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Research white paper and pilot proposal

Connect the account

Commercial identity for the DSCSA pharmaceutical supply chain. A verified account-binding profile that borrows proven ad-tech coordination mechanics, set out as an executive decision brief and a technical package.

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Proposed profile, not a compliance certification. No FDA, GS1, HIBCC, PDG, HDA, OCI or IAB approval is claimed. Evidence checked 27 September 2026.

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Executive brief

Technical package

How to read this package. The executive brief (E1 to E10) is written for the people who will approve a pilot. The technical package (T1 to T20) is written for the engineers, integrators and reviewers who will build and judge it.

Reference numbers are shared across both tracks and link to the source list. Evidence labels: established, documented, proposed, open dependency. The interactive edition is at dscsa.centillion.ai.

Executive narrative and decision brief

Pharmaceutical supply chain transparency

Connect the account. Keep the product trace. A practical plan for manufacturers, wholesalers and dispensers, written for the people who will approve it.

E1 The decision

The recommendation

Improve the customer relationships already recorded in pharmaceutical systems. Add a small, verifiable account crosswalk, a link from each customer account to its organization, location and role, only where cleanup and existing provider configuration are insufficient. Keep the product trace exactly where it is.

1 / The problem

Two systems agree on the drug and disagree on the customer

A product record and a commercial customer record can refer to the same activity without agreeing on the account, the location, the purchasing relationship or the relevant date. The friction is documented. Its identity-related cost is not yet quantified.

2 / Why it persists

Records are distributed and updates do not propagate

Different companies maintain different records and rules. Contractual reporting rights do not create common definitions. A shared GLN, HIN or street address does not make two commercial relationships interchangeable.

3 / How to address it

Extend what exists; reference, do not re-issue

Retain EPCIS and existing security. Extend issuer customer masters with effective-dated account relationships, evidence, explicit lookup results and a durable reference to the version used. The added profile is a proposal.

4 / The intended outcome

Fewer avoidable disputes, reproducible interpretation

Fewer mapping disputes and manual handoffs; reproducible customer interpretation; clearer exception ownership. Measure the benefit against a strengthened existing-system baseline before expanding.

The boundary that makes this workable

Product tracing and commercial transparency are related but distinct. FDA recommends EPCIS for tracing-data exchange; manufacturers obtain downstream sales and account information through commercial arrangements. A new schema creates neither disclosure rights nor proof of product authenticity. Established

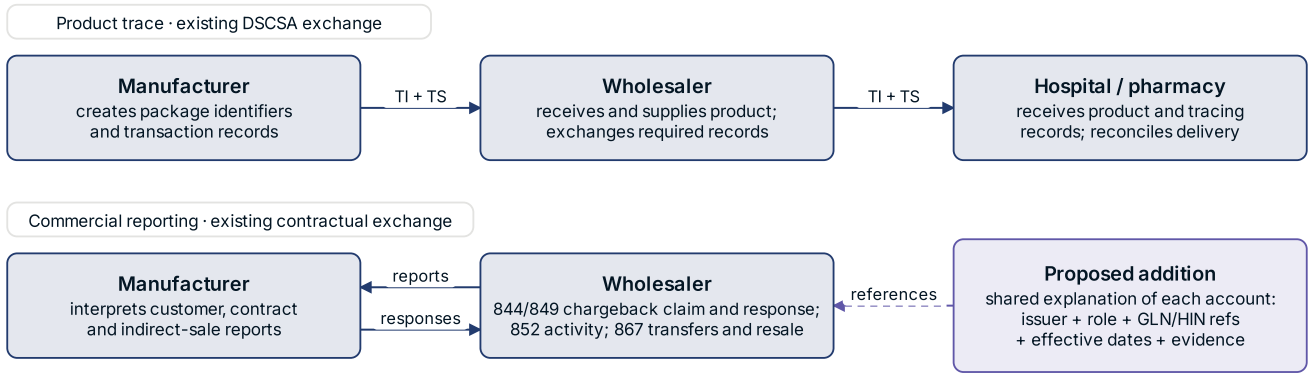
What you are asked to approve

A measured pilot with gates, not a new standard and not a promised savings number. The pilot first establishes how much of the observed friction is caused by account identity, then tests whether the small extension beats cleanup alone. If cleanup wins, cleanup is the answer.

Evidence labels used in this package: Established Documented Proposed Open dependency

E2 Two information flows, not one missing ledger

Keep product tracing separate from the manufacturer's commercial reporting.



The product trace (top) already moves one hop at a time under DSCSA. Commercial reporting (bottom) already moves between manufacturer and wholesaler under data agreements. The proposal adds a shared explanation of each account to the bottom flow. It adds nothing to the top.

What already exists Established

Product trace. Transaction Information and Transaction Statements, serialized package records, transfer-party references, aggregation and correction mechanisms. EPCIS is the exchange model. A Verification Router Service routes product-identifier verification; it is not a universal commercial-account directory. [1, 2, 3, 4]

Commercial interpretation. Customer masters, HIN and GLN references, contract and membership records, price authorization and chargeback processing. The 844/849, 852 and 867 message families serve different purposes, and their availability depends on the trading-partner arrangement. [5, 6, 7]

> **Trace history is not a commercial reporting right**
>
> FDA states that routine Transaction History exchange effectively ended on November 27, 2023. DSCSA did not create a general manufacturer entitlement to all downstream Transaction Information. Investigation-related information gathering remains a separate statutory workflow. [2, 8]

E3 Dispenser problem: correct accounts, stale shared data

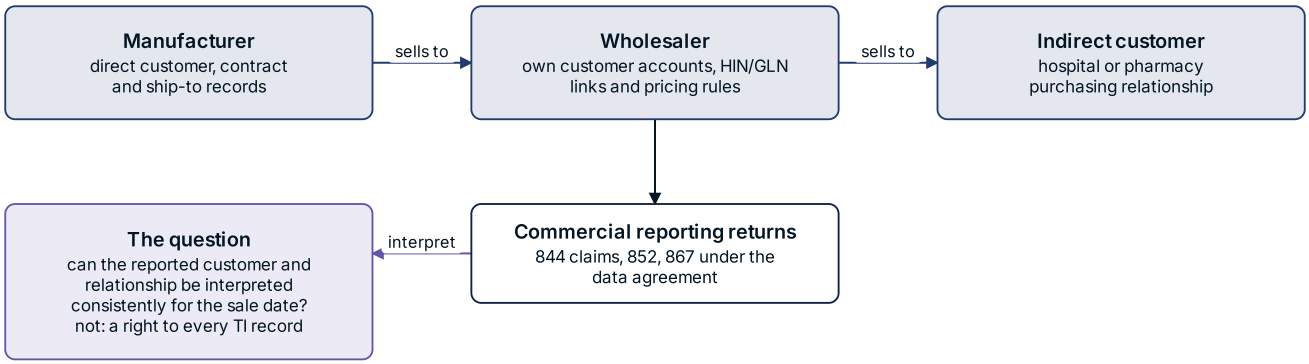
Cencora's September 2024 guidance ties WAC, GPO and 340B accounts at one physical location to one location GLN. The three commercial relationships remain distinct. The failure is not the existence of three accounts; it is a duplicate or retired GLN that remains in a partner system after cleanup, leaving a correct account linked to stale location data. [9]

Documented friction	Why it matters and the narrow response
Duplicate and inactive GLNs	The 2024 cleanup required customer-master updates. GS1 already supports inactive and replacement handling. Synchronize the confirmed successor; do not merge accounts blindly. [9, 10]
Portals and onboarding	The 2025 PDG town hall reports portal fragmentation. One provider cited 192 percent connection growth. A 2018 manufacturer-onboarding pilot reported two to three months per manufacturer; that is a historical observation, not a current service level. [11, 12]
Drop-ship purchase order mismatch	A dispenser may receive the distributor's purchase-order reference instead of its own. Preserve both typed references and their issuers; do not invent another custody chain. [11]
340B inventory context	Participants reported difficulty distinguishing 340B inventory in tracing systems. Keep purchasing context separate from product identity; the proposed binding does not determine patient or program eligibility. [11]
Exception communication	PDG categories and structured notification assets already exist. The July 2026 design still supports email for the near term. Reuse the message model before adding transport automation. [13, 14, 15]

Removed from the gap diagram: an unsupported "four accounts" prevalence claim, account-string collisions as a measured industry failure, and NPI-to-staff linkage. Namespace conflicts remain a defensive test, not a demonstrated business case.

E4 Manufacturer problem: interpret the indirect customer

The opportunity is better commercial interpretation, not access to every downstream tracing record.



Commercial reporting returns to the manufacturer under the data agreement. The question is whether a reported customer and relationship can be interpreted consistently for the relevant sale date, not whether the manufacturer has a right to every downstream record.

Customer interpretation today

HIN changes, split customer records, local class-of-trade definitions and out-of-date relationship data.

Proposed intervention

Resolve the reported account to the existing identifiers and preserve the exact relationship version used.

Why existing identifiers do not settle every dispute

HIN was built to connect trading partners' customer records. Its guide already includes audit fields and a referback link when a move leads to a replacement HIN. Different service and location records can be legitimate. The remaining question is whether each partner uses the right record and relationship at the right time. [5, 16]

Class-of-trade definitions and eligibility rules differ between organizations. A correct account match still requires the applicable contract, product scope, membership and date rules before eligibility is decided. [6]

Evidence is historical, and the addressable dollar share is unknown Documented

The 2018 HDA and Rutgers report cites a 0.7 percent weighted chargeback rejection rate from the 2017 HDA Factbook. In two survey subgroups, 43 percent and 46 percent of respondents cited eligibility. These are not identity-error rates or shares of disputed dollars. The report could not derive an industry cost. [6]

Commercial gate: agree on which downstream fields may be shared, who may use them, correction duties and retention. No reliable 852/867 error-rate estimate was established in the reviewed evidence. Morningstar's June 2025 analysis placed the three national wholesalers above 90 percent of United States distribution revenue; one willing wholesaler is the practical pilot partner, not proof of universal adoption. [17]

E5 What ad tech contributes

Borrow coordination mechanics. Do not transplant an advertising identity system.

Digital advertising is a market in which every participant keeps its own account numbers for the same counterparties and no central directory was ever trusted. Between 2017 and 2024 it produced a set of coordination patterns that solved that ambiguity without a registry. Six of them fit the pharmaceutical problem, plus three implementation patterns learned from the same industry.

Mechanic and origin	Proposed pharmaceutical use	What changes
Issuer-scoped lookup `sellers.json` [18]	Keep the account issuer attached to each identifier. Resolve richer metadata outside the transaction through a permissioned customer-master interface.	Makes the source of account meaning explicit. No public customer registry.
Mapping provenance **OpenRTB extended identifiers** [19]	Record who asserted the relationship, who inserted it, who matched it and how. Tie claims to evidence and the issuer's authority.	A recipient can investigate a crosswalk instead of trusting an unexplained match.
Batch resolution and refresh **Unified ID 2.0 mapping v3** [20]	Support batch lookup, per-item outcomes and refresh timestamps. Keep durable pharmaceutical identifiers; use domain-specific unresolved reasons.	Reduces repetitive lookup work and makes failure visible. Does not infer identity from hashing.
Versioned vocabulary **IAB taxonomy practice** [21]	Use small code systems for account roles and mapping methods. Preserve source codes and exact, broader, narrower, ambiguous or unmapped crosswalks.	Makes meaning and version changes explicit without replacing CBV or PDG categories.
Evidence label fields **Data Transparency Standard** [22]	Attach source, checked-at date, method and evidence reference. Keep the fields; do not import a paid audit program.	Shows freshness and accountability. A label is not a guarantee of correctness.
Two-sided corroboration `ads.txt` **against** `sellers.json` [23]	A second authorized source can confirm a new or disputed relationship. Apply it on a risk basis to new, changed or conflicting routes.	A useful verification pattern, not a universal prerequisite and not proof that an undeclared existing account is invalid.
Partner adapter contract **Prebid Server adapter discipline** [24]	Isolate each partner's interface behind a small, tested contract that declares identifier types, schema versions, lookup capabilities and error mappings.	Reduces repeated bespoke logic without pretending every partner has the same data model.
Activity-specific controls **Prebid activity controls** [25]	Check the authenticated actor, operation, resource and fields before an adapter runs and before data is released.	Permission is decided per operation, not inferred from a label.

