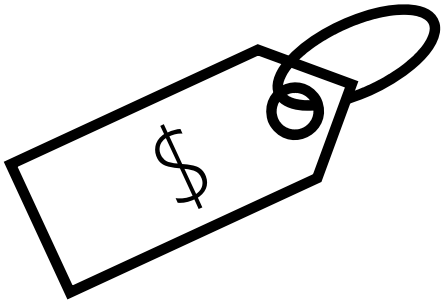
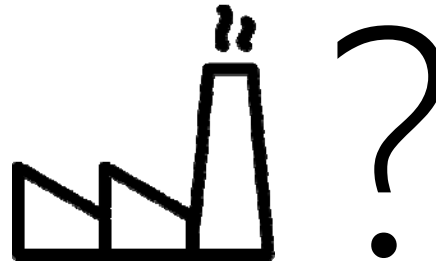


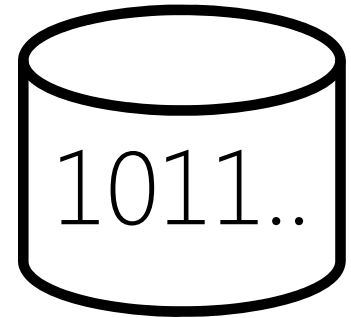
Problem!



1 ton of steam?



Site competitive?



Suitable data-
model?

From Legacy-Accounting to Process-Oriented

Christian Fischer-Pauzenberger
Technische Universität Wien
November 2016

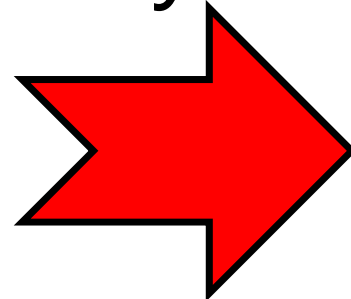
Title? – My Story

Legacy-Accounting

- Static Environment
 - UGB/IFRS/US GAAP
 - Cost Center/Object Accounts
 - Validierte Systeme (Pharmatechnik)



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Process-Oriented

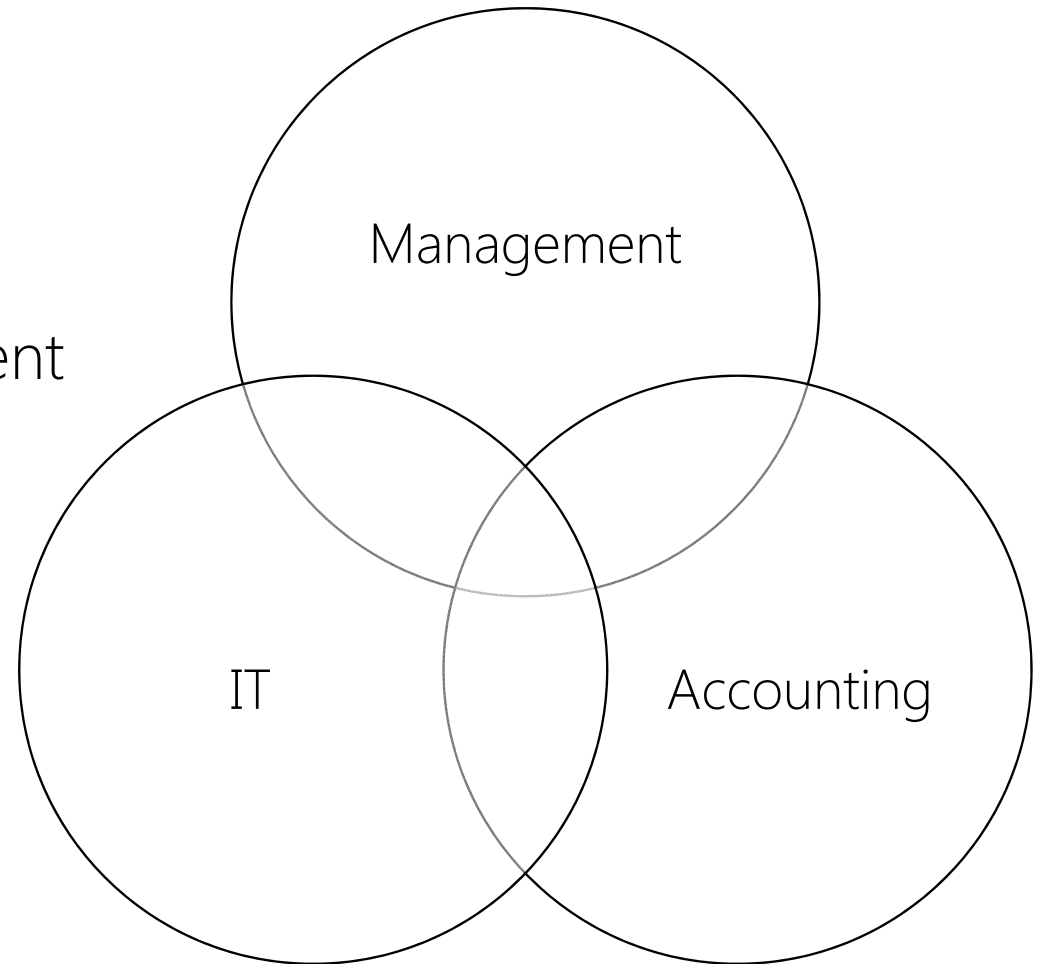
- Dynamic Requirements
 - Product portfolio
 - Production lines
 - Equipment
 - ...
- Dynamic Analysis
 - Costs
 - Benchmarking
 - Dashboards
 - ...



