Data Models of Accounting Information Systems REA vs. IAC

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Abstract: The purpose of a data model is to describe logic structure of the object system, as it is looked by his users. In Accounting Information Systems, the object is the economic entrepreneur and the information stored which is needed in a structural way so the data may be consistent and integrated.

Reality modeling of the components around the economic unit is very important for building an efficient system which stores the information about the economic unit.

In the beginning of Accounting Information Systems modeling of the data was made by materializing the processes of the economic unit into process which the computer may process fast and with fewer errors than humans. This model didn't take into consideration the structure of traditional data of the discipline of accounting. They stored the model intact as it was described by Pacioli during the "Renaissance". The Conservatism is really appreciated in the accounting profession. So the change from a stable model and which has been in use more than half millennium in a new model would not be easy accepted from the community, unless the new model wasn't clear enough and usable.

The Traditional Model uses statements to prevent errors and repetitions in computing. As the computers do the calculations very fast and without errors, there is no need for these statements. So the statements are just converted in virtual views that contains the information processed and is viewed as many times as the user need.

Beginning from the years 1975 until the beginning of 80 a number of changes happened in the field of data modelling in general and in the modelling of data in Accounting Information Systems.

REA Model

In 1979 William E. McCarthy on his thesis "An entity-Relationship View of Accounting Models" introduced a model which is now implemented in the most famous AIS and ERP.

His suppose was based on the postulate: "AIS may be naturally simulated on a relational database which contains real world entity and relations between these entities".

In his thesis he emphasized the need to not be focused on the model: "Transaction Table + Double Entry Principle" – which restraint the information of the entrepreneur in only one aspect. Importance can be given to the financial information system (e.g. ERP) which doesn't have anything from traditional system.

The procedure which is recommended to be taken while building an AIS model is:

1. Identification of classified entities in Agents, Events and Resources.
2. The building of an E-R diagram which will expose the meaning of these entities and relations between them.
3. Definition of entities characteristics and of the relationships between them, classified by the demands of the different level users.

4. Organization of results from the previous steps in the tables and identification of their unique characteristics (Keys).

Information Identification and protection in this model is done by following these steps:
1. Event
2. Sources which are consumed or added by this event
3. Internal Agents
4. External Agents

The main rules are:
1. Every Event is connected to at least one Source from which it differ
2. Every Event is connected to at least one other Event.
3. Every Event is connected to at least two Agents (The economic duality principle).
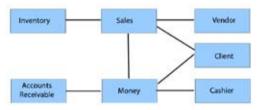

Figure 1: Process example

A schematic presentation of the above rules for a process example. Basing on the REA cycles model of AIS, they would be presented in this way.
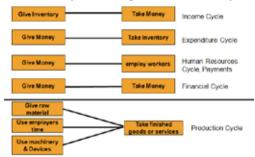

Figure 2: REA cycles model of AIS

The REA Model spring up in a time where it was being talked about "re-engineering" term which inclines the fundamental change of a

process as the only way of his enhancement. REA presents the fundamental change in the data modeling of AIS, so it presents AIS itself. REA model is the base of all other models of AIS and there have been a lot of his versions, for example: REA-L – which adds the entity: Locations to the REA model, etc.

McCarthy is being thanked in a lot of books about AIS as the person who had the courage to think different from the others.

Double Entry Principle Consistency

Double Entry Principle seems that it makes a lot of information redundancy, but in fact this doesn't happen. This principle means that we have to register at the same time the taking or letting of a good or service with the corresponding balanced amount in money or credit of the taking or letting. There isn't redundancy; these aren't different actions but complementary ones.
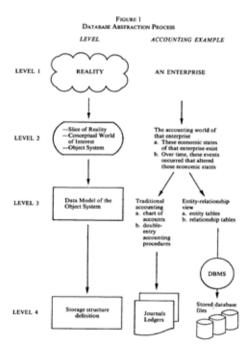

Figure 3: Database Abstraction Process

The IAC Model

This section describes a model with an alternate accounting data structure that radically eliminates the most pervasive and potentially inconsistent redundancies of the traditional administrative-accounting model. The model is called IAC and makes up the data structure of the Secure Accounting system (both property of Cautus Network Corporation, Miami, FL.). The system (and in consequence the underlying data structure –IAC-) has been in place and under intensive use in over fifty companies in the past two years. The name IAC comes from the initials of **Items, Agents, and Cash**.

The traditional accounting model contains five types of entities. They are Assets, Liabilities, Capital, Revenues, and Expenses. The three main entities of IAC, the model we propose, are Items, Agents, and Cash. They reclassify and consolidate all of the entities of the traditional model. The IAC classification is a more normalized data structure that eliminates many of the redundancies present in the traditional model.

The traditional model subdivides the main accounts (entities) in sub-accounts. Many of the sub-accounts are kept in separate books due to their different nature and structure. Additionally, some sub-accounts that have very similar structure are stored separately because they originate from different main accounts. For example, Accounts receivable is an Asset and Accounts payable is a Liability; they are kept separate although their structure is almost the same. There probably is a third group of sub-accounts called Employees (used for payroll purposes at a minimum), which is also kept separately. The IAC model consolidates customers, suppliers, employees, and stockholders into one entity: Agents. In general, Agents are all people and institutions that exchange cash, goods, and/or services with the company. They all have many attributes in common (like name, address, and balance) but what is even more important, they all have the same type of database relationships with the other two main entities (Items and Cash).

