

End User Development of Information Artefacts

A Design Challenge for Enterprise Systems

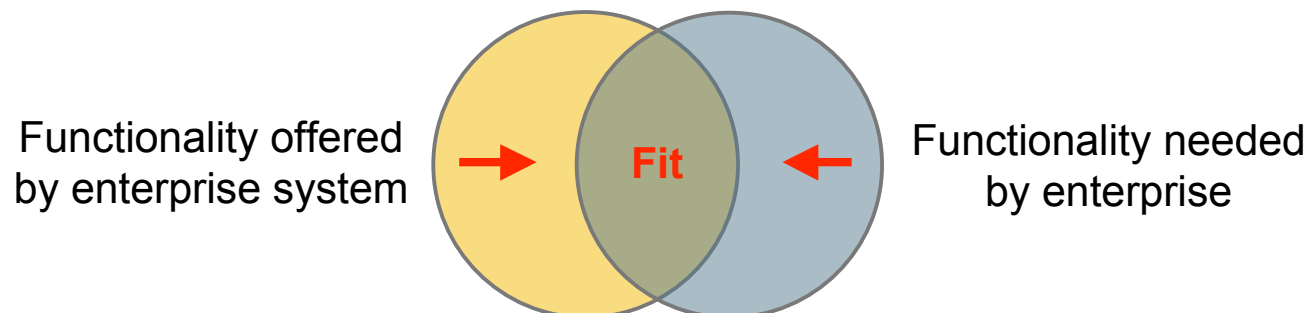


Michael Spahn, Christian Dörner, Volker Wulf

- Introduction
- End User Development (EUD)
- Empirical studies
 - Problem areas
 - Design behaviour
- Conclusions
- Outlook

Basic problem

- Lacking adaptability of enterprise software systems (e.g. ERP) by end users
 - Impossible to capture all requirements at design time
 - Requirements change; adaptations are needed
 - Especially SMEs: lack of expertise, resources and budget
 - Adaptations have to be delegated to experts (costly); often abandoned
 - Consequences
 - Limited fit between existing and needed functionality
 - Time, cost and quality of realized business processes suffer
 - Limited ability to innovate, differentiate and gain competitive advantages



User-centred perspective

■ End User Development (EUD)



“[...] a set of methods, techniques, and tools that allow users of software systems, who are acting as non-professional software developers, at some point to create or modify a software artifact.”

Lieberman, H., Paternò, F. and Wulf, V. (2006). *End User Development*. Springer, Dordrecht

■ Basic approach

- Empower end users as domain experts to adapt the systems to their needs
- EUD environments
 - Adapt system or create tools suitable for individual working tasks
 - Tradeoff: simplicity vs. power



EUD Environment

- Addresses specific context in which complexity reduction should be achieved
- Basic phases of developing an EUD environment

(i) Identify domain and context

(ii) Understand domain and user problems

(iii) Design environment based on insights

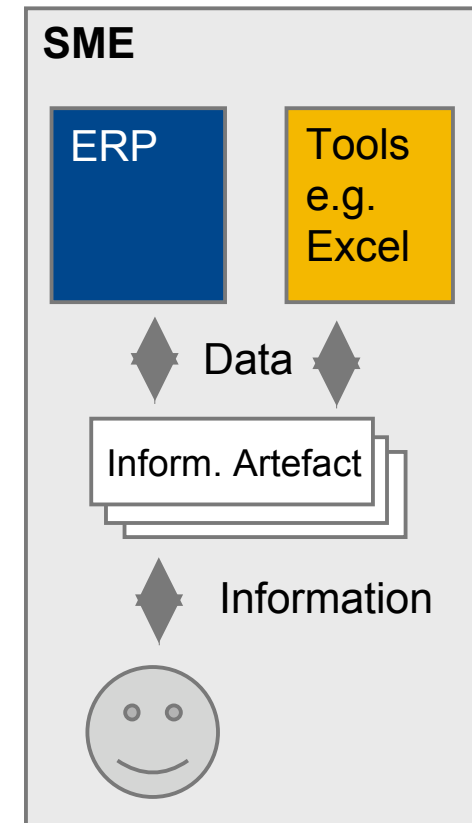
(iv) Evaluate environment to measure its success

