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Part 21: Guidance on the application of the Open-edi business transaction ontology in distributed business transaction repositories

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Foreword

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This document was prepared jointly by Technical Committee ISO/IEC JTC 1, *Information technology*, Subcommittee SC 32, *Data management and interchange*.

A list of all parts in the ISO/IEC 15944 series can be found on the ISO and IEC websites.

Any feedback or questions on this document should be directed to the user's national standards body. A complete listing of these bodies can be found at www.iso.org/members.html and www.iec.ch/national-committees.

Introduction

ISO/IEC 15944-4 defines the Open-edi Business Transaction Ontology (OeBTO) as a formal, rule-based specification and definition of the concepts pertaining to business transactions and scenarios and the relationships that hold among these concepts.

Figure 1 overviews the ontology of a business transaction. It is taken from ISO/IEC 15944-4:2015, Figure 21, modified as follows to bring to light certain properties that were not illustrated at the time:

— the generalization of "Partner" to "Person" is according to ISO/IEC 15944-4:2015, Figure 18;

— the business policy connections between the three types (i.e. Economic Resource Type, Economic Event Type and Economic Role) is according to ISO/IEC 15944-4:2015, Figure 13; and

— the connections of party (OeP) and counterparty (OeCP) are shown as distinct persons having negotiated the Economic Contract.

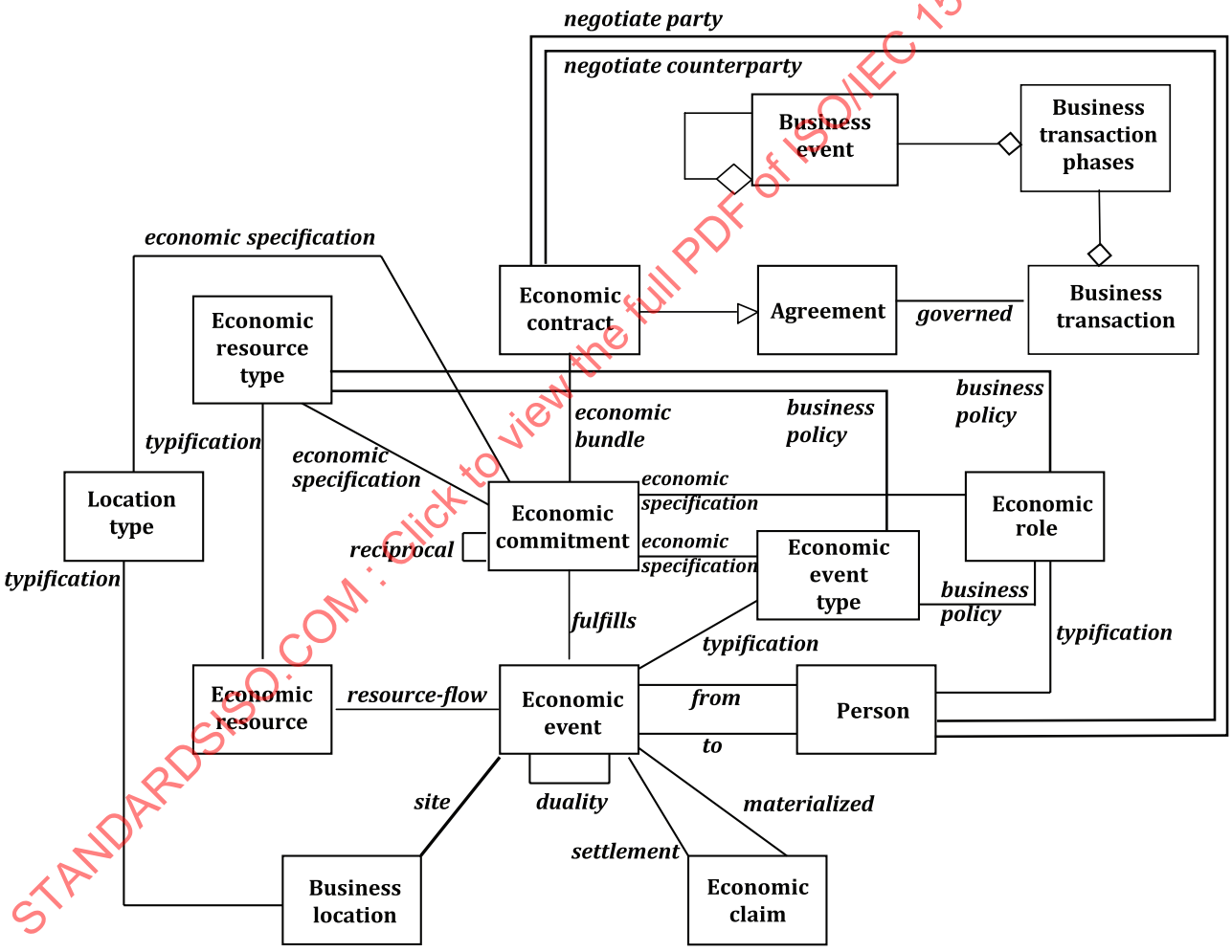

Figure 1 — Open-edi Business Transaction Ontology

According to ISO/IEC 15944-4, each business entity, depicted as a box in the diagram, is a computable representation of a real- world entity that participates, occurs, or is materialized during a business transaction. These are either static representations for the duration of the business transaction or dynamically changing representations implemented as individual state machines. Different business events effecting the business transaction are inputs influencing different sets of one or more of the state machines and changing their individual states. The particular states that each business entity can exhibit are established prior to the business transaction starting in order that the state machines act

as deterministic automatons for the duration. Initiating the business transaction instantiates the state machine of each business entity based on its negotiated definition.

The concept of a business collaboration that is illustrated in Figure 2. It has been updated from ISO/IEC 15944-4:2015, Figure 3 to bring to light the party (OeP) and counterparty (OeCP) as distinct persons of a generic nature, not necessarily a buyer nor a seller.

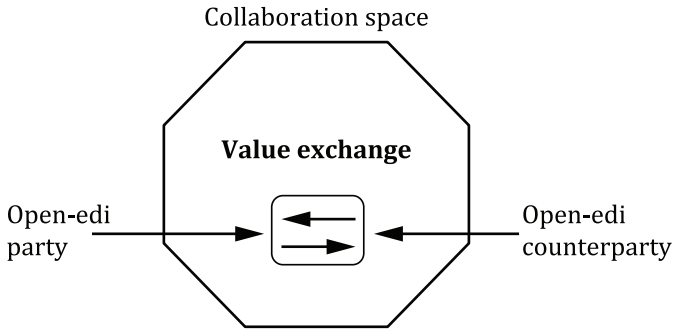

Figure 2 — Concept of a Business Collaboration

The collaboration space captures the information regarding a value exchange between the party and counterparty who have entered into an economic contract. The business transaction occurs within this space. The duality of the business transaction is that it involves two economic events, that is, two transfers of value in the value exchange. One transfer of value is from the OeP to the OeCP, and the other transfer of value is from the OeCP to the OeP.