The entity Item consolidates fixed assets, inventory, and all the goods and services that the company buys or sells including shares (stock). They are generally kept in separate books although they have many attributes in common (e.g. name, description, measurement unit, quantity, cost, and price). Furthermore, they all maintain the same type of database relationships with the other two main entities (Agents and Cash).

Finally the entity Cash consolidates bank accounts, petty cash, and any other account that reflects the flow of money.

Administrative and accounting systems register the economic activity of a company. In general, this economic activity is made up of the exchange of goods or services for money (or in certain cases for other goods or services). The Agent entity responds to the question of "Who" (surrenders or receives the goods or services); Item responds to the question of "What" (goods or services); and Cash to the "How much" (money it is given or received in exchange for the goods or services). This way the three IAC entities cover all the entities involved in economic activity and therefore consolidates all of the accounts of an administrative or accounting system.

However, the consolidation of all sub-accounts into three main entities is a necessary but not sufficient condition to eliminate the redundancies present in the traditional model. Further work is needed to eradicate them.

The following three sections mirror (but in reverse order) the last three sections of the previous section. They explain how IAC eliminates each of those redundancies.

The Fundamental Accounting Equation under IAC

Assets are the resources that a company owns. When a company is started, the only assets it holds are those that the stockholders provide as their initial investment in exchange for shares. The company may also acquire additional assets by incurring in debt. Therefore, total assets will be equal to the sum of the assets provided by the stockholders and the sum of the assets provided by the creditors. This is what is called the fundamental accounting equation and it is generally written as follows:

$$Assets = Liabilities + Capital$$

The fundamental accounting equation must be held true at all times. Each side of the equation may be calculated separately for comparison and thus checking that the equation is maintained. Therefore if we add all the assets we will get the same number than if we add together all of the debt provided by creditors and the stockholder's equity.

As the accounting cycle advances, two more entities are used: Revenues and Expenses. However, at any time we may add all the Revenues and subtract all the Expenses and we would get the operating result which is part of the Capital. Summarizing: the traditional accounting model contains five types of entities. They are Assets, Liabilities, Capital, Revenues, and Expenses.

Revenues and Expenses are operating entities that show the results of the company's activity during a given period; they are cleared at the end of the period and the difference between them is added (or subtracted) from the Capital account.

The traditional accounting model classifies information based on ownership (assets are owned by the company, liabilities are owned by creditors, and capital is owned by stockholders). On the other hand the IAC accounting model classifies information based on data structure similarities which not only facilitates the use of information technology to process the data but also helps in eliminating redundancies. Moreover, although the classification is different the model still allows easy testing of the fundamental accounting equation; in fact, it makes the process much faster and easier.

We can apply the logic of the fundamental equation in different terms. For example, a company acquires assets in exchange for cash or debt from stockholders or third parties. It can also sell goods (or services) in exchange for cash or loans given to third parties. Therefore, following a similar methodology to the one applied earlier to obtain the fundamental accounting equation we get that:

Account of Goods (Items) = Accounts of People (Agents) + Accounts of Money (Cash) where each side of the equality may be calculated independently of the other as required by the double entry bookkeeping method.

The process required under the IAC model to verify the fundamental equation is very basic and simple making it even more reliable than the traditional one. All we have to verify is that:

Σ Items(Amount) = Σ Agents(Amount) + Σ Cash(Amount)

and since all of the data is contained in only two tables very little programming is required.

To guarantee that the fundamental equation holds for the whole, we need to assure that it holds for each part. In other words, every time an economic event (i.e. purchase, sale, etc) is registered, the set of records entered need to comply with the equation. However, this is quite easy and intuitive. Every good or amount of cash received or surrendered comes or goes

to a person or institution (even if it is to the same company being administered or to a part or department of the same). We can establish that the amount of every record in Agents will be the same to the related records in Cash and Items. In more technical terms, let AgentTransID be the attribute in Cash and/or Items that contains the ID of the related transaction in Agents (in other words, AgentTransID is the foreign key in Cash and Items that relates the records to Agents whose primary key is ID). We then have that:

Σ Agent(ID, Amount) = Σ Item(AgentTransID=ID, Amount) + Σ Cash(AgentTransID=ID, Amount)

We have shown that both the traditional model and the IAC model are equally effective in controlling the required balance in bookkeeping (verifying the fundamental accounting equation); however, we also showed how the IAC model is easier to implement in computerized information systems. The IAC model eliminates most of the redundancies present in the traditional classification therefore increasing data integrity. Furthermore, we can use the IAC model for physical storage and still use the traditional data structure for data presentation and manipulation at the user level. Finally, the IAC model is not a theoretical model looking for an application but a theoretically grounded model that has been tested and is implemented in accounting software that has been in use in over fifty companies for the past two years.

Conclusions

Why REA is the best data model...

• REA is a data model that everyone may use; it's not "proprietary".

• REA Data Model may cover administration of multiple companies.

• REA Data Model predicts all types of activities and relations between them in a uniform way.

• REA Data Model manage all the sources: -products, money, work, and enginery – in a consistent way.

• REA Data Model can be built in an incremental way letting the modifications of the system and his expansion.

The IAC model is a model generally more advanced than REA, but his implementation is difficult for two reasons:

1. IAC is a proprietary model – CAUTUS NETWORKS CORPORATION

2. Lack of the detailed information – there exists only one published document from Prof. Carlos Ferran - Penn State University

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