Domain

- Small and medium sized enterprises (SMEs)
- Enterprise resource planning (ERP) systems

Context

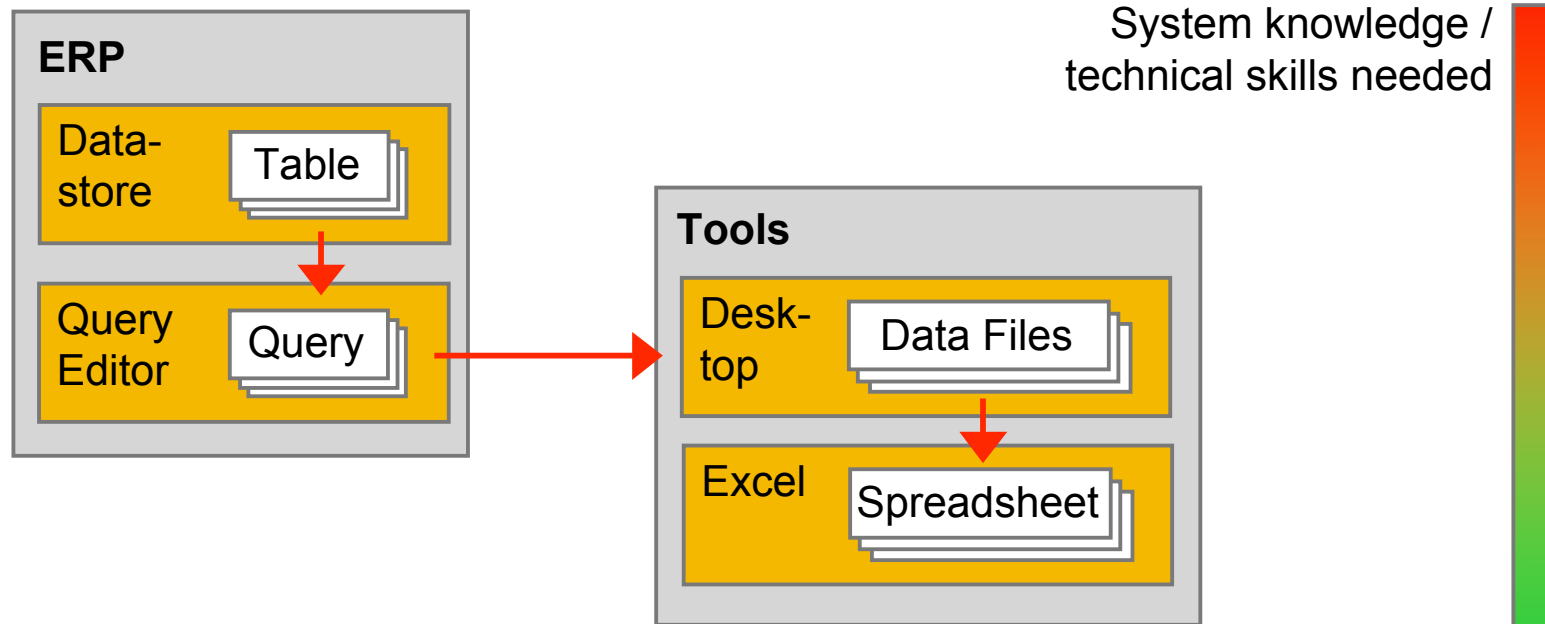
- Using ERP as central data storage of business data for
 - information self-service
 - creation of individual tools to facilitate working tasks
- Main adapting and developing task
 - Create and modify information artefacts
 - Information artefacts are data-centric artefacts like
 - Queries
 - Reports
 - Spreadsheets
 - Databases



Empirical Study - Phase I

- Intent
 - Understand domain and identify real-life problems of business users
 - Derive first requirements for simplified EUD tools
- Type of study
 - Series of semi-structured interviews
- Interviews
 - Conducted interviews: 14 (60 to 120 min. each)
 - Selection criteria: interviewees, who consume, modify or create information artefacts
- Participating companies: 5 German SME