ISO/IEC 15944-4 describes the ontology as the properties of this active multi-step process of the business transaction between party and counterparty from planning through to post-actualization. The business transaction transits through a series of states, one with each step, with each state stimulus being a business event. After any business event in the business transaction one can view the status of the interrelations between the ontology components as an outcome of that event.

This document supplements ISO/IEC 15944-4 by describing the Open-edi Distributed Business Transaction Repository (OeDBTR) properties of an indelible history or formal record of these changes in interrelations. This history can subsequently be queried or inspected. Without such a history of the state transitions of business entities, there is no record of the life cycle of the business transaction from instantiation to termination.

Information technology — Business operational view —

Part 21: Guidance on the application of the Open-edi business transaction ontology in distributed business transaction repositories

1 Scope

This document specifies the business operational view of an implementation of an Open-edi Distributed Business Transaction Repository (OeDBTR), building on the principles and concepts defined in ISO/IEC 15944-4 of a business transaction. The repository stores the history of the transitions in states of the economic claim and/or other business entities that happen over the course of a business transaction, and does so for a collection of business events. These business events, comprised of transactions and their states, can be identified unambiguously so as to provide the ability to inspect or query the information at some point after the record has been made. The distributed nature of the repository offers users ubiquitous and robust access to the recorded history.

A history of business transactions of market exchanges can be useful in auditing or other memoing-based activities, looking back at the immutable record of the interactions between parties.

This document does not specify the Functional Services View of a particular implementation of an Open-edi Distributed Business Transaction Repository. For best performance, candidate technologies would likely exhibit properties of long-term permanence, robust immutability, decentralized access, distributed resilience, and fine-grained addressability.

2 Normative References

The following documents are referred to in the text in such a way that some or all of their content constitutes requirements of this document. For dated references, only the edition cited applies. For undated references, the latest edition of the referenced document (including any amendments) applies.

ISO/IEC 15944-4, *Information technology — Business operational view — Part 4: Business transaction scenarios — Accounting and economic ontology*

3 Terms and definitions

For the purposes of this document, the following terms and definitions apply.

ISO and IEC maintain terminological databases for use in standardization at the following addresses:

— ISO Online browsing platform: available at https://www.iso.org/obp

— IEC Electropedia: available at http://www.electropedia.org/

3.1
business
series of *processes* (3.34), each having a clearly understood purpose, involving more than one *Person* (3.33), realized through the exchange of information and directed towards some mutually agreed upon goal, extending over a period of time

[SOURCE: ISO/IEC 14662:2010, 3.2]

3.2
business event
occurrence in time that an *Open-edi Party* (3.28) and an *Open-edi Counterparty* (3.26) in a *business transaction* (3.4) wish to monitor or control

Note 1 to entry: Business events are the workflow tasks that business partners need to accomplish to complete a business transaction among themselves. As business events occur, they cause a business transaction to move through its various phases of planning, identification, negotiation, actualization, and post-actualization.

Note 2 to entry: Occurrences in time can either: (a) be internal as mutually agreed to among the parties to a business transaction and/or (b) reference some common publicly available and recognized date/time referencing schema (e.g. one based on using ISO 8601 and/or ISO 19135 standards).

[SOURCE: ISO/IEC 15944-4:2015, 3.5 (adapted)]

3.3
business operational view
BOV
perspective of *business transactions* (3.4) limited to those aspects regarding the making of business decisions and *commitments* (3.6) among *Persons* (3.33), which are needed for the description of a *business transaction*

[SOURCE: ISO/IEC 14662:2010, 3.3]

3.4
business transaction
predefined set of activities and/or *processes* (3.34) of *Persons* (3.33) which is initiated by a *Person* to accomplish an explicitly shared *business* (3.1) goal and terminated upon recognition of one of the agreed conclusions by all the involved *Persons* although some of the recognition might be implicit

[SOURCE: ISO/IEC 14662:2010, 3.4]

3.5
collaboration space
business activity space where an *economic exchange* (3.12) of valued resources is viewed independently and not from the perspective of any business partner

Note 1 to entry: In collaboration space, an individual partner's view of economic phenomena is de-emphasized. Thus, the use of common business and accounting terms like purchase, sale, cash receipt, cash disbursement, raw materials, and finished goods, etc. is not allowed because they view resource flows from a participant's perspective.

[SOURCE: ISO/IEC 15944-4:2015, 3.12]

3.6
commitment
making or accepting of a right, obligation, liability or responsibility by a *Person* (3.33) that is capable of enforcement in the jurisdictional domain in which the commitment is made

[SOURCE: ISO/IEC 14662:2010, 3.5]

3.7
constraint
rule, explicitly stated, that prescribes, limits, governs or specifies any aspect of a *business transaction* (3.4)

Note 1 to entry: Constraints are specified as rules forming part of components of Open-edi scenarios, i.e., as scenario attributes, roles, and/or information bundles.

Note 2 to entry: For constraints to be registered for implementation in Open-edi, they shall have unique and unambiguous identifiers.

Note 3 to entry: A constraint may be agreed to among parties (condition of contract) and is therefore considered an "internal constraint". Or a constraint may be imposed on parties (e.g., laws, regulations, etc.), and is therefore considered an "external constraint".

[SOURCE: ISO/IEC 15944-1:2023, 3.11]

3.8
data
reinterpretable representation of *information* (3.18) in a formalized manner suitable for communication, interpretation, or processing

Note 1 to entry: Data can be processed by humans or by automatic means.

[SOURCE: ISO/IEC 2382:2015, 2121272]

3.9
eBusiness
business transaction (3.4), involving the making of *commitments* (3.6), in a defined *collaboration space* (3.5), among *Persons* (3.33) using their *Information Technology System* (3.20), according to *Open-edi standards* (3.30)

Note 1 to entry: eBusiness can be conducted on both a for-profit and not-for-profit basis.

Note 2 to entry: A key distinguishing aspect of eBusiness is that it involves the making of commitment(s) of any kind among the Persons in support of a mutually agreed upon goal, involving their IT systems, and doing so through the use of EDI (using a variety of communication networks including the Internet).

Note 3 to entry: eBusiness includes various application areas such as e-commerce, e-administration, e-logistics, e- government, e-medicine, e-learning, etc.

Note 4 to entry: The equivalent French language term for “eBusiness” is always presented in its plural form.

[SOURCE: ISO/IEC 15944-7:2009, 3.6]

3.10
economic claim
expectation of one *Person* (3.33) to receive a future inflow of an *economic resource* (3.13) from another Person because of an *economic exchange* (3.12) which is currently incomplete

[SOURCE: ISO/IEC 15944-4:2015, 3.21]

3.11
economic event
occurrence in time wherein ownership of an *economic resource* (3.13) is transferred from one *Person* (3.33) to another Person

Note 1 to entry: Occurrences in time can either: (a) be internal as mutually agreed to among the parties to a business transaction and/or (b) reference some common publicly available and recognized date/time referencing schema (e.g. one based on using ISO 8601 and/or ISO 19135 standards).