Mechanic and origin	Proposed pharmaceutical use	What changes
Configuration acknowledgment and polling repair **IAB Tech Lab Deals API** [26]	When a roster, relationship or endpoint changes, publish an immutable version; the receiver acknowledges receipt and separately records whether it applied it; periodic reconciliation catches missed updates.	Silent update loss becomes detectable. An acknowledgment is not contract acceptance.

Violet marks a proposed adaptation, not an IAB-approved pharmaceutical standard

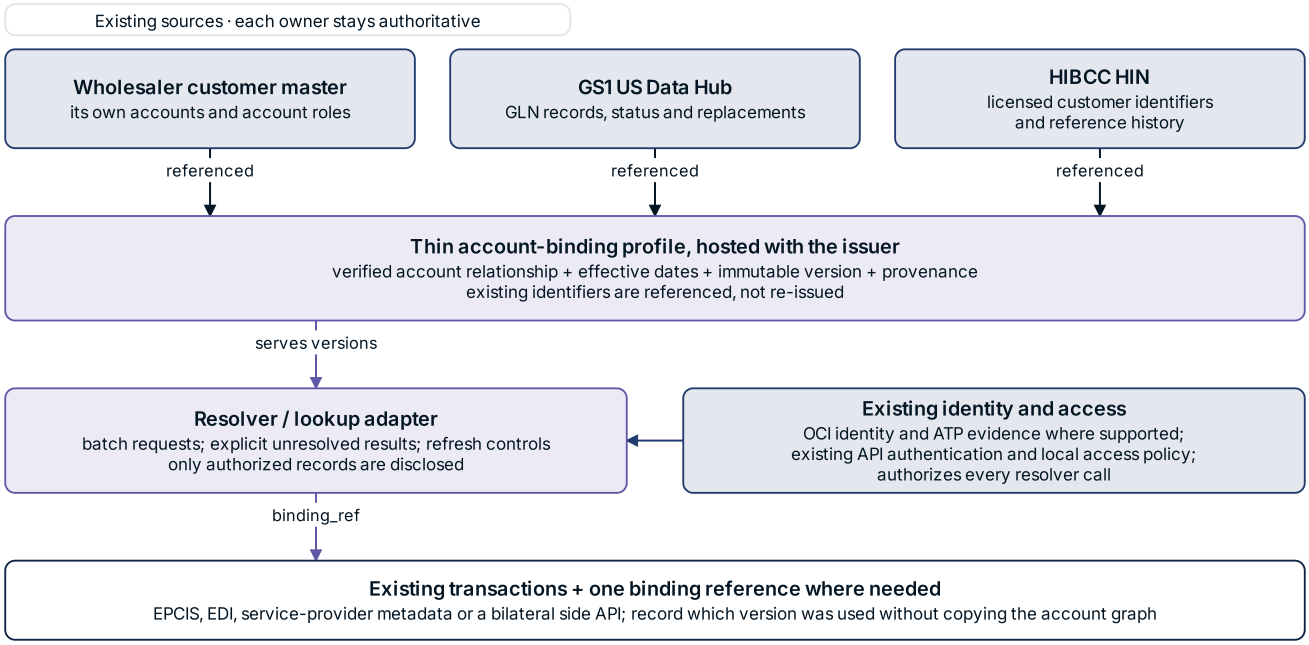
The lookup and provenance concepts are adaptations of published ad-tech mechanisms. Unified ID 2.0 is an adjacent framework, not an IAB-owned pharmaceutical identifier. Existing GS1, HIBCC, PDG, HDA and OCI capabilities remain the starting point. Governance for any shared vocabulary would be sought from PDG or HDA in alignment with GS1 and HIBCC; their agreement has not been obtained.

What stays in advertising

Consumer identity values and rotating tokens. Consumer consent semantics. Signed resale chains (the product trace already records each hop). ads.cert (existing OCI and enterprise security are stronger for this purpose). Private clean-room matching, deferred until a confidential-roster need is measured. A paid data-label audit program. A public directory of all commercial accounts. A compact binary envelope. Any claim that an identifier proves authorization or authenticity.

E6 The smallest useful solution

Extend the customer master. Reference established registries. Preserve the existing transaction channels.



Each existing source stays authoritative for its own records. The thin binding profile is hosted with the issuer and references, never re-issues, the identifiers those sources hold. The resolver discloses only authorized records. Existing transactions carry one binding reference where needed. "Federated" means authorized lookup against existing sources, not a pooled registry and not a claim that those registries have accepted this schema. [4, 5, 10]

Implementation boundary. The issuer remains authoritative for its accounts. The manufacturer receives only its permitted commercial subset. Registry access, licensing and archival rights must be verified before integration. A successful lookup is not an access grant. The extension may be a few columns and a versioned API, not a new platform.

Keep two things out of the binding

Product facts stay in EPCIS and transaction records. **Contract eligibility** stays with the applicable contract and membership rules. The binding supplies verified relationship context; it does not replace either system.

E7 How one transaction would work

Proposed workflow, illustrated with three price-class accounts at one hospital site. The scenario is fictional and shaped by the documented pattern.

1 **Establish rights.**
Manufacturer and wholesaler agree on commercial fields, permitted recipients and correction responsibilities. Confirm registry licensing and provider delegation.

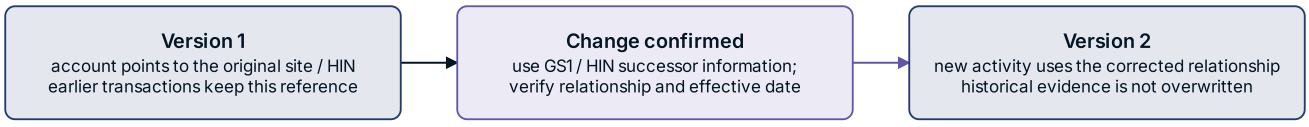
2 **Verify the relationship.**
The wholesaler confirms its account record. The hospital confirms the intended site and receiving service. GLN and HIN conflicts are resolved through the source owner.

3 **Publish a version.**
Expose the active relationship with effective dates, evidence and source record version. An unresolved or ambiguous match stays out of automatic disclosure.

4 **Use the right context.**
An order on the GPO account resolves to that account relationship and destination. Other accounts at the same site remain separate. Drop ships retain both purchase-order references.

5 **Exchange and reconcile.**
Use the existing tracing or commercial channel. Log the binding version used. Distinguish message received, data accepted, records stored and physical product reconciled.

6 **Evaluate and correct.**
Apply contract rules separately for chargebacks. Correct relationship records by issuing successors; correct product events through the established EPCIS procedure.



A confirmed change produces a successor version. Earlier transactions keep their reference to the original version. Store when the relationship applied and when the system learned it, so a retrospective correction is separate from the decision made at the time.

Minimum record, only when the baseline lacks it Proposed

Identity of the relationship: issuer, source-system namespace, account ID, durable binding ID and version. **Meaning:** existing party, location and HIN references, account role, effective interval. **Evidence:** asserted, inserted and matched by, method, evidence reference, last verification time. **Use:** status, separately verified endpoint delegation, and the existing transaction's binding reference. Many values already exist locally. No real customer identifiers or production payloads are asserted here.

E8 Adversarial review: keep the useful parts, remove the rest

Design agreement is not a claim that every operational, legal or economic question is closed. The design was narrowed through recorded challenge rounds. The table records what was proposed, how it was tested and what survived.

Proposal challenged	Red-team test	Resolved design
New national account registry	Would this duplicate HIN, GS1 and customer masters?	No registry. Extend issuer records and integrate existing licensed sources.
Automatic matching	Does name, address or identifier similarity prove authority?	No. Only source-confirmed relationships drive disclosure. Keep candidate matches separate.
Rotating identifiers	Will rotation improve a durable business relationship?	No default rotation. Borrow the resolver contract and refresh discipline only.
ads.cert or new security	Does a domain or account ID prove licensure and permission?	Reuse OCI evidence where supported, plus existing authentication, authorization and revocation controls.
Signed resale chains	Does a second chain establish physical truth?	Drop them. Keep EPCIS and authenticated tracing exchanges; signatures do not make false source data true.
Purpose determines disclosure	Can a code be abused to claim a right?	A request declares its workflow context and it is logged, but authority and scope are verified separately. No purpose is treated as an entitlement.
Both parties must declare every account	Would a new dependency block correct existing exchanges?	Risk-based corroboration for new, changed or conflicting routes. Verified existing routes continue.
NPI, clean rooms, audit program	Is a measured problem present that needs these components?	Exclude NPI linkage and the audit program from this pilot. Defer private matching absent a demonstrated confidential-roster need.

Security and continuity are acceptance criteria

A stale, conflicting or unauthorized binding cannot redirect records. Endpoint changes require delegated authority. Retain bounded approved fallback routes, isolate unresolved data, and preserve correction history. Missing optional metadata must not itself replace an established compliant exchange with a guess.

What the source checks changed

Earlier claim	Treatment in this package
"HIN has a history-linking gap"	Too broad. The HIBCC guide includes audit fields and a referback link to a prior HIN after a move. The pilot tests whether partners use existing history consistently. [5]
"HDA has five categories; transport is email"	Editions differ. The supplied HDA guide has six named scenario sections; PDG Chapter 3 v1.6 uses five categories. PDG notification v1.0.1 includes structured fields and a JSON schema; email is a supported near-term approach, not the only transport. [13, 14, 15, 27]
"OpenRTB 2.6-202402 adds provenance"	The release history places inserter, matcher and match method in 2.6-202409. The proposed pharmaceutical fields are adaptations, not source-standard fields. [19]
"UID2 supplies all proposed unmapped reasons"	The current v3 API documents opt-out and invalid-identifier outcomes. Pharmaceutical reasons such as ambiguous or inactive must be defined as new vocabulary. [20]
"72 percent of DSCSA transactions failed"	Not supported. Cardinal Health's 507 logged pilot samples were exception and support oriented, not a representative transaction sample. Product before data was 114 of 507; missing master data 40; master-data setup 6. Do not infer industry prevalence. [28]
"A unanimous panel reached 100 percent"	Retired. The same decisions are recorded as a design-assurance register. Agreement on a design is not evidence about outcomes; outcomes require the pilot in E9.
"This is a proven commercial return"	Not established. The identity share of dispute dollars and 852/867 error rates remain unquantified.