Common types of information artefacts and creation



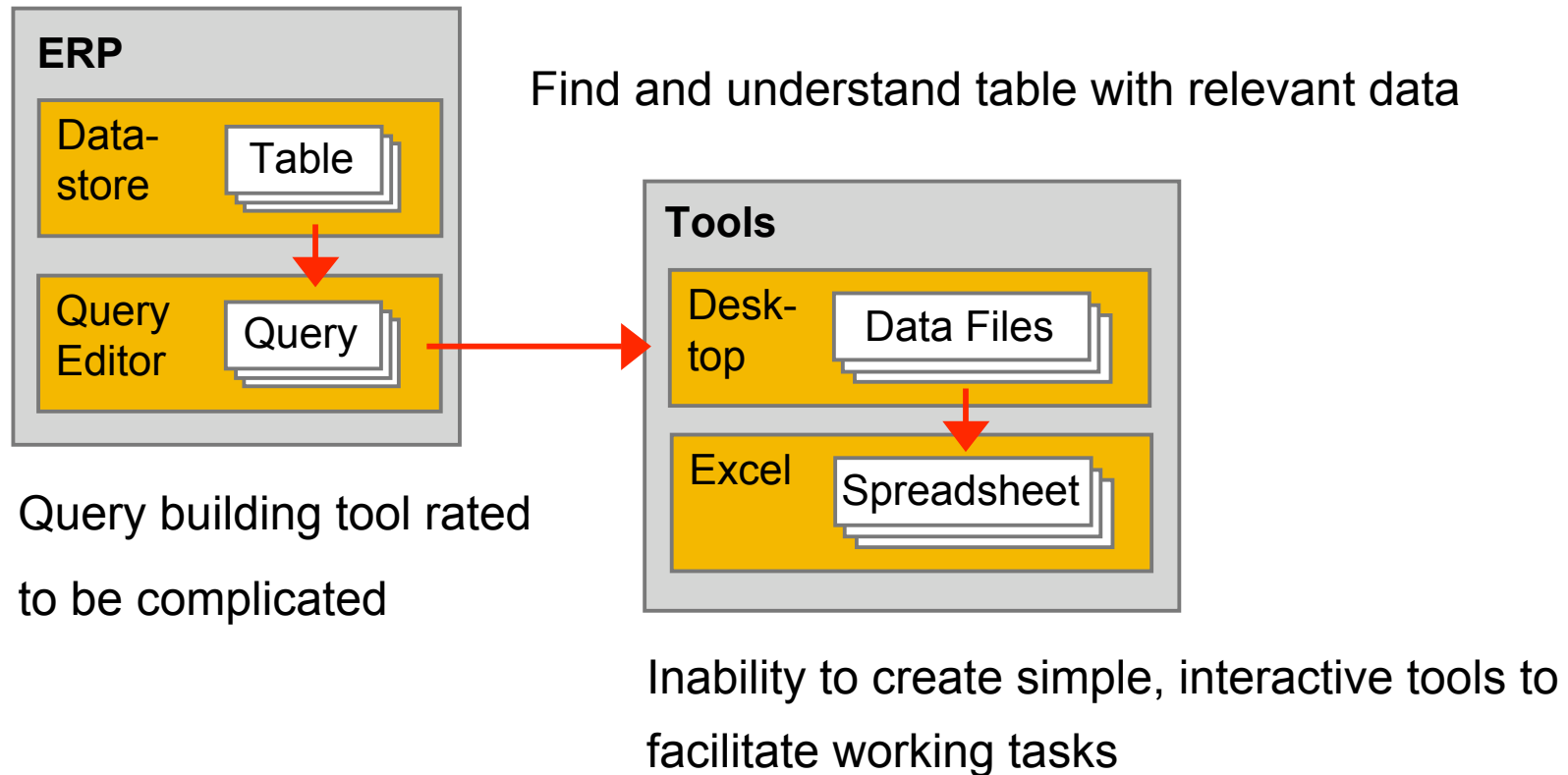
2 layers of composition

- 1. layer: orchestrate queries of tables (select individually needed data)
- 2. layer: orchestrate spreadsheets (individual solutions) of query data

