

Generativity Governance of Open Knowledge Propagation: A Preliminary Discussion of Events, Relations, and Conditions under Nonlinear and Multi-Entity Causation

Wanhong Huang

huangwanhong@serendip.ngo

Abstract

Once a body of knowledge enters an open commons it propagates through a system of many heterogeneous participants, in which copies are modified, recombined, implemented, automated, commercialised and redeployed, and in which the conditions of further propagation are altered by the propagation itself. Where harm eventually appears in such a system, the reconstruction of a complete causal history is frequently unavailable, and the legal apparatus of attribution, which requires an antecedent subject, an acyclic chain, a datable injury and a proportionate contribution, is correspondingly difficult to apply. This paper asks what governance remains possible when complete causal reconstruction is unavailable, and what form it should take so that it neither waits for a proof it cannot obtain nor suppresses the propagation it exists to protect.

The answer developed here places three objects under governance in place of one. Events supply observable points at which duties may attach, records may be created and interventions may occur. Relations supply the structure through which a local disturbance is amplified or damped, and which determines whether an event has consequences at all. Conditions supply the settings, defaults, terms and incentives under which further generation proceeds, and they operate on whole populations at once where an event duty operates on a single act. The paper defines generativity governance as the governance of these three, and states at the outset that the term names an object of governance and never an objective of maximisation.

The framework's instruments are matched to its objects. Event duties take the form of requirement sets attaching to classes of consequential transformation, with capability transformation identified as the class that existing law, whose triggers are largely transactional, does not reach. Relational duties are supervisory and bound amplification in place of adjudicating contributions. Condition duties are structural and operate through defaults, terms and infrastructure. A provenance ledger is examined as evidence infrastructure, together with the two limits that govern its use: the schema of recordable events is itself chosen by an interested party, and the population a voluntary ledger reaches is correlated with willingness to comply. Post-hoc attribution is retained as a backstop for deliberate misconduct and clear negligence, and is shown to be admissible at an event only as compliance with the requirements in force there, never as a share of a distant outcome.

Keywords: open knowledge commons; generativity governance; event-based duties; provenance infrastructure; distributed responsibility; critical transitions; adaptive regulation

Notices

Status. This is a working draft circulated for discussion. It is a preliminary discussion paper and is not a finished statement of its author's position. Sections and statement numbers are subject to change.

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Statement on the use of language models. Drafting, literature search and argumentative criticism for this paper were conducted in dialogue with large language models, specifically Claude (Anthropic) and ChatGPT (OpenAI). The claims, the structure, the selection of material and the position taken are the author's. References cited have been checked; any that remain unverified are marked in the text.

Companion paper. This paper is the second of a pair. The first, *Rethinking Fa Bu Qing Chuan ("The Dharma Should Not Be Transmitted Lightly"): Knowledge Propagation Ethics and Implications for Open Knowledge Platforms*, states the ethics of transmission for an individual transmitter. The present paper takes up the institutional side of the same problem.

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Discussion Paper Note

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Part I. The Problem

1 Introduction

A body of knowledge placed in an open commons acquires a history its originator does not write. It is copied and modified; it is recombined with material from elsewhere; it is turned from a description into an implementation and from an implementation into a deployed system; it is commercialised, automated, and incorporated into arrangements remote from the setting in which it was produced. Each of these operations changes what the next party receives, and several of them change the conditions under which further propagation occurs. A commons of this kind is not a channel along which a fixed object travels. It is a system whose state is altered by every transformation performed within it.

Where harm eventually appears in such a system, a familiar legal question is asked: who caused it. The question is poorly matched to the structure of the system it is asked about, and the mismatch is not a matter of evidentiary difficulty alone. Contributions may be individually lawful, individually trivial, and jointly sufficient. The interval between an early contribution and a late harm may exceed the period within which a claim survives. The meaning and the capability associated with a body of knowledge may have changed in transit, so that what a later party deployed is not what an earlier party released. A harm may follow a small final act only because several long-running processes had already brought the system near a boundary, in which case the final act is disproportionate to the outcome and every earlier act is beneath the threshold at which any of them would be actionable. And the parties whose acts composed the outcome may never have met, coordinated, or known of one another.

This paper takes that difficulty as its premise in place of its subject. The failure of post-hoc attribution in distributed generative systems has been analysed elsewhere, including in work of the present author (Huang 2026e), and §3 states the results relied upon and cites them without re-deriving them. The question taken up here is the one that follows: what governance remains available when a complete causal history is unavailable, and what form should it take so that it neither waits for a proof it cannot obtain nor suppresses the propagation it exists to protect.

The answer developed here places three objects under governance in place of one. The first is the class of *events*: observable transformations at which a party acts, at which records may be created, at which duties may attach, and at which an intervention is possible. Events are tractable for exactly the reasons a trajectory is not, since an event has an actor, a time, an input, an output, and a set of risks visible at the moment it occurred. The second is the class of *relations*: the structure of couplings through which a local disturbance is amplified or damped, which determines whether an event has consequences at all, and which no single event exhibits. The third is the class of *conditions*: the settings, defaults, terms, incentives and infrastructures under which further generation proceeds, which operate on whole populations at once where a duty attaching to an event operates on a single act.

Governing events alone would be a reduction, and it is worth stating why at the outset, since the reduction is tempting. A critical transition may present as a discrete occurrence at a particular moment while the conditions for it accumulated across several long-running

processes, so that the visible rupture and its causal history are different objects. A framework attaching all of its duties to the visible rupture would govern the last step of a history it had not examined, and it would do so in a way that loads responsibility onto whichever party happened to act last. Relations and conditions are therefore not context for the treatment of events. They are governed objects with instruments of their own.

Generativity governance. The term used here for the governance of these three objects requires a definition at the outset, since it is open to a reading the paper rejects.

Definition 1.1. (Generativity governance). The governance of the events, relations and conditions under which a system's capacity to generate further states, capabilities and consequences unfolds. The object of such governance is that capacity's conditions of operation. The term names an object and carries no objective of increasing, maximising or optimising the capacity so governed.

The second sentence of the definition is the paper's principal guardrail and is stated in the first section for that reason. A framework that took the quantity of generation as its objective would licence the sacrifice of any particular party's position to an aggregate, which is the utilitarian structure that a relational account exists to avoid, and it would also licence the suppression of generation wherever an aggregate could be shown to improve. The orientation adopted here is different in form: preserve the conditions under which generation can continue, detect the accumulation of harmful capacity and the loss of the system's capacity to absorb it, intervene in proportion, and keep the arrangements themselves revisable. Each of the four is stated as a constraint on conduct and none as a quantity to be maximised.

The instruments are matched to the objects. Events admit duties of a kind that can be assessed after the fact by inspection: a requirement set attaches to a class of consequential transformation, and what is assessed is whether the party conducting the transformation satisfied the requirements in force at the time. Relations admit supervisory instruments, which bound amplification and require the maintenance of capacity to absorb disturbance, and which do not require anyone to apportion a contribution. Conditions admit structural instruments, which operate through defaults, terms, licences and infrastructure, and which fix behaviour for a population without any determination about any member of it. The allocation is not an aesthetic preference. It follows from a result stated in §3: the form a legal representation of causality can take is determined by the form of the available response, so a continuing supervisory response can hold objects that a terminal adjudicative response cannot.

The four contributions. The paper identifies capability transformation as a class of consequential event that existing law, whose triggers are largely transactional, does not reach, and states the requirement form appropriate to it. It states the conditions on the form such a requirement may take, so that a duty attaching to a class of acts does not become a determination about a class of parties. It examines the provenance ledger as evidence infrastructure and states the two limits that govern its use, namely that the schema of recordable events is chosen by an interested party and that a voluntary ledger reaches a population correlated with willingness to comply. And it fixes the place of post-hoc attribution within the architecture, retaining it as a backstop while showing that what may be assessed at an event is compliance

with the requirements in force there and never a share of a distant outcome.

What the paper does not claim. Four restrictions apply throughout. The paper does not claim that improved observability yields causal knowledge, and §14 is written to prevent that inference, since a recorded topology of transformations exhibits reachability and not causation. It does not propose that early intervention take a criminal form; the intervention it describes is administrative and supervisory, and §18 states the reason. It offers no procedure for deciding whether a particular transformation should proceed, and the determination remains with the parties who must answer for it. And it takes no position on the disputed empirical question of how far any existing instrument it examines succeeds in its own terms, assessing designs and stated rationales in place of effects.

The paper is organised in seven parts. Part I states the problem, the causal character of open propagation, the attribution results relied upon, and the relation to prior work. Part II sets out the three objects and defines the class of consequential events. Part III develops duties attaching to events. Part IV develops duties attaching to relations. Part V develops the governance of conditions, including the provenance ledger and its limits. Part VI treats detection near a transition, early intervention and its bounds, and attribution as a backstop. Part VII states the adaptive cycle, the limits of the framework, and the questions it leaves open.

2 Open Knowledge Propagation and Its Causal Character

This section fixes the system the paper is about and establishes the properties of it that later parts rely upon. Its objective is to replace the transmission picture, in which a fixed object travels from a holder to a recipient, with an account adequate to a commons in which transformation is the normal operation. The section describes the participants and the operations performed among them; states the four properties of the resulting system that bear on governance, namely branching with recombination, feedback into the conditions of propagation, transformation of capability in transit, and partial observability; and states the composition of a harmful outcome in a form that separates a triggering occurrence from the processes that made it consequential. The account is structural, and no claim is entered here about how frequently any of the properties obtains in any particular commons.

2.1 The Participants and the Operations

An open knowledge commons is composed of heterogeneous participants and heterogeneous objects. Among the participants are individual contributors, research groups, communities of practice, platforms and repositories, firms, standard-setting bodies, funders and regulators. Among the objects are descriptions, methods, datasets, models, implementations, documentation, licences and deployed systems. Neither list is a taxonomy, and the point of stating them together is that governance instruments addressed to one kind of participant, or to one kind of object, will meet a system in which the two are continuously converted into one another.

The operations performed within such a system include copying, revision, translation, recombination with unrelated material, implementation, packaging, automation, incorporation into a larger system, commercialisation, restriction, and withdrawal. Each of these has

three properties that matter here. It is performed by an identifiable party at an identifiable time. It changes what a subsequent party receives. And it is, in the ordinary case, lawful and unremarkable.

Claim 2.1. (The insufficiency of the transmission picture). A commons in which transformation is the normal operation is inadequately described by a relation between a transmitting party and a receiving party. What a later party receives is the product of an intervening history of transformations, and the party who produced the material at the origin of that history stands to the later object in a relation of ancestry, which is compatible with any degree of similarity and with none.

The claim has an immediate consequence for the allocation of duties, and the consequence runs in both directions. A régime attaching duties to origination alone would place them on the party least able to know what its material had become. A régime attaching duties to the final act alone would place them on the party who inherited a capability whose construction it did not perform. Neither the first nor the last position in a history of transformations is, without more, the right place to look.

2.2 Branching, Recombination, and Feedback

This subsection states two structural features that distinguish propagation in a commons from propagation along a chain, and draws from the second the reason conditions appear in this paper as a governed object.

The first is branching with recombination. A body of material may be taken up independently by several parties, developed in divergent directions, and later merged, so that the resulting object has more than one line of descent and the lines are not independent of one another. A history of this shape has no unique path from an origin to an outcome, which is the structural fact behind the observation in §3 that legal causal doctrine, which tests one link at a time, possesses no operator for composing many such tests.

The second is feedback into the conditions of propagation. A transformation may change what subsequent transformations are available, cheap or expected: an implementation makes a method usable by parties who could not have implemented it; a standard makes one variant the default; a commercial deployment creates an incentive for further deployment; and a widely adopted interface makes some developments easy and others costly. The conditions under which the system propagates are therefore endogenous to the propagation.

Claim 2.2. (Endogeneity of the conditions of propagation). In a commons of the kind described, the conditions under which further transformation occurs are altered by the transformations already performed. A governance instrument that treats those conditions as a fixed background will therefore be assessing conduct against a setting the conduct itself has been producing.

Claim 2.2 is the reason conditions appear in this paper as a governed object in their own right. An arrangement that governs only acts, against conditions it takes as given, cedes to the ungoverned process the determination of what the acts will be.

2.3 Transformation of Capability in Transit

The property that most directly concerns governance is that what propagates is not only material but capability, and that capability is not conserved along a line of descent.

A description of a method confers little capability on a party who cannot implement it. An implementation confers it on any party who can run it. A packaged and documented implementation confers it on parties with no relevant expertise. An automated deployment confers it without any party exercising it at all. At each of these steps the material is, in an ordinary sense, the same, and the capability associated with it differs by a large factor.

Claim 2.3. (Non-conservation of capability along a line of descent). The capability associated with a body of knowledge is a function of its form, its packaging, and the systems into which it has been incorporated, and it may increase by large factors at a single transformation without the underlying content changing. The party performing such a transformation is therefore the party that produced the increase, whatever the position of the material's origin.

Claim 2.3 carries much of the paper's normative weight and is stated early for that reason. It supplies the ground on which duties may attach to a transformation in place of to an origin, and it identifies which transformations matter: those at which the capability associated with the material materially increases. §6 takes this as the criterion of a consequential event.

2.4 Partial Observability

No party, and no supervisory arrangement, observes the state of an open commons. What is available are traces: publications, repositories, releases, deployments, incident reports, and whatever records the participants have chosen to keep. Writing x_t for the state of the system and y_t for what is available to an observer, the relation between them is a projection that discards most of the state, and the projection is not chosen by the observer alone, since what is recorded depends on the practices of the parties who record it.

Claim 2.4. (The character of the observational deficit). The deficit in an open commons is not primarily a deficit of quantity. The material that is unobserved includes classes of object systematically unlikely to be recorded, among them private use, informal transfer, capability acquired by parties who publish nothing, and the reasoning behind decisions that were never contested. An increase in the volume of records leaves those classes where they were.

The claim bears on the evidentiary infrastructure examined in Part V, and it is the first of the two limits placed on that infrastructure there. A record of transformations improves what can be established about the parties who record, and leaves the remainder of the system as it was.

2.5 The Composition of a Harmful Outcome

This subsection states the structure that later parts govern, assembling the properties set out above into a single expression. The expression separates what enters a harmful outcome into components with different attributive properties.

An outcome H appearing at a particular time is ordinarily the joint product of a triggering occurrence, of several longer-running processes that changed the system's susceptibility, and

of background conditions that were in place before either. Writing E for the trigger, $\Gamma_1, \dots, \Gamma_n$ for the contributory processes and C for the conditions,

$$H = \Phi(E, \Gamma_1, \dots, \Gamma_n, C), \quad (1)$$

which is to be read as a statement about what enters the outcome and not as a functional form to be estimated. Equation (1) is stated because of what it separates. The trigger is discrete, dated and attributable. The contributory processes are extended, undated and distributed. The conditions belong to no party at all.

Claim 2.5. (Divergence of the visible occurrence from its causal history). Where the contributory processes have brought a system near a boundary of its own stability, the triggering occurrence may be arbitrarily small in relation to the outcome, and each contributory process may be individually insufficient to produce any part of it. The visible occurrence and the history that made it consequential are therefore distinct objects, and an instrument addressed to the first governs the last step of a history it has not examined.

Claim 2.5 is the reason the framework of this paper is event-centered and trajectory-aware in place of event-based. Events are where duties can attach, records can be made and interventions can be conducted. The processes are what makes a particular event consequential, and they enter the framework as the object of the supervisory instruments of Part IV in place of the adjudicative instruments of Part III. The division of labour between the two is stated in §12.

3 The Limits of Post-Hoc Attribution in Systems of This Kind

This section states the results about legal attribution that the remainder of the paper relies upon. Its objective is to establish, compactly and without re-derivation, why an architecture resting principally on post-hoc responsibility attribution is unavailable for the system described in §2, and to state the one positive result from that literature which the present framework uses constructively. The section sets out the representational requirements that legal attribution imposes; the two ends at which attribution fails where a system has been brought near a boundary; the reason apportionment at the margin is unsafe in such a system; and the projection result, which converts the whole analysis from a criticism into an allocation rule. The results are drawn from existing work, including work of the present author (Huang 2026e, 2026c), and are cited in place of being argued again; what is new here is the use made of them in §5 and after.

3.1 The Representational Requirements of Legal Attribution

Legal attribution is not indifferent to the shape of the causal structure it is asked to represent. A determination of responsibility requires an antecedent subject to whom conduct may be ascribed; a chain in which contribution is apportionable, which requires acyclicity; a duty-bearer at the level at which the harm occurred; a locatable place of the wrong; and an injury with a date. Dynamical properties that a distributed generative system exhibits routinely, among them feedback, level-crossing, path dependence, non-locality, and change in the causal gram-

mar over the period adjudicated, violate these requirements severally and independently.

Two observations from that analysis are used later and are recorded here. The first is that the requirements are violated independently, which explains why each doctrinal advance addresses exactly one of them and why no accumulation of such advances closes the problem. The second is that legal causal doctrine possesses a refined apparatus for the single intervening act and no operator for composing many such tests, so that a doctrine adequate to a medical intervention following an injury is inapplicable to a history in which thirty transformations were each lawful, each slight, and each one of many.