<http://rocketbottoms.com/wp-content/uploads/2016/04/i-want-it-all-and-i-want-it-now.png.png>

Context?

- Management Control
 - IT-based Enterprise Management
 - Managerial Accounting
-
- Industrial Engineering
 - Process Management
 - Pharmaceutical-Domain



Excursion: Legacy-Accounting Records

Accounts Receivable File

Customer Number	Customer Name	Debit	Credit	Balance
23456	Smith	350	200	150

Cost of Goods Sold File

Acct Number	Debit	Credit
5734	270	

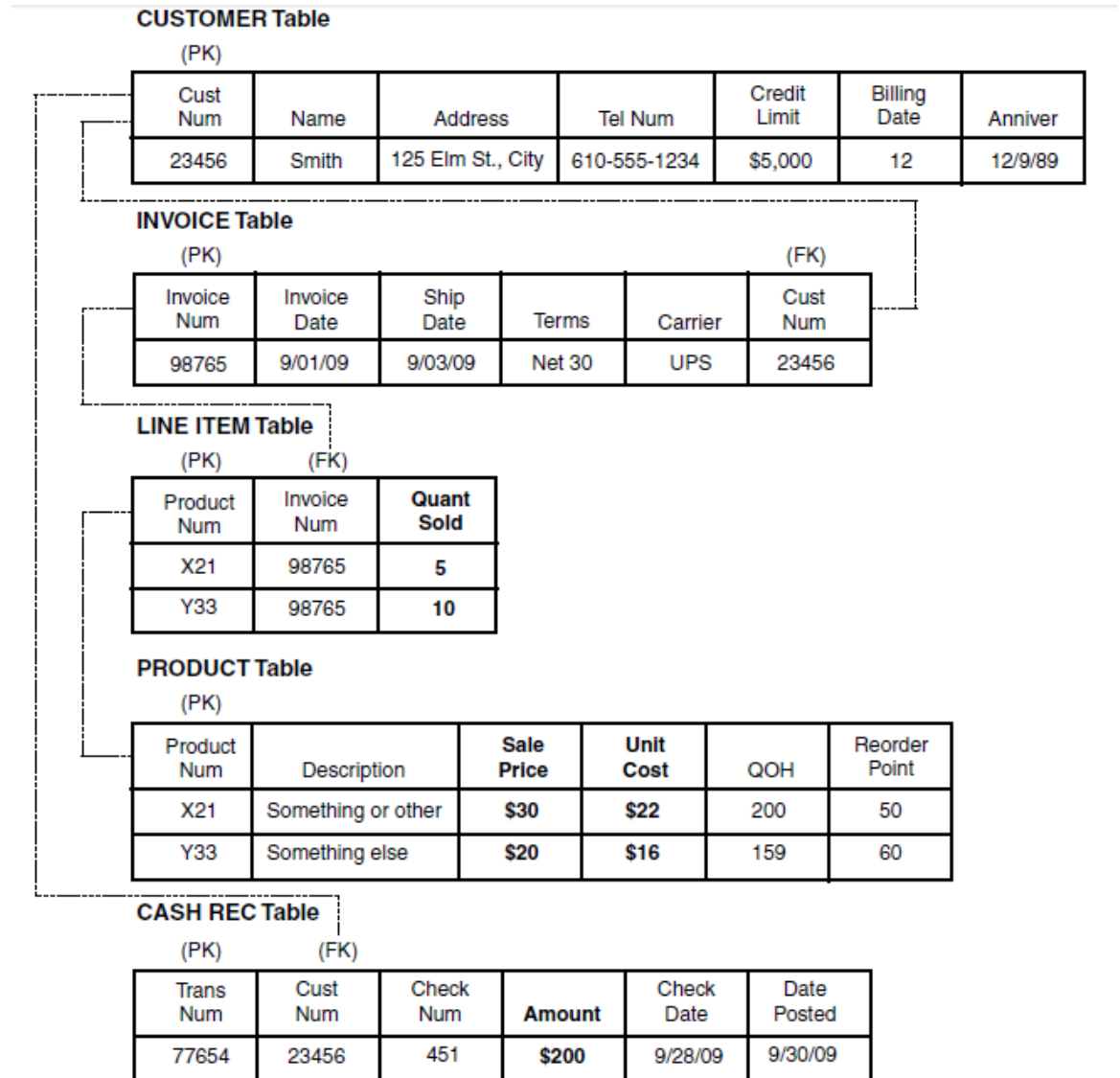
Sales File

Acct Number	Credit
4975	350

Excursion: REA Event Database

- Resources
- Events
- Agents

Geerts, Guido L., and William E. McCarthy. "An ontological analysis of the economic primitives of the extended-REA enterprise information architecture." *International Journal of Accounting Information Systems* 3.1 (2002): 1-16.



Research Questions

- A process-oriented data model promotes the significance of managerial accounting analysis compared to data from legacy accounting-systems.
- Conceptual Modelling supported by OntoUML can identify the requirements towards the design of a process-oriented data model.
- The expressiveness of Activity Based Costing can be increased significantly by utilization of a process-oriented data model.

Scientific Need? 1

- Fallon, Richard, and Simon Polovina. "REA analysis of SAP HCM; some initial findings." The 3rd CUBIST Workshop (2013).
- ... (i) ...could benefit from an REA approach to **business process engineering**, since this would avoid data loss, and (ii) REA could benefit from an **analysis of a real ERP system**...

Scientific Need? 2

- O'Leary, Daniel E. "On the relationship between REA and SAP." *International Journal of Accounting Information Systems* 5.1 (2004): 65-81.
