FAKULTÄT FÜR !NFORMATIK
Faculty of Informatics

Financial accounting with REA

A framework for modeling phenomenas of financial accounting with resources, events and agents

Proposal

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Problem definition

Drawbacks of traditional Information Systems

Business Information Systems are commonly used to store data that are shared between different departments like HR, Sales, Production, Accounting etc. If a company uses separate systems this means often incompatible "data-islands" and that leads to a lot of adapting tasks to get data from one system, sanitize and import them into another system. Data in separated systems are duplicated by design and data synchronization tasks have to be actively maintained. ERP systems only solve parts of this problems because they usually consist of more or less integrated subsystems that exchange data internally. This architecture leads to duplicates again and if data get corrupt it's a painful task to restore a working state.

Benefits of "Ressources, Events and Agents"

The REA ontology was introduced by William E. Mccarthy in 1982 as "A Generalized Framework for Accounting Systems in a Shared Data Environment". [McC82] It's core idea is to model every aspect for every department that belongs to one business transaction. With it's basic building blocks "events, resources and agents" it's possible to model almost every flow of the usual acquisition-, conversion- and sales-processes with actors in- and outside a company and later restore the needed point of view at runtime. This makes it possible to have a unified, vendor-agnostic storage engine even with third-party software where each department can restore it's favoured point of view.

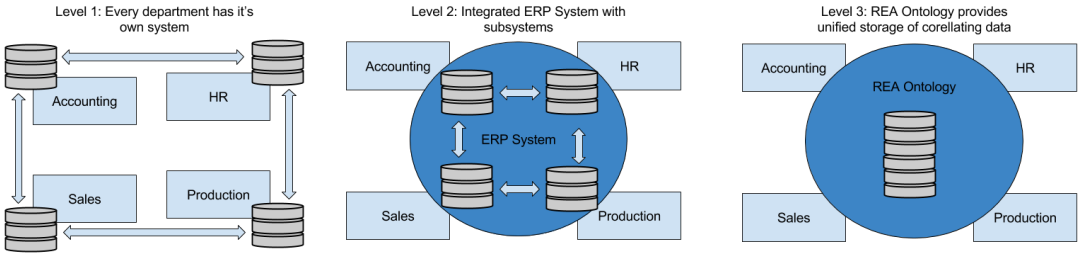
Figure 1 visualizes the different maturity levels for systems mentioned in this section. It shows from left to right separated information systems with explicit data exchange, then an ERP system with integrated data exchange and finally a representation of what could be achieved if REA was used to store all transaction in one information system.

REA by example

Figure 2 shows an example of a sales event with delayed payment in REA: The sales event leads to a stock-flow of cookies from the company to the customer. The reciprocal payment event leads to a stock-flow of cash from customer to the company and has not yet happened. Instead there is a commitment between customer and company to pay the amount in cash in future.

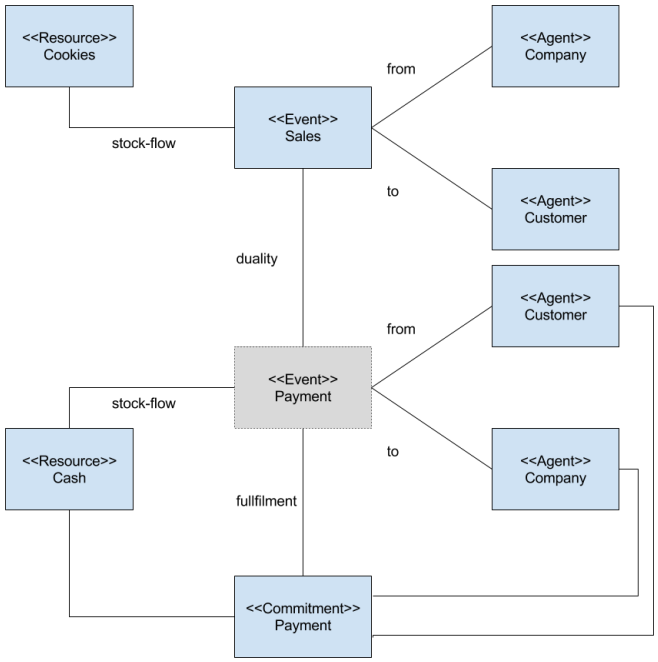
In traditional Information Systems this example would create data in a few subsystems: The sales department wants to benchmark sales of different products and control marketing. The stocks department needs to follow stock counts and has to order new items if needed. The finance department is responsible for internal and external financial reporting. The treasury has to follow unpaid invoices. Every department has their own needs and would generate their own data in an usual system. But REA proposes a data model with all information for the transaction available in one single place and every department has access to their point of view.

Figure 1: Different information system maturity levels to REA



Distributed systems have their own storage and data exchange often happens manually. ERP systems often use subsystems internally. These two variants lead to duplicates and complicated data storage. REA stores all events in unified way and restores the point of view for each deparment at runtime.

