On Some Outstanding Problems in Accounting Information Systems

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Some Outstanding Problems in Accounting Information Systems

- Taxonomy of concepts (Accounting Wordnet?)
- Taxonomy (and equivalences) of transactions
- Vocabulary changes in accounting
- Formal Models that unify Accounting & Auditing

Taxonomy of concepts (Accounting Wordnet?)

- Semantic network of English for accounting
- Based on statistical analysis of EDGAR data
- Ontology for accounting (specially transactions, footnotes, …

Taxonomy (and equivalences) of transactions

- Why do we draw homomorphism for certain transactions but not others?
  - Parking transactions (using an intermediary for off-balance sheet financing)
  - US.V Simon (Related party transactions)
- Need for a theory of transactional equivalences

Vocabulary changes in accounting

- Comparison of WSJ data with EDGAR data in the USA
- Idiomatic accounting language (phrase detection)
- Problems of synonymy/polysemy in accounting, inter-lingual translation

FORMAL MODELING OF ACCOUNTING INFORMATION SYSTEMS

- Advances in security technologies (secure operating systems, role-based access controls, specification/verification/validation)
- Advances in Graph Theoretic models of business Processes, particularly workflow nets)
- Advances in representation of business rules

Formal Models that unify Accounting & Auditing

- Need to answer questions:
  - A. study AIS properties *before* it is implemented
    - What are its *control* properties?
    - How *resilient* is it to various inputs?
    - How does it *scale* with respect to the computational burden, I.e., what is the *computational complexity* of the algorithms underlying the system?
    - Is it *correct* in that it does not have logical flaws which will result in anomalies later on?
    - Is it *efficient* in that alternative implementations of the system do not yield superior results?

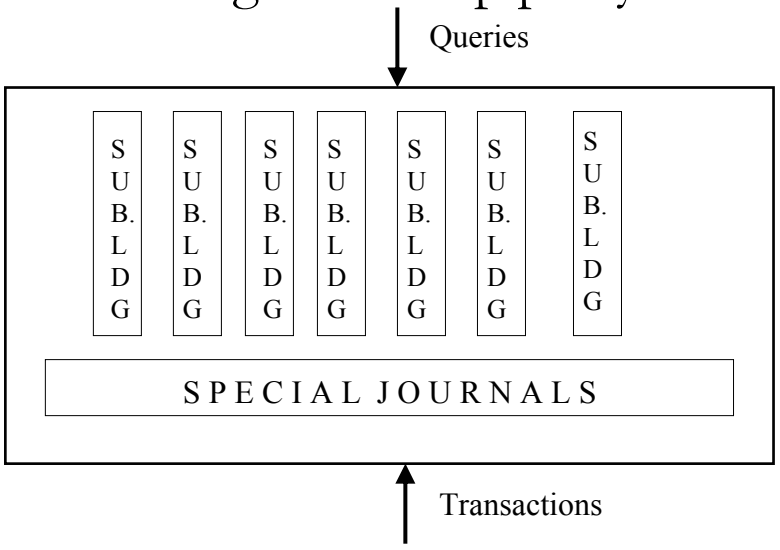
Formal Models that unify Accounting & Auditing

- Need to answer questions:
  - B. Aid to Planning
    - Will the present computing capacity suffice, should the transaction load grow by a specified factor?
    - How much computing capacity will be needed for a certain transaction density?

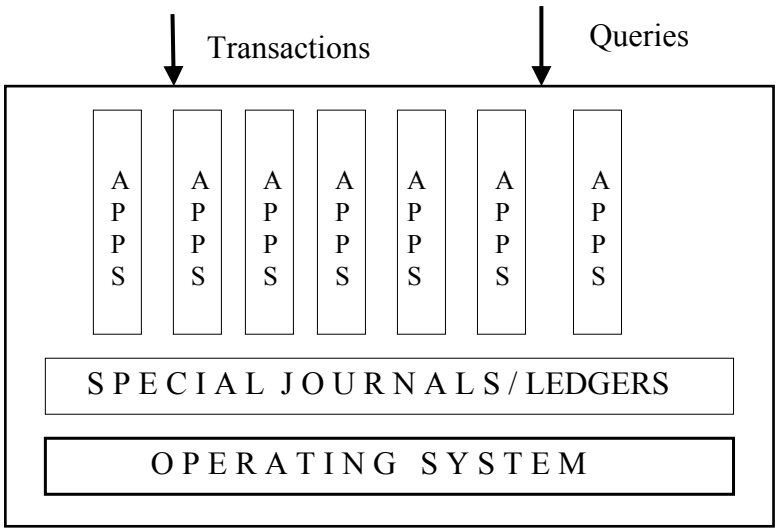
Formal Models that unify Accounting & Auditing

- Need to answer questions:
  - C. Theoretical foundation for the discipline of auditing.
    - Does the *system* have controls *adequate* in a specified sense?
    - What is the *computational burden* of answering such a question?
    - Assuming a certain transaction density, what is the computational burden of an algorithm to test the database underlying such a system to provide assurance that the controls operate as specified in the model?