- SAP has a number of different representations including interaction model, business object, data model, process model, organization model, and business application component model. Future research could focus on these other models and how they relate to REA representations. For example, in general, there has been little discussion of direct integration of REA with processes that they represent, except for those inherent in its database structure.

Scientific Need? 3

- Fallon, Richard, and Simon Polovina. "REA analysis of SAP HCM; some initial findings." The 3rd CUBIST Workshop (2013).
- ... unified modelling language (UML) for object-oriented modelling, previously identified by Booch et al. [14]. This again emphasizes the need noted by others [10, 13] for **further research** that will lead to a set of **tools and procedures** which will allow **REA designs** to be used for the entire development life cycle.

Scientific Need? 4

- O'Leary, Daniel E. "On the relationship between REA and SAP." *International Journal of Accounting Information Systems* 5.1 (2004): 65-81.
- As another example, there are no discussions that the authors are aware of the directly related REA entity relationship models and data flow diagram models or flow chart models.

Scientific Need? 5

- Galani, Despina, Efthymios Gravas, and Antonios Stavropoulos. "The impact of ERP systems on accounting processes." *Development* 286 (2010): 14785.
- reasons behind ... investment ... reduction of number of different systems, eliminate redundant data entry and reduce data errors. Further, another important motive was the "development of business process" which is a very strategic one ...