Understand Domain and User Problems



Common problems of business users acting as end user developers



Conclusions

- Complexity of tools and ERP data model limit EUD possibilities of business users
- EUD tools should improve the following aspects
 - Data abstraction to conceptual level using business terms
 - Data searching and browsing
 - Orchestrating data
 - Creation of interactive tools

==> There is a need for an EUD environment

Empirical Study Part II

■ Intent

- Test how business users intuitively use a simple box and wires design paradigm for information artefact creation
- Derive first requirements for a suitable design paradigm usable in a visual, lightweight EUD composition environment

■ Type of study

- Participatory design workshop (1 day)

■ Participants

- 3 employees of mid-sized company

■ Problem to solve

- Create information artefact supporting the stock forecast
- Refine stock forecast by combining data from different SAP ERP modules and manually entered data

Design elements “box & wires”

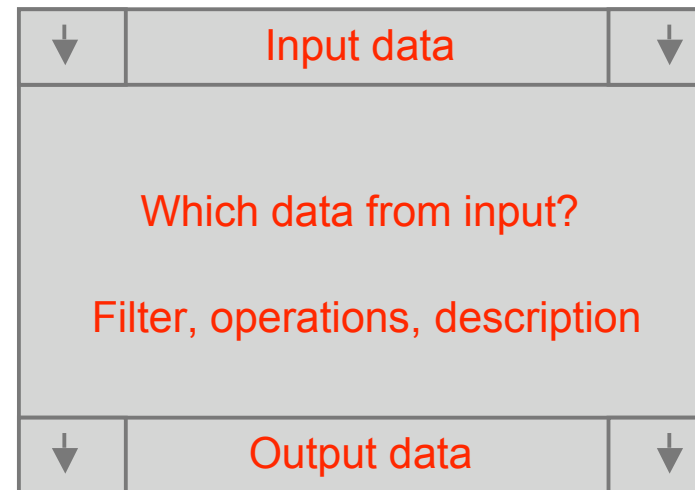
■ Box

- Definition of data sets and operations
- Definition by user annotations

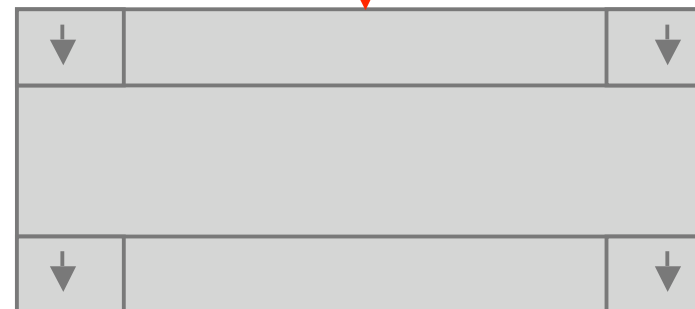
■ Wire

- “Wire” line defining information flow between boxes

Box



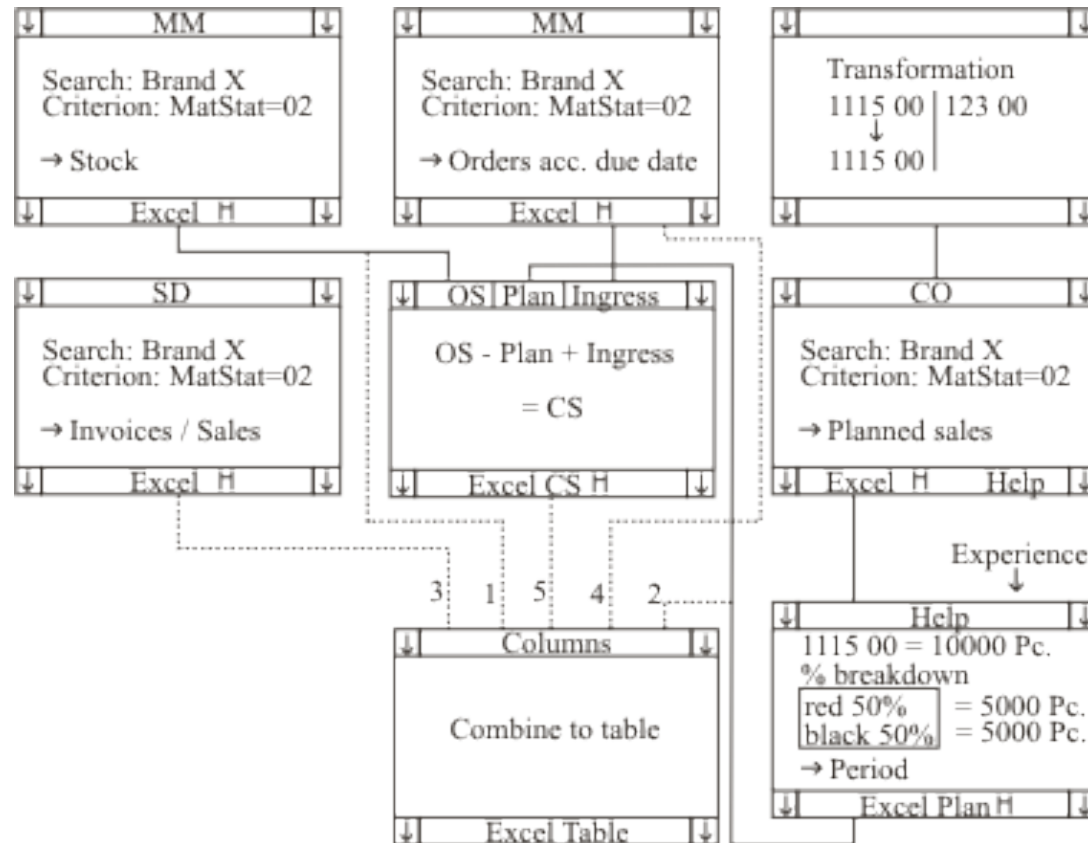
„Wire“ line



Empirical Study – Design Paradigm



Artefact designed by participants (simplified)



Conclusions

- Design paradigm itself usable by business users
- Formal specification of data should try to avoid need of system knowledge

Current situation in SMEs

- Creation of individual information artefacts still too complex
- Need for highly simplified tools usable by business users
- Main problem areas
 - Data abstraction to conceptual level using business terms
 - Data searching and browsing
 - Orchestrating data
 - Creation of interactive tools
- Simple visual design paradigms (like box & wire) can be understood and applied fast