Regulatory note, checked 27 September 2026

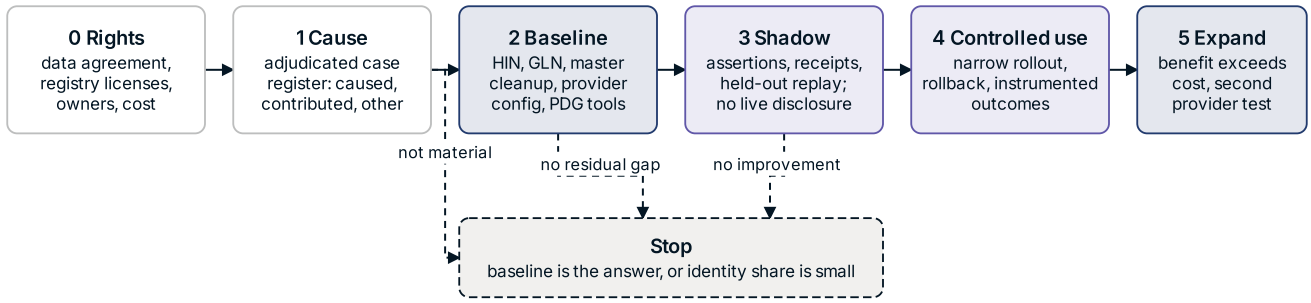
FDA's August 6, 2026 letter extends specified relief through November 27, 2027 for qualifying small business dispensers and applicable trading-partner activities. The definition uses 25 or fewer full-time pharmacist and technician employees across the owning corporate entity, measured as of November 27, 2026. Other DSCSA requirements remain; partner-specific status needs verification. [29]

E9 The outcome must be earned

Approve a measured pilot, not a new standard or a promised savings number.

Intended end state

A manufacturer can interpret the permitted indirect-customer record using the relationship that applied at the sale date. A dispenser can receive the correct records without collapsing legitimate purchasing accounts. Both can identify the source of a mapping and reproduce its history.



Six gates. Each requires evidence before the next begins, and the pilot can stop at any gate. Gate 1 answers the question this package cannot: how much of the observed friction is caused by account identity.

Outcome sought	Measure and decision rule
Less avoidable work	Manual touches and median and 95th-percentile resolution time for attributable account issues, compared with the improved baseline.
Fewer account-related rejections	Root-cause-reviewed counts and dollars, with transaction volume and case mix reported. No inferred industry savings.
Safer, reproducible routing	Wrong-recipient test cases, confirmed endpoint changes, stale-binding behavior and historical reconstruction. Any unauthorized routing fails the release gate.
No new bottleneck	Data availability, physical reconciliation latency, lookup overhead and fallback behavior must not deteriorate.

Stop criterion

If cleanup and existing provider capabilities deliver the same benefit, retain those improvements and do not build the profile. If the identity-attributable problem is small, redirect work to the larger observed causes. All outcomes above are proposed targets, not measured results.

E10 Sources and evidence notes

Sources cited in the executive brief. Numbers are shared with the technical package, which lists every source.

1. **FDA** · DSCSA standards for the interoperable exchange of information for tracing, final guidance (September 2023)
   EPCIS recommendation, exchange architecture and protection of confidential commercial information.
2. **FDA** · Enhanced drug distribution security at the package level, guidance (January 2024, procedural revision 1)
   Reconciliation, information gathering and protected exchange.
3. **GS1** · EPCIS 2.0.1
   Event model, ErrorDeclaration, capture and query interfaces and extension mechanisms.
4. **Open Credentialing Initiative** · DSCSA interoperability profile, v3.4 series
   Identity and ATP credential profiles; deployment support must be confirmed.
5. **HIBCC** · The HIN system: a user guide
   Undated guide. Account-number bridge, audit fields and referback after a move; not a current API contract.
6. **HDA Research Foundation and Rutgers University** · Change management: best practices in contract and chargeback administration (2018)
   Weighted 0.7 percent rejection rate from the 2017 HDA Factbook; eligibility survey subgroups; industry cost not derived.
7. **X12** · Transaction set descriptions
   844 and 849 product transfer account adjustment and response; 845, 852 and 867 per the X12 catalog. No segment-level validation claimed.
8. **FDA** · Exemptions from the enhanced drug distribution security requirements of section 582(g)(1) (October 9, 2024)
   States that section 582(k)(1) effectively ended routine Transaction History exchange on November 27, 2023; phased exemption dates by trading partner type.
9. **Cencora** · DSCSA: understanding GLN requirements (September 13, 2024)
   Company-specific WAC, GPO and 340B account example and the 2024 duplicate GLN cleanup.
10. **GS1 US** · Location data quality, Data Hub help
    Inactive and replacement GLN handling; registry data and access remain source-controlled.
11. **PDG and FDA** · 2025 dispenser town hall report (November 2025)
    Participant reports of portal growth, misrouted files, drop-ship references and 340B context; not a prevalence survey.
12. **AmerisourceBergen** · Exceptions pilot white paper (2018)
    Historical manufacturer-onboarding duration.
13. **PDG** · Interoperability blueprint, chapter 3 (v1.5, January 2026; v1.6, July 2026)
    TI and TS design, exception categories and near-term email notification.
14. **PDG** · Exception notification guideline v1.0.1
    Structured notification content; not a universal transport mandate.
15. **PDG** · Blueprint resources: exception notification JSON schema and connection template
    Confirm the partner-supported schema before implementation.
16. **HIDA** · Navigating healthcare identifiers: HIN assignments and updates
    Webinar resource on HIN assignment, location distinctions and updates.
17. **Morningstar** · Drug distribution industry trends (June 2025)
    Concentration by revenue, not shipment share.
18. **IAB Tech Lab** · sellers.json and the SupplyChain object
    Issuer-scoped seller identifiers and out-of-band participant metadata.
19. **IAB Tech Lab** · OpenRTB 2.x release history
    2.6-202409 adds the EID inserter, matcher and mm fields; latest tagged release observed is 2.6-202606.
20. **Unified ID 2.0** · POST /v3/identity/map
    Batch results, refresh timestamp and temporary prior identifier; not archival versioning.

21. **IAB Tech Lab** · Taxonomies repository
    Independently versioned taxonomies and mappings; no pharmaceutical ownership implied.
22. **IAB Tech Lab** · Data Transparency Standard
    Data-label disclosure; does not certify the correctness of a mapping.
23. **IAB Tech Lab** · ads.txt: authorized digital sellers
    Authorized-seller publication mechanics.
24. **Prebid.org** · Prebid Server: new bid adapter (Go)
    Adapter JSON schemas, fixture tests and endpoint restrictions.
25. **Prebid.org** · Activity controls
    Per-activity permission rules; permissive defaults are not adopted.
26. **IAB Tech Lab** · Deals API v1.0 (released for public comment, December 4, 2025)
    Origin-scoped deal identity, receiver status and polling repair.
27. **HDA** · Exceptions handling guidelines for DSCSA (2023)
    Six named scenario sections in the edition reviewed.
28. **Cardinal Health, hosted by FDA** · Interoperability data exchange errors and exception handling DSCSA pilot project, final report
    Logged exception and support samples, May 2017 to January 2020; not a representative transaction sample.
29. **FDA** · Small business dispenser exemption extension (letter, August 6, 2026)
    Specified relief through November 27, 2027; size measured at the owning corporate entity as of November 27, 2026.

Evidence checked 27 September 2026. Proposed profile, not a compliance certification. No customer master, commercial agreement, live claim dataset or partner system was inspected. No FDA, GS1, HIBCC, PDG, HDA, OCI or IAB approval is claimed.

Technical package

The commercial identity gap in pharmaceutical distribution

A verified account-binding profile, not a new drug-tracking system. Architecture, records, contracts, evaluation design and the design-assurance register, for the engineers, integrators and reviewers who will build and judge the pilot.

T1 Scope, method and evidentiary boundary

The focus is United States prescription-drug distribution involving manufacturers, wholesalers, dispensers and their delegated service providers. The account profile supports two existing contexts: required tracing and investigation workflows, and separately authorized commercial reporting. It does not establish a universal manufacturer right to downstream records.

Earlier project research, including an adversarial-tribunal draft, is treated as design input. Its assertions are not promoted to independent evidence because they recur in several documents. This package replaces the earlier conclusion that a unanimous review proves the design with an assurance register and explicit deployment gates. The account-binding and transfer-context separation is retained; the purpose and settlement rules are rewritten.

Evidence labels

Label	Meaning
Established	Supported by the cited official specification, regulator publication or identified primary source, within its scope.
Documented	A named pilot, company document or participant report. It may demonstrate a failure mode without measuring national prevalence.
Proposed	A design choice made here. It is not a new field in an IAB, GS1, X12 or OCI standard.
Locally checked	Only specified synthetic fixture tests were executed. This label does not imply production interoperability or security validation.
Open dependency	Requires partner evidence, legal review, access rights, deployment testing or operational measurement.

Research discipline. Primary sources were used for load-bearing requirements and mechanism descriptions. Specification availability, implementation documentation and production adoption are different forms of evidence. This package does not assign calibrated probabilities to source quality or infer pharmaceutical results from advertising adoption. No confidential customer or account data was sent to public research services. No downloaded research code was executed.

Regulatory timing. FDA's August 6, 2026 letter provides specified relief through November 27, 2027 for qualifying small business dispensers and applicable trading-partner activities. Eligibility is defined at the owning corporate entity and includes the stated employee and date criteria. Pilot partners' actual obligations, exceptions and service arrangements must be established individually. [29, 30]

> **Evidence boundary**
>
> The existence of coordination friction is supported. Its identity-attributable dollar value, the prevalence of this exact account-binding defect and the proposed profile's incremental effectiveness remain unmeasured.

T2 The documented problem

Multiple accounts are legitimate; inconsistent interpretation is the failure. Cencora's September 2024 guidance describes WAC, GPO and 340B accounts at the same physical location being associated with one GLN. That is a documented company configuration, not a universal rule that every street address has exactly one GLN. It illustrates why the destination identifier and the purchasing relationship must remain separate. [9]

Documented issue	Evidence and limitation	Narrow response
Duplicate or inactive location records	Cencora described an industry cleanup in 2024. GS1 provides inactive and replacement handling. No duplicate count is established. [9, 10]	Consume confirmed source changes; preserve the affected account's historical interpretation.
Portals and onboarding friction	The PDG town hall reported fragmented portals; one provider described 192 percent connection growth. A participant observation, not a national rate. [11]	Reuse existing connections; standardize adapter inputs and failures rather than require another portal.
Drop-ship purchase-order mismatch	Town-hall participants reported distributor PO references where dispenser references were expected. [11]	Preserve both issuer-scoped, typed PO references and their relationship.
340B context and exceptions	Participants reported difficulty distinguishing 340B context within tracing systems. [11]	Keep purchasing context with the commercial relationship, without inferring patient or program eligibility.
Chargeback interpretation	The 2018 HDA and Rutgers study reported proprietary class-of-trade variation and eligibility, pricing and date concerns. [6]	Separate account resolution, contract eligibility and monetary calculation.

Two denominator corrections that change the business case

The Cardinal Health pilot's 507 records were logged transmission and support samples, not a representative sample of shipments. Successful automated exchanges without the specified human interaction were excluded. The 364 exception records therefore do not establish a 72 percent industry failure rate. The timing and master-data categories are useful for designing test cases, not for estimating national incidence. [28]

The HDA and Rutgers paper cites a weighted 0.7 percent chargeback rejection rate from the 2017 HDA Factbook. Its 43 percent and 46 percent eligibility figures concern respondents in two trade-letter-information subgroups. They are not identity-error rates or shares of disputed dollars; the study did not derive an industry rejection cost. [6]

> **What must not appear as an established gap**
>
> Account-number collisions across issuers remain a defensive namespace test, not an evidenced prevalence claim. NPI-to-personnel linkage is outside this pilot's supported problem statement. No authoritative 852/867 error-rate estimate or identity share of rejected dollars was established. Nor does an unmapped account prove that an identity defect caused a rejection.

T3 Preserve the pharmaceutical baseline

Product-tracing flow	Commercial reporting flow
Manufacturer to wholesaler to dispenser, with applicable ownership and possession arrangements and each participant's records.	Wholesaler and manufacturer exchange the commercial reports and responses their applicable arrangements support.
TI and TS, package identifiers, event and transaction context, product verification and defined investigation processes.	844/849 adjustment request and response, 845 price authorization, 852 activity, and 867 transfer and resale reporting.
EPCIS, CBV and pharmaceutical implementation profiles supply event structure.	Existing customer masters, contracts, rosters, price rules and partner-specific EDI and API guides supply business context.

