

A concept for the visual and interactive impact analysis and simulation of data changes to enterprise metrics

Final Presentation

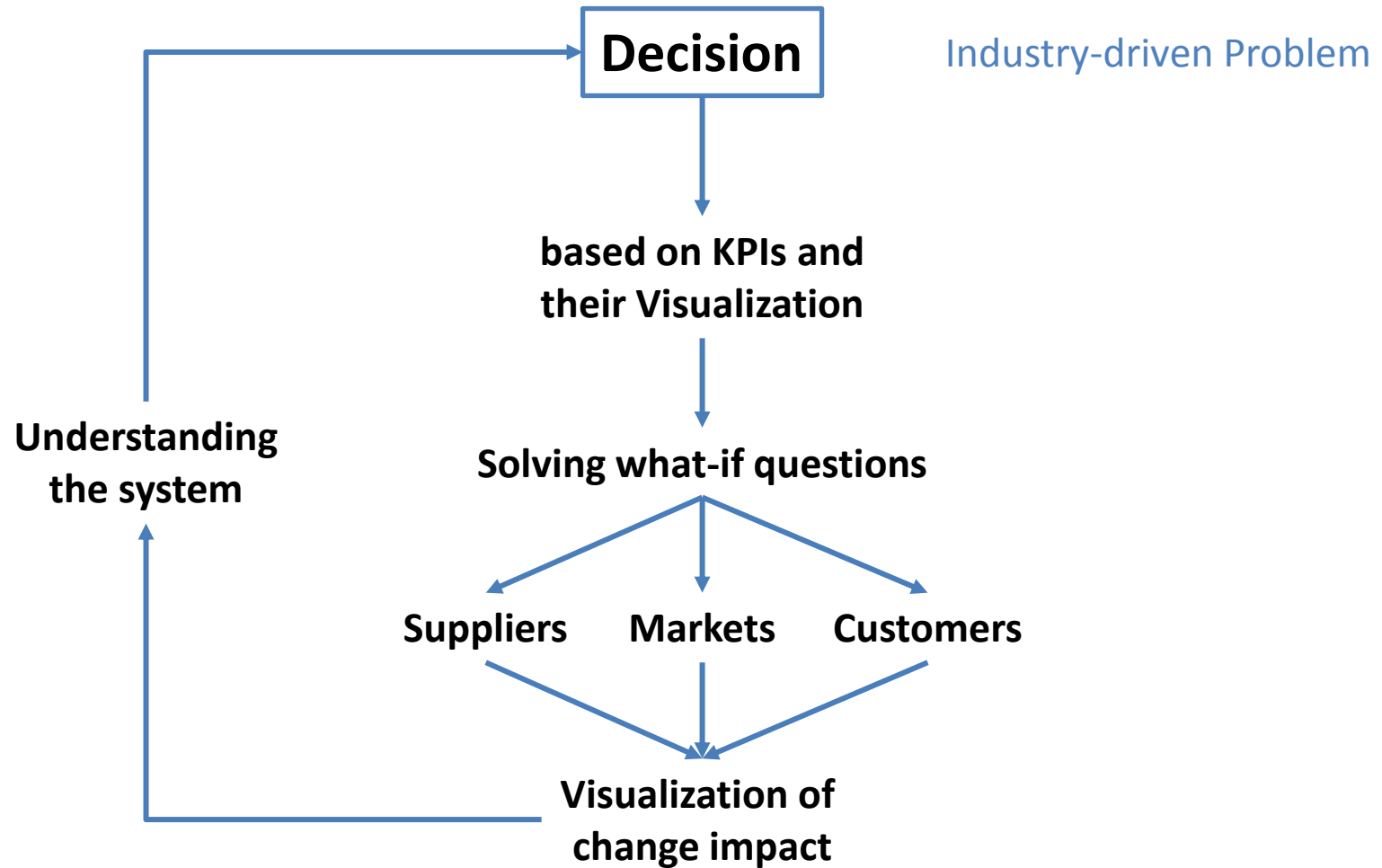


Room Rate of Trinidad	Tapia
Room Rate of Rosalia	Daugherty
Room Rate of Hunter	Mcconnell
Room Rate of Dominic	Bradshaw
Room Rate of Aiden	Barber
Room Rate of Clinton	Peters
Room Rate of Maricruz	Lopez
Room Rate of Ayako	Ware
Room Rate of William	King
Room Rate of Matthew	Macdonald
Room Rate of Marguerite	Mcguire
Room Rate of Nelson	Foster
Room Rate of Nicholas	Lynn
Room Rate of Marguerite	Quinn
Room Rate of Dian	Snyder
Room Rate of Audrey	Bishop
Room Rate of Sebastian	Reed
Room Rate of Edmund	Wu
Room Rate of Benjamin	Olson
Room Rate of Edmund	Macdonald
Room Rate of Lucy	Hinton
Room Rate of Olivia	Church
Room Rate of Taylor	Juarez
Room Rate of Dian	Conway
Room Rate of Timmy	Stevenson
Room Rate of Maricruz	Marks