Figure 2: An example for a transaction in REA ontology



This example shows the sales of cookies with delayed payment in cash. Based on [McC04]. This diagram shows only parts of the REA ontology that are in scope of this work and omits other data like VAT.

Figure 3: ALE Accounting Matrix

Transaction Types		Credit		
		A-	L+	E+
Debit	A+	1	2	7
	L-	4	3	8
	E-	5	6	9

with 9 transaction types, source: [Sch15]

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Financial accounting

In financial accounting the "ALE" equitation

$$Assets = Liabilities + Equity$$

has always to be true. This systematic is called “ALE accounting” because every booking is affecting one or more of it’s building blocks “Assets”, “Liabilities” and “Equity”. [Sch15] In standard double entry bookkeeping this equitation is always true because both sides of the equitation have to be booked at the same time. Assets belong to the company whereas Liabilities and Equity represent debts. Incomes and expenses are considered as in- or decreases to owners equity. [Hor06] There are 9 different possibilities to book between these three categories as shown in Figure 3.

REA and ALE accounting

Although McCarthy proposed in his initial paper [McC82] the REA ontology as suitable for financial accounting as well, he concentrated on the asset side only. He stated that all physical and intangible assets can be represented by resources and all kind of receivables by claims. Equity is identified as “imbalance” and it is proposed to model it as a “stock information object”. Liabilities are not mentioned explicitly and it’s unclear how to cope with them. Equity and liabilities are future outflows of cash or cash-equivalences in traditional accounting and core components for analysing a company’s financial situation. They are especially in the banking sector treated as resources themselves that can be traded or leverage investments. McCarthy proposes a mapping between events and income and expenses as well but it’s questionable if this definition is sufficient in view of the simultaneous changes in equity.

Research question

There is a lot of literature that teaches how to model business cases in REA but there is still a lack of formalization how to restore the point of view for financial accounting. REA is good at modelling assets as they are simply resources that belong to a company. But as liabilities and equity are very important concepts for financial accounting and are somehow treated as resources, there is a need for more investigation how to cope with them in REA and if the mapping for events is complete. These points lead to the following research question: "What formalisms have to be defined for financial accounting in REA?"

Expected outcome

The expected outcome of the planned master thesis is a framework for modelling phenomena of financial accounting in REA. It will describe needed properties of REA models to have all information for financial accounting statements based on principles from ISO standards, existing business patterns and terms from financial accounting. At best it will make it possible to include the "ALE-equitation" in REA directly.

It will especially focus on:

- Typification: What kind of hierarchies is needed to categorize resources, events and future events in financial accounting
- Liabilities & Equity: A guidance how to cope with liabilities and especially equity in scope of mechanics of REA
- Constraints: Which constraints have to be fulfilled to enable extraction of financial accounting from REA models

Methodology and approach

The methodological approach consists of three parts.

Literature research and identification of relevant parameters

At first a thorough definition of all REA related concepts will be made. The most important sources will be papers written bei William E. McCarthy (e.g. [McC82]), the ISO 15944:4 standard in it's version from 2007 [ISO07] and books about Information Systems design with REA ([DCH05], [HKS06] and [Hol00]). The outcome will be an in deep description of all used terms especially with focus on financial accounting.

Case studies for typical booking cases

A set of typical booking-cases is defined and then a mapping in REA with focus only on financial accounting is done for each case. This will start with basic examples that can be easy modelled in REA for purchases, sales and don't include any future events. Later more complex situations as delayed payments, provisions and financial instruments will be analysed. At last transactions from and to Equity will be discussed.

Generalized framework

Based on the findings in the case studies general rules for the planned framework are extracted and presented in a formalized way. This will end in a set of type hierarchies and constraints that work on these type hierarchies.

State of the art

In addition to Papers by McCarthy and Geerts there is some literature that focuses on the datamodel and business patterns ([DCH05], [HKS06] and [Hol00]). In 2007 the semantic concepts of REA where reused in an UN/CEFACT standard [ISO07] as an intermediate language called Open-edi Business Transaction Ontology (OeBTO). Right now REA seems to be established as an intermediate language.

There was a study group at TU Wien (See `http://www.big.tuwien.ac.at/projects/29`) that lead to some papers (e.g. [WMKH15]) about REA. It's outcome was a layered prototype of a cloud-based REA-based ERP system with a REA-based storage API.

There is an online ERP system for HR and Finance called "Workday" publicly available and it's claimed to be based on the REA ontology ([Nit12] and [How07]).

Relevance

The REA-ontology is teached in the curriculum Bussines Informatics and there is research about this at TU Wien as well. It combines several techniques and methodologies discussed in different courses listed beneath:

- Accounting and Finance: The topic of the thesis is clearly settled in this academic field
- Model Engineering: Techniques from this course a used to describe properties for financial REA models
- E-Commerce: REA touches the field of electronic data interchange (EDI)
- Enterprise Information Systems: This thesis discusses properties of informations systems as well

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