Table 1 pairs the two lists, since the paper’s architecture follows from the pairing and not from the lists severally. Each row names a property the system exhibits, the requirement of legal attribution that the property defeats, the consequence for a determination, and the object of this framework to which the corresponding remedy is assigned. The last column is what converts the classification from a catalogue of difficulties into the argument of Parts II to VI.

Table 1: Dynamical properties of a distributed generative system, the representational requirement each defeats, the consequence for attribution, and the object to which this framework assigns the remedy.

Property	Requirement defeated	Consequence for a determination	Remedy assigned to
Feedback, circular causation	Apportionability, which requires acyclicity	Contribution is undefined in place of hard to measure, and no finding terminates	Event: compliance assessed at the act
Level-crossing, emergence	A duty-bearer at the level of the harm	The injured level has no party occupying it	Relational structure: supervision
Path dependence, hysteresis	Reversibility of the wrong	Cessation restores nothing, and the remedy addresses acts in place of a changed disposition	Condition: prospective alteration
Non-locality	A locatable place of the wrong	The forum is chosen territorially while the effect is topological	Condition: terms of a facility
Accumulation toward a boundary	A dated injury, and proportionality of the trigger	Both ends eliminated: early acts by threshold and time, the trigger by proportionality (Claim 3.2)	Relational structure: reading the approach
Non-stationarity of the causal grammar	A fixed grammar over the adjudicated period	The standard applied was not the standard in force	Arrangement: revision of its own instruments
Convergence of independent lines	An operation composing many local tests	Doctrine tests interruption and has no operation for merging (Claim 11.2)	Position of composition, and conditions

Two observations about the table are used later. The first is that the rows are independent, so a doctrinal advance addressing one leaves the others where they were, which is why no

accumulation of such advances closes the problem. The second is that the last column contains no entry reading “attribution”, which is the whole of the paper’s architectural claim stated in a single column.

Claim 3.1. (The unavailability of attribution as the primary instrument). In a system exhibiting the properties of §2, the representational requirements of legal attribution are violated in ways that are independent of one another and that no single doctrinal adjustment repairs. An architecture in which responsibility attribution is the primary governance instrument therefore depends, for its operation, on a reconstruction the system does not permit.

The claim is about primacy and not about availability. Attribution remains available and appropriate where conduct is locatable, deliberate and proximate, and §19 states the place it holds in the architecture proposed here.

3.2 The Failure of Attribution at Both Ends of the History

Where the contributory processes of Equation (1) have brought a system near a boundary, attribution fails at both ends of the history, and it fails for different reasons at each, which is why the failure is invisible from within any single doctrine.

At the early end, the contributory acts are individually beneath the threshold at which any of them would be actionable, are individually lawful, and are by the time of the outcome frequently outside the period in which a claim survives, since the period runs from a datable injury and the approach to a boundary has no date. At the late end, the triggering occurrence fails the proportionality tests that legal causation applies, since near a boundary the trigger is by construction small in relation to the outcome it precedes.

Claim 3.2. (Causal saturation with attributive vacancy). A system brought to a critical state by an extended history and then tipped by a small occurrence is causally saturated and attributively empty: every candidate contribution is eliminated, the early ones by threshold and by time and the late one by proportionality, and no single doctrine appears defective because each has eliminated only what it was designed to eliminate.

3.3 The Instability of Apportionment at the Margin

This subsection states a result about apportionment near a boundary that bears directly on the design of event duties, and that is the ground on which §7 states those duties as compliance requirements.

Where contributions accumulate toward a boundary, the system’s remaining margin is a concave function of the accumulated forcing, and its derivative diverges as the boundary is approached. An apportionment rule that assesses each contribution by the difference it made at the margin therefore depends on the order in which the contributions are considered, and under any such rule the final contribution absorbs the greater part of the responsibility.

Claim 3.3. (Order dependence of marginal apportionment near a boundary). Assessment of contributions by their marginal effect on a system’s remaining margin is order-dependent where that margin is concave in the accumulated forcing, and it loads responsibility onto the last contribution, which is the contribution that proportionality doctrine excludes. Marginal

apportionment and proportionality therefore give opposite answers in the same case.

The consequence for this paper is definite and is applied in Part III: what may be assessed at a consequential event is whether the party conducting it satisfied the requirements in force there. A share of a distant outcome may not be assessed at an event, and the ground is Claim 3.3 in place of any general caution.

3.4 The Projection Result and Its Constructive Use

This subsection states the result that the framework of this paper builds on, and it is the one result in the section that is constructive. The findings set out above are ordinarily read as a criticism of legal form, and one further result converts them into an allocation rule, and it is the result this paper builds on.

The structure of legal causal representation is determined by the structure of the response available. Acyclicity is required because a judgment must terminate, and a cyclic finding has no terminating node. Binary contribution appears where the verdict is binary and fractional contribution where the remedy is divisible. Locality appears where jurisdiction is territorial. On this reading, the representational requirements are not an epistemic deficiency of law. They are the shape imposed by terminal, binary and local responses.

Claim 3.4. (Relaxation of the requirements under continuing responses). Where the available response is continuing in place of terminal, the requirements that a terminal response imposes are relaxed. Supervisory instruments, structural orders, continuing jurisdiction, monitoring arrangements and requirements of non-repetition do not require a terminating node, a binary finding, or a datable injury, and they can therefore hold objects that an adjudicative determination cannot.

Claim 3.4 is the hinge between this section and the architecture of the paper, and it is worth stating the inference explicitly, since it is the paper's structural argument. Events admit terminal responses and are therefore the objects to which adjudicable duties may attach. Relations and the approach to a boundary admit only continuing responses and are therefore the objects of supervision. The allocation of instruments to objects in Parts III to V is not a matter of convenience. It follows from what each kind of response can represent.

An immediate corollary constrains the paper's own proposals. An instrument that governs a relational object and is then enforced by a terminal, binary determination has reimported the requirements that made the object ungovernable, and will fail in the manner Claim 3.2 describes. Where Part IV proposes duties over relational objects it therefore states the continuing form of the response along with the duty, and §12 states the boundary in general terms.

4 Relation to Prior Work

This section situates the framework among the literatures and practices that already own parts of it, with the objective of fixing what the paper claims. It proceeds from the regulatory literature that supplies the framework's form, through the bodies of law that already attach duties to events, to the infrastructures that already record transformations, and closes with

the residue this paper claims. Each subsection states what the prior work establishes and where the object here separates from it. Two of the literatures named are ones the framework adopts wholesale, and the paper's contribution in relation to them is a transposition and not a discovery.

4.1 Regulation Addressed to Process in Place of Outcome

A substantial regulatory literature and practice addresses itself to the processes by which a regulated party conducts its activity, in place of the outcomes it produces or the technologies it employs. Management-based regulation prescribes planning, assessment and internal control where outcomes are costly to monitor (Coglianese and Lazer 2003) and where the regulated parties hold information the regulator does not. Safety-case régimes require a duty-holder to produce a documented argument that its arrangements are adequate, and place the regulator in the position of assessing that argument. Reflexive and responsive accounts of regulation (Teubner 1983; Ayres and Braithwaite 1992), meta-regulation (Parker 2002), and experimentalist arrangements (Sabel and Zeitlin 2008) each develop a version of the same move, in which the regulator specifies the form of an internal process and the deliberation about substance is conducted within the regulated arrangement.

The present framework adopts this form for its event duties without amendment, and the differentiation lies in the ground and in the object. The stated ground of management-based regulation is the cost of monitoring outcomes. The ground here is stronger and is stated in §3: for the outcomes at issue, attribution is not merely expensive but structurally unavailable, so process requirements are the instrument that remains, and not merely the instrument that costs less. The object also differs, since the literature addresses parties within a regulated industry, identified in advance and holding a licence or a facility, whereas an open commons has no such closed set of parties, and §7 accordingly attaches requirements to classes of act in place of classes of party.

4.2 Duties Attaching to Events in Existing Law

Law already attaches duties to events, and the framework proposed here should not be presented as introducing that idea. Obligations attach at the formation of a contract, at publication, at the placing of a product on the market, at a filing, at a registration, at a transaction above a threshold, and at the commencement of a project requiring environmental assessment. In each case the trigger is an observable occurrence with an actor and a date, and the duties attaching to it are documentary, assessive or procedural.

Claim 4.1. (The character of the shift proposed). Existing legal triggers are predominantly transactional, marking a change in the legal relations between parties. The events identified in §6 are transformations of capability, marking a change in what the material makes possible. The proposal is therefore an extension of the class of legally consequential events, and not an introduction of event-triggered duties into a body of law that lacked them.

One existing régime attaches duties to a transformation of capability in place of a transaction, and it is the nearest ancestor of the proposal made here. Export control of controlled technology attaches at the transfer of technical knowledge, including transfer to a person, and

treats the making available of knowledge itself as the regulated occurrence. The framework here differs from that régime in three respects that should be stated together: its triggers are defined by increase in capability in place of membership of a listed category; its duties are documentary and assersive in place of prohibitive and licensed; and its determinations are not addressed to the identity or the nationality of the receiving party, which §7.3 states as a constraint on admissible rule form. The comparison is nonetheless the sharpest available, and it is also a warning, since the régime it names is one whose administration has been criticised precisely for the effects that constraint is meant to prevent.

4.3 Provenance and Integrity Infrastructures

Infrastructures that record the origin, transformation and custody of digital objects exist and are in production use. Provenance data models specify entities, activities and agents together with the relations among them (W3C 2013). Content provenance and authenticity arrangements attach signed records of creation and modification to media objects (C2PA). Software supply-chain integrity systems record the steps by which an artifact was produced, together with attestations by the parties that performed them (in-toto), and bills of materials record composition (SPDX). Version control systems record authorship, parentage, time and a stated rationale for every change, and the analogy between such a record and the ledger described in §14 is close enough to be worth stating and to require qualification.

What these systems establish is that a record of transformations at the granularity required is technically routine, which removes feasibility as an objection. What they do not settle is the question this paper takes up in §15: which transformations are recordable, who fixes that schema, and what follows from the schema being fixed by parties whose conduct it records.

4.4 Governance of Research and Release under Recognised Risk

Arrangements exist for review of research whose publication carries recognised risks, for staged and structured release of artifacts, and for coordinated disclosure of defects. These are examined in the companion paper (Huang 2026g) as instruments available to an individual transmitter, and they appear here in a different capacity, as existing instances of duties attaching to a release event and administered by a body other than the party releasing.

Two features of those arrangements are carried into Part III. Their criteria concern the material and its applications and not the identity of prospective recipients, which is the constraint of §7.3. And their determinations are made against criteria stated in advance and published, which is what permits a party subject to them to contest an application of the criteria without contesting the criteria themselves.

4.5 Anticipatory and Adaptive Arrangements

A body of work on the governance of emerging technologies holds that determinations should be provisional, monitored, and revised as conditions develop (Sabel and Zeitlin 2008; Abbott and Snidal 2000), in place of settled once at the outset, and develops instruments for doing so. The framework's Part VII adopts this posture and adds one element to it: the revision of the requirement sets and of the recording schema is stated as a duty of the governing arrange-

ment, with its own occasions and its own record, on the ground that an arrangement whose own instruments are unrevisable will govern a system that has moved past them.

4.6 Distributed and Forward-Looking Responsibility

Philosophical accounts of responsibility in structures with many participants (Young 2011), of complicity (Kutz 2000), of shared responsibility in international law (Nollkaemper and Jacobs 2013), and of distributed moral action (Floridi 2016) have established that responsibility need not be exhausted by individual backward-looking liability, and that participants in a structure may bear obligations in respect of what the structure produces. That literature is the general setting of the present framework and is conceded as such.

The object here is narrower and more institutional. The question taken up concerns what an arrangement should require, in place of what responsibility a participant bears, at which occasions, in what form, and with what evidence. The framework accordingly says little about the moral position of any participant and a good deal about the design of requirement sets, schemas and supervisory instruments.

4.7 The Normative Orders in Which an Instrument May Be Held

This subsection sets out the distinct normative orders available in a knowledge commons, states what each is able to verify and how far each reaches, and fixes what this paper does and does not settle about them. The subsection is required because the instruments described in Parts III to VI have been stated without reference to who holds them, and a reader is entitled to know whether that silence is an omission or a division of labour.

Five orders are ordinarily present, and they differ in three respects that bear on every instrument in this paper: what each can verify, whom each reaches, and what each can do upon a finding.

A facility's own rules, meaning the terms on which a platform, repository or registry may be used, verify what the facility can observe directly, which is a great deal, and reach every party using it and no other. Upon a finding they can withdraw the facility's own service and nothing further.

Professional and disciplinary norms verify what expertise is needed to assess, which includes judgements about a transformation's significance that no other order can make, and reach members of the relevant community. Upon a finding they can withdraw standing within that community.

Technical standard-setting arrangements verify conformity with a specification, which is narrow and unusually reliable, and reach those who adopt the standard, which in practice includes parties that adopt it because others require it. Upon a finding they can withhold conformity.

Public law verifies what a court or an administrative body can establish on evidence, reaches within a territory, and upon a finding can compel. Its verification capacity is the most constrained of the five, which is the substance of §3, and its power upon a finding is the greatest.

Community norms verify what participants can see of one another and reach those who

care to remain participants, and upon a finding they can withdraw regard, which is weaker than the others and cheaper to apply.

Claim 4.2. (The dependence of an instrument upon the verifying capacity of its order). An instrument is operable in a normative order only where that order can verify what the instrument requires. The requirement sets of Part III are verifiable by a facility and by a professional community and only partly by a public authority; the capacity duties of Part IV are verifiable by a party holding a longitudinal record and by nobody else; and the conditions of Part V are set by whoever holds the facility, whatever any order provides. The orders therefore differ in which of this paper's instruments they can hold, and an instrument placed in an order that cannot verify it becomes a form of words.

Two consequences are recorded and neither is developed here. The orders overlap unevenly, so an instrument may be held in more than one and will then be verified to different standards in each. And the order with the greatest power upon a finding is the one with the least verification capacity, which is a general feature of the domain and not a defect of any arrangement.

What this paper settles is the allocation of instruments to *objects*, on the ground stated in Claim 5.5. What it does not settle is the allocation of instruments to *orders*, which requires an account of what each order may admissibly be asked to do and of how a duty is divided where no single order can verify it. That question is the subject of a companion enquiry into rule form across levels of normative order, and §22 records it as open.

4.8 The Position This Paper Claims

This subsection states the residue the paper claims, against the six bodies of work set out above, and identifies why the elements of the claim belong together.

Claim 4.3. (The unclaimed position). Existing work establishes the form of process-directed regulation and its rationale in monitoring cost; the attachment of duties to transactional events; the technical feasibility of transformation records; the administration of release review by bodies other than the releasing party; the posture of anticipatory and adaptive arrangements; and the distribution of responsibility in structures with many participants. No existing treatment states a governance framework for an open knowledge commons that takes events, relations and conditions as three governed objects with instruments matched to each; that identifies capability transformation as the class of consequential event and states the admissible form of a duty attaching to it; that states the limits of a provenance record arising from the interested character of its schema and the population it reaches; and that fixes the place of post-hoc attribution as a backstop on the ground that marginal apportionment and proportionality give opposite answers near a boundary.

The four elements of the claim are separately modest. Their conjunction is what the paper offers, and the conjunction is what the domain requires, since an instrument addressed to any one of the three objects alone can be defeated by movement in the other two.

Part II. The Objects of Governance

5 The Objects of Governance and the Instruments Matched to Them

This section sets out the three objects that the framework places under governance and establishes why three are required. Its objective is to show that each object carries something the others cannot, that an instrument addressed to any one of them alone is defeasible by movement in the other two, and that the instruments appropriate to each follow from what a response of the corresponding form is able to represent. The section defines each object in turn and states what it carries; states the matching of instruments to objects and its ground; and states the interaction among the three, which is what makes the framework a single architecture in place of three independent proposals. The definitions are stipulative and are defended by the work they do in Parts III to V.

5.1 The Object Set and Its Irreducibility

The material in §2 exhibits three kinds of thing that a governing arrangement might address. There are occurrences: discrete acts performed by identifiable parties at identifiable times, each of which changes what a subsequent party receives. There is structure: the pattern of couplings among participants, objects and systems, which determines whether an occurrence propagates, is amplified, or is absorbed. And there are settings: the terms, defaults, incentives and infrastructures within which occurrences are performed and structure develops.

Occurrences, structure and settings are related and are not reducible to one another, and the paper's architecture depends on that. A structure is not an aggregate of occurrences, since the same set of occurrences in a differently coupled system produces a different result. A setting is not an aggregate of structures, since a setting persists across changes in who is coupled to whom. And an occurrence is not derivable from either, since a structure and a setting fix what is possible and leave what is done to the party who does it.

Definition 5.1. (Event). An occurrence, performed by an identifiable party at an identifiable time, that transforms a knowledge object or its availability, and that admits of a record stating the party, the time, the input, the operation, the output, and the risks visible at the moment of performance.

Definition 5.2. (Relational structure). The pattern of couplings among participants, objects, and systems in a commons, in virtue of which a disturbance originating at one point is transmitted, amplified, or absorbed, and which no single event exhibits.

Definition 5.3. (Condition). A setting that holds for a population of participants or objects without reference to any particular act, including licence terms, platform defaults, funding and commercial incentives, published standards, and the infrastructures available for recording and retrieval.