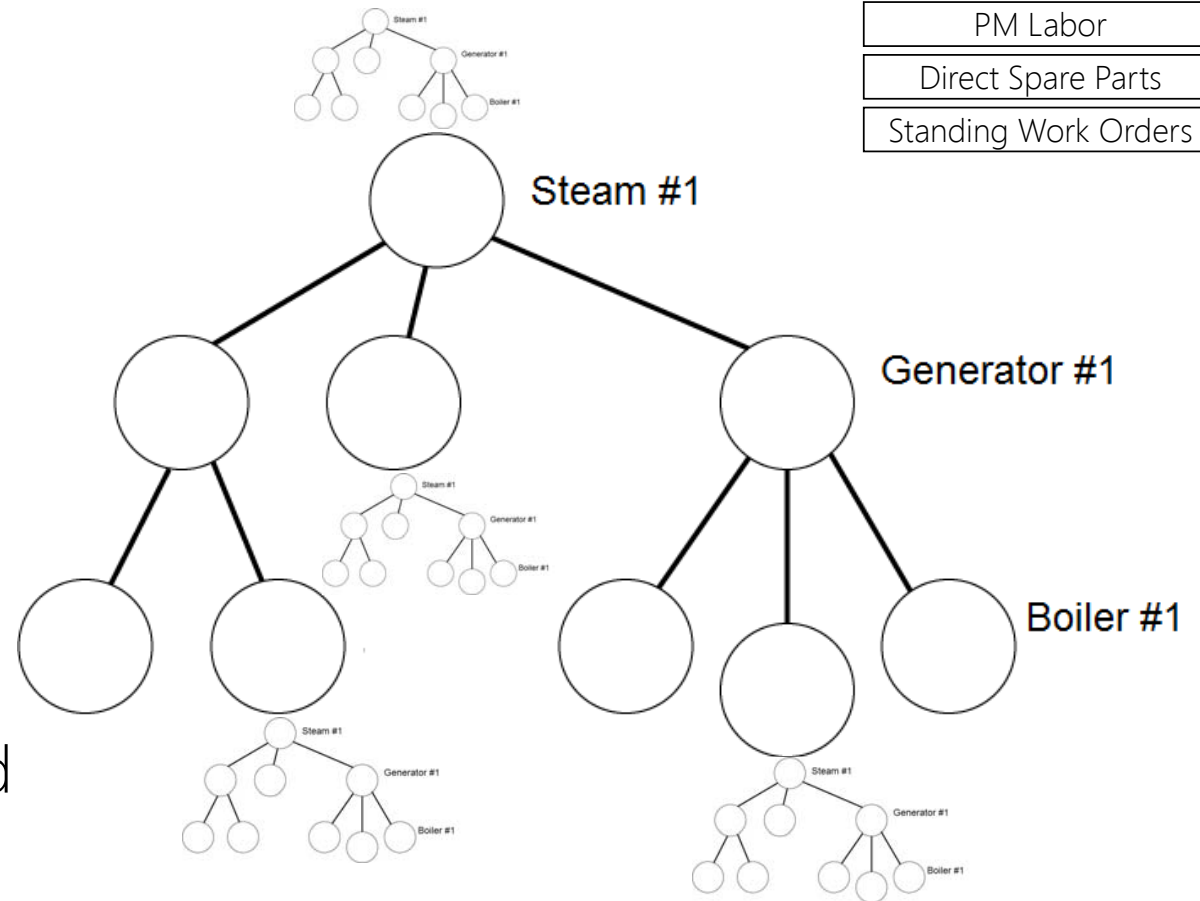
Scientific Need? 6

- O'Leary, Daniel E. "On the relationship between REA and SAP." *International Journal of Accounting Information Systems* 5.1 (2004): 65-81.
- Finally, although this paper has focused on the relationship between SAP and REA, the **analysis of relationships could be extended** to other ERP systems including PeopleSoft and Oracle Applications, etc.