FDA recommends EPCIS for interoperable tracing-data exchange. Statutory TI includes product and transaction information and the business names and addresses of transfer parties; it is not legally defined as a list of GLNs alone. Routine Transaction History exchange effectively ended on November 27, 2023, but relevant tracing-information gathering continues under the applicable provisions. DSCSA does not establish a general manufacturer entitlement to every downstream TI record. [1, 2, 8, 31]

An actual route may include a 3PL, a drop shipment or another arrangement in which possession and ownership diverge. Do not draw every physical handler as a legal ownership hop. EPCIS and CBV already distinguish owning party, possessing party and location, and support business-transaction references, aggregation and corrections. [1, 3, 32]

Existing coverage is substantial

Existing component	Use it before adding anything
GS1 identifiers and Data Hub	Typed party and location references and status and replacement information. A location and a legal entity are not interchangeable. [10, 33]

Existing component	Use it before adding anything
HIBCC HIN	Customer, location and service identification and existing audit and referback information. Do not recreate HIN's predecessor history or assume every HIN represents a legal entity. [5]
PDG and HDA workflows	Existing exception content, partner configuration and notification assets. PDG Chapter 3 v1.6 supports near-term email; structured message resources also exist. [13, 14, 15]
OCI and deployed security	Identity and ATP evidence within the supported credential profile, plus existing authentication and authorization. Credential possession is not account ownership. [4, 34]
X12 and provider implementations	Existing business documents and response workflows. A public transaction-set description does not validate a new line-level reference segment. [7]

Residual opportunity: a shared way to expose and interpret an issuer's account relationship, its evidence and the exact version used. This is primarily a configuration and governance problem with a possible narrow interface-profile gap, not proof of a missing industry-wide identity standard.

T4 Ad-tech mechanisms worth retaining

Reuse coordination behavior, not advertising semantics.

Source mechanism	Proposed pharmaceutical application	Reuse boundary
sellers.json: issuer-scoped IDs and out-of-band metadata	Keep the issuing organization or system attached to every account ID. Look up authorized relationship details outside the transaction. [18]	Private customer-master interface, not a public customer graph or a new registry.
OpenRTB EID provenance	Distinguish the source assertion, insertion step, matching actor and method. Attach source evidence rather than a bare match score. [19, 35]	`asserted_by`, `inserted_by`, `matched_by` and `match_method` are proposed pharmaceutical fields. They do not make the object OpenRTB-compliant.
UID2 v3 mapping contract	Batch lookups, per-item outcomes and a revalidation time. Refresh only what requires rechecking. [20]	No email or phone normalization, consumer token, salt rotation or UID2 network. Its temporary prior-ID window is not a retention standard.
IAB taxonomy practice	Separate small code systems; pin versions and preserve source codes when translating across vendors. [21]	No advertising category becomes a drug, contract or legal-role classification.
Data Transparency label fields	Source record, methodology, checked-at time and evidence references accompany a mapping. [22]	Descriptive metadata is not certification or verified accuracy. No paid audit program is required.

Source mechanism	Proposed pharmaceutical application	Reuse boundary
ads.txt-style corroboration	A second authorized source can confirm a new or disputed relationship.	A useful verification pattern, not a universal prerequisite or proof that an undeclared existing account is invalid.

Exact source correction

The OpenRTB release history places the EID `inserter`, `matcher` and `mm` additions in **2.6-202409**, not 2.6-202402. This package pins the field model to the observed **2.6-202606** specification. Source namespaces and asserted authority still need explicit pharmaceutical interpretation. [19, 35]

These sources establish published formats and operational interface patterns. They do not establish how much of a pharmaceutical rejection rate is addressable, or prove that a particular wholesaler would adopt the profile. The SupplyChain object contributes a useful issuer and account tuple, not a second custody graph. A declared path-complete flag cannot certify tracing completeness, and an existing seller or domain entry cannot prove drug authenticity.

T5 Three more ad-tech patterns that close implementation gaps

A common adapter contract, learned from Prebid

Prebid Server requires explicit adapter schemas and provides request and response fixture-testing patterns; its guidance also restricts arbitrary endpoint behavior. The lesson is not to run a pharmaceutical workflow through an auction server. It is to isolate each partner's interface behind a small, tested contract. [24]

Proposed implementation. Each wholesaler or registry adapter declares its source owner, supported identifier types, schema versions, lookup capabilities, error mappings and authorized endpoints. Contract tests cover nulls, leading zeros, multiple matches, stale source status, missing permissions and unsupported history. No adapter can promote a candidate match or reinterpret an authorization decision.

Activity-specific controls, not a purpose entitlement string

Prebid activity controls separate component activities from a component's mere presence. That enforcement structure adapts to `resolve_account`, `read_history`, `manage_endpoint` and `release_fields`. Its advertising defaults and privacy predicates must not be imported; some documented defaults are permissive. [25]

Proposed implementation. An existing policy enforcement point checks the authenticated actor, represented organization, operation, resource, fields and authority evidence before an adapter is invoked and again before data is released. Supplemental data access is denied unless authorized. An established statutory tracing route is not disabled because an optional account-profile field is missing.

Configuration acknowledgment plus polling repair, learned from the Deals API

IAB Tech Lab's Deals API v1.0, released for public comment in December 2025, separates origin-provided configuration from receiver status, preserves the origin's ID and recommends polling to recover missed notifications. It explicitly excludes revisions, negotiation and deciding whether a deal applies. Public specification

availability is not evidence of broad deployment. [26]

Proposed implementation. When a contract roster, account relationship or endpoint changes, the sender publishes an immutable version reference. The receiver acknowledges receipt and separately records whether it can apply that version. A periodic reconciliation detects missing updates. An acknowledgment means neither contract acceptance nor transaction eligibility.

> **Incremental value**
>
> Adapters reduce inconsistent integration logic; activity controls separate permitted operations; acknowledgments plus reconciliation reduce silent update loss. None substitutes for source verification, contract interpretation or product tracing. OpenDirect was screened as an adjacent workflow precedent; replacing pharmaceutical order and adjustment messages with an advertising order API would duplicate existing processes and is not selected. [36]

T6 Established non-IAB mechanisms where they fit better

Remaining hole	Existing mechanism	Minimum adaptation and limit
Purpose label mistaken for a right	OAuth Rich Authorization Requests, resource indicators and deployed policy enforcement [37, 38]	Request action, resource and fields explicitly. Establish authority separately; do not infer entitlement from the request.
Credentials reused outside the intended service	OAuth security BCP; mTLS-bound tokens where supported [39, 40]	Pin the recipient and the supported credential flow. Do not invent a new bearer string.
Ambiguous HTTP errors	RFC 9457 Problem Details [41]	Standardize top-level failures; define per-item batch results separately and suppress unauthorized existence details.
Unexplained mapping lineage	W3C PROV-O [42]	Identify source entities, transformation activity and responsible agents. Provenance does not prove the source assertion true.
Crosswalk claims treated as equality	W3C SKOS [43]	Use explicit exact, broad and narrow relationships only when defensible; ambiguous and unmapped are proposed workflow statuses.
Lost or duplicate change notifications	Existing bus plus outbox and inbox; optional CloudEvents [44, 45]	Atomic source and outbox commit, idempotent receiver, ordered per-record sequence and polling repair. No global exactly-once promise.
Cache staleness confused with access validity	HTTP caching controls [46]	Private, scoped caching and revalidation; check current permission independently of stored data freshness.
Undefined signed representation	JWS and an explicit canonicalization profile if needed [47, 48, 49, 50, 51]	Sign a specified representation with trusted keys. JSON byte canonicalization and RDF normalization are different choices.
Revoked sessions remain usable	Existing identity-provider controls; optional OpenID Shared Signals [52]	Security-state notifications only. Account history and regulator or licensure status have separate authorities.

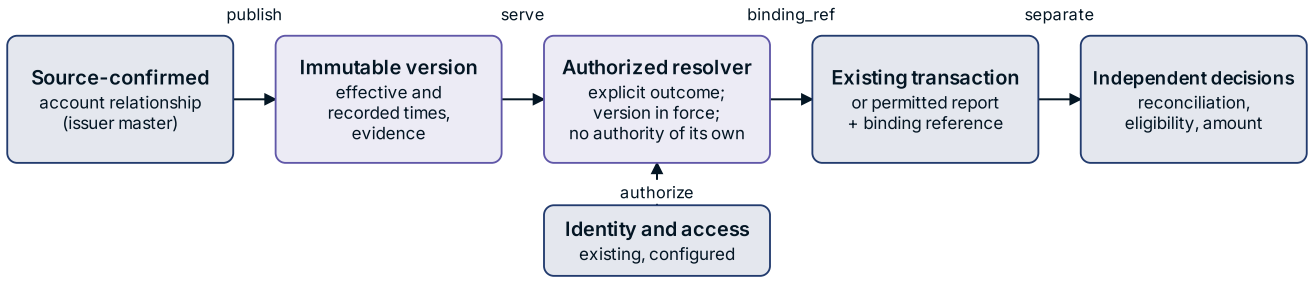
Remaining hole	Existing mechanism	Minimum adaptation and limit
Incomplete request troubleshooting	W3C Trace Context [53]	Operational correlation, without commercial IDs in public tracing metadata. Keep unsampled decision records separately.

Selection rule. Use the deployed identity provider, message bus, audit store and integration framework first. A standard is not a requirement to introduce another product or service. Add a mechanism only when its acceptance test cannot be satisfied cleanly by the existing stack.

Code reuse versus design reuse. No UID2, Prebid or Deals API code is required. Copying their wire schemas would carry unsuitable defaults and semantics. Use supported enterprise libraries for schema validation, OAuth and signatures; review licenses, maintenance and vulnerabilities before selecting packages. Where supported, token exchange can distinguish an acting service from the organization it represents; it does not authorize the service to read every record belonging to that organization. [50, 52, 54]

T7 Target architecture and assertion authority

One thin integration profile; existing systems retain ownership.



Logical flow: a source-confirmed account relationship becomes an immutable version; an authorized resolver selects the version in force; the existing transaction or permitted commercial report carries a binding reference; reconciliation and eligibility decisions remain independent. Existing layers (steel blue) keep ownership; proposed layers (violet) are an extension, an adapter and an audit record, not six services.

Layer	Existing or proposed	Responsibility
Pharmaceutical records	Existing	EPCIS and CBV product events and tracing information; X12 and provider commercial records.
Source identity and master data	Existing	Wholesaler accounts; licensed HIN and GS1 records; contract and membership systems.
Account-binding profile	Proposed, issuer-hosted	Typed account relationships, evidence, immutable versions and effective and recorded times.
Resolver adapter	Proposed only where needed	Authorized lookup, explicit outcomes and version selection. Not the authority over another issuer's account.

Layer	Existing or proposed	Responsibility
Decision receipt	Existing audit extended if needed	Exact binding used, source and knowledge times, policy reference and result.
Identity and access	Existing, configured	Authentication, delegated representation, applicable ATP evidence and operation and field-level authorization.