Each definition is stated so as to name what makes the object governable. An event admits of a record, which is what allows a duty to attach to it and compliance to be assessed afterwards. A relational structure has a transmission characteristic, which is what allows an arrangement to require that the characteristic be kept within bounds. A condition holds for a

population, which is what allows an arrangement to alter the behaviour of many parties by a single act and without a determination about any of them.

5.2 The Content Each Object Carries and Conceals

This subsection states what each of the three objects makes available to a governing arrangement and what each withholds from it, since the complementarity of the three is what requires all of them to be governed.

An event carries an actor, a moment, and a described change, and it carries the state of knowledge at the moment of performance, which is what makes a foreseeability question answerable in the terms available to the party at the time. What an event conceals is its own significance, since whether a transformation mattered depends on the structure into which it was released and on the conditions then obtaining.

A relational structure carries the significance that events conceal. It determines whether a released implementation is taken up by ten parties or ten thousand, whether a defect is corrected upstream or replicated downstream, and whether a disturbance is absorbed by parties with the capacity to absorb it. What a structure conceals is agency: it is produced by many parties and controlled by none, and it therefore supports no determination about who made it what it is.

A condition carries reach. A term written into a default licence, a threshold set in a platform's release interface, or a requirement attached to funding operates on every party within its scope from the moment it is set, and it operates without any assessment of any of them. What a condition conceals is the particular case: it is set in advance for a population whose members differ, and it will be badly fitted to some of them.

Claim 5.4. (The non-reducibility of the three objects). Each of the three objects carries information and admits of instruments that the other two do not. Events carry agency and the state of knowledge at a moment and conceal significance; relational structure carries significance and conceals agency; conditions carry reach and conceal the particular case. A governing arrangement addressing fewer than three therefore lacks either the means to assess conduct, or the means to know which conduct mattered, or the means to act on a population.

5.3 The Matching of Instruments to Objects

This subsection assigns an instrument to each object, and states the ground of the assignment. The instruments follow from Claim 3.4, which holds that the form of a response determines what it can represent.

Events admit terminal responses. A determination that a party did or did not satisfy the requirements in force at a transformation it performed has an actor, a date, a finite object, and a terminating point, so it satisfies the representational requirements that adjudication imposes. Duties attaching to events may therefore be adjudicable.

Relational structure admits continuing responses. A requirement that a coupling characteristic be kept within bounds, or that capacity to absorb disturbance be maintained, has no terminating point and no datable breach, and an attempt to enforce it by a terminal determination would require an apportionment among the many parties that produced the structure,

which is the operation Claim 3.3 shows to be unsafe. Duties attaching to relational structure are therefore supervisory.

Conditions admit structural instruments. A term, a default or an infrastructure is set by an arrangement and takes effect without any determination about a party, so the enforcement question does not arise in the form it takes for the other two.

Table 2: The three objects, what each makes available to a governing arrangement, and the instrument matched to it.

Object	Carried	Concealed	Instrument and response
Event	Actor, moment, described change, state of knowledge at the time	Its own significance	Requirement set attaching to a class of act; terminal assessment of compliance
Relational structure	Significance: transmission, amplification, absorptive capacity	Agency	Standing requirement on a party who maintains it; continuing observation and direction
Condition	Reach over a population, at a cost independent of its size	The particular case	Term, default, licence, interface, infrastructure; prospective change of the setting

Claim 5.5. (The allocation of instruments). Adjudicable duties are available for events, supervisory instruments for relational structure, and structural instruments for conditions; and the allocation follows from the form of response each object admits, with no preference of the designer entering it. An instrument applied to an object whose form it does not fit reimports the representational requirements that made the object ungovernable, and fails in the manner of Claim 3.2.

Two consequences of the allocation are recorded here and are relied upon later. Because relational duties are supervisory, they cannot be the vehicle by which an individual party is held liable, and Part IV states throughout what an authority may require in place of what a party may be made to pay. And because condition-setting requires no determination about any party, it is the only one of the three instruments that operates without the interested-party problem examined in §15, which is a reason to prefer it wherever it will serve.

5.4 The Interaction Among the Objects

This subsection states the dependences among the three objects, which run in every direction, and draws from them the consequence that an instrument addressed to any one alone is defeasible.

Conditions determine which events occur and how often, since a default that makes an operation easy makes it common. Events change the relational structure, since a release creates couplings that did not exist and an implementation creates dependence on the party that maintains it. Relational structure changes the conditions, since concentration of a capability

in a small number of parties makes those parties the setters of terms for everyone coupled to them. And the resulting structure and conditions determine which further events are consequential, which is the endogeneity recorded in Claim 2.2.

Claim 5.6. (Defeasibility of a single-object instrument). An instrument addressed to one of the three objects is defeasible by movement in the other two. Event duties are defeated where conditions make the regulated operation unnecessary or make an unregulated substitute cheaper; supervisory instruments over structure are defeated where the events that constitute the structure are unrecorded; and conditions are defeated where the structure has concentrated sufficiently that the parties setting the conditions are the parties the conditions were to bind.

The claim is the reason this paper treats the three together in place of proposing any one of them. It also supplies the paper's principal diagnostic, since a failing arrangement can be examined for which of the three defeats it is suffering, and the remedies differ in each case. §20 states the form this takes as a duty of revision on the governing arrangement itself.

6 The Capability Transformation and the Class of Consequential Events

This section identifies the class of events to which the duties of Part III attach. Its objective is to supply a criterion of consequence that follows from the account of propagation in §2 in place of a list assembled by intuition, to state the classes the criterion selects, and to fix the boundaries of the class so that a duty attaching to it does not expand indefinitely. The section states the criterion; sets out the classes of transformation it selects, including those that reduce capability as well as those that increase it; distinguishes transformations of the material from transformations of the record; states the threshold problem and the discipline that follows from it; and distinguishes the resulting class from the transactional triggers of existing law. The classes are offered as a proposal for a schema and not as a closed enumeration, and §15 states who should be able to revise them.

6.1 The Criterion of Consequence

Claim 2.3 established that the capability associated with a body of knowledge is not conserved along a line of descent, and that it may increase by a large factor at a single transformation with the underlying content unchanged. That result supplies the criterion.

Definition 6.1. (Consequential event). An event, in the sense of Definition 5.1, at which the capability associated with a knowledge object materially changes for some class of parties, whether by a change in the form of the object, in its packaging, in the systems into which it is incorporated, in the parties to whom it is available, or in the safeguards attending its use.

Three features of the definition are deliberate. Consequence is defined by change in capability and not by change in risk, since a change in risk is a judgement about the world and a change in capability is a property of the object and its setting, which is the more tractable of the two and the one the acting party is in the best position to state. Consequence is relative to a class of parties, since a transformation making a method usable by specialists who could already have implemented it changes little, and the same transformation making it usable by

parties who could not is the consequential one. And the definition is symmetrical about the direction of change, for the reason given below in the treatment of transformations that reduce capability.

The criterion also fixes where duties fall. The party performing a transformation that materially increases capability is the party that produced the increase, whatever the position of the material's origin, and the duty attaches there. This is the sense in which the framework rejects both of the positions Claim 2.1 excluded.

6.2 The Classes of Consequential Transformation

This subsection sets out the classes of transformation that the criterion of Definition 6.1 selects. The following eight are offered as an initial schema and not as a closed enumeration.

The first is operationalisation: the conversion of a description, a result or a method into an executable, reproducible or directly applicable form. This is the class in which capability increases most sharply for the widest new population, since it removes the requirement that a party be able to construct the implementation for itself.

The second is packaging and lowering of the threshold of use: documentation, interfaces, defaults, and integration that make an existing implementation usable by parties who lack the relevant expertise.

The third is scale-up: the transition from bounded or experimental use to deployment at a scale at which the aggregate effect differs in kind from the effect at the original scale.

The fourth is automation: the removal of a requirement that a competent party exercise judgement at the point of use, so that the capability operates without a party exercising it.

The fifth is removal or weakening of a safeguard: the deletion of a restriction, check, filter, licence condition, or documented limitation that was present in the object as received.

The sixth is incorporation: the embedding of an object into a larger system, on which parties come to depend, and from which it cannot be withdrawn without cost to them.

The seventh is commercial deployment into a use whose consequences the deploying party is in a position to assess and the originating parties are not.

The eighth is continued propagation after a risk has become known to the propagating party, which is the only class in the schema whose defining element is a state of knowledge in place of a transformation of the object.

Claim 6.2. (The character of the classes). Each class in the schema names an operation at which the capability associated with an object changes materially for a class of parties, and each is performed by an identifiable party at an identifiable time. The classes are not exhaustive, and the schema is a proposal to be revised under §15; what is claimed is that the criterion of Definition 6.1 selects classes of this character and excludes the ordinary operations of a commons, which include revision, criticism, replication, translation and citation.

The exclusion in the second half of the claim is as important as the inclusion in the first. A framework whose duties attached to every transformation would impose a cost on every act of participation, and would fall most heavily on parties with the least capacity to bear it, which is the failure §9 is written to prevent.

6.3 Transformations That Reduce Capability

This subsection states why the criterion of Definition 6.1 is symmetrical about the direction of change, and why a schema registering only increases in capability would be defective. Three reasons are given, and the third concerns the arrangement's own viability.

Withdrawal of an object, correction of a defect, addition of a safeguard, restriction of an interface, publication of a limitation, and issue of a warning are all transformations of capability, and they are consequential in the same sense. They matter to a governing arrangement for three reasons. They are the acts by which a party discharges a duty that arose at an earlier event, so a record containing only increases cannot show that discharge. They are evidence about the state of knowledge, since a warning issued at one point establishes what was visible at that point to every party who received it. And an arrangement that records only what parties did to expand capability, and never what they did to contain it, produces a record whose only use is adverse, which is a poor design for an instrument that depends on voluntary participation.

Claim 6.3. (Symmetry of the schema). A recording schema that registers increases in capability and omits reductions cannot evidence the discharge of a duty, loses the record of what was known and when, and gives participating parties a record that can only count against them. The schema should therefore register transformations in both directions, with the same fields.

6.4 Transformations of the Material and Transformations of the Record

This subsection distinguishes transformations of a knowledge object from transformations of the record of such transformations, and states why the second requires separate treatment. The eight classes set out above all concern the object.

Definition 6.4. (Second-order event). An event whose object is the record of events: the creation, amendment, withholding, deletion, or misstatement of a record, and the alteration of the schema by which records are made.

Second-order events require separate treatment for a reason that has no analogue among the first-order classes. The evidentiary value of the whole arrangement depends on them, so a defect at this level defeats the instrument entire and is not merely one further harm within it. Deliberate deletion or falsification of provenance is the form of second-order event most easily recognised, and §15 argues that a subtler form, the selection of what the schema admits, is the more consequential of the two, since it operates before any party has anything to delete.

6.5 The Threshold and Its Administration

Definition 6.1 turns on a material change in capability, and materiality is a threshold. The threshold is a choice, it will be contested, and the framework is under an obligation to say how it is set in place of leaving it to the party whose conduct it governs.

Claim 6.5. (The threshold as a governed object). The threshold at which a change in capability becomes material determines the scope of every duty in Part III, and it is therefore not a technical parameter to be fixed by the parties subject to those duties. It is set as part of the schema, published, applied uniformly to a class of acts, and revised by a party other than

those it governs, on the conditions stated in §7.3 and §15.

The claim leaves the level of the threshold open, and deliberately. A level appropriate to one domain will be wrong for another, and the framework's contribution here is the discipline and not the number: the threshold is public, uniform across the class, and revisable by a party who does not act under it.

6.6 The Distinction from Transactional Triggers

The class defined here differs from the events to which law ordinarily attaches duties, and the difference is worth stating precisely, since it identifies what is being proposed.

A transactional trigger marks a change in legal relations: an offer accepted, a product placed on the market, a security issued, a filing made. Such an event is defined by a legal operation and is, in the ordinary case, one the acting party performs deliberately and records for its own purposes. A capability transformation marks a change in what the material makes possible. It may be performed without any legal operation occurring, it is frequently not recorded, and it may be performed by a party who has no relation, legal or otherwise, with any party affected by it.

Claim 6.6. (The extension proposed). The proposal of this paper is an extension of the class of legally consequential events to include transformations of capability, and not the introduction of event-attached duties into a body of law that lacked them. The extension is required because the transactional class does not intersect the transformations that matter here: an operationalisation, a scale-up, an automation and a safeguard removal may each occur without any transaction, and a transaction may occur with no change in capability at all.

One existing régime attaches duties to a transformation of knowledge in this sense, as §4 recorded, and its example is instructive in both directions. It demonstrates that a legal system can treat the making available of knowledge as the regulated occurrence. It also demonstrates the failure this framework is constructed to avoid, since its determinations run in part on the identity and the nationality of the receiving party, which is the form §7.3 excludes.

Part III. Duties Attaching to Events

7 The Requirement Set at a Consequential Event

This section states the duties that attach to the events defined in §6, and the form those duties take. Its objective is to establish that what a party may be required to do at a consequential transformation is to satisfy a set of requirements in force at the time, and that what may be assessed afterwards is compliance with that set and nothing beyond it. The section states the requirement set and its members; establishes why the assessable object is compliance and not contribution; states the conditions on the form such a requirement may take, which are the constraints that prevent a duty attaching to a class of acts from becoming a determination about a class of parties; and states what the arrangement owes in return to the party it binds. The requirements are stated at the level of form, and their content in any domain is a matter for the arrangement that adopts them.

7.1 The Requirement Set and Its Members

This subsection defines the requirement set attaching to a class of consequential events and states the five kinds of obligation composing it, none of which the framework claims as its own invention.

Definition 7.1. (Requirement set). For a class E of consequential events, the set $\Pi(E)$ of obligations in force upon a party performing an event of that class, each of which is satisfiable by the party at the time of performance and assessable afterwards by inspection of what the party did.

Compliance is written $E_i \models \Pi(E)$ for an event E_i of the class, and the notation is used in place of a further definition because the relation it names is the ordinary one: the party did or did not do what was required.

The members of a requirement set fall into five kinds, and the framework claims no novelty in any of them, since each is drawn from an existing régime named in §4.

The first is documentation: a record of the transformation performed, in the fields the schema requires, made at the time of performance. The second is a statement of what the transformation makes possible: what capability changed, for which class of parties, and by what margin. The third is an assessment of what the party knew: which risks were visible at the time, from what sources, and what the party concluded about them. The fourth is safeguard accounting: which restrictions, checks or limitations were present in the object as received, which remain, which were removed, and on what reasoning. The fifth is a statement of the terms of onward propagation: to whom the output is available, on what conditions, and with what provision for correction.

Claim 7.2. (The character of the members). Each member of a requirement set is satisfiable by an act the performing party is in a position to perform at the moment of the transformation, and each is assessable afterwards without reconstructing anything that occurred subsequently. The set therefore imposes no obligation whose discharge depends on knowledge the party does not have.

The claim states the discipline that governs the composition of any particular set. A requirement that the party establish that its transformation will not contribute to a distant harm would violate it, since the discharge would depend on the future. A requirement that the party state what its transformation makes possible, and what it knew, does not.

7.2 The Object of Assessment at an Event

This subsection states what may be determined at a consequential event and what may not, which is the framework's most important restriction. The restriction follows from Claim 3.3 and is not a matter of caution.

Claim 7.3. (Compliance as the object of assessment at an event). What may be assessed at a consequential event is whether the party satisfied the requirements in force there. A share of a distant outcome may not be assessed at an event, and the ground is Claim 3.3: near a boundary, apportionment by marginal contribution is order-dependent and loads the final contribution, which is the contribution that proportionality doctrine excludes, so the two

available rules give opposite answers in the same case.

Two consequences follow and are relied upon throughout Parts III to VI.

The first is that a duty of this kind is discharged at the moment it arises. A party who documented the transformation, stated what it made possible, recorded what it knew, accounted for the safeguards and stated the terms of onward propagation has done what was required, whatever occurs afterwards. That is what makes the duty satisfiable, and it is also what makes it acceptable to parties who would refuse an open-ended exposure.

The second is that the framework's event duties are not a route by which liability for a downstream harm is reached indirectly. An arrangement that treated a documentation failure as evidence of responsibility for a later outcome would have used the assessable object to obtain the unassessable one, and it would face the objection Claim 7.3 records. §19 states the relation between the two determinations and keeps them separate.

7.3 The Conditions on Admissible Form

This subsection states the four conditions that a requirement must satisfy if it is to remain a rule about acts, and identifies the failure each condition blocks. A duty attaching to a class of acts can be written so that it operates as a determination about a class of parties, and the difference between the two is the difference between a rule and a gate. Four conditions distinguish them, and the framework treats them as constraints on any requirement set it proposes.

Definition 7.4. (Admissible form of a requirement). A requirement is in admissible form where four conditions hold. It binds the process of the party performing the act, in place of conditioning that party's entitlement to perform it on an assessment of the party. It is stated in advance of the acts it governs, in terms a party can apply to its own conduct. It applies uniformly to every party performing an act of the class, with no distinction drawn by the identity, nationality, affiliation or standing of the performing party or of any recipient. And its application terminates in a determination, so that a party subject to it knows when it has been discharged.

The four conditions are not stipulations of taste. Each blocks a specific failure with a documented history.