[SOURCE: ISO/IEC 15944-4:2015, 3.25]

3.12
economic exchange
type of a *business transaction* (3.4) where the goal is an exchange of *economic resources* (3.13) between two *Persons* (3.33) where both parties derive higher utility after the settlement of the *business transaction*.

Note 1 to entry: An economic exchange usually involves two economic events with different types of economic resources flowing in opposite directions. For example, an exchange of cash for a good involves a shipment with a requited payment following.

[SOURCE: ISO/IEC 15944-4:2015, 3.27]

3.13
economic resource
good, right, or service of value, under the control of a *Person* (3.33)

[SOURCE: ISO/IEC 15944-4:2015, 3.28]

3.14
Electronic Data Interchange
EDI
automated exchange of any predefined and structured data for *business* (3.1) purposes among information systems of two or more *Persons* (3.33)

Note 1 to entry: This definition includes all categories of electronic business transactions.

[SOURCE: ISO/IEC 14662:2010, 3.8]

3.15
entity
any concrete or abstract thing that exists, did exist, or might exist, including associations among these things

EXAMPLE A person, object, event, idea, process, etc.

Note 1 to entry: An entity exists whether data about it are available or not.

[SOURCE: ISO/IEC 2382:2015, 2121433]

3.16
external constraint
constraint (3.7) which takes precedence over *internal constraints* (3.21) in a *business transaction* (3.4), i.e. is external to those agreed upon by the parties to a *business transaction*

Note 1 to entry: Normally, external constraints are created by law, regulation, orders, treaties, conventions or similar instruments.

Note 2 to entry: Other sources of external constraints are those of a sectorial nature, those which pertain to a particular jurisdictional domain or mutually agreed common business conventions (e.g., INCOTERMS, exchanges, etc.).

Note 3 to entry: External constraints can apply to the nature of the good, service and/or right provided in a business transaction.

Note 4 to entry: External constraints can demand that a party to a business transaction meet specific requirements of a particular role. For example:

a) Only a qualified medical doctor may issue a prescription for a controlled drug.

b) Only an accredited share dealer may place transactions on the New York Stock Exchange.

c) Hazardous wastes may only be conveyed by a licensed enterprise.

Note 5 to entry: Where the Information Bundles (IBs), including their Semantic Components (SCs) of a business transaction are also to form the whole of a business transaction (e.g., for legal or audit purposes), all constraints shall be recorded. For example, there may be a legal or audit requirement to maintain the complete set of recorded information pertaining to a business transaction, i.e., as the information bundles exchanged, as a "record".

Note 6 to entry: A minimum external constraint applicable to a business transaction often requires one to differentiate whether the Person that is a party to a business transaction is an "individual", "organization", or "public administration". For example, privacy rights apply only to a Person as an "individual".

[SOURCE: ISO/IEC 15944-1:2023, 3.23]

3.17
Functional Service View
FSV
perspective of *business transactions* (3.4) limited to those information technology interoperability aspects of *Information Technology Systems* (3.20) needed to support the execution of *Open-edi transactions* (3.31)

[SOURCE: ISO/IEC 14662:2010, 3.10]

3.18
information
knowledge concerning *objects* (3.23), such as facts, events, things, *processes* (3.34), or ideas, including concepts, that within a certain context has a particular meaning

[SOURCE: ISO 2382-1:1993 (01.01.01)]

3.19
Information Bundle
IB
formal description of the semantics of the *recorded information* (3.36) to be exchanged by *Open-edi Parties* (3.28) playing *roles* (3.38) in an *Open-edi Scenario* (3.29)

[SOURCE: ISO/IEC 14662:2010, 3.11]

3.20
Information Technology System
IT System
set of one or more computers, associated software, peripherals, terminals, human operations, physical processes, information transfer means, that form an autonomous whole, capable of performing information processing and/or information transfer

[SOURCE: ISO/IEC 14662:2010, 3.13]

3.21
internal constraint
constraint (3.7) which forms part of the *commitment(s)* (3.6) mutually agreed to among the parties to a *business transaction* (3.4)

Note 1 to entry: Internal constraints are self-imposed. They provide a simplified view for modelling and re-use of scenario components of a business transaction for which there are no external constraints or restrictions to the nature of the conduct of a business transaction other than those mutually agreed to by the buyer and seller.

[SOURCE: ISO/IEC 15944-1:2023, 3.11]

3.22
materialized
association between an *economic event* (3.11) and an *economic claim* (3.10) where the occurrence of the *economic event* causes the *economic claim* to come into existence

[SOURCE: ISO/IEC 15944-4:2015, 3.40]

3.23
object
anything perceivable or conceivable

Note 1 to entry: Objects may also be material, (e.g., engine, a sheet of paper, a diamond), or immaterial, (e.g., conversion ratio, a project play), or imagined, (e.g., a unicorn).

[SOURCE: ISO 1087-1:2000, 3.1.1]

3.24
Open-edi
Electronic Data Interchange (3.14) among multiple autonomous *Persons* (3.33) to accomplish an explicit shared *business* (3.1) goal according to *Open-edi standards* (3.30)

[SOURCE: ISO/IEC 14662:2010, 3.14]

3.25
Open-edi Business Transaction Ontology
OeBTO
formal, rule-based specification and definition of the concepts pertaining to *business transactions* (3.4) and scenarios and the relationships that hold among those concepts

[SOURCE: ISO/IEC 15944-4:2015, 3.44]

3.26
Open-edi Counterparty
OeCP
Open-edi Party (3.28) distinct from another *Open-edi Party* where both have negotiated *roles* (3.38) in an economic contract and between which there is an exchange of value in a *business transaction* (3.4), such that the temporal distinction is an Open-edi Counterparty is the responding party in the relationship initiated by another *Open-edi Party*

3.27
Open-edi Distributed Business Transaction Repository
OeDBTR
repository storing, in a distributed manner, *sets of recorded information* regarding *business transactions* (3.4)

3.28
Open-edi Party
OeP
Person (3.33) that participates in *Open-edi* (3.24)

Note 1 to entry: Often referred to generically in this and other eBusiness standards (e.g. other parts of this ISO/IEC 15944 multi-part "eBusiness" standard) as "party" or "parties" for any entity modelled as a Person as playing a role in Open-edi Scenarios.

[SOURCE: ISO/IEC 14662:2010, 3.17]

3.29
Open-edi Scenario
OeS
formal specification of a class of *business transactions* (3.4) having the same *business* (3.1) goal

[SOURCE: ISO/IEC 14662:2010, 3.18]

3.30
Open-edi standard
standard that complies with the Open-edi Reference Model

[SOURCE: ISO/IEC 14662:2010, 3.19]

3.31
Open-edi transaction
business transaction (3.4) that is in compliance with an *Open-edi Scenario* (3.29)

[SOURCE: ISO/IEC 14662:2010, 3.23]

3.32
organization
unique framework of authority within which a person or persons act, or are designated to act, towards some purpose

Note 1 to entry: The kinds of organizations covered by this part of ISO/IEC 15944 include the following examples:

a) an organization incorporated under law.

b) an unincorporated organization or activity providing goods and/or services, including:

   1) partnerships;

   2) social or other non-profit organizations or similar bodies in which ownership or control is vested in a group of individuals;

   3) sole proprietorships;

   4) governmental bodies.

c) groupings of the above types of organizations where there is a need to identify these in information interchange.