Development of the EUD Environment

(i) Identify domain and context

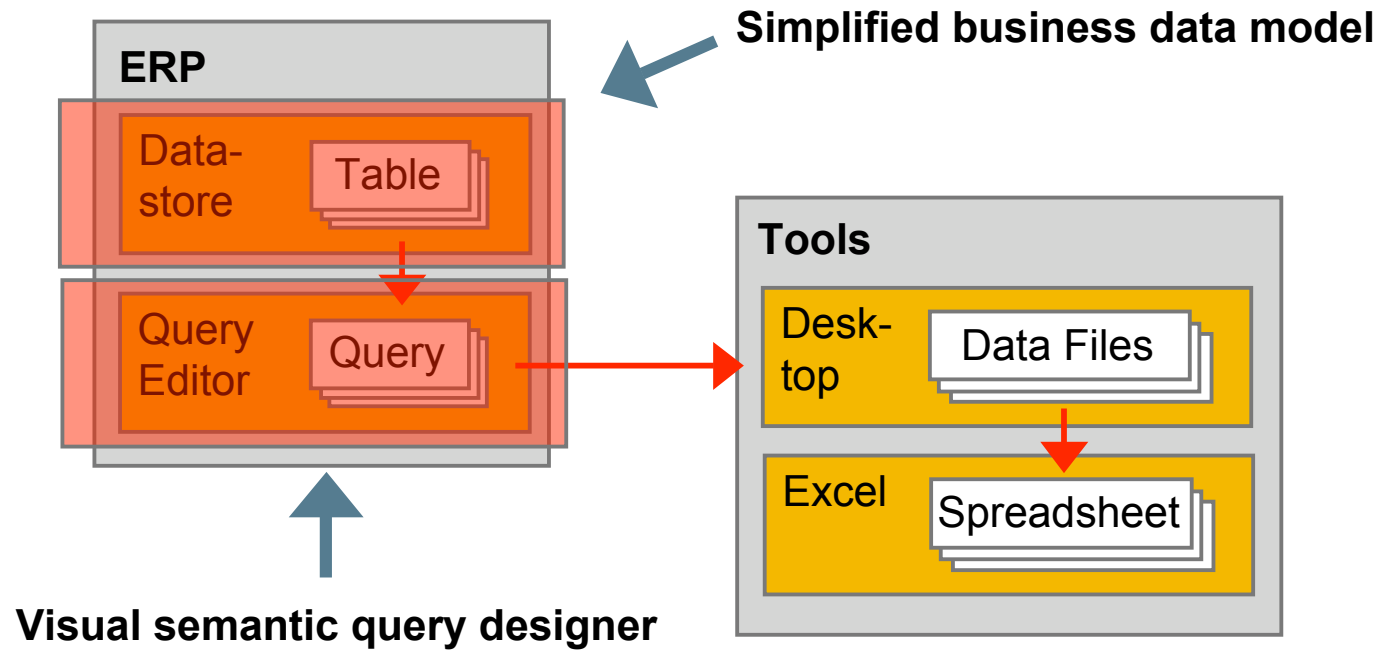
(ii) Understand domain and user problems

(iii) Design environment based on insights

(iv) Evaluate environment to measure its success



Approach



Visual Semantic Query Designer

Concept Navigation Options [Testing]

Search/Filter Concepts

Enter Search Criteria:

Node

- Address
- AddressType
- AdventureWorks
- AWBuildVersion
- BillOfMaterials
- Contact
- ContactCreditCard
- ContactType
- CountryRegion
- CountryRegionCurrency
- CreditCard
- Culture
- Currency
- CurrencyRate
- Customer
- CustomerAddress
- DatabaseLog
- dbo
- Department