The first blocks the conversion of a process requirement into a licensing régime. A requirement that a party document a transformation binds conduct; a requirement that a party be approved before transforming conditions the act on an assessment of the actor, and the assessment is then made by a body with an interest in the outcome and with no procedure by which a refused party may examine the finding.

The second blocks retrospective application, and it also secures the assessability of the first: a requirement stated in advance can be complied with, and a requirement discovered afterwards can only be breached.

The third is the constraint that most directly connects this paper to the companion. A determination that turns on who the receiving party is, or on which country the receiving party belongs to, is a readiness assessment of the kind the companion paper found defective: it is administered by an interested party, it filters on a property uncorrelated with the disposition it is supposed to detect, and it is insulated from the objection of the party it concerns.

The régime cited in §4 as the nearest existing ancestor of this framework is also the clearest demonstration of the failure, since its determinations run in part on the nationality of the recipient.

The fourth blocks the standing exposure. A requirement with no terminating point leaves a party permanently uncertain whether it has complied, which converts a documentation duty into a general liability under another name.

Claim 7.5. (The consequence of inadmissible form). A requirement failing the conditions of Definition 7.4 reinstates, at the level of an arrangement, the determination that the companion paper found defective at the level of a person; and it is the more consequential in that position, since a party subject to an arrangement cannot decline it as a party may decline an individual's judgement.

7.4 The Obligations of the Arrangement Imposing the Requirement

This subsection states the obligations that fall on the arrangement imposing a requirement set, in return for what the requirement asks of the parties bound by it. A framework requiring parties to record, state and account is asking for something, and what it accepts in return is what makes the requirement sustainable. Three are recorded here and are developed in Part V.

The arrangement owes publication of the schema and of the requirement sets, since a party cannot comply with a requirement it cannot read, and a requirement that is not public cannot be applied uniformly. It owes a route by which a party may contest an application of a requirement to its conduct without contesting the requirement, and a separate route by which the requirement itself may be contested. And it owes symmetry of use: a record made in compliance evidences the discharge of a duty as well as its breach, which is the point of Claim 6.3 and the reason the schema registers reductions in capability alongside increases.

Claim 7.6. (The reciprocity of the arrangement). A requirement set is sustainable in a commons only where the arrangement imposing it publishes the requirements, provides a route of contestation, and constructs the record so that compliance is evidenced by it. An arrangement supplying none of these has produced an instrument whose only use is adverse, and it will be complied with by the parties least in need of it.

The final clause states a coverage property that recurs throughout the paper and is examined in §16. A voluntary requirement reaches parties willing to be reached. That is a real limit and it is not a reason against the instrument, provided the limit is stated and the instrument is not credited with what it does not do.

8 The Assessment of Conduct at a Consequential Event

This section states how compliance at a consequential event is assessed and what the assessment establishes. Its objective is to supply a frame of four questions that can be answered from the event and its circumstances, to state what each question does and does not settle, and to fix the relation between this assessment and any later determination about a harmful outcome. The section sets out the four questions in turn; states the frame's boundary, which

is that it establishes conduct at an event and never causation of a consequence; and states how the frame applies to the second-order events of Definition 6.4, where the object of the transformation is the record itself.

8.1 The Questions Composing the Frame

This subsection sets out the four questions composing the assessment frame, each answerable from the event and the circumstances obtaining when it was performed, and states what each is for.

The first concerns control. Which party performed the transformation, and which party was in a position to perform it otherwise or to decline it. The question is answerable because an event has an actor, and it is the question that distinguishes a party who acted from a party who was affected by the act.

The second concerns visibility. Which risks associated with the transformation were visible to the performing party at the time, from what sources, and with what degree of specificity. The question is answered in the terms available then and not in the terms available afterwards, which is a discipline the record makes possible and memory does not.

The third concerns obligation. Which requirements were in force upon a party performing an event of that class at that time, under a schema published in advance. The question has a determinate answer wherever the conditions of Definition 7.4 are satisfied, and it has no determinate answer where they are not.

The fourth concerns alternatives. What alternative forms of the transformation were available to the party, at what cost, and with what difference in the capability conferred. The question is asked because a requirement to account for safeguards is empty where no alternative existed, and because the availability of a less consequential form is the fact that makes a choice a choice.

Claim 8.1. (The answerability of the frame). Each of the four questions is answerable from the event, its record, and the circumstances obtaining at the time of performance, and none requires reconstruction of what occurred afterwards. The frame is therefore applicable at the moment of the event, by the party performing it, and afterwards by a party examining the record, with the same materials available to both.

The symmetry recorded in the second sentence is a design property worth stating. A party can put the four questions to itself before acting, and the answers it records are the answers by which its conduct is later assessed. An assessment frame with this property gives a party notice of the standard it will be held to, which the conditions of Definition 7.4 require and which an outcome-based standard cannot provide.

8.2 The Boundary of the Frame

This subsection states the boundary of the assessment frame, which establishes something narrower than the four questions may appear to establish. The narrowness is deliberate and is what keeps the frame separate from any determination about a consequence.

Claim 8.2. (What the frame establishes). An affirmative answer to the four questions establishes that a party performed a transformation of a specified class, was in a position to

perform it otherwise, had specified risks visible to it, was subject to specified requirements, and had specified alternatives available. It establishes nothing about whether that transformation caused, contributed to, or was necessary for any subsequent outcome.

The gap between the two is not closed by any accumulation of event records, and §14 states the general form of the point. A record of transformations exhibits which party did what and when, which is a relation of reachability among recorded acts. Causation is a further matter requiring a causal standard and a normative rule, and the framework's position is that improved visibility of the first supplies no purchase on the second. The consequence for practice is that an assessment under this frame is complete in itself and yields a determination about conduct, and that a party wishing to reach a determination about a consequence must satisfy the requirements stated in §19 separately.

8.3 The Frame Applied to Records

This subsection applies the assessment frame to second-order events, whose object is the record itself, and states the one modification the application requires. Definition 6.4 identified that class.

For a first-order event, an absent record is a failure of a requirement in force at the event. For a second-order event, an absent record is the subject matter itself, and the assessment cannot proceed from the record, since the record is what is at issue. The questions are therefore answered from other sources: the state of the record before and after, the party holding the facility in which it was kept, and the schema in force at the time.

Claim 8.3. (The asymmetry of second-order events). A defect in a record of events is assessable only from materials outside the record, so the arrangement's capacity to assess second-order events depends on properties it must possess independently: retention of prior states, identification of the party controlling the facility, and publication of the schema in force at each time. An arrangement lacking these can record first-order events and cannot establish anything about the integrity of its own record.

The claim states a design requirement, and it also states the reason the schema question of §15 is treated as it is there. An arrangement whose schema may be altered without a record of the alteration has a defect of the second order that no volume of first-order records repairs.

9 Proportionate Requirement Sets and the Cost They Impose

This section states the cost that the duties of §7 impose and the discipline by which that cost is kept proportionate. Its objective is to establish that every requirement added to a commons reduces participation in it, that the reduction falls unevenly, and that the framework is therefore under an obligation to state how requirement sets are graded and bounded. The section states the cost and its incidence; states the tension between reducing harmful transformation and preserving the propagation the arrangement exists to support; sets out the grading of requirement sets by the consequence of the event class; and states the constraint that grading must never be conducted by the standing of the party.

9.1 The Cost and Its Incidence

This subsection states the cost a requirement set imposes and how that cost falls across the parties in a commons, since the incidence is a route by which the framework can defeat itself. A requirement set is a fixed cost attaching to each event of its class. Documentation takes time; a statement of what a transformation makes possible takes judgement and exposes the party to disagreement; safeguard accounting requires that the party examine what it received closely enough to say what was in it.

Claim 9.1. (The incidence of a fixed requirement cost). A cost attaching to each event of a class falls more heavily, in proportion to capacity, on parties with less of it. A requirement set imposed uniformly across a commons therefore selects against individual contributors, small groups and parties without administrative support, and in favour of parties for whom compliance is a marginal addition to functions they already perform.

The claim is uncomfortable for the framework and is stated for that reason. An instrument justified by the protection of a commons, whose incidence is to concentrate participation among the parties best equipped to bear administrative cost, has produced a concentration of the kind Claim 5.6 identifies as the condition under which the setters of terms become the parties the terms were to bind. The incidence is therefore not merely an equity concern; it is a route by which the framework can defeat itself.

9.2 The Tension Between Containment and Propagation

This subsection states the general tension of which the incidence recorded in Claim 9.1 is the local form, and identifies the two arguments the tension bars, one available to an arrangement and one to a party objecting to it.

Claim 9.2. (The tension between containment and propagation). Each requirement that reduces the incidence of harmful transformation also reduces the incidence of transformation generally, including transformations the arrangement exists to support. The two effects are produced by the same mechanism, since a requirement operates by making an act costlier, and no requirement distinguishes in advance between the transformations it should deter and those it should not.

The claim bars a particular kind of argument and it is worth saying which. An arrangement may not defend a requirement by observing that it reduces harmful transformation without also stating what it costs in transformation generally, since the first effect is evidence of the second. The defence must therefore be comparative, and the material for a comparison is the consequence of the event class, which is what the next subsection uses.

The claim also bars a second argument, running the other way. A party objecting to a requirement may not rely on the observation that it will reduce participation, since every requirement will, and the objection is available against all of them equally. What such an objection must state is that the reduction is disproportionate to the consequence of the class, which is a comparison and not an observation.

9.3 The Grading of Requirement Sets

This subsection sets out the grading by which requirement sets are matched to the consequence of the events they govern. Three grades are sufficient for the purposes of this framework, and they are distinguished by whether a statement and a review are required in addition to a record.

At the first grade the requirement is a record and nothing further. The event is registered in the schema's fields, and no assessment, statement or review is required. This grade is appropriate for transformations whose consequence is small and whose evidentiary value lies in the sequence they compose in place of any one of them.

At the second grade the requirement is a record together with a statement: what the transformation makes possible, for which class of parties, what risks were visible, and what safeguards remain. No party other than the performing party is involved, and the statement is made at the time of performance.

At the third grade the requirement is a record, a statement, and a review by a party other than the performing party, conducted against criteria published in advance, within a stated period, and terminating whether or not the review has been completed. This grade is appropriate to the classes at which capability increases most sharply for the widest new population, and §18 states the constraints on what a review may produce.

Claim 9.3. (The principle of grading). The grade of a requirement set is fixed by the consequence of the class of events to which it attaches, assessed in advance and published as part of the schema, and by nothing else. In particular it is not fixed by the standing, resources, affiliation or history of the party performing the event, which would convert a requirement in admissible form under Definition 7.4 into a determination about parties.

The constraint has a cost that should be stated alongside it. Grading by class alone means that the same requirement attaches to a well resourced party and to an individual contributor performing the same transformation, which is the incidence recorded in Claim 9.1. The framework accepts that cost, and the reason is that the alternative, grading by the capacity or standing of the party, is the one adjustment that would defeat the third condition of Definition 7.4. Where an arrangement wishes to relieve the incidence, the admissible route is to reduce the cost of compliance for everyone, through tooling, defaults and shared facilities, which is a matter of conditions and is treated in §13.

9.4 The Bounding of the Class

This subsection states the discipline that bounds the extent of the framework's demands over time, since a schema of governed classes tends to grow once the means of recording exist.

Claim 9.4. (The bounding of the governed class). The classes of Definition 6.1 exclude the ordinary operations of a commons, and the exclusion is a component of the framework and not an omission from it. An arrangement extending its requirement sets to revision, criticism, replication, translation or citation has abandoned the criterion of Definition 6.1 and has begun to govern participation as such.

The claim supplies a test an arrangement may apply to its own schema over time, and the

test is worth stating because schemas grow. Each proposed addition to the governed classes is to be justified by the criterion of consequence and not by the availability of a record, since the availability of a record makes an addition easy and says nothing about whether it is warranted. §15 places this among the matters on which the revising party is to be someone other than the parties governed, and §20 treats the removal of classes as a duty of the same standing as their addition.

Part IV. Duties Attaching to Relational Structure

10 Amplification, Damping, and the Duties Attaching to Them

This section states the duties that attach to the second of the three objects. Its objective is to establish that the relational structure of a commons determines whether an event has consequences at all, that this property is governable, and that the instruments available for governing it differ in form from those of Part III. The section states the property at issue and the two directions in which it operates; states why a duty over that property cannot take the form of a duty over an act; sets out the form such a duty does take, which is a duty to maintain a capacity in place of a duty to achieve a result; states the measurement problem that attends any such duty and the exposure that follows from solving it; and states what the arrangement may require of the parties positioned to alter the structure. The account is confined to what an arrangement may require, and the question of what a party may be made to pay is excluded throughout for the reason given in §12.

10.1 The Property at Issue and the Directions in Which It Operates

An output released into a commons has consequences that depend on the structure into which it is released. Where parties are positioned to implement, package, deploy and recombine it, and are inclined to do so, the release is followed by further transformations, each of which may increase the capability associated with the material. Where no party is so positioned, the same release produces nothing further. And where a party is positioned to examine, correct, restrict or supersede the release, the structure produces a correction.

The property has therefore two directions, and a framework attending to only one of them is defective in a way worth stating. Amplification is the propagation of a release into a sequence of further transformations of increasing consequence. Damping is the absorption of a release by a structure containing parties able to correct it, to supply the context it lacked, to withhold the resources its next transformation would require, or to publish a limitation before it propagates.

Claim 10.1. (The dependence of consequence upon structure). Whether an event has consequences, and of what magnitude, is a property of the structure into which its output is released and is not a property of the event. Two identical transformations performed by two parties into differently configured structures therefore differ in consequence without differing in any respect the party performing them controls.

Claim 10.1 has an implication for Part III that should be recorded here, since it bounds

what event duties can achieve. A requirement set is satisfiable by a party at the moment of a transformation because it asks about what the party did and knew. It cannot ask about the structure, since the party does not observe it and could not alter it if it did. The framework's event duties are therefore, by construction, blind to the property that determines whether the events they govern matter, and the gap is what Part IV exists to fill.

10.2 The Unavailability of an Act-Shaped Duty

A duty over relational structure cannot take the form the duties of Part III take, and three properties of the object are jointly responsible.

The structure belongs to no party. It is constituted by the positions and couplings of many participants, none of whom holds it, and a duty addressed to a participant to alter it would require of that participant something outside its power. The structure has no occasion. It changes continuously and by increments, so there is no moment at which a duty concerning it arises and no moment at which compliance could be assessed. And the structure's state is visible only in aggregate over a period, so a party observing its own position observes nothing about it, and rising variability near a boundary makes each local observation less informative in exactly the conditions that matter most.

Claim 10.2. (The form a structural duty must take). A duty over relational structure cannot be a duty to perform or refrain from an act, since the object belongs to no party, has no occasion, and is unobservable from any single position. It can be a duty upon a party that holds a position within the structure sufficient to affect its transmission characteristics, and it must be continuing in form, assessed over a period, and discharged by the maintenance of a capacity in place of the achievement of a result.

The claim follows from Claim 3.4 and is the point at which the projection result does its work in this Part. A continuing supervisory response can hold an object that has no date and no terminating node; a terminal adjudicative response cannot. An arrangement that stated a structural duty and then enforced it by a terminal determination about a particular party would have reimported the requirements that made the object ungovernable, and it would produce the vacancy Claim 3.2 describes.

10.3 The Content of a Capacity Duty

This subsection states what a duty of the form Claim 10.2 identifies actually requires, since a duty to maintain a capacity is empty until the capacity is named.

Three capacities are available, and each is held by a party whose position makes it available.

The first is the capacity to observe. A party holding a longitudinal record of transformations across a commons, which in practice means a platform, a repository, a registry or a funder, is the only kind of party positioned to see the aggregate properties of Claim 10.1 at all. A duty to maintain that capacity requires the retention of the record, the retention of the ability to read it across time, and the retention of whatever comparability makes a trend distinguishable from a change of practice.

The second is the capacity to interpose. A party through which a substantial share of

transformations of a class passes is positioned to attach a requirement, to supply a missing context, to publish a limitation, or to decline to carry a particular transformation, and each of these damps. A duty to maintain that capacity requires that the party not divest itself of the means of interposition while retaining the position that made it consequential.

The third is the capacity to absorb. A commons in which correction is possible has parties able to examine, replicate, contradict and supersede, and the availability of those parties is what converts an erroneous or dangerous release into a corrected one. That capacity is degraded by concentration, by the withdrawal of independent replication, and by conditions that make correction costlier than the original release. A duty to maintain it falls on the parties whose decisions determine those conditions.

Claim 10.3. (The content of a capacity duty). A duty attaching to relational structure requires of a party holding a relevant position that it maintain its capacity to observe the aggregate state, its capacity to interpose upon transformations passing through it, or its capacity to sustain the correction of what has propagated, according to which of these its position affords. The duty is discharged by the maintenance of the capacity and is breached by its divestment, and neither assessment requires any finding about a particular downstream outcome.

The last clause is what makes the duty compatible with Claim 3.3. Whether a party retained a longitudinal record, retained the means to attach a requirement, or continued to support independent replication is establishable without apportioning any outcome to anybody.

10.4 The Measurement Problem and the Exposure It Creates

This subsection states the difficulty that attends every duty of the kind Claim 10.3 states, and the reason the framework declines to solve it by the obvious method.

