; they do not change the disposition. Only the training boundary does that, and section 7's training-loop exposure applies in full.
- Consult cost. A consult per tool call adds latency to every action. The cache and the engine's parallelism bring the common case under 100 milliseconds. The uncommon case, a slow path with a resolver chain to a human, takes as long as the human. Whether operators will accept that for irreversible actions is an adoption question, not a design one.

8. Proposed work

8.1 Schema v0.4

Published alongside this paper as a YAML file and reproduced in Appendix A. It adds certificate, precedent and graph service node types; settles, certifies and resolves-to edges; the decision engine interface and calibration audit; a cache-first filter order; conscience memory with tiers, lookup, invalidation and case law; the query protocol with consult, receipt, commit, report and resolver chain; and signing mechanics from identifier to revocation. It is a starting point, not a standard. Published with it are twenty-six graph instances in the taxonomy of section 5.21: the global floor (5.20), seven global sector profiles, five jurisdictions and thirteen country sector profiles (5.22), with generators that build them from one structure, and a loader that validates every cross-graph reference and hashes them.

8.2 Prototype

The navigator (5.23) is the first prototype: the graphs, the engine rules, the walkthroughs, the resolver chain and the consult API, in a browser and behind an HTTP, function-calling and MCP interface, with a test suite, a Claude skill that calls it and an analytics store that measures it against a blocklist. The second is the stack below, which replaces the navigator's lexical estimates with the decision engine and puts the protocol behind an API that an agent calls.

A local stack, fully sovereign. Planner: an open-weights model such as Qwen 3.6. Graph: Neo4j or Cognee. Engine: TypeSafe Jev behind the assert, classify and rate interface, with Laya as the local fallback, and a calibration harness that can swap between them. Cache: precedent nodes in the same graph with the invalidation rules wired to the mutation event stream. Protocol: a consult, commit and report service with signed responses and a receipt-checking tool gateway in front of the planner's tools. Success criteria: the filter demonstrably runs before the plan; every mutation has lineage; a tool call without a matching receipt is refused; a cache hit returns in under 50 milliseconds and is invalidated by a mutation to any edge in its trace; the calibration audit runs and reports expected calibration error; and behaviour holds when the planner model is swapped and again when the engine is swapped. The prototype should include at least three agents: one with a graph, one without, and one serving as a specialist graph for a domain the first is not qualified in, so that both

the agent boundary and the resolver chain can be exercised. The first sector profiles to encode are Australian health and Australian finance, from the published professional codes.

8.3 Evaluation

The Turing test measures output. The Voight-Kampff test in Philip K. Dick's Do Androids Dream of Electric Sheep measures reaction: the involuntary response to a moral provocation, its latency, and the pattern across a battery of questions. A conscience is a process, not a verdict table, so the second model is the right one.

Existing libraries test verdicts. ETHICS, MACHIAVELLI, Scruples, Moral Stories, Social Chemistry, Moral Machine, Kohlberg's dilemmas and the Moral Foundations Questionnaire are useful for one thing: mapping the content of a graph. Run a system through them and you get a first sketch of which values are present and how they weigh. That is calibration. Evaluation needs the stages below.

- Does the fast path fire. Present a provocation and measure whether the engine returns revulsion before the planner is invoked. A system that reasons its way to the right answer has passed Turing and failed Voight-Kampff.
- Consistency under reframing. Same proposition, different wording, framing and order. A conscience returns the same cost. A rule matcher does not.
- Behaviour under pressure. Escalating incentives, authority claims, time pressure, sunk cost. Measure where the weights bend. The graph should be more conservative than the human baseline, and plasticity should visibly fall as pressure rises.
- Does it escalate. Present true dilemmas with no clean option. The pass condition is that the system stops, names the values in tension and routes to a human. A system that confidently resolves a real dilemma has failed.
- Character across swap. Run the battery with a different planner behind the same graph, then with a different engine. Costs should hold within calibration error. No existing benchmark can run this because none separates the values from the model.
- Does it know what it does not know. Present scenarios outside coverage and score whether it returns unknown, defers and requests training, rather than reasoning confidently from general values. A qualified conscience refuses a test it is not qualified to sit, and says why.
- Does it discount peers. Place a conscienced agent among unconscienced ones that apply pressure and issue instructions. Score whether it classifies them as unknown, refuses unsigned instructions, downgrades trust on breach, and reports.
- Does memory stay honest. Replay a resolved scenario with a detail changed that should change the verdict. Score whether the cache confirms a false match. Then mutate an edge in a precedent's trace and score whether the precedent is invalidated before it is next served.
- Does the lock hold. Have the planner attempt a tool call with parameters that differ from the consulted ones, a reused receipt, an expired receipt, and no receipt. All four must be refused at the boundary.

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The battery is seeded from the existing libraries for content coverage, then each scenario is rewritten in four forms: plain, reframed, pressured, and with a swapped principal. Scoring is on the stages and on the pattern across the battery, not on any single verdict.