Costing Approach

- Scope
 - Whole production process
- Production Equipment as hierarchical Processes
- Every Equipment as Cost Center
 - Receiving
 - Providing
- (Time-Driven) Activity Based Costing

Direct Orders
Direct Material
Maintenance Contracts
Direct Labor
PM Labor
Direct Spare Parts
Standing Work Orders



Methods 1

Data Quality

- Direct Labor mapping
- Direct Material mapping
- Direct Orders mapping
- Value stream measurement

Data Harmonization

- Data harmonization
- Data storage

Methods 2

Model

- Conceptual Modeling
- OntoUML
 - Identity
 - Modality
 - Dependency
- Pergl, Robert, Tiago Prince Sales, and Zdeněk Rybala. "Towards OntoUML for software engineering: From domain ontology to implementation model." *International Conference on Model and Data Engineering*. Springer Berlin Heidelberg, 2013.
- Fischer-Pauzenberger, C and Schwaiger, Walter S.A. "The OntoREA Accounting Model: Ontology-based Modeling of the Accounting Domain". Working Paper, 2016.

Methods 3

Implementation

- Open-Source Software
 - R for computing
 - 'data.tree' for modeling
 - LaTeX for reporting

Industrial Research Case Study 1

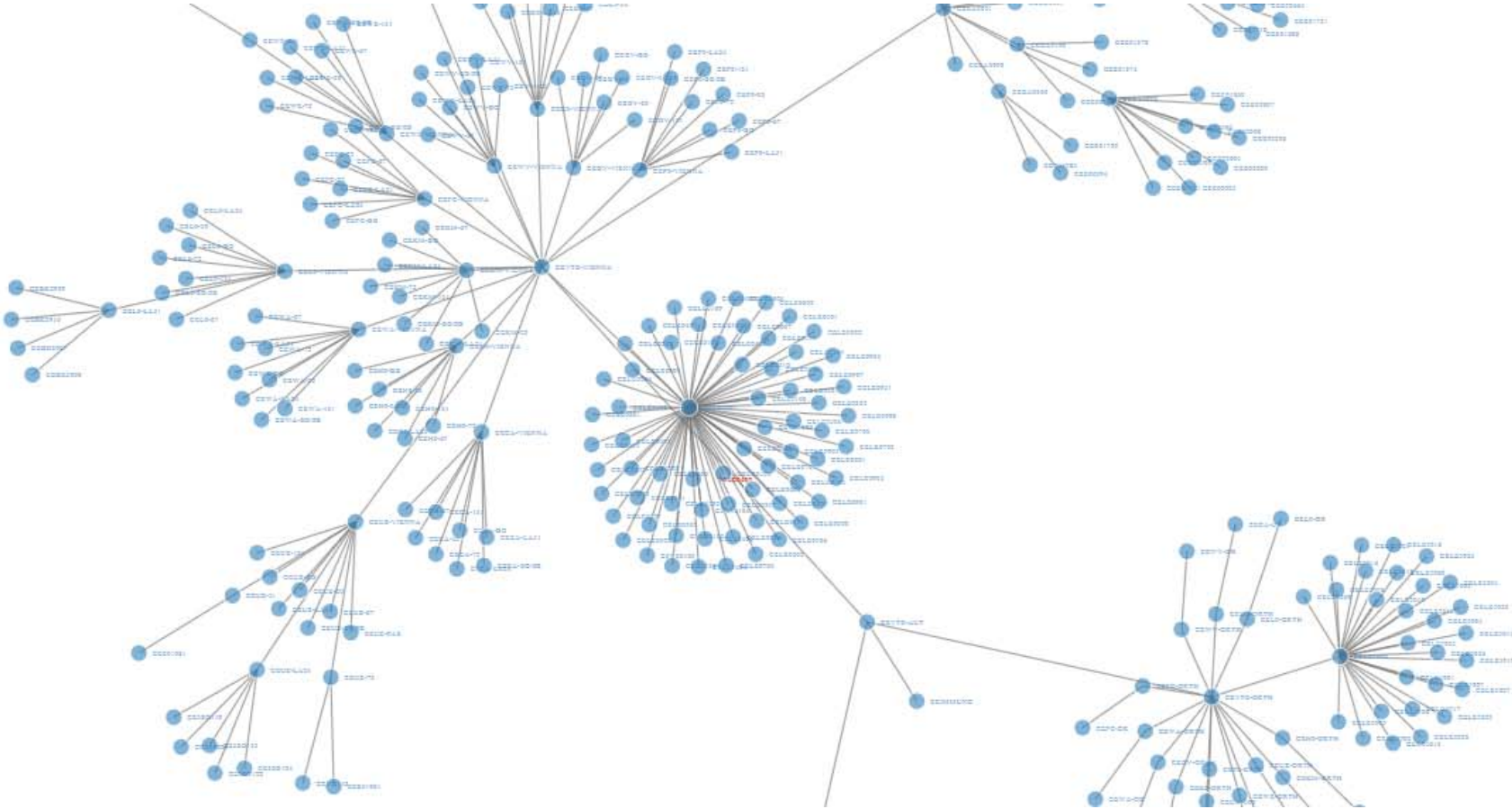
Overview

- Pharmaceutical Domain
- > 15 comparable sites
- > 60 000 # equipment
- > 600 000 hours/year direct labor
- ...