A capacity is not directly observable, so a duty over it is administered through a proxy: a retention period, a count of independent implementations, a measure of the share of transformations passing through a single party, a rate of correction. Each such proxy is a quantity, and a quantity used to administer a duty becomes a quantity the parties subject to the duty have reason to produce.

Claim 10.4. (The exposure of any capacity duty to its own proxy). A duty to maintain a capacity is administrable only through a measured proxy, and a measured proxy administering a duty ceases to measure what it was chosen for. Capacity duties are therefore attainable only in a form exposed to this defect, and an arrangement claiming otherwise has concealed the exposure in place of removing it.

The framework accepts the claim and states two disciplines in place of a solution. A proxy should be published together with the reasoning that selected it, so that a party may contest the proxy's fitness separately from its own compliance. And the proxy should be revised on a stated occasion, on the ground that a proxy which has been in force long enough to be optimised against has stopped performing the function for which it was adopted, and §20 states that revision as a duty of the arrangement.

An honest statement of the limit belongs here. Nothing in this section makes relational structure as tractable as an event. What it establishes is that the property determining whether

events matter is governable in one form, that the form is continuing and supervisory, that its content is the maintenance of named capacities by parties whose positions afford them, and that the resulting duties are exposed to a defect the framework can discipline and cannot remove.

11 Coupling and Convergence Among Independent Parties

This section treats a configuration that the duties of Part III cannot reach and that the capacity duties of §10 address only in part. Its objective is to establish that a harmful capability may be assembled from contributions that no party coordinated, that each of the contributing transformations may be unremarkable under any requirement set, and that what an arrangement can require in such a case differs from what it can require of a party that performed a consequential transformation knowingly. The section states the configuration; states why the assessment frame of §8 returns nothing in it; distinguishes it from the configurations that existing doctrine does reach; and states the two instruments that remain available, which are addressed to the party through which the convergence occurs and to the conditions that made it available.

11.1 The Configuration

Several parties, acting independently, without agreement and without knowledge of one another, may each release a transformation that is unremarkable in itself, and the combination of those releases may constitute a capability that none of them released. A method published by one party, an implementation contributed by another for an unrelated purpose, a dataset assembled by a third, and an integration performed by a fourth may compose into something that no single contribution approaches.

Three features of this configuration matter for governance. The composition may be performed by a party who did not produce any of the components, and who may have performed only an integration that was trivial in itself. The composition may also occur without any party performing it, where a system assembles available components automatically or where a subsequent party finds the components already assembled by the conditions of a platform. And the assembled capability may be recognisable as consequential only after assembly, so that at each contributing event there was nothing to record.

Claim 11.1. (The unavailability of the assessment frame under convergence). Where a capability is composed of contributions released independently, the assessment frame of §8 returns nothing at any contributing event. Each contributing party controlled its own transformation and no other; the risk attending the assembly was not visible in the terms available at any single contribution; the requirement set in force at each event was satisfied by what the party did; and the alternative of withholding was, at each event, disproportionate to what that event made possible.

The claim states a limit of Part III plainly. A framework of event duties is a framework about what a party knew and did at a transformation it performed. Convergence is precisely the case in which the consequential object was produced by no transformation any party per-

formed.

11.2 The Distinction from the Configurations Doctrine Reaches

This subsection distinguishes convergence from three configurations that existing law does reach, since the distinctions identify what is genuinely absent.

Concerted action is reached by the doctrines addressed to agreement and common design, and convergence differs in the element those doctrines require, since the parties neither agreed nor knew of one another. Aggregation of like contributions is reached, in some jurisdictions and for some subject matter, by rules that substitute contribution to a risk for causation of a harm; convergence differs because the contributions are not of like kind and do not aggregate along a single dimension. And successive transformation along a line is reached by the doctrines addressed to intervening acts, which test one link at a time; convergence differs because the contributions lie on separate lines that meet, and the doctrines that test a single link supply no operation for a meeting.

Claim 11.2. (The absent operation). Legal causal doctrine possesses tests for the interruption of a line of transmission and no operation for the merging of two. Convergence is therefore not a hard case within an existing doctrinal category; it is a configuration for which the category lacks a corresponding operation, which is why additional evidence does not improve the position.

11.3 The Instruments That Remain

Two instruments remain available, and neither is addressed to the contributing parties.

The first is addressed to the party through which the convergence occurs. A platform, repository, registry or integration facility through which components are assembled occupies the position that Claim 10.3 identifies as affording a capacity to interpose. Where a facility composes components automatically, or presents them as composable, or supplies the means by which composition is performed, that facility is the only party positioned to observe the composition at all. What may be required of it is what may be required of any party holding such a position: that it maintain the capacity to observe what is assembled through it, that it retain the means of interposition, and that it record compositions of classes stated in advance. What may not be required of it is that it establish the consequences of what it assembled, for the reason given in Claim 7.3.

The second is addressed to the conditions. Where a convergence has occurred, the compositability that made it available was a property of the conditions: interfaces that made the components fit, defaults that made assembly the path of least resistance, and the absence of any requirement that a composition be recorded. Those conditions are set by identifiable parties and are alterable by decision, and Part V treats them as the framework's principal instrument for exactly this reason.

Claim 11.3. (The relocation of the governable object under convergence). Where a capability is composed from independent contributions, the governable objects are the position through which the composition occurred and the conditions that made it available, and not the contributing transformations. An arrangement that responds to a convergence by extend-

ing duties backward over the contributing parties has selected the one set of objects that its instruments cannot reach, and it will impose the cost of Claim 9.1 without obtaining anything.

11.4 The Consequence for the Framework's Own Claims

This subsection states what the section concedes, since a section identifying a limit should say how large the limit is.

The framework does not close the convergence case. What it does is locate the case correctly, which has three consequences that are worth having. It identifies the party who can be required to observe, which is the party through whom the assembly ran and not the parties who supplied the components. It identifies the conditions that made the assembly available, which are alterable prospectively even though the assembly is not undoable. And it removes a temptation whose cost is high, since the natural response to a convergence is to reach back along the lines of contribution, and Claim 11.3 states why that response fails.

Two residues remain and are recorded for §21. Where a convergence occurs across facilities, no party holds the position Claim 11.3 identifies, and neither instrument is available. And where the composition was performed by no party at all, the assessment frame has no addressee even at the composing position, so what remains is a duty over conditions and nothing else.

12 The Boundary Between Supervision and Adjudication

This section states the boundary that governs the whole of Part IV and constrains Parts V and VI. Its objective is to establish which determinations may be made about which objects, and to prevent the framework from converting a supervisory instrument into a liability rule by a route that its own results forbid. The section states the two kinds of response and what each requires; states the boundary and the ground of it; states the three ways the boundary is crossed in practice and what each produces; and states the one direction in which the objects may legitimately be connected, which is the direction Part VI uses. The section is the framework's principal internal constraint and its conclusions apply to the framework's own proposals before they apply to anything else.

12.1 The Adjudicative and the Supervisory Response

An adjudicative response determines the position of a particular party in respect of a particular matter and closes. It requires an addressee, a matter with boundaries, a moment at which the position is fixed, and a finding that terminates. What it can hold is therefore constrained: the matter must have a date, the contribution must be apportionable, and the chain must terminate, which are the requirements recorded in §3.

A supervisory response maintains a continuing relation with a party or a system, sets requirements that apply over a period, observes, and revises what it requires as conditions change. It requires none of the four. It has no need of a terminating finding, since it does not close; no need of a datable matter, since it addresses a state; and no need of apportionment, since it assigns no share of anything.

Claim 12.1. (The boundary). Objects possessing a date, an addressee and boundaries admit adjudicative responses. Objects whose state is constituted over a period, belongs to no party, and is observable only in aggregate admit supervisory responses only. Events fall on the first side of the boundary and relational structure falls on the second, and the boundary is a consequence of what each response requires and not a choice about how strictly to govern.

Two corollaries constrain what follows. Nothing established by a supervisory instrument about a structure supports a determination about a party's position in respect of an outcome. And nothing established adjudicatively about a party's conduct at an event establishes anything about the structure, since an event does not exhibit the structure into which its output was released.

12.2 The Crossings of the Boundary and Their Characteristic Failures

This subsection sets out the ways the boundary is crossed in practice, since each is attempted, each is intelligible, and each fails in a manner that can be stated in advance.

The first crossing enforces a structural duty by a terminal determination against a particular party. An arrangement finding that a commons has become dangerously concentrated, and responding by a finding against one participant for that state, has required of that participant something outside its power and has produced a finding about an object with no date. The result is the vacancy of Claim 3.2 with an addressee attached, which is worse than the vacancy alone, since it has the appearance of a resolution.

The second crossing uses an event determination to obtain a structural conclusion. An arrangement that treats a party's compliance record as evidence of the state of the commons has inferred an aggregate property from local observations, which §10 established to be unavailable, and it has done so using a record produced by the parties whose participation is voluntary.

The third crossing uses a structural finding to establish a party's responsibility for an outcome. An arrangement that finds a structure to have been in a dangerous state, and treats that finding as establishing that a party which contributed to the structure is answerable for what the structure produced, has performed the apportionment that Claim 3.3 shows to be order-dependent, and has performed it with a quantity that has no natural unit.

Claim 12.2. (The characteristic failure of each crossing). Enforcing a structural duty adjudicatively produces a determination about an object with no date; inferring structure from event records infers an aggregate property from local observations produced by self-selected parties; and deriving responsibility for an outcome from a structural finding performs an apportionment that is order-dependent and dimensionally undefined. Each crossing therefore fails for a reason internal to the objects, and no improvement in evidence removes any of the three.

12.3 The Permitted Connection

This subsection states the one direction in which the two objects may be connected, since a framework that forbade every connection would have produced two governance systems with no relation between them.

What supervision establishes about a structure may inform what an arrangement requires of parties at events. A finding that a commons has become concentrated, that correction has become rare, or that a class of transformation is propagating faster than the capacity to examine it, is a reason to alter the requirement sets attaching to that class of event, to alter the threshold at which the class is triggered, or to alter the conditions under which the transformations occur. The connection runs from the structural finding to the prospective requirement, and it never runs from the structural finding to a determination about a party's past conduct.

Claim 12.3. (The admissible use of a structural finding). A finding about relational structure is admissible as a ground for altering, prospectively, the requirements attaching to a class of events, the threshold at which the class is triggered, and the conditions under which transformations of the class occur. It is inadmissible as a ground for a determination about any party's position in respect of any outcome.

The claim identifies the mechanism by which the two Parts of this framework are joined, and it locates that mechanism in Part VII in place of a proceeding: the supervisory instruments observe, the observations enter the revision of the requirement sets and the conditions, and the revised requirements bind prospectively at events. That circuit is the framework's substitute for the inference the boundary forbids, and its adequacy is one of the open questions recorded in §22.

12.4 The Constraint Applied to the Framework's Own Proposals

This subsection applies the boundary to the instruments proposed in this paper, since a framework stating a constraint should show its own compliance with it.

The capacity duties of Claim 10.3 are discharged by the maintenance of a capacity and breached by its divestment, and both are establishable without any finding about a downstream outcome, which keeps them on the supervisory side while leaving them assessable. The instruments of §11 require observation, retention and recording of a facility, and require nothing about what the facility's assemblies produced. The requirement sets of Part III are adjudicable and are confined to compliance by Claim 7.3. And the backstop of §19 is adjudicative and is confined to conduct with the properties adjudication requires, which §19 states.

One exposure remains and is recorded here in place of the closing section, since it belongs to this argument. A capacity duty administered through a proxy, per Claim 10.4, produces a documented failure to maintain a proxy value, and such a document is exactly the material from which a party seeking a determination about an outcome would construct one. The framework's boundary is therefore maintained by the arrangement's own discipline and not by the unavailability of the material, and an arrangement that publishes proxy compliance should expect the material to be used in proceedings it does not control.

Part V. The Governance of Conditions

13 Conditions and the Instruments That Act upon Them

This section opens the treatment of the third governed object. Its objective is to establish what an arrangement can achieve by altering conditions that it cannot achieve by attaching duties to events or by supervising structure, and to state the constraints under which that power should be exercised. The section states the properties that give conditions their reach; sets out the four kinds of condition an arrangement in a commons is in a position to set; states the two advantages conditions hold over the instruments of Parts III and IV; states the corresponding deficit, which is that a condition operates without an occasion and is therefore contestable by nobody; and states the constraints that follow. The instruments described are those available to a platform, a repository, a funder, a standard-setting body or a community, and the section takes no position on which of these should hold which.

13.1 The Properties That Give Conditions Their Reach

A condition, in the sense of Definition 5.3, holds for a population without reference to any particular act. Three properties follow, and together they account for both the power of the instrument and the caution the framework attaches to it.

A condition operates prospectively and universally within its domain. An alteration to a default licence, a required field in a schema, an interface that makes one operation available and another costly, or a term attached to the use of a facility applies to every subsequent act of the relevant class by every party, with no determination about any of them and no occasion on which any party is addressed.

A condition operates by altering the cost and the availability of acts in place of their permissibility. It does not forbid, and a party willing to bear the cost may proceed. This is what makes a condition compatible with a commons in a way a prohibition is not, and it is also what makes its effects difficult to attribute, since nothing was refused to anyone.

A condition is set by an identifiable party and is alterable by that party's decision. Unlike relational structure, which belongs to no one, conditions have holders, and the holders are ordinarily few.

Claim 13.1. (The reach of a condition). An alteration of conditions binds a population prospectively, without an occasion, without a determination about any party, and without any party being addressed. It is therefore the instrument of widest reach available to an arrangement in a commons, and the instrument whose exercise leaves the least trace.

13.2 The Kinds of Condition Available

This subsection sets out the four kinds of condition that an arrangement in a knowledge commons is ordinarily in a position to set, since the instrument is otherwise abstract.

The first is the default terms on which material is made available: which licence is offered first, what the licence permits by way of derivation, what attribution and marking it requires, and what it requires of a party who transmits onward. The companion paper treats these terms as the instrument by which the transmitter's own obligations are discharged; here they

appear as conditions, since a default set by a facility fixes the terms for everyone who deposits there without any of them deciding.

The second is the recording schema: which fields exist, which are required, which classes of transformation the schema recognises, and what is retained and for how long. A schema determines what can subsequently be established about anything, and §15 treats it separately for that reason.

The third is the arrangement of the facility itself: which operations are available, which are one step and which are many, what is presented first, what is composable with what, and what is retained by default when a party does nothing. These determine the distribution of acts within a commons more directly than any requirement, since most parties do what the facility makes easy.

The fourth is the allocation of resources: what is funded, what is required as a condition of funding, what is maintained, and which capacities are supported. The capacity to absorb identified in Claim 10.3 is in practice sustained or degraded here, since independent replication and correction are activities somebody must be in a position to conduct.

13.3 The Advantages of Acting on Conditions

Two advantages are worth stating explicitly, since they are the reason the framework prefers this instrument wherever it will serve.

The first concerns the interested-party problem. An event duty is administered by an arrangement making determinations about parties, and a supervisory instrument is administered by an arrangement observing parties. Both raise the question of who administers and with what interest. An alteration of conditions makes no determination about anyone, so the failure that Part III's admissible-form conditions are constructed to prevent does not arise at all in respect of any individual case.

The second concerns cost. Claim 9.1 established that a requirement imposes a fixed cost per event and that the cost falls hardest on parties with the least capacity. A condition frequently costs a party nothing, since it operates by determining what is easy, and the relief available for the incidence problem is accordingly located here: the way to reduce the burden of a requirement across a whole commons is to alter the conditions under which compliance is performed, through tooling, defaults and shared facilities.

Claim 13.2. (The preference for conditions where they will serve). Where an objective is attainable by altering conditions and by attaching duties to events, the alteration of conditions is preferable, since it makes no determination about any party, raises no question about who administers a determination, and imposes its cost on the facility in place of on each participant.

The claim is stated as a preference and not as a rule, since the two instruments do different things. A condition cannot require a party to state what it knew, and no arrangement of defaults produces the record on which §8 depends.

13.4 The Deficit and the Constraints That Follow

This subsection states the corresponding disadvantage and the constraints the framework attaches to it, which are the price of the reach recorded in Claim 13.1.

A condition operates without an occasion. No party is addressed, no determination is made, and nothing is refused, so no party has a proceeding in which to appear and nothing generates a record of the instrument's operation. The parties affected may be unaware that a decision was taken at all, and where they are aware, the ordinary responses available against a determination are unavailable against a default.

Claim 13.3. (The contestability deficit of a condition). A condition affects a population and addresses nobody, so the parties affected by it have no occasion on which to contest it and no proceeding in which to appear. The instrument of widest reach is therefore the instrument of least contestability, and the two properties have a single source.

Three constraints follow, and the framework treats them as binding on its own proposals.

A condition should be published as a decision, with its date, its holder, and the reasoning that selected it, so that a party may address the decision even though the decision did not address the party. A condition should be revisable on a stated occasion, and §20 states that occasion as a duty of the arrangement. And a condition should be examined for the population it selects, since the party that alters a default has determined what most parties will do and has done so without any of them being consulted.

The third constraint has a particular application worth stating. Where an arrangement holds both the conditions and the requirement sets, it is in a position to relieve a requirement's cost through the conditions and equally in a position to compound it. An arrangement adding a requirement and simultaneously altering a facility so that compliance is one step has done something different from an arrangement that adds the requirement alone, and the difference falls entirely on the parties Claim 9.1 identifies.