Concept Details

Search Paths

Selected Query Relations

Navigation View

Visual Navigation

Navigation buttons: Navigate, Show incoming, Show outgoing, Show query

Checkboxes: Display domains, Display subdomains, Display datasources

Refresh view

Concept Preview max. Rows: 20

Preview of Concept Instances

Drag & Drop Query Building

Deploy as Service or export to Excel

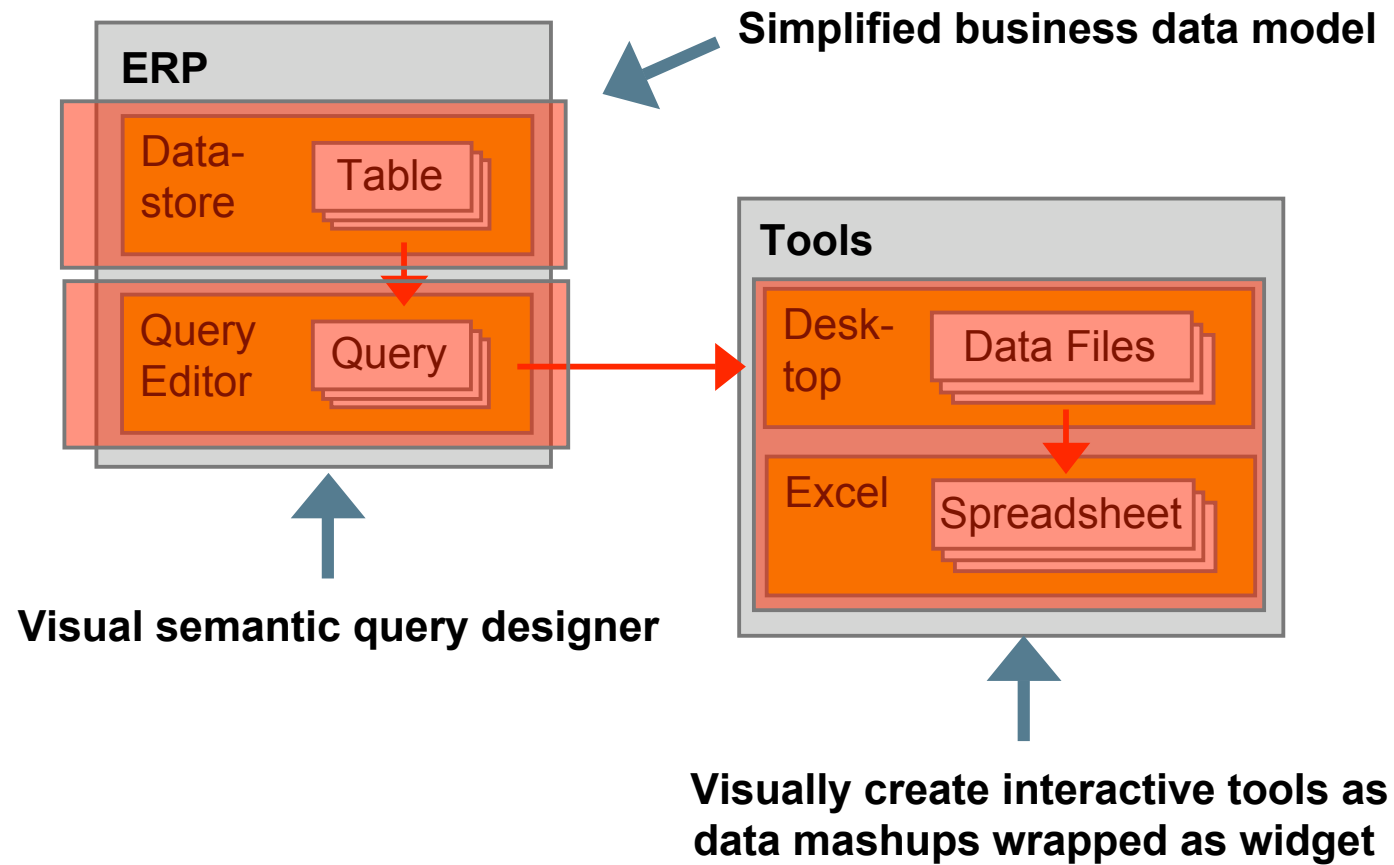
Query Preview Deploy to WCP Export to Excel

Drop attributes here!

Instant Preview



Approach





Widget Composition Platform

The screenshot displays the SAP Widget Composition Platform interface in DESIGN View. On the left, a 'Services' tree lists various data sources like RSS feeds and SAP services. The central workspace shows a 'Box & wires design paradigm' with two tables. The top table, titled 'Products', has columns for Name, ProductNumber, SafetyStockLevel, and ReorderPoint. The bottom table, titled 'Work Orders with Scrap', has columns for Date, OrderQty, ScrappedQty, and ScrapName. Orange arrows indicate the 'Drag & drop' process of connecting data from the services to the tables. On the right, a 'Design Elements' panel lists available widgets (Textfield, Label, Separator, Mailto, Skype) and a 'Properties' panel for the selected widget, showing settings like Text Size, Text Style, and Text Color.