GS1 and HIBCC integration means authorized reference and lookup, not a claim that either registry accepts this custom schema. Registry licensing, caching, archive and redistribution rights must be confirmed. HIBCC's existing collaboration with MediLedger cautions against claiming a previously empty market. [5, 10, 33, 55]

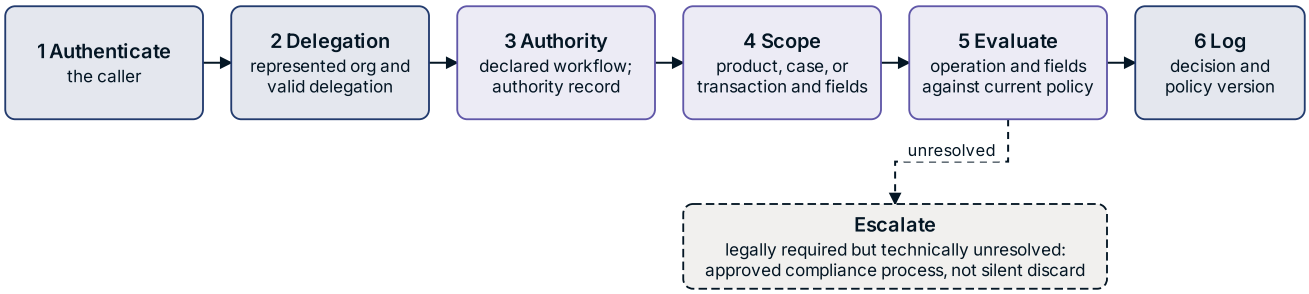
Who can assert what

Actor	Authority in the proposed workflow
Account issuer	Meaning and lifecycle of its own system's account, with source evidence and correction duties.
Hospital, legal purchaser or delegate	Its represented organization, receiving context and approved service delegation; not another issuer's namespace.
GS1 or HIBCC source	The identifier record within that source's scope; not all contract rights or operational permissions.
Licensing or credential authority	Applicable identity and licensure evidence, not the commercial account-to-contract decision.
Manufacturer or contract owner	Applicable contract terms and permitted commercial use, subject to actual agreements and law.
Resolver or service provider	Faithful processing under delegated authority; no independent authority to invent a relationship.

The issuer is authoritative about its account assignment, not infallible about external facts. Conflicts require source-owner correction. Two agreeing assertions can still be wrong; bilateral corroboration is evidence, not certainty.

T8 Access without invented disclosure rights

A request declares its workflow context, the idea the Transparency and Consent Framework applies when a purpose is declared at impression time. The declaration is logged and used to scope the response. It does not create a statutory obligation, a contractual entitlement or permission to disclose a complete account history. DSCSA information-gathering and verification obligations depend on the requester, role, transaction and applicable provision; protection of confidential commercial information remains relevant. A non-refusable purpose class at the resolver is therefore not adopted. [2, 31]



The decision sequence for every request. Authority is verified at step three, scope is restricted at step four and policy is applied at step five. A legally required but technically unresolved request is escalated through the approved compliance process rather than silently discarded.

Workflow declared	Required context	Response boundary
Routine tracing exchange	Applicable trading-partner relationship, transaction and verified destination	Required tracing data through the existing exchange; optional binding metadata must not create a new gate.
Product verification or saleable return	Correct verification role, product identifiers and applicable evidence	Use the existing verification route; account lookup alone cannot establish saleability.
Suspect-product or government request	Authenticated request, applicable authority, case, product and time scope	Required responsive information, not automatically every commercial relationship.
Chargeback interpretation	Agreed customer and claim scope and contractually permitted fields	Relevant account version and evidence subset; eligibility evaluated separately.
Downstream analytics	Explicitly permitted report scope and use	Only the agreed commercial subset. No general right inferred from being the manufacturer.
Binding maintenance	Authorized source administrator or delegated correction process	Specific record action; not a newly invented statutory directory obligation.

Implementation detail. Rich Authorization Requests can express requested actions, resources and data types where the authorization server supports them. They do not decide whether the asserted legal authority is valid. Separate authorization-detail entries are needed when different actions apply to different resources. A local policy decision object is sufficient where RAR is not deployed. [37, 38]

A regulator need not impersonate a commercial account holder. Conversely, a commercial requester cannot obtain investigation-level information by changing an operation code. The response references the verified authority decision and applied policy version; it does not store reusable credentials in an enduring product record.

NPI boundary. No NPI-to-staff or account requirement is introduced. Existing identifiers may be retained where legitimately used, but employment, representation and permission come from verified organizational access controls.

T9 Minimal records and cardinality

The profile has two necessary logical artifacts: an account assertion and the transaction's resolution receipt. Lifecycle and delegation evidence may reuse existing source events and access records. They are not forced into one envelope.

Field group	Proposed content	Rule
Relationship identity	`binding_id`, `version`, `issuer_ref`; account `namespace` and string `id`	Preserve leading zeros. Issuer and system namespace is mandatory. Reused account numbers receive a distinct logical binding identity.
Typed relationships	One or more `role`, `subject_kind`, `subject_ref` entries with existing identifier references	Purchaser and bill-to concern an organization; ship-to concerns a location in the narrow fixture profile. More complex cases require an explicit extension.
Purchasing context	Separate code-system, version and code entries such as GPO, WAC or 340B	Not mixed into physical roles; not an eligibility verdict.
Valid and recorded times	Effective interval; `recorded_at`; optional predecessor reference	Validity is half-open. A null end means open-ended, not unknown identity. Missing essential dates require review.
Provenance	Asserted, inserted and matched by; method; source record; evidence references; checked-at time	Original issuer and transformation actors remain distinguishable. Unknown is explicit; no guessed verifier.
Assurance	Candidate, reviewed or source-confirmed evidence assessment	Independent of the active or suspended lifecycle and of a current caller's access.
Resolution receipt	Transaction, document and line reference, exact binding versions, effective lookup time, knowledge cutoff, resolver and policy or decision reference	Does not overwrite original TI, claim contents or the old decision. No bearer token.

Illustrative account assertion (fictional, unsigned, not an EPCIS document) Proposed profile 0.2

```
{
  "schema_version": "0.2",
  "record_kind": "account_binding",
  "binding_id": "urn:example:binding:gpo-001",
  "version": 1,
  "issuer_ref": "urn:example:org:wholesaler-a",
  "account": { "namespace": "urn:example:wholesaler-a:erp1:accounts", "id": "004921" },
  "relationships": [
    { "role": "purchaser", "subject_kind": "organization", "subject_ref": "urn:example:org:hospital", "identifier_refs": [] },
    { "role": "ship_to",   "subject_kind": "location",     "subject_ref": "urn:example:site:hospital-north", "identifier_refs": [] }
  ],
  "purchasing_context": [{ "system": "urn:example:codes:purchasing-program", "version": "1", "code": "GPO" }],
  "valid_time": { "from": "2026-01-01T00:00:00Z", "to": null },
  "recorded_at": "2026-01-02T10:00:00Z",
  "provenance": { "asserted_by": "urn:example:org:wholesaler-a", "matched_by": "urn:example:org:wholesaler-a",
                  "match_method": "issuer_record_confirmed", "evidence_refs": ["urn:example:evidence:crm-export-2026-01"],
                  "checked_at": "2026-01-02T10:00:00Z" },
  "assurance": "source_confirmed"
}
```

Illustrative resolution receipt (fictional, separate from eligibility)


```
{
  "record_kind": "resolution_receipt",
  "transaction_ref": "urn:example:edi:844:doc-77:line-3",
  "binding_refs": [{ "binding_id": "urn:example:binding:gpo-001", "version": 1 }],
  "effective_at": "2026-02-15T00:00:00Z",
  "knowledge_cutoff": "2026-02-20T10:00:00Z",
  "resolved_at": "2026-02-20T10:00:00Z",
  "resolver_ref": "urn:example:service:resolver-a",
  "resolution_outcome": "resolved",
  "authorization_decision_ref": "urn:example:authz:decision-83",
  "policy_version": "bilateral-profile-4",
  "workflow_declared": "chargeback_interpretation",
  "eligibility_decision_ref": null
}
```

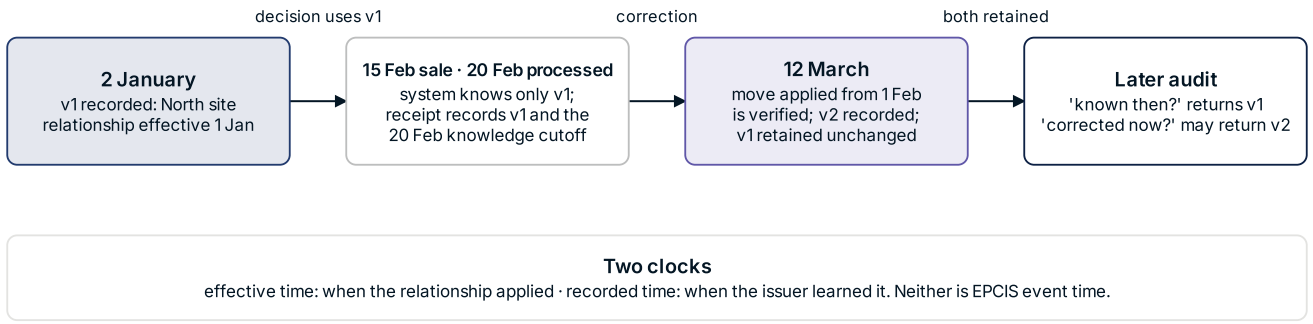

`eligibility_decision_ref: null` means no eligibility decision is represented, not that eligibility passed. The receipt cannot itself grant access. A later reassessment creates another receipt and retains the original.

Referential integrity. A binding may have several locations; the transaction must select its actual destination under the agreed relationship rules. An array match must not fan records out to every location. A `binding_ref` points to one immutable version while the logical `binding_id` may have successors; these are different API operations. A new owner does not automatically acquire access to the old owner's commercial records.

Excluded from the binding: package serial, lot and expiry, EPCIS disposition, full TI and TS, contract prices, approval verdicts, private keys and patient data.

T10 Time, corrections and lifecycle

Two times answer different questions. **Effective time** says when a relationship applied. **Recorded time** says when the issuer's system learned or recorded the assertion. Neither is the same as EPCIS event time or repository capture time. The relationship history complements existing HIN and GS1 predecessor information and EPCIS corrections; it does not replace them. [3, 5, 10]



A worked, fictional example. Version 1 is recorded on 2 January. A 15 February sale is processed on 20 February while the system still knows only v1. A move effective 1 February is confirmed on 12 March and recorded as v2. "What was known then?" returns v1. "What is the corrected view now?" may return v2. No silent historical rewrite.

The first assertion is not edited to conceal its existence. A projection may derive valid and recorded intervals from successor and correction events. The original record bytes, the later correction and the reason for change remain retained. Ambiguous or conflicting assertions are not resolved merely by taking the latest timestamp across unrelated issuers.

Keep three state axes separate

Assurance: candidate, reviewed or source-confirmed. This describes evidence quality under the pilot's rules; it is not a calibrated probability. **Lifecycle:** proposed, active, suspended, retired or withdrawn, expressed by authorized lifecycle events. A past assertion can remain readable even though it can no longer route new transactions. **Access:** allowed, denied, restricted or escalated for a specific authenticated request. A valid active binding does not make every requester authorized.

Successor discovery is not historical retrieval. An exact-version lookup either returns the named version or a controlled unavailable response. It never redirects to the latest owner or location. A separate successor query may return candidates and effective dates. Account reuse, merges, splits and retrospective corrections require explicit lineage.

T11 Resolver and adapter contract

The paths below are proposed pilot interfaces, not existing GS1, UID2 or OCI endpoints. A partner's existing interface may implement equivalent behavior without these names.

Operation	Input and output	Required behavior
`POST /account-resolution/v1/resolve`	Request ID; authorized issuer, namespace and account items; effective time; optional historical knowledge cutoff; requested operation and fields	One result per input item, preserving a caller-supplied item ID. Do not reorder silently or copy UID2 capacity limits without measurement.
`GET /bindings/{id}/versions/{version}`	Immutable identifier and version and current authenticated request context	Exact historical retrieval, no automatic successor redirect, no bypass of current access policy.
`GET /changes?cursor=...`	Authorized source partition and opaque cursor	Optional incremental feed; bounded retention and explicit resynchronization when a cursor expires.
Existing configured metadata endpoint	Supported profile and schema, operations and endpoint identity	Use an approved service catalog or onboarding configuration. No claim of a new globally registered well-known URL.