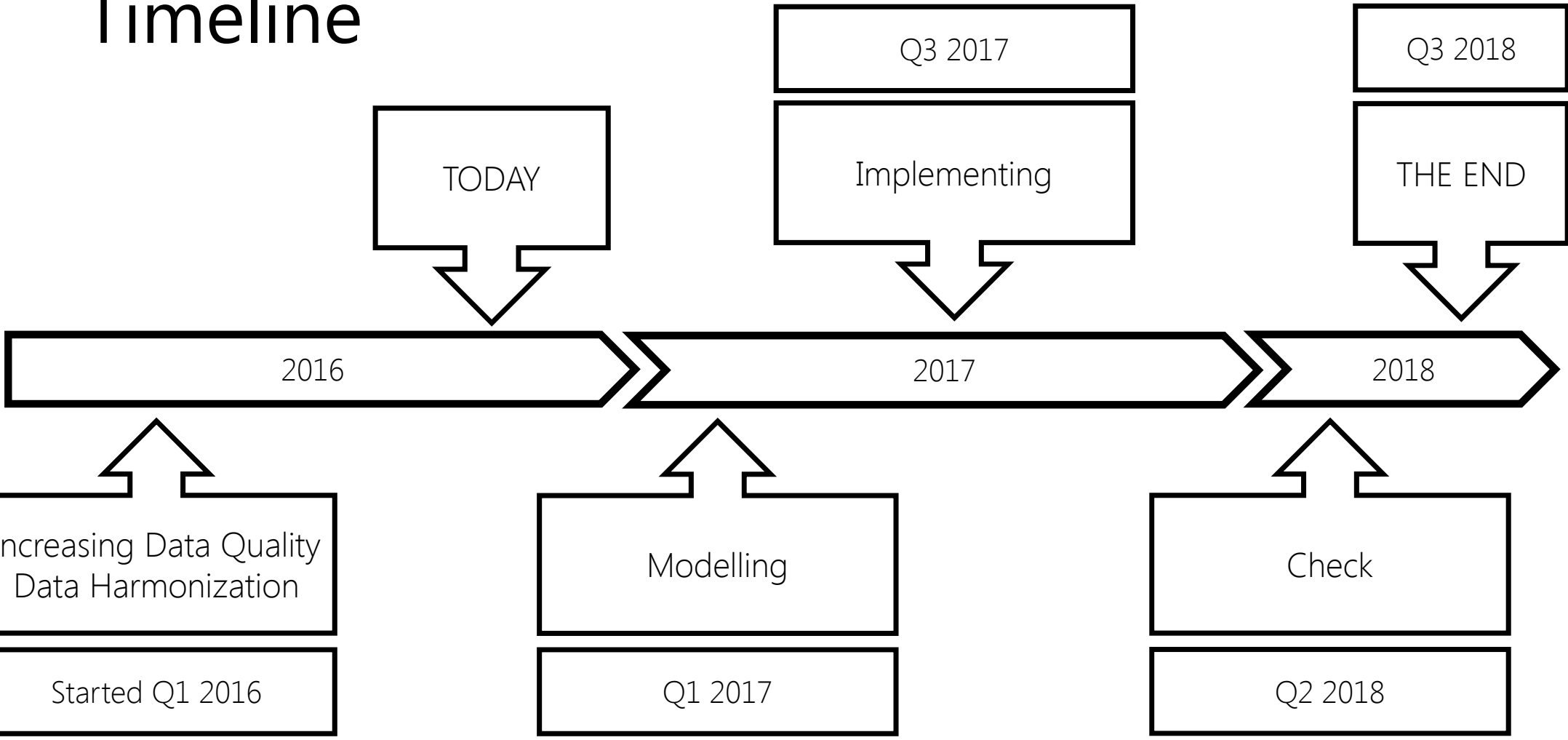
Products and Services assessed

- Technical Utilities
 - Steam, Gas, Heating, Water, Air, Waste Water, HVAC, ...
- Services
 - Room, Clean Room, Maintenance, Engineering, Reliability, Planning, Scheduling, ...
- Production/Plant Engineering