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Motivation



Research Questions

1) What is an appropriate concept to visualize the impact of data changes to enterprise metrics?

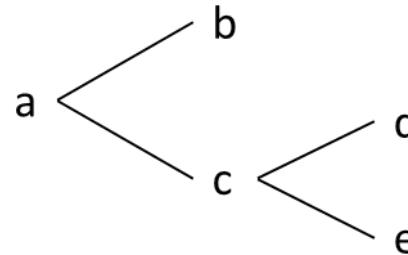
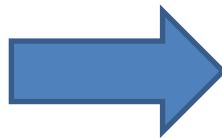
→ *appropriate*: theoretically profound, technically viable

2) How can interaction on this visualization help to improve the user's understanding of the calculation system?

Literature Review: KPI Visualization

- Common visualization technique:
Dashboard [1]
 - Each KPI, one graphical component
 - Supportitive diagrams (charts, graphs, tables)
- Generic adequate visualization technique:
2-dimensional graph-based layouts [2]
- Equations well represented by *node+link graphs* [3]

$$\begin{aligned} a &= b + c \\ c &= d + e \end{aligned}$$



Literature Review: Impact Visualization

- **Impact of influencing factors on processes** evaluated by Hao et al. [4]
 - Hyperbolic graph layout
 - Different colors and line weights show impact of each factor
- **Display delta** between an original value and a new value with size of node [3]
- Enable the user to **interact with the model** and **compare scenarios** [5]

Market Overview



Simulation tools

e.g. Simio, SimuLink/MathWorks, Simul8, OptQuest, OpenSim, OpenModelica

- Targeted at engineers and scientists
- Usability for user group,
e.g. console view only, complex languages
- Not suitable for the problem



Microsoft Excel

- Insufficient visualization of impact
- Understanding the system difficult
if formulas are hidden



Powersim Studio 10

- No comparison between original and deviated values
- No support for "Virtual Data"