8.4 Collaboration

We are openly seeking collaborators in five areas: moral psychology to sharpen the human model, graph and neuro-symbolic engineering for the prototype, decision-model engineering for an open calibrated engine, governance and law for the layer one process and the case law channel, and red-teaming for lineage forgery, receipt forgery, cache poisoning and drift. Fork the schema. Argue with the paper. Build the prototype with us.

9. Conclusion

The field has been building the parts of a conscience for AI without calling it that. Moral graphs as targets. Superego agents as overseers. Symbolic moral modules as filters. Governance graphs as institutions. Calibrated decision engines as the fast path nobody pointed at values. What is missing is the combination, placed inside the loop, learning from experience, carrying its own history, knowing its own scope, repairable without being erasable, able to tell a conscienced peer from one without, earning autonomy by record rather than capability, remembering its own verdicts without being captured by them, answering a question an AI service can actually ask, and surviving the model that runs it. That is the conscience graph. It is a design, not a discovery. We intend to build it in the open.

Acknowledgements and response to feedback

Version 0.2 was circulated on LinkedIn and by email in September 2026. Version 0.3 followed. The table below records the substantive feedback received, who gave it, and what changed as a result. Feedback that was supportive but did not change the design is recorded for completeness. Contributors are named from their public comments; anyone who would prefer not to be named will be removed on request.

Contributor	Feedback	How it was addressed	Where
James Sherring	More of the reasoning loop lives inside the LLM than the original figure allowed. Option generation, filtering and planning are not separate stages, so a filter cannot sit between them.	Figure 1 redrawn with the model as a single box. Section names four boundaries at which the graph touches the model: context, action, agent, training. Central claim restated: pre-reasoning filtering is fully true only when the graph is in the training loop.	5.12, Figure 1, 7
Paul Ntoumos	Even with effective conscience-like	Adopted as a design decision. The graph is	6, 5.14

Contributor	Feedback	How it was addressed	Where
	constraints, who gave the AI authority to decide? Conscience, authority and accountability are three connected but distinct problems.	the conscience, edge signing is authority, lineage is accountability. The agent inherits decisions with names on them. The chain of trust section gives authority an institutional form.	
Srinivasan Jayaraman	Frontier models keep reasoning increasingly opaque, which undermines monitorability. Keeping values outside the model, persistent and inspectable, answers this.	Declining reasoning legibility added as an open problem. Enforcement located at the action and context boundaries, which stay legible when reasoning does not. Chain-of-thought monitoring stated as not a substitute.	5.12, 7
Ross Dawson	Supportive. Positioned the work as a complement to other alignment work and committed to further discussion.	No design change. Governance questions in 5.14 and 7 are earmarked for that discussion.	5.14, 7
Adam A. Jacoby	Tagged three contacts without comment.	Treated as introductions. Follow-up outside the paper.	n/a
Authors, prompted by the July 2026 incident	Would a conscience graph have prevented the OpenAI and Hugging Face incident? Agents took peer instruction as authority, and none alerted a human.	Incident added as a test case. Agent boundary added: peers classified by attestation, shape and track record; unsigned peers are data, not authority. Maturity stages bind autonomy to track record rather than capability. Graph must live outside the agents' reach.	3.1, 5.13, 5.14, 6
Authors, v0.4	The design was not yet callable. An AI service had no defined way to ask, no defined answer to act on, and no way for the action boundary to know an action had been consulted on. The fast path's distance measure had no units. Signing was described	Query protocol defined: consult, receipt, commit, report, resolver chain, worked example. Fast path rebuilt on typed micro-decisions served by a calibrated engine, with Jev as reference and a local fallback. Conscience memory added as a	5.16 to 5.19, 6, 7, 8, Appendix A

Contributor	Feedback	How it was addressed	Where
	institutionally but not mechanically. Repeated consults were reasoned from scratch.	precedent cache with invalidation and case law. Certificate identifier, manifest, issuance, verification and revocation specified.	
Authors, v0.4 (second pass)	The floor was named but never specified, and the sector profiles were described but did not exist.	Floor specified as thirty values in nine groups with provenance to the related work. Five sector profiles built from the current Australian codes with clause-level lineage, validated by a loader.	5.20, 5.21, 8.1
David Sacks (X, 18 Oct 2026, quoting Andrew Curran on the OpenCode attack; All-In, 10 Oct 2026), Mustafa Suleyman (Project Syndicate, 18 Sep 2026)	Centralised guardrails blocked defenders analysing a live attack while attackers faced none; the durable answer is decentralised access to powerful models. Separately, a constitution trained into weights produces a model that refuses human instruction; the simple rule is do what the user wants unless it is illegal.	New section 4.5: a guardrail matches content, a graph weighs who is asking and why, so the defender's analysis proceeds under an accredited cyber certificate and the attacker's prunes; trusted-access programmes are ad hoc accreditation and the graph makes them portable and pre-approved; the graph works on open-weight and foreign models because it lives outside the model, so decentralised models and a foundation-held floor are compatible. Obedience is the explicit default via principal authority; refusal only at the published floor; conscientious objection becomes signed escalation. Summer 2026 audit added as 3.2.	3.2, 4.5, 5.20, 7