[SOURCE: ISO/IEC 6523-1: 1998, 3.1]

3.33
Person
entity (3.15), i.e. a natural or legal person, recognized by law as having legal rights and duties, able to make *commitment(s)* (3.6), assume and fulfil resulting obligation(s), and able to be held accountable for its action(s)

Note 1 to entry: Synonyms for "legal person" include "artificial person", "body corporate", etc., depending on the terminology used in competent jurisdictions.

Note 2 to entry: Person is capitalized to indicate that it is being utilized as formally defined in the standards and to differentiate it from its day-to-day use.

Note 3 to entry: Minimum and common external constraints applicable to a business transaction often require one to differentiate among three common sub-types of Person, namely "individual", "organization", and "public administration".

[SOURCE: ISO/IEC 14662:2010, 3.24]

3.34
process
series of actions or events taking place in a defined manner leading to the accomplishment of an expected result

[SOURCE: ISO/IEC 15944-1:2023, 3.53]

3.35
public administration
entity (3.15), i.e., a *Person* (3.33), which is an *organization* (3.32) and has the added attribute of being authorized to act on behalf of a *regulator* (3.37)

[SOURCE: ISO/IEC 15944-1:2023, 3.54]

3.36
recorded information
any *information* (3.18) that is recorded on or in a *medium* (3.24) irrespective of form, recording *medium* or technology used, and in a manner allowing for storage and retrieval

Note 1 to entry: This is a generic definition and is independent of any ontology (e.g., those of "facts" versus "data" versus "information" versus "intelligence" versus "knowledge", etc.).

Note 2 to entry: Through the use of the term "information", all attributes of this term are inherited in this definition.

Note 3 to entry: This definition covers:

a) any form of recorded information, means of recording, and any medium on which information can be recorded; and,

b) all types of recorded information including all data types, instructions or software, databases, etc.

[SOURCE: ISO/IEC 15944-1:2023, 3.56]

3.37
regulator
Person (3.33) who has authority to prescribe *external constraint* (3.16) which serve as principles, policies or rules governing or prescribing the behavior of *Persons* involved in a *business transaction* (3.4) as well as the provisioning of goods, services, and/or rights interchanged

[SOURCE: ISO/IEC 15944-1:2023, 3.59]

3.38
role
specification which models an external intended behavior (as allowed within a scenario) of an *Open-edi Party* (3.28)

[SOURCE: ISO/IEC 14662:2010, 3.25]

3.39
Semantic Component
SC
unit of *recorded information* (3.36) unambiguously defined in the context of the *business* (3.1) goal of the *business transaction* (3.4)

Note 1 to entry: An SC may be atomic or composed of other SCs.

[SOURCE: ISO/IEC 14662:2010, 3.27]

3.40
set of recorded information
recorded information (3.36) of an *organization* (3.32) or *public administration* (3.35), which is under the control of the same and which is treated as a unit in its information life cycle

Note 1 to entry: An SRI can be a physical or digital document, a record, a file, etc., that can be read, perceived or heard by a person or computer system or similar device.

Note 2 to entry: An SRI is a unit of recorded information that is unambiguously defined in the context of the business goals of the organization, i.e. a semantic component.

Note 3 to entry: An SRI can be self-standing (atomic), or an SRI can consist of a bundling of two or more SRIs into another "new" SRI. Both types can exist simultaneously within the information management systems of an organization.

[SOURCE: ISO/IEC 15944-5:2008, 3.137]

3.41
settlement
association between a requiting *economic event* (3.11) and an *economic claim* (3.10) where the occurrence of the event causes the *economic claim* to expire

[SOURCE: ISO/IEC 15944-4:2015, 3.63]

4 Symbols and abbreviations

BOV	Business Operational View
EDI	Electronic Data Interchange
FSV	Functional Service View
IB	Information Bundle
IT	Information Technology
IT System	Information Technology System
OeBTO	Open-edi Business Transaction Ontology
OeCP	Open-edi Counterparty
OeDBTR	Open-edi Distributed Business Transaction Repository
OeP	Open-edi Party
SC	Semantic Component
SRI	Set of Recorded Information

5 Ontology of an Open-edi Distributed Business Transaction Repository

5.1 Transitions of the economic claim in a business transaction

Critical to the prototypical business transaction described in ISO/IEC 15944-4 are the economic resources being exchanged between persons to fulfil an economic event. An economic resource from the party to the counterparty is exchanged for an economic resource from the counterparty to the party. The economic claim is but one example of many business entities of the business transaction. Describing the history of the economic claim provides an illustration of how the history of any of the business entities can be recorded in an Open-edi Distributed Business Document Repository (OeDBTR).

Consider in Figure 3 the basic components of a business transaction ontology taken from ISO/IEC 15944-4:2015, Figure 1. Depicted here is an example business transaction of two requited economic events involving two economic resources, some goods being sold and some payment for those goods. Two persons are involved, the seller [the Open-edi Party (OeP)] and the buyer [the Open-edi counterparty (OeCP)] in dual economic events where the economic claim materialized from the exchange is somehow settled.

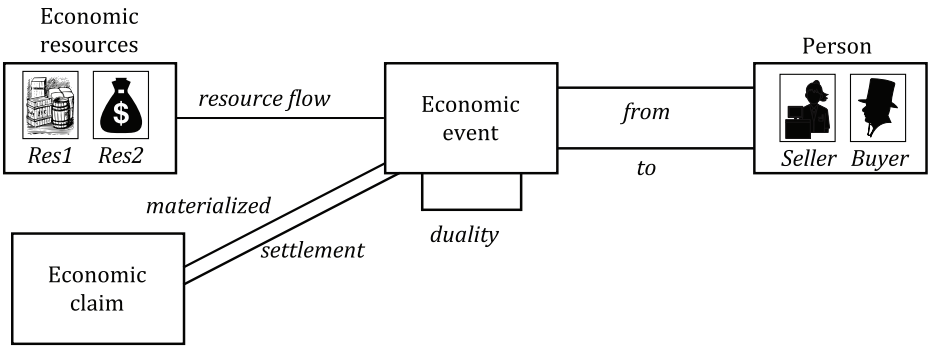

Figure 3 — Basic Open-edi Business Transaction Ontology components

An instantaneous settlement would effect two transfers at the same time, with no need for a lingering economic claim. In this example, the buyer presents the requiting payment to the seller who then immediately exchanges it for the goods. In effect, this immediate exchange both materializes and settles the economic claim as a single state transition. This is illustrated in Figure 4. The state transition also would be representative of non-monetary-based economic events where the materialization and settlement are instantaneous and implicit in the nature of the exchange of the non- monetary resources.