Name	ProductNumber	SafetyStockLevel	ReorderPoint
Bearing Ball	BA-8327	1000	750
BB Ball Bearing	BE-2349	800	600
Headset Ball	BE-2908	800	600

Date	OrderQty	ScrappedQty	ScrapName
2001-07-15	40	1	Wheel misaligned
2001-07-29	50	1	Drill pattern in correct
2001-08-14	50	1	Primer process
2001-08-18	60	1	Brake assembly not
2001-09-01	80	2	Gouge in metal

Services

- RSS
 - Google News
 - Yahoo News
 - Google Search
 - NASDAQ Headlines - Resea
 - NY Times - Business Hea
 - Washington Post - Busines
 - Mergers & Acquisition New
 - C-Level Management Chan
 - Handelsblatt Headlines in G
 - Wirtschaftswoche Headline
 - NYSE Headlines - Research
- HTML Wrapper
- ASX Gains
- ASX Declines
- SAP Services
 - SAPCon Level [XMLA Url]
 - SAPCon Level [MDX Q
 - Sales Service (IWP)
 - Sales Order (AP)
 - IT Support Tickets (CSS)
 - Customer Messages (CSS)
 - My Accounts
 - My Opportunities
 - Correction Requests (CSS)
 - Internal Messages (CSS)
 - Sales Service [MDX Query
 - Internet Sales (DWH)
 - Products
 - Work Orders with Scrap
 - Sales Territory Overview (
 - Sales Persons
 - Sales Countries

Design Elements

- Elements
 - Textfield
 - Label
 - Separator
 - Mailto
 - Skype

Properties

Text Size: 11
Text Style: plain
Text Color: [Blue]
Lines: 10
TopCut: 0
Headers:
HeadColor: [Grey]
BackColor1: [Grey]
BackColor2: [White]
Columns: RowNo 0
Date 0
ProductID 0
ProductName 0
OrderQty 0
ScrappedQty 0
ScrapName 0

Default Background Images: [Icons]
Custom Background Images: [Image Upload](#)

WIDGET COMPOSITION PLATFORM

Questions



Thank you!



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Results

- Common IT infrastructure
 - SAP ERP and Microsoft Office
 - Microsoft Excel main “composition environment” for information artefacts
 - Advanced users use SAP Query Editor to create individual data sources
 - No business intelligence (BI) or data warehousing (DWH) solutions
 - IT departments avoid developing individual solutions
 - Reasons: limited expertise, high costs, requires maintenance
 - Consequences: user mainly have to arrange with just SAP and Office
 - No support technology for knowledge management
 - Users do not document and share EUD related knowledge (e.g. using wiki)

Future work

- Development of EUD tools in accordance to identified problem areas
- Validation of tools in real enterprise environments

Current state

- Lightweight composition approach
 - Reduced and simplified business data model
 - Visual tool for navigating ERP information space and simple query creation
 - Sophisticated visualisation and search, drag & drop query creation
 - Wrap and deploy queries as services
 - Visual tool for orchestrating interactive tools (widgets) from services
 - Mix internal and external services to mashups and wrap in widget
 - Simple box and wires design paradigm
 - Absolutely no programming skills needed to create useful interactive tools

Common problems of business users acting as end user developers

- Inability to create simple, interactive tools to facilitate working tasks
 - Example: need to access different screens of ERP system and manually write down data in order to collect needed data related to a customer. Desirable: interactive tool returning needed data set after entering customer.
- Creating individual queries
 - Find and understand table with relevant data
 - Search capability not suitable for business users
 - Missing business terms (e.g. table 'VBAK' stores sales order header data)
 - No detailed description of table attributes
 - Incomprehensible help system
 - Query building tool rated to be complicated
 - Complex GUI
 - Need to understand some database concepts (e.g. foreign keys, joins)

Empirical Study

■ Setup

- Collaborative specification of real problem to solve with information artefact
- Introduction to design paradigm to use for information artefact creation
- Collaborative development of information artefact

Problem to solve

- Create information artefact supporting the stock forecast
- Refine stock forecast by combining data from different SAP ERP modules and manually entered data

Participatory design workshop



Observations in design process

- No problems understanding and applying the box & wires design paradigm itself
- Users intuitively thought of data being organized as tables
- No problem to specify data using business terms
- Problems transforming specification in a way “understandable by the machine”
 - Specifications are short descriptions of how to access data in the ERP system
 - Inherently difficult for users with limited system knowledge
 - Operations and functions specified by formula or example

Conclusions

- Design paradigm itself usable by business users
- Formal specification of data should avoid problematic need of system knowledge

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