14 The Event Ledger and the Scope of Its Evidence

This section examines the infrastructure on which the requirement sets of Part III depend. Its objective is to state what a record of consequential transformations makes available to a governing arrangement, and to fix what it does not, since the framework's usefulness and its principal danger both lie here. The section describes the record and the fields a governance record requires beyond those a version-control system keeps; states the four uses to which such a record may be put; states the inference the record does not license, which is the inference from a recorded topology to a causal account; distinguishes recording from monitoring and states why the two should be separated; and states what the record establishes about the party who keeps it. The two limits arising from the schema and from the population reached are treated separately in §15 and §16.

14.1 The Record and Its Fields

A record of the kind required is a sequence of entries, each describing one event in the sense of Definition 5.1, appended as the event occurs and retained thereafter. §4 recorded that infrastructures of this form are in production use for the provenance of digital objects, for content authenticity, for software supply-chain integrity and for source control, so the question here is what a governance record requires beyond them.

Four kinds of field are additional. A statement of what the transformation makes possible, which is the second member of the requirement set of Definition 7.1, and which no existing system records because none of them is concerned with capability. A statement of what was known at the time, with its sources, which converts the record from a history of acts into a history of what was visible when each act was performed. A safeguard account, stating what restrictions were present in the input and which remain in the output. And the terms of onward propagation, which fix what the next party receives and on what conditions.

The record's most useful property follows from its being appended in place of amended. A correction adds an entry and does not remove one, so the record retains the superseded state alongside the correction, and a party's discharge of a duty by correcting an earlier release is evidenced by the same mechanism that evidences the release.

14.2 The Uses of the Record

Four uses are available, and stating them separately keeps the fifth, which is unavailable, distinguishable from them.

The record establishes what was done, by whom, and when, for the events it contains. It establishes what was visible at the time of an event, since a risk recorded at one entry is visible to every party who subsequently received the object through that record. It establishes whether the requirements in force were satisfied at a particular event, which is the object of assessment fixed by Claim 7.3. And it exhibits the shape of propagation across a commons: how a class of transformation branches, where it merges, how quickly it moves from one class to another, and whether the parties performing a class are becoming fewer.

The fourth use is the one that supports the supervisory instruments of Part IV, and it should be marked as differing in kind from the first three. The first three concern particular events and support determinations about parties. The fourth concerns aggregate properties and supports no determination about any party, by Claim 12.1.

14.3 The Inference the Record Does Not License

This subsection states the framework's most important restriction on its own infrastructure, since the restriction is easy to state and hard to observe in practice.

A record of transformations exhibits which objects descended from which, which parties performed which operations, in what order, and with what stated knowledge. It thereby exhibits reachability: that one object lies in the ancestry of another, and that a party's act preceded another party's act.

Claim 14.1. (Reachability and causation). A record of transformations establishes that an object is reachable from an earlier object through a sequence of recorded operations. It does not establish that the earlier object or any operation upon it caused any subsequent outcome. The recorded relation is topological and the required relation is causal, and no increase in the completeness of the record converts the first into the second.

Three grounds support the claim and each has been established elsewhere in this paper. The outcome may depend on conjunctions of contributions on separate lines, for which no operation exists among the doctrines that test single links, per Claim 11.2. The unobserved

classes identified in Claim 2.4 are systematically unlikely to be recorded, so the record's completeness is bounded in a direction that does not improve with volume. And where a system has been brought near a boundary, the recorded trigger is by construction disproportionate to the outcome, per Claim 3.2.

The practical danger the claim addresses is specific and should be named. A record renders a history visible and orderly, and a visible orderly history is persuasive out of proportion to what it establishes. An arrangement holding such a record will be under pressure, particularly after a harmful outcome, to treat the most legible path through it as the explanation. The record's value lies in what it establishes about conduct at events, which is considerable, and the arrangement's discipline consists in declining to convert that into an account of an outcome.

14.4 Recording and Monitoring

This subsection distinguishes two operations that a single infrastructure makes available and that the framework separates deliberately.

Recording is the appending of an entry when an event occurs, and its subject is the event. Monitoring is the continuing observation of a party or a class, and its subject is whoever is observed. An infrastructure that records is capable of monitoring, and the two are separated here on two grounds.

The first is that they are governed differently. Recording is a requirement upon a party performing an act, and it falls within the admissible form of Definition 7.4, since it binds the process of the party performing the act, applies uniformly to the class, and terminates when the entry is made. Continuous observation of a party is a determination about that party, and it is a determination made by an arrangement with an interest in what it finds.

The second is that recording every event and observing every party have very different costs and produce very different arrangements. A commons in which every participant is under observation has acquired a property that no requirement set entails and that the framework does not propose.

Claim 14.2. (The separation of recording from monitoring). Recording attaches to events and is discharged when the entry is made; observation attaches to parties and continues. An arrangement should record by default across the classes its schema recognises, and should observe only classes of event stated in advance, on published criteria, and never parties. The two operations use one infrastructure and are subject to different constraints, and an arrangement that treats the availability of the first as authority for the second has made a determination it has not stated.

14.5 The Evidentiary Position of the Party Keeping the Record

This subsection states a use of the record that the framework relies on in Part VI and that is easily overlooked, since it runs against the party holding the infrastructure.

The party keeping the record occupies the position Claim 10.3 identifies as affording a capacity to observe, and the record is the instrument of that capacity. Whether the capacity was maintained is therefore establishable from the record's own properties: whether prior states

were retained, whether the schema in force at each time is recoverable, whether the classes recognised were revised, and whether entries were amended in place. Those are properties of the arrangement and not of any participant, and they are assessable by a party other than the keeper only where the keeper has published enough for the assessment to be conducted.

Claim 8.3 stated the general form of the point, that a defect in a record is assessable only from outside the record. The application here is that an arrangement operating a ledger has thereby made itself the subject of a duty, and that the discharge of that duty is not establishable from within the instrument by which it is discharged.

15 The Schema and the Party That Fixes It

This section treats the question the infrastructure of §14 leaves open, and which the framework regards as the most consequential of the design questions it raises. Its objective is to establish that the schema of recordable events is a governing instrument in its own right, that its selection is ordinarily made by parties whose conduct it records, and that the resulting defect is more consequential than the deletion or falsification it is easy to name. The section states what a schema determines; states the interested character of its selection; distinguishes selection from deletion and states why the first is the graver; states the conditions the framework places on a schema; and states what remains after those conditions are met. The conditions are the conditions of Definition 7.4 applied to the schema itself, on the ground that a schema is a rule in the sense that section defines.

15.1 The Determinations a Schema Makes

A schema fixes which classes of transformation are recognised, which fields are recorded for each, which are required, what is retained, and for how long. Four consequences follow, and they are consequences for everything downstream of the record.

A class of transformation absent from the schema produces no entry, so it cannot be the subject of a requirement, cannot be assessed under §8, and does not appear in the aggregate properties on which the supervisory instruments of Part IV rely. A field absent from the schema is unavailable afterwards, and unlike an unrecorded event it cannot be reconstructed even in principle, since the information existed only at the moment of the act. A retention period fixes the interval over which any trend is visible, and therefore fixes what can be established about a slow process. And the classes the schema recognises determine, through Claim 13.1, what most parties will attend to, since parties record what they are asked to record and consider what they record.

Claim 15.1. (The schema as a governing instrument). The schema of recordable events determines which transformations can be governed at all, which properties of a commons can be observed, and over what interval a trend can be established. It is therefore a governing instrument of the widest reach identified in Claim 13.1, and it operates before any requirement is stated, any observation is made, or any party is addressed.

15.2 The Interested Character of the Selection

This subsection states who ordinarily fixes a schema and what follows from it, and the observation is the one this section exists to make.

A schema is ordinarily fixed by the party operating the facility, which is also a party whose own conduct the schema records, whose commercial and institutional interests are affected by what is visible, and which is in most cases among the parties Claim 10.3 identifies as holding a position of consequence. The selection is made once, is rarely revisited, and is presented as a technical matter.

Claim 15.2. (The interested selection of the schema). Where the schema of recordable events is fixed by a party whose conduct the schema records, the determination of what can be established about that party is made by that party. The defect is of the same form as the defect the companion paper identifies in an assessment administered by the party a finding relieves: the evidence is held by the interested party, the criterion is applied by it, and no procedure exists by which another party may examine the selection.

The framework treats this as the principal structural danger in its own proposals, and the reason is worth stating. Every instrument in Parts III and IV depends on the record. If the schema is chosen by an interested party, then the requirement sets govern what that party was willing to have recorded, the supervisory instruments observe the aggregate of what that party admitted, and the assessment frame of §8 is applied to a selection made before any of it began.

15.3 Selection and Deletion

This subsection distinguishes two failures of a record and states why the framework regards the less visible of them as the graver.

Deletion and falsification of entries are second-order events in the sense of Definition 6.4. They are recognisable, they are assessable from outside the record where the conditions of Claim 8.3 are met, and they are ordinarily treated as the characteristic wrong of a provenance system.

Selection operates before any of that. A class of transformation the schema never recognised leaves no gap, since nothing is missing from a record that was never designed to hold it. No party deleted anything, no entry is inconsistent, and the record is complete on its own terms.

Claim 15.3. (The priority of selection over deletion). Deletion removes an entry from a record and leaves an absence that a well-constructed arrangement can detect. Selection determines that no entry was ever made, and leaves a record that is complete with respect to its own schema and silent about everything the schema excluded. Selection is therefore the graver failure, it is undetectable from within the record, and it requires no party to do anything wrong at the time of any event.

15.4 The Conditions Placed on a Schema

This subsection states the conditions the framework attaches to a schema, and they are the conditions of Definition 7.4 applied to an instrument the framework itself proposes.

A schema should be published in the form in force, with a record of the versions in force at earlier times, since an assessment of past conduct against a present schema is an assessment against a standard that did not exist.

A schema should be uniform across the parties subject to it, with no class of party recorded in less detail than another, since a schema that records some parties' transformations and not others' has made a determination about parties under the appearance of a technical decision.

A schema should be revised on stated occasions and by a party other than those whose conduct it principally records, which is the condition that responds to Claim 15.2 and the one hardest to satisfy in practice. Where an independent party is unavailable, the framework's fallback is procedural: a published proposal, a stated period in which parties may object, publication of the objections and of the response, and a record of what was declined.

And a schema should be assessable for what it excludes, which requires that the arrangement publish the classes it considered and did not adopt, together with the reasoning. Without that, Claim 15.3's failure is invisible by construction, since a reader of the record cannot see what the schema was designed not to hold.

Claim 15.4. (The conditions on an admissible schema). A schema is in admissible form where it is published with its version history, applies uniformly across the parties subject to it, is revised on stated occasions by a party other than those it principally records or under a published procedure in which objections are recorded, and publishes what it considered and excluded. The fourth condition is the one directed at Claim 15.3 and is the one existing infrastructures do not supply.

15.5 The Residue After the Conditions Are Met

This subsection states what survives after the conditions are met, since the section should not leave the impression that the conditions dissolve the problem.

An arrangement satisfying Claim 15.4 has made its selection visible and contestable, and it has not made the selection neutral. Some party still decides, the decision still determines what can be established about everything, and a party contesting the exclusion of a class must do so without the evidence that recording the class would have produced. The condition improves the position of a party who suspects an exclusion and does not equip that party to demonstrate it.

The framework's response to this residue is the revision duty of §20, and its adequacy is limited in a way that should be stated here. Revision addresses an exclusion once someone has noticed it. Nothing in the framework causes an exclusion to be noticed, and the classes most likely to remain unrecorded are those whose absence serves the party that fixed the schema.

16 Coverage and the Population an Arrangement Reaches

This section states the second limit on the infrastructure of §14 and, with it, the limit on the framework as a whole. Its objective is to establish which parties an arrangement of the kind proposed here actually reaches, to state honestly what follows for the parties it does not, and to identify what the instrument is worth once the limit is admitted. The section states the selection that participation performs; states the resulting composition of the recorded population; states the two uses that survive the limit; states the instruments that reach populations a voluntary arrangement does not; and closes with the position the framework takes on what remains uncovered. The section is written to prevent the arrangement from being credited with a coverage it does not have.

16.1 The Selection That Participation Performs

An arrangement of requirement sets, schemas and ledgers binds the parties that participate in the facility operating it. Participation is, in a commons, ordinarily voluntary, and where it is a condition of using a facility the party may use another facility or none.

Claim 16.1. (The composition of the reached population). The parties recorded by a voluntary arrangement are those willing to be recorded. That population is correlated with willingness to comply with the requirements the arrangement imposes, and it is therefore composed disproportionately of the parties whose conduct the arrangement was least needed to govern. A party intending misuse, a party wishing its transformations unobserved, and a party for whom the cost of compliance exceeds the value of the facility are each outside it.

The claim is the same structure as the limit the companion paper records for licence terms that restrict use, and its recurrence across two different instruments in two different papers suggests it is a property of voluntary instruments in general in place of a defect in any of them.

A second selection compounds the first and is worth stating separately. Claim 9.1 established that a fixed requirement cost falls hardest on parties with the least capacity. The parties excluded by cost are therefore individual contributors and small groups, while the parties excluded by intention are those the arrangement most wishes to reach. A voluntary arrangement thus loses population at both ends and retains the middle.

16.2 The Uses That Survive the Limit

This subsection states what the arrangement is worth once Claim 16.1 is admitted, since a limit of this size might be thought to defeat the instrument.

The first surviving use is evidentiary and runs in favour of the recorded party. A party that documented a transformation, stated what it made possible, recorded what it knew and accounted for the safeguards has, by that act, the material with which to show what it did and when. That material is worth having to a party acting in good faith, and its availability is what makes participation attractive independently of any sanction. Claim 7.6's requirement that the record evidence discharge as well as breach is what secures this use, and an arrangement that neglected it would lose the population it does reach.

The second surviving use is the detection of absence. Where a class of transformation is

recorded by most participants in a domain, the parties that perform such transformations and record nothing are visible as a class, and the absence of a record where one would be expected is itself assessable by Claim 8.3. This does not identify wrongdoing, and it identifies where the arrangement's instruments have no purchase, which is information an arrangement should have about itself.

Claim 16.2. (What a voluntary arrangement establishes). A voluntary recording arrangement establishes what participating parties did and knew, and establishes where its own coverage ends. It establishes nothing about the parties outside it, and an arrangement citing the state of its record as evidence about a commons has generalised from a population selected by willingness to be recorded.

16.3 The Instruments That Reach Further

This subsection states what is available where the coverage of a voluntary arrangement is insufficient, and states the cost of each, since the framework should not treat its own limit as the end of the matter.

Conditions reach further than requirements, and they do so without requiring participation in any recording arrangement. A default licence, an interface, the composability of components and the terms on which a facility may be used bind every party using the facility, including parties that record nothing. This is a further reason for the preference recorded in Claim 13.2, and it is the framework's principal answer to the coverage limit.

Compulsory arrangements reach parties that voluntary ones do not, at the cost of requiring an authority with jurisdiction, and §4 recorded that such authority over an open commons is available in no general form. Where it exists it is territorial, and propagation crosses territories, so a compulsory arrangement displaces activity at least as readily as it binds it.

And the ordinary law reaches conduct that is independently wrongful, without reference to any of this, which is the backstop §19 describes.

16.4 The Position on the Uncovered Residue

This subsection states the framework's position on the residue, since the honest answer is small and should be given plainly.

A party determined to transform, deploy and propagate without record, outside any facility that imposes conditions, and beyond the reach of an authority with jurisdiction, is not governed by anything in this paper. No arrangement of requirement sets, schemas, ledgers or conditions reaches such a party, and the framework should not be presented as though it did.

What follows from that is a statement about objectives in place of a remedy. The arrangement's objective cannot be the prevention of misuse, since the parties most likely to misuse are the parties least likely to be reached. Its objectives are what the instruments can deliver: that transformations conducted in the open be conducted with a record and with the requirements the class attracts; that the aggregate properties of the commons be observable to somebody; that the conditions under which transformation occurs be set deliberately in place of by default; and that where an outcome does occur, the material exists from which conduct

at particular events can be assessed. Each of those is worth having, and none of them is the prevention of misuse.

Part VI. Detection, Intervention, and the Backstop

17 Detection in the Approach to a Critical Transition

This section states what an arrangement can observe about a system approaching a transition, and what follows for the duties of the parties positioned to observe. Its objective is to establish that the approach to a boundary is detectable without knowledge of where the boundary lies, that the detection is available only to a party holding a longitudinal record, and that the duty which follows is a duty to read what has already occurred in place of a duty to foresee an outcome. The section states the epistemic problem and why foresight is the wrong requirement; states what is observable in the approach; states the distribution of that observability across positions; states the distinction between reading disturbances that occurred anyway and generating disturbances in order to measure; and states the duty that results. The section relies on results established in work cited in §3 and states the use made of them here.

17.1 The Unavailability of Foresight and the Requirement That Replaces It

A duty framed as a requirement to foresee an outcome is unsatisfiable in the system described in §2, and the reason is not that the parties are inattentive. The outcome depends on the conjunction of processes on separate lines, on conditions belonging to no party, and on a trigger whose magnitude is uninformative about the result. A party asked to foresee such an outcome is asked for something no position in the system affords.

