Towards REA Ontology Based Ledger for Small and Medium Enterprise Information Systems

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Abstract

While REA Enterprise Ontology has unprecedented achievements in modeling, education and standards areas, the development of Enterprise Information Systems (EIS) based on this ontology remains limited.

At the same time existing and new EIS still continue to be document oriented and manual accounting procedure influenced. Using REA Ontology could substantially increase their characteristics.

Author sees the following ways of improving the situation:

1. To demonstrate the adequacy of REA ontology to model most practical situations
2. To provide implementation compromises to allow for traditional accounting methods
3. To demonstrate the method of developing a practical system using technology that allows use REA Ontology as a core with easy possibility of expanding; both standalone and as a mapping to the existing EIS.

An open source EIS project based on the abovementioned principles and database technology has been initiated, and author seeks feedback on the early stages.

A simple data structure for storing and specifying EIS transactions, using REA Objects is proposed.

One data row - Ledger line, references one event of interest for the particular enterprise, including Economic Event/Commitment and object definition, typification and policy establishing events. The Ledger is sparse in a sense that not all attributes are relevant for all the line types. Ledger can be extended by adding attributes or additional tables with the Ledger line id, but inherits the REA ontology based core with its structure and behavior. Ledger may also be mapped on existing EIS database.

The Ledger is intended to store information in a uniform way, unifying the specification, understanding, processing, exchange, development, customization and reporting, both for online transaction processing (OLTP) and online analytical processing (OLAP).

Following accounting traditions one-to-many relationships are modeled within the line, while many-to-many as between the lines.

The Ledger lines keep information about the Fulfillment of Commitments. The Fulfillment ID is proposed, which is filled both for Commitment and Economic Event.

In the case of Economic Events, Resource and other object types may be specified (as implementation compromise) for:

- Economic Events without explicit Commitments

- Economic Events with coincident Commitments

- Subtyping of Committed Resource

- Fulfillment options specified among the partners

Special options of policy allow for enforcing the Commitment types in Event lines.

The Ledger keeps two relationships about the Duality/Reciprocity. Both mark Ledger lines involved, with Duality/Reciprocity ID. This allows for single line entries, where the duality could be established later.

The Transfer Duality shows the trade relationship with the current entry lines, but the Transformation Duality shows the production relationship. One event generally takes part in two Dualities simultaneously. For example, service use is not modeled as two events, because service is an event itself. It is also common in accounting practice to allocate service with the same event as its acquisition.

Internal movements of resources are modeled as exchanges between two different Internal Agents and two or more lines (In this situation the External Agent is empty). Introducing them into one line would lead to need to introduce two locations and time points which would substantially change the model. In case of a simple change of locations within one Internal Agent, this is modeled by duplicating the Agent in both lines and interpreting event as Business Event.

Simplified List of Ledger line attributes is given in the Appendix. It is restricted to "trading partner view". Also the important issues of communication, audit and workflow attributes of entries are not included.

The proposed Ledger concept has been tested on four popular SMEIS data, representing hundreds of Source Documents and their data models, including thousands of data fields, which were mapped to less than hundred Ledger line attributes.

Appendix. Ledger line common attributes.

Ledger line attributes			Possible values/ Description	Example
Ledger line (event)		Type	Increment economic event	Increment economic event
			Decrement economic event	
			Increment commitment	
			Decrement commitment	
			Snapshots and statistics	
			Business events	
			Object definition events	
			Object typification events	
			Policy definition events	
		ID	Primary key	11
		Datetime	Of line (event)	09.11.2009
		Status	Draft	Posted
			Completed	
			Approved,...	
			Posted	
Source document		Type	Purchase Order, Sales Invoice,...	Timesheeet
		ID	Document element internal id	1.1.Monday
		Datetime	Of registration of event	15.11.2009
Commitment/Economic event		Type	Type of an increment or a decrement in the value of economic resources that are under control of the enterprise.	Employee time recording
		ID		1
Contract fulfillment relationship		ID	Many-to-many relationship between trade commitments and executing events, Contract or generated id, marking commitments/events, e.g., matching several orders with several receipts	Employment contract monthly work time commitment
		Fulfilled?	Yes/No	No

Ledger line attributes			Possible values/ Description	Example
Transfer duality/reciprocity relationship		Type	Many-to-many relationship type between trade increment/decrement commitments or increment/decrement events. Specifies cardinality and refines object types of the lines. On policy level used to describe agent related relationships	Employment contract monthly work time exchange against monthly payment
		ID	Document or generated id	Contract.Period
		Exchanged?	Yes/No	No
Schedule fulfillment relationship		ID	Many-to-many relationship between production commitments and executing events. Shedule ID.	Employee allocation to Project 1 for 09.11.2009
		Fulfilled?	Yes/No	Yes
Transformation duality/reciprocity relationship		Type	Many-to-many relationship type between production increment/decrement commitments or increment/decrement events. Specifies cardinality and refines object types of the lines. On policy level used to describe resource related relationships - currency, UOM conversion, linkage, BOM	Project execution
		ID	Document or generated id	Project 1
		Exchanged?	Yes/No	No
External participation	Agent	Type	Role of external agent in the event	Consultant
		Organization	Organization ID	Our organization
		Person	Person ID	Smith
Internal participation	Agent	Type	Role of internal agent in the event	Project manager
		Organization	Organization ID	Our organization
		Person	Person ID	Brown
Reserve/Stockflow	Resource	Type	Category.Item	Labor
		ID	Batch.Serial number	Project 1
Site	Location	Type	Type of the location of the event, e.g. Address, Bank account.	Address
		ID	Location ID	First street 1
Time points		Type	Type of groups of time points when events occured or could occur in the future, e.g., due date, period, recurring dates, work schedules.	Work time interval
		ID	Time points group ID	Consultants work time
	Datetime	From	May be relative	09.11.2009 9:00
		To	May be relative	09.11.2009 18:00
Measure		Feature	Measured property of the event/object	Chargeable
		UOM	Unit of measure	Hours
		QTY	Quantity	8
Valuation		Type	Function or table of measure valuation, e.g., LIFO, Pricelist, Taxation	List
		ID	Function or table identification	Standard
		Rate	Rate for valuation	50.00
		Amount	Extended amount	400.00
Currency conversion		ID	ISO currency code	EUR
		Rate	Conversion rate	1.0000
		Base amount	Converted amount in base currency	400.0
Other attributes	Description	Text	Description of the event/object	Testing
	External	ID	External agent ID for the event/object	
		Language	ISO code	LV
		Description	Event/object description for external agent	Testēšana
	Standard	Type	Standard type for object code - ISBN, IBAN, SSN,...	
		ID	Standard code for object	
	Attachments	URI	www.odo.lv/...	Progress report
	Other...			

References

William E. McCarthy. The REA Accounting Model: A Generalized Framework for Accounting. Systems in a Shared Data Environment. *The Accounting Review*, LVII(3):554–578, July 1982.

Guido L. Geerts and William E. McCarthy. The Ontological Foundation of REA Enterprise Information Systems. http://www.msu.edu/user/mccarth4/Alabama.doc, August 2000.