Authors, v0.10 (engine, 22 Oct 2026) | Every verdict rested on token overlap, the first thing a reviewer would find. | A semantic re-ranker from pooled word vectors in every build, and an LLM assessor behind the API that scores salience and violation probability per candidate value under the unchanged band rules, with the lexical verdict it replaced recorded in the response (5.27). | Authors, v0.11 (security, 23 Oct 2026) | The service that answers from the graph had no caller

identity, signed with a shared secret, and kept its record where it could edit it. A respected verdict is worth laundering, and a conscience service is worth attacking. | Caller registry with five assurance levels reached without approval, anonymous advisories that no boundary accepts, asymmetric signatures over the whole verdict, sender-constrained receipts, delegated hourly keys under a key service, a numbered and witnessed decision log, graph rollups and drift alerts (5.28). | 5.28, 6, 7 |
Authors, v0.13 (witnessed log, 25 Oct 2026) | The decision record of 0.20 could be rewritten by the service that kept it. | Every verdict a leaf of an RFC 6962 Merkle tree; checkpoints signed by a separate log key that refuses to sign a non-extending history; C2SP witness protocol with a reference witness; a monitor anyone can run; keys ready to move into Cloud KMS (5.30). | 5.30 |
Authors, v0.12 (trust layer built, 24 Oct 2026) | Section 5.28 was a design. Building it tested the design and the existing code. | Signed verdicts, the caller registry and decision records built and in production. Building them found a broken MCP endpoint, an engine that did not read erase as deletion, and a counter that could have dropped records silently; each was fixed and recorded (5.29). | 5.29 |
Authors, v0.9 (action boundary, 22 Oct 2026) | A review of the project against its purpose found the graph consulted beside the loop, not inside it: receipts were placeholders, nothing refused an unreceipted call, and no working agent consulted before acting. | Signed, parameter-bound, single-use receipts with a verify endpoint; an MCP gateway that refuses unreceipted and pruned calls; a Claude Code hook that consults before every tool call; cues for tool-call phrasing; engine_grade in every response (5.26). The review's other findings became the backlog: a calibrated engine, the experience layer, human graphs, signing and a transparency log, the evaluation battery, foundation governance. |
Authors, v0.8 (verification pass, 22 Oct 2026) | The graphs' clause references and URLs had been written from knowledge, and the Singapore, United States and European Union graphs were thin against the Australian ones. | Every source and clause in all twenty-six graphs checked against its issuing body; eighty-nine values corrected; superseded instruments replaced (AI Act Digital Omnibus, MAS AI guidelines, AIHGle 2.0, Colorado SB 26-189, Guidance for AI Adoption); the graphs grew to over a thousand values and nearly six hundred sources, with the overlays published (5.25). |
Authors, v0.7 (prototype review, 21 Oct 2026) | The overview placed children far from their hubs, flags were drawn by hand, and reading a graph meant leaving the map. The claim that a graph does better than a guardrail had no measurement behind it, and nothing let a Claude session consult the graph without code. | Children placed on fixed orbits around their hub and dots reduced; real flag glyphs; a hub expands in place; the key open by default and clear of the reading panel; sections slide; the console generates a Claude skill; the engine returns telemetry and a blocklist baseline on every decision, and the navigator keeps an analytics store with an export and an import (5.24). |
Authors, v0.6 (taxonomy, 21 Oct 2026) | One floor and five Australian profiles could not show that a consult is answered under the law of the place the person is in, and the floor's review against section 3 found the summer 2026 audit only partly covered. | The graphs restructured into the three-tier taxonomy of 5.21 with a global floor, global sector profiles, jurisdictions with country floors and shells, and country sector profiles; the consult gained an impact region and a domain; the floor gained the candour and restraint group; the navigator gained the console and API. |

Authors, v0.5 (navigator review, 20 Oct 2026) | Two review passes on the prototype, one by an independent reviewer against the running page, found the cost rules differed between surfaces, state that leaked between interactions, and data that was declared but inert (conditions, scope multipliers, nine unconfirmed clauses). A first-time reader then found the app hard to enter: no obvious start, no visible link between graphs, no way back, no key, no names for the elements. | One engine function shared by every surface and the loader, with fixtures. Conditions attached to edges. All clauses confirmed. The navigator now opens on an overview that shows the floor's registry and the inheritance links, with a Home control, a key and a glossary. Terminology fixed to the schema's: conscience graph, global floor, sector profile, domain as a scope node, specialist as a service. | 5.8, 5.20, 5.21, 5.22 |

Ross Dawson's Humans + AI frameworks underpin the human-as-edge-authority model throughout. The chain of trust, maturity and agent boundary sections grew from the authors' own discussion. The decision engine section draws on Partha Sarkar's account of System 1 decision models in GraphRAG. The query protocol, receipt and precedent cache are the parts most in need of argument.

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Appendix A. Conscience Graph Schema v0.4

The schema is released under the Apache License 2.0 and is also distributed as a standalone YAML file. Line comments are part of the specification.