Solution Approach: Basics

(1) $d * \Delta + c = s$ with $\Delta = 0$ for $c \neq 0$

d: original value

Δ : simulated delta

c: value replacement / constant

s: simulated value

(2) $D \cup V = S$

D: original data

V: virtual data

S: simulated data

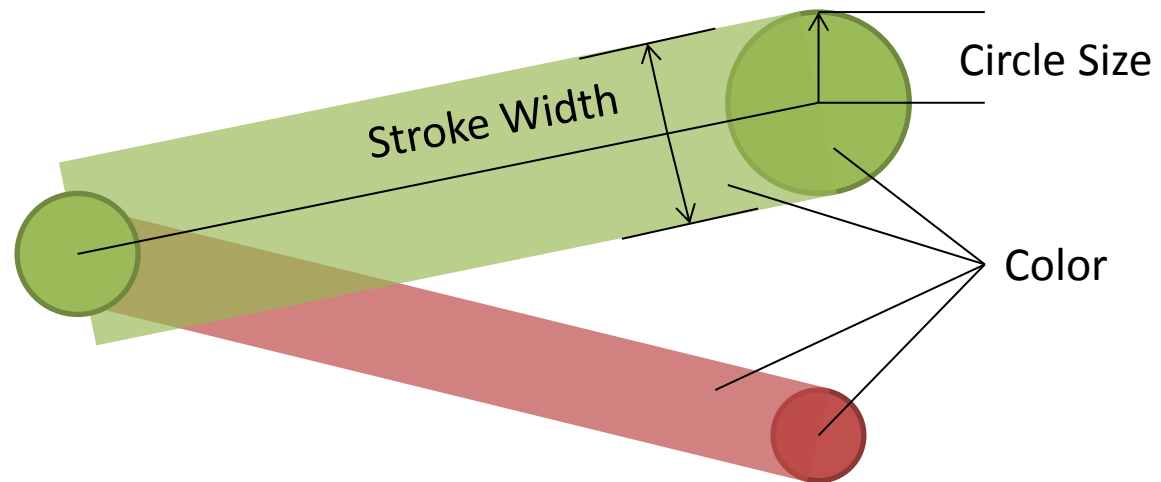
Solution Approach: Visualization

KPIs based on **Formula**

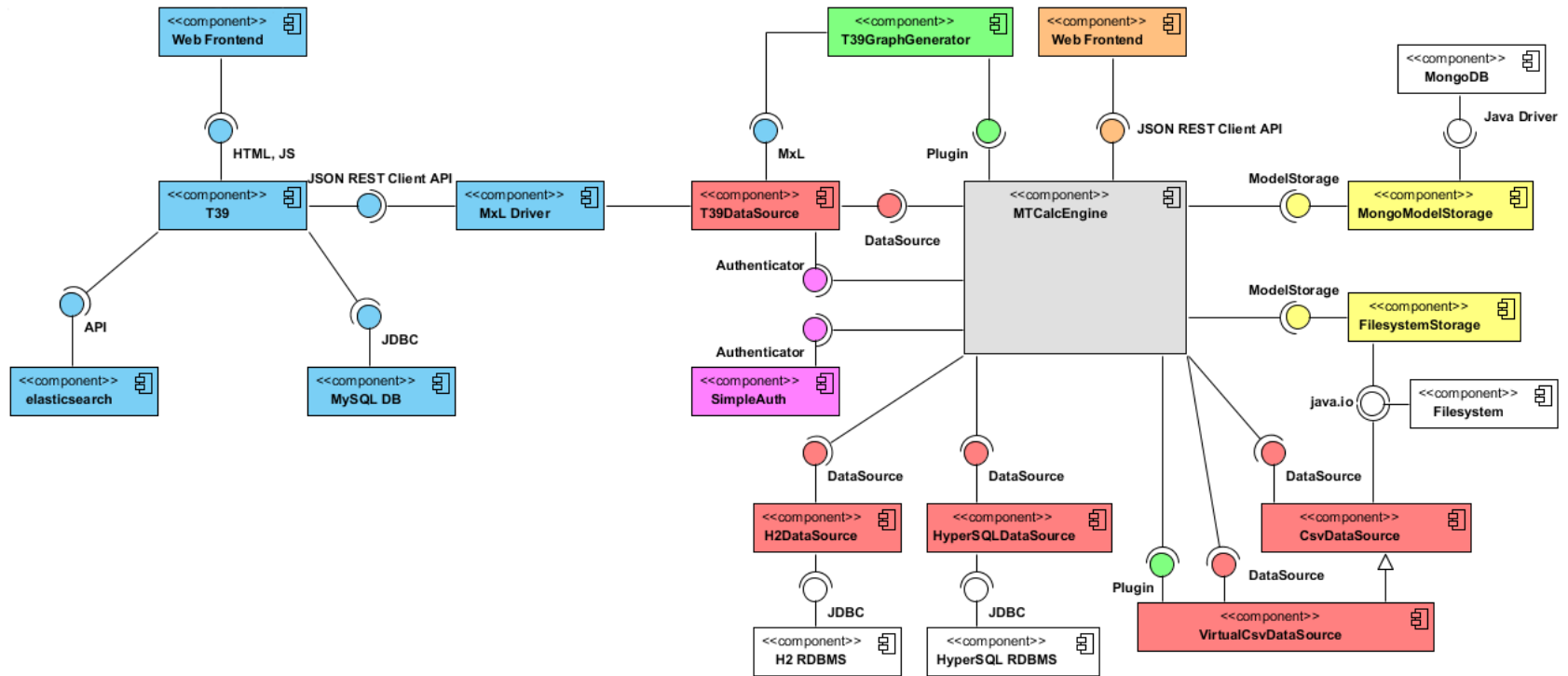
Visualization of Formula based on Spence [3]

Different **weights and colors** [4]