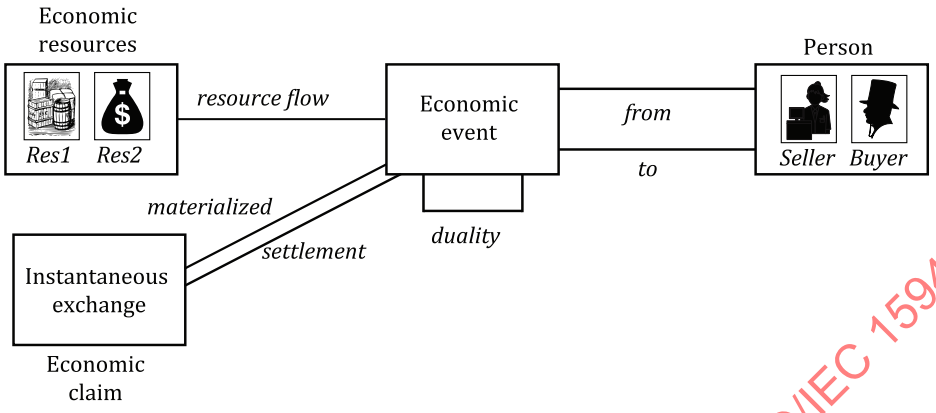

Figure 4 — State transition for the instantaneous settlement of a materialized claim

More commonly, perhaps through some logistics process, the economic transfer has been completed in one direction by the successful delivery to and receipt of the goods by the buyer. This triggers the economic claim of a monetary amount from the seller requiring materialization and settlement. For the sale of goods this economic claim is usually expressed from seller to buyer in the formal form of some kind of a commercial invoice as a demand for payment. The final settlement completes the economic transfer in the other direction with the successful remittance of the full payment of the invoice.

Moreover, non-monetary-based economic events also may be governed by a business process that progresses the economic claim from materialization to settlement. Examples would be a qualification or a negotiation of the terms of rights or privileges in exchange for evidence of entitlement of said benefits.

Here would be a period of time elapsing from the materialization of the economic claim to its settlement, possibly involving a number of intermediate steps as Business Events in a temporal order per ISO/IEC 15944-4, triggering transitions in the state of the economic claim as shown in Figure 5.

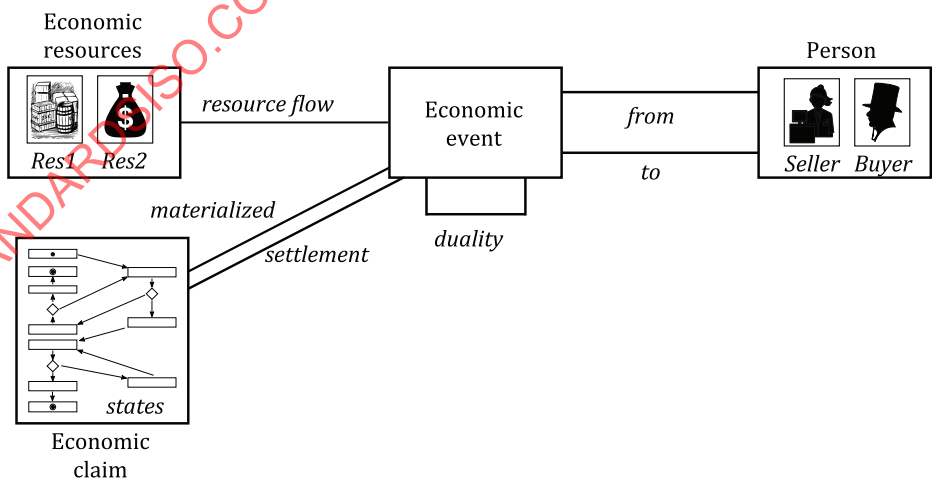

Figure 5 — Changing state of an economic claim

These business events recognized between the OeP and OeCP need to be agreed upon in the negotiation phase of the business transaction so that the seller and buyer can progress the economic claim through the transitions in state from materialization to settlement. Consider the Figure 6 illustrative example

of a simple state machine of the business events for an invoice using a simplified notation of initial, intermediate, and final states and the flow between states based on decisions that need to be made.

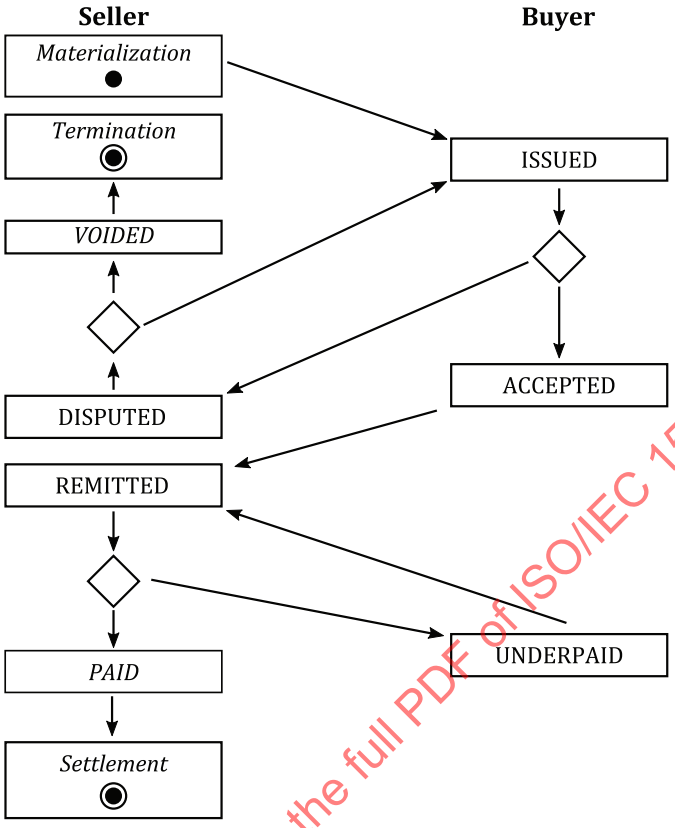

Figure 6 — Example simple invoice business event state machine

NOTE 1 This example includes the concept of termination for a materialized economic claim that would require the materialization of a revised economic claim. Such a modification of the original terms of the value exchange might be required in the example of damaged or incomplete goods or a misunderstanding of terms that would nullify the original economic claim in preference for a revision that addresses the prior inconsistencies. This does not supplant the ultimate requirement for a satisfying materialization and settlement for the economic claim as described and depicted in ISO/IEC 15944-4, but recognizes the real-world occurrences of such. Such alternate paths are specified in the negotiation phase of the business transaction.

NOTE 2 The term "underpaid" represents the concept of insufficient payment.

The ISO/IEC 15944-4 business transaction components are illustrated below using a subset of the business entities shown in Figure 1.

The first business event is when the economic claim is materialized, that is, the invoice is presented from the seller to the buyer. That initializes the invoice in the state of "ISSUED". See Figure 7.