Two levels of failure. Top-level authentication, authorization, malformed-request, capacity and availability failures use the selected HTTP semantics and RFC 9457 where appropriate. A valid batch can return HTTP 200 with explicit per-item application outcomes. [41]

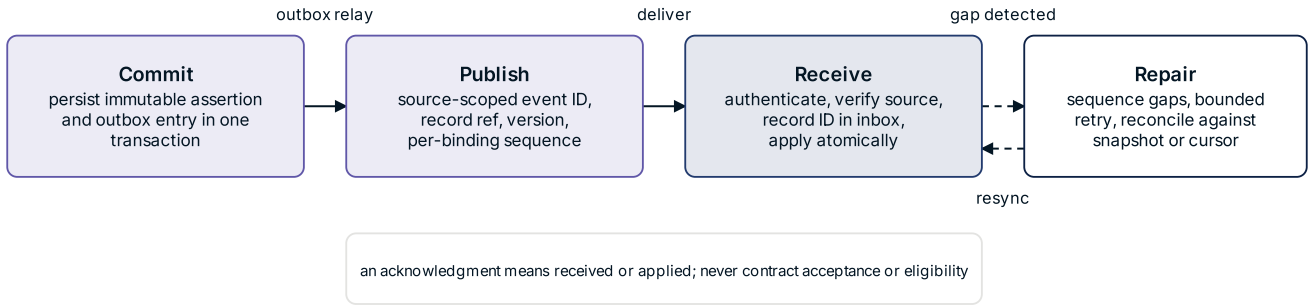
Result vocabulary (proposed): `resolved`, `unknown_account`, `needs_destination`, `ambiguous_binding`, `inactive_binding`, `evidence_stale`, `unsupported_history`, `not_accessible`. These are new pharmaceutical-profile terms, not UID2's consumer outcomes. A caller outside an account's permitted scope receives a non-enumerating result rather than an existence or evidence report.

Adapter invariants. Every adapter preserves the source account string and its namespace. It reports unsupported functionality explicitly. It cannot invent missing valid-time history, treat a timeout as no match, merge distinct subjects on address similarity, or convert a probabilistic candidate into a verified route. All outgoing destinations come from approved configuration; caller-controlled URLs and untrusted evidence links are not fetched. [24]

Cache rule. Cache by issuer, account, time mode, source and version and disclosure scope. `refresh_after` is a profile recheck hint, not a promise that current authorization cannot change. Revalidate permission on access and apply bounded continuity rules when a source is unavailable. [20, 46]

T12 Reliable updates and explicit acknowledgments

A notification is not the state of record. The account store and its update mechanism must not disagree silently. Use the existing enterprise event infrastructure where it already provides durable publication, deduplication and reconciliation; an additional bus is not a prerequisite.



Commit, publish, receive, repair. The assertion and its outbox entry are persisted in one transaction; the recipient records the source event ID in an inbox and applies the change atomically; sequence gaps, retries and cursor expiry are repaired against an authorized source snapshot. An expired cursor requires controlled resynchronization, not a claim that nothing changed.

State	What it means	What it does not mean
Message received	Transport durably accepted the message.	Business fields are valid.
Payload accepted	Schema and relevant semantic checks passed.	An account is authorized or data was applied.
Relationship applied	The verified version entered the recipient's supported projection.	A contract was accepted or a sale was eligible.
Tracing data stored	The product-data repository accepted its own record.	The physical shipment reconciled.
Physical receipt reconciled	The receiving process matched physical and electronic evidence.	A chargeback amount was approved.

CloudEvents can standardize the envelope if both systems support it; it supplies neither delivery guarantees nor pharmaceutical business meaning. The outbox pattern does not remove the need for idempotent receivers. EPCIS subscriptions and capture jobs remain bound to their defined queries, events and status semantics; they do not automatically carry arbitrary resolver errors. PDG's structured notification content can travel over an agreed API, service-provider integration or existing email bridge. [3, 13, 14, 15, 44, 45]

T13 Integration with EPCIS, X12 and existing masters

Required information	Existing representation	Proposed addition, only if missing
Product name, strength, dosage form, NDC and packaging	DSCSA TI plus applicable master-data or profile representation [3, 31]	None in the account binding.
Package serial, lot and expiry	Product identifiers and EPCIS or profile fields [3, 31]	Reference the existing transaction when authorized; do not duplicate package lists.
Ownership, possession and location	Typed EPCIS source and destination; read point and business location [3, 32]	Link an issuer account to the appropriate typed subject.
Purchase order, invoice or other business reference	`bizTransactionList` and deployed business documents [3, 32]	Preserve both dispenser and distributor PO references in drop-ship correlation.
Wrong product event	EPCIS `ErrorDeclaration` and applicable correction events [3]	Do not fix a product event by changing an account mapping.
Customer account meaning	Existing issuer master; HIN and GLN references [5, 10, 33]	Effective and recorded history and explicit mapping evidence where existing facilities are inadequate.
Which mapping was used	Existing transaction processing and audit context	Immutable binding reference and resolution receipt, not a new TI attestation.
Contract and chargeback interpretation	Contract, roster and price engines; existing X12 and provider workflows [7]	References to the exact customer, roster, contract and rule versions used.

EPCIS integration order. First use existing provider routing and audit metadata. Next consider a bilateral sidecar keyed to an existing document or event identifier. Add a namespaced event extension only when the deployed application profile and counterparties preserve it and it belongs at that event. EPCIS `eventID` is optional in the core model; when absent, define an agreed stable document or record locator rather than quietly minting an ID. [3]

X12 integration order. Default to an associated record keyed by issuer, document, line, business date and original identifiers, with the unaltered source retained. A reference inside 844 or 867 is an alternative only after the actual version, segment, loop, qualifier, length and partner implementation guide are verified. Nothing here asserts that a universal REF placement exists or that "no X12 change" is required. [7]

T14 Vocabulary and semantic crosswalks

Use separate dimensions for organization role, account relationship, purchasing context, assurance, lifecycle, resolution outcome and operation. Reuse EPCIS, CBV and PDG meanings where they already apply. Do not place GPO and ship-to in the same mutually exclusive role list. [13, 14, 15, 32]

Proposed dimension	Illustrative values	Interpretation
Account relationship	purchaser, bill_to, ship_to	What the account relationship concerns; the fixture model has explicit organization and location kinds.
Purchasing context	GPO, WAC, 340B	Commercial and program context, not patient eligibility or a physical-custody state.
Match method	issuer_record_confirmed, approved_crosswalk, probabilistic_candidate	How a relationship assertion was produced. Candidate inference cannot activate disclosure.
Resolution outcome	resolved, needs_destination, ambiguous_binding, not_accessible	Result of this lookup, not certification that product or claim is legitimate.

Each production vocabulary needs a named owner, namespace, version, definitions, effective dates, compatibility rules and a deprecation path. PDG, HDA and relevant GS1 and HIBCC participants are potential governance collaborators, not committed sponsors. Until governance is agreed, the vocabulary is a bilateral pilot profile.

Source code and definition	Target	Relation and action
Vendor A SHIP: physical delivery site	ship_to	Exact within the declared version and scope.
Vendor A CUST: mixed billing and ordering record	purchaser	Ambiguous; preserve the source code and request clarification.
Vendor A BILL: billing organization	bill_to	Exact, not receiving authority.
Vendor B DELIVERY_SITE: physical destination	ship_to	Exact within the declared scope.
Vendor B HOSP_ACCT: hospital-only purchaser class	purchaser	Source is narrower; it does not match all purchaser classes.
Vendor B MAIN: undefined primary account	none	Unmapped; no invented target.

SKOS supplies precise concept-mapping predicates, but `exactMatch` is transitive; assigning it loosely can spread an unjustified equivalence through a graph. Broader and narrower mappings do not establish that two parties or contracts are identical. PROV-O can connect each mapping to source records, transformation activity and responsible agents; the initial implementation can retain equivalent plain JSON fields. [42, 43]

T15 Worked workflows, investigations and continuity

A. Order, tracing exchange and chargeback (one hospital site, three purchasing relationships; fictional)

1 **Establish the account.**
The wholesaler records the GPO account's issuer namespace, purchaser and ship-to references. Existing GS1 and HIN records are checked under their access terms. The hospital's appropriate administrator confirms a new receiving-service delegation.

2 **Publish evidence.**
The verified relationship becomes an immutable assertion with effective and recorded times. A contradictory location remains an exception rather than being resolved by a name or address score.

3 **Process the order.**
The transaction resolves the specific GPO account and selected destination. The WAC and 340B account relationships are not merged into it. The resolver checks current authorization and records the exact binding version used.

4 **Exchange records.**
Product tracing follows the existing channel. A sidecar or supported metadata extension links the transaction to its binding reference. The receiving organization separately matches product and electronic evidence.

5 **Interpret the claim.**
The manufacturer's authorized 844 workflow receives the permitted account context. Its eligibility engine checks contract, membership or roster, product scope and effective dates. The calculation then applies price, quantity and duplicate controls. These are separate decisions with possibly different outcomes.

6 **Resolve disagreement.**
A claim can have a correct account mapping but a wrong price or inapplicable contract. The record cites which evidence and rules produced each decision. An account-related correction creates a successor and a reassessment; it does not overwrite the submitted claim.

B. Drop shipment. The wholesaler may issue a PO to the manufacturer while the dispenser uses a different PO. Preserve both issuer-scoped references and the supported document and line relationship. A commercial account assertion explains the customer reference; it does not insert a fictitious wholesaler possession event. [3, 11, 32]

C. A late location correction. If a move is confirmed after a sale, keep the old processing receipt and the later corrected interpretation. Eligibility reassessment is explicitly authorized and separately logged; a successor identifier is not automatic proof of retroactive contract coverage.

Investigation: a scoped route, not a full-history switch

An investigator requests records for a specified product, transaction range or case. The service authenticates the requester and checks the applicable authority through the established process. It resolves only the necessary relationship context and releases the responsive fields. A request marked `suspect_product` cannot automatically retrieve every superseded customer account. A purpose mismatch produces a recorded policy decision or escalation, not a hidden denial of a valid legal obligation. [2, 31]

Optional manufacturer sourcing information

A machine-readable manufacturer distributor list may improve a voluntarily adopted sourcing or risk check. It must remain distinct from DSCSA ATP status and from product-specific authenticity. Presence is not proof of a legitimate package; absence is not automatic proof of illegal resale. The reviewed eCFR text of 21 CFR 203.50 includes written-list and public-on-request language. FDA's February 2022 proposal contemplated removal of that section after statutory changes. This package does not resolve its current operative applicability or present a signed list as a DSCSA mandate; the optional design requires counsel review. The 2023 Gilead opinion discusses allegedly forged pedigrees and licensed downstream wholesalers; it does not establish that every manufacturer-unauthorized resale is illegal. [23, 56, 57, 58]

Controls when a dependency fails

Situation	Proposed behavior
Optional profile is absent, established route is verified	Continue the approved exchange and record missing supplemental evidence; do not introduce a universal new gate.
New route or endpoint is unverified	Do not redirect or disclose based on it. Use the existing approved route or authorized resolution process.
Account sources conflict	Stage supplemental processing, notify the source owners and avoid a guessed match.
Resolver is unavailable	Apply a bounded, preapproved continuity policy using appropriate cached data and current security controls. Do not treat stale permission as valid indefinitely.
Data and product mismatch	Use the existing product-discrepancy procedure. Relationship success cannot override a product concern.
Required response cannot be automated	Escalate to the compliance owner and approved alternative channel; preserve the request and deadlines.