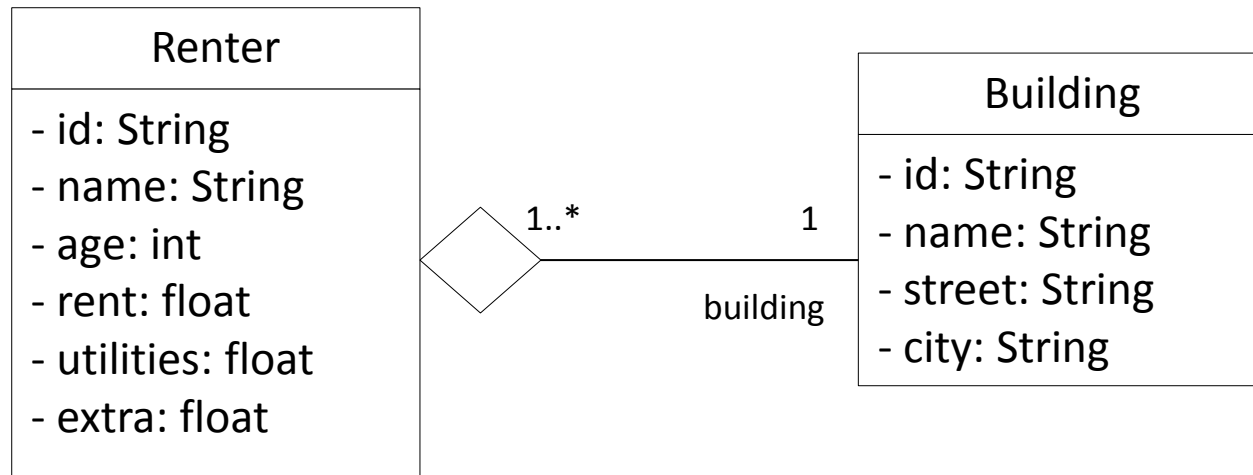
Interaction with scenario [5]



Modular Architecture



Demo



Research Questions Answered

1) What is an appropriate concept to visualize the impact of data changes to enterprise metrics?

- Visualization of KPIs with 2-dimensional graphs
- Visualization of data changes with size and color

2) How can interaction on this visualization help to improve the user's understanding of the calculation system?

- Compare scenarios
- See where impact originates

Byproducts



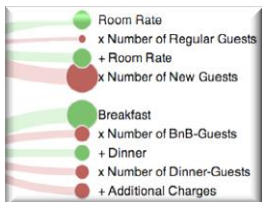
MxLDriver for Java

CRUD operations, authentication, meta information, static/dynamic graph generation



Documentation in Swagger [6]

Interactive and static documentation



Modelling Patterns

Aggregation, Condition, Implicit Join and more

Outlook



**User Validation Needed
(Industry Partner)**



**Usability Validation
Needed (User Tests)**



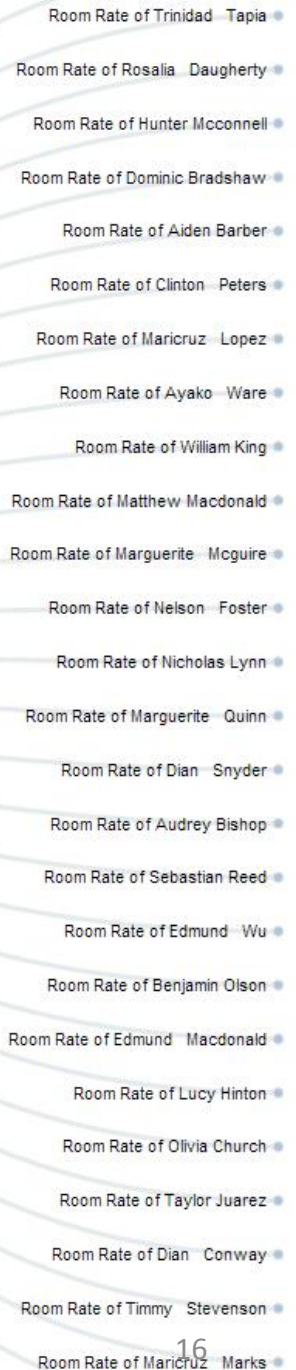
**Data Source Integration
(e.g. SAP HANA)**