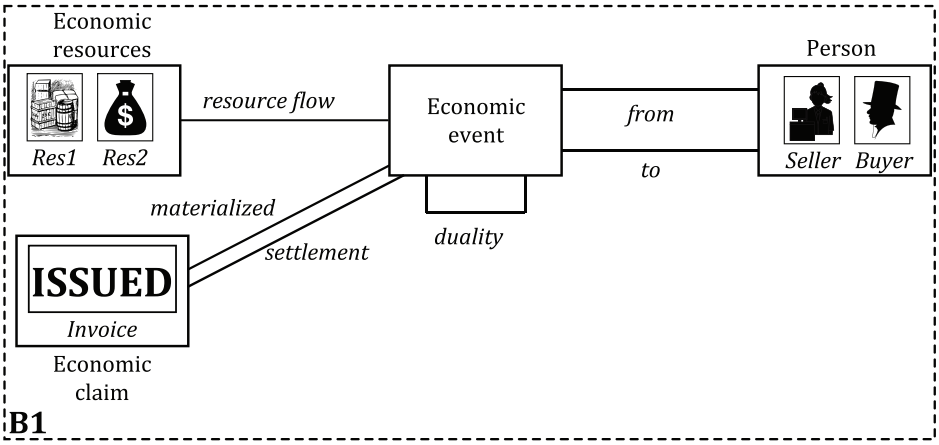

Figure 7 — Example transaction with an economic claim having been materialized

The second business event happens when the buyer disputes the invoice. They do not agree with something about the invoice. This transitions the invoice to the state of "DISPUTED". See Figure 8.

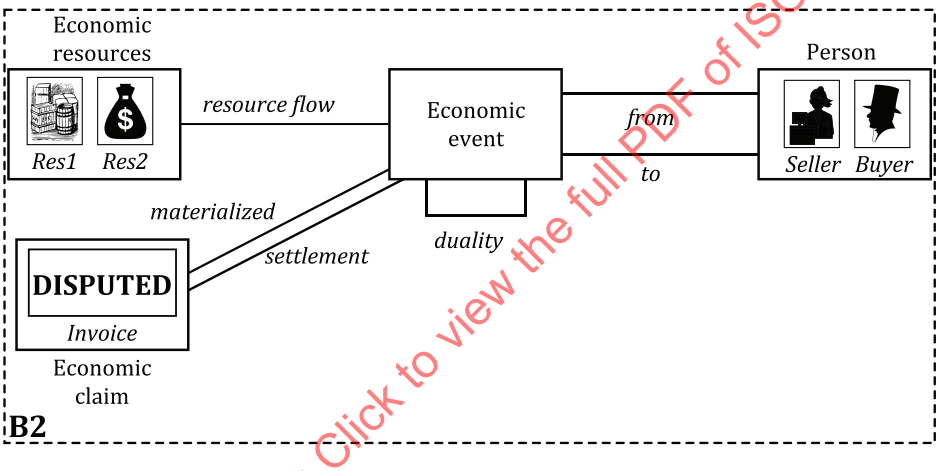

Figure 8 — Example state after a dispute

The third business event happens when the seller disagrees with the disputation arguments and resubmits the original invoice again unchanged. This transitions the invoice back to the state of "ISSUED". See Figure 9.

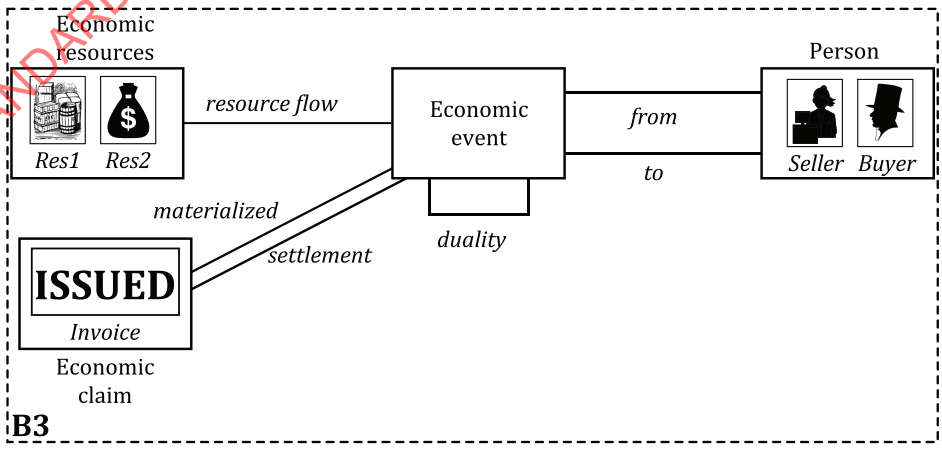

Figure 9 — Example state after disagreeing with the dispute

The fourth business event happens when the buyer has accepted all aspects of the invoice. This transitions the invoice to the state of "ACCEPTED". See Figure 10.

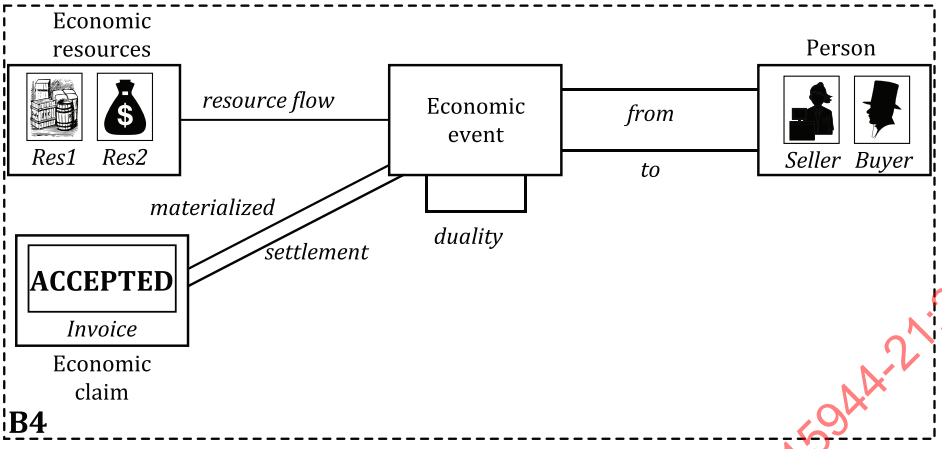

Figure 10 — Example state after accepting the invoice

The fifth business event happens when the buyer asserts that the invoice has been remitted in full. This transitions the invoice to the state of "REMITTED". See Figure 11.

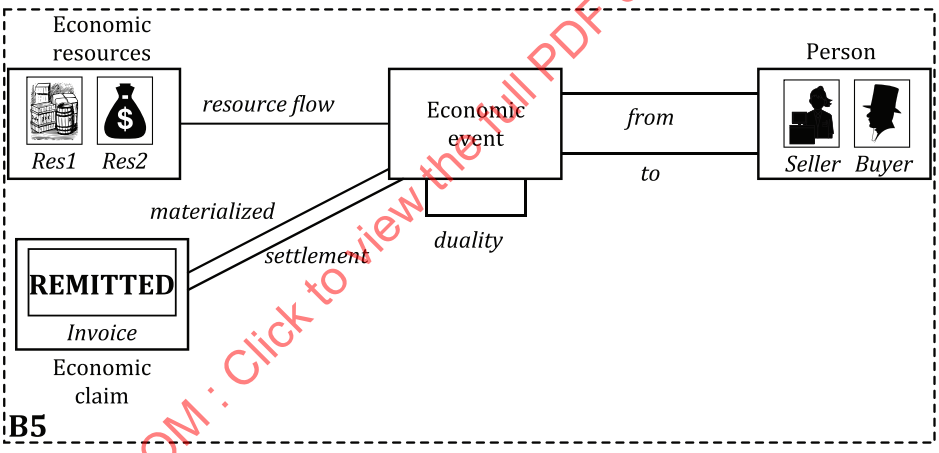

Figure 11 — Example state after asserting payment

The sixth business event happens when the seller reviews their bank account only to find that not enough money has been remitted. This transitions the invoice to the state of "UNDERPAID". See Figure 12.