The framework therefore replaces the requirement with one that is satisfiable, and the replacement is the substance of this section. What is required is that a party positioned to observe the aggregate state should read what its own record already contains. That requirement asks for no prediction, no model of the system, and no knowledge of where any boundary lies.

Claim 17.1. (The substitution of reading for foresight). A duty to foresee an outcome in a system of the kind described is unsatisfiable from any position within it. A duty to read the disturbances that have already occurred and are already recorded is satisfiable, is assessable by inspection of what the party did with material it held, and requires neither a model of the system nor knowledge of the location of any boundary.

17.2 The Indications Available in the Approach

This subsection states what a longitudinal record exhibits as a system approaches a transition, since the substitution of Claim 17.1 is empty unless something is there to be read.

A system approaching a boundary of its own stability exhibits changes in how it responds to disturbances, and those changes are visible in the record of disturbances and responses without any knowledge of the boundary. Recovery from a disturbance takes longer as the boundary is approached (Scheffer et al. 2009). The variability of the system's responses increases. And responses to disturbances of a given kind become more alike, since the system's

behaviour is increasingly dominated by the mode that is losing stability.

Three properties of these indications matter for governance. They are properties of the response and not of the disturbance, so they are readable from events that occurred for their own reasons. They require a series and are invisible in any single observation. And they indicate the approach without indicating the distance, so a party reading them learns that the system is losing resilience and does not learn how much remains.

The last property bounds what the framework claims. Detection of this kind supports a change in the requirements attaching to a class of events, a change in a threshold, and a change in conditions. It does not support a statement that a transition is imminent, and an arrangement asserting one on this evidence has claimed more than the indications carry.

17.3 The Distribution of Observability Across Positions

This subsection states who can observe what, since the duty follows the observability and not the power.

An individual participant observes its own transformations and the material it receives. The indications described above are invisible from that position, and the increase in variability near a boundary makes each local observation less informative in exactly the conditions where information would matter most. A participant's failure to notice the approach is therefore genuine and is not a failure of attention.

A party holding a longitudinal record across a commons is in a different position, and it is the only kind of party that is. The indications require a series, comparability across the series, and coverage of enough of the system for aggregate properties to be visible, which are the components of the capacity to observe identified in Claim 10.3.

Claim 17.2. (Duty allocated by observability). The duty to read the approach to a transition falls on the party positioned to read it, and that position is constituted by the holding of a longitudinal record and not by power, resources or standing. The allocation is therefore structural: an individual participant is not merely less able to see the approach, it is unable to see it from where it stands.

The claim also supplies the framework's answer to an objection that the requirement sets of Part III invite. A party performing a consequential transformation cannot be required to assess the aggregate state, because it cannot see it. What it can be required to state is what it knew, which is the third member of the requirement set of Definition 7.1, and the aggregate falls to the party that holds the record.

17.4 Reading and Probing

This subsection distinguishes two ways of obtaining information about a system's remaining resilience, and states why the framework relies on one and restricts the other.

Reading uses disturbances that occurred anyway. Every consequential transformation recorded under Part III is a disturbance to the commons, and the system's response to it is recorded alongside it. The information is therefore obtained at no additional cost to anyone, since the perturbation would have occurred whether or not it was read.

Probing generates a disturbance in order to observe the response. It obtains information

the record does not contain, and it does so by imposing on the system the disturbance whose effects are to be measured.

Claim 17.3. (The asymmetry between reading and probing). Reading imposes no burden, since the disturbance occurred independently of the decision to read it. Probing imposes the burden on the system whose resilience is in question, and it does so in proportion to the information obtained. Failing to read is therefore culpable in a way that failing to probe is not, since in the first case the information was in hand and went unexamined.

The framework accordingly grounds its duty on reading. Probing is not excluded in every form, and the permissible forms have a common structure: they test the arrangement's own response pathway in place of the participants. A test submission through a reporting channel, measured for whether it is routed and answered, imposes on the arrangement and not on any participant, and it establishes something the record does not contain.

17.5 The Duty That Results

Claim 17.4. (The duty of the recording party). A party holding a longitudinal record of a commons is under a duty to examine that record for the indications described in this section, at stated intervals, and to publish what the examination found. The duty is satisfiable, since the material is in the party's possession; it is assessable, since the examination and its publication are acts; and it requires no prediction, since what is reported is the state of the indications and never the imminence of any outcome.

Two limits belong with the duty and are stated here in place of the closing part.

The duty is exposed to the defect of Claim 10.4, since the indications will be reported through measures and a measure administering a duty becomes a quantity to be produced. The disciplines stated there apply: publish the measure with the reasoning that selected it, and revise it on a stated occasion.

And the duty is bounded by Claim 16.1. A record covering the participating population exhibits the aggregate properties of that population, and a commons whose consequential activity has moved outside the recording arrangement will show a record that is stable and quiet. An arrangement should therefore read its own coverage alongside its indications, since a decline in recorded activity has two readings and only one of them is reassuring.

18 Early Intervention and the Bounds upon It

This section states what an arrangement may do on the strength of what §17 makes available, and the bounds upon it. Its objective is to establish that intervention before a harmful outcome is available in an administrative and supervisory form, that it is not available in a punitive form, and that the difference is not a matter of severity but of what each form requires in order to operate. The section states the occasions on which intervention arises; states the graded responses available and the property each requires; states the bound against punitive anticipation and the ground of it; states the proportionality constraint and what it is measured against; and states what an intervening arrangement owes the party intervened upon. The section is the point at which the framework is most exposed to misuse, and its restrictions are

stated accordingly.

18.1 The Occasions of Intervention

Intervention arises on three occasions and on no others within this framework, and stating them exhaustively is part of the restriction.

The first is a recorded event of a class whose requirement set includes review, per the third grade of §9. The occasion is the event, the trigger is the class, and the arrangement's response is the review the requirement set provides for.

The second is a failure of compliance at an event of a class carrying requirements. The occasion is the failure, and what is available is addressed to the failure and not to what the transformation may produce, per Claim 7.3.

The third is a finding under §17 about the state of the commons. The occasion is the finding, and by Claim 12.3 what is available is prospective alteration of requirements, thresholds and conditions, and nothing addressed to any party's past conduct.

Claim 18.1. (The exhaustiveness of the occasions). Intervention within this framework arises at a recorded event of a reviewable class, at a failure of compliance, and upon a finding about the aggregate state; and in the third case what is available is prospective and general. An arrangement intervening on any other occasion has acted outside the framework, and in particular an arrangement intervening upon a party because of what that party might do has done so on no occasion the framework recognises.

18.2 The Graded Responses

This subsection sets out the responses available at those occasions, ordered by what each requires of the arrangement, since a response that requires more should be available on less.

Recording alone is the response at the first grade, and it requires nothing of the arrangement beyond the schema.

A request for a statement is available where a record is incomplete or where a stated element of a requirement set is missing. It asks the party to supply what the requirement already required, and it requires of the arrangement only that the requirement was published in advance.

Review against published criteria within a stated period is the third grade, and it requires of the arrangement that criteria exist, that they are published, that the period is fixed in advance, and that the review terminates at the end of the period whether or not it has concluded. The last of these is what prevents review from becoming an approval requirement by default.

Publication of a finding is available where a review has concluded, and it requires that the party has had an opportunity to respond and that the response is published with the finding.

Alteration of conditions is available upon a finding under §17, and it requires the constraints of Claim 13.3, since it operates on a population that is not party to the finding.

Suspension of a facility's own service to a party is available only for failure to comply with a published requirement, and it is the strongest response the framework contemplates. It requires everything the preceding grades require, together with a stated ground referring to the failure and not to any assessment of what the party would otherwise do.

Claim 18.2. (The ordering of responses by what they require). Each response available to an arrangement requires of the arrangement everything the lesser responses require, together with a further condition of its own. An arrangement employing a response without the conditions the response requires has employed a weaker instrument under a stronger name, and the party subject to it has lost the protections the conditions constitute.

18.3 The Bound Against Punitive Anticipation

This subsection states the bound the framework places on the whole of Part VI, and the ground is a general one that the framework did not invent.

An arrangement holding indications that a system is approaching a transition, and holding a record identifying the parties active in the relevant class, is in a position to act against those parties before anything has occurred. The temptation is strong in proportion to the seriousness of what is anticipated, and the instruments described in this paper make it available in a form it has not previously had.

Claim 18.3. (The bound against punitive anticipation). Intervention before an outcome is available in this framework in administrative and supervisory forms only: a requirement, a review, a finding, an alteration of conditions, and a withdrawal of a facility's own service for non-compliance. It is unavailable in punitive form. A sanction imposed on a party for conduct that is not itself a breach of a published requirement, on the ground of what the conduct is expected to contribute to, is a penalty for an anticipated wrong, and it requires precisely the establishment of contribution that Claim 3.3 and Claim 14.1 show to be unavailable.

Two grounds support the claim and they are independent. The first is the one just stated: the anticipated contribution cannot be established, so a sanction resting on it rests on nothing the arrangement can demonstrate. The second is that the extension of penalties into the region before a wrong has a documented history in criminal theory, where it is recognised as a distinct and dangerous form, since it converts membership of a class into the operative fact and dispenses with the elements that ordinary liability requires.

The bound has a consequence for the drafting of any requirement set. A requirement whose breach is defined by what a transformation might lead to has smuggled the anticipation into the requirement, and it fails the admissible form of Definition 7.4 by not being applicable by a party to its own conduct at the time.

18.4 Proportionality and the Quantity Against Which It Is Assessed

This subsection states the proportionality constraint and identifies the quantity against which it is assessed, since the natural quantity is unavailable.

The natural measure of proportionality is the harm the intervention prevents, and that quantity is unavailable, since it requires an estimate of what would otherwise have followed, which is what the whole of §3 shows to be out of reach. An arrangement that assessed proportionality against anticipated harm would therefore be assessing against a number it constructed.

Claim 18.4. (The measure of proportionality). Proportionality of intervention is assessed against the consequence of the event class, as fixed by the grading of §9, and against the cost

the response imposes on the party and on participation generally, per Claim 9.2. It is not assessed against anticipated harm, since the quantity is unavailable and an arrangement constructing it would be constructing the justification for its own action.

The consequence is that the framework's proportionality is coarse. A class of events carries a grade, the grade determines what responses are available, and the arrangement's judgement operates in selecting among the responses at that grade. That coarseness is deliberate, since the alternative is a finer judgement resting on a quantity nobody can supply.

18.5 The Obligations of an Intervening Arrangement

This subsection states what falls on the arrangement when it intervenes, which is the counterpart of Claim 7.6 for this Part.

An arrangement intervening owes a stated ground referring to a published requirement or to a published finding. It owes an opportunity to respond before a finding is published and a route by which the response is recorded alongside it. It owes a terminating point, so that a review ends and a party knows its position. It owes publication of its interventions in aggregate, so that the pattern of its own conduct is examinable by parties other than those it has addressed. And it owes the record of its own decisions, which is the second-order material of Definition 6.4 applied to the arrangement in place of to the participants.

Claim 18.5. (The reciprocity of intervention). An arrangement intervening upon a party owes a stated ground, an opportunity to respond, a terminating point, publication of its interventions in aggregate, and a record of its own decisions. An arrangement supplying none of these has acquired the position of a party that determines without being examinable, which is the position the framework's own constraints exist to prevent any party from occupying.

19 The Backstop and the Conduct It Reaches

This section states the place of post-hoc responsibility attribution within the architecture, and the conduct it can reach. Its objective is to establish that attribution is retained, that it is retained for a narrower class of conduct than a general liability rule addresses, and that the framework's own instruments do not extend it. The section states why attribution is retained; states the two classes of conduct it reaches and the property those classes share; states the three uses to which the framework's records may legitimately be put in a proceeding and the one to which they may not; states the effect of the framework upon the existing law of attribution, which is smaller than it may appear; and states the residue of cases that neither the framework nor the backstop reaches. The section applies the restrictions of §12 to the framework's relation with proceedings it does not control.

19.1 The Retention of Attribution

An architecture that dispensed with attribution altogether would be defective for three reasons, and stating them fixes what the backstop is for.

Some conduct in a commons is wrongful independently of anything in this framework. A party that deliberately constructs a capability for a harmful purpose, that falsifies a record, or

that continues to propagate after being told of a serious risk has done something the ordinary law addresses, and an architecture displacing that would have removed a protection while supplying nothing in its place.

Some parties are outside the framework's coverage entirely, per Claim 16.1, and for those parties the ordinary law is the only instrument that applies at all.

And a framework of process requirements without any backstop offers a party the option of compliance with the requirements as a complete answer to any conduct whatever, which converts a floor into a ceiling.

Claim 19.1. (The function of the backstop). Attribution is retained for conduct that is wrongful independently of the requirements this framework states, for parties the framework does not reach, and to prevent compliance with process requirements from operating as an answer to conduct the ordinary law addresses. It is not retained as the framework's means of dealing with the outcomes described in §2.

19.2 The Conduct the Backstop Reaches

This subsection states which conduct is available to attribution in a system of this kind, and identifies the property the available classes share.

The first class is deliberate conduct directed at the outcome. Where a party constructed, packaged or deployed a capability in order to produce a harm, the difficulties recorded in §3 are substantially reduced, since the party's own purpose supplies what a reconstruction of the causal history could not: the connection between the act and the outcome runs through an intention the party held, and the doctrines addressed to intended consequences are available.

The second class is conduct at a proximate event where the connection to the outcome is short, local and datable. A party that removed a safeguard from a system already in use, or deployed at scale a capability whose failure mode was recorded in the material it received, has acted at a point close enough to the outcome for the ordinary tests to operate.

Claim 19.2. (The property shared by the reachable classes). The classes of conduct that attribution reaches in a system of this kind are those in which the connection between the act and the outcome is supplied by something other than a reconstruction of the propagation history: by the party's own purpose, or by proximity in time and in the chain. Where neither is present, the difficulties of §3 are unmitigated, and the framework's instruments do not supply what is missing.

The second half of the claim is the framework's principal restriction upon itself in this Part, and it should be read alongside Claim 14.1. A record improves what can be established about conduct at events. It does not convert a distributed history into an attributable one, so the class of conduct the backstop reaches after the framework is in operation is the class it reached before.

19.3 The Use of the Framework's Records in a Proceeding

This subsection states what the material generated by Parts III to V may establish in a proceeding, since the material will be used whether or not the framework says how.

Three uses are legitimate. The record may establish what a party did and when, which is

a matter of fact about an event. It may establish what was visible to a party at the time, since a risk recorded in the material the party received was available to it. And it may establish whether a published requirement in force at the time was satisfied, which is the object of assessment fixed by Claim 7.3.

One use is illegitimate and is the one the framework must guard against most carefully. The record may not establish that a party's transformation contributed to an outcome, and a proceeding treating a recorded path from a party's act to a harm as establishing contribution has performed the inference Claim 14.1 forbids. The danger is acute because the material is well-ordered, legible and produced by the party itself, and those properties make it persuasive in a manner unrelated to what it shows.

Claim 19.3. (The admissible use of the record). The record established under this framework is admissible to establish conduct at an event, the visibility of a risk at a time, and compliance with a requirement in force. It is not evidence of contribution to an outcome, and its legibility is not a reason to treat it as such.

The framework cannot enforce this restriction in a proceeding it does not control, and the closing observation of §12 applies here in a stronger form: an arrangement that requires parties to produce records has produced material whose use it cannot govern. That is a cost of the instrument, it falls on the parties who complied, and an arrangement should state it to them in advance in place of discovering it with them afterwards.

19.4 The Effect upon the Existing Law

This subsection states what the framework changes in the law of attribution, since the honest answer is little and the appearance is otherwise.

The framework does not alter any doctrine of causation, does not propose a new head of liability, and does not extend liability to parties who would not otherwise bear it. What it alters is the material available and the requirements in force: a party's conduct at an event is assessable against requirements that were published in advance, and the assessment of that conduct is a distinct matter from any question about an outcome.

One second-order effect is worth recording, since it runs in the direction the framework did not design for. Where requirements are published and generally observed, a party's failure to observe them becomes evidence about that party's conduct in any proceeding, and the framework has thereby increased the exposure of non-complying parties without any doctrinal change. That effect is a consequence of publishing standards and is common to every régime that does so; it is recorded here because it is a real consequence of adopting the framework and is not among its stated objectives.

19.5 The Residue

This subsection states the cases that neither the framework nor the backstop reaches, since the architecture's boundary should be stated by the architecture.

Where a harmful capability was assembled from independent contributions, none deliberate and none proximate, the backstop reaches nobody, and §11 established that the framework's instruments are addressed to the composing position and to the conditions in place

of the contributors. Where the composing position is held by no party, neither instrument is available. Where the parties operated outside any recording arrangement and beyond any authority, nothing in the architecture applies. And where an outcome followed from a system's accumulated loss of resilience with no single act disproportionate to it, the two ends of Claim 3.2 remain as they were.

Claim 19.4. (The unreached residue). The architecture reaches conduct at recorded events, the positions through which transformations pass, the conditions under which they occur, and deliberate or proximate conduct through the ordinary law. It does not reach distributed contributions to an outcome where no party acted deliberately, none acted proximately, and no position or condition was available to be governed. That residue is not closed by this framework and the framework should not be described as closing it.