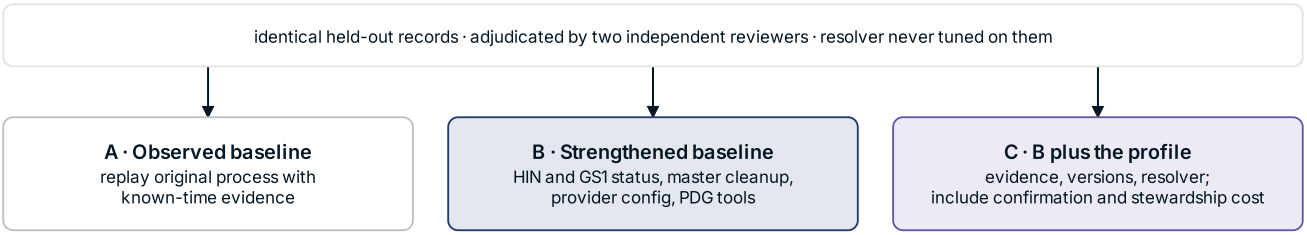
Signed resale chains, universal pharmacy tokens, ads.cert deployment and a paid Data Transparency audit program are not selected. PAIR and ADMaP remain deferred unless a measured confidential-roster use case establishes a need and valid shared matching material. No collective commercial-customer pool is proposed. A private delegated service may support more than one issuer only with tenant separation and explicit authority; federation does not make it the owner of those account facts.

T16 Measure cause, not just lookup success

An unresolved mapping may coexist with a price error without causing the rejection. A resolved mapping may be confidently wrong. A report of resolved, unmapped and ambiguous outcomes is therefore a diagnostic, not the identity share of exceptions or disputed dollars.

Independent adjudication. Use representative records from both accepted transactions and exceptions, with known sampling probabilities where sampling is used. Retain product family, partner, workflow, period and case-mix information. Reconstruct the evidence available at the original decision, not just today's corrected master. Two qualified reviewers independently classify a bounded sample, with adjudication for disagreement. Reviewers must not accept the new resolver's output as evidence of correctness. Record missing evidence rather than force a category.

Causal class	Meaning in the proposed evaluation
Identity-caused	Correcting the account or relationship defect would have avoided the outcome, with the other required conditions satisfied.
Identity-contributed	Identity was one of multiple material causes; correcting it alone may not avoid the outcome.
Unrelated	The evidence supports another cause, such as pricing, aggregation or product-before-data timing.
Indeterminate	Available evidence cannot support a defensible causal classification.

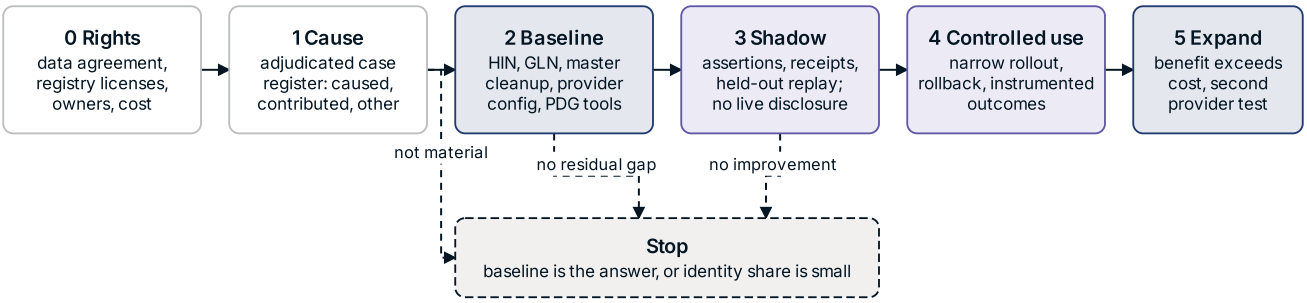


Three evaluation arms on identical held-out records. Arm A replays the original process with its known-time evidence. Arm B applies existing HIN and GS1 predecessor and status data, customer-master cleanup, provider configuration and PDG tools. Arm C adds the proposed profile to B. The resolver is never tuned on the adjudicated records used to report its final accuracy.

Retrospective replay can test historical reconstruction and mapping agreement. Reduced live rejection rates, staff effort and time to resolution require a prospective controlled phase or a separately instrumented work study. Neither a simulated tribunal nor a passing fixture suite supplies those outcomes.

T17 Pilot gates, metrics and economic decision

Use one willing manufacturer, one wholesaler, one health system with the documented price-class account pattern, and their existing service providers. A second issuer or provider is a later interoperability test, not a prerequisite for discovering whether the first gap exists.



Gate 0 establishes rights and feasibility before any data moves. Gate 1 establishes cause with the adjudicated case register. Gate 2 strengthens the baseline and measures its work cost. Only a residual gap justifies gates 3 to 5.

Gate	Deliverable	Proceed only when
0. Rights and feasibility	Data agreement, registry licenses, retained evidence scope, partner guides, accountable owners and cost estimate	Required records can legally and technically be obtained; no presumed wholesale data right.
1. Establish cause	Independent case register with caused, contributed, unrelated or indeterminate categories	A material, addressable account-related problem is demonstrated.
2. Strengthen baseline	HIN, GLN, master-data and provider improvements and measured work cost	A residual gap remains after existing capabilities are used.

Gate	Deliverable	Proceed only when
3. Shadow the profile	Immutable assertions and receipts, adapter tests and held-out replay	It improves relevant agreement and history measures without unsafe disclosure behavior.
4. Controlled operational use	Narrow authorized rollout, rollback and instrumented outcomes	Security, availability and process-owner acceptance tests pass.
5. Expand or stop	Incremental benefit and cost decision and second-provider conformance test	Improvement exceeds implementation and stewardship cost under observed conditions.

Required measures. Accuracy: agreement with independently adjudicated account and relationship truth, including wrong confident matches; coverage and unresolved cases reported separately. Operational benefit: manual touches, median and 95th-percentile resolution time, avoidable resubmissions, onboarding effort and partner correction latency. Economic effect: root-cause-reviewed counts and dollars with transaction volume and case mix; a rejected claim's face value is not automatically a recoverable loss. Safety and continuity: wrong-recipient tests, endpoint changes, unavailable-source behavior, historical reconstruction, product and data latency and added lookup cost; any unauthorized routing blocks release.

> **Decision rule**
>
> Retain the new profile only when its incremental benefit over arm B exceeds integration, ongoing evidence stewardship and security and operating cost. If B performs equivalently, B is the solution.

Targets and sampling thresholds must be set before evaluation. Zero observed errors is not proof of zero risk: under independent identical trials, a zero-error sample of size n has a one-sided 95 percent binomial upper bound of 1 minus 0.05 to the power 1/n; real claim clusters may violate those assumptions. Duration depends on access, data quality, staffing and partner testing. There is no unconditional "export plus a fortnight" estimate and no new automatic chargeback withholding rule.

T18 Design-assurance register and acceptance contract

Analytical perspectives, not an independent expert tribunal. The table records revised design decisions. It does not claim that a real panel voted, that external reviewers endorsed the system, or that design agreement demonstrates operational effectiveness.

Blue-team proposal	Red-team challenge	Resolved design and remaining gate
One account layer will solve identity	Existing HIN, GLN and masters may already be sufficient.	Test the combined baseline first; build only the residual functions. Data-owner gate.
Hash accounts into common IDs	Hashing neither joins different accounts nor establishes authority.	Issuer namespaces and durable relationship refs; no consumer rotation. Adapter tests.
Require both parties to declare every account	A new dependency could block correct existing exchanges.	Risk-based corroboration for new, changed or conflicting routes; preserve verified routes. Operator gate.
Purpose determines disclosure	A code can be abused to claim a right.	Verify request authority and scope; filter fields; retain compliance escalation. Counsel and security gate.

Blue-team proposal	Red-team challenge	Resolved design and remaining gate
Binding determines eligibility	Contract, roster, product, price and date still matter.	Separate resolution, eligibility and amount decisions with their own evidence refs. Finance gate.
Directory membership proves legitimate drugs	Legal identity, ATP, manufacturer relationship and physical truth differ.	Optional sourcing signal only; existing product verification and investigation remain. Compliance gate.
Latest binding should serve all requests	It rewrites history and can reveal a predecessor's records.	Exact-version fetch plus separate successor lookup; current access check. Temporal and security tests.
Push notifications keep everybody current	Updates can be lost, duplicated or arrive out of order.	Durable publication, idempotent inbox, sequence-gap repair and polling. Failure-injection tests.
EPCIS or REF already carries everything	Extensibility is not shared semantics or partner acceptance.	Existing metadata and sidecar first; validate any EPCIS or EDI extension against real guides. Provider gate.
Confidence labels certify the mapping	A self-reported score is not verified truth.	Evidence provenance plus explicit assurance state and independent adjudication. Data-quality gate.
A shadow score measures avoided rejection	It does not identify causation or live work saved.	Separate adjudicated replay from prospective operational measurement. Evaluation gate.
Signed JSON solves integrity completely	Bytes, keys, delegation and historical compromise must be defined.	Pinned signing profile and evidence-retention tests; no fake signatures. Security gate.

Ordered implementation increments

1 **Existing-system baseline.**
Data owners inventory identifier history, update HIN and GLN records, classify accounts and correct partner routing. Finance and compliance agree on evidence and rights. The output is a measured baseline, not a new platform.

2 **Issuer extension.**
Add immutable relationship versions and evidence references where absent. Preserve effective and recorded times, typed subjects and source account strings. Deploy one adapter and a read-only resolver using existing security.

3 **Decision receipts.**
Connect selected transactions to their exact interpreted versions in existing audit storage. Keep contract and eligibility decisions separate. Introduce portable signatures only where authenticated lookup plus retained source evidence is insufficient for the agreed audit use case.

4 **Reliability and narrow activation.**
Reuse existing notification channels; add durable change delivery and reconciliation where needed. Validate partner guides and current permissions. Activate only the reviewed use case, with a rollback to approved existing behavior.

Acceptance cases beyond the local fixture checks

Test group	Required result
Identity and roles	Three purchasing contexts remain distinct; leading zeros persist; duplicate account strings across issuers do not collide; multiple destinations require selection; billing is not receiving authority.
Time and history	Late correction reproduces both original knowledge and corrected interpretation; exact old refs never redirect; account reuse and ownership change do not reassign old records or permissions.
Access and delegation	Purpose spoofing, stale credentials, unauthorized history reads and endpoint changes fail safely; proper legal requests have an approved escalation route.
Integration	Real partner schema and profile fixtures pass; absent optional fields preserve a valid existing exchange; unsupported history is explicit; sidecars retain document and line correlation.
Delivery	Duplicate and out-of-order changes, missed notifications, expired cursors, source outages and replay do not silently corrupt the projection or disclose to a guessed recipient.
Semantics	Unknown critical codes require negotiation or review; broader and narrower taxonomic links do not become exact eligibility or identity matches.
Evidence	Signature tampering, untrusted keys, changed source contexts and inaccessible archives are detected under the selected profile; source error is not relabeled cryptographic success.
Evaluation	Held-out adjudication distinguishes caused, contributed, unrelated or indeterminate; costs include partner confirmation and stewardship; live benefits are not inferred from replay.