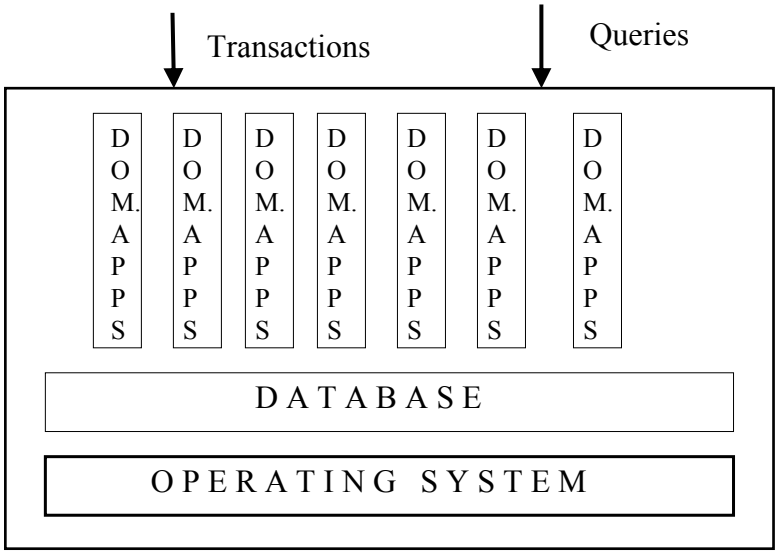
AIS Stage I: Stovepipe Systems



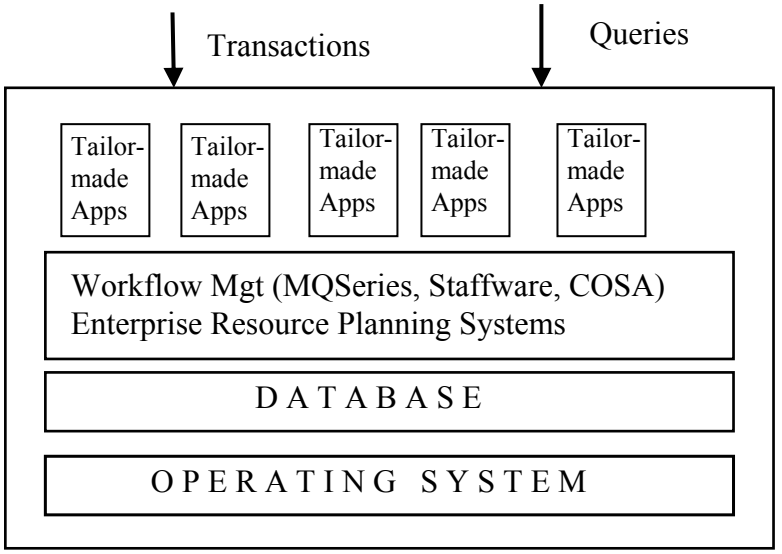
AIS Stage II: Stove piped File-oriented Applications



AIS Stage III: Database System



AIS Stage IV: Workflow/ERP based Systems



AIS: Aggregate Trends

- From Programming to Assembling
- From Data to Process orientation
- From design to Redesign & Organic Growth

Source: "**Making Work Flow: On the Application of Petri Nets to Business Process Management"**
Wil M. P. van der Aalst

From Programming to Assembling

- Development of Object-Oriented methodologies, programming, and class libraries (J2EE, STL, g++, MFC,..)
- Ineffectiveness of structured methods when quick response is needed

From Data to Process orientation

- Data is just one component of a system, yet it occupies most of our mental space
- Business processes are dynamic systems, and therefore study of their behaviors is important
- Theoretical developments in Graph Theory, networking, and security makes building formal models possible

From design to Redesign & Organic Growth

- Need for quick changes to complex systems
- Drastic changes in technology in very short period of time

Prior Work in Modeling (Accounting)

- REA Models (McCarthy [1982])
- Audit Planning (Kelly [1983?])
- TICOM papers (Bailey et al [1985])
- Models of Internal Control (Verghese [1988])
- Models of Planning (Natovich/Vasarhelyi[1998])
- Informal models with lack of analytics

Prior Work in Modeling (Computing)

- Trusted Computing (TCSEC, Common Criteria,…) (Confidentiality)
- Trusted Computing (Integrity)
  - Biba, Clark-Wilson models
- Role Based Access Controls (RBAC)

Prior Work in Modeling (Workflows)

- Colored Petri net models of workflows
- Analytics based on Petri net models
- Integration of workflow models with backend databases (INCOME, EXSPECT)

Formal Model (Philosophy)

- Accounting information systems are monitoring & control systems the same way operating systems (and physical systems) are. There is no reason we can not use the same tools in our designs

Formal Model

- Set of People, business processes
- Business processes consist of tasks, data structures, precedence relationships between tasks and data structures
- Set of Roles, assignment of people to roles, assignment of tasks to roles
- Control rules (expressible as statements in an appropriate logic)

Formal Model II (Planned activities)

- Development of algorithms for feasible role assignments and their complexity
- Development of algorithms for audits
  - Conformance to transaction structure
  - Conformance to control rules
- Complexity of audit algorithms

Concluding Observations

- Need for formal models of accounting systems
- Need for automation of system audit functions and consequently need to develop algorithms
- Use of models for planning as well as decision making