Part VII. The Position

20 The Cycle of Revision and the Duties It Places on the Arrangement

This section states how the instruments of Parts III to VI operate together over time, and what the operation requires of the arrangement holding them. Its objective is to establish that the framework is a cycle in place of a settlement, that the revision of its own instruments is a duty with occasions and a record, and that an arrangement whose instruments are unrevisable governs a system that has moved past them. The section states the cycle and the passage between its stages; states the revision duty and the four objects it applies to; states the occasions on which revision arises; states what an outcome yields to the arrangement beyond any question of responsibility; and states the constraint that keeps a revising arrangement from revising itself into a position no party can contest. The duties stated here fall on the arrangement and on no participant.

20.1 The Cycle and the Passage Between Its Stages

The instruments described in this paper compose a cycle with six stages, and the passage between the stages is what the earlier Parts have established.

The arrangement fixes conditions and a schema, which determines what can be recorded and what most parties will do. Requirements attach to classes of consequential event, and parties record as they perform them. The party holding the record reads it, both for compliance at particular events and for the aggregate indications of §17. Findings from that reading produce intervention where an occasion of §18 arises. The same findings produce, by Claim 12.3, prospective alteration of requirements, thresholds and conditions. And conduct that is independently wrongful passes to the backstop of §19, which operates on its own terms and returns nothing to the cycle except what an outcome reveals.

Two passages in that sequence are constrained by results already established and are worth restating here, since the cycle is where the constraints do their work. The passage from a structural finding to an alteration of requirements is prospective and general, and never runs to a determination about a party. And the passage from a compliance record to a conclusion

about a party's contribution to an outcome does not exist, by Claim 14.1.

20.2 The Revision Duty of the Arrangement

Claim 20.1. (The revision duty). An arrangement operating the instruments of this framework is under a duty to revise them, and the duty extends to four objects: the schema of recordable events, the classes of consequential event and their thresholds, the requirement sets attaching to those classes, and the conditions the arrangement sets. The duty is discharged by revision on stated occasions with a published record of what was changed, what was proposed and declined, and on what reasoning.

Three grounds support the duty and each has been established earlier.

The system moves, and the classes that were consequential at one time are not the classes that are consequential later, since Claim 2.2 established that the conditions of propagation are altered by the propagation. An arrangement holding a schema fixed while the commons develops governs a set of transformations that have ceased to be the ones that matter.

A proxy administering a duty ceases to measure what it was chosen for, by Claim 10.4, so any measure in continued use is degrading from the moment it is adopted, and revision is the only response the framework has to that.

And the selection recorded in Claim 15.3 is invisible from within the record, so the only occasion on which an exclusion can be corrected is an occasion on which the schema itself is examined.

20.3 The Occasions of Revision

This subsection states when revision arises, since a duty without occasions is discharged whenever the party holding it prefers.

Revision arises on a stated period, which is the ordinary case and which fixes a floor. It arises on a finding under §17 that the aggregate indications have changed, which is the passage Claim 12.3 permits. It arises on a demonstrated failure of an instrument, which includes a class of transformation performed repeatedly outside the schema, a requirement generally unobserved, and a proxy shown to have been optimised against. And it arises on an outcome, for the reason given in the following subsection.

A fifth occasion belongs with these and is the one an arrangement is least likely to supply for itself. Revision should arise on a proposal from a party subject to the instruments, and the arrangement should record such proposals and its responses to them whether or not it adopts any. Without that occasion, the constraint of Claim 15.4 operates only when the arrangement chooses to look, and the classes least likely to be examined are those whose absence suits the arrangement.

20.4 The Yield of an Outcome

This subsection states what an arrangement takes from a harmful outcome, which is distinct from and larger than what any proceeding takes from it.

An outcome establishes that a configuration was reachable. Whatever the difficulties of attributing it, the fact that it occurred is information about the system that no amount of

observation had supplied, since it exhibits a path from a set of transformations to a result that the arrangement had not treated as available.

Claim 20.2. (The yield of an outcome to the arrangement). A harmful outcome yields to an arrangement a demonstration that a configuration was reachable, an indication of which transformations composed it, and a test of whether the instruments in force recorded them. That yield is available whether or not any party is answerable, and it is the principal reason an arrangement should examine an outcome independently of any proceeding concerning it.

Two disciplines attach to the examination and both matter.

The examination should be conducted separately from any question of responsibility, and its findings should be published in a form that does not require the resolution of that question. An examination conducted inside a proceeding produces findings shaped by what the proceeding requires, and the parties best placed to explain what occurred are the parties with most at stake in the finding.

And the examination should be directed at the instruments in place of at the parties. The questions it answers are whether the transformations that composed the outcome were of classes the schema recognised, whether the requirements in force would have recorded them, whether the indications of §17 were present and read, and which of the framework's own objects failed. Those questions have answers, and none of them requires an apportionment.

20.5 The Constraint on a Revising Arrangement

This subsection states the constraint that prevents the revision duty from becoming a power, since an arrangement able to revise its own instruments is an arrangement able to revise itself out of any position it finds uncomfortable.

An arrangement that may alter its schema, its classes, its thresholds, its requirements and its conditions holds every instrument in this framework and holds them at its own discretion. The constraints stated in Parts III to VI apply to each instrument individually and none of them constrains the revision itself.

Claim 20.3. (The constraint on revision). A revision is admissible where it is published with its reasoning before it takes effect, where the version in force at each earlier time remains recoverable, where it applies prospectively to acts performed after it takes effect, and where the proposals declined are published alongside those adopted. A revision failing these has altered, retrospectively and without record, the standard against which conduct is assessed, and it has done so by the instrument the framework provided.

The last clause states the general danger the framework should acknowledge about itself. Every instrument described in this paper increases the capacity of the party operating it to determine what can be established about everyone else. That capacity is what makes the instruments useful and it is also the thing they are most likely to be used for, and the constraints of Claim 15.4, Claim 18.5 and Claim 20.3 are the framework's whole answer to it.

21 The Limits of the Framework

This section states what the framework does not establish and where it is most exposed. Its objective is to fix the paper's claims at the strength its arguments support, and to assemble in one place the defeats and residues that individual sections recorded as they arose. The section states what is established; states the matters left undetermined; states the six weaknesses of the framework, each of which the paper has argued for elsewhere and none of which it has answered; and states the defeat conditions under which the framework fails as a whole. The weaknesses are stated by the paper in place of being left for a reader to locate.

21.1 The Established Results

Six results are established. The three objects are distinguished by what each carries and conceals, and instruments are matched to them on the ground of what each kind of response can represent, which is Claim 5.5 resting on Claim 3.4. Capability transformation is identified as a class of consequential event that transactional triggers do not intersect, with a criterion following from the non-conservation of capability along a line of descent. The object of assessment at an event is fixed as compliance with the requirements in force, on the ground that marginal apportionment and proportionality give opposite answers near a boundary. The admissible form of a requirement is stated in four conditions, and shown to be the constraint that keeps a rule about acts from operating as a determination about parties. The limits of a provenance record are stated in three: reachability is not causation, the schema is selected by an interested party, and the reached population is selected by willingness to comply. And the duty of the party holding a longitudinal record is stated as a duty to read what has already occurred, allocated by observability in place of by power.

Two subsidiary results carry beyond the framework's immediate subject. The separation of recording from monitoring identifies a distinction that one infrastructure makes easy to elide. And the priority of selection over deletion identifies the graver failure of a provenance system as the one that requires no party to do anything wrong.

21.2 The Instruments Assembled

This subsection assembles the instruments proposed across Parts III to VI, since they were developed section by section and a reader assessing the framework needs them together. Table 3 states, for each instrument, the object it governs, the form of the response it admits, what it establishes, and the limit under which it operates, with the section where that limit is argued.

Three properties of the table are worth stating, since they are the framework's structure seen at once. No instrument establishes contribution to an outcome, which is the architectural claim of §3 appearing as an empty column. Every instrument governing relational structure is limited by a measurement problem, and every instrument governing conditions is limited by a contestability problem, so the two objects fail in characteristically different ways. And the last row is held by the party that operates all the others, which is why the constraints of Claim 20.3 carry a weight disproportionate to their length.

Table 3: The instruments proposed, the object each governs, what each establishes, and the limit under which each operates.

Instrument	Object	What it establishes	Limit, and where argued
Requirement set at a consequential event	Event	Compliance at the act, and what was known then	Compliance only, never contribution (§7); cost falls hardest where capacity is least (§9)
Assessment frame	Event	Control, visibility, obligation, available alternative	Returns nothing under convergence (§11)
Capacity duty	Relational structure	Whether a capacity to observe, interpose or absorb was maintained	Administrable only through a proxy that degrades (§10)
Reading of the approach	Relational structure	That resilience is declining, without the distance remaining	Requires a series and a common quantity of response (§17)
Event ledger	Conditions, serving all three	What was done, when, and what was visible	Reachability is not causation (§14)
Recording schema	Conditions	What can be governed or observed at all	Selected by an interested party, and exclusions are invisible from within (§15)
Terms, defaults, facility design	Conditions	Nothing about any party; it alters what parties do	Widest reach and least contestability (§13)
Graded intervention	Event, conditions	That a requirement was enforced or a setting changed	Administrative forms only; no punitive anticipation (§18)
Backstop attribution	Event	Deliberate or proximate conduct	Reaches the class it reached before the framework (§19)
Revision of the instruments	The arrangement itself	That the instruments were corrected, and on what reasoning	Self-imposed, and held by the party the instruments empower (§20)

21.3 The Matters Left Undetermined

The framework fixes no threshold, since materiality in a domain is a matter for the arrangement in that domain, and Claim 6.5 states the discipline in place of the number. It fixes no content for any requirement set beyond the five kinds of member, for the same reason. It allocates no instrument to any level of authority, since the question of which body should hold which instrument depends on what bodies exist in a domain and command assent, and the paper takes no position on it. It offers no procedure for deciding whether a particular transformation should be performed. And it takes no position on how far any existing instrument it examines succeeds in its own terms.

21.4 The Weaknesses

Six weaknesses are stated by the paper, and each was argued for in the section that produced it.

The framework's coverage is selected against it. Claim 16.1 established that a voluntary arrangement retains the middle of a population and loses both ends, and that the parties most likely to misuse are among those it does not reach. The framework's answer is conditions, which reach further, and conditions cannot require anyone to state what they knew.

The schema is chosen by an interested party. Claim 15.2 is the framework's principal internal danger, since every instrument depends on the record and the record's scope is fixed by a party whose conduct it records. The conditions of Claim 15.4 make the selection visible and contestable and do not make it neutral, and nothing in the framework causes an exclusion to be noticed.

Capacity duties are exposed to their own proxies. Claim 10.4 holds without qualification, so every structural duty in Part IV is administered through a quantity that ceases to measure what it was chosen for. The framework offers two disciplines and no solution.

The requirement cost falls hardest where capacity is least. Claim 9.1 established that the incidence concentrates participation among parties best equipped to bear administrative cost, and Claim 5.6 established that concentration is the condition under which those who set terms become the parties the terms were to bind. The framework's own instrument therefore produces a movement in the object it is least able to govern.

The boundary of §12 is maintained by discipline and not by unavailability of material. A published proxy failure and a documented compliance gap are exactly the material a party seeking an outcome determination would use, and the framework cannot govern proceedings it does not control.

And the convergence case is not closed. §11 located the governable objects and conceded two residues: convergence across facilities, where no party holds the composing position, and composition performed by no party at all.

21.5 The Defeat Conditions

This subsection states the conditions under which the framework fails as a whole, since a position stating weaknesses should also state what would refute it.

The framework is defeated in its central claim if the three objects prove not to be separately

governable, which would show if instruments addressed to conditions and to structure were found in practice to operate only through determinations about parties, so that the matching of Claim 5.5 collapses into a single instrument with the interested-administrator problem attached.

The framework is defeated in its principal instrument if requirement sets in admissible form prove unable to attach to capability transformations at all, which would show if the classes of §6 could not be specified without reference to the identity or purpose of the parties performing them.

The framework is narrowed in scope if the criterion of Definition 6.1 selects a class so large that the exclusion of ordinary operations recorded in Claim 6.2 fails, since a framework whose duties reach revision, criticism and replication has imposed the cost of Claim 9.1 on the activity the commons consists in.

The framework is narrowed in application if the indications of §17 prove unreadable in commons of the relevant kind, which is an empirical question the paper does not settle and on which the duty of Claim 17.4 depends.

And the framework is refuted in its ordering if post-hoc attribution proves tractable after all in systems of this kind, since the whole architecture rests on Claim 3.1's holding that attribution cannot be the primary instrument. A demonstration that a doctrine composes many local tests into an aggregate finding, or that a legal system holds a looped or level-crossing object as its primary legal object, would require the ordering to be reconsidered from the beginning.

22 Open Questions

This closing section states the questions the enquiry leaves open and the position the paper reaches. Its objective is to identify what would have to be established for the framework to be operable, and to state plainly what the framework offers in place of what it does not. The questions are ordered by tractability, and each is stated with what would answer it. The section closes with the position.

The enquiry leaves the following questions open.

1. What constitutes a governance-relevant event in a given domain. The criterion of Definition 6.1 selects by material change in capability for a class of parties, and the classes of §6 are a proposal. Whether that criterion can be operationalised in a domain, and what the eight classes become when it is, is answerable by attempting it in one commons and recording what the criterion admits and excludes.
2. Whether the indications of §17 are readable in a knowledge commons. The indications are established for systems whose responses to disturbance can be observed in a common quantity, and a commons supplies heterogeneous events with no such quantity. Whether recovery time, variability and similarity of response have usable analogues here is answerable from existing records of commons that have undergone a rapid change of régime.
3. How a schema is revised by a party other than those whose conduct it records. Claim 15.4

states the condition and §15 concedes that it is the hardest of the four to satisfy. What arrangements have supplied an independent revising party in comparable infrastructures, and on what terms, is answerable from the governance histories of existing standards and provenance bodies.

4. Whether the composition of a proxy for a capacity duty can be disciplined in the manner Claim 10.4 requires. The two disciplines offered are publication with reasoning and revision on a stated occasion, and whether they slow degradation of a proxy enough to be worth the administrative cost is an empirical question with a substantial existing literature to draw on.
5. What the coverage of a voluntary arrangement actually is in a domain. Claim 16.1 asserts the direction of the selection and offers no magnitude. Whether the reached population is most of the consequential activity or a small part of it determines whether the framework is a governance instrument or an evidentiary convenience, and it is measurable by comparison of recorded transformations against independent indications of activity.
6. Whether the circuit of Claim 12.3 is adequate. The framework forbids the inference from a structural finding to a determination about a party and substitutes a circuit running from observation to prospective revision. Whether that circuit is fast enough to matter, in a system whose conditions change on the timescale Claim 2.2 describes, is the question on which the whole supervisory half of the framework depends.
7. Which body should hold which instrument. The paper allocates instruments to objects and declines to allocate them to levels of authority. Which of a platform, a professional body, a standard-setting arrangement, a funder or a public authority is positioned to hold the schema, the requirement sets, the conditions and the reading duty is the subject of the companion enquiry into rule form across levels, and it is not answered here.
8. Whether an arrangement holding all of these instruments can be constrained by the conditions of Claim 15.4, Claim 18.5 and Claim 20.3. Those constraints are the framework's whole answer to the concentration of determination in the party operating the instruments, and they are self-imposed. What would induce an arrangement to bind itself is outside the argument of this paper, as it was outside the argument of its companion.
9. How the residues of §11 are to be treated. Convergence across facilities and composition performed by no party are configurations for which the framework supplies no instrument, and whether anything short of a general authority reaches them is unresolved.
10. What the framework costs the commons it governs. Claim 9.2 establishes the tension and supplies no magnitude, and the comparison it requires between reduced harmful transformation and reduced transformation generally has not been attempted for any instrument described here.

The position the paper reaches may be stated briefly. Once knowledge propagates through a system of many participants in which transformation is the normal operation, the question

of who caused a harmful outcome is frequently unanswerable, and an architecture resting on that question waits for a proof the system does not permit. What remains available is not a substitute for the answer but a different set of objects: the transformations at which parties act, which admit duties assessable as compliance; the relational structure that determines whether those transformations matter, which admits supervision and no adjudication; and the conditions under which further transformation proceeds, which admit alteration by decision and reach every party at once.

Governing those three is what this paper means by generativity governance, and the term carries no objective of increasing what it governs. The orientation is to preserve the conditions under which generation continues, to read the indications that a system is losing its capacity to absorb what it produces, to intervene in proportion and in administrative form, and to keep the instruments themselves revisable. None of this prevents misuse, and §16 states why no arrangement of this kind could. What it offers is that transformations conducted in the open are conducted with a record and with the requirements their class attracts, that the aggregate state of a commons is visible to somebody, that the conditions of propagation are set deliberately in place of by default, and that where an outcome does occur there exists the material from which conduct at particular events may be assessed and the instruments themselves corrected.

The last of these is the framework's principal claim on a reader's attention. An architecture that could not attribute an outcome, and could not learn from it either, would leave a commons with nothing but the hope that the next configuration is benign. An architecture that declines the attribution and takes the learning has given up what was unavailable and kept what was not.

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