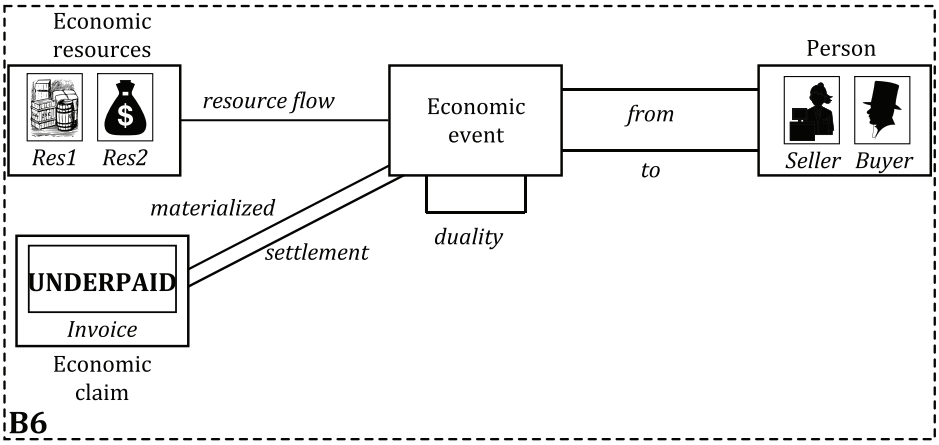

Figure 12 — Example state after checking the bank account

The seventh business event happens when the buyer asserts once again that the invoice has been remitted in full. This transitions the invoice back to the state of "REMITTED". See Figure 13.

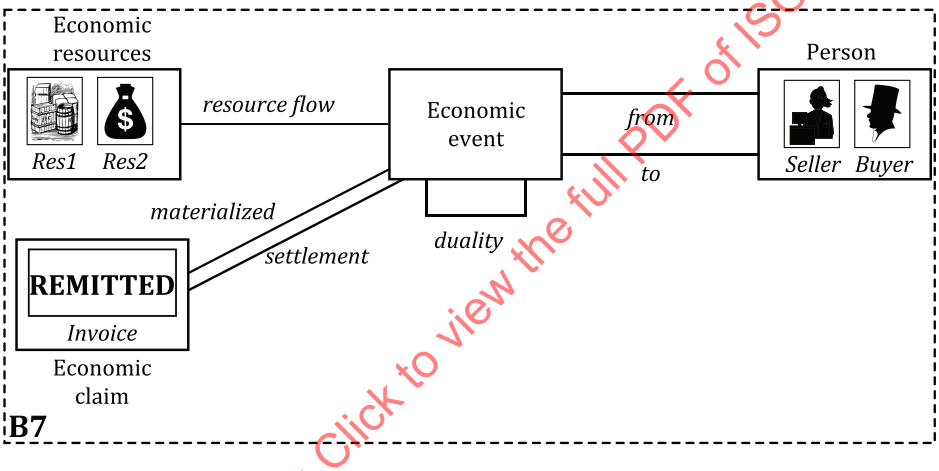

Figure 13 — Example state after asserting payment a second time

The eighth business event happens when the seller has confirmed that full payment has been made. This transitions the invoice to the final state of "PAID". See Figure 14.

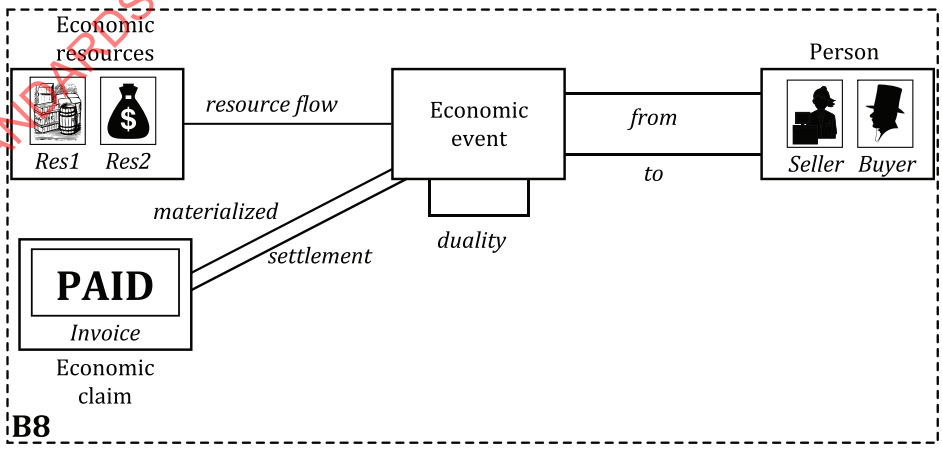

Figure 14 — Example state after full payment received

At this point the economic claim has been settled. This satisfies the materialization/settlement contributions of the economic claim as depicted in a business transaction defined in ISO/IEC 15944-4. The completed deposit of funds is the successful transfer of the money economic resource from the buyer back to the seller in exchange for the goods.

However, the illustrative use of invoice in Figure 7 to Figure 14 is but one example of a reified economic claim.

Economic claims need not necessarily involve currency or monetary return. A barter transaction can satisfy the perceived balance of Economic Resources going in both directions between persons.

Economic claims need not necessarily involve tangible items. For example, an economic claim is the exchange of a government tax credit in return for a successful submission being made of an application for the credit. In such an example, the OeP is the applicant and the OeCP is the government agency. And in such an example, the available state transitions are semantically identified very differently and interact very differently than for the above example of an invoice. These different sequences of business events would be specified in a different set of economic commitments in the negotiation phase of the business transaction.

Moreover, the example state transitions for an invoice are merely illustrative and an invoice state machine in particular can very well be a complex interaction between the persons and their financial services representatives who are then introduced into the business transactions as additional persons involved in the business transaction.

5.2 Repository of business transaction information

All of the economic claim state transitions have happened in a time sequence, and the OeDBTR stores all of the snapshots of state transitions of this business entity for future reference. In Figure 15, an independent view of this business transaction can identify, query, and inspect any particular business event and the resulting state transitions from that event happening. In this example, the independent viewer is inspecting the "ACCEPTED" state of the economic claim.