References

- [1] Kerzner, H. R. (2013): Project Management Metrics, KPIs, and Dashboards: A Guide to Measuring and Monitoring Project Performance: Wiley. Available online at <http://books.google.de/books?id=BRNwAAAAQBAJ>.
- [2] Nazemi, Kawa; Breyer, Matthias; Kuijper, Arjan (2011): User-Oriented Graph Visualization Taxonomy: A Data-Oriented Examination of Visual Features. In David Hutchison, Takeo Kanade, Josef Kittler, Jon M. Kleinberg, Friedemann Mattern, John C. Mitchell et al. (Eds.): Human Centered Design. Berlin, Heidelberg: Springer Berlin Heidelberg (Lecture notes in computer science), pp. 576–585.
- [3] Spence, Robert (2007): Information visualization. Design for interaction. 2nd ed. Harlow, England, New York: Addison Wesley.
- [4] Hao, Ming C.; Keim, Daniel A.; Dayal, Umeshwar; Schneidewind, Jörn (2006): Business process impact visualization and anomaly detection. In Inf Vis 5 (1), pp. 15–27. DOI: 10.1057/palgrave.ivs.9500115.
- [5] Russell, Karl; Carter, Shan (2009): How the Giants of Finance Shrank, Then Grew, Under the Financial Crisis. Edited by The New York Times. Available online at http://www.nytimes.com/interactive/2009/09/12/business/financial-markets-graphic.html?_r=0, updated on 9/20/2009, checked on 5/13/2014.
- [6] wordnik (2014): Swagger RESTful API Documentation Specification. Reverb Technologies, Inc. Available online at <https://github.com/wordnik/swagger-spec/blob/master/versions/1.2.md>, updated on 6/6/2014, checked on 7/21/2014.

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by Matti Maier



Additional Information

BACKUP

Examples within this Thesis

1. Hotel Business

- On SQL Database and T39
- Generated Data
- Goal: Easy example for presentation

2. EAM

- On T39
- E.g. simulating the impact of additional applications in domains

Other areas of application include gross margin calculations, financial portfolio analysis, risk management evaluation and more.

Research Methodology

Design Science (Hevner et al. 2004)

- Design as an Artifact:
 - Models (e.g. architecture) and a prototype (application)
- Problem relevance:
 - Problem is to visualize impact of influencing factors --> solve with an application
- Design evaluation:
 - Descriptive Evaluation -> Scenario to demonstrate the utility
 - Testing -> Black- and Whitebox with Unit tests
 - Analytical -> fit of architecture into application landscape
-> SQL databases as common data stores, CSV for Excel as a common tool, etc.
- Research Contributions:
 - Visualization technique
 - Application design, e.g. data source interface
- Research Rigor:
 - Construction methods: patterns (e.g. composite, singleton, client/server)
 - Evaluation methods: (see above)
- Design as a Search Process:
 - evolution of the architecture --> refinement, extension
 - Different model storages to proof the portability and improve the interface design
- Communication of Research:
 - Presentations
 - Final paper
 - Swagger UI

Systematic Literature Review (Kitchenham/Charters 2007)

- Review Protocol
 - Questions
 - Resources
 - Search Terms
 - Selection Criteria

Challenges in Implementation

- **Connecting T39**
 - Result: MxL Driver
 - Specialty: Data retrieval over MxL
- **Generating Queries**
 - Different operations
 - Different data sets
 - Recursive dependencies
- **Finding the right frameworks**
 - D3.js vs. Gephi vs. GraphStream vs. ...
 - Tempo.js for JavaScript/JSON Templates
 - Validation frameworks

Performance

- **Parallelization**
 - Calculation is performed in parallel as much as possible
- **Code to Data**
 - Computation is pushed to data as far as possible
- **Connection Pooling**
 - JDBC Data Sources are connected using connection pools
- **Lightweight JSON REST Interfaces**
 - Reuse of JSON where possible
 - Thus little conversion necessary

Security

- **Input Validation**
 - from User
 - from external systems, e.g. T39
 - Counter measure against XSS
- **Session Reinitialization**
 - Prevent Session Fixation
- **Forced HTTPS Connections**
 - Forward from HTTP to HTTPS connections
- **Custom Error Pages**
 - No presence of version and server

Modelling Patterns

- **Column Aggregation**
e.g. sum of a column in a table
- **Calculating the Average**
i.e. $\text{sum} / \text{count}$
- **Copying Node**
How to copy and reuse a node?
- **Condition**
How to model conditions?
- **Implicit Join**
How to implicitly join tables?

Migration on T39

Why was this application not migrated on T39?

- **Industry-driven Topic**
 - Various data sources, e.g. SAP HANA
- **Integration of T39 earlier this year**
 - Could have lead to a delay of the thesis
- **Incompatible libraries in T39**
 - e.g. D3.js requires other jQuery(s)
 - When DataWidgets are completed, then integration in DW Infrastructure