The companion fixture suite's 24 passing checks cover only a narrow subset of schema, time and immutable-fixture behavior. They do not implement these end-to-end gates. Assign the data owner, integration owner, security owner, commercial process owner and compliance owner explicitly before any production change. [59]

T19 Revision ledger and final conclusion

Earlier premise or addition	Treatment in this package
Commercial identity has no existing solution	Narrowed: existing sources are substantial; test whether their capabilities are consistently applied.
"100 percent" tribunal and calibrated certainty	Removed. Replaced with evidence categories, design-assurance decisions and external release dependencies.
TCF-derived non-refusable purposes, including directory maintenance	Removed. Requests declare workflow context for scoping and logging; scoped authority checks and current response policy govern each workflow.
Only newly corroborated bindings may route or settle	Removed as a universal gate. Established verified routes continue; changed or uncertain routes need appropriate verification.
Account binding resolves contract eligibility	Corrected. Binding, eligibility and amount are distinct decisions.
OCI-signed TI plus ADR membership proves authenticity	Removed. Credentials, payload integrity, manufacturer policy and physical-product evidence are distinct.
HIN has no usable history	Corrected. Existing referback and audit information is part of the strengthened baseline.

Earlier premise or addition	Treatment in this package
OpenRTB provenance in 2.6-202402	Corrected to 2.6-202409; field inspection pinned to 2.6-202606.
UID2 supplies an append-only archive	Corrected to batch and refresh mechanics; explicit bitemporal evidence supplies the proposed history.
EPCIS webhooks retire email; no X12 change needed	Replaced by negotiated adapters, PDG content reuse and validated sidecar or extension options.
Resolver outcomes measure causal identity share	Replaced by independent adjudication and separate retrospective and prospective stages.
Two weeks, no material build or adoption cost	Replaced by prerequisite gates and measured integration and stewardship costs.
Reference numbering in v3.0	Corrected in v3.1. One shared list numbered by first citation; every citation re-mapped to its source.
"IAB Deal Sync API"	Corrected to the IAB Tech Lab Deals API v1.0, released for public comment in December 2025.
Manufacturer forcing function by chargeback withholding	Reframed. The commercial data agreement negotiated at Gate 0 is the lever; no automatic withholding rule is proposed.

Final recommendation

A manufacturer does not need an advertising identity system for medicines. It needs reliable interpretation of the customer relationships in the records it is entitled to receive, at the time those relationships applied, and with evidence of how the interpretation was produced.

The strongest incremental solution is a **verified account-binding profile hosted with the issuer**, connected to existing identifier sources and existing transaction channels. Ad tech contributes disciplined namespaces, lookup, provenance, adapters, activity controls and synchronization patterns. Established IETF and W3C mechanisms provide more precise technical semantics for gaps that ad-tech analogies alone did not close.

The end state is concrete: a correct relationship can be resolved; an uncertain one is explicit; a past decision is reproducible; a changed endpoint requires real authority; and an eligibility dispute identifies the actual contract and roster evidence rather than assuming identity settles it. Product authenticity and required tracing procedures remain outside the account resolver.

> **What would invalidate the recommendation**
>
> If corrected HIN, GLN and customer-master and provider configurations already deliver equivalent accuracy, history, interoperability and work reduction, the added profile is unnecessary. If account defects are a minor contributor, prioritize the larger measured causes. This is a complete proposed decision and implementation framework, not a claim that the outcome has already been achieved.

T20 References and source notes

Numbers are shared with the executive track. Titles open the source where a link is available. Proposed adaptations are not endorsements by the source organizations.

1. **FDA** · DSCSA standards for the interoperable exchange of information for tracing, final guidance (September 2023)
   EPCIS recommendation, exchange architecture and protection of confidential commercial information.
2. **FDA** · Enhanced drug distribution security at the package level, guidance (January 2024, procedural revision 1)
   Reconciliation, information gathering and protected exchange.
3. **GS1** · EPCIS 2.0.1
   Event model, ErrorDeclaration, capture and query interfaces and extension mechanisms.
4. **Open Credentialing Initiative** · DSCSA interoperability profile, v3.4 series
   Identity and ATP credential profiles; deployment support must be confirmed.
5. **HIBCC** · The HIN system: a user guide
   Undated guide. Account-number bridge, audit fields and referback after a move; not a current API contract.
6. **HDA Research Foundation and Rutgers University** · Change management: best practices in contract and chargeback administration (2018)
   Weighted 0.7 percent rejection rate from the 2017 HDA Factbook; eligibility survey subgroups; industry cost not derived.
7. **X12** · Transaction set descriptions
   844 and 849 product transfer account adjustment and response; 845, 852 and 867 per the X12 catalog. No segment-level validation claimed.
8. **FDA** · Exemptions from the enhanced drug distribution security requirements of section 582(g)(1) (October 9, 2024)
   States that section 582(k)(1) effectively ended routine Transaction History exchange on November 27, 2023; phased exemption dates by trading partner type.
9. **Cencora** · DSCSA: understanding GLN requirements (September 13, 2024)
   Company-specific WAC, GPO and 340B account example and the 2024 duplicate GLN cleanup.
10. **GS1 US** · Location data quality, Data Hub help
    Inactive and replacement GLN handling; registry data and access remain source-controlled.
11. **PDG and FDA** · 2025 dispenser town hall report (November 2025)
    Participant reports of portal growth, misrouted files, drop-ship references and 340B context; not a prevalence survey.
12. **AmerisourceBergen** · Exceptions pilot white paper (2018)
    Historical manufacturer-onboarding duration.
13. **PDG** · Interoperability blueprint, chapter 3 (v1.5, January 2026; v1.6, July 2026)
    TI and TS design, exception categories and near-term email notification.
14. **PDG** · Exception notification guideline v1.0.1
    Structured notification content; not a universal transport mandate.
15. **PDG** · Blueprint resources: exception notification JSON schema and connection template
    Confirm the partner-supported schema before implementation.
16. **HIDA** · Navigating healthcare identifiers: HIN assignments and updates
    Webinar resource on HIN assignment, location distinctions and updates.
17. **Morningstar** · Drug distribution industry trends (June 2025)
    Concentration by revenue, not shipment share.
18. **IAB Tech Lab** · sellers.json and the SupplyChain object
    Issuer-scoped seller identifiers and out-of-band participant metadata.
19. **IAB Tech Lab** · OpenRTB 2.x release history
    2.6-202409 adds the EID inserter, matcher and mm fields; latest tagged release observed is 2.6-202606.
20. **Unified ID 2.0** · POST /v3/identity/map
    Batch results, refresh timestamp and temporary prior identifier; not archival versioning.

21. **IAB Tech Lab** · Taxonomies repository
    Independently versioned taxonomies and mappings; no pharmaceutical ownership implied.
22. **IAB Tech Lab** · Data Transparency Standard
    Data-label disclosure; does not certify the correctness of a mapping.
23. **IAB Tech Lab** · ads.txt: authorized digital sellers
    Authorized-seller publication mechanics.
24. **Prebid.org** · Prebid Server: new bid adapter (Go)
    Adapter JSON schemas, fixture tests and endpoint restrictions.
25. **Prebid.org** · Activity controls
    Per-activity permission rules; permissive defaults are not adopted.
26. **IAB Tech Lab** · Deals API v1.0 (released for public comment, December 4, 2025)
    Origin-scoped deal identity, receiver status and polling repair.
27. **HDA** · Exceptions handling guidelines for DSCSA (2023)
    Six named scenario sections in the edition reviewed.
28. **Cardinal Health, hosted by FDA** · Interoperability data exchange errors and exception handling DSCSA pilot project, final report
    Logged exception and support samples, May 2017 to January 2020; not a representative transaction sample.
29. **FDA** · Small business dispenser exemption extension (letter, August 6, 2026)
    Specified relief through November 27, 2027; size measured at the owning corporate entity as of November 27, 2026.
30. **FDA** · Exemptions under the Drug Supply Chain Security Act
    Current exemption status; page updated August 26, 2026.
31. **U.S. Code** · 21 U.S.C. 360eee and 360eee-1 (FD&C Act sections 581 and 582)
    Definitions, Transaction Information and Statements, verification and information-gathering provisions.
32. **GS1** · Core Business Vocabulary 2.0
    Owning party, possessing party, location and business-transaction semantics.
33. **GS1 US** · Healthcare managed GLN subscription, Data Hub help
    Program-administrator and location-record workflow; not hosting approval for a custom profile.
34. **Open Credentialing Initiative** · Frequently asked questions
    Credential issuer, holder presentation and verification; a credential is not a TI signing key.
35. **IAB Tech Lab** · OpenRTB 2.6 specification, tag 2.6-202606
    SupplyChain, SupplyChain node, EID and UID objects.
36. **IAB Tech Lab** · OpenDirect
    Adjacent order-workflow specification; not selected.
37. **IETF** · RFC 9396: OAuth 2.0 Rich Authorization Requests
    Structured authorization_details; a request is not legal authority.
38. **IETF** · RFC 8707: Resource Indicators for OAuth 2.0
    Resource and audience scoping for OAuth requests.
39. **IETF** · RFC 8705: OAuth 2.0 mutual-TLS client authentication and certificate-bound access tokens
    Certificate-bound tokens where supported.
40. **IETF** · RFC 9700: OAuth 2.0 security best current practice
    Select a supported security profile rather than a new bearer scheme.
41. **IETF** · RFC 9457: Problem Details for HTTP APIs
    Top-level error representation; per-item batch outcomes remain application-specific.
42. **W3C** · PROV-O: the PROV ontology
    Entities, activities and agents for provenance; neither truth certification nor authorization.
43. **W3C** · SKOS reference
    Mapping relations; exactMatch is transitive and must not be assigned casually.

44. **CloudEvents** · CloudEvents specification v1.0.2
    Envelope attributes and source-scoped identity; not a delivery or ordering guarantee.
45. **AWS Prescriptive Guidance** · Transactional outbox pattern
    Atomic database and outbox write; duplicate delivery still requires idempotent consumers.
46. **IETF** · RFC 9111: HTTP caching
    Cache controls; current authorization remains separate from data freshness.
47. **IETF** · RFC 7515: JSON Web Signature
    Signature over specified bytes and protected metadata.
48. **IETF** · RFC 8785: JSON Canonicalization Scheme
    Deterministic JSON serialization when explicitly selected.
49. **W3C** · RDF dataset canonicalization
    A distinct canonicalization route; not interchangeable with JCS.
50. **IETF** · RFC 9421: HTTP Message Signatures
    Optional message-component protection; does not establish licensure or physical truth.
51. **IETF** · RFC 9530: Digest Fields
    Content-Digest and Repr-Digest; a bare digest does not authenticate its issuer.
52. **OpenID Foundation** · OpenID Shared Signals Framework 1.0 (final, 2025)
    Optional security-event integration; not account-master transport.
53. **W3C** · Trace Context
    Operational correlation only; sampled telemetry is not the decision audit record.
54. **IETF** · RFC 8693: OAuth 2.0 Token Exchange
    Optional subject and actor delegation where deployed; not authority to acquire a customer graph.
55. **HIBCC** · MediLedger and HIN collaboration
    Existing-industry integration announcement; not independent return-on-investment evidence.
56. **U.S. District Court, E.D.N.Y.** · Gilead Sciences v. Safe Chain Solutions, opinion (July 31, 2023)
    Allegations and findings in their procedural context.
57. **eCFR** · 21 CFR 203.50, requirements for wholesale distribution of prescription drugs
    Written authorized distributor list, available to the public on request; read with the 2022 proposed rule.
58. **FDA, Federal Register** · Certain requirements regarding prescription drug marketing, proposed rule (February 4, 2022)
    Proposes removing section 203.50 in its entirety; not treated here as a final repeal.
59. **Centillion.ai** · Reference fixture checks, profile 0.2 (internal, not published)
    24 authored synthetic checks; no live interoperation, signature, access-control or outcome validation.

v3.1, 27 September 2026. Proposed profile, not compliance certification. v3.1 re-maps every citation to one shared reference list and names the IAB Tech Lab Deals API correctly. Package unified from: Unified Narrative v2.0, DSCSA Commercial Identity White Paper v2.0, the v2.1 consensus amendment and the v2.1 solution board, with source re-checks on 27 September 2026.