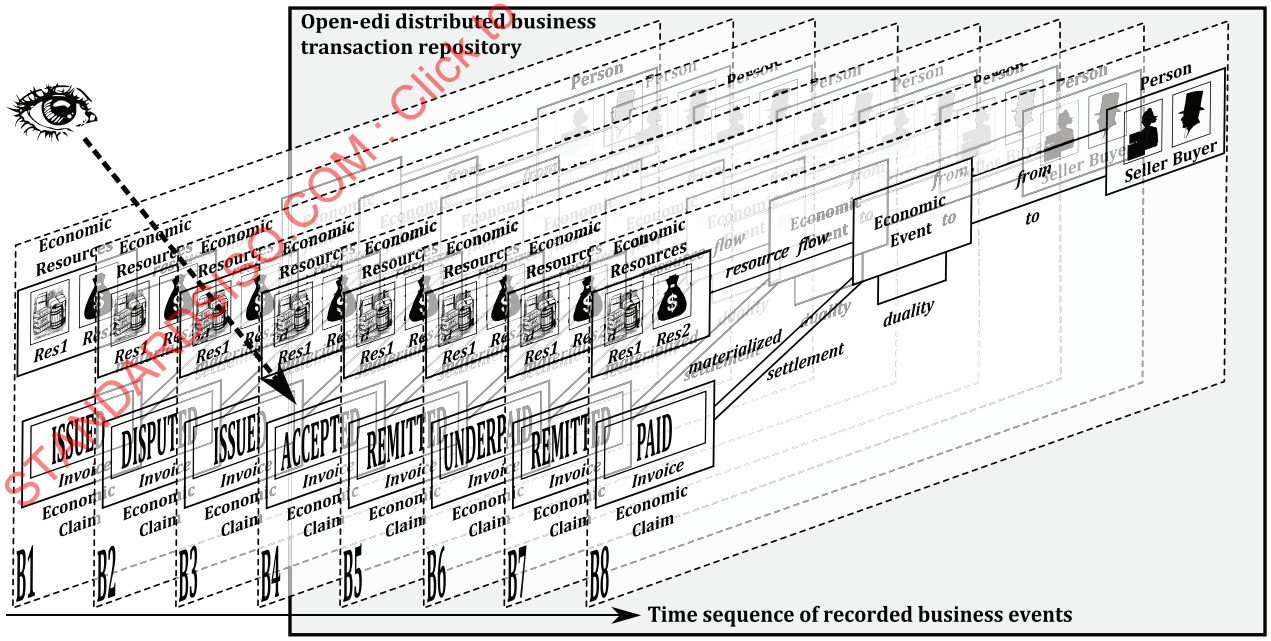

Figure 15 — Business transaction repository record of history of state transitions after business events of a single business entity

The specified state machine for the economic claim business entity negotiated during the negotiation phase of the business transaction, regardless of the domain in which the business transaction is

performed (e.g. not just for an invoice but any transaction), governs the available states of the economic claim.

The prototypical Open-edi Business Transaction Ontology (OeBTO) governs the suite of business entities available to be tracked in the OeDBTR repository. As shown in Figure 16, the OeDBTR to be implemented for a particular type of business transaction stores the history of the state changes described by the state machines for any suite of the business entities described in ISO/IEC 15944-4 and illustrated in Figure 1 to be tracked in the repository. An independent viewer can then reliably query or inspect the recorded change of state of any of the OeBTO business entities. In Figure 16, the independent viewer is inspecting the historical state of an economic resource business entity.

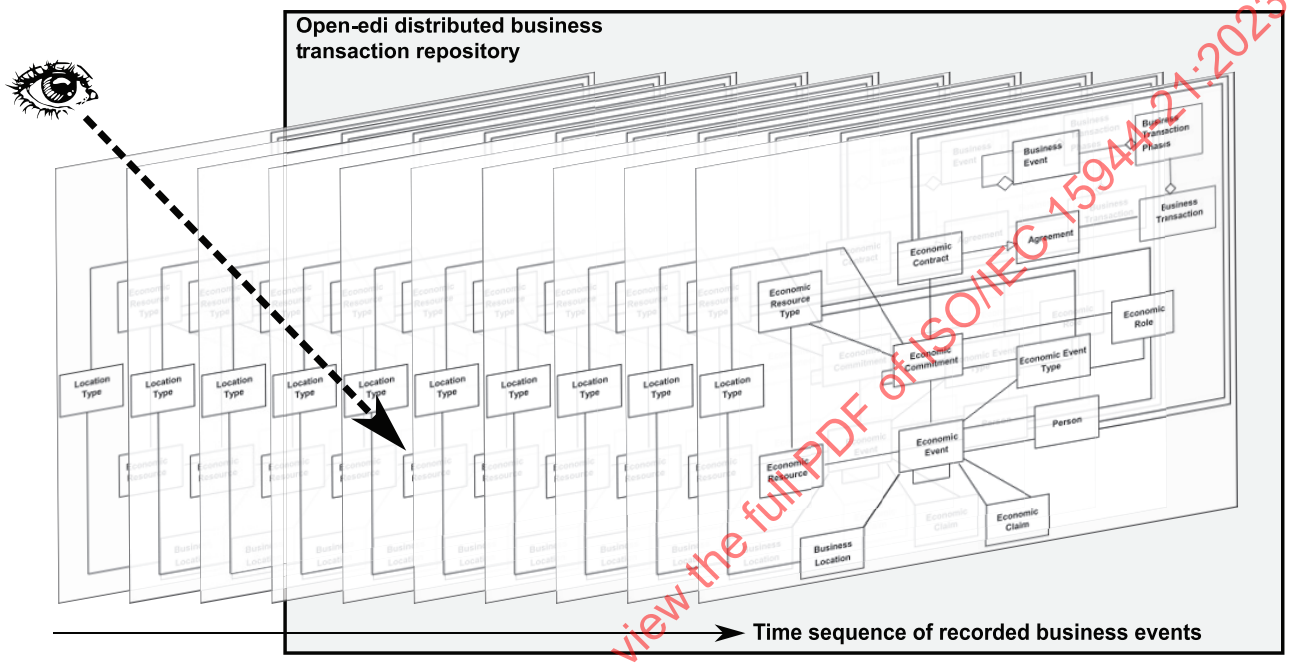

Figure 16 — Business transaction repository record of history of state transitions after business events of all business entities

The entire business transaction itself is addressable, and all entities within the transaction are addressable, in order that all can be referenced by queries at some point after the state of the business transaction has terminated.

From a business operational view, the repository shall be accessible to all parties for whom the repository is serving queries of its immutable contents. Such access in the environment shall be open to its authorized users and be ubiquitous and robust in its availability to those users.

The requisite properties of such a repository of having decentralized access by users' IT systems and being stored in a distributed fashion for resilience and integrity are regarded as properties of the Functional Services View.

5.3 Implementation rules of a business transaction information repository

5.3.1 Rule 1

An Open-edi Distributed Business Transaction Repository (OeDBTR) shall be a queryable data store of snapshots of business transaction entities of business transactions.

5.3.2 Rule 2

Each business transaction snapshot shall be taken after the impact of a business event has been assessed for each affected entity.