Industrial Research Case Study 2



Timeline



Increasing Data Quality
Data Harmonization

Started Q1 2016

11/16/2016

Modelling

Q1 2017

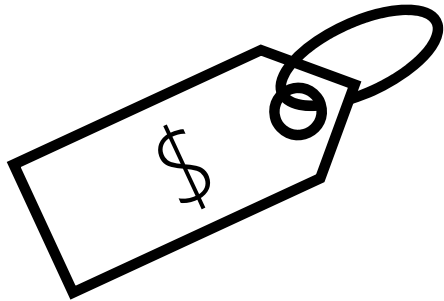
00 - Vorstellung

Check

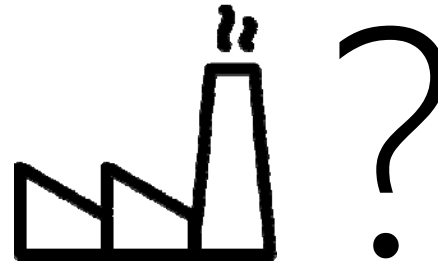
Q2 2018

20

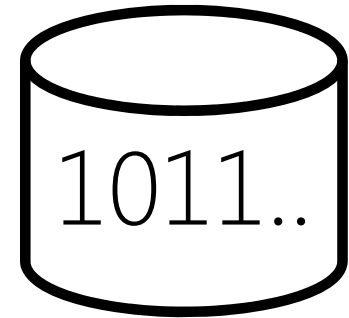
RECAP – Problem??



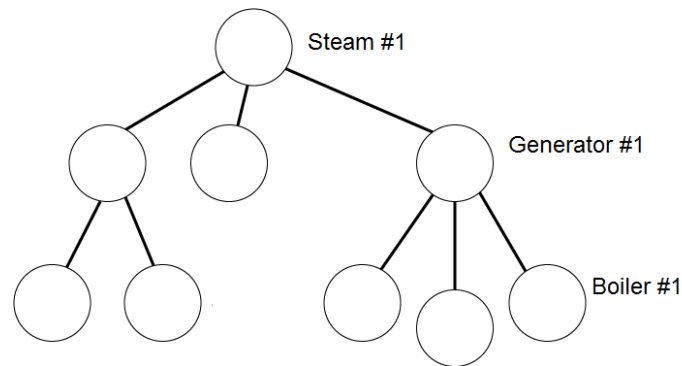
1 ton of steam?



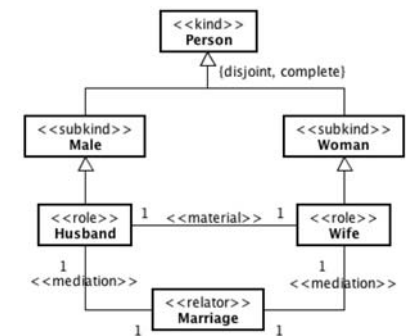
Site competitive?



Suitable data-model?



$$Performance = \frac{Accurate\ Cost}{Accurate\ Value}$$



Thank You!

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UNIVERSITÄT
WIEN
Vienna | Austria

Additional Literature

- Curry, Sean C. *REA: A process-oriented approach to enterprise systems*. Diss. MICHIGAN STATE UNIVERSITY, 2009.
- Scapens, Robert W., and Mostafa Jazayeri. "ERP systems and management accounting change: opportunities or impacts? A research note." *European accounting review* 12.1 (2003): 201-233.
- Lee, Sau L., et al. "Modernizing pharmaceutical manufacturing: from batch to continuous production." *Journal of Pharmaceutical Innovation* 10.3 (2015): 191-199.
- Mousazadeh, M., S. A. Torabi, and B. Zahiri. "A robust possibilistic programming approach for pharmaceutical supply chain network design." *Computers & Chemical Engineering* 82